Plan Number	S Standard Title
S-600-02	Abbreviations and Acronyms
S-612-1	Delineator Installations
S-613-1	Roadway Lighting
S-613-2	Alternative Roadway Lighting
S-613-3	Pull Box Detail
S-613-4	Traffic Signal One-Line Diagrams
S-614-1	Ground Sign Placement
S-614-2	Class I Signs
S-614-3	Class II Signs
S-614-4	Class III Signs
S-614-5	Break-Away Sign Support Details for Class III Signs
S-614-6	Concrete Footings and Sign Islands for Class III Signs
S-614-8	Tubular Steel Sign Support Details
S-614-10	Marker Assembly Installations
S-614-11	Milepost Sign Detail for High Snow Areas
S-614-12	Structure Number Installation
S-614-14	Flashing Beacon and Sign Installations
S-614-15	Chain Station Signage
S-614-17	Radar Speed Feedback Sign (RSFS)
S-614-19	Late/Zipper Merge Signage
S-614-20	Typical Pole Mount Sign Installations

Plan Number	S Standard Title
S-614-21	Concrete Barrier Sign Post Installations
S-614-22	Typical Multi-Sign Installations
S-614-23	J-Post Sign Support
S-614-40	Typical Traffic Signal 15'-75' Double Mast Arms & 60'-75' Single Mast Arm
S-614-40A	Alternative Traffic Signal 15'-55' Single Mast Arm
S-614-41	Temporary Span Wire Signals
S-614-42	Cabinet Foundation Detail
S-614-43	Traffic Loop and Miscellaneous Signal Details
S-614-44	Pedestal Pole Signals
S-614-45	Pedestrian Push Button Post Assembly Details
S-614-50	Static Sign Monotube Structures
S-614-60	Dynamic Sign Monotube Structures
S-627-1	Pavement Markings
S-630-1	Traffic Controls for Highway Construction
S-630-2	Barricades, Drums, Concrete Barriers (Temp) & Vertical Panels
S-630-3	Flashing Beacon (Portable) Details
S-630-4	Steel Sign Support (Temporary) Installation Details
S-630-5	Portable Rumble Strips (Temporary)
S-630-6	Emergency Pull-Off Area (Temporary)
S-630-7	Rolling Roadblocks for Traffic Control

CDOT Standards and Specifications

The CDOT S Standards contain details common for safety, such as: delineators, lighting, signs, sign supports, traffic signals and accessories, pavement markings, and traffic control.

Individual files for each S Standard in this file may be found in the CDOT Standards & Specifications Web Page.

CDOT Safety (S) Standards Web Page: CDOT S Standards Web Page

The latest version of the CDOT S Standard Plans List to be inserted into Highway Plans set may be found at the following Web Page: CDOT S Standards Plans List Web Page

Often, these S Standards reference CDOT Construction Specifications. CDOT Construction Specifications may be found at the following Web Page: CDOT Construction Specifications Web Page

The CDOT M Standards contain details common for roadway construction, such as: roadway appurtenances, drainage features, guardrails and barriers, fencing, curbs, gutters, sidewalks, etc.

CDOT Miscellaneous (M) Standards Web Page: CDOT M Standards Web Page

Colorado
Department Of Transportation
S Standards
Table of Contents
July 01, 2026

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S Standard Table of Contents

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-600-01
Standard Sheet No. 1 of 1
Project Sheet Number:

A

A, Amps	Ampere
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AIC	Ampere Interrupting Capacity
ANSI	American National Standards Institute
AP	Advance Placement Distance
ASTM	American Society for Testing and Materials
AWG	American Wire Guage

B

B.O.C.	Back of Curb
BT	Buffer Terminals

C

CAD	Computer Aided Design, Computer Aided Drafting
CCTV	Closed-Circuit Television
CDOT	Colorado Department of Transportation
cf	Cubic Feet
CLR	Clear
CU	Copper
CVN	Charpy V-Notch

D

DALI	Digital Addressable Lighting Interface
Deg - °F, °C	Degrees (Thermal) - Degrees Fahrenheit, Degrees Celsius
DIA	Diameter
DMS	Dynamic Message Sign

E

e.g. =	Exempli Gratia (For Example)
E.O.P.	Outside Edge of Pavement

F

FHWA	Federal Highway Administration
ft	Feet
ft kip	Foot Kips
ft lb	Foot Pounds

G

GA	Gage or Gauge
Galv	Galvanized
GFCI	Ground Fault Circuit Interrupter
GFI	Ground Fault Interrupter
GND	Ground
GP	General Purpose Lane
GRC	Galvanized Rigid Conduit

H

HDPE	High Density Polyethylene
Hex Hd	Hexagonal Head
HOA	Hand-Off-Auto (Switch)
HS	High Strength
HSS	Hollow Structural/Steel Section
HVAC	Heating, Ventilation, and Air Conditioning
Hwy	Highway

I

ID	Inside Diameter
IES	Illuminating Engineering Society
in	Inches
in kips	Inch Kips
in lb	Inch Pounds
ISCA	Short-Circuit Current
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems

K

kip	Thousand Pounds
ksi	Kips per Square Inch

L

lb	Pounds
lb ft	Pounds per Foot
LCC	Lighting Control Center
LED	Light Emitting Diode
LRFD	Load and Resistance Factor Design

General Notes

1. Words are preferred over abbreviations and ancronyms.
2. Use words in notes, except where space is limited on the plan sheet.
3. Do not use abbreviations or ancronyms where the meaning may be in doubt.
4. Abbreviations or ancronyms may be used in callouts, dimensions, and tables.
5. Abbreviations should be upper and lower case letters except where all upper case letters are required.
   Hex Hd = Hexagonal Head
6. Acronyms shall be all upper case letters.
   VMS = Variable Message Sign

Symbols

@	at
&	and
ϕ ⌀	Diameter
°	Degrees
', ''	Feet, Inches
#	Number
≈	Approximate

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Acronyms and Abbreviations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-600-02
Standard Sheet No. 1 of 2
Project Sheet Number:

M

MAX	Maximum
MCB	Miniature Circuit Breaker
MHT	Method of Handling Traffic
MIN	Minimum
Misc	Miscellaneous
MPH	Miles per Hour
MPP	Meter Power Pedastal
MUTCD	Manual on Uniform Traffic Control Devices

N

NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
No	Number
NPT	National Pipe Thread

O

OD	Outside Diameter
OSHA	Occupational Safety and Health Administration

P

PC	Point of Curvature
pcf	Pounds per Cubic Foot
PCPHPL	Passenger Cars Per Hour Per Lane
Ped	Pedestrian
Ph	Phase
POI	Point of Intersection
psf	Pounds per Square Foot
psi	Pounds per Square Inch
PT	Point of Tangent
PUC	Public Utilities Commission
PVC	Polyvinyl Chloride

R

R	Radius
Req'd	Required
RRFB	Rectangular Rapid Flashing Beacon
RSFS	Radar Speed Feedback Sign

S

SAE	Society of Automotive Engineers
SC	Spiral to Curve
SF	Safety Factor
SHT	Sheet
sq	Square
sq ft	Square Feet
ST	Spiral to Tangent
Std	Standard

T

TC	Tension Control (Bolts)
TCP	Traffic Control Plan
TEL	Toll Express Lane
Temp	Temporary
THWN	Thermoplastic High Water-Resistant Nylon Coated (Insulation designation for wire)
TM	Technical Memorandum
TMA	Truck-Mounted Attenuator
TYP	Typical

U

UL	UL Solutions formerly Underwriters Laboratories, a Nationally Recognized Testing Laboratory
UNO	Unless Noted Otherwise
UGR	Under Ground Rated
UV	Ultraviolet

V

V	Volts
VA	Volt-Ampere
VAC	Volts Alternating Current
VHB	Very High Bond
VMS	Variable Message Sign
VSL	Variable Speed Limit

W

W	Watt
WP	Work Point
WT	Weight

X

XHHW	Cross-Linked Polyethylene (XLPE), High Heat-Resistant, Water Resistant (Insulation designation for wire)
XS	Extra Strong (Pipe)

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Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
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Acronyms and Abbreviations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-600-02
Standard Sheet No. 2 of 2
Project Sheet Number:

SPACING FOR DELINEATOR POSTS ON HORIZONTAL CURVES

'R' RADIUS (FEET)	'D' DEGREE OF CURVE	✳ SPACING● ON CURVE (FEET)	✳ SPACING IN ADVANCE OF AND BEYOND CURVE (FEET)		
			FIRST SPACE	SECOND SPACE	THIRD SPACE
20000	0° 17'	300	300	300	300
17000	0° 20'	300	300	300	300
14000	0° 25'	300	300	300	300
12000	0° 29'	300	300	300	300
10000	0° 34'	299	300	300	300
8000	0° 43'	267	300	300	300
6000	0° 57'	231	300	300	300
5000	1° 09'	211	300	300	300
4000	1° 26'	189	300	300	300
3500	1° 38'	176	300	300	300
3000	1° 55'	163	300	300	300
2500	2° 18'	148	297	300	300
2000	2° 52'	132	265	300	300
1800	3° 11'	125	251	300	300
1600	3° 35'	118	236	300	300
1400	4° 06'	110	220	300	300
1200	4° 47'	102	203	300	300
1000	5° 44'	92	185	277	300
900	6° 22'	87	175	262	300
800	7° 10'	82	164	246	300
700	8° 11'	76	153	229	300
600	9° 33'	70	141	211	300
500	11° 28'	64	127	191	300
450	12° 44'	60	120	180	300
400	14° 20'	56	112	168	300
350	16° 22'	52	104	156	300
300	19° 06'	47	95	142	285
250	22° 55'	42	85	127	255
200	28° 39'	37	73	110	220
150	38° 12'	30	60	90	180
100	57° 18'	21	42	64	127
75	76° 24'	20	30	45	90

✳ On conventional roadways omit the "Third Space" and double the spacing "On the Curve" and "In Advance of and Beyond the Curve" (300' Max).

● Spacing for curves not shown may be computed from the formula:

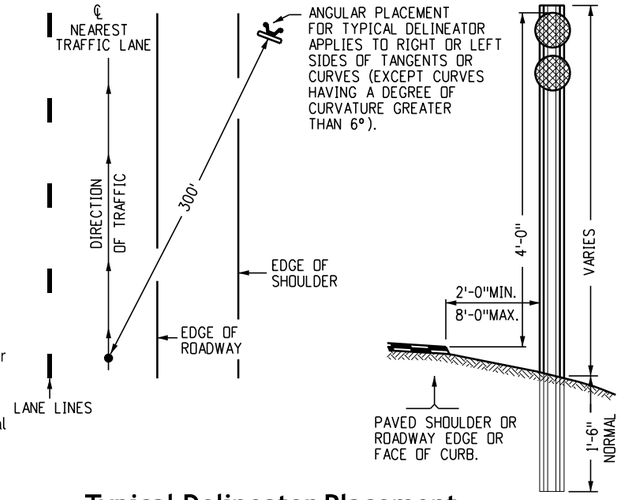
$S = 3\sqrt{R-50}$

Spacing in advance of and beyond the curve is; First Space = 2S, Second Space = 3S and Third Space =3S. Spaces should not be less than 20 feet or greater than 300 feet.

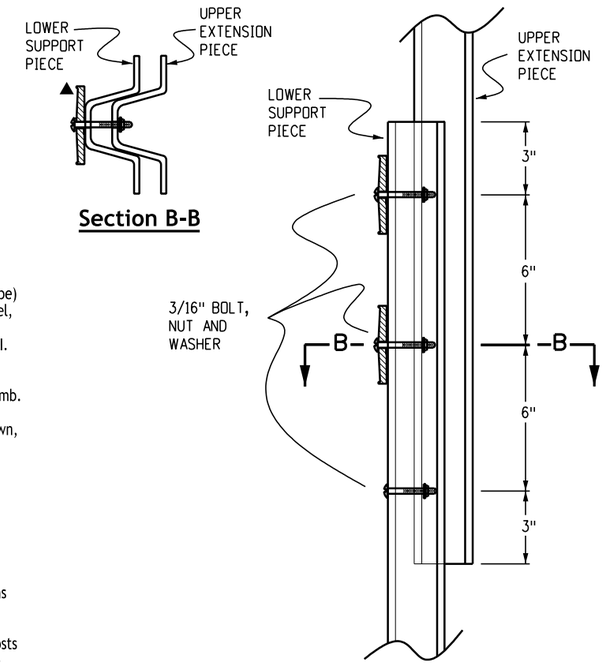
Residual space after "On Curve" spacing is applied, shall be divided equally among all of the "On Curve" spaces so that the last delineator falls at the P.T. or C.S of the curve.

General Notes

1. See the tabulation of quantities included in the plans for the numbers and locations of delineators required.
2. The color of delineator reflectors shall, in all cases, conform to the color of edge lines, except:
   a. Red, green, and blue delineators.
   b. Type III delineators (3 Yellow).
3. The color of delineator posts and all special mounting brackets shall be interstate green.
4. Delineators are mandatory on all roadways on the state highway system. They are optional where fixed source lighting is in operation; however, all concrete barriers and Type 3 guardrail shall have reflectors or supplemental tabs.
5. Type I (Yellow) delineators are mandatory on the left side of expressway roadways (median).
6. Red delineators may be installed on the reverse side of any delineator and/or a separate post on one-way roadways or ramps where investigation shows a need for wrong-way movement protection.
7. Type III (3-Yellow) delineators are to be installed to warn of the existence of objects not actually in the roadway but that may be so close to the edge of the roadway that they need a marker. These include underpass piers, bridge abutments, handrails, and culvert heads. The inside edge of the marker shall be in line with the inner edge of the obstruction.
8. Interchange ramps shall be delineated on the right side, the left side, or both sides with Type I delineators of the appropriate color (crystal or yellow) as illustrated on Sheet Number 3.
9. Frontage road delineators are not to be installed where they might be misleading to mainline traffic.
10. Spacing of delineators for tunnels and snow sheds shall be as shown on the plans.
11. Where practicable, the approach ends of islands and medians should be delineated.
12. Typical installation locations for all Type I delineators on tangent sections shall be on 1/10th-mile intervals in relation to the highway mile markers. A 200-foot minimum will apply to the "last space" exiting a horizontal curve, and the following delineator shall be installed on the next 1/10th-mile location (maximum spacing is also 528 feet). At all other locations, such as A & D lanes, ramps, width transitions, and turn lanes, a "last space" should not be less than 50% of the spacing shown for that location.
13. Type II delineators shall be installed at 100-foot spacing on all acceleration lanes and tapers, deceleration lanes and tapers, and lane transitions involving pavement width reductions in the direction of traffic. Type II delineators are not required for redirect tapers, for traffic moving in the direction of wider pavement, or on the side of the roadway where the alignment is not affected by the lane reduction. Type II (Yellow) delineators shall only be used when a raised or depressed median is present. For width transitions where traffic moves in the direction of wider pavement, the normal spacing shall be adjusted so there is a delineator at each of the angle points of the width transition.
14. Type I delineators shall be installed at 100-foot spacing on interchange ramp tangent sections and by the spacing table on ramp curves. Spacing "in advance of and beyond curve" does not apply to ramp curves.
15. For spacing on a curve that follows a tangent section with spaces shorter than those shown in the curve spacing table: modify the table so that the curve spacing is no greater than the tangent spacing.
16. Where guardrail intrudes into the space between the pavement edge and the line of delineators, place the delineators immediately above or behind the rail face; delineator spacing shall remain the same behind the rail face.
17. When normal spacing falls on an intersecting roadway, driveway, etc., the delineator may be moved in either direction to a distance not exceeding one-quarter of the normal spacing.
18. The angular placement for all delineators should be by the "traffic orienting" method: aim the face of the delineator at the centerline of the nearest lane of approaching traffic at a point 300 feet away (or as directed by the engineer for special locations and curves having a degree of curvature greater than 6 degrees).
19. Type III (Yellow-Blue-Yellow) delineators are to be installed to warn of the existence of an asphalt curb installed below guardrail. The delineator shall be placed in line with the asphalt curb.
20. If farming or other oversize loads actively utilize sections of any two-lane state highway, the delineator posts shall be staggered no less than one-tenth of a mile. Flexible delineators or other engineering solutions shall be considered under the discretion of the engineer. Delineator posts shall not be staggered where it is deemed unsafe by the engineer (e.g., curves).



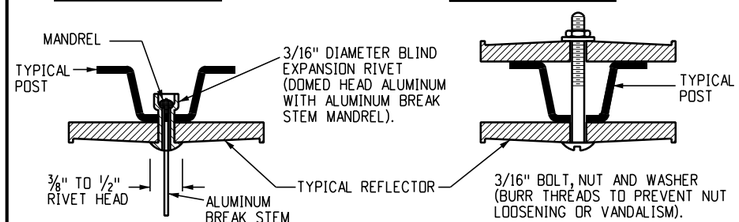
Typical Delineator Placement



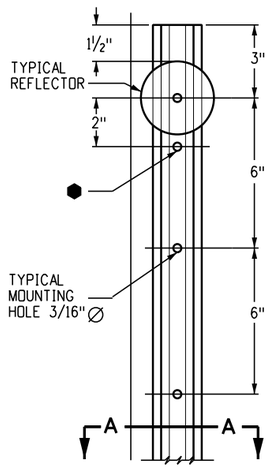
Typical Double Height Installation

Typical Installation Single Direction

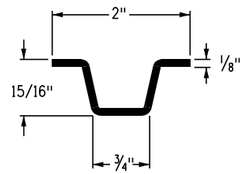
Typical Installation Back - to - Back



Typical Delineator Fabrication Details



Typical 1.12# Delineator Post



Section A-A

Allowable Tolerance Dimension:

1" and Up	± 1/8"
1/2" to 1"	± 1/16"
1/2" and Below	± 1/32"

Weight:

Minus 3 1/2% of the weight of any one post.

Post Notes

1. Posts shall be a uniform flanged channel section (U-Shape) made from hot rolled structural steel, re-rolled rail steel, or new billet steel, having a minimum yield strength of 30,000 PSI and a minimum tensile strength of 50,000 PSI.
2. Posts shall be set in drilled or excavated holes, placed plumb and firmly tamped in place;or may be driven plumb.
3. A minimum of 3 holes of 3/16" diameter, spaced as shown, are required for all delineator posts.

⬢ An additional hole is required when the adjustable reflector bracket is used.

Double Height Posts

4. The lower section of the 2-post combinations shall be installed according to the same placement specifications as a typical single post installation.

▲ 5. Reflectors shall be mounted at the connection of the posts and at the top of the upper post in accordance with the appropriate configuration for the application.

6. The length of the upper extension piece shall not exceed 7 feet.

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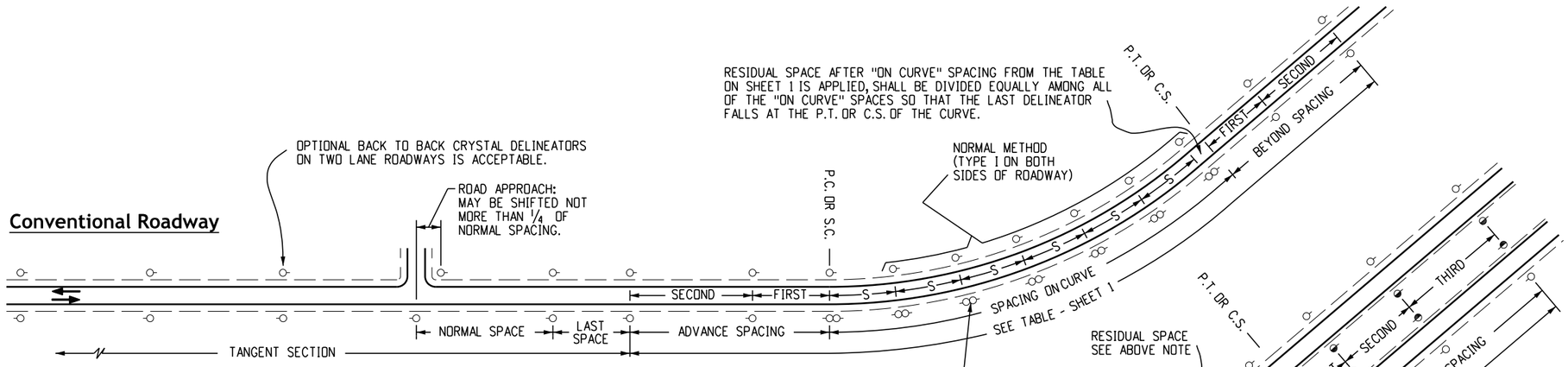
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Delineator Installations

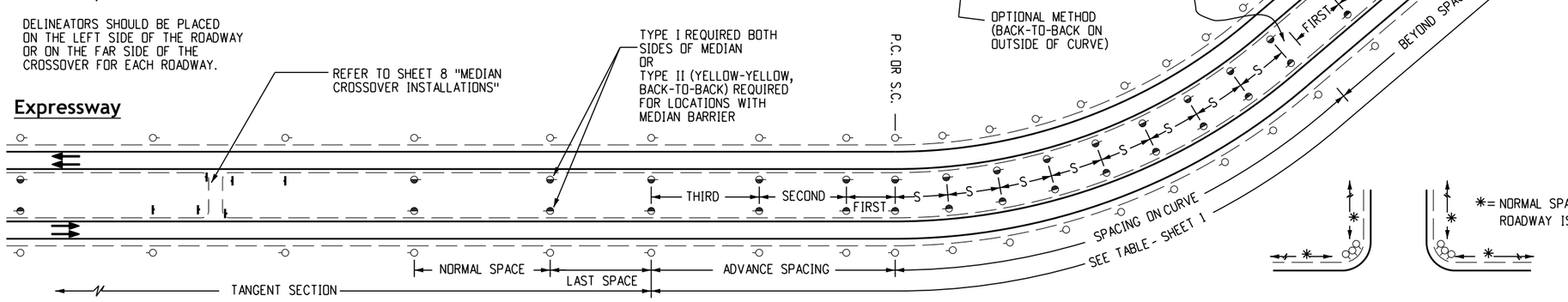
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Standard Plan No.
S-612-1
Standard Sheet No. 1 of 8
Project Sheet Number:

Conventional Roadway

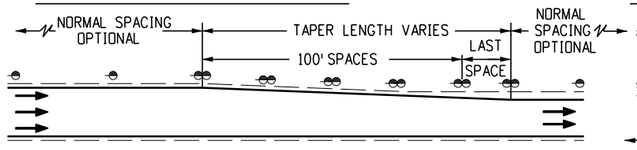


Expressway

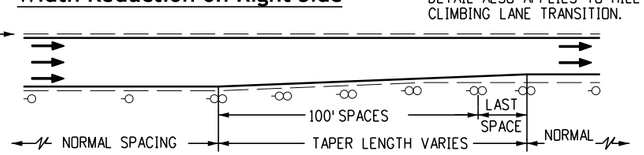


Typical Installation for Tangent Section and Curves

Width Reduction on Left Side

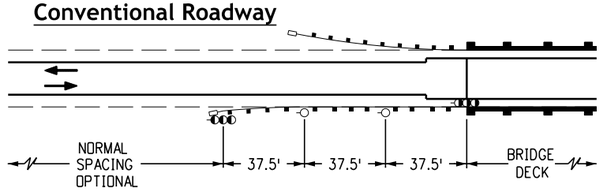


Width Reduction on Right Side

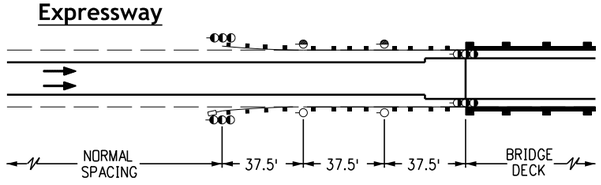


Typical Installation for Lane Transition

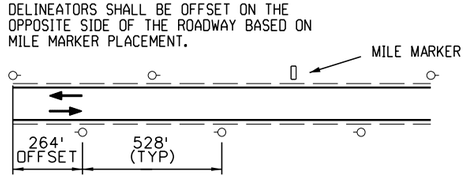
Conventional Roadway



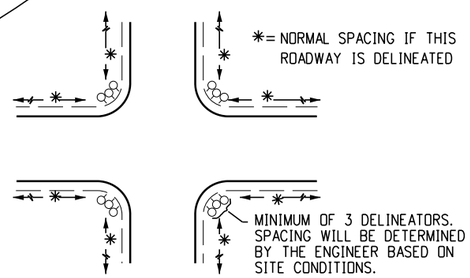
Expressway



Typical Installation for Bridge Approaches



Typical Installation Staggered Delineators, 2-Lane State Highway



Typical Installation for Minor Intersection

Delineator Symbols and Typical Configuration

- Type I (Crystal)
- Type I (Yellow)
- Type I (Red)
- Type I (Blue) (Maintenance Marker)
- Type I (Green) (Maintenance Marker)
- Type II (2 Crystal)
- Type II (2 Yellow)
- Type II (Crystal-Crystal 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 III (3 Yellow)
- Type III (2 Crystal-Red, Back-to-Back)
- Type III (2 Yellow-Red, Back-to-Back)
- Type III (Green) (Maintenance Marker)
- Type III (Blue) (Maintenance Marker)
- Median Crossover Delineator
- Type III (Yellow-Blue-Yellow)
- Bridge Joint Marker (OM1-U, OM1-D)

Bridge Approach Notes

1. Where the curb-to-curb width of a bridge is equal to or greater than the roadway width plus the usable shoulder width, use Type III delineators only and omit Type I delineators.
2. For guardrail installations where the approach end is not flared, place a Type III delineator (3 Green) immediately in advance of the approach end.
3. All Type I delineators are to be mounted above or immediately behind the guardrail and are not placed at a constant distance from the roadway.

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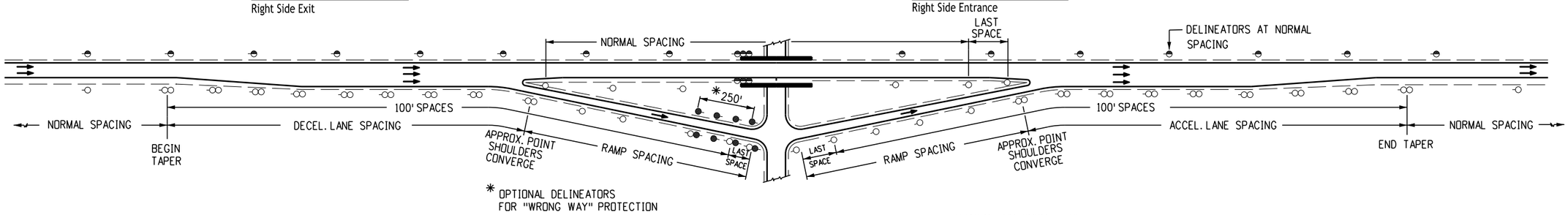
Delineator Installations

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Standard Plan No.
S-612-1
Standard Sheet No. 2 of 8
Project Sheet Number:

Decel. Lane & Ramp
Right Side Exit

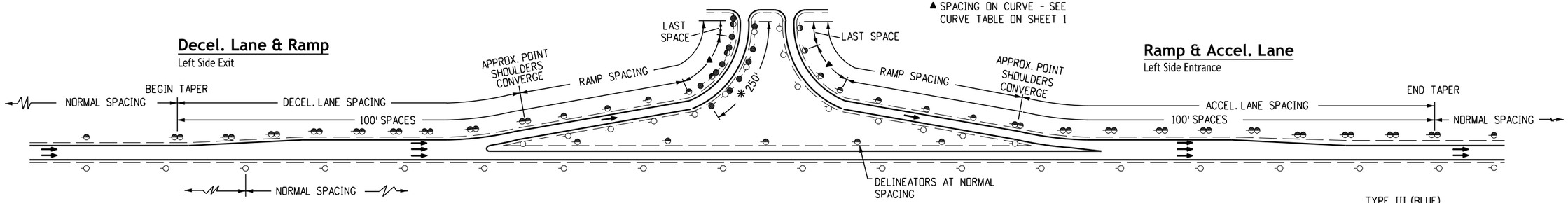
Ramp & Accel. Lane
Right Side Entrance



▲ SPACING ON CURVE - SEE CURVE TABLE ON SHEET 1

Decel. Lane & Ramp
Left Side Exit

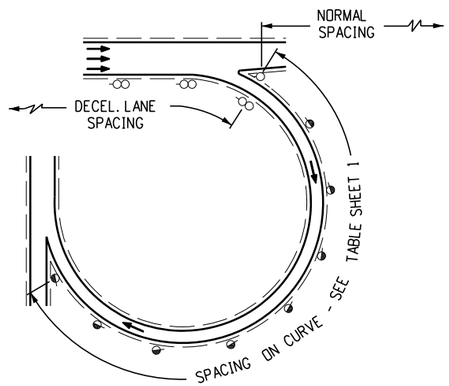
Ramp & Accel. Lane
Left Side Entrance



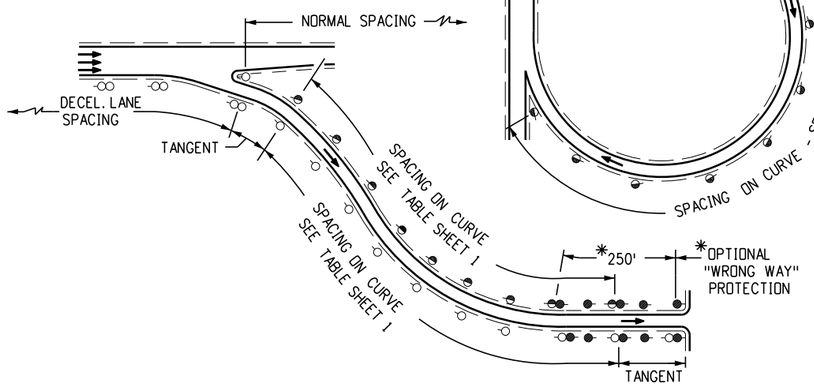
Typical Installation for Interchanges

Note
"Spacing in Advance of and Beyond The Curve" (1st., 2nd. & 3rd. Spaces) as shown in the spacing table on Sheet 1 shall not apply to ramp curves.

Cloverleaf Curve



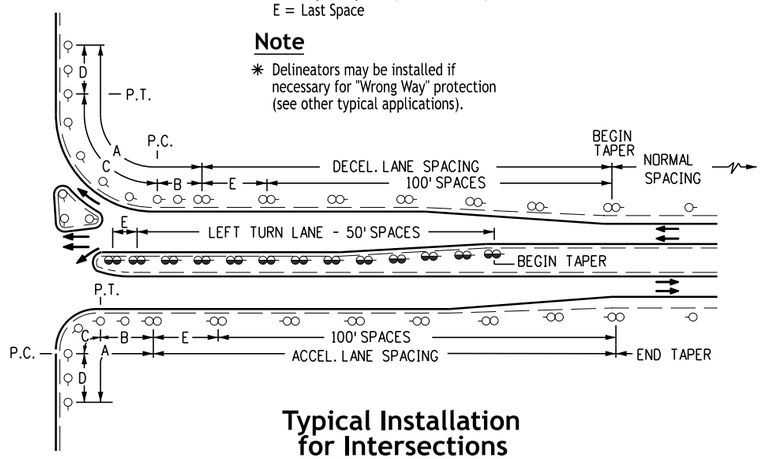
Curve & Reverse Curve



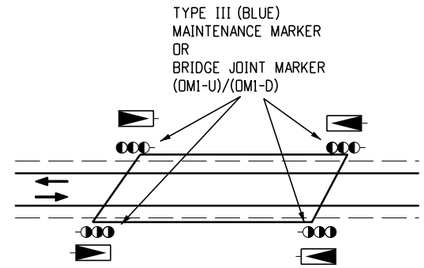
Typical Installation for Ramp Curves

Legend
A = See Curve Spacing Table
B = Advance Spaces (First & Second)
C = Spacing On Curve
D = Beyond Spaces (First & Second)
E = Last Space

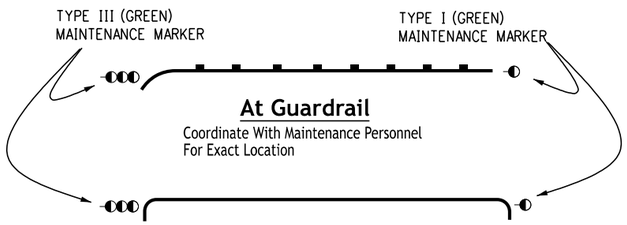
Note
* Delineators may be installed if necessary for "Wrong Way" protection (see other typical applications).



Typical Installation for Intersections
With Accel. & Decel. Lanes



At Bridge Joints



At Guardrail
Coordinate With Maintenance Personnel For Exact Location

At Curbs
When Deemed Necessary By Maintenance Superintendent

Maintenance Marker Locations for Obstructions

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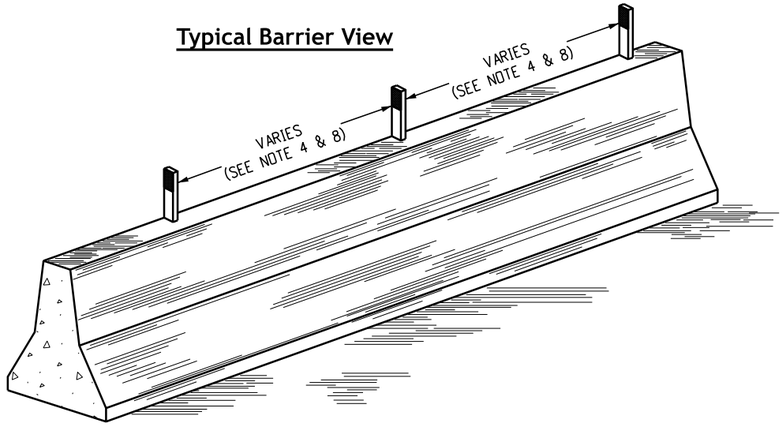
Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
EB

Delineator Installations

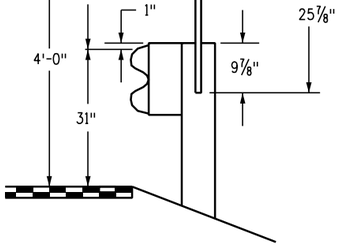
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Standard Plan No.
S-612-1
Standard Sheet No. 3 of 8
Project Sheet Number:

Typical Barrier View

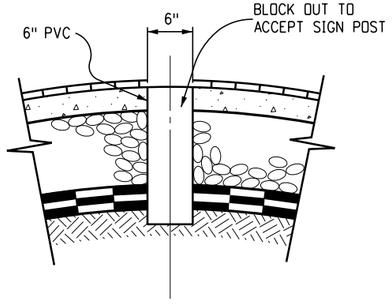


Typical Reflector Details for Concrete Barrier



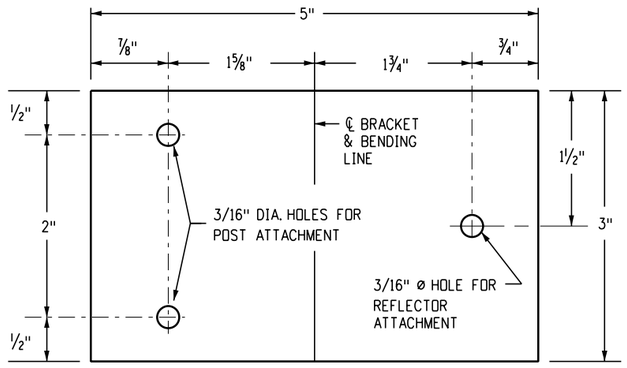
Typical Guardrail Post Mount Delineators

Post mount delineators shall be attached by a method approved by the Engineer or a method required by the device manufacturer.

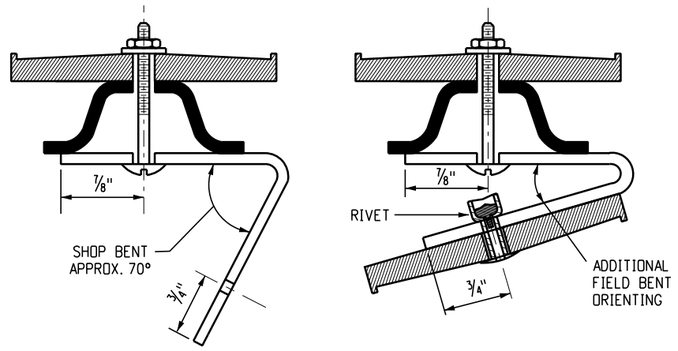


Typical Sleeve Installation for Median Delineator Posts

Plan View



Typical Adjustable Reflector Bracket

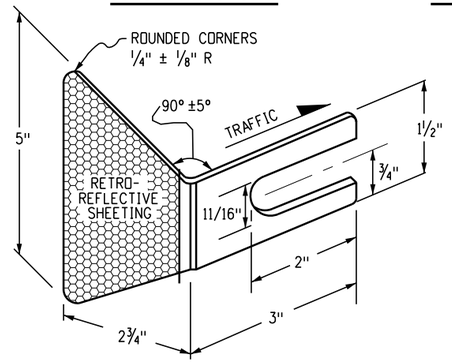


Typical Bracket Fabrication Details

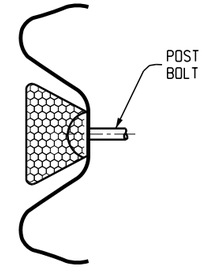
Bracket Notes

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 gage, 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 3/16 inch diameter and delineator posts require an additional hole 2 inches below the top hole provided in the post.
5. Shop bend the bracket approx. 70 degrees as shown, attach to the delineator post with 3/16 inch bolts and field bend as necessary to "Traffic Orient". Then the bracket reflector can be attached with a 3/16 inch blind expansion rivet or a bolt.
6. Burr the threads of all bolts to prevent nut loosening or vandalism.

Reflector Tab



Mounting Position On Guard Rail Type 3



Typical Guardrail Reflector Tab

See M-606-1 Standard Plan for reflector tab fabrication and placement details. Retroreflective sheeting shall conform to ASTM D4956 Type IV.

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). The 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 method of application shall be as recommended by the reflector manufacturer.
4. Barrier reflectors shall be installed to meet the minimum spacing requirements of standard typical delineator installations. A 200 foot maximum tangent and curve spacings apply to barrier reflectors, unless otherwise noted in the plans or directed by the Engineer.
5. Top mount reflectors are standard, side-mount 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, barrier reflectors shall be installed to meet the minimum spacing requirements of the standard typical delineator installations. The maximum spacing shall be 50 feet, and they will not be paid for, but are included in the work.

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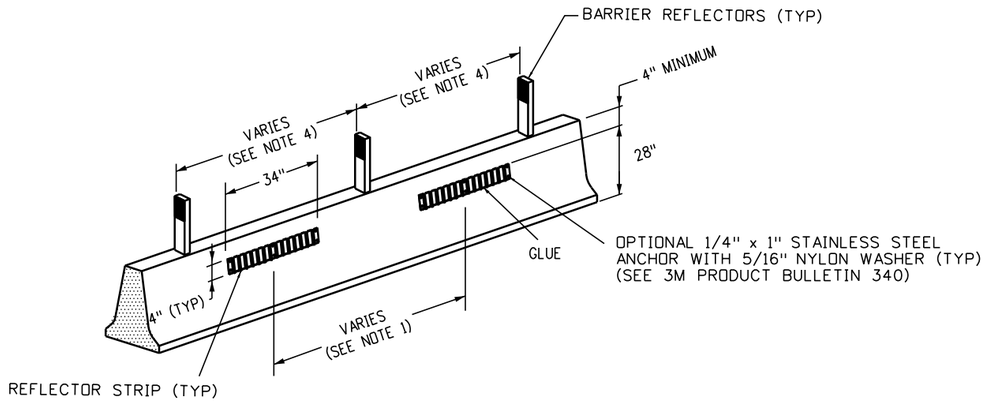
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Delineator Installations

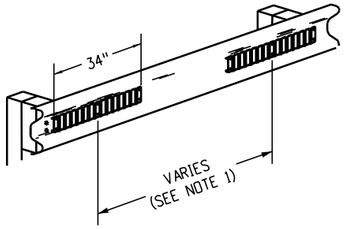
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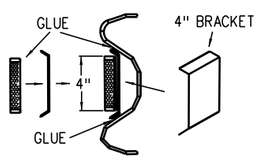
Standard Plan No.
S-612-1
Standard Sheet No. 4 of 8
Project Sheet Number:

Typical Installation Detail for Continuous Concrete Barrier



Typical Installation Detail For Guardrail Type 3





Attachment Details

Typical Reflector Strip Installation

1. Reflector 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 ensure 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 Windo-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 use 1/4" x 1" stainless steel anchor with 5/16 inch nylon washer, as specified in 3M Product Bulletin 340.
4. Barrier reflectors shall be installed to meet the minimum spacing requirements of standard typical delineator installations. A 200-foot maximum tangent and curve spacing applies to barrier reflectors along the top of the barrier, unless otherwise noted in the plans or directed by the Engineer.

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 type for the 4-inch reflector strip and another for the 6-inch reflector strip. The brackets must be matched to fit 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 strips 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 Windo-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 use 1/4 inch x 1 inch stainless steel anchor with 5/16 inch nylon washer, as specified in 3M Product Bulletin 340.
5. Installation requires the use of three brackets (minimum) per reflector strip corresponding to the pre-drilled reflector strip holes.

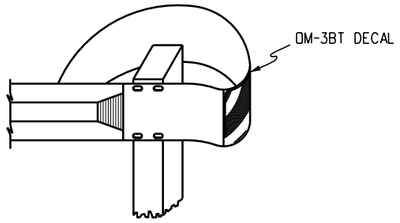
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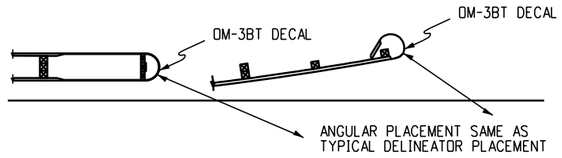
Delineator Installations

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Standard Plan No.
S-612-1
Standard Sheet No. 5 of 8
Project Sheet Number:

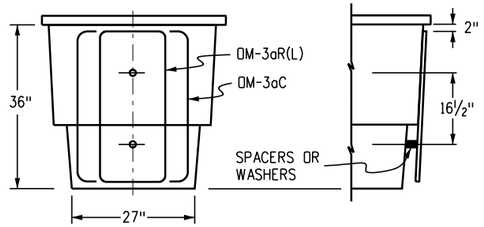


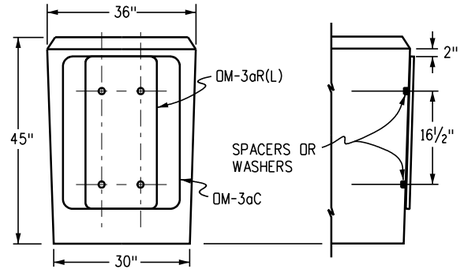
Side View



Top Views

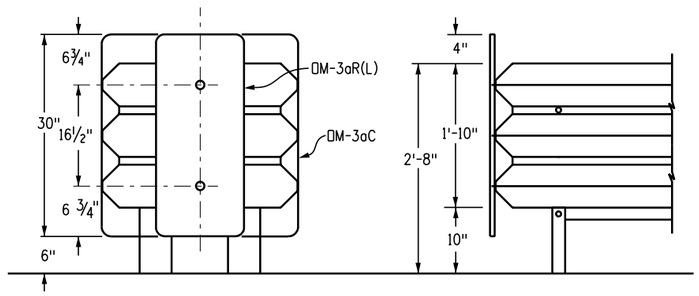
Buffer Terminals (BT)





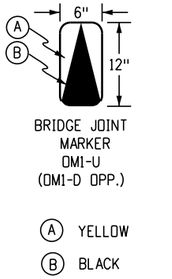
Front Views Side Views

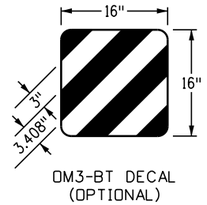
Impact Attenuator (Sand Filled)

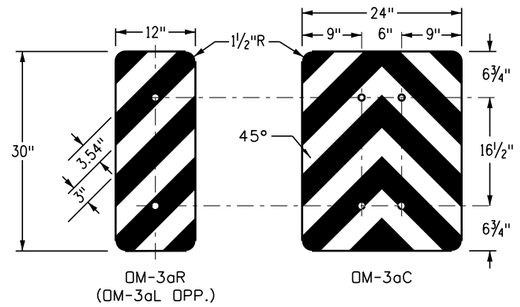


Front View Side View

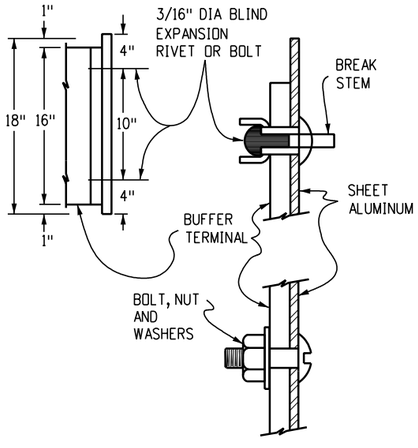
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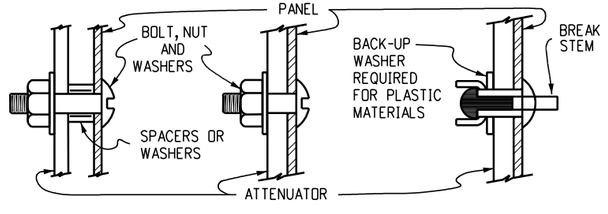




Supplemental Delineation Details



Buffer Panel Attachment Details



Attenuator Panel Attachment Details

Supplemental Panel Notes

1. All supplemental delineation panels shall be single sheet aluminum, 0.080" minimum thickness.
2. Panels shall be fastened directly to the impact attenuator with 2 or 4-3/16 inch diameter blind expansion rivets, or 2 or 4-3/16 inch bolts, nuts and washers.
3. Expansion rivets shall be domed head aluminum with aluminum break stem mandrel, and shall have a back-up washer when used with plastic materials.
4. Bolts, nuts and washers shall be galvanized or cadmium plated.
5. Spacers, or spacing washers shall be used as necessary for sand filled attenuators.
6. 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).
7. Retroreflective sheeting shall conform to ASTM D4956, Type IV. The sheeting shall be yellow for permanent installations. OM-3BT decal and OM-3AR(L)(C) panels shall have yellow 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.
8. 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.
9. Reference S-612-1 Sheet 7 of 8 for base detail.

Supplemental Delineation for Guard Rail
Buffer Terminals and Impact Attenuators

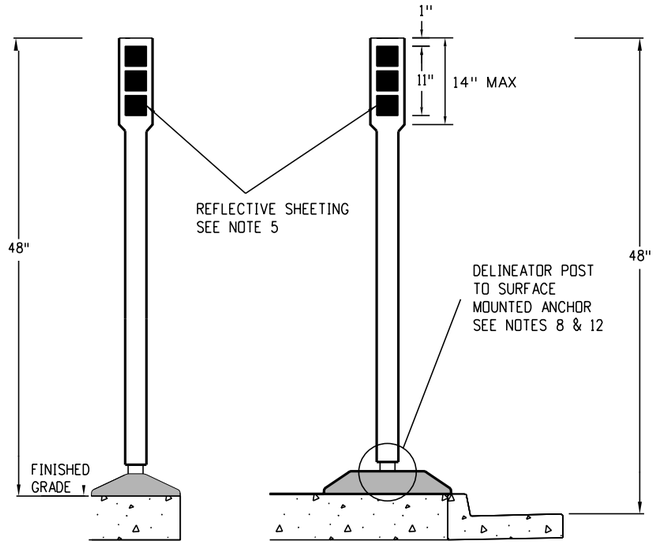
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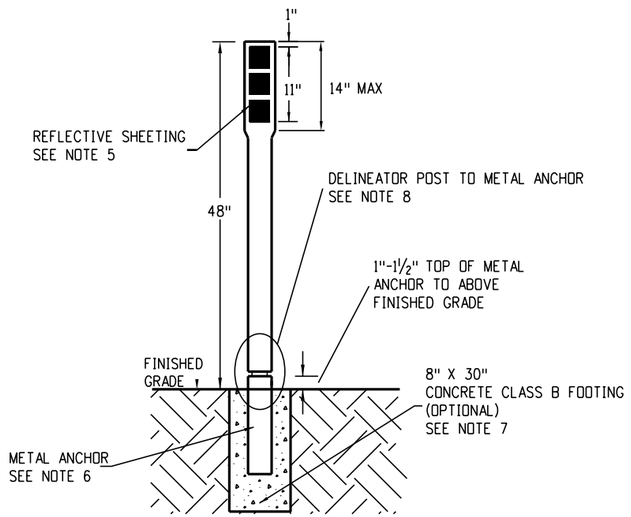
Delineator Installations

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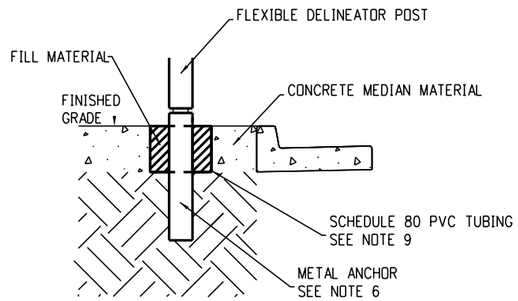
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S-612-1
Standard Sheet No. 6 of 8
Project Sheet Number:



Surface Mounted

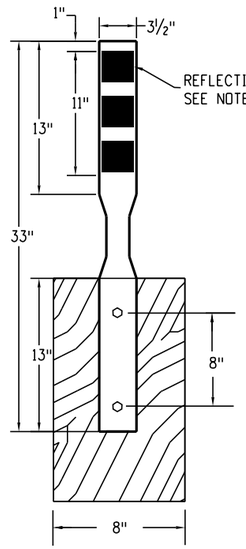


Typical Soil Conditions



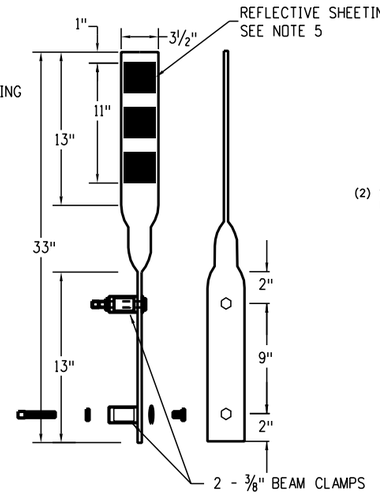
Concrete Median Material

Driveable Method



Post Mounted

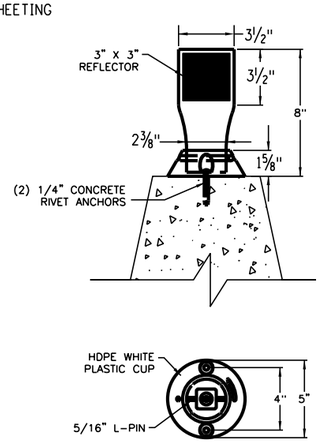
Guardrail



Front and Side View

Clamp Mounted

Cable Rail



Front and Top View

Cup Mounted

Concrete Barrier

Flexible Delineator Notes

1. Flexible delineator posts shall follow the requirements as outlined in CDOT's most recent version of the "Standard Specifications for Road and Bridge Construction". Flexible delineator posts shall be listed on CDOT's "Approved Products List" prior to installation.
2. The length of the flexible delineator post shall be installed to provide a height of 48 inches above the edge of pavement.
3. Flexible delineator posts shall be installed so that the reflective elements face oncoming traffic.
4. Reflective elements shall be pre-installed at the manufacturer's facility.
5. Reflective elements (sheeting) shall be Type IV or Type V. Reflective sheets shall be 3 inch squared. Reflective sheets shall be placed in a straight vertical column starting 1 inch from the top edge and separated by 1 inch vertically in the column. Sheeting quantity and color are dependent on the location of the delineator. See Sheet 2 of S-612-01 for typical configurations.
6. The metal anchor shall be 2 inch galvanized steel perforated square tubing measuring 24 inches in length and shall have an anchoring depth of 22 1/2 to 23 inches.
7. When a concrete base is required or as directed by the engineer, the metal anchor shall be encased in an 8 inch diameter by 30 inch depth concrete Class B footing. Concrete shall be included in the cost of the pay item.
8. The connection between the flexible delineator post and the metal anchor is product specific. all flexible delineator posts shall be installed per manufacturer's instructions.
9. Concrete median installations shall include a 4 inch diameter schedule 80, PVC tube. The tube length shall match the thickness of the concrete median material, be cut flush with the concrete, and be backfilled with soil.
10. "Drivable Method" is the preferred installation method for ground installations.
11. "Surface Mounted" installation shall only be installed during retrofit applications or as directed by the Engineer.
12. Surface mounted delineators should only be utilized for temporary configurations during construction. Surface mounted delineators may be utilized for curb and gutter applications; however, the "Drivable Method" is preferred. Surface mounted bases shall be attached to the surface via either bolt down or glue down methods.

Flexible Delineator Installations

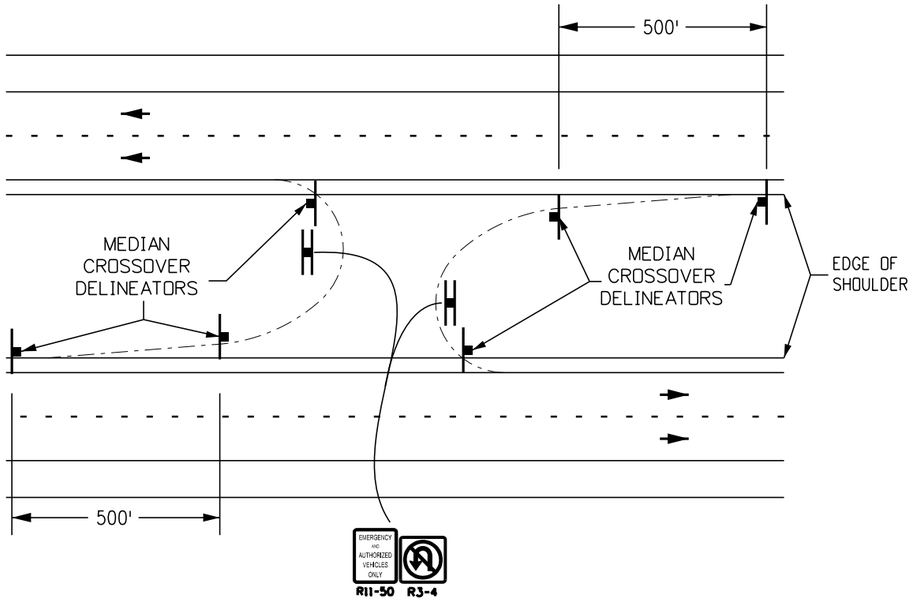
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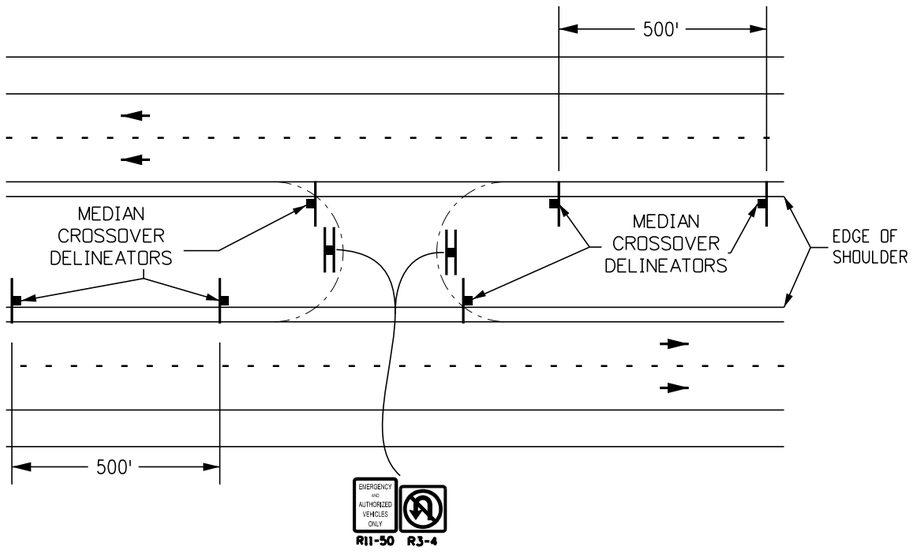
Delineator Installations

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Standard Plan No.
S-612-1
Standard Sheet No. 7 of 8
Project Sheet Number:



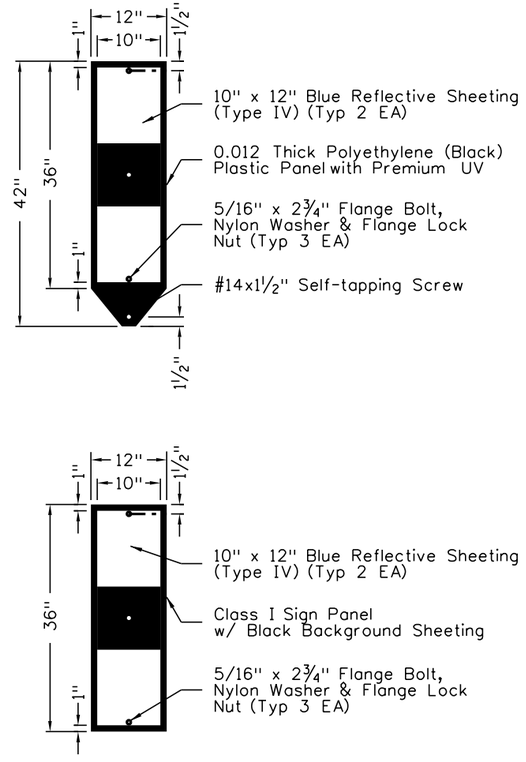
Median Width Greater Than 50 Feet



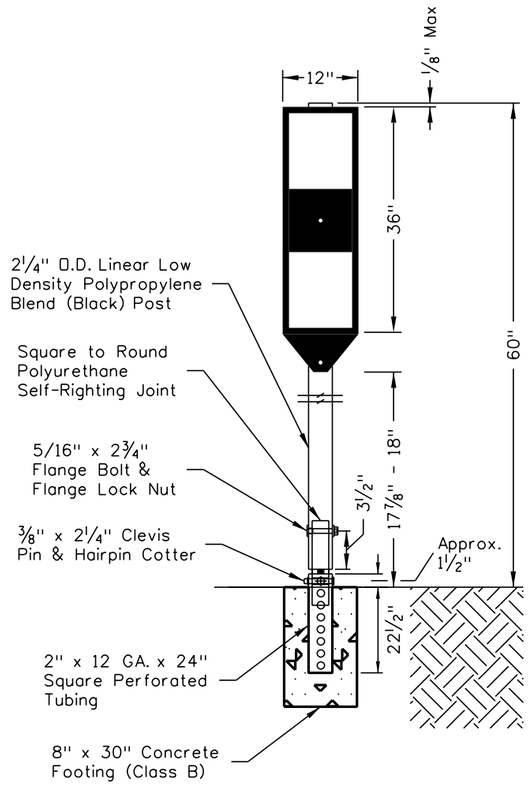
Median Width Less Than 50 Feet

Median Crossover Notes

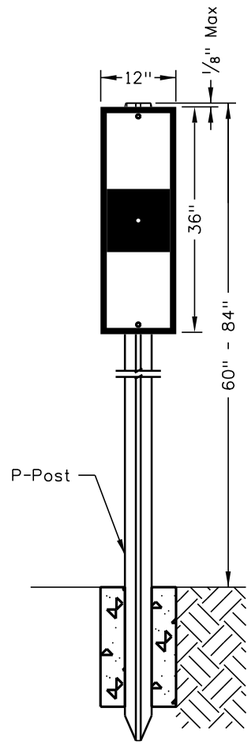
1. Mounting height to bottom of R11-50, "Emergency and Authorized Vehicles Only" sign, shall be 7 feet from the original ground.
2. See tubular steel sign support details (S-614-8) for concrete footing information for socket system installations and additional post installation requirements.
3. Place six (6) median crossover delineators, one 500 feet in advance of median crossover and one on each side of crossover as shown on the detail.
4. For visually constrained median crossovers, multiple sign panels (R3-4 and R11-50) may need to be placed within the crossover on separate posts, as directed by the Engineer.
5. The polyethylene plastic panel may be used on either polypropylene blend post and P-Post installations. In contrast, the Class I sign panel shall only be used on P-Post installations.



Median Crossover Delineators



Driveable (Preferred)



Socket System (Alternate)

Median Crossover Installations

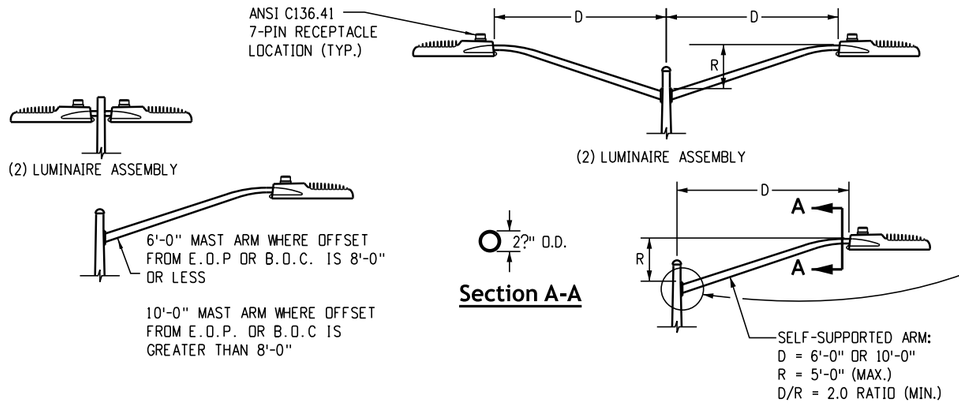
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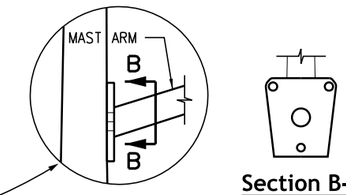
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Delineator Installations

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Standard Plan No.
S-612-1
Standard Sheet No. 8 of 8
Project Sheet Number:



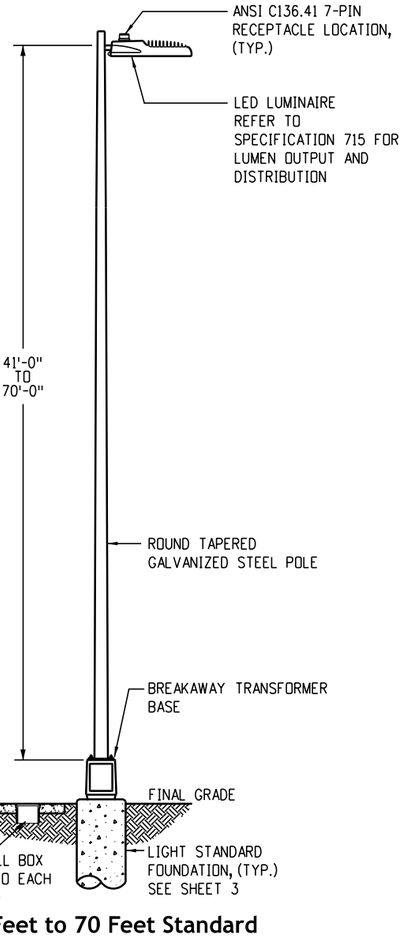


Section B-B

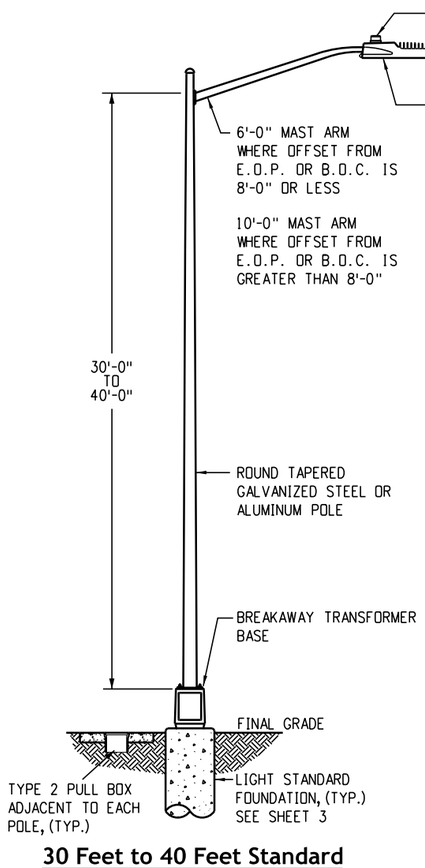
Section A-A

3-Bolt Mast Arm Mounting Plate

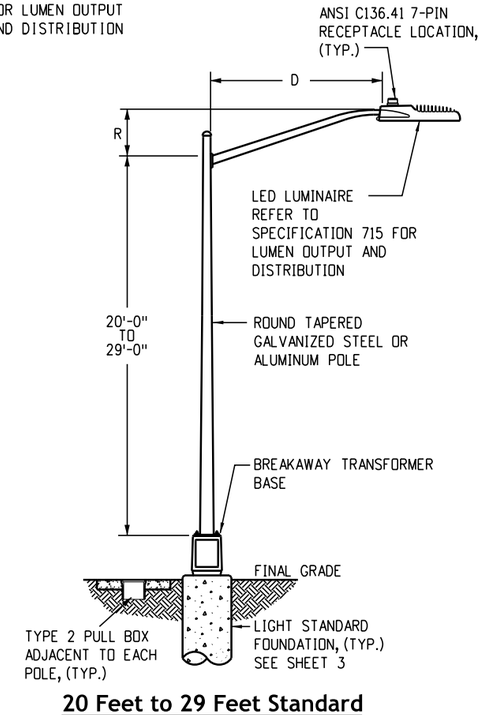
Arm plate shall meet applicable AASHTO requirements



41 Feet to 70 Feet Standard



30 Feet to 40 Feet Standard



20 Feet to 29 Feet Standard

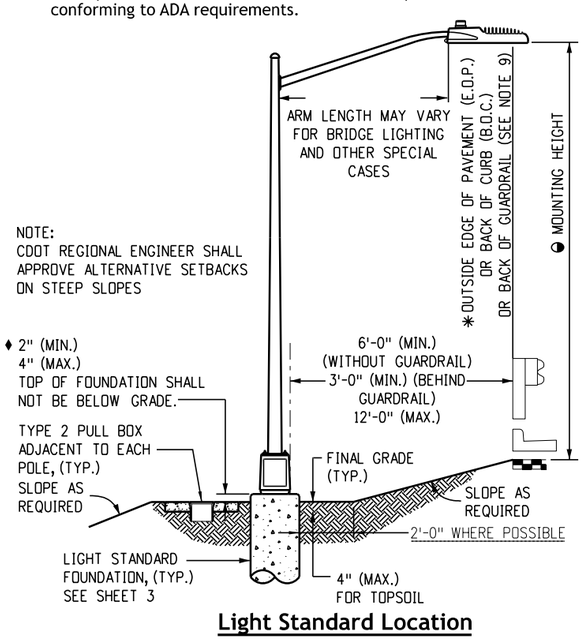
Luminaire and Light Standard Notes:

1. Luminaires with light sources rated more than 3200 lumens shall have no uplight (U0 rating) per IES TM-15-20 and mounted level and plumb.
2. All luminaires shall be equipped with an ANSI C136.41 7-pin receptacle and shorting cap for wireless control node.
3. All LED luminaires shall be 3000K nominal or less, per ANSI C78.377-2011 Standard and equipped with a surge suppression device with an immunity level of 10kV (minimum). All LED luminaires shall be equipped with a 0-10V or DALI dimming driver.
4. Light standards shall not be placed in ditches or other low areas unless an alternative location is not possible.
5. Backfill shall be compacted in accordance with Section 203.
6. Pole caps and base plate covers are required.
7. All electrical components shall be UL listed per the appropriate UL requirements. Including but not limited to 508A industrial control panels.
8. Electrical splices may be made within the pole base or transformer base at each region's discretion. The CDOT Project Manager shall confirm whether splice boxes shall be installed for the project or whether splices shall be made in the pole.
9. Guardrail placement shall be per M-606-1.

◒ Pole assembly shall be supplied in sufficient length to accommodate luminaire mounting height.

✳ Final location of the luminaires shall be approved by the Engineer.

♦ Where foundation is located in sidewalk, pavers or other hardscape, the top of foundation shall be flush with the top of the sidewalk conforming to ADA requirements.



Light Standard Location

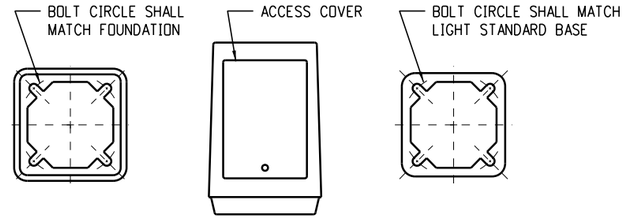
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Roadway Lighting

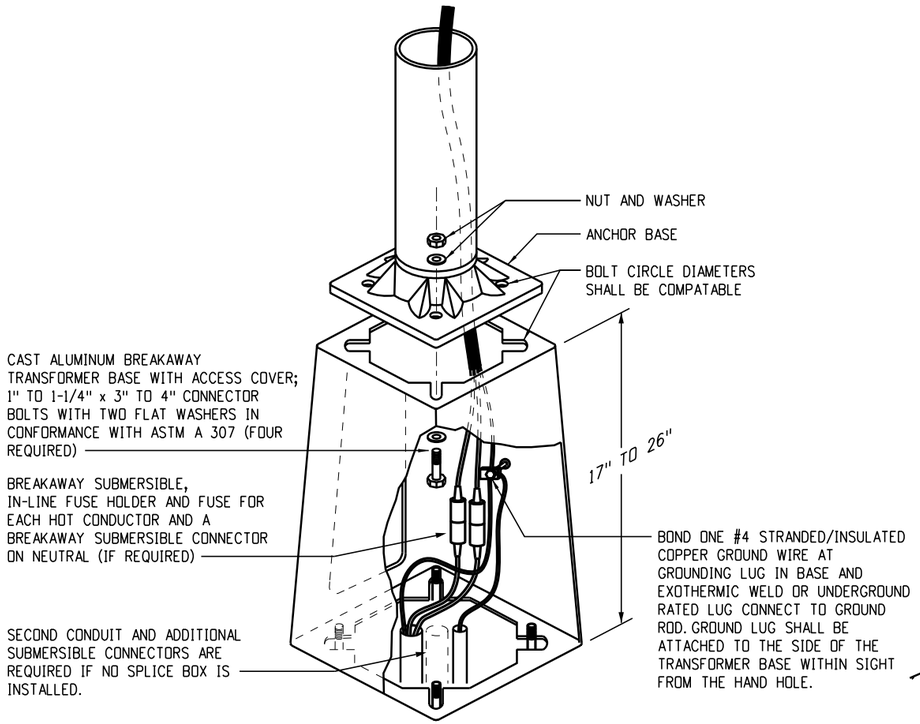
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Standard Plan No.
S-613-1
Standard Sheet No. 1 of 6
Project Sheet Number:



Bottom Plate **Front View** **Top Plate**

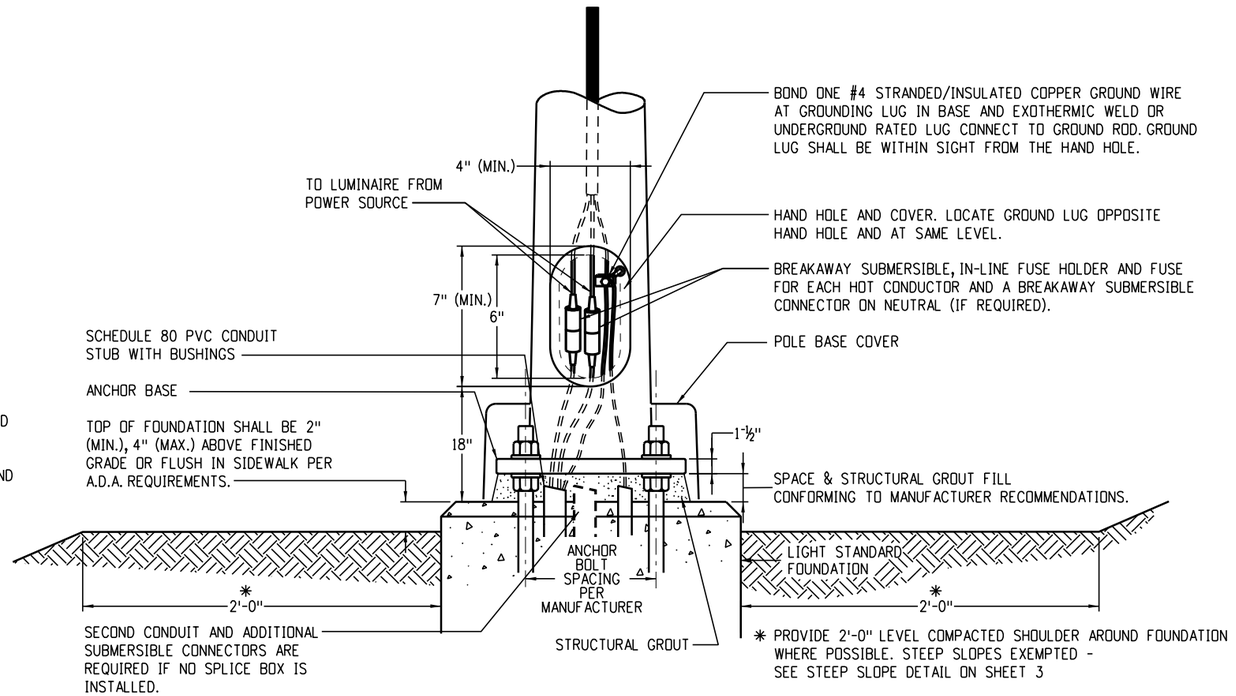
Note: match existing breakaway transformer base as closely as possible.



Typical Breakaway Type Transformer Base Detail

Detail Notes:

1. All breakaway transformer bases shall conform to AASHTO "LRFD 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. Breakaway bases should not be used when the light standard is located at least one and a half times (1.5x) mounting height away from pedestrian occupied areas. Refer to current Utility Accommodation Code Section 3.3.3 for clear zone requirements.
4. Breakaway bases shall not be used when the light standard is mounted on top of a median barrier. Poles without breakaway transformer bases must have hand hole.
5. All conductors shall be sized in conformance with N.E.C. requirements S.O.O.W. 12/3 stranded copper conductor or #12 AWG minimum color code black, white, green.
6. Light standards shall be grounded in accordance with N.E.C. Article 250 "Grounding and Bonding".
7. Lock washers, jam nuts, thread locker adhesive or other solutions as approved by the manufacturer are required to prevent nuts from loosening on the breakaway base.



Typical Non-Breakaway Base Detail

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Roadway Lighting

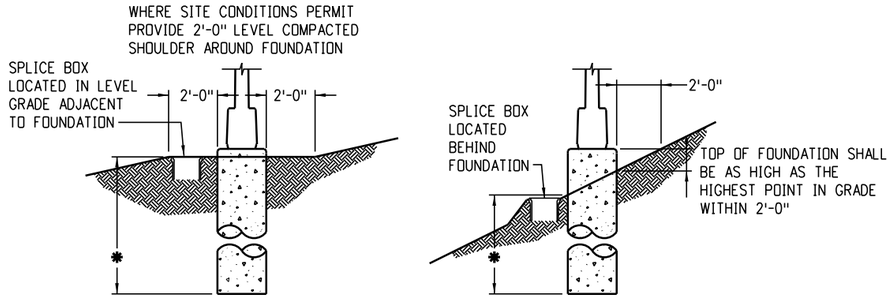
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Standard Plan No.

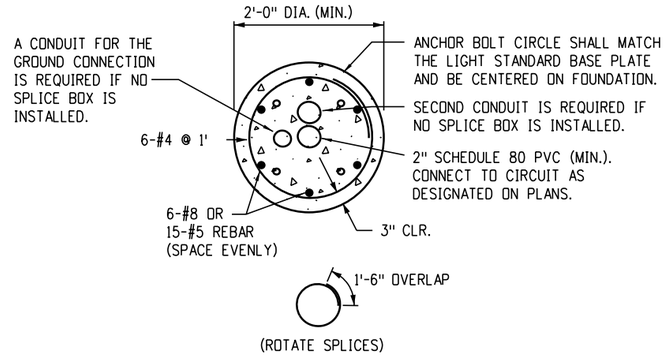
S-613-1

Standard Sheet No. 2 of 6

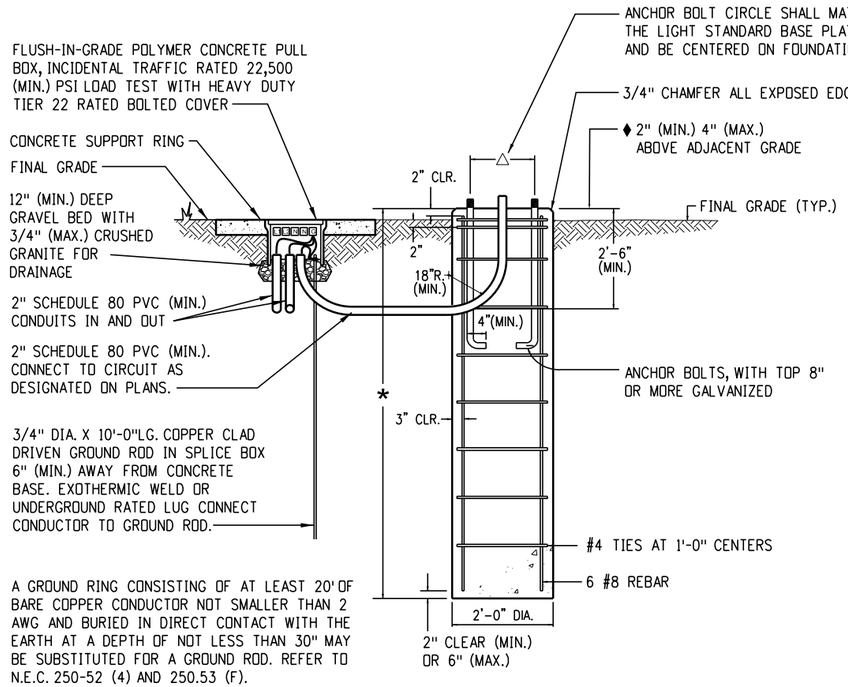
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Foundation Requirements for Steep Slopes



Typical Foundation Section



Typical Concrete Light Standard Foundation

Light standard foundation shall be cast-in-place concrete. A complete foundation includes the Class BZ concrete, reinforcing steel, PVC stub out(s), grounding electrode(s), anchor bolts and connector bolts (for breakaway type transformer bases).

Notes:

1. Dimensions for the transformer base, anchor base and anchor bolts are variable for the height of the light standard and the mast arm configuration. All components shall fit and accommodate the requirements of the light standard supplied.

♦ 2. Concrete shall be air entrained Class BZ and shall conform to Section 601 for concrete and Section 602 for reinforcing steel.

* 3. Where light standard foundation occur 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 A.D.A. requirements. Where exposed light standard foundation complies with A.D.A. requirements, foundation shall be installed 2 inches above hardscape with CDOT approval.

4. Bond (1) #4 stranded/insulated copper to ground rod in pull box / splice box and grounding lug in pole base hand hole.

5. Provide 4-terminal submersible underground rated lug connections to fit #12 AWG - #350 AWG copper wire. Electrical splices may be made within the pole base or transformer base at each regions discretion. Submersible underground rated lug connections are not required when splices are made in the pole.

6. All PVC conduit ends shall have end bells or male adaptor, threaded terminal ends with screw on bushing.

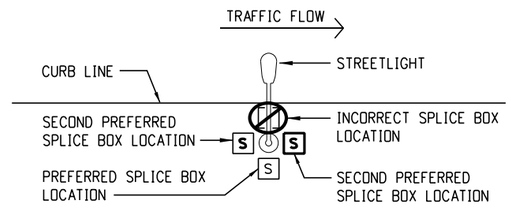
7. Foundation dimensions per foundation schedule below and as noted. Light standards higher than 50 feet or with banners, precast foundation, varying soil, or wind conditions shall be designed by a Structural Engineer licensed in the State of Colorado. For design wind speeds greater than v=155mph add an additional 1 foot to the foundation depth shown in the foundation schedule below.

Foundation Schedule

Pole Height	Foundation Depth	Foundation Diameter
< 20'	8'-0"	24"
20' - < 30'	9'-0"	24"
30' - 50'	12'-0"	24"
> 50'	P.S.E.	P.S.E.

P.S.E. (Per Structural Engineer)
Foundation design data:
Broms' method using AASHTO LFRD LTS 1st, 2015 with 2018 interims.

The design assumes following soil parameters:
Soil density = 110 lb/cf
Soil cohesion = 750 lb/sqft for medium stiff cohesive soil
Soil angle = 30° for medium dense cohesionless soil
Resistance factor = 0.4 for flexure.



Typical Street Light Splice Box Placement

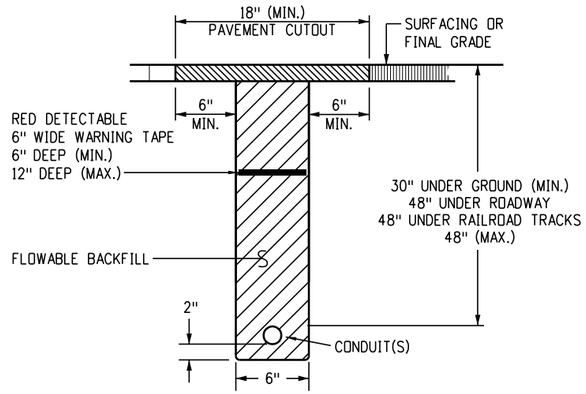
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Roadway Lighting

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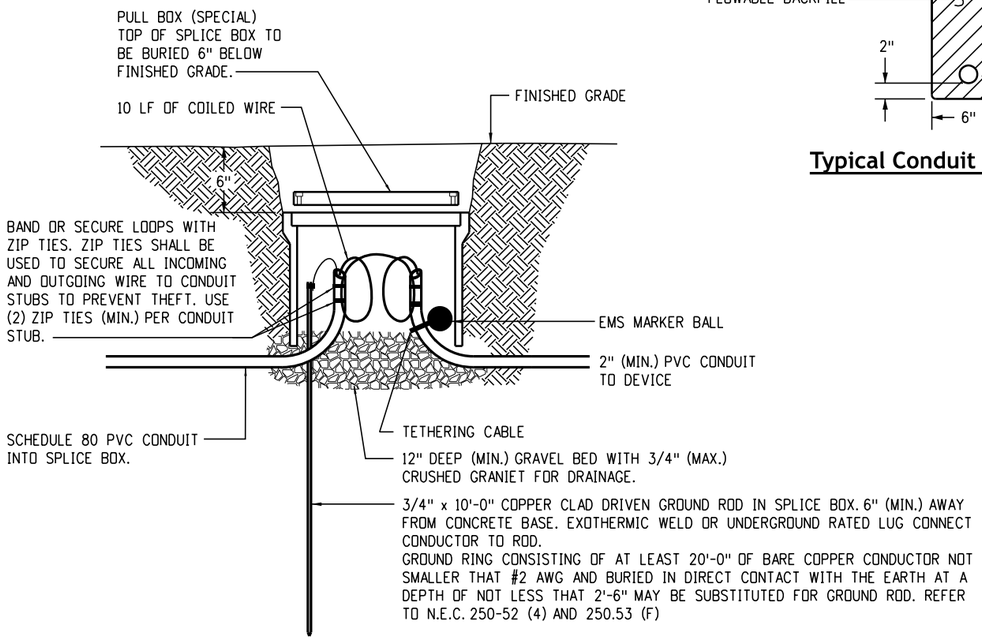
Standard Plan No.
S-613-1
Standard Sheet No. 3 of 6
Project Sheet Number:



Typical Conduit Burial - Section

Conduit Burial Notes

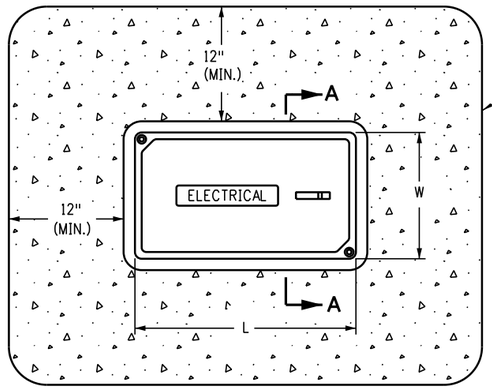
1. Contractor shall coordinate trenching with other underground utilities, ramp metering and irrigation. Contractor shall use common trenches at all road crossings where possible.
2. One conduit per bundle shall have one #12 AWG locate wire and a nylon or polyester pull tape with 1,250 pounds test strength and footage markings in all empty conduits. Locate wires shall not be installed in fiber optic conduits.
3. Electrical conduit (bored) shall be UL listed HDPE and installed using trenchless technology or either jacked conduit or directional boring. If trenched conduit is specified on plans, bored conduit of equal or greater size may be substituted for trenched conduit if paid for under the originally designed trenched conduit pay item and at no additional cost to the project. Electrical conduit (bored) shall conform to the same minimum depth requirements.
4. Installing conduit in any method other than trenching or directional bore, that may cause damage to the embankment or highway area, or be hazardous to the traveling public will not be permitted. When jacking is specified, disruption of highway traffic will not be permitted.
5. For all Schedule 80 PVC conduit, provide slip fit expansion fittings at 100 foot intervals and 6 feet (maximum) from each elbow. Expansion fittings will be installed per N.E.C. requirements for 65 degree Fahrenheit temperature change.
6. For all trenched conduit, elbows shall be wide sweeps (36 inches minimum) with PVC coated GRC on the outside and threaded couplings.
7. All PCV conduit ends in pull boxes shall have end bells or male adaptor, threaded terminal ends with screw on bushing.



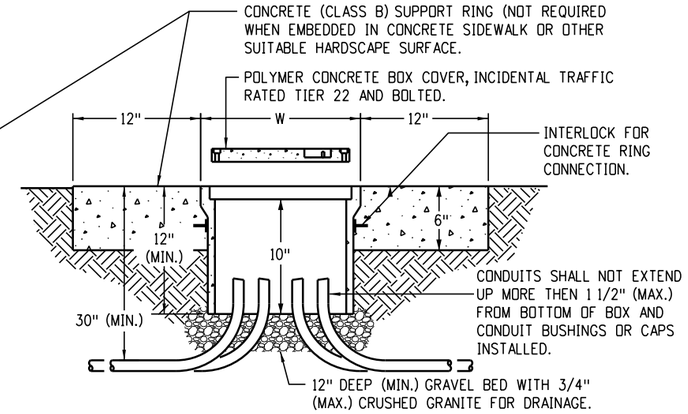
Buried Splice Box with EMS Marker Ball

Buried Splice Box Notes

1. All pull boxes shall be incidental traffic rated 22,500 psi load test (minimum) with heavy duty Tier 22 rated covers.
2. All pull boxes shall be Type 2. 13 inches x 24 inches x 12 inches deep (minimum) unless noted otherwise on plans. Refer to N.E.C. Section 314.28A for box size requirements. Refer to CDOT Standard Plan No. S-613-3 for typical pull box sizes.
3. All pull boxes shall be buried 6 inches below final grade and covered with embankment and topsoil. Buried pull boxes shall not be covered with concrete, asphalt, rock or any other hardscaping. Concrete support ring is not required for these special buried anti-theft pull boxes.
4. Connect copper ground wire to helical foundation.
5. Buried splice boxes shall only be used where approved by CDOT Engineer.
6. The wire terminations in pull boxes shall be made using UGR, submersible insulated pedestal lug connections. Provide one multi-lug connector for each phase, neutral and ground conductor to be spliced in the in-grade pull box.



Plan View



Section A-A

Typical Pull or Splice Box

Splice Box Notes

1. Box covers must be polymer concrete with fiberglass reinforcement, incidental traffic rated to Tier 22 and bolted with an HS load rating of 22,500 psi (minimum).
2. Box covers shall be labeled as follows:
   "ELECTRIC" or "STREET LIGHTING" on all pull boxes containing CDOT owned electrical service.
   "UTILITY ELECTRIC" on all pull boxes containing utility owned electrical service.
   Labeling must be cast into the cover and not as a separate independent tag.
3. Refer to CDOT Standard Plan No. S-613-3 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. Refer to CDOT Specification 601 for cast-in-place concrete specification.
5. The wire terminations in pull boxes shall be made using UGR, submersible insulated pedestal lug connections. Provide one multi-lug connector for each phase, neutral and ground conductor to be spliced in the in-grade pull box.

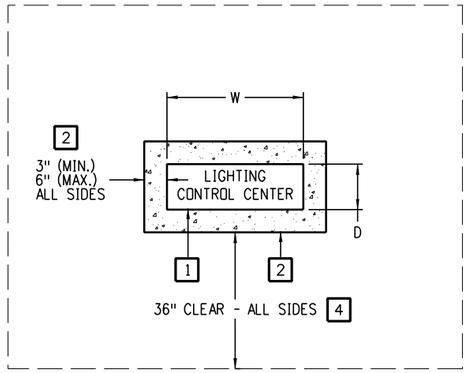
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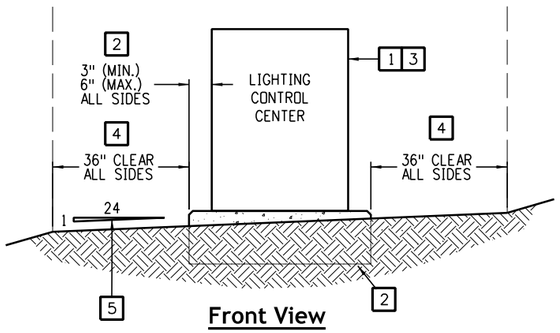
Roadway Lighting

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Standard Plan No.
S-613-1
Standard Sheet No. 4 of 6
Project Sheet Number:



Plan View

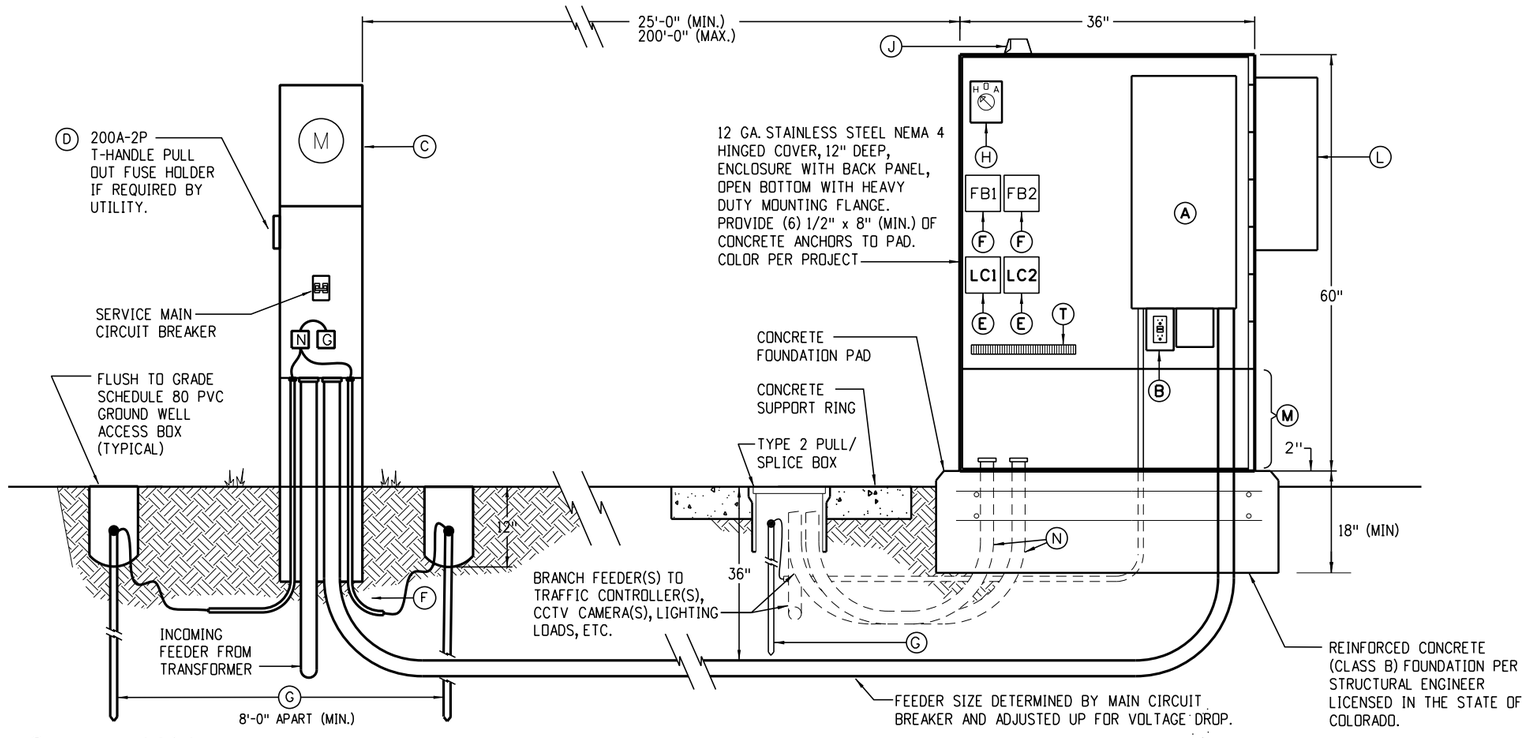


Front View

Lighting Control Center Placement

Detail Notes

1. Prebuilt NEMA 3R lighting control center cabinet (LCC). Refer to lighting control center details for more information.
2. Reinforced concrete (Class B) foundation pad, per Structural Engineer licensed in the State of Colorado, with 1 inch chamfer on all exposed edges. Edge of concrete to extend 3 inches (minimum) or 6 inches (maximum) beyond edge of cabinet.
3. The LCC shall not be located in any intersection sight triangles. Placement shall conform to allowable encroachments in the public row.
4. 36 inch clear zone (minimum) on all sides of concrete pad when located in softscape. 48 inches of clear zone (minimum) on all sides of concrete pad when located within the sidewalk.
5. 1:24 slope (maximum) in clear zone area.



Component List

- (A) NEMA 1, service entrance rated, single phase load centers. (See panel schedule for quantity and size of main and branch breakers). Mounted inside NEMA 4 enclosure.
- (B) GFCI maintenance receptacle in a 1-gang back box with cover.
- (C) 200A, 1 ph., NEMA 3R, direct bury meter pedestal service entrance rated with lever bypass to utility company specifications. Provide service MCB size as indicated on one-line diagram with neutral & ground bars.
- (D) 200A, 2 pole, 250V, heavy duty, NEMA 3R, T-handle pull-out meter disconnect, UL listed for service equipment and type and size fuses as shown on one-line diagram. May be omitted by utility company specifications hot sequence requirements.
- ✱ (E) 4 pole, 30A, 250V electrically held lighting contactors with 120V coils. Two (2) required.
- ✱ (F) 4 pole, 30A, fuse blocks with 30A, FRNR fuses to the lighting contactors as required by UL 508A (2001 Standard for Industrial Control Panels). Two (2) required.
- (G) 3/4 inch x 10 feet long, copper-clad driven ground rod with ground conductor exothermic weld or underground rated lug connect ground conductor to ground rod. Provide schedule 80 PVC ground wells.
- ✱ (H) H.O.A. switch - hand-off-auto with 15A 120V contacts, back box, cover, knob & legend and the photocell control wired in the auto position.
- ✱ (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 or window facing north or down to minimize the sun's interference.
- (L) Optional cabinet HVAC per Engineering request. Paint to match NEMA 4 enclosure.
- (M) Optional 18 inch high skirt per Engineer request.
- (N) Branch raceways - provide branch circuit raceway to all lighting fed from this LCC. See plan and feeder schedule for size and quantity.
- (T) Terminal strip - 600V rated, lugs to accept #1 - 10 AWG copper with all marking strip, end caps and mounting hardware. Provide the number of terminal points as required, minimum of 36 points.

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.

✱ Only required for loads not controlled by local nodes.

Recommended Cabinet Type Lighting Control Center Detail

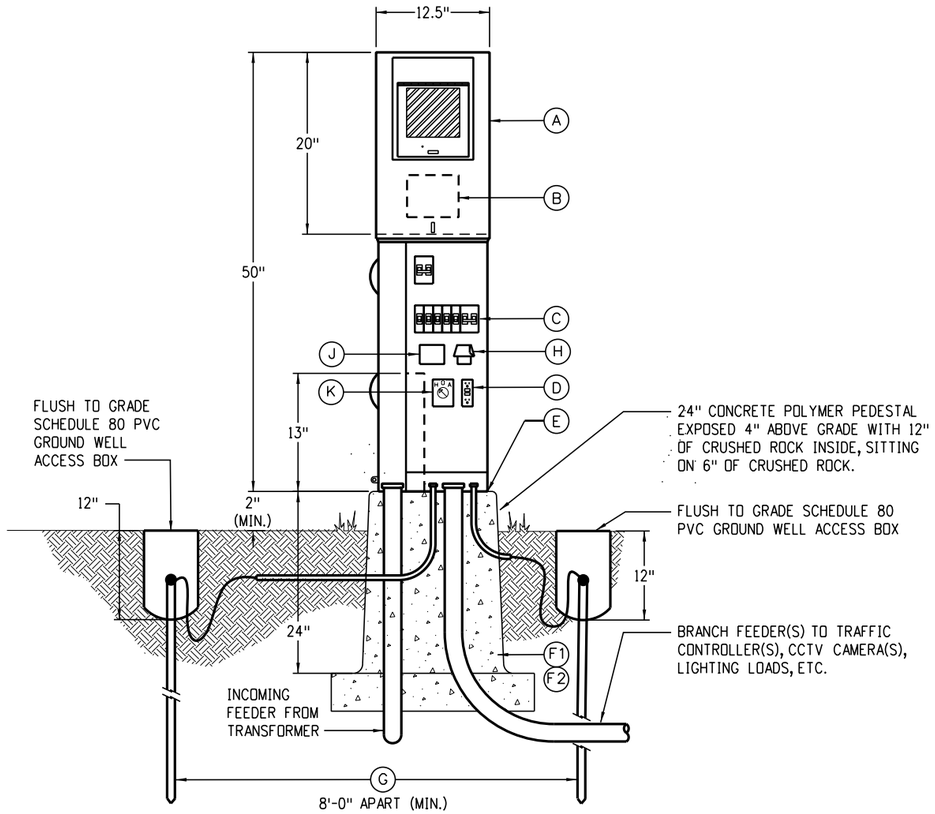
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Roadway Lighting

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Standard Plan No.
S-613-1
Standard Sheet No. 5 of 6
Project Sheet Number:



Lighting Control Center (Pedestal Only) Detail

Component List

(A) Stainless steel, 200A, 120/240V, NEMA 3R combination, service entrance rated, cold sequence, meter/power pedestal with 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) T-handle, pull-out fuse type meter, disconnect flush mounted into the back side of the enclosure for meter protection per utility specification, cold sequence meter with weatherproof cover and 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.

(F1) 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 stenciled on the sidewall of the foundation.

(F2) Option 2: Provide 4500 psi, re-bar reinforced, concrete with a direct earth bury depth of 18 inches (minimum), 2 inches overlap of the enclosure on all sides front and back and 2 inches exposure above grade. Provide 3/4 inch chamfered edges. Provide Structural Engineering stamped drawing for pad.

(G) 3/4 inch x 10 feet long, copper-clad driven ground rods. Exothermic weld or underground lug connect conductor to rod. Two (2) ground rods required. Ground rod to be located in Schedule 80 PVC ground well access with bolt down cover and "ground" cast into lid.

(H) Optional photocell - NEMA 3R 120V photoelectric control with 3-prong twist-lock receptacle base. The photocell shall be mounted inside the enclosure with a glass lens covered hole in the exterior of the enclosure to allow the photocell to receive daylight.

(J) Optional lighting contactor - controlled by optional photocell item 'H' above when more than one circuit is to be controlled by the photocell.

(K) Optional hand-off-auto switch when items 'H' and 'J' above are used. Provide this HOA switch with the photocell control wired in the auto position.

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.

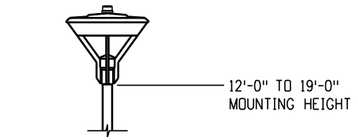
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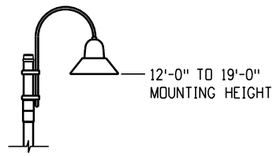
Roadway Lighting

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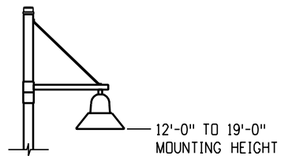
Standard Plan No.
S-613-1
Standard Sheet No. 6 of 6
Project Sheet Number:



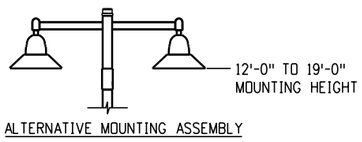
ALTERNATIVE MOUNTING ASSEMBLY



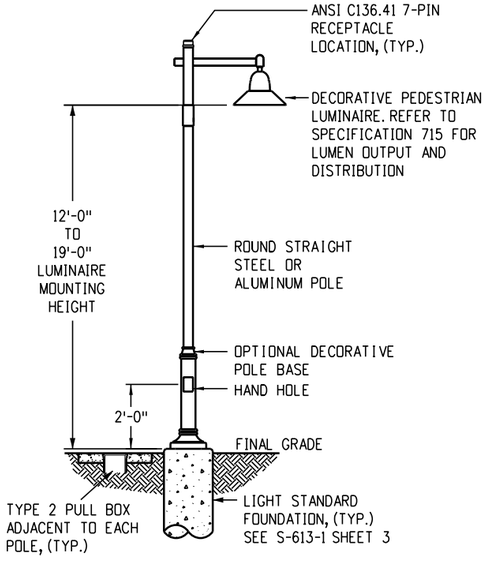
ALTERNATIVE MOUNTING ASSEMBLY



ALTERNATIVE MOUNTING ASSEMBLY



ALTERNATIVE MOUNTING ASSEMBLY



12 Feet to 19 Feet Standard

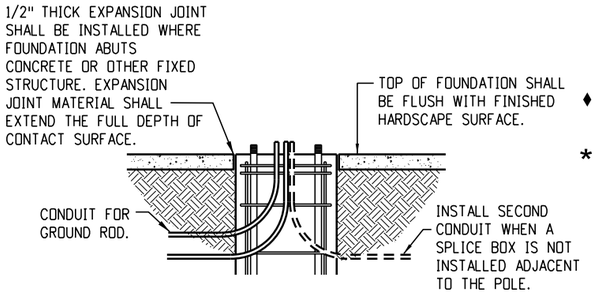
Luminaire and Light Standard Notes:

1. Luminaires with light sources rated more than 3200 lumens shall have no uplight (U0 rating) per IES TM-15-20 and mounted level and plumb.
2. All luminaires shall be equipped with an ANSI C136.41 7-pin receptacle and shorting cap for wireless control node.
3. All led luminaires shall be 3000K nominal or less, per ANSI C78.377-2011 standard and equipped with a surge suppression device with an immunity level of 10kV (minimum). All LED luminaires shall be equipped with a 0-10V or DALI dimming driver.
4. Light standards shall not be placed in ditches or other low areas unless an alternative location is not possible.
5. Backfill shall be compacted in accordance with Section 203.
6. Pole caps and base plate covers (or optional nut covers) are required.
7. All electrical components shall be UL listed per the appropriate UL requirements. Including but not limited to 508A industrial control panels.
8. Electrical splices may be made within the pole base or transformer base at each regions discretion. The CDOT Project Manager shall confirm whether splice boxes shall be installed for the project or whether splices shall be made in the pole.

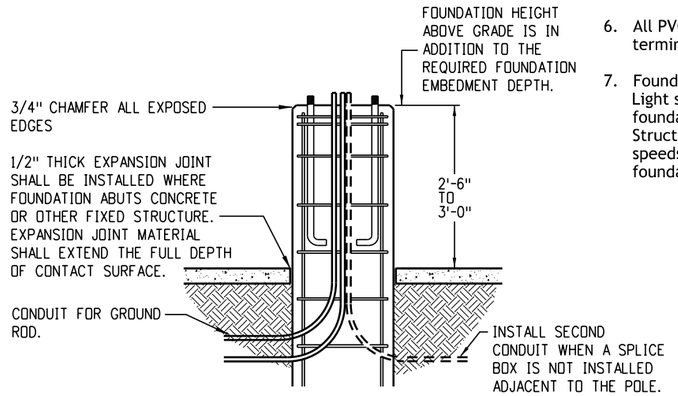
◒ Pole assembly shall be supplied in sufficient length to accommodate luminaire mounting height.

✳ Final location of the luminaires shall be approved by the Engineer.

♦ Where foundation is located in sidewalk, pavers or other hardscape, the top of foundation shall be flush with the top of the sidewalk conforming to ADA requirements.



***Light Standard Foundation in Hardscape**



Light Standard Foundation in Parking Lot

Where light standard foundations occur in or around parking areas and are located less than 2 feet behind curb, or where unprotected by curbs, the foundation should be extended a minimum of 2 feet 6 inches vertically, in addition to foundation depth listed in the foundation schedule, to protect the light standard from damage and/or knock-down due to vehicle contact.

Light Standard Foundation Notes:

1. Dimensions for the transformer base, anchor base and anchor bolts are variable for the height of the light standard and the mast arm configuration. All components shall fit and accommodate the requirements of the light standard supplied.

♦ 2. Concrete shall be air entrained Class BZ and shall conform to Section 601 for concrete and Section 602 for reinforcing steel.

* 3. Where light standard foundation occur 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 A.D.A. requirements. Where exposed light standard foundation complies with A.D.A. requirements, foundation shall be installed 2 inches above hardscape with CDOT approval.

4. Bond (1) #4 stranded/insulated copper to ground rod in pull box / splice box and grounding lug in pole base hand hole.
5. Provide 4-terminal submersible underground rated lug connections to fit #12 AWG - #350 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 and as noted. Light standards higher than 50 feet or with banners, precast foundation, varying soil, or wind conditions shall be designed by a Structural Engineer licensed in the State of Colorado. For design wind speeds greater than v=155mph add an additional 1 foot to the foundation depth shown in the foundation schedule below.

Foundation Schedule

Pole Height	Foundation Depth	Foundation Diameter
< 20'	8'-0"	24"
20' - < 30'	9'-0"	24"
30' - 50'	12'-0"	24"
> 50'	P.S.E.	P.S.E.

P.S.E. (Per Structural Engineer)
Foundation design data:
Broms' method using AASHTO LFRD LTS 1st, 2015 with 2018 interims.

The design assumes following soil parameters:
Soil density = 110 lb/cf
Soil cohesion = 750 lb/sqft for medium stiff cohesive soil
Soil angle = 30° for medium dense cohesionless soil
Resistance factor = 0.4 for flexure.

Parking Lot and Decorative Lighting Standards

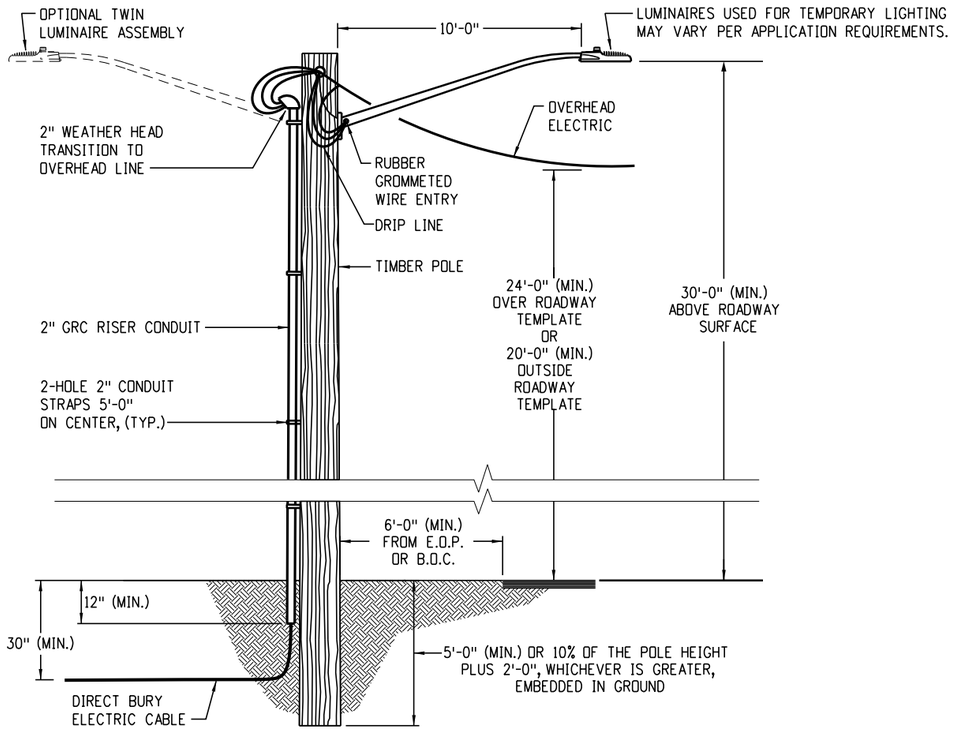
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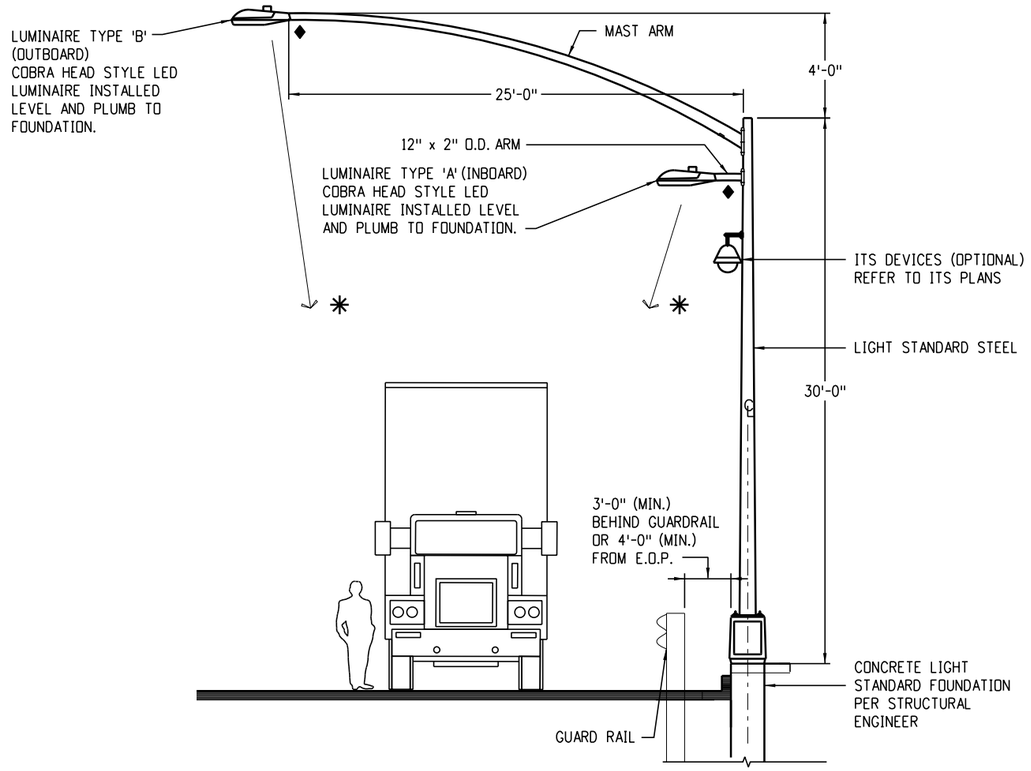
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Alternative Roadway Lighting

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-613-2
Standard Sheet No. 1 of 4
Project Sheet Number:





Temporary Lighting Notes

1. The contractor shall provide installation, maintenance, and removal of all temporary lighting equipment, luminaires, conduit, and power sources.

2. Temporary light standard shall be protected. Protection shall meet the recommendations of the AASHTO Roadway Design Guide.
   Speed limit less then 40mph:
   - located 6 feet (minimum) from the front face of curb.
   - mounted on barrier.
   - located behind barrier or appropriate impact attenuator.

   Speed limits of 40mph or greater:
   - 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 standards and luminaires should be located along traffic detour routes with the luminaires positioned over the edge of the travel lane.

6. Overhead electrical conductors supplying power to the luminaires shall maintain 24 feet (minimum) clearance over the roadway template and 20 feet (minimum) outside the roadway template. Overhead electrical shall not be mounted on breakaway poles.

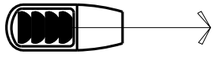
7. The power for temporary lighting shall be metered. All utility bills for temporary lighting shall be paid for by the contractor.

8. Temporary lighting system shall be paid for on a lump sum basis which includes the luminaire, arm, light standard and all necessary electrical for a complete and operational lighting system.

Chain Station Lighting 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 a minimum of 120 feet apart. Parking lane shall be determined by striping and verified by Field Engineer.

2. Light standard shall be a minimum of 4 feet behind edge of pavement when installed on a breakaway base and not installed behind guardrail.



✳ Luminaire optics oriented away from mainline

Type 'B' (Outboard)



✳ Luminaire optics oriented toward mainline

Type 'A' (Inboard)

◆ Provide luminaire with horizontal slip fitter for use with 2 inches outer diameter pipe tenon.

✳ Luminaire optics shall be aimed towards truck.

Light Standard Timber (Temporary)

Light Standard Metal (30 Feet) (2 Arm) (Spec)

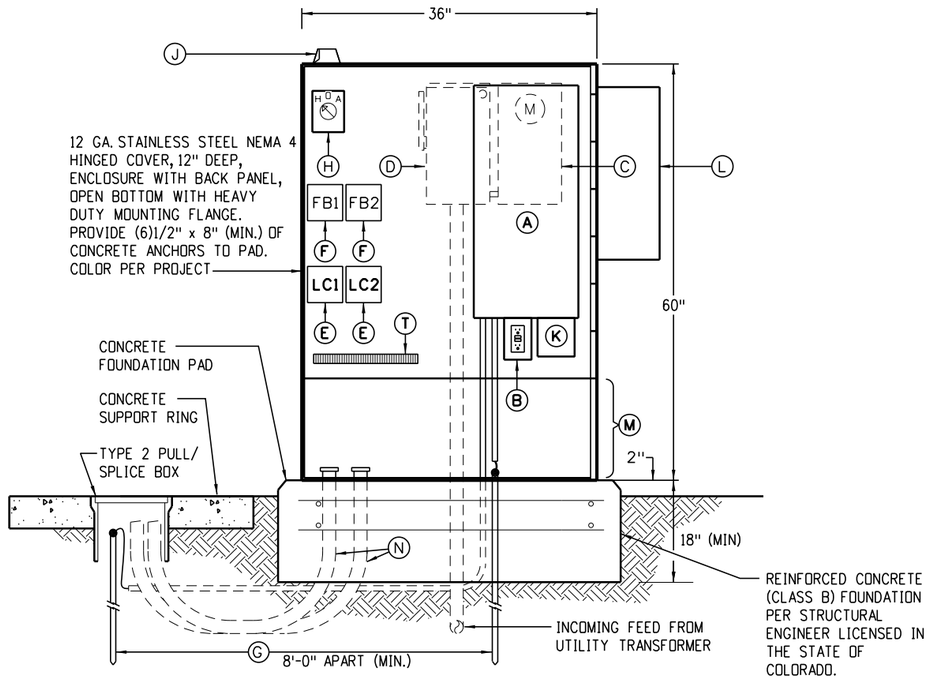
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Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-613-2
Standard Sheet No. 2 of 4
Project Sheet Number:



Component List

Ⓐ NEMA 1, service entrance rated, single phase load centers. (See panel schedule for quantity and size of main and branch breakers). Mounted inside NEMA 4 enclosure.

Ⓑ GFCI maintenance receptacle in a 1-gang back box with cover.

Ⓒ 200A, 1 ph., NEMA 3R, meter housing mounted on back side of NEMA 4 enclosure with lever bypass to utility company specifications. Paint to match NEMA 4 enclosure.

Ⓓ 100A (minimum amperage), 2 pole, 250V, heavy duty, NEMA 3R, fused meter disconnect, UL listed for service equipment and FRN-R fuses as shown on one-line diagram with neutral & ground bars. Mounted on back side of NEMA 4 enclosure. Paint to match NEMA 4 enclosure. May be omitted by utility company specifications hot sequence requirements.

✱ Ⓔ 4 pole, 30A, 250V electrically held lighting contactors with 120V coils. Two (2) required.

✱ Ⓕ 4 pole, 30A, fuse blocks with 30A, FRNR fuses to the lighting contactors as required by UL 508A (2001 Standard for Industrial Control Panels). Two (2) required.

Ⓖ 3/4 inch x 10 feet long, copper-clad driven ground rod with ground conductor exothermic weld or underground rated lug connect ground conductor to ground rod.

✱ Ⓗ H.O.A. switch - hand-off-auto with 15A 120V contacts, back box, cover, knob & legend and the photocell control wired in the auto position.

✱ Ⓙ 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 or window facing north or down to minimize the sun's interference.

Ⓚ Surge protection device-10kA, 120/240VAC single phase, 3W+G 200kAIC, protection modes L-G, N-G, L-N or L-L. Standard options (red & green LED's, audible alarm with enable/disable feature) LEA #B70-00-7000 international or approved equal.

Ⓛ Optional cabinet HVAC per Engineering request. Paint to match NEMA 4 enclosure.

Ⓜ Optional 18 inch high skirt per Engineer request.

Ⓝ Branch raceways - provide branch circuit raceway to all lighting fed from this LCC. See plan and feeder schedule for size and quantity.

Ⓣ Terminal strip - 600V rated, lugs to accept #1 - 10 AWG copper with all marking strip, end caps and mounting hardware. Provide the number of terminal points as required, minimum of 36 points.

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.

✱ Only required for loads not controlled by local nodes.

Lighting Control Center

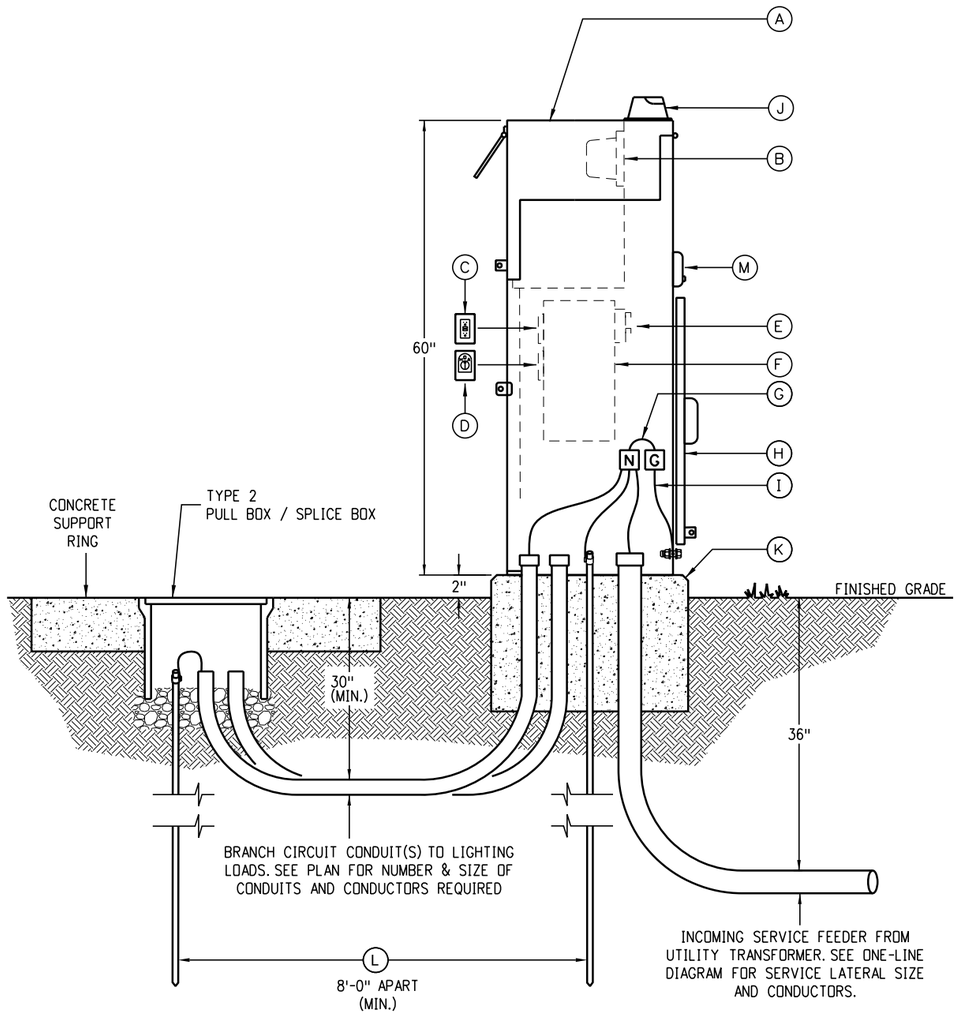
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Alternative Roadway Lighting

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-613-2
Standard Sheet No. 3 of 4
Project Sheet Number:



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. Paint color per project.

(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) GFCI maintenance receptacle flush mounted in panel dead front inside of the NEMA 3R enclosure.

(D) Hand-off-auto switch - 15A-2p, H.O.A. 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 #6 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 or window facing north or down to minimize the sun's interference.

(K) Reinforced concrete (Class B) foundation Per Structural Engineer licensed in the State of Colorado. 2 inch (minimum) above grade, 3/4 inch chamfer all exposed edges, 3 inch (minimum), 6 inch (maximum) overlap on all sides.

(L) 3/4 inch x 10 feet long, copper clad driven ground rod. exothermic weld or underground rated lug connect conductor to ground rod. (2) required - 8 feet apart (minimum).

(M) T-handle, pull-out 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 hot sequence requirements.

Typical Cabinet Requirements:

200A MCB, 120/240V-1ph-3W service entrance rated stainless steel, NEMA 3R, meter/power pedestal with separate sealable and lockable customer section with:

1. Load center (Engineer shall provide schedule for # of circuits) for "always on" loads that include:
   (applies to streetlights and pedestrian lights)

   Service entrance M.C.B. - Engineer to provide size on the panel schedule.
   Control power circuit breaker - Engineer to provide size on the panel schedule.
   Switched 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 confirguration 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 receptacle, mounted externally on NEMA-3R enclosure.
   One hand-off-auto (H.O.A.) switch flush mounted in dead front.
   One lighting contactor controlling 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.

Lighting Control Center (Special)

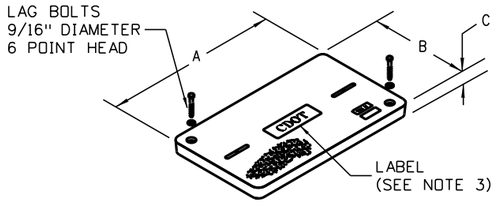
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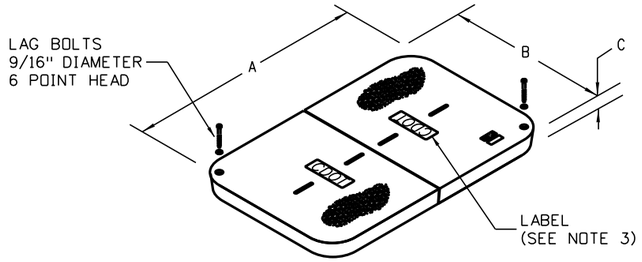
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Standard Plan No.
S-613-2
Standard Sheet No. 4 of 4
Project Sheet Number:



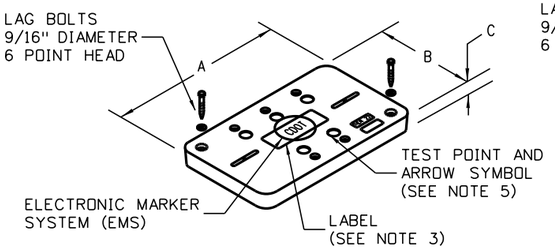
Type A One-Piece Lid

Typical application for Type 1, 2, and 3 pull boxes



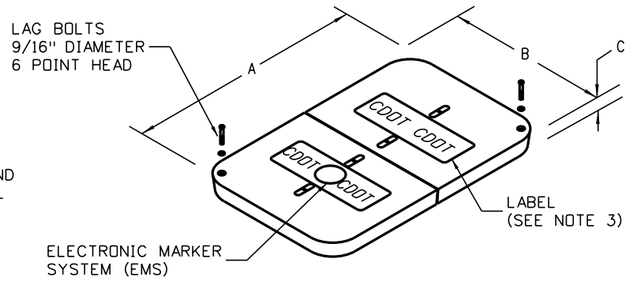
Type A Split Lid

Typical application for Type 4 and 5 pull boxes



Type B One-Piece Lid

Typical application for Type 1, 2, and 3 pull boxes

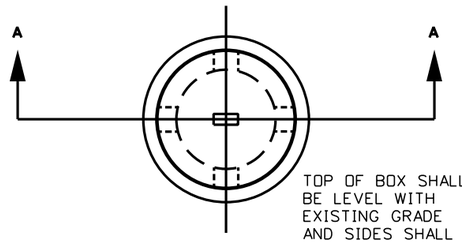


Type B Split Lid

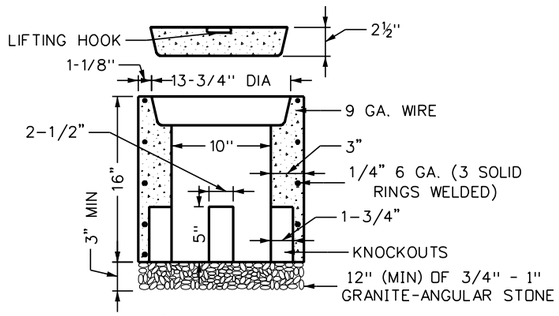
Typical application for Type 4 and 5 pull boxes

General Notes

1. All pull box types shall be paid for under the corresponding pull box item, and shall be sized as tabulated and shown in the plans.
2. Work to install pull box shall include, but not be limited to, saw cutting of concrete sidewalks, removal of pavement, concrete, earthwork, all landscape restoration and shall be paid for as part of the pull box.
3. Labels shall read in accordance to Section 613 of the current CDOT Standard Specification for Road and Bridge Construction.
4. Type B Lid Notes
   A. Required for all pull boxes containing only fiber.
   B. Shall contain a communications Electronic Marker System (EMS) embedded into the cover.
   C. Shall be furnished with 3/8 (35) x 1/16 (2), deep test point areas, with 2 - 3/8-7 lag long stainless steel hex head bolts, 2 - 3/8 (10) stainless steel flat washers, directional labels and 1 - ground label. The minimum number of test point areas and directional labels shall equal the number of conduit banks entering the pull box, up to a maximum of 5 test points. Type B split lids shall have test points on one split lid section only.
   D. Shall contain a 1½ inch diameter orange circle test point label with a black arrow graphic. One arrow graphic shall be installed for each test point used indicating the direction the conduit exits the pull box.
5. Pull rope shall be tied off to the ground rod, conduits, or each other. Do not clutter ground rod.



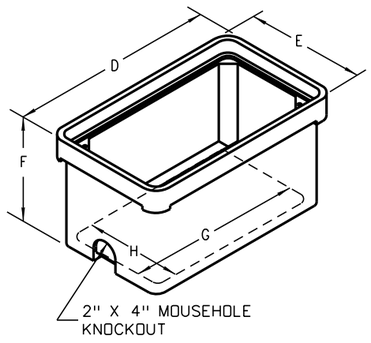
Top View



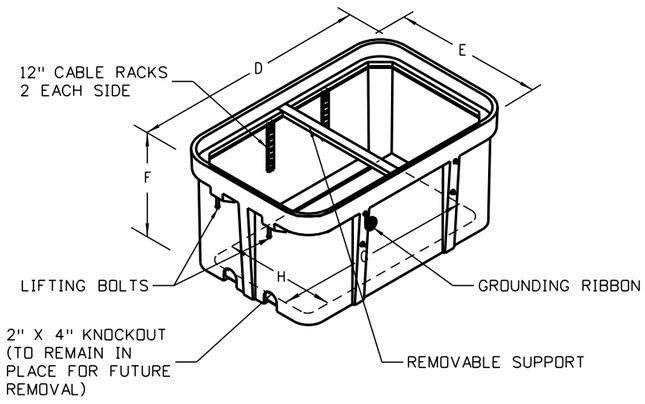
Section A-A

Type 6 Pull Box Standard

(Not to scale)



Type 1, 2, and 3 Pull Box Standard



Type 4 and 5 Pull Box Standard

TABLE OF DIMENSIONS FOR TYPE 1 THRU 5 PULLBOXES (MINIMUMS)									
TYPE	DESCRIPTION	DIMENSIONS (IN.)							
		A	B	C	D	E	F	G	H
1	PULL BOX - (11" X 18" X 18")	18⅛	11¼	1¾	20¼	13⅜	18	15¾	8⅞
2	PULL BOX - (13" X 24" X 18")	23¼	13¾	2	25	15½	18	19¼	9¾
3	PULL BOX - (17" X 30" X 18")	30½	17½	2	32¼	19¼	18	26½	13½
4	PULL BOX - (24" X 36" X 24")	35⅝	24	3	37⅝	26	24	30⅛	18½
5	PULL BOX - (30" X 48" X 24")	47⅝	30	3	49⅝	32⅛	24	45⅝	28⅛

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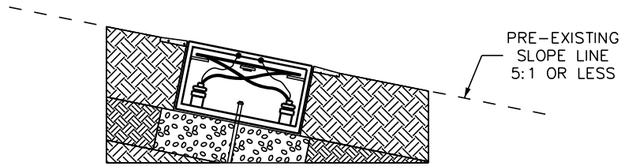
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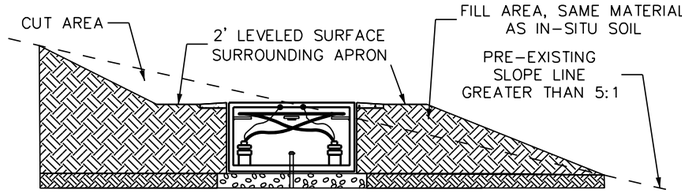
Pull Box Detail

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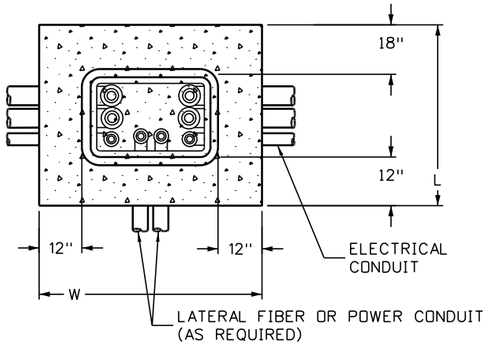
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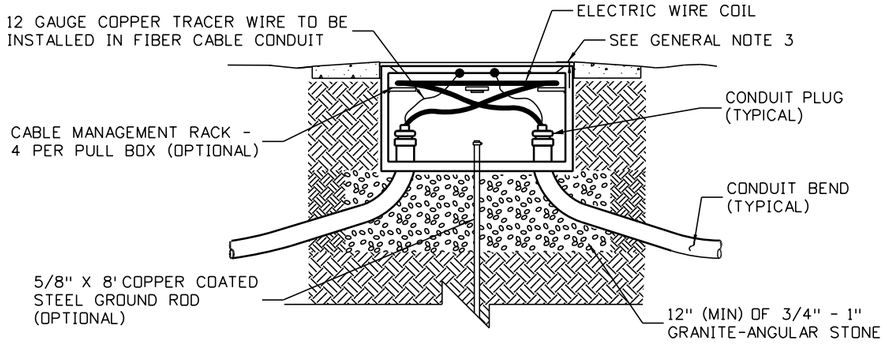
Typical Installation on Slopes 5:1 or Less



Typical Installation on Slopes Greater Than 5:1



Top View



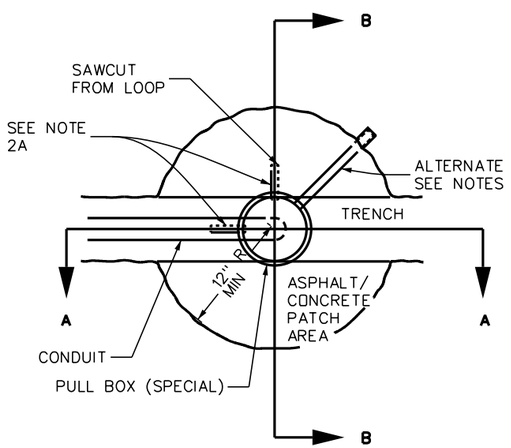
Cross Section

Type 1 thru 5 Pull Box Detail

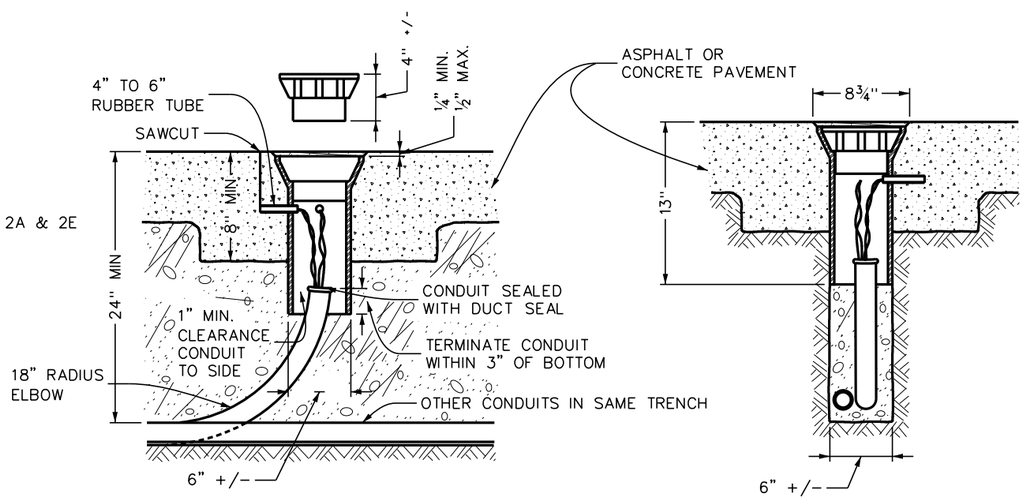
(Not to scale)

Notes

1. Type 1 Thru 5 Pull Box Detail Notes:
   - A. Pull boxes shall have a 12-inch wide minimum by 6-inch deep pre-cast polymer concrete apron, except when installed at a sidewalk, sloped away from the pull box opening. The gap between the apron and outer wall shall be a maximum of 1/4 inch. The cost of the concrete apron shall be paid for as part of the pull box item.
   - B. The pull box lid shall be flush with the surface.
2. Type 6 Pull Box Detail Notes:
   - A. Pull box shall have 3/4-inch to 1-inch diameter holes drilled or torched 3 inch from top to accept a 4-inch to 6-inch long rubber tube (3/4-inch garden hose). The number of holes shall be as per plans or as directed by the Engineer.
   - B. Care shall be taken during backfill to prevent collapse of tubes.
   - C. A minimum 2 feet of slack is to be provided on both feed and loop wires so that all testing and splicing can be done outside the pull box.
   - D. Shall be installed in an area of the roadway not heavily traveled, if possible, and a minimum of 12 inches from the concrete gutter pan.
   - E. If hot asphalt is not available, a concrete ring (12 inch minimum radius and 8 inch minimum depth) may be allowed by the Engineer. If concrete is allowed, the rubber tube must be extended beyond the concrete to the asphalt joint.
3. Electric Cable Label Detail Notes:
   - A. Communication and electric cable labels shall be provided in all Intelligent Transportation Systems (ITS) pull boxes.
   - B. When provided, cable labels shall be weatherproof tags and shall be included in the cost of the electrical conduit item.
4. Conduits Notes:
   - A. Conduits depicted in this standard detail are representative only. The number of conduits and conduit size shall be as tabulated and shown on the plans.
   - B. Conduit centerline shall be aligned to the top edge of the pull box to facilitate cable pulling.
   - C. Radius must not be less than 48 inches for conduits containing fiber.
   - D. All conduits shall terminate in the pull box with flared ends or appropriate bushing per NEC.
   - E. All conduit spacing in the pull box shall be per NEC.



Top View

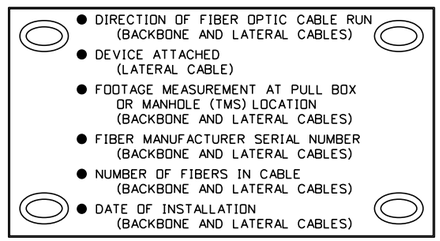


Section A-A

Section B-B

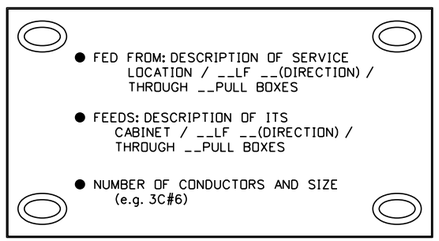
Type 6 Pull Box Detail

(Not to scale)



Communications Cable Label Detail

To be attached by plastic tie to each communications cable located in pull boxes and manholes (TMS)



Electric Cable Label Detail

To be attached by plastic tie to each electric cable located in pull boxes

Computer File Information		Sheet Revisions	
Creation Date: 06/03/21		Date:	Comments
Created By: AVU			
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Last Modified By: GLY			
CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
EB

Pull Box Detail

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-613-3
Standard Sheet No. 2 of 2
Project Sheet Number:

INDIVIDUAL COLD SEQUENCE MPP FAULT CURRENT TABLE FOR TRAFFIC CABINET

METER POWER PEDESTAL	SERVICE MAIN CIRCUIT BRKR.	TRANSFORMER KVA	'ISCA-T'	SEC. VOLTAGE-PHASE	SERVICE LATERAL FEEDER (1)	MIN. CONDUCTOR LENGTH TO MPP ~	MAX. CONDUCTOR LENGTH TO MPP^	INTERRUPT SHORT CIRCUIT AMPACITY 'ISCA-P' @ MIN. CONDUCTOR LENGTH	MINIMUM AIC RATING FOR MAIN CIRCUIT BREAKER
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	6,872 A	10,000 A
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	20-FT	240-FT	6,566 A	10,000 A
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	20-FT	305-FT	6,712 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	35-FT	190-FT	9,423 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	12,768 A	22,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	40-FT	240-FT	9,711 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	50-FT	305-FT	9,646 A	10,000 A

~ = MINIMUM SERVICE LATERAL CONDUCTOR LENGTH FOR THE ISCA VALUE GIVEN. IF CONDUCTOR LENGTH IS LESS THAN THIS VALUE THE PANEL SHALL BE BRACED AT THE NEXT HIGHER AIC RATING CALCULATED BY AN ELECTRICAL ENGINEER.

^ = MAXIMUM FEEDER LENGTH TO MAINTAIN LESS THAN 2% VOLTAGE DROP.

MOUNTING: PEDESTAL — **PANEL "MPP_"** — 120/240V-1PH-3W

NEMA 3R ENCLOSURE SERVICE ENTRANCE RATED

FEEDER:BOTTOM — 100 AMPS MAIN BREAKER

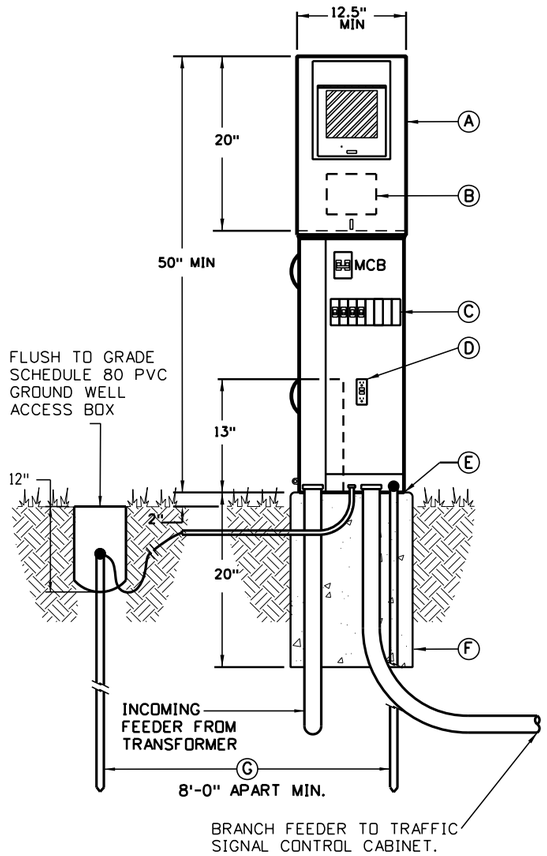
BRANCH BREAKER

				LEFT PHASE LOAD L1	LEFT PHASE LOAD L2	RIGHT PHASE LOAD L1	RIGHT PHASE LOAD L2	Ckt#	Size	P	DESCRIPTION
SPARE	20	1	1			180		2	20	1	MPP_ MAINTENANCE RECEPT.
SPARE	20	1	3				4800	4	50	1	TRAFFIC CONTROL CABINET
SPACE ONLY			5					6			SPACE ONLY
SPACE ONLY			7					8			SPACE ONLY
				0	0	180	4800				
				180	4800	Total Connected V.A.					
					4980	=Total Connected VA Both Phases					

LOAD	CONNECTED	D.FACT.	Est. KVA	AMPS
LIGHTING	0 VA	1.25	0.00	
RECEPTACLES (1ST 10000)	180 VA	1.00	0.18	
RECEPTACLES (REMAINING)	0 VA	0.50	0.00	
MOTOR (LARGEST)	0 VA	1.25	0.00	
MOTORS (REMAINING)	0 VA	1.00	0.00	
ELECTRICAL HEATING	0 VA	1.25	0.00	
ELECTRICAL MISC.	4800 VA	1.00	4.80	
TOTAL ESTIMATED LOAD	4980 VA		4.98	21

180 VA=Total Receptacle Load

NOTE:
ALL LIGHTING CONTROL CENTERS AND ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH "ARC-FLASH HAZARD WARNING" LABELS PER THE NATIONAL ELECTRIC CODE NEC 110.16 AND NFPA 70E, AND ALL OTHER LABELS REQUIRED BY NFPA 70.



Component List

(A) 200A meter socket, 100A MCB, 120/240V, NEMA 3R combination service entrance rated, cold sequence, meter/power pedestal with lever bypass, load center, MCB and fused tee-handle pull out disconnect ahead of meter. See panel schedule on this sheet for size of main and number and size of branch breakers. Set on new concrete pad plumb and level.

(B) Tee-handle, pull-out fuse type, disconnect flush mounted into the back side of the enclosure with tab for seal.

(C) Service entrance panel breaker section, for customer loads. See panel schedules on this sheet for size of breakers and number of poles required.

(D) 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 stenciled on the sidewall of the foundation.

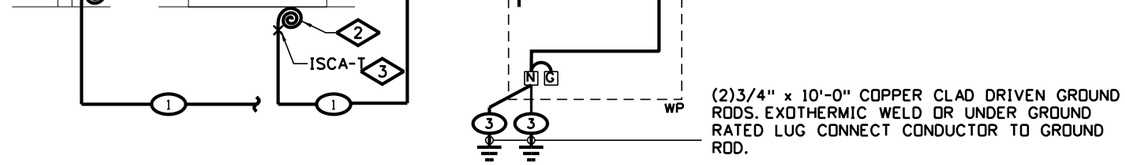
Option 2: Provide 4000 psi, re-bar re-enforce, concrete with a minimum direct earth bury depth of 18-inch, 2-inch overlap of the enclosure on all sides front and back and 2-inch exposure above grade. Provide 3/4-inch chamfered edges. Provide structural engineered stamped drawing for pad.

(G) 3/4 inch x 10 feet long, copper-clad driven ground rod with exothermic weld or underground lug connect conductor to rod. (2) rods required.

Note:
All components listed shall be included in the pay item '613-50109 Meter Power Pedestal'. All components shall meet current National Electric Code (NEC) and be UL listed for the application.

Cold Sequence Meter Power Pedestal Elevation Detail for Traffic Signal

Not To Scale



Feeder Schedule

(1) See the "Individual Cold Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

(2) Internal feeder supplied with pedestal

(3) 1●4 stranded bare copper through feeder enclosure to ground rods.

(4) (2●6THWN CU & 1●10GND) 2 inch PVC conduit

One-Line Notes:

(1) Coil enough conductors at the base of the pole to reach the transformer terminals at the top of the pole. Final routing of conductors up the pole and connection to transformer by electric utility.

(2) Coil minimum of 5 feet of conductors at the transformer base. Final connection to transformer by electric utility.

(3) See the "Individual Cold Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

Cold Sequence Meter Power Pedestal One-line Diagram for Traffic Signal

Not To Scale

Computer File Information	Sheet Revisions	
Creation Date: 06/14/2023	Date:	Comments
Created By: KUCZKOWSKI		
Last Modification Date: 07/01/26		
Last Modified By: GLY		
CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English		

Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
EB

Traffic Signal One-Line Diagrams

Issued by the Traffic Safety & Engineering Services: July 01, 2026

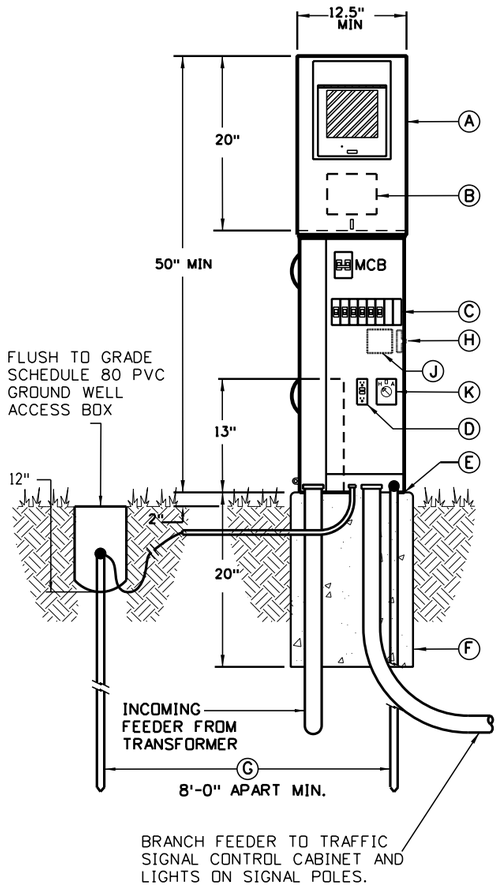
Standard Plan No.
S-613-4
Standard Sheet No. 1 of 6
Project Sheet Number:

INDIVIDUAL COLD SEQUENCE MPP FAULT CURRENT TABLE FOR TRAFFIC SIGNAL WITH LUMINAIRES

METER POWER PEDESTAL	SERVICE MAIN CIRCUIT BRKR.	TRANSFORMER KVA	'ISCA-T'	SEC. VOLTAGE-PHASE	SERVICE LATERAL FEEDER (1)	MIN. CONDUCTOR LENGTH TO MPP ~	MAX. CONDUCTOR LENGTH TO MPP^	INTERRUPT SHORT CIRCUIT AMPACITY 'ISCA-P' @ MIN. CONDUCTOR LENGTH	MINIMUM AIC RATING FOR MAIN CIRCUIT BREAKER
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	6,872 A	10,000 A
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	20-FT	240-FT	6,566 A	10,000 A
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	20-FT	305-FT	6,712 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	35-FT	190-FT	9,423 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	12,768 A	22,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	40-FT	240-FT	9,711 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	50-FT	305-FT	9,646 A	10,000 A

~ = MINIMUM SERVICE LATERAL CONDUCTOR LENGTH FOR THE ISCA VALUE GIVEN. IF CONDUCTOR LENGTH IS LESS THAN THIS VALUE THE PANEL SHALL BE BRACED AT THE NEXT HIGHER AIC RATING CALCULATED BY AN ELECTRICAL ENGINEER.

^ = MAXIMUM FEEDER LENGTH TO MAINTAIN LESS THAN 2% VOLTAGE DROP.



Component List

(A) 200A meter socket, 100A MCB, 120/240V, NEMA 3R combination service entrance rated, cold sequence, meter/power pedestal with lever bypass, load center, MCB and fused tee-handle pull out disconnect ahead of meter. See panel schedule on this sheet for size of main and number and size of branch breakers. Set on new concrete pad plumb and level.

(B) Tee-handle, pull-out fuse type, disconnect flush mounted into the back side of the enclosure with tab for seal.

(C) Service entrance panel breaker section, for customer loads. See panel schedules on this sheet for size of breakers and number of poles required.

(D) 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 stenciled on the sidewall of the foundation.

Option 2: Provide 4000 psi, re-bar re-enforce, concrete with a minimum direct earth bury depth of 18-inch, 2-inch overlap of the enclosure on all sides front and back and 2-inch exposure above grade. Provide 3/4-inch chamfered edges. Provide structural engineered stamped drawing for pad.

(G) 3/4 inch x 10 feet long, copper-clad driven ground rod with exothermic weld or underground lug connect conductor to rod. (2) rods required.

(H) Built-in photocell for on/off control of luminaires on signals poles.

(J) Built-in, 2-pole 20A, lighting contactor for on/off control of lights on signal poles

(K) Optional hand-off-auto switch when items 'H' and 'J' above are used. Provide this HOA switch with the photocell control wired in the auto position.

Note:
All components listed shall be included in the pay item '613-50109 Meter Power Pedestal'. All components shall meet current nNational Electric Code (NEC) and be UL listed for the application.

Cold Sequence Meter Power Pedestal Elevation Detail for Traffic Signal with Luminaires

Not To Scale

MOUNTING: PEDESTAL — **PANEL "MPP_"** — 120/240V-1PH-3W
NEMA 3R ENCLOSURE SERVICE ENTRANCE RATED
FEEDER:BOTTOM — 100 AMPS MAIN BREAKER

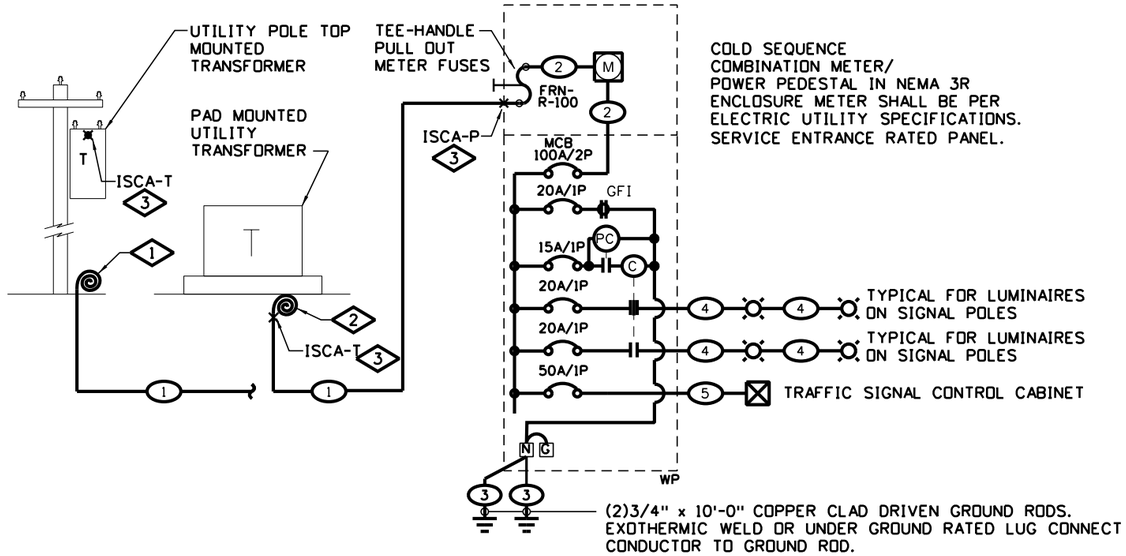
BRANCH BREAKER

DESCRIPTION	Size	P	Ckt#	LEFT PHASE LOAD L1	LEFT PHASE LOAD L2	RIGHT PHASE LOAD L1	RIGHT PHASE LOAD L2	Ckt#	Size	P	DESCRIPTION
TRAFFIC SIGNAL POLE LIGHTING	20	1	1	240		180		2	20	1	MPP_ MAINTENANCE RECEPT.
TRAFFIC SIGNAL POLE LIGHTING	20	1	3		240		4800	4	50	1	TRAFFIC CONTROL CABINET
MPP_ LIGHTING CONTROL CKT.	15	1	5	200				6			SPACE ONLY
SPARE	20	1	7					8			SPACE ONLY
				440	240	180	4800				
				620	5040	Total Connected V.A.					
					5660	=Total Connected VA Both Phases					

LOAD	CONNECTED	D.FACT.	Est. KVA	AMPS
LIGHTING	480 VA	1.25	0.60	
RECEPTACLES (1ST 10000)	180 VA	1.00	0.18	
RECEPTACLES (REMAINING)	0 VA	0.50	0.00	
MOTOR (LARGEST)	0 VA	1.25	0.00	
MOTORS (REMAINING)	0 VA	1.00	0.00	
ELECTRICAL HEATING	0 VA	1.25	0.00	
ELECTRICAL MISC.	5000 VA	1.00	5.00	
TOTAL ESTIMATED LOAD	5660 VA		5.78	24

180 VA=Total Receptacle Load

NOTE:
ALL LIGHTING CONTROL CENTERS AND ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH "ARC-FLASH HAZARD WARNING" LABELS PER THE NATIONAL ELECTRIC CODE NEC 110.16 AND NFPA 70E-2015, AND ALL OTHER LABELS REQUIRED BY NFPA 70.



Feeder Schedule

(1) See the "Individual Cold Sequence MPP Fault Current Table For Traffic Signal With Luminaires" on this sheet for these ISCA values.

(2) Internal feeder supplied with pedestal

(3) 1●4 stranded bare copper through feeder enclosure to ground rods.

(4) (2●10THWN CU & 1●10GND) 2 inch PVC conduit

(5) (2●6THWN CU & 1●10GND) 2 inch PVC conduit

One-Line Notes:

<1> Coil enough conductors at the base of the pole to reach the transformer terminals at the top of the pole. Final routing of conductors up the pole and connection to transformer by electric utility.

<2> Coil miniumum of 5 feet of conductors at the transformer base. Final connection to transformer by electric utility.

<3> See the "Individual Cold Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

Cold Sequence Meter Power Pedestal One-line Diagram for Traffic Signal with Luminaires

Not To Scale

Computer File Information		Sheet Revisions	
Creation Date: 06/14/2023		Date:	Comments
Created By: KUCZKOWSKI			
Last Modification Date: 07/01/26			
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CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
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EB

Traffic Signal One-Line Diagrams

Issued by the Traffic Safety & Engineering Services: July 01, 2026

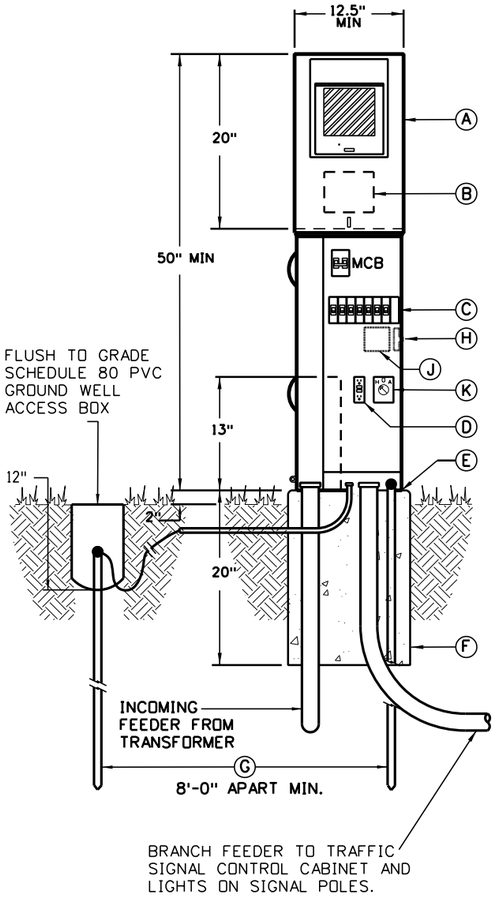
Standard Plan No.
S-613-4
Standard Sheet No. 2 of 6
Project Sheet Number:

INDIVIDUAL COLD SEQUENCE MPP FAULT CURRENT TABLE FOR SIGNAL WITH LUMINAIRES AND CAMERA

METER POWER PEDESTAL	SERVICE MAIN CIRCUIT BRKR.	TRANSFORMER KVA	'ISCA-T'	SEC. VOLTAGE-PHASE	SERVICE LATERAL FEEDER	MIN. CONDUCTOR LENGTH TO MPP ~	MAX. CONDUCTOR LENGTH TO MPP^	INTERRUPT SHORT CIRCUIT AMPACITY 'ISCA-P' @ MIN. CONDUCTOR LENGTH	MINIMUM AIC RATING FOR MAIN CIRCUIT BREAKER
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	6,872 A	10,000 A
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	20-FT	240-FT	6,566 A	10,000 A
NEW-MPP_	100A-2P	25kVA	7440 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	20-FT	305-FT	6,712 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	35-FT	190-FT	9,423 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	12,768 A	22,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	40-FT	240-FT	9,711 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	50-FT	305-FT	9,646 A	10,000 A

~ = MINIMUM SERVICE LATERAL CONDUCTOR LENGTH FOR THE ISCA VALUE GIVEN. IF CONDUCTOR LENGTH IS LESS THAN THIS VALUE THE PANEL SHALL BE BRACED AT THE NEXT HIGHER AIC RATING CALCULATED BY AN ELECTRICAL ENGINEER.

^ = MAXIMUM FEEDER LENGTH TO MAINTAIN LESS THAN 2% VOLTAGE DROP.



Component List

Ⓐ 200A meter socket, 100A MCB, 120/240V, NEMA 3R combination service entrance rated, cold sequence, meter/power pedestal with lever bypass, load center, mcb and fused tee-handle pull out disconnect ahead of meter. See panel schedule on this sheet for size of main and number and size of branch breakers. set on new concrete pad plumb and level.

Ⓑ Tee-handle, pull-out fuse type, disconnect flush mounted into the back side of the enclosure with tab for seal.

Ⓒ Service entrance panel breaker section, for customer loads. See panel schedules on this sheet for size of breakers and number of poles required.

Ⓓ Built-in GFCI NEMA 5-20R, duplex, GFCI maintenance receptacle flush mounted in panel dead-front.

Ⓔ Provide recessed concrete pad mounting plate with L-bolts to match the enclosure base bolt pattern.

Ⓕ 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 stenciled on the sidewall of the foundation.

Option 2: Provide 4000 psi, re-bar re-enforce, concrete with a minimum direct earth bury depth of 18-inch, 2-inch overlap of the enclosure on all sides front and back and 2-inch exposure above grade. Provide 3/4-inch chamfered edges. Provide structural engineered stamped drawing for pad.

Ⓖ 3/4 inch x 10 feet long, copper-clad driven ground rod with exothermic weld or underground lug connect conductor to rod. (2) rods required.

Ⓗ Built-in photocell for on/off control of luminaires on signals poles.

Ⓙ Built-in, 2-pole 20A, lighting contactor for on/off control of lights on signal poles

Ⓚ Optional hand-off-auto switch when items 'H' and 'J' above are used. Provide this HOA switch with the photocell control wired in the auto position.

Note:
All components listed shall be included in the pay item '613-50109 Meter Power Pedestal'. All components shall meet current National Electric Code (NEC) and be UL listed for the application.

Cold Sequence Meter Power Pedestal Elevation Detail for Traffic Signal with Camera

Not To Scale

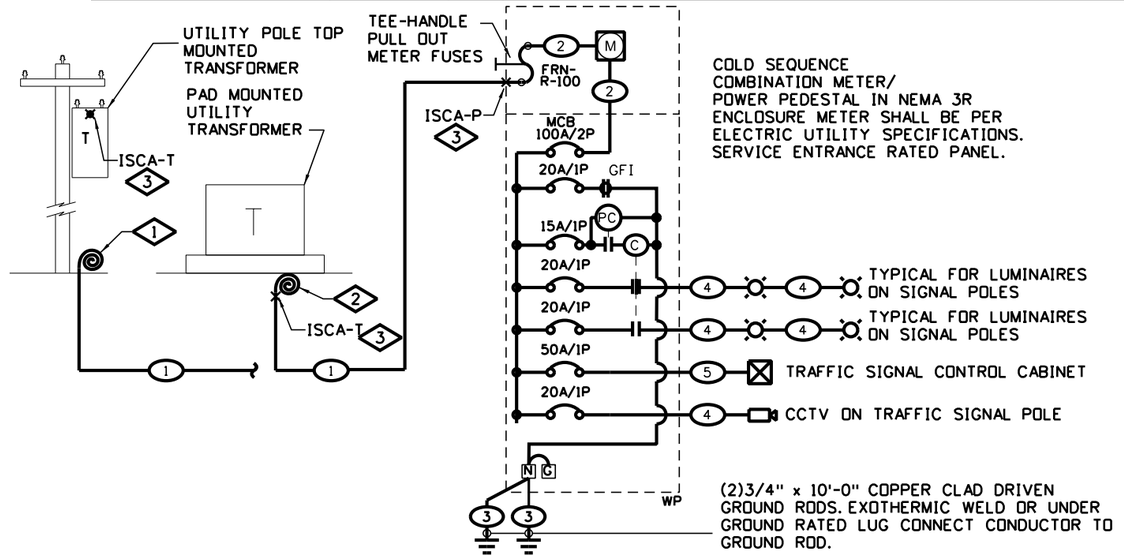
MOUNTING: PEDESTAL — **PANEL "MPP_"** — 120/240V-1PH-3W
NEMA 3R ENCLOSURE SERVICE ENTRANCE RATED
FEEDER:BOTTOM — 100 AMPS MAIN BREAKER
BRANCH BREAKER

				LEFT PHASE LOAD			RIGHT PHASE LOAD					
DESCRIPTION	Size	P	Ckt#	L1	L2		L1	L2	Ckt#	Size	P	DESCRIPTION
TRAFFIC SIGNAL POLE LIGHTING	20	1	1	240			180		2	20	1	MPP_ MAINTENANCE RECEPT.
TRAFFIC SIGNAL POLE LIGHTING	20	1	3		240			4800	4	50	1	TRAFFIC CONTROL CABINET
MPP_ LIGHTING CONTROL CKT.	15	1	5	200			300		6	20	1	CCTV CAMERA ON SIGNAL POLE
SPARE	20	1	7						8			SPACE ONLY
				440	240		480	4800				
				920	5040	Total Connected V.A.						
					5960	=Total Connected VA Both Phases						

LOAD	CONNECTED	D.FACT.	Est. KVA	AMPS
LIGHTING	480 VA	1.25	0.60	
RECEPTACLES (1ST 10000)	180 VA	1.00	0.18	
RECEPTACLES (REMAINING)	0 VA	0.50	0.00	
MOTOR (LARGEST)	0 VA	1.25	0.00	
MOTORS (REMAINING)	0 VA	1.00	0.00	
ELECTRICAL HEATING	0 VA	1.25	0.00	
ELECTRICAL MISC.	5300 VA	1.00	5.30	
TOTAL ESTIMATED LOAD	5960 VA		6.08	25

180 VA=Total Receptacle Load

NOTE:
ALL LIGHTING CONTROL CENTERS AND ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH "ARC-FLASH HAZARD WARNING" LABELS PER THE NATIONAL ELECTRIC CODE NEC 110.16 AND NFPA 70E-2015, AND ALL OTHER LABELS REQUIRED BY NFPA 70.



Feeder Schedule

1. See the "Individual Cold Sequence MPP Fault Current Table For Signal With Luminaries And Camera" on this sheet for these ISCA values.
2. Internal feeder supplied with pedestal
3. 1•4 stranded bare copper through feeder enclosure to ground rods.
4. (2•10THWN CU & 1•10GND) 2 inch PVC conduit
5. (2•6THWN CU & 1•10GND) 2 inch PVC conduit

One-Line Notes:

1. Coil enough conductors at the base of the pole to reach the transformer terminals at the top of the pole. Final routing of conductors up the pole and connection to transformer by electric utility.
2. Coil minimum of 5 feet of conductors at the transformer base. Final connection to transformer by electric utility.
3. See the "Individual Cold Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

Cold Sequence Meter Power Pedestal One-Line Diagram for Traffic Signal with Camera

Not To Scale

Computer File Information		Sheet Revisions	
Creation Date: 06/14/2023		Date:	Comments
Created By: KUCZKOWSKI			
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Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
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Traffic Signal One-Line Diagrams

Issued by the Traffic Safety & Engineering Services: July 01, 2026

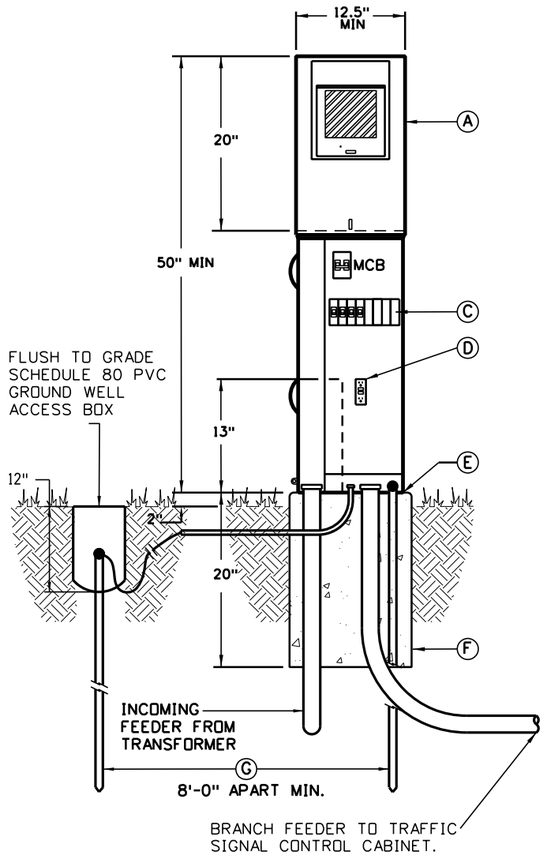
Standard Plan No.
S-613-4
Standard Sheet No. 3 of 6
Project Sheet Number:

INDIVIDUAL HOT SEQUENCE MPP FAULT CURRENT TABLE FOR TRAFFIC CABINET

METER POWER PEDESTAL	SERVICE MAIN CIRCUIT BRKR.	TRANSFORMER			SERVICE LATERAL FEEDER (1)	MIN. CONDUCTOR LENGTH TO MPP ~	MAX. CONDUCTOR LENGTH MPP^	SHORT CIRCUIT AMPACITY 'ISCA-P' @ MIN. CONDUCTOR LENGTH	MINIMUM AIC RATING FOR MAIN CIRCUIT
		KVA	'ISCA-T'	SEC. VOLTAGE-PHASE					
NEW-MPP_	100A-2P	15 kVA	4464 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	4,253 A	10,000 A
NEW-MPP_	100A-2P	15 kVA	7440 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	15-FT	240-FT	4,212 A	10,000 A
NEW-MPP_	100A-2P	25 kVA	7440 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	6,872 A	10,000 A
NEW-MPP_	100A-2P	25 kVA	7440 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	30-FT	305-FT	6,399 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	12,768 A	22,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	35-FT	190-FT	9,423 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	40-FT	240-FT	9,711 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	50-FT	305-FT	9,646 A	10,000 A

~ = MINIMUM SERVICE LATERAL CONDUCTOR LENGTH FOR THE ISCA VALUE GIVEN. IF CONDUCTOR LENGTH IS LESS THAN THIS VALUE THE PANEL SHALL BE BRACED AT THE NEXT HIGHER AIC RATING CALCULATED BY AN ELECTRICAL ENGINEER.

^ = MAXIMUM FEEDER LENGTH TO MAINTAIN LESS THAN 2% VOLTAGE DROP.



Component List

(A) 200A meter socket, 100A MCB, 120/240V, NEMA 3R combination service entrance rated, hot sequence, meter/power pedestal with lever bypass, load center, and MCB. See panel schedule on this sheet for size of main and number and size of branch breakers. Set on new concrete pad plumb and level.

(C) Service entrance panel breaker section, for customer loads. See panel schedules on this sheet for size of breakers and number of poles required.

(D) 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 stenciled on the sidewall of the foundation.

Option 2: Provide 4000 psi, re-bar re-enforce, concrete with a minimum direct earth bury depth of 18-inch, 2-inch overlap of the enclosure on all sides front and back and 2-inch exposure above grade. Provide 3/4-inch chamfered edges. Provide structural engineered stamped drawing for pad.

(G) 3/4 inch x 10 feet long, copper-clad driven ground rod with exothermic weld or underground lug connect conductor to rod. (2) rods required.

Note:
All components listed shall be included in the pay item '613-50109 Meter Power Pedestal'. All components shall meet current National Electric Code (NEC) and be UL listed for the application.

Hot Sequence Meter Power Pedestal Elevation Detail for Traffic Signal

Not To Scale

MOUNTING: PEDESTAL — **PANEL "MPP_"** — 120/240V-1PH-3W

NEMA 3R ENCLOSURE SERVICE ENTRANCE RATED

FEEDER:BOTTOM — 100 AMPS MAIN BREAKER

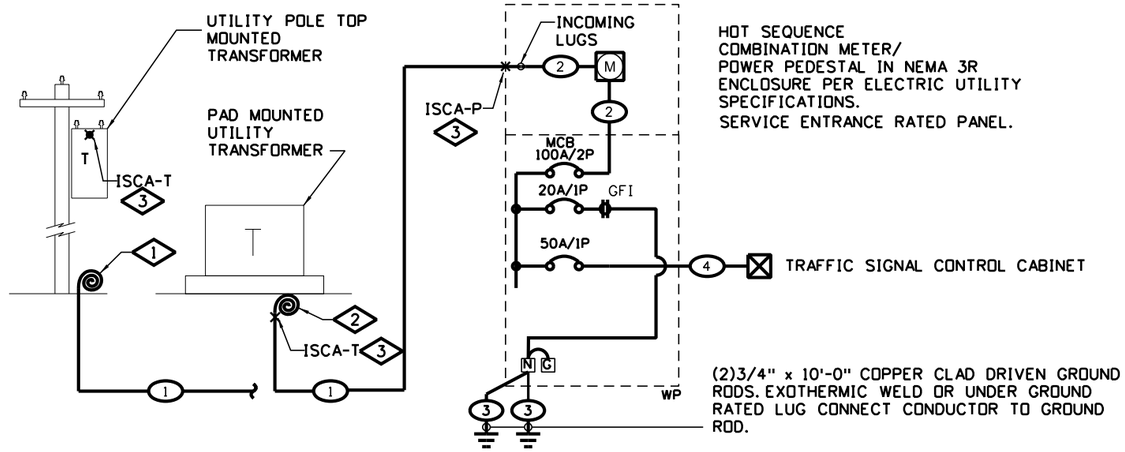
BRANCH BREAKER

				LEFT PHASE LOAD			RIGHT PHASE LOAD					
DESCRIPTION	Size	P	Ckt#	L1	L2		L1	L2	Ckt#	Size	P	DESCRIPTION
SPARE	20	1	1				180		2	20	1	MPP_ MAINTENANCE RECEPT.
SPARE	20	1	3					4800	4	50	1	TRAFFIC CONTROL CABINET
SPACE ONLY			5						6			SPACE ONLY
SPACE ONLY			7						8			SPACE ONLY
				0	0		180	4800				
				180	4800	Total Connected V.A.						
					4980	=Total Connected VA Both Phases						

LOAD	CONNECTED	D.FACT.	Est. KVA	AMPS
LIGHTING	0 VA	1.25	0.00	
RECEPTACLES (1ST 10000)	180 VA	1.00	0.18	
RECEPTACLES (REMAINING)	0 VA	0.50	0.00	
MOTOR (LARGEST)	0 VA	1.25	0.00	
MOTORS (REMAINING)	0 VA	1.00	0.00	
ELECTRICAL HEATING	0 VA	1.25	0.00	
ELECTRICAL MISC.	4800 VA	1.00	4.80	
TOTAL ESTIMATED LOAD	4980 VA		4.98	21

180 VA=Total Receptacle Load

NOTE:
ALL LIGHTING CONTROL CENTERS AND ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH "ARC-FLASH HAZARD WARNING" LABELS PER THE NATIONAL ELECTRIC CODE NEC 110.16 AND NFPA 70E, AND ALL OTHER LABELS REQUIRED BY NFPA 70.



Feeder Schedule

(1) See the "Individual Hot Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

(2) Internal feeder supplied with pedestal

(3) 1•4 stranded bare copper through feeder enclosure to ground rods.

(4) (2•6THWN CU & 1•10GND) 2 inch PVC conduit

One-Line Notes:

(1) Coil enough conductors at the base of the pole to reach the transformer terminals at the top of the pole. Final routing of conductors up the pole and connection to transformer by electric utility.

(2) Coil minimum of 5 feet of conductors at the transformer base. Final connection to transformer by electric utility.

(3) See the "Individual Hot Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

Hot Sequence Meter Power Pedestal One-Line Diagram for Traffic Signal

Not To Scale

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Colorado Department of Transportation

Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204

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Traffic Signal One-Line Diagrams

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-613-4
Standard Sheet No. 4 of 6
Project Sheet Number:

INDIVIDUAL HOT SEQUENCE MPP FAULT CURRENT TABLE FOR TRAFFIC SIGNAL WITH LUMINAIRES

METER POWER PEDESTAL	SERVICE MAIN CIRCUIT BRKR.	TRANSFORMER			SERVICE LATERAL FEEDER (1)	MIN. CONDUCTOR LENGTH TO MPP ~	MAX. CONDUCTOR LENGTH MPP^	SHORT CIRCUIT AMPACITY 'ISCA-P' @ MIN. CONDUCTOR LENGTH	MINIMUM AIC RATING FOR MAIN CIRCUIT
		KVA	'ISCA-T'	SEC. VOLTAGE-PHASE					
NEW-MPP_	100A-2P	15 kVA	4464 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	4,253 A	10,000 A
NEW-MPP_	100A-2P	15 kVA	7440 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	15-FT	240-FT	4,212 A	10,000 A
NEW-MPP_	100A-2P	25 kVA	7440 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	6,872 A	10,000 A
NEW-MPP_	100A-2P	25 kVA	7440 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	30-FT	305-FT	6,399 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	12,768 A	22,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	35-FT	190-FT	9,423 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	40-FT	240-FT	9,711 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	50-FT	305-FT	9,646 A	10,000 A

~ = MINIMUM SERVICE LATERAL CONDUCTOR LENGTH FOR THE ISCA VALUE GIVEN. IF CONDUCTOR LENGTH IS LESS THAN THIS VALUE THE PANEL SHALL BE BRACED AT THE NEXT HIGHER AIC RATING CALCULATED BY AN ELECTRICAL ENGINEER.

^ = MAXIMUM FEEDER LENGTH TO MAINTAIN LESS THAN 2% VOLTAGE DROP.

MOUNTING: PEDESTAL — **PANEL "MPP_"** — NEMA 3R ENCLOSURE SERVICE ENTRANCE RATED — 120/240V-1PH-3W

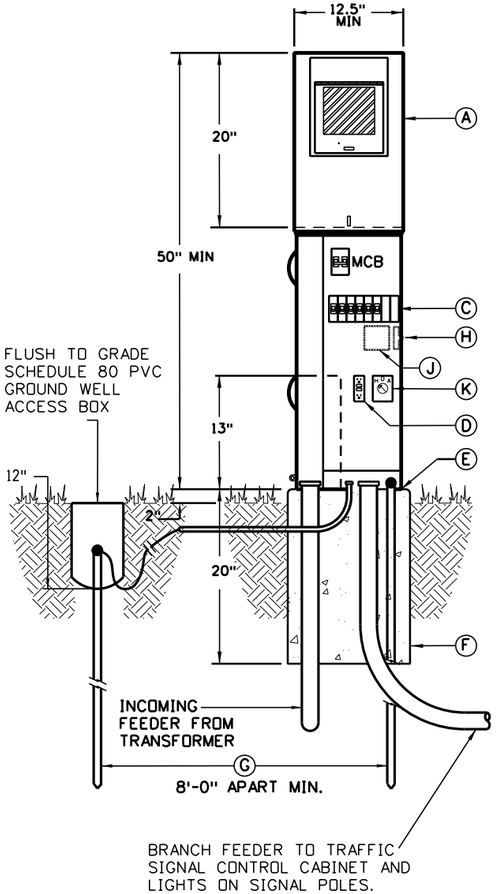
FEEDER:BOTTOM — BRANCH BREAKER — 100 AMPS MAIN BREAKER

DESCRIPTION	Size	P	Ckt#	LEFT PHASE LOAD L1	LEFT PHASE LOAD L2	RIGHT PHASE LOAD L1	RIGHT PHASE LOAD L2	Ckt#	Size	P	DESCRIPTION
TRAFFIC SIGNAL POLE LIGHTING	20	1	1	240		180		2	20	1	MPP_ MAINTENANCE RECEPT.
TRAFFIC SIGNAL POLE LIGHTING	20	1	3		240		4800	4	50	1	TRAFFIC CONTROL CABINET
MPP_ LIGHTING CONTROL CKT.	15	1	5	200				6			SPACE ONLY
SPARE	20	1	7					8			SPACE ONLY
				440	240	180	4800				
				620	5040	Total Connected V.A.					
					5660	=Total Connected VA Both Phases					

LOAD	CONNECTED	D.FACT.	Est. KVA	AMPS
LIGHTING	480 VA	1.25	0.60	
RECEPTACLES (1ST 10000)	180 VA	1.00	0.18	
RECEPTACLES (REMAINING)	0 VA	0.50	0.00	
MOTOR (LARGEST)	0 VA	1.25	0.00	
MOTORS (REMAINING)	0 VA	1.00	0.00	
ELECTRICAL HEATING	0 VA	1.25	0.00	
ELECTRICAL MISC.	5000 VA	1.00	5.00	
TOTAL ESTIMATED LOAD	5660 VA		5.78	24

180 VA=Total Receptacle Load

NOTE:
ALL LIGHTING CONTROL CENTERS AND ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH "ARC-FLASH HAZARD WARNING" LABELS PER THE NATIONAL ELECTRIC CODE NEC 110.16 AND NFPA 70E-2015, AND ALL OTHER LABELS REQUIRED BY NFPA 70.



Component List

(A) 200A meter socket, 100A MCB, 120/240V, NEMA 3R combination service entrance rated, hot sequence, meter/power pedestal with lever bypass, load center, and MCB. See panel schedule on this sheet for size of main and number and size of branch breakers. Set on new concrete pad plumb and level.

(C) Service entrance panel breaker section, for customer loads. See panel schedules on this sheet for size of breakers and number of poles required.

(D) 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 stenciled on the sidewall of the foundation.

Option 2: Provide 4000 psi, re-bar re-enforce, concrete with a minimum direct earth bury depth of 18-inch, 2-inch overlap of the enclosure on all sides front and back and 2-inch exposure above grade. Provide 3/4-inch chamfered edges. Provide structural engineered stamped drawing for pad.

(G) 3/4 inch x 10 feet long, copper-clad driven ground rod with exothermic weld or underground lug connect conductor to rod. (2) rods required.

(H) Built-in photocell for on/off control of luminaires on signals poles.

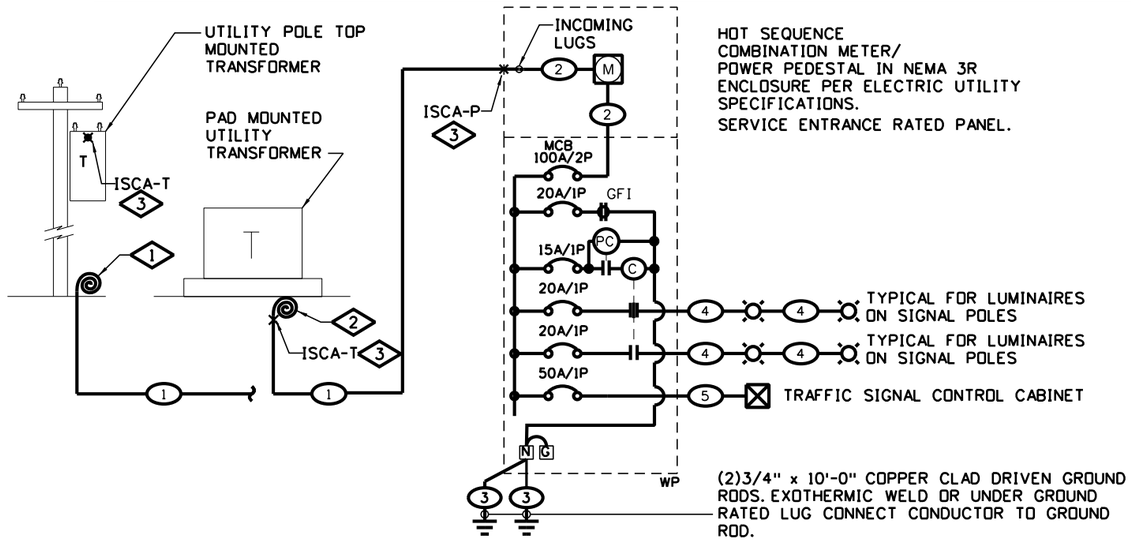
(J) Built-in, 2-pole 20A, lighting contactor for on/off control of lights on signal poles

(K) Optional hand-off-auto switch when items 'H' and 'J' above are used. Provide this HOA switch with the photocell control wired in the auto position.

Note:
All components listed shall be included in the pay item '613-50109 Meter Power Pedestal'. All components shall meet current National Electric Code (NEC) and be UL listed for the application.

Hot Sequence Meter Power Pedestal Elevation Detail for Traffic Signal with Luminaires

Not To Scale



Feeder Schedule

(1) See the "Individual Hot Sequence MPP Fault Current Table For Traffic Signal With Luminaires" on this sheet for these ISCA values.

(2) Internal feeder supplied with pedestal

(3) 1•4 stranded bare copper through feeder enclosure to ground rods.

(4) (2•10THWN CU & 1•10GND) 2 inch PVC conduit

(5) (2•6THWN CU & 1•10GND) 2 inch PVC conduit

One-Line Notes:

(1) Coil enough conductors at the base of the pole to reach the transformer terminals at the top of the pole. Final routing of conductors up the pole and connection to transformer by electric utility.

(2) Coil minimum of 5 feet of conductors at the transformer base. Final connection to transformer by electric utility.

(3) See the "Individual Hot Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

Hot Sequence Meter Power Pedestal One-Line Diagram for Traffic Signal with Luminaires

Not To Scale

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Colorado Department of Transportation
Traffic Safety & Engineering Services
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Traffic Signal One-Line Diagrams

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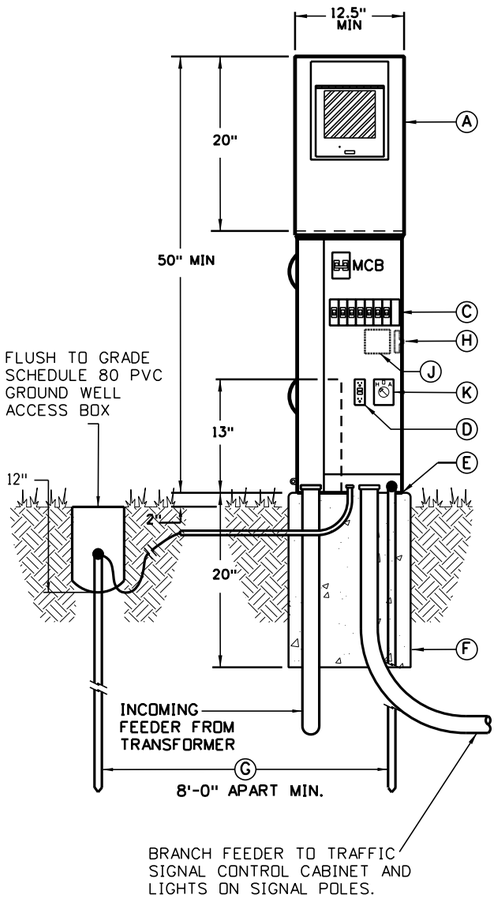
Standard Plan No.
S-613-4
Standard Sheet No. 5 of 6
Project Sheet Number:

INDIVIDUAL HOT SEQUENCE MPP FAULT CURRENT TABLE FOR SIGNAL WITH LUMINAIRES AND CAMERAS

METER POWER PEDESTAL	SERVICE MAIN CIRCUIT BRKR.	TRANSFORMER			SERVICE LATERAL FEEDER (1)	MIN. CONDUCTOR LENGTH TO MPP ~	MAX. CONDUCTOR LENGTH MPP^	SHORT CIRCUIT AMPACITY 'ISCA-P' @ MIN. CONDUCTOR LENGTH	MINIMUM AIC RATING FOR MAIN CIRCUIT
		KVA	'ISCA-T'	SEC. VOLTAGE-PHASE					
NEW-MPP_	100A-2P	15 kVA	4464 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	4,253 A	10,000 A
NEW-MPP_	100A-2P	15 kVA	7440 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	15-FT	240-FT	4,212 A	10,000 A
NEW-MPP_	100A-2P	25 kVA	7440 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	6,872 A	10,000 A
NEW-MPP_	100A-2P	25 kVA	7440 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	30-FT	305-FT	6,399 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	10-FT	190-FT	12,768 A	22,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1 XHHW CU) 2" PVC	35-FT	190-FT	9,423 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#1/0 XHHW CU) 2" PVC	40-FT	240-FT	9,711 A	10,000 A
NEW-MPP_	100A-2P	50 kVA	14881 A	120/240V-1PH	(3#2/0 XHHW CU) 2" PVC	50-FT	305-FT	9,646 A	10,000 A

~ = MINIMUM SERVICE LATERAL CONDUCTOR LENGTH FOR THE ISCA VALUE GIVEN. IF CONDUCTOR LENGTH IS LESS THAN THIS VALUE THE PANEL SHALL BE BRACED AT THE NEXT HIGHER AIC RATING CALCULATED BY AN ELECTRICAL ENGINEER.

^ = MAXIMUM FEEDER LENGTH TO MAINTAIN LESS THAN 2% VOLTAGE DROP.



Component List

(A) 200A meter socket, 100A MCB, 120/240V, NEMA 3R combination service entrance rated, hot sequence, meter/power pedestal with lever bypass, load center, and MCB. See panel schedule on this sheet for size of main and number and size of branch breakers. Set on new concrete pad plumb and level.

(C) Service entrance panel breaker section, for customer loads. See panel schedules on this sheet for size of breakers and number of poles required.

(D) 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 stenciled on the sidewall of the foundation.

Option 2: Provide 4000 psi, re-bar re-enforce, concrete with a minimum direct earth bury depth of 18-inch, 2-inch overlap of the enclosure on all sides front and back and 2-inch exposure above grade. Provide 3/4-inch chamfered edges. Provide structural engineered stamped drawing for pad.

(G) 3/4 inch x 10 feet long, copper-clad driven ground rod with exothermic weld or underground lug connect conductor to rod. (2) rods required.

(H) Built-in photocell for on/off control of luminaires on signals poles.

(J) Built-in, 2-pole 20A, lighting contactor for on/off control of lights on signal poles

(K) Optional hand-off-auto switch when items 'H' and 'J' above are used. Provide this HOA switch with the photocell control wired in the auto position.

Note:
All components listed shall be included in the pay item '613-50109 Meter Power Pedestal'. All components shall meet current National Electric Code (NEC) and be UL listed for the application.

Hot Sequence Meter Power Pedestal Elevation Detail for Traffic Signal with Camera

Not To Scale

MOUNTING: PEDESTAL — **PANEL "MPP_"** — 120/240V-1PH-3W

NEMA 3R ENCLOSURE SERVICE ENTRANCE RATED

FEEDER:BOTTOM — 100 AMPS MAIN BREAKER

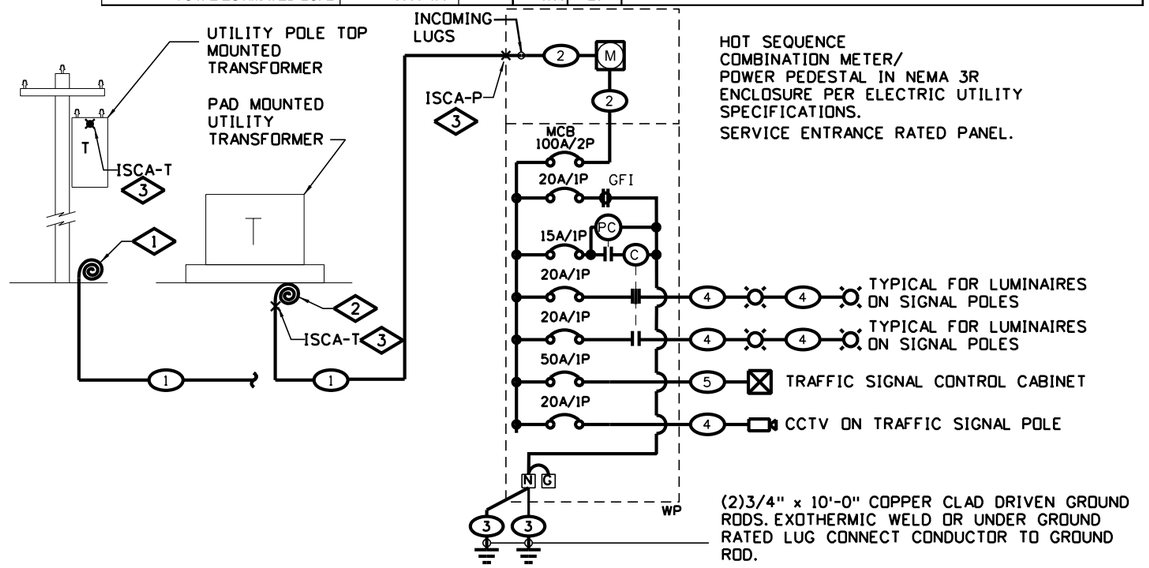
BRANCH BREAKER

				LEFT PHASE LOAD			RIGHT PHASE LOAD					
DESCRIPTION	Size	P	Ckt#	L1	L2		L1	L2	Ckt#	Size	P	DESCRIPTION
TRAFFIC SIGNAL POLE LIGHTING	20	1	1	240			180		2	20	1	MPP_ MAINTENANCE RECEPT.
TRAFFIC SIGNAL POLE LIGHTING	20	1	3		240			4800	4	50	1	TRAFFIC CONTROL CABINET
MPP_ LIGHTING CONTROL CKT.	15	1	5	200			300		6	20	1	CCTV CAMERA ON SIGNAL POLE
SPARE	20	1	7						8			SPACE ONLY
				440	240		480	4800				
				920	5040	Total Connected V.A.						
					5960	=Total Connected VA Both Phases						

LOAD	CONNECTED	D.FACT.	Est. KVA	AMPS
LIGHTING	480 VA	1.25	0.60	
RECEPTACLES (1ST 10000)	180 VA	1.00	0.18	
RECEPTACLES (REMAINING)	0 VA	0.50	0.00	
MOTOR (LARGEST)	0 VA	1.25	0.00	
MOTORS (REMAINING)	0 VA	1.00	0.00	
ELECTRICAL HEATING	0 VA	1.25	0.00	
ELECTRICAL MISC.	5300 VA	1.00	5.30	
TOTAL ESTIMATED LOAD	5960 VA		6.08	25

180 VA=Total Receptacle Load

NOTE:
ALL LIGHTING CONTROL CENTERS AND ELECTRICAL EQUIPMENT SHALL BE PROVIDED WITH "ARC-FLASH HAZARD WARNING" LABELS PER THE NATIONAL ELECTRIC CODE NEC 110.16 AND NFPA 70E-2015, AND ALL OTHER LABELS REQUIRED BY NFPA 70.



Feeder Schedule

(1) See the "Individual Hot Sequence MPP Fault Current Table For Signal With Luminaires And Cameras" on this sheet for these ISCA values.

(2) Internal feeder supplied with pedestal

(3) 1●4 stranded bare copper through feeder enclosure to ground rods.

(4) (2●10THWN CU & 1●10GND) 2 inch PVC conduit

(5) (2●6THWN CU & 1●10GND) 2 inch PVC conduit

One-Line Notes:

(1) Coil enough conductors at the base of the pole to reach the transformer terminals at the top of the pole. Final routing of conductors up the pole and connection to transformer by electric utility.

(2) Coil minimum of 5 feet of conductors at the transformer base. Final connection to transformer by electric utility.

(3) See the "Individual Hot Sequence MPP Fault Current Table For Traffic Cabinet" on this sheet for these ISCA values.

Hot Sequence Meter Power Pedestal One-line Diagram for Traffic Signal with Camera

Not To Scale

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Colorado Department of Transportation

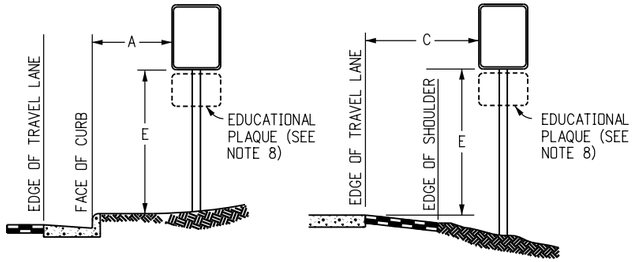
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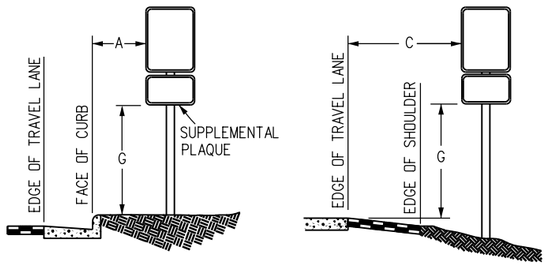
EB

Traffic Signal One-Line Diagrams

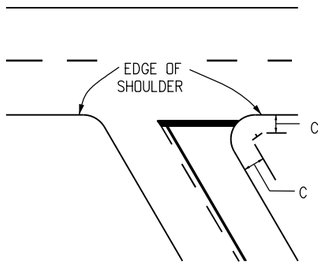
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-613-4
Standard Sheet No. 6 of 6
Project Sheet Number:

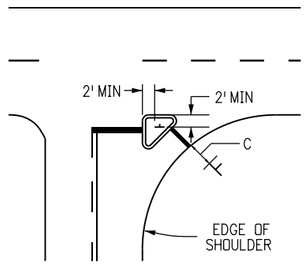




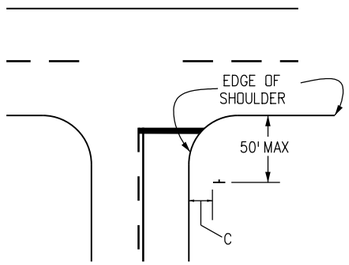
Regulatory, Recreational And Cultural Information Sign Placement



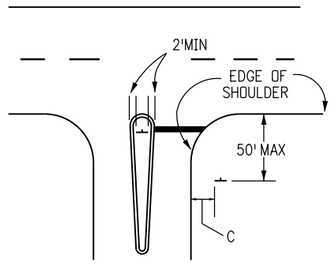
Acute Angle Intersection



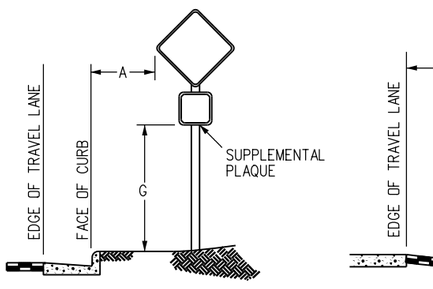
Channelized Intersection



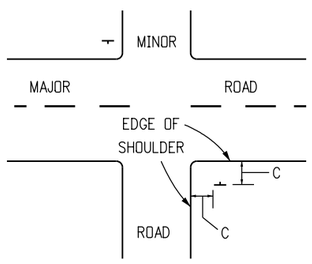
Wide Throat Intersection



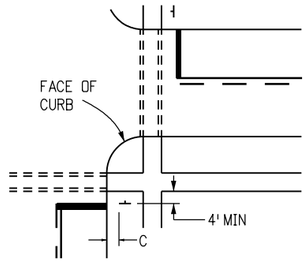
Divisional Island



Warning Sign Placement



Minor Crossroad



Urban Intersection

Typical Locations-Stop Signs And Yield Signs

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. Minimum post embedment shall be 3 feet for U-2 posts and 4-inch x 4-inch timber posts, and 5 feet for 6-inch x 6-inch timber posts. See S-614-6 and S-614-8 for footing depth. 6-inch x 6-inch timber posts shall be provided with two 2-inch diameter holes through the neutral axis at right angles to the roadway for induced breakaway function, one drilled at 4 inches and one at 18 inches above the ground level.
4. If a shoulder is wider than 6 feet, the minimum lateral offset distance should be 6 feet from the edge of shoulder, except for mile marker signs. See Figure 2A-2(B) of the MUTCD.
5. Normal lateral placement is measured from the edge of the travel lane.
6. In urban areas, a lateral clearance of 1 foot 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 7 or 8 feet. Other heights may be required when signs are mounted on steeper fill or cut slopes.
8. "Educational Plaques" accompanying symbol signs will not be considered when determining the vertical placement of symbol signs. For information of Educational Plaques, see page 3 of the 2021 CDOT Guide Signing Policies & Procedures, and Section 2M.06 of the MUTCD.
9. When lateral placement is 30 feet or more for signs without a supplemental plaque, vertical placement D may be reduced to 5 feet when lateral placement is 30 feet or more for signs with a supplemental panel, vertical placement F does not does not apply - use only vertical placement H.
10. Normal angular placement is 0 degrees. Signs closer than 30 feet should be turned slightly away to minimize specular reflection. Signs placed 30 feet or more should generally be turned toward the road.
11. The exit panel is mounted on the right hand side for right hand exits and the left hand side for left hand exits.
12. Post shall be installed plumb, vertical deviation shall not exceed ½-inch in 10 feet.
13. On all two-lane, undivided highways, the mile marker and post shall be installed on the right shoulder in the ascending direction with the mile marker panels displayed on the front and back side of the post.
14. On all undivided multi-lane and divided highways, and interstates, 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 1 to 1-½ inch, typical.
16. The mounting height of crossbuck signs, measured vertically from the center bottom of the sign to the elevation of the near edge of the pavement, should be approximately 7 feet, except as otherwise provided in the Colorado Supplement to Section 8B.03 of the MUTCD.

Placement Tables

LATERAL PLACEMENT		
KEY	ALL CLASSES OF STREETS AND HIGHWAYS	
	MINIMUM	NORMAL
A	2'-0"	15'-0" PLUS CURB
B	2'-0"	30'-0" OR MORE INCLUDES CURB
C	2'-0"	6'-0" PLUS EDGE OF 6' + WIDE SHOULDER. IF NONE, 15'-0" FROM EDGE OF TRAVEL LANE.

VERTICAL PLACEMENT						
KEY	FREEWAYS AND EXPRESSWAYS		CONVENTIONAL STREETS AND HIGHWAYS			
	MIN.	MAX.	URBAN		RURAL	
			MIN.	MAX.	MIN.	MAX.
D	7'-0" OR NOTE NO. 9	12'-0"	7'-0"	8'-0"	5'-0"	8'-0"
E	7'-0"	8'-0"	7'-0"	8'-0"	5'-0"	8'-0"
F	8'-0" OR NOTE NO. 9	12'-0"	8'-0"	9'-0"	5'-0"	9'-0"
G	6'-0"	7'-0"	6'-0"	7'-0"	4'-0"	7'-0"
H	5'-0"	10'-0"	6'-0"	7'-0"	4'-0"	7'-0"

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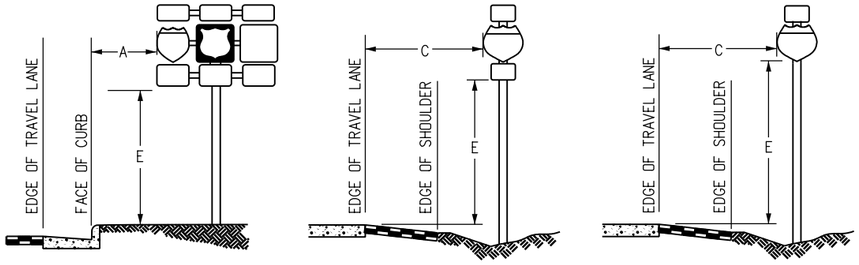
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Date:	Comments

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Denver, CO 80204
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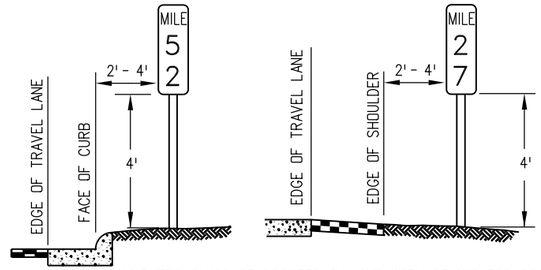
Ground Sign Placement

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-1
Standard Sheet No. 1 of 2
Project Sheet Number:

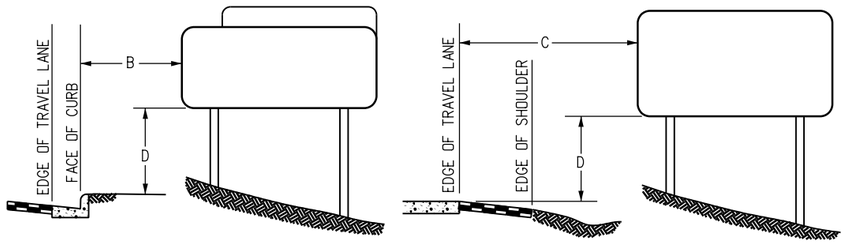


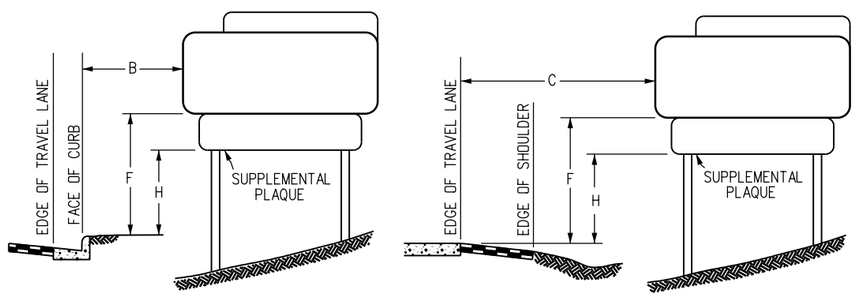
Route Marker Assembly Placement



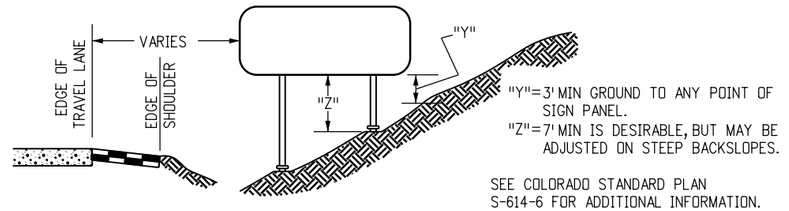
NOTE: MILE MARKERS SHALL BE LOCATED IN LINE WITH DELINEATOR POSTS.

Mile Marker Placement





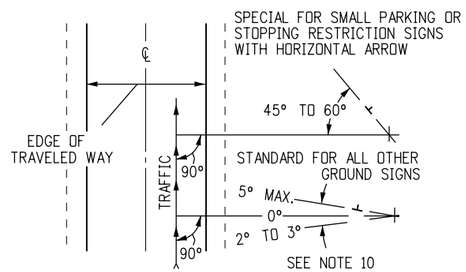
Class III Sign Placement



"Y"=3' MIN GROUND TO ANY POINT OF SIGN PANEL.
"Z"=7' MIN IS DESIRABLE, BUT MAY BE ADJUSTED ON STEEP BACKSLOPES.

SEE COLORADO STANDARD PLAN S-614-6 FOR ADDITIONAL INFORMATION.

Class III Signs, Panel Ground Clearance



Angular Placement

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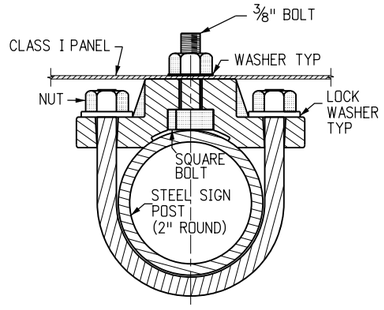
Colorado Department of Transportation
Traffic Safety & Engineering Services
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Denver, CO 80204
EB

Ground Sign Placement

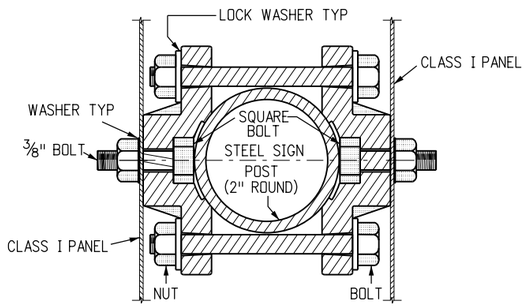
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Standard Plan No.
S-614-1
Standard Sheet No. 2 of 2
Project Sheet Number:

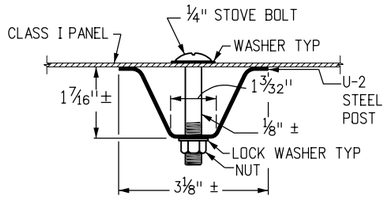
Typical Single Bracket



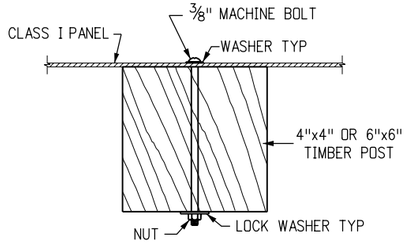
Typical Back To Back



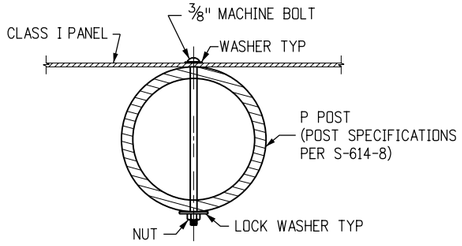
Typical Round Steel Pole Section



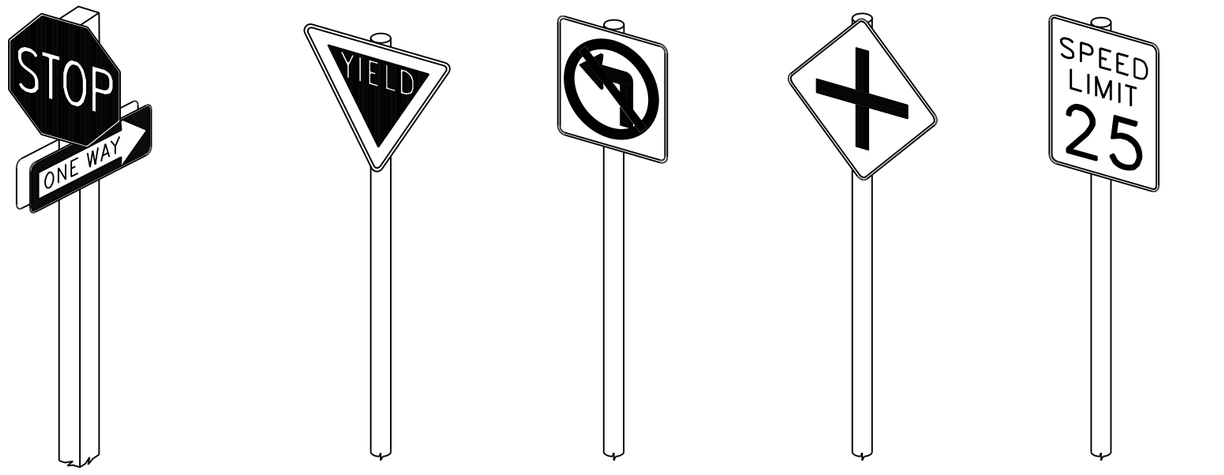
Typical U-2 Post Section



Typical Timber Post Section



Typical P Post Section



Typical Class I Ground Signs

General Notes

1. Timber signposts may only be used for temporary signage during construction. Tubular steel shall be used for permanent installations.
2. Class I sign panels are those that do not require backing zees. Sign panels up to 60 inches in width may be attached directly to T brackets. Sign panels up to 48 inches in width may be attached directly to U brackets. Class **I** sign panels shall be 0.10 inches minimum thickness single sheet aluminum.
3. Class I sign panels shall be fastened to the U-2 post with 2-¼ inch diameter stove bolts and to timber posts and P post with 2-⅜ inch diameter machine bolts. See Standard Plans S-614-20 and S-614-22 for exceptions.
4. A washer with a diameter of 1.25 inches shall be placed between the bolt head and the face of the sign panel. The washer shall not cover any lettering on the sign panel that could confuse the traveling public. A 1 inch diameter washer shall be placed between the nut and timber post.
5. Bolts, nuts and washers shall be galvanized or cadmium plated.
6. The retro-reflective sheeting shall be on the Department's approved product list.
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 plaques. "U" shape steel posts shall be a uniform flanged channel section made from hot rolled structural steel, re-rolled rail steel, or new billet steel having a minimum yield strength of at least 30,000 psi, and a minimum tensile strength of at least 50,000 psi. "U" shape posts shall weigh 2 pounds/foot, except that a mill tolerance of minus 3½% of the weight of any one post will be allowed. "U" shape posts shall have 5/16 inch holes drilled or punched on 1 inch or 2 inch centers for the top 4 feet of the post as a minimum, with the first hole 1½ inch 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 inch to 1½ inch.

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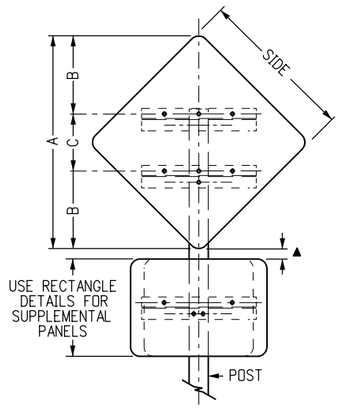
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Class I Signs

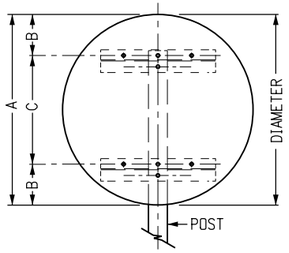
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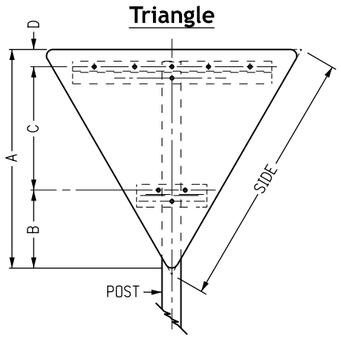
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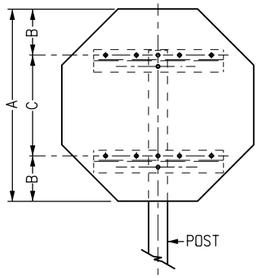
Circle



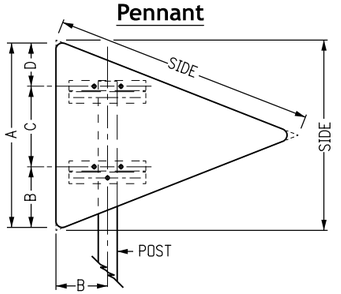
Triangle



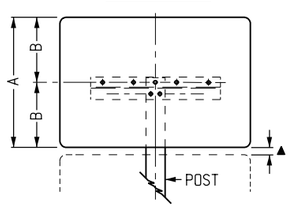
Octagon



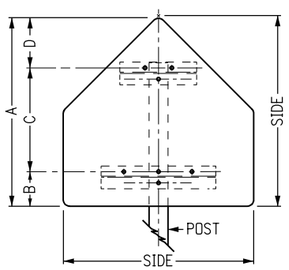
Pennant



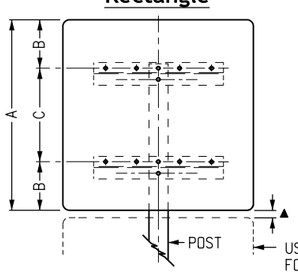
(One Zee)



Pentagon



(Multi-Zee) Rectangle

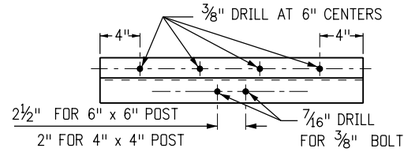


Typical Panel Details

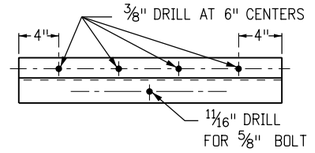
CLASS II PANEL MOUNTING DATA (*TIMBER POSTS)						
SIGN TYPE		A	B	C	D	POST SIZE
DIAMOND, 36" SIDES		49 1/16"	14 1/32"	21"	—	6" x 6"
48" SIDES		65 3/8"	20 3/16"	25"	—	6" x 6"
60" SIDES		81 1/2"	25 3/4"	30"	—	6" x 6"
TRIANGLE, 36" SIDES		29 3/16"	14 3/16"	9"	6"	4" x 4"
48" SIDES		38 9/16"	14 9/16"	18	6"	4" x 4"
60" SIDES		48"	20"	22"	6"	6" x 6"
OCTAGON, 36" x 36"		36"	9"	18"	—	6" x 6"
48" x 48"		48"	12"	24"	—	6" x 6"
CIRCLE, 36" DIAMETER		36"	8"	20"	—	6" x 6"
PENNANT, 48" x 36" SIDES		34"	10 3/4"	15"	8 1/4"	4" x 4"
64" x 48" SIDES		45"	12 1/2"	21 1/2"	11"	6" x 6"
PENTAGON, 36" SIDES		35"	6"	20"	9"	4" x 4"
48" SIDES		46 3/4"	9"	25 3/4"	12"	6" x 6"
RECTANGLE						
WIDTH	HEIGHT					
36"	24"	24"	12"	—	—	4" x 4"
48"	24"	24"	12"	—	—	6" x 6"
36" to 60"	30"	30"	9"	12"	—	6" x 6"
36" to 60"	36"	36"	9"	18"	—	6" x 6"
36" to 60"	42"	42"	9"	24"	—	6" x 6"
36" to 60"	48"	48"	12"	24"	—	6" x 6"
48"	54"	54"	12"	30"	—	6" x 6"
48" to 60"	60"	60"	12"	36"	—	6" x 6"
SUPPLEMENTAL PANELS						
RECTANGLE, 24" x 18"		18"	9"	—	—	4"x4"or 6"x6"
48" x 18"		18"	9"	—	—	6" x 6"
24" x 24"		24"	12"	—	—	6" x 6"
36" x 24"		24"	12"	—	—	6" x 6"
48" x 36"		36"	9"	18"	—	6" x 6"

* For additional Class II sizes that utilize steel posts, see Standard Plan S-614-8.

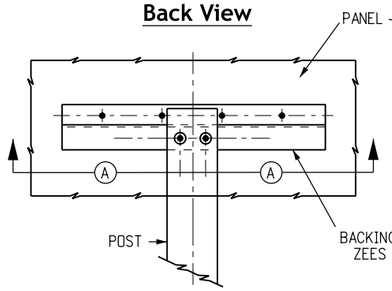
One Post - One Zee



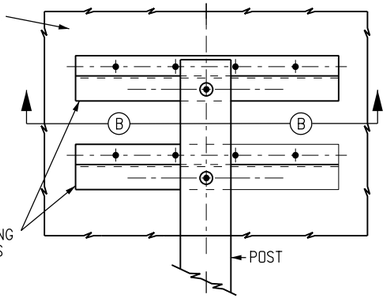
One Post - Two Zees



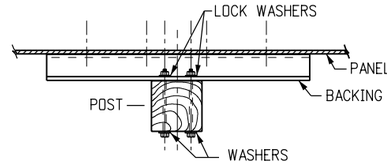
Back View



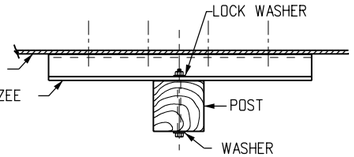
Back View



Section A-A



Section B-B



END VIEW

Typical Backing Zees

General 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 one to two backing zees and are less than 72 inches in height. Class II sign panels may use more than two backing zees when attached to a Class III assembly. Class II sign panels shall be 0.10 inch minimum thickness single sheet aluminum.
3. Z-Bar length shall be 3 inches (± ½ 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 inch x 2 1/16 inch x 2.33, 6061-TB aluminum alloy weighing 2.33 pounds per foot.
6. For sign placement, see Standard Plan S-614-1.
7. All signs shall be fabricated using retro-reflective sheeting conforming to ASTM D956. 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 1½ inches.
10. Washers on timber posts shall be 1½ inches diameter.

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Last Modification Date: 07/01/26			
Last Modified By: YSP			
CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

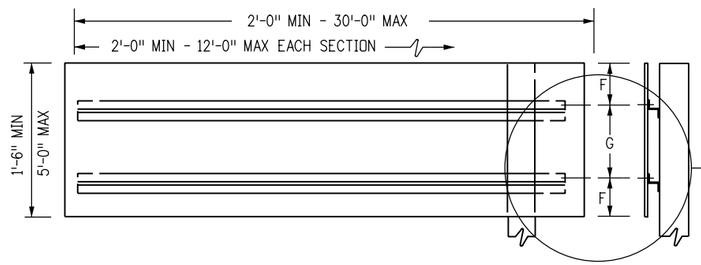
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Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
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Class II Signs

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-3
Standard Sheet No. 1 of 1
Project Sheet Number:

Horizontal Sections



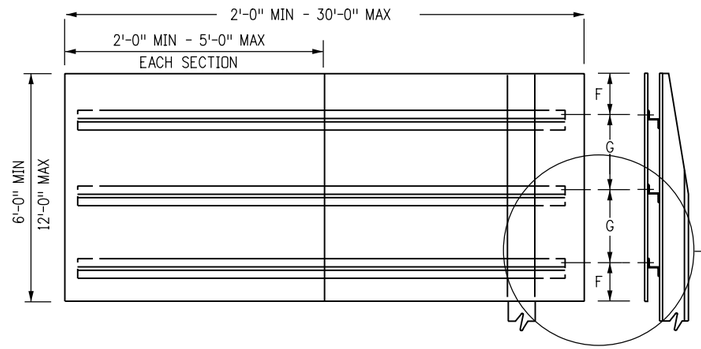
SECTIONS REQUIRED

WIDTH	*SECTIONS
2'-0" TO 12'-0"	1
12'-6" TO 24'-0"	2
24'-6" TO 30'-0"	3

*NUMBER OF SECTIONS SHALL NOT EXCEED MAXIMUM SHOWN IN TABLE

SEE TYPICAL DETAIL ON SHEET 2

Vertical Sections



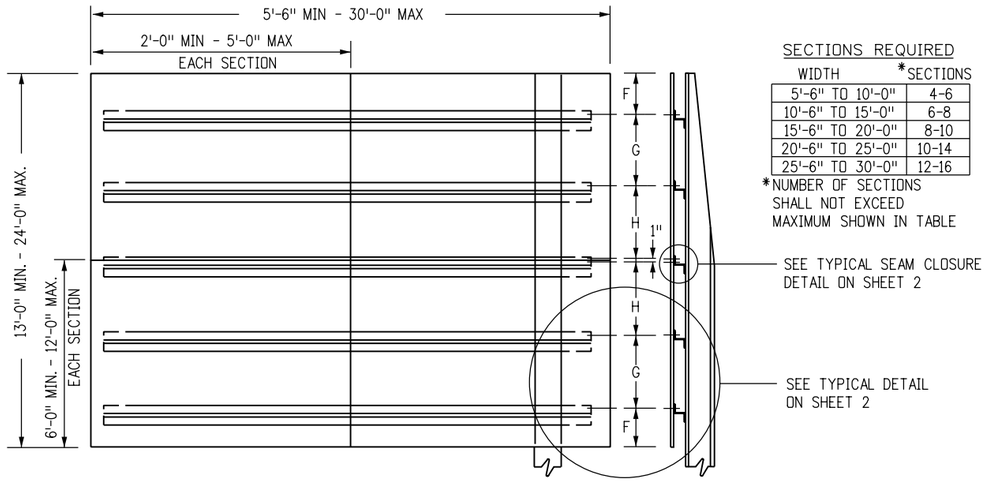
SECTIONS REQUIRED

WIDTH	*SECTIONS
2'-0" TO 5'-0"	1
5'-6" TO 10'-0"	2-3
10'-6" TO 15'-0"	3-4
15'-6" TO 20'-0"	4-5
20'-6" TO 25'-0"	5-7
25'-6" TO 30'-0"	6-8

*NUMBER OF SECTIONS SHALL NOT EXCEED MAXIMUM SHOWN IN TABLE

SEE TYPICAL DETAIL ON SHEET 2

Multi-Vertical Sections



SECTIONS REQUIRED

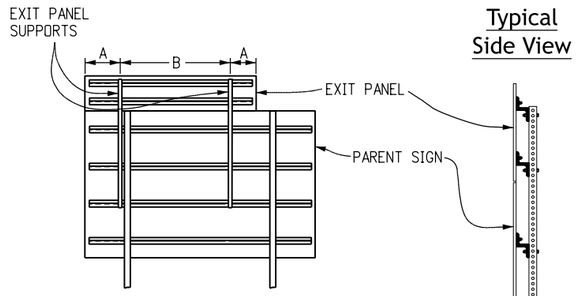
WIDTH	*SECTIONS
5'-6" TO 10'-0"	4-6
10'-6" TO 15'-0"	6-8
15'-6" TO 20'-0"	8-10
20'-6" TO 25'-0"	10-14
25'-6" TO 30'-0"	12-16

*NUMBER OF SECTIONS SHALL NOT EXCEED MAXIMUM SHOWN IN TABLE

SEE TYPICAL SEAM CLOSURE DETAIL ON SHEET 2

SEE TYPICAL DETAIL ON SHEET 2

Typical Panel Elevations



Typical Side View

SUPPORT SPACING TABLE		
EXIT PANEL WIDTH	OVERHANG "A"	SPACING "B"
7'	1'-0"	5'
8'	1'-6"	5'
9'	2'-0"	5'
10'	2'-6"	5'
11'	2'-6"	6'
12'	2'-6"	7'

Typical Exit Panel Installation For Ground Signs

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 those where a single panel requires 3 or more backing zees and are 72 inches or more in height. Ground mount and overhead exit sign panel assemblies shall be Class III. Class iii sign panels shall be 0.125 inch minimum thickness sheet aluminum.
3. See the applicable standards for sign placement, footing details and post spacing tables.
4. A 3/8-inch 90-degree countersunk huckbolt and collar shall be used to fasten the sign panel to the backing zee. A hex-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 flange. A lock washer shall be placed under the nut on a steel post or a backing zee. A 1-1/2 inch diameter washer shall be placed under the bolt head on a timber post.
6. All exposed sign panel section joints, except the multi-vertical sections horizontal seam, shall be covered on the backside of the sign panel with an aluminum closure strip. Closure strips shall be riveted or taped. See fabrication notes.
7. Sections illustrated based on utilizing 12-feet x 5-feet stock. 4-feet wide stock may be used with appropriate adjustment in number of sections.
8. All signs shall be fabricated using retroreflective sheeting conforming to ASTM D4956. The type shall be as described in the standard specifications and/or as shown on the plans.
9. For the design of posts and footings design, see 'Class **III** Sign Post and Footing Calculation' spreadsheet on CDOT website.

EXIT PANEL NOTES

1. The exit panel shall be mounted with two supports. Right hand exits require the edge of the exit panel to be mounted even with the right edge of the parent sign. Left hand exits require the left edge of the exit panel to be mounted even with the left edge of the parent sign.
2. The supports shall be square steel tubing a minimum width of 2-1/4 inch with 7/16 inch holes punched or drilled on 1-inch centers along the length of each side while maintaining a minimum section modulus of 0.499 cubic inches. The steel must have a minimum yield stress of 33 ksi. Alternately, zee bar may used for the support members with 7/8 inch holes punched where needed.
3. The supports shall be fastened to the backing zee using 3/8-inch bolts.
4. The exit panel support may be moved 6-inches 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.

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Colorado Department of Transportation

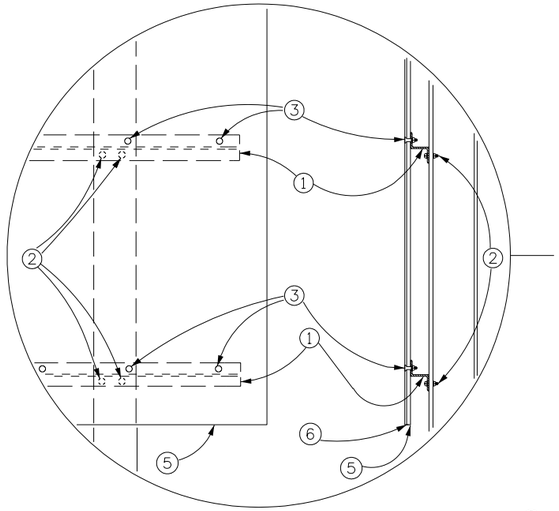
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Class III Signs

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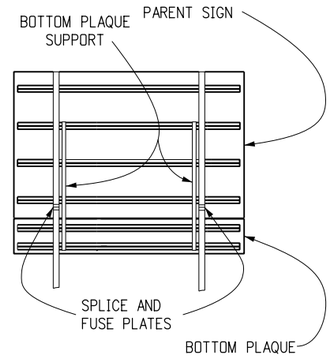
Standard Plan No.
S-614-4
Standard Sheet No. 1 of 3
Project Sheet Number:



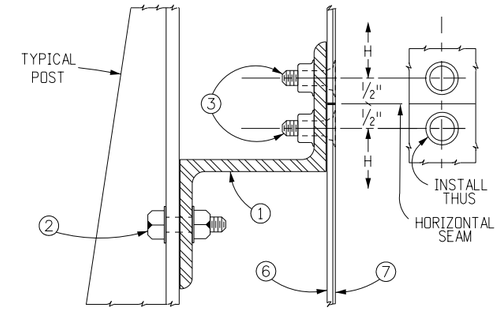
Typical Elevation Detail

Fabrication Notes

1. Backing zee. see "zee spacing table" on sheet 3. aluminum alloy 6061-t6. each zee to be provided with a 9/16 inch x 2 inch horizontal slot for each post mounting bolt.
2. 3/8-inch hex-head bolt with nut and washers; 2 per backing zee per post required. washers on post shall be 1-1/2 inch diameter.
3. 3/8 inch (number 6) 90 degree countersunk huckbolt with collar.
4. 2 inch x 0.025 inch aluminum closure strip riveted above the top zee and below the bottom zee 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 inch minimum thickness.
6. Adhesives shall be Class I or Class II adhesives of ASTM D4956.
7. Backing zees shall extend to the edge of the panel on 6 feet, 7 feet & 8 feet wide signs.



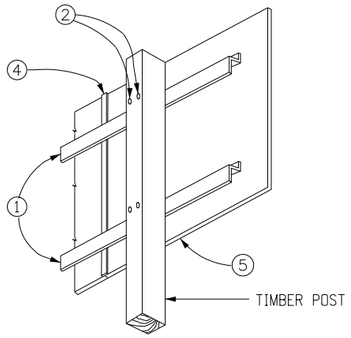
*Typical Bottom Plaque Installation for Ground Signs (Full Width Plaque Support)



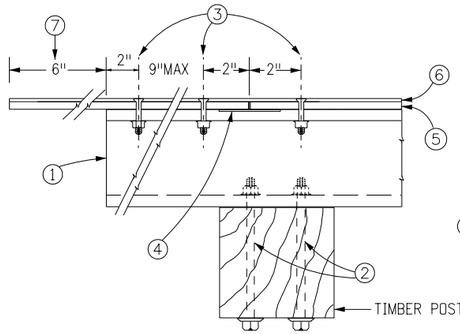
Typical Detail Seam Closure Zee

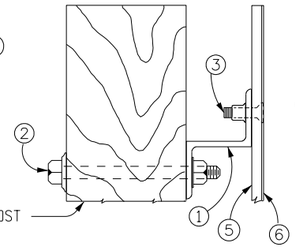
(Multiple-Vertical Sections, Horizontal Seams)

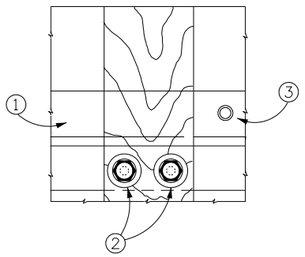
* IN NO CASE SHALL ANY PORTION OF A SIGN PANEL OR PLAQUE BE ATTACHED TO A BREAKAWAY POST BELOW THE FUSE AND SPLICE PLATES.



Typical View

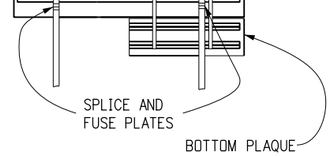




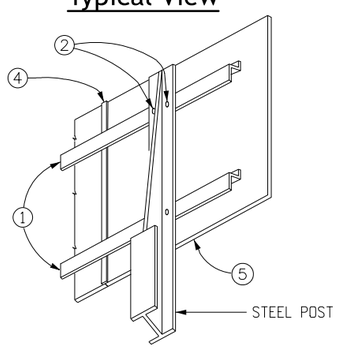


Typical Timber Post Installation

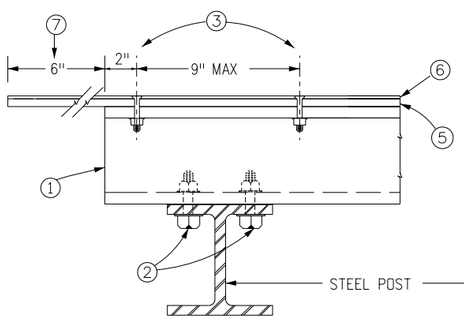
Panel Fabrication and Mounting Details

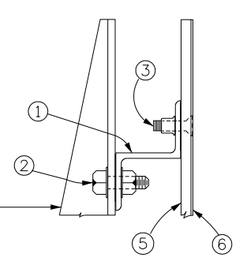


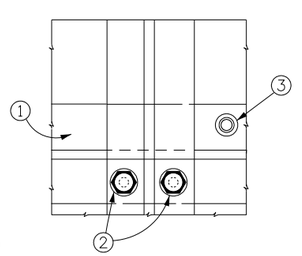
*Typical Bottom Plaque Installation for Ground Signs (Partial Width Plaque Support)



Typical View

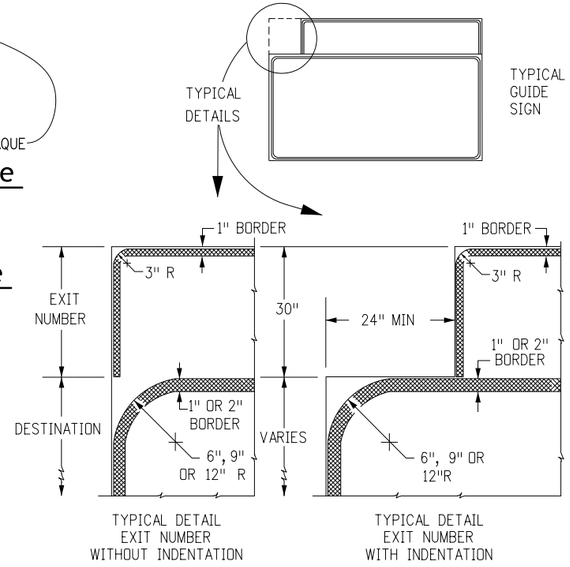






Typical Steel Post Installation

Panel Fabrication and Mounting Details



Typical Border Details with Exit Number

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Colorado Department of Transportation

Traffic Safety & Engineering Services

2829 West Howard Place
Denver, CO 80204

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Class III Signs

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.

S-614-4

Standard Sheet No. 2 of 3

Project Sheet Number:

POST SPACING TABLE
FOR SHEET ALUMINUM SIGN PANELS

WIDTH OF SIGN	NO. OF POSTS	OVERHANG "A"	POST SPACING "B"
1'-6"	1	0'-9"	
2'-0"	1	1'-0"	
2'-6"	1	1'-3"	
3'-0"	1	1'-6"	
4'-0"	1	2'-0"	
5'-0"	1	2'-6"	
6'-0"	2	0'-3"	5'-6"
7'-0"	2	0'-3"	6'-6"
8'-0"	2	0'-3"	7'-6"
9'-0"	2	0'-9"	7'-6"
10'-0"	2	1'-3"	7'-6"
11'-0"	2	1'-9"	7'-6"
12'-0"	2	2'-3"	7'-6"
13'-0"	2	2'-6"	8'-0"
14'-0"	2	2'-6"	9'-0"
15'-0"	2	3'-0"	9'-0"
16'-0"	2	3'-3"	9'-6"
17'-0"	2	3'-3"	10'-6"
18'-0"	2	3'-6"	11'-0"
19'-0"	2	3'-9"	11'-6"
20'-0"	2	4'-0"	12'-0"
21'-0"	3	2'-6"	8'-0"
22'-0"	3	3'-0"	8'-0"
23'-0"	3	3'-6"	8'-0"
24'-0"	3	3'-8"	8'-4"
25'-0"	3	4'-0"	8'-6"
26'-0"	3	4'-0"	9'-0"
27'-0"	3	4'-0"	9'-6"
28'-0"	3	4'-0"	10'-0"
29'-0"	3	4'-0"	10'-6"
30'-0"	3	4'-0"	11'-0"

(1) , (2)
(1) , (2)
(1)

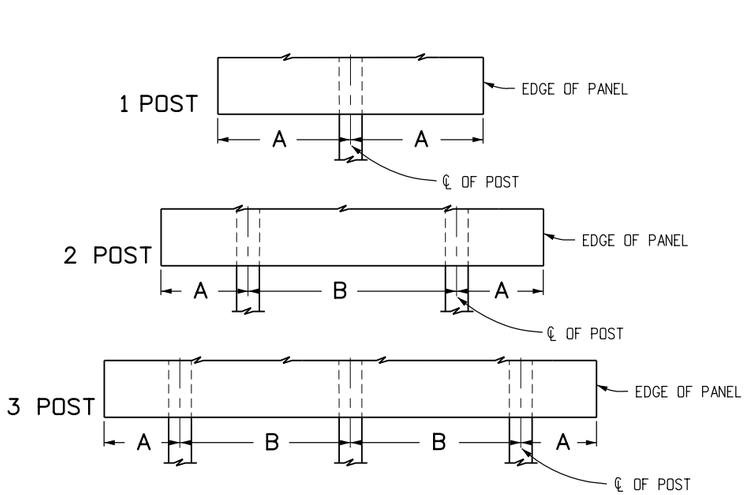
(1) BACKING ZEE SHALL EXTEND TO THE EDGE OF THE PANEL, EXCEPT FOR EXIT PANELS ATTACHED BY SQUARE STEEL TUBING.

(2) 6" X 6" TIMBER POSTS WILL NOT BE USED FOR THESE SIZES OF PANEL.

ZEE SPACING TABLE
FOR 3" X 2-11/16 X 2.33 ALUMINUM BACKING ZEES

SIGN PANEL HEIGHT	NUMBER OF ZEES	OVERHANG "F"	SPACING "G"	SIGN PANEL HEIGHT	NUMBER OF ZEES	OVERHANG "F"	SPACING "G"	SPACING "H"
1'-6"	2	0'-4"	0'-10"	13'-0"	7	1'-0"	1'-10"	1'-9½"
2'-0"	2	0'-5"	1'-2"	14'-0"	7	0'-6"	2'-2"	2'-1½"
2'-6"	2	0'-6"	1'-6"	15'-0"	7	1'-0"	2'-2"	2'-1½"
3'-0"	2	0'-7"	1'-10"	16'-0"	7	0'-6"	2'-6"	2'-5½"
4'-0"	2	0'-11"	2'-2"	17'-0"	7	1'-0"	2'-6"	2'-5½"
5'-0"	2	1'-3"	2'-6"	18'-0"	9	0'-4"	2'-2"	2'-1½"
6'-0"	3	0'-10"	2'-2"	19'-0"	9	0'-10"	2'-2"	2'-1½"
7'-0"	3	1'-0"	2'-6"	20'-0"	9	1'-4"	2'-2"	2'-1½"
8'-0"	4	0'-9"	2'-2"	21'-0"	9	0'-6"	2'-6"	2'-5½"
9'-0"	4	1'-3"	2'-2"	22'-0"	9	1'-0"	2'-6"	2'-5½"
10'-0"	4	1'-3"	2'-6"	23'-0"	11	0'-8"	2'-2"	2'-1½"
11'-0"	5	1'-2"	2'-2"	24'-0"	11	1'-2"	2'-2"	2'-1½"
12'-0"	5	1'-0"	2'-6"					

NOTES: FOR F, G & H. SEE DETAILS ON SHEET 1.



Typical Post Spacing

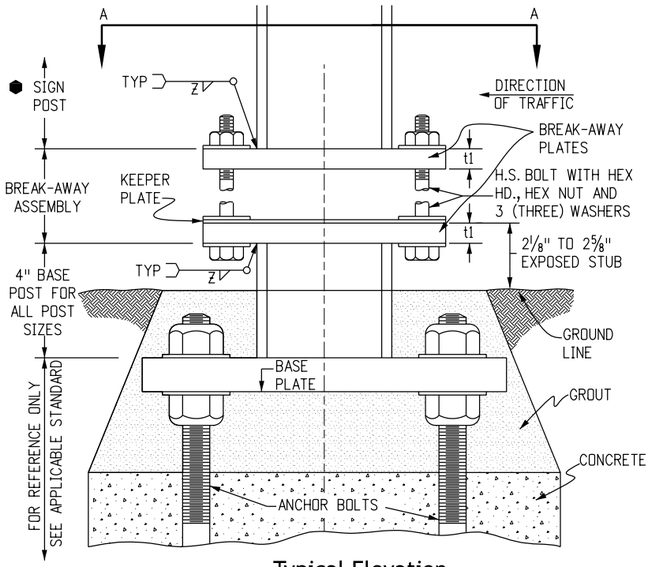
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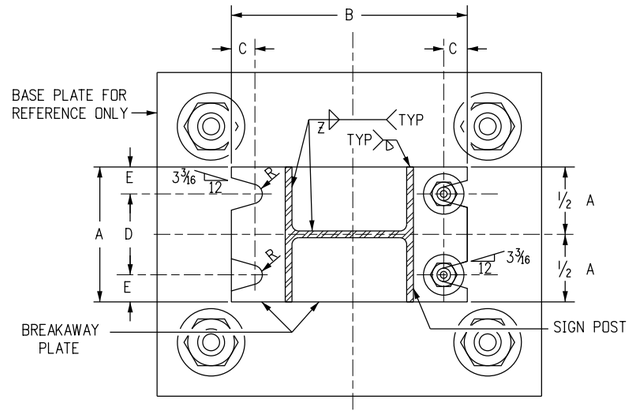
Class III Signs

Issued by the Traffic Safety & Engineering Services: July 01, 2026

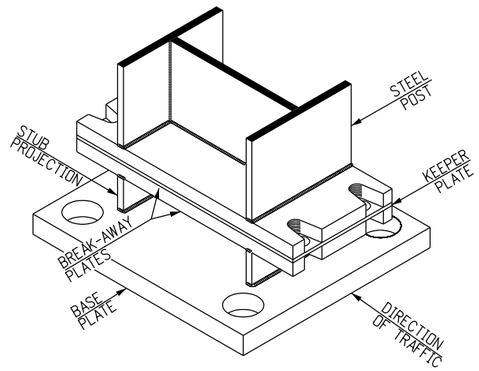
Standard Plan No.
S-614-4
Standard Sheet No. 3 of 3
Project Sheet Number:



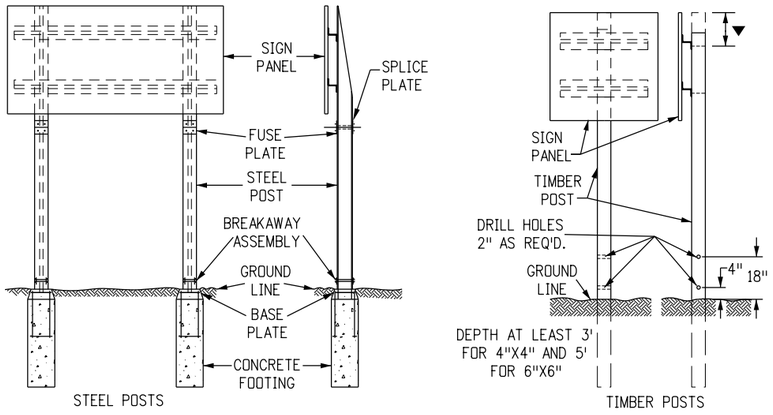
Typical Elevation
Steel Post Assembly



Section A-A



Typical Projected View
Steel Post Assembly



Typical Breakaway Sign Support Installations

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 12 inch to 15 inch wrench, to bed the washers and clean the bolt threads. Then loosen each bolt in turn, and retighten in a systematic order to the prescribed torque (see Breakaway Plate Data tables).
3. Burr threads at junction with nut to prevent nut loosening.

General Notes

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 (ASTM A709) Grade 36 and Sections 509 and 614 of the Standard Specifications.
3. Steel fuse plates and splice plates shall conform to AASHTO M270 (ASTM A709) grade 36.
4. All structural steel including fuse and splice plates shall be galvanized in accordance with astm A123 after fabrication. Steel posts shall be stamped with their size.
5. All high strength bolts, nuts and washers shall conform to ASTM-A325. Washers used in the break-away plate and fuse plate assemblies shall be of sufficient strength to prevent any deflection or cupping into the slotted grooves under bolt torquing.
6. All bolts, nuts, and washers shall be galvanized as per ASTM-A153 or ASTM-A164.
7. All holes in fuse plate and post flange on which it mounts, shall be drilled. All others may be drilled or sub-punched and reamed.
8. All steel cuts shall preferably be saw cuts; however, flame cutting will 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 28-gage galvanized sheet metal, fabricated to match breakaway plate dimensions but with holes rather than slots, shall be used to prevent bolt loosening due to wind vibration.
10. High strength bolts in the breakaway assembly shall be tightened only to the torque shown in the table. Do not overtighten.
11. Timber posts shall be in accordance with Section 614 of the Standard Specifications as to size, alternate size, grade, species, treament, and breakaway.
12. For all base plate and footing work see Standard Plan S-614-6.
13. For additional information, refer to "Tabulation of Sign and Cross Sections for Class **III** Signs" included in the plans.
14. ▼ Timber post shall be flush with top of sign panel for direct mount and 3 3/16 inch minimum above bolt for backing zee mount.
15. Timber sign post may only be used for temporary signage during construction. Tubular steel shall be used for permanent installations.
16. In no case shall a backing zee be placed below the fuse plates.
17. Sign post pay length is from the upper breakaway plate to the top of the "Cope". The 4-inch "Base Post" and the lower "Breakaway Plate" are paid for as part of the footing. The upper "Breakaway Plate" and all nuts, bolts, washers and keeper plate for fastening the breakaway plates are paid for as a part of the post.

BREAKAWAY PLATE DATA TABLE

DIMENSION / POST SIZE	BOLT SIZE AND TORQUE	A	B	C	D	E	t1	WELD Z	R
W 12 X 26	¾"ø X 3¾" 46 Ft. Lb.	6½"	17"	⅞"	3½"	1½"	1"	5/16"	13/32"
W 10 X 26		5¾"	14⅞"	⅞"	3¼"	1¼"	1"	5/16"	13/32"
W 10 X 22		5¾"	14⅝"	⅞"	3¼"	1¼"	1"	5/16"	13/32"
W 8 X 21		5¼"	12⅝"	⅞"	2¾"	1¼"	1"	5/16"	13/32"
W 8 X 18	⅝"ø X 3" 29 Ft. Lb.	5¼"	12"	¾"	3"	1⅛"	¾"	¼"	11/32"
W 6 X 15		6"	10"	¾"	3¾"	1⅛"	¾"	¼"	11/32"
W 6 X 12		5"	10"	¾"	2¾"	1⅛"	¾"	¼"	11/32"

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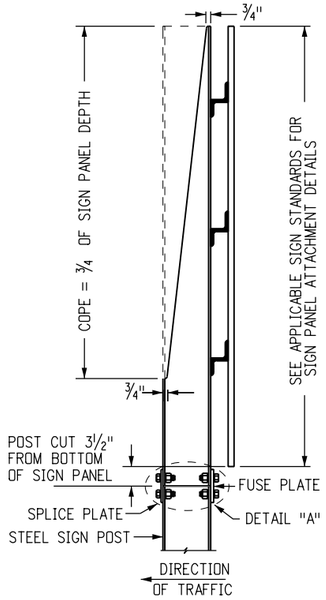
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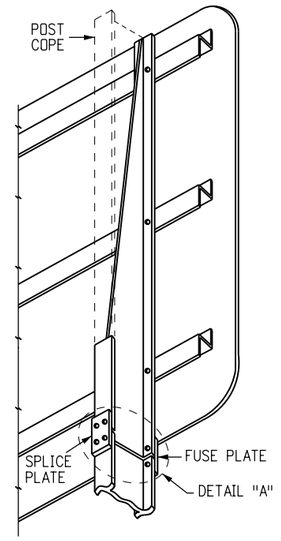
Break-Away Sign Support Details For Class III Signs

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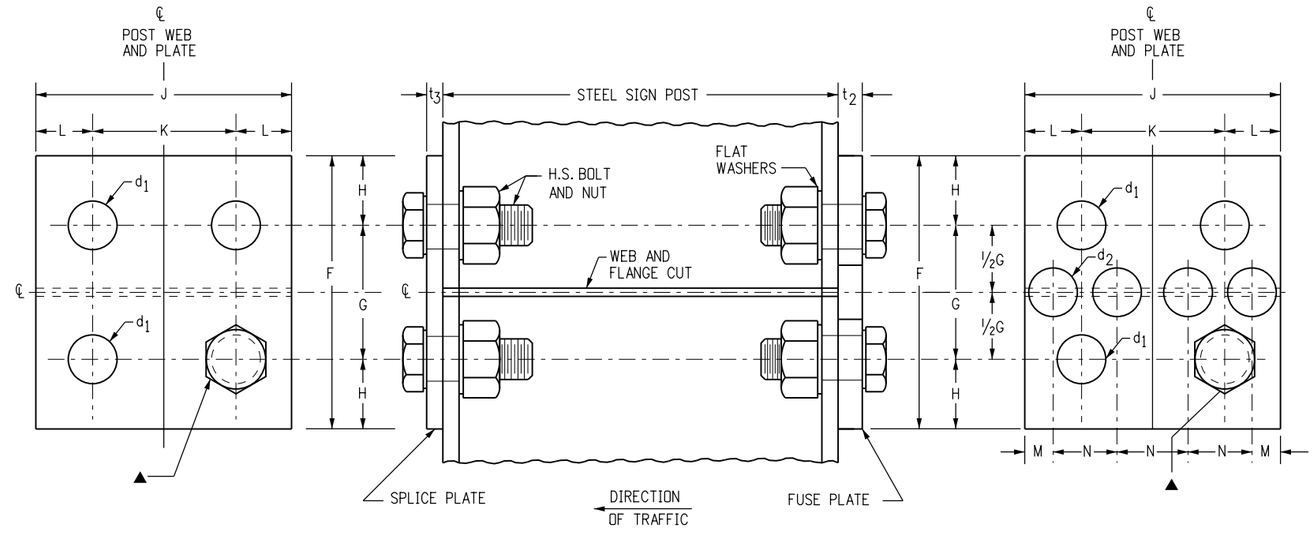
Standard Plan No.
S-614-5
Standard Sheet No. 1 of 2
Project Sheet Number:



Typical Side View
Fuse Plate and Post Cope



Typical Projected View
Fuse Plate and Post Cope



Splice Plate Detail

Detail "A" - Side View

Fuse Plate Detail

Typical Fuse and Splice Plate Hinge Details

▲ HOLE DIAMETER= d1
USE HIGH STRENGTH BOLTS WITH HEX HEAD AND HEX NUT, WITH ONE FLAT WASHER UNDER EACH

FUSE AND SPLICE PLATE HINGE DATA TABLE

SIZE / POST	F	G	H	J	K	L	M	N	d_1	d_2	t_2	t_3	BOLT SIZE	FABRICATION NOTES
W 12 X 26	6"	3"	1½"	6½"	3½"	1½"	13/16"	1⅝"	13/16"	1⅝"	½"	7/16"	¾" ø X 2½"	ALL HOLES IN FUSE PLATE AND POST FLANGE HOLES ON WHICH IT MOUNTS SHALL BE DRILLED. ALL OTHERS MAY BE PUNCHED. BURR THREADS AT JUNCTION WITH NUT TO PREVENT NUT LOOSENING. ASTM-A441, ASTM-572 GRADE 50, OR ASTM-A588 MAY BE SUBSTITUTED FOR AASHTO M270 (ASTM A709) GRADE 36 AT THE OPTION OF THE FABRICATOR. STEEL USED SHALL HAVE AN ULTIMATE TENSILE STRENGTH NOT TO EXCEED 80 KSI.
W 10 X 26	6"	3"	1½"	5¾"	2¾"	1½"	13/16"	1⅜"	13/16"	1⅛"	½"	7/16"	¾" ø X 2½"	
W 10 X 22	6"	3"	1½"	5¾"	2¾"	1½"	13/16"	1⅜"	13/16"	1⅛"	½"	⅜"	¾" ø X 2½"	
W 8 X 21	5½"	2½"	1½"	5¼"	2¾"	1¼"	¾"	1¼"	13/16"	1"	½"	⅜"	¾" ø X 2½"	
W 8 X 18	5"	2½"	1¼"	5¼"	2¾"	1¼"	¾"	1¼"	11/16"	1 1/16"	⅜"	⅜"	⅝" ø X 2½"	
W 6 X 15	5"	2½"	1¼"	6"	3½"	1¼"	¾"	1½"	11/16"	1¼"	⅜"	¼"	⅝" ø X 2½"	
W 6 X 12	4¼"	2"	1⅛"	4"	2¼"	⅞"	½"	1"	9/16"	¾"	¼"	¼"	½" ø X 2¾"	

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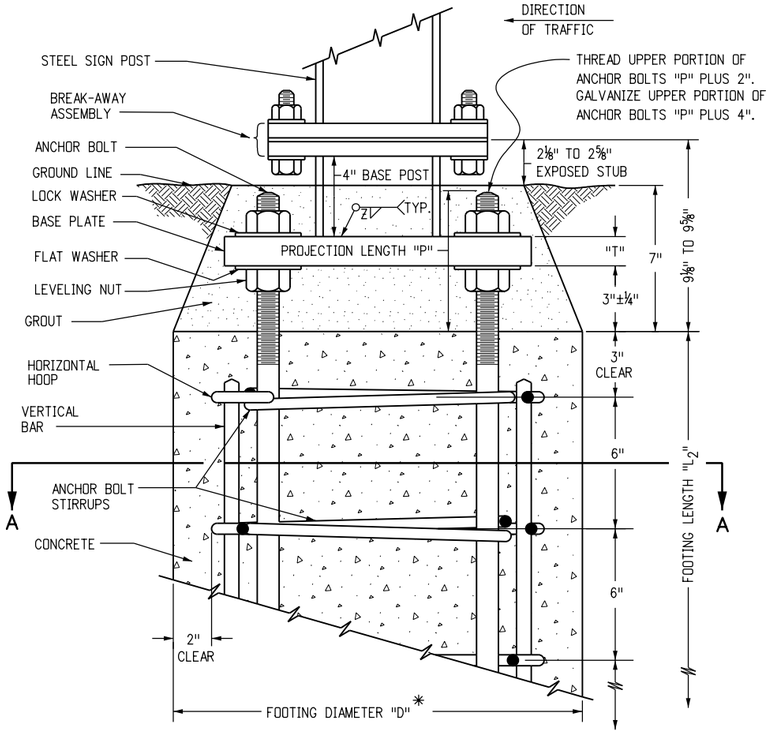
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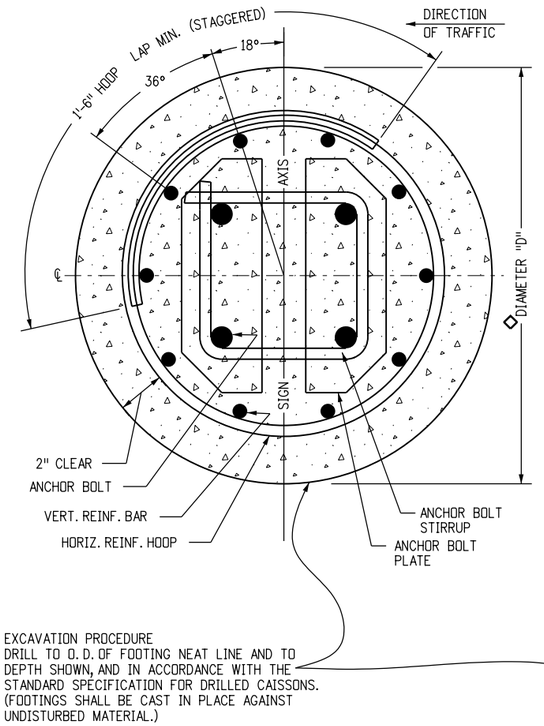
Break-Away Sign Support Details For Class III Signs

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Standard Plan No.
S-614-5
Standard Sheet No. 2 of 2
Project Sheet Number:

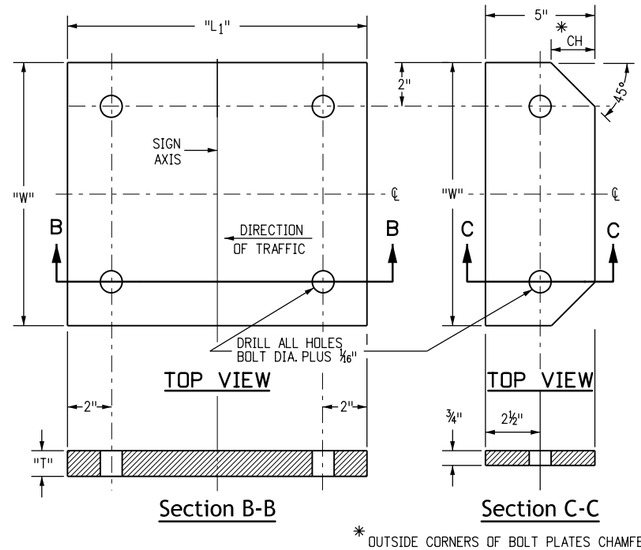


Typical Concrete Footing Assembly



EXCAVATION PROCEDURE
DRILL TO O.D. OF FOOTING NEAT LINE AND TO DEPTH SHOWN, AND IN ACCORDANCE WITH THE STANDARD SPECIFICATION FOR DRILLED CAISSONS. (FOOTINGS SHALL BE CAST IN PLACE AGAINST UNDISTURBED MATERIAL.)

Section A-A



* OUTSIDE CORNERS OF BOLT PLATES CHAMFERED AS SHOWN FOR FOOTING TYPES 1-4 ONLY. PLATES FOR TYPES 5-7 HAVE SQUARE CORNERS.

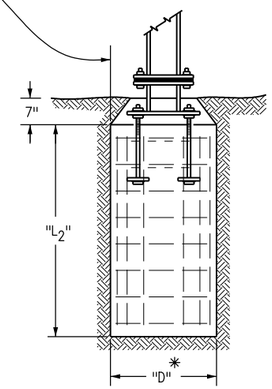
Base Plate Typical Details

Bolt Plate Typical Details

CONCRETE FOOTING TABLE

POST BASE STRUCTURAL DATA										FOOTING STRUCTURAL DATA				
SIZE	MAXIMUM ALLOWABLE MOMENT	POST TO BASE ℄ WELD Z	BASE PLATE			ANCHOR COMPONENTS				SIZE			REINFORCING	
			"L1"	"W"	"T"	ANCHOR BOLTS	BOLT PLATES	"CH"	STIRRUPS	"P"	TYPE	◇ "D"	"L2"	VERT. BAR	HORIZ. HOOP
W 12X26	46.5 KIP FT.	⅜" FILLET	20¼"	14"	1⅜"	4-1¼"øX2'-6"	2-5"X¾"X14"	N/A	2-½"ø	6⅝"	7	36"	10'	10-#9X9'-6"	20-#4@6"
W 10X26	38.9 KIP FT.	⅜" FILLET	17"	14"	1¼"	4-1"øX2'-6"	2-5"X¾"X14"	N/A	2-½"ø	6¼"	6	30"	9'	10-#9X8'-6"	18-#4@6"
W 10X22	32.3 KIP FT.	⅜" FILLET	16¼"	14"	1¼"	4-1"øX2'-6"	2-5"X¾"X14"	N/A	2-½"ø	6¼"	5	30"	8'	10-#8X7'-6"	16-#4@6"
W 8X21	24.4 KIP FT.	⅜" FILLET	15"	13¼"	1⅛"	4-⅞"øX2'-0"	2-5"X¾"X13¼"	2-½"	2-½"ø	6"	4	24"	7'	10-#8X6'-6"	14-#4@6"
W 8X18	20.4 KIP FT.	⅜" FILLET	14"	13¼"	1⅛"	4-⅞"øX2'-0"	2-5"X¾"X13¼"	2-½"	2-½"ø	6"	3	24"	6'	10-#7X5'-6"	12-#4@6"
W 6X15	13.8 KIP FT.	⅜" FILLET	14"	12¼"	1"	4-¾"øX1'-6"	2-5"X¾"X12¼"	2"	2-½"ø	5¾"	2	24"	5'	10-#6X4'-6"	10-#4@6"
W 6X12	8.3 KIP FT.	¼" FILLET	13"	12"	⅞"	4-¾"øX1'-6"	2-5"X¾"X12"	2"	2-½"ø	5⅝"	1	24"	4'	10-#5X3'-6"	8-#4@6"
6X6 TIMBER	5.0 KIP FT.	TIMBER POSTS SHALL BE SET IN DRILLED OR EXCAVATED HOLES--DEPTH SHALL BE 5 FT. FOR 6X6 POSTS AND 3 FT. FOR 4X4 POSTS UNLESS OTHERWISE NOTED ON THE TABULATION OF SIGNS IN THE PLANS. POSTS SHALL BE PLACED PLUMB, BACKFILLED WITH EXCAVATED MATERIALS, AND THOROUGHLY TAMPED INTO PLACE.													
4X4 TIMBER	1.4 KIP FT.														

* FOR MULTI-DIRECTIONAL BREAKAWAY ONLY: TYPE 1 THRU TYPE 6 FOOTINGS REQUIRE A 6 IN. INCREASE IN DIAMETER ("D") TO ACCOMMODATE ANCHORS SHOWN ON THE DETAILS INCLUDED IN THE PLANS. ALSO, 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.



Typical Footing Installation

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Concrete Footings and Sign Islands for Class III Signs

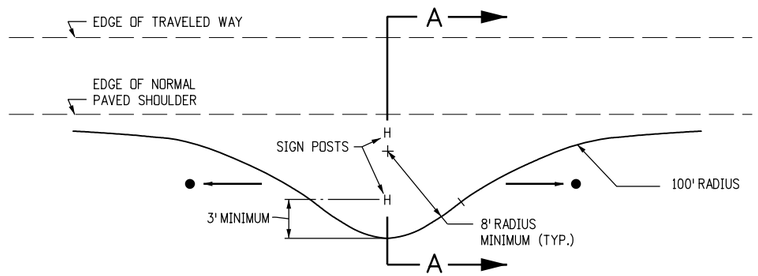
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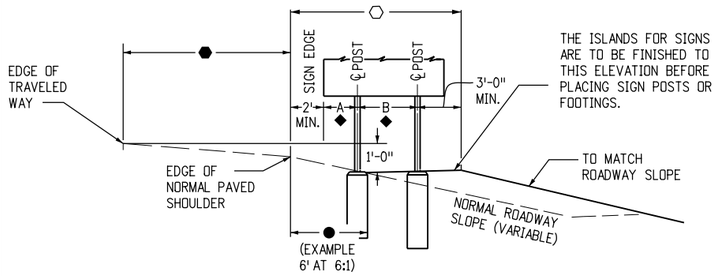
S-614-6

Standard Sheet No. 1 of 2

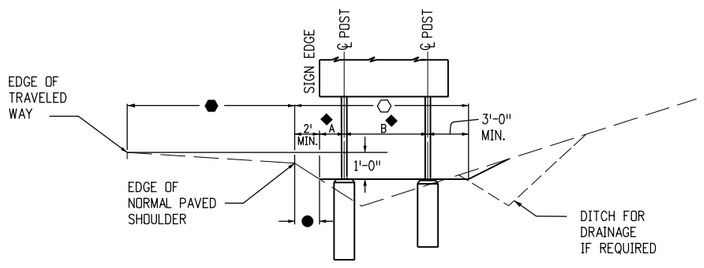
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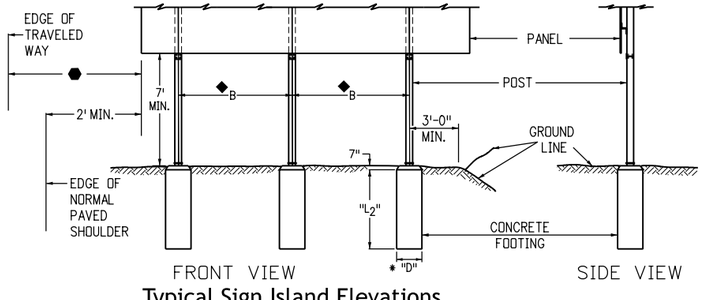
Typical Sign Island Plan



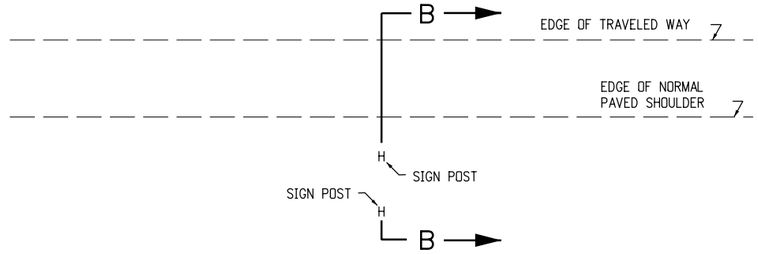
Typical Fill Section A-A



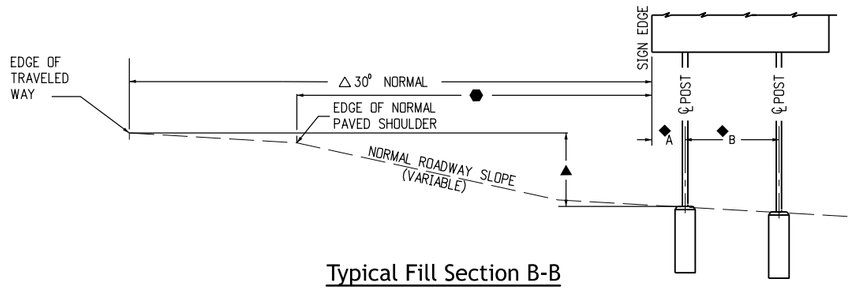
Typical Cut Section A-A



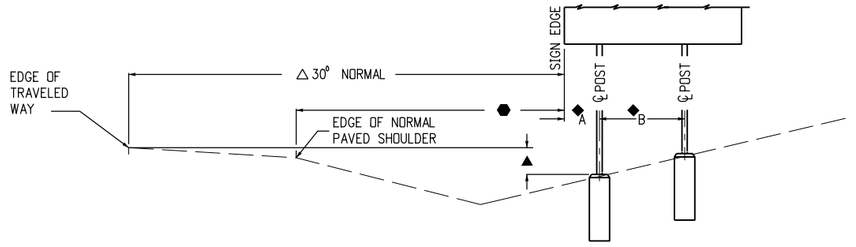
Typical Sign Island Elevations



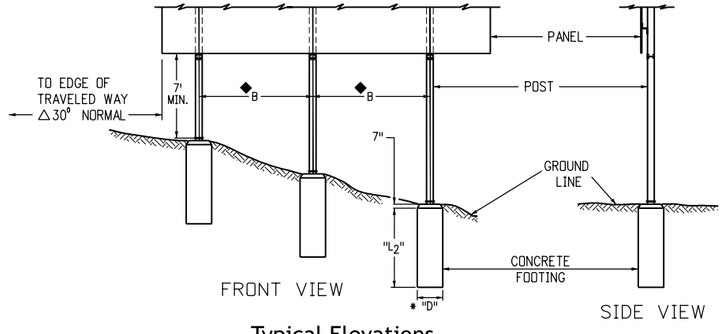
Normal Clearance Plan



Typical Fill Section B-B



Typical Cut Section B-B



Typical Elevations

Details of Sign Placement

General Notes

1. All concrete is to be class "BZ" air entrained. Grout shall conform to "Joint Mortar".
2. Use AASHTO M270 (ASTM A709) grade 36 steel for base plates and bolt plates. Use ASTM-A307 steel for anchor bolts.
3. Use grade 60 for reinforcing steel vertical bars, horizontal hoops, 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 Plans.
5. For additional information, refer to "Tabulation of Signs" and "Cross Sections for Class III Signs" included in the Plans.
6. ◆ For "A" and "B" dimensions. See Colorado Standard Plan S-614-4.
7. ● The sign island side slope parallel to the roadway shall be 6:1 or flatter. See typical sections.
8. ⬡ The sign island side slope parallel to the roadway shall be 6:1 or flatter. See typical sections.
9. ⬢ Variable dimensions. See cross sections.
10. ▲ Variable footing elevations. See cross sections for placement.
11. △ The lateral placement may be reduced to a minimum of 2 feet from the edge of normal paved shoulder to fit field conditions when 30 feet from the edge of the traveled way is not feasible. See the cross sections and/or Typical Ground Sign Placement Standard.
12. Embankment for sign islands is to be compacted as required under item 203 of the Standard Specifications.
13. For angular placement of signs, see Colorado Standard PlanS-614-1.
14. The 4-inch "Base Post" and lower "Break-Away Plate"shall be paid for as part of the footing.

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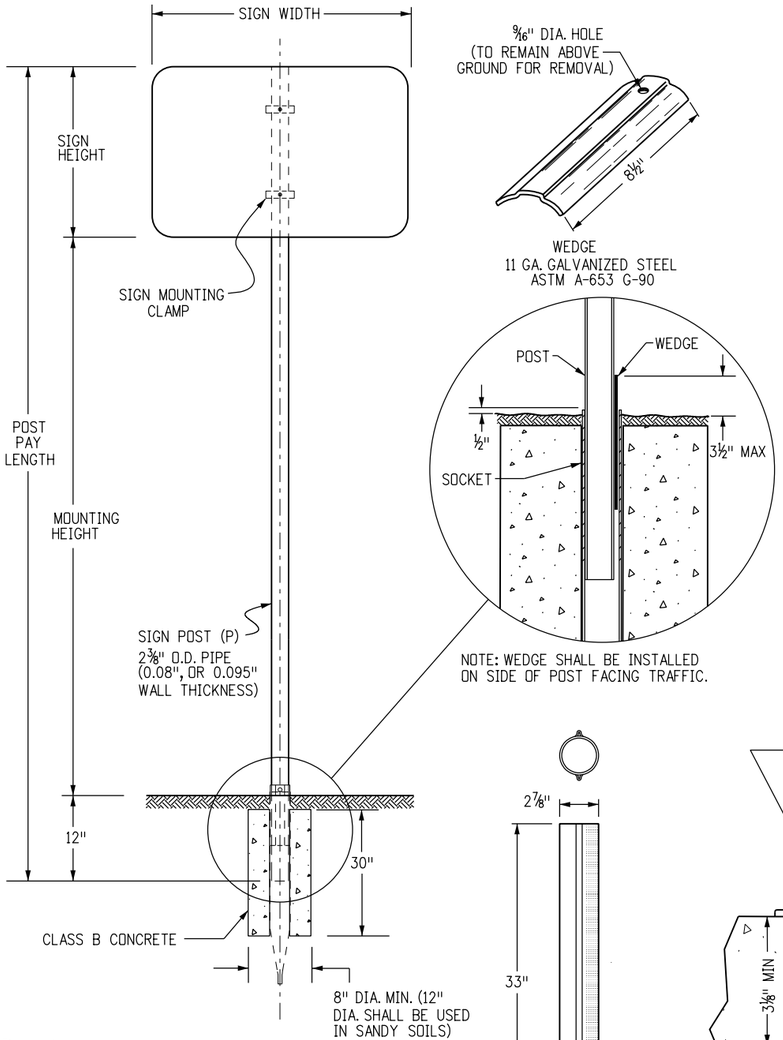
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Concrete Footings and Sign Islands for Class III Signs

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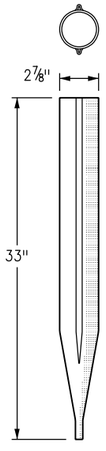
Standard Plan No.
S-614-6
Standard Sheet No. 2 of 2
Project Sheet Number:

Tubular Steel Posts
(Socket System) (for use with all P-post Installations)
(See Sheet 2 for P1 and P2 Post Installations)



WEDGE
11 GA. GALVANIZED STEEL
ASTM A-653 G-90

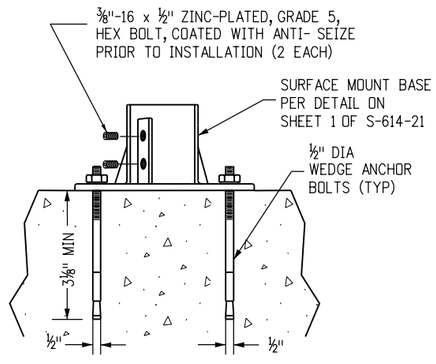
NOTE: WEDGE SHALL BE INSTALLED ON SIDE OF POST FACING TRAFFIC.



TUBULAR CONCRETE FOOTING
12 GA. GALVANIZED
STEEL ASTM - 787

Post Notes

The post may be pre-punched with ⅜" diameter holes and the sign mounted directly to the post, or 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", 3", 10", 16", 21", 23", 24", 27", 33", 37", 39", AND 45"



SIDE VIEW

Surface Mount Detail (P Post Only)

The post may be surface mounted when approved by the Engineer

Signpost Selection Guide (90 MPH Wind Load Design)
(for Socket System and Slipbase Installations Using P, P1 or P2 Posts)

7' MOUNTING HEIGHT

SIGN HEIGHT (FT) \ SIGN WIDTH (FT)	1	2	2.5	3	4	5	6	7	8	9	10	11	12+
1	P	P	P	P	P	P1	SIZES NOT USED						
2	P	P	P	P	P	P1							
2.5	P	P	P	P	P1	P1							
3	P	P	P		P1	P1	P1						
4	P	P1	P1	P1	P1	P1					TWO P1'S		
5	SIZES NOT USED		P1	P1	P1	P1							TWO P2'S
6			P1	P1	P1	▼P2					TWO P2'S	THREE P2'S	
7			P1	P1	▼P2						TWO P2'S		SEE CHART NOTE 5.

▼SEE CHART NOTE 4.

8' MOUNTING HEIGHT

SIGN HEIGHT (FT) \ SIGN WIDTH (FT)	1	2	2.5	3	4	5	6	7	8	9
1	P	P	P	P	P	P1	SIZES NOT USED			
2	P	P	P	P	P1	P1				
2.5	P	P	P	P1	P1	P1				
3	P	P	P1	P1	P1	P1	TWO P1'S			
4	P	P1	P1	P1	P1	P1				
5	SIZES NOT USED		P1	P1	P1	▼P2				
6			P1	P1	P1	▼P2				TWO P2'S
7			P1	P1	TWO P1'S	TWO P1'S		TWO P2'S	SIZES NOT USED	

9' MOUNTING HEIGHT

SIGN HEIGHT (FT) \ SIGN WIDTH (FT)	1	2	2.5	3	4	5	6	7	8	9
1	P	P	P	P	P	P1	SIZES NOT USED			
2	P	P	P	P	P1	P1				
2.5	P	P	P	P1	P1	P1				
3	P	P	P1	P1	P1	P1	TWO P1'S			
4	P	P1	P1	P1	P1	P1				
5	SIZES NOT USED		P1	P1	P1	▼P2				TWO P2'S
6			P1	P1	▼P2	TWO P1'S			TWO P2'S	
7			P1	P2	TWO P1'S	TWO P1'S		TWO P2'S	SIZES NOT USED	

Chart Notes

1. Typical post mounting heights from ground to bottom of sign panel are 7, 8 or 9 feet. Other heights may be required when signs are mounted on steeper fill or cut slopes.
2. For signs mounted on two posts, the minimum distance between posts shall be 2 feet and the maximum distance shall be 8 feet. Distance from post to edge of sign panel(s) shall be 0 to 4 inches. When backing zees are used, posts shall be installed with a minimum of 2 inches to the edge of the backing zee.
3. All sign panels greater than 60 inches in width must be mounted on two posts to prevent turning.
4. The post sizes shown are the minimum sizes required. Two P1 posts may be substituted where one P2 post is indicated. P2 posts may substituted for p1 posts when directed by the Engineer. W-shape beam may be substituted for P2 posts when directed by the Engineer.
5. Use W-shape beams only for sign posts.

General Notes

1. Sign panels less than 60 inches in width may be attached directly to t brackets without zees and sign panels less than 48 inches in width may be attached directly to U-brackets without zees. Width of a diamond configured sign panel is measured across opposite corners.
2. U-brackets may be used for multiple sign installations.
3. For backing zee requirements and details, see Standard Plans S-614-3 and S-614-4.
4. The contractor shall install the posts per the manufacturer's recommendations without additional compensation.

Post Specifications

POST SIZE	OUTSIDE DIAMETER	WALL THICKNESS	MATERIAL	** COATING	MAX ALLOW MOMENT	PAID FOR AS:
P	2.375"	.080"	ASTM-513	ASTM A-653 G-210 WITH 3.0 MIL POLYMER COATING PER ASTM A123 CLEAR COATING	1.47 KIP FT	STEEL SIGN SUPPORT (2 INCH ROUND)
P1	2.875"	.160"	ASTM-513		4.02 KIP FT	STEEL SIGN SUPPORT (2½ INCH ROUND NP-40)
P2	2.875"	.276"	ASTM-500	GC HOT DIPPED PER ASTM-123	5.13 KIP FT	STEEL SIGN SUPPORT (2½ INCH ROUND SCH 80)

** COLOR POWDER COATING MAY BE ADDED ACCORDING TO MANUFACTURER SPECIFICATIONS FOR SPECIAL LOCATIONS WHEN SHOWN ON THE PLANS.

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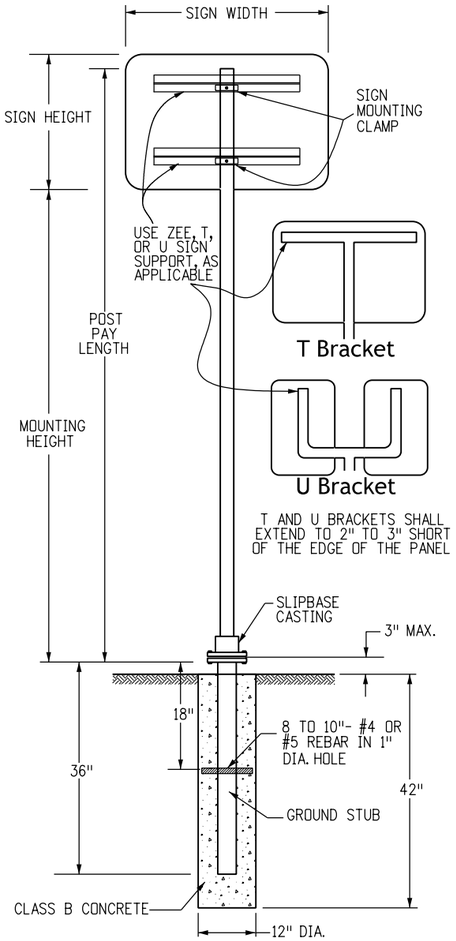
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Tubular Steel Sign Support Details

Standard Plan No.
S-614-8
Standard Sheet No. 1 of 7

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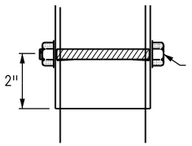


Tubular Steel Post
(with Slipbase)
(for Use with All P1 and
(See Sheet 1 for P-Post Installations)

Dimensions For Mounting Clamp (all Dimension Are In Inches)

STANDARD PIPE SIZE	A	B	C	D	E	F	G	K	L	R_1	R_2
2	3¾	2¾	1½	1⅛	½	3/16	1	2 1/16	1 7/32	1¼	1 3/16
2½	4¼	3¼	2	1¼	½	¼	1	3 3/16	1 15/32	1½	1 7/16

T and U Bracket Attachment

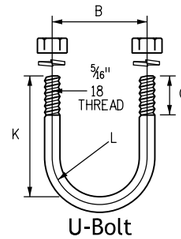


½" x 4½" INCH LONG ZINC-PLATED OR GALVANIZED, GRADE 5 HEX BOLT. 2 FLAT AND 1 LOCK WASHER REQUIRED.

REPLACE FLAT WASHERS WITH 1½" FENDER WASHER IN HIGH WIND/SNOW AREAS OR AS DIRECTED BY THE ENGINEER.

Pipe Clamp Casting

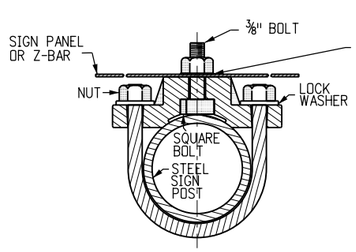
PIPE CLAMP CASTING SHALL BE ASTM B26 OR B108 ALUMINUM ALLOY A444.0-T4 OR 356.0-F. ALL SIGN MOUNTING CLAMP PARTS NOT MADE FROM ALUMINUM SHALL BE GALVANIZED STEEL IN CONFORMANCE WITH ASTM A153 OR STAINLESS STEEL.



U-Bolt

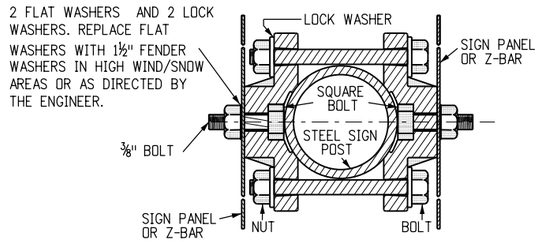
U-BOLT TO BE MADE IN ACCORDANCE WITH STANDARD MANUFACTURING PROCEDURE. ¼" OR 5/18" DIAMETER STOCK IS PERMISSIBLE. AMERICAN STANDARD REGULAR SEMI-FINISHED HEX NUTS AND SPRING LOCKWASHERS.

Typical Single Bracket

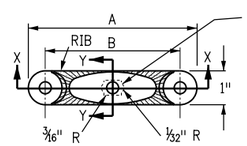


FLAT WASHER. REPLACE FLAT WASHER WITH 1½" FENDER WASHER IN HIGH WIND/SNOW AREAS OR AS DIRECTED BY THE ENGINEER.

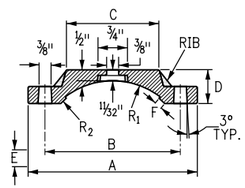
Typical Back To Back



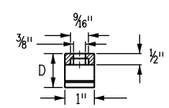
Details for Sign Panel Attachment



SLOT TO HOLD HEAD OF 3/8" HEX HEAD BOLT. THE BOLT SHALL BE 1¼" LONG, WITH FULL THREADS, A MEDIUM WASHER, AND GALVANIZED STEEL OR ALUMINUM SELF-LOCKING HEX HEAD NUT. THE BOLT HEAD MUST NOT TURN IN THE SLOT.



Section X-X



Section Y-Y

Mounting Clamp for Socket Or Slipbase

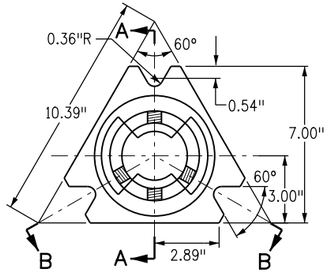
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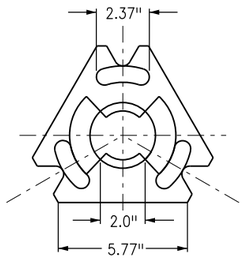
Tubular Steel Sign Support Details

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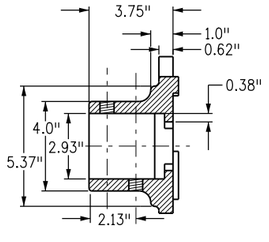
Standard Plan No.
S-614-8
Standard Sheet No. 2 of 7
Project Sheet Number:



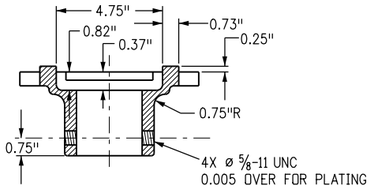
Top View



Bottom View



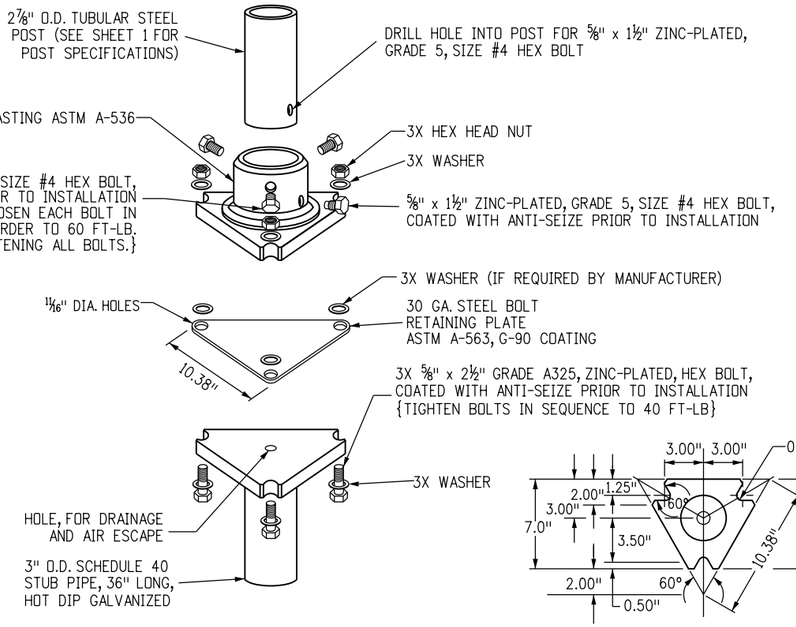
Section A-A



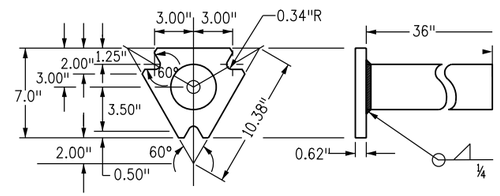
Section B-B

Slipbase Casting 1

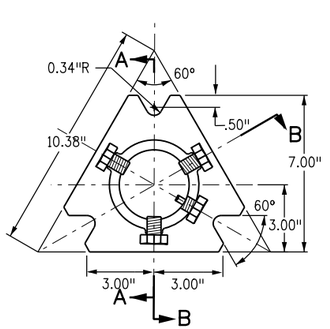
DIRECTION OF TRAVEL



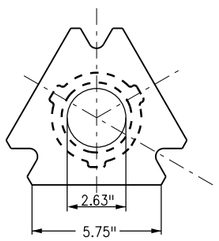
Typical Assembly



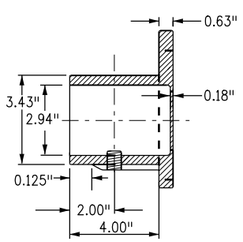
Slipbase Stub Base



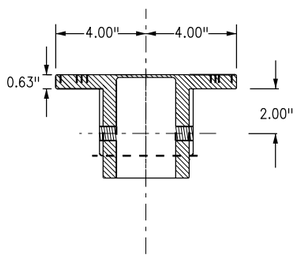
Top View



Bottom View



Section A-A



Section B-B

Slipbase Casting 2

DIRECTION OF TRAVEL

Slipbase Casting Requirements

For 2-7/8 inch posts (P1 or P2 posts)
galvanized steel slipbase casting ASTM-536

Mounting Hardware

- 3 - Each 5/8 x 2½ inch long hex bolt
- 3 - Each 5/8 x 1 inch long zinc-plated, grade 5 size #4 hex bolt
- 1 - Each 5/8 x 1½ inch long zinc-plated, grade 5 size #4 hex bolt
- 1 - Each 30 gauge steel bolt retaining plate ASTM A-563, G-90 coating

All hardware will be galvanized or zinc plated.

Installation Requirements
All hex bolts shall be coated with anti-seize prior to installation.

Tubular Steel Sign Support Slipbase Notes

1. Refer to signing plans for sign locations and height.
2. Minumum allowable tension capacity for wedge anchors = 3,000 pounds.
3. Maximum allowable moment for sign base = 5.13 kip-feet.
4. Pay item "Steel Sign Support(X-Inch Round)(Slipbase)" shall include stub base, casting and necessary hardware (slipbase casting mounting hardware as shown on this sheet).
5. Pay item "Steel Sign Support Casting" shall include casting and necessary mounting hardware (slipbase casting mounting hardware as shown on this sheet).
6. Pay item "Steel Sign Ground Stub Base (36 Inch)" shall include slipbase stub base.

Cast-in-place Slipbase For New Installations

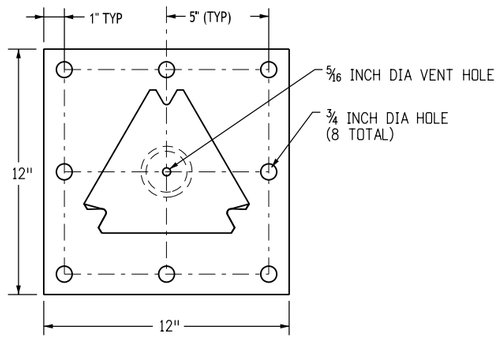
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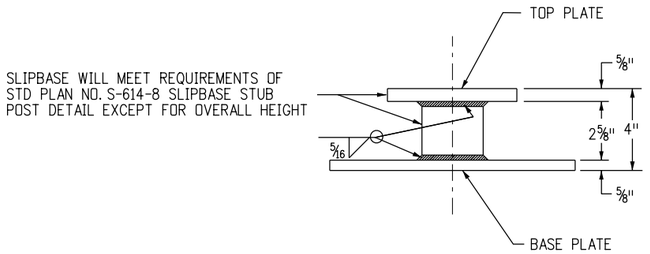
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Tubular Steel Sign Support Details

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Standard Plan No.
S-614-8
Standard Sheet No. 3 of 7
Project Sheet Number:





Surface Mount Slipbase Base Plate

Surface Mount Slipbase Base Plate Fabrication Requirements

Base Plate - ¾ inch ASTM A 36 plate steel
Pipe Stub - 3 inch Nominal Schedule 80, ASTM A-500 Grade B
Top Plate - meet requirements of sheet 3

Meet ASTM A-123 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 5/8 x 5 59/64 inch long "Hilti Kwik HUS-EZ Screw Anchors
- 16 - each 5/8 inch flat washers
- 8 - each 5/8 inch lock washers
- 8 - each 5/8 inch nuts

All hardware will be galvanized or zinc plated.

Installation Requirements:

Drill: (8) - 5/8 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 Sheet 3 for slipbase casting information
3. Minumum allowable tension capacity for wedge anchors = 3000 pounds
4. Maximum allowable moment for sign base = 5.13 kip-feet
5. Pay item "Steel Sign Surface Mount Base Plate (Slipbase)" shall include base plate, casting and all necessary hardware (slipbase casting mounting hardware as shown on Sheet 3 and surface mount slipbase mounting hardware as shown on this Sheet)
6. Pay item "Steel Sign Surface Mount Base Plate" shall include base plate and necessary hardware (surface mount slipbase mounting hardware as shown on this Sheet)

Surface Mount Slipbase for Retrofit Installations

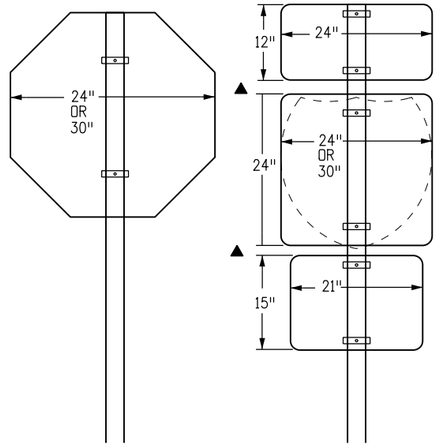
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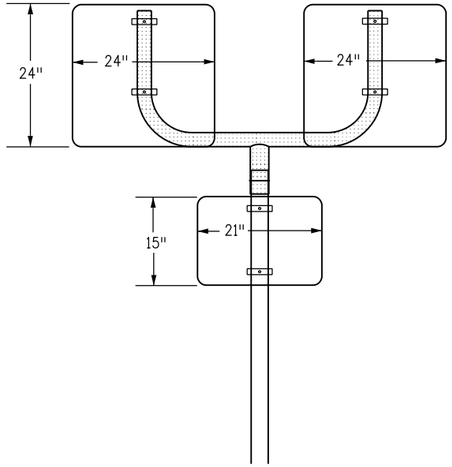
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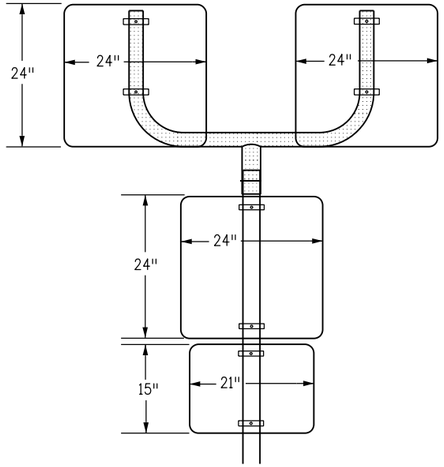
Tubular Steel Sign Support Details

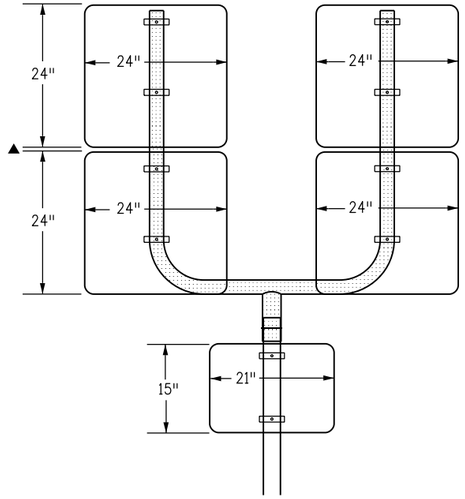
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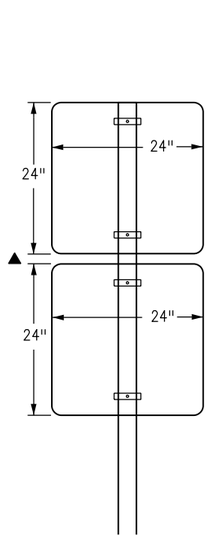
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S-614-8
Standard Sheet No. 4 of 7
Project Sheet Number:

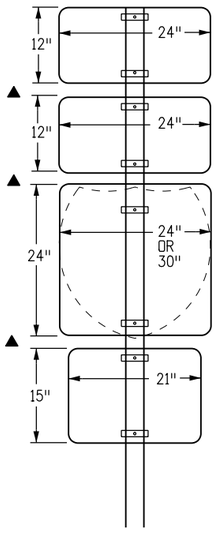


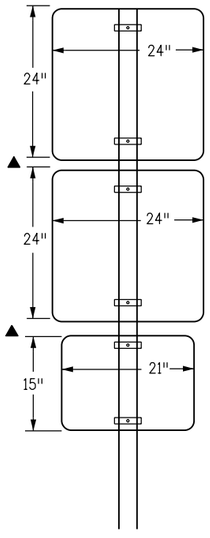




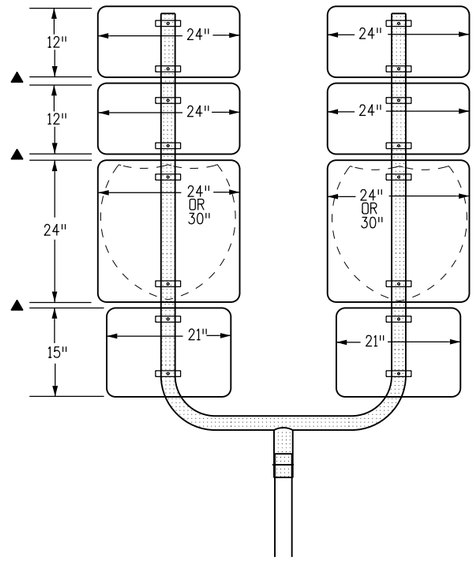








Class I Sign Combinations (Direct Attachment)



Class I Sign Combinations Using U-Brackets

▲ SEE NOTE 6 ON SHEET 6

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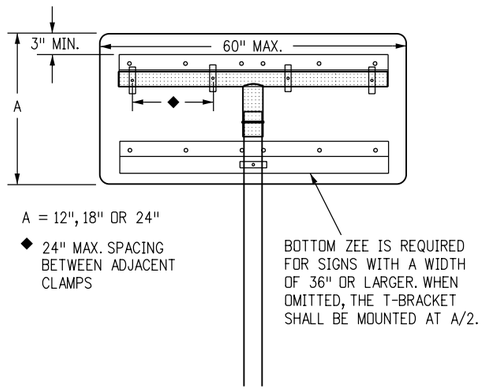
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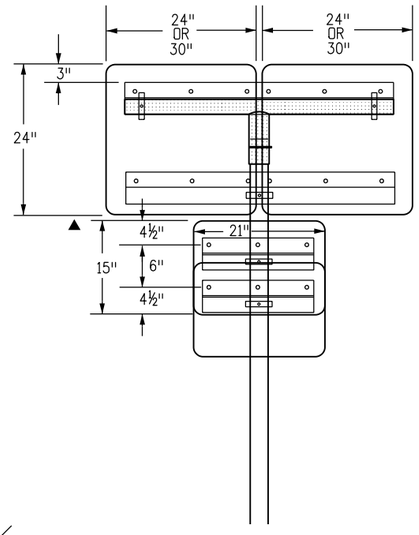
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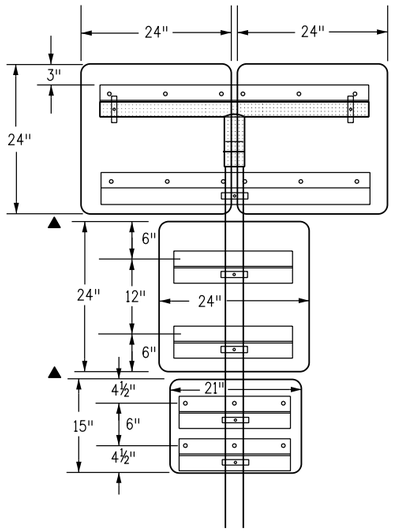
Tubular Steel Sign Support Details

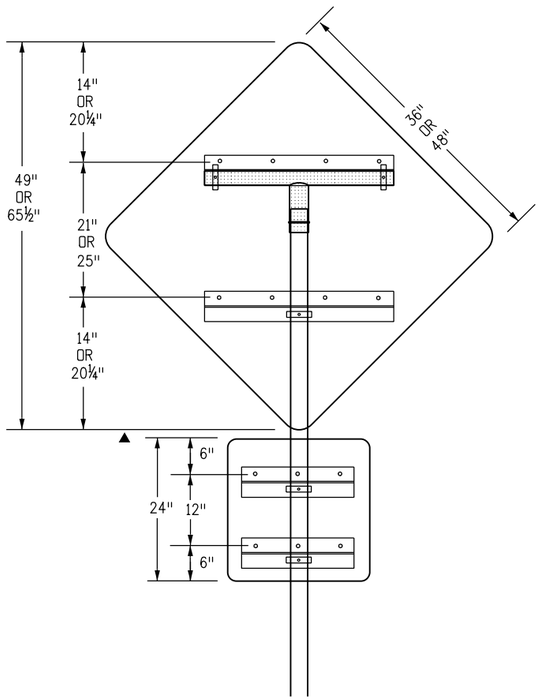
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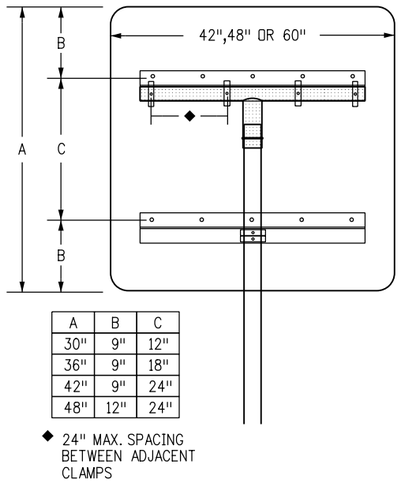
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S-614-8
Standard Sheet No. 5 of 7
Project Sheet Number:











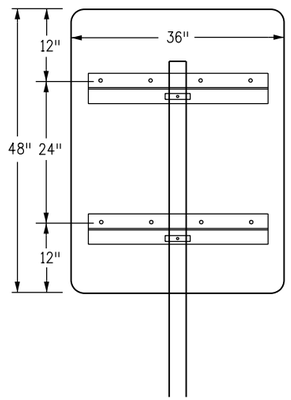
A	B	C
30"	9"	12"
36"	9"	18"
42"	9"	24"
48"	12"	24"

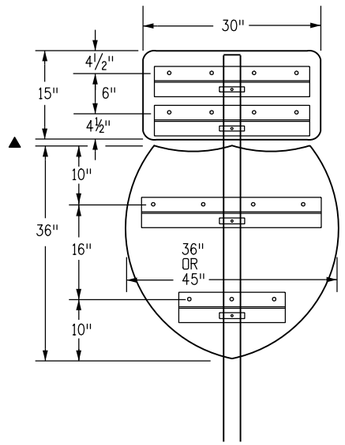
Class II Sign Combinations Using T-Brackets With Z-Bar

PANEL WIDTH	ZEE LENGTH
21"	15"
24"	18"
30"	24"
36"	30"
42"	36"
45"	39"
48"	42"
54"	48"
60"	54"
36" DIAMOND	22"
48" DIAMOND	36"
24" & 24"	43"
24" & 30"	49"
30" & 30"	55"
36" & 36"	67"
45" & 36"	76"
24" & 24" & 24"	68"
24" & 24" & 30"	74"
24" & 30" & 24"	74"
30" & 24" & 30"	80"
24" & 30" & 30"	80"
30" & 30" & 30"	86"

NOTES

1. Z-Bar length shall be 3 inch (± ½ inch) short of the edge of the sign or 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 inch from edge of z-bar. The holes in between shall be 6 inch to 8 inch apart.
3. T and U brackets shall terminate 2 inches to 3 inches from edge of sign panel. When a zee is connected to a T-bracket, they shall be the same length except when the zee 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 inch to 1½ inch 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.





Single Post Class II Signs Using Z-Bar

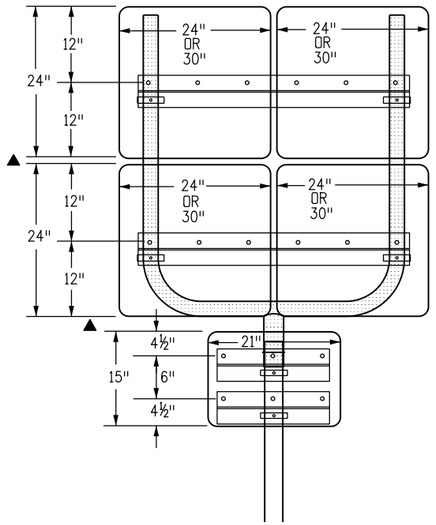
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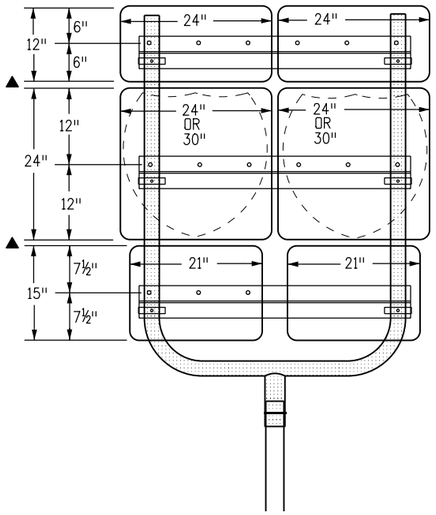
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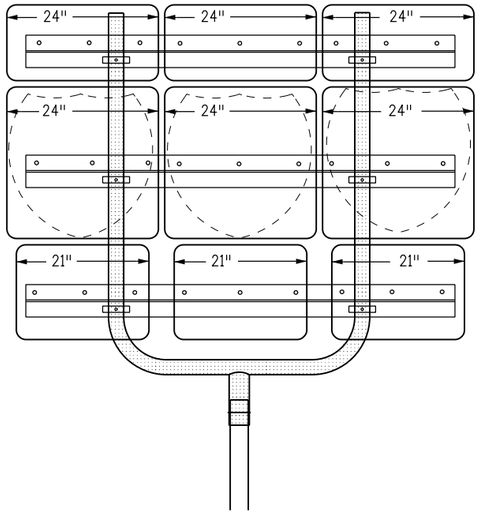
Tubular Steel Sign Support Details

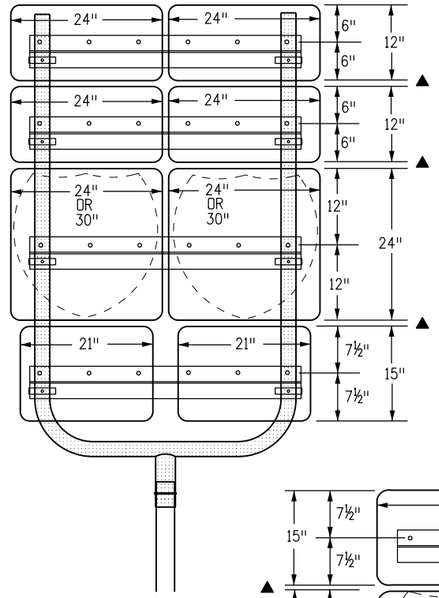
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Standard Plan No.
S-614-8
Standard Sheet No. 6 of 7
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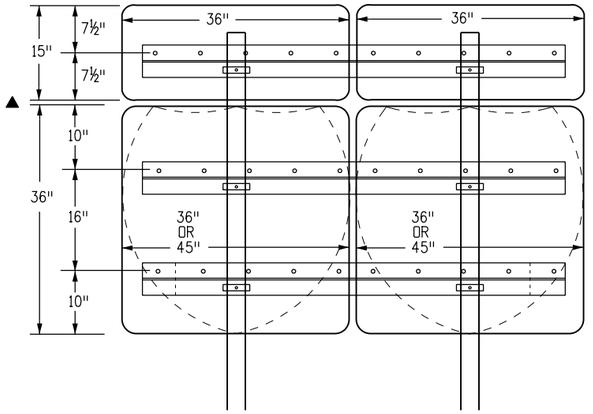




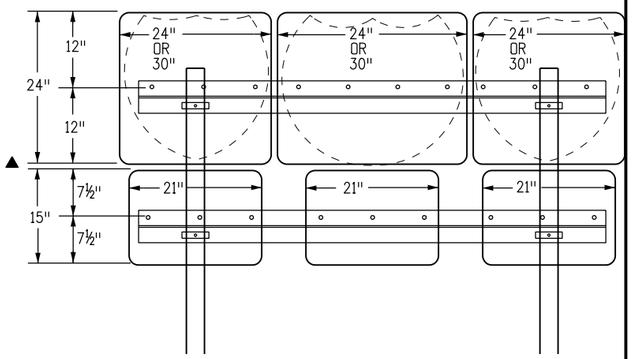


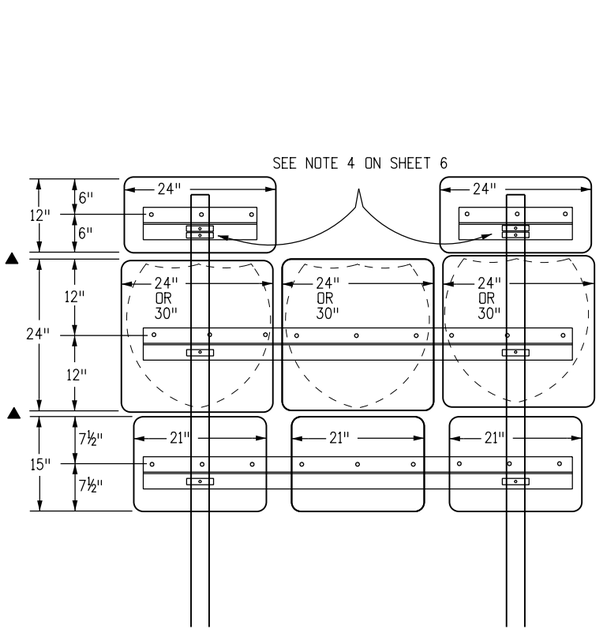


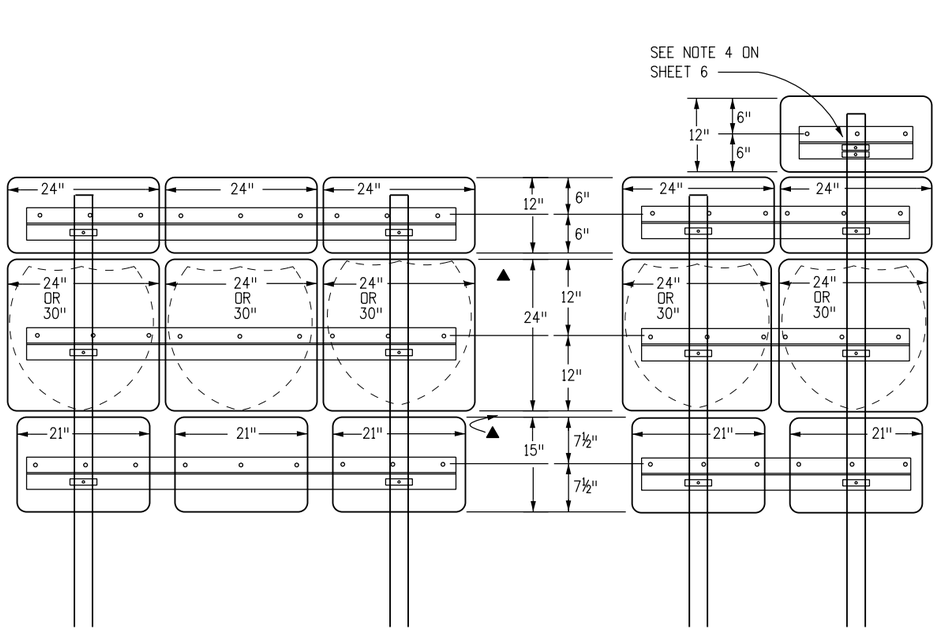
Class II Sign Combinations Using U-Brackets



NOTE: THIS CONFIGURATION IS PREFERABLE TO USING TWO SEPARATE SIGNS.







▲ SEE NOTE 6 ON SHEET 6

Class II Sign Combinations Using Two Posts

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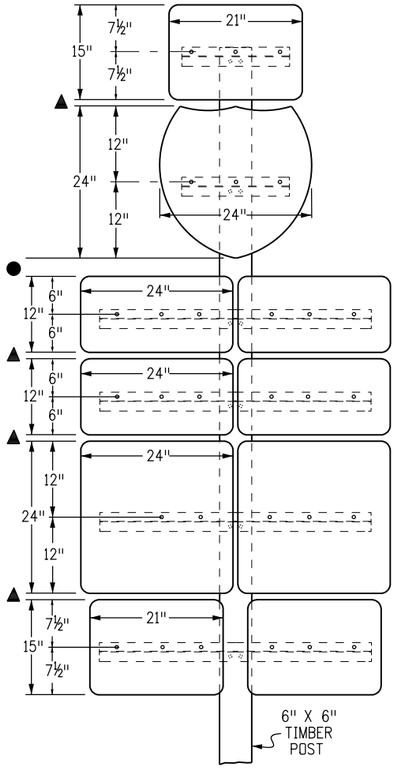
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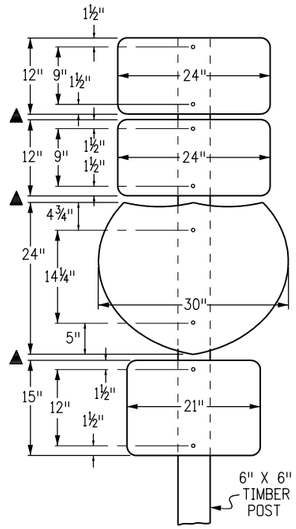
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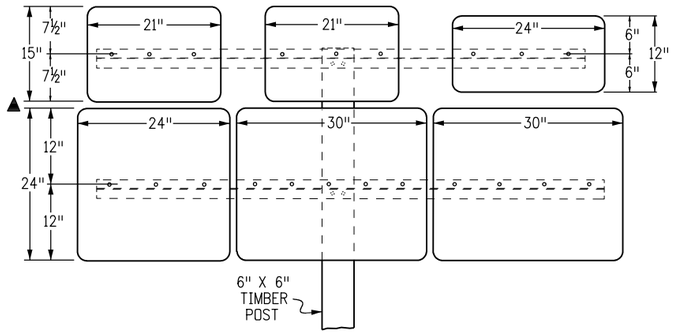
Tubular Steel Sign Support Details

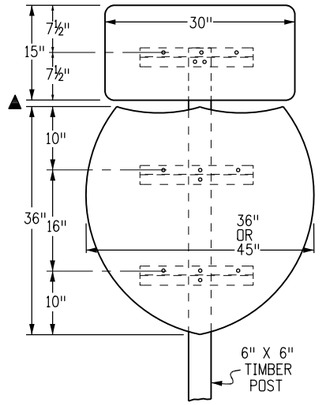
Issued by the Traffic Safety & Engineering Services: July 01, 2026

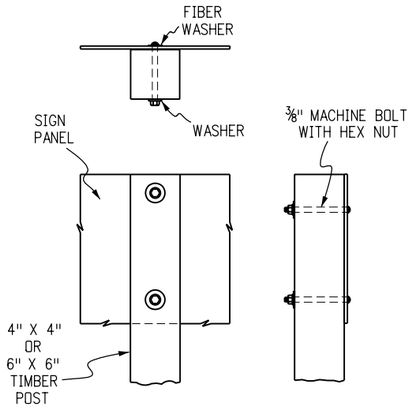
Standard Plan No.
S-614-8
Standard Sheet No. 7 of 7
Project Sheet Number:



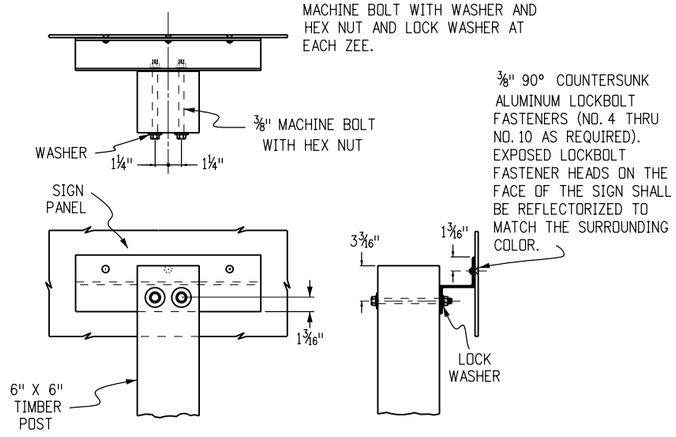




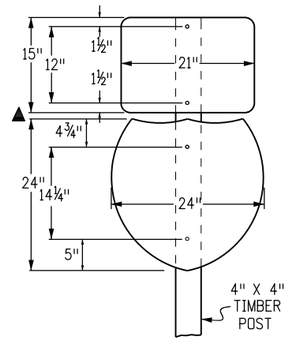




Class I Marker
Assembly Installation



Class II Marker
Assembly Installation



General Notes

1. Timber sign posts may only be used for temporary signange during construction. Tubular steel shall be used for permanent installation.
2. For sign placement, see Standard Plan S-614-1.
3. For tubular steel post information, see Standard Plan S-614-8.
4. Route markers shall be single sheet aluminum, 0.100 inch minimum thickness.
5. Backing zees are 3-inch x 2-inch x $^{11}/_{16}$-inch 2.33 6061-T6 aluminum alloy weighing 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 1-½ inch maximum.
8. ● Vertical spacing between groups of panels shall be 4 inch.
9. Bolts, nuts, and metal washers shall be galvanized or cadmium plated.
10. Z-Bar length and hole spacing for auxiliary markers to be the same as for corresponding route markers.
11. Washers on timber posts shall be 1 inch diameter.

PANEL COMBINATIONS	ZEE LENGTH
21", 24", 30", 36", 45"	*
24" & 24"	43"
24" & 30"	49"
30" & 30"	55"
36" & 36"	67"
45" & 36"	76"
24" & 24" & 24"	68"
24" & 24" & 30"	74"
24" & 30" & 24"	74"
30" & 24" & 30"	80"
24" & 30" & 30"	80"
30" & 30" & 30"	86"

NOTES:

1. HOLE 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 Z-BAR. HOLES IN-BETWEEN SHALL BE 6-INCHES TO 8-INCHES APART.
2. * Z-BAR LENGTH SHALL BE 3-INCHES (± ½-INCH) SHORT OF THE EDGE OF THE SIGN ON BOTH SIDES.
3. SUPPLEMENTAL PANELS SHALL BE CENTERED RELATIVE TO THE PRIMARY PANELS. Z-BAR LENGTHS FOR SUPPLEMENTAL PANEL GROUPS MAY BE ADJUSTED TO FIT.

Computer File Information	
Creation Date: 07/04/12	
Created By: Nakao	
Last Modification Date: 07/01/26	
Last Modified By: YSP	
CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English	

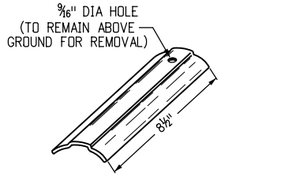
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Date:	Comments

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2829 West Howard Place
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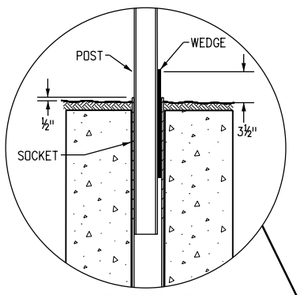
Marker Assembly Installations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

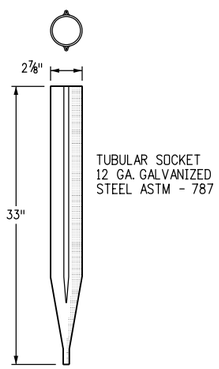
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S-614-10
Standard Sheet No. 1 of 1
Project Sheet Number:



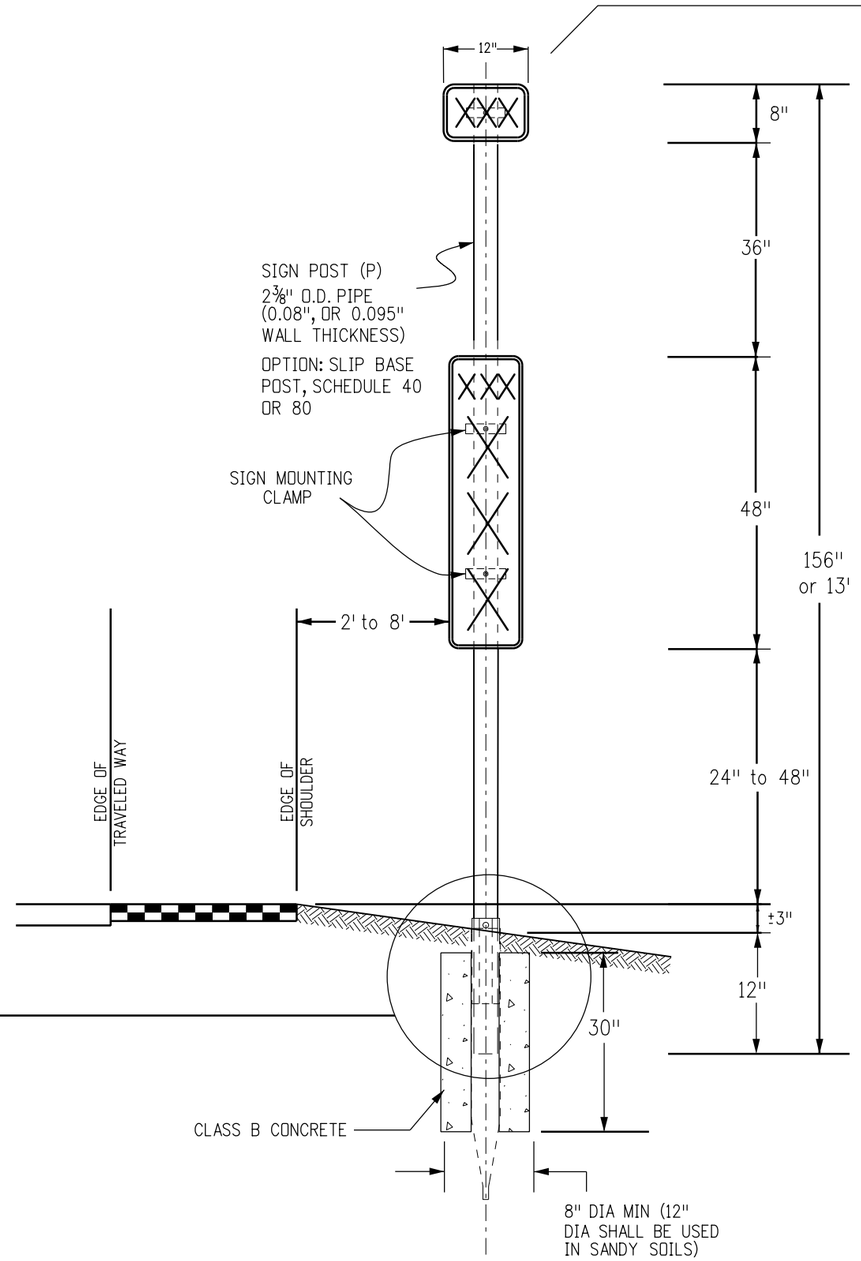
WEDGE
11 GA. GALVANIZED STEEL
ASTM A-526 G-90

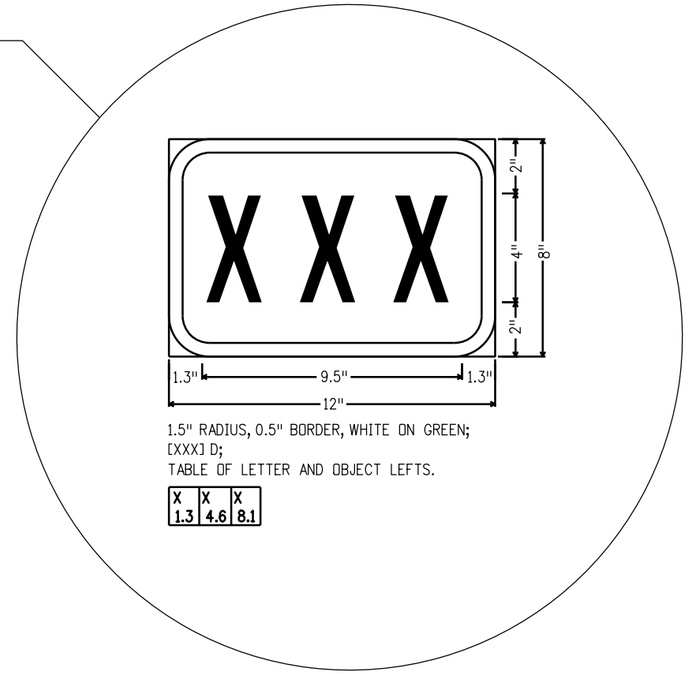


NOTE: WEDGE SHALL BE INSTALLED
ON SIDE OF POST FACING TRAFFIC.



TUBULAR SOCKET
12 GA. GALVANIZED
STEEL ASTM - 787





1.5" RADIUS, 0.5" BORDER, WHITE ON GREEN;
[XXX] D;
TABLE OF LETTER AND OBJECT LEFTS.

X	X	X
1.3	4.6	8.1

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12		Date:	Comments
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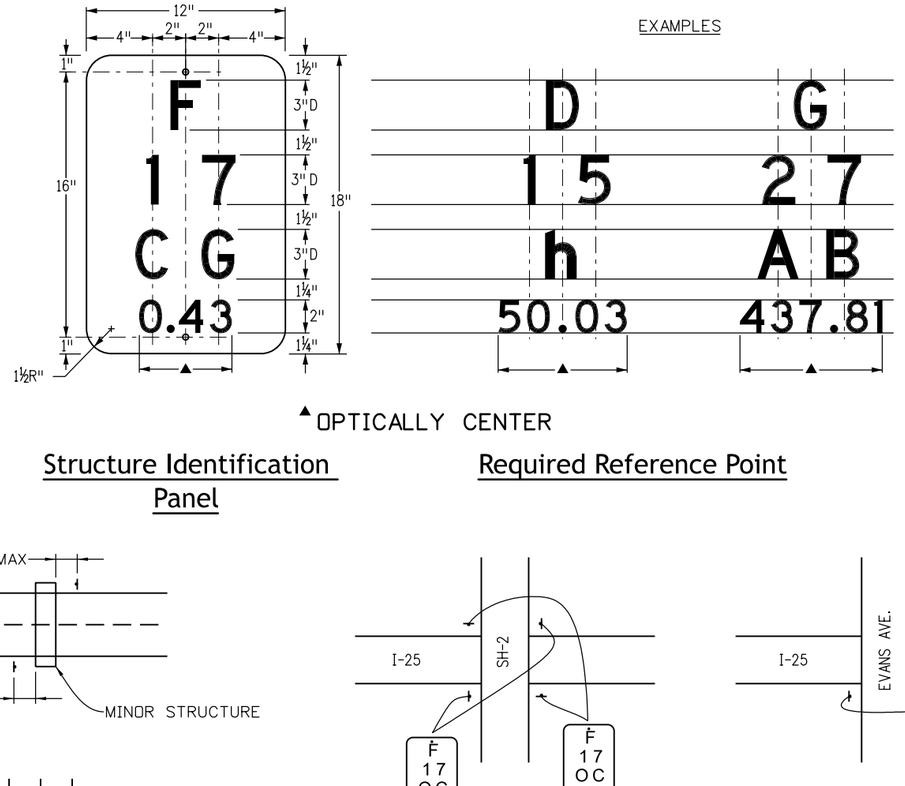
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Milepost Sign Detail For High Snow Areas

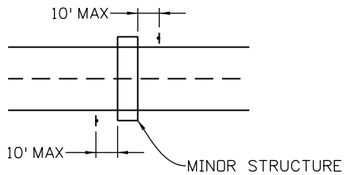
Issued by the Traffic Safety & Engineering Services: July 01, 2026

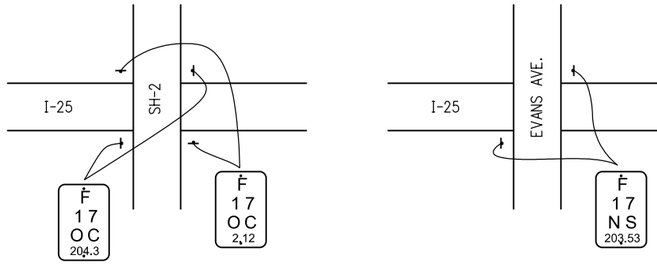
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S-614-11
Standard Sheet No. 1 of 1
Project Sheet Number:

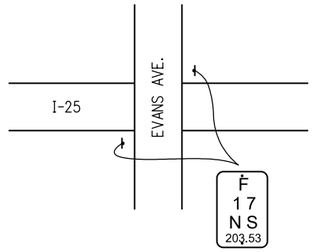


Structure Identification Panel

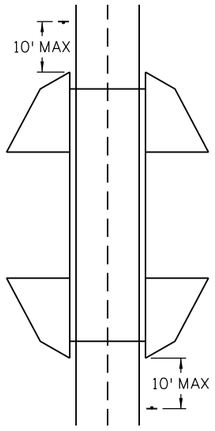
Required Reference Point



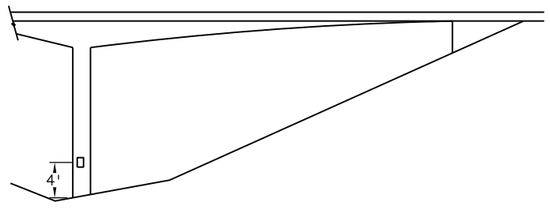




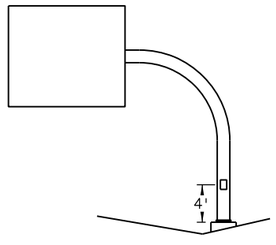
Highway System Location



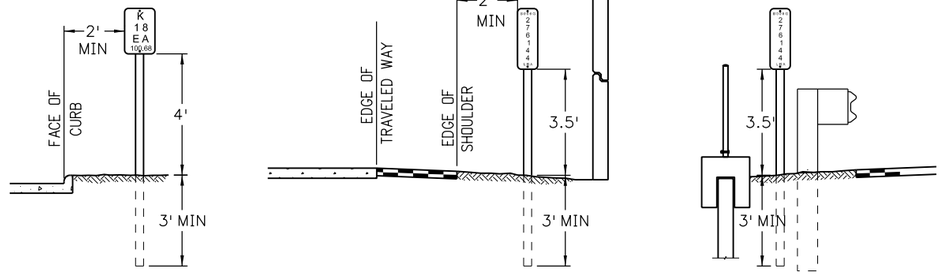
Location Details



Location On Piers



Location On Sign Structure



Vertical and Lateral Placement Details

General Notes

1. Sign panel shall be fabricated from single sheet aluminum 0.080 inch minimum thickness.
2. When sign panels are not attached to the structure, they shall be fastened to U-posts 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-614-8 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 crossroads are to be placed at the following points using two ½ inch wide stainless steel bands and stainless steel flared leg brackets with hex head bolts (Band-it D315 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 per 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 on this panel (do not round off).
8. The structure identification shall be displayed on all state highways but not on off-system crossroads.
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 still be installed by the contractor. Separate wall identification panels shall be placed at each unique wall design type.
10. Signs shall be visible from the highway in the direction of travel.

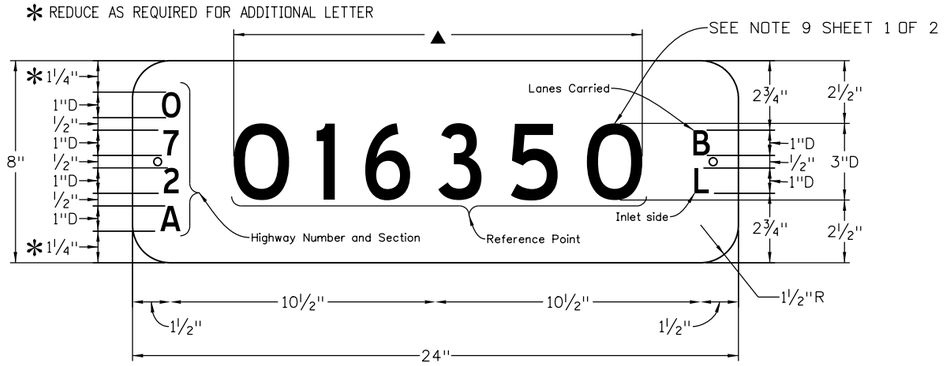
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Structure Number Installation

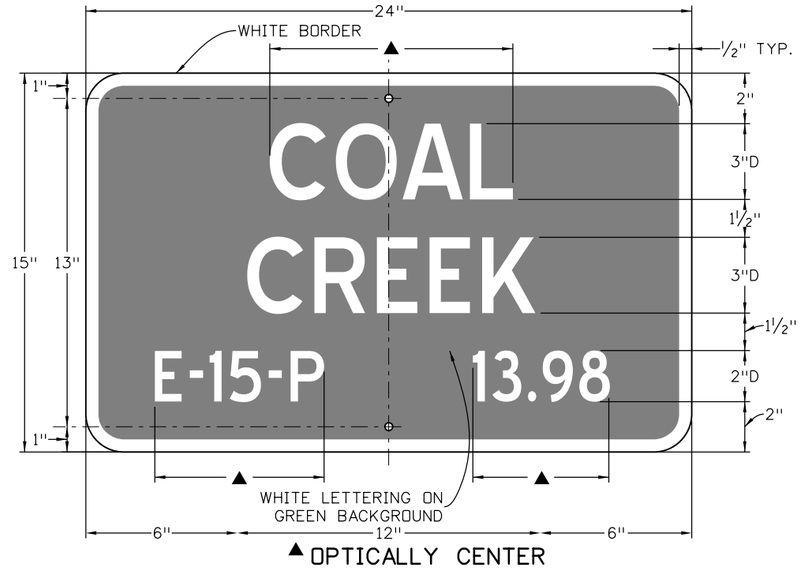
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-12
Standard Sheet No. 1 of 2
Project Sheet Number:

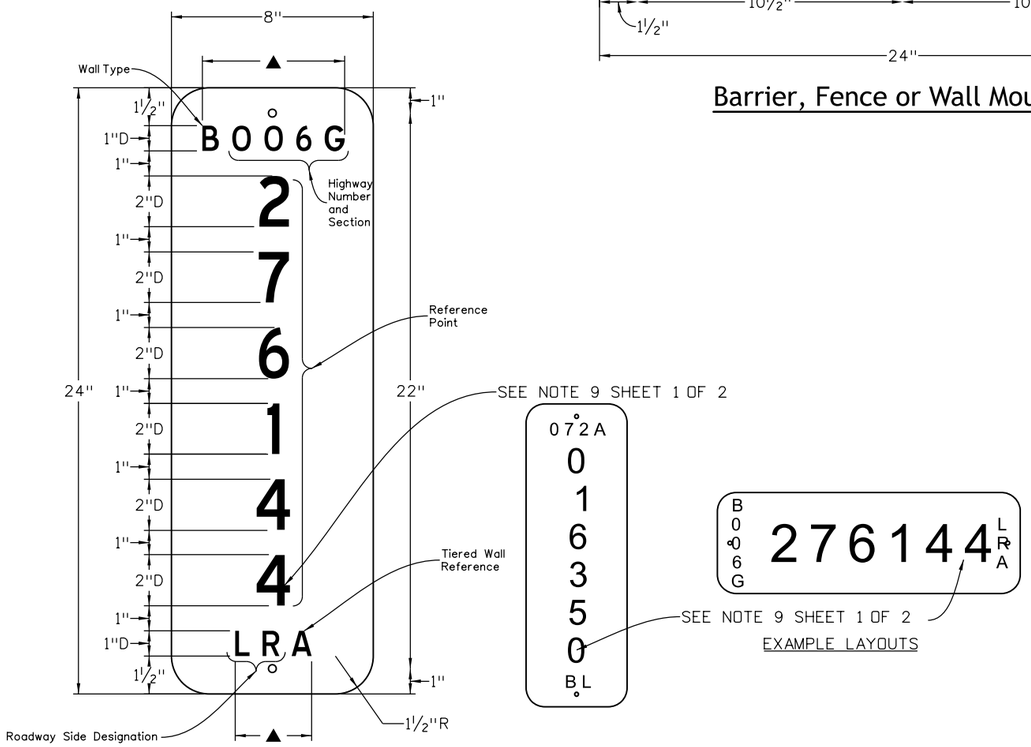


Barrier, Fence or Wall Mounted

EXAMPLE OF MINOR STRUCTURE IDENTIFICATION PANEL OVER STREAM

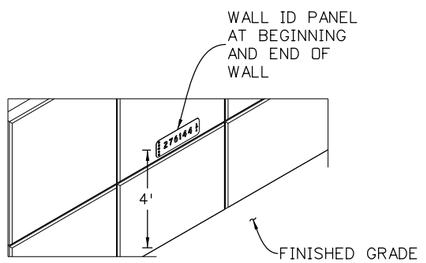


Optional Structure Number Panel Over Streams

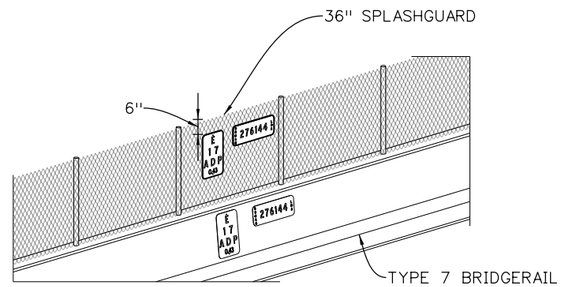


POST MOUNTED

Wall and Minor Structure Identification Panels



Wall Mounted Option



Barrier and Fence Mounted Options

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Structure Number Installation

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-12
Standard Sheet No. 2 of 2
Project Sheet Number:

Complete Installation With Diamond Panel

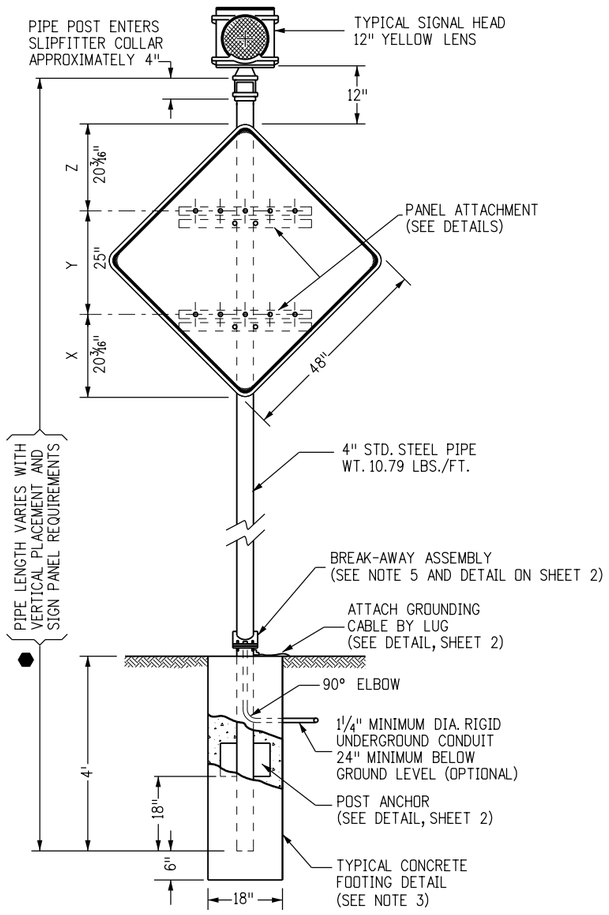
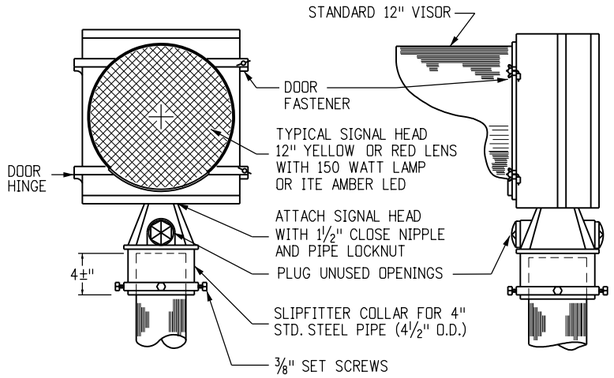
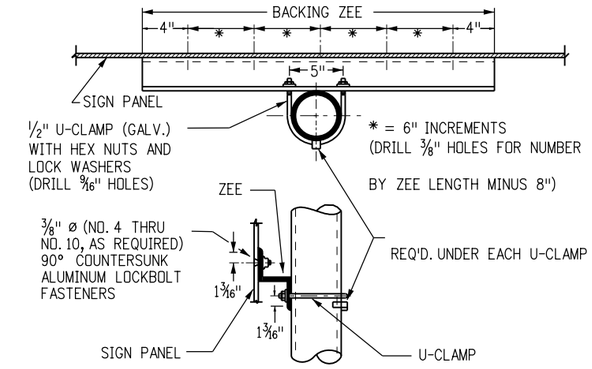


TABLE OF DIMENSIONS FOR PANELS NOT ILLUSTRATED					
DESCRIPTION	DIMENSIONS (IN.)			LENS TYPE	BACKING ZEES
	X	Y	Z		
36" DIAMETER CIRCLE PANEL (●)	8	20	8	12" YELLOW	20"
48" DIAMETER CIRCLE PANEL (●)	10½	27	10½	12" YELLOW	20"
36" PENTAGON PANEL (⬟)	9	20	9	12" YELLOW	20"
48" PENTAGON PANEL (⬟)	12	25¾	9	12" YELLOW	20"
48" OCTAGON PANEL (●)	12	24	12	12" RED	20"
24" X 48" RECTANGLE PANEL (▬)	12	24	12	12" YELLOW	20"

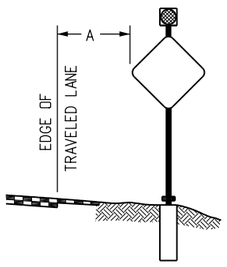
Typical Elevation Facing Traffic



Typical Signal Head - 12 Inch Lens



Typical Panel Attachment Details



Lateral Placement ("A")

Normal lateral placement "A" for warning signs is 12 feet plus curb or shoulder width.

Normal lateral placement "A" for regulatory signs is 6 feet plus curb or shoulder width, or if none 12 feet from edge of pavement.

2 feet shall be considered minimum except that in urban areas 1 foot from the curb face is permissible where sidewalk width is limited or where existing poles are close to the curb.

Refer to CDOT Standard Plan S-614-1 for vertical placement requirements.

Typical Sign Placement

General Notes

1. All sign panels used on flashing beacons are Class II and shall be fabricated in accordance with:
   a. Panels shall be single sheet aluminum 0.100 minimum thickness.
   b. Backing zees are 3 in. x 2 11/16 in. and 2.33 lbs. per ft. aluminum.
   c. All signs shall be fabricated using retroreflective sheeting conforming to ASTM D4956. The type shall be described in the standard specifications and/or as shown on the plans.
   d. Bolts, u-clamps, nuts and metal washers shall be galvanized or cadmium plated.
2. Installation design conforms with AASHTO "Standard Specifications for Structure Supports for Highway Signs, Luminaires and Traffic Signals" and shall be fabricated in accordance with:
   a. Steel pipe, post anchor plates and break-away plates shall conform to AASHTO M270 (ASTM A709) Grade 36.
   b. High strength bolts, nuts and washers shall conform to ASTM-A325 and shall be galvanized or cadmium plated.
   c. Holes shall be drilled and cuts shall preferably be saw cuts; However, flame cutting will be permitted provided all edges are ground. Metal shall not project beyond the plane of the plate face on break-away plates.
   d. All welding is to be continuous and in accordance with current AWS specifications.
   e. A "Keeper Plate" of thin (28 gage) galvanized sheet metal, fabricated to match break-away plate dimensions but with holes rather than slots, shall be used to restrain bolt loosening due to wind vibration.
   ⬣ f. Pipe length varies with vertical placement, minimum ground clearance (7 ft.) and the sign panel required. It will be as shown on the plans, or as determined by cross-section, or as directed by the Engineer for each location (maximum length is approximately 20 ft.-10 in. and minimum length is approximately 15 ft.-4 in., if length is not specified supply maximum - may require field cut to conform to typical sign placement details).
3. Concrete footings for flashing beacon installations shall conform to "Drilled Caissons" and "Structural Concrete" (Class "BZ"). Integrity testing per 503 is not required.
4. All electrical materials and workmanship shall conform to the latest requirements of the NEC, NEMA, UL or EIA wherever applicable; the Colorado PUC and any local codes or ordinances which may apply; and the following:
   a. The contractor is to provide all necessary wiring within the beacon and from there to the power source provided by the utility company. The utility company will make the connection with the contractor's wiring.
   b. The electrical service between the power source and the flashing beacon shall be underground unless an aerial drop is authorized by the Engineer. All wiring excluding the aerial drop wire shall be in conduit.
   c. 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 pipe or that the device may be contained within the signal head itself.
   d. A suitable enclosure for the flasher shall be in accordance with "a rain tight junction box or can, approximately 8 in. x 8 in. x 4 in., surface mount, with a flanged screw attached cover, and fabricated from not less than 16 gage galvanized steel".
   e. A built-in radio interference suppression device and a photocell sensor type signal lamp dimmer shall be provided for each flashing beacon.
   f. Beacons shall flash at a rate of not less than 50 and not more than 60 times per minute.
5. Breakaway base installation shall be used for uni-directional configuration only. Pedestal foundation (as shown on Sheet 3) may be used for both uni-directional and bi-directional configurations.
6. When specified in the plans, solar powered system may be used in place of the AC power system shown on this sheet.
7. For advance placement of warning signs see MUTCD Section 2C.04 and Table 2C-3.

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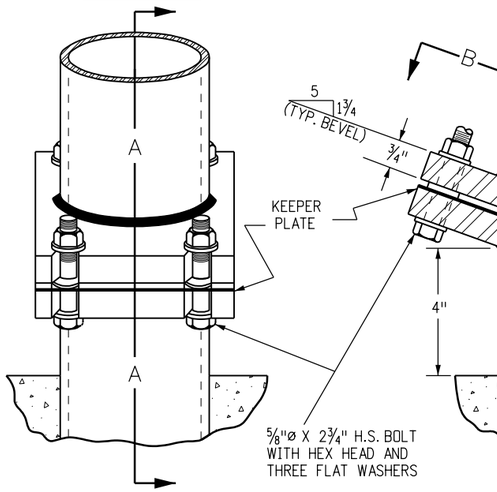
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Denver, CO 80204
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Flashing Beacon and Sign Installations

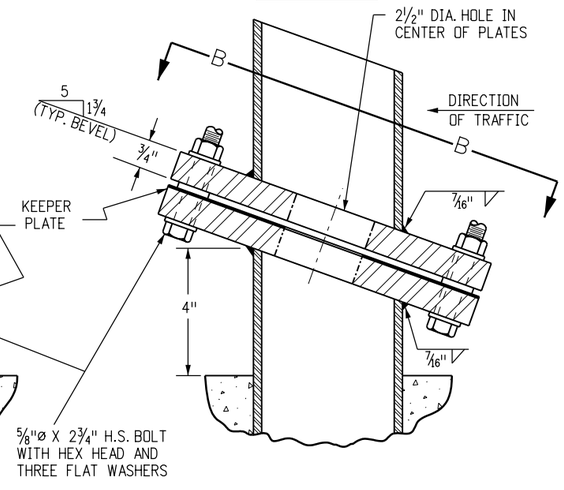
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-14
Standard Sheet No. 1 of 4
Project Sheet Number:

Front View



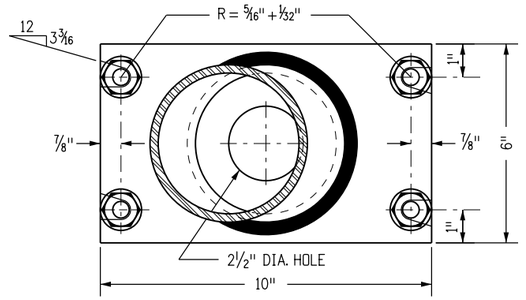
Section A-A



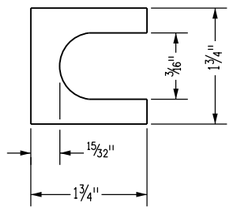
Break-away Assembly Bolting Procedure

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 hand-strength 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-pounds torque.
3. Burr threads at junction with nut using a center punch to prevent nut loosening.

Section B-B (Plate Detail)



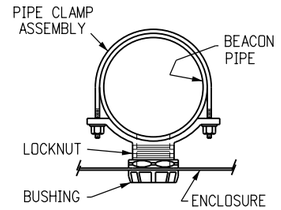
Shim Detail



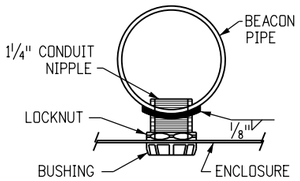
Furnish two (2) .012 inch ± thick and two (2) .032 inch ± thick shims.

Shims shall be fabricated from brass shims stock or strip conforming to ASTM-B36.

Pole Clamp



Welded Nipple

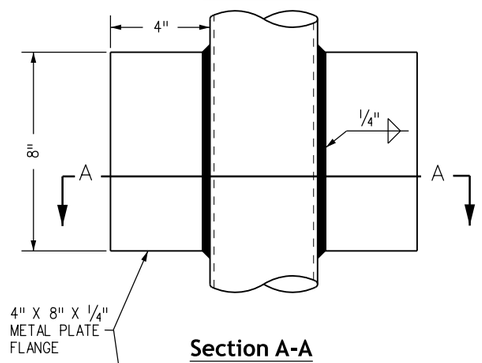


(Note: Weld varies with conduit or nipple wall thickness.)

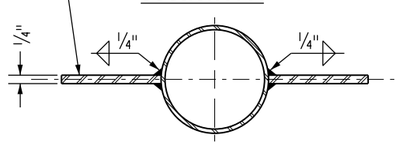
Typical Pipe Attachments

Typical Break-away Assembly Details

Front View

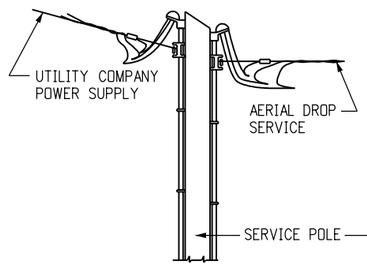


Section A-A

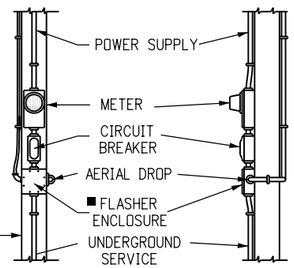


Post Anchor Details

View At Power Source



Views At Enclosures



Notes

Location and configuration of electrical equipment is diagrammatic only (use any method complying with the general notes).

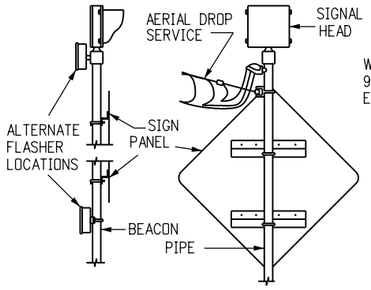
▲ Existing ground at service pole; otherwise pull through conduit or attach to conduit and tap off underground.

● Drill and tap pipe for 1/4" round head brass screw, 3/4" long, for ground lug.

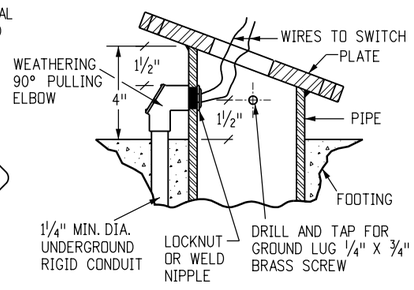
■ Provide a weep hole with aerial drop service.

\# Bedding material for conduit shall be placed in accordance with the National Electrical Code.

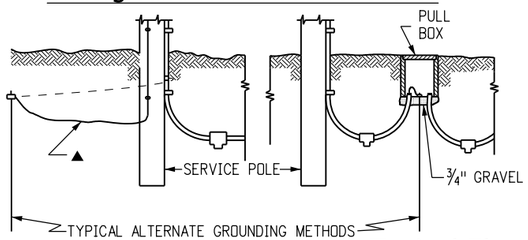
View At Beacon



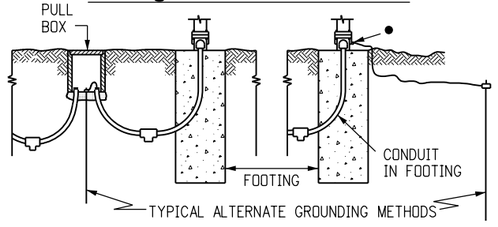
Underground Connection



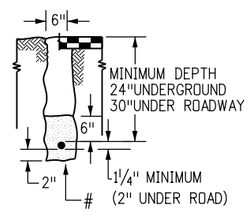
Underground Views At Power Source



Underground Views At Beacon



Trenching Detail



Typical Electrical Service Detail

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Last Modified By: NRR			
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Traffic Safety & Engineering Services

2829 West Howard Place
Denver, CO 80204

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Flashing Beacon and Sign Installations

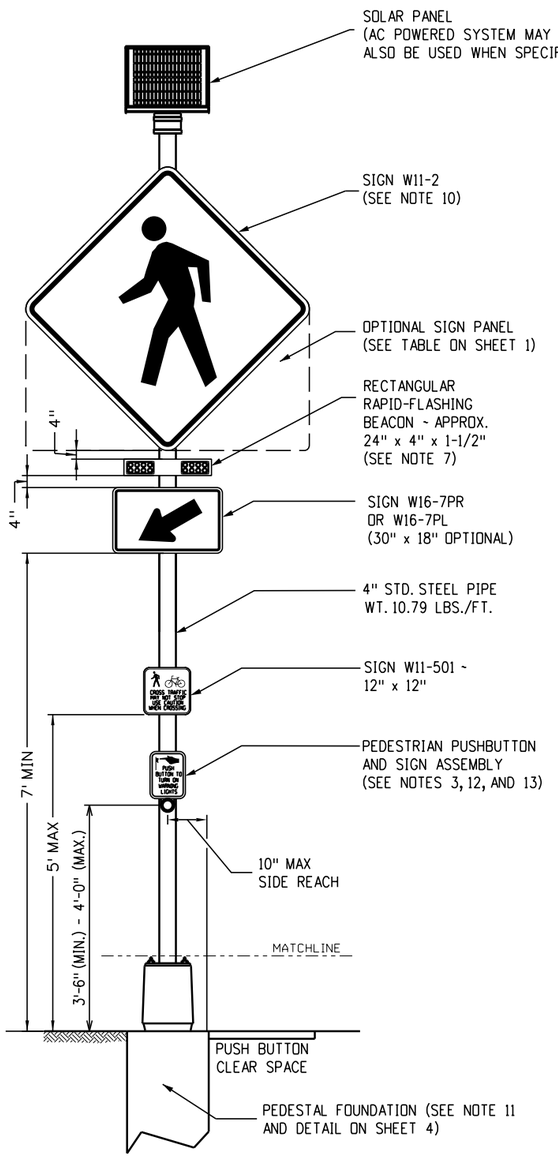
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.

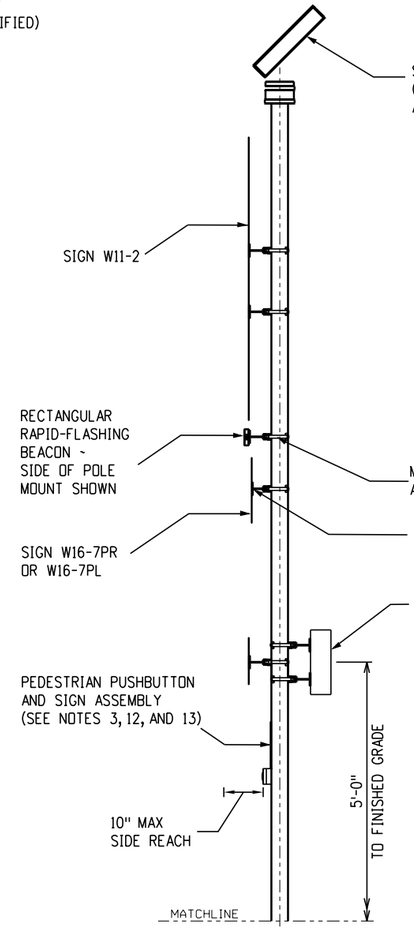
S-614-14

Standard Sheet No. 2 of 4

Project Sheet Number:

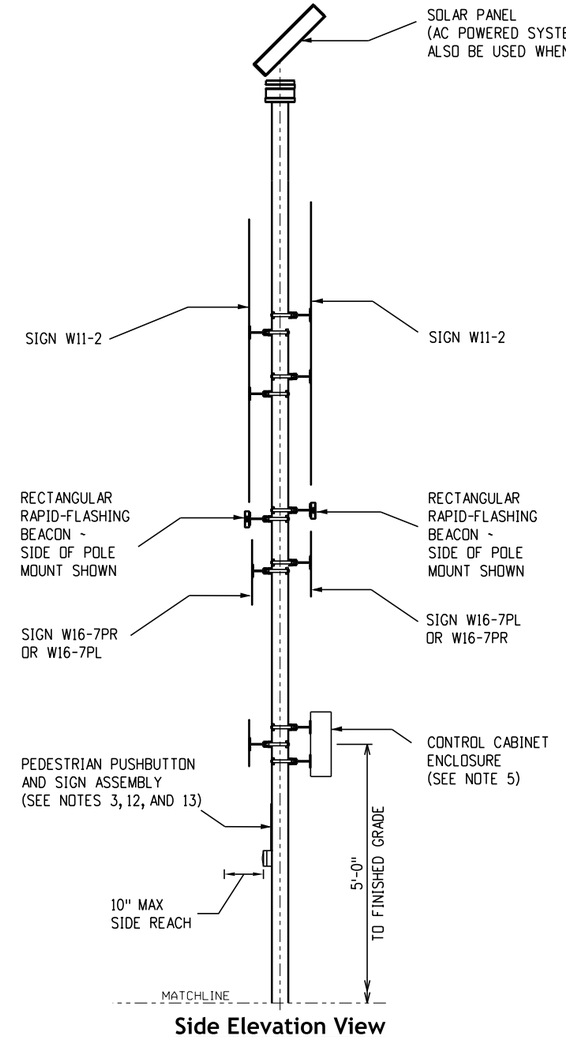


Front Elevation View



Side Elevation View

Uni-Directional Configuration Details



Side Elevation View

Bi-Directional Configuration Details

Notes

1. The RRFB system shall adhere to all aspects of MUTCD Chapter 4L.
2. An RRFB shall only be used to supplement a post-mounted W11-2, S1-1, or W11-15 sign with a 16-7p plaque, located immediately adjacent to an uncontrolled marked crosswalk.
3. Pedestrian pushbutton and sign assembly may be separate parts. Use R10-25 (9" x 12") sign in accordance with 2023 MUTCD. Sign may include integrated warning lights.
4. Terminate RRFB connections per manufacturer's recommendation.
5. Control cabinet enclosure 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 LED displays shall meet the intensity requirements of SAE J595 for Class 1 yellow. An automatic signal dimming device shall be used to reduce the brilliance of the RRFB indications during nighttime operations.
8. See Sheets 1, 2, and 4 for standard base and foundation details.
9. When specified in the plans, AC power system (as shown on Sheet 1) may be used in place of the solar powered system shown on this sheet.
10. For posted speeds of 35 mph or lower, the W11-2 signs shall be 36" x 36". For posted speeds of 40 mph or higher, the W11-2 signs shall be 48" x 48".
11. Pedestal foundation may be used for both uni-directional and bi-directional configurations. Breakaway base installation (as shown on Sheet 1) shall be used for uni-directional configuration only.
12. Pedestrian pushbutton shall be within 10 inch reach distance of adjacent landing area.
13. Pedestrian pushbutton shall be accessible by reaching to the side. If the button is not accessible by reaching to the side, the pushbutton shall be placed on a separate push button post per Standard S-614-45.

Rectangular Rapid-Flashing Beacon (RRFB)

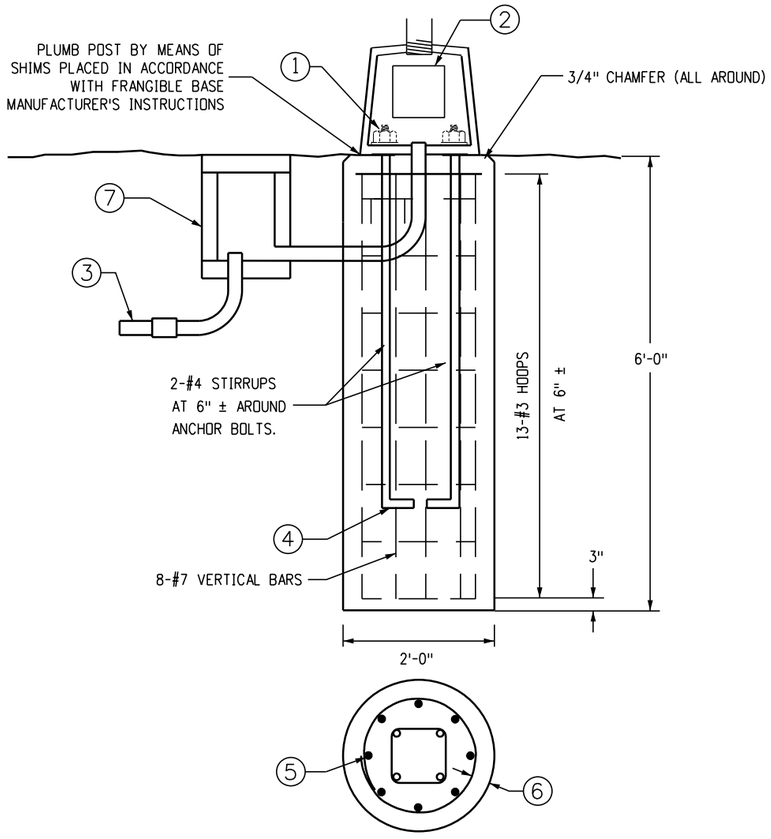
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Flashing Beacon and Sign Installations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-14
Standard Sheet No. 3 of 4
Project Sheet Number:



Alternate Pedestal Base Installation

General Notes

1. The 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 v = 110 lb./cu. ft.
Soil Cohesion = 750 lb./sq. ft. for Medium Stiff Cohesive Soil
Soil Ø Angle = 30 Degrees 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 homogenous.
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 inch x 48 inch diamond sign panel mounted 9 feet above the ground, with a 24 inch x 24 inch rectangular plaque underneath and a flashing beacon 12 inches 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. Hand Hole Shall Be Provided.
3. Schedule 80 PVC (24 Inch Min. Depth, 30 Inch Min. Depth Under Roadway) Conduit stub from pull box to pole shall be 2 Inch Min. Diameter.
4. Install Anchor Bolts (Furnished with Pole) per Manufacturer's Template Print (Furnished with Order).
5. Minimum Overlap Of 12 Inch
6. 3 Inch Clearance for Hoops
7. Standard Pull Box

Caisson designs require that the caisson be founded in compact sand, clay, or sandy clay. If, by visual inspection of the hole, other material is present, the caisson design shall be modified as determined by the Engineer.

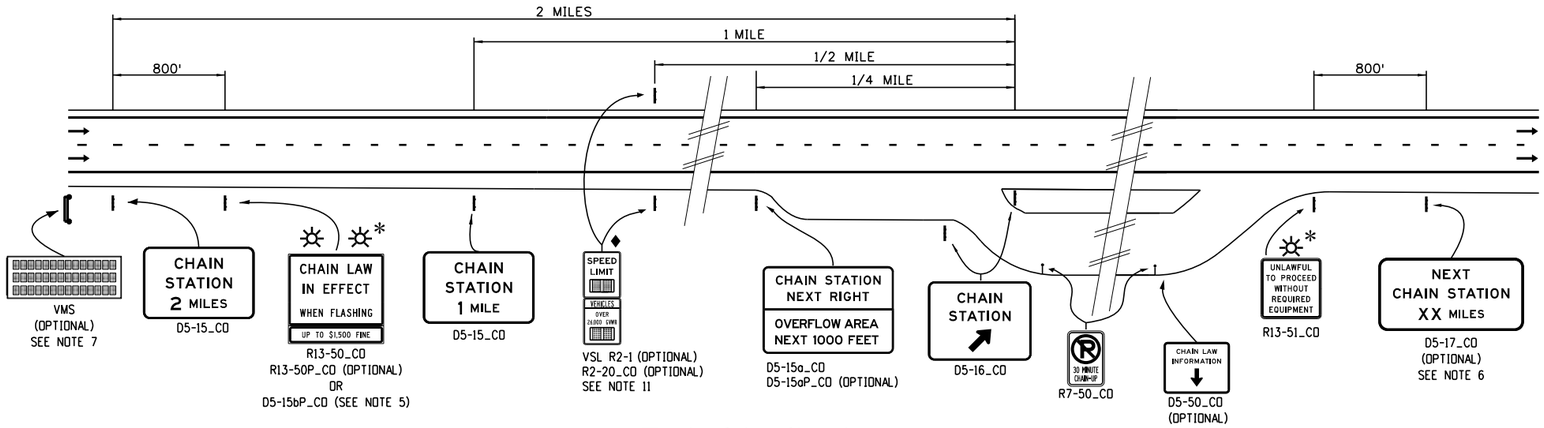
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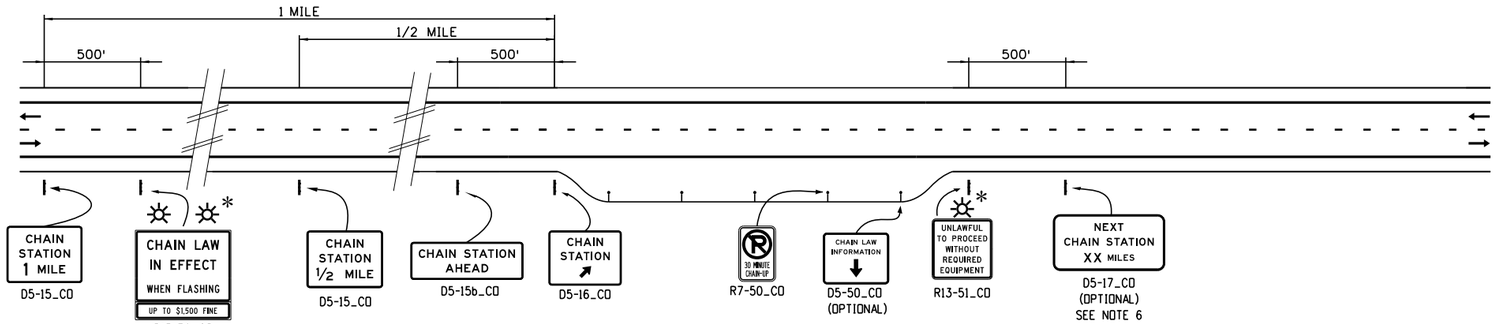
Flashing Beacon and Sign Installations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-14
Standard Sheet No. 4 of 4
Project Sheet Number:



Typical Application
Chain Station - Freeway/Expressway



Typical Application
Chain Station - Conventional Highway

General Notes

1. Chain station signs shall have a white legend and border on a blue background. Alternate legend "Chain-Up Station" or "Chain-Down Station" may be used in place of the standard "Chain Station" as directed by the Engineer.
2. Chain Station Gore Sign with an Exit Directional Arrow (D5-16_CO) shall be used when leaving thru lane lines. A temporary "Trucks Only" plaque (D5-16p_CO) may supplement the exit gore sign to deter passenger vehicles from entering the chain station. D5-16p_CO should be removed after 2 years of use to reduce sign clutter.
3. Unlawful to Proceed Without Required Equipment signs (R13-51_CO) shall be installed at the downstream end of the last station available for chain-up applications only. Next Chain Station signage (D5-17_CO) shall not be installed with Unlawful to Proceed signage.
4. Chain Law In Effect signs (R13-50_CO) and Unlawful to Proceed Without Required Equipment signs (R13-51_CO) shall not be installed for chain-down station applications.
5. Chain Law In Effect signs (R13-50_CO) should be installed at approach road intersections or other locations where commercial vehicles can detour or turn around safely. A "X Miles Ahead" plaque (D5-15bp_CO) should supplement R13-50_CO if it is the first advance sign in sequence to the chain station.
6. Next Chain Station signage (D5-17_CO) should be installed at the end of succeeding chain stations.
- ⬣ 7. Variable message signs (VMS) may be used in addition or in place of the Chain Station 2 Miles sign (D5-15_CO) as directed by the Engineer. A roadway condition message should be displayed to increase driver compliance when speeds are reduced ahead.

   Refer to CDOT VMS Statewide Guidelines.
- ✻ 8. Regulatory signs, Chain Law In Effect When Flashing (R13-50_CO) and the Unlawful to Proceed Without Required Equipment (R13-51_CO), may be posted on each side of roadway (double posted). Unlawful to Proceed Without Required Equipment (R13-51_CO) may be installed with flashing beacons to enhance conspicuity.
9. No Parking 30 Minute Chain-Up signs (R7-50_CO) may be hinged and folded during summer months if more than 1600 ft from residential areas as directed by the Region Traffic Engineer.
10. Refer to S-613-2 for Chain Station Lighting Detail.
- ♦ 11. The use of and final placement of variable speed limit signs shall be approved by the Region Traffic Engineer.

Legend

- → Direction Of Travel
- ☼ Flashing Beacon
- ↑ Overhead Lighting (See Note 10)
- ⬣ VMS Option (See Note 7)
- ✻ Double Posted Option (See Note 8)
- ♦ Variable Speed Limit Option (See Note 11)

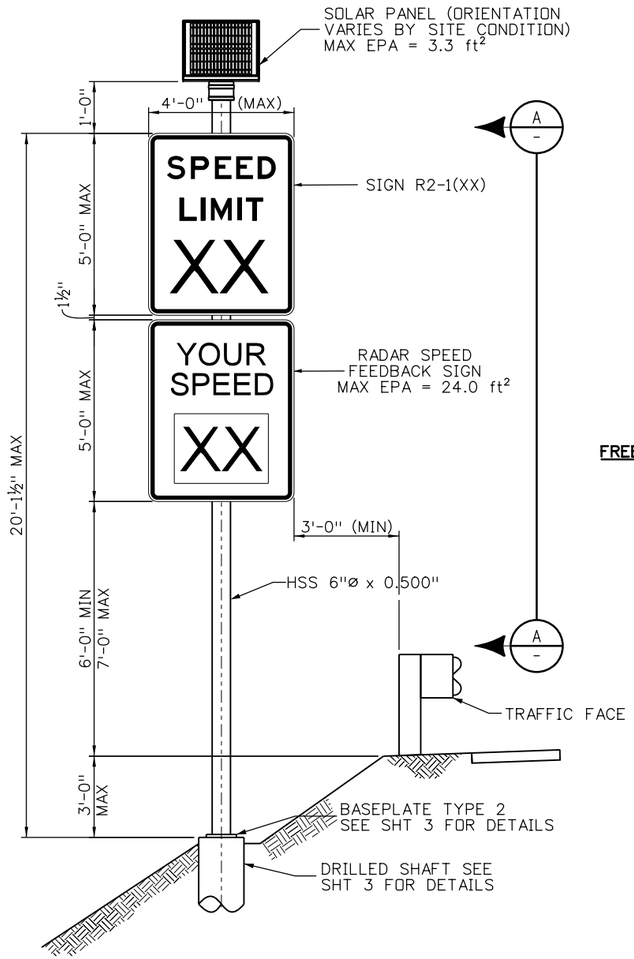
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Chain Station Signage

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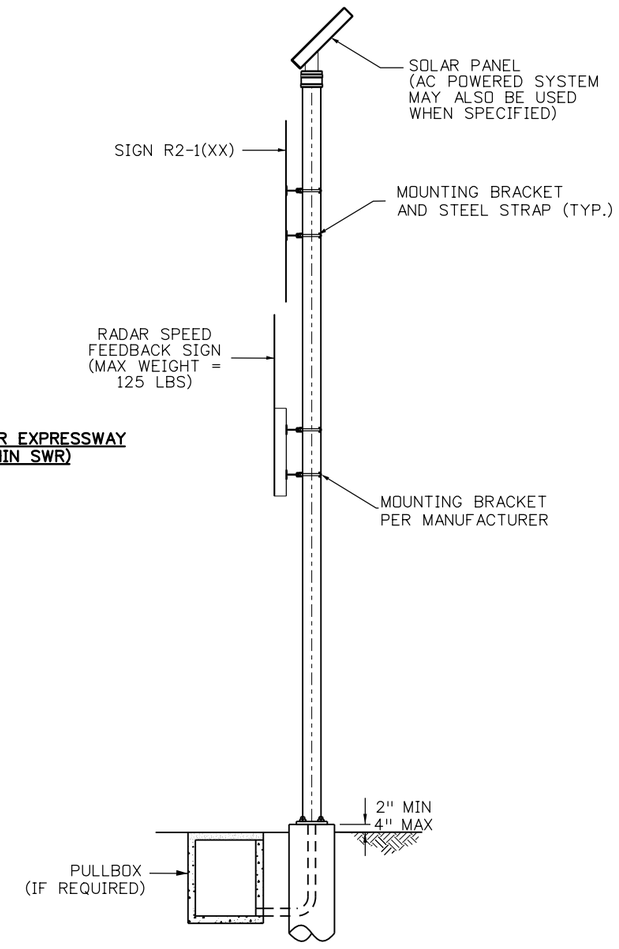
Standard Plan No.
S-614-15
Standard Sheet No. 1 of 1
Project Sheet Number:



Radar Speed Feedback Sign

(Freeways and Expressways Configuration within the SWR)

FREEWAY OR EXPRESSWAY (WITHIN SWR)



Section A

POST SELECTION TABLE				
CONFIGURATION	WIND REGION	POST SELECTION	MAX POST HEIGHT	DETAIL LOCATION
FREEWAYS & EXPRESSWAYS	SPECIAL WIND REGION	HSS 6.00x0.500	20'-1½"	SHEET 1 OF 3
	ALL OTHER LOCATIONS	HSS 6.00x0.375	18'-8½"	SHEET 2 OF 3
CONVENTIONAL HIGHWAYS	ALL REGIONS	HSS 5.00x0.375	14'-8½"	SHEET 2 OF 3

General Notes

1. Radar Speed Feedback Sign (RSFS) shall be in accordance with Section 614 of the CDOT Standard Specifications.
2. A Radar Speed Feedback Sign (RSFS) can be mounted below a speed limit sign or within 100 feet downstream of a speed limit sign.
3. Radar Speed Feedback Sign materials shall conform to the following:

A. Round Hollow Steel Sections (HSS)	ASTM A500 Grade C
B. Baseplates	ASTM A572 Grade 50
C. Threaded Anchor Rod	ASTM F1554 Grade 55
D. Anchor Rod Nuts	ASTM A563
E. Washers	ASTM F436

4. Installation design conforms with the latest AASHTO "LRFD Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" and shall be fabricated in accordance with:
   A. High strength bolts, nuts and washers shall conform to ASTM-A325 and shall be hot dip galvanized in accordance with ASTM A153.
   B. Holes shall be drilled and cuts shall preferably be saw cuts; however, flame cutting will be permitted provided all edges are ground. Metal shall not project beyond the plane of the plate face on break-away installations.
   C. All welding is to be continuous and in accordance with current AWS specifications.
   D. Post length will be as shown on the plans, or as determined by cross section, or as directed by the Engineer for each location. Post lengths exceeding the maximums presented herein require a special design.
5. All RSFS post steel, including baseplates, shall be hot dip galvanized inside and outside in accordance with ASTM A123.
6. Mounting hardware for each sign shall be furnished by the Manufacturer.
7. All electrical materials and workmanship shall conform to the latest requirements of the NEC, NEMA, UL, OR EIA wherever applicable; The Colorado PUC and any local codes or ordinances which may apply.
8. Terminate RSFS connections per Manufacturer's recommendation.
9. When specified in the plans, AC power system may be used in place of solar powered system.
10. R2-1 size shall be per MUTCD requirement. The RSFS size shall match the size of the R2-1 it is supplementing.
11. The RSFS shall include "YOUR SPEED" legend and shall be a black legend on a yellow background. For school zones the RSFS shall include the "YOUR SPEED" legend and shall be a black legend on a fluorescent yellow-green background.
12. For vertical and lateral placement of signs, see S-614-1.
13. Post shall be installed plumb to the foundation. Plumbing the post shall be accomplished by:
    A. Baseplate Type 1: Shims positioned beneath the frangible base in accordance with the Manufacturer's instructions.
    B. Baseplate Type 2: Adjusting the leveling nuts before the foundation is finished to final grade.

Design: AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1st Edition (2015) with 2022 Interims.
AASHTO LRFD Bridge Design Specifications, 10th Edition (2025)

Wind Loading: Per CDOT Bridge Design Manual Section 32.3:
165 mph inside special wind region (SWR)
120 mph base wind speed (all other locations)

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Sheet Revisions	
Date:	Comments

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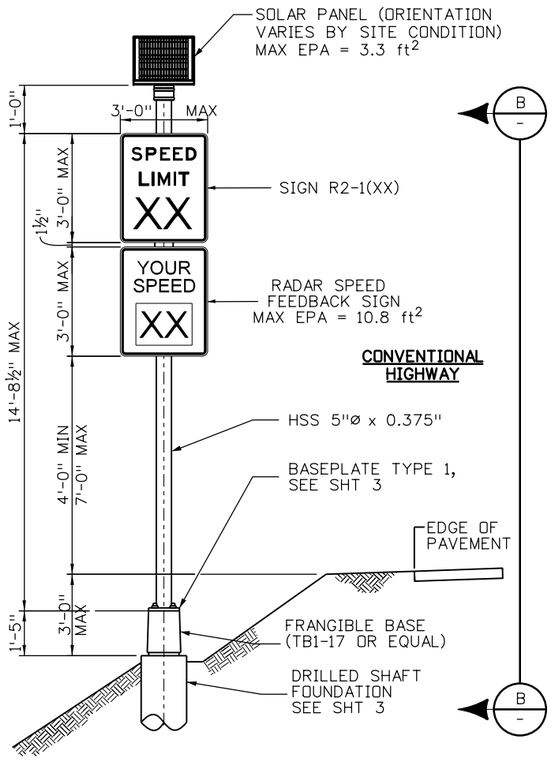
Radar Speed Feedback Sign (RFSF)

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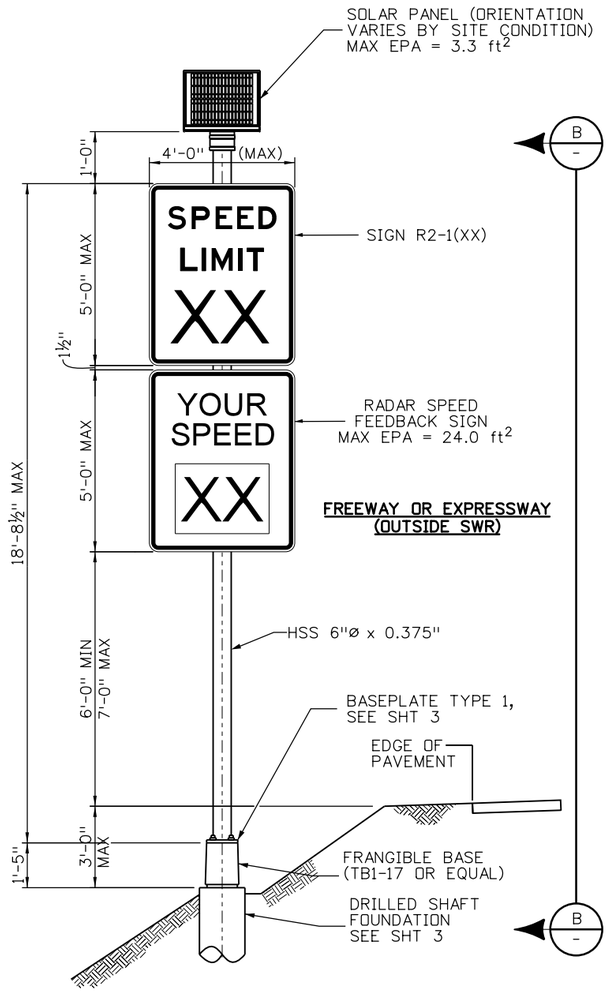
Standard Plan No.
S-614-17
Standard Sheet No. 1 of 3
Project Sheet Number:

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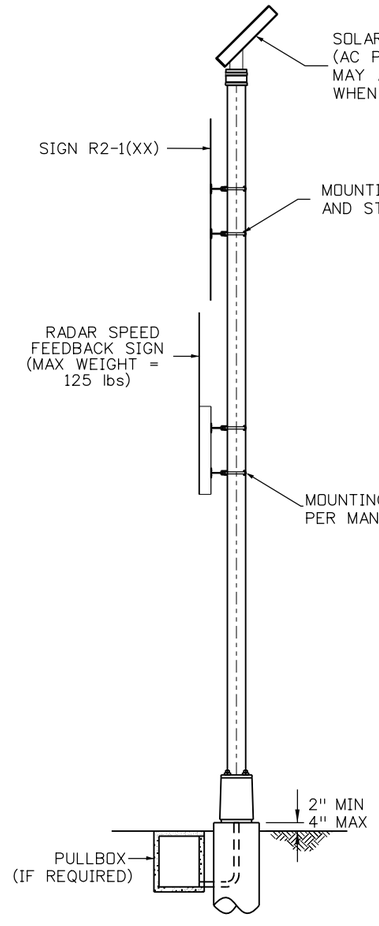
1. Frangible base shall be TB1-17 or approved equal.
2. Anchor bolt spacing, hardware, and torque shall conform to Manufacturer's recommendations. All components shall fit and accommodate the requirements of the RSFS assembly and frangible base.
3. Connecting bolts, flat washers, bearing washers, and hex nuts shall be provided by frangible base Manufacturer.



Radar Speed Feedback Sign
(Conventional Highway Configuration)



Radar Speed Feedback Sign
(Freeways and Expressways Outside SWR)



Section B-B

Computer File Information		Sheet Revisions	
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Radar Speed Feedback Sign (RFSF)

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Standard Plan No.
S-614-17
Standard Sheet No. 2 of 3
Project Sheet Number:

Foundation Notes

1. Drilled shaft 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. Drilled shaft concrete must have a minimum compressive strength of 3,200 psi prior to installing the pedestal poles.
4. Drilled shaft shall be placed against undisturbed earth.
5. Integrity testing per 503 not required.

Foundation Design Data:

Brom's method using AASHTO LRFD LTS 1st, with 2022 Interims.

Drilled Shaft Concrete:
Class BZ Concrete:f'c = 4,000 psi
Reinforcing Steel:fy = 60,000 psi

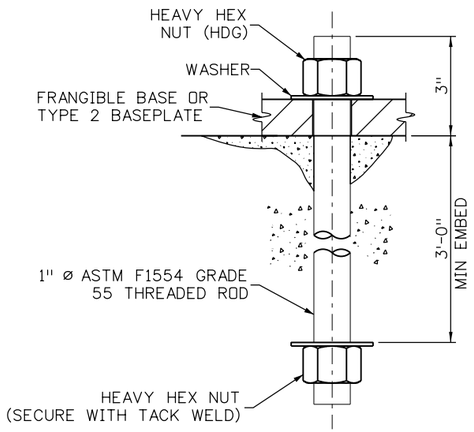
The designs herein assume that the RSFS is installed adjacent to the roadway prism with the following parameters:

Medium Dense Cohesionless Soil:
Soil Density, γ = 110 pcf
Soil Angle = 30°
SF = 2.5 for flexural resistance

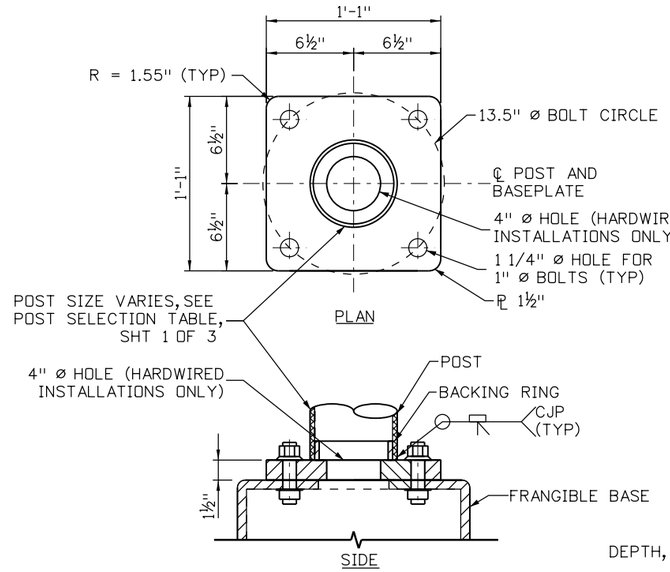
Medium Stiff Cohesive Soil:
Soil Density, γ = 110 pcf
Soil Cohesion = 750 psf
SF = 2.5 for flexural resistance

Contact the Engineer if any of the following soil conditions are encountered during drilling:

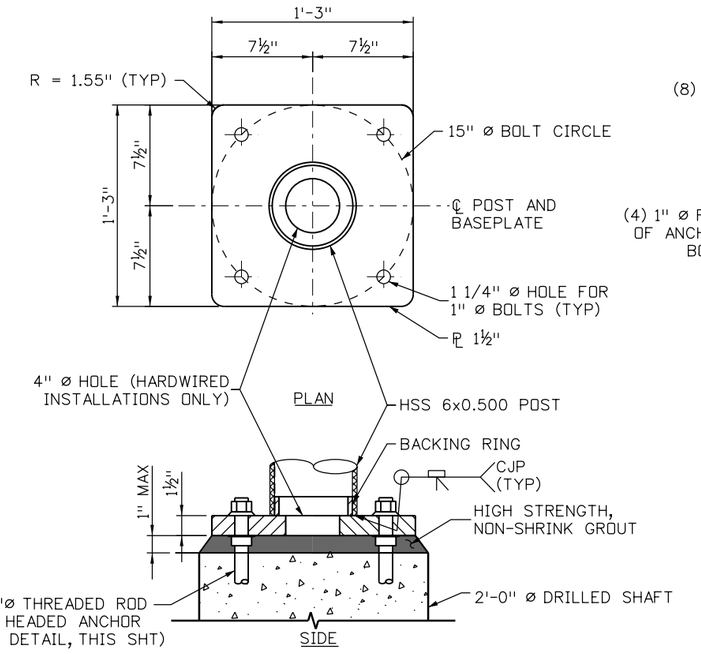
(A) The soil has a high organic content or consists of saturated silt and clay.
(B) The site won't support the weight of the drilling rig.
(C) The foundation soils are not homogenous.
(D) Firm bedrock is encountered.



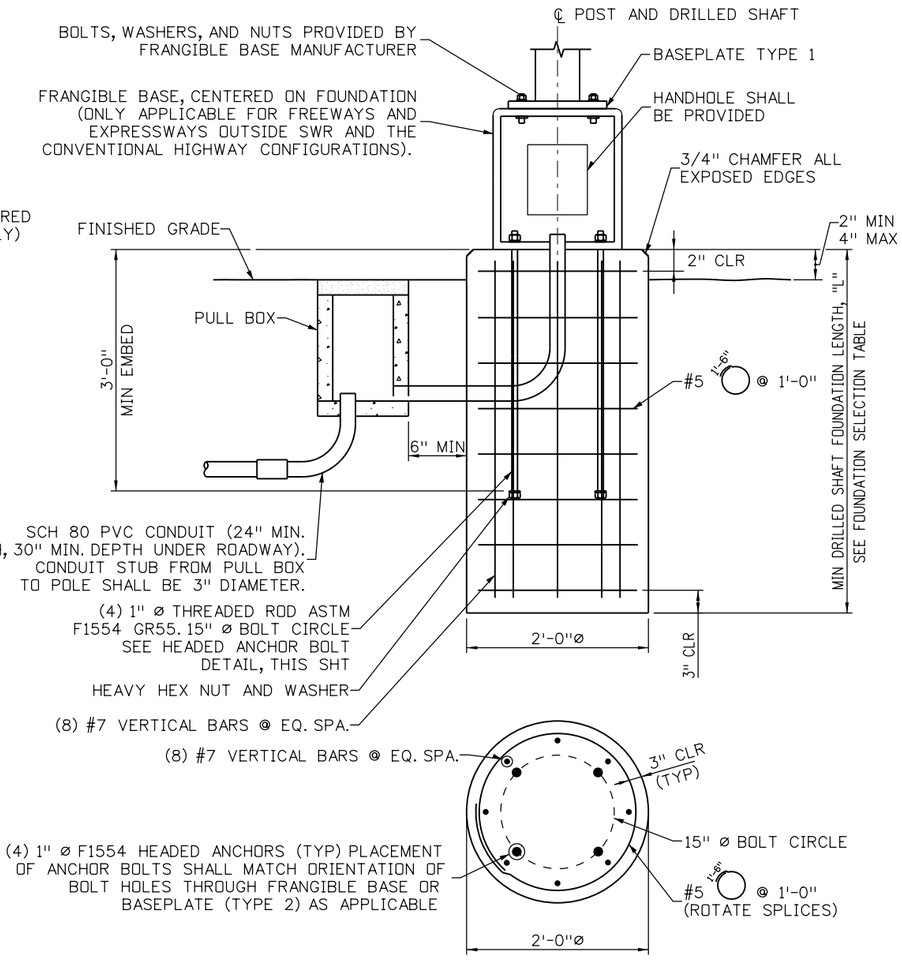
Headed Anchor Bolt Detail



Typical Baseplate Type 1 Details
(Only Applicable for Frangible Base Assemblies)



Typical Baseplate Type 2 Details
(Only Applicable for Freeways & Expressways Configuration within SWR)



Drilled Shaft Foundation

FOUNDATION SELECTION TABLE		
CONFIGURATION	WIND REGION	"L"
FREEWAYS & EXPRESSWAYS	SPECIAL WIND REGION	11'-0"
	ALL OTHER LOCATIONS	9'-0"
CONVENTIONAL HIGHWAYS	ALL REGIONS	9'-0"

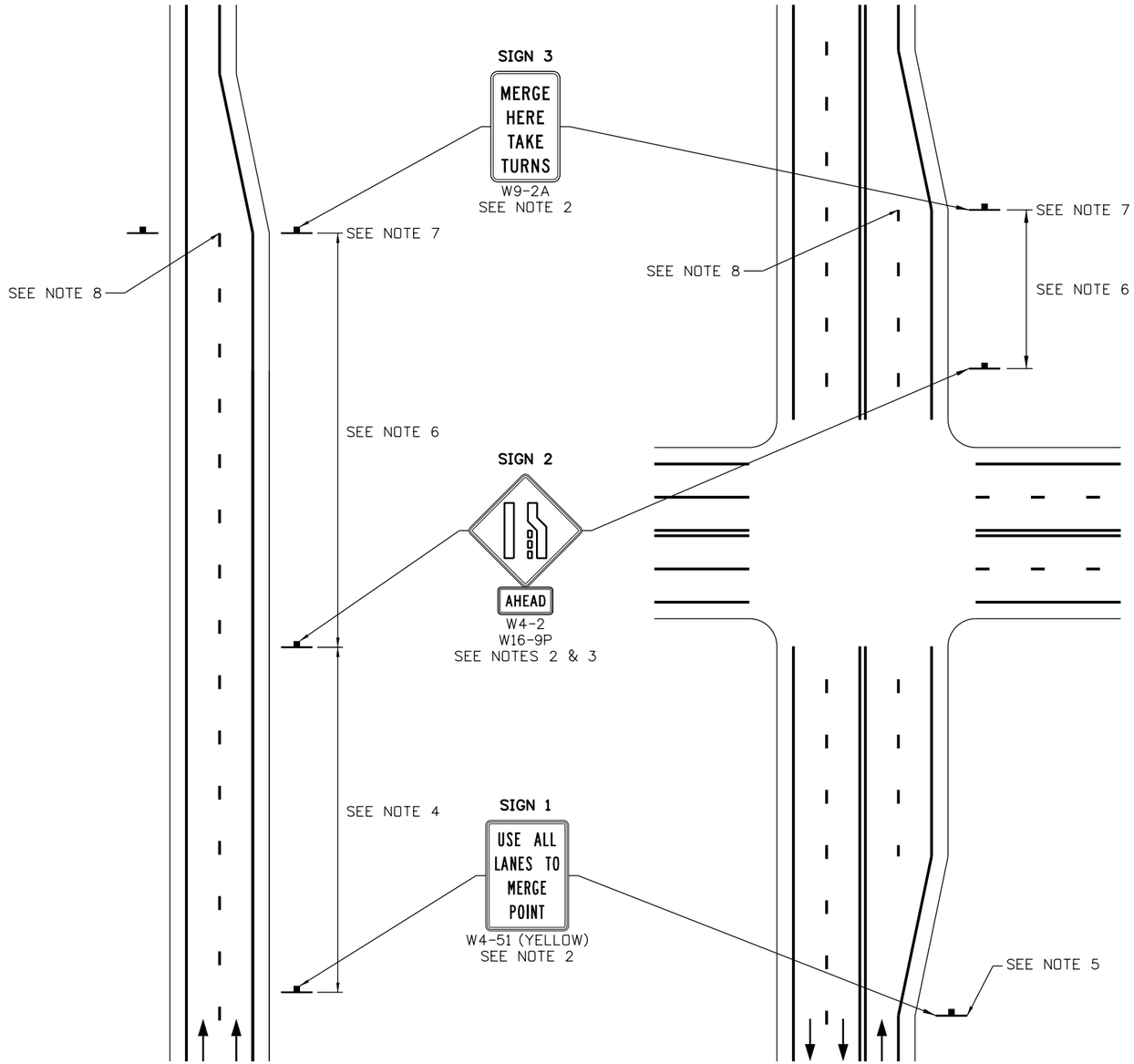
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CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

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Radar Speed Feedback Sign (RFSF)

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-17
Standard Sheet No. 3 of 3
Project Sheet Number:



Typical Application

Arterial Lane Drop Downstream of a Traffic Signal

Notes

1. Late/zipper merge locations shall be determined per the direction of THE Region Traffic Engineer.
2. All zipper merge signing shall have a black legend on a yellow background.
3. When the geometric condition exists where both approach lanes merge, a W4-8 sign shall be used instead of the W4-2.
4. Sign 1 shall be placed at least 500 feet upstream of the sign 2 location and no greater than 1000 feet upstream of the sign 2 location. At lane drop locations where backups greater than 1000 feet regularly occur, an additional sign 1 may be installed at the discretion of the Region Traffic Engineer.
5. Sign 1 shall be placed a minimum of 500 feet and in advance of the upstream lane taper, and the sign location may be adjusted based on geometric conditions and engineering judgment.
6. Sign 2 shall be placed using Guidelines for the Advanced Placement of Warning Signs from the current MUTCD. Table 2C-3 from the MUTCD 11th Edition is presented below for reference.
7. Sign 3 shall be placed at the beginning of the lane taper (merge point). Sign 3 should be double posted where roadway conditions permit.
8. White broken lane line shall be placed to the beginning of the lane taper (merge point). Do not install any lane reduction arrow pavement markings.
9. A TAKE TURNS ROAD stencil may be placed in each of the merging lanes at the merge point, at the discretion of the Engineer. See S-627-1 for stencil.

Table 2C-3. Guidelines for Advance Placement of Warning Signs

Posted or 85th-Percentile Speed	Advance Placement Distance[1]									
	Condition A: Speed reduction and lane changing in heavy traffic[2]	Condition B: Deceleration to the listed advisory speed (mph) for the condition								
		0[3]	10[4]	20[4]	30[4]	40[4]	50[4]	60[4]	70[4]	80[4]
20 mph	225 ft	115 ft	N/A[5]	–	–	–	–	–	–	–
25 mph	325 ft	155 ft	N/A[5]	N/A[5]	–	–	–	–	–	–
30 mph	460 ft	200 ft	N/A[5]	N/A[5]	–	–	–	–	–	–
35 mph	565 ft	250 ft	N/A[5]	N/A[5]	N/A[5]	–	–	–	–	–
40 mph	670 ft	305 ft	100 ft[6]	100 ft[6]	N/A[5]	–	–	–	–	–
45 mph	775 ft	360 ft	125 ft	100 ft[6]	100 ft[6]	N/A[5]	–	–	–	–
50 mph	885 ft	425 ft	200 ft	175 ft	125 ft	100 ft[6]	–	–	–	–
55 mph	990 ft	495 ft	275 ft	225 ft	200 ft	125 ft	N/A5	–	–	–
60 mph	1,100 ft	570 ft	350 ft	325 ft	275 ft	200 ft	100 ft[6]	–	–	–
65 mph	1,200 ft	645 ft	450 ft	400 ft	350 ft	275 ft	200 ft	100 ft[6]	–	–
70 mph	1,250 ft	730 ft	525 ft	500 ft	450 ft	375 ft	275 ft	150 ft	–	–
75 mph	1,350 ft	820 ft	625 ft	600 ft	550 ft	475 ft	375 ft	250 ft	100 ft[6]	–
80 mph	1,475 ft	910 ft	725 ft	700 ft	625 ft	550 ft	450 ft	350 ft	200 ft	–
85 mph	1,600 ft	1,010 ft	825 ft	800 ft	750 ft	675 ft	575 ft	450 ft	300 ft	150 ft

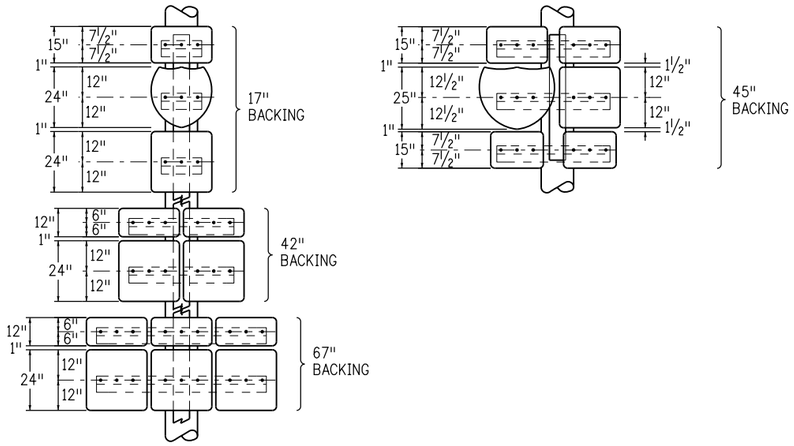
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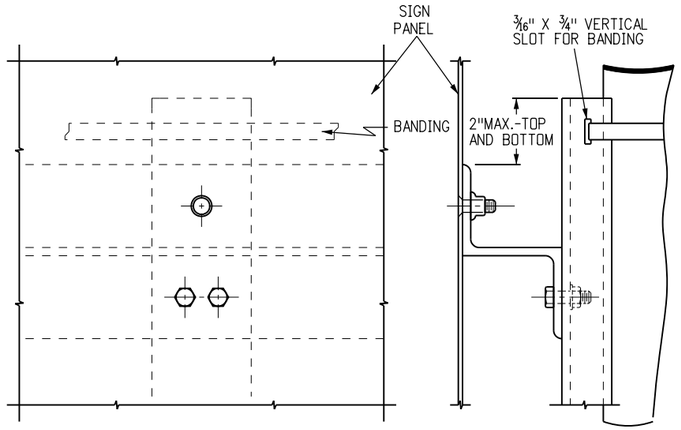
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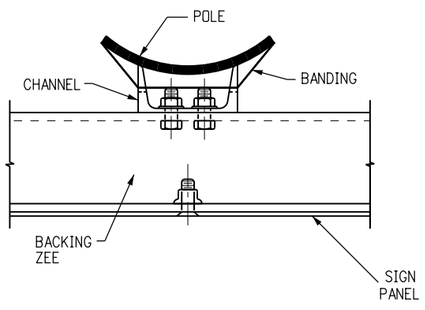
Late / Zipper Merge Signage

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-19
Standard Sheet No. 1 of 1
Project Sheet Number:



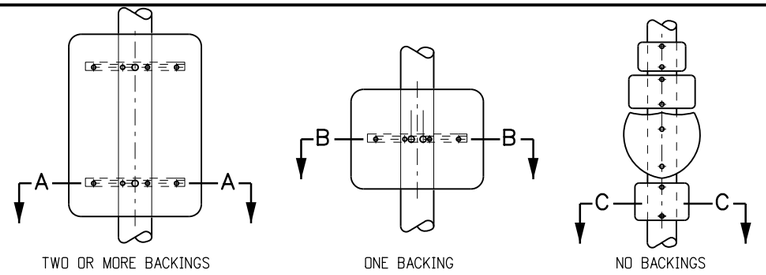


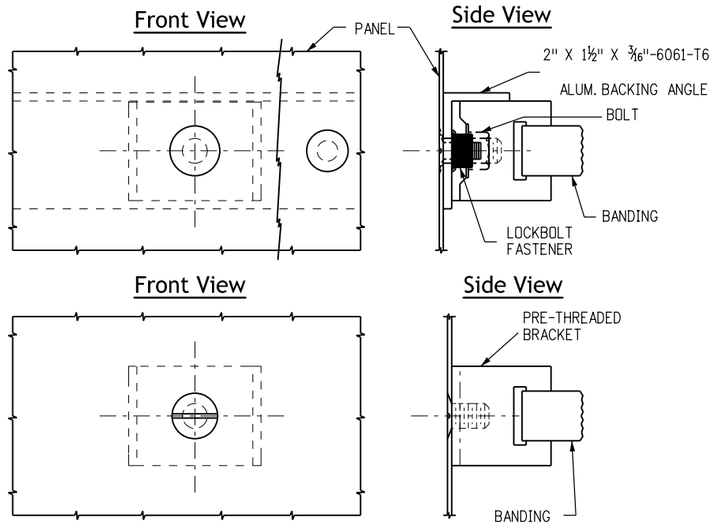


Typical Pole Mount Installation
For Class II Marker Assembly

Class II Marker Assembly Fabrication Notes

1. Horizontal and vertical members to be the same material as the sign panel.
2. Vertical member to be 3 inch x 1.420 pounds 6061-T6 aluminum channel bonded to the pole with a minimum of two bands.
3. Horizontal members to be 3 inch x 2 inch 2.33 inch backing zees, fastened to vertical member with ⅜ inch machine bolts with hex nut.
4. Sign panels to be fastened to horizontal members with ⅜ inch - 90 countersunk lockbolt fasteners.
5. Vertical spacing between groups of panels in one marker assembly shall be 4 inches.





Typical Pole Mount Installation
For Class I And II Sign Panels

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 ½ inch x .025 inch 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 inch or greater width must have backing members in addition to brackets. Class **II** panels of less than 36 inch width and Class **I** panels of greater than 24 inch 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 1½ inch.
3. Panels may be installed back-to-back on the same bands.
4. In no case shall bolts of less than 5/16 inch diameter be used for any portion of the assembly.

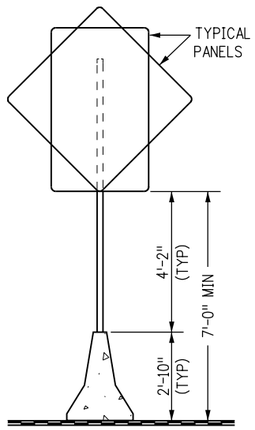
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Typical Pole Mount Sign Installation

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-20
Standard Sheet No. 1 of 1
Project Sheet Number:



Typical Elevation

POST SELECTION TABLE
(90 MPH WIND LOAD DESIGN)

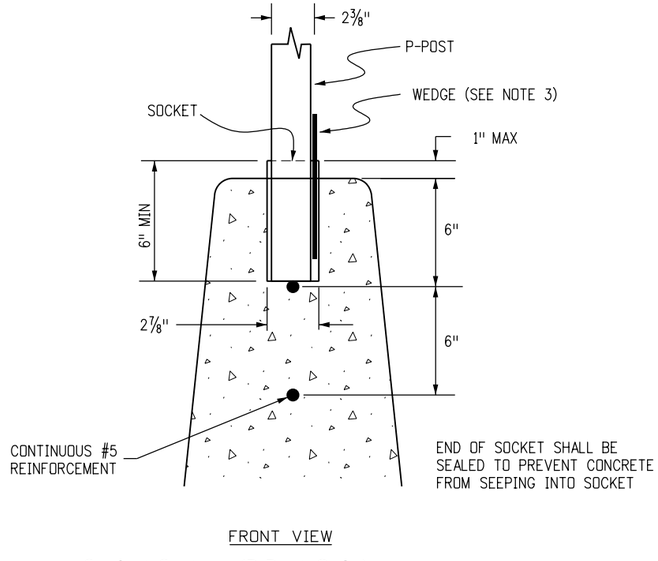
SIGN PANEL HEIGHT \ SIGN PANEL WIDTH	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	5'-0"
1'-6"	P	P	P	P	P	P	P1
2'-0"	P	P	P	P	P	P	P1
2'-6"	P	P	P	P	P1	P1	P1
3'-0"	P	P	P	P	P1	P1	P1
3'-6"	P	P	P1	P1	P1	P1	P1
4'-0"	P	P	P1	P1	P1	P1	P1
5'-0"	P1	P1	P1	P1	P1	P1	P1
6'-0"	P1	P1	P1	P1	P1	P1	P1
7'-0"	P1	P1	P1	P1	P1	P1	P2
8'-0"	P1	P1	P1	P1	P2	P2	P2

DIAMOND PANELS (30", 36" AND 48" SIDES) - P1

POST TYPE	P	P1	P2	FOR DETAILED POST SPECIFICATIONS SEE STANDARD PLAN S-614-8
OUTSIDE DIAMETER	2.375"	2.875"	2.875"	
WALL THICKNESS	0.080"	0.160"	0.276"	

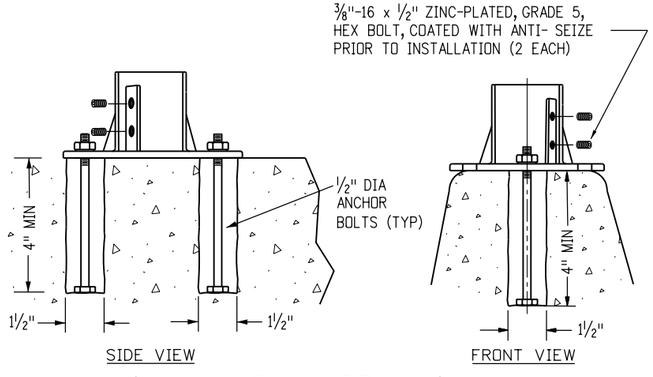
General Notes

1. For details of concrete barrier (cast-in-place and/or precast), see Standard Plans M-606-13, M-606-14, and M-606-15.
2. For sign panel fabrication details, see Standard Plans S-614-2, S-614-3, and S-614-4.
3. Socket systems 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 slipbase stub 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 A307. They shall all be galvanized in accordance with ASTM A153 or ASTM A164.
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 'Hilti Kwik Hus-ez' screw anchors and shall be drilled and filled with approved epoxy grout in 2 inch holes for ⅞-inch bolts and 1-½ inch holes for ½-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 travel lane.

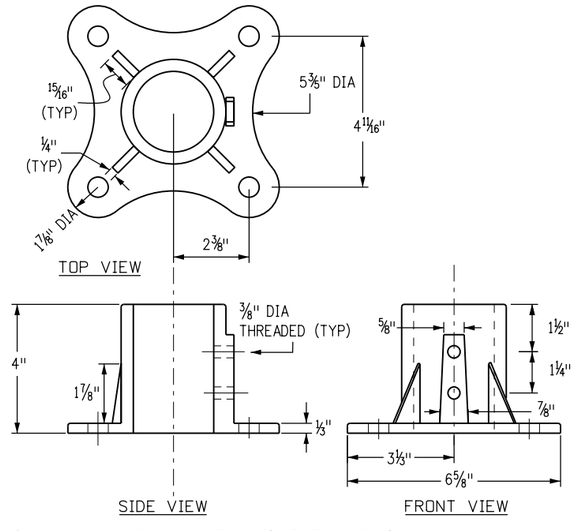


Socket System (P Post Only)

Cast-In-place Concrete Barrier Installation



Surface Mount Casting (P Post Only)



Surface Mount Casting Detail (P Post Only)

Retro-fit Concrete Barrier Installation

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Concrete Barrier Sign Post Installations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-21
Standard Sheet No. 1 of 2
Project Sheet Number:

Surface Mount Slipbase Tubular Steel Sign Base Requirements

For 2⅞ 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 ⅝ x 5½ inch long 'Hilti Kwik Hus-Ez' Screw Anchors
- 16 - Each ⅝ inch flat washers
- 8 - Each ⅝ inch lock washers
- 8 - Each ⅝ inch nuts

All hardware will be galvanized or zinc plated.

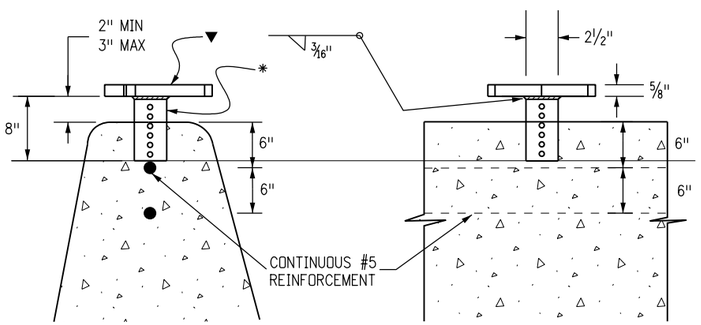
Installation Requirements:

Drill: (8) - ⅝ inch holes 6 inch deep, clean hole prior to installing anchors

Use additional washers for shimming to level base plate.

Surface Mount Slipbase Tubular Steel Sign Base Notes

1. Refer to signing plans for sign locations and height
2. Minumum allowable tension capacity for wedge anchors = 3000 pounds.
3. Maximum allowable moment for sign base = 5.13 kip-feet.

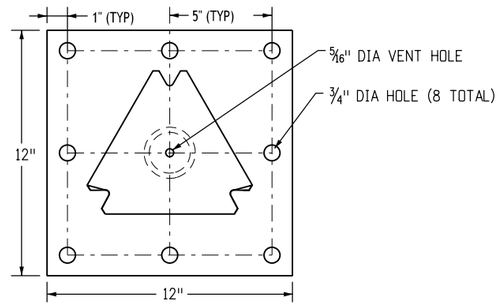


▼ BASE PLATE SHALL BE ⅝" ASTM A-36, 441 OR 572 STEEL PLATE. SEE STANDARD PLAN S-614-8 FOR DIMENSIONS.

* BASE STUB SHALL BE 2½" SQUARE 10 GAGE PERFORATED TUBING, FABRICATED AND GALVANIZED CONFORMING TO ASTM A-153

Slipbase Barrier Stub (P1 & P2 Posts)

Cast-In-Place Barrier Installation



Surface Mount Casting Detail (P1 & P2 Posts)

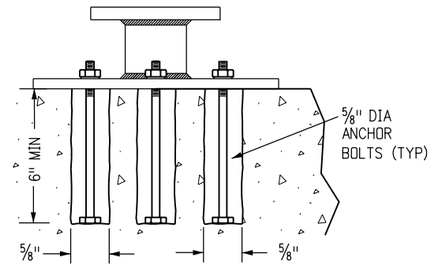
BASE PLATE FABRICATION REQUIREMENTS:

BASE PLATE: ¾ INCH ASTM A 36 PLATE STEEL

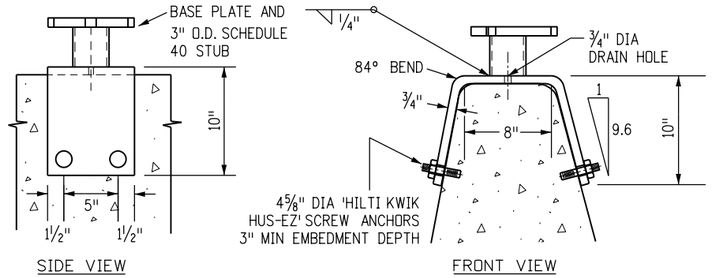
PIPE STUB: 3 INCH NOMINAL SCHEDULE 80, ASTM A 500 GR B

TOP PLATE: MUST BE COMPATIBLE WITH SLIPBASE CASTING FROM STANDARD PLAN NO. S-614-8

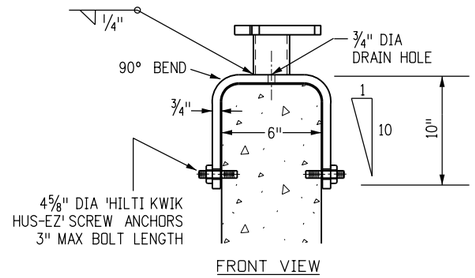
MEET ASTM A 123 GALVANIZING AFTER FABRICATION IS COMPLETED.



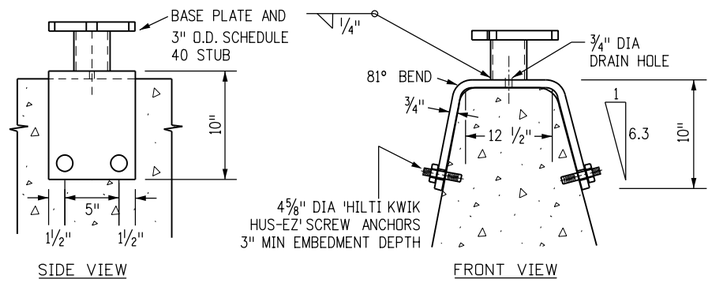
Surface Mount Casting (P1 & P2 Posts)



Type 7 Installation



Concrete Glare Screen Installation



Type 9 Installation

Saddle Bracket (P1 & P2 Posts)

Retro-fit Concrete Barrier Installation

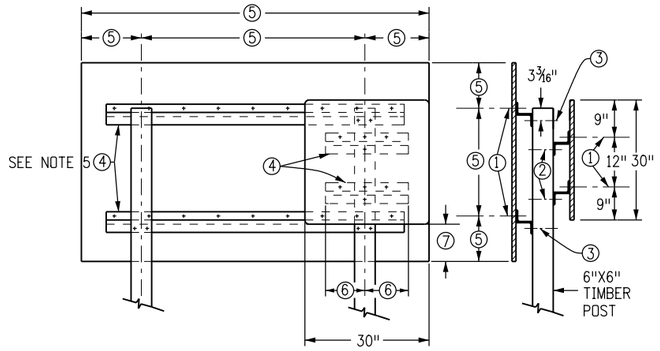
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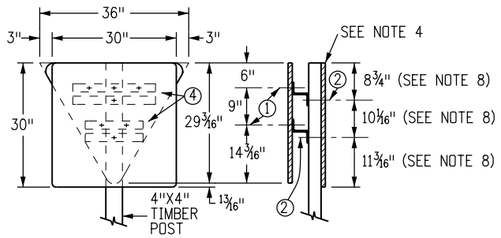
Concrete Barrier Sign Post Installations

Issued by the Traffic Safety & Engineering Services: July 01, 2026

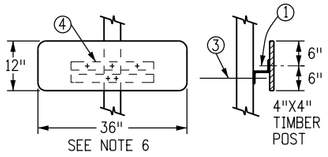
Standard Plan No.
S-614-21
Standard Sheet No. 2 of 2
Project Sheet Number:



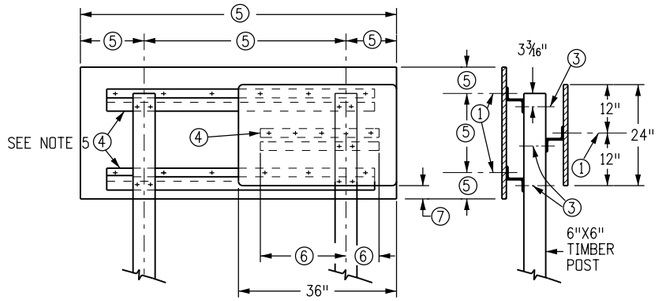
30" Regulatory Sign and Guide Sign



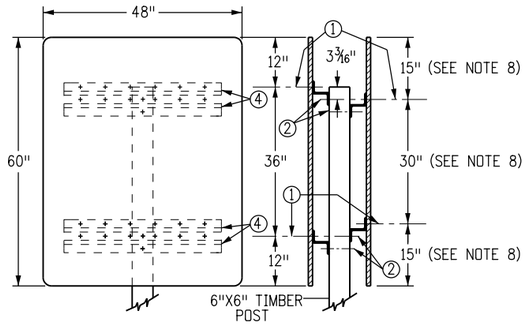
30" Regulatory Sign and 36" Triangle



36" X 12" Regulatory Sign
(This detail applies only when sign is mounted on the same face with a Class II sign.)



36" X 24" Regulatory and Guide Sign



48" X 60" Regulatory Signs

General Notes

1. Timber sign posts may only be used for temporary signange during construction. Tubular steel shall be used for permanent installation.
2. For sign placement see Colorado Standard Plan S-614-1.
3. For typical Class **I**, **II** and **III** Ground Sign Installation Details See Colorado Standard Plans S-614-2, S-614-3 and S-614-4.
4. If the back-side of any panel used in the multi-sign installations (do not enter, wrong way, etc.) protrudes beyond the edge of another panel that faces traffic approaching from a normal or proper direction, the entire back-side of the protruding panel shall be painted flat black enamel.
5. A backing zee size of 3 inch x $2\frac{11}{16}$ inch x ¼ inch shall be used for most guide sign installations.
6. 36 inch x 12 inch and all signs 30 inch wide or less become Class **II** And require backing zee(s) when they are mounted on the same face as a normal Class **II** sign. One regular 1 foot-8 inch zee will be used for those 15 inches or less in height and 2 regular 1 foot-8 inch zees for those greater than 15 inches in height.
7. Other multi-sign installations, not detailed on this standard, may be required by the plans and are to be fabricated 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 ⅜-inch 90° countersunk aluminum lockbolt fastener.

② ⅝-inch galvanized or cadmium plated machine bold, nut and washers.

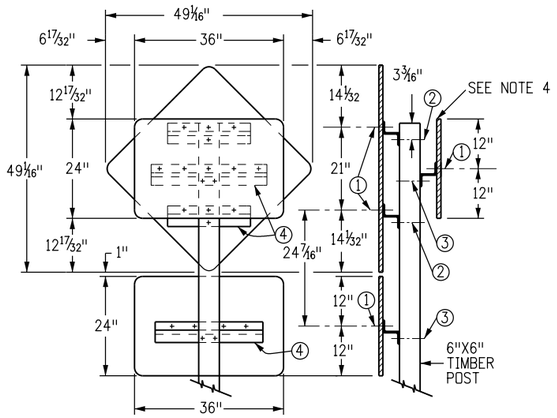
③ ⅜-inch galvanized or cadmium plated machine bolt, nut and washers.

④ 3-inch X $2\frac{11}{16}$-inch X ¼-inch backing zee.

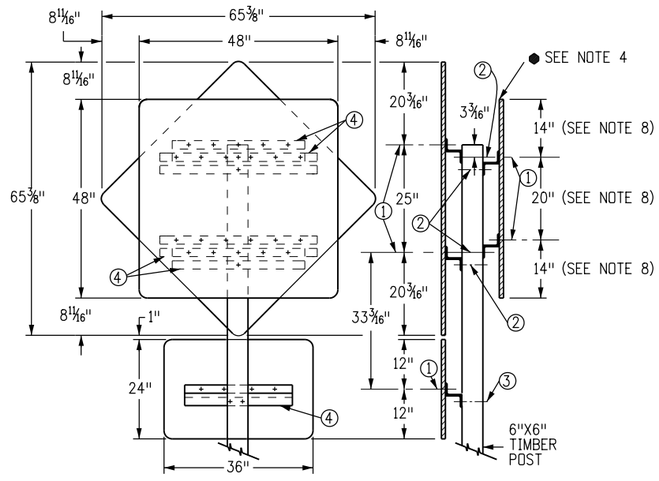
⑤ Guide sign dimension varies.

⑥ Dimension varies, panel shall not project beyond the edge of the guide sign.

⑦ This Space Not To Exceed 1-inch- 6-inch, Otherwise Center Panel Vertically On The Guide Sign.



36" X 24" Regulatory Sign and
36" Diamond with Educational Plaque



48" X 48" Regulatory Sign and
48" Diamond with Educational Plaque

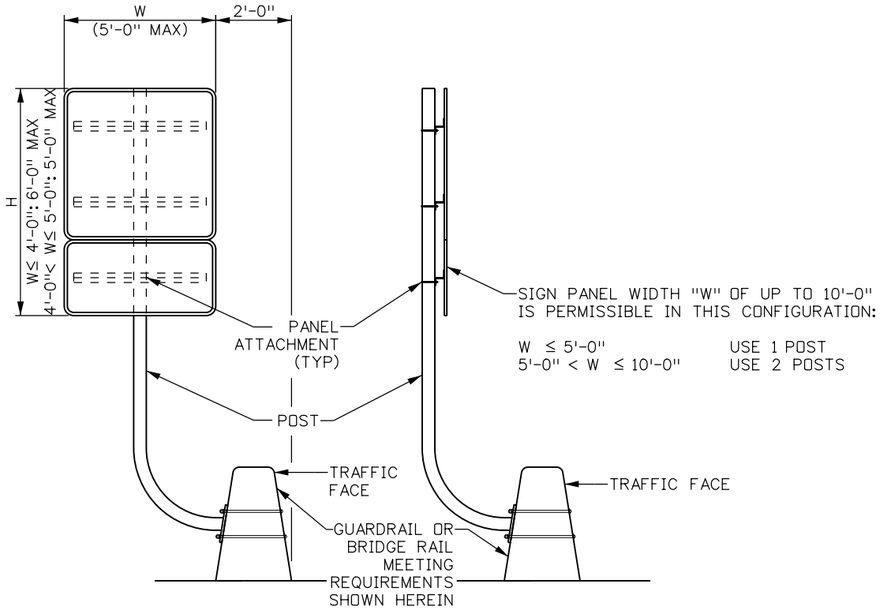
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Typical Multi-Sign Installations

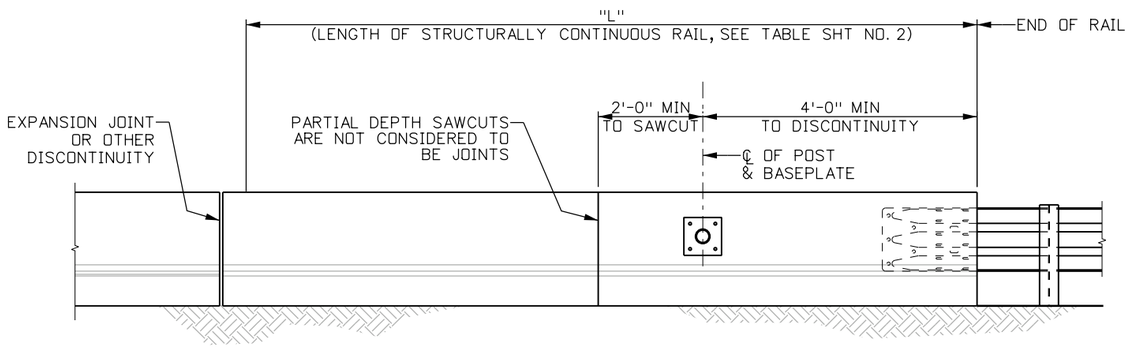
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-22
Standard Sheet No. 1 of 1
Project Sheet Number:



Perpendicular **Parallel**

Sign Panel Dimensions & Orientation



J-Post Placement Requirements

General Notes:

1. J-Post mount is specified for installation on Bridge Rail Type 7, Bridge Rail Type 9, Guardrail Type 7 styles CA and CC, and Guardrail Type 9 styles CA and CC.

2. J-Post materials shall conform to the following:

a. Round Hollow Steel Sections (HSS)	ASTM A500 Grade C
b. Baseplates	ASTM A709 Grade 50
c. Bolts	ASTM F3125 Grade A 325
d. Nuts	ASTM A563
e. Washers	ASTM F436

3. Bolts, u-clamps, nuts, and metal washers shall be galvanized.

4. Vent holes shall be provided prior to galvanization. Vent holes on horizontal segment of post shall be oriented down so as to drain water from the interior of the member when installed.

5. All signs shall be as required per CDOT M&S Standards Plans and Specifications and/or as shown on the plans.

6. Reference Standard S-614-3 for sign details, including sign panel and zee backing. Post shall be attached to zee members with u-bolts. Reference Standard S-614-8. Adjust u-bolt dimensions based on selected post diameter.

7. Guardrail parameters must be verified prior to installation.

8. Batter angle of guardrail or bridge rail shall be field verified prior to fabrication.

9. J-Post Mount is intended for back (Non-Traffic Face) of guardrail or bridge rail. Do not use on retaining wall facing, wall coping, or traffic-facing side of barrier.

10. J-Post mount is only applicable for use on permanent, cast-in-place guardrail, not temporary or precast barriers that are pinned together.

11. J-Post shall not be mounted on a segment of barrier where the guardrail was previously damaged and repaired.

12. Reference Standard S-614-14 for flashing beacon electrical requirements and details.

Design Data:

Specifications:

Design:	AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1st Edition (2015) with 2020 Interims.
	AASHTO LRFD Bridge Design Specifications, 9th Edition (2020).
Wind Loading:	Per CDOT Bridge Design Manual Section 32.3: 120 Mph Outside Of Special Wind Region 165 Mph Inside Special Wind Region

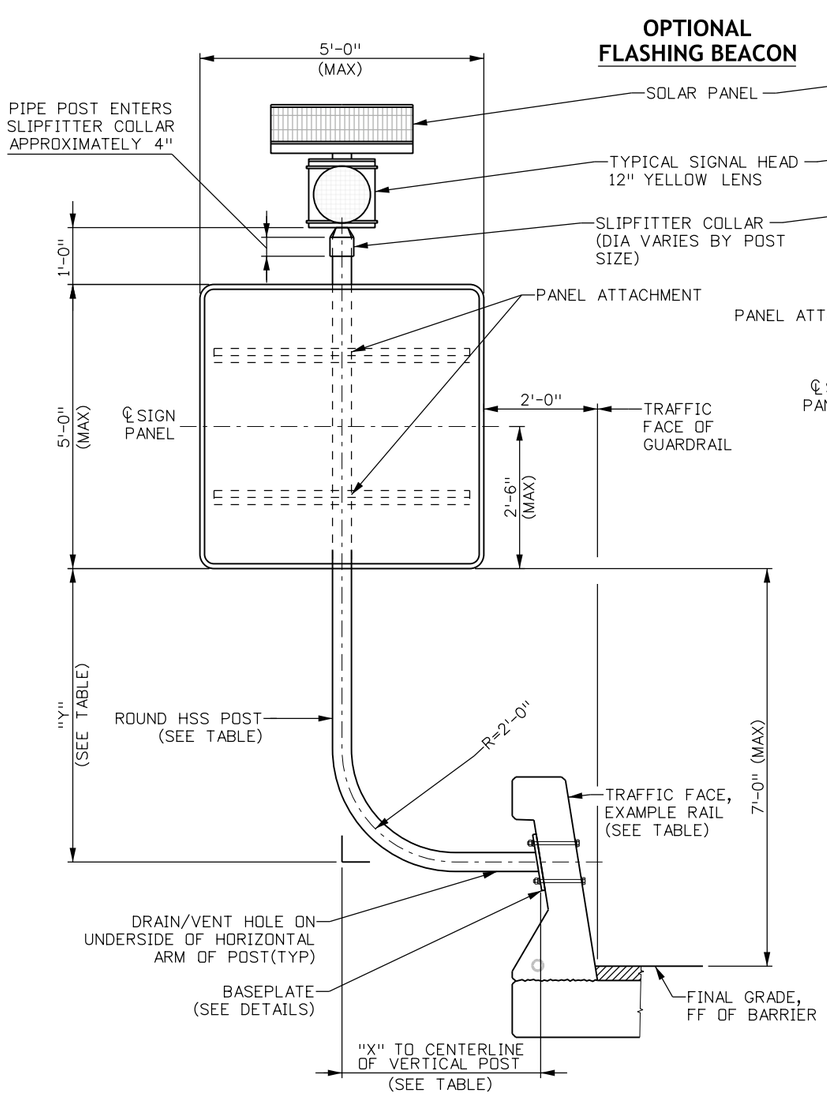
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Last Modified By: NRR			
CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

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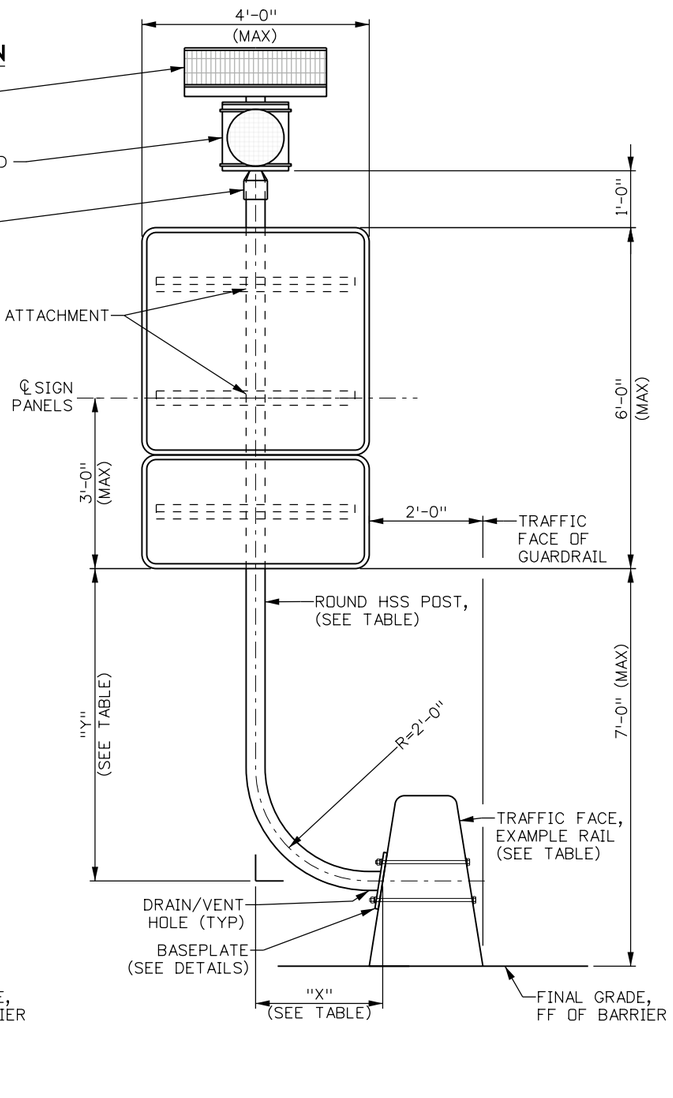
J- Post Sign Support

Issued by the Traffic Safety & Engineering Services: July 01, 2026

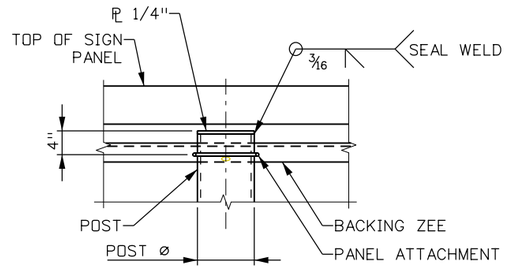
Standard Plan No.
S-614-23
Standard Sheet No. 1 of 3
Project Sheet Number:



5' Wide Sign Typical Elevation



4' Wide Sign Typical Elevation



Post Cap Detail

(Required for all installations except where flashing beacon is installed)

POST SELECTION TABLE		
WIND REGION	DESIGN WIND SPEED	POST SELECTION
SPECIAL WIND REGION	165 MPH	HSS6.000x0.312
ALL OTHER LOCATIONS	120 MPH	HSS4.500x0.337

GUARDRAIL OFFSET AND APPLICABILITY TABLE				
		HORIZONTAL POST DIMENSION "X"		VERTICAL POST
BARRIER TYPE	REQUIRED CONTINUOUS LENGTH "L"	4'-0" WIDE SIGN	5'-0" WIDE SIGN	DIMENSION "Y"
BRIDGE RAIL TYPE 7	N/A (MOUNTED ON MOMENT SLAB)	2'-6"	3'-0"	5'-8"
BRIDGE RAIL TYPE 9	N/A (MOUNTED ON MOMENT SLAB)	3'-0"	3'-6"	5'-2"
GUARDRAIL TYPE 7	L ≥ 15'-0"	2'-7"	3'-1"	5'-6"
GUARDRAIL TYPE 9	L ≥10'-0"	2'-3"	2'-9"	5'-6"

Note:

1. Length of structurally continuous guardrail shall not be less than the dimension "L" as shown in the table. If a moment slab is required, the presence of the moment slab shall be field verified by a CDOT or other designated Structural Engineer prior to installation.
2. Required length "L" shall be increased by 3'-0" for double post installation.

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2829 West Howard Place
Denver, CO 80204

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J-Post Sign Support

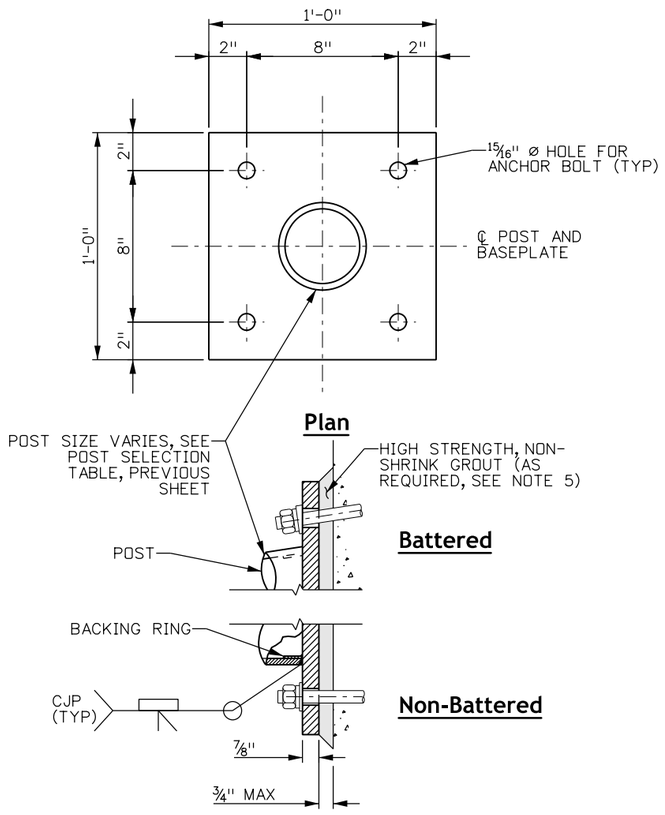
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Standard Plan No.
S-614-23
Standard Sheet No. 2 of 3
Project Sheet Number:

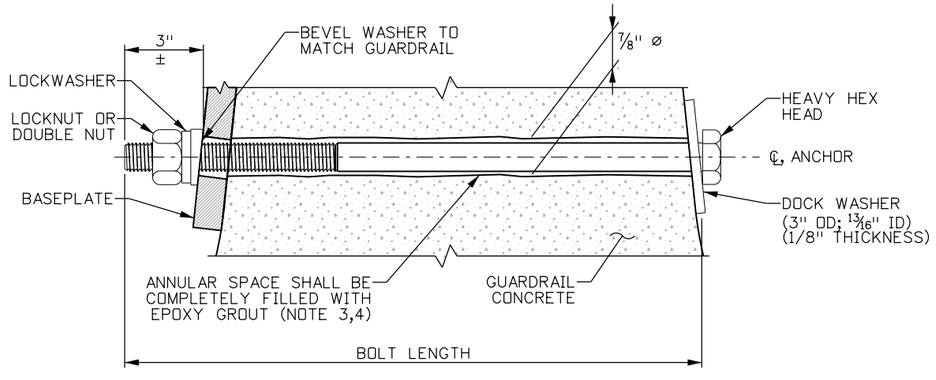
Baseplate Installation Notes:

1. Prior to drilling, locate existing reinforcement and position the baseplate to avoid. In situations where reinforcement is encountered during drilling, the baseplate must be repositioned so that new bolt holes are at least 6" offset from unused hole. Holes that are not used shall be grouted with high strength grout.
2. Bolt holes shall be core-drilled using equipment capable of penetrating the entire barrier. Drill from back side of barrier to match baseplate holes. Drill holes should be parallel to the ground/horizontal. Following drilling, holes shall be cleaned with compressed air.
3. Epoxy grout shall completely fill the annular space. Grout shall be applied from both sides of the hole prior to inserting the bolts. Twist bolt while inserting.
4. Epoxy grout for bolts shall be high-strength and non-shrink. The minimum bond strength shall be 2,200 psi when tested in accordance with ASTM C882.
5. Confirm post is plumb prior to finalizing install. If post is out of plumb by more than 2%, use grout pad to correct the position. Grout pad shall be comprised of non-shrink, high-strength cementitious grout. The grout shall have a positive expansion of 0.0% to 0.3% when tested in accordance with ASTM C1090.
6. Nuts shall be tightened to a snug-tight condition following installation.
7. In situations where through-bolting is not feasible, the Contractor may submit alternate details for anchoring the J-Post for acceptance. The alternate anchor details shall be signed and sealed by a registered Professional Engineer in the State of Colorado. The anchor design shall consider the following loads:

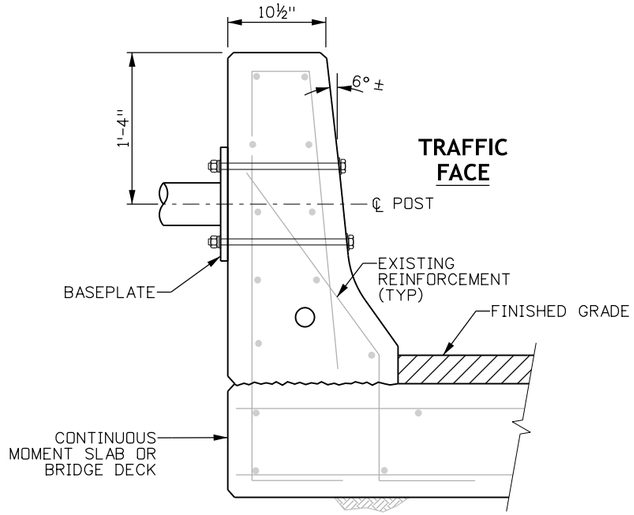
Design Wind Speed:	120 mph
Factored Tension Per Bolt:	10.6 kips
Permanent Tension Per Bolt:	1.3 kips
Design Wind Speed:	165 mph
Factored Tension Per Bolt:	18.8 kips
Permanent Tension Per Bolt:	1.5 kips



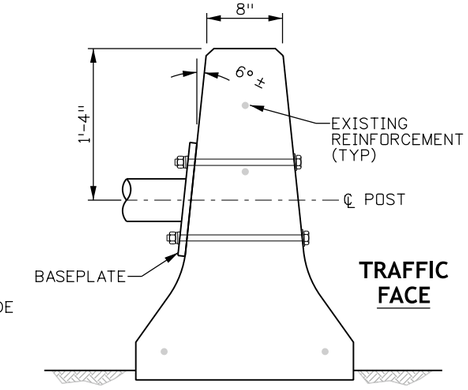
Typical Baseplate Details



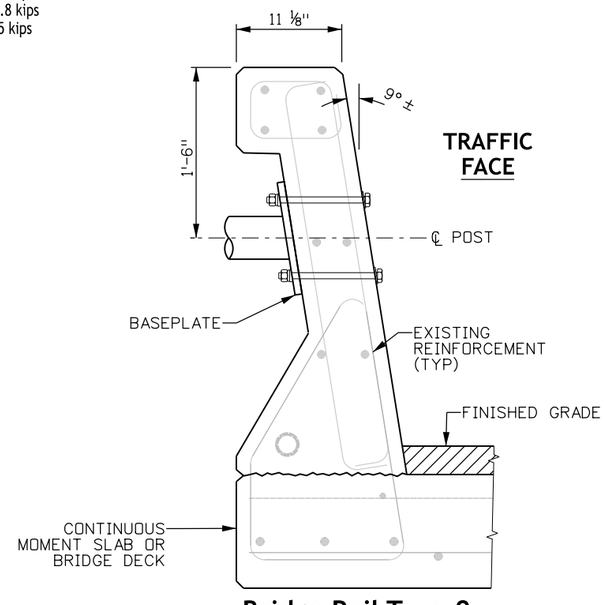
Thru Bolt Anchor Detail



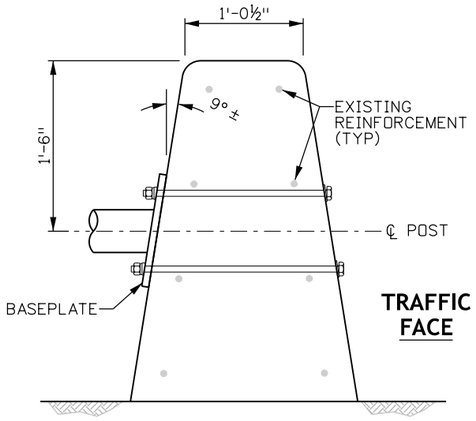
Bridge Rail Type 7



Guardrail Type 7



Bridge Rail Type 9



Guardrail Type 9

See M-606-15 (1/1)

BOLT SELECTION TABLE (FOR ALL WIND REGIONS)			
BARRIER TYPE	DIAMETER	MIN BOLT LENGTH **	
		TOP BOLT	BOTTOM BOLT
BRIDGE RAIL TYPE 7	3/4"	1'-3¾"	1'-4½"
BRIDGE RAIL TYPE 9		1'-0"	1'-0"
GUARDRAIL TYPE 7		1'-2½"	1'-4"
GUARDRAIL TYPE 9		1'-8¾"	2'-0"

** Field Verify Required Bolt Length Prior To Installation.

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2829 West Howard Place
Denver, CO 80204
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J Post Sign Support

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-23
Standard Sheet No. 3 of 3
Project Sheet Number:

General Notes

1. Refer to roadway plans for the actual configuration and location of traffic signal heads and signs marked with a ■.
2. All poles and arms shall be fabricated with ASTM A572 Grade 65 steel. Luminaire arms may be fabricated with ASTM A595 Grade A steel with a minimum yield point of 55 KSI.
3. All poles and arms shall comply with the dimensional tolerances specified in ASTM A500, A501, or A595.
4. All poles and arms shall be round or dodecagonal (12 sided) tubes with a 0.14 inch/foot taper.
5. Hardened washers shall conform to ASTM F436.
6. All poles and arms shall be galvanized inside and outside after fabrication in accordance with ASTM A123. Painting shall conform to Section 522, Duplex Coating System.
7. Pole and mast arm splices shall be mechanically forced together for a snug fit.
8. Blind bolts shall be A307 Grade A steel and are not required for multisided poles. Mechanical alternatives to blind bolts utilizing friction, keys, interlocking teeth or a combination thereof to prevent the built-up box from twisting on the pole may be used as approved by CDOT Staff Bridge.
9. All mast arms more than 40 feet in length shall be two piece construction to limit arm weights.
10. Galvanized ASTM A325 HS bolts shall be used for attaching luminaire and mast arms. A lubricated tightening torque of 178 foot-pounds for ¾ inch diameter bolts, 395 foot-pounds for 1 inch diameter bolts and 1300 foot-pounds for 1½ inch diameter bolts shall be used to tighten all HS bolts. Mast arms shall be temporarily supported to take load off of field connections while bolts are tightened in order to firmly seat the flange plate. 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.
11. Cast pole end cap to be secured in place with 3 set screws.
12. All signal heads, signs, and hardware shall be field positioned.
13. Accessories to be hot dip galvanized in accordance with ASTM A153.
14. All plates and stiffeners shall be fabricated with AASHTO M270 (ASTM A709) Grade 36 steel and shall comply with the dimensional tolerances specified in ASTM A6. All handholes shall be fabricated with ASTM A572 Grade 42 steel.
15. Leveling concrete shall be 3000 psi air entrained concrete vibrated in place below the pole base plate.
16. 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.
17. Caissons shall be constructed with air entrained Class BZ concrete in accordance with Section 503 of the Standard Specifications. Reinforcing steel shall be Grade 60.
18. Caisson concrete must have a minimum compressive strength of 2,700 psi before installing the signal structure; verify concrete strength with maturity meter.
19. U-Bolts and anchor bolts shall be fabricated with AASHTO M314-90 Grade 55 steel.
20. Anchor bolts shall be fabricated with heavy hex nuts and flat washers, and extended a minimum of ¾ inches above the nut after completing the tightening process. Thread upper 12 inches and galvanize upper 13 inches of the anchor bolts. Field welding of anchor bolts to rebar during erection will not be allowed. Anchor bolts shall be set with a steel template until the concrete has cured at least two days. 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 mast arms free to deflect, the upper and lower nuts shall then each be rotated an additional ⅓ turn (30° ± 5°) with a slugging, hydraulic or air impact wrench.
21. Welding of steel shall conform to the requirements of ANSI/AWS D1.1. All areas to be welded shall be ground to bright metal. All welding and required testing shall be complete before any material is galvanized. All circumferential and stiffener welds shall be non-destructively tested using the enhanced magnetic particle method in accordance with Subsection 509.18 (d) of the Standard Specifications. The acceptance criteria is stated in Table 8.1 of ANSI/AWS D1.1. All longitudinal welds within 6 inches of full penetration circumferential groove welds and full penetration groove welds shall be inspected as specified above. Maximum weld undercut shall be 0.01 inches.
22. All electrical connections to the signal shall be grounded in accordance with applicable Electrical Codes.
23. Certified Mill Test Reports Including Charpy V-notch Test Results, Weld Inspection Reports and Enhanced Magnetic Particle Test Reports Shall be submitted to CDOT Staff Bridge, 2829 W Howard Place, Denver Colorado, 80204 as soon as they become available. CVN Test Results for ASTM A572 Grades 42 and 65 steel shall have a minimum value of 15 feet-pounds at 40°F as per the H Frequency Test requirements in AASHTO T243 (ASTM A673).
24. Shop drawings shall be submitted to the Engineer for review in accordance with Subsection 105.02 of the Standard Specifications.
25. Standard Abbreviations: UNO = Unless Noted Otherwise
    WP = Work Point
26. Traffic signals mounted on mast arms shall be furnished with Astro type mounting brackets.
27. End section diameters must be increased to accommodate out-of-roundness, galvanizing thickness and seam weld profiles to provide the minimum required arm slip splice lengths and pole member overlaps.
28. Use 35 feet of ⅜ inch high strength chain (safe working load of 5,000 pound), two "S" shaped hooks properly forged from 1 inch square bar stock and two 4,000 pound capacity come-alongs to seat the pole end section on its base section by attaching the come-alongs to opposing access holes in the built-up box with the "S" shaped hooks and pulling against the chain which is strung underneath the pole base plate. Apply enough force to align the wire access holes and to seat the slip splice within 4 inch of the specified length.
29. Secure arm flange plate, pole base plate, and connection faceplate during welding to prevent distortion.
30. One drilled hole with a maximum diameter of ¾ inch is allowed at locations marked with a ▲ to accommodate electrical wiring.
31. See S-614-42 and S-614-43 for "Cabinet Foundation Details" and "Traffic Loop And Misc. Signal Details" respectively.
32. Signal faces shall be the same size within each signal head.
33. Traffic control devices on a Colorado State Highway that is being replaced or refurbished because it is damaged, missing, or no longer serviceable for any reason shall be replaced with a device compliant with all applicable CDOT Standards and Specifications.

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Colorado Department of Transportation

Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204

EB/SNH

Typical Traffic Signal
15' - 75' Double Mast Arms
60' - 75' Single Mast Arm

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-40
Standard Sheet No. 1 of 6
Project Sheet Number:

Design Data

1. Drawing shown has 5 signal heads, shorter arm lengths may have fewer heads. This configuration is intended to represent a worst case loading condition.

70', (75')	55', 60', (65')	45', (50')	35', (40')	25', (30')
5 Signal Heads	5 Signal Heads	4 Signal Heads	3 Signal Heads	2 Signal Heads

   The design length "L" for each series is shown in parentheses.

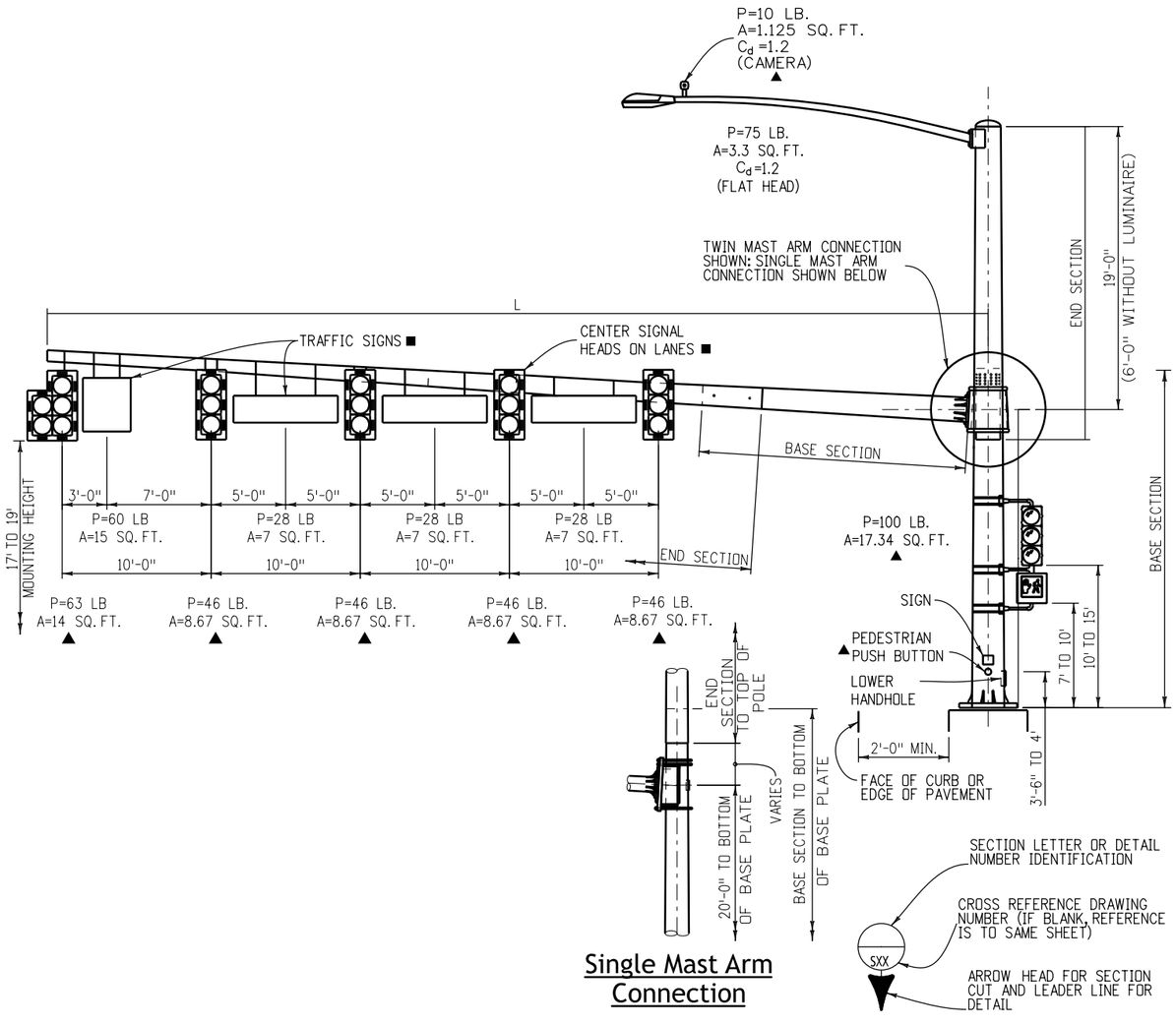
2. For the twin mast arm connection, the second arm is assumed to be within 60° to 120° of the primary arm and is assumed to be loaded with the same loads as shown above. The secondary arm may be the same length as or shorter than the primary arm.

3. The designs herein assume that signals are installed within the roadway earthwork prism with the following soil parameters:
   Soil Density γ = 110 pound/cubic feet
   Soil Cohesion = 750 pound/ square feet for medium stiff cohesive soil
   Soil ϕ Angle = 30° for medium dense cohesionless soil
   SF = 1.5 for torsional resistance and 3.0 for flexural resistance

4. Contact the Engineer if any of the following soil conditions are encountered during drilling:
   (A) Signals will not be installed within the roadway earthwork 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 homogenous.
   (E) Firm bedrock is encountered.

5. Traffic signal structures have been designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Fourth Edition, 2001.

6. A design wind velocity of 100 mph and one 12 foot lane with a 65 mph truck induced gust loading have been used for the designs herein.



Single Mast Arm Connection

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EB/SNH

Typical Traffic Signal
15' - 75' Double Mast Arms
60' - 75' Single Mast Arm

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-40
Standard Sheet No. 2 of 6
Project Sheet Number:

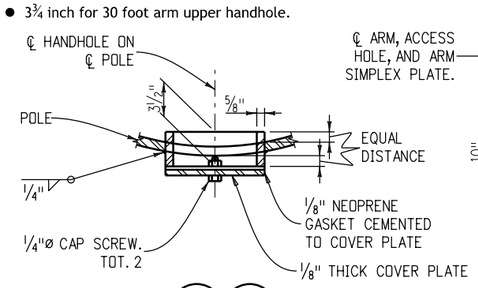
MAST ARM LENGTH (L) (FT.)	MAST ARM DATA								MAST ARM CONNECTION DATA																
	BASE SECTION ★				END SECTION ◆				STIFFENER								FLANGE			BOLT					
	LENGTH (FT.)	TIP Ø (IN.)	TRUNK Ø (IN.)	THK. (IN.)	LENGTH (FT.)	TIP Ø (IN.)	TRUNK Ø (IN.)	THK. (IN.)	NO. OF	THK. (IN.)	WIDTH (IN.)	HEIGHT (IN.)	RADIUS (IN.)	ANGLE	WALL WELD (IN.)	PLATE WELD (IN.)	DIA. (IN.)	THK. (IN.)	SOCKET WELD (IN.)	NO. OF	DIA. (IN.)	CIRCLE DIA. (IN.)	HOLE DIA. (IN.)	ANGLE
30	29.25	6.50	10.59	0.1793	N.A.	N.A.	N.A.	N.A.	6	0.50	3.5	7	6.89	30.0°	0.179	0.375	20	1.00	0.179	6	1.0	16	1.125	60.0°
40	39.11	6.50	11.98	0.2391	N.A.	N.A.	N.A.	N.A.	8	0.50	4.0	8	8.12	22.5°	0.239	0.375	23	1.25	0.239	8	1.5	17	1.625	45.0°
50	25.15	9.47	12.99	0.3125	25	6.50	10.00	0.1793	8	0.75	4.0	8	8.12	22.5°	0.250	0.625	24	1.50	0.250	8	1.5	18	1.625	45.0°
65	25.35	12.52	16.07	0.3125	40	7.50	13.10	0.1793	8	0.75	5.0	10	10.60	22.5°	0.250	0.625	29	1.75	0.250	8	1.5	23	1.625	45.0°
75	35.23	12.52	17.45	0.3125	40	7.50	13.10	0.1793	10	0.75	5.5	11	11.84	18.0°	0.250	0.625	31	1.75	0.250	10	1.5	25	1.625	36.0°

★ Base section length includes the splice length as per the "Mast Arm Slip Splice Detail" below.

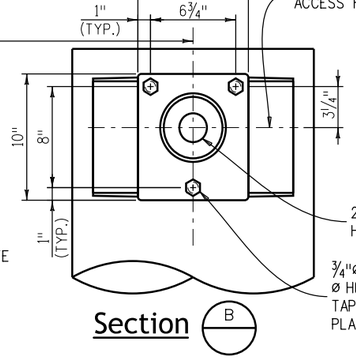
◆ See General Note 27 on Sheet 1 of 6.

■ Stop all welds ½ inch short of plate edges and bolt holes.

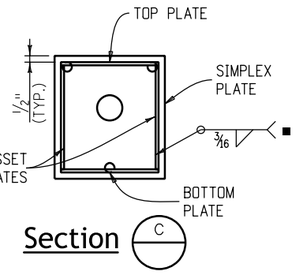
● 3¾ inch for 30 foot arm upper handhole.



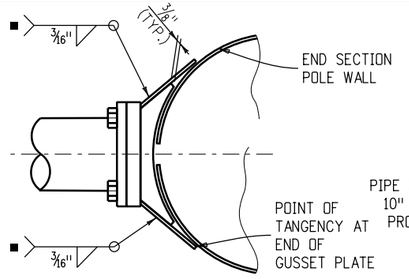
Section E/S4 E/S5



Section B

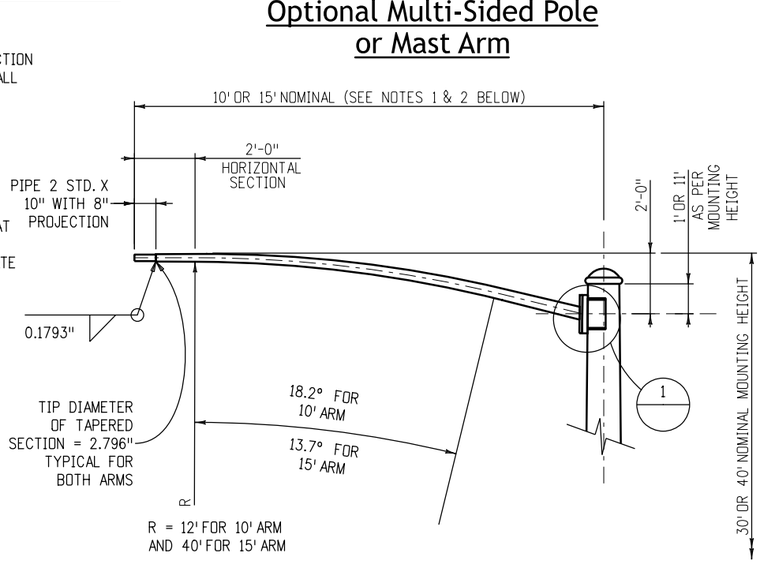


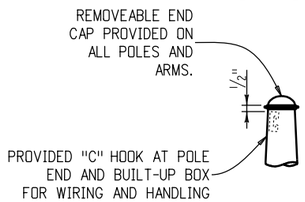
Section C



(TYPICAL TOP AND BOTTOM PLATES)

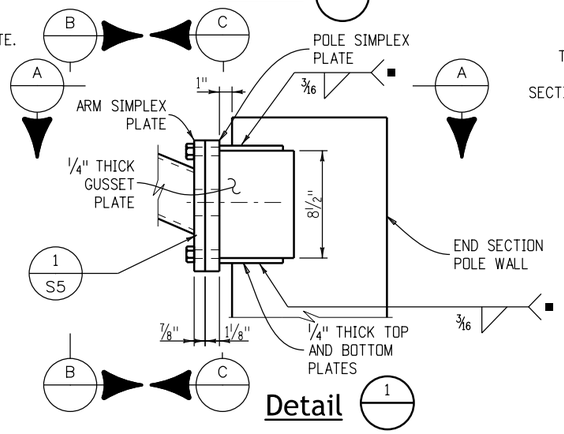
Section A



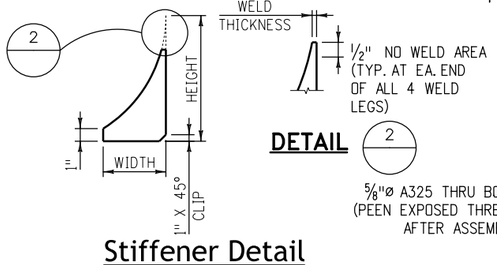


End Cap Detail

Section F/S4 Detail 3/S5

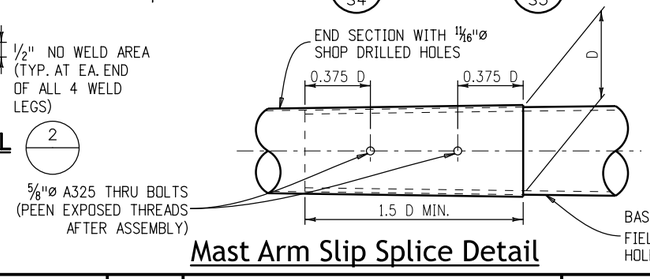


Detail 1

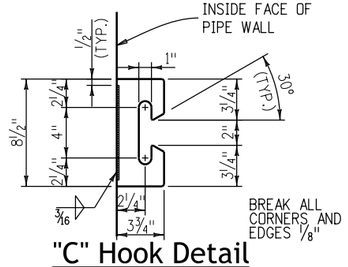


DETAIL 2

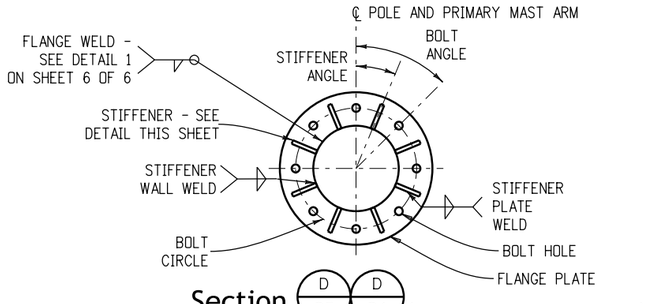
Stiffener Detail



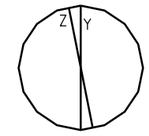
Mast Arm Slip Splice Detail



"C" Hook Detail



Section D/S3 D/S4 (BOLTS NOT SHOWN FOR CLARITY)



Y = DIAMETER OF A ROUND TUBE.
Z = PERPENDICULAR DISTANCE BETWEEN FLATS.
Y AND Z ARE OUTSIDE DIAMETER DIMENSIONS.
Z/Y RATIO MUST BE .98 MINIMUM.

Optional Multi-Sided Pole or Mast Arm

Luminaire Arm Notes

1. 10 foot luminaire arm shaft: wall thickness = 0.1793 inches; linear taper = 0.14 inch/foot.; diameter at arm simplex plate = 4.066 inches

   15 foot luminaire arm shaft: wall thickness = 0.1793 inches; linear
2. taper = 0.14 inch/foot.; diameter at arm simplex plate = 4.679 inches.

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Colorado Department of Transportation

Traffic Safety & Engineering Services

2829 West Howard Place
Denver, CO 80204

EB/SNH

Typical Traffic Signal 15' - 75' Double Mast Arms 60' - 75' Single Mast Arm

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.

S-614-40

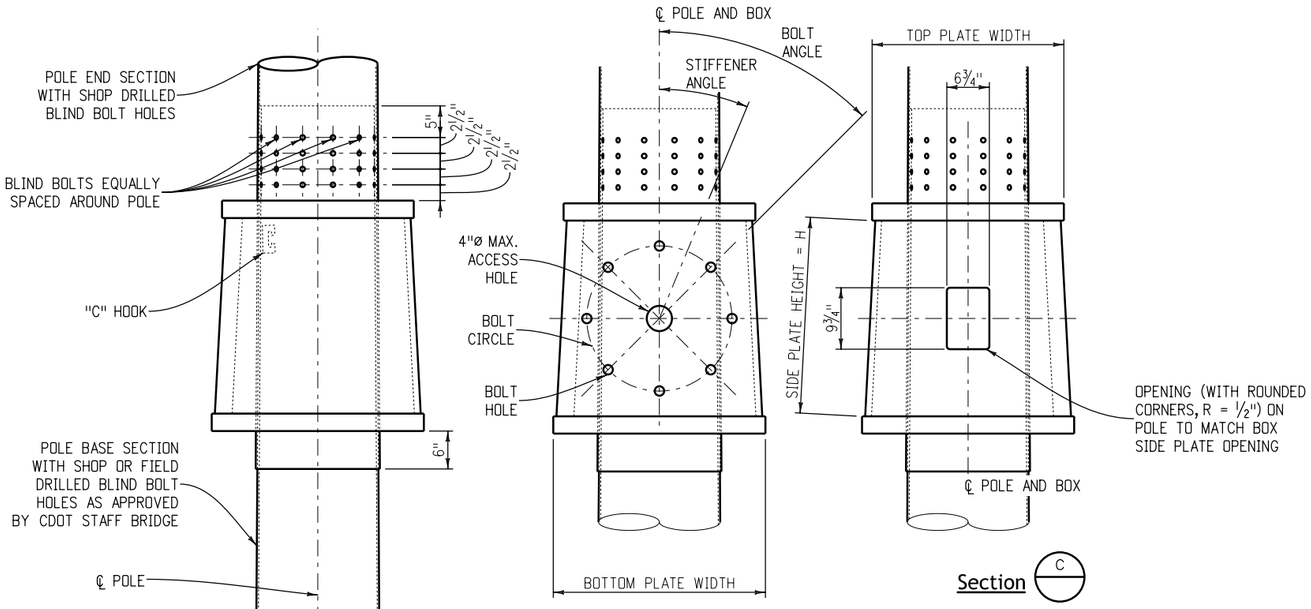
Standard Sheet No. 3 of 6

Project Sheet Number:

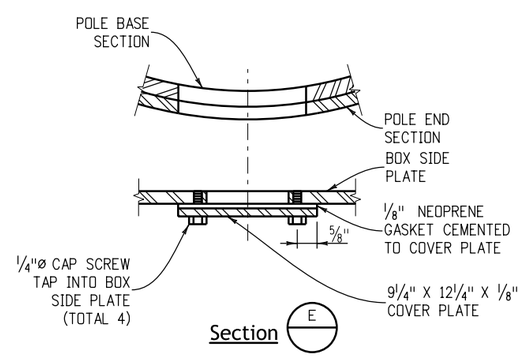
MAST ARM LENGTH (FT.)	BLIND BOLT DATA				BUILT-UP BOX DATA ✶					POLE DATA							
										BASE SECTION				END SECTION WITH LUMINAIRE ◆			
	NO. OF	DIA. (IN.)	BOLTS PER ROW	NO. OF ROWS	THICKNESS OF BOX PLATES UNO (IN.)	POLE WELD (IN.)	SIDE PLATE H (IN.)	TOP PLATE WIDTH FOR θ = 45° (IN.)	BOTTOM PLATE WIDTH FOR θ = 45° (IN.)	LENGTH (FT.)	TOP Ø (IN.)	BOTTOM Ø (IN.)	THK. (IN.)	LENGTH (FT.)	TOP Ø (IN.)	BOTTOM Ø (IN.)	THK. (IN.)
30	24	0.75	6	4	1.50	0.1875	22	23.75	26.053	22.29	9.11	12.23	0.3125	20.54	7.25	10.13	0.2391
40	30	0.75	6	5	2.00	0.1875	25	26.75	29.367	22.67	11.81	14.98	0.3125	20.71	10.00	12.90	0.2391
50	36	0.75	12	3	2.50	0.1875	26	27.75	30.471	22.33	14.86	17.98	0.3125	20.79	13.00	15.91	0.2391
65	48	0.75	12	4	2.75	0.1875	31	32.75	35.995	22.77	18.54	21.73	0.3125	21.02	16.75	19.69	0.2391
75	60	0.75	12	5	3.00	0.1875	33	34.75	38.204	23.08	20.75	23.98	0.3125	21.12	19.00	21.96	0.2391

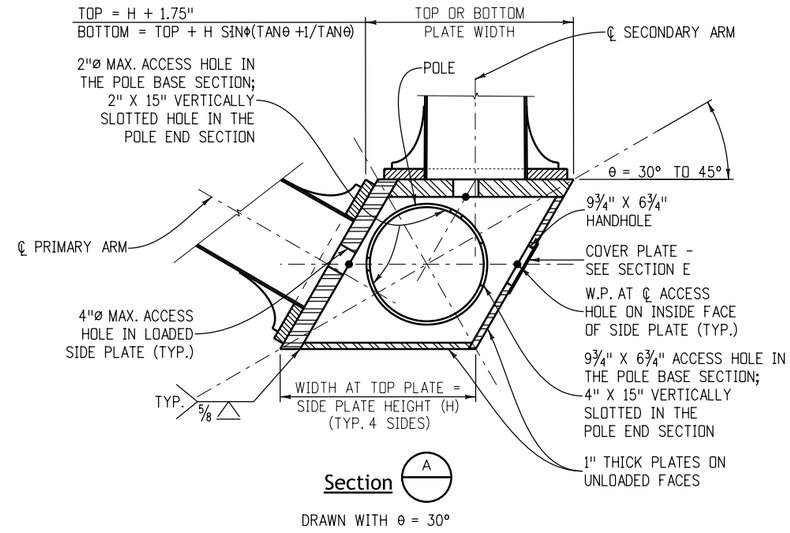
✶ Use larger arm in a double arm signal to determine plate thickness and dimensions.

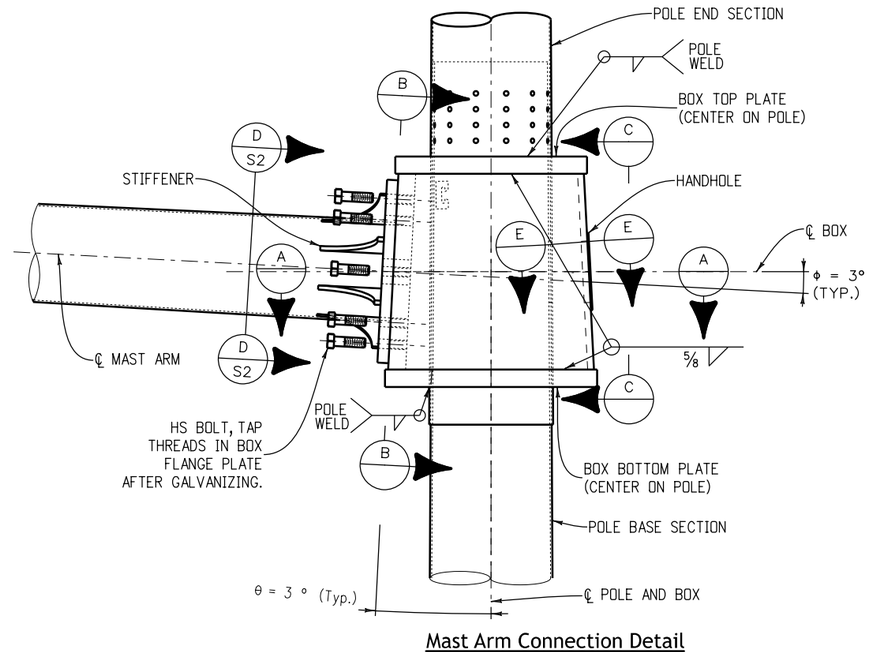
◆ See general note 27 on sheet 1 of 6.



Pole End Section
Slip Connection Detail
(See General Note 8 on sheet 1 of 6 regarding the need for blind bolts)







Mast Arm Connection Detail

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Colorado Department of Transportation

Traffic Safety & Engineering Services
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EB/SNH

Typical Traffic Signal
15' - 75' Double Mast Arms
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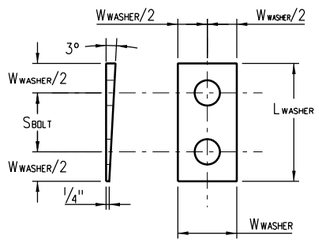
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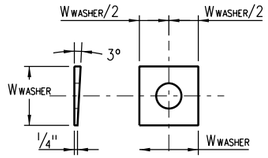
Standard Plan No.
S-614-40
Standard Sheet No. 4 of 6
Project Sheet Number:

MAST ARM LENGTH (FT.)	FACEPLATE DATA								STOP BAR DATA	SIDE PLATE DATA		WASHER DATA			U-BOLT DATA ●			
	FACEPLATE HEIGHTS			THICKNESS OF FACEPLATE	WIDTH OF FACEPLATE		RADIUS	EDGE DISTANCE										
	TOP (H_{TOP}) (IN.)	BOTTOM (H_{BOTTOM}) (IN.)	TOTAL (H_{FACE})(IN.)	(T_{FACE}) (IN.)	ENDS (W_E) (IN.)	CENTER (W_C) (IN.)	(IN.)	(S_{EDGE}) (IN.)	BAR LENGTH (L_{BAR}) (IN.)	THICKNESS OF SIDE PLATE (T_{SP}) (IN.)	EAR HEIGHT (H_{EAR}) (IN.)	LENGTH OF WASHER (L_{WASHER}) (IN.)	WIDTH OF WASHER (W_{WASHER}) (IN.)	BOLT SPACING (S_{BOLT}) (IN.)	DIAMETER OF U-BOLT ($D_{U\text{-}BOLT}$) (IN.)	BEND RADIUS U-BOLT (A) (IN.)	BEND RADIUS U-BOLT (B) (IN.)	DIAMETER OF OVERSIZED HOLE (IN.)
65	24.91	20.91	45.81	2.375	25.67	29.00	158.58	2.563	28.000	1.125	1.500	8.500	3.50	5.000	1.375	10.05	10.26	1.688
75	26.59	22.59	49.19	2.500	28.07	31.00	207.07	2.563	31.000	1.125	1.625	8.500	3.50	5.000	1.500	11.23	11.46	1.813

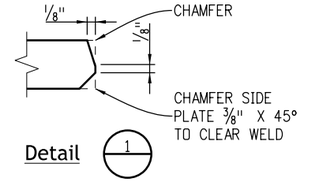
MAST ARM LENGTH (FT.)	POLE DATA								SADDLE DATA
	BASE SECTION ✶				END SECTION WITH LUMINAIRE ◆				THICKNESS OF SADDLE PLATES (T_{SA}) (IN.)
	LENGTH (FT.)	TOP ⌀ (IN.)	BOTTOM ⌀ (IN.)	THK. (IN.)	LENGTH (FT.)	TOP ⌀ (IN.)	BOTTOM ⌀ (IN.)	THK (IN.)	
65	26.30	18.05	21.73	0.3125	14.99	16.75	18.85	0.2391	1.500
75	26.74	20.24	23.98	0.3125	14.83	19.00	21.07	0.2391	1.625

- ● Bend radius measured to the ℄ of each U-Bolt. Increase radii as needed to accommodate out-of-roundness, galvanizing thickness and seam weld profiles. U-Bolts shall be tightened 1/12 turn (30° ± 5°) past snug tight; peen threads after tightening. U-Bolts and faceplate shall be mounted on base section prior to shipment.
- ✚ Match fit stop bar to side plate using tack welds to ensure uniform bearing.
- ✶ Base section lengths include the splice length as per the "Mast Arm Slip Splice Detail" on sheet 3 of 6.
- ◆ See general note 27 on sheet 1 of 6.
- ■ End all welds 1/2 inch short of bolt hole and plate edges.
- ▼ Bend stop bar to match pole curvature.

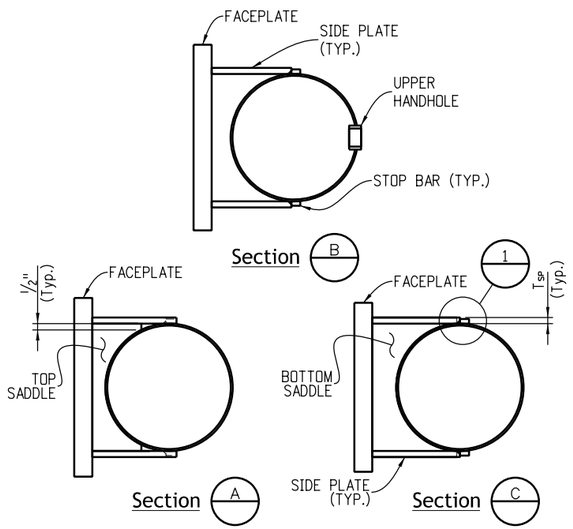


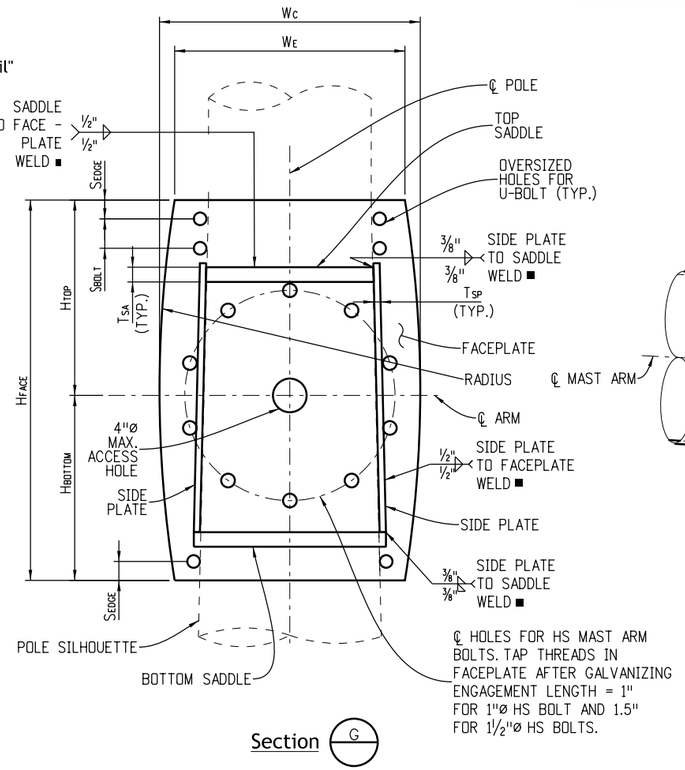


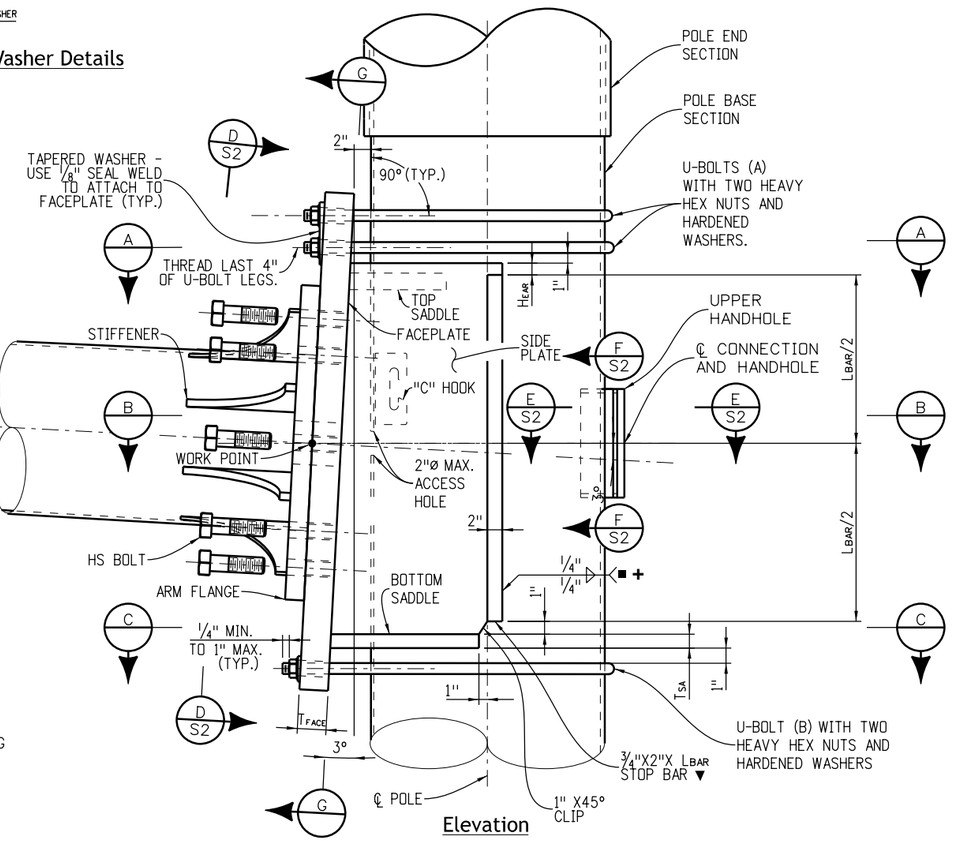
Tapered Washer Details



Detail 1







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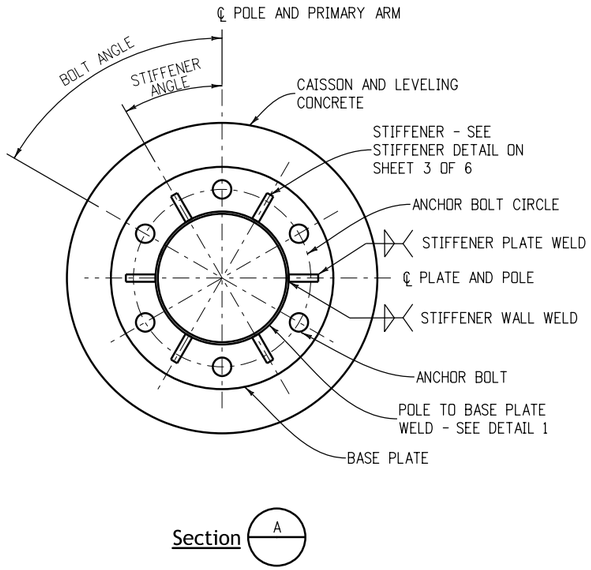
Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
EB/SNH

Typical Traffic Signal
15' - 75' Double Mast Arms
60' - 75' Single Mast Arm

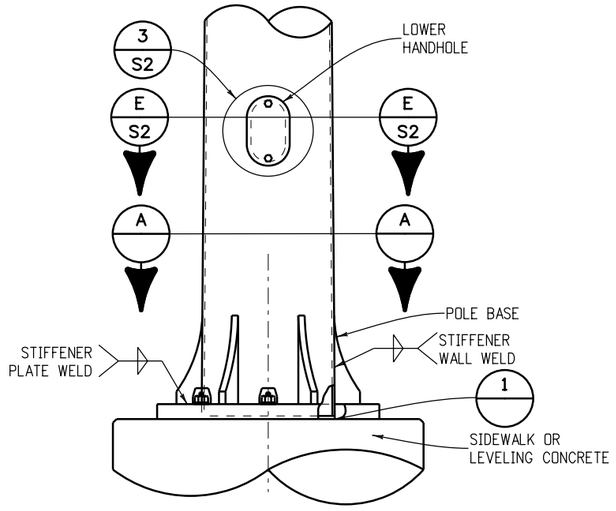
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Standard Plan No.
S-614-40
Standard Sheet No. 5 of 6
Project Sheet Number:

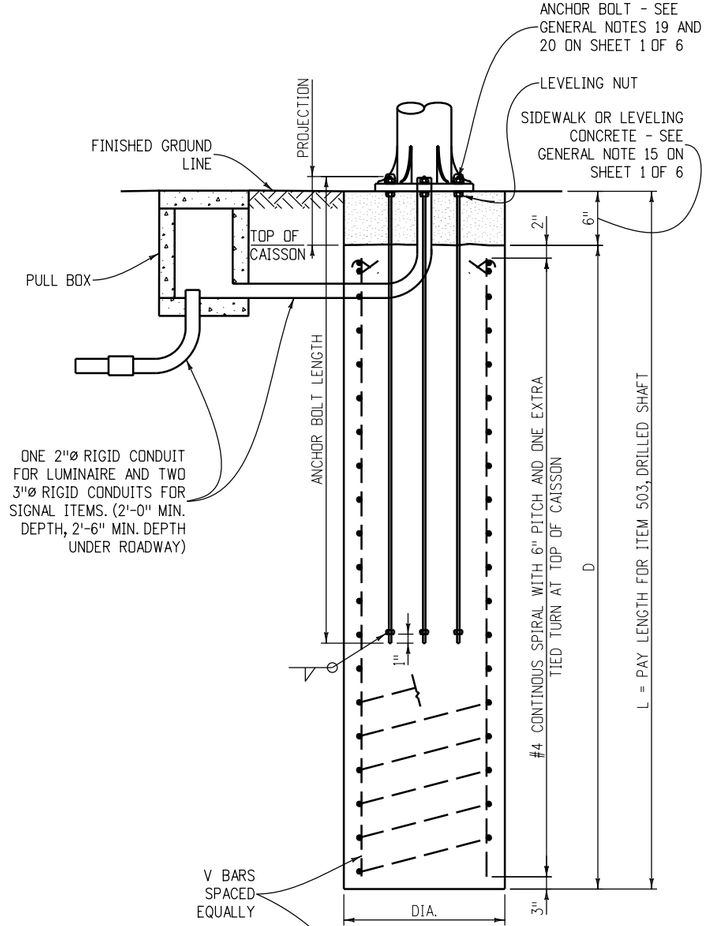
MAST ARM LENGTH (FT.)	POLE BASE CONNECTION DATA																	CAISSON DATA (FOR SINGLE AND DOUBLE ARM INSTALLATIONS)				
	STIFFENER								BASE PLATE		ANCHOR BOLT										V BARS	
	NO. OF	THK. (IN.)	WIDTH (IN.)	HEIGHT (IN.)	RADIUS (IN.)	ANGLE	WALL WELD (IN.)	PLATE WELD (IN.)	DIA. (IN.)	THK. (IN.)	NO. OF	DIA. (IN.)	LENGTH (IN.)	CIRCLE DIA. (IN.)	HOLE DIA. (IN.)	ANGLE	PROJECTION (IN.)	DIA. (IN.)	DEPTH (D) (FT.)	PAY LENGTH (L) (FT.)	SIZE	TOTAL
30	6	0.75	5.0	10	10.600	30.0°	0.25	0.625	24	2.25	6	2.0	63	17.75	2.25	60.0°	11.25	36	12.5	13	#9	11
40	6	0.75	5.5	11	11.841	30.0°	0.25	0.625	27	2.50	6	2.0	63	21.00	2.25	60.0°	11.50	36	14.5	15	#9	11
50	6	0.75	6.5	13	14.327	30.0°	0.25	0.625	32	2.75	6	2.0	63	25.00	2.25	60.0°	11.75	42	16.5	17	#9	14
65	6	0.75	8.0	16	18.063	30.0°	0.25	0.625	39	3.00	6	2.5	63	30.25	2.75	60.0°	12.50	48	20.5	21	#9	18
75	6	0.75	8.5	17	19.309	30.0°	0.25	0.625	42	3.25	6	2.5	63	33.00	2.75	60.0°	12.75	54	20.5	21	#9	23



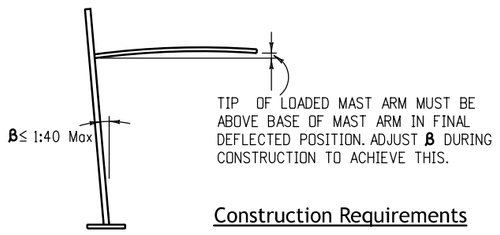
Section A



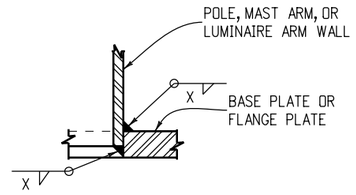
Base Plate Detail



Traffic Signal Pole Caisson

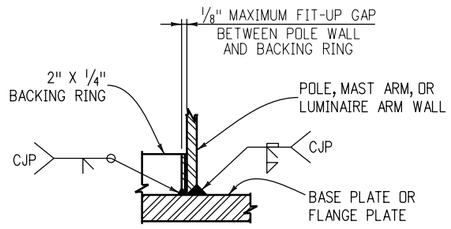


Construction Requirements



Socket Weld

X = 3/16 inch for luminaire arms and 1/4 inch for poles. See table on sheet 3 of 6 for mast arms.



Backing Ring Weld

Detail 1 1 S2

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EB/SNH

Typical Traffic Signal 15' - 75' Double Mast Arms 60' - 75' Single Mast Arm

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Standard Plan No.

S-614-40

Standard Sheet No. 6 of 6

Project Sheet Number:

General Notes

1. Refer to the roadway 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 arms shall be fabricated with ASTM A572 Grade 65 steel or ASTM A595 Grade a steel with a minimum yield point of 55 KSI.
4. All poles and arms shall comply with the dimensional tolerances specified in ASTM A500, A501, or A595.
5. All poles and arms shall be round or dodecagonal (12 sides) tubes with a 0.14 inch/foot taper.
6. Hardened washers shall conform to ASTM F436.
7. All poles and arms shall be galvanized inside and outside after fabrication in accordance with ASTM A123. Painting shall conform to Section 522, Duplex Coating System.
8. Pole and mast arm splices shall be mechanically forced together for a snug fit.
9. All mast arms more than 35 feet in length shall be two piece construction to limit arm weights.
10. Galvanized ASTM A325 HS bolts shall be used for attaching mast arms. A lubricated tightening torque of 178 foot-pounds for ¾ inch diameter bolts, and 1300 foot-pounds for 1½ inch diameter bolts shall be used to tighten all HS bolts. Mast arms shall be temporarily supported to take load off of field connections while bolts are tightened in order to firmly seat the flange plate. Bolts shall be sequentially tightened.
11. Cast pole end cap to be secured in place with 3 set screws.
12. All signal heads, signs, and hardware shall be field positioned.
13. Accessories to be hot dip galvanized in accordance with ASTM A153.
14. All plates shall be fabricated with AASHTO M270 (ASTM A709) Grade 36 steel and shall comply with the dimensional tolerances specified in ASTM A6. All handholes shall be fabricated with ASTM A572 Grade 42 steel.
15. Leveling concrete shall be 3000 psi air entrained concrete vibrated in place below the pole base plate.
16. 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.
17. Caissons shall be constructed with air entrained Class BZ concrete in accordance with Section 503 of the Standard Specifications. Reinforcing steel shall be Grade 60.
18. Caisson concrete must have a minimum compressive strength of 2,700 psi before installing the signal structure; verify concrete strength with maturity meter.
19. U-Bolts and anchor bolts shall be fabricated with AASHTO M314-90 Grade 55 steel.
20. Anchor bolts shall be fabricated with heavy hex nuts and flat washers, and extended a minimum of ¾ inches above the nut after completing the tightening process. Thread upper 12 inches and galvanize upper 13 inches of the anchor bolts. Field welding of anchor bolts to rebar during erection will not be allowed. anchor bolts shall be set with a steel template until the concrete has cured at least two days. They shall be tightened using the turn-of-nut method by first tightening them 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 mast arms free to deflect, the upper and lower nuts shall then each be rotated an additional 1/12 turn (30° ± 5°) with a slugging, hydraulic or air impact wrench.
21. Welding of steel shall conform to the requirements of ANSI/AWS D1.1. All areas to be welded shall be ground to bright metal. All welding and required testing shall be complete before any material is galvanized. All circumferential welds shall be non-destructively tested using the enhanced magnetic particle method in accordance with Subsection 509.18 (d) of the Standard Specifications. The acceptance criteria is stated in Table 8.1 of ANSI/AWS D1.1. All longitudinal welds within 6 inches of full penetration circumferential groove welds and full penetration groove welds shall be inspected as specified above. Maximum weld undercut shall be 0.01 inches.
22. All electrical connections to the signals shall be grounded in accordance with applicable Electrical Codes.
23. 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 Place, 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 feet-pounds at 40°F as per the H Frequency Test Requirements in AASHTO T243 (ASTM A673).
24. Shop drawings shall be submitted to the Engineer for review in accordance with Subsection 105.02 of the Standard Specifications.
25. Traffic signals mounted on mast arms shall be furnished with Astro type mounting brackets.
26. End section diameters must be increased to accommodate out-of-roundness, galvanizing thickness and seam weld profiles to provide the minimum required arm slip splice lengths and pole member overlaps.
27. Secure arm flange plate, pole base plate, and connection face plate during welding to prevent distortion.
28. If the vertical deflections during a 10 to 20 mph wind exceed the galloping deflection limits listed in the table on sheet 3 of 4, the Owner shall install an aluminum sign blank (16 inch x 66 inch or larger) near the free end of the traffic signal mast arm. Said sign blank shall be rotated about the longitudinal axis of the arm while the wind blows to minimize the galloping deflections. Contact Staff Bridge for more information.
29. One drilled hole with a maximum diameter of ¾ inches is allowed at locations marked with a ▲to accommodate electrical wiring.
30. See S-614-42 and S-614-43 For "Cabinet Foundation Details" and "Traffic Loop and Misc. Signal Details" respectively.
31. Signal faces shall be the same size within each signal head.
32. A traffic control device that is being replaced or refurbished because it is damaged, missing, or no longer serviceable for any reason shall be replaced with a device compliant with all applicable CDOT Standards and Specifications

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EB/SNH

Alternate Traffic Signal 15' - 55' Single Mast Arm

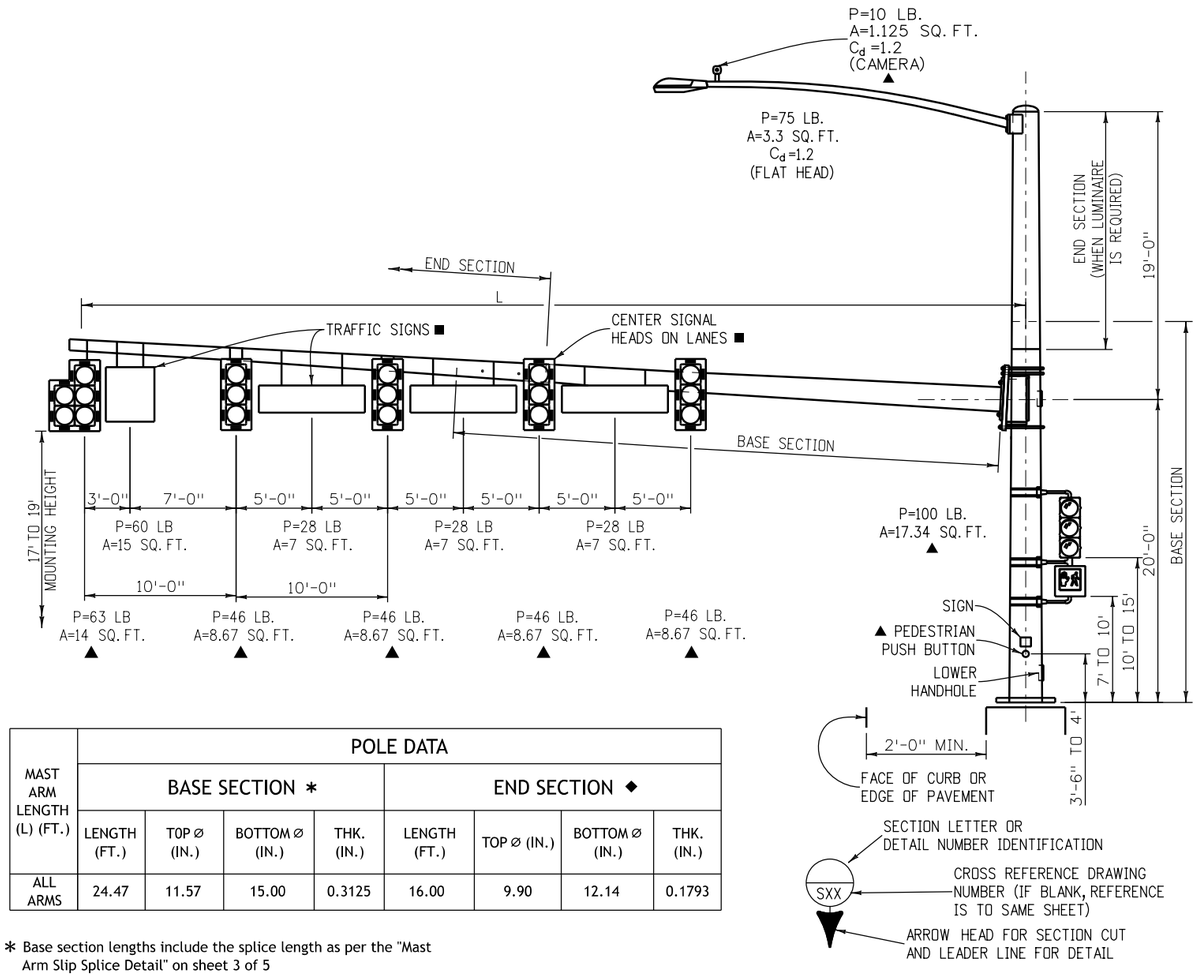
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Standard Plan No.

S-614-40A

Standard Sheet No. 1 of 5

Project Sheet Number:



MAST ARM LENGTH (L) (FT.)	POLE DATA							
	BASE SECTION *				END SECTION ◆			
	LENGTH (FT.)	TOP ⌀ (IN.)	BOTTOM ⌀ (IN.)	THK. (IN.)	LENGTH (FT.)	TOP ⌀ (IN.)	BOTTOM ⌀ (IN.)	THK. (IN.)
ALL ARMS	24.47	11.57	15.00	0.3125	16.00	9.90	12.14	0.1793

* Base section lengths include the splice length as per the "Mast Arm Slip Splice Detail" on sheet 3 of 5

◆ See general note 26

Design Data

1. Drawing shown has 5 signal heads, shorter arm lengths may have fewer heads. this configuration is intended to represent a worst case loading situation.

(55'), 50'	(45'), 40'	(35'), 30'	(25')
5 Signal Heads	4 Signal Heads	3 Signal Heads	2 Signal Heads

   The design length "L" for each series is shown in parentheses.

2. The designs herein assume that signals are installed within the roadway earthwork prism with the following soil parameters:
   Soil Density γ = 110 pound/cubic feet
   Soil Cohesion = 750 pound/square feet for medium stiff cohesive soil
   Soil ϕ Angle = 30° for medium dense cohesionless soil
   SF = 1.25 for torsional resistance and 3.0 for flexural resistance

3. Contact the Engineer if any of the following soil conditions are encountered during drilling:
   (A) Signals will not be installed within the roadway earthwork 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 homogenous.
   (E) Firm bedrock is encountered

4. Traffic signal structures have been designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs Luminaires, and Traffic Signals, Fourth Edition, 2001.

5. A design wind velocity of 100 mph and one 12 foot lane with a 65 mph truck induced gust loading have been used for the designs herein.

6. Galloping loads are excluded from fatigue design and category two importance factors have been used.

7. The socket weld option is limited to 150% of the allowable fatigue stress for an E' weld in order to recognize the beneficial effects derived from load sharing between the two welds.

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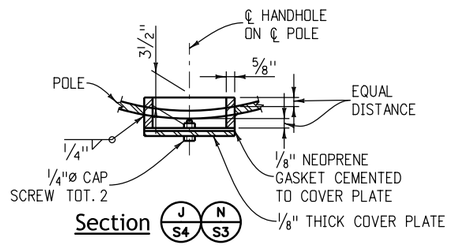
Alternate Traffic Signal 15' - 55' Single Mast Arm

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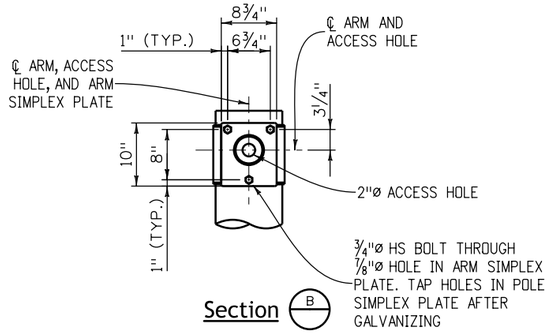
Standard Plan No.
S-614-40A
Standard Sheet No. 2 of 5
Project Sheet Number:

MAST ARM LENGTH (L) (FT.)	MAST ARM DATA								GALLOPING DEFLECTION LIMITS (△) (IN) ●
	BASE SECTION ✶				END SECTION ◆				
	LENGTH (FT.)	TIP ⌀ (IN.)	TRUNK ⌀ (IN.)	THK (IN.)	LENGTH (FT.)	TIP ⌀ (IN.)	TRUNK ⌀ (IN.)	THK. (IN.)	
25	23.92	6.65	10.00	0.2391	N.A.	N.A.	N.A.	N.A.	✦
35	33.92	7.50	12.25	0.2391	N.A.	N.A.	N.A.	N.A.	✦
45	25.16	9.73	13.25	0.3125	20.00	7.46	10.26	0.1793	6"
55	25.34	11.20	14.75	0.3125	30.00	7.56	11.76	0.1793	11"

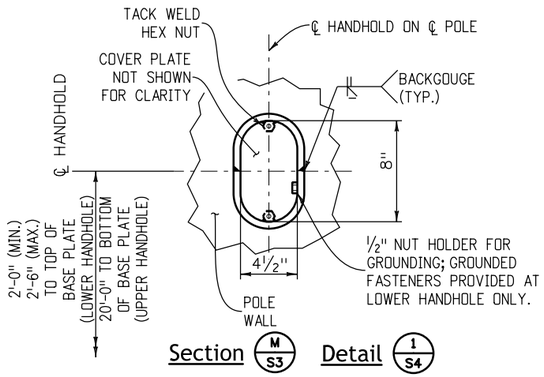
✶ Base section length includes the splice length as per the "Mast Arm Slip Splice Detail" below.
◆ See General Note 26 on sheet 1 of 5.
● See General Note 28 on sheet 1 of 5.
✦ Deflection too small to measure.
■ Stop all welds ½ inch short of plate edges and bolt holes.



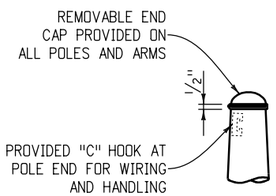
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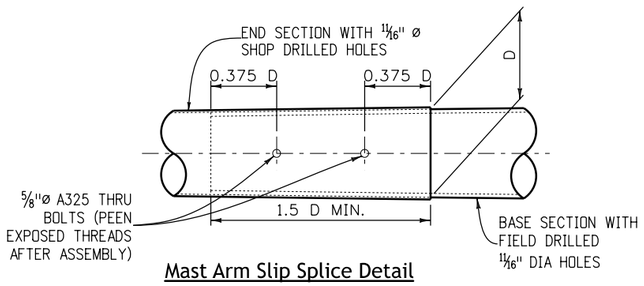
Section (B)



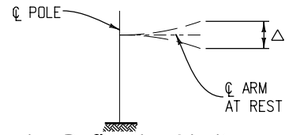
Section (M S3) Detail (1 S4)



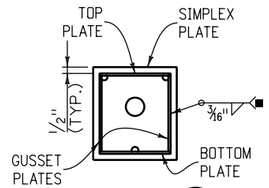
End Cap Detail



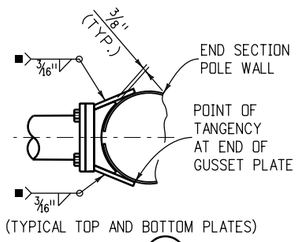
Mast Arm Slip Splice Detail



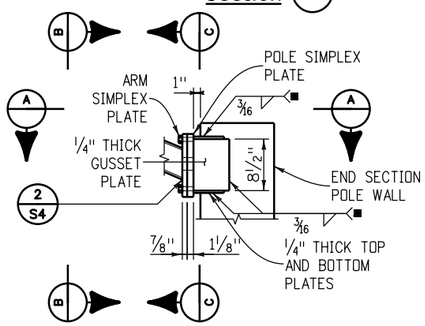
Galloping Deflection Limits



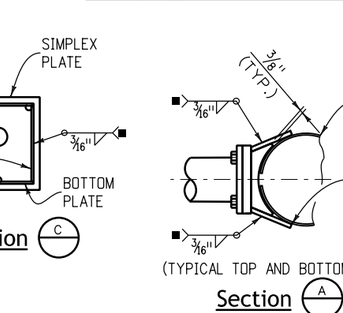
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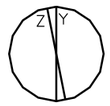
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Detail (3)

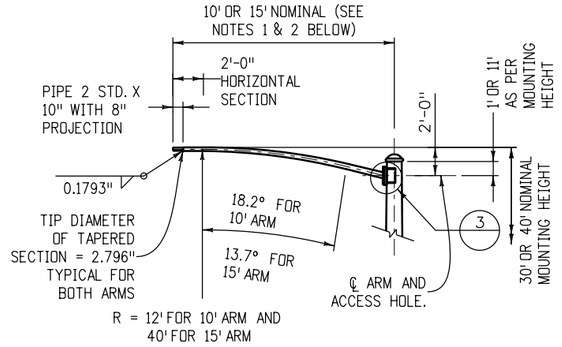


"C" Hook Detail



Y = DIAMETER OF A ROUND TUBE.
Z = PERPENDICULAR DISTANCE BETWEEN FLATS.
Y AND Z ARE OUTSIDE DIAMETER DIMENSIONS.
Z/Y RATIO MUST BE .98 MINIMUM.

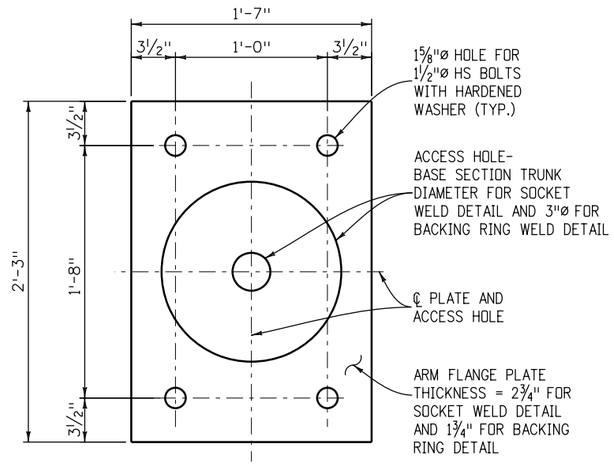
Optional Multi-Sided Pole or Mast Arm



Luminaire Arm Notes

1. 10 foot luminaire arm shaft: wall thickness = 0.1793 inches; linear taper = 0.14 inch/foot.; diameter at arm simplex plate = 4.066 inches.

2. 15 foot luminaire arm shaft: wall thickness = 0.1793 inches; linear taper = 0.14 inch/foot.; diameter at arm simplex plate = 4.679 inches.



Section (D S3)

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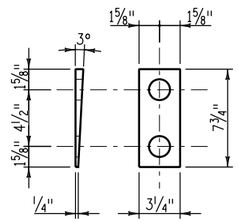
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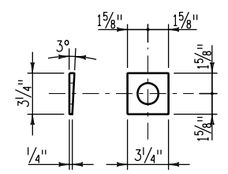
Alternate Traffic Signal 15' - 55' Single Mast Arm

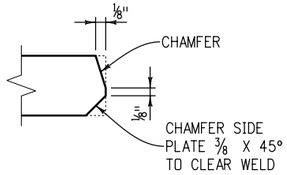
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-40A
Standard Sheet No. 3 of 5
Project Sheet Number:

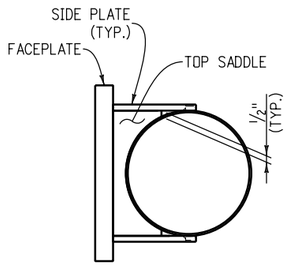
- Bend radius measured to the ℄ of each U-Bolt. Increase radii as needed to accomodate out-of-roundness, galvanizing thickness and seam weld profiles. U-Bolts shall be tightened 1/12 turn (30° ± 5°) past snug tight; peen threads after tightening. U-Bolts and faceplate shall be mounted on base section prior to shipment.
- ✚ Match fit stop bar to side plate using tack welds to ensure uniform rearing.
- ■ Stop all welds ½ inch short of plate edges and bolt holes.
- ✶ Bend stop bar to match pole curvature.



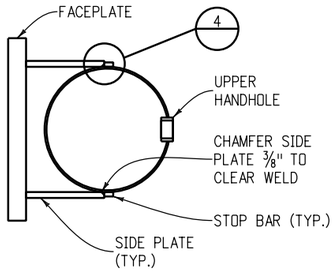




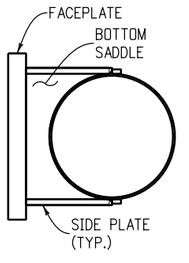
Detail 4



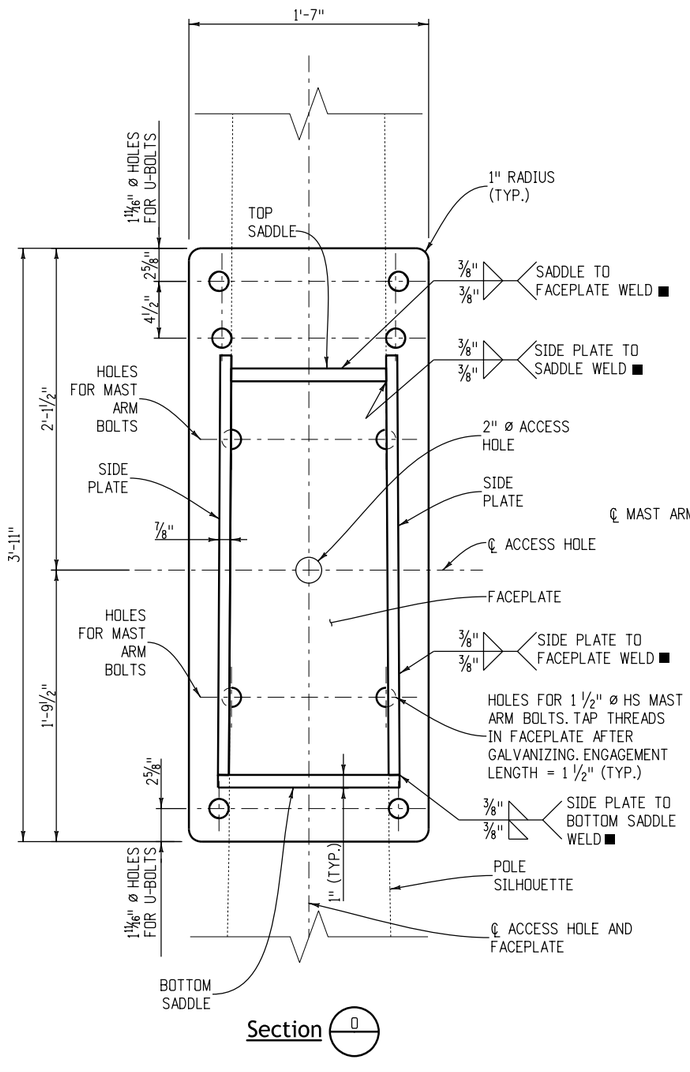
Section P



Section Q

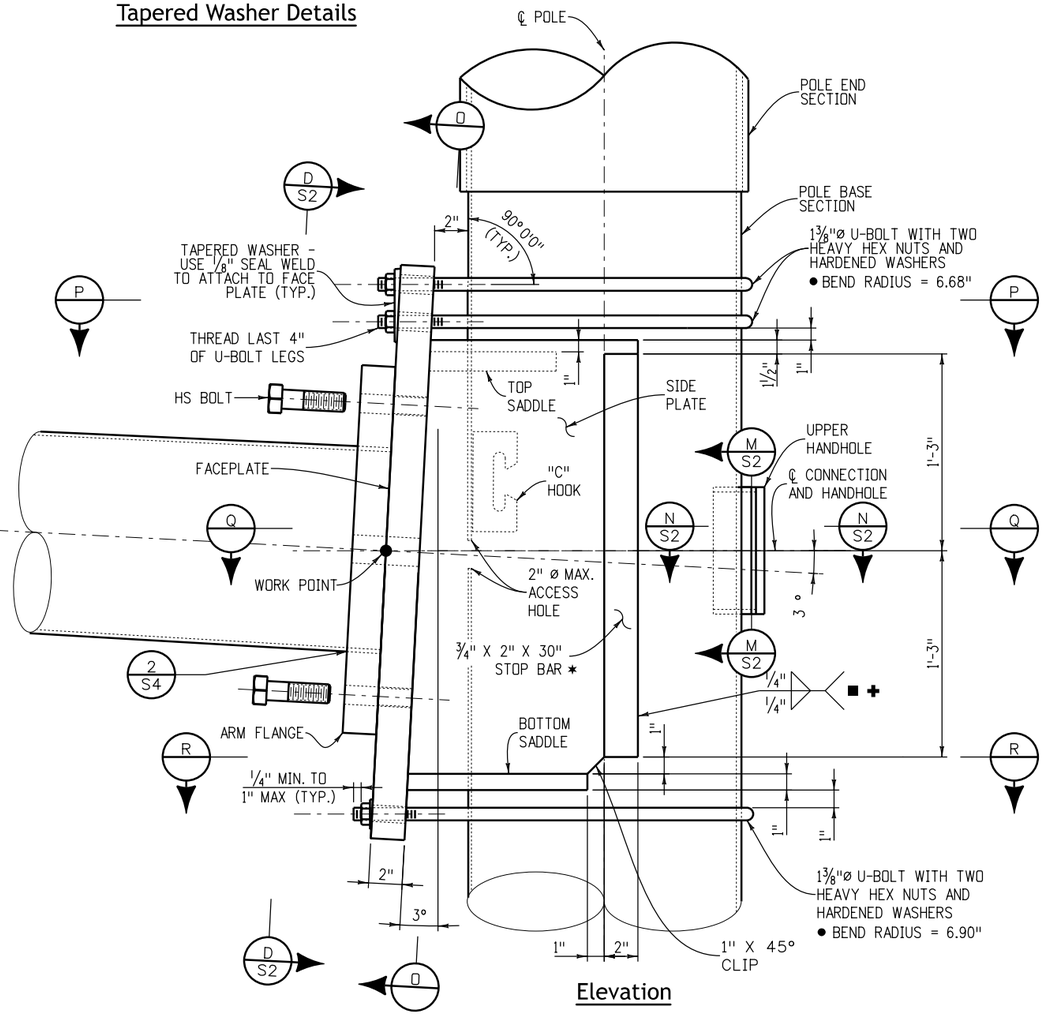


Section R



Section O

Tapered Washer Details



Elevation

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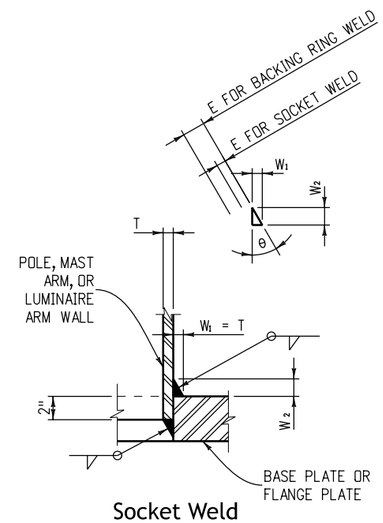
Alternate Traffic Signal 15' - 55' Single Mast Arm

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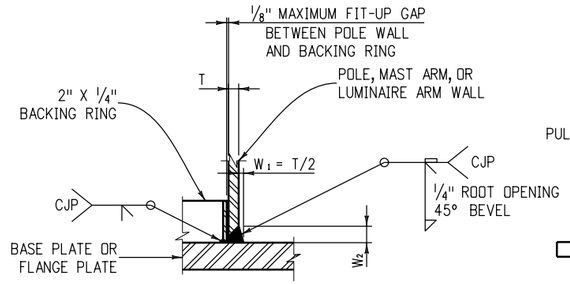
Standard Plan No.
S-614-40A
Standard Sheet No. 4 of 5
Project Sheet Number:

SOCKET WELD DATA					
	ARM LENGTH (FT.)	W_1 (IN.[1])	W_2 (IN.[2])	E (IN.)	θ (DEG.)
MAST ARMS	25	0.2391	0.285	0.183	40
	35	0.2391	0.285	0.183	40
	45	0.3125	0.372	0.239	40
	55	0.3125	0.372	0.239	40
POLE	ALL	0.3125	0.372	0.239	40
LUMINAIRE ARMS	ALL	0.1793	0.214	0.138	40

BACKING RING WELD DATA					
	ARM LENGTH (FT.)	W_1 (IN.[1])	W_2 (IN.[2])	E (IN.)	θ (DEG.)
MAST ARMS	25	0.1196	0.489	0.289	14
	35	0.1196	0.489	0.289	14
	45	0.1566	0.563	0.385	16
	55	0.1566	0.563	0.385	16
POLE	ALL	0.1566	0.563	0.385	16
LUMINAIRE ARMS	ALL	0.0897	0.429	0.212	12

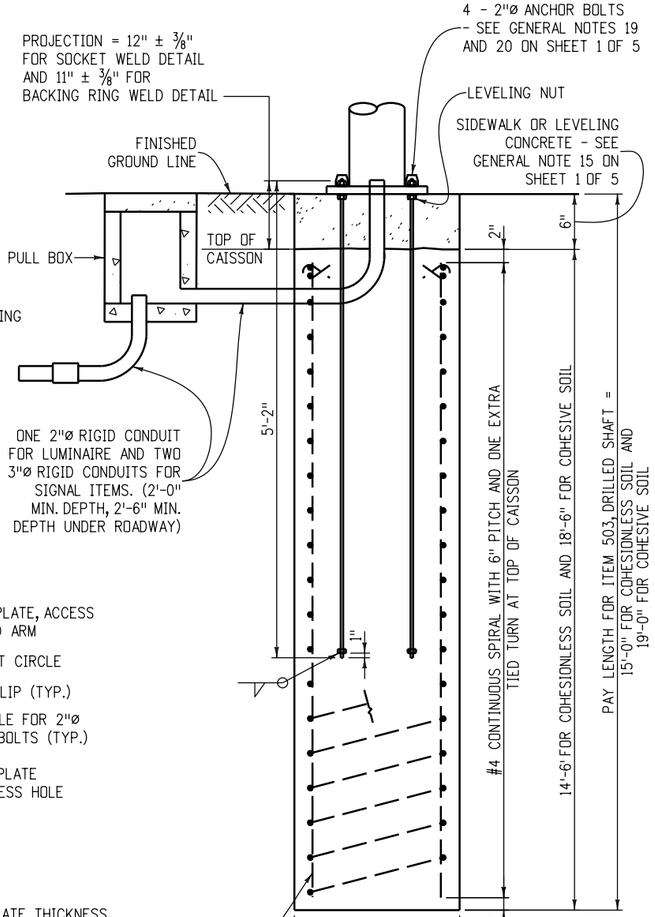


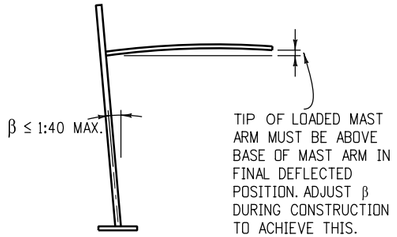
Socket Weld



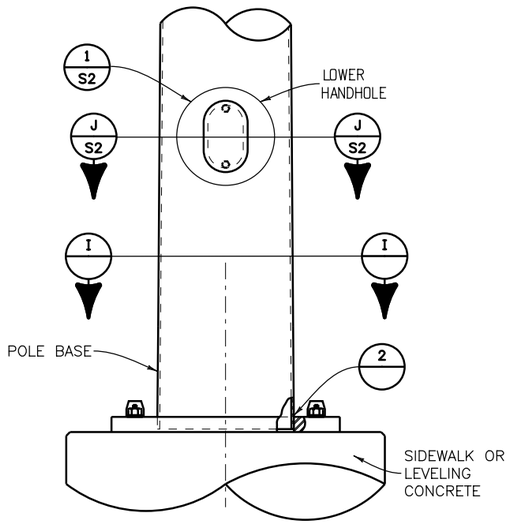
Backing Ring Weld

Detail (2) (2 S2) (2 S3)

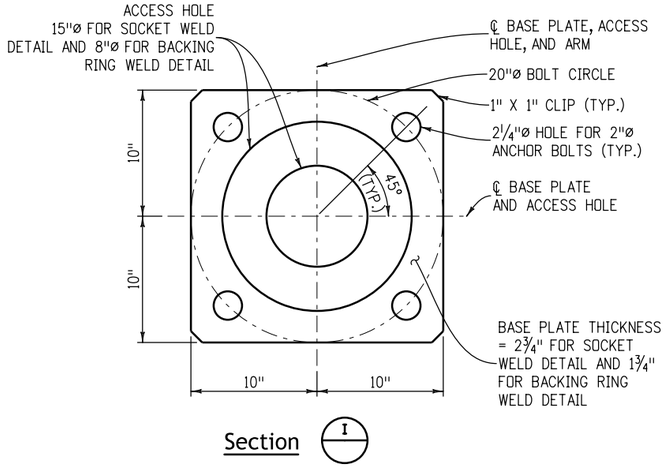




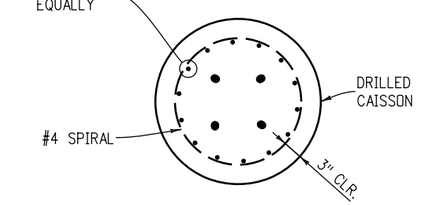
Construction Requirements



Base Plate Detail



Section (I)



Traffic Signal Pole Caisson

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Alternate Traffic Signal 15' - 55' Single Mast Arm

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-40A
Standard Sheet No. 5 of 5
Project Sheet Number:

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 13 prior to drilling holes for tether and span wire eyebolts.
2. Orient span wire holes on a straight line between poles without kinks.
3. Poles shall be hot-dip galvanized in accordance with Section 509.24 of the Standard Specifications as called for on the roadway plans.
4. 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.
5. Caisson concrete shall reach 80% of the required strength prior to installing span wire and tether cables.
6. Welding of steel shall conform to the requirements of ANSI/AWS D1.1. All areas to be welded shall be ground to bright metal. All welding and required testing shall be complete before any material is galvanized. All circumferential welds shall be non-destructively tested using the enhanced magnetic particle method in accordance with Subsection 509.18 (D) of the Standard Specifications. The acceptance criteria is stated in Table 6.1 of ANSI/AWS D1.1. All longitudinal welds within 6 inches of full penetration circumferential groove welds and full penetration groove welds shall be inspected as specified above. Maximum weld undercut shall be 0.01 inches.
7. All electrical connections to the signals shall be grounded in accordance with applicable electrical codes.
8. Working drawings shall be submitted to the Engineer for review in accordance with Subsection 105.02 of the Standard Specifications.
9. Definitions:
   I.D. = inside diameter
   O.D. = outside diameter
   NPS = nominal pipe size

Design Data

Span wire loading is based on the sign and signal locations shown on Sheet 2.

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

Soil density= 110 lb./cu.ft
Soil cohesion= 750 lb./sq.ft
Soil ∅ angle= 30 deg. for medium dense cohesionless soil
S.F.= 2.0 for flexural resistance (overturning)

Contact the Engineer if any of the following soil conditions are encountered during drilling:

(a) Strain poles 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 homogenous.
(e) Firm bedrock is encountered.

Span wire structures have been designed in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, Fourth Edition, 2001 with current interims (2006).

A design wind velocity of 110 mph was used in the design.

An importance factor of 0.71 was used in the design.

Material Data

Element	Standards (ASTM/AASHTO; CDOT)	Notes
Span and Tether Wires	A475	See Note 1
Strain Pole	Various	See Note 2
Eyebolts	A307	See Note 3
Bars, Plates and Curved Washers	A709/M-270	Grade 36 or 50
Nuts	A563/M-291	
Hardned Washers	F436	
Poles, Bars And Plates	Various	See Note 4
Poles	Various	See Note 5
Caisson Concrete	CDOT	See Note 6

Notes:

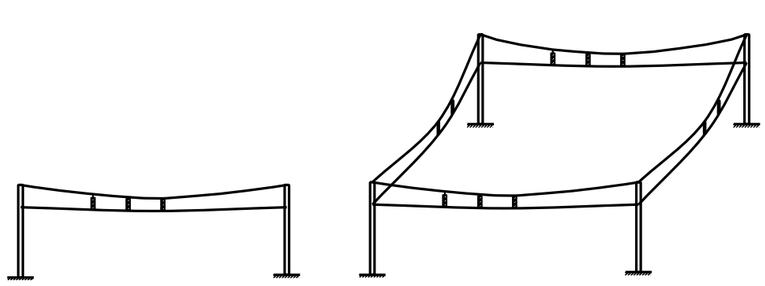
1. Span wire shall be seven wire strand, zinc-coated steel wire, utilities grade or better. Tether wire shall be ⅜ inch ∅, seven wire strand, zinc-coated steel wire, utilities grade or better.
2. Strain pole shall be welded or seamless steel pipe conforming to the specifications of ASTM A53 Grade B, A500 Grade B, or A106 Grade B.
3. Span wire eyebolts shall be 1 inch ∅. Tether wire eyebolts shall be ¾ inch ∅.
4. Poles, bars and plates shall comply with the dimensional tolerances that are specified in ASTM A500, A501, 595 or A6, as applicable.
5. 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 as per the H frequency test requirements in AASHTO T243 (ASTM A673).
6. Caissons shall be constructed with air entrained (5 to 8%) Class BZ concrete in accordance with Section 503 of the Standard Specifications.

Roadway Traffic Signal Plans Shall Show:

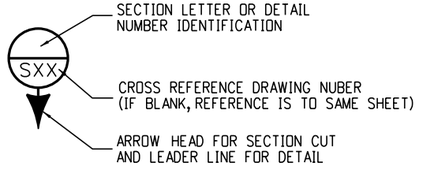
1. Strain pole sizes and locations (intersection, x & y coordinates).
2. Length of span wire between each set of strain poles.
3. Traffic sign and signal size and locations along each span wire.
4. Span wire and tether cable sizes.
5. Lane line locations under span wires.
6. Pole height at each corner.
7. Caisson pay length.
8. Luminaire locations and orientation angles.

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 Charts
8. Double Span Strain Pole Selection Charts (1 Of 4)
9. Double Span Strain Pole Selection Charts (2 Of 4)
10. Double Span Strain Pole Selection Charts (3 Of 4)
11. Double Span Strain Pole Selection Charts (4 Of 4)
12. Double Span Span-wire Diameter Selection Charts (1 Of 2)
13. Double Span Span-wire Diameter Selection Charts (2 Of 2)



Single Span Double Span



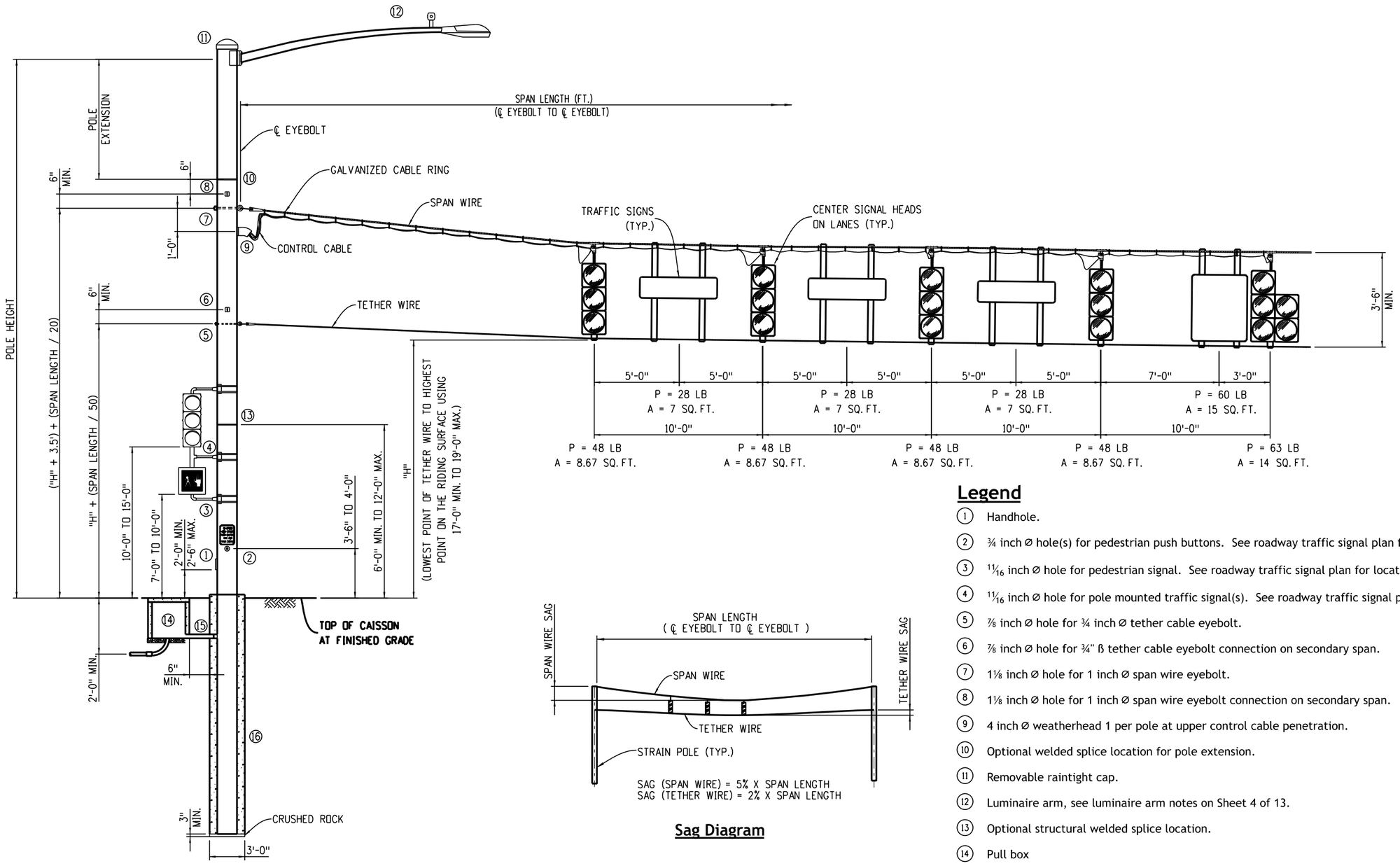
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Temporary Span Wire Signals

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-41
Standard Sheet No. 1 of 13
Project Sheet Number:



Elevation

Sag Diagram

Legend

1. Handhole.
2. ¾ inch ⌀ hole(s) for pedestrian push buttons. See roadway traffic signal plan for locations.
3. $1\frac{1}{16}$ inch ⌀ hole for pedestrian signal. See roadway traffic signal plan for locations.
4. $1\frac{1}{16}$ inch ⌀ hole for pole mounted traffic signal(s). See roadway traffic signal plan for locations.
5. ⅞ inch ⌀ hole for ¾ inch ⌀ tether cable eyebolt.
6. ⅞ inch ⌀ hole for ¾" ß tether cable eyebolt connection on secondary span.
7. 1⅛ inch ⌀ hole for 1 inch ⌀ span wire eyebolt.
8. 1⅛ inch ⌀ hole for 1 inch ⌀ span wire eyebolt connection on secondary span.
9. 4 inch ⌀ weatherhead 1 per pole at upper control cable penetration.
10. Optional welded splice location for pole extension.
11. Removable raintight cap.
12. Luminaire arm, see luminaire arm notes on Sheet 4 of 13.
13. Optional structural welded splice location.
14. Pull box
15. Lower control cable penetration
16. Foundation

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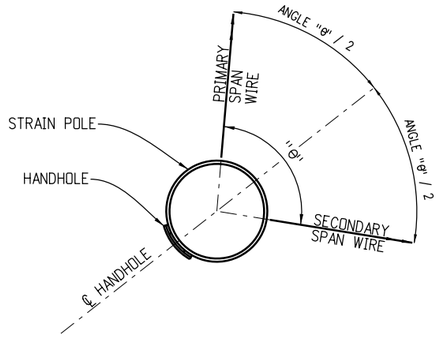
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Temporary Span Wire Signals

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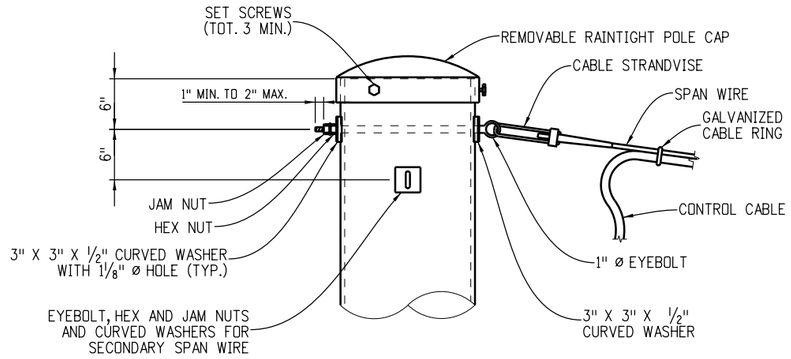
Standard Plan No.
S-614-41
Standard Sheet No. 2 of 13
Project Sheet Number:

-Span Wire Details (2 of 3)-

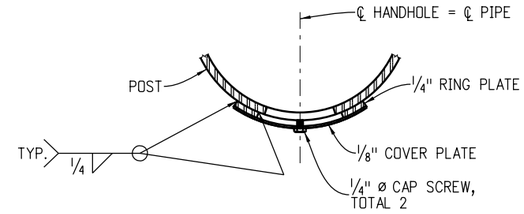


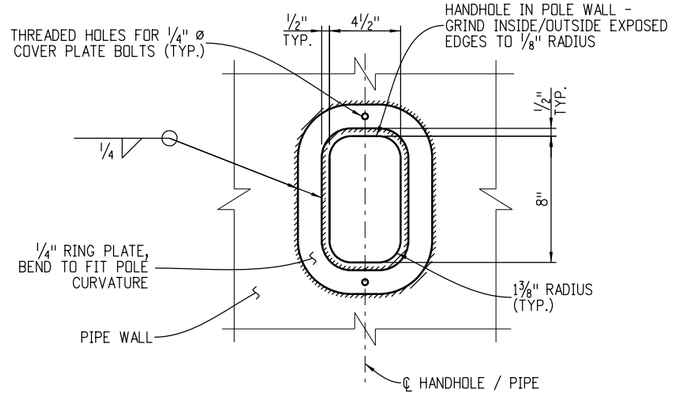
Span Wire Orientation

(Eyebolts and washers not shown for clarity)

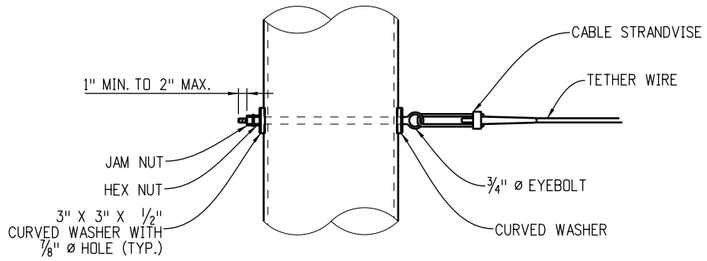


Strain Pole Without Luminaire Arm Extension





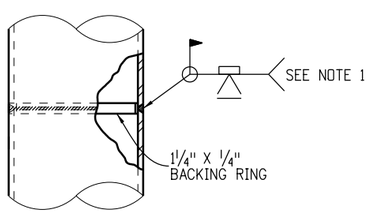
Handhole Details



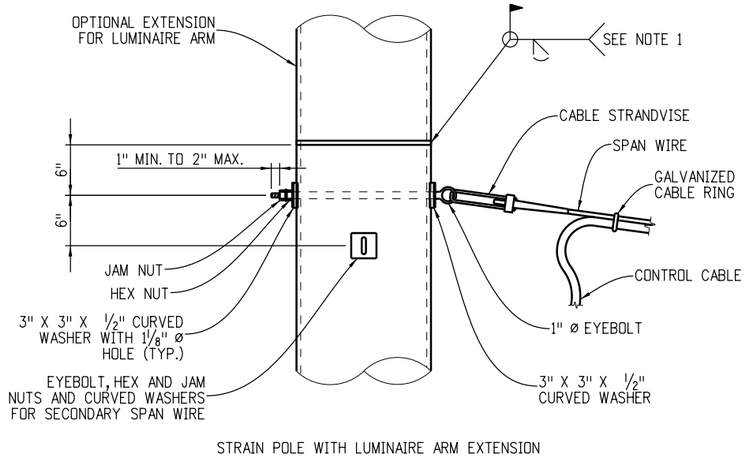
Tether Wire Connection to Strain Pole

Notes:

1. Optional field weld: Repair damaged hot-dip galvanizing with zinc-based alloy solder as per ASTM A780 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.

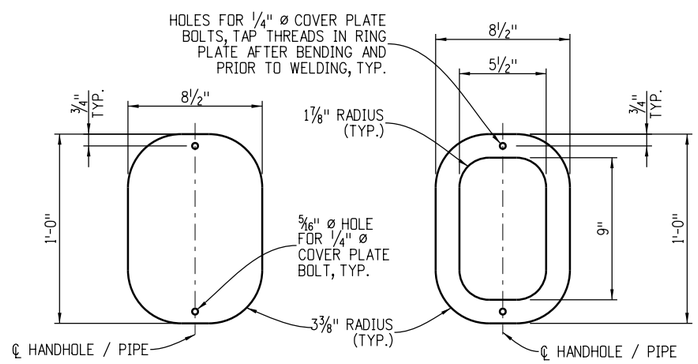


Structural Welded Splice



STRAIN POLE WITH LUMINAIRE ARM EXTENSION

Span Wire Connection to Strain Pole



⅛ Inch Thick Cover Plate

(Bend to fit ring plate curvature)

¼ Inch Thick Ring Plate

(Bend to fit pole curvature)

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Temporary Span Wire Signals

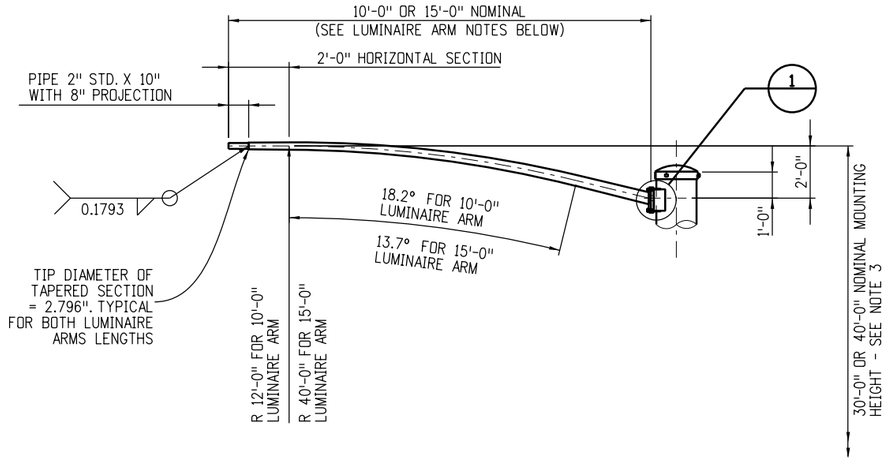
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Standard Plan No.

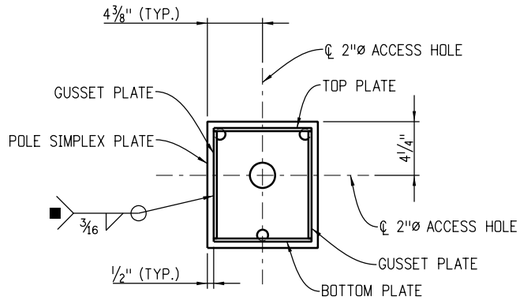
S-614-41

Standard Sheet No. 3 of 13

Project Sheet Number:



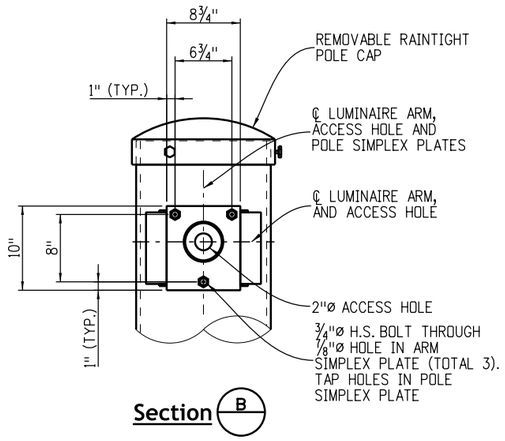
Luminaire Arm



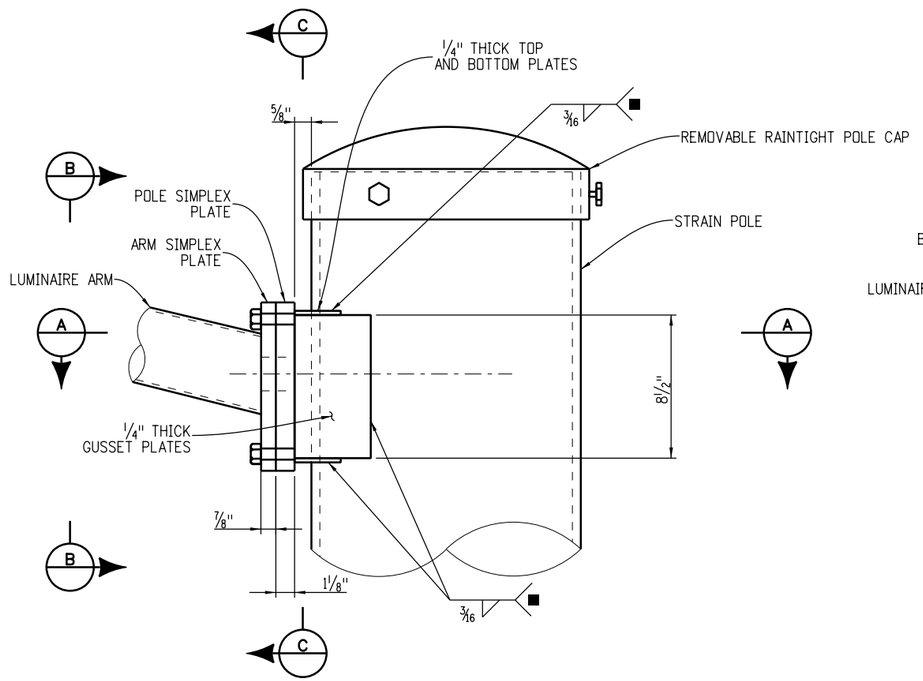
Section C

Luminaire Arm Notes

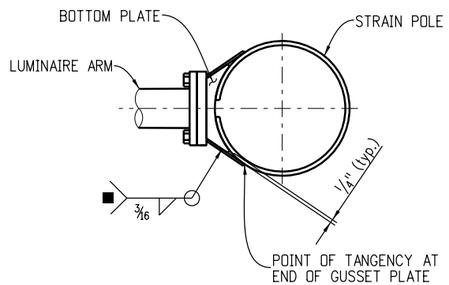
1. 10 foot luminaire arm shaft: wall thickness = 0.1793 inch; Linear taper = 0.14 in./ft.; diameter at arm simplex plate = 4.066 inches
2. 15 foot luminaire arm shaft: wall thickness = 0.1793 inch; Linear taper = 0.14 in./ft.; diameter at arm simplex plate = 4.679 inches.
3. The 30 foot or 40 foot height is measured from the edge of shoulder or guter flow line to the center of the luminaire. Pole assembly shall be at sufficient length to obtain mounting height, with max. permissible mast arm rise of 2 feet from top of pole to center of luminaire.



Section B



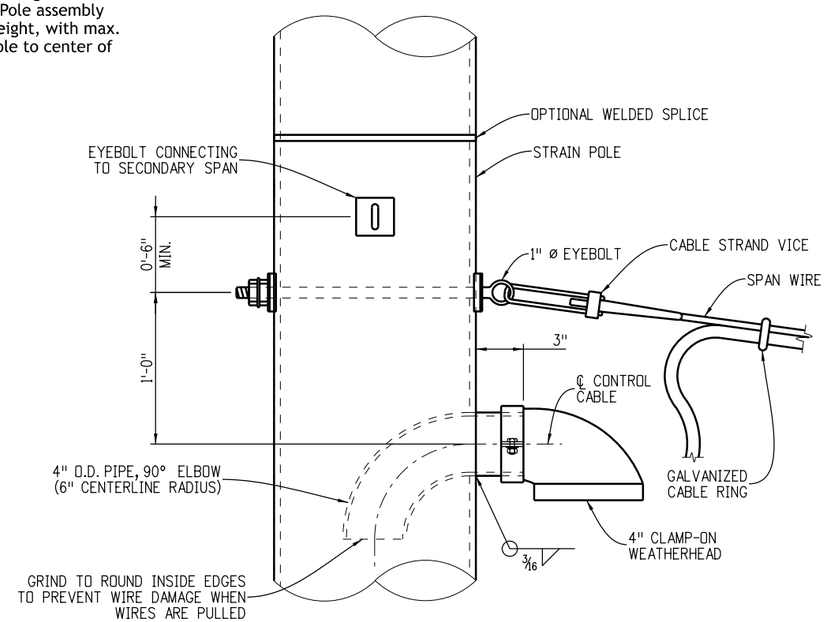
Detail 1



Section A

(Bottom plate shown; top plate similar)

■ Stop all welds ½ inch short of plate edges and bolt holes.



Upper Control Cable Penetration Detail

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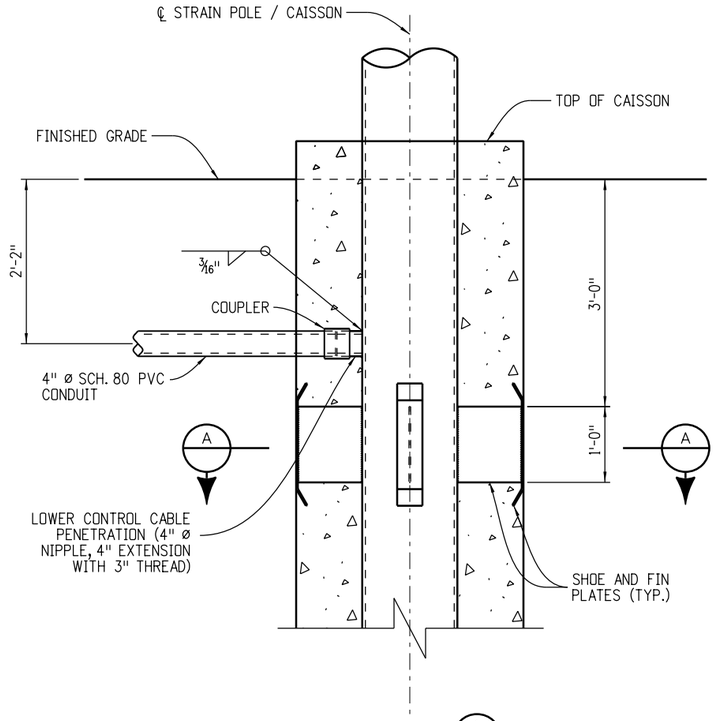
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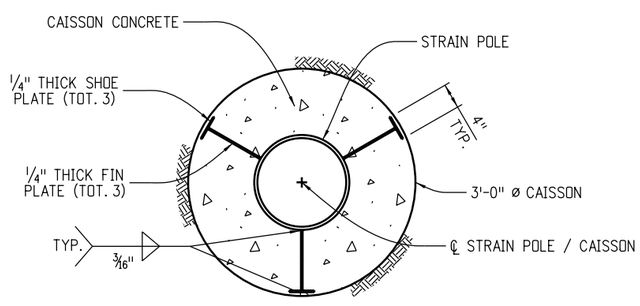
Standard Plan No.
S-614-41
Standard Sheet No. 4 of 13
Project Sheet Number:

-Foundation Details-

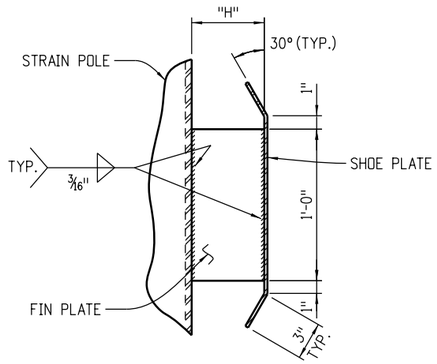


Detail 1

(Optional centralizer with shoe and fin plates, and pull box not shown for clarity)

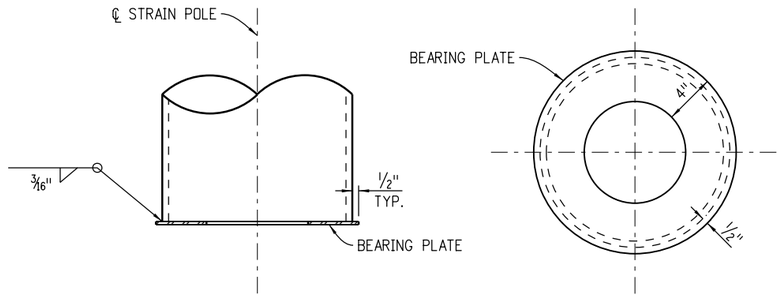


Section A



Shoe And Fin Plate Details

(¼ inch thick)

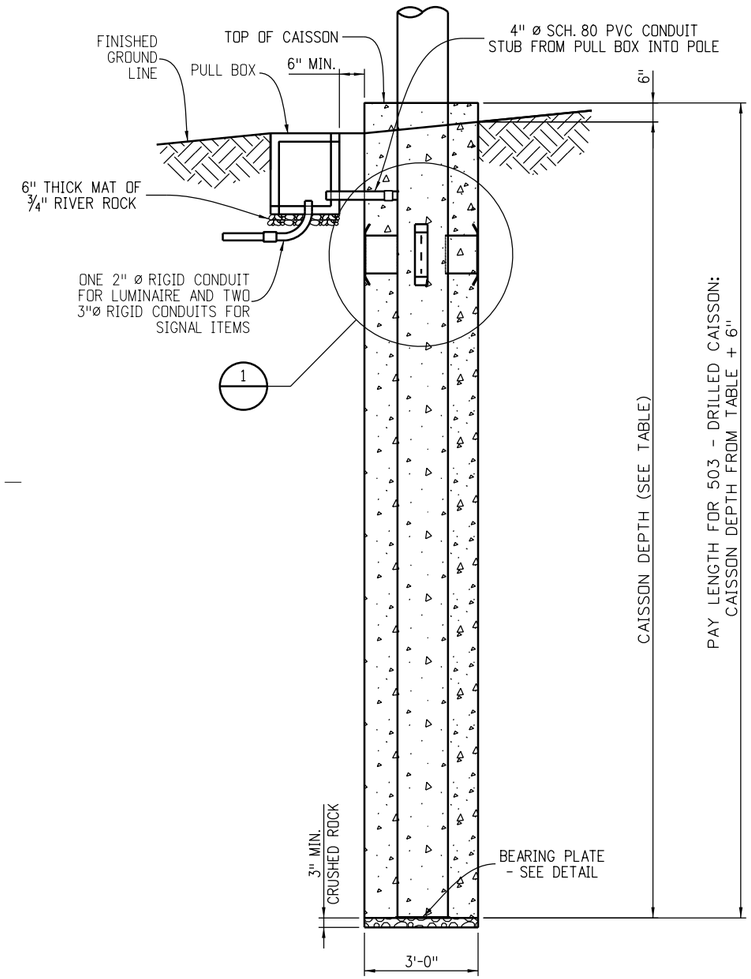


Bearing Plate Details

(¼ inch thick)

Caisson Details

STRAIN POLE SIZES (IN. X IN.)	CAISSON DEPTHS		"H" (IN.)
	COHESIVE SOIL (FT.)	COHESIONLESS SOIL (FT.)	
12.75 x 0.500	14.5	12.5	10¾
14 x 0.500	15.5	12.5	10⅛
16 x 0.500	17.5	13.5	9⅛
18 x 0.500	18.5	14.5	8⅛
20 x 0.500	20.5	14.5	7⅛
24 x 0.500	22.5	15.5	5⅛
24 x 0.688	23.5	16.5	5⅛



Span Wire Pole Caisson

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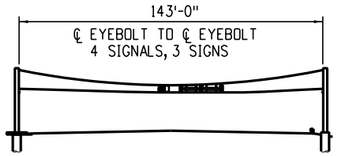
Standard Plan No.

S-614-41

Standard Sheet No. 5 of 13

Project Sheet Number:

Example 1:



Select the strain pole size, span-wire diameter, and caisson depth for a single span installation founded in cohesionless soil as shown above.

Solution:

1. Determine the load key as shown hereon or on Sheets 7 to 13.

   4 signals and 3 signs = [4] (loads for 4 signals and 4 signs max.)

2. Determine the strain pole size by using single span strain pole selection chart on Sheet 7.

   Find the 143 foot span length on the horizontal axis of the chart, then go vertically to meet with line [4]. The required strain pole size is 18 inch ⌀ XS pipe.

3. Determine the span wire diameter by using the single span span-wire diameter selection chart on Sheet 7.

   Find the 143 foot span length on the horizontal axis of the chart, then go vertically to meet with line [4]. The required span wire diameter is $\frac{7}{16}$ inch ⌀.

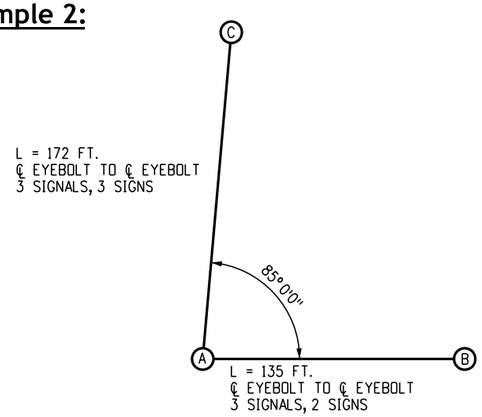
4. Determine the caisson depth by using the table on Sheet 5.

   Look up the caisson depth for cohesionless soil and 18 inch ⌀ strain pole. The required caisson depth is 14.5 feet.

Load Key

- [5] = 5 signals and 4 signs max.
- [4] = 4 signals and 4 signs max.
- [3] = 3 signals and 3 signs max.
- [2] = 2 signals and 2 signs max.
- [1] = 1 signal and 1 sign max.

Example 2:



Select the strain pole sizes, span-wire diameters, and caisson depths for a double span (L-plan box) founded in cohesive soil as shown above.

Solution:

1. Determine the load keys as shown hereon or on Sheets 7 to 13.

   Span AC: 3 signals and 3 signs = [3] (loads for 3 signals and 3 signs max.)
   Span AB: 3 signals and 2 signs = [3] (loads for 3 signals and 3 signs max.)

2. Determine the sizes of strain poles Ⓐ, Ⓑ and Ⓒ.

   For pole Ⓐ using the double span strain pole selection chart for $80° \leq \Theta < 90°$ on Sheet 9:

   Either the horizontal chart or the vertical chart can be used for Span AC or Span AB. Using the horizontal chart for Span AC and the vertical chart for Span AB, locate the 172 foot Span AC on the horizontal chart then go vertically to meet with line [3]. Locate the 135 foot Span AB on the vertical chart then go horizontally to meet with line [3]. From these interception points, go horizontally and vertically to the square box. The required pipe diameter for pole Ⓐ is 20 inch ⌀ XS pipe.

   For poles Ⓑ and Ⓒ, use the single 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 logic, the required pole size is 16 inch ⌀ XS pipe for strain pole Ⓑ and 18 inch ⌀ XS pipe for strain pole Ⓒ.

3. Determine the span wire diameter by using the double span span-wire diameter selection chart for 20 inch ⌀ pole Ⓐ on Sheet 13.

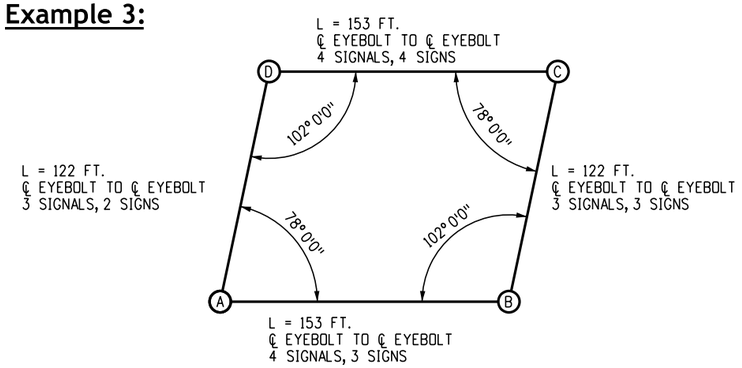
   Span AC: locate the 172 foot span length on the horizontal axis, then go vertically to meet with line [3]. The required span wire diameter is $\frac{7}{16}$ inch ⌀.

   Span AB: do the same for the 135 foot long Span AB. The required span wire is $\frac{7}{16}$ inch ⌀.

4. Determine the caisson depths by using the table on Sheet 5.

   Look up the caisson depth for cohesive soil. The required caisson depth for 20 inch ⌀ strain pole Ⓐ is 20.5 feet, the required depth for 16 inch ⌀ strain pole Ⓑ is 17.5 feet, and the required depth for 18 inch ⌀ strain pole Ⓒ is 18.5 feet.

Example 3:



Select the strain pole sizes, span wire diameters and caisson depths for caissons for a double span (rectangular plan box) founded in cohesionless soil as shown above.

Solution:

1. Determine the load keys as shown hereon or on Sheets 7 to 13.

   Span AB: 4 signals and 3 signs = [4] (loads for 4 signals and 4 signs max.)
   Span BC: 3 signals and 3 signs = [3] (loads for 3 signals and 3 signs max.)
   Span CD: 4 signals and 4 signs = [4] (loads for 4 signals and 4 signs max.)
   Span AD: 3 signals and 2 signs = [3] (loads for 3 signals and 3 signs max.)

2. Determine the size of poles Ⓐ, Ⓑ, Ⓒ and Ⓓ.

   For pole Ⓐ using the double span strain pole selection chart for $70° \leq \Theta < 80°$ on Sheet 8:

   Either the horizontal chart or the vertical chart can be used for Span AB or Span AD. Using the horizontal chart for Span AB and the vertical chart for Span AD, locate the 153 foot Span AB on the horizontal chart then go vertically to meet with line [4]. Locate the 122 foot Span AD on the vertical chart then go horizontally to meet with line [3]. From these interception points, go horizontally and vertically to the square box. The required pipe diameter for pole Ⓐ is 24 inch ⌀ XS pipe.

   For pole Ⓑ using the double span strain pole selection chart for $100° \leq \Theta < 110°$ on Sheet 10:

   Either the horizontal chart or the vertical chart can be used for Span AB or Span BC. Using the horizontal chart for Span AB and the vertical chart for Span BC, locate the 153 foot Span AB on the horizontal chart, then go vertically to meet with line [4]. Locate the 122 foot Span BC on the vertical chart, then go horizontally to meet with line [3]. From these interception points, go horizontally and vertically to the square box. The required pipe diameter for pole Ⓑ is 20 inch ⌀ XS pipe.

   Likewise, strain pole Ⓒ is 24 inch ⌀ XS pipe and strain pole Ⓓ is 20 inch ⌀ XS pipe.

3. Determine the span-wire diameter by using the double span span-wire diameter selection chart for 24 inch ⌀ pole on Sheet 13. For this case, the 24 inch ⌀ strain poles Ⓐ and Ⓒ control the design.

   Span AB: locate the 153 foot span length on the horizontal line, then go vertical to meet with line [4] the required span-wire is ½ inch ⌀.

   Spans AD, BC and CD: doing the same as for Span AB for different load keys, the required span-wire diameters for Spans AD and BC is $\frac{7}{16}$ inch ⌀, and ½ inch ⌀ for span CD.

4. Determine caisson depth by using table on Sheet 5.

   Look up the caisson depth for cohesionless soil on Sheet 13. The required caisson depth for 24 inch ⌀ strain poles Ⓐ and Ⓒ is 15.5 feet, and the required depth for 20 inch ⌀ strain poles Ⓑ and Ⓓ is 14.5 feet.

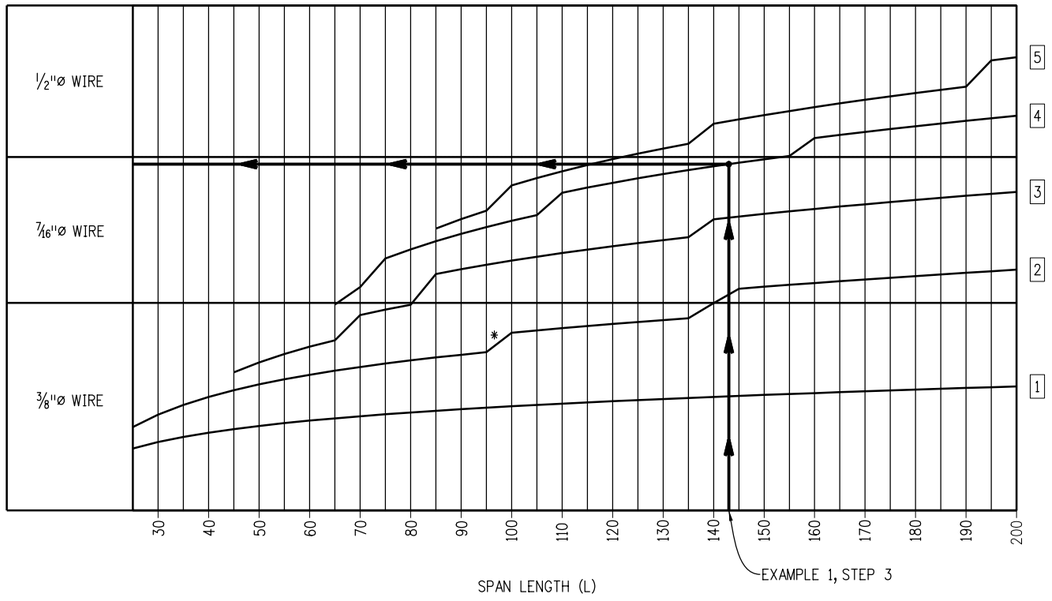
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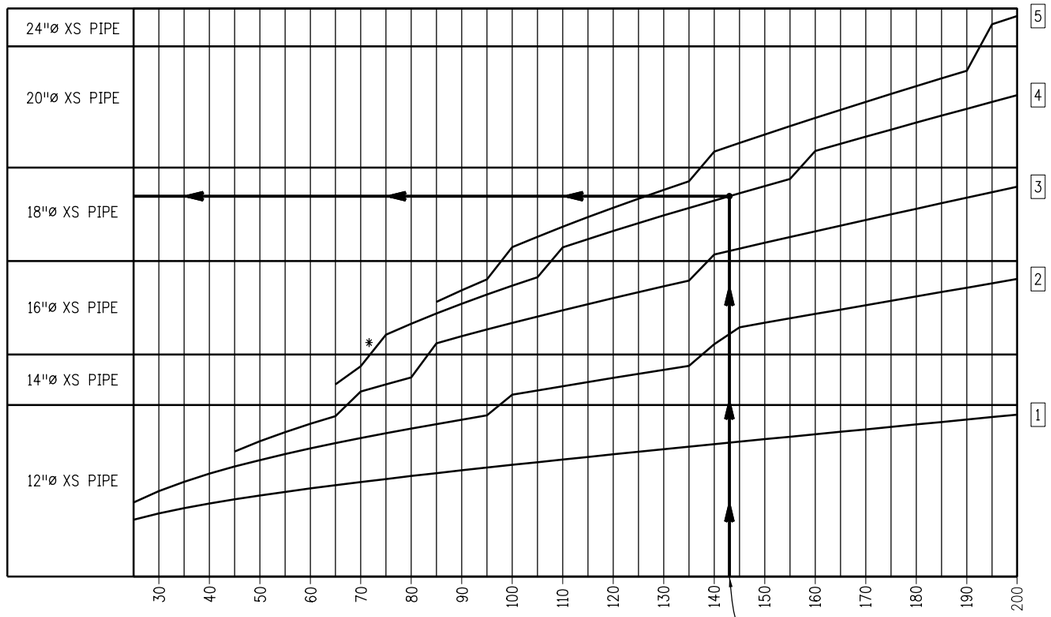
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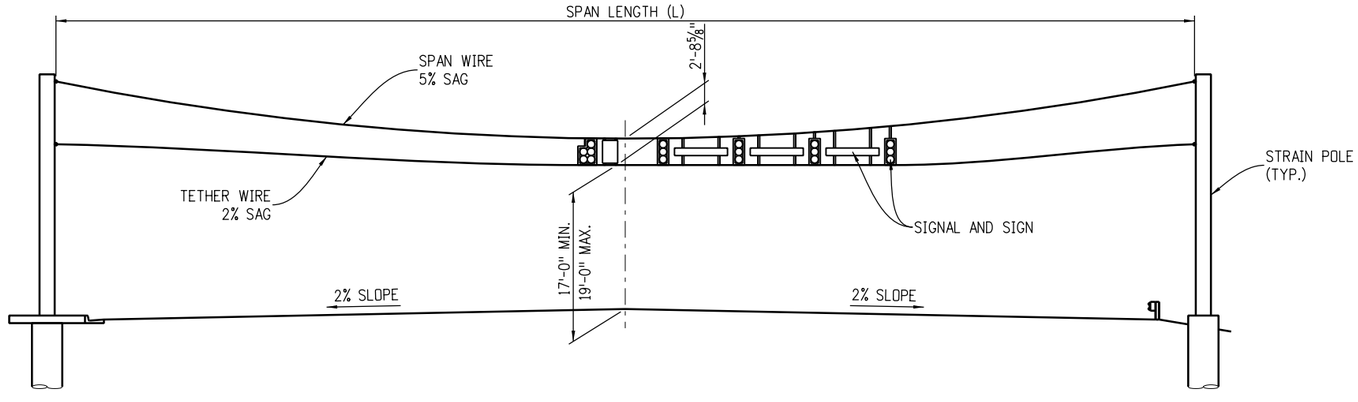
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Single Span Span-Wire Diameter Selection Chart



Single Span Strain Pole Selection Chart





Elevation

Load Key

- [5] = 5 signals and 4 signs max.
- [4] = 4 signals and 4 signs max.
- [3] = 3 signals and 3 signs max.
- [2] = 2 signals and 2 signs max.
- [1] = 1 signal and 1 sign max.

Legend

* = Typical jump caused by change in pole size using span length increasement of 5 feet.

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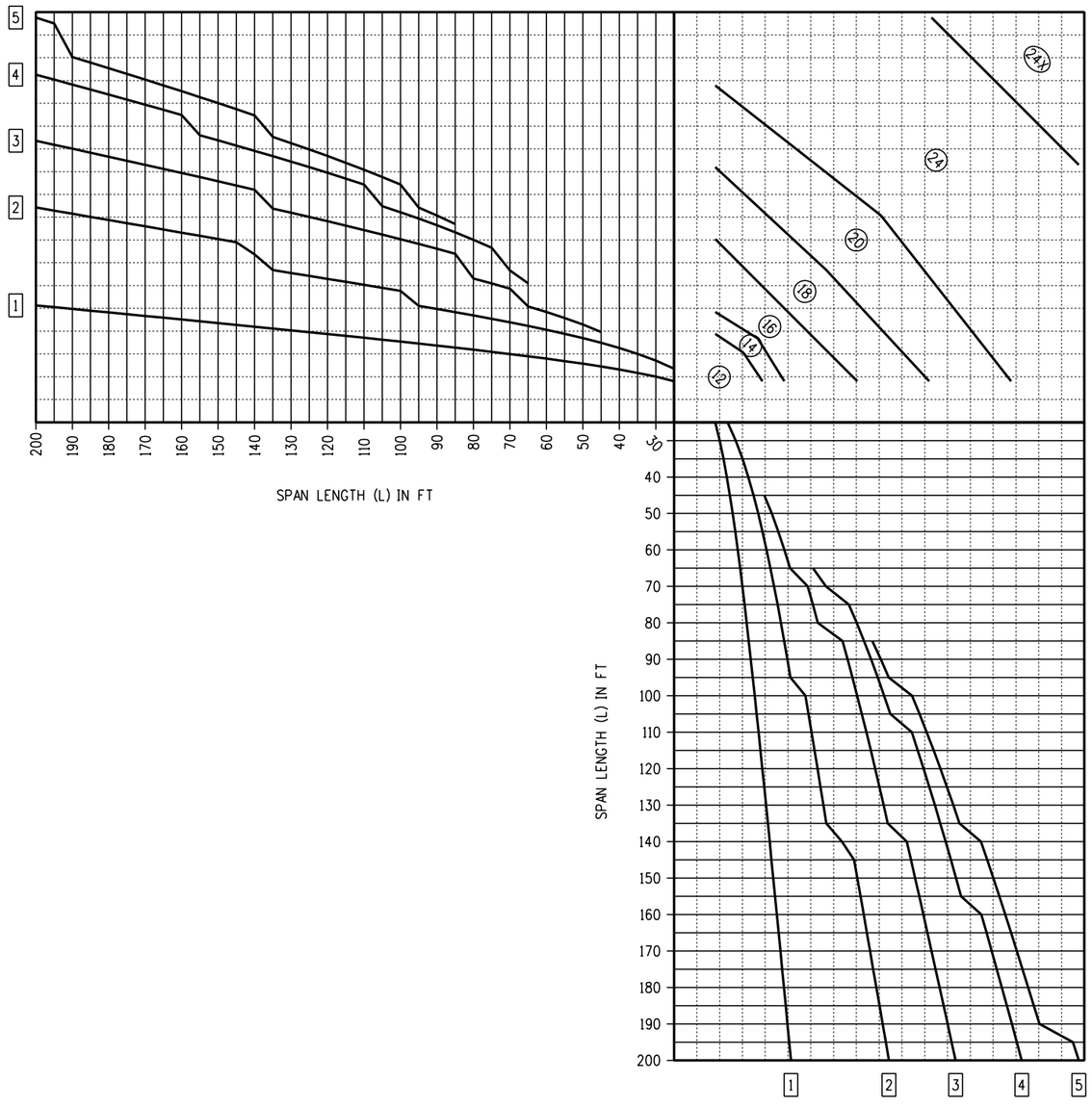
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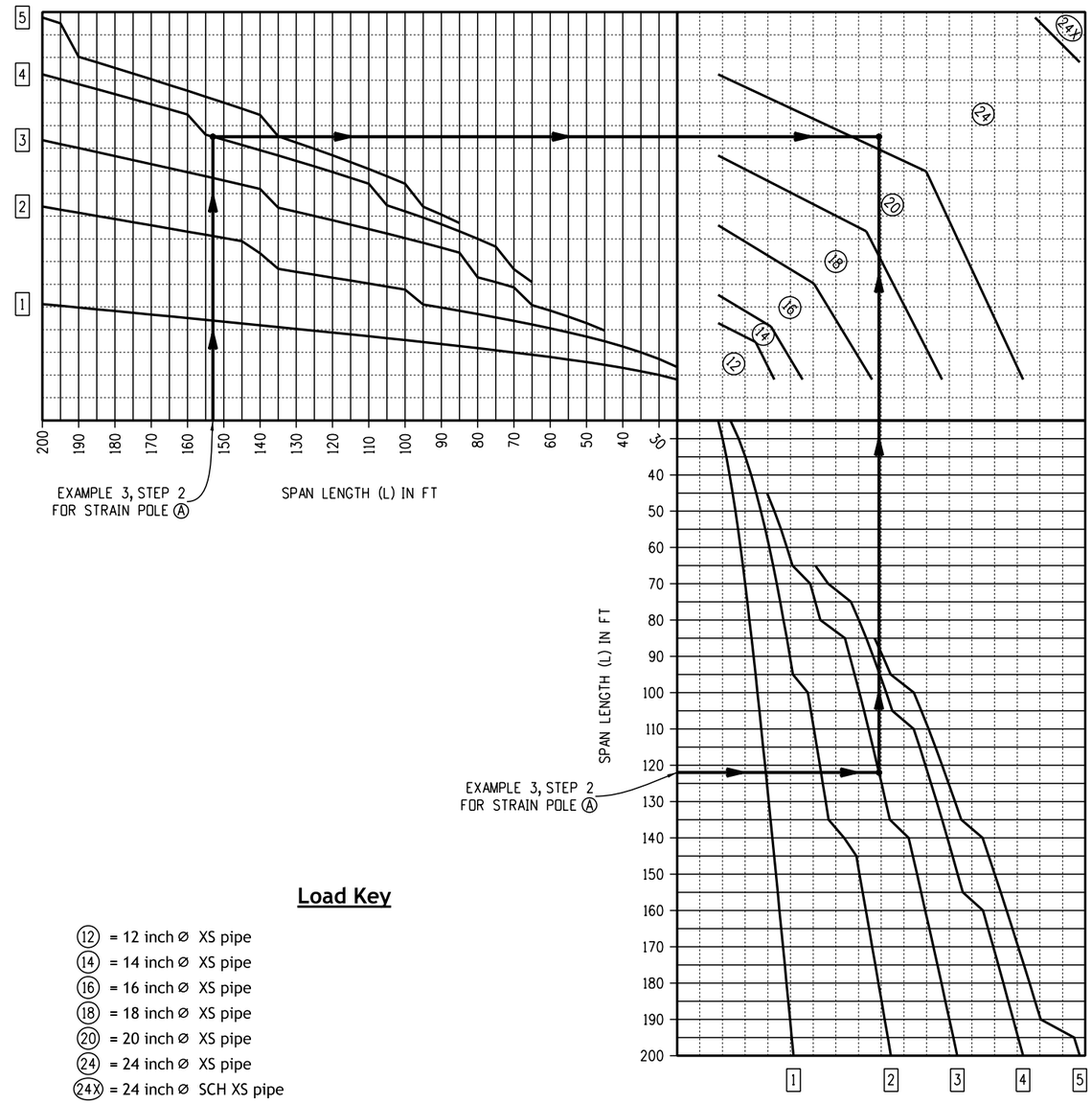
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Standard Plan No.
S-614-41
Standard Sheet No. 7 of 13
Project Sheet Number:

Double Span Strain Pole Selection Chart for 60° ≤ θ < 70°



Double Span Strain Pole Selection Chart for 70° ≤ θ < 80°



Load Key

- (12) = 12 inch ∅ XS pipe
- (14) = 14 inch ∅ XS pipe
- (16) = 16 inch ∅ XS pipe
- (18) = 18 inch ∅ XS pipe
- (20) = 20 inch ∅ XS pipe
- (24) = 24 inch ∅ XS pipe
- (24X) = 24 inch ∅ SCH XS pipe

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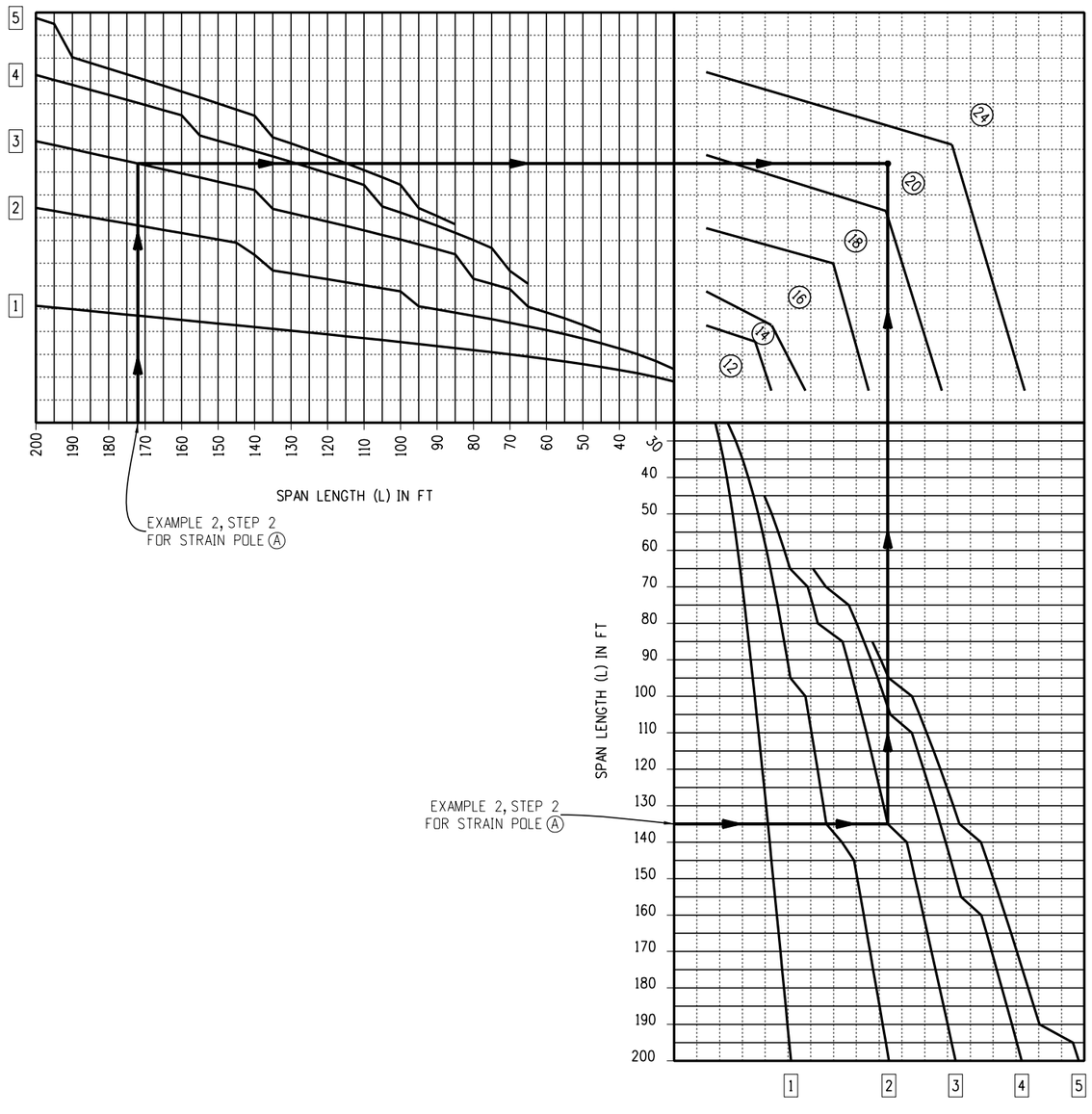
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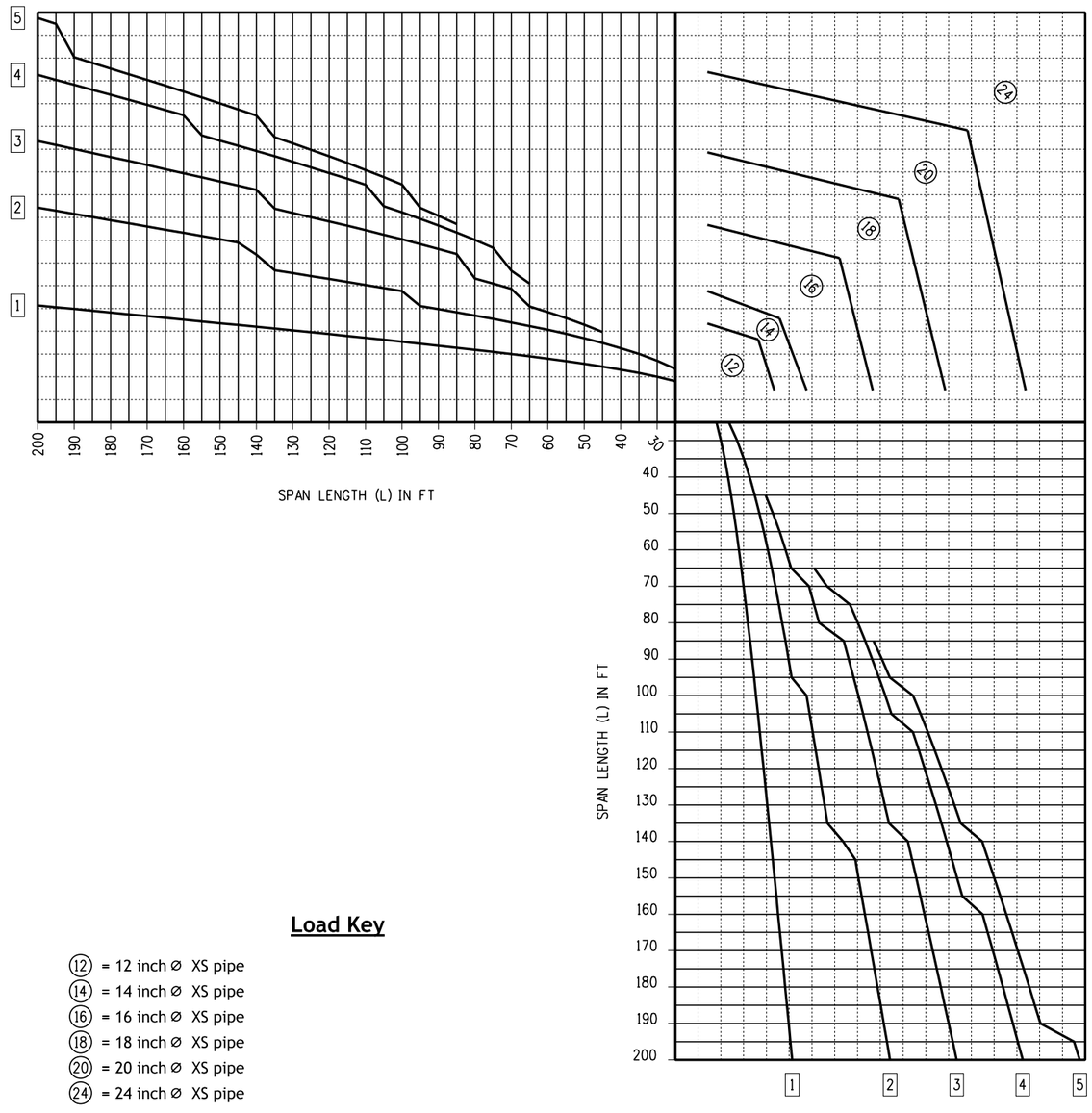
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Standard Plan No.
S-614-41
Standard Sheet No. 8 of 13
Project Sheet Number:

Double Span Strain Pole Selection Chart for 80° ≤ θ < 90°



Double Span Strain Pole Selection Chart for 90° ≤ θ < 100°



Load Key

- (12) = 12 inch ⌀ XS pipe
- (14) = 14 inch ⌀ XS pipe
- (16) = 16 inch ⌀ XS pipe
- (18) = 18 inch ⌀ XS pipe
- (20) = 20 inch ⌀ XS pipe
- (24) = 24 inch ⌀ XS pipe

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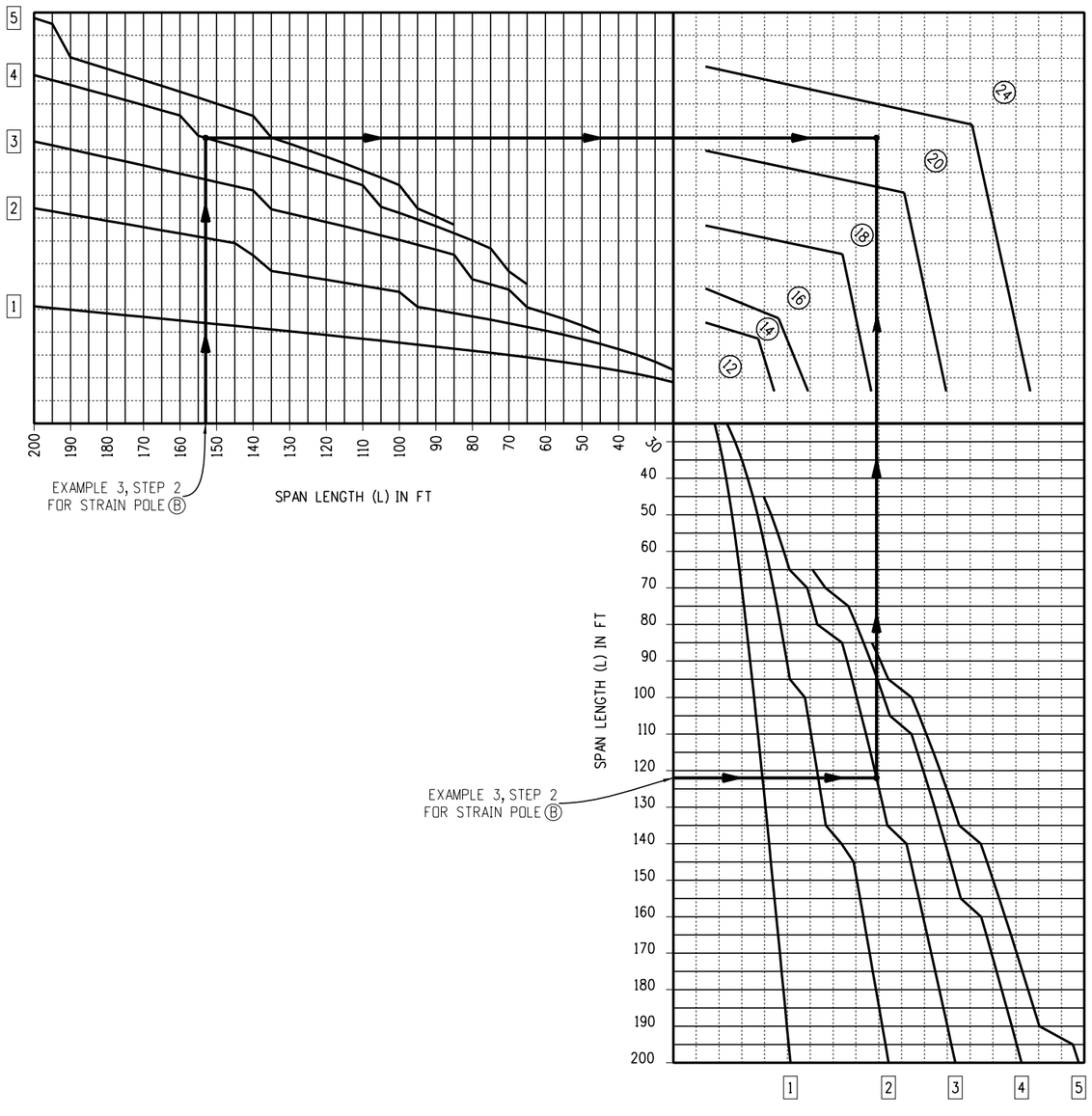
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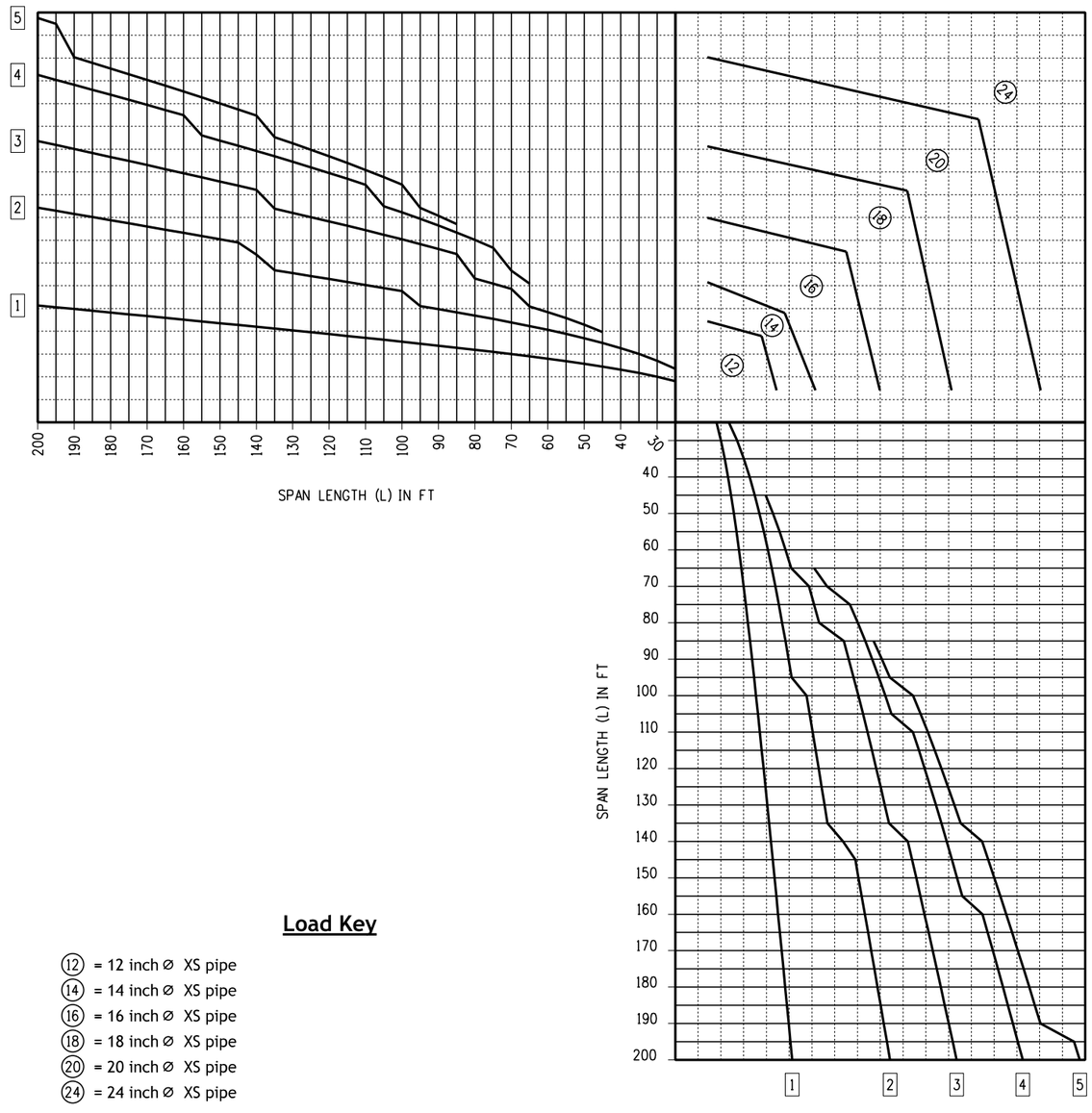
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Standard Plan No.
S-614-41
Standard Sheet No. 9 of 13
Project Sheet Number:

Double Span Strain Pole Selection Chart for 100° ≤ θ < 110°



Double Span Strain Pole Selection Chart for 110° ≤ θ < 120°



Load Key

- (12) = 12 inch ⌀ XS pipe
- (14) = 14 inch ⌀ XS pipe
- (16) = 16 inch ⌀ XS pipe
- (18) = 18 inch ⌀ XS pipe
- (20) = 20 inch ⌀ XS pipe
- (24) = 24 inch ⌀ XS pipe

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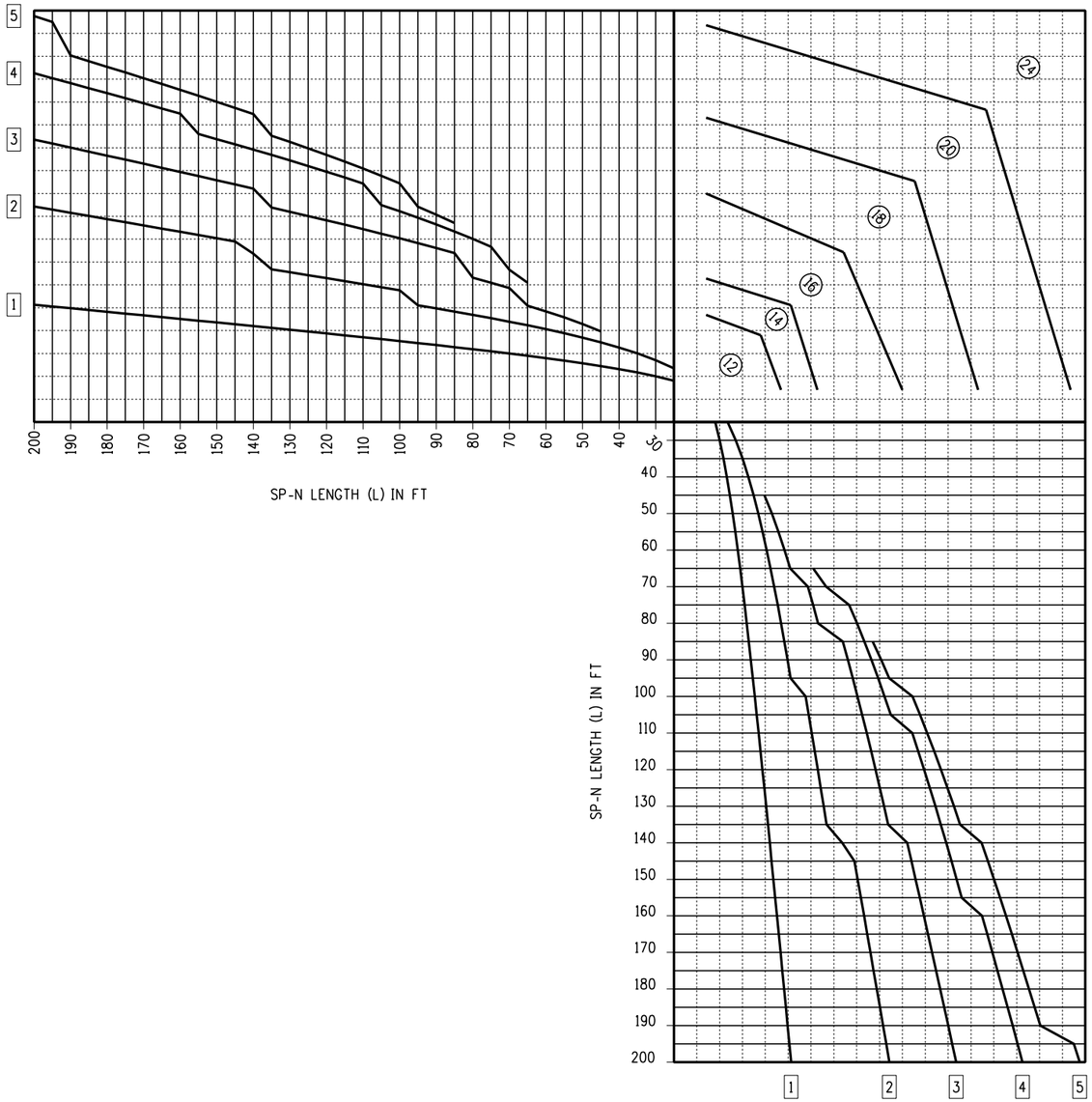
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Temporary Span Wire Signals

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-41
Standard Sheet No. 10 of 13
Project Sheet Number:

Double Span Strain Pole Selection Chart for θ ≥ 120°



Load Key

(12) = 12 inch ∅ XS pipe
(14) = 14 inch ∅ XS pipe
(16) = 16 inch ∅ XS pipe
(18) = 18 inch ∅ XS pipe
(20) = 20 inch ∅ XS pipe
(24) = 24 inch ∅ XS pipe

Computer File Information		Sheet Revisions	
Creation Date: 07/01/11		Date:	Comments
Created By: LEC			
Last Modification Date: 07/01/26			
Last Modified By: GLY			
CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

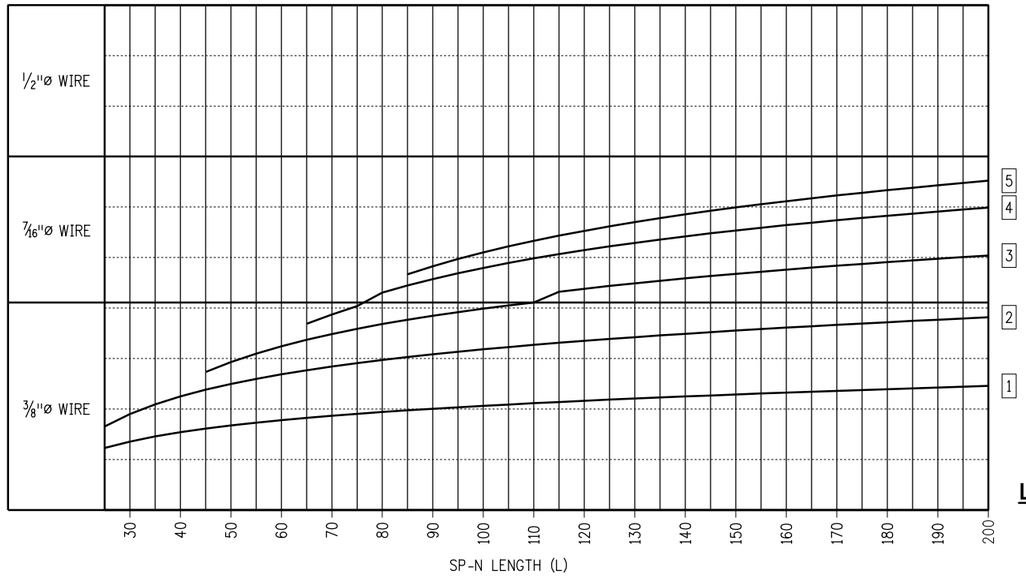
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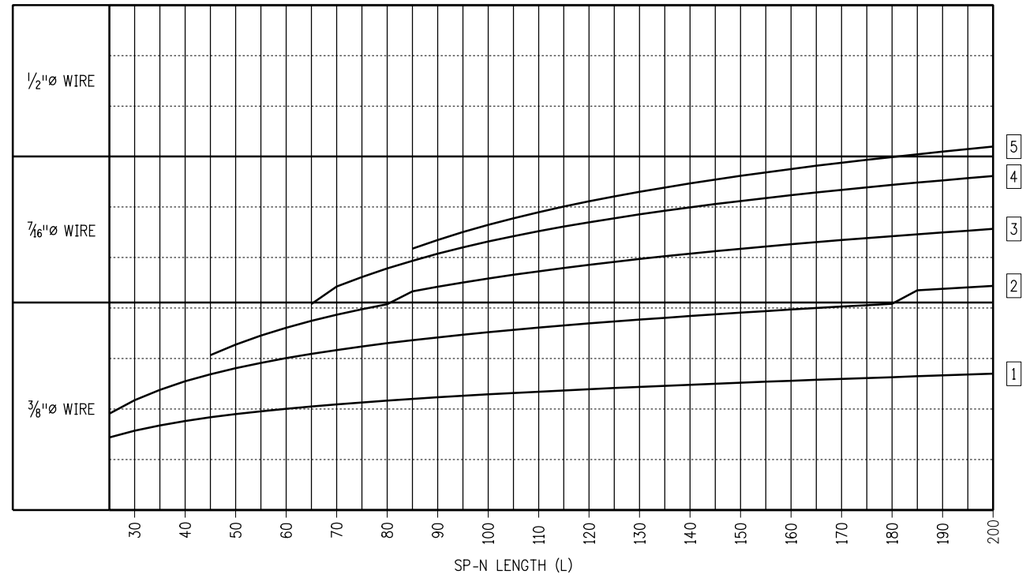
Standard Plan No.
S-614-41
Standard Sheet No. 11 of 13
Project Sheet Number:

Double Span Span-Wire Diameter Selection Chart for 12 Inch Ø XS Pole

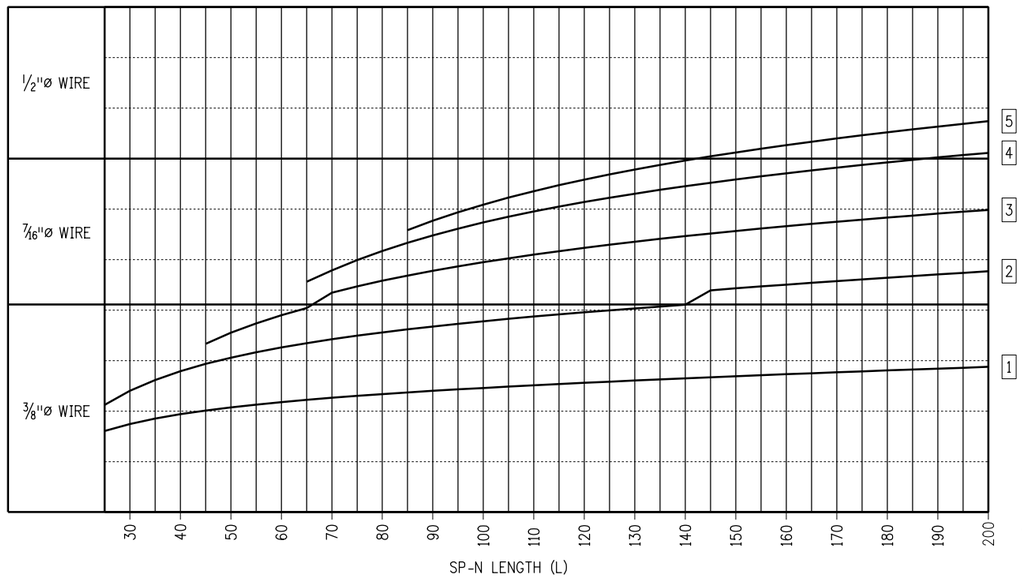


Load Key

Double Span Span-Wire Diameter Selection Chart for 14 Inch Ø XS Pole

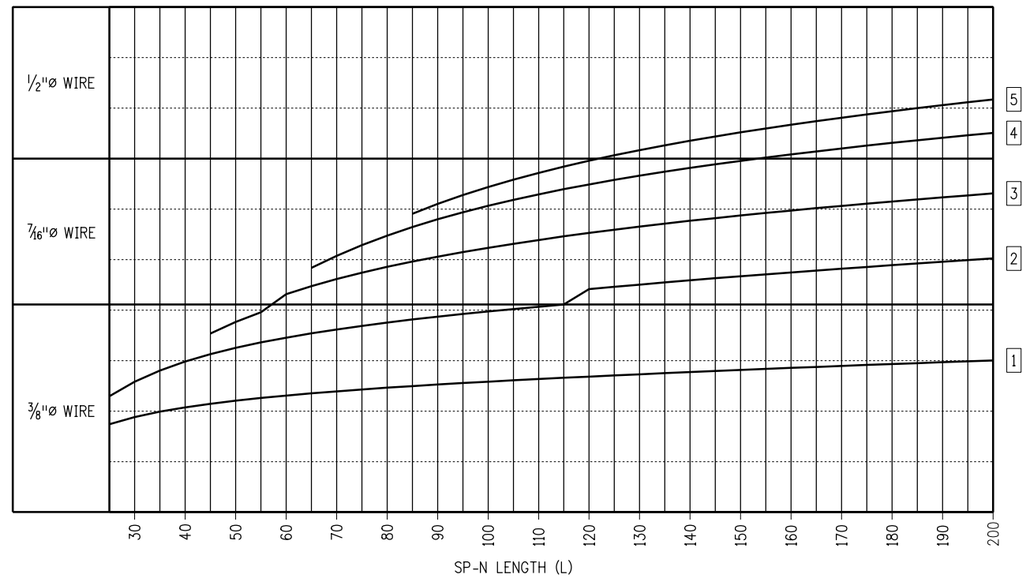


Double Span Span-Wire Diameter Selection Chart for 16 Inch Ø XS Pole



Legend

Double Span Span-Wire Diameter Selection Chart for 18 Inch Ø XS Pole



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Creation Date: 07/01/11		Date:	Comments
Created By: LEC			
Last Modification Date: 07/01/26			
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CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

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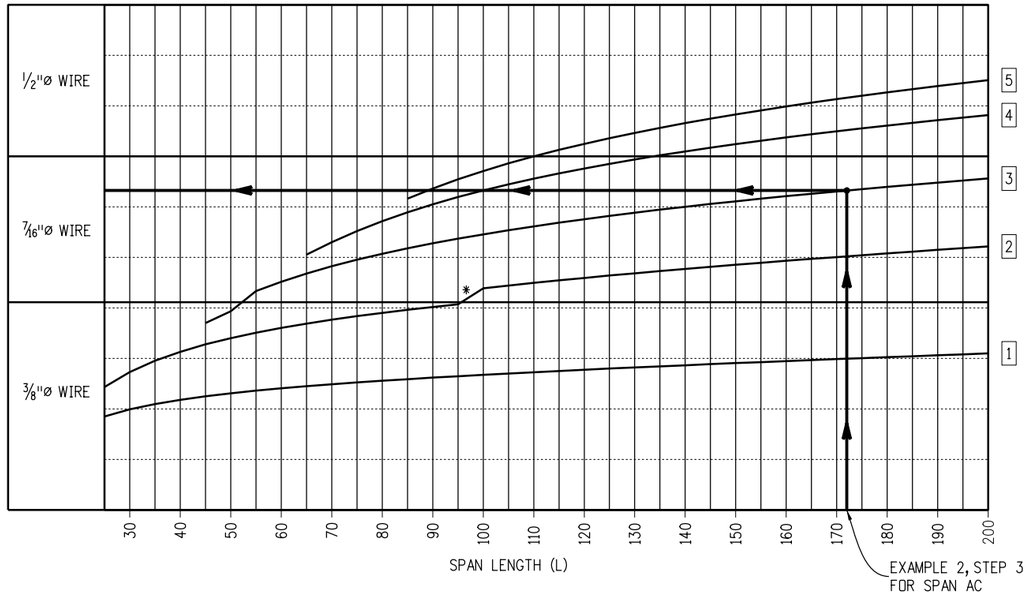
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Temporary Span Wire Signals

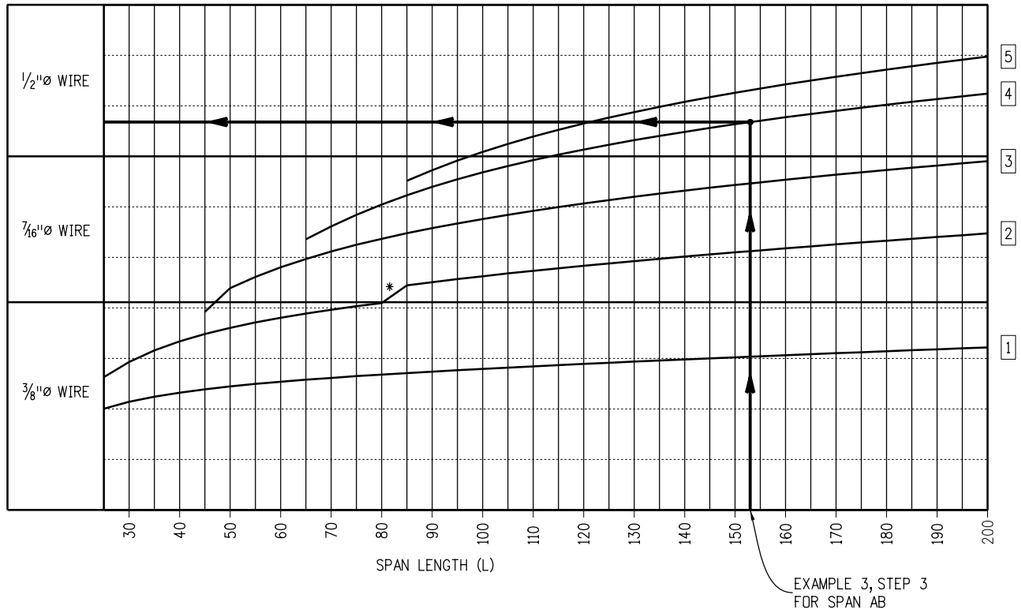
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Standard Plan No.
S-614-41
Standard Sheet No. 12 of 13
Project Sheet Number:

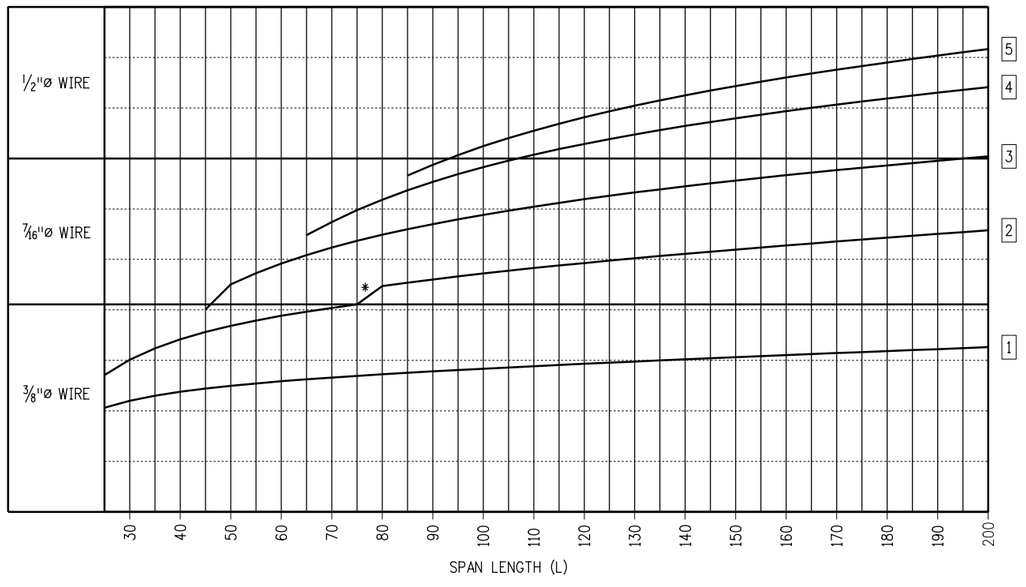
Double Span Span-Wire Diameter Selection Chart for 20 Inch Ø XS Pole



Double Span Span-Wire Diameter Selection Chart for 24 Inch Ø XS Pole



Double Span Span-Wire Diameter Selection Chart for 24 Inch Ø SCH 40 Pole



Load Key

- 5 = 5 signals and 4 signs max.
- 4 = 4 signals and 4 signs max.
- 3 = 3 signals and 3 signs max.
- 2 = 2 signals and 2 signs max.
- 1 = 1 signal and 1 sign max.

Legend

* = TYPICAL JUMP CAUSED BY CHANGE IN POLE SIZE USING SPAN LENGTH INCREASEMENT OF 5'.

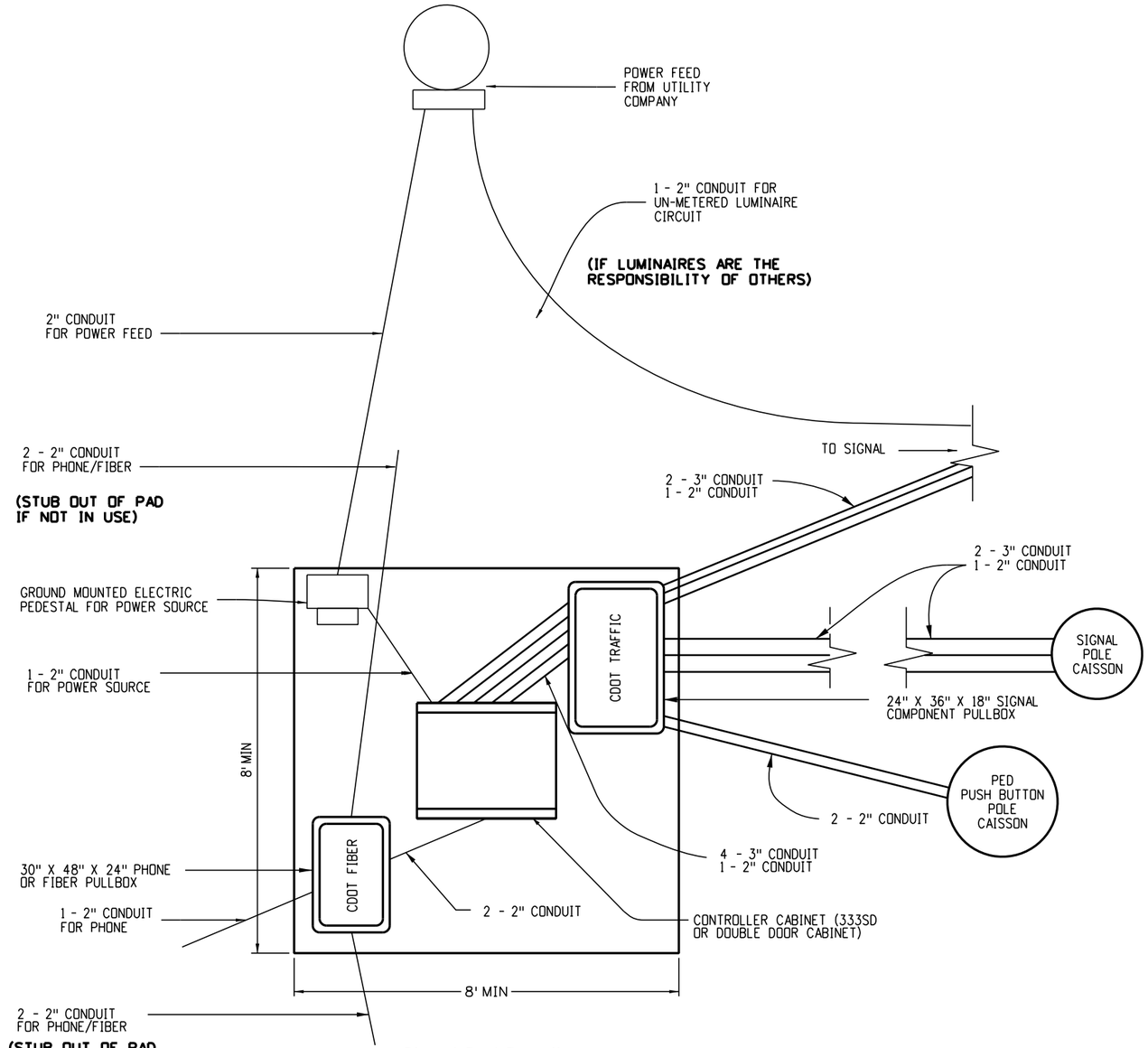
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Temporary Span Wire Signals

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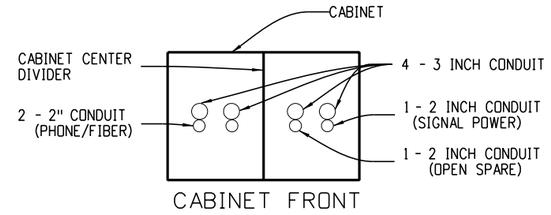
Standard Plan No.
S-614-41
Standard Sheet No. 13 of 13
Project Sheet Number:



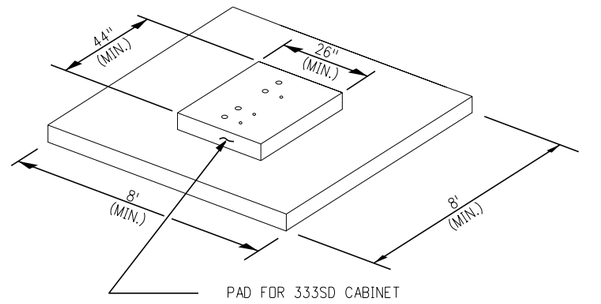
Signal Pad Detail
Top View
(Not to scale)

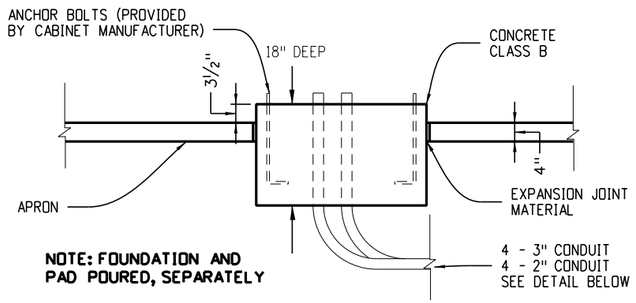
General Notes

1. The concrete pad surrounding the cabinet base shall be Class B mix. Glass or synthetic fibers shall be incorporated into the concrete mix. The dosage rate of the glass or synthetic fibers shall be the dosage rate recommended by the manufacturer of the glass or 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 pay item.



Conduit Detail
Cross Section
(Not to scale)





Foundation Cross Section
(Not to scale)

Cast-In-Place Foundation

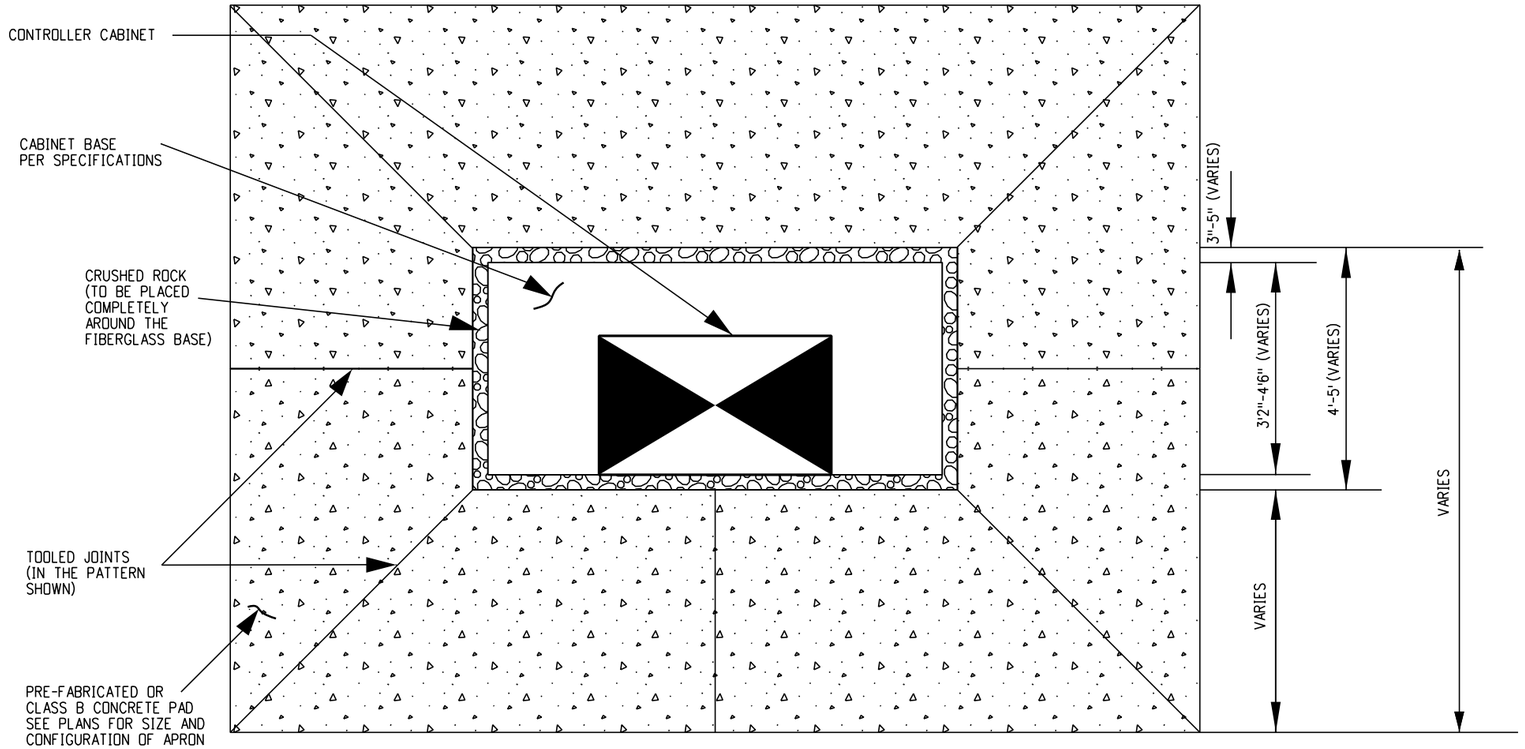
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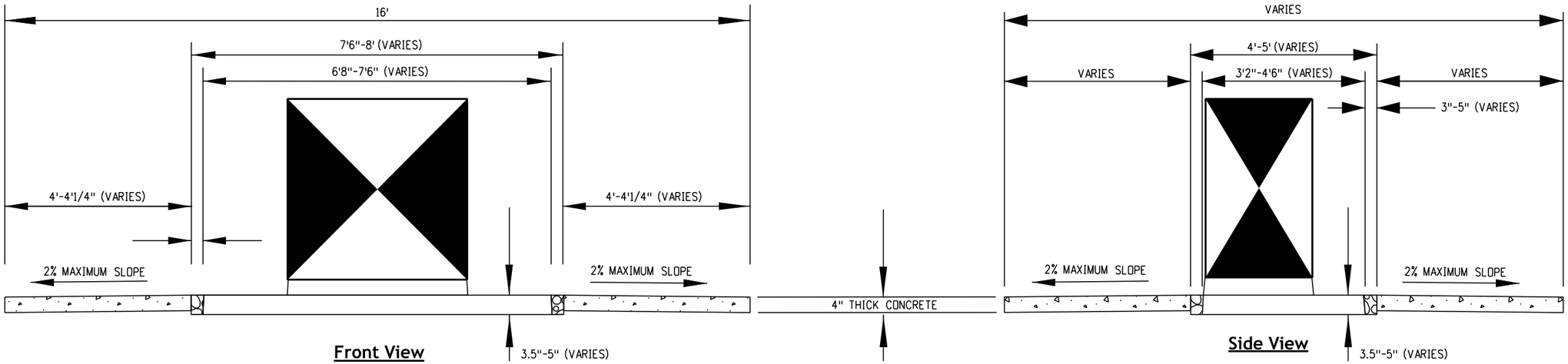
Cabinet Foundation Detail

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-42
Standard Sheet No. 1 of 4
Project Sheet Number:



Top View



Front View

Side View

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.
3. The concrete pad surrounding the cabinet base shall be Class B mix. Glass or synthetic fibers shall be incorporated into the concrete mix. The dosage rate of the glass or synthetic fibers shall be the dosage rate recommended by the manufacturer of the glass or 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 the cost of the controller cabinet pay item.
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 controller cabinet specified in the plans.

Pre-Fabricated Fiberglass Foundation

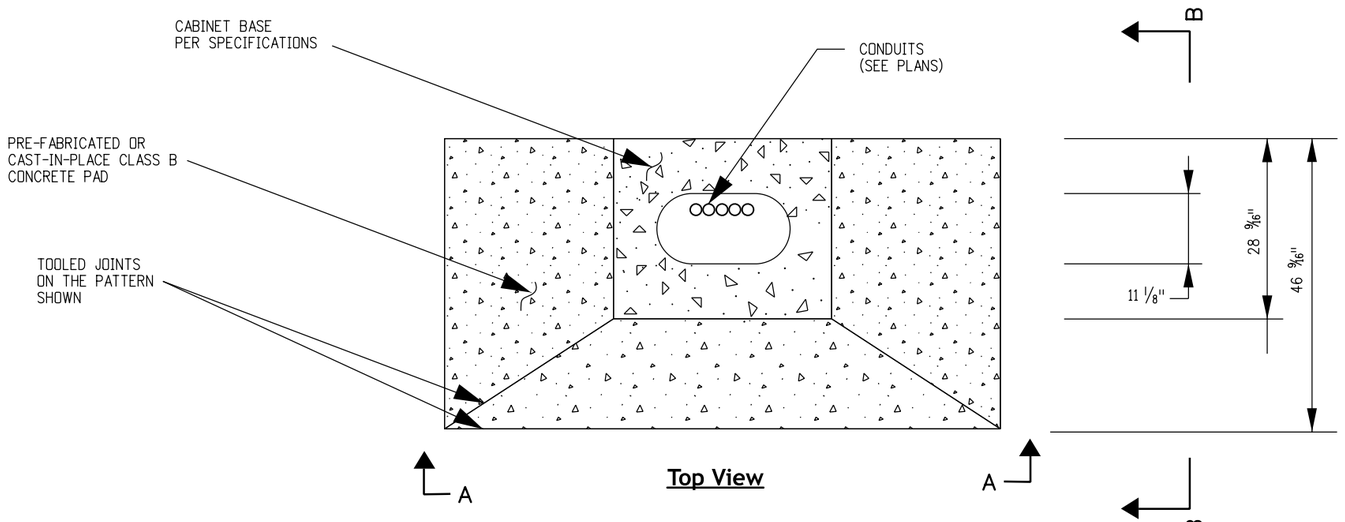
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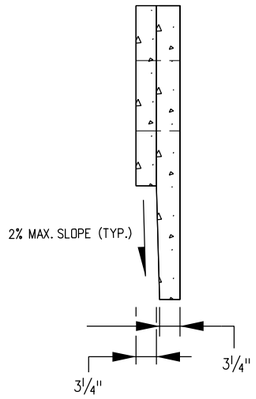
Cabinet Foundation Detail

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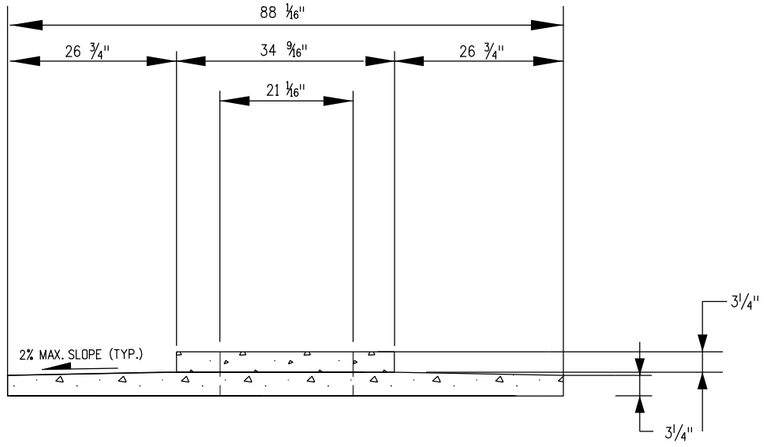
Standard Plan No.
S-614-42
Standard Sheet No. 2 of 4
Project Sheet Number:



Top View



Section B-B



Section A-A

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 3¼-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 fiberglass base at a maximum 2% slope.
3. The concrete pad surrounding the pre-fabricated or cast-in-place base shall be Class B mix. Glass or synthetic fibers shall be incorporated into the concrete mix. The dosage rate of the glass or synthetic fibers shall be the dosage rate recommended by the manufacturer of the glass or 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 the cost of the controller cabinet pay item.
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 332 - 334 controller cabinets shall be three (3) inches above surrounding grade.
6. Fiberglass base dimensions shown vary per manufacturer's specifications.

Foundation Details

For Model 332 through 334 controller cabinets

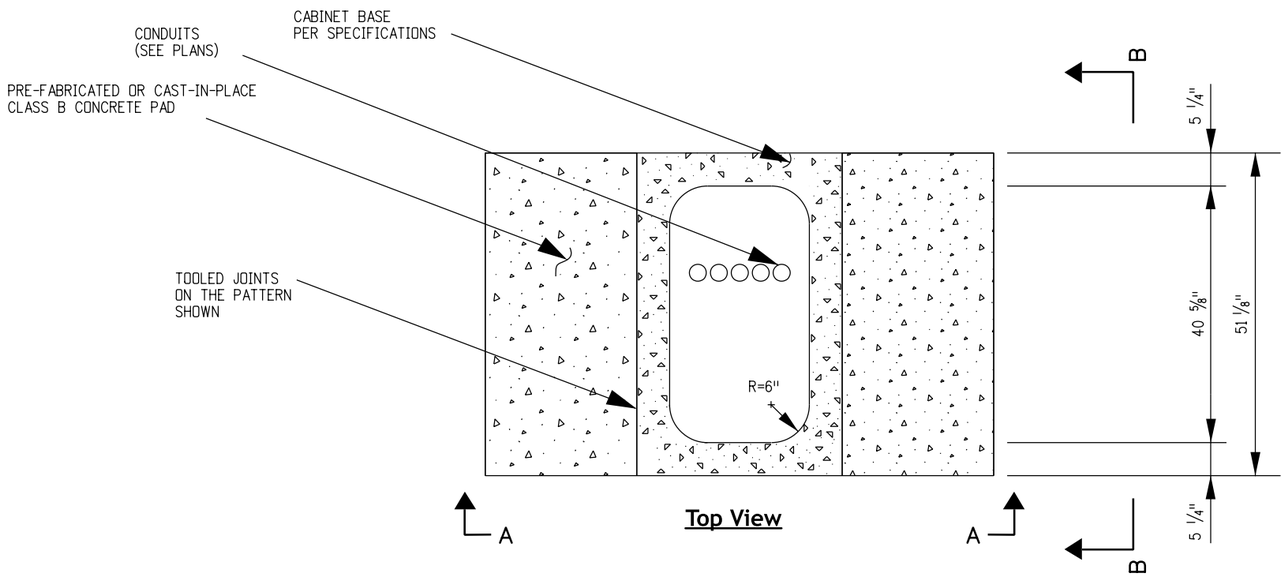
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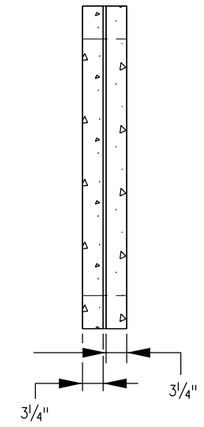
Cabinet Foundation Detail

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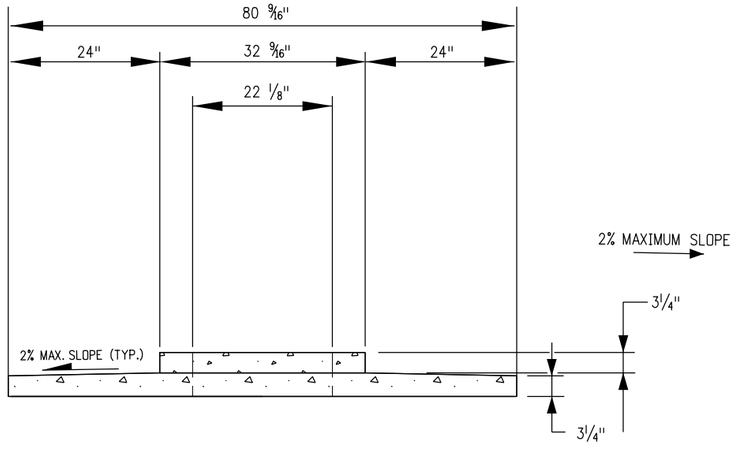
Standard Plan No.
S-614-42
Standard Sheet No. 3 of 4
Project Sheet Number:



Top View



Section B-B



Section A-A

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. Concrete shall place a 3¼-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 fiberglass base at a maximum 2% slope.
3. The concrete pad surrounding the pre-fabricated or cast-in-place base shall be Class B mix. Glass or synthetic fibers shall be incorporated into the concrete mix. The dosage rate of the glass or synthetic fibers shall be the dosage rate recommended by the manufacturer of the glass or 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 the cost of the controller cabinet pay item.
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. Fiberglass base dimensions shown vary per manufacturer's specifications.

Foundation Details

For Model 332D - 333JP cabinets

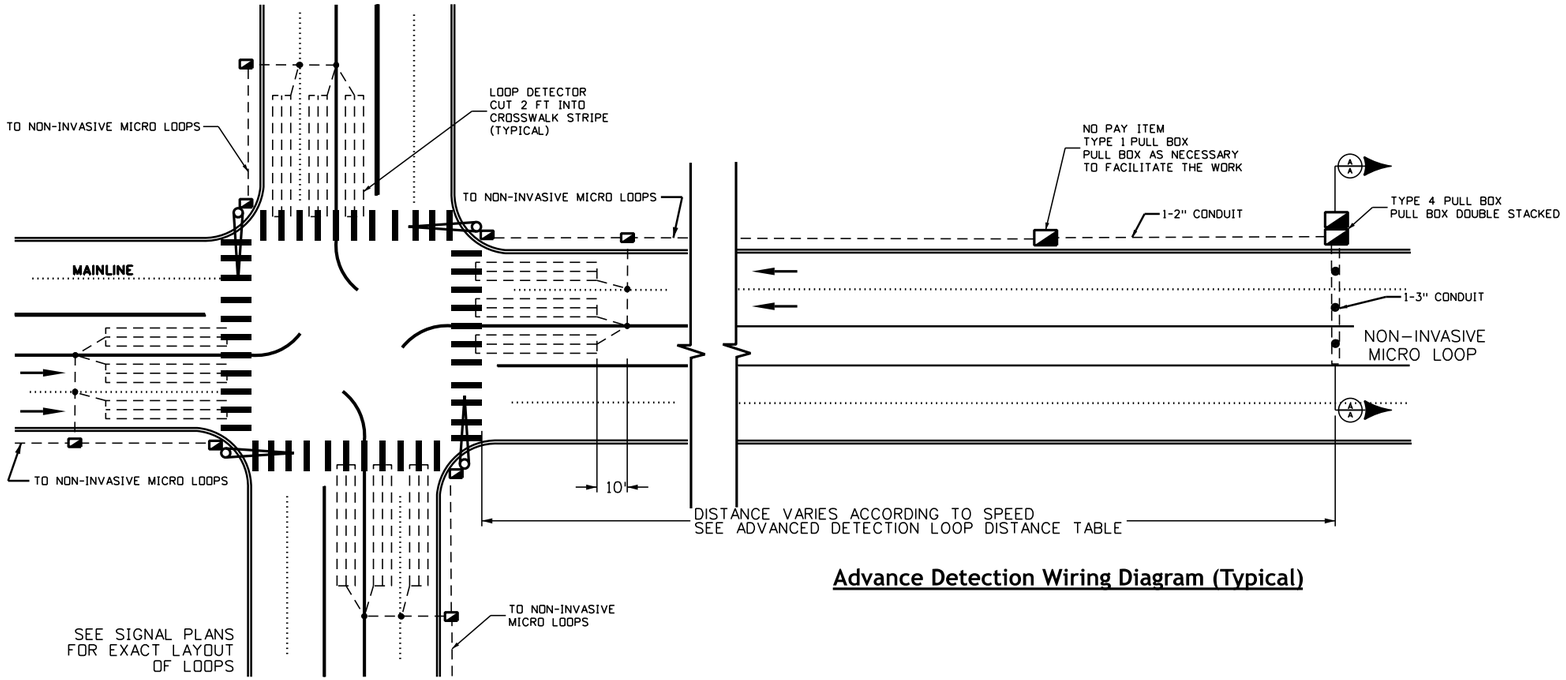
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Cabinet Foundation Detail

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Standard Plan No.
S-614-42
Standard Sheet No. 4 of 4
Project Sheet Number:



Advance Detection Wiring Diagram (Typical)

Advanced Detection Loop Distance Table

APPROACH SPEED		DISTANCE FROM INTERSECTION
MPH	KM/HR	FEET
35	56	254
40	64	284
45	72	327
50	80	353
55	88	386

Legend

Controller and cabinet.....

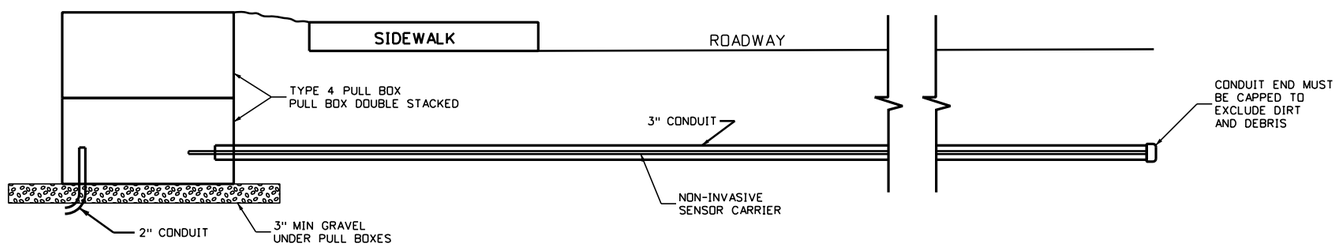
Electrical conduit and pull box.....

Loop detector.....

Pullbox (special).....

Micro detector.....

Intersection Detector Wiring Diagram (Typical)
(Not to scale)



Section A-A

Typical Detail
Non-Invasive Microdetector
(Dilemma Zone)

Notes

1. All pull boxes are not to be paid for seperately, 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 CDOT Region Traffic Engineers, two working days in advance.
4. See plans for actual lane configurations.

Computer File Information		Sheet Revisions	
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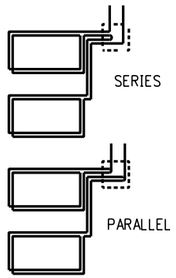
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Traffic Loop and Miscellaneous Signal Details

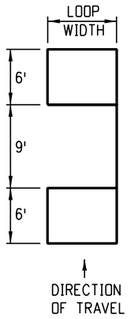
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-43
Standard Sheet No. 1 of 8
Project Sheet Number:

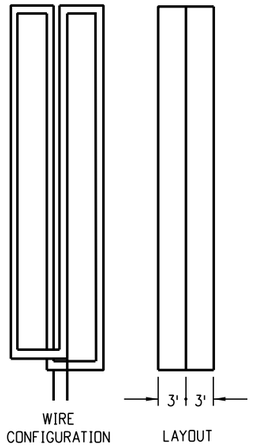
Wire Configuration



Layout



Standard Loop



Quadrapole Loop

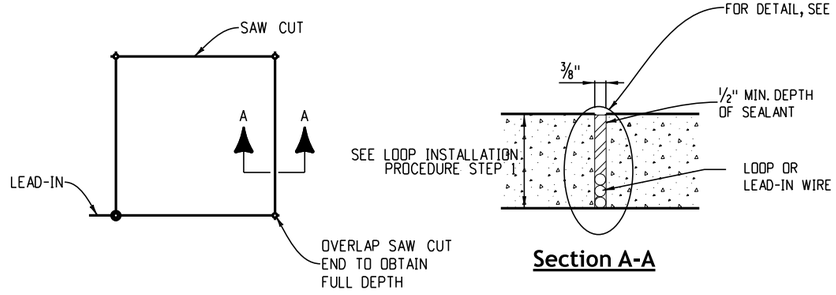
Standard Loop - Wiring and Connection Table

NO. OF LOOPS	WIDTH OF LOOP (FEET)									
	6	8	10	12	14	16	18	20	24-36	40+
1	4	3	3	3	3	3	3	3	2	2
2	3S	3S	3S	3P	2S	2S	2S	2S	2S	2P
3	3S	3S	2S	2S	3SP	3SP	3SP	3SP	2SP	2P
4	3SP	3SP	3SP	2SP	3SP	3SP	3SP	2SP	2SP	2SP

Turns per loop and type connection
(S = series, P = parallel)

Loop Installation Procedure

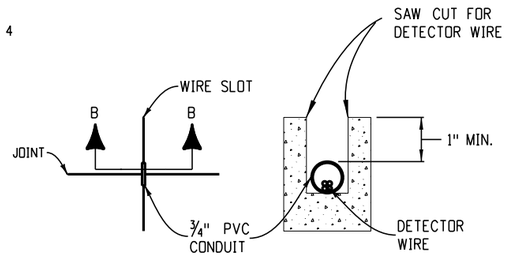
1. Cut slots in pavement to 3 inch minimum depth (4 inch minimum for ramp meters).
2. Clean and dry slots with oil-free compressed air.
3. One continuous length of 14/IC, RHW, USE, XLPE, RHWN or THW wire shall be used for each loop from signal base or pull box around the loop with the number of turns 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 lif of asphalt on mill and fill projects.
8. Seal slots as specified.



Section A-A

Vehicle Detector Loop Saw Cut Details

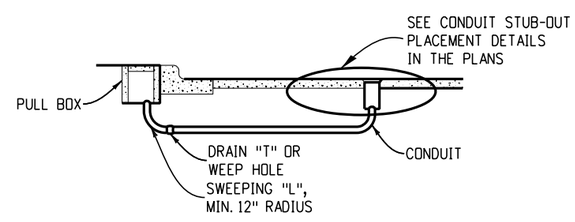
(For use with vinyl tubing encased loop detector wire)



Section B-B

Detector Wire Across Bridge Joints

Quadrapole loops shall be of the size shown unless otherwise on the plans.



Loop Detector Lead-In

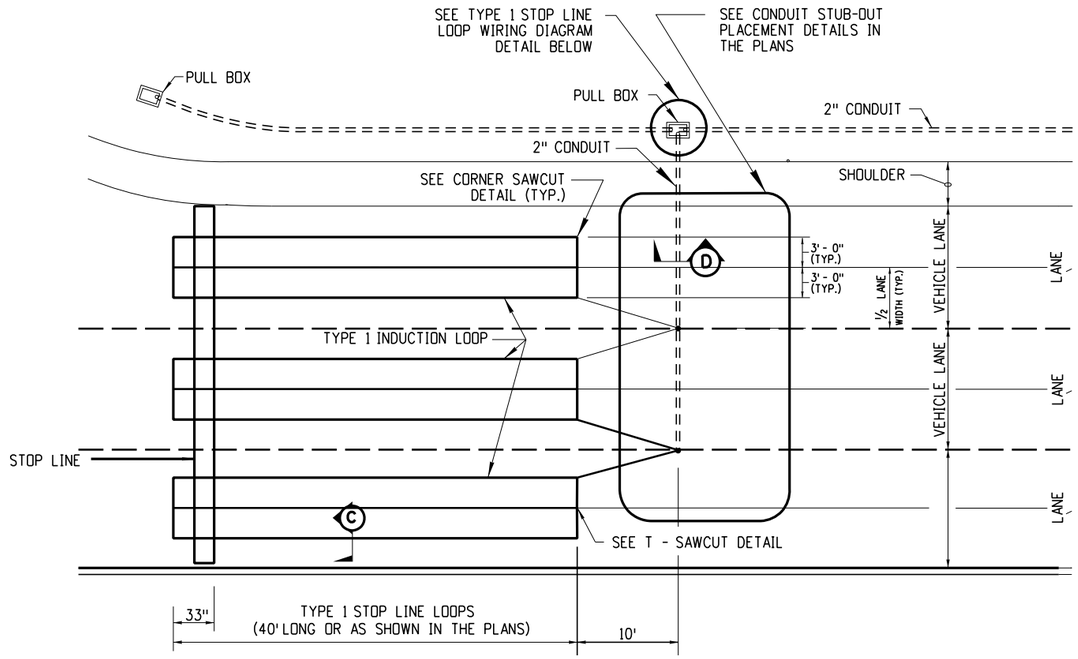
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CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

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Traffic Loop and Miscellaneous Signal Details

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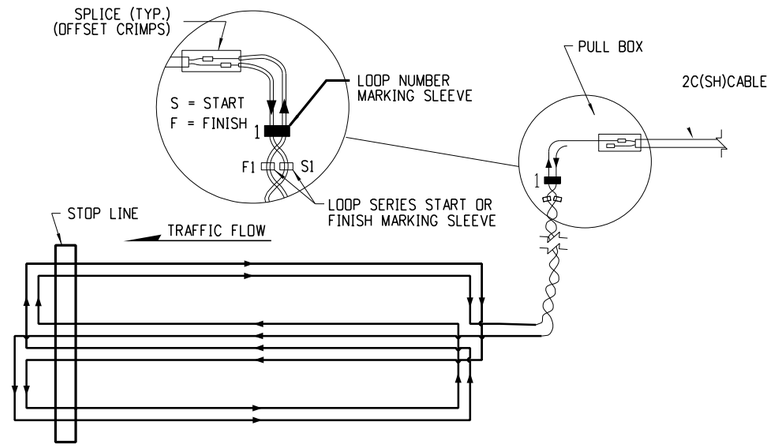
Standard Plan No.
S-614-43
Standard Sheet No. 2 of 8
Project Sheet Number:



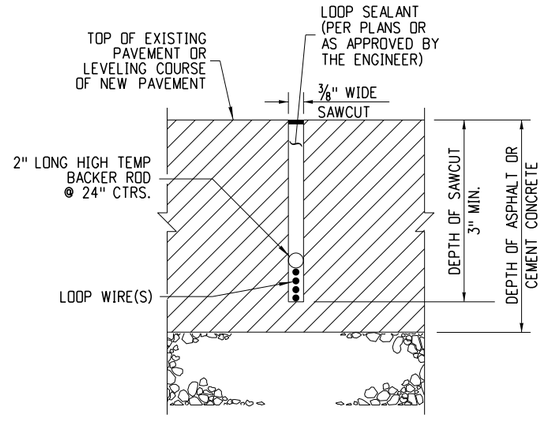
Type 1 Stop Line Loops - Plan View

Notes

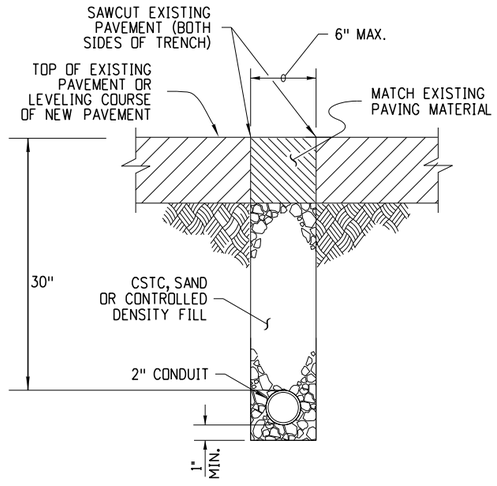
1. Twist lead-in cables all the way to pull box.
2. Splice lead-in in first pull box on side of the roadway.



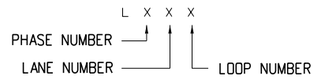
Type 1 Stop Line Loop Wiring Diagram



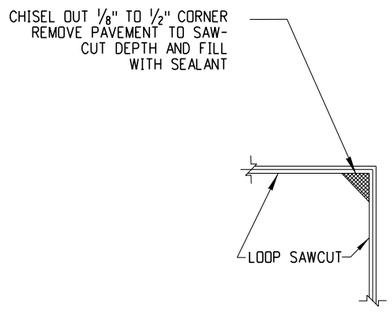
Section C-C



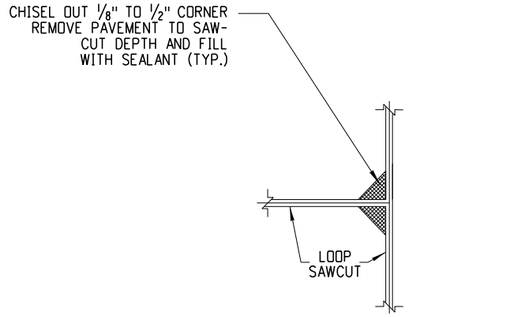
Section D-D



Loop Number Marking Detail



Corner Sawcut Detail



T - Sawcut Detail

Type 1 Induction Loop

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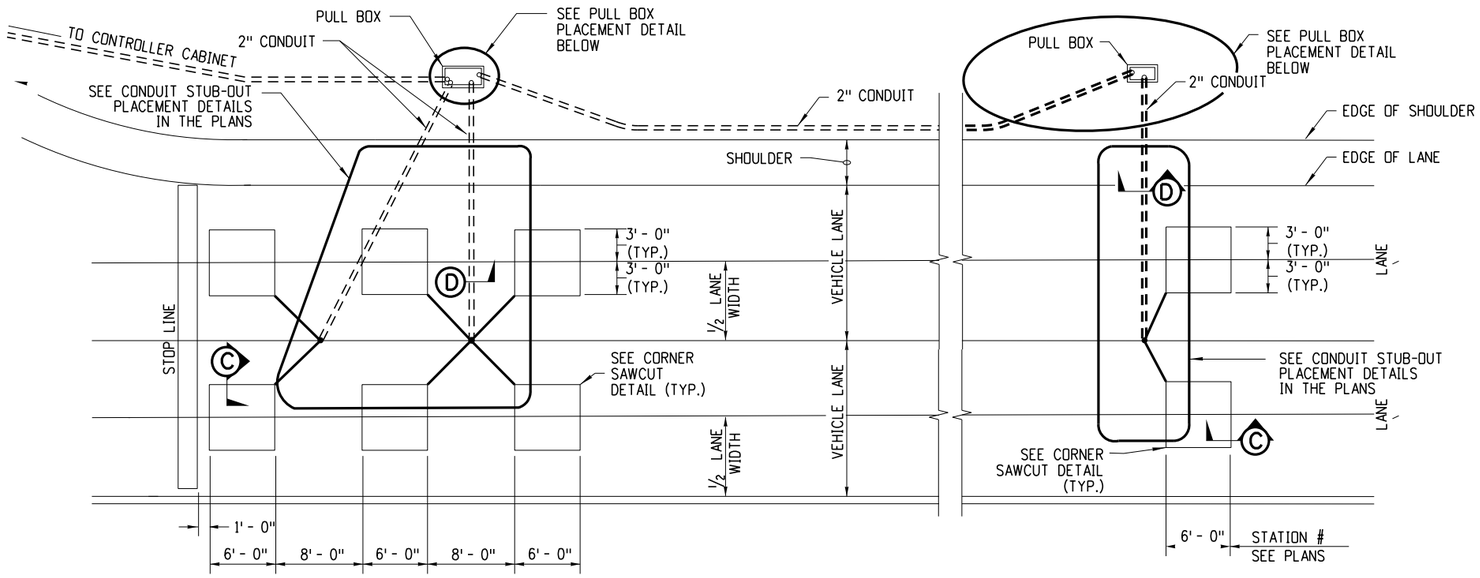
Traffic Loop and Miscellaneous Signal Details

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Standard Plan No.
S-614-43
Standard Sheet No. 3 of 8
Project Sheet Number:

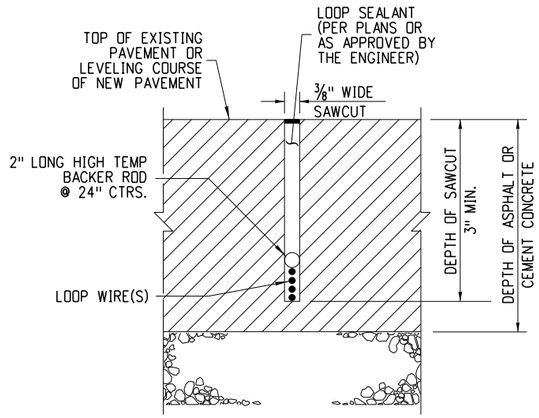
Notes

1. All of the loop lead-in wires shall return to the pull box.

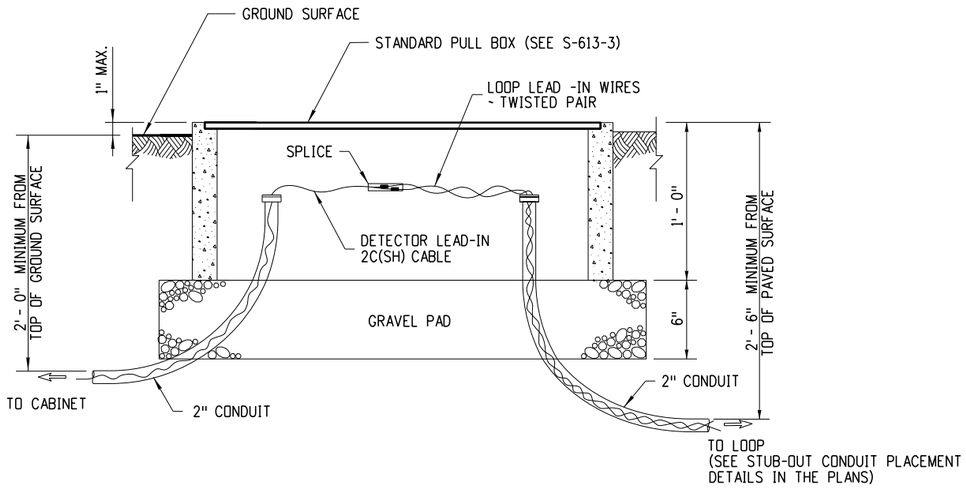


Type 2 Stop Line Loops

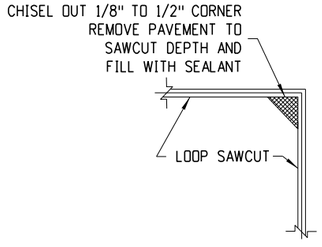
Type 2 Advance Loops



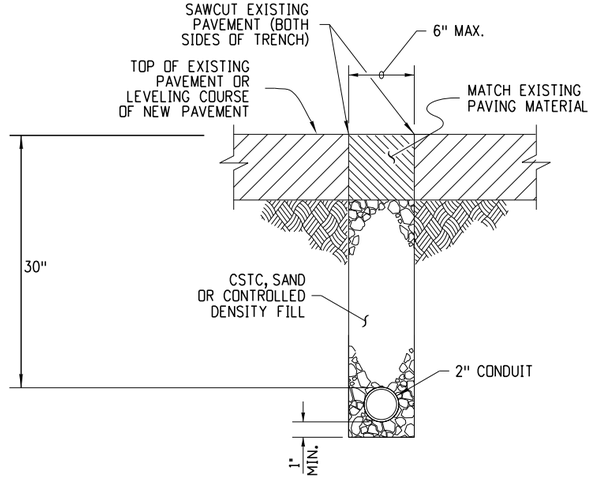
Section C-C



Pull Box Placement Detail



Corner Sawcut Detail



Section D-D

Type 2 Induction Loops (For conventional highways)

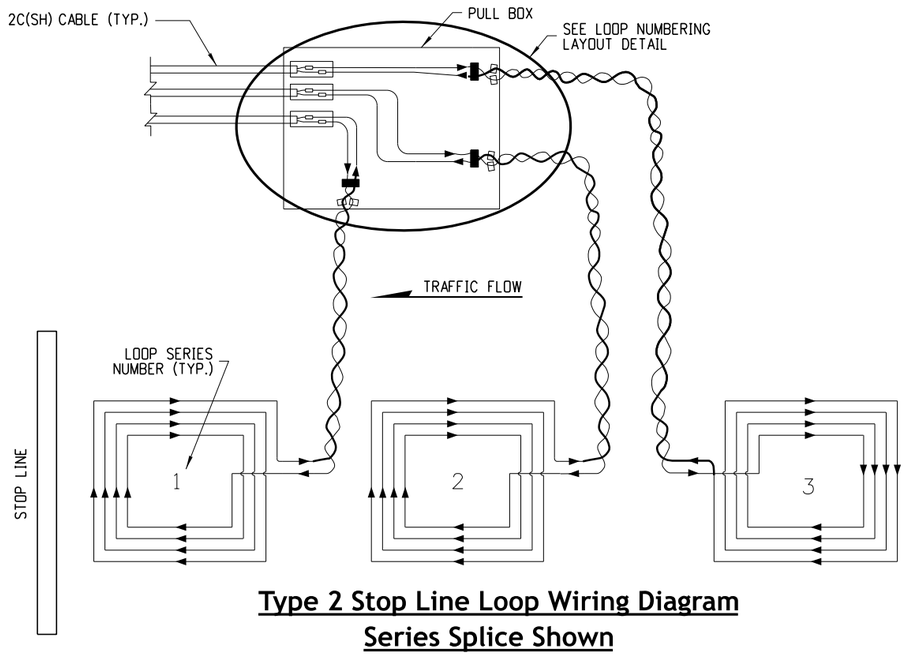
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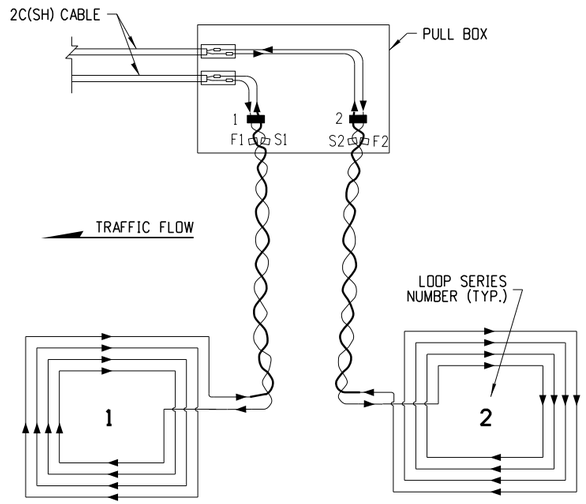
Traffic Loop and Miscellaneous Signal Details

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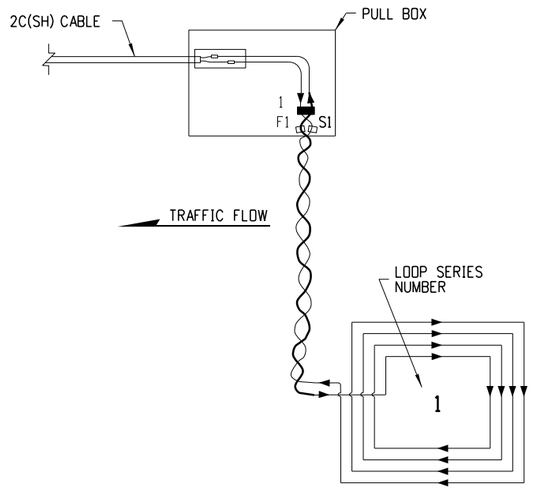
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S-614-43
Standard Sheet No. 4 of 8
Project Sheet Number:



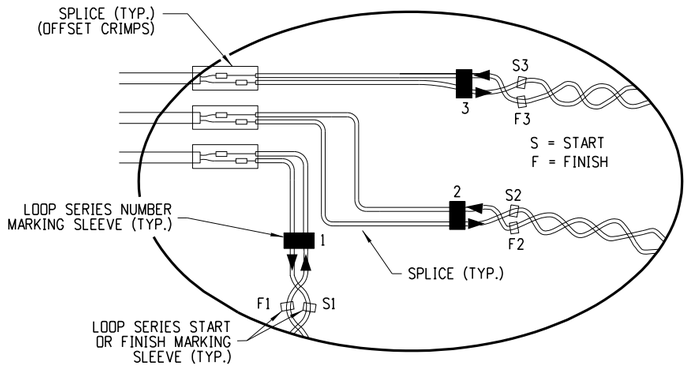
Type 2 Stop Line Loop Wiring Diagram
Series Splice Shown



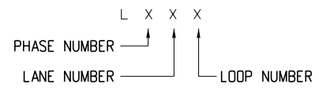
Type 2 Sampling Loop Wiring Diagram
Series Splice Shown



Type 2 Advance Loop Wiring Diagram



Loop Numbering Layout Detail



Loop Number Marking Detail

Notes

1. For wiring and conduit layout, see conduit stub-out placement detail in plans.
2. Splice lead-in in first pull box on the side of the roadway.

Type 2 Induction Loop

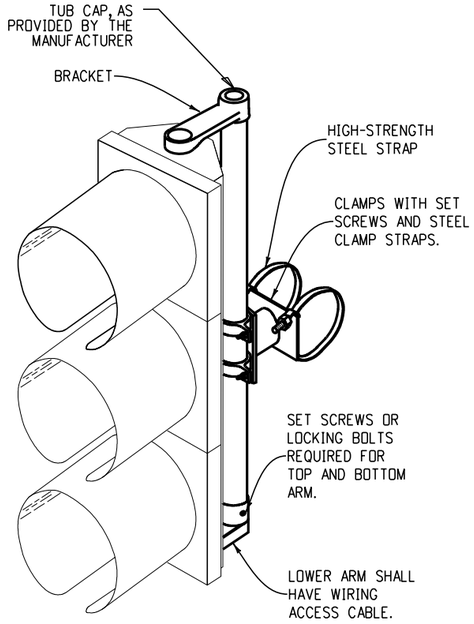
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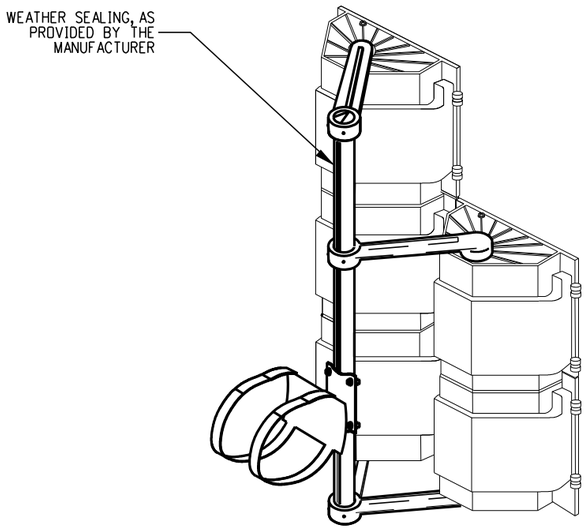
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Traffic Loop and Miscellaneous Signal Details

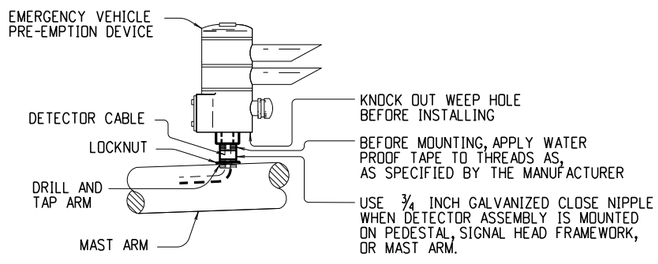
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Standard Plan No.
S-614-43
Standard Sheet No. 5 of 8
Project Sheet Number:





Astro-Type Mounting Bracket



Emergency Vehicle Pre-Emption Device Mounting Detail

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 S-614-20, using ¾ inch wide banding.
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 gasket 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.

Mast-Arm Mounting Brackets

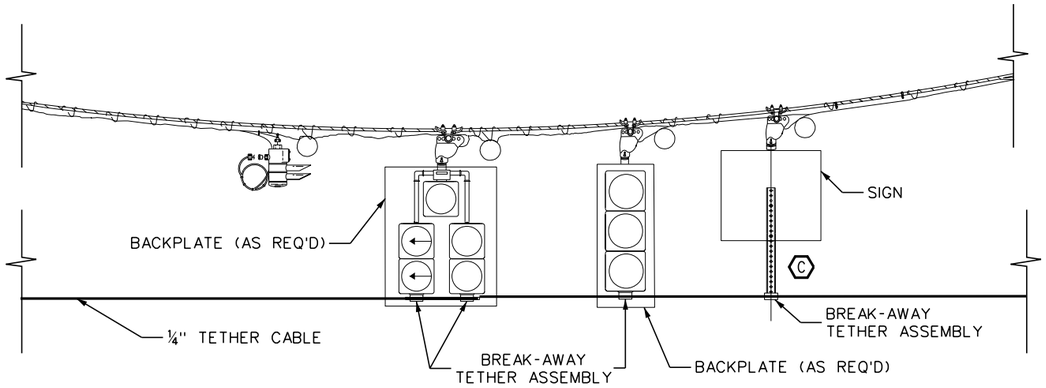
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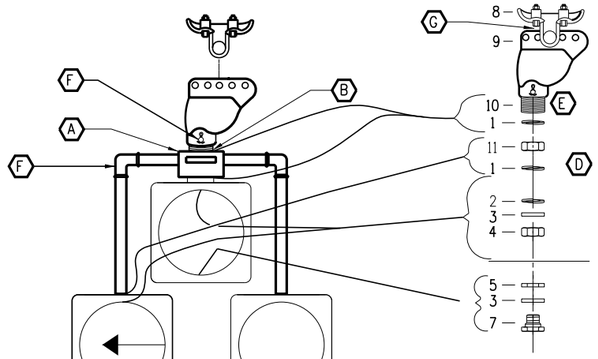
Traffic Loop and Miscellaneous Signal Details

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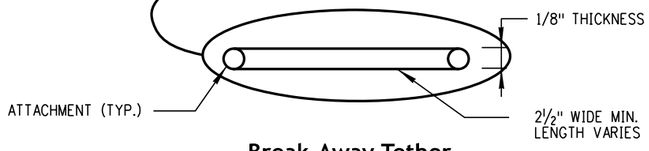
Standard Plan No.
S-614-43
Standard Sheet No. 6 of 8
Project Sheet Number:



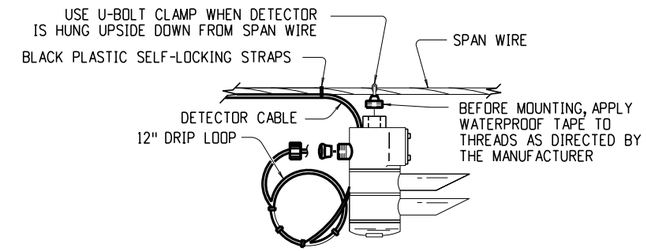
Span Wire Hanger Assembly Detail for Traffic Signals



Direct Assembly Detail



Break-Away Tether Assembly Detail



Span Wire Mounting Detail for Emergency Vehicle Pre-Emption Device

Legend

- (A) Top bracket center hub shall be minimum 3.5 inch square and 3 inches deep or equal volume. Serration cast in hub, tabbed or serrated lockring, openings shall be threaded.
- (B) Nipple length depends on span height.
- (C) Sign support bracket assembly shall utilize span wire clamp adjustment and be adjustable to accommodate varying span height. Tether support bar shall be attached to the sign using a minimum of two (2), 5/16 inch bolts, spaced a minimum of 6 inches apart.
- (D) Apply silicone caulk between or around serrated lockring and housing.
- (E) All thread
- (F) Setscrew (square or allen) on all fittings.
- (G) Install stainless steel washer on the inside of the cotter pin. Cotter pin and washer shall be on the side of the hanger away from the signal cables.

Item Description for Assembly Detail

1 - Serrated tabbed lockring, aluminum (tab must be full width of ring)

2 - Gasket, neoprene

3 - Washer, steel

4 - Hex nut, steel

5 - Conduit locknut, steel

6 - Bushing plastic (only in junction box or nippled down traffic signal)

7 - Octagonal cap, aluminum

8 - Span wire clamp

9 - Wire outlet body, steel, female only

10 - Nipple, steel

11 - Hex nut, steel, notched with setscrews

Span Wire Mounting Bracket Details

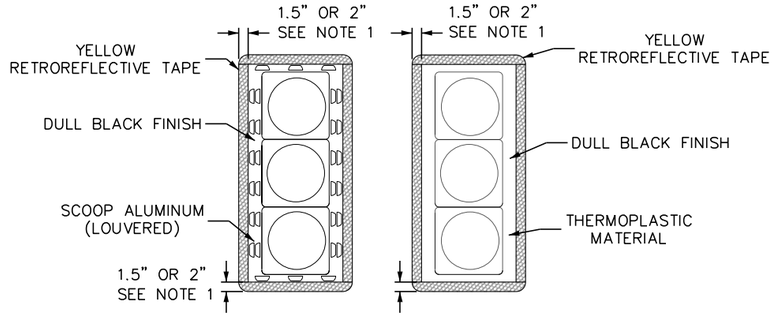
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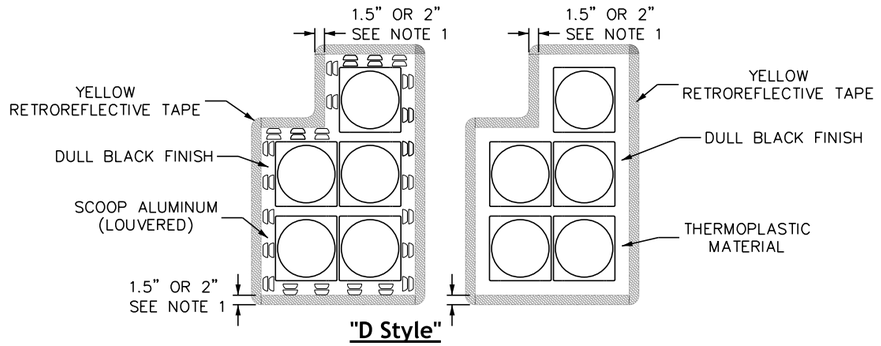
Traffic Loop and Miscellaneous Signal Details

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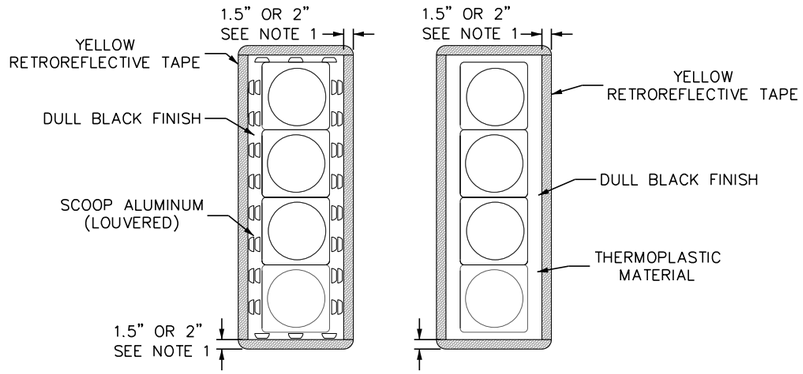
Standard Plan No.
S-614-43
Standard Sheet No. 7 of 8
Project Sheet Number:



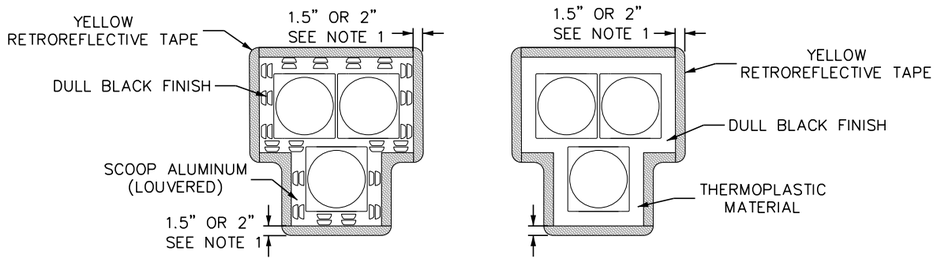
Three-Section Backplate with Retroreflective Borders



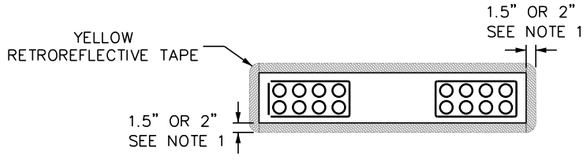
"D Style"
Five-Section Backplate with Retroreflective Borders



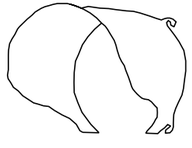
Four-Section Backplate with Retroreflective Borders



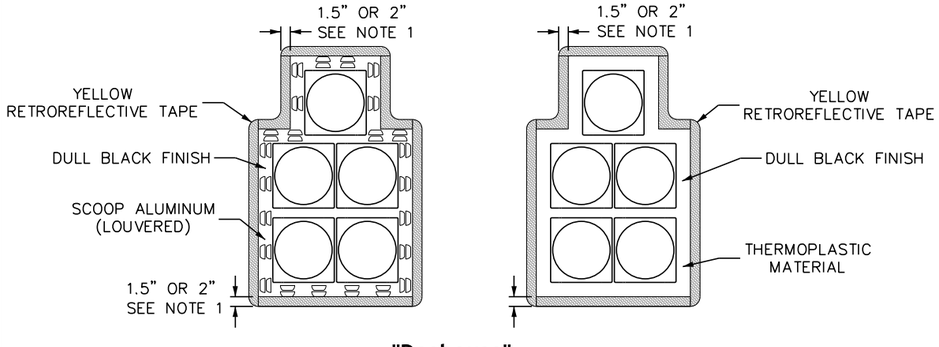
Pedestrian Hybrid Beacon Backplate with Retroreflective Borders



Rectangular Rapid Flashing Beacon with Retroreflective Borders



Traffic Signal Ball Cap Visor



"Doghouse" Five-Section Backplate with Retroreflective Borders

Notes

1. Retroreflective borders shall be 1.5 or 2 inches in thickness as shown in the project plans.
2. Traffic signal equipment shall obtain approval from the Engineer prior to ordering.
3. Retroreflective tape shall meet or exceed ASTM D4956 Type XI requirements.
4. Traffic signal backplates shall be installed at the locations shown in the project plans.
5. Traffic signal ball cap visors shall be installed with an identical color to the existing visors.
6. Traffic signal backplates may be field modified to fit to existing traffic signal heads.

Typical Installation
Backplates with Retroreflective Borders

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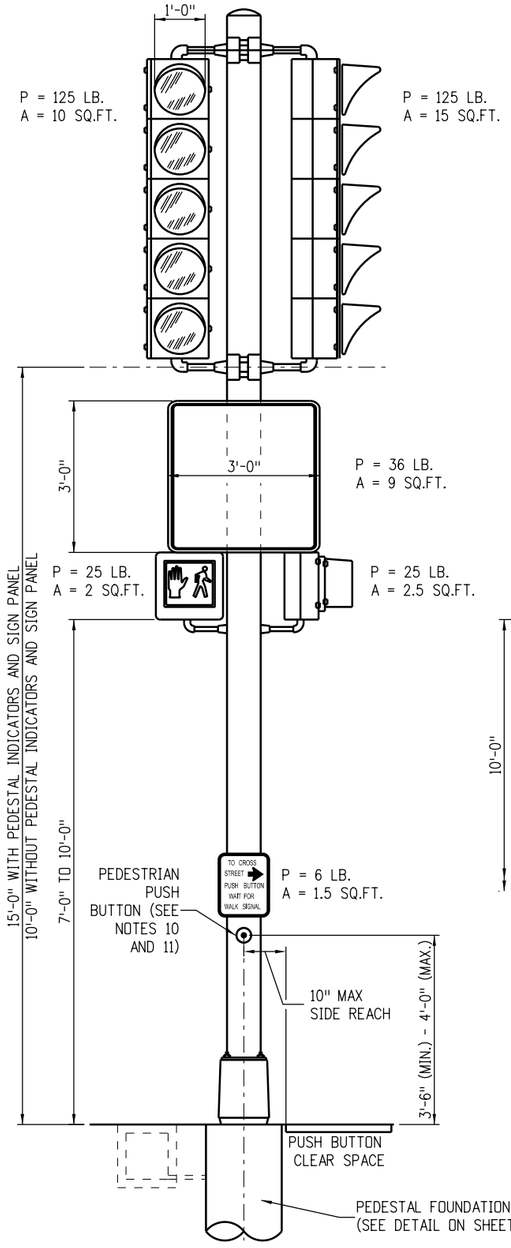
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Traffic Loop and Miscellaneous Signal Details

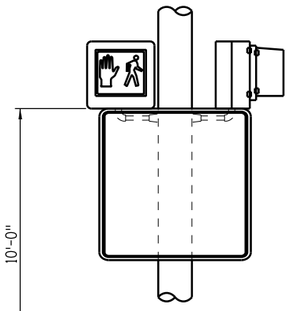
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Standard Plan No.
S-614-43
Standard Sheet No. 8 of 8
Project Sheet Number:

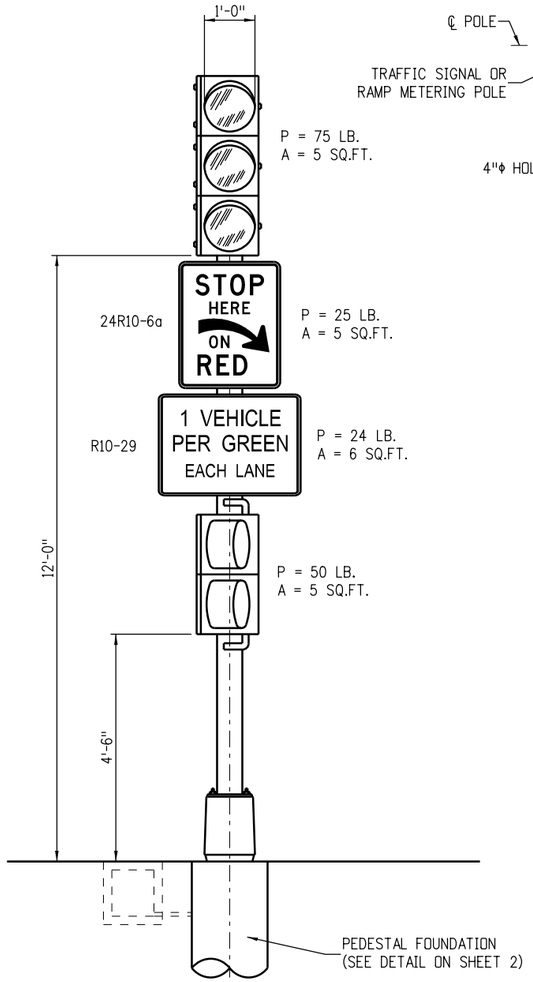
-Pedestal Pole Configurations-



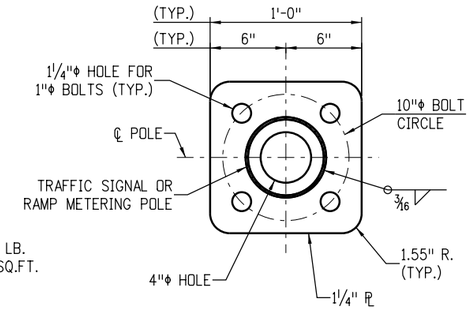
Traffic Signal
Pedestal Pole Detail



Optional
Sign Panel Location



Ramp Metering
Pedestal Pole Detail
(Left side installation shown)



Base Plate

Index

1. Pedestal pole installation
2. Pedestal pole foundation details

General Notes

1. All pedestal pole steel shall be ASTM A53 GRB 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 cabinets 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 inch 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 left side pole installation shall contain a right-pointing arrow. 24R10-6A for right side pole shall installation contain a left-pointing arrow. Typical special sign messages are "1 VEHICLE PER GREEN" for single-lane metered ramps, and "1 VEHICLE PER GREEN EACH LANE" 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 a pedestrian (10 inches or less and unobstructed in accordance with the Americans With 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-614-45 and "Section 4E.08 through 4I.05 - Pedestrian Detectors" in the 2023 MUTCD.
10. Pedestrian push button shall be within 10 inches reach distance of adjacent landing area.
11. Pedestrian push button shall be accessible by reaching to the side. If the button is not accessible by reaching to the side, the push button shall be placed on a separate push button post per Standard S-614-45.

Pole and Caisson Information

MEMBER	ATTRIBUTES AND LOADS	TRAFFIC SIGNAL POLE	RAMP METERING POLE
POLE	SIZE	6"ϕ SCH 40	4"ϕ SCH 40
	SERVICE MOMENT	14.72 k.ft.	4.23 k.ft.
	SERVICE SHEAR	0.97 kip	0.45 kip
CAISSON	SIZE	SEE SHEET 2	SEE SHEET 2

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Pedestal Pole Signals

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-44
Standard Sheet No. 1 of 2
Project Sheet Number:

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.
6. Integrity testing per 503 not required.

Design Data

Caisson concrete:
Class BZ concrete: f'c = 4,000 psi
Reinforcing steel: fy = 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, γ = 110 pcf
Soil ϕ angle = 30°
SF = 1.25 for flexural resistance

Medium Stiff Cohesive Soil:
Soil density, γ = 110 pcf
Soil cohesion = 750 psf
SF = 1.25 for flexural resistance

Contact the Engineer if any of the following soil conditions are encountered during drilling:

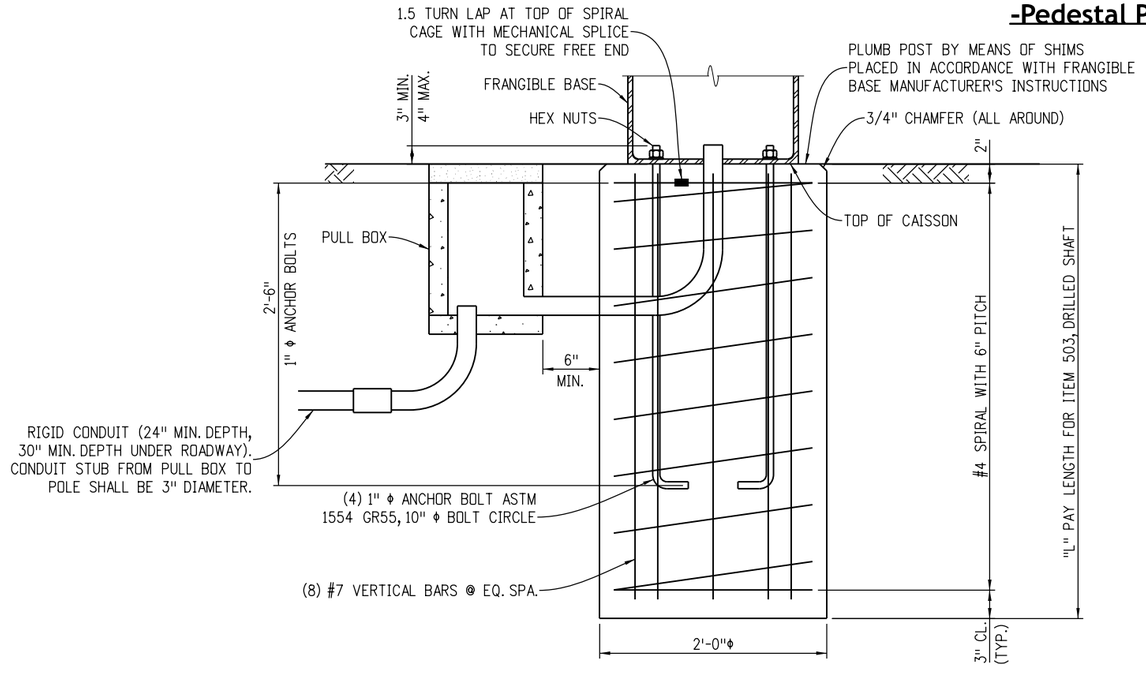
(A) Signals will not be installed within the roadway prism.
(B) The soil has a high organic content or consists of saturated silt and clay.
(C) The site won't support the weight of the drilling rig.
(D) The foundation soils are not homogenous.
(E) Firm bedrock is encountered.

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.

Stability analysis includes soil support acting on uppermost 1.5xd of shaft length (d = dia of shaft).

-Pedestal Pole Foundation Details-



Pedestal Pole Caisson

Caisson Data Table

	TRAFFIC SIGNAL PEDESTAL POLE CAISSON	RAMP METERING PEDESTAL POLE CAISSON
"L"	4'-8"	3'-2"
PAY LENGTH	5'-0"	3'-6"

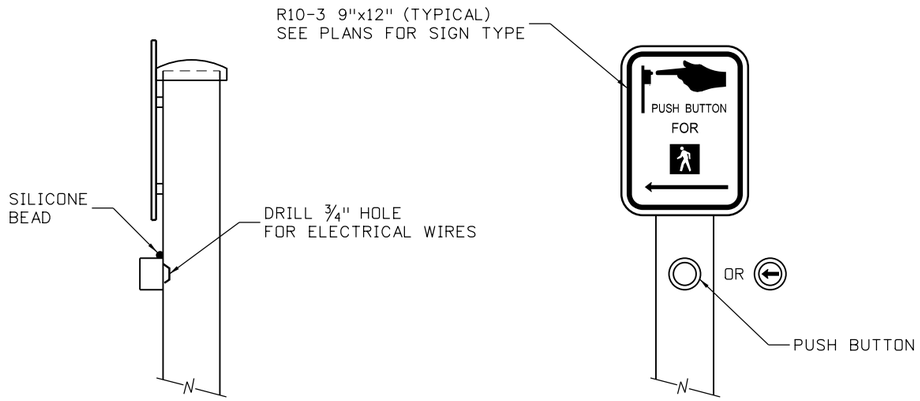
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Pedestal Pole Signals

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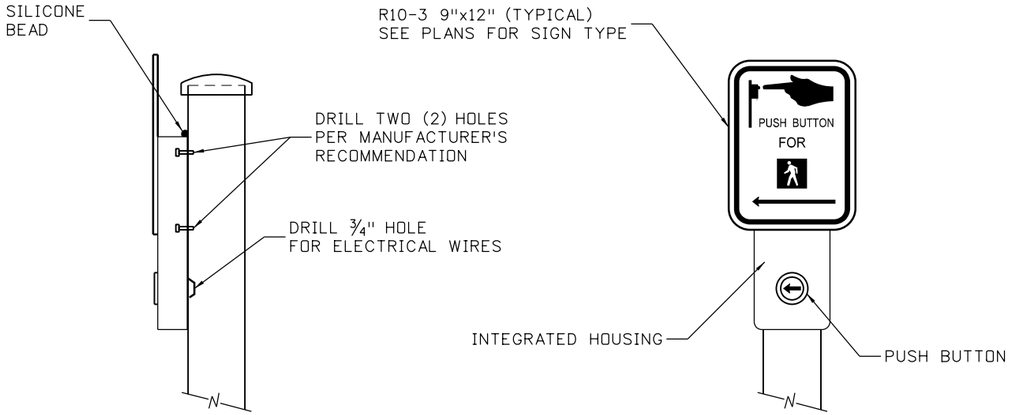
Standard Plan No.
S-614-44
Standard Sheet No. 2 of 2
Project Sheet Number:



Side View **Front View**

Push Button and Sign Detail

Pedestrian Push Button

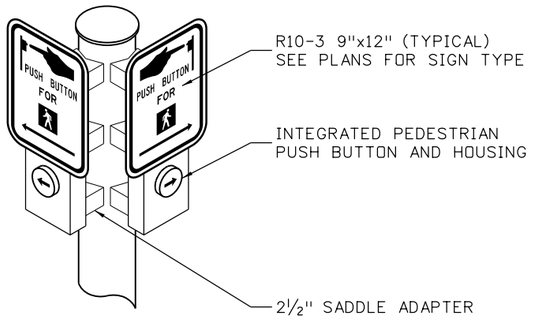


Side View **Front View**

Integrated Housing Detail

General Notes

1. Pedestrian push button shall utilize piezo switch technology. The actuator color shall contrast with the housing or mounting. If a tactile arrow is provided, the tactile arrow shall be part of the actuator and shall contrast with the background.
2. Accessible pedestrian signal shall integrate a pedestrian push button into its housing. The actuator color shall contrast with the housing and shall vibrate during the walk interval. A contrasting tactile arrow shall be part of the actuator.
3. Accessible pedestrian signal dual mount applications shall include the required amount of 2½-inch saddle adapters and all hardware to facilitate the work in addition to the items identified in Note 2. The saddle adapter hardware is specific to the installed accessible pedestrian signal.
4. Pedestrian push button post assembly shall include aluminum shaft, push button base, hardware, any addtional mounting/saddle brackets not identified in Notes 1 and 3, wiring, concrete, and all other items necessary to complete the work.
5. Signs shall be included in the cost of either "Pedestrian Push Button" or "Accessible Pedestrian Signal" (to which the sign is installed for).
6. Pedestrian push button, accessible pedestrian signal, and the location of the pedestrian push button post assembly shall be ADA compliant and meet the provisions found in Sections 4I.05 through 4I.06 of the MUTCD.
7. Install all signs, pedestrian push buttons, and accessible pedestrian signals per the Manufacturer's installation recommendations.
8. Apply anti-seize compound to all bolts prior to assembly.
9. Apply a bead of 100% silicone sealant along the push button unit where it comes in contact with the 4" aluminum shaft (or saddle brackets) and along the push button base where it comes in contact with the concrete.
10. Every effort should be made to install pedestrian push buttons (or accessible pedestrian signals) on separate poles. The "Dual Mount Detail" should only be utilized when all other efforts have been exhausted and must, in-turn, adhere to Notes 12 and 13 found on Sheet 4 of this standard.
11. Accessible pedestrian signal request forms, which are requested locally due to a visual impairment, can be obtained by reaching out to CDOT's Civil Rights & Business Resource Center.



Dual Mount Detail
(Alternate)

Accessible Pedestrian Signal

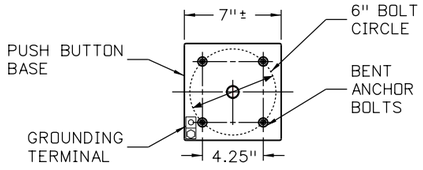
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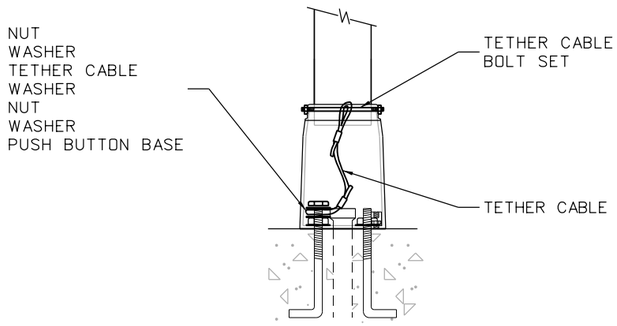
Pedestrian Push Button Post Assembly Details

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Standard Plan No.
S-614-45
Standard Sheet No. 1 of 6
Project Sheet Number:



Anchor Rod Placement



Tether Detail

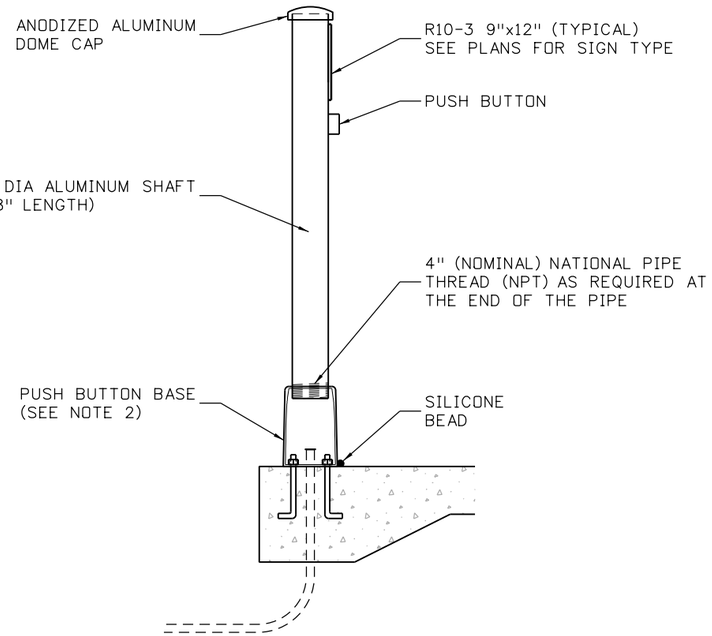
Notes

1. Posts shall be Schedule 40 aluminum and painted (if necessary) with the color specified in the plans according to the Manufacturer's recommendations.
2. Approved push button bases are listed on CDOT's Approved Products List website under 'Traffic Control\Signal'.
3. All electrical conduit shall be PVC Schedule 80.
4. Grounding wire shall be #10 AWG (minimum) copper and laid in the 2 inch PVC conduit. Terminate grounding wire to the signal grounding system in pullbox.
5. Post assemblies shall be tethered to an anchor bolt. Follow the Manufacturer's installation recommendations.
6. Apply anti-seize compound to all bolts prior to assembly.
7. Bent anchor bolts shall be embedded into new concrete.
8. Concrete shall be Class B or match the proposed sidewalk/curb concrete Class Type as specified in the plans.

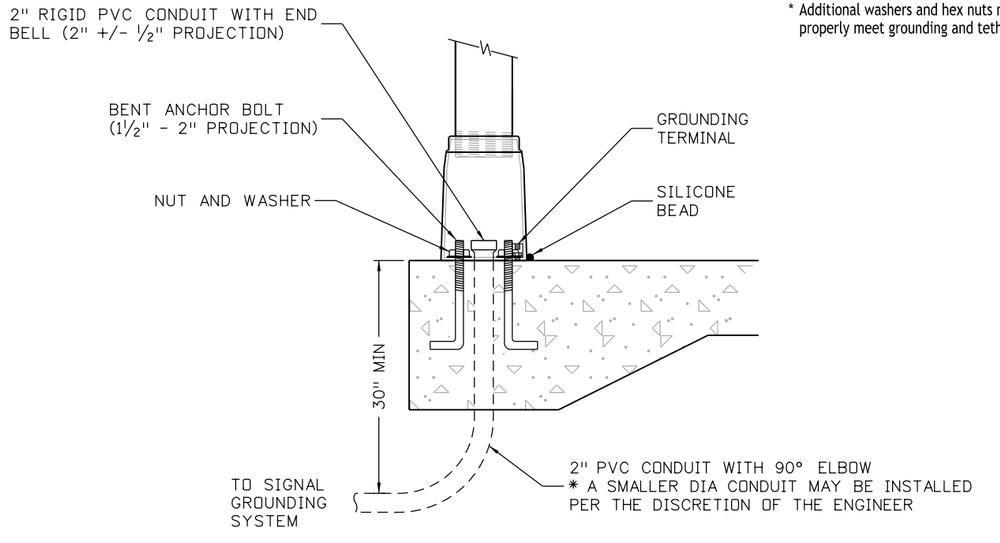
Anchor Rod Mounting Hardware

4 ea - ⅝" x 8"	A449, Type 1, Galvanized Bent Anchor Bolt
4 ea - ⅝"	A563DH Heavy Hex, Galvanized Hex Nut
4 ea - ⅝"	F436 Washer

* Additional washers and hex nuts may be required to properly meet grounding and tethering requirements.



Pedestrian Push Button Post Assembly



Pedestal Base Detail

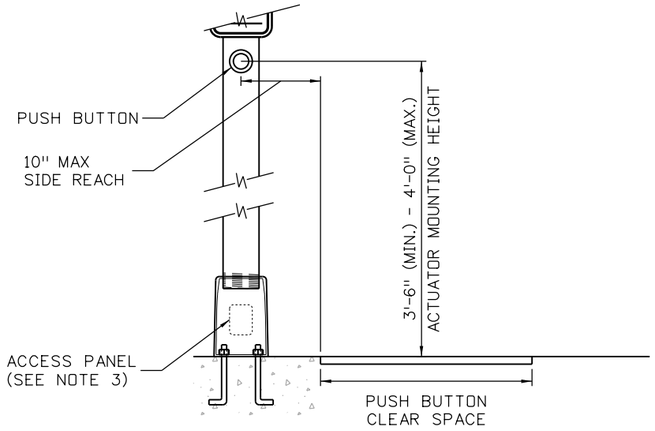
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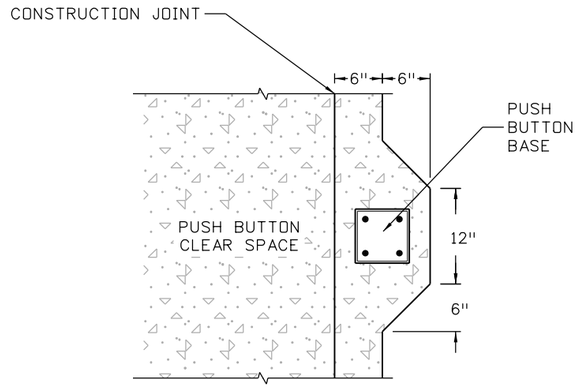
Pedestrian Push Button Post Assembly Details

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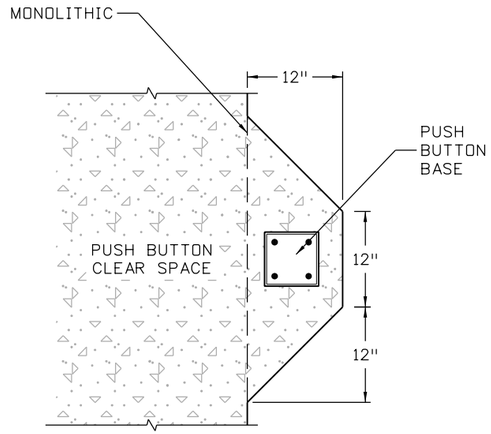
Standard Plan No.
S-614-45
Standard Sheet No. 2 of 6
Project Sheet Number:



Front View



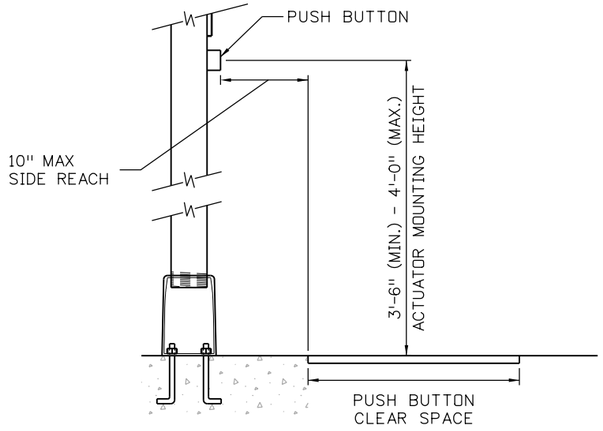
Plan View



Plan View

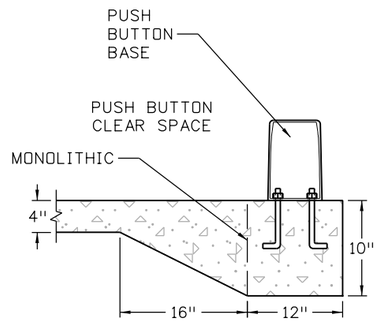
Notes

1. 10 inches is the maximum side reach allowed. The pedestrian push button shall be located as close as possible to the push button clear space.
2. Bent anchor bolts shall maintain a minimum clear cover from the edge of concrete for the following installation conditions:
   - 2 inch clear cover for installations utilizing formwork
   - 3 inch clear cover for installations against earth
3. The access panel should be located on the opposite side of the push button base in relation to the pedestrian push button. If there is not 3 feet of access room behind the panel, locate the access panel below the pedestrian push button.



Side View

Profile View



Profile View

Push Button Location Detail

In-Curb Installation

Sidewalk Adjacent Installation

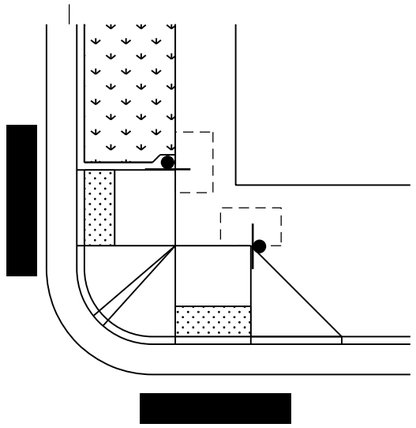
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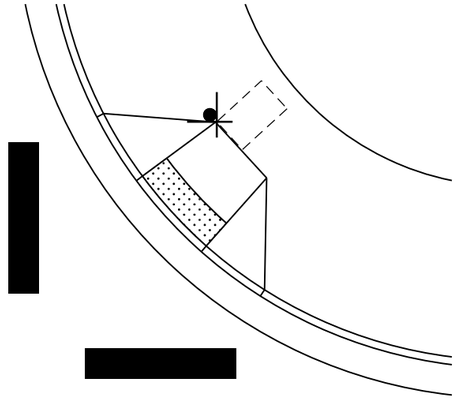
Pedestrian Push Button Post Assembly Details

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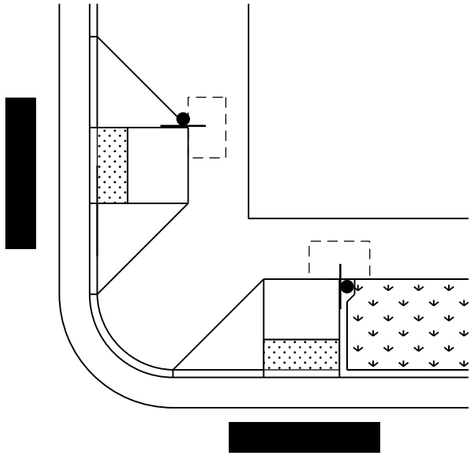
Standard Plan No.
S-614-45
Standard Sheet No. 3 of 6
Project Sheet Number:



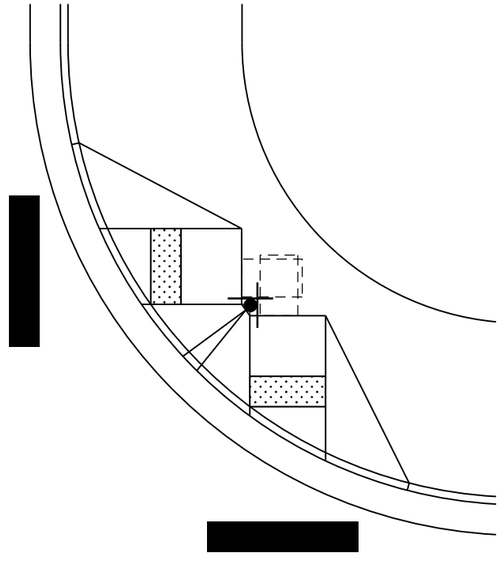
Type 1 Ramps For Wide Sidewalk



Type 1 Ramp



Type 1 Ramps For Wide Sidewalk



Type 1 Directional Ramps

Notes

1. Pedestrian push button post assemblies shown on Sheets 4 through 6 are recommended locations. If the recommended locations are not feasible, see Notes 6, 7 & 8 for alternate location placements.
2. See Standard M-608-1 for all slope, length, allowable use, and other requirements for curb ramps.
3. A clear space shall be provided adjacent to the pedestrian push button. The clear space shall measure 2.5 feet (minimum) in width and 4 feet (minimum) in the direction of pedestrian travel.
4. The clear space shall have a running slope consistent with the grade of the adjacent pedestrian access route and a cross slope of 2.0% maximum. Placement of the pedestrian push button post assembly at the corner of the clear space is acceptable as long as the side reach and mounting height are met. However, best practice should be to locate the pedestrian push button post assembly in the middle of the 4 foot clear space dimension to better facilitate side reach.
5. Mounting height of the pedestrian push button shall be between 42 and 48 inches.
6. The pedestrian push button shall be located as close as possible to the push button clear space. 10 inches is the maximum side reach allowed.
7. The pedestrian push button post assembly should be placed between 1.5 and 6 feet from the edge of curb, shoulder, or pavement. Where there are constraints that make it impractical to meet this distance, it should not be placed farther than 10 feet from the edge of curb, shoulder, or pavement. Pedestrian push button post assemblies shall not obstruct the required 4 foot pedestrian access path.
8. The pedestrian push button post assembly shall be placed within 5 feet of the edge of crosswalk/crossing.
9. Mount the pedestrian push button, the sign, and/or sign housing so that the face is parallel with the associated crosswalk/crossing.
10. Screw the shaft to a tightened position before mounting the pedestrian push button unit to the shaft.
11. Plumb the pedestrian push button post assembly with leveling shims.
12. Two push buttons on the same corner should be separated by 10 feet. Where there are physical constraints on a particular corner that make it impractical to provide this separation, the push buttons may be placed closer together or on the same pole.
13. When two push buttons are separated by less than 10 feet, accessible pedestrian signals shall be installed and the speech walk message shall be activated.

Legend

Pedestrian Push Button Post Assembly

Clear Space (2.5' X 4') (minimums)

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Pedestrian Push Button Post Assembly Details

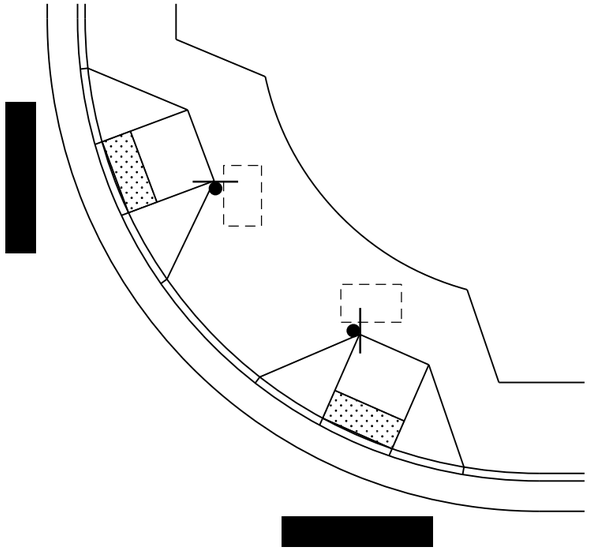
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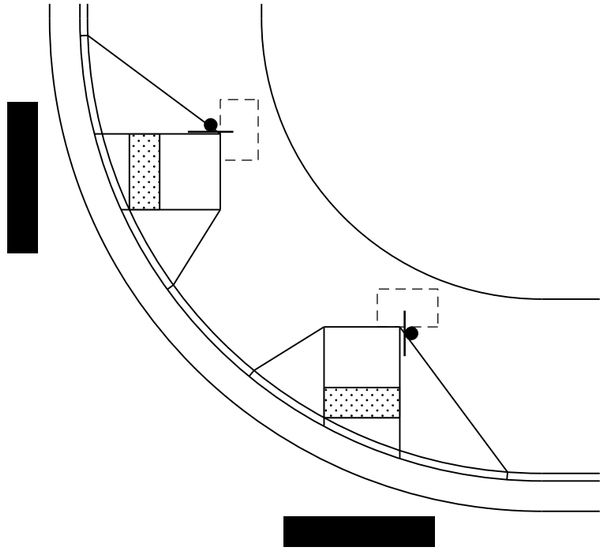
S-614-45

Standard Sheet No. 4 of 6

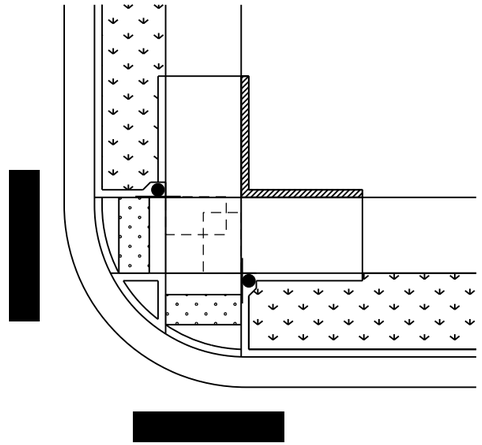
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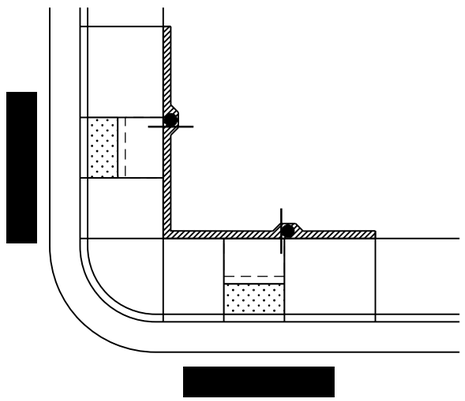
Type 1 Perpendicular Ramps



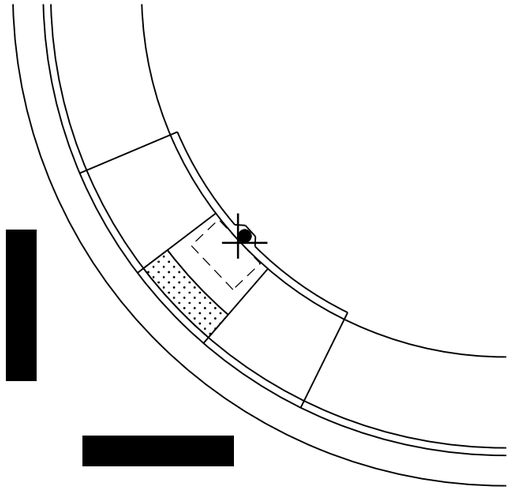
Type 1 Directional Ramps



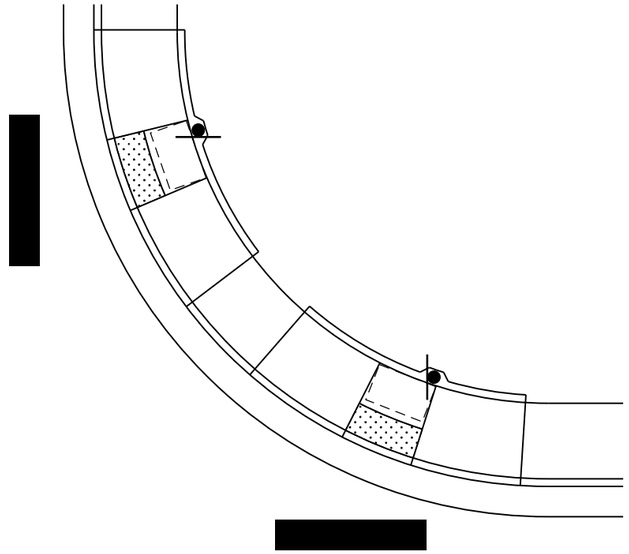
Type 1 Combination Ramp



Type 2 Ramps Small Radius



Type 2 Ramp (Diagonal)



Type 2 Ramps Large Radius

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Pedestrian Push Button Post Assembly Details

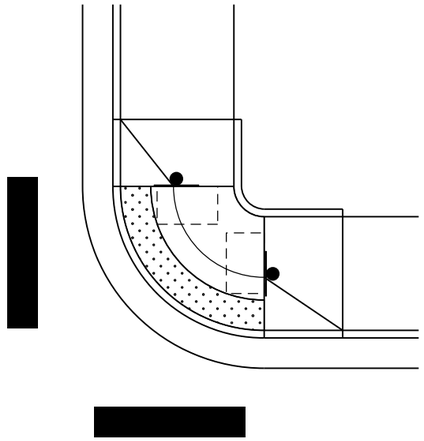
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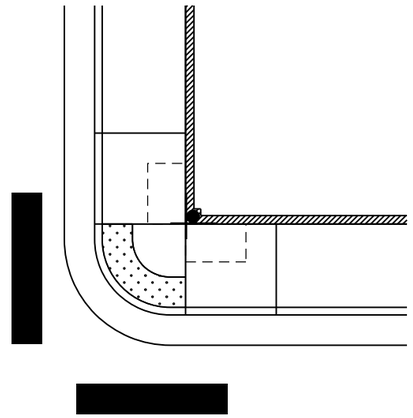
S-614-45

Standard Sheet No. 5 of 6

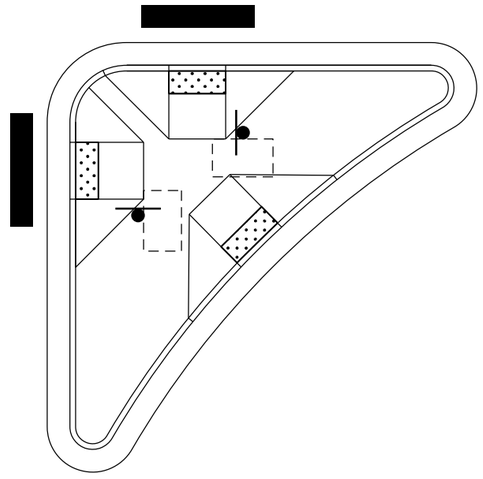
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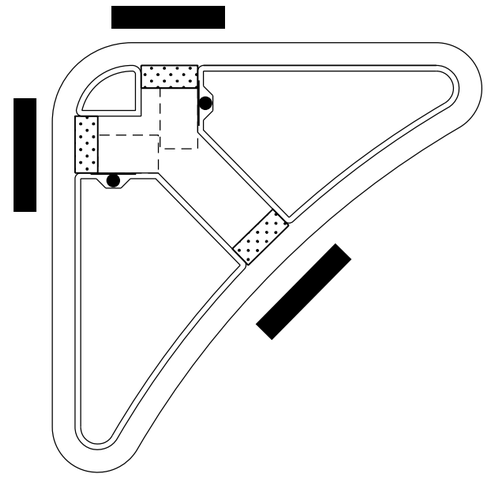


Blended Transition



Depressed Corner





Intersection Islands

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Pedestrian Push Button Post Assembly Details

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Standard Plan No.

S-614-45

Standard Sheet No. 6 of 6

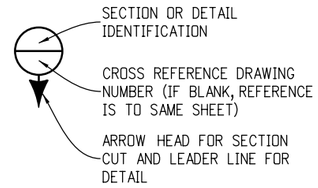
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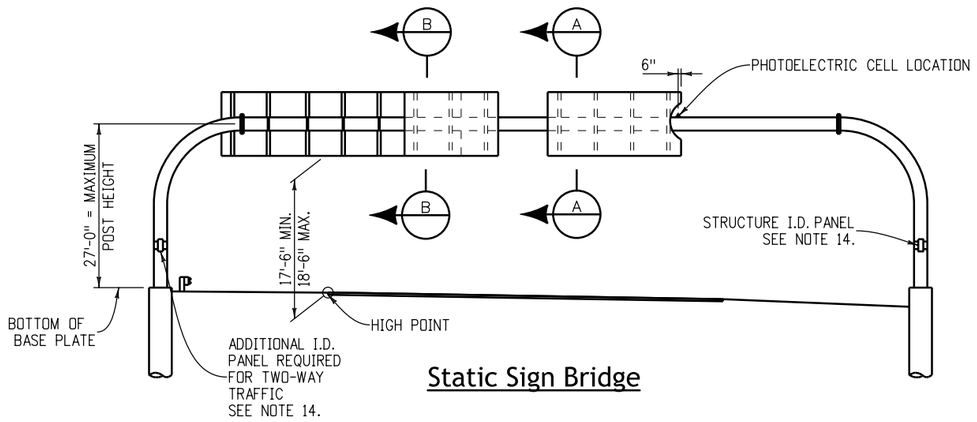
General Notes

1. All structural steel shall conform to the requirements shown in the materials table on Sheet 2.
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 sections shall be assembled in the shop and shall be checked for straightness, alignment, and dimensional accuracy. Any variations shall be corrected to the satisfaction of the Engineer.
3. Mast arms shall be temporarily supported to take all load off of the field splices while bolts are being tightened in order to firmly seat the flange plates.
4. Posts for tubular sign structures shall be formed to the radii 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 509.28 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.
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 A123. Painting shall conform to Section 522, Duplex Coating System. Steel mountings for light fixtures and all nuts, bolts and washers for sign structures shall be galvanized after fabrication per ASTM A123 or ASTM A153, 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 B695, coating Class 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.
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; OD = Outside Diameter.
13. Shop drawings shall be submitted to the Engineer for review in accordance with ssubsection 105.02 of the Standard Specifications.
14. Install structure identification panel in accordance with M and S Standard S-614-12 using two ½ inch wide stainless steel bands and stainless steel flared leg brackets with hex head bolts (Band-It D315 or equivalent)
15. Caisson steel supports and survey work shall be paid for in accordance with bid items 503, 614 and 625 respectively.
16. Cantilever arms marked with a ▲ must be level or tilted upward no more than 1° maximum after installation of the sign.
17. There shall be no penetrations of the tube members other than as shown in these plans unless approved by the Engineer prior to fabrication.

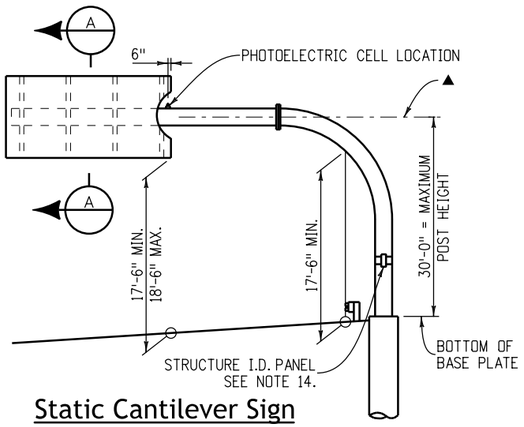
Index

1. Sign Notes (1 of 2)
2. Sign Notes (2 of 2)
3. Cantilever Installation Detail ■
4. Sign Bridge Installation Details ■
5. Sign Mounting Bracket Details
6. Post and Arm Details
7. Field Splice Details
8. Base Plate/Anchor Bolt Details
9. Sign Lighting Details
10. Cantilever Sign Pipe Selection Tables ■
11. Sign Bridge Pipe Selection Tables ■
12. Foundation Details ■

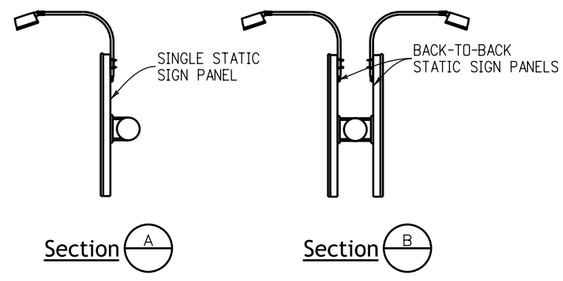




Static Sign Bridge



Static Cantilever Sign



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Static Sign Monotube Structures

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Standard Plan No.
S-614-50
Standard Sheet No. 1 of 12
Project Sheet Number:

General Notes (Continued)

18. Welding of steel shall conform to the requirements of AWS D 1.1. 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 E 709 and AWS D 1.1, except as amended herein. Alternating current shall be used. The yoke spacing shall be between 2 and 4 inches. The minimum lifting power shall be 10 pounds. Red dry particles shall be used. The light intensity shall meet ASTM E 709, Section 7. Particle application and specimen preparation shall meet the requirements of ASTM E 709 Sections 9 and 15, Except white non-aqueous developer meeting ASTM E 165, Type 3, 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 Tests shall be performed at the following locations:

    (1) Base Metal. All areas contacted by the carbon arc gouge electrode, the electrode cup, and the welding electrode. All three conditions are arc strikes.

    (2) Fillet Welds. Each design weld size on main member to main member and secondary member to main member weldments. All stop-starts and weld termini. All linear indications shall further be evaluated with 10x or 30x magnification. Verification shall be resolved by excavation.

    (3) Groove Welds. All through thickness edges on transverse butt joint weldments in tension areas.

    (4) Repairs. All repair welds to correct defects in groove and fillet welds, plate cut edges, correction of fabrication errors in cutting, punching, drilling, or fitting, and members which are tacked or welded and subsequently cut apart and rewelded.

19. All circumferential and all longitudinal pipe seam welds within 5 inches 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 inches.

20. The Contractor shall provide a survey of each overhead sign after installation verifying the minimum vertical clearance of the sign from finished grade. The survey shall conform to Section 625, Construction Surveying.

Design Data

Specifications:

Design: "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", American Association of State Highway and Transportation Officials (1994 AASHTO).

"Fatigue-Resistant Design of Cantilevered Signal, Sign and Light Supports", National Cooperative Highway Research Program (NCHRP) Report 412, 1998.

Subsection 17.4, Signs, in the 2012 Staff Bridge Branch Bridge Design Manual.

Construction: CDOT Standard Specifications, these Standard Sheets and the Project Plans.

Wind Loading: 80, 90 or 100 MPH velocity as per the selection tables.

Materials

Element	Specification ASTM	AASHTO	Clarifications
Posts, Mast Arms	See Note #1		#1
Bars, Plates And Shapes	A709	M-270	#2
Hollow Structural Sections (HSS)	A500		#3
High-Strength Bolts (HS Bolts)	A325	M-164	#4
High-Strength Nuts	A563	M-291	
High-Strength Washers	F436	M-292	#5
U-Bolts (Rods)	F1554	M-314	GRADE 55 Steel
Anchor Bolts	F1554	M-314	GRADE 55 Steel

#1 Pipes shall be welded or seamless steel pipe conforming to the Specifications of ASTM designation A53 GRADE B, A500 Grade B, or ASTM A106 Grade B.

#2 Grades 36 or 50 steel. ASTM A992 shapes may be substituted.

#3 Hollow Structural Section Specifications apply to the Structural Tubing Sections (TS) used at handholes and static sign lighting locations.

#4 Tension control (TC) bolts conforming to ASTM F1852 may be substituted for ASTM A325 bolts. All other bolts and nuts shall conform to the Specifications of ASTM designation: A307. Install A307 bolts with commercial quality washers.

#5 ASTM F959, compressible-washer-type direct tension indicators may be substituted for ASTM F436 washers at high-strength bolted connections.

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. Stations and Offsets to Caisson
10. Guardrail Protection Limits
11. Lane Line Location(s)
12. As Constructed Block
13. Photoelectric Cell Location if Required

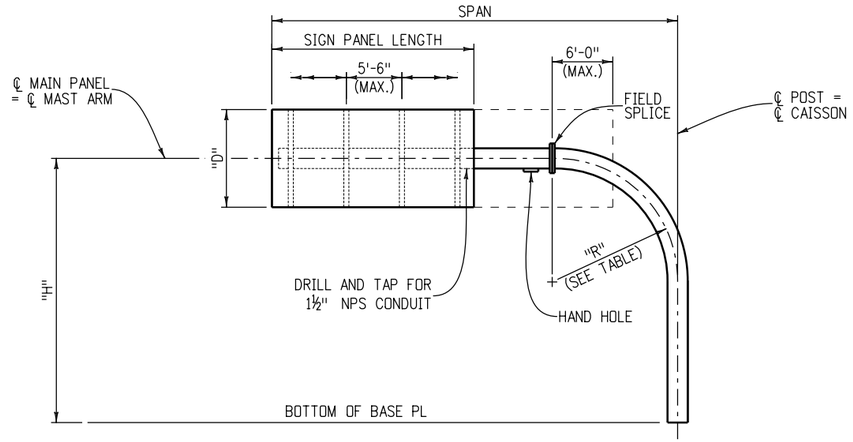
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Static Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-50
Standard Sheet No. 2 of 12
Project Sheet Number:



Cantilever

Cantilever Notes

1. The maximum sign panel overlap onto elbow shall not exceed 6 feet 0 inches from the field splice.
2. All posts between base plate and field splice shall have a tube wall thickness of ½ inches. All mast arms shall have a tube wall thickness of ⅜ inches.
3. See Sheet 7 for Field Splice Details.

PIPE POST	
PIPE OD (IN.)	"R" (FT.)
12.75	8
14	8
16	8
18	8
20	8
24	10

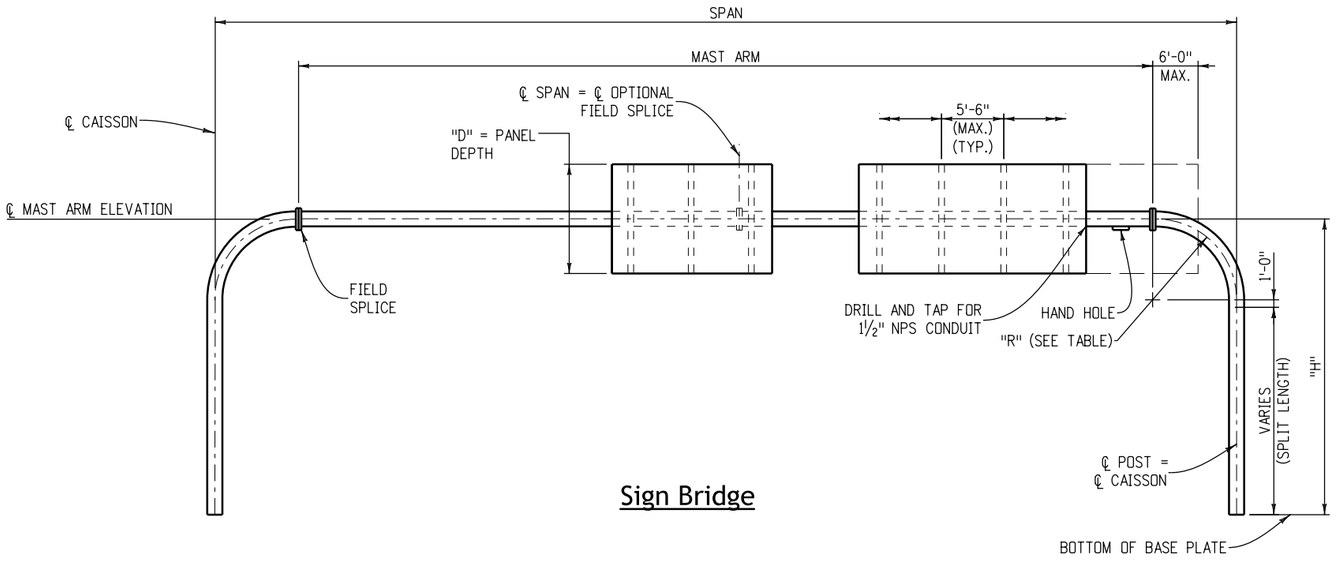
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Static Sign Monotube Structures

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Standard Plan No.
S-614-50
Standard Sheet No. 3 of 12
Project Sheet Number:



Sign Bridge

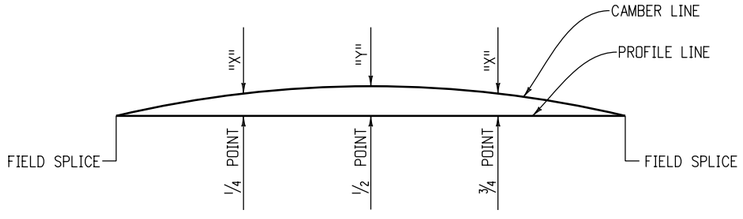
✳ PIPE POST

PIPE OD (IN.)	"R" (FT.)	CAMBER TYPE
12.75	8	Ⓐ
14	8	Ⓐ
16	8	Ⓑ
18	8	Ⓒ
20	10	Ⓒ
24	12	Ⓓ•

CAMBER

TYPE	"X"	"Y"
Ⓐ	1½"	2"
Ⓑ	2¼"	3"
Ⓒ	2¾"	4"
Ⓓ	3½"	5"
Ⓔ	4½"	6"

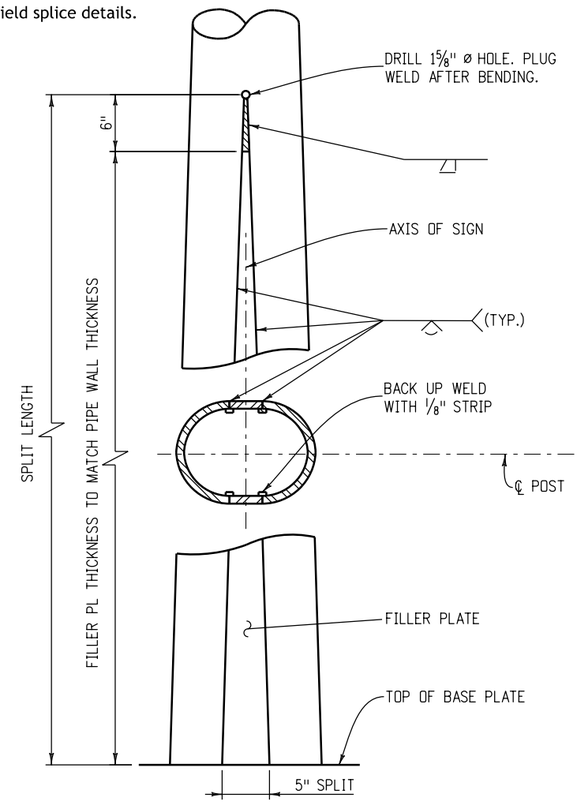
• USE CAMBER TYPE E FOR 130' - 140'.
✳ MAST ARM DIAMETER SAME AS POST.
◯ INDICATES CAMBER TYPE, SEE TABLE.



Camber Diagram

Notes

1. The maximum sign panel overlap onto elbow shall not exceed 6 feet-0 inches from the field splice.
2. All posts between base plate and field splice shall have a tube wall thickness of ½ inches. All mast arms shall have a tube wall thickness of ⅜ inches.
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 ½ inches of the field measured span lengths between foundations.
4. If the sign frames are erected as one unit, they shall be adequately suspended to avoid distortions or changes in span length between base plates.
5. For mast arms with lengths between 40 feet-0 inches and 80 feet-0 inches a bolted field splice will be permitted at ℄ of the arm to facilitate galvanizing and hauling operations. For mast arms with lengths greater than 80 feet-0 inches, two bolted field splices will be permitted at the ⅓ points to facilitate galvanizing and hauling operations.
6. See Sheet 7 for field splice details.



Post Split Details

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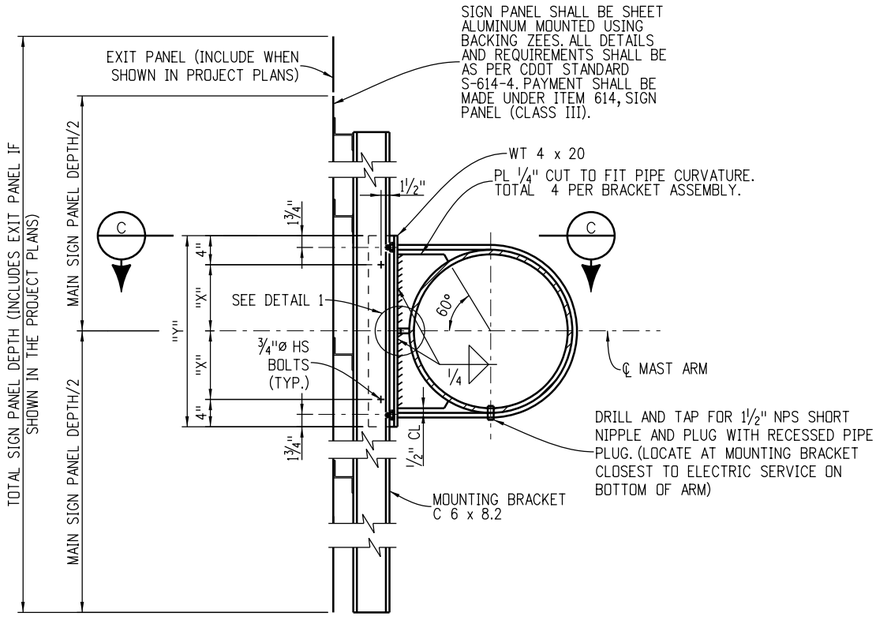
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Static Sign Monotube Structures

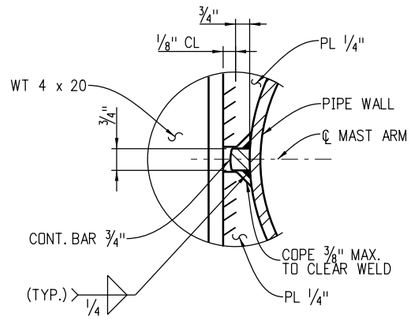
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Standard Plan No.
S-614-50
Standard Sheet No. 4 of 12
Project Sheet Number:

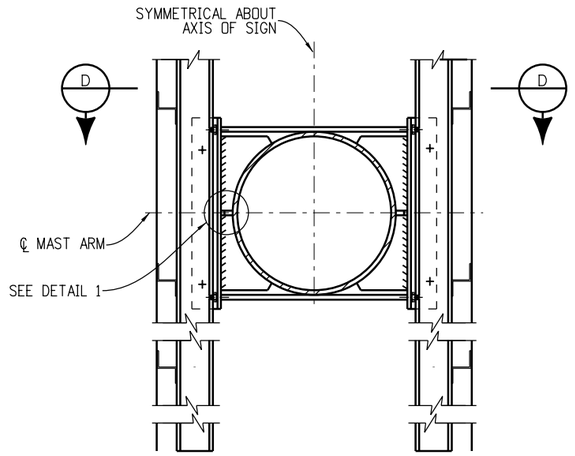
-Sign Mounting Bracket Details-



Single Sign Panel



Detail 1

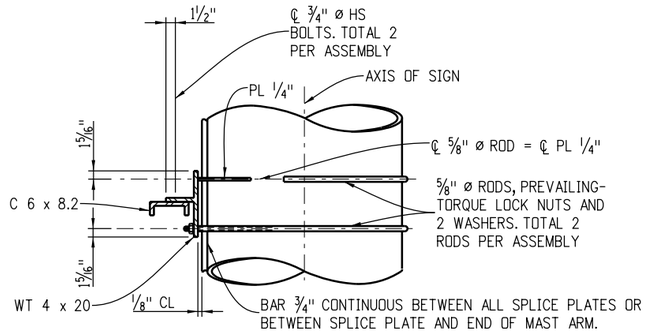


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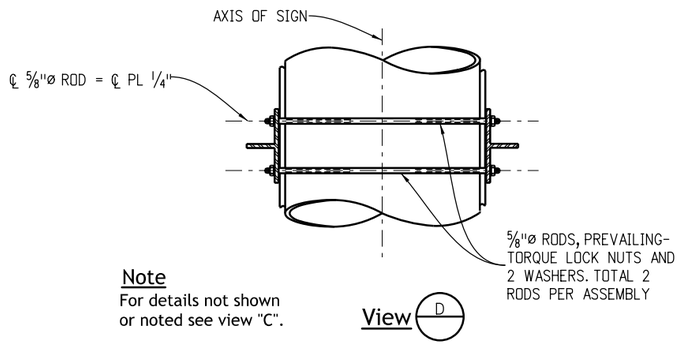
For details not shown or noted see "Single Sign Panel". Assembly details shown apply to tangent portion of pipe only. For mounting bracket on elbow see Detail 2.

Back-to-Back Sign Panels

PIPE OUTSIDE DIAMETER (IN.)	DISTANCE "X" (IN.)	DISTANCE "Y" (IN.)
12.75	4 7/16	16 7/8
14	5 1/16	18 1/8
16	6 1/16	20 1/8
18	7 1/16	22 1/8
20	8 1/16	24 1/8
24	10 1/16	28 1/8



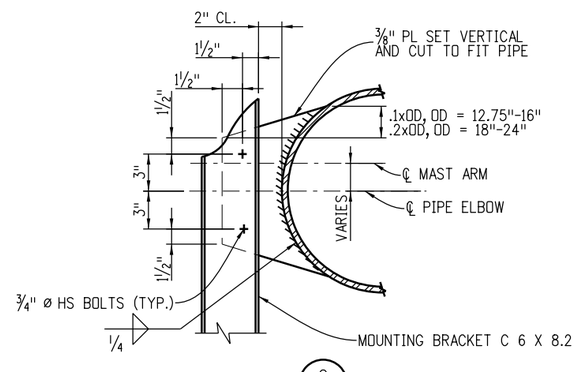
View C



Note

For details not shown or noted see view "C".

View D



Detail 2

Mounting Bracket on Elbow

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Static Sign Monotube Structures

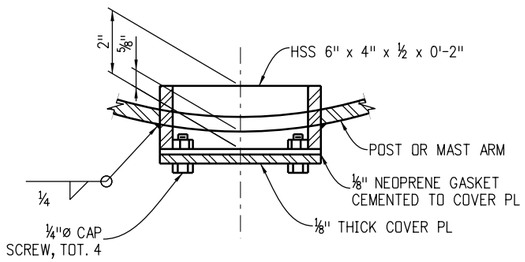
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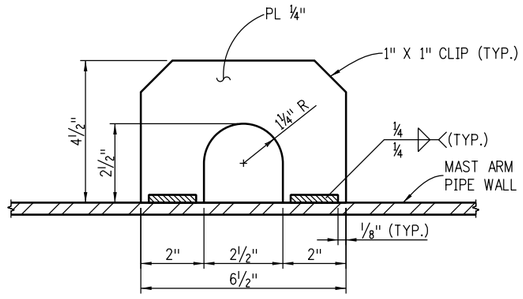
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S-614-50

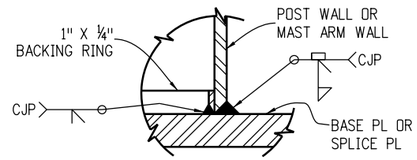
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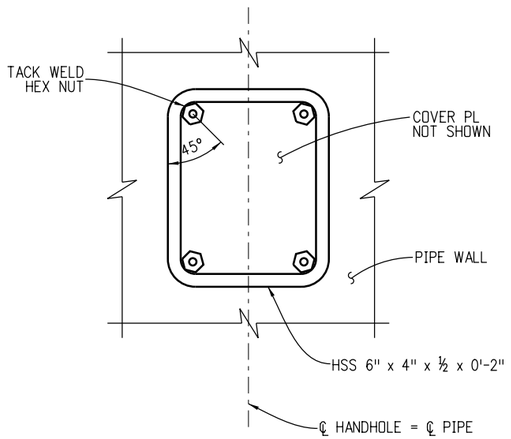




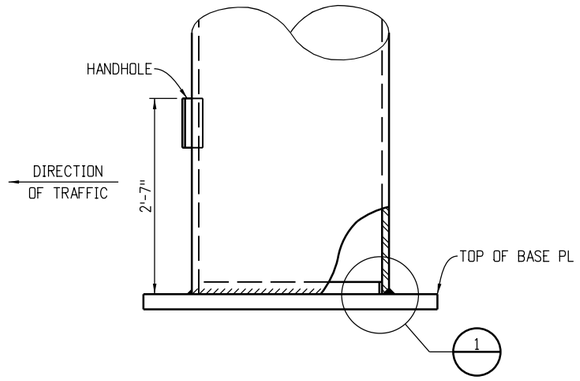
Lifting Eye Detail



Detail 1

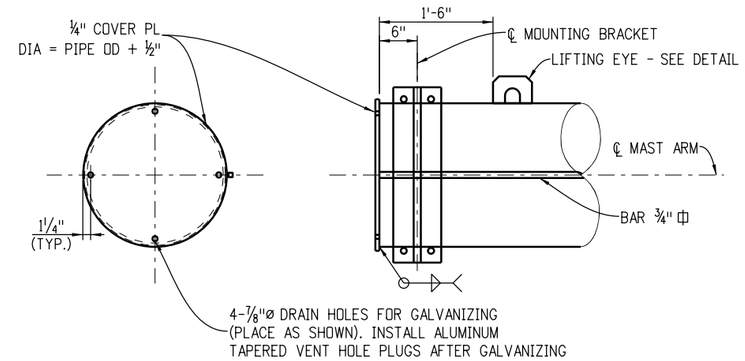


Handhole and Cover Details



Post Base Elevation

(For Base PL Details See Sheet 8)



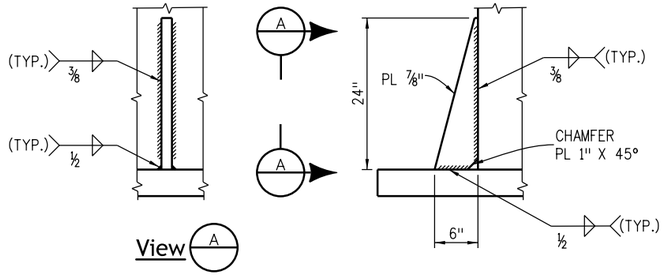
Mast Arm End Detail

(For Cantilever Arms)

Notes:

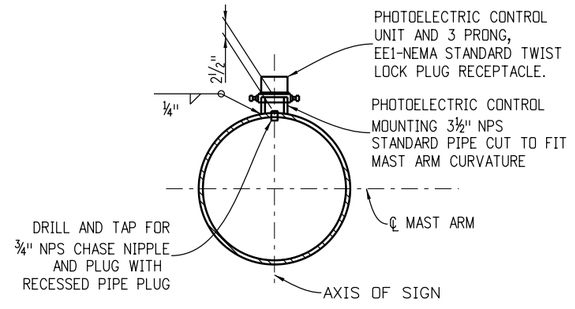
1. Stiffeners are to be placed at the base of all posts. See Sheet 8 for the location of stiffeners. Stiffeners are not shown elsewhere in these sheets for clarity.

2. Terminate weld ½ inch short of the top of the stiffener plate. At the other 3 weld terminations on these two typical welds stop the weld ¼ inch short of the end of the plate.



Stiffener Details

(At Pole Base - See Notes)



Photoelectric Control Details

(See "Layout" Sheet For Location When Required)

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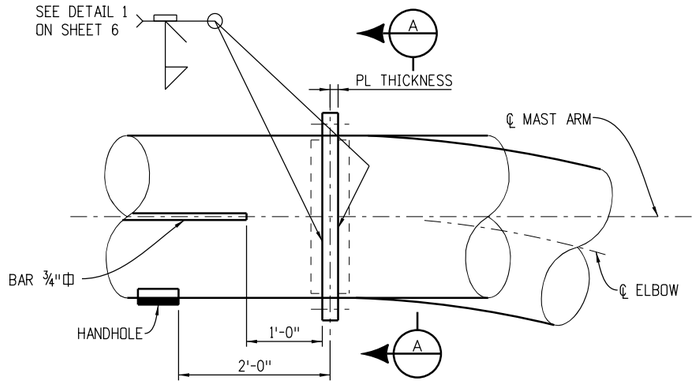
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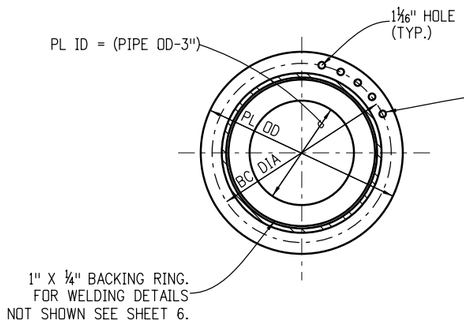
Static Sign Monotube Structures

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Standard Plan No.
S-614-50
Standard Sheet No. 6 of 12
Project Sheet Number:



Field Splice

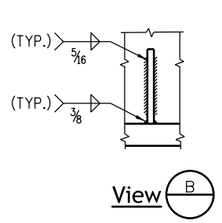


1" Ø HS BOLTS (GALVANIZED) EQUALLY SPACED. BOLTS SHALL BE SEQUENTIALLY TIGHTENED. ASSUMING 12 BOLTS AND A CLOCK FACE, THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7 ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED. SEE THE FIELD SPLICE TABLE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

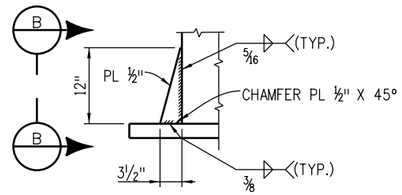
Section A

FIELD SPLICE					
PIPE OUTSIDE DIAMETER (IN.)	PL THICKNESS (IN.) *	BC DIAMETER (IN.)	PL OD (IN.)	# OF STIFF.	# OF BOLTS
12.75	1¼	16	21	6	14
14	1¼	17	22	6	16
16	1¼	21	24	6	20
18	1⅜	23	26	10	22
20	1⅜	25	28	10	24
24	1½	29	32	12	28

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



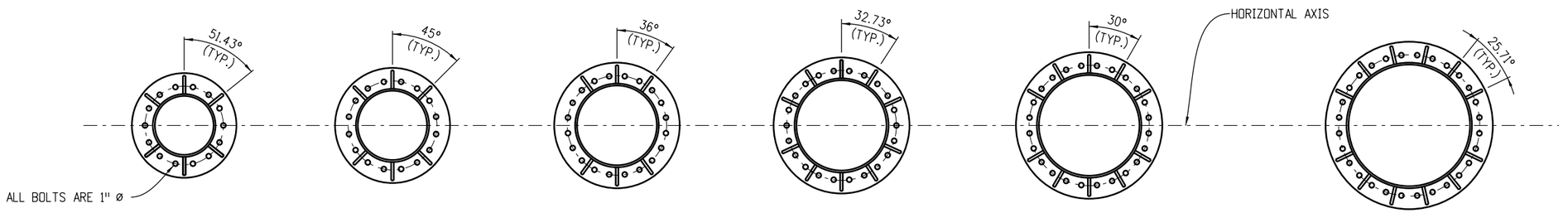
View B



Notes:

1. Stiffeners are to be placed on all field splices. Stiffeners are not shown elsewhere in these sheets for clarity.
2. Terminate weld ½ inch short of the top of the stiffener plate. At the other 3 weld terminations on these two typical welds, stop the weld ¼ inch 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 inches using a portable flange facer after welding and prior to galvanizing.

Stiffener Details
(At Field Splice)



12.75" Pipe | 14" Pipe | 16" Pipe | 18" Pipe | 20" Pipe | 24" Pipe

Field Splice Details

Stiffeners shall be located on both sides of the field splice.
Clip washers as needed to avoid interference with stiffener welds.

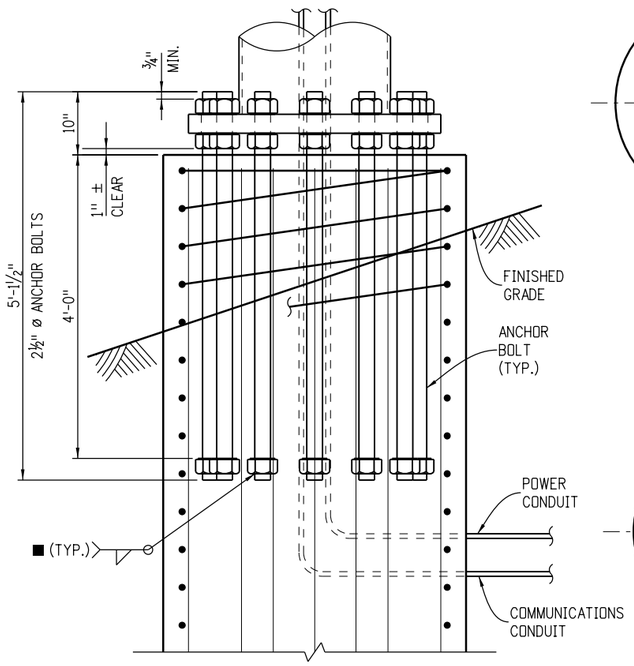
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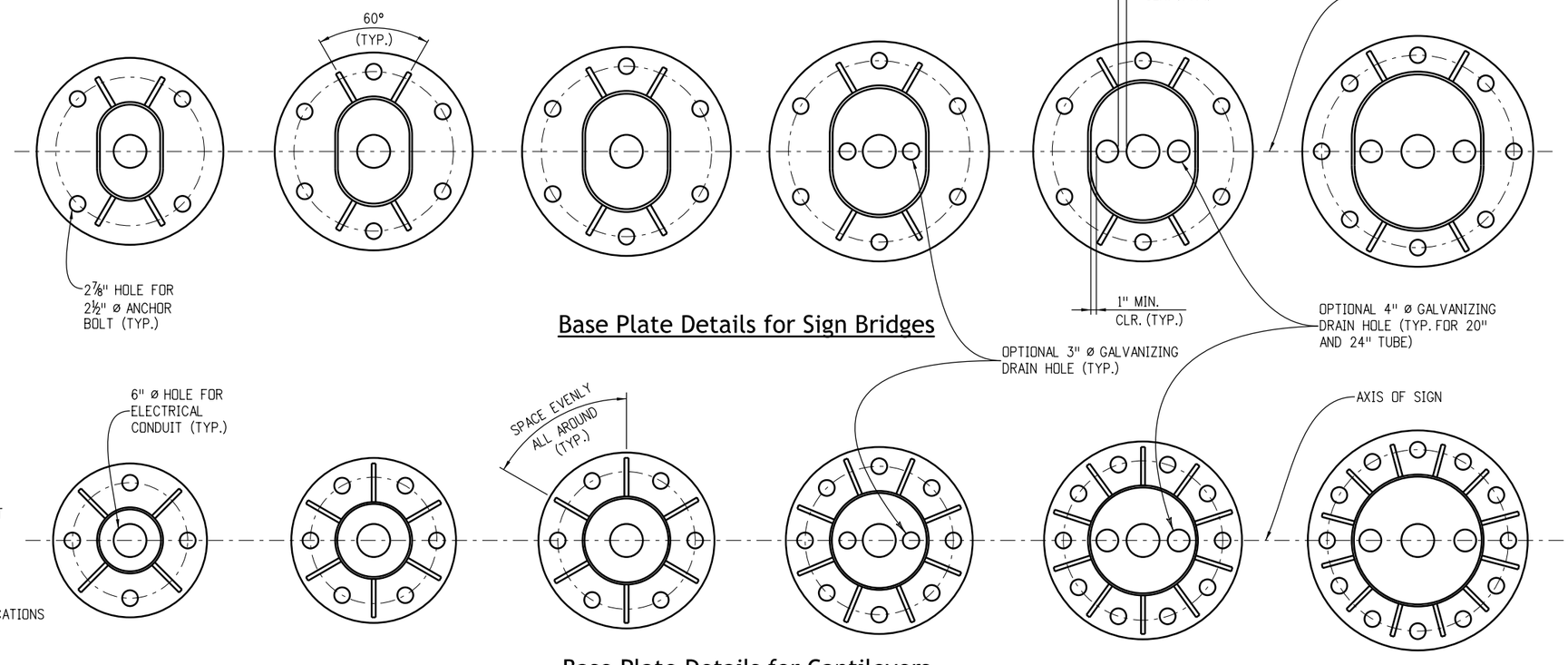
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Standard Plan No.
S-614-50
Standard Sheet No. 7 of 12
Project Sheet Number:



Anchor Bolt Detail

■ WELDING PROCEDURE IS NOT REQUIRED FOR THIS WELD



Base Plate Details for Sign Bridges

Base Plate Details for Cantilevers

12.75" Pipe | 14" Pipe | 16" Pipe | 18" Pipe | 20" Pipe | 24" Pipe

CANTILEVERS

PIPE OD (IN.)	SPLIT (IN.)	BASE PL SIZE (DIAM. X THICK.) (IN.)	BOLT CIRCLE (IN.)	# OF ANCHOR BOLTS	# OF STIFF.
12.75	–	28" x 2.5"	21"	4	4
14	–	30" x 2.5"	23"	6	6
16	–	32" x 2.5"	25"	6	6
18	–	34" x 2.75"	27"	8	8
20	–	36" x 3.0"	29"	10	10
24	–	40" x 3.0"	33"	12	12

SIGN BRIDGES

PIPE OD (IN.)	SPLIT (IN.)	BASE PL SIZE (DIAM. X THICK.) (IN.)	BOLT CIRCLE (IN.)	# OF ANCHOR BOLTS	# OF STIFF.
12.75	5	34" x 2.5"	27"	4	4
14	5	36" x 2.5"	29"	6	4
16	5	38" x 2.5"	31"	6	4
18	5	40" x 2.75"	33"	6	4
20	5	40" x 3.0"	33"	6	4
24	5	42" x 3.0"	35"	8	4

NOTES

1. Thread upper 10 inches and galvanize upper 1 foot-3 inches 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 $\frac{1}{12}$ 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.

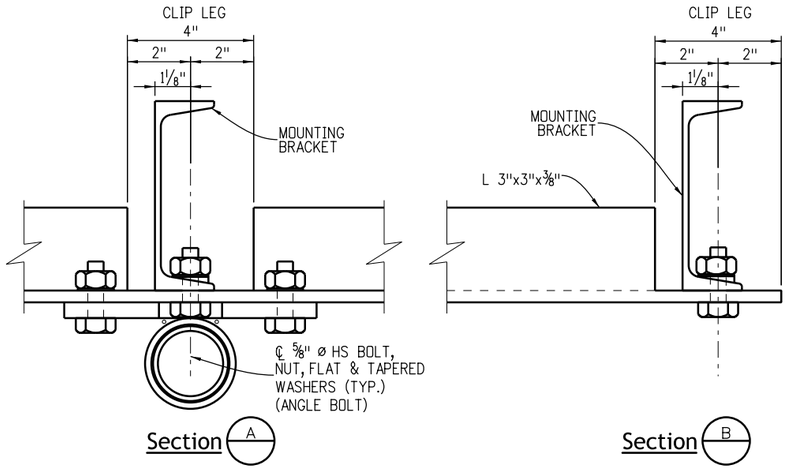
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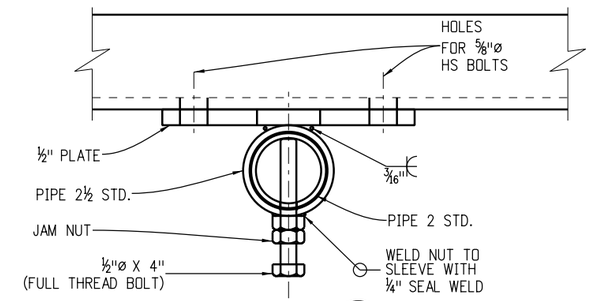
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Standard Plan No.
S-614-50
Standard Sheet No. 8 of 12
Project Sheet Number:

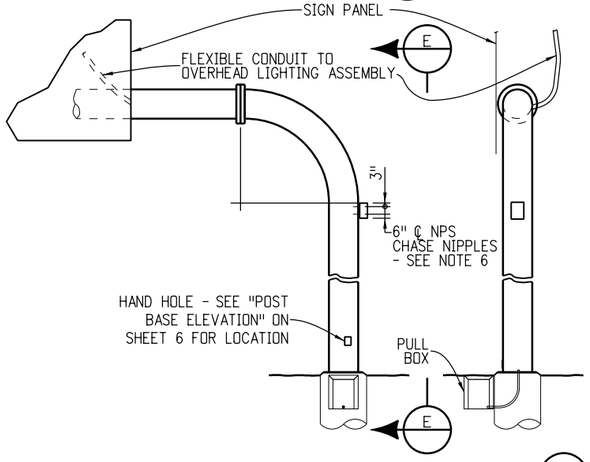


Section A

Section B

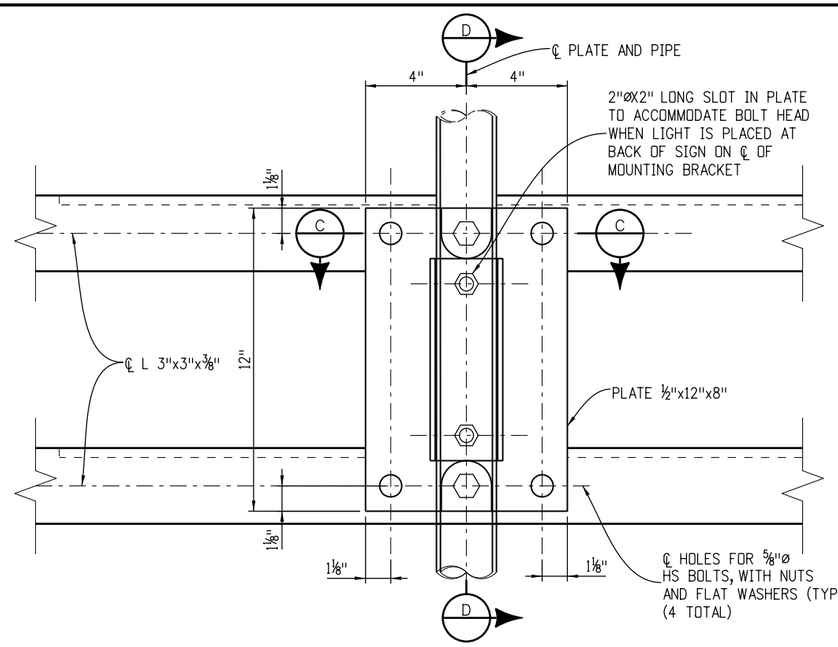


Section C

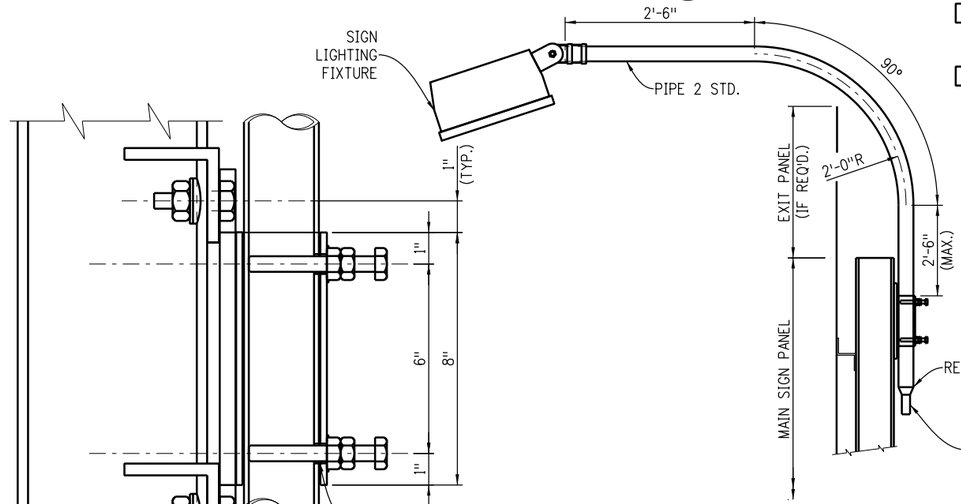


Post

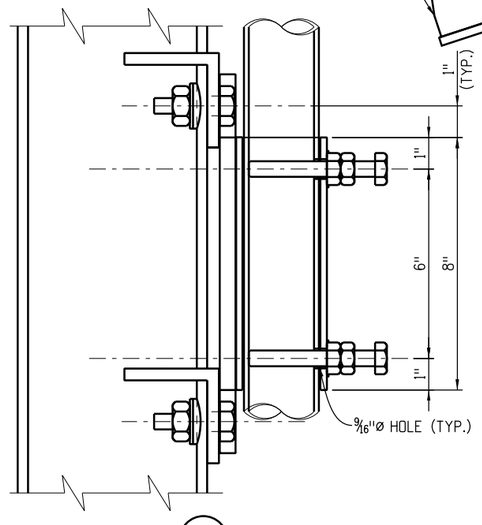
View E



Detail 1



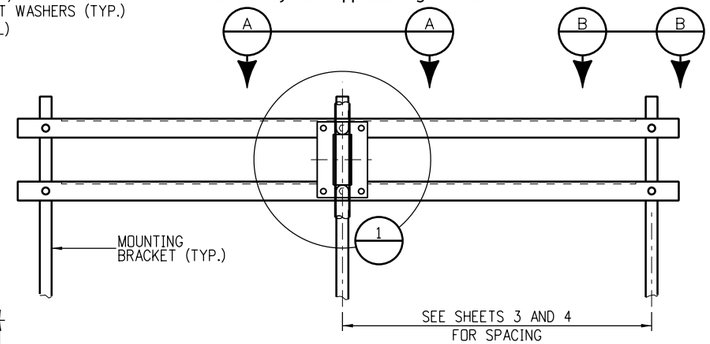
Overhead Lighting Assembly



Section D

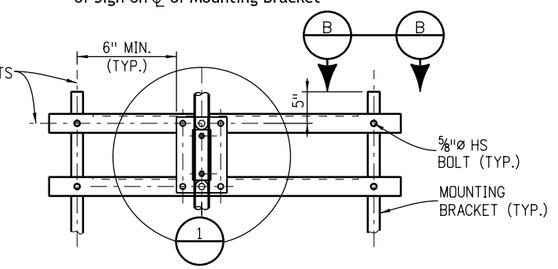
Lighting Notes

1. Fixtures shall be watertight, 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 ballast 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 1½" NPS chase nipples and plug with recessed pipe plugs. Place perpendicular to sign panel axis and away from approaching traffic.



Elevation

Light Connection Placed at Back of Sign on ℄ of Mounting Bracket



Elevation

Light Connection Placed at Back of Sign Between Mounting Brackets

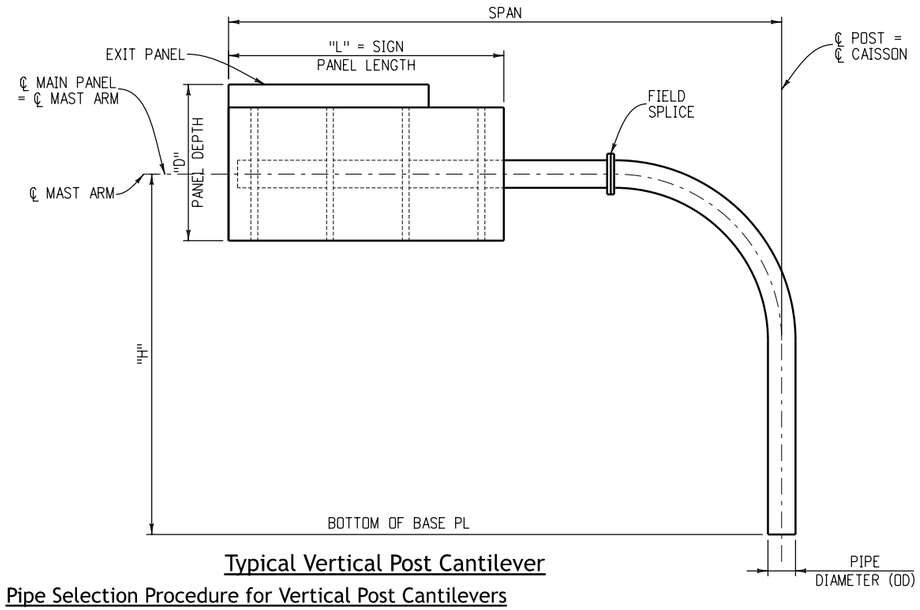
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Static Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-50
Standard Sheet No. 9 of 12
Project Sheet Number:



Typical Vertical Post Cantilever

Pipe Selection Procedure for Vertical Post Cantilevers

A. Coverage Percentage = $\frac{\text{Sign Panel Length}}{\text{Span}}$ For the span length use the span from one of the charts (25', 35', etc.), not the actual span

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 "D" for the selection charts add the area of the exit panel, if present, to the main sign panel area. divide by the main panel length to obtain "D".

D. If no pipe is shown for a certain span this indicates that this span/sign 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.

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

80 MPH WIND

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	12.75	14	14	14	14	16
	25	14	16	16	16	16	18
	30	16	18	18	18	18	20
	35	18	20	20	20	24	24
	40	20	24	24	24	24	24
	45	24	24	24	24		

UP TO 50% COVERAGE CHART

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	16	16	16	18	18	20
	25	18	18	18	20	20	24
	30	20	20	20	24	24	24
	35	24	24	24	24	24	
	40	24	24				
	45						

51-80% COVERAGE CHART

-Cantilever Sign Pipe Selection Tables-

90 MPH WIND

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	14	14	16	16	16	18
	25	16	18	18	18	18	20
	30	18	20	20	20	24	24
	35	20	24	24	24	24	24
	40	24	24	24			
	45						

UP TO 50% COVERAGE CHART

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	16	18	18	20	20	20
	25	20	20	20	24	24	24
	30	24	24	24	24	24	
	35	24					
	40						
	45						

51 - 80% COVERAGE CHART

100 MPH WIND

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	16	16	16	18	18	18
	25	18	18	20	20	20	24
	30	20	24	24	24	24	24
	35	24	24	24			
	40						

UP TO 50% COVERAGE CHART

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	18	20	20	24	24	24
	25	20	24	24	24	24	
	30	24	24				
	35						

51 - 80% COVERAGE CHART

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 Boulder County.

If there are questions concerning the proper design wind speed contact the Staff Bridge Branch.

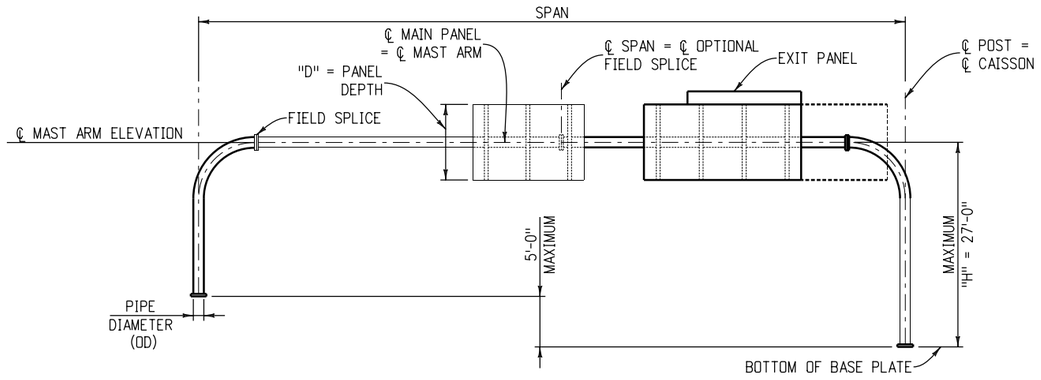
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Static Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-50
Standard Sheet No. 10 of 12
Project Sheet Number:



Typical Vertical Post Sign Bridge

Structure Selection Procedure for Sign Bridges

A. Design is based on a sign height of 15 feet 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 feet. 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 OD 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.

-Sign Bridge Pipe Selection Tables-

80 MPH WIND

SPAN ≤	MAXIMUM SIGN PANEL AREA (SQ. FT.)	* PIPE POST	
		PIPE OD (IN.)	SPLIT (IN.)
50'	375	12.75	5
60'	450	14	5
70'	525	16	5
80'	600	18	5
90'	675	20	5
100'	750	20	5
110'	825	24	5
120'	900	24	5
130'	780	24	5
140'	700	24	5

90 MPH WIND

SPAN ≤	MAXIMUM SIGN PANEL AREA (SQ. FT.)	* PIPE POST	
		PIPE OD (IN.)	SPLIT (IN.)
50'	375	14	5
60'	450	16	5
70'	525	18	5
80'	600	20	5
90'	675	24	5
100'	750	24	5
110'	775	24	5
120'	650	24	5
130'	585	24	5
140'	525	24	5

100 MPH WIND

SPAN ≤	MAXIMUM SIGN PANEL AREA (SQ. FT.)	* PIPE POST	
		PIPE OD (IN.)	SPLIT (IN.)
50'	375	16	5
60'	450	18	5
70'	525	20	5
80'	600	24	5
90'	675	24	5
100'	660	24	5
110'	580	24	5
120'	500	24	5
130'	450	24	5
140'	400	24	5

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 Boulder County.

If there are questions concerning the proper design wind speed contact the Staff Bridge Branch

* Mast arm diameter same as post.

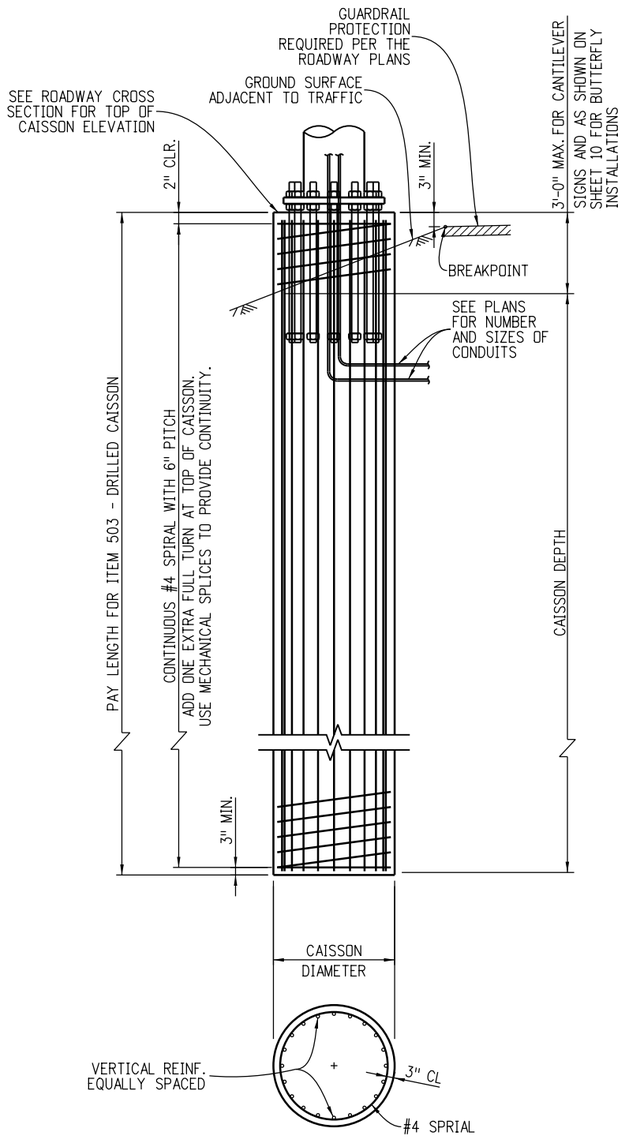
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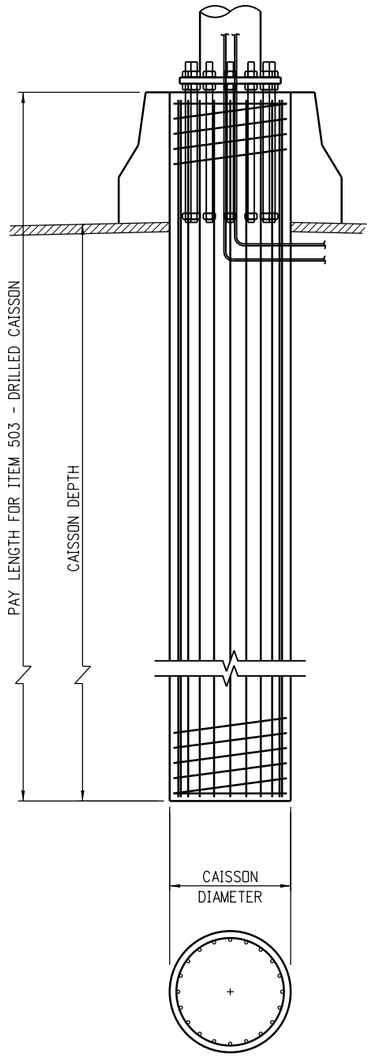
Static Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-50
Standard Sheet No. 11 of 12
Project Sheet Number:



Roadside Shoulder Installation



Median Rail Installation
(See Roadside Shoulder Installation for Additional Information)

Caisson Foundation Details

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 won't support the weight of the drilling rig.
   - C) The foundation soils are not homogenous.
   - 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. If casings are used by the Contractor and cannot be removed, shafts for cantilever sign structures shall be abandoned and another shaft drilled and placed as approved by the Engineer at no cost to the project. Unremoveable casings for sign bridge shafts may be left in place without relocation.
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.
4. The Contractor shall provide a survey of each overhead sign foundation to verify placement soon after work on the foundation has been completed. The survey shall conform to the requirements of Section 625, 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, projections, and orientations, and in the case of sign-bridge type of overhead signs, the distance measured between the centerline of the anchor bolt groups. The elevation of the ground surrounding each foundation shall also be provided. The Contractor shall compare the survey information to the reviewed shop drawings and reconcile any differences between them. The Contractor shall submit all proposed adjustments or modifications to the Engineer for approval.

BRIDGES

PIPE OUTSIDE DIAMETER (INCHES)	SPLIT (INCHES)	CAISSON DIAMETER (INCHES)	CAISSON DEPTH (FEET)	VERTICAL REINF.
12.75	5	48	17	18 - #8
14	5	48	19	24 - #8
16	5	48	20	24 - #8
18	5	54	21	24 - #9
20	5	54	22	24 - #9
24	5	54	24	24 - #9

CANTILEVERS

PIPE OUTSIDE DIAMETER (INCHES)	SPLIT (INCHES)	CAISSON DIAMETER (INCHES)	CAISSON DEPTH (FEET)	VERTICAL REINF.
12.75	-	36	13	13 - #8
14	-	42	15	18 - #8
16	-	42	16	18 - #8
18	-	42	17	18 - #8
20	-	48	18	24 - #8
24	-	48	20	24 - #8

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Static Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-50
Standard Sheet No. 12 of 12
Project Sheet Number:

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 509.28 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 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.
4. 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.
5. A disconnect for the power supply to the DMS shall be provided as shown in the roadway plans.
6. Structures shall be grounded in accordance with applicable electrical codes.

General Notes (Continued)

7. 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.
8. NPS = Nominal Pipe Size; OD = Outside Diameter; DMS = Dynamic Message Sign.
9. Shop drawings shall be submitted to the Engineer for review in accordance with Subsection 105.02 of the Standard Specifications.
10. Caissons, steel supports and survey work shall be paid for in accordance with bid items 503, 614 and 625 respectively.
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 ½ inch wide stainless steel bands and stainless steel flared leg brackets with hex head bolts (Band-It D315 or equivalent).
13. Install structure identification panel in accordance with M and S Standard S-614-12 using two ½ inch wide stainless steel bands and stainless steel flared leg brackets with hex head bolts (Band-It D315 or equivalent).

General Notes (Continued)

14. Welding of steel shall conform to the requirements of AWS D 1.1. 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 E 709 and AWS D 1.1, except as amended herein. Alternating current shall be used. The yoke spacing shall be between 2 and 4 inches. The minimum lifting power shall be 10 pounds. Red dry particles shall be used. The light intensity shall meet ASTM E 709, Section 7. Particle application and specimen preparation shall meet the requirements of ASTM E 709 sections 9 and 15, except white non-aqueous developer meeting ASTM E 165, type 3, 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 Tests shall be performed at the following locations:

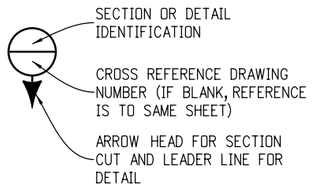
    (1) Base Metal. All areas contacted by the carbon arc gouge electrode, the electrode cup, and the welding electrode. all three conditions are arc strikes.

    (2) Fillet Welds. Each design weld size on main member to main member and secondary member to main member weldments. All stop-starts and weld termini. All linear indications shall further be evaluated with 10x or 30x magnification. Verification shall be resolved by excavation.

    (3) Groove Welds. All through thickness edges on transverse butt joint weldments in tension areas.

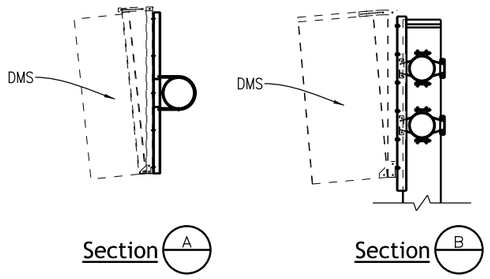
    (4) Repairs. All repair welds to correct defects in groove and fillet welds, plate cut edges, correction of fabrication errors in cutting, punching, drilling, or fitting, and members which are tacked or welded and subsequently cut apart and rewelded.

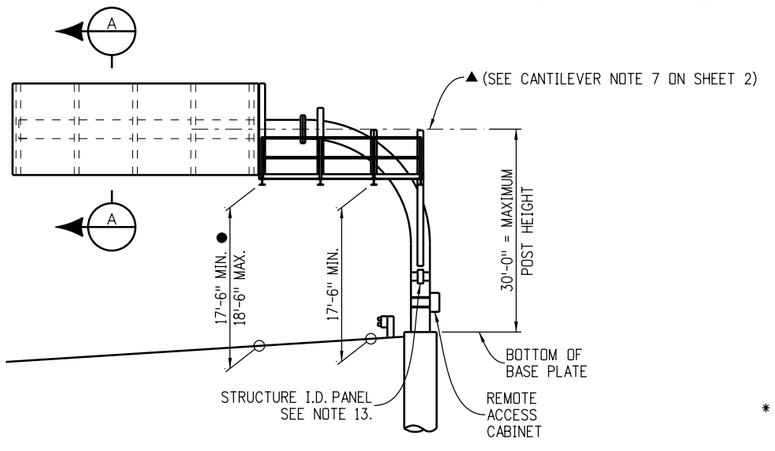
15. All circumferential and all longitudinal pipe seam welds within 5 inches of full penetration circumferential groove welds shall be full penetration groove welds and shall be inspected as specified herein. The acceptable maximum weld undercut is 0.01 inches.
16. See table on Sheet 4 for cabinet rotation adjustments to vertical clearances marked with a ● .



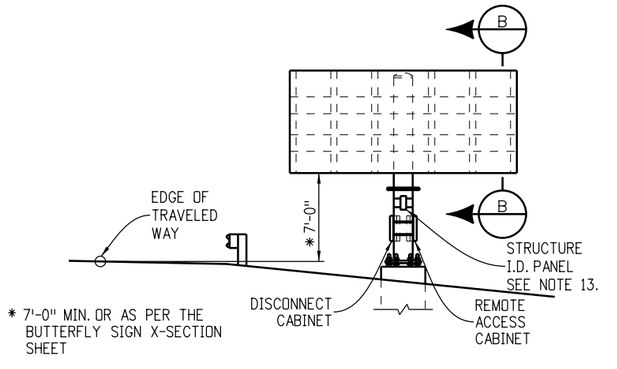
Index

1. Sign Notes (1 of 2)
2. Sign Notes (2 of 2) ■
3. Cantilever Installation Details ■
4. Cantilever Sign Mounting Brackets
5. Cantilever Post and Arm Details
6. Cantilever Field Splice Details
7. Cantilever Base Plate Details
8. Cantilever Sign Walkway Details (1 of 2)
9. Cantilever Sign Walkway Details (2 of 2)
10. Butterfly Installation Details ■
11. Butterfly Assembly Details
12. Butterfly Sign Mounting Details
13. Butterfly Post Details
14. Foundation & Anchor Bolt Details ■

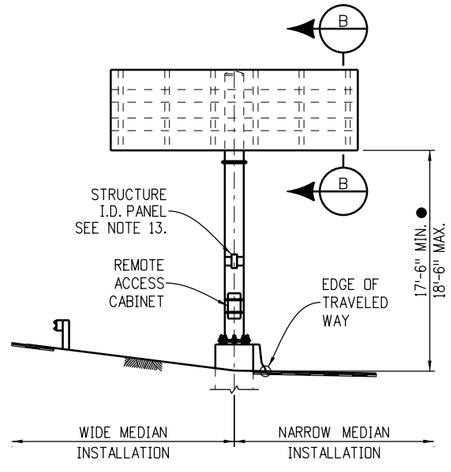




Cantilever Sign



Butterfly Sign (Roadside Installation)
(See Sign X-Section Sheet in Traffic Plans)



Butterfly Sign (Median Installation)
(See Sign X-Section Sheet in Traffic Plans)

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Dynamic Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-60
Standard Sheet No. 1 of 14
Project Sheet Number:

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 and shall be checked for straightness, alignment, and dimensional accuracy. Any variations shall be corrected to the satisfaction of the Engineer.
2. Mast arms shall be temporarily supported to take all load off of the field splices while bolts are being tightened in order to firmly seat the flange plates.
3. Post members shall be formed to the radii 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.
4. Clips, eyes, or removable brackets shall be affixed to post and mast arm, 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.
5. Walkways shall lead up to the cabinet access door as specified on the sign x-section sheets in the roadway plans.
6. All pipe members shall be hot-dip galvanized inside and outside after fabrication as per ASTM A123. Painting shall conform to Section 522, Duplex Coating System. Walkway gratings, walkway brackets, safety railings and all nuts, bolts and washers for sign structures shall be galvanized after fabrication as per ASTM A123 or ASTM A153, as appropriate, and shall not be painted. Tension control bolts or direct tension indicating washers used in high-strength bolted connections shall be mechanically galvanized per ASTM B695, Coating Class 55.
7. Cantilever arms marked with a ▲ must be level or tilted upward no more than 1° maximum after installation of the sign.

Butterfly Notes

1. Sign structures shall be constructed true to the specified dimensions, shall be free of kinks, twists or bends, and shall be uniform in appearance. The post to cross arm connections shall be preassembled in the shop after galvanizing. Assemblies with the optional field splice shall be preassembled above the splice for shipping to the job site.
2. Post and cross arms shall be fabricated in single sections prior to galvanizing. 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 galvanized surfaces. Temporary brackets on sign structure shall be removed after erection. Details of such devices shall be shown on the shop drawings. Erection lugs are required on one end of the cross arms to facilitate pulling of the cross arms through the post. The erection lugs shall be positioned to force the "Pull" to occur on the centerline of the cross arm. Erector shall support the post on either side of the cross-arm prior to pulling the cross-arm through the hole in the post.
4. All pipe members shall be hot-dip galvanized inside and outside after fabrication as per ASTM A123. Painting shall conform to Section 522, Duplex Coating System. All nuts, bolts and washers for sign structures shall be galvanized after fabrication as per ASTM A123 or ASTM A153, as appropriate, and shall not be painted. Tension control bolts or direct tension indicating washers used in high-strength bolted connections shall be mechanically galvanized per ASTM B695, Coating Class 55.
5. See the butterfly mounted sign x-section sheet in the traffic plans for the DMS panel width, height, depth, and weight; top of caisson elevation, station and offset; DMS panel offset from shoulder; support post height, angle θ, and guardrail protection limits. Do not use any post height which exceeds the maximum post height shown in the Post And Cross Arm Pipe Data Table on Sheet 11. Structures over traffic and structures that could fall into the traveled way or onto the shoulder shall be assigned a Staff Bridge generated structure number.

Cantilever Design Data

Specifications:

Design: "Standard Specifications For Structural Supports For Highway Signs, Luminaires And Traffic Signals", American Association Of State Highway And Transportation Officials (2001 AASHTO).

Subsection 17.4, Signs, in the 2012 Staff Bridge Branch Bridge Design Manual.

Construction: CDOT Standard Specifications, these Standard Sheets and the Project Plans.

Wind Loading: 100 mph velocity

Butterfly Design Data

Specifications:

Design: "Standard Specifications for Structural Supports for Highway Signs, Luminaires And Traffic Signals", American Association of State Highway and Transportation Officials (2009 AASHTO).

Subsection 17.4, Signs, in the 2012 Staff Bridge Branch Bridge Design Manual.

Construction: CDOT Standard Specifications, these Standard Sheets and the Project Plans.

Wind Loading: 110 mph velocity (3-second gust).

Materials

	SPECIFICATION			
Element	ASTM	AASHTO	AISI	Clarifications
Posts, Mast/Cross Arms	A53			#1
Bars, Plates And Shapes	A709	M-270		#2
Hollow Structural Sections (HSS)	A500			#3
High-Strength Bolts (HS Bolts)	A325	M-164		#4
High-Strength Nuts	A563	M-291		
High-Strength Washers	F436	M-292		#5
U-Bolts (Rods)	F1554	M-314		Grade 55 Steel
Anchor Bolts	F1554	M-314		Grade 55 Steel
Spherical Washer Sets	A29		4140	#6
Collar Nuts	A29		4140	#6, #7

#1 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, A500 Grade B, or A106 Grade B.

#2 Grades 36 or 50. ASTM A992 shapes may be substituted.

#3 Hollow Structural Section Specifications apply to the Structural Tubing Sections (TS) used at handholes and safety railings.

#4 Tension control (TC) bolts conforming to ASTM F1852 may be substituted for ASTM A325 bolts. All other bolts and nuts shall conform to the Specifications of ASTM designation: A307. Install A307 bolts with commercial quality washers.

#5 ASTM F959, compressible-washer-type direct tension indicators may be substituted for ASTM F436 washers at high-strength bolted connections.

#6 Spherical washer sets and collar nuts shall be hardened in accordance with ASTM F436 and hot-dip galvanized in accordance with ASTM A153.

#7 A spherical washer set and an A325 nut may be substituted for a collar nut.

Overhead Sign X-Section Sheet(s) Shall Show:

1. Sign Structure Location (Highway, Station and Direction)
2. Length of Structure Span
3. DMS Size (Width, Height, Depth and Weight) and Location on Structure
4. Offset From Shoulder
5. Post Height From Top of Caisson to ℄ Mast Arm
6. Caisson Diameter and Minimum Embedment
7. Top of Caisson Elevation
8. Caisson Pay Length
9. Stations and Offsets To Caisson
10. Angle θ for Butterfly Installations
11. Guardrail Protection Limits
12. Walkway Location if Required
13. Lane Line Location(s) if Structure is Over Traffic
14. Location of Disconnect for The Power Supply
15. Location of Remote Access Cabinet on Pole
16. As Constructed Block

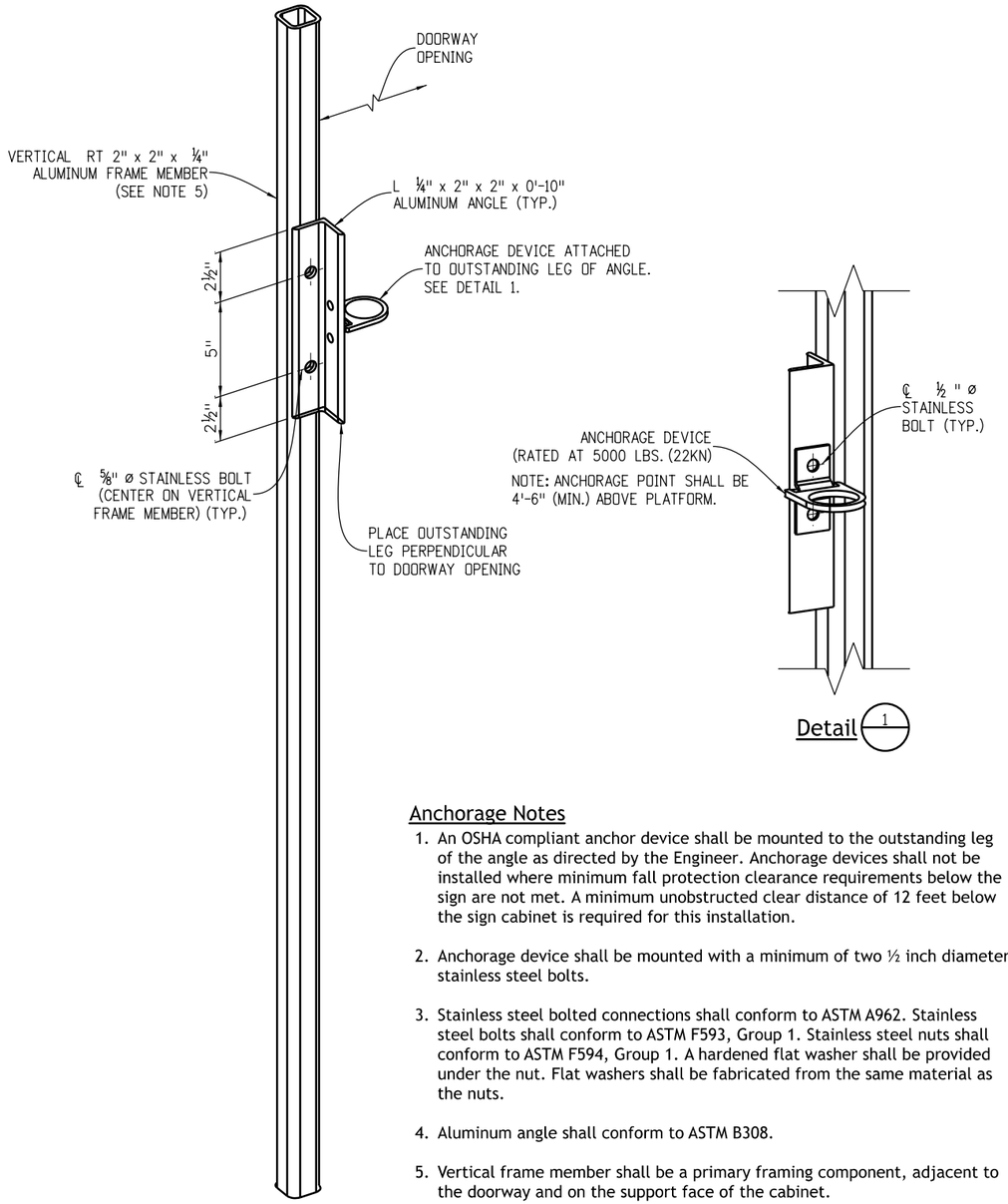
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Dynamic Sign Monotube Structures

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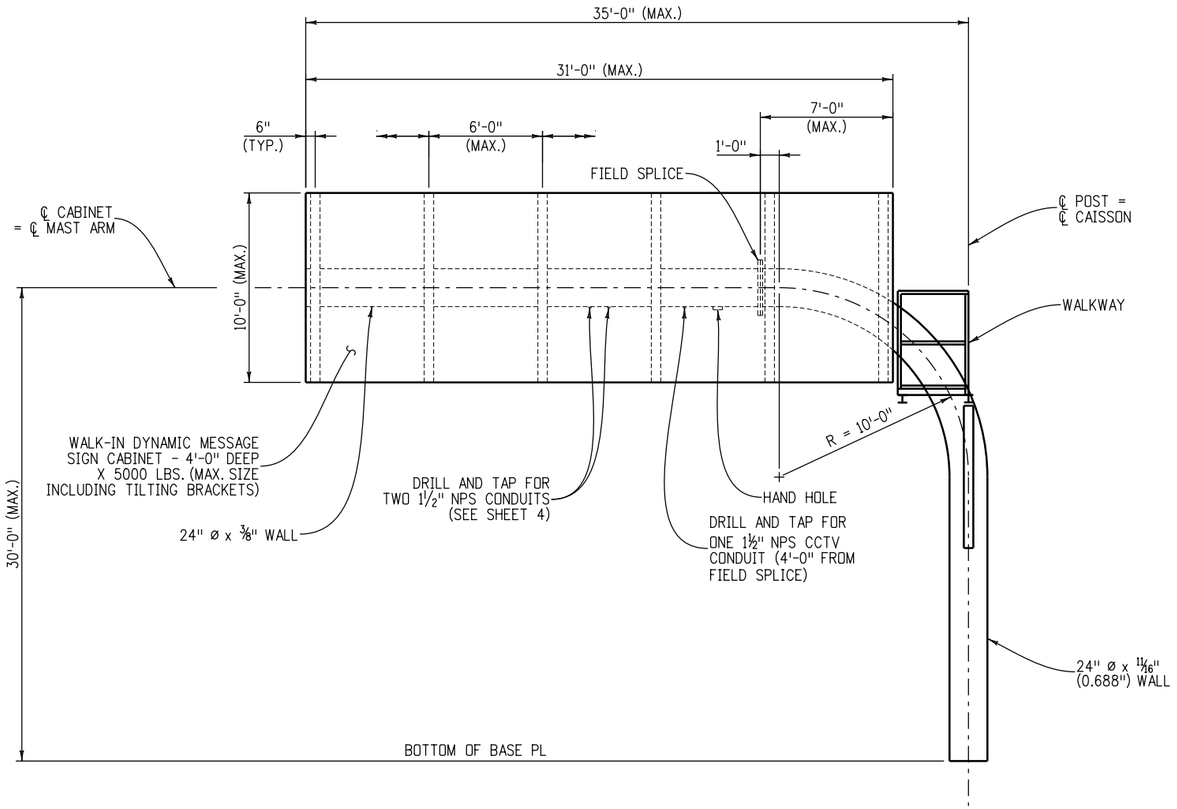
Standard Plan No.
S-614-60
Standard Sheet No. 2 of 14
Project Sheet Number:



Detail 1

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.
2. Anchorage device shall be mounted with a minimum of two ½ inch diameter stainless steel bolts.
3. Stainless steel bolted connections shall conform to ASTM A962. Stainless steel bolts shall conform to ASTM F593, Group 1. Stainless steel nuts shall conform to ASTM F594, 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 B308.
5. Vertical frame member shall be a primary framing component, adjacent to the doorway and on the support face of the cabinet.



Cantilever Notes

1. The maximum cabinet overlap onto elbow shall not exceed 7 feet-0 inches from the field splice.
2. All posts between base plate and field splice shall have a tube wall thickness of $^{11}/_{16}$ inches (0.688 inches). All mast arms shall have a tube wall thickness of ⅜ inches.
3. See Sheet 6 for field splice details.

OSHA Compliant Anchorage Details

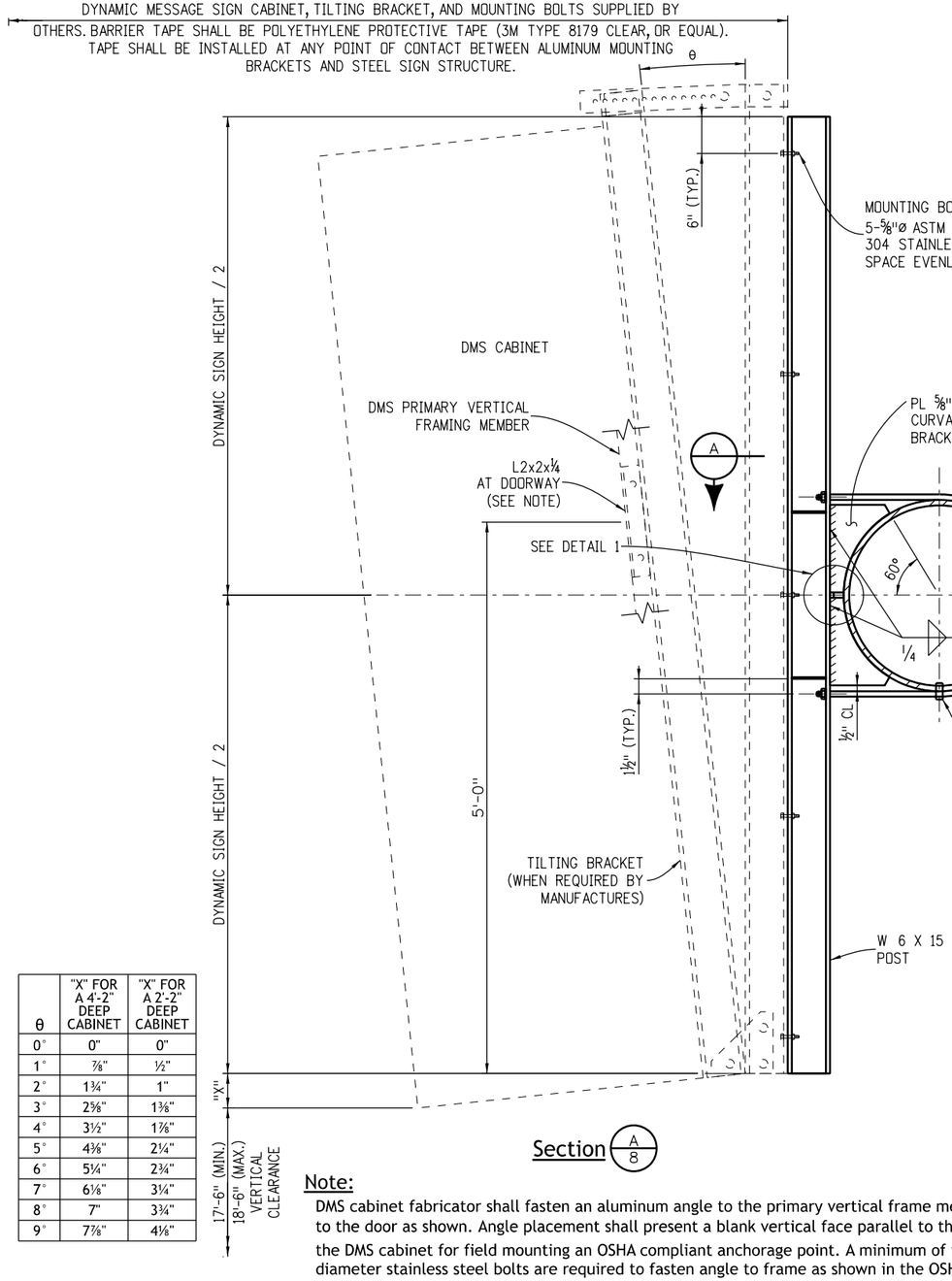
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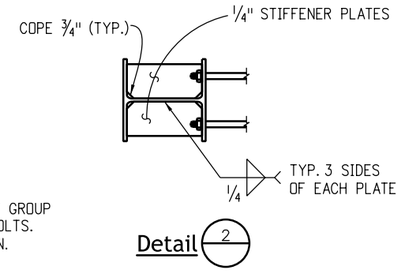
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S-614-60
Standard Sheet No. 3 of 14
Project Sheet Number:

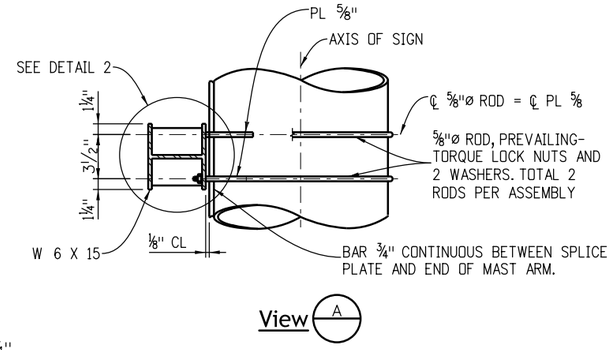


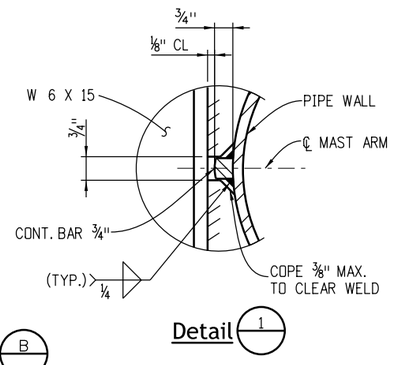
θ	"X" FOR A 4'-2" DEEP CABINET	"X" FOR A 2'-2" DEEP CABINET
0°	0"	0"
1°	⅞"	½"
2°	1¾"	1"
3°	2⅝"	1⅜"
4°	3½"	1⅞"
5°	4⅜"	2¼"
6°	5¼"	2¾"
7°	6⅛"	3¼"
8°	7"	3¾"
9°	7⅞"	4⅛"

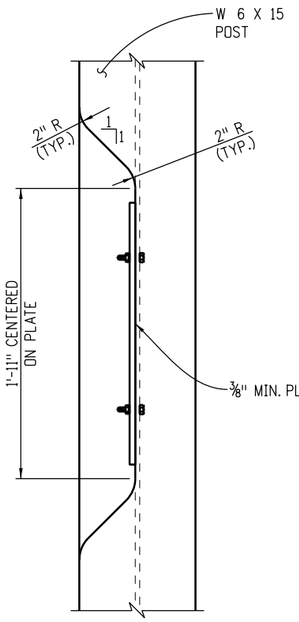
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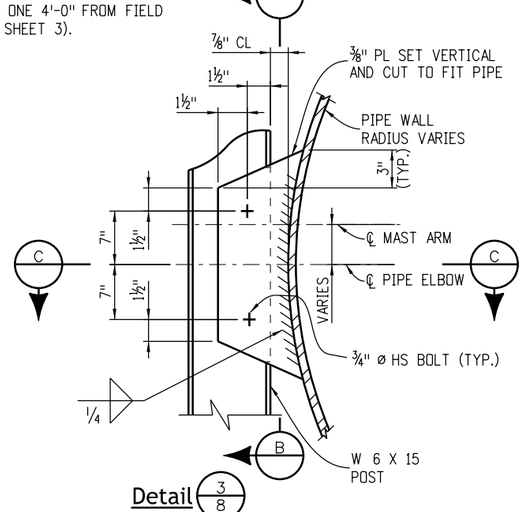
DMS cabinet fabricator shall fasten an aluminum angle to the primary vertical frame member adjacent to the door as shown. Angle placement shall present a blank vertical face parallel to the front face of the DMS cabinet for field mounting an OSHA compliant anchorage point. A minimum of two ⅝ inch diameter stainless steel bolts are required to fasten angle to frame as shown in the OSHA compliant anchorage details on Sheet 3 of 14.

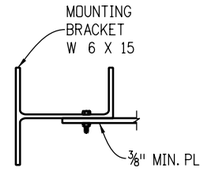












Mounting Bracket on Elbow and Pole

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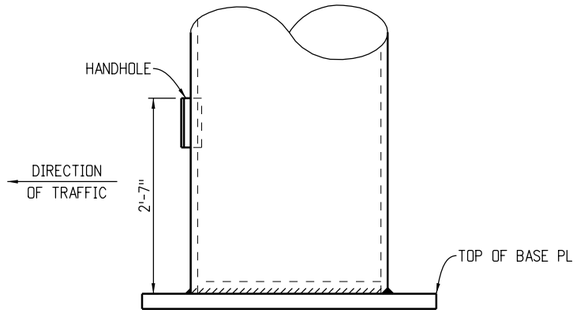
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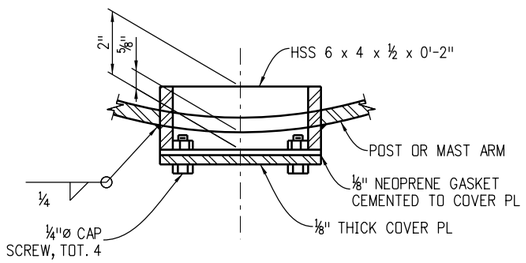
S-614-60

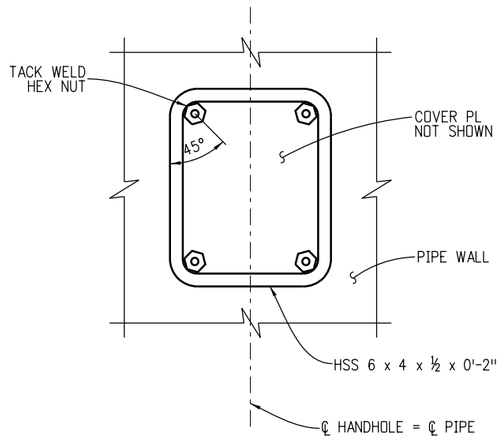
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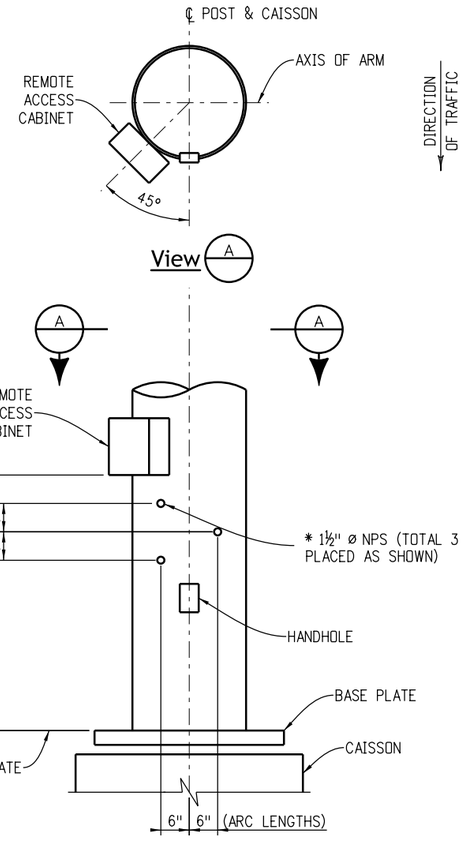


Post Base Elevation
(for Base PL Details see Sheet 7)

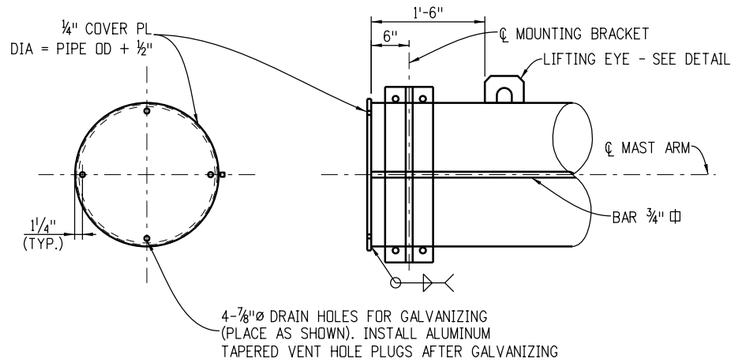




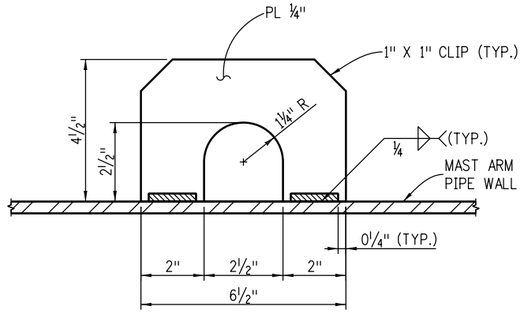
Handhole and Cover Details



Conduit Penetration Details
* Plug with recessed pipe plugs.
■ Disconnect cabinet for the power supply shall be located outside of the clear-zone.



Mast Arm End Detail



Lifting Eye Detail

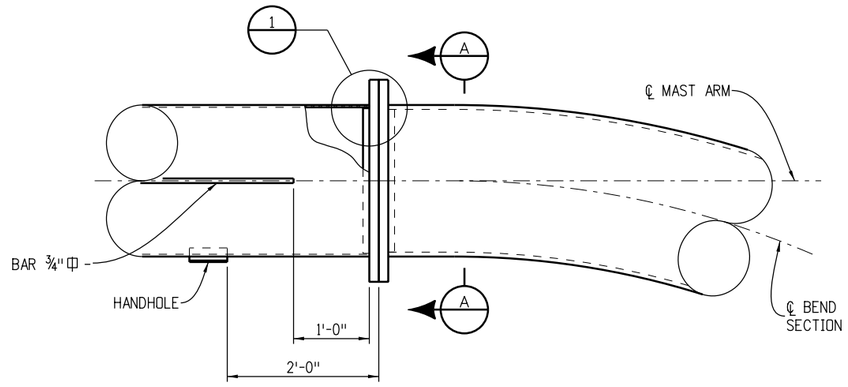
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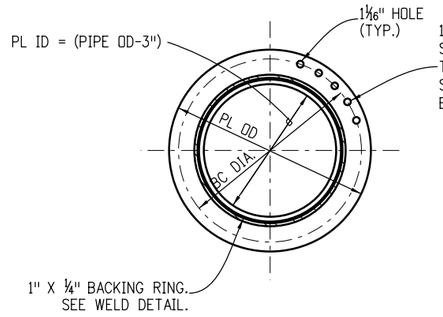
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Standard Plan No.
S-614-60
Standard Sheet No. 5 of 14
Project Sheet Number:

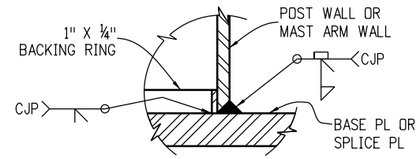


Field Splice

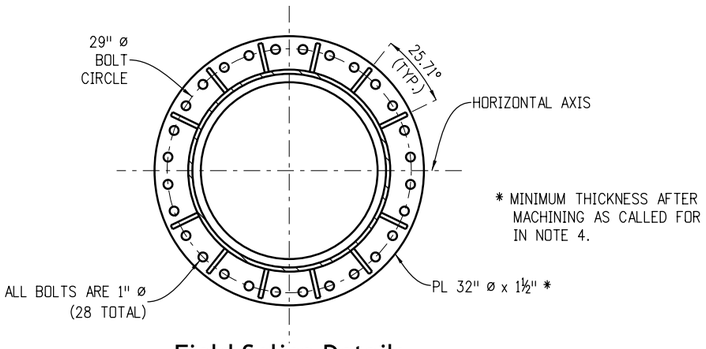


1" ø HS BOLTS (GALVANIZED) EQUALLY SPACED. BOLTS SHALL BE SEQUENTIALLY TIGHTENED. ASSUMING 12 BOLTS AND A CLOCK FACE, THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7 ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED.

Section A

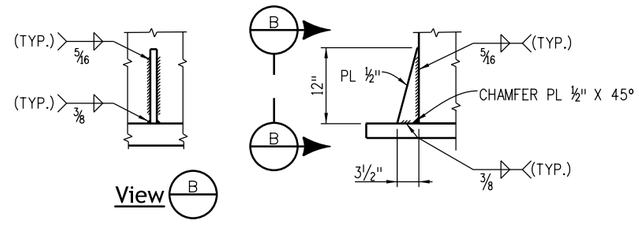


Detail 1



Field Splice Details

Stiffeners shall be located on both sides of the field splice.
Clip washers as needed to avoid interference with stiffener welds.



View B

Stiffener Details

Notes:

1. Stiffeners are to be placed on all cantilever field splices. Stiffeners are not shown elsewhere in these sheets for clarity.
2. Terminate weld ½ inch short of the top of the stiffener plate. At the other 3 weld terminations on these two typical welds, stop the weld ¼ inch 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 inches using a portable flange facer after welding and prior to galvanizing.

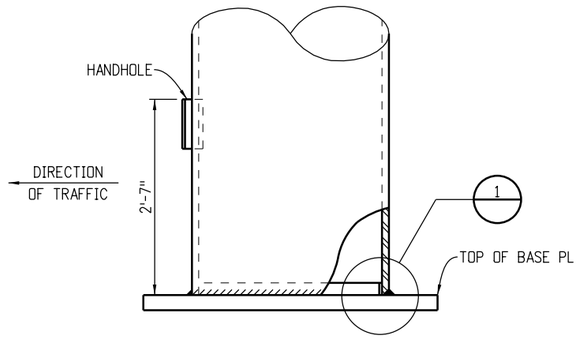
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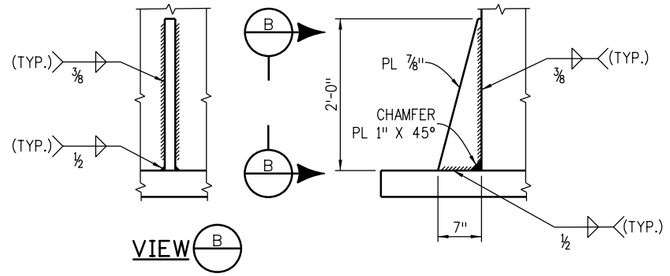
Dynamic Sign Monotube Structures

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Standard Plan No.
S-614-60
Standard Sheet No. 6 of 14
Project Sheet Number:

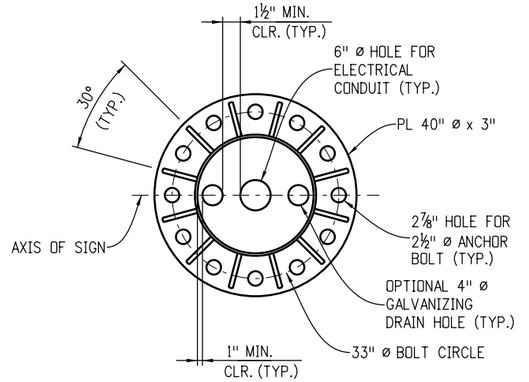


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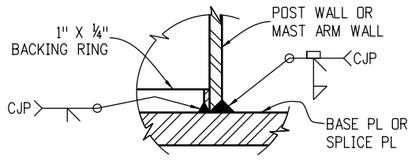


VIEW B

Stiffener Details
(At Post Base - See Notes)



Base Plate Details



Detail 1

Notes:

1. Stiffeners are not shown elsewhere in these sheets for clarity.
2. Terminate weld ½ inch short of the top of the stiffener plate. At the other 3 weld terminations on these two typical welds stop the weld ¼ inch short of the end of the plate.

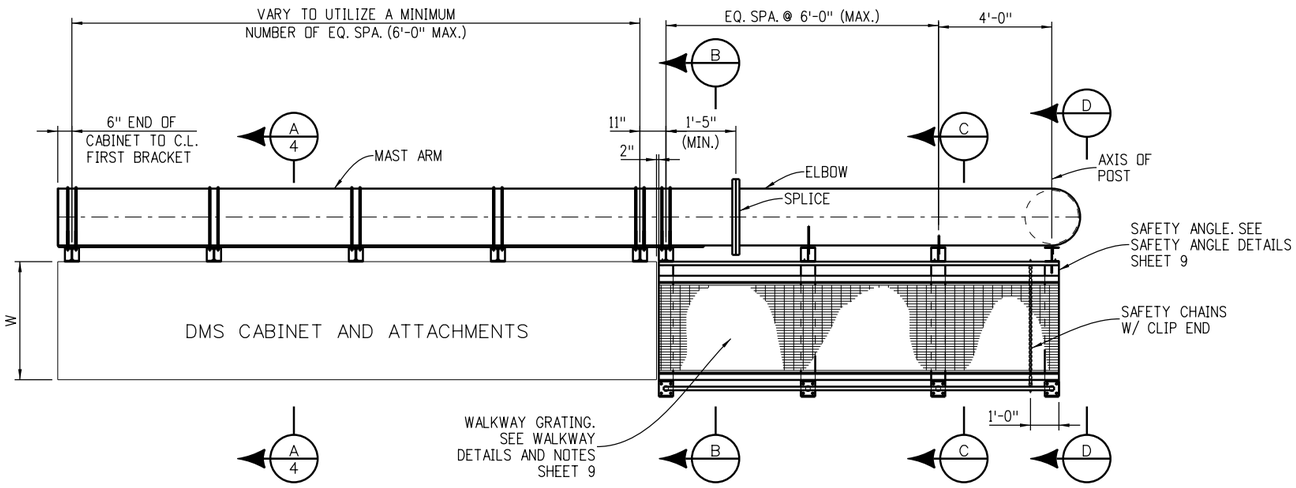
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Dynamic Sign Monotube Structures

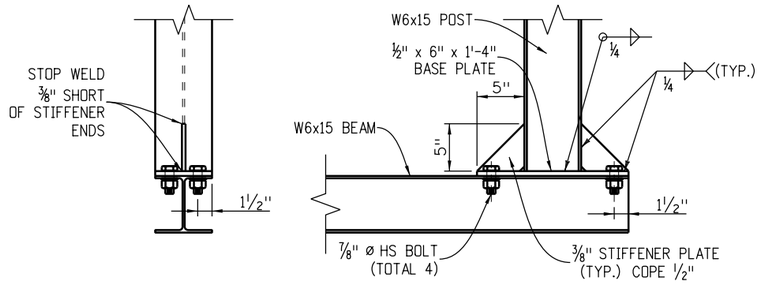
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S-614-60
Standard Sheet No. 7 of 14
Project Sheet Number:



Walkway Plan

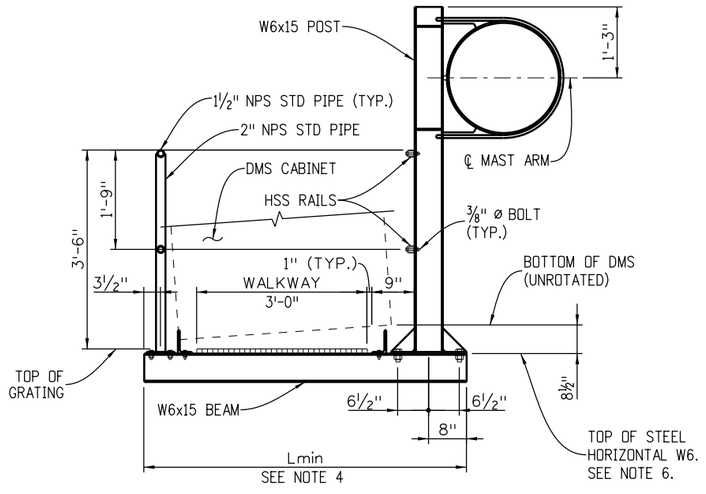
Walkway leading to cabinet



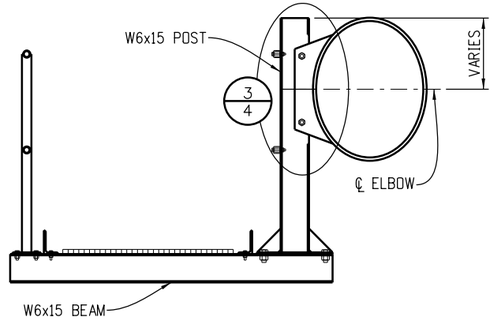
Beam to Post Connection Detail

Notes

1. Maintain uniform post spacing where possible.
2. Maximum post spacing shall not exceed 6 feet - 0 inches.
3. See sheets 4 and 9 for additional details not shown hereon.
4. Length of beam shall be based on DMS width (W) to permit clearance between rails for unobstructed opening of DMS access door. Lmin = W+27 inches.
5. Safety chain shall be ¼ inch galvanized steel coil chain, approximately 36 links per yard.
6. Top of horizontal W6x15 elevation shall be 8½ inches below bottom of DMS cabinet with the tilting bracket in the 0° (unrotated) position.



Section B



Section C

View D

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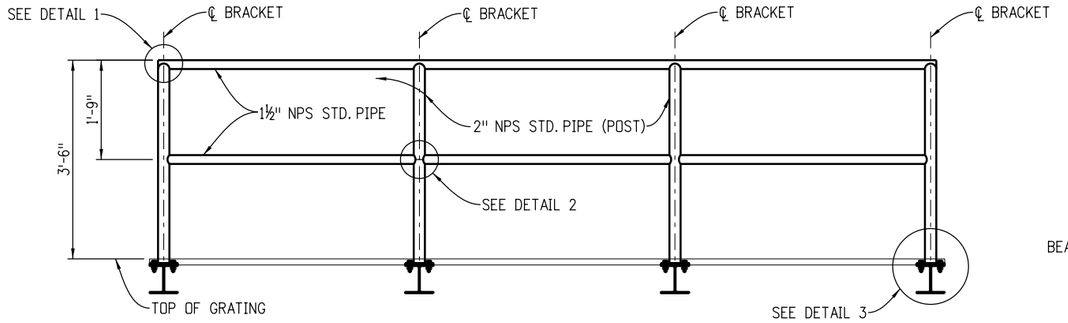
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Dynamic Sign Monotube Structures

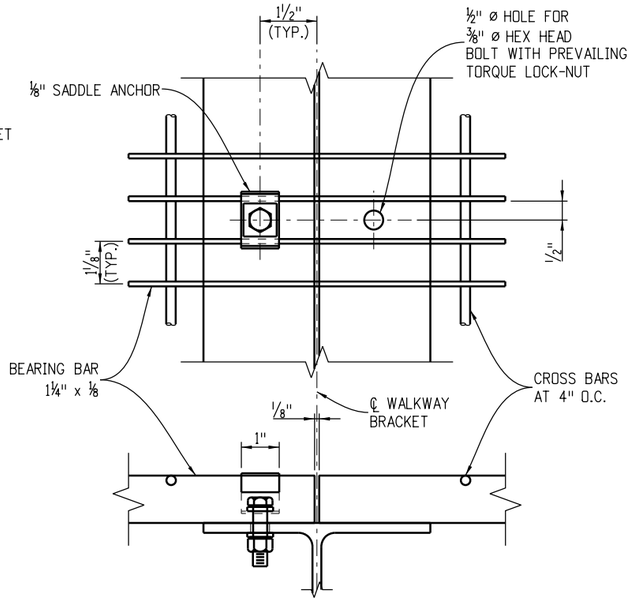
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Standard Plan No.
S-614-60
Standard Sheet No. 8 of 14
Project Sheet Number:

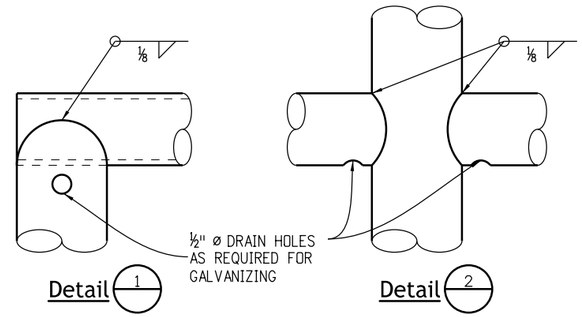


Safety Railing Elevation

(Outside safety railing location - safety angles not shown for clarity)

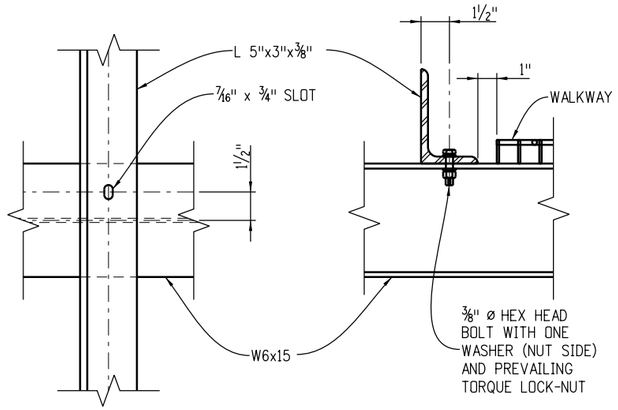


Walkway Details

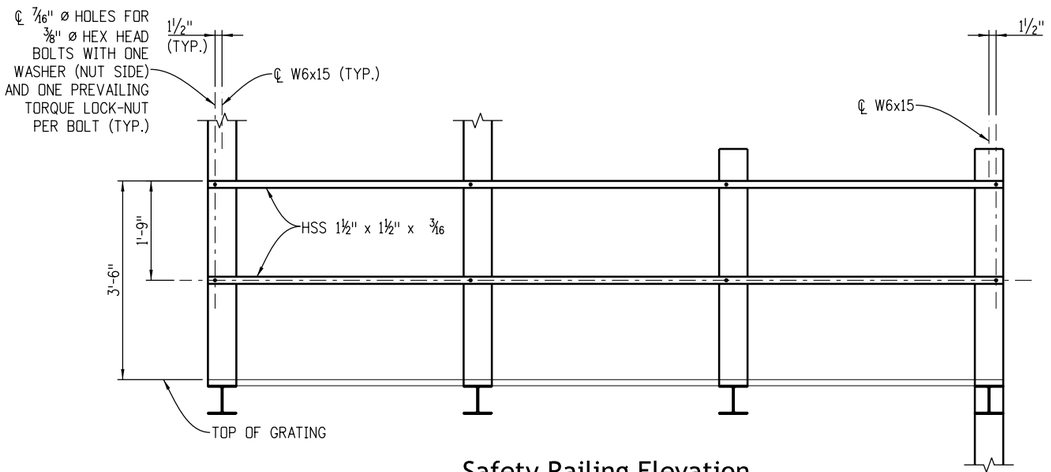


NOTES

Alternative venting methods may be used if approved by the Engineer.

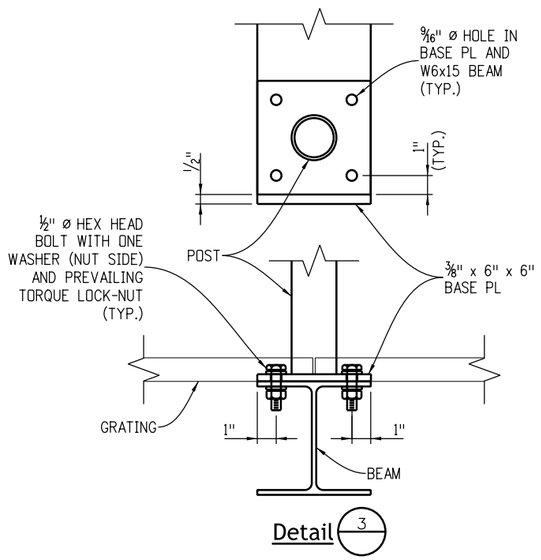


Safety Angle Details



Safety Railing Elevation

(Inside safety railing location - safety angles not shown for clarity)



Notes

1. Welded type grating shall have 1¼ inch x ⅛ inch bearing bars at 1⅛ inch centers with ¼ inch diameter (or equal) cross bars at 4 inch 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 feet-pounds for ⅜ inch Ø bolts and 40 feet-pounds for ½ inch Ø bolts. Do not over tighten bolts at walkway saddle anchor locations.

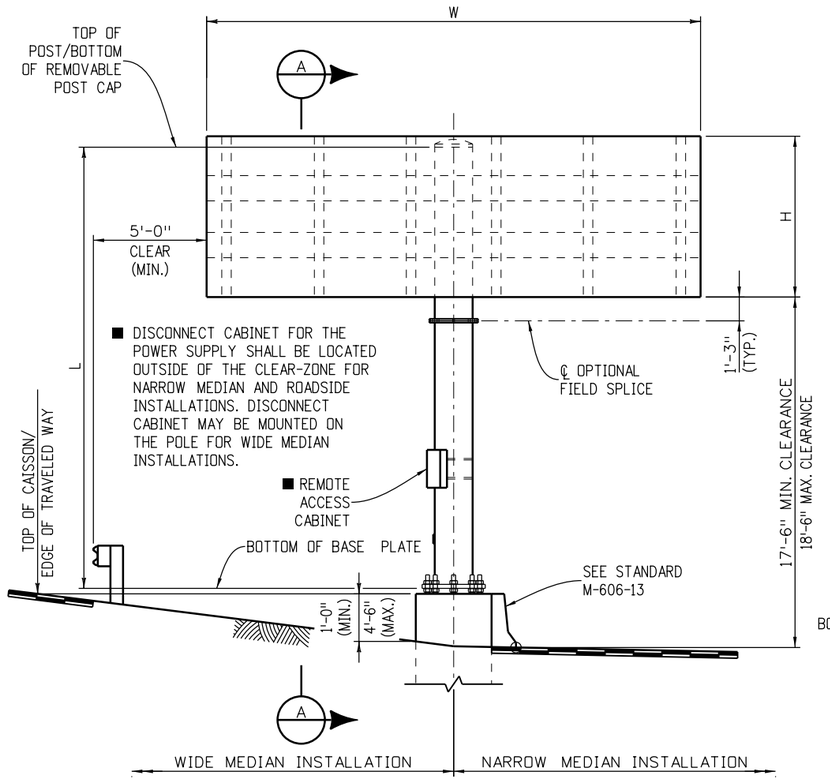
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Last Modified By: YSP			
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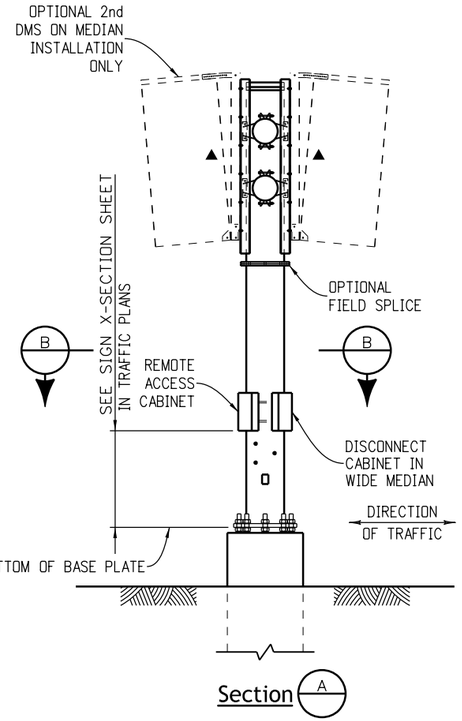
Dynamic Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-60
Standard Sheet No. 9 of 14
Project Sheet Number:

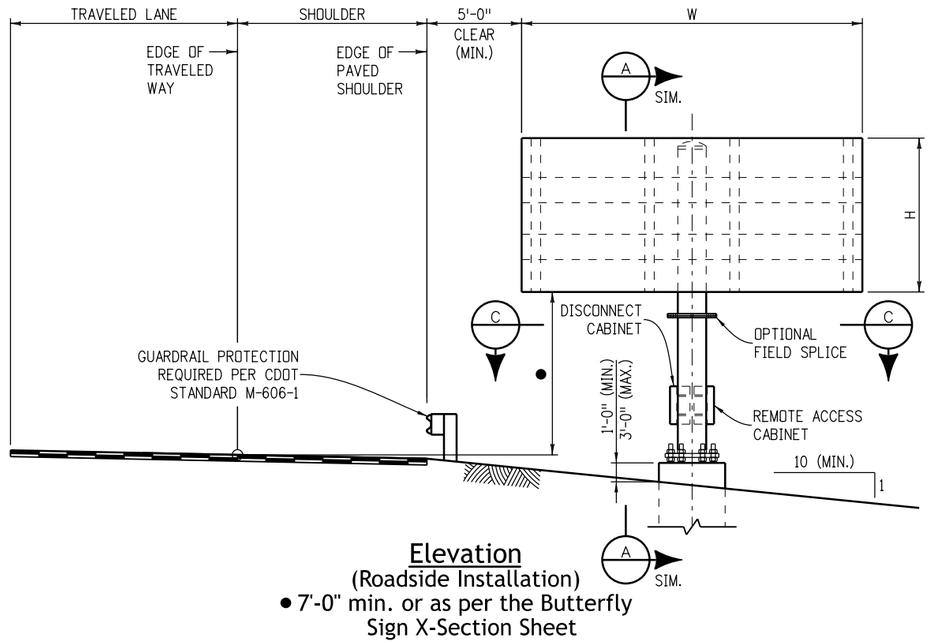


Elevation
(median Installation)

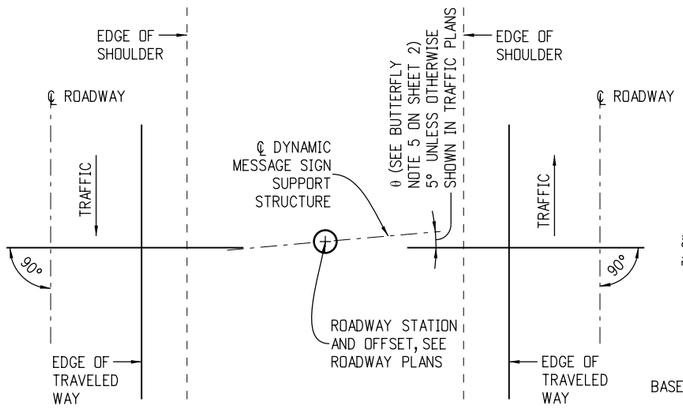


Section

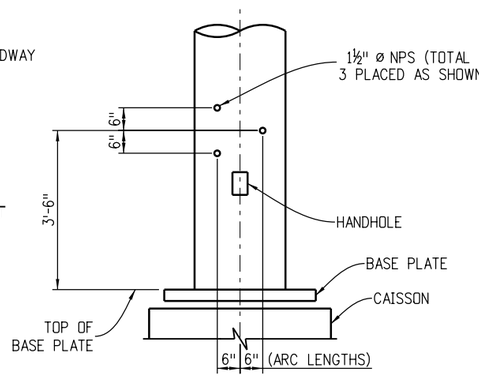
▲ PROVIDE OSHA COMPLIANT ANCHORAGE POINT AS DIRECTED BY THE ENGINEER. SEE SHEETS 3 & 4 FOR MOUNTING INFORMATION.



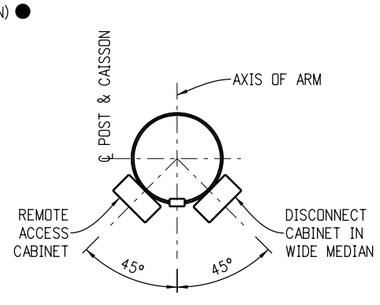
Elevation
(Roadside Installation)
● 7'-0" min. or as per the Butterfly Sign X-Section Sheet



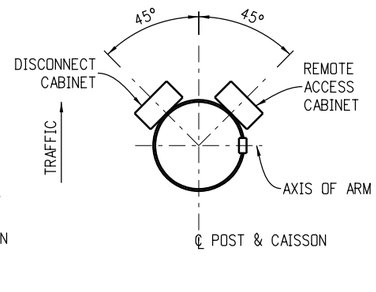
Median Installation Plan



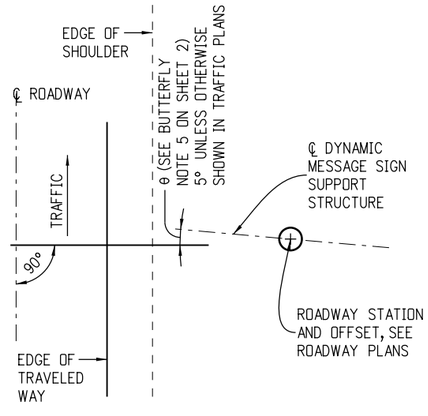
Conduit Penetration Details
● Plug with Recessed Pipe Plugs



Section B



Section C



Roadside Installation Plan

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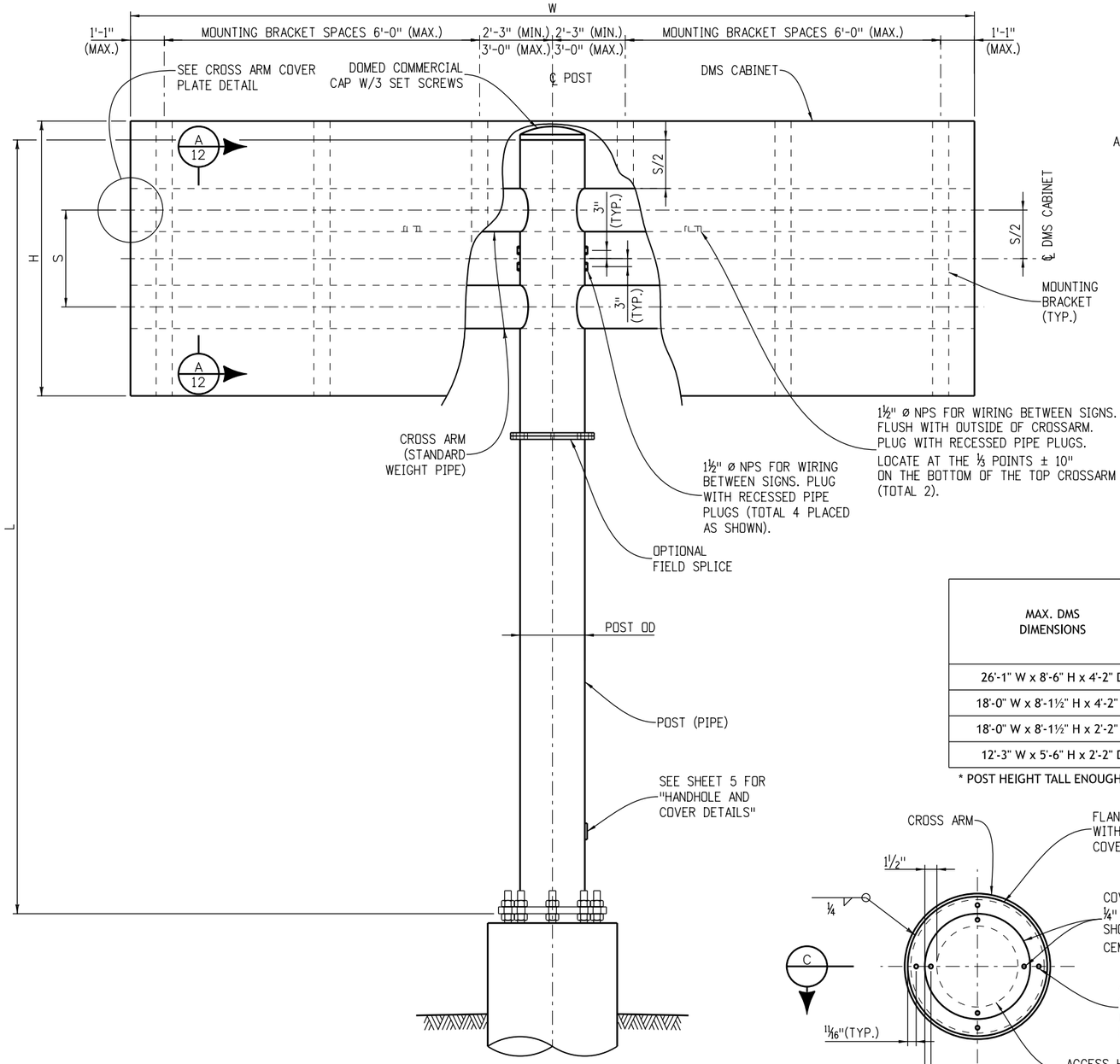
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Dynamic Sign Monotube Structures

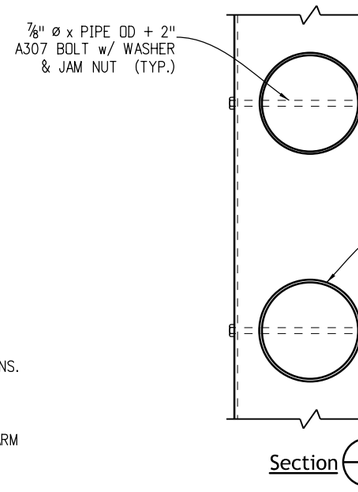
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Standard Plan No.
S-614-60
Standard Sheet No. 10 of 14
Project Sheet Number:

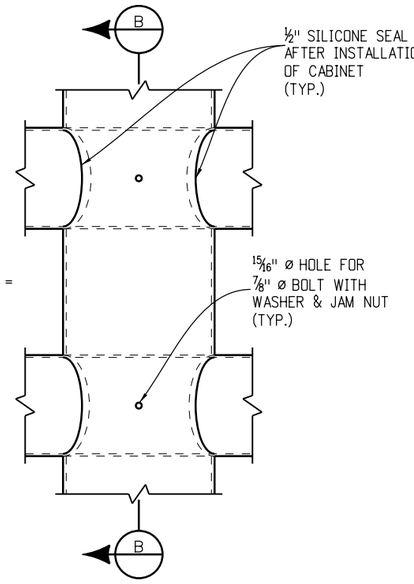
-Butterfly Assembly Details-



Elevation



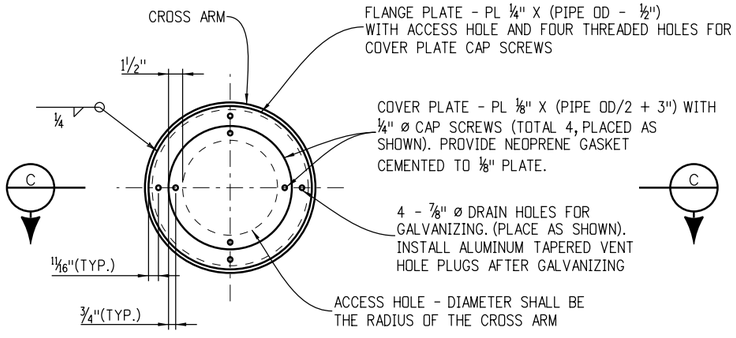
Section B



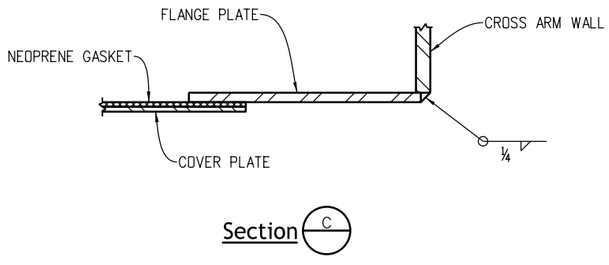
Arms to Post Connection

MAX. DMS DIMENSIONS	MAX. DMS WEIGHT	POST PIPE DATA			CROSS ARM PIPE DATA			
		PIPE OD (IN)	MIN. WALL THICKNESS (IN)	MAX. POST HEIGHT (FT) "L"	PIPE OD (IN)	MIN. WALL THICKNESS (IN)	CROSS ARM LENGTH (FT) "W"	CROSS ARM SPACING (FT) "S"
26'-1" W x 8'-6" H x 4'-2" D	4100 LBS.	24.0	0.50	24.0 *	16.0	0.375	26.0	3.0
18'-0" W x 8'-1½" H x 4'-2" D	3000 LBS.	18.0	0.50	17.0	12.75	0.375	18.0	3.0
18'-0" W x 8'-1½" H x 2'-2" D	2280 LBS.	18.0	0.375	17.0	12.75	0.375	18.0	3.0
12'-3" W x 5'-6" H x 2'-2" D	1520 LBS.	18.0	0.375	14.0	12.75	0.375	12.25	2.5

* POST HEIGHT TALL ENOUGH TO ACCOMMODATE TRAFFIC UNDERNEATH SIGN.



Cross Arm Cover Plate Detail



Section C

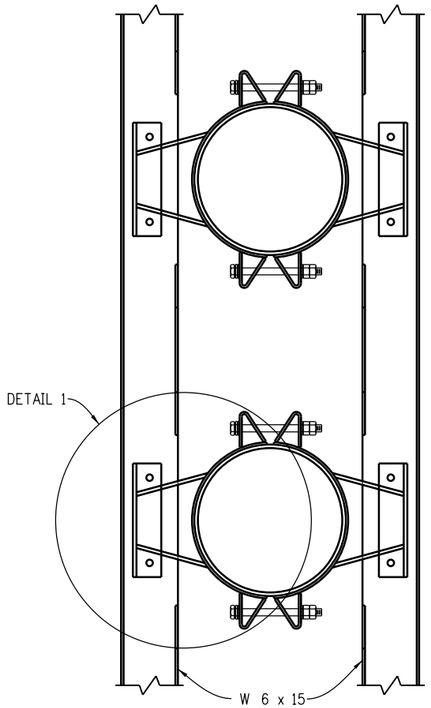
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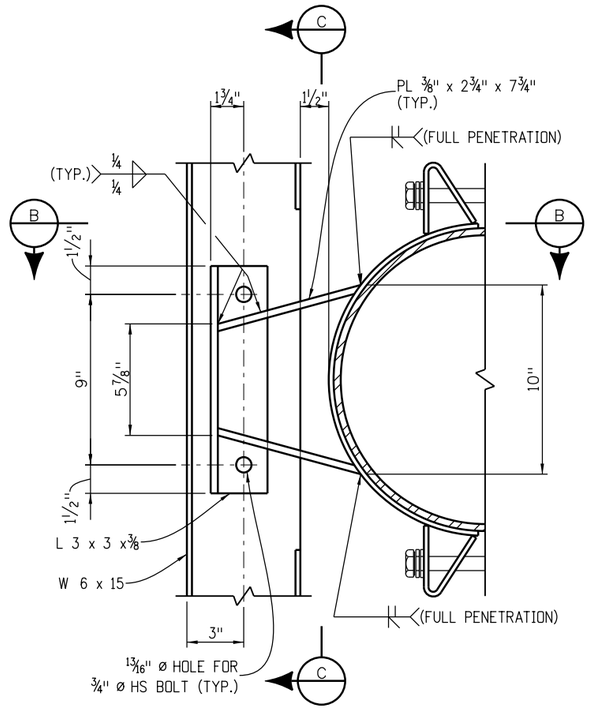
Dynamic Sign Monotube Structures

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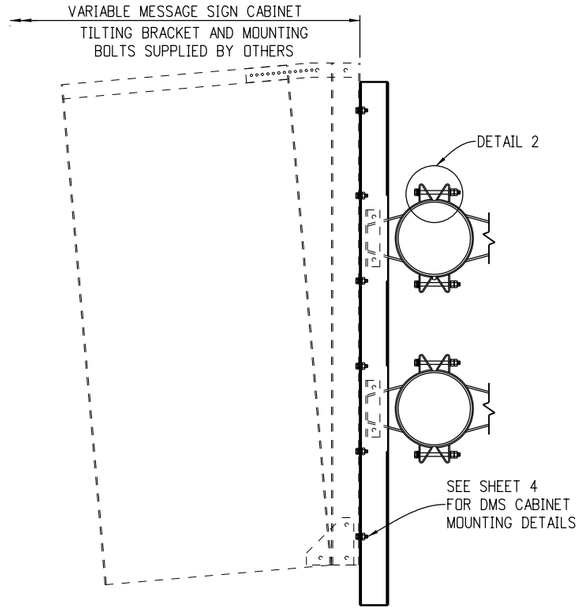
Standard Plan No.
S-614-60
Standard Sheet No. 11 of 14
Project Sheet Number:



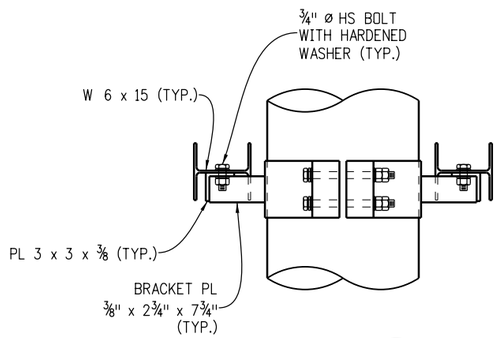
Section A/11



Detail 1

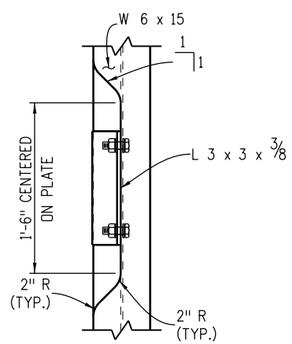


Typical Bracket Connection

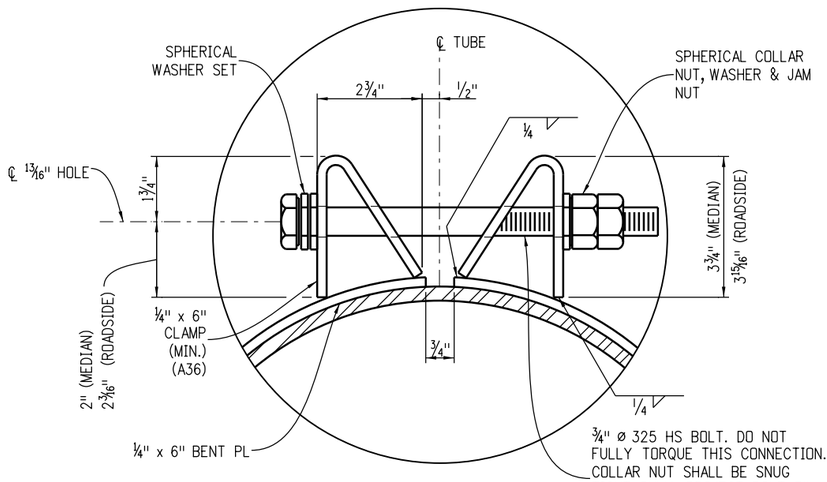


Section B

See Detail 2 for Clamp Details.



Section C



Detail 2

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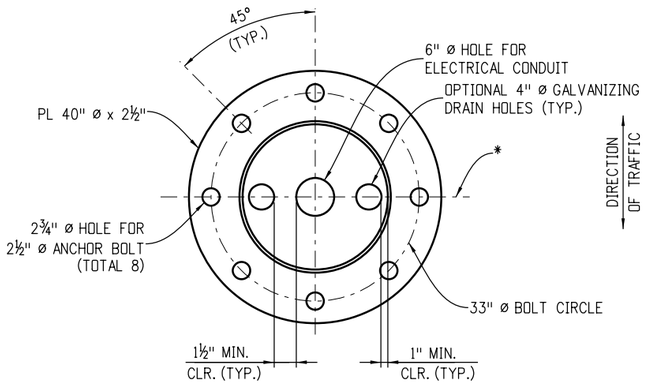
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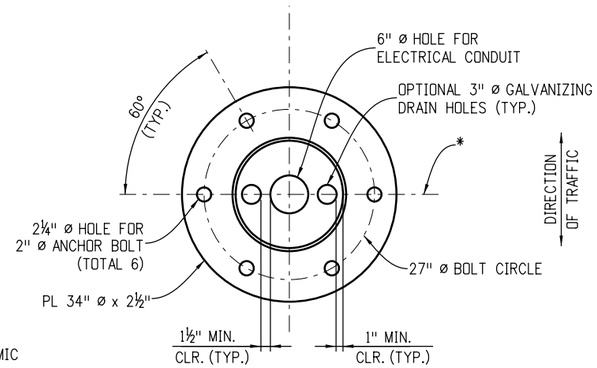
Dynamic Sign Monotube Structures

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-614-60
Standard Sheet No. 12 of 14
Project Sheet Number:

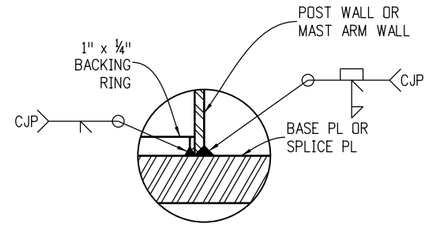


Base Plate Detail
24" Pipe Post

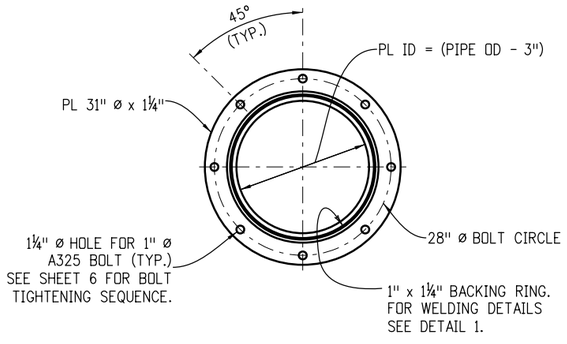


* CENTERLINE OF DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE, SEE SHEET 10.

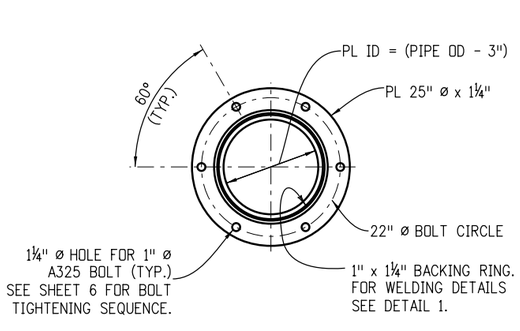
Base Plate Detail
18" Pipe Post



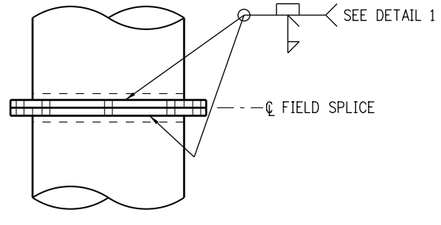
Detail 1



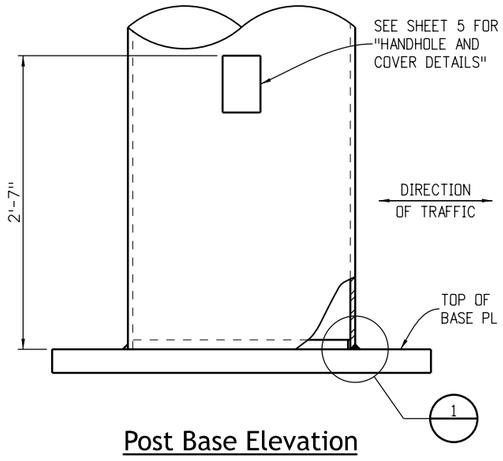
Optional Field Splice
24" Pipe Post



Optional Field Splice
18" Pipe Post



Optional Field Splice



Post Base Elevation

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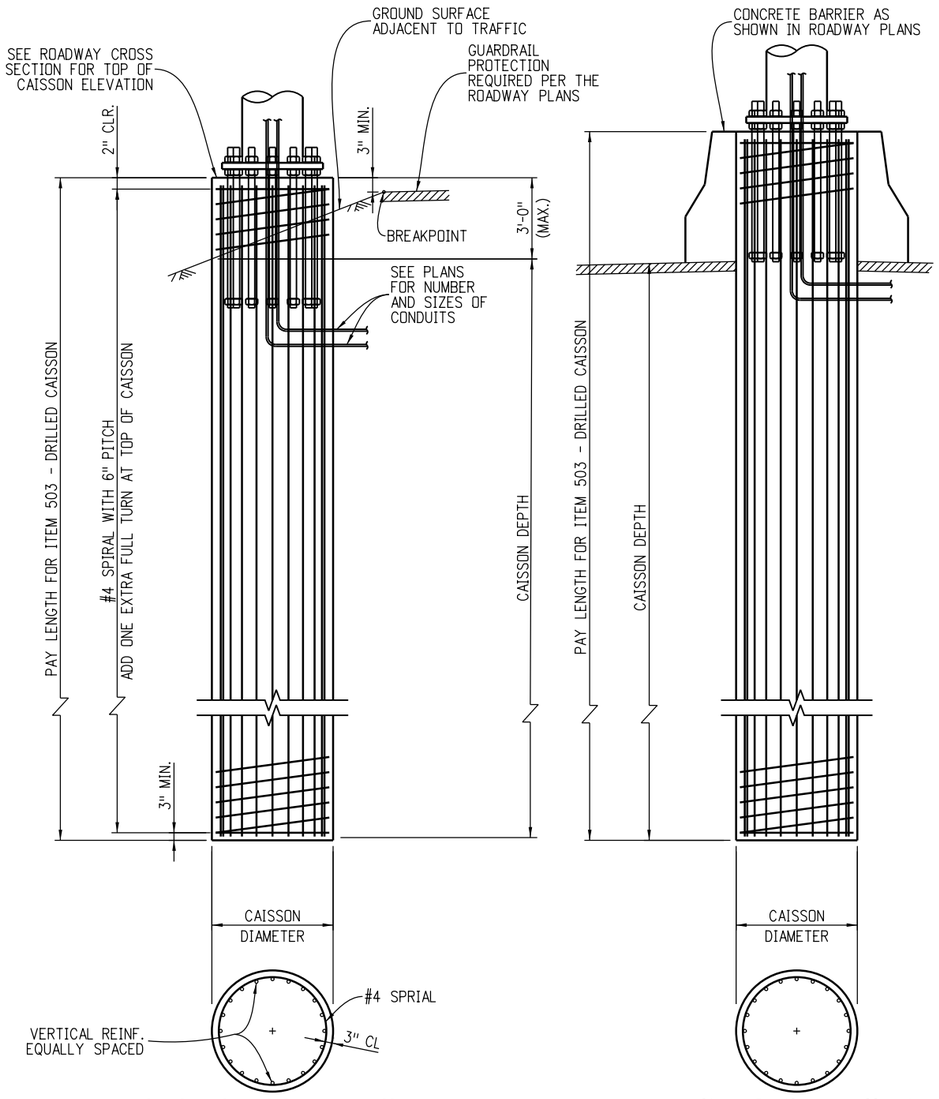
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Dynamic Sign Monotube Structures

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Standard Plan No.
S-614-60
Standard Sheet No. 13 of 14
Project Sheet Number:

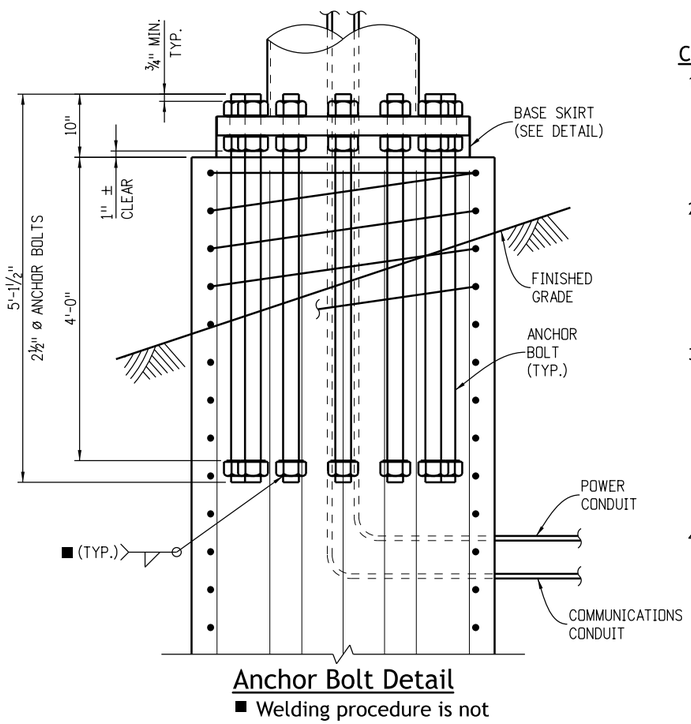
-Foundation & Anchor Bolt Details-



Roadside Shoulder Installation

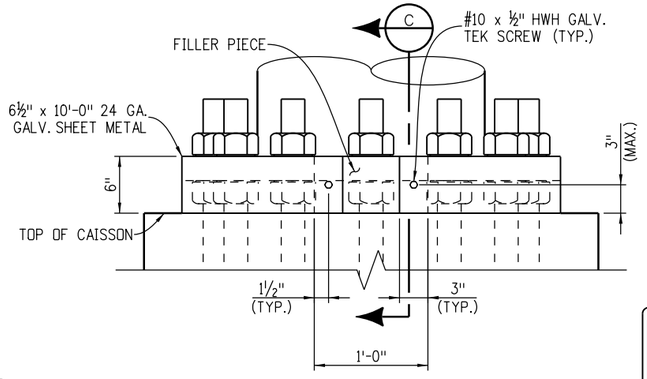
Median Rail Installation

(See roadside shoulder installation for additional information)



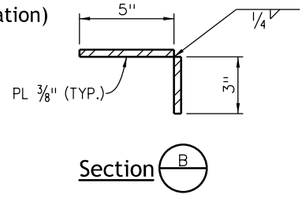
Anchor Bolt Detail

■ Welding procedure is not required for this weld.

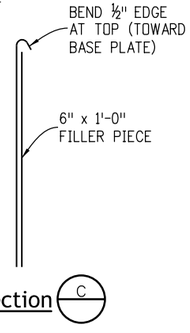


Base Skirt Detail

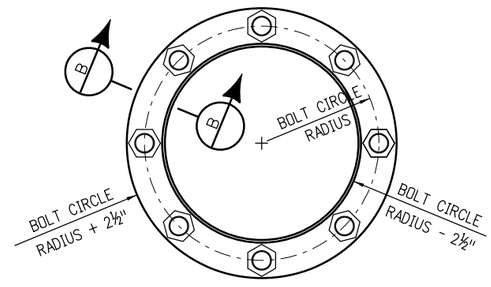
Note: Use BAND-IT straps to tighten skirt onto base plate prior to installing self tapping screws.



Section B



Section C



Bolt Template

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. If casings are used by the Contractor and cannot be removed, shafts for cantilever sign structures shall be abandoned and another shaft drilled and placed as approved by the Engineer at no cost to the project. Unremoveable casings for butterfly sign shafts may be left in place without relocation.

2. The design herein assumes that DMS supports are installed within the roadway prism with the following soil parameters:

   Soil Density = 110 pound/ cubic foot
   Soil Cohesion = 750 pound/ square foot for medium stiff cohesive soil
   Soil Φ Angle = 30° for medium dense cohesionless soil
   SF = 3.0 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) The site won't support the weight of the drilling rig.
   (D) The foundation soils are not homogenous.
   (E) Firm bedrock is encountered.
   (F) High groundwater is encountered.
   (G) Large boulders are encountered.

4. The Contractor shall provide a survey of the DMS foundation to verify placement soon after work on the foundation has been completed. The survey shall conform to the requirements of Section 625, 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, projections, and orientations. The elevation of the ground surrounding the foundation shall also be provided. The Contractor shall compare the survey information to the reviewed shop drawings 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 inches and galvanize upper 1foot-3 inches 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 1/12 turn (30° ± 5°) using a slugging wrench.

CAISSON FOUNDATION DETAILS

STRUCTURE TYPE	PIPE OD (IN)	CAISSON DIAMETER (IN)	CAISSON DEPTH (FT)	VERTICAL REINF.
CANTILEVER	24	48	29	18 - #9
BUTTERFLY	24	48	21	18 - #9
BUTTERFLY	18	42	16	14 - #9

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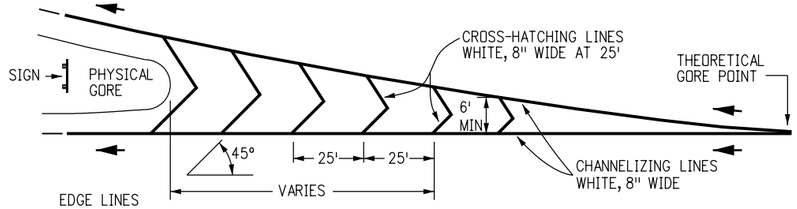
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Date:	Comments

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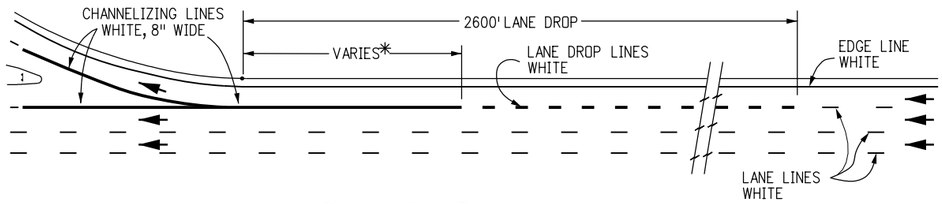
Dynamic Sign Monotube Structures

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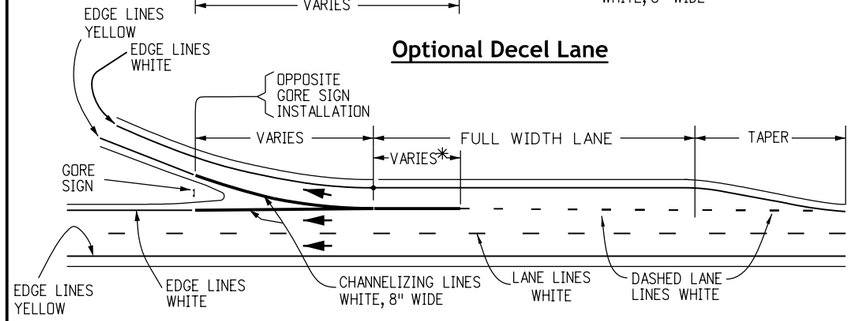
Standard Plan No.
S-614-60
Standard Sheet No. 14 of 14
Project Sheet Number:



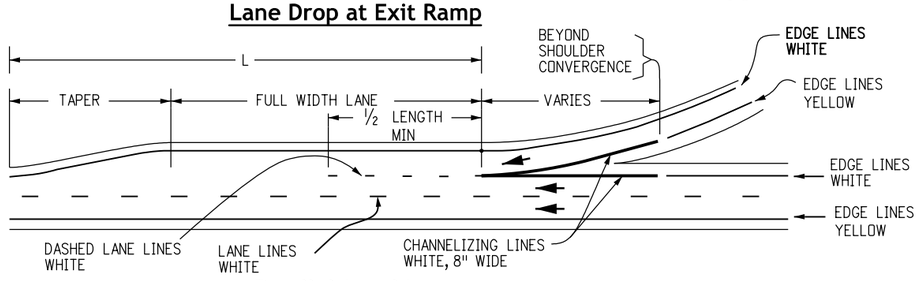
Optional Decel Lane



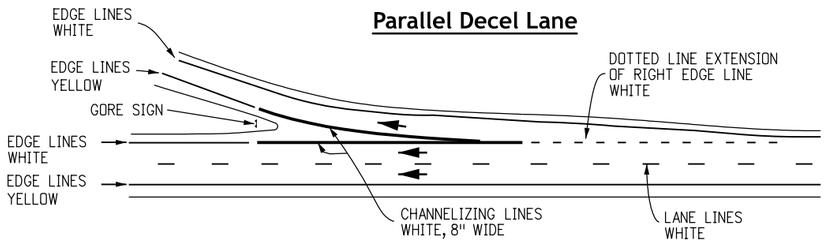
Lane Drop at Exit Ramp



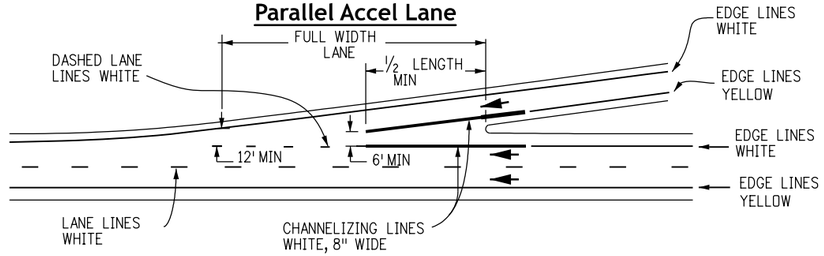
Parallel Decel Lane



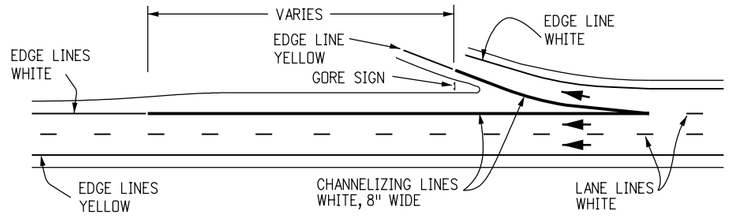
Parallel Accel Lane



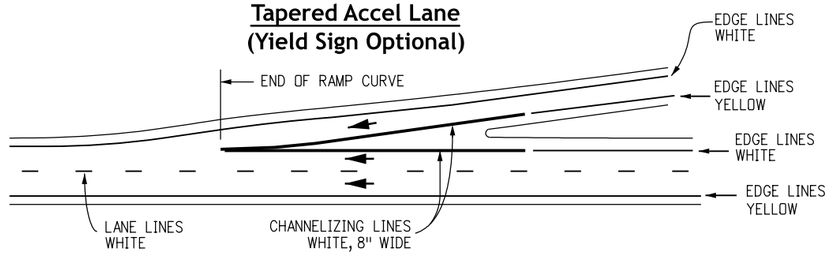
Tapered Decel Lane



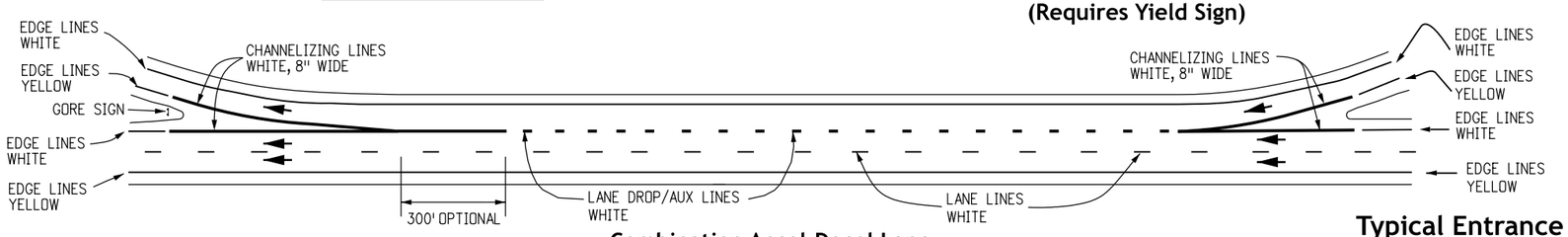
Tapered Accel Lane



Decel Recovery Zone



No Accel Lane



Combination Accel-Decel Lane

Typical Entrance And Exit Ramp Markings

General Notes

1. Minimum longitudinal pavement marking width:

Facility Type	Speed	Edge Lines	Lane Lines	Center Lines[1]	Dotted Lane Lines	Lane Drop/ Aux Lines
2-Lane Facilities	All	6"	n/a	4"	n/a	n/a
3- Lane Facilities	All	6"	6"	4"	6"	8"
Multi-Lane Facilities	≥ 50 MPH	6"	6"	4"	6"	8"
Multi-Lane Facilities	≤ 45 MPH	4"	4"	4"	4"	8"

[1]Applies to facility types with double yellow lines, painted median, or undivided highway.

2. Temporary Pavement Marking
   4 inch wide marking can be used instead of 6 inch wide marking for temporary marking unless otherwise directed by the Region Traffic Engineer.

3. Center Lines
   a. Broken yellow, 4 inch wide 10-foot segments with 30-foot gaps.
   b. Solid yellow, 4 inch wide. These lines separate adjacent-opposite direction traffic lanes. Double lines shall be spaced 4 inches apart.

4. Lane Lines
   a. Broken white, 4 or 6 inches wide 10-foot segments with 30-foot gaps.
   b. Solid white, 4 or 6 inches wide. These lines separate adjacent-same direction traffic lanes. A solid line may be used to discourage lane changing, while two parallel solid white lines are required to prohibit lane changing.

5. Edge Lines
   a. Solid white or yellow edge lines shall be 4 or 6 inches wide.Yellow edge lines shall be used only for left edge, in the direction of travel of divided streets and highways (separated by other than a painted median) and one-way roadways (including ramps).
   b. Edge lines are not continued through intersections and are not broken for driveways. Care must be taken to avoid edge line appearing as lane line along roadways with wide shoulders and/or closely spaced driveways.

6. Dotted Line Extensions
   Broken white, width matching the line being extended 2-foot segments with 4-foot gaps. These lines are used to delineate the extension of a line through an intersection or interchange area.

7. Lane Drop / Aux Lines
   Broken white, 8 inch wide 3-foot segments with 12-foot gaps.These lines should begin 2600 feet in advance of the theoretical gore point to distinguish the lane drop from a continuous lane.

8. Dashed lane lines
   Broken white, 4 or 6 inches wide 3-foot segments with 12-foot gaps. Line width shall match the adjacent lane line. These lines separate a through lane from an adjacent deceleration or acceleration lane.

9. Channelizing Lines
   Solid white, 8 inch wide. These lines are used with acceleration-deceleration lanes, pavement width transitions, and left-right turn slots or islands.

* The channelizing line may be extended 300 feet (typical) upstream from the theoretical gore. Final length depends on site conditions.

(Continued on Sheet No. 2)

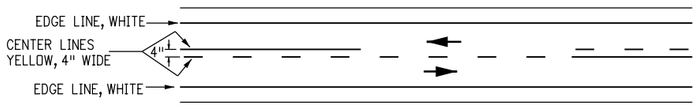
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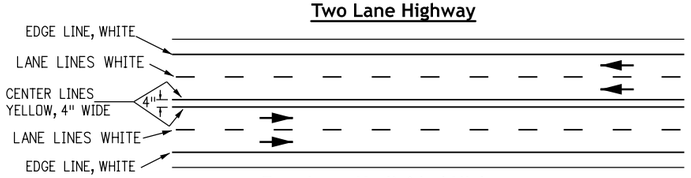
Pavement Markings

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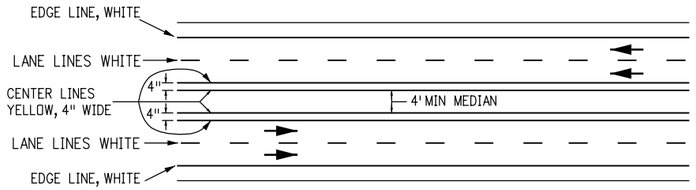
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Standard Sheet No. 1 of 11
Project Sheet Number:



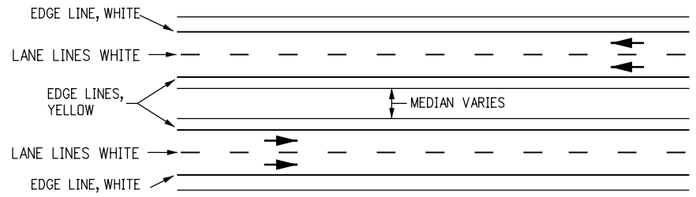
Two Lane Highway



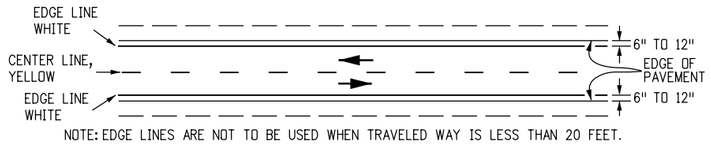
Four Lane Undivided Highway



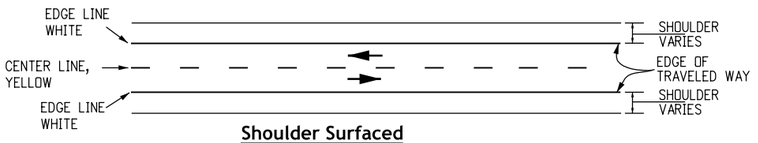
Four Lane Paint Divided Highway



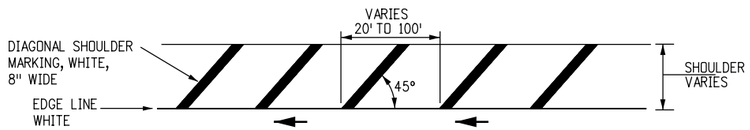
Four Lane Divided Highway



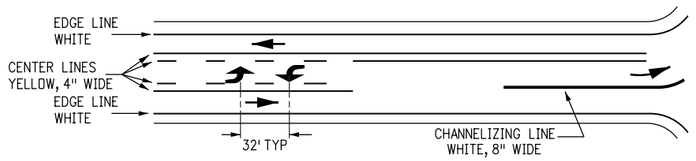
No Shoulder Or Unsurfaced Shoulder



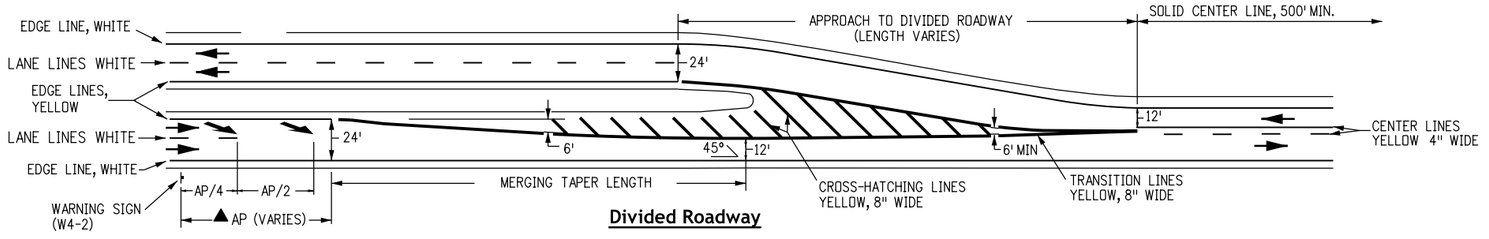
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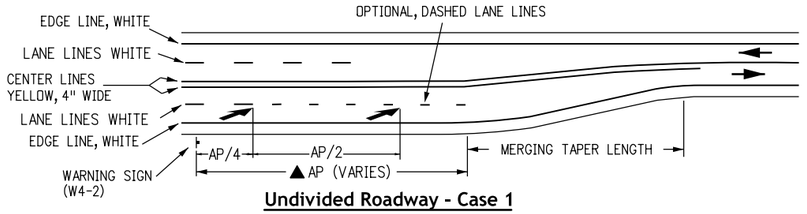
Edge Line With Optional Diagonal Shoulder Marking



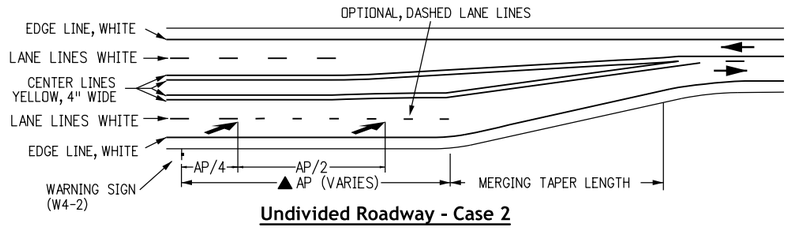
Typical Two Way Left Turn Lane



Divided Roadway



Undivided Roadway - Case 1



Undivided Roadway - Case 2

Typical Pavement Width Transition Markings

General Notes

(Continued from Sheet No. 1)

10. Cross-Hatching Lines
    a. Solid white or yellow, 8 inches wide-45 degree diagonal, spaced at 25 feet intervals. These lines are optional and may be placed at locations indicated on the plans or determined by the Engineer. Yellow shall be used for painted medians or pavement width transitions only.

    b. Optional diagonal shoulder markings shall be solid white, 8 inches wide, spaced at intervals of 20 feet minimum to 100 feet maximum.

11. Parking Lines
    Solid white, 3 inches wide-diagonal or parallel as shown on the plans or directed by the Engineer.

12. Stop Lines
    Solid white, 24 inches wide-extend parallel to intersected roadway across all approach lanes or as indicated at locations on the plans. Locate at the desired stopping point, not more than 30 feet, nor less than 4 feet from the nearest edge of the intersected traffic lane.

13. Yield Lines
    a. Solid white, the individual triangles comprising yield lines shall have a base of 1 to 24 inches wide and a height equal to 1.5 times the base and shall be parallel to the intersected roadway across all approach lanes or as indicated at locations on the plans.

    b. The space between each triangle shall be 3 to 12 inches.

14. Crosswalk Lines
    a. Solid white, 12 inches wide for transverse line type extend across entire width of pavement. If no advance stop line is provided, increase the width of the crosswalk lines to 24 inches. The distance between the lines is usually determined by the width of the sidewalks connected, in any case this shall not be less than 6 feet.

    b. Complicated and/or channelized intersections and mid-block crosswalks shall be solid white, 12 inches to 24 inches wide and 8 to 10 feet long for longitudinal line type as detailed in the plans or as directed by the Engineer.

15. Word, Arrow and Symbol markings
    All letters, arrows and symbols shall be in conformance with "The Standard Alphabets for Highway Signs and Pavement Markings" adopted by the Federal Highway Administration.

16. Merging Taper Length
    L = Minimum Length of Taper.
    S = Design speed for new construction or numerical value of the posted speed limit of the 85th Percentile Speed of existing traffic.
    W = Width Transitioned.

    Formula: For speeds 45 mph or more, $L = S \times W$

    For speeds 40 mph or less, $L = \frac{WS^2}{60}$

17. Transition Lines
    Solid yellow, 8 inches wide. these lines are used where additional emphasis or visibility is desirable at pavement width transitions. place at locations indicated on the plans or as directed by the Engineer.

18. Speed Measuring Marking
    Solid white, 24 inches extend 4 feet from outside of edge lines on shoulders.

19. All spacing is determined center on center except for double lines.

▲ Note:

AP = Advance placement distance from the lane ends sign (W4-2) to the beginning of the merging taper. See Section 2C of the MUTCD for advance placement distances.

Legend

→ Direction Of Travel

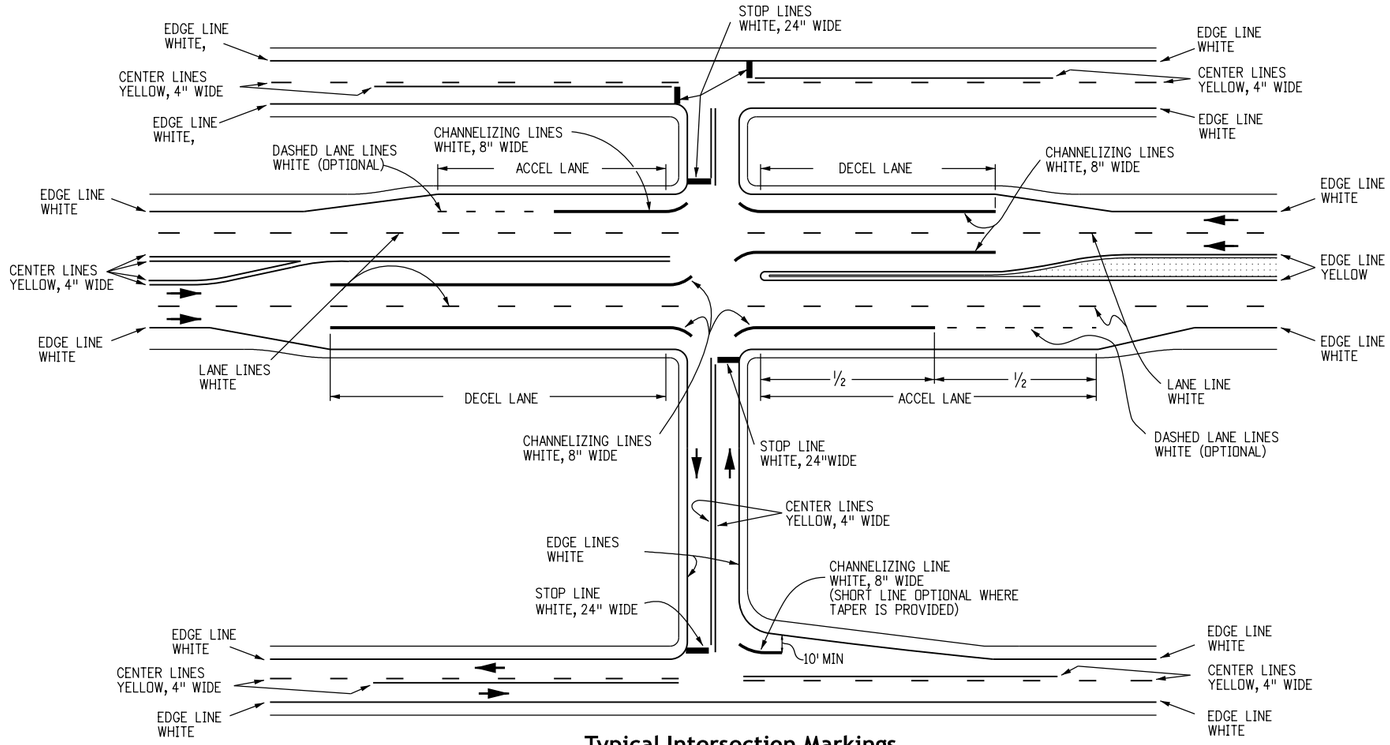
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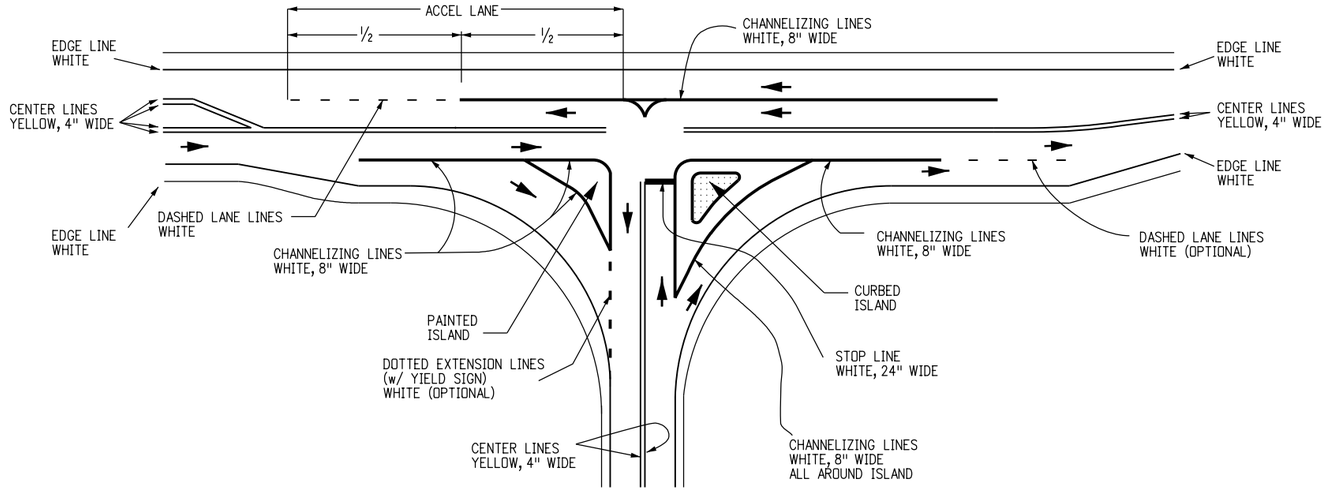
Pavement Markings

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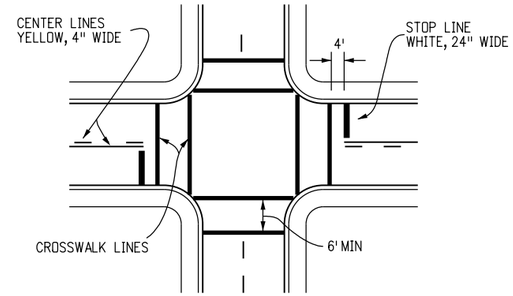
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S-627-1
Standard Sheet No. 2 of 11
Project Sheet Number:



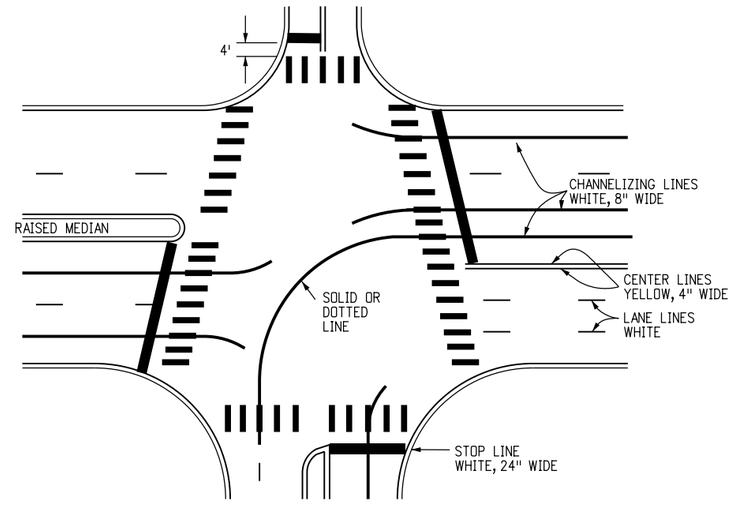
Typical Intersection Markings



Typical Island Markings

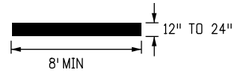


Typical Transverse Line Crosswalk Markings



Typical Continental Crosswalk Markings

Crosswalk Line Detail



Legend

→ Direction Of Travel

Continental Crosswalk Notes

1. Center crosswalks on curb ramps, if such ramps are not provided, center on signal poles wherever practical.
2. Center crosswalks on edge lines, lane lines and channelizing lines.
3. Center crosswalks between adjacent lines.
4. Markings shall not be within wheel path of vehicles.
5. Center on extended flow line.
6. Lines and spaces to approximate adjacent pattern.

Intersections, Islands and Crosswalks

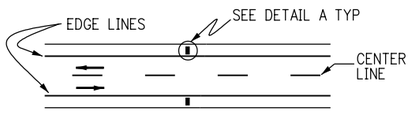
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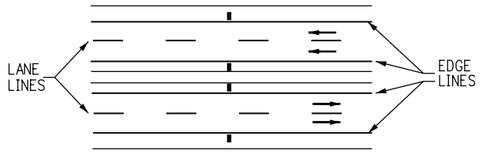
Pavement Markings

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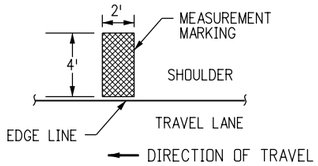
Standard Plan No.
S-627-1
Standard Sheet No. 3 of 11
Project Sheet Number:



Two - Way Roadway

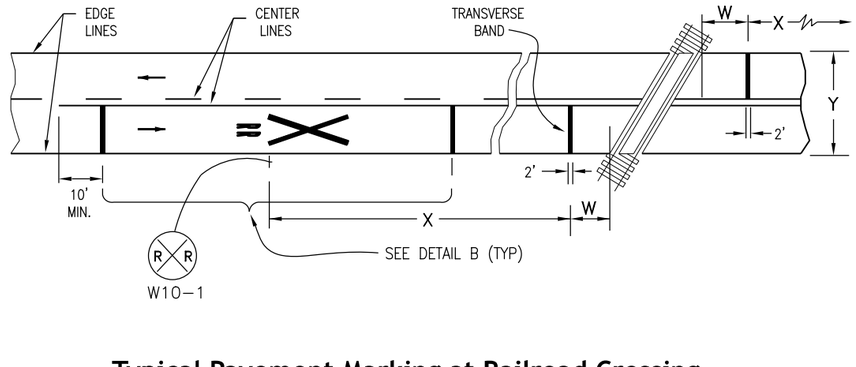


Multi - Lane Divided Highway

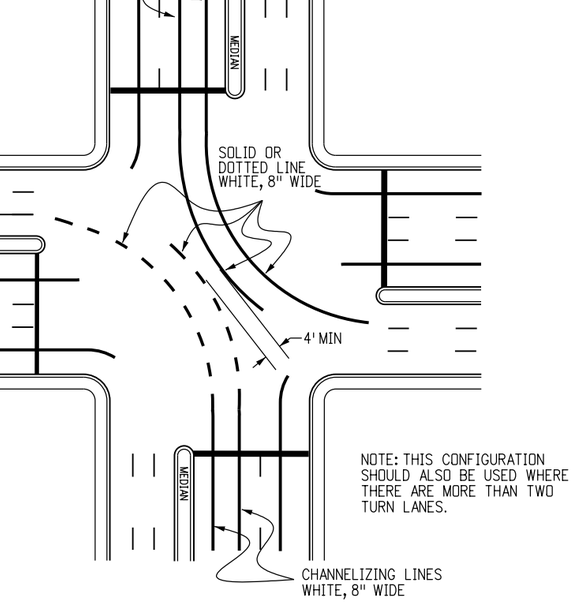


Detail A

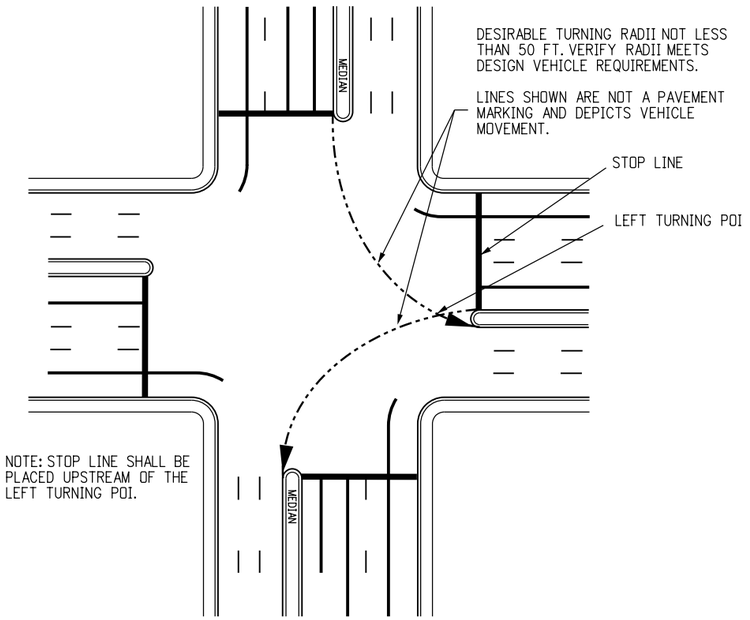
Typical Speed Measurement Marking



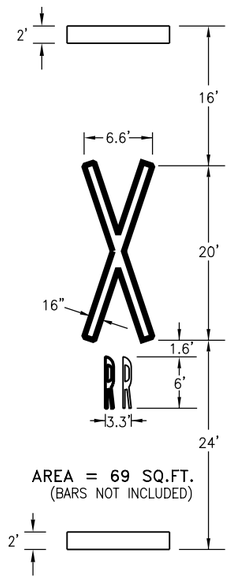
Typical Pavement Marking at Railroad Crossing



Typical Double Left Turn Markings



Typical Stop Line Placement



Detail B

W = Approximately 15 ft. (stop line should be 8' in advance of active traffic control systems; i.e., automatic gates and/or flashing signals).

X = 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, but not less than 100 ft. (Reference Note 1).

Y = On multi-lane roads the transverse bands should extend across all approach lanes, and individual railroad symbols should be used in each approach lane.

Notes

1. The warning sign shall be placed according to the warning sign placement table in the MUTCD (Chapter 2C, Table 2C-3). If conditions do not allow placement according to the table, it shall be as approved by the Engineer.
2. For railroad symbol details, refer to "The Standard Alphabets for Highway Signs and Pavement Markings", adopted by the Federal Highway Administration.

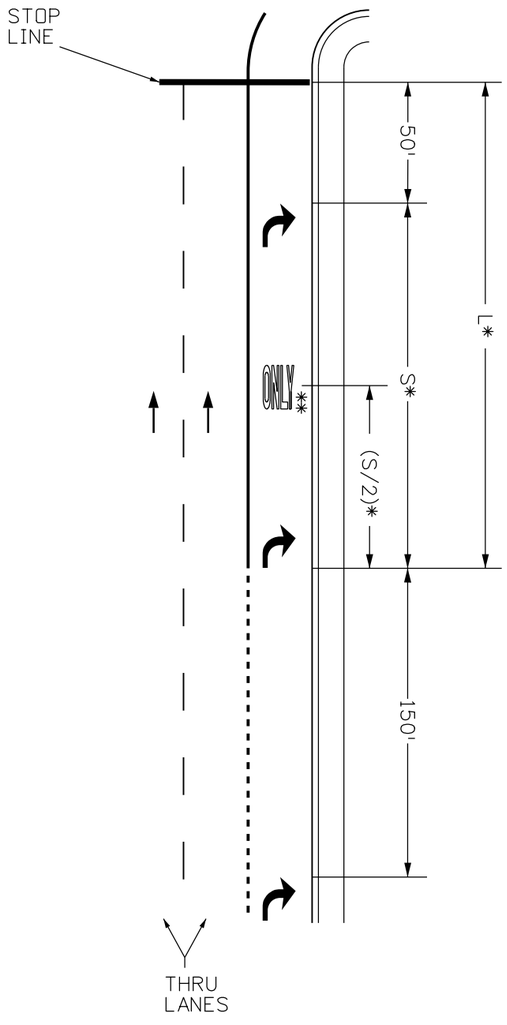
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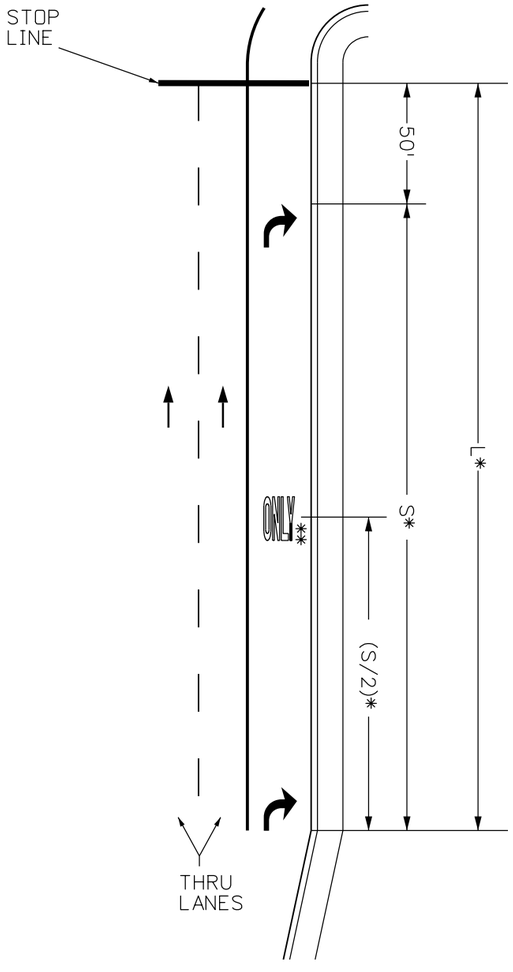
Pavement Markings

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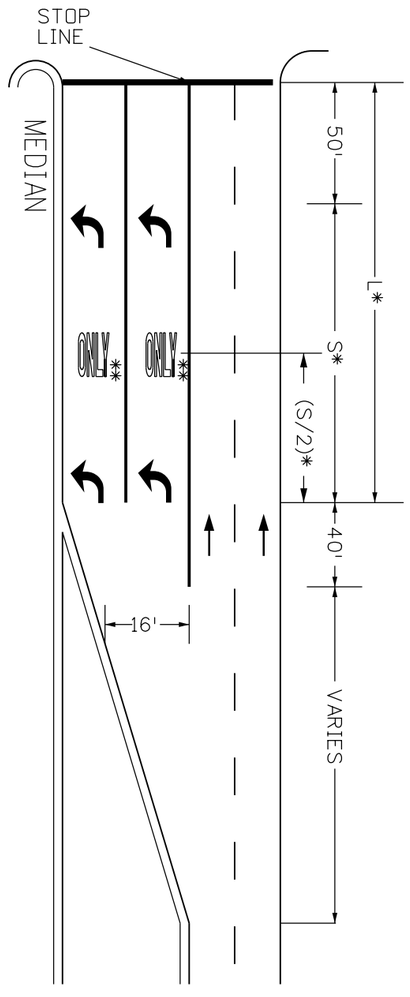
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S-627-1
Standard Sheet No. 4 of 11
Project Sheet Number:



Lane Drop



Pocket Lane



Double Turning

Arrow Placement Notes

1. The spacing, in the table applies to left and right turn lanes.

** 2. The 'ONLY' word marking is optional. Contact the region traffic engineer for guidance.

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.

LENGTH (L)	LEFT AND RIGHT TURN ARROW		NO. OF 'ONLY' PER LANE
	NO. OF ARROWS PER LANE	SPACING (S)	
L < 200'	1	NA	NA
200' - 350'	2	EVENLY SPACED BETWEEN 150'-300'	1
350' - 650'	3		2
650' - 950'	4		3
950' ≤	≥5		≥4

* L (length) and * S (spacing) 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

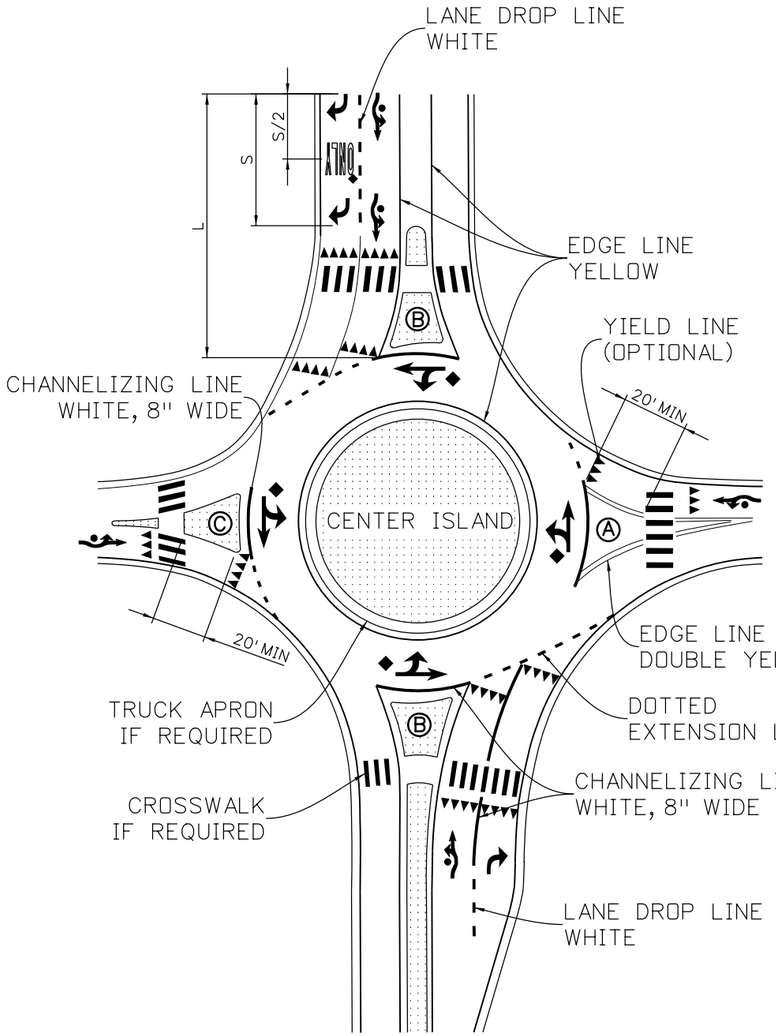
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Pavement Markings

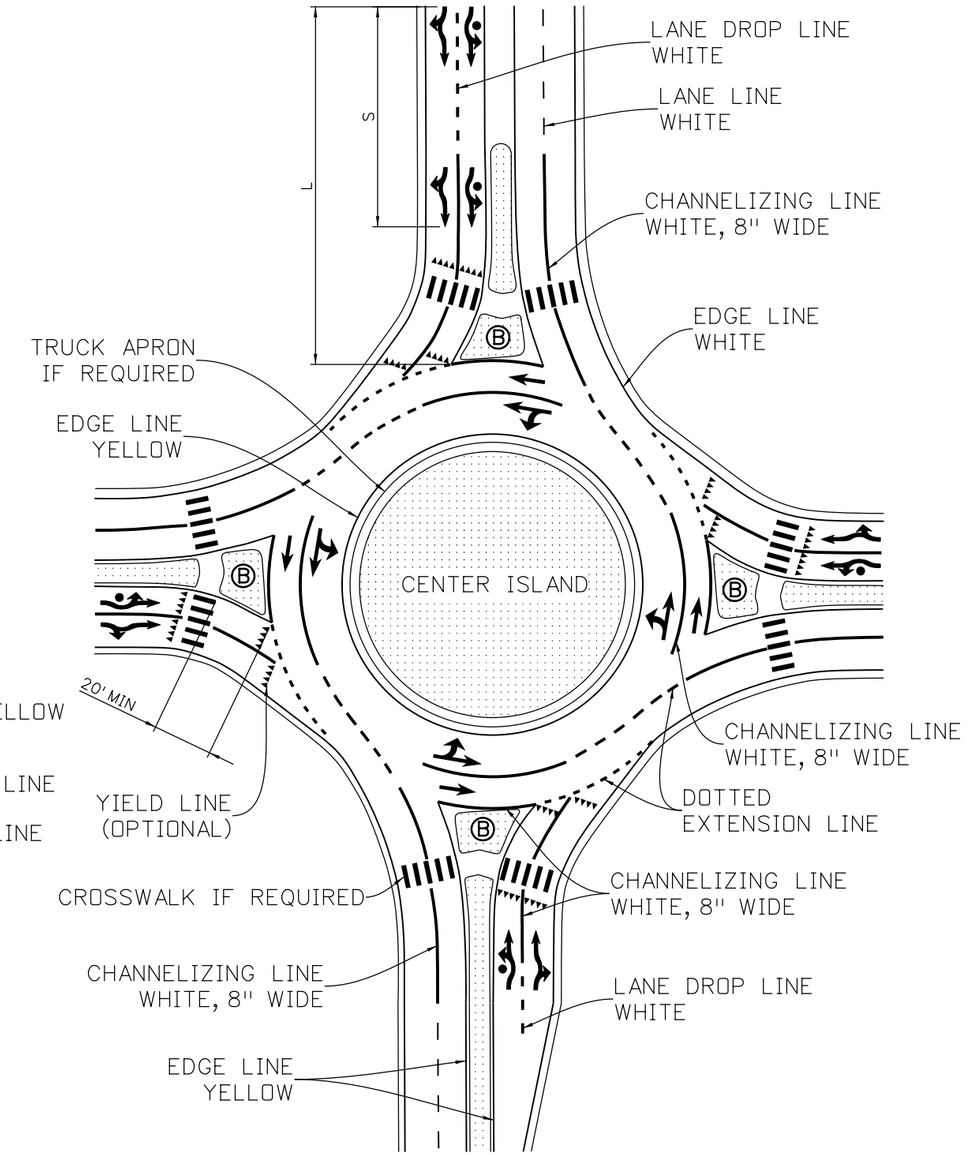
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Standard Plan No.
S-627-1
Standard Sheet No. 5 of 11
Project Sheet Number:



Single Lane Roundabout (Typical)

Note: Splitter island may be formed by two yellow lines, raised non-mountable, or raised mountable.



Two Lane Roundabout (Typical)

Notes

1. Unless shown in this standard, the widths of pavement markings shall match the largest line width of the adjacent facilities.
2. Pavement marking lines along non-mountable splitter islands are optional.
3. Normal lane-use arrows shall be used in the roundabout.
4. Normal or fish-hook lane-use arrows may be used on the approach. Advanced signing shall match the pavement marking used.

   a. When one (1) arrow is used on the approach, it shall be placed at the beginning of the channelizing line. otherwise, use table below.

LENGTH (L)	LEFT AND RIGHT TURN ARROW		NO. OF 'ONLY' PER LANE
	NO. OF ARROWS PER LANE	SPACING (S)	
L < 200'	1	NA	NA
200' - 350'	2	EVENLY SPACED BETWEEN 150'-300'	1
350' - 650'	3		2
650' - 950'	4		3
950' ≤	≥5		≥4

5. The inscribed oval is optional and may be combined with the lane-use arrow in the left-most lane.
6. See Sheet 10 for lane-use arrow dimensions.
7. Yield lines utilized at crosswalk shall be placed 20 to 50 feet in advanced of the crosswalk.

Legend

- Ⓐ Splitter Island Formed By Two Yellow Lines
- Ⓑ Raised Non-mountable Splitter Island
- Ⓒ Mountable Splitter Island
- ◆ Optional

Roundabout Pavement Markings

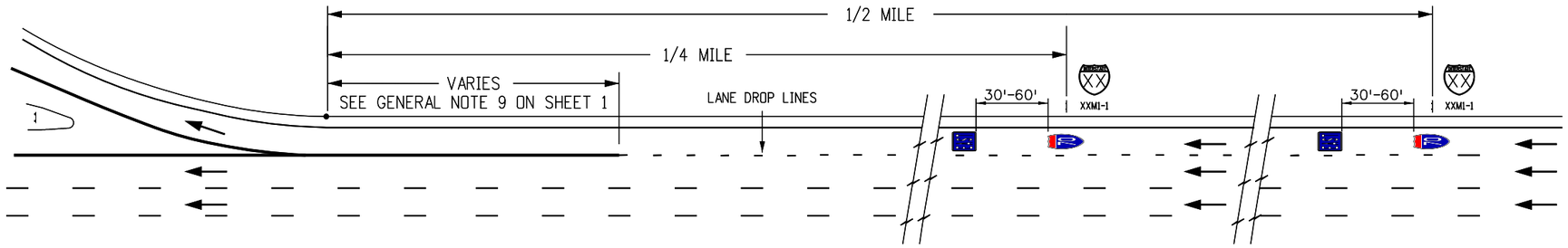
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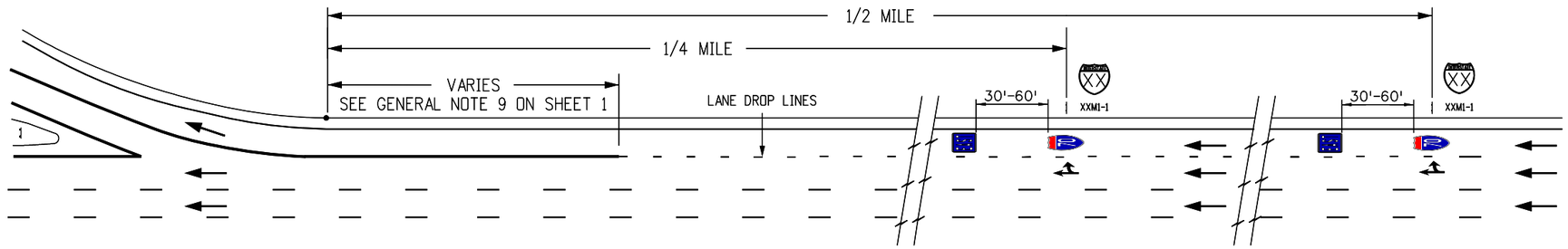
Pavement Markings

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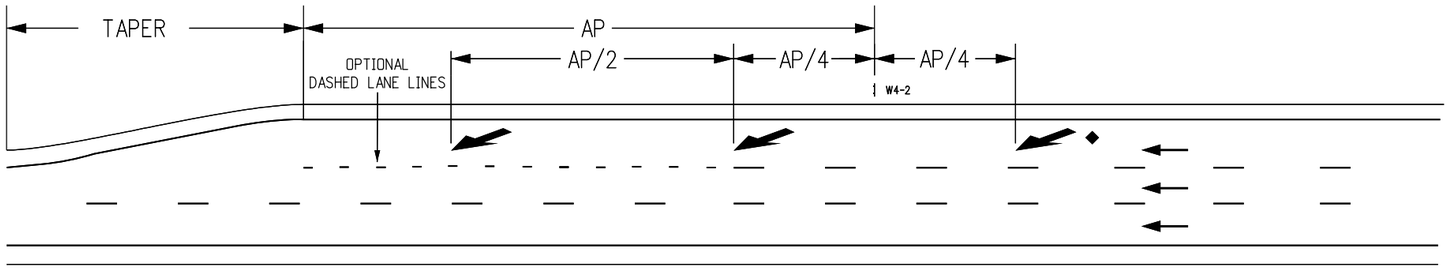
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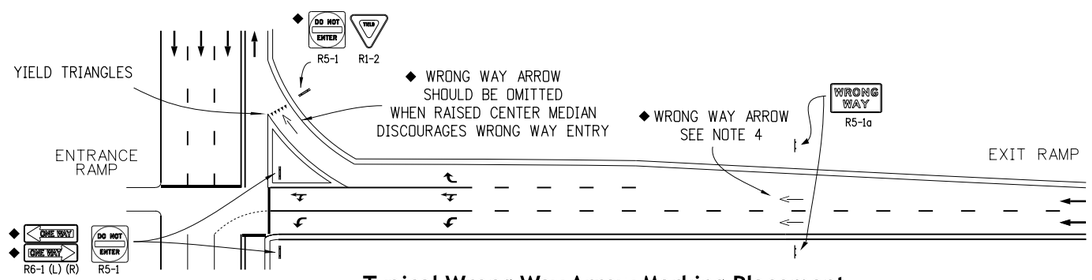
Typical Shield Placement



Typical Shield & Option Arrow Pavement Marking Placement

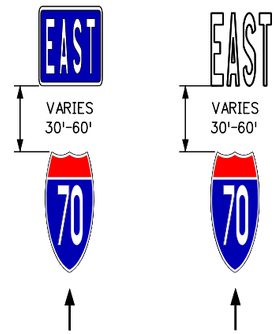


Lane Reduction Markings



Typical Wrong Way Arrow Marking Placement

Shield Layout Detail



Notes

1. Shield and cardinal direction pavement markings are optional and shall be installed as shown in the plans.
2. Lane-reduction arrow markings are not required for acceleration lanes. Lane-reduction arrow markings may be installed in long acceleration lanes as shown in the plans or as directed by the Engineer.
3. Lane-reduction arrow markings are optional for speeds less than 45 mph.
4. Wrong way arrow markings may be installed as directed by the Engineer. If used, wrong way arrow markings shall be the last arrow marking in sequence from the intersection to the beginning of the exit ramp.
5. Refer to Sheet 5 for lane use arrow placement at intersections. See arrow details on Sheets 9 and 10.
6. See Note 2 "Cardinal Directions" on Sheet 11

Legend

←	Direction of Travel
AP =	Advance placement distance from the lane ends sign (W4-2) to the beginning of the merging taper. See Section 2C of the MUTCD for advance placement distances.
◆	Optional

Typical Arrow and Shield Pavement Markings

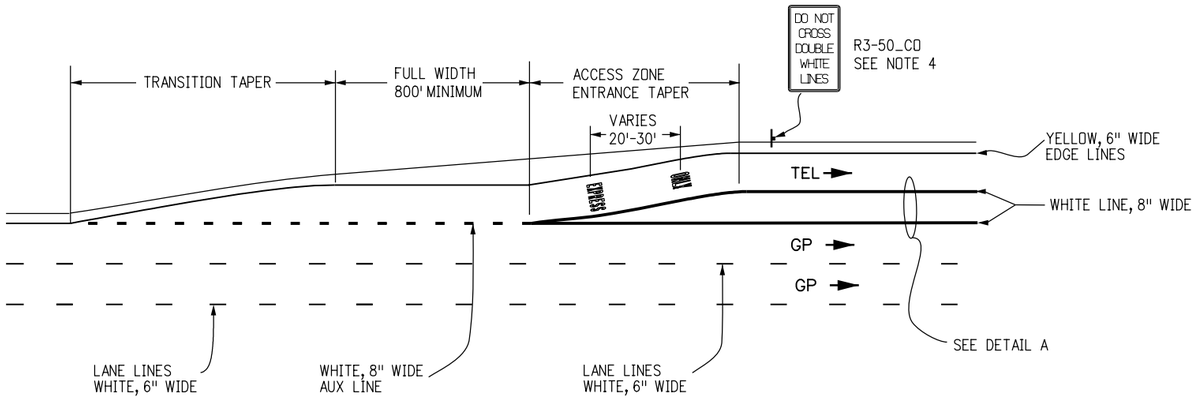
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Created By: MKB			
Last Modification Date: 07/01/26			
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CAD Ver.: ORD 10.12 Scale: Not to Scale Units: English			

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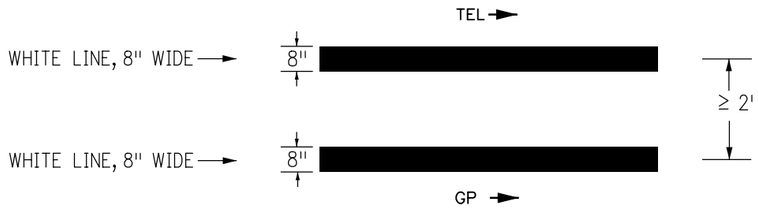
Pavement Markings

Issued by the Traffic Safety & Engineering Services: July 01, 2026

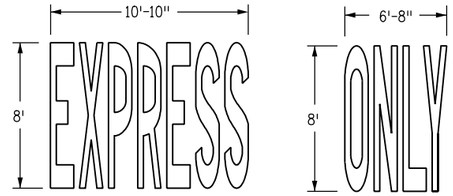
Standard Plan No.
S-627-1
Standard Sheet No. 7 of 11
Project Sheet Number:



Typical Entrance Marking for Buffer
Width 12' and Where Buffer Crossing is Prohibited



Detail A



Notes

1. For transition taper use 25:1 ratio.
2. For access zone entrance taper length use:

   L = S X W

   L = Minimum Length Of Taper

   S = Design speed for new construction or numerical value of the posted speed limit

   W = Width Transitioned

3. If buffer space is wider than 4 feet, chevron markings should be installed (see MUTCD Section 3B.25, 3E.02, and Figure 3E-2(A)).
4. For each section prohibiting entering and exiting movements, the R3-50_CO sign shall be installed within 300 feet of the start of the express lane. Additional R3-50_CO signage shall be installed as shown in the plans.
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.

Legend

TEL - Toll/Express Lane

GP - General Purpose Lane

→ - Direction Of Travel

Toll Express Lane Pavement Markings

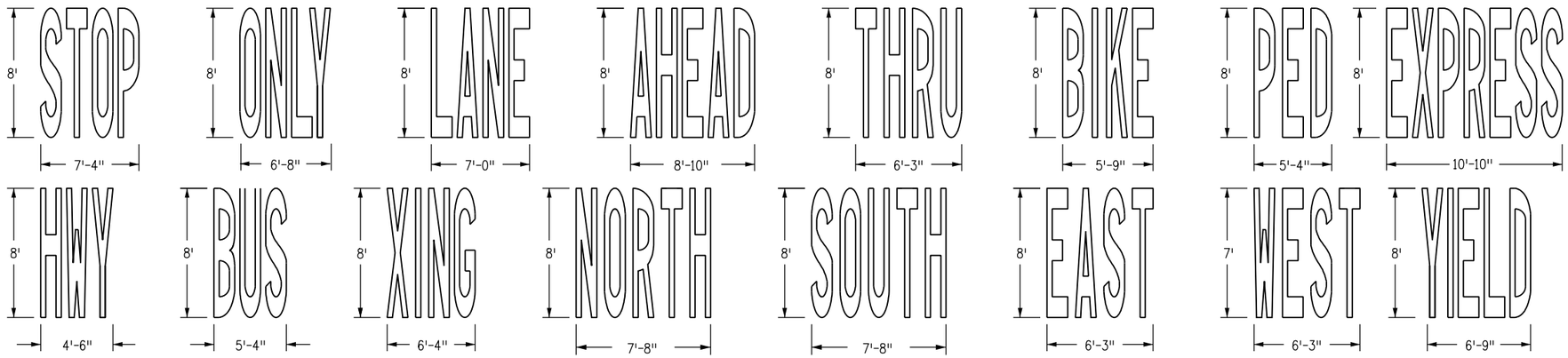
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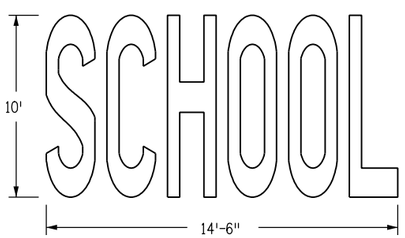
Colorado Department of Transportation
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2829 West Howard Place
Denver, CO 80204
EB

Pavement Markings

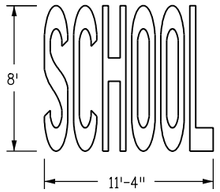
Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-627-1
Standard Sheet No. 8 of 11
Project Sheet Number:

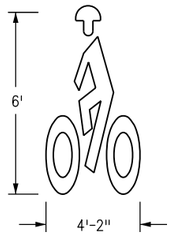




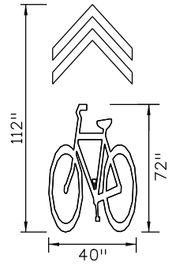
Stroke = 8"
2-Lane School



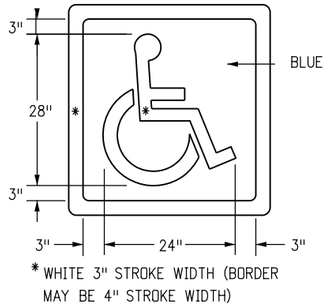
1-Lane School

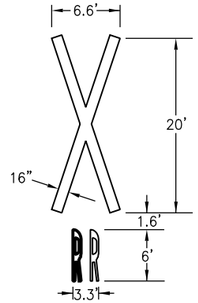


Area = 11.9 sq.ft.

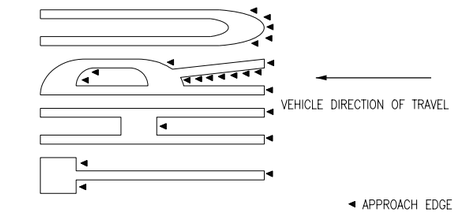


"Sharrow"
Shared Lane Marking

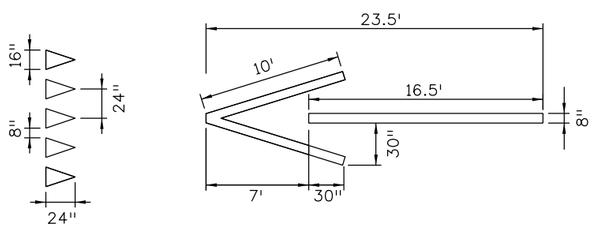




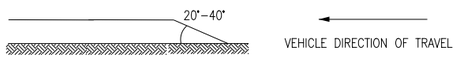
Area = 10 sq.ft.



Typical Approach Edge Tapering View



Typical Yield Triangles and Wrong Way Arrow



Typical Approach Edge Tapering Profile View

Word and Symbol Notes

1. If height is increased or decreased then all measurements change proportionately. Example: "H" measurement for stop is reduced to 4 feet from 8 feet then square feet 5.75 (¼ of 23.0 sq. ft.).
2. Pavement word and symbol markings, transverse and longitudinal (continental) crosswalk lines, and stop lines will be paid for in square feet using their specific bid items.
3. Letter spacing shall be 8 in. except for the letter "A" which is 6 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 H, W, and S dimensions pay:

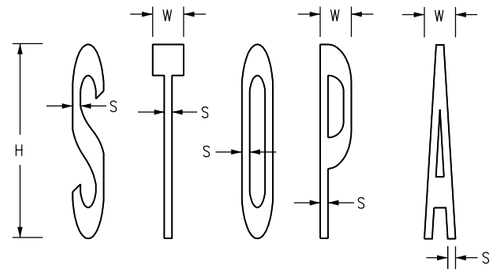
H = 4' Words

- Bike - 5.5 sq.ft.
- Lane - 6.0 sq.ft.
- Only - 6.0 sq.ft.
- XING - 5.0 sq.ft.

H = 8' Words

- Stop - 23.0 sq.ft.
- XING - 20.0 sq.ft.
- Only - 22.5 sq.ft.
- Lane - 22.5 sq.ft.
- Ahead - 29.0 sq.ft.
- Bike - 21.0 sq.ft.
- Bus - 18.5 sq.ft.
- Hwy - 16.5 sq.ft.
- School(1L) - 33.0 sq.ft.
- Thru - 22.0 sq.ft.
- School(2L) - 85.0 sq.ft.
- Ped - 17.5 sq.ft.
- North - 30.6 sq.ft.
- South - 28.5 sq.ft.
- East - 22.1 sq.ft.
- West - 23.7 sq.ft.
- X With RR - 69 sq.ft.
- Express - 41 sq.ft.
- Yield - 23 sq.ft.

Typical Letter Measurements



H = HEIGHT
W = WIDTH

H = 8'
W = 1'-3.4" TO 1'-4"

H = 4'
W = XX TO XX

Pavement Marking Words and Symbols (Page 1)

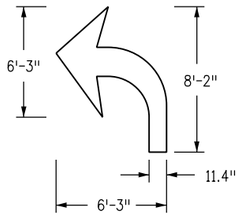
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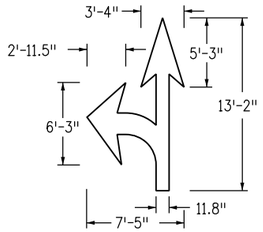
Pavement Markings

Issued by the Traffic Safety & Engineering Services: July 01, 2026

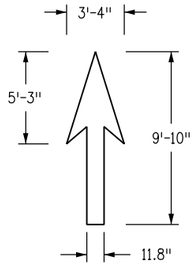
Standard Plan No.
S-627-1
Standard Sheet No. 9 of 11
Project Sheet Number:



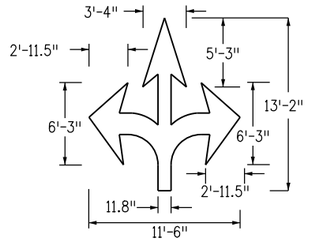
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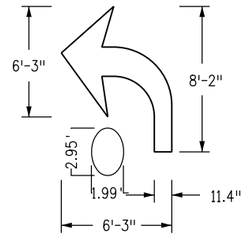
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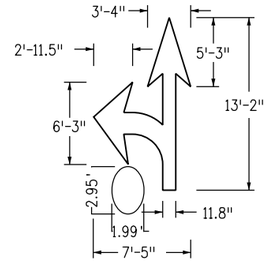
Area = 12.1 sq.ft.



Area = 39.8 sq.ft.



Area = 20.7 sq.ft.

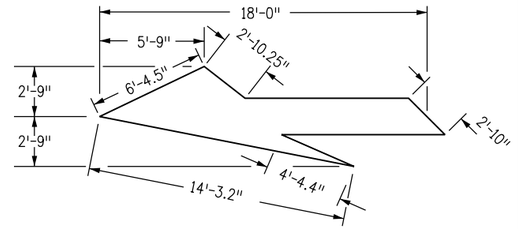


Area = 32.1 sq.ft.

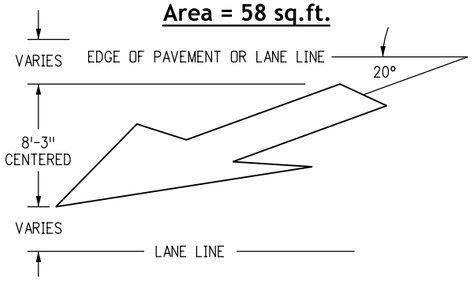
Word and Symbol Notes

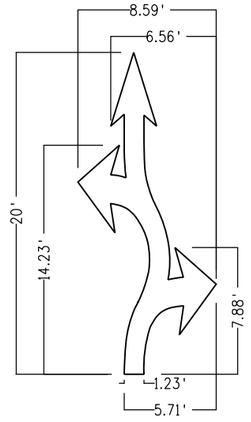
1. If height is increased or decreased then all measurements change proportionately example: "H" measurement for stop is reduced to 4 ft. from 8 ft. then square feet 5.75 (¼ of 23.0 sq. ft.).

2. Pavement word and symbol markings, transverse and longitudinal (continental) crosswalk lines, and stop lines will be paid for in. square feet using their specific bid items.

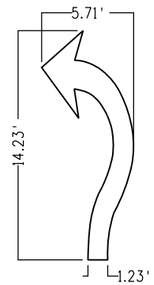


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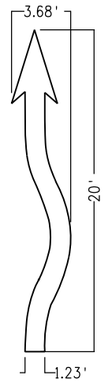




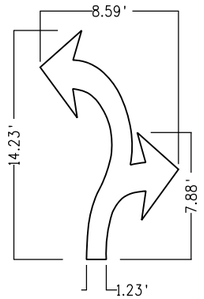
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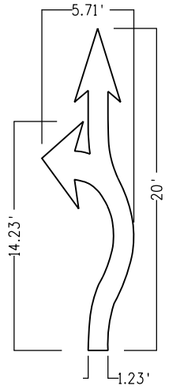
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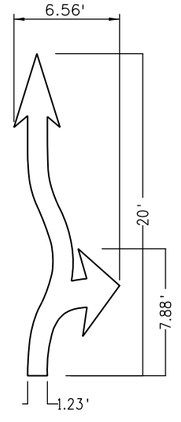
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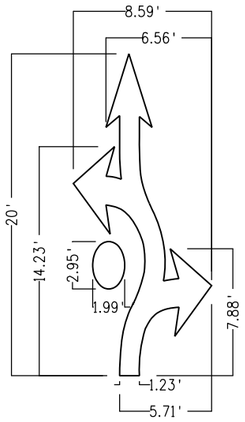
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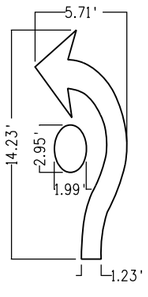
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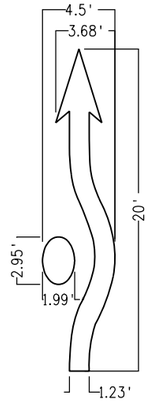
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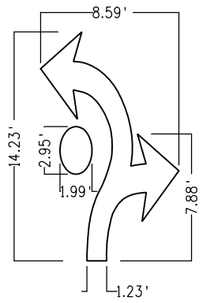
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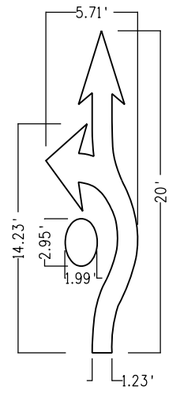
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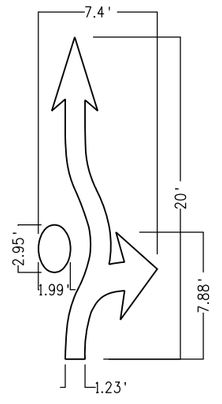
Area = 30.6 sq.ft.



Area = 35.3 sq.ft.



Area = 38.3 sq.ft.



Area = 38.1 sq.ft.

Pavement Marking Words and Symbols (Page 2)

Computer File Information		Sheet Revisions	
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Last Modification Date: 07/01/26			
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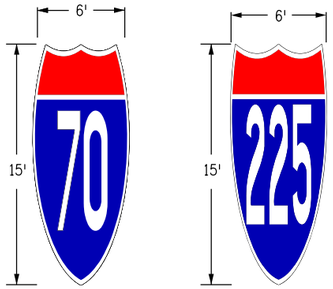
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Pavement Markings

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Standard Plan No.
S-627-1
Standard Sheet No. 10 of 11
Project Sheet Number:

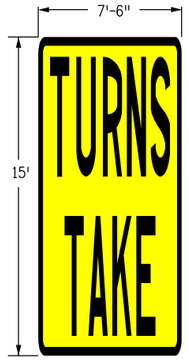
Elongated Interstate Route Shields







Late/Zipper Merge



Area = 112.5 sq.ft.

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

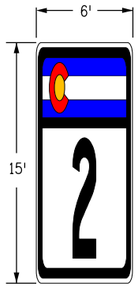
8' X 10' - 80 sq.ft.

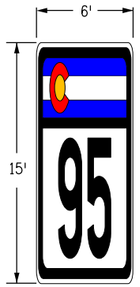
9' X 10' - 90 sq.ft.

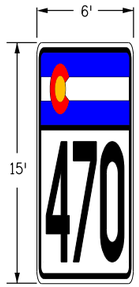
Notes

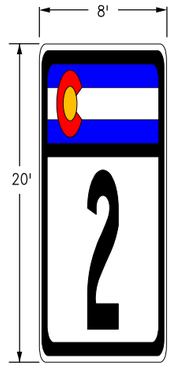
1. Dimensions
   a. Elongated route shields shall be at least 8'x20' when used on high speed roadways (55 mph or more).
   b. Elongated route shield colors shall conform with the Standard Highway Signs and Markings book.
2. Cardinal Directions
   a. Use cardinal directions with white on blue when using interstate route shields.
   b. Use cardinal directions with black on white when using either Colorado State or US highway route shields.
   c. Cardinal direction marking word symbol from Sheet 9 of 11 may be used instead of plaque.

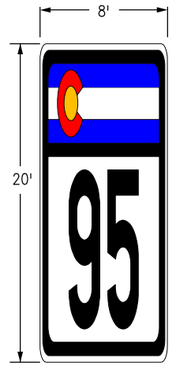
Elongated Colorado State Route Shields

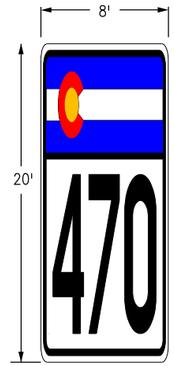




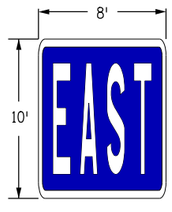


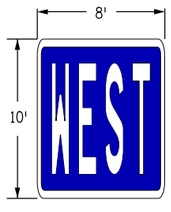


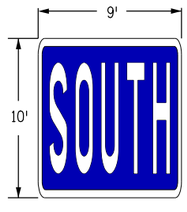


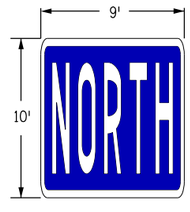


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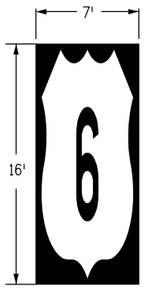


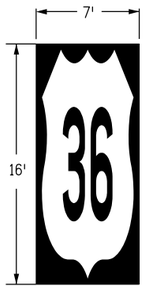


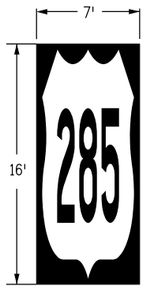


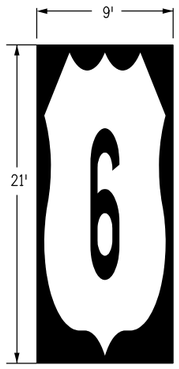


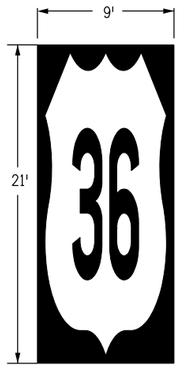
Elongated US Highway Route Shields

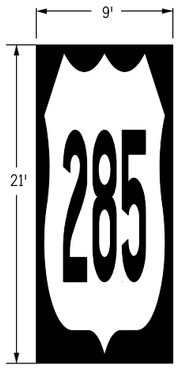




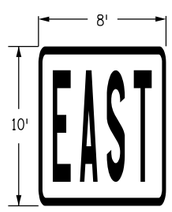


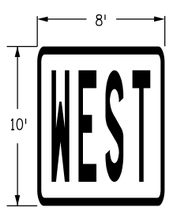


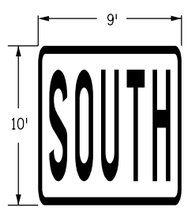


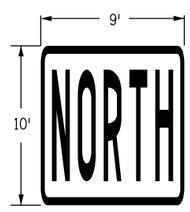


Cardinal Directions (Black Lettering on White Background with Black Border)









Elongated Route Shields & Cardinal Direction Markings

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Colorado Department of Transportation

Traffic Safety & Engineering Services

2829 West Howard Place
Denver, CO 80204

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Pavement Markings

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.

S-627-1

Standard Sheet No. 11 of 11

Project Sheet Number:

Table Of Contents

Typical Case Description	Case No.	Sheet No.
General Notes for S-630-1	-	2
Closure of One Roadway, Four-Lane Highway	1	3
Closure of Half of Four-Lane Undivided Highway	2	4
Road Closure, Use of Adjacent Shoulders	3	
Road Closure, Bypass Detour Provided	4	5
Lane #1 Closure, Multi-Lane Freeway	5	
Lane #2 Closure, Multi-Lane Freeway	6	6
Lane #3 Closure, Multi-Lane Freeway	7	
Lane #4 Closure, Multi-Lane Freeway	8	
Center Lane Closure - Multi-Lane Freeway	9	7
One Lane Closed - Four-Lane Divided Highway	10	
Shoulder Work - Freeway/Expressway	11	
Traffic Control on Freeway Near an Off-Ramp	12	8
Traffic Control on Freeway Before an On-Ramp	13	
Traffic Control on Freeway Allowing Access from On-Ramp	14	
Blasting Zone	15	9
Ramp Construction Where Partial Ramp Is Closed	16	
Lane Closure, Two-Lane Highway, At Curve	17	
Traffic Control Around a Work Area Near an Intersection, One Lane Closed	18	10
Traffic Control Around a Work Area Near an Intersection	19	
Typical Signing for Road Closure	20	
Full Closure, Multi-Lane Freeway	21	11
Continuous Lane Ramp Closure, Multi-Lane Freeway	22	
Simple Ramp Closure, Multi-Lane Freeway	23	

Typical Case Description	Case No.	Sheet No.
"Fines Double In Work Zone" Signing (with Speed Reduction)	24	12
Shifting of One Roadway on Four-Lane Divided Highway	25	13
Shoulder Work - Freeway/Expressway W/ 65 Mph Speed Limit	26	14
Shoulder Work - Freeway/Expressway W/ 75 Mph Speed Limit	27	
Rock Scaling - Road Closure, Four-Lane Divided Highway	28	15
Late Merging - One Lane Closed, Four-Lane Divided Highway	29	16
Roundabout - Partial Closure Near One-Lane Roundabout	30	17
Roundabout - Inside Lane Closure for Two-Lane Roundabout	31	18
Roundabout - Outside Lane Closure for Two-Lane Roundabout	32	19
Roundabout - Partial Closure for One-lane Roundabout	33	20
Mobile Pavement Marking Zone, Mobile Shoulder Closure on Two-Lane Undivided Highway	34	21
Mobile Pavement Marking Zone, Centerline Striping on Two-Lane Undivided Highway	35	
Mobile Pavement Marking Zone, Lane Line Striping Operations on Multi-Lane Divided Highway	36	22
Mobile Pavement Marking Zone, Mobile Ramp Work Zone - Expressway/Freeway	37	
Mobile Striping Operation of Lane Closure of Multi-Lane Highway (not for Use on Freeways)	38	23
Mobile Operation of Lane Closure of Multi-Lane Highway	39	
Mobile Sweeping Operation 1 Mile or Less	40	24
Chip Seals - Two-Lane Undivided Highway	41	25
Pilot Car - Lane Closure, Two-Lane Undivided Highway	42	
Typical Construction Zone Signs and Advance Warning Sign Placement	-	26

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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.

S-630-1

Standard Sheet No. 1 of 26

Project Sheet Number:

General Notes

1. All construction zone traffic control devices, including but not limited to barricades, signs, arrow panels, flashing beacon (portable), and channelizing devices, shall be furnished, installed, maintained (including washing), replaced if damaged, removed when temporarily not in use and returned when required, reset 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".

2. Work on the project shall 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 CDOT Form 568, "CDOT Temporary Speed Limit Reduction."

   When a change in an existing speed limit is required, the R2-1 signs, shown on the schedule of construction traffic control devices, should be installed at the locations shown on the typical cases by R2-1 (Optional) signs.

   An advisory speed plaque (W13-1p) may be used with a warning sign when the maximum recommended speed for condition named is lower than the posted speed limit.

   The regulatory or advisory speed reduction displayed shall not exceed 15 mph per sign installation.

4. Work Zone (G20-5p) and Fines Double (R2-6p) signs shall be provided every 2640' between R2-10 and R2-11 signs. The spacing of these signs may be changed as directed by the Engineer.

5. Any traffic control device that is damaged, weathered, worn, or otherwise deemed no longer serviceable by the Engineer, shall be replaced.

6. Contractor and personal vehicle parking is prohibited within the right-of-way unless designated on the plans, or approved by the Engineer.

7. Construction traffic signs shall be measured by the following sizes and descriptions:

Panel Size A	0.01 to 9.00 sq. ft. (including Type 1 and Type 2 barricades).
Panel Size B	9.01 to 16.00 sq. ft.
Panel Size C	Greater than 16 sq. ft.

   Construction traffic sign (special), sq. ft., may be used for some project specific information signs.

   For detailed dimensions of signs with sign code numbers, see "Standard Highway Signs" and the "Colorado Supplement" thereto. Sign layouts for other signs will be furnished in the plans, transmitted to the Engineer after award, or may be available upon request.

   W20-5 warning signs shall be furnished with exchangeable plaques reading "Right", "Left", "Center", "Right 2", etc. at no additional cost.

8. All warning and regulatory signs shall be posted on both sides of the roadway on divided highways, multi-lane ramps, one-way streets, and as directed by the Engineer, except where only one shoulder is closed (ex: Case 11 on Sheet 7).

9. Additional traffic control devices addressing flagging, speed reduction, etc. will be necessary for set-up and take-down of most case applications; daily work site access; and pavement marking removal and installation operations.

10. Based on sight distance and other considerations, the final locations of signs are subject to approval of the Engineer.

11. If construction related traffic congestion backs up beyond the installed advance sign sequence, additional advance signing shall be placed beyond the congestion.

12. All sign material shall be sound and durable to the degree necessary for maintaining effective and neat appearing traffic controls, and:

    a. Sign panels may be fabricated from plywood, steel, aluminum, or other suitable material.
    b. Reflective sheeting shall conform to ASTMD4956. The type shall be as described in the standard specifications and/or as shown on the plans.
    c. Symbols and legends shall be of good workmanship (uneven or hand lettering will not be accepted).
    d. Portable or temporary mounting shall not be constructed or weighted by any method or material that makes them hazardous to traffic.
    e. Certain post sizes and shapes require a "Break-Away" device. See the applicable standard plan. Other post designs or systems require the submittal of an FHWA eligibility letter of acceptance to the Engineer, and must be approved by the Engineer prior to their use.

13. All construction sign placement shall be in accordance with Standard Plan "Typical Ground Sign Placement" unless otherwise approved.

    Signs approved to be mounted on portable supports, or appropriate signs mounted on barricades, may be at lower heights, but the bottom of the signs shall not be less than one foot above the pavement elevation.

14. Signs mounted on the median of divided highways where median barrier is in place may be mounted on the barrier with a saddle type bracket. If the bracket allows the sign panel to be turned parallel to the roadway, the sign may remain in place when not applicable, but laying the sign panel down in a horizontal position is not permitted.

15. Traffic cones shall be at least 28 inches in height. However, the minimum size shall be 36 inches when they are used on freeways and expressways, or during nighttime working hours. They should also be 36 inches when used on other high speed roadways (45 mph or more) with an ADT of 6,000 or more.

16. Type 1 barricades shall not be used on freeways, expressways, or other high speed roadways (55 mph or more).

17. When two-way traffic is placed on one roadway of a normally divided highway, opposing traffic shall be separated either with concrete barrier (temporary), or with channelizing devices approved for this application, throughout the length of two-way operation. The transition zones shall have concrete barrier (temporary). The barrier shall be tied to an existing structure or guard rail, flared or extended, to meet clear zone requirements, or fitted with an impact attenuation device.

18. Channelizing device spacing, in feet, shall be as follows:
    a. For tapers and transitions, spacing equals the numerical value of the speed limit. (e.g. 45 mph = 45 feet)

    b. For tangents along the buffer space or work area, spacing may not be greater than two times the speed limit. (e.g. 50 mph = 50 feet to 100 feet maximum)

19. For details on barricades, concrete barrier (temporary), vertical panels, and flashing beacon (portable), see the applicable standard plans.

20. Flagger station shall comprise of either a flagger or an automated flagger assistance device (AFAD). See the most recent CDOT Standard Specifications for Road and Bridge Construction for additional guidance regarding AFAD.

21. Flagging operations shall not override visible regulatory signing or traffic signals, even when traffic signals have been disabled or set to flash mode. Only a uniformed police officer may direct traffic in a signalized intersection. Flagging is not permitted on interstates unless approved by the Region Traffic Engineer.

22. Flood lights shall be used to illuminate flagger stations during the hours of darkness unless otherwise approved. A typical light should provide the following: a fully directional swivel mount quartz light source (500 watt minimum), self-supporting stand with variable light height from a minimum of eight feet above the roadway, and a power source. It shall illuminate the station area and a flagger escape path, but shall not present any glare to traffic.

23. For temporary pavement markings and control points for installing those pavement markings for undivided roadways that are being constructed under traffic, full compliance center line, lane line, and edge line temporary markings shall be in place at the end of each work day in accordance with the most recent CDOT Standard Specifications for Road and Bridge Construction.

    For additional pavement marking details, see Standard Plan S-627-1 "Pavement Markings".

24. Buffer space is optional. Need must be determined on a project or site specific basis as directed by the Engineer. When a buffer space is used, dimensions and/or devices used are to be incorporated in the traffic control plan (TCP) or the contractor's method of handling traffic (MHT).

25. Additional VMS signage should be considered at least a mile in advance of the signing shown in the detail for any lane closures on interstate and other high speed facilities especially when the level of service is significantly reduced as a result of construction. The legends should be changed to advise motorists of upcoming traffic conditions and to alert them of upcoming lane usage.

    Additional advance warning signage is encouraged in all cases where traffic volumes and speeds are high and/or where there are infrequent exits. Additional signage is also encouraged in locations where drivers' line of sight to advance warning signs is obstructed.

26. When arrow boards are used to close multiple lanes, a separate arrow board shall be used for each closed lane.

    If arrow boards are used for shoulder work, blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-wayroadway, use the arrow boards only in the caution mode.

27. Raised pavement markers may be used to supplement temporary striping during non-snow periods. Their use is encouraged on higher speed facilities when traffic is being diverted from its usual course.

28. The typical cases depicted in this standard reflect the minimum requirements, unless as otherwise directed by the project plans and specifications, and/or the Project Engineer.

29. A significant project is defined as one that, alone or in combination with other concurrent projects nearby, is anticipated to cause sustained work zone impacts at a location for three or more consecutive days with either intermittent or continuous lane closures.

30. Project information signage may be installed if specified in Project Special Provision 626 - Public Information Services.

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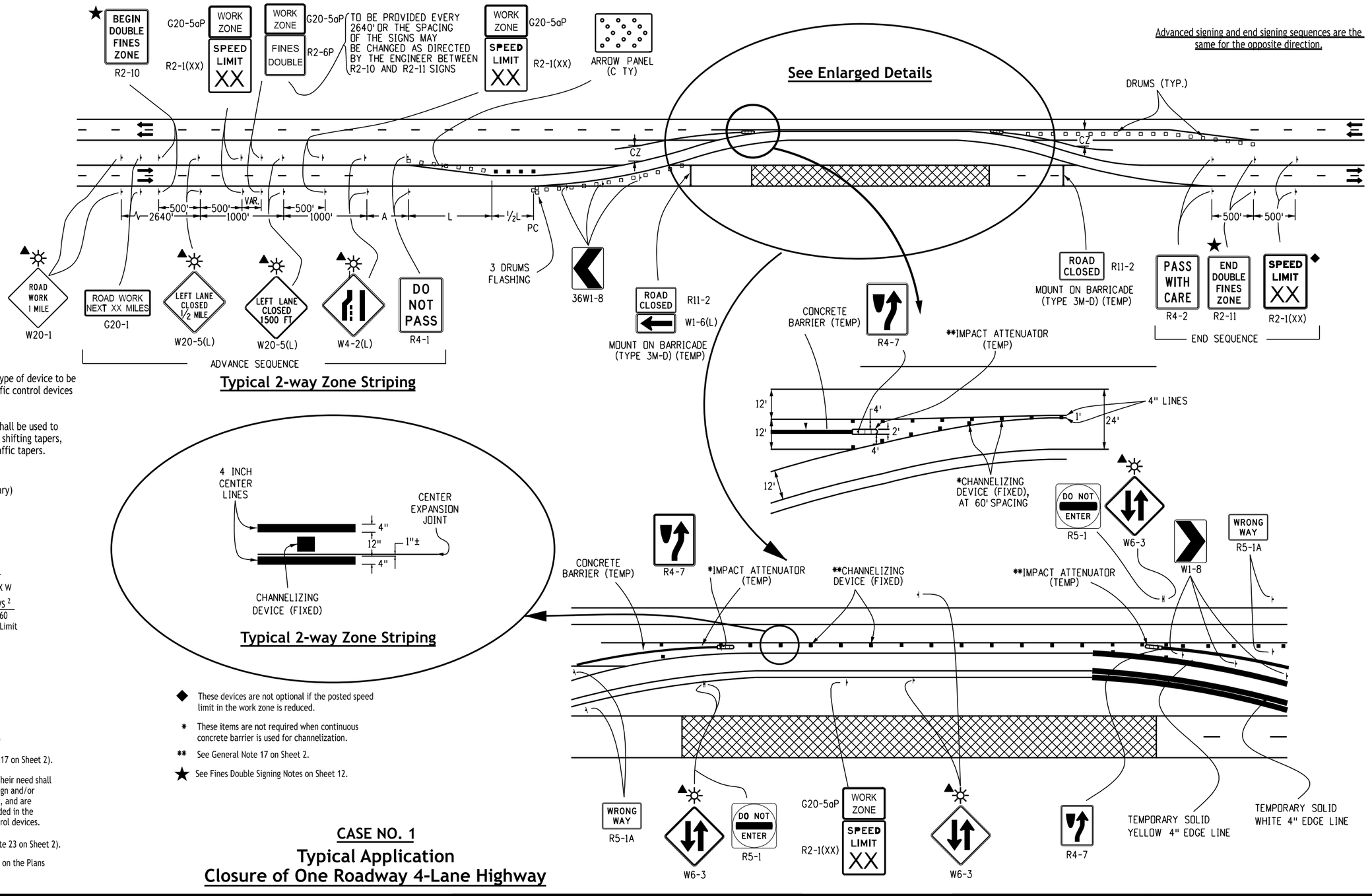
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Standard Plan No.

S-630-1

Standard Sheet No. 2 of 26

Project Sheet Number:



Typical 2-way Zone Striping

Typical 2-way Zone Striping

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- Direction of Travel
- Work Area
- L — Transition Taper Length:
  - L = Minimum Length of Taper
  - Speed 45 Mph or More: $L = S \times W$
  - Speed 40 Mph or Less: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 85 Percentile Speed
  - W = Width of Offset
- Advance Warning Flashing or Sequencing Arrow Panel
- A = 100' (Urban Low Speed), 350' (Urban High Speed), 500' (Rural), 1,000' (Expressway / Freeway)
- CZ Clear Zone (see General Note 17 on Sheet 2).
- ▲ 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.
- VAR. Buffer Space (see General Note 23 on Sheet 2).
- Impact Attenuator as Detailed on the Plans
- Flashing Beacon

◆ These devices are not 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 17 on Sheet 2.

★ See Fines Double Signing Notes on Sheet 12.

CASE NO. 1

Typical Application
Closure of One Roadway 4-Lane Highway

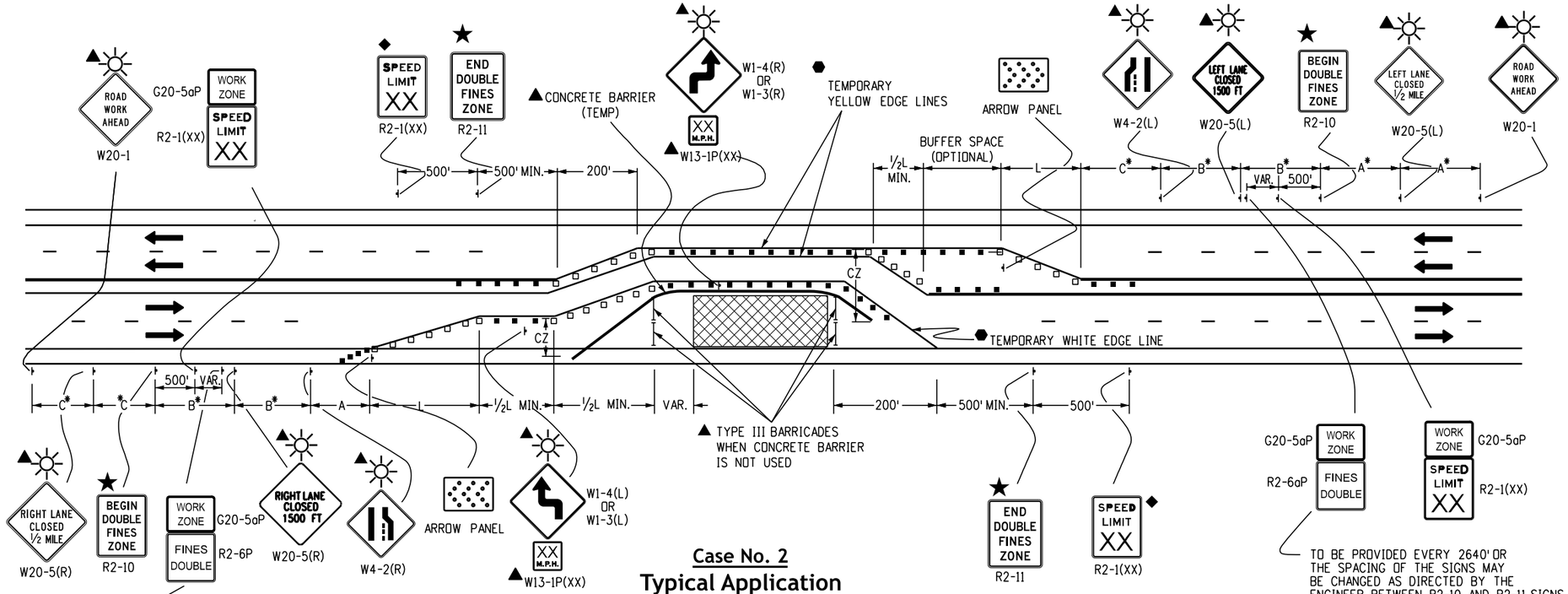
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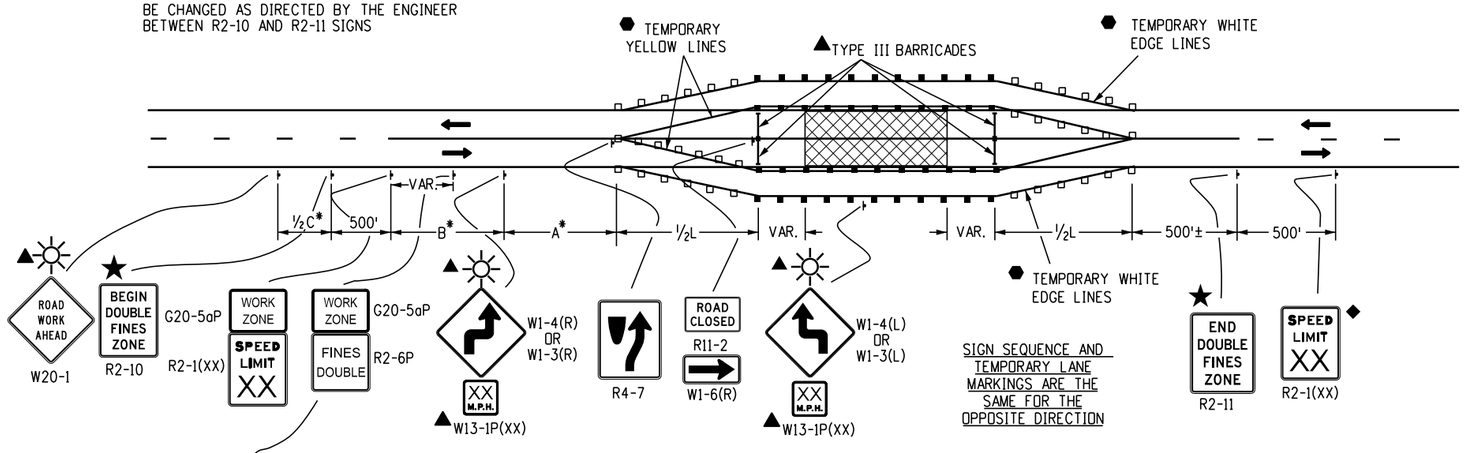
Traffic Controls for Highway Construction

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Standard Plan No.
S-630-1
Standard Sheet No. 3 of 26
Project Sheet Number:



Case No. 2
Typical Application
Closure of Half of Four-Lane Undivided Highway



Case No. 3
Typical Application
Road Closure, Use of Adjacent Shoulders

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 merging tapers, shifting tapers, and one way, two-way traffic tapers.
- Type III Barricade
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 85 Percentile Speed
  - W = Width of Offset
  - Shoulder Taper = 1/3 L
- Advance Warning Flashing or Sequencing Arrow Panel.
- A = 100' (Urban Low Speed) 350' (Urban High Speed) 500' (Rural) 1,000' (Expressway / Freeway)
- CZ — Clear Zone (see General Note 17 on Sheet 2).
- ▲ 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.
- VAR. — Buffer Space (See General Note 23 on Sheet 2).
- ⬢ Required when work occupies the location for more than 3 days.
- Flashing Beacon
- ★ See Fines Double Signing Notes on Sheet 12.

* Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

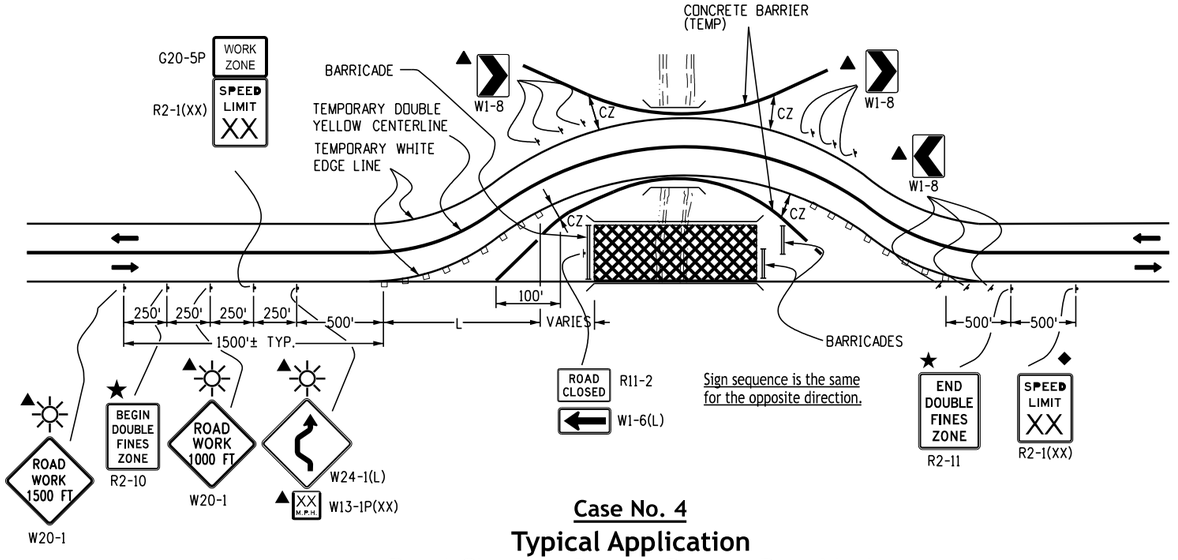
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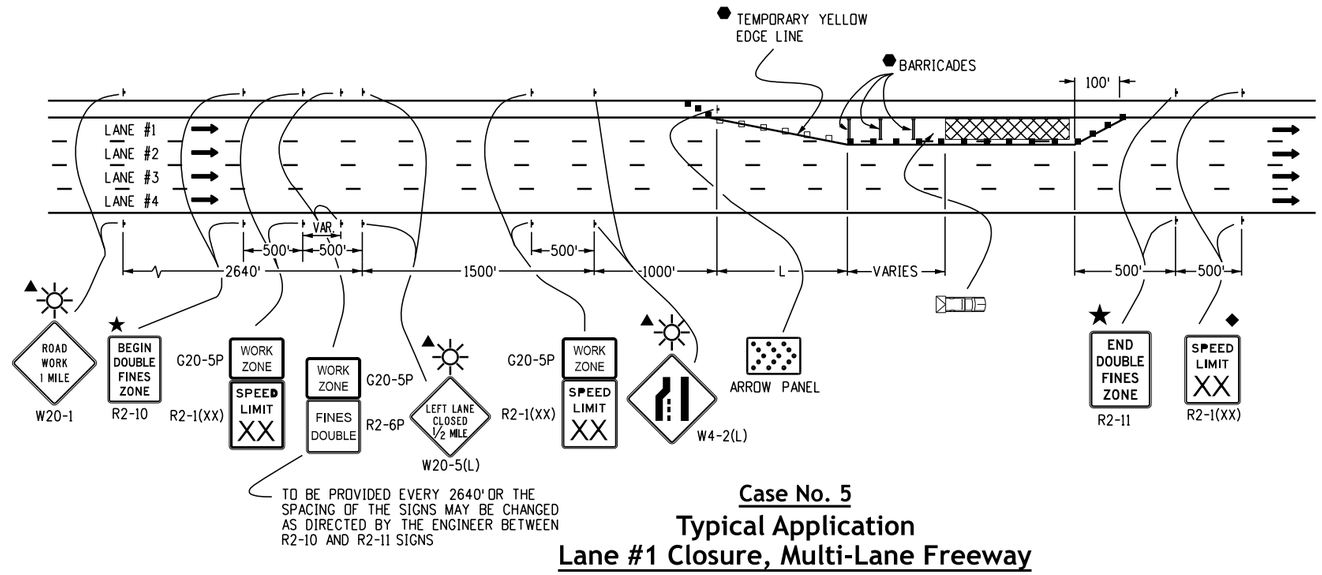
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Standard Plan No.
S-630-1
Standard Sheet No. 4 of 26
Project Sheet Number:



Case No. 4
Typical Application
Road Closure, Bypass Detour Provided



Case No. 5
Typical Application
Lane #1 Closure, Multi-Lane Freeway

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- Direction Of Travel
- Work Area
- L — Transition Taper Length:
  - L = Minimum Length Of Taper
  - Speed 45 Mph or More: $L = S \times W$
  - Speed 40 Mph or Less: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction control devices.
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- VARIES — Buffer Space (see General Note 23 on Sheet 2).
- ⬢ Required when work occupies the location for more than 3 days.
- Mobile Attenuator
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

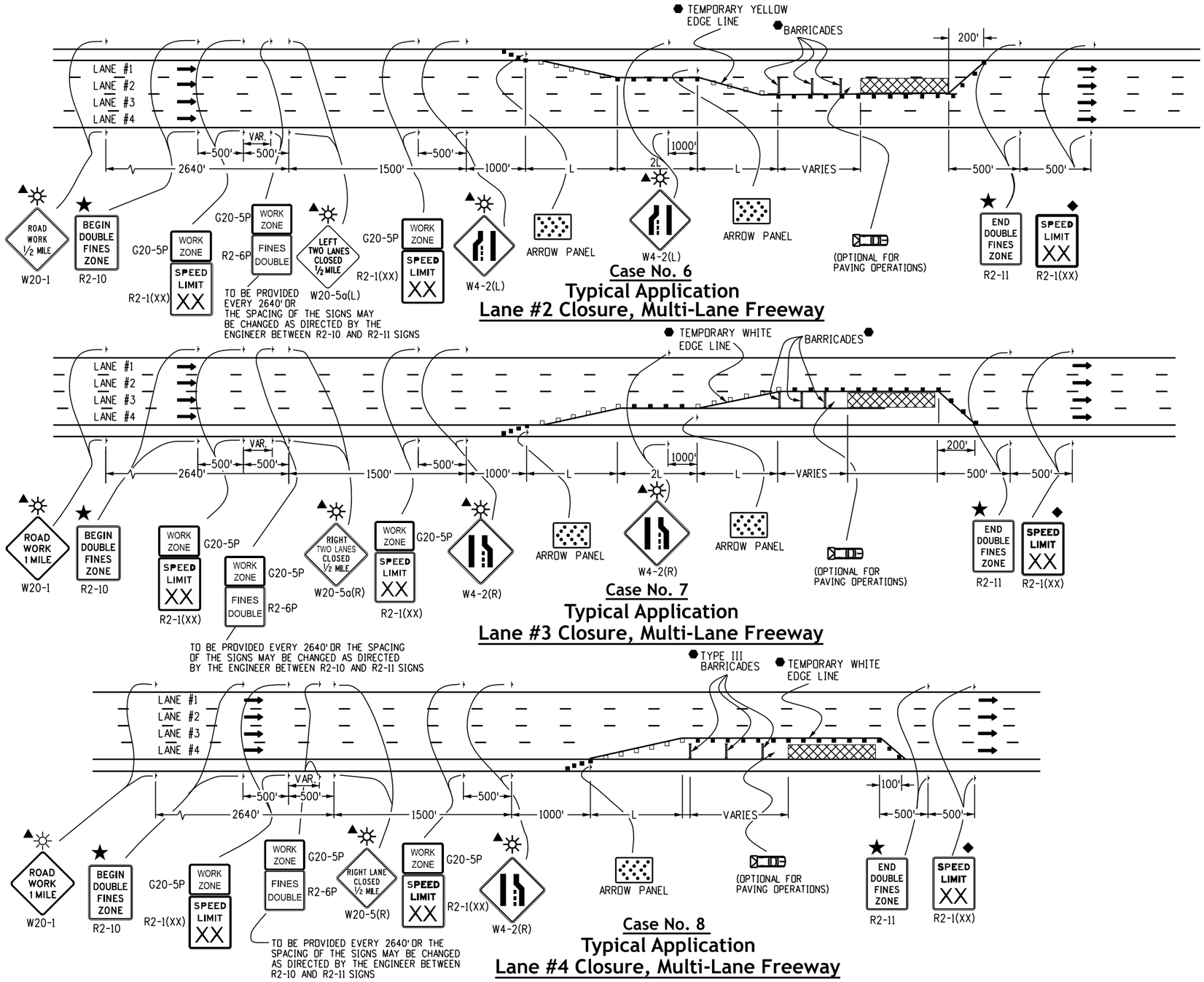
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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 5 of 26
Project Sheet Number:



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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction control devices.
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- VARIES — Buffer Space (see General Note 23 on Sheet 2).
- ⬢ Required when work occupies the location for more than 3 days.
- Mobile Attenuator
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

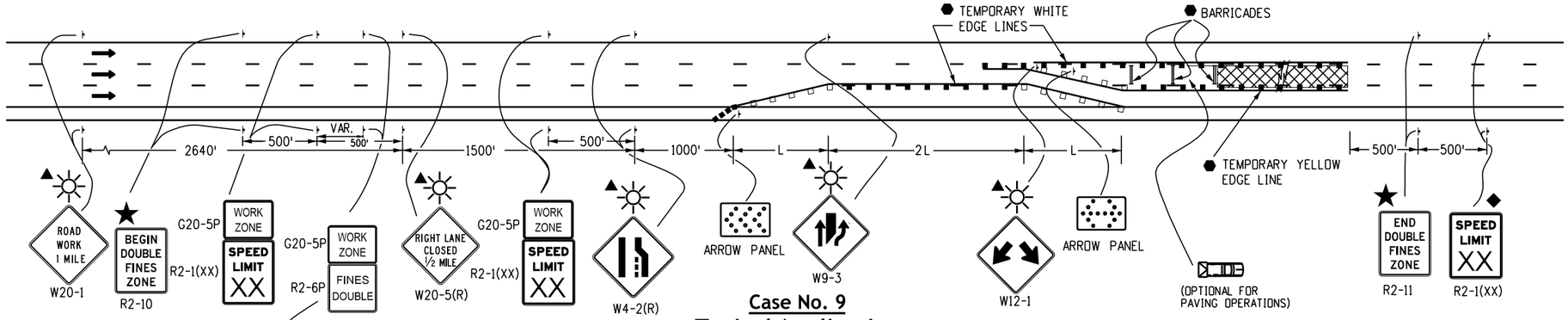
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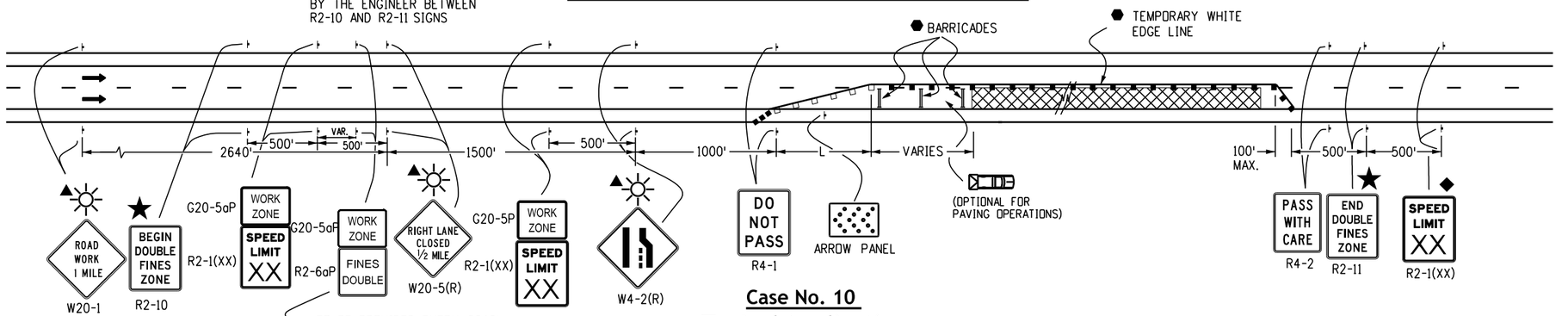
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Standard Plan No.
S-630-1
Standard Sheet No. 6 of 26
Project Sheet Number:



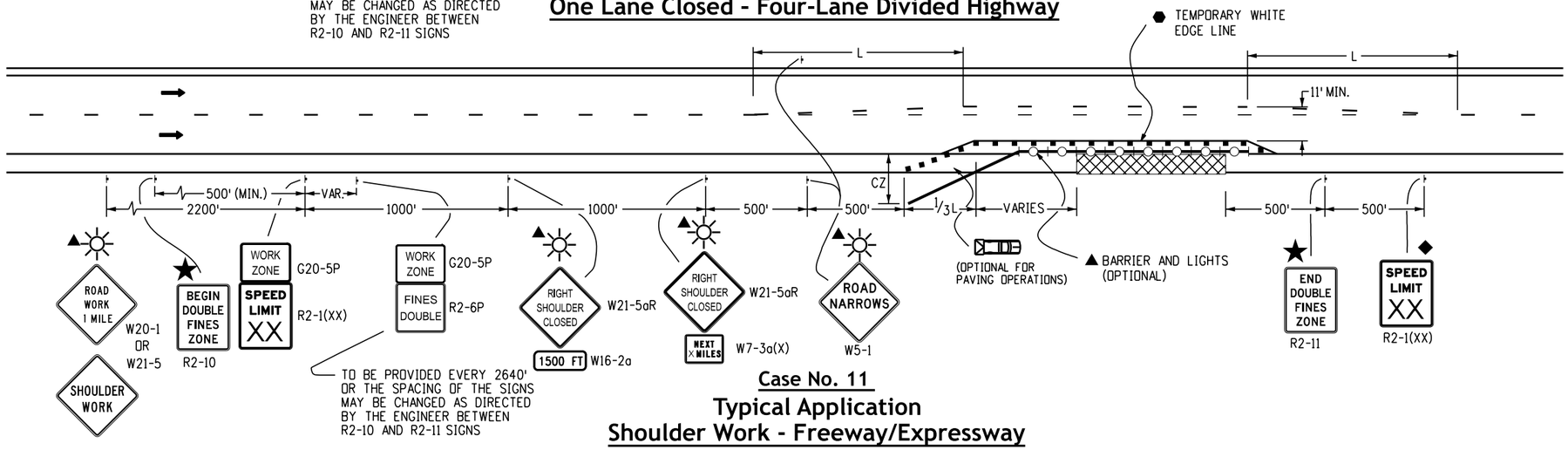
Case No. 9

Typical Application
Center Lane Closure - Multi-Lane Freeway



Case No. 10

Typical Application
One Lane Closed - Four-Lane Divided Highway



Case No. 11

Typical Application
Shoulder Work - Freeway/Expressway

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction control devices.
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- VARIES — Buffer Space (see General Note 23 on Sheet 2).
- ⬢ Required when work occupies the location for more than 3 days.
- Mobile Attenuator
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.
- Concrete Barrier (Temporary) with Lights

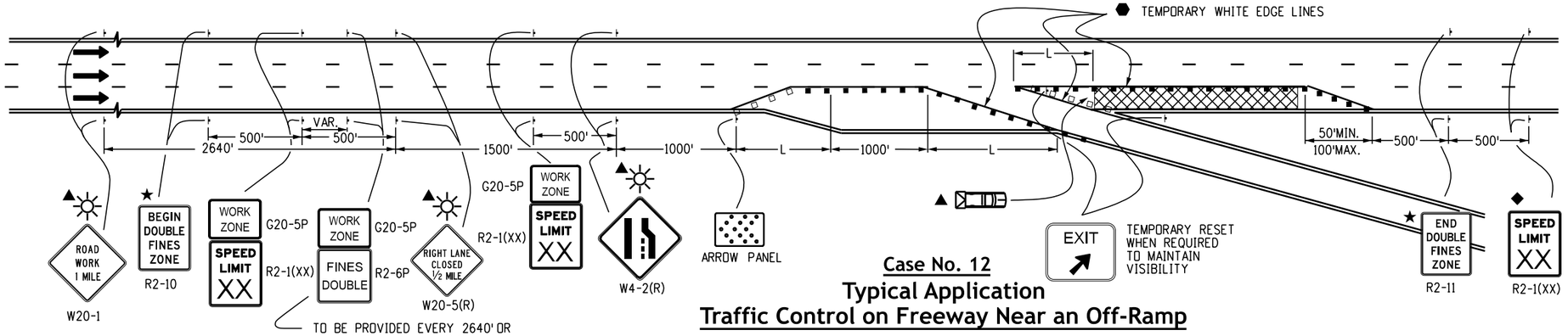
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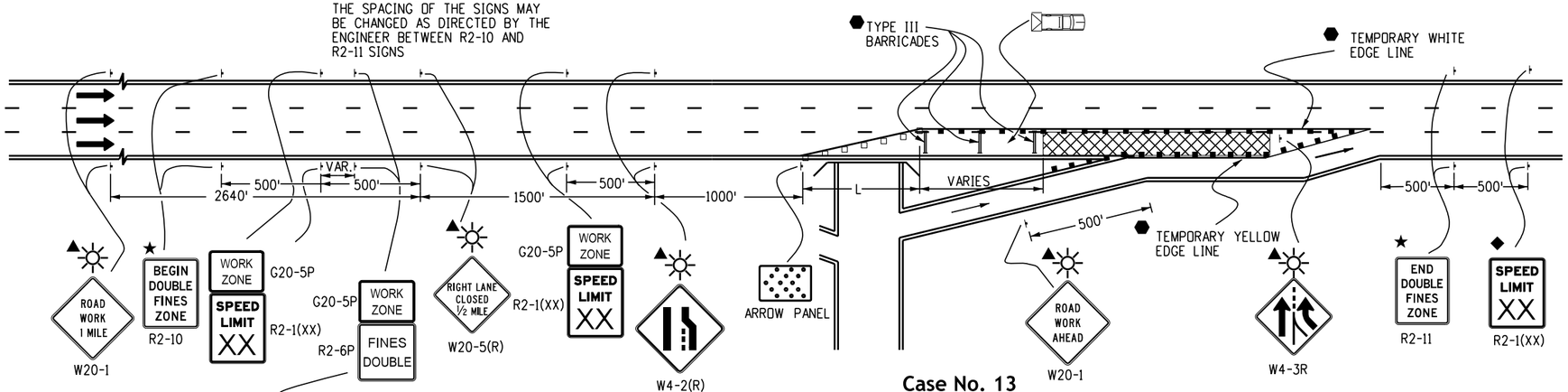
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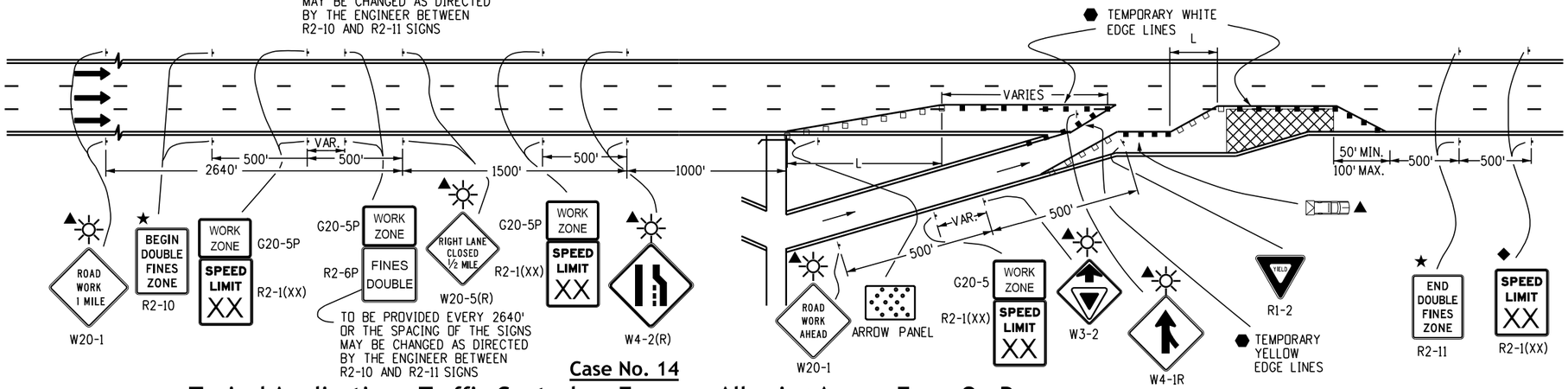
Standard Plan No.
S-630-1
Standard Sheet No. 7 of 26
Project Sheet Number:



Case No. 12
Typical Application
Traffic Control on Freeway Near an Off-Ramp



Case No. 13
Typical Application - Traffic Control On Freeway Before An On-Ramp



Case No. 14
Typical Application - Traffic Control on Freeway Allowing Access From On-Ramp

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction control devices.
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- VARIES — Buffer Space (see General Note 23 on Sheet 2).
- ⬢ Required when work occupies the location for more than 3 days.
- Mobile Attenuator
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

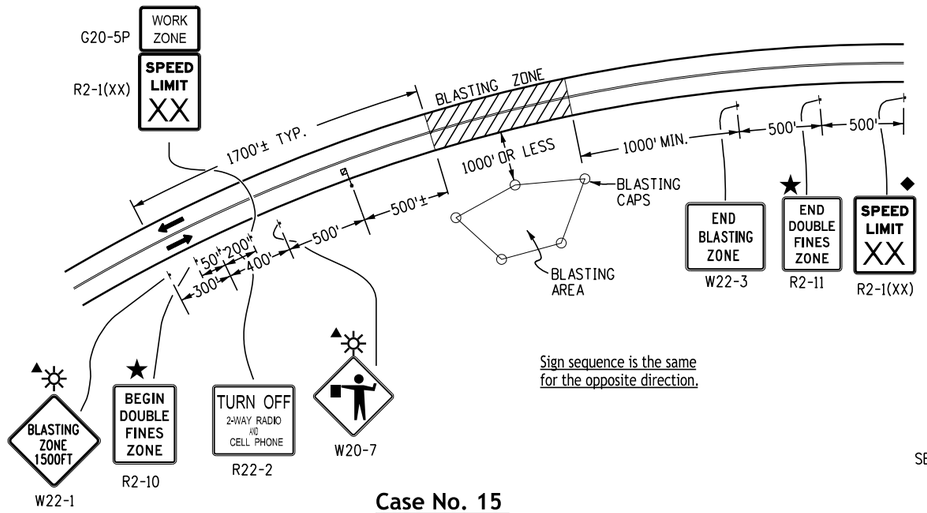
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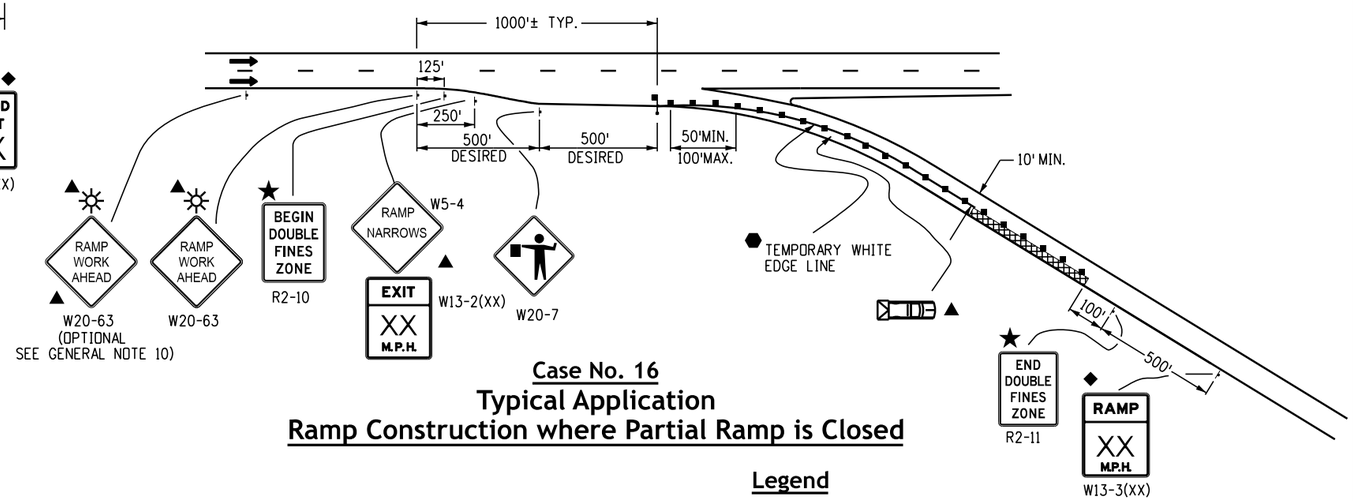
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Standard Plan No.
S-630-1
Standard Sheet No. 8 of 26
Project Sheet Number:

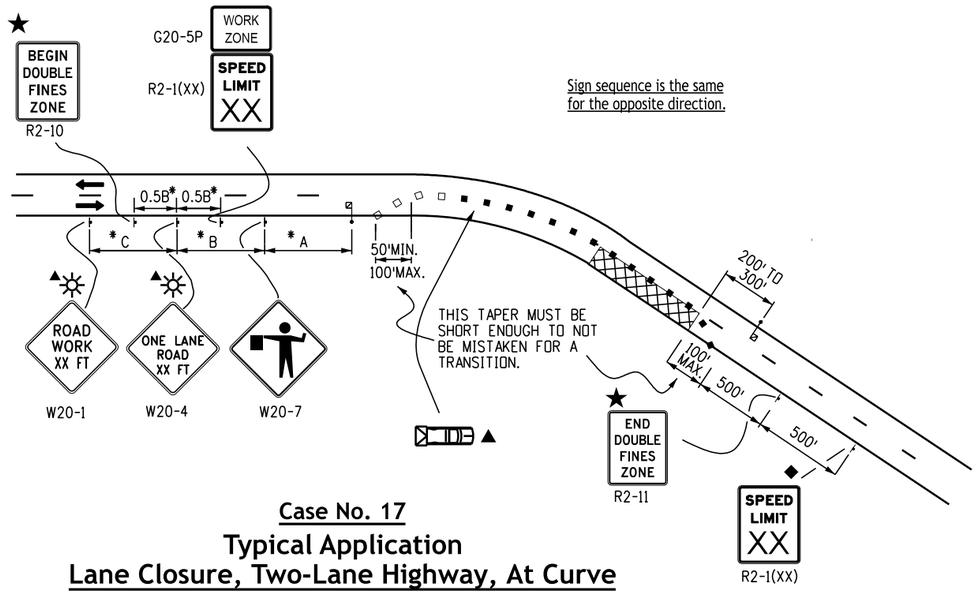


Sign sequence is the same for the opposite direction.

Case No. 15
Typical Application
Blasting Zone



Case No. 16
Typical Application
Ramp Construction where Partial Ramp is Closed



Sign sequence is the same for the opposite direction.

Case No. 17
Typical Application
Lane Closure, Two-Lane Highway, At Curve

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 85 Percentile Speed
  - W = Width of Offset
  - Shoulder Taper = 1/3 L
- Mobile Attenuator
- ★ See Fines Double Signing Notes on Sheet 12.
- Advance Warning Flashing or Sequencing Arrow Panel
- CZ Clear Zone (see General Note 17 on Sheet 2).
- ▲ 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 consturction 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.
- Flashing Beacon

✳ Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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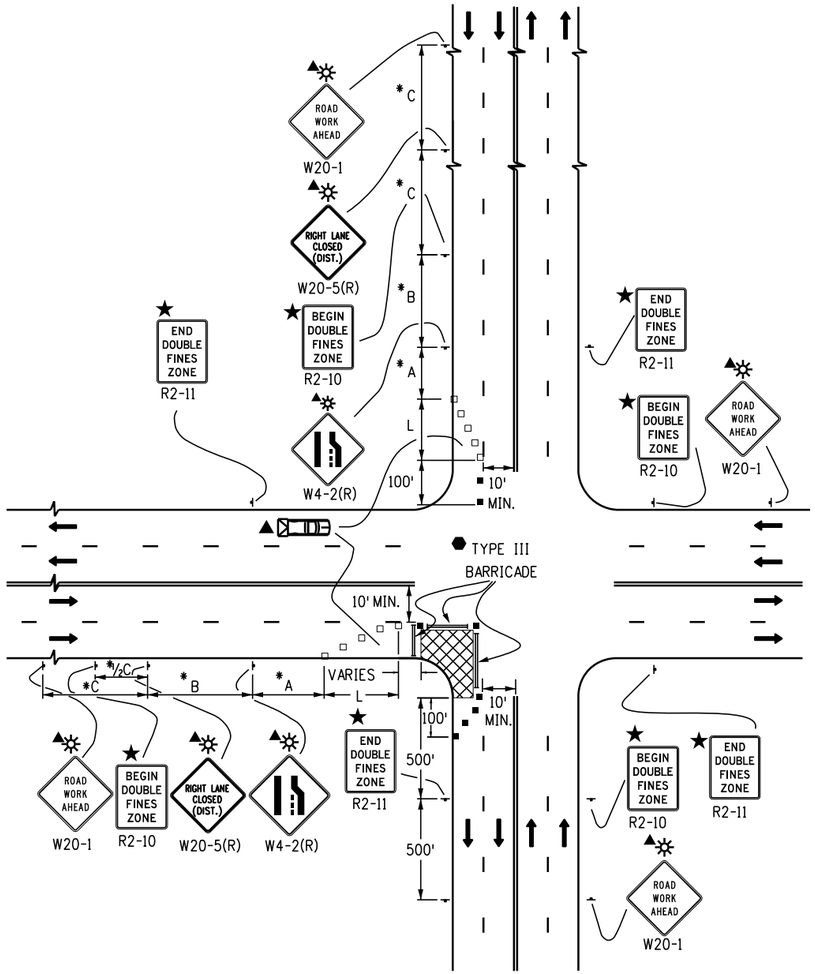
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Standard Plan No.
S-630-1
Standard Sheet No. 9 of 26
Project Sheet Number:

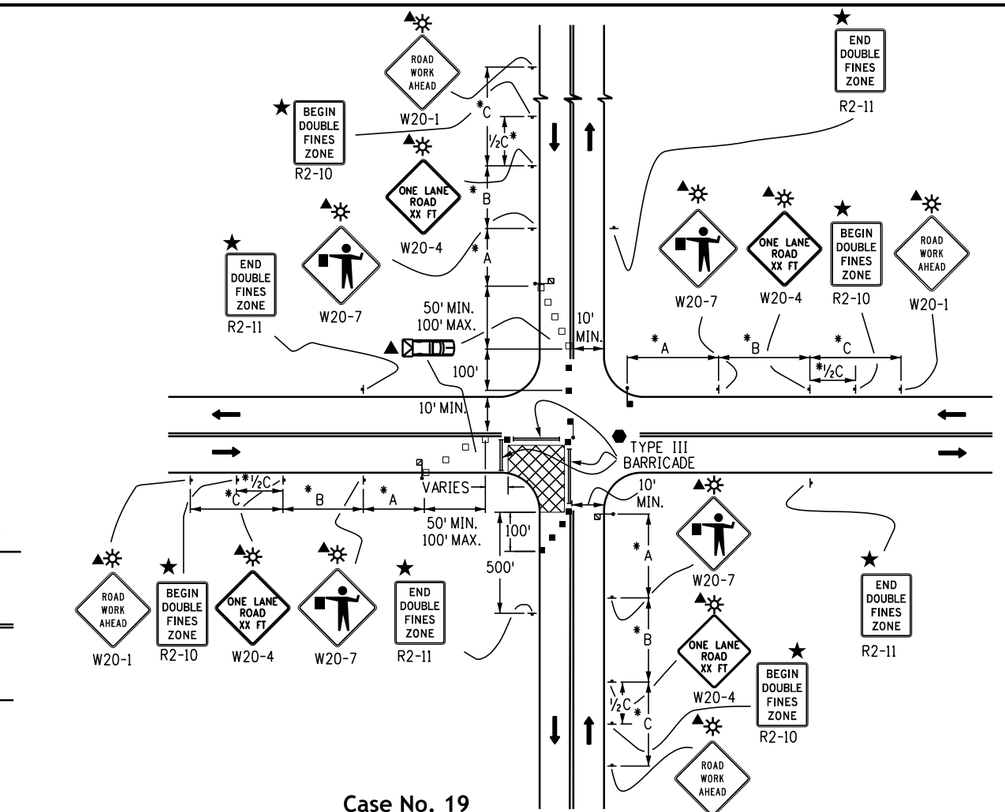


Case No. 18

Typical Application Traffic Control Around a Work Area Near an Intersection, One Lane Closed

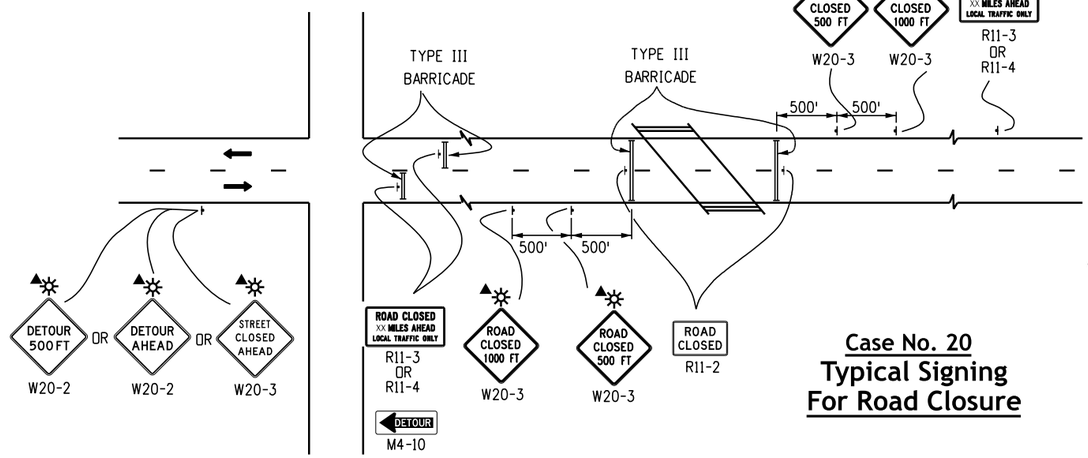
Notes:

1. Sign placement shown on cases 18 and 19 typifies rural applications. Urban applications require the signs to be placed within one, or perhaps two, blocks.
2. Truck-mounted attenuators (TMA) optional for all cases as determined by the Engineer.



Case No. 19

Typical Application of Traffic Control Around a Work Area Near an Intersection



Case No. 20

Typical Signing For Road Closure

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction control devices.
- VARIES — Buffer Space (see General Note 23 on Sheet 2).
- ⬢ Required when work occupies the location for more than 3 days.
- Mobile Attenuator
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

* Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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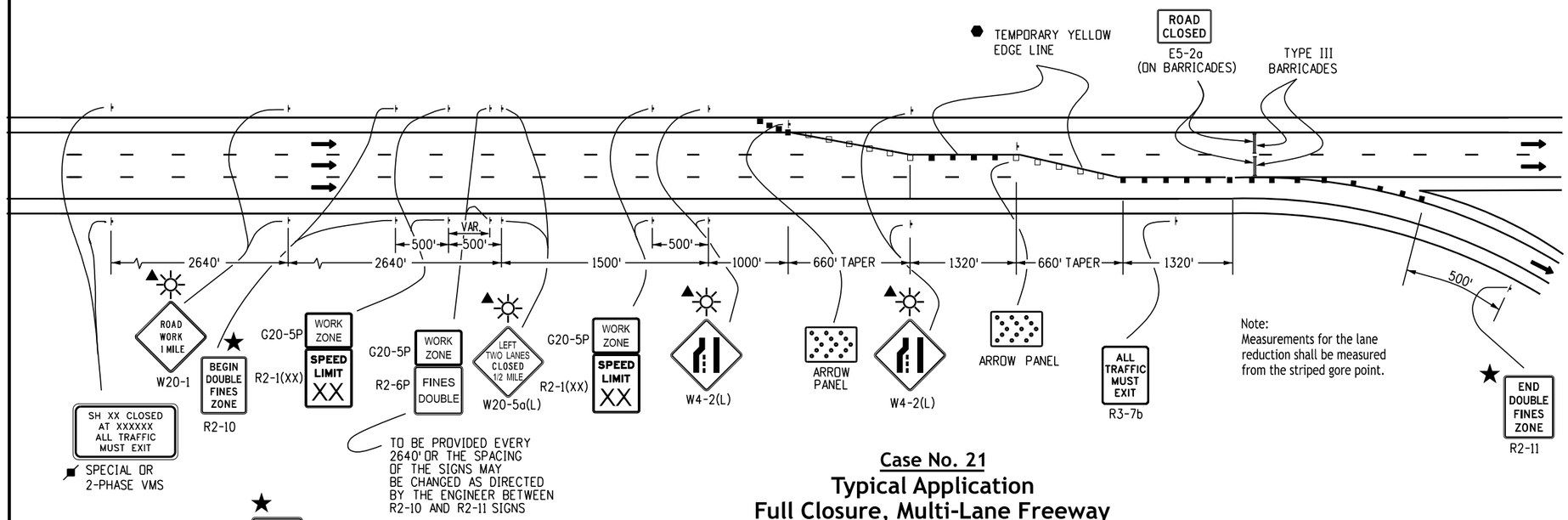
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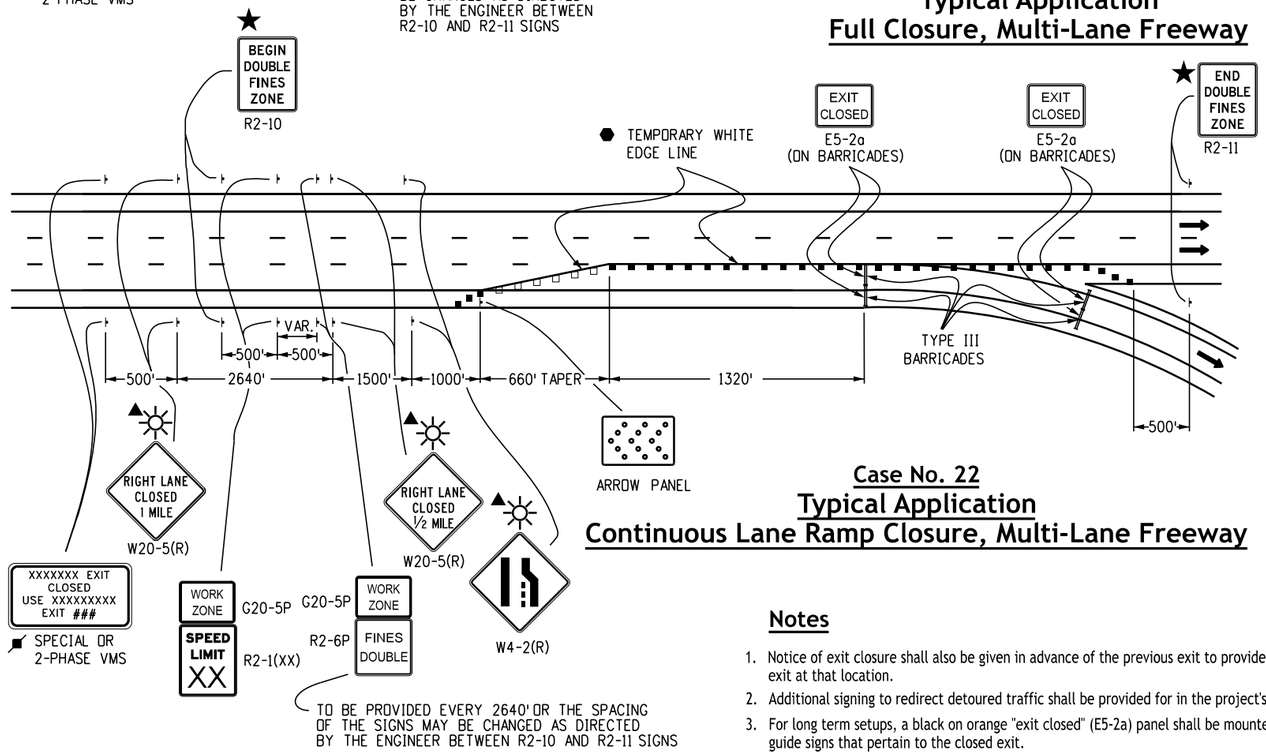
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Standard Plan No.
S-630-1
Standard Sheet No. 10 of 26
Project Sheet Number:

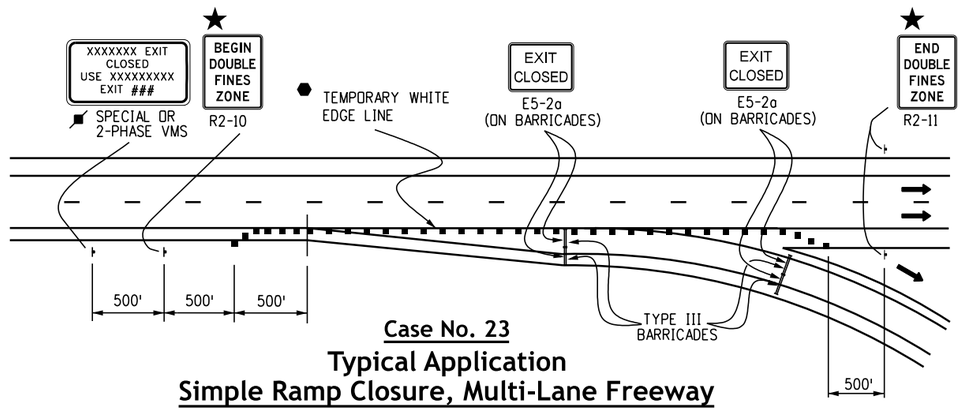


Note:
Measurements for the lane reduction shall be measured from the striped gore point.

Case No. 21
Typical Application
Full Closure, Multi-Lane Freeway



Case No. 22
Typical Application
Continuous Lane Ramp Closure, Multi-Lane Freeway



Case No. 23
Typical Application
Simple Ramp Closure, Multi-Lane Freeway

Notes

1. Notice of exit closure shall also be given in advance of the previous exit to provide motorists with the option to exit at that location.
2. Additional signing to redirect detoured traffic shall be provided for in the project's method of handling traffic.
3. For long term setups, a black on orange "exit closed" (E5-2a) panel shall be mounted diagonally across all existing guide signs that pertain to the closed exit.

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Direction Of Travel
- L — Transition Taper Length:
  - L = Minimum Length Of Taper
  - Speed 45 Mph or More: L = S X W
  - Speed 40 Mph or Less: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 85 Percentile Speed
  - W = Width of Offset
  - Shoulder Taper = 1/3 L
- 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 consturction control devices.
- Required when work occupies the location for more than 3 days.
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

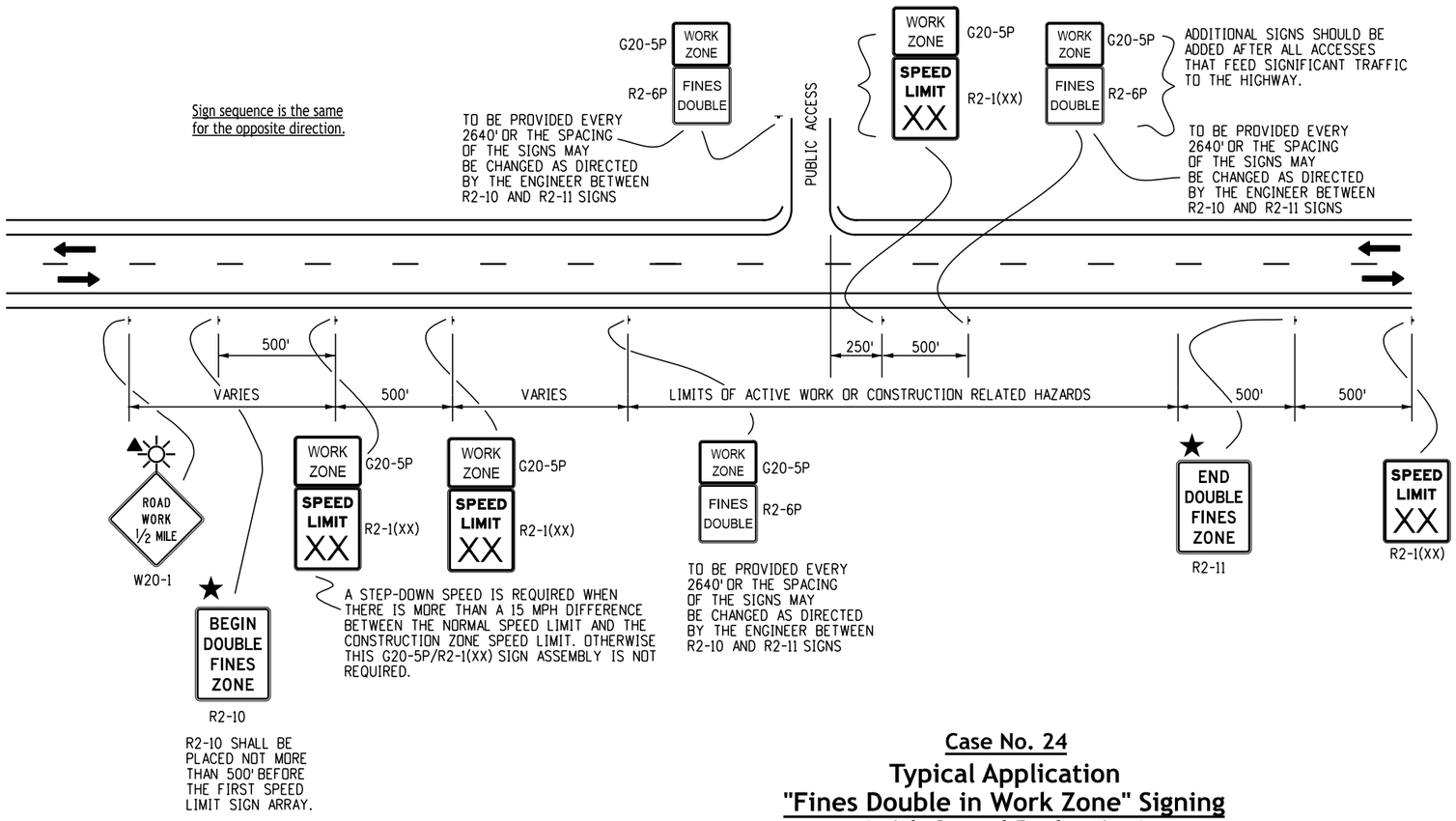
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Standard Plan No.
S-630-1
Standard Sheet No. 11 of 26
Project Sheet Number:



Case No. 24

Typical Application
"Fines Double in Work Zone" Signing
(with Speed Reduction)

Legend

- Direction Of Travel
- 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.
- Flashing Beacon
- Fines Double Signing Notes, See Below

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, unless potential hazards introduced as a result of the work are still present at the end of the work day. FF signs are left in place after work activities, the Traffic Control Supervisor shall make an entry in their daily diary that justifies their use.

   "Hazards" include but are not limited to:
   - Edge Drop Offs
   - Equipment, Workers or Non-Shielded Objects in the Clear Zone
   - Rough Pavement
   - Major Change in Alignment
   - Reduced Shoulder Width
   - Temporary Guard Rail or Barrier
   - Lane Closure

2. Signs shall 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 presentwork 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 shall be in accordance with that normally required for the particular work zone. Placement of "Double Fines" signing may be adjusted as needed to provide a minimum 250' spacing between other signing required for the specific work zone setup.

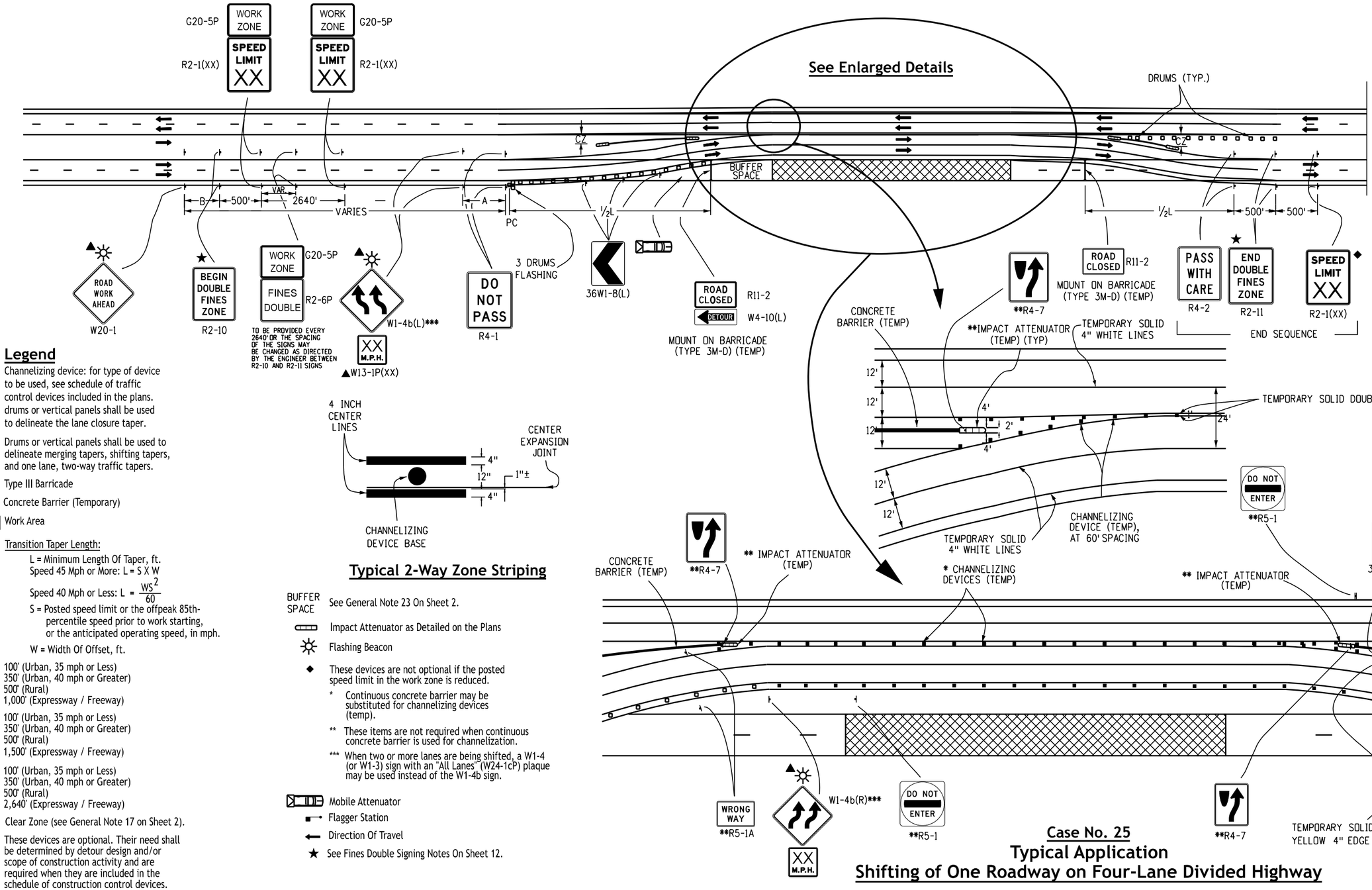
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Standard Plan No.
S-630-1
Standard Sheet No. 12 of 26
Project Sheet Number:



Legend

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- ▫ Drums or vertical panels shall be used to delineate merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Work Area

L Transition Taper Length:

L = Minimum Length Of Taper, ft.
Speed 45 Mph or More: L = S X W
Speed 40 Mph or Less: $L = \frac{WS^2}{60}$
S = Posted speed limit or the offpeak 85th-percentile speed prior to work starting, or the anticipated operating speed, in mph.
W = Width Of Offset, ft.

A = 100' (Urban, 35 mph or Less)
350' (Urban, 40 mph or Greater)
500' (Rural)
1,000' (Expressway / Freeway)

B = 100' (Urban, 35 mph or Less)
350' (Urban, 40 mph or Greater)
500' (Rural)
1,500' (Expressway / Freeway)

C = 100' (Urban, 35 mph or Less)
350' (Urban, 40 mph or Greater)
500' (Rural)
2,640' (Expressway / Freeway)

CZ Clear Zone (see General Note 17 on Sheet 2).

▲ 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.

Typical 2-Way Zone Striping

BUFFER SPACE See General Note 23 On Sheet 2.

Impact Attenuator as Detailed on the Plans

Flashing Beacon

◆ These devices are not optional if the posted speed limit in the work zone is reduced.

* Continuous concrete barrier may be substituted for channelizing devices (temp).

** These items are not required when continuous concrete barrier is used for channelization.

*** When two or more lanes are being shifted, a W1-4 (or W1-3) sign with an "All Lanes" (W24-1cP) plaque may be used instead of the W1-4b sign.

Mobile Attenuator

Flagger Station

Direction Of Travel

★ See Fines Double Signing Notes On Sheet 12.

Case No. 25
Typical Application
Shifting of One Roadway on Four-Lane Divided Highway

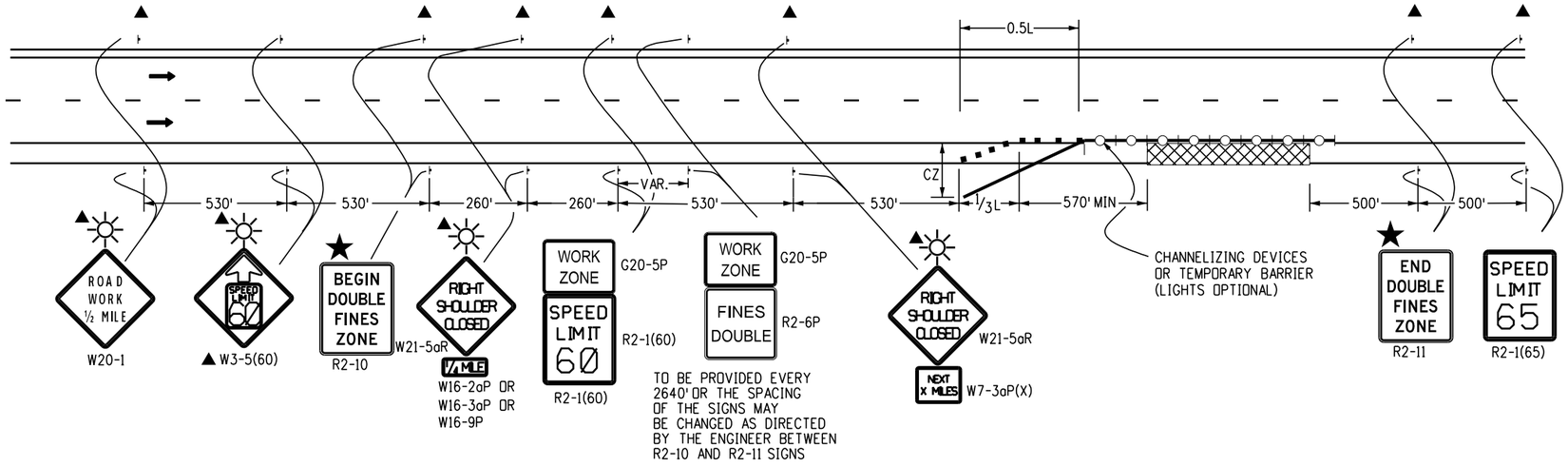
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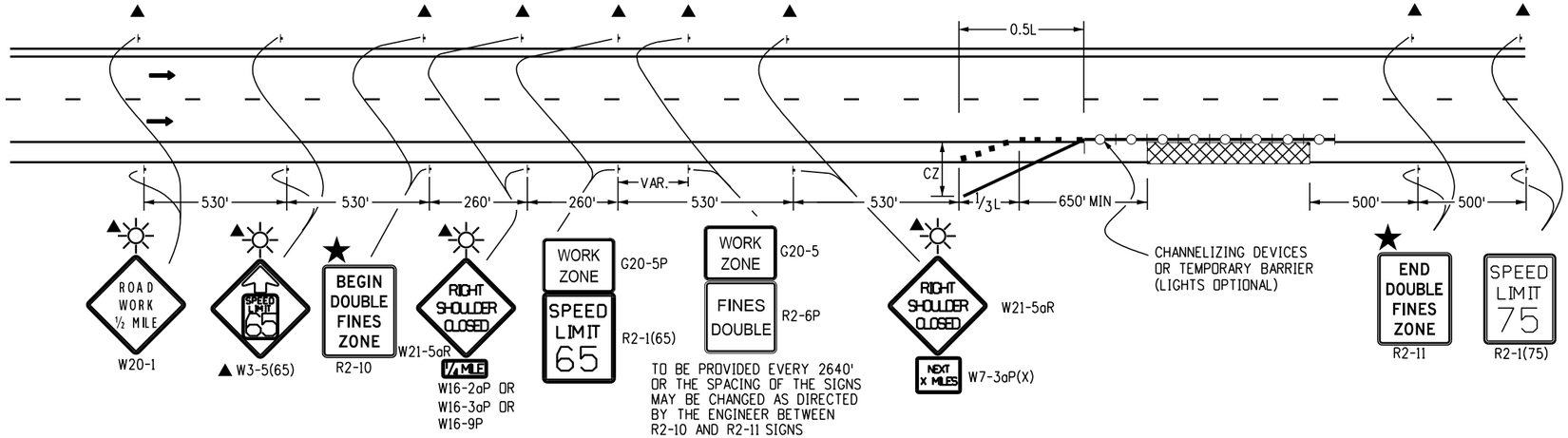
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Standard Plan No.
S-630-1
Standard Sheet No. 13 of 26
Project Sheet Number:



CASE NO. 26
Typical Application
Shoulder Work - Freeway/Expressway w/ 65 MPH Speed Limit

When Hazards (Workers, Equipment, Or Temporary Barrier) are Within 8 Feet of Travel Way



Case No. 27
TYPICAL APPLICATION
Shoulder Work - Freeway/Expressway w/ 75 MPH Speed Limit

When Hazards (Workers, Equipment, Or Temporary Barrier) are Within 10 Feet of Travel Way

Legend

- ■ Channelizing device: for type of device to be used, see schedule of traffic control devices included in the plans.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction 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.
- Mobile Attenuator
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

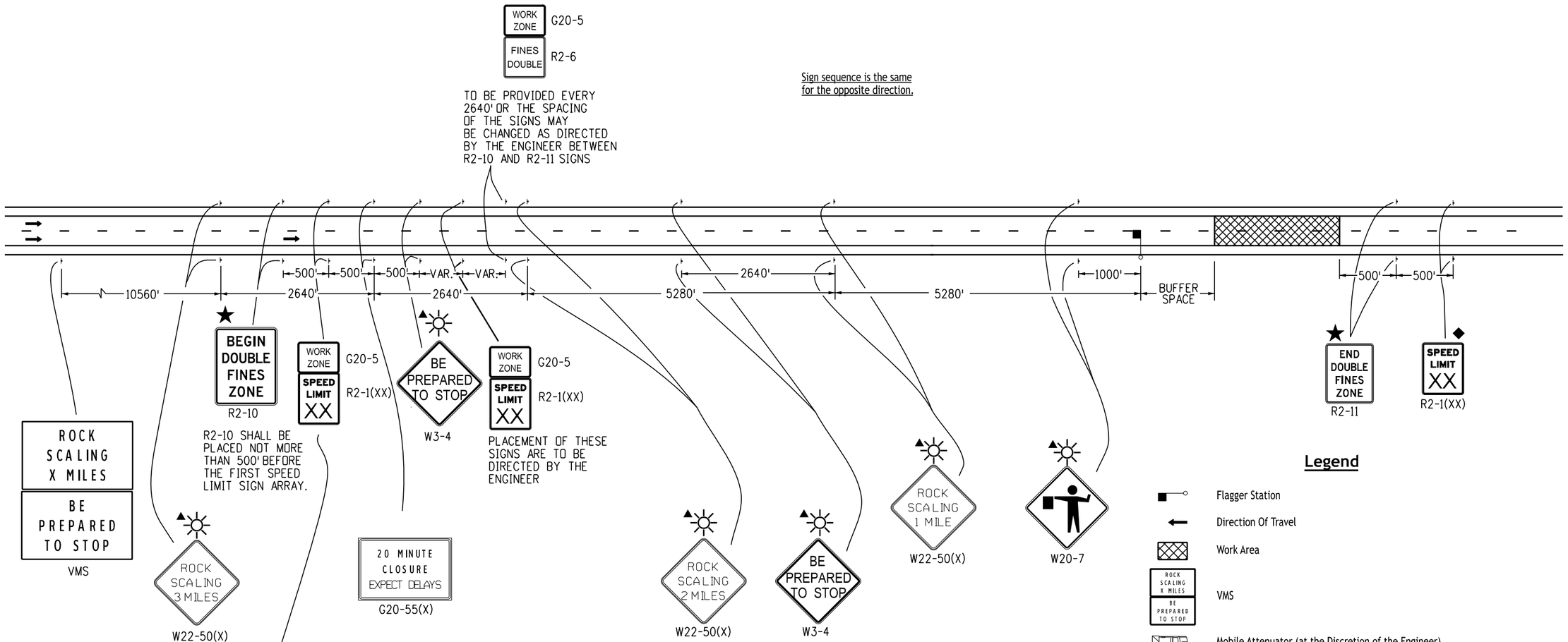
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Created By: KEN			
Last Modification Date: 07/01/26			
Last Modified By: NRR			
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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 14 of 26
Project Sheet Number:



Legend

- Flagger Station
- Direction Of Travel
- Work Area
- VMS (ROCK SCALING X MILES / BE PREPARED TO STOP)
- Mobile Attenuator (at the Discretion of the Engineer)
- ▲ 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.
- BUFFER SPACE — See General Note 23 on Sheet 2.
- Flashing Beacon
- ★ See Fines Double Signing Notes on Sheet 12.

Case No. 28

Typical Application

Rock Scaling - Road Closure, Four-Lane Divided Highway

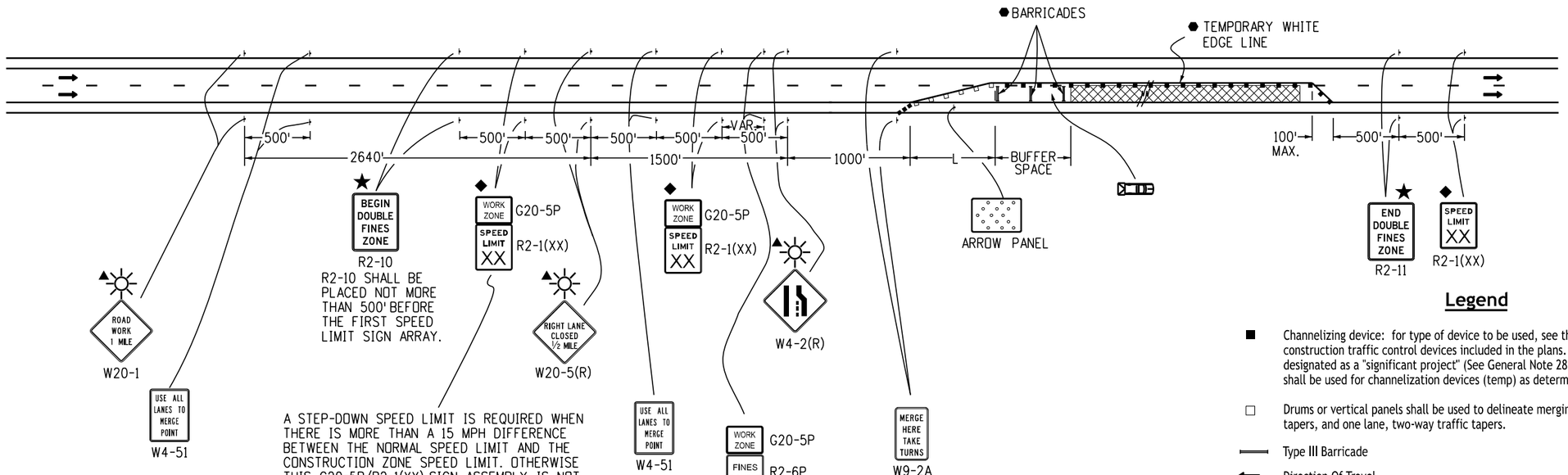
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Last Modification Date: 07/01/26			
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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 15 of 26
Project Sheet Number:



Case No. 29

Typical Application
Late/Zipper Merging - One Lane Closed, 4-Lane Divided Highway

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 28), concrete barrier shall be used for channelization devices (temp) as determined by the Engineer.
- □ Drums or vertical panels shall be used to delineate merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III 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.
- Flashing Beacon
- ⬣ Required when work occupies the location for more than 3 days.
- ★ See Fines Double Signing Notes on Sheet 12.
- Mobile Attenuator
- BUFFER SPACE See General Note 23 on Sheet 2.
- L Transition Taper Length:
  - L = Minimum Length Of Taper
  - Speed 45 Mph or More: L = S X W
  - Speed 40 Mph or Less: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 85 Percentile Speed
  - W = Width of Offset
  - Shoulder Taper = 1/3 L

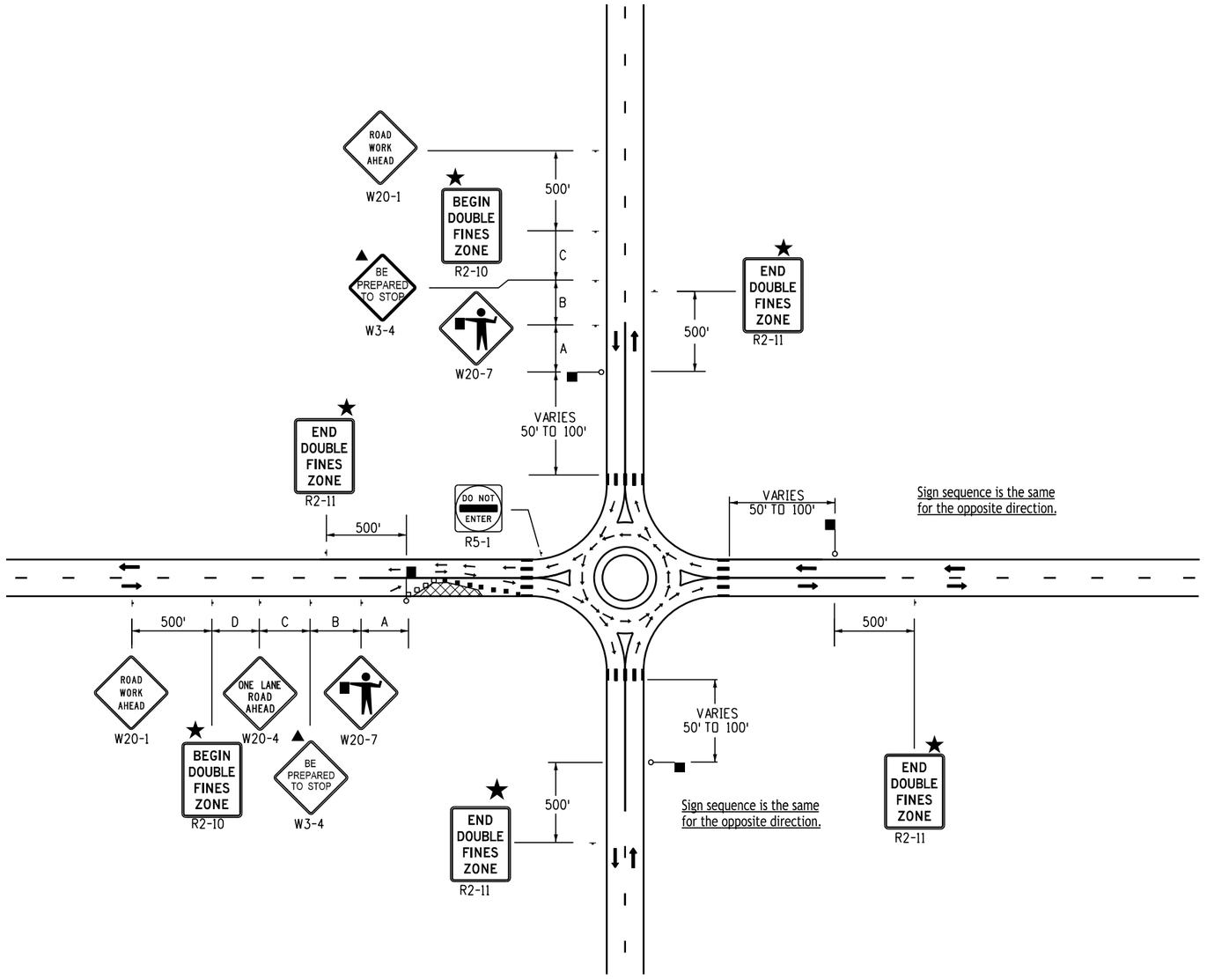
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Traffic Controls for Highway Construction

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Standard Plan No.
S-630-1
Standard Sheet No. 16 of 26
Project Sheet Number:



Case No. 30
Typical Application
Roundabout - Partial Closure Near One-Lane Roundabout

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III Barricade
- Concrete Barrier (Temporary)
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 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 17 on Sheet 2).
- ▲ 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 consturction control devices.
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- BUFFER SPACE — Buffer Space (see General Note 23 on Sheet 2).
- ⬣ Required when work occupies the location for more than 3 days.
- Flashing Beacon
- ★ See Fines Double Signing Notes On Sheet 12.

Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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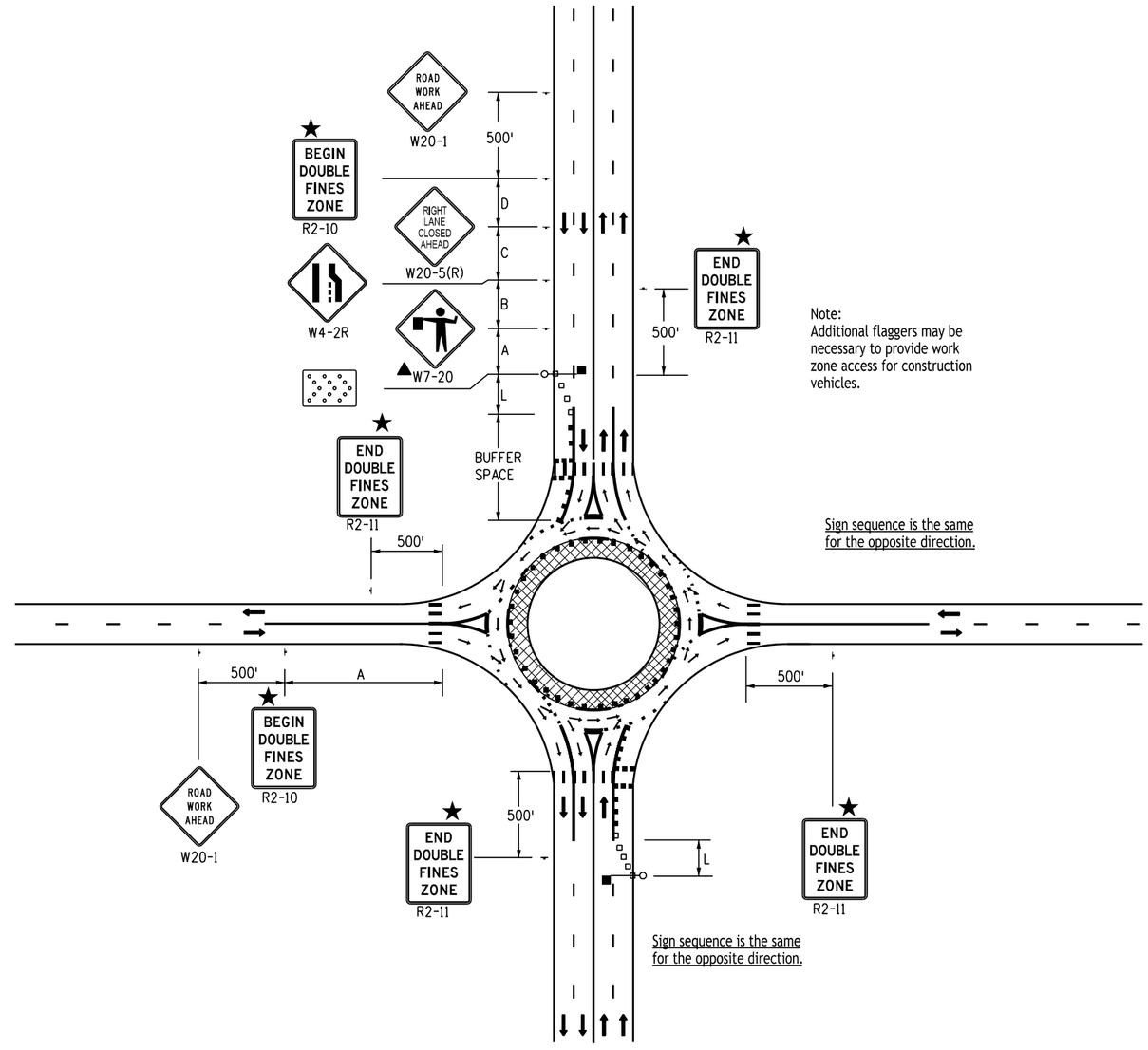
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Standard Plan No.
S-630-1
Standard Sheet No. 17 of 26
Project Sheet Number:



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 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 28), concrete barrier shall be used for channelization devices (temp) as determined by the Engineer.
- □ Drums or vertical panels shall be used to delineate merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III 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.
- Flashing Beacon
- ⬣ Required when work occupies the location for more than 3 days.
- ★ See Fines Double Signing Notes on Sheet 12.
- Mobile Attenuator
- L Transition Taper Length:
  - L = Minimum Length Of Taper
  - Speed 45 Mph Or More: $L = S \times W$
  - Speed 40 Mph Or Less: $L = \frac{WS^2}{60}$
  - S = Numerical Value Of Speed Limit Or 85 Percentile Speed
  - W = Width Of Offset
  - Shoulder Taper = 1/3 L
- BUFFER SPACE See General Note 23 on Sheet 2.
- Flagger Station

Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

Case No. 31

Typical Application *

Roundabout - Inside Lane Closure for Two-Lane Roundabout

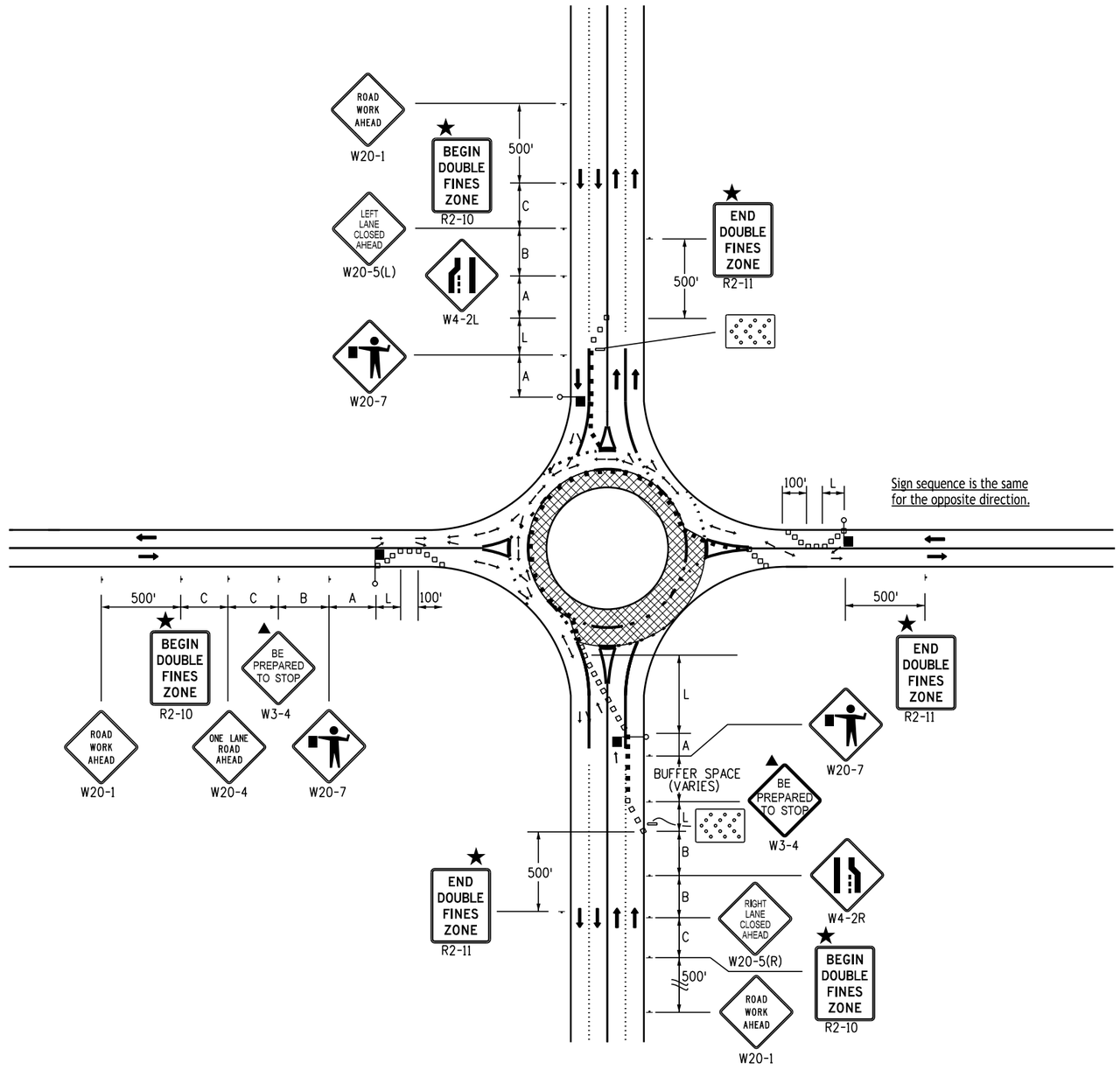
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Standard Plan No.
S-630-1
Standard Sheet No. 18 of 26
Project Sheet Number:



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 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 28), concrete barrier shall be used for channelization devices (temp) as determined by the Engineer.
- □ Drums or vertical panels shall be used to delineate merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III 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.
- Flashing Beacon
- ⬣ Required when work occupies the location for more than 3 days.
- ★ See Fines Double Signing Notes on Sheet 12.
- Mobile Attenuator
- L Transition Taper Length:

  L = Minimum Length Of Taper

  Speed 45 Mph Or More: $L = S \times W$

  Speed 40 Mph Or Less: $L = \frac{WS^2}{60}$

  S = Numerical Value Of Speed Limit Or 85 Percentile Speed

  W = Width Of Offset

  Shoulder Taper = 1/3 L
- BUFFER SPACE See General Note 23 on Sheet 2.
- Flagger Station

Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

Case No. 32

Typical Application *

Roundabout - Outside Lane Closure for Two-Lane Roundabouts

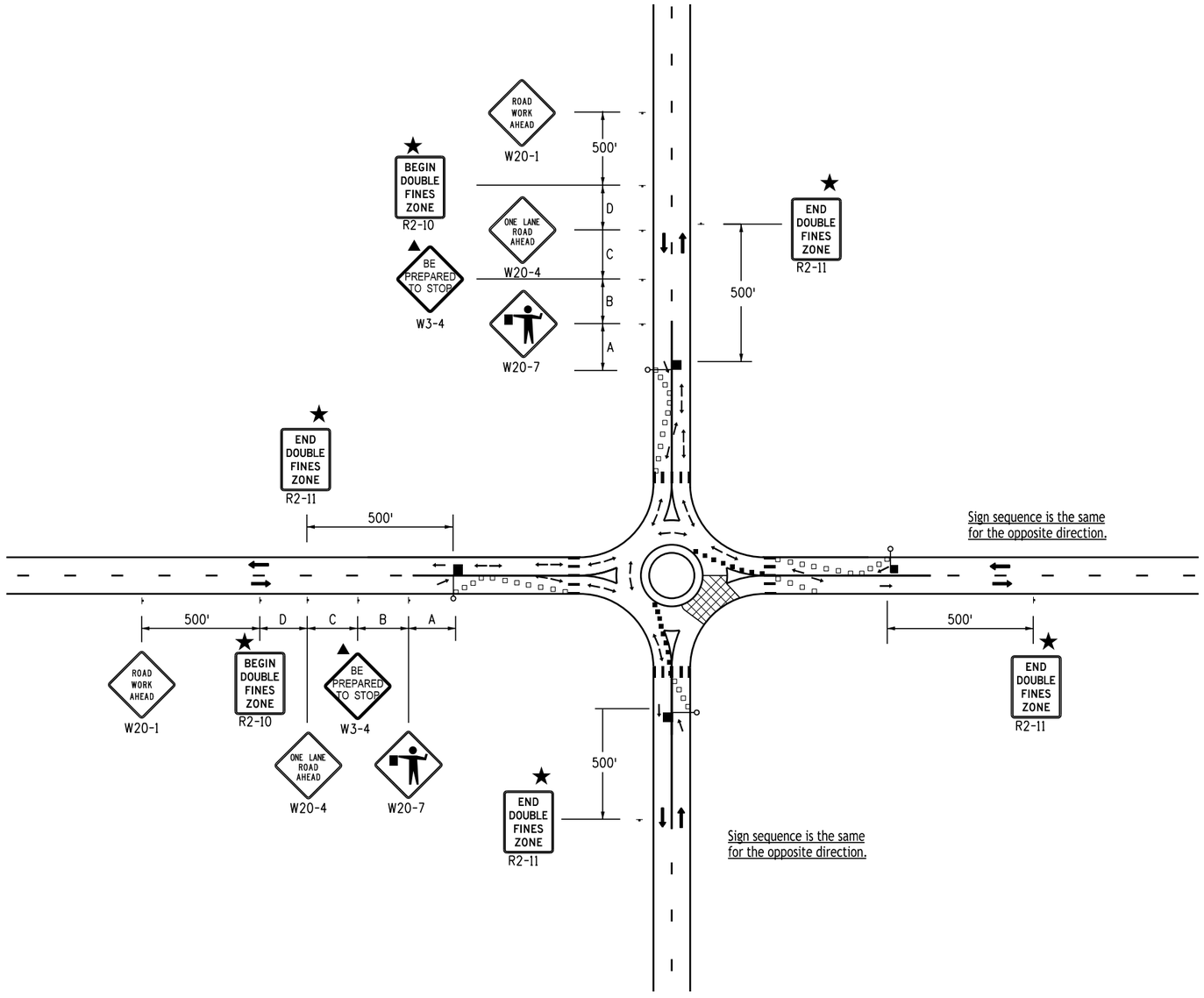
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Traffic Controls for Highway Construction

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Standard Plan No.
S-630-1
Standard Sheet No. 19 of 26
Project Sheet Number:



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 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 28), concrete barrier shall be used for channelization devices (temp) as determined by the Engineer.
- □ Drums or vertical panels shall be used to delineate merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Type III 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.
- Flashing Beacon
- ⬢ Required when work occupies the location for more than 3 days.
- ★ See Fines Double Signing Notes on Sheet 12.
- Mobile Attenuator
- L Transition Taper Length:

  L = Minimum Length Of Taper

  Speed 45 Mph Or More: $L = S \times W$

  Speed 40 Mph Or Less: $L = \frac{WS^2}{60}$

  S = Numerical Value Of Speed Limit Or 85 Percentile Speed

  W = Width Of Offset

  Shoulder Taper = 1/3 L
- BUFFER SPACE See General Note 23 on Sheet 2.
- Flagger Station

Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

CASE NO. 33
Typical Application *
Roundabout - Partial Closure for One-Lane Roundabout

Computer File Information		Sheet Revisions	
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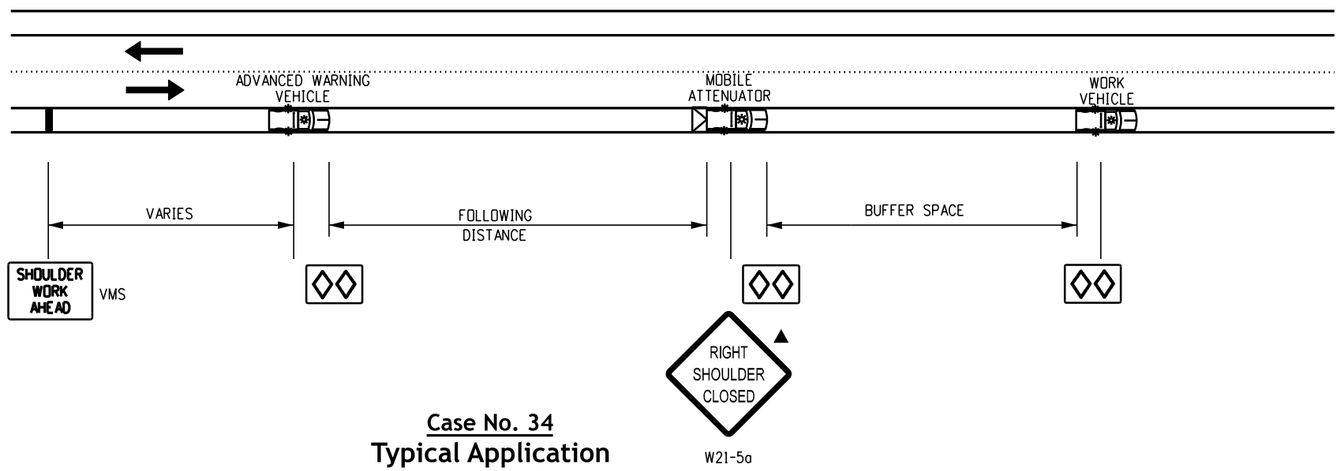
Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 20 of 26
Project Sheet Number:

Legend

- Mobile attenuator vehicle, two 360-degree yellow flashing beacons, and yellow flashing vehicle lights or strobes.
- VMS — Variable Message Sign (VMS).
- Arrow Board
- ▲ When VMS is used, the "Right Shoulder Closed" (W21-5a) sign becomes 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 pavement marking material.
- ⬬ Optional

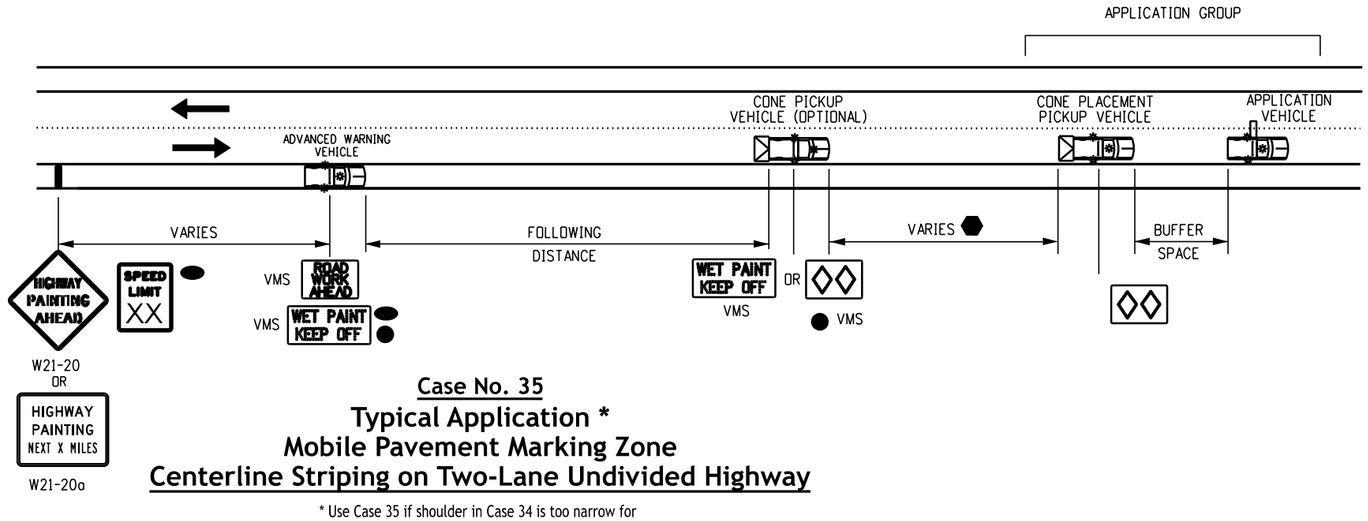


Case No. 34
Typical Application
Mobile Work Zone
Mobile Shoulder Closure on Two-Lane Undivided Highway

* Use Case 35 if shoulder in Case 34 is too narrow for group vehicle use.

Following Distance Chart for Warning and Mobile Attenuator (or Cone Pickup) Vehicle

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)	BUFFER SPACE (FEET)
0 - 30	250 - 550	100 - 120
35 - 40	325 - 700	100 - 120
45 - 50	600 - 900	120 - 140
55	750 - 1200	120 - 140
60	1000 - 1400	180 - 200



Case No. 35
Typical Application *
Mobile Pavement Marking Zone
Centerline Striping on Two-Lane Undivided Highway

* Use Case 35 if shoulder in Case 34 is too narrow for group vehicle use.

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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 21 of 26
Project Sheet Number:

Legend

Mobile attenuator vehicle, two 360-degree yellow flashing beacons, and yellow flashing vehicle lights or strobes.

Advance Warning Flashing or Sequencing Arrow Panel.

VMS — Variable Message Sign (VMS).

Arrow Board

▲ When the VMS is used, the "Shoulder Closed" W21-5a(R/L) and "Ramp Closed Ahead" W5-40 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 pavement marking material.

⬬ Optional

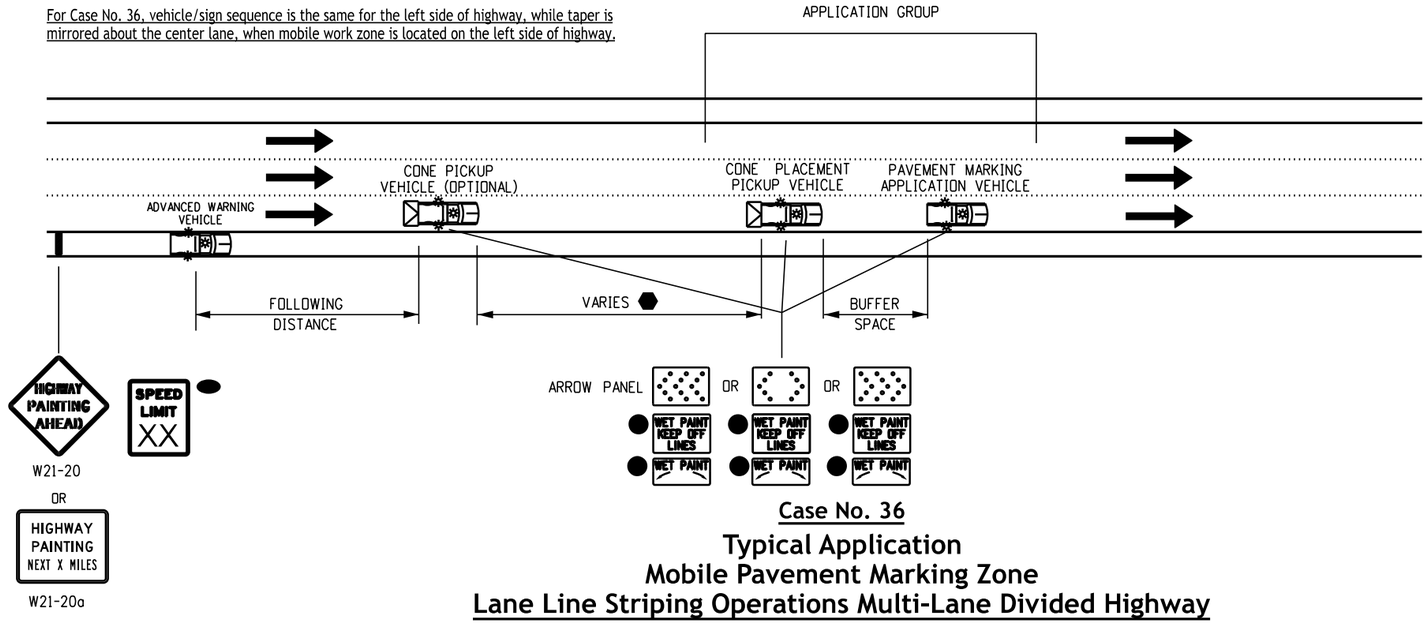
Notes

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.

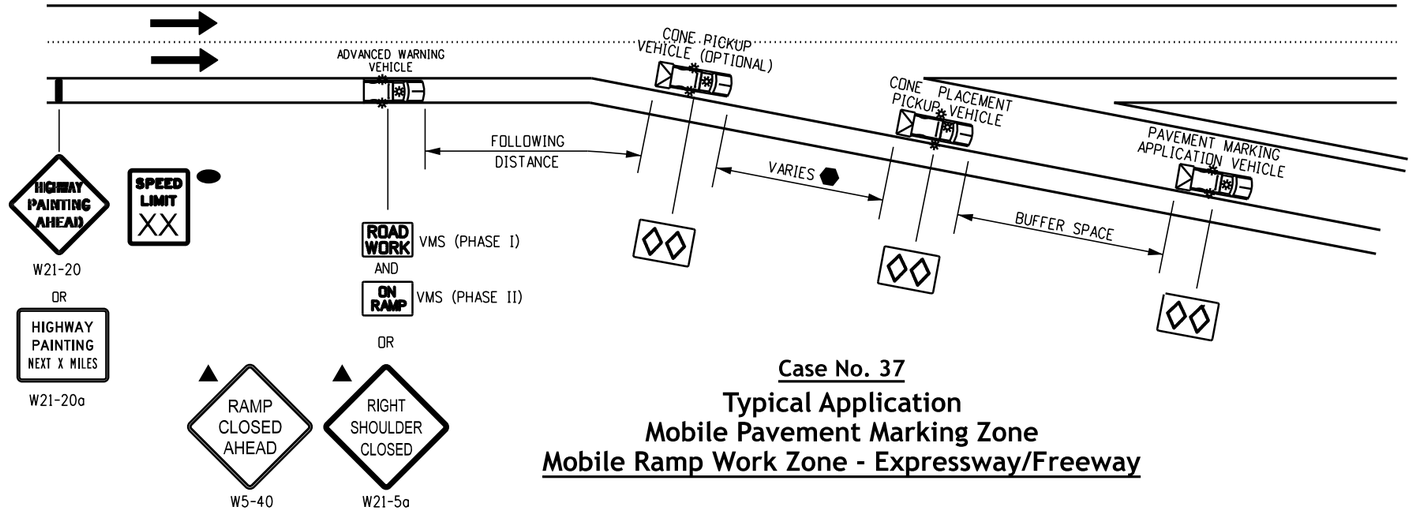
Following Distance Chart For Warning Vehicle And Cone Pickup Vehicles

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)	BUFFER SPACE (FEET)
0 - 30	250 - 550	100 - 120
35 - 40	325 - 700	100 - 120
45 - 50	600 - 900	120 - 140
55	750 - 1200	120 - 140
60	1000 - 1400	180 - 200

For Case No. 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.



Case No. 36
Typical Application
Mobile Pavement Marking Zone
Lane Line Striping Operations Multi-Lane Divided Highway



Case No. 37
Typical Application
Mobile Pavement Marking Zone
Mobile Ramp Work Zone - Expressway/Freeway

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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 22 of 26
Project Sheet Number:

Legend

Mobile attenuator truck, two 360-degree yellow flashing beacons, and yellow flashing vehicle lights or strobes.

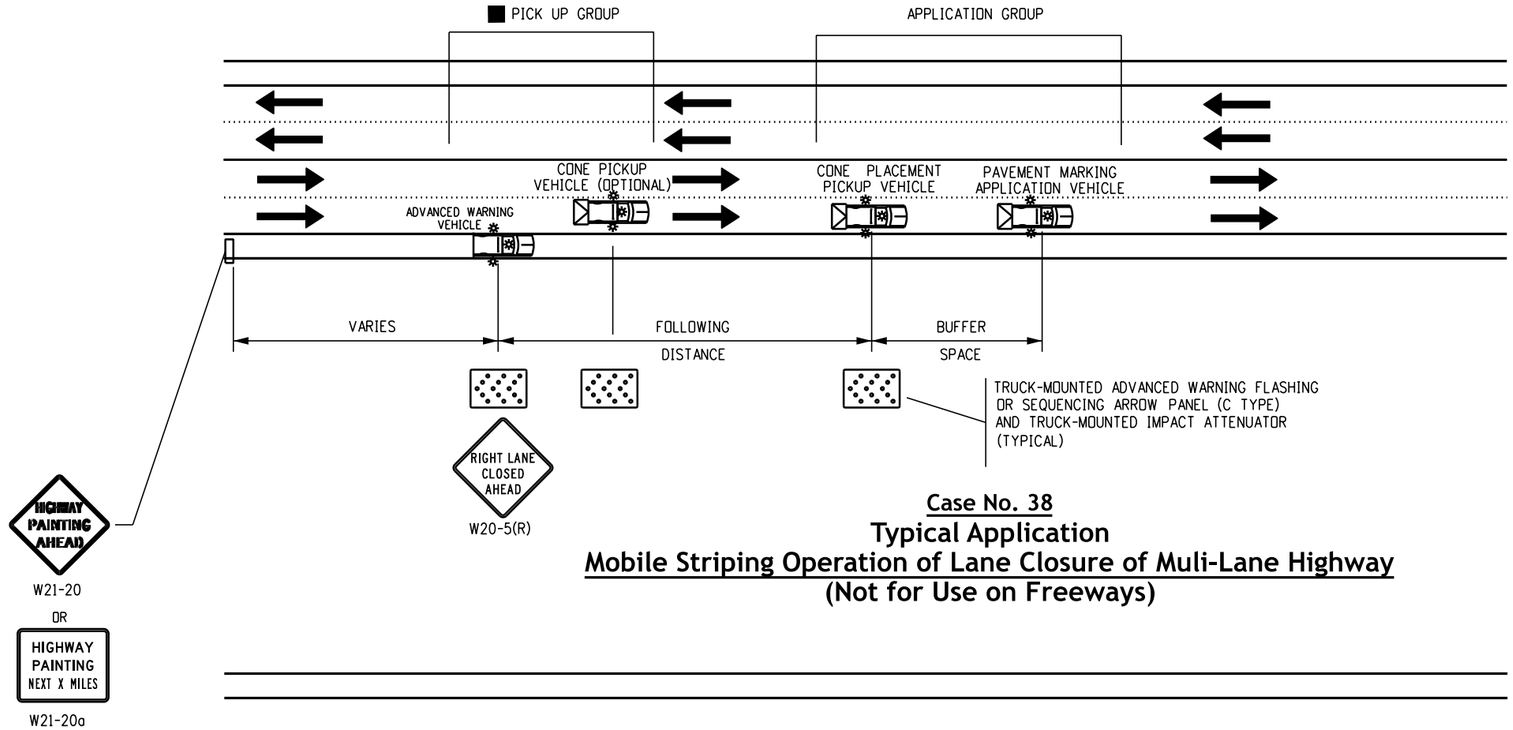
Advance Warning Flashing or Sequencing Arrow Panel.

▲ When the VMS is used, the "Right Lane Closed Ahead" W9-3(R/L) sign becomes optional.

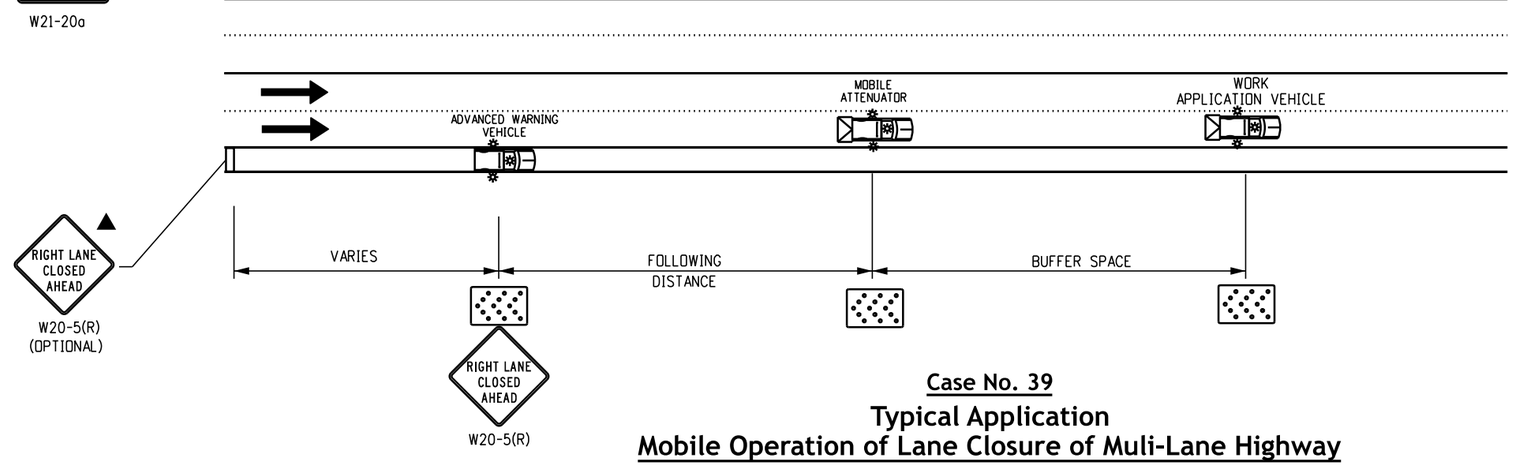
■ The "Cone Pick Up Vehicle" or "Warning Vehicle" may encroach into the traffic lane when the shoulder is too narrow to drive on.

Notes

1. In 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 ramp(s).



Case No. 38
Typical Application
Mobile Striping Operation of Lane Closure of Muli-Lane Highway
(Not for Use on Freeways)



Case No. 39
Typical Application
Mobile Operation of Lane Closure of Muli-Lane Highway

Following Distance Chart for Warning Vehicle and Signing Vehicles

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)	BUFFER SPACE (FEET)
0 - 30	250 - 550	100 - 120
35 - 40	325 - 700	100 - 120
45 - 50	600 - 900	120 - 140
55	750 - 1200	120 - 140
60	1000 - 1400	180 - 200

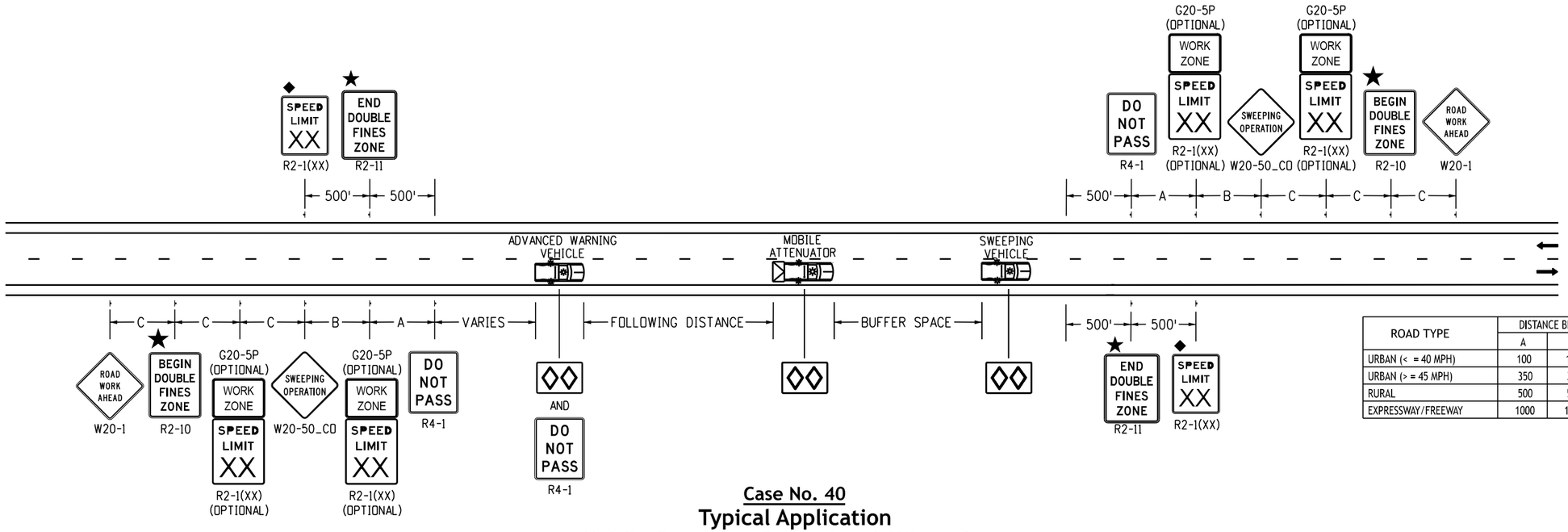
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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 23 of 26
Project Sheet Number:



ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

Case No. 40
Typical Application
Mobile Sweeping Operation 1 Mile or Less

Following Distance Chart for Warning and Mobile Attenuator (or Sweeping) Vehicle

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)	BUFFER SPACE (FEET)
0 - 30	250 - 550	100 - 120
35 - 40	325 - 700	100 - 120
45 - 50	600 - 900	120 - 140
55	750 - 1200	120 - 140
60	1000 - 1400	180 - 200

SPEED REDUCTION CHART (SEE GENERAL NOTE 3)			
EXISTING POSTED SPEED	FIRST WORK ZONE SPEED	SECOND WORK ZONE SPEED	SPEED AFTER WORK ZONE
75 MPH	60 MPH	45 MPH	75 MPH
70 MPH	55 MPH	40 MPH	70 MPH
65 MPH	50 MPH	40 MPH	65 MPH
60 MPH	45 MPH	40 MPH	60 MPH
55 MPH	40 MPH	N/A	55 MPH
50 MPH	40 MPH	N/A	50 MPH
45 MPH	40 MPH	N/A	45 MPH

Legend

- Mobile attenuator vehicle, two 360-degree yellow flashing beacons, and yellow flashing vehicle lights or strobes.
- Arrow Board
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- ★ See Fines Double Signing Notes on Sheet 12.

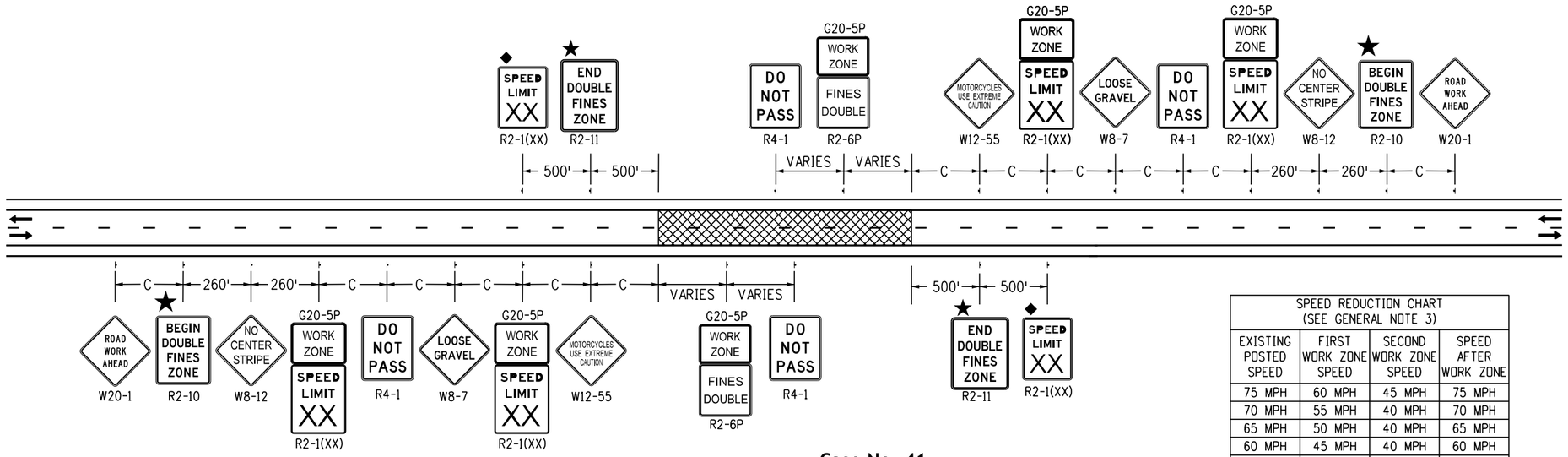
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Traffic Controls for Highway Construction

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-1
Standard Sheet No. 24 of 26
Project Sheet Number:

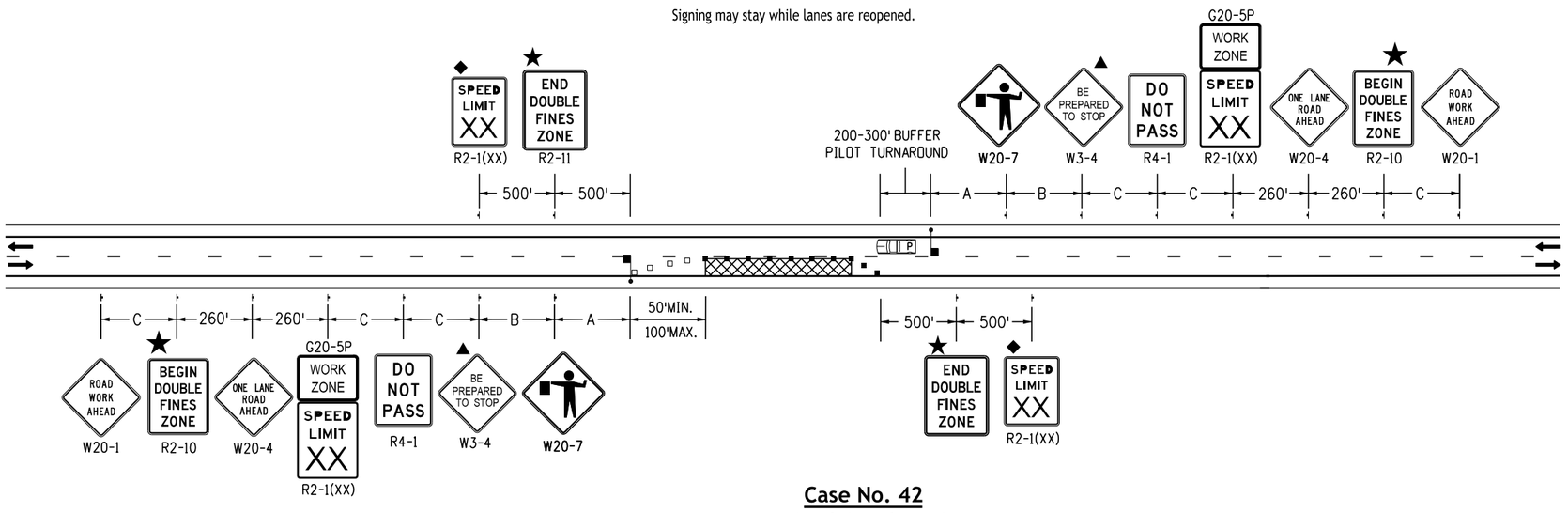


Case No. 41
Typical Application
Chip Seals - Two-Lane Undivided Highway

Note: Follow applicable standards as shown in Case No. 17 on Sheet 9, Case No. 19 on Sheet 10, and Part 6 of the latest MUTCD for lane closure in work area.

Signing may stay while lanes are reopened.

SPEED REDUCTION CHART (SEE GENERAL NOTE 3)			
EXISTING POSTED SPEED	FIRST WORK ZONE SPEED	SECOND WORK ZONE SPEED	SPEED AFTER WORK ZONE
75 MPH	60 MPH	45 MPH	75 MPH
70 MPH	55 MPH	40 MPH	70 MPH
65 MPH	50 MPH	40 MPH	65 MPH
60 MPH	45 MPH	40 MPH	60 MPH
55 MPH	40 MPH	N/A	55 MPH
50 MPH	40 MPH	N/A	50 MPH
45 MPH	40 MPH	N/A	45 MPH



Case No. 42
Typical Application
Pilot Car - Lane Closure, Two-Lane Undivided Highway

Notes

1. All night hazards will be marked and delineated.
2. All speed limit signs conflicting with work zone speed shall be covered during speed reduction.

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 merging tapers, shifting tapers, and one lane, two-way traffic tapers.
- Flagger Station
- 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: $L = \frac{WS^2}{60}$
  - S = Numerical Value of Speed Limit or 85 Percentile Speed
  - W = Width of Offset
  - Shoulder Taper = 1/3 L
- ▲ 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 consturction control devices.
- ◆ These devices are not optional if the posted speed limit in the work zone is reduced.
- VARIES Buffer Space (see General Note 23 on Sheet 2).
- Pilot Car
- ★ See Fines Double Signing Notes On Sheet 12.

Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (< = 40 MPH)	100	100	100
URBAN (> = 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
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Traffic Controls for Highway Construction

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Standard Plan No.
S-630-1
Standard Sheet No. 25 of 26
Project Sheet Number:

Typical Construction Zone Signs

These signing notes are intended as a quick reference for typical sign use and placement in construction zones.

G20-1 "Road Work Next XX Miles" - This sign shall be erected at the limits of any road construction or maintenance project of more than two (2) miles in length where traffic is maintained through the project.

G20-4 "Pilot Car Follow Me" - This sign shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way traffic through or around the project.

G20-5P "Work Zone" - This plaque shall be mounted just above the work zone speed limit signs prior to the work zone area.

G20-55(X) "X Minute Closure Expect Delays" - This sign is intended for use 500 feet past the "Work Zone" with speed limit sign.

M4-9() "Detour/<<<<" - This sign is used for unnumbered routes; for use in emergency situations; for periods of short duration; or where, over relatively short distances. It is not necessary to show route markers to guide traffic along the detour and back to its authorized route.

M4-10 () "Detour Arrow" - 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 highway to through traffic.

R2-1() "Speed/Limit/XX" - These signs are intended to reduce traffic speed in advance of the daily work area within the overall project limits.

R2-1(XX) "Speed/Limit/XX" - This sign is intended for use 500 feet "End Double Fines Zone" sign to bring traffic back to original posted speed.

R2-6P "Fines Double" - This sign is intended for use within work zones to provide notice of increased fines for traffic violations within work zones.

R4-1 "Do Not Pass" - This sign should be placed at transition taper point.

R4-2 "Pass With Care" - This sign should be placed at transition taper point.

R2-10 "Begin Double Fines zone" - Sign is placed at the beginning of the advanced warning area of the traffic control zone.

R2-11 "End Double Fines Zone" - Sign is placed after work zone area, past downstream taper section.

R11-2 "Road/Closed" - This sign is to be mounted on the barricade that is placed before the work zone entrance to prohibit traffic from entering the work zone.

R11-3 "Road Closed/X Miles Ahead/Local Traffic Only." - 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.

R11-4 "Road Closed/To/Thru Traffic" for urban use - 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.

R22-2 "Turn Off/2-Way Radios/and/Cellular/Phones" - This sign is to be used in sequence with the W22-1 and W22-3 signs and placed at least 1000 feet from the beginning of the blasting zone.

W1-1() "Turn Arrow" - This sign is intended for use where engineering investigations of roadway conditions show the recommended speed on the turn to be 30 mph or less. ✱

W1-2() "Curve Arrow" - this sign is intended for use where engineering investigations of roadway conditions show the recommended speed on the curve to be in the range between 30 and 60 miles per hour. ✱

W1-3() "Reverse Turn Arrow" - This sign is intended for use where two turns or the curve and a turn in opposite directions are separated by a tangent of less than 600 feet.✱

W1-6() "Arrow" - This sign should be mounted just below the road closed sign at the point where the diversion has been established due to the lane closure.

W3-2 "Yield Ahead" - This sign is intended for use at the approach to the yield sign that is not visible for a sufficient distance to permit the driver to bring his vehicle to a stop at the yield sign. ✱

W3-4 "Be Prepared To Stop" - This sign to be placed in advance of a flagger.

W4-2(X) "Left (Right) Lane Transition Symbol" - This sign is intended for use in advance of the reduction in the number of traffic lanes in the direction of travel on the multilane highway. ✱

W4-50 "Use Both Lanes During congestion" - This sign is intended for use in advance of the "Road Work X Mile" advanced warning sign.

W4-51 "Use Both Lanes To Merge Point" - This sign is intended to direct motorists to use both travel lanes until the lanes are reduced to one lane.

W4-51 "Take Turns Merge Here" - This sign is intended to warn motorists in advanced to move from the closed travel lane to the open travel lane, usually 500 feet in advanced of the start of the transition taper.

W5-1 "Road Narrows" - This sign is intended for use in advance of the transition on the road where the pavement width is reduced abruptly to a width such that two cars cannot pass without reducing speed. ✱

W5-2a "Narrow Bridge symbol" - This sign is intended for use in advance of a bridge or culvert having a clear two-way roadway width of 16 to 18 feet or any bridge or culvert having a roadway clearance less than the width of the approach pavement. ✱

W5-3 "One Lane/Bridge" - This sign should be placed on two-way roadways in advance of the bridges or culverts where the roadway width is less than 16 feet (18 feet for commercial vehicles) or when the alignment is poor on the approach to the structure having a clear roadway width of 18 feet or less. ✱

W6-1 "Divided Highway Symbol" - This sign should be placed on the approaches to the section of highway where opposing flows of traffic are separated by a physical median.

W6-2 "Divided Highway Ends Symbol" - This sign should be placed at the end of the section of physically divided highway as a warning of two-way traffic ahead.

W6-3 "Two-Way Traffic Symbol" - this sign is intended for use to give warning of transition from a separated one-way roadway to a two-way roadway. ✱

W7-1 "Hill Symbol" - This sign should be placed at a point in advance of the downgrade where the length, percent of grade, horizontal curvature, or other physical features require special consideration on the part of drivers. ✱

W8-1,W8-2 "Bump"/"Dip" - These signs are intended for use to give warning of a sharp rise ordepression in the profile of the road that is sufficiently abrupt to affect vehicle operation or cause considerable discomfort to passengers. ✱

W8-3a "Pavement Ends Symbol" - This sign is intended for use in advance of a point where the pavement surface changes from a hard-surfaced pavement to the low-type surface or earth road. ✱

W8-4 "Soft Shoulder" - This sign is intended for use to warn of a soft shoulder condition that could present a problem to vehicles that may get off the pavement. ✱

W8-5 "Slippery When Wet Symbol" - This sign should be placed in advance of the condition where the highway surface is slippery beyond what is ordinary when wet. ✱

W8-9a "Shoulder Drop-Off" - This sign is intended for use in advance of a shoulder drop-off that exceeds three inches in height. ✱

W8-11 "Uneven Lanes" - This sign is intended for use in advance of an uneven adjacent lane situation that exceeds one inch in height. ✱

W9-1() "Left (Right) Lane Ends" - This sign is intended for use in advance of the pavement width transition sign (W4-2).

W9-2() "Lane Ends/Merge Left (Right)" - This sign is intended for use as a supplement to the pavement width transition sign (W4-2).

W9-3 "Center Lane Closed Ahead Symbol" - This sign should be used in advance of the point where work occupies the center lane and traffic is directed to the right or left of the work zone. ✱

W12-1 "Double Arrow Symbol" - This sign should be placed at the point of the obstruction in the roadway, where traffic is permitted to pass on either side of the obstruction.

W12-2 "Low Clearance Symbol" - This sign is intended for use in advance of an obstruction to warn vehicle operators of clearances less than the maximum vehicle height permitted plus 12 inches. ✱

W13-1P() "Advisory Speed Plaque" - This plaque is intended to supplement warning signs only and shall not be mounted alone. it is used to indicate the maximum recommended speed for the indicated condition.

W13-3 "Advisory Ramp Speed" - This sign is to be posted to inform motorists what the suggested speed limit is on a ramp.

W20-1 "Road/Work/Ahead" - This sign is to be located in advance of the initial activity or detour a driver may encounter, and is intended to be used as a warning of obstructions or restrictions.

W20-2 "Detour/(Dist.)" - This sign is intended for use in advance of the point at which traffic is diverted over a temporary roadway or route.

W20-3 "Road/Closed/(Dist.)" - This sign is intended for use in advance of a point at which a roadway is closed to all traffic or to all but local traffic.

W20-4 "One Lane/Road/(Dist.)" - This sign is intended for use in advance of a point where traffic in both directions must use a single lane.

W20-5() "XXX Lane/Closed/(Dist.)" - This sign is intended for use in advance of a point where one lane of a multiple-lane roadway is closed. it should be provided with interchangeable plaques reading "right", "left", and "center" at no additional cost to the project.

W20-7 "Flagger Symbol" - This sign is intended for use in advance of any point at which a flagger has been stationed to control traffic through or around the project. ✱

W20-52 "Grooved/Pavement/Ahead" - This sign is intended to be used in advance of a roadway that has been grooved and/or roto milled.

W21-1a "Worker Symbol" - This sign is intended for use in conjunction with minor maintenance and public utility operations for the protection of men working in or near the roadway.

W21-2 "Fresh/Oil" - This sign is intended for use where re-surfacing operations have rendered the surface of the pavement temporarily wet, and objectionable splashing on vehicles may occu✱

W21-3 "Road/Machinery/Ahead" - This sign is intended for use in advance of the areas where heavy equipment is operating in or adjacent to the roadway. ✱

W21-4 "Road/Work/(Dist.)" - This sign is intended for use in advance of maintenance for minor reconstruction operations in the roadway.

W21-5 "Shoulder/Work" - This sign is intended for use in advance of the project involving the shoulder, where the traveled way remains unobstructed.

W21-6 "Survey/Crew" - This sign is intended for use in advance of a point where a surveying crew is working in or adjacent to the roadway. ✱

W21-20 "Highway Painting Ahead" - This sign is intended for use in advance of a point where a paint crew is working in or adjacent to the roadway.

W21-20a "Highway Painting Next X Miles" - This sign is intended for use in advance of paint crew working in or adjacent to the roadway.

W22-1 "Blasting/Zone/(Dist.)" - This sign is intended for use in advance of any point or work site where there are explosives being used. the R22-2 and W22-3 signs must be used in sequence with this sign.

W22-3 "End/Blasting/Zone" - This sign is to be used to denote the end of the radio influence area and shall be placed a minimum of 1000 feet from the blasting zone, either with or preceding the end construction sign.

W22-50(X) "Rock Scaling X Mile(s)" - This sign is intended to be used in advanceof a flagger in advanced of the work zone area.

Advance Placement Of Warning Signs

POSTED OR 85TH PERCENTILE SPEED	ADVANCE PLACEMENT DISTANCE (FEET)								
	+ CONDITION A	++ CONDITION B: DECELERATION TO THE LISTED ADVISORY SPEED (MPH) FOR THE CONDITION							
		MPH							
		0	10	20	30	40	50	60	70
20	225	115	●	--	--	--	--	--	--
25	325	155	●	●	--	--	--	--	--
30	460	200	●	●	--	--	--	--	--
35	565	250	●	●	●	--	--	--	--
40	670	305	100'	100'	●	--	--	--	--
45	775	360	125	100'	100'	●	--	--	--
50	885	425	200	175	125	100'	--	--	--
55	990	495	275	225	200	125	●	--	--
60	1100	570	350	325	275	200	100'	--	--
65	1200	645	450	400	350	275	200	100'	--
70	1250	730	525	500	450	375	275	200	--
75	1350	820	625	600	550	475	375	300	150

+ Condition A: Speed reduction and lane changing in heavy traffic. Typical signs are "Merge" and "Right Lane Ends".

++ Condition B: Typical conditions are the warning of a potential stop situation and locations where the road user must decrease speed to maneuver through the warned condition. Typical signs are "Stop Ahead", "Signal Ahead", "Yield Ahead", "Curve", "Reverse Curve", "Turn".

● No suggested distances are provided at these speeds, as the placement is dependent on site conditions and other signing.

Δ The minimum advance placement distance is listed as 100 feet to provide adequate spacing between signs.

A supplemental plaque may be used with warning signs specifying the distance to the condition if there is an in-between intersection that might confuse the motorist.

✱ Placement should be in accordance with warning sign placement table.

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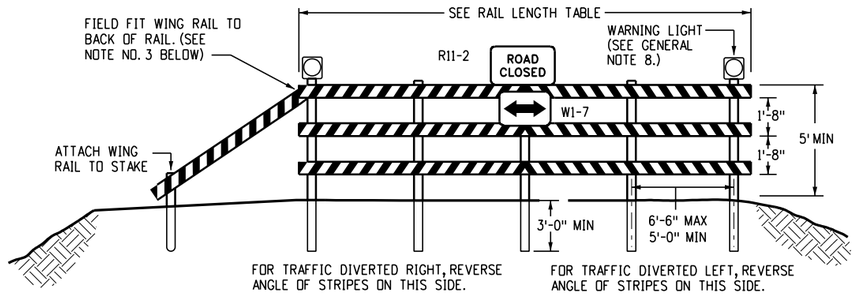
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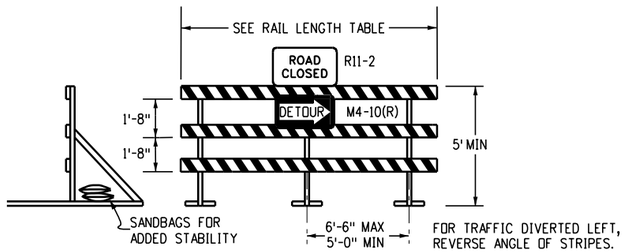
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Standard Sheet No. 26 of 26

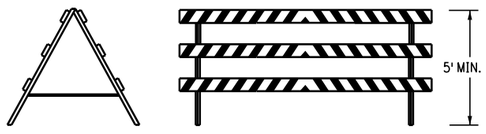
Project Sheet Number:



Fixed



Movable-Skids



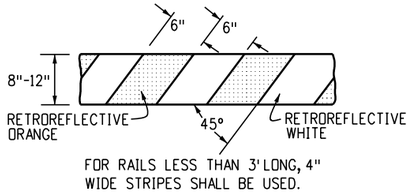
Movable-Hinged

Typical Type 3 Barricades

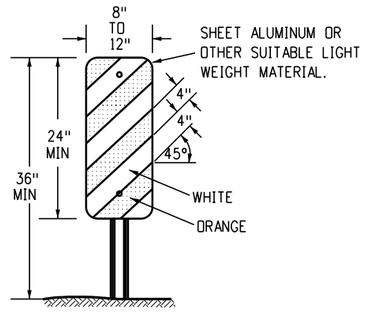
1. Type 3 barricades have 3 reflectorized rail faces if facing traffic in one direction and 6 if facing traffic in two directions.
2. The portion of the post above the ground line shall be painted in accordance with the appropriate General Note.
3. Detachable extension wing rails for bypassing of construction equipment are permitted, when necessary, on fixed or movable Type 3 barricades. The length shall be adequate to close the borrow pit and/or shoulder as required.

Rail Length Table

TYPE 3 BARRICADE		LENGTH
FIXED	MOVABLE	
F - A	M - A	8'- 14'
F - B	M - B	15'- 24'
F - C	M - C	25'- 35'
F - D	M - D	> 35'

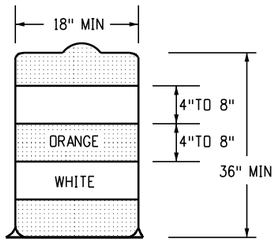


Rail Striping Detail



Typical Vertical Panel

1. If special panels 3 feet or greater in height are required, then 6 inch stripes shall be used.
2. If fixed placement is required, mount on delineator post. See Colorado Standard Plan S-612-1.



Typical Drum

1. The 18 inch minimum dimension shall apply to the smallest measurement of oblong, rectangular, or flattened side drums.
2. There shall be at least two orange and two white horizontal, circumferential, retroreflective stripes on each drum.

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 detailed in the plans.
   B. As shown in applicable 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 with the following:
   A. The applicable Section of 508 of the Standard Specifications.
   B. All skids, braces and posts shall be painted with 2 coats of exterior white paint.
   C. The backsides of rails and vertical panel channelizing devices facing one direction of traffic only shall be painted with exterior white paint.
   D. Aluminum or galvanized steel skids, braces and posts shall not be painted.
4. All striped surfaces shall conform with the following:
   A. The entire area of orange and white stripes shall be fabricated as one piece.
   B. Horizontal rails, wing rails and vertical panel channelizing devices shall have orange and white stripes on the face side(s) slanting downward at a 45° angle toward the side(s) to which traffic is to pass or turn.
   C. Permanent barricades shall have retroreflective red 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 crossroad or outlet.
   D. All retroreflective sheeting shall conform to ASTM D4956:
      1. Orange and white shall be Type IV minimum.
      2. Red and white shall be Type IV minimum.
5. For all wooden barricade components nominal lumber dimensions are satisfactory.
6. All screws, bolts, nuts and washers shall be galvanized or cadmium plated.
7. Stability of barricades and channelizing devices shall conform with the following:
   A. Skids (bases) of movable barricades shall be weighted with sandbags only where necessary to provide stability
   B. No movable or portable device shall be weighted by any method or with any material that would make them hazardous to motorists.
8. Warning lights used with barricades, drums and vertical panels shall conform with the following:
   A. Use flashing warning lights when devices are used singly, and steady burn lights when they are used in a series for channelization.
   B. They shall be positioned above the top rail of barricades or on top of drums and vertical panels.
9. Concrete barrier (temporary) shall conform with:
   A. Precast concrete barrier as shown on Colorado Standard Plan M-606-14.
   B. Barrier reflectors shall be installed that meet the 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 cost of the barrier.
   C. Concrete barrier end treatment shall be in accordance with clear zone criteria, and placed as shown on the plans.
   D. Inspection and condition assessment of concrete barrier shall be in accordance with M-606-14, Sheet 4.
10. Sign panels mounted on barricades will be paid for separately.

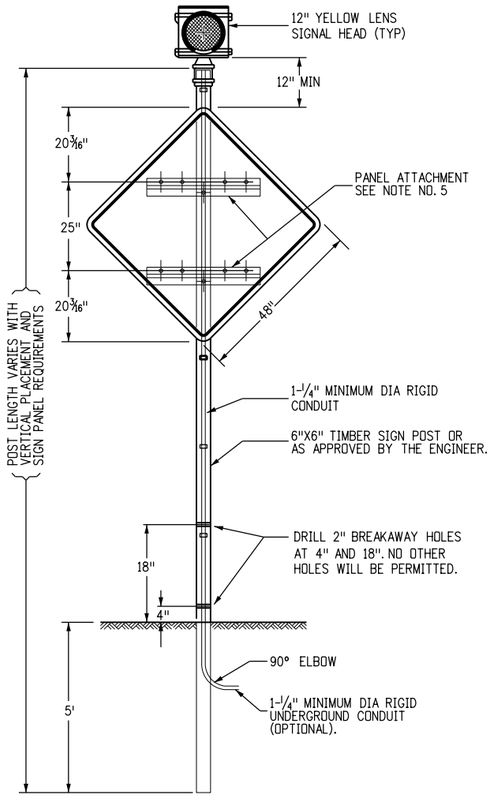
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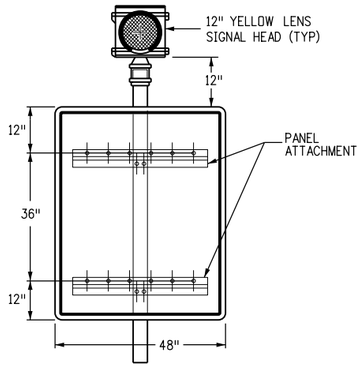
Barricades, Drums, Concrete Barriers (Temp) & Vertical Panels

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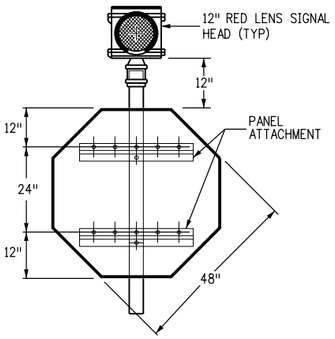
Standard Plan No.
S-630-2
Standard Sheet No. 1 of 1
Project Sheet Number:



Complete Installation with Diamond Panel

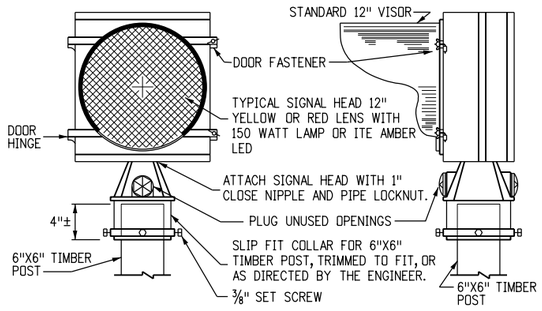


With Rectangle Panel

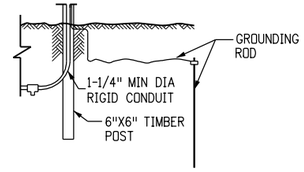


With Octagon Panel

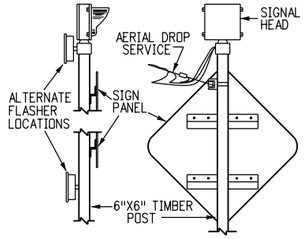
Typical Elevation Facing Traffic



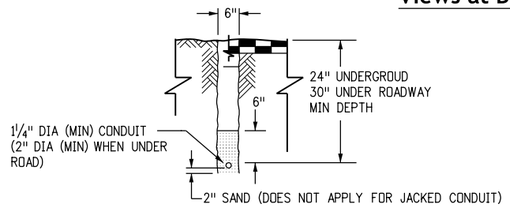
Typical Signal Head - 12 Inch Lens



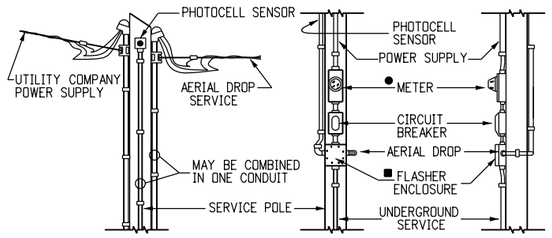
Underground View at Beacon



Views at Beacon

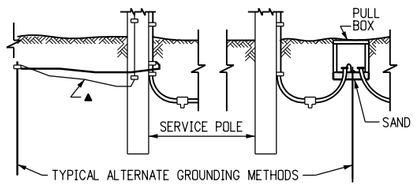


Trenching Detail



View at Power Source

Views at Enclosures



Underground Views at Power Source

Location and configuration of electrical equipment is diagrammatic only (use any method complying with the General Notes)

Typical Electrical Service Details

General Notes

1. All electrical materials and workmanship shall conform to the latest requirements of the NEX, NEMA, UL or EIA wherever applicable, any state 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 wiring within the beacon and from there to the power source. The utility company will make the connection with the contractor's wiring.
   - C. The electrical service between a remote power source and the flashing beacon shall be underground or aerial dropped as authorized by the Engineer.
   - D. If power is supplied by solar panels, the solar panels and power box should be mounted on a separate post beyond the clear zone or behind guard rail or barrier. Where this is not possible the panels must be a minimum height of 7 feet from the base of the post and shall face away from traffic. Power boxes shall be buried so that no more than 4 inches of the box is above 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 post or that the device may be contained within the signal head itself.
   - F. A suitable enclosure for the flasher shall be provided. A rain tight junction box or can, with a surface mount measuring approximately 8 inches x 8 inches x 4 inches, with a flanged screw attached cover, and fabricated from not less than 16 gage galvanized steel, shall be provided.
   - G. A built-in radio interference suppression device and a photocell sensor type signal lamp dimmer shall be provided for each flashing beacon.
   - H. An automatic and manual mechanism for turning off the flasher, approved by the Engineer, shall be provided. If the field condition does not warrant the use of the sign, the flashing beacon shall be turned off and the sign shall be covered with the appropriate material as approved by the Engineer or the sign shall be turned so it is not facing traffic.
2. Timber posts shall be in accordance with Section 614 of the Standard Specifications as to size, alternate size, grade, species, treatment, and breakaway holes.
3. For lateral and vertical placement of flashing beacon (portable), see Colorado Standard Plan S-614-1.
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 "saddle" type bracket. If the bracket allows the sign panel to be turned parallel to the roadway, the sign may remain in place when not applicable, but laying the sign panel down in a horizontal position is not permitted. All other signs that are not in use shall be removed from the shoulder and clear zone, solar panels shall not be placed on top of barrier or within a median.
5. Backing zee panel attachment is not required. If used, see Colorado Standard Plan S-614-3.

Legend

- ▲ Existing ground at service pole; otherwise pull thru conduit or attach to conduit and tap off underground
- ● Provide weep hole with aerial drop service
- ■ Optional (per utility company requirements)

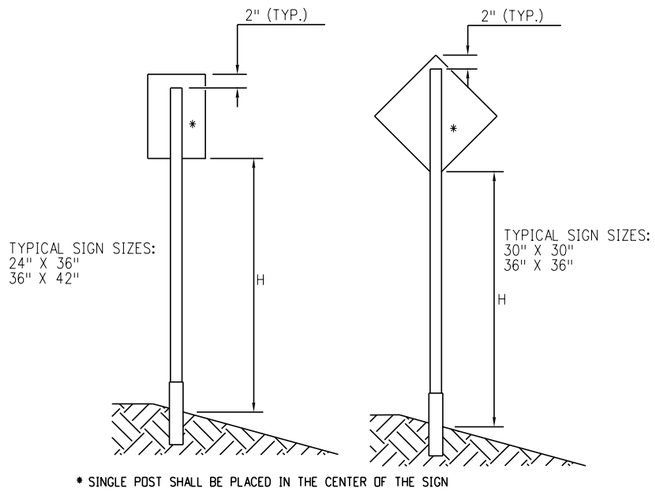
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Flashing Beacon (Portable) Details

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-3
Standard Sheet No. 1 of 1
Project Sheet Number:



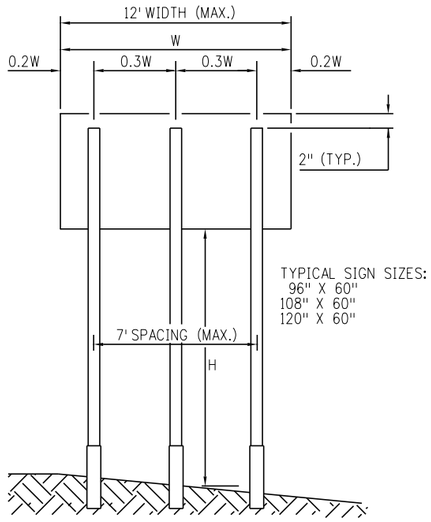
* SINGLE POST SHALL BE PLACED IN THE CENTER OF THE SIGN

● **Sign Post Requirements**

POST TYPE	POST SIZE	MAX. CLEAR HEIGHT, H (FT.)	MAX. SIGN AREA (SF)
SQUARE TUBING	2.25" X 2.25" (12 GA.)	10	10.5
SQUARE TUBING	1.75" X 1.75" (12 GA.)	9	5
SQUARE TUBING	2.00" X 2.00" (12 GA.)	9	8
SQUARE TUBING	2.25" X 2.25" (12 GA.)	9	10.5
SQUARE TUBING	1.75" X 1.75" (12 GA.)	8	6
SQUARE TUBING	2.00" X 2.00" (12 GA.)	8	9
SQUARE TUBING	1.75" X 1.75" (12 GA.)	7	7
SQUARE TUBING	2.00" X 2.00" (12 GA.)	7	10

Single Post Installation

(Total sign area not to exceed 10.5 sf)



● **Sign Post Requirements**

POST TYPE	POST SIZE	MAX. CLEAR HEIGHT, H (FT.)	MAX. SIGN AREA (SF)
△ U-CHANNEL	3 LB./FT.	11	36
△ SQUARE TUBING	2.50" X 2.50" (10 GA.)	9	45
△ SQUARE TUBING	2.50" X 2.50" (10 GA.)	7	50
⬡ SQUARE TUBING	2.50" X 2.50" (10 GA.)	11	36
⬡ SQUARE TUBING	2.50" X 2.50" (10 GA.)	9	45

Triple Post Installation

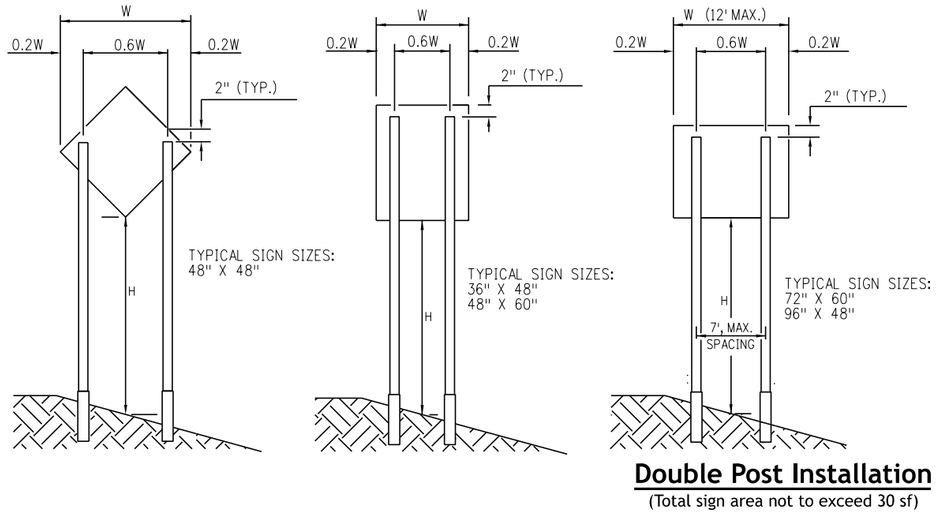
(Total sign area not to exceed 50 sf)

General Notes

1. All square tubing sign post requirements are based on a 10 or 12-gauge thickness, ASTM A570 grade 50 steel, a minimum yield strength of 60,000 psi and a 70 mph wind load. All U-channel sign posts requirements are based on a minimum yield strength of 80,000 psi and 85 mph wind load.
2. Steel posts, base posts, and slip bases for aluminum panel signs shall be selected from the CDOT Approved Product List.
3. Base posts shall not extend more than 4 inches above ground level and shall be of the same weight/gauge and type as the sign post.
4. Intermixing of 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 6 inches.
7. Sign panels placed parallel to traffic shall be mounted on a multi-directional breakaway system. (see Standard 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-base post overlap), including types of nuts, bolts, washers, and other parts required for product use.
10. Lap-splice or 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.
● See General Note 9.
⬡ See General Note 10.



Double Post Installation

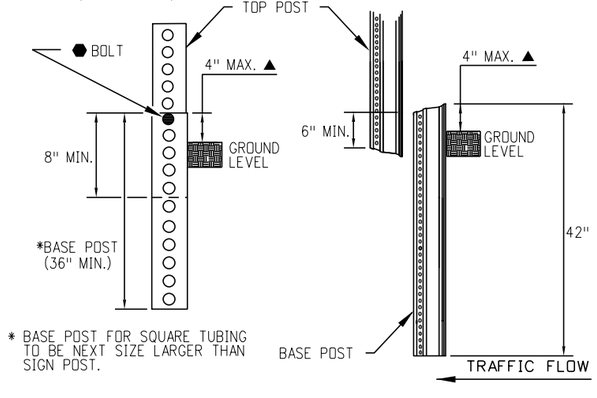
(Total sign area not to exceed 30 sf)

● **Sign Post Requirements**

POST TYPE	POST SIZE	MAX. CLEAR HEIGHT, H (FT.)	MAX. SIGN AREA (SF)
SQUARE TUBING	2.25" X 2.25" (12 GA.)	11	13
SQUARE TUBING	2.25" X 2.25" (12 GA.)	9	15
SQUARE TUBING	2.25" X 2.25" (12 GA.)	8	16
SQUARE TUBING	2.25" X 2.25" (12 GA.)	7	20
△ U-CHANNEL	3 LB./FT.	11	25
△ U-CHANNEL	3 LB./FT.	9	30
△ SQUARE TUBING	2.50" X 2.50" (10 GA.)	7	36

● **Square Tubing**
(Sleeve base)

● **U-Channel**
(Lap splice)



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)

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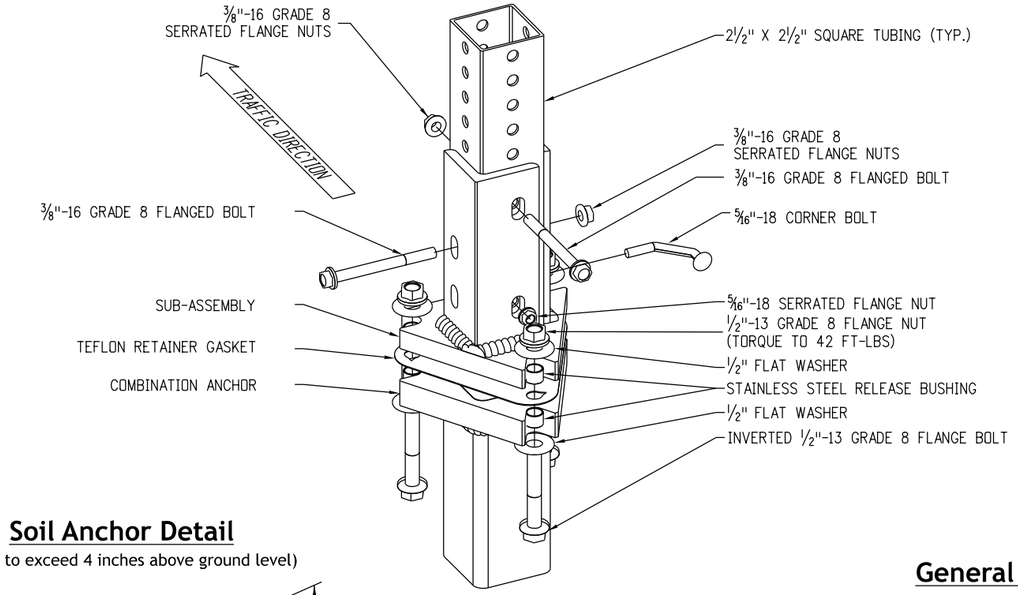
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Steel Sign Support (Temporary) Installation Details

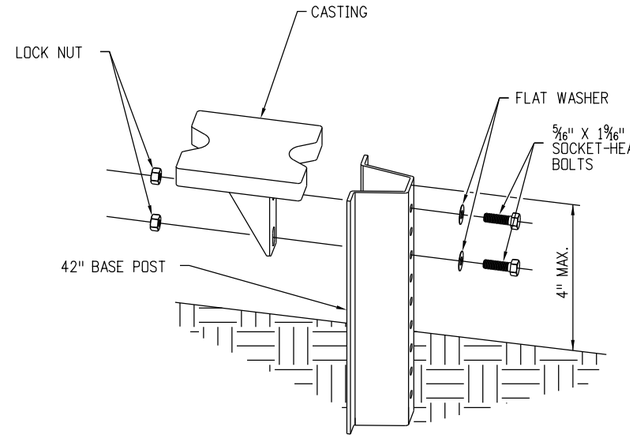
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Standard Plan No.
S-630-4
Standard Sheet No. 1 of 2
Project Sheet Number:

Square Tubing Slip Base

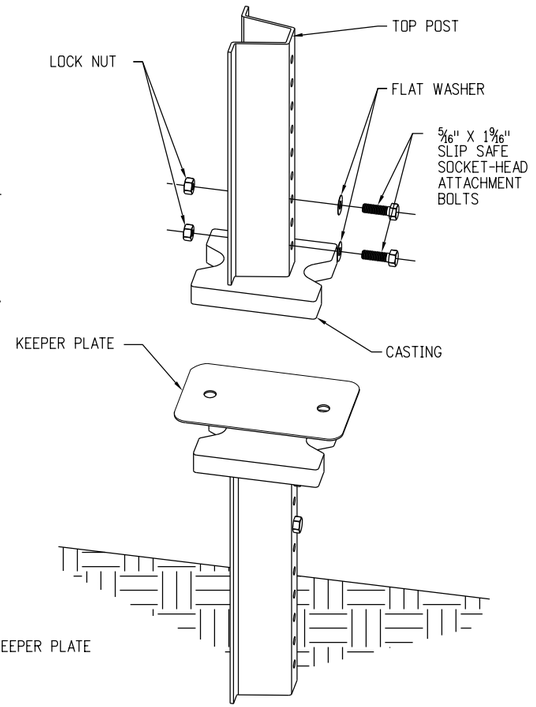


U-Channel Slip Base



Note: bolts should be tightened ½ to ¾ turn after snug.

Step 1



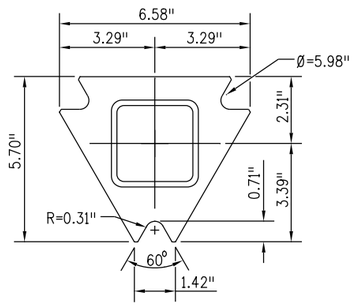
Step 2

Note: tighten nut ¼ to ½ turn after snug.

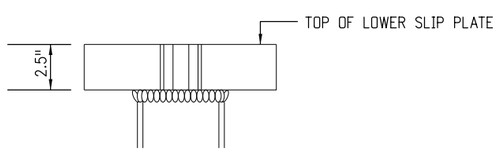
Step 3

Soil Anchor Detail

(Not to exceed 4 inches above ground level)



Anchor Top View



Anchor Front View

General Note:

The contractor shall install the soil anchor and slip base per the manufacturer's recommendations without additional compensation.

Multi-Directional Slip Base Post Details

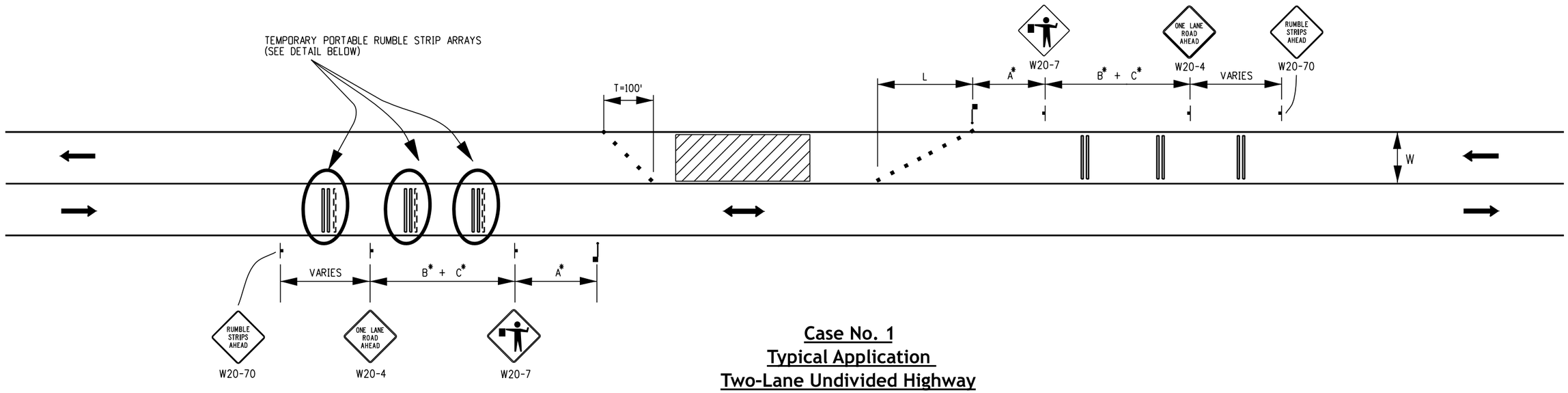
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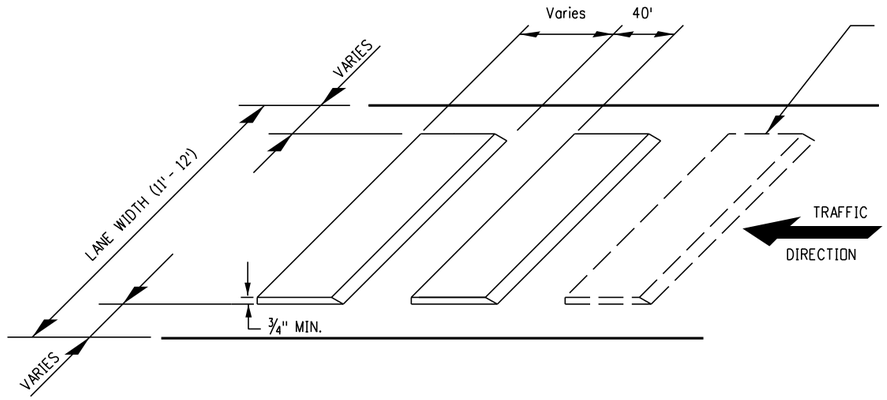
Steel Sign Support (Temporary) Installation Details

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-4
Standard Sheet No. 2 of 2
Project Sheet Number:



Case No. 1
Typical Application
Two-Lane Undivided Highway



Detail - Temporary Portable Rumble Strip Array

General Notes

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 lanes 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 75 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.

Legend

- ▪ Channelizing device: 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) = WxS
L = Merging taper (S < 45 mph) = $(WxS^2)/60$
N = number of devices (L/S) + 1
N = Number of devices at termination taper = 5 (min.)

*Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT.)		
	A	B	C
URBAN (S < 45 MPH)	100	100	100
URBAN (S ≥ 45 MPH)	350	350	350
RURAL	500	500	500

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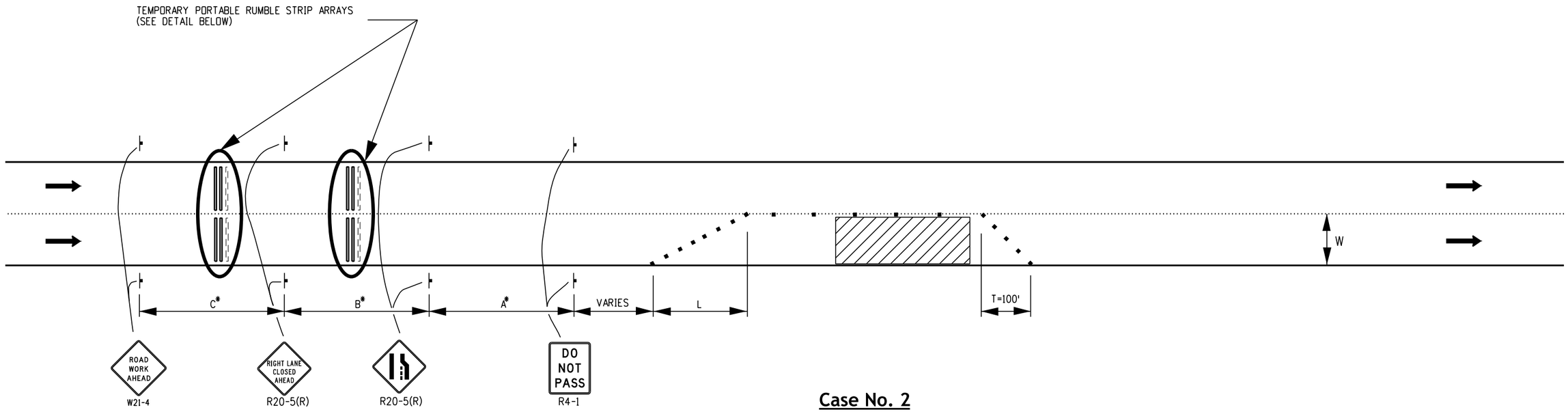
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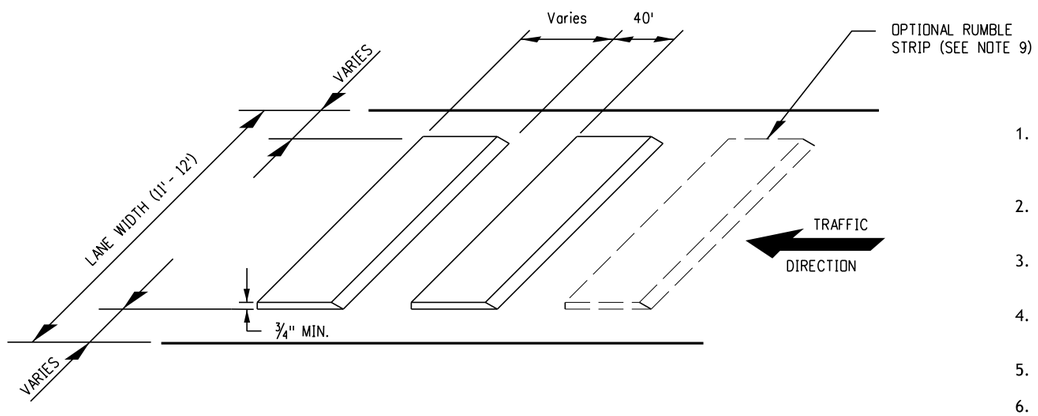
Portable Rumble Strips (Temporary)

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-5
Standard Sheet No. 1 of 2
Project Sheet Number:



Case No. 2
Typical Application
Multi-Lane Divided Highway with Right Lane Closed



Detail - Temporary Portable Rumble Strip Array

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 pavement.
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 pavements, 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 device: 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 = 100'
S = Work zone speed limit
W = Lane width
L = Merging taper (S > 45 mph) = WxS
L = Merging taper (S < 45 mph) = (WxS^2)/60
N = Number of devices (L/S) + 1
N = Number of devices at termination taper = 5 (min.)

*Key to Advance Signing Distances

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT.)		
	A	B	C
URBAN (S < 45 MPH)	100	100	100
URBAN (S ≥ 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1,000	1,500	2,640

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Portable Rumble Strips (Temporary)

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-5
Standard Sheet No. 2 of 2
Project Sheet Number:

Legend

Impact attenuator (temp)

Concrete barrier (temp)

Concrete barrier (temp) (optional)

■ Channelizing device: for type of device to be used, see schedule of traffic control devices included in the plans.

The added embankment shall be constructed in accordance with Section 203 (if applicable).

L_{PO} = Temporary emergency pull-off length
= 725' minimum, 0.25 mile desirable. An additional 100 feet should be added to the length of the temporary emergency pull-off to serve as an accident investigation area.

W = Temporary emergency pull-off width
= 12' minimum
= 15' maximum

T = Taper
= 11:1 minimum
= 17:1 desirable

* See Table 2C-3 (Condition A) of the MUTCD for the placement distance of the "Emergency Pull-off Area" advance warning sign.

L = Transition Taper Length:

L = minimum length of taper

Speed 45 mph or more: L = S x W

Speed 40 mph or less: $L = \frac{WS^2}{60}$

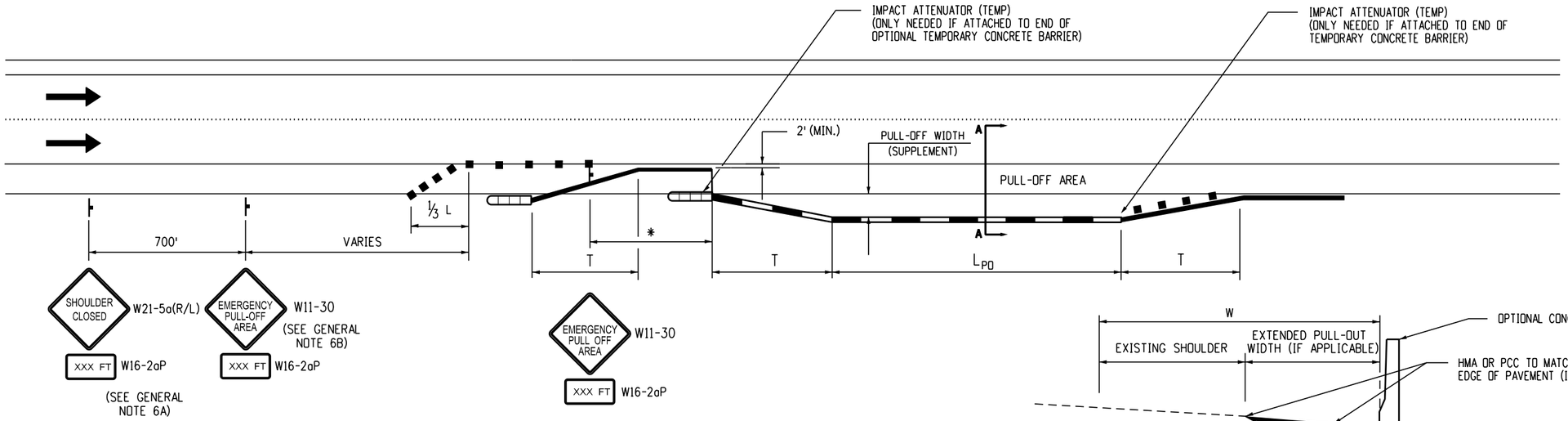
S = Numerical value of speed limit or 85 percentile speed

W = width of offset

Shoulder taper = 1/3 L

General Notes

1. Consider adding temporary emergency pull-off area(s) 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 CDOT Work Zone Safety and Mobility Rule Procedures Document - August 2019).
   C. On divided highways with three or more lanes in each direction, the left or right shoulder is to be open while 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 CLOSED, 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. Mount 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 traffic barrier and construction activities occurring on the inside of horizontal curves just behind that barrier should be considered when determining whether motorists will have adequate sight distance through a horizontal curve.
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. W7-3aP plaque 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, or
      - a "EMERGENCY PULL-OFF AREA" advanced warning sign with a W16-2aP 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, flared or extended, to meet clear zone requirements, or fitted with an impact attenuator device.



Emergency Pull-Off Layout

Interstate, Freeway, Expressway or Other Divided Highways with Minimum 11' Travel Lanes

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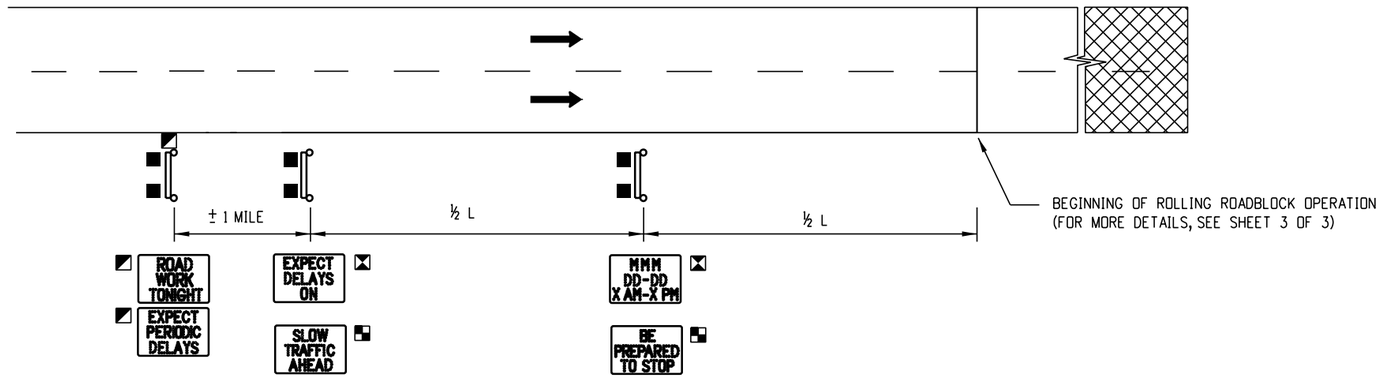
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Emergency Pull-Off Area (Temporary)

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-6
Standard Sheet No. 1 of 1
Project Sheet Number:



Typical Placement Of VMS

Symbols

- Portable variable message sign (VMS)
- Law enforcement vehicle with flashing red and blue lights
- Direction of travel
- Channeling device: for type of device to be used, see schedule of traffic control devices included in the plans.
- Work area
- L — Length of rolling roadblock operation
- To be placed on day 1 of the rolling roadblock operation
- To be placed one week prior to rolling roadblock operation
- To be placed during 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 sign(s) 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 attenuator(s) with variable message sign(s) shall be used to protect construction workers and/or equipment positioned in a travel lane(s) 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(s) at the work area, truck-mounted attenuator(s) 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.

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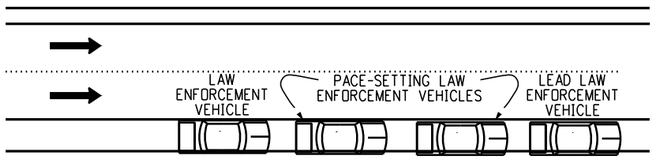
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Rolling Roadblocks For Traffic Control

Issued by the Traffic Safety & Engineering Services: July 01, 2026

Standard Plan No.
S-630-7
Standard Sheet No. 1 of 3
Project Sheet Number:

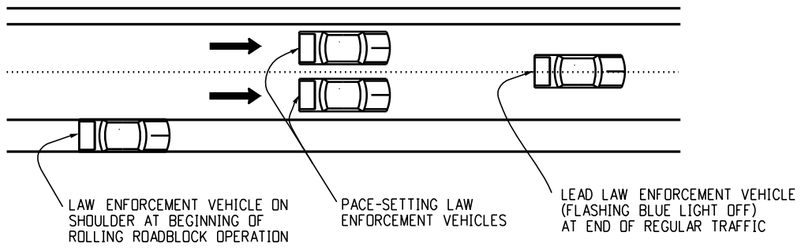
Stage 1



Stage 1 Note:

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.

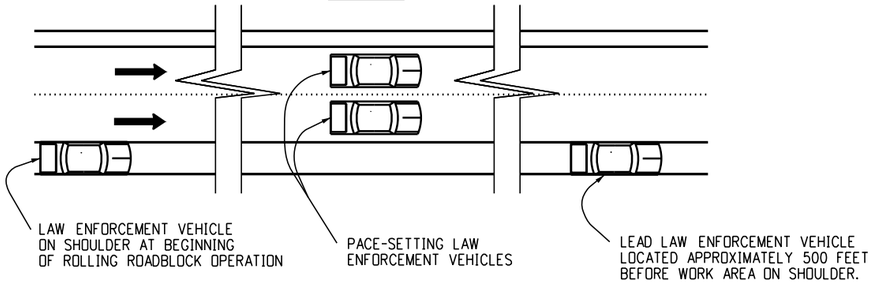
Stage 2



Stage 2 Note:

Once the law enforcement vehicles are in place and the law enforcement supervisor at the work area notifies all law enforcement officers involved to begin the rolling roadblock operation, the last three (3) law enforcement vehicles shall turn on their flashing blue lights. The first three (3) law enforcement vehicles shall enter the travel lanes, with the second and third law enforcement vehicles immediately forming a side-by-side "pacing operation" of all lanes behind the lead law enforcement vehicle (flashing blue lights off).

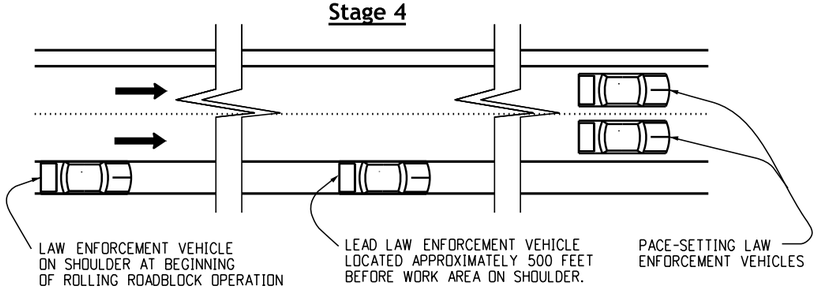
Stage 3



Stage 3 Notes:

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.
2. The lead law enforcement vehicle (flashing blue lights off) shall match the speed of the last vehicles ahead of the pace-setting law enforcement vehicles, and continue following traffic until a point approximately 500 feet in advance of the work area. the lead law enforcement vehicle shall then come to a complete stop on the right shoulder, and turn on its' flashing blue lights. If required, crash trucks with rear-mounted attenuator(s) and changeable message sign(s) shall move into the travel lanes approximately 200 feet upstream of the work area with the impact attenuators down and operating once traffic has cleared the work area.

Stage 4

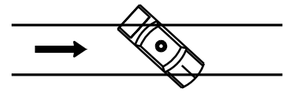


Stage 4 Notes:

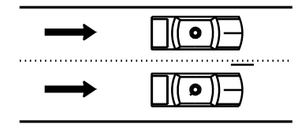
1. When the pace-setting law enforcement vehicles are within approximately two (2) miles of the work area, they shall notify the onsite Traffic Control Supervisor of their location. Once the contractor's on-site superintendent has been notified of the pace-setting law enforcement vehicles' location, the contractor shall begin to clear the travel lanes 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 once they reach the lead police vehicle. If no emergency is encountered, the crash truck(s) shall be moved from the travel lanes, and the two (2) pace-setting law enforcement vehicles 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. Once the two (2) pace-setting law enforcement vehicles pass the work area, the Traffic Control Supervisor shall instruct the lead and last law enforcement vehicles to turn off their flashing blue lights.

Typical Applications
Rolling Roadblock - Multi-lane Mainline Pacing Details

One Lane Ramp



Two Lane Ramp



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 vehicle at the indicated ramp shall turn their flashing blue lights on, and position the vehicle across the ramp lane(s) to close ramp access.
2. Once the rolling roadblock operation passes the closed on-ramp, the law enforcement vehicle on the ramp shall turn off their flashing blue lights, and move from the ramp lane(s) to allow traffic to enter the mainline rolling roadblock operation.

General Notes:

Each law enforcement officer shall have a marked vehicle with flashing blue lights for the rolling roadblock operation. The location and number of law enforcement officers at each location shall be as follows:

NO. OF LAW ENFORCEMENT VEHICLES*	FUNCTION	LOCATION
1, MINIMUM	SUPERVISOR	WORK AREA
1 LEAD VEHICLE	VARIES	MOBILE OPERATION
1 PER TRAVEL LANE	PACING OPERATION	MOBILE OPERATION BEGINNING X MILES UPSTREAM AND TERMINATING AT THE WORK AREA.
1 STATIONED AT BEGINNING OF ROLLING ROADBLOCK OPERATION	ADVANCED WARNING TO MOTORISTS	STATIONED AT THE BEGINNING OF ROLLING ROADBLOCK OPERATION
1 PER ENTRANCE RAMP	ENTRANCE RAMP ROADBLOCKS	ONE AT EACH OF THE ENTRANCE RAMPS UPSTREAM OF THE WORK AREA

* There shall be at least one law enforcement vehicle per lane. final number of law enforcement vehicles shall be determined by the law enforcement agency.

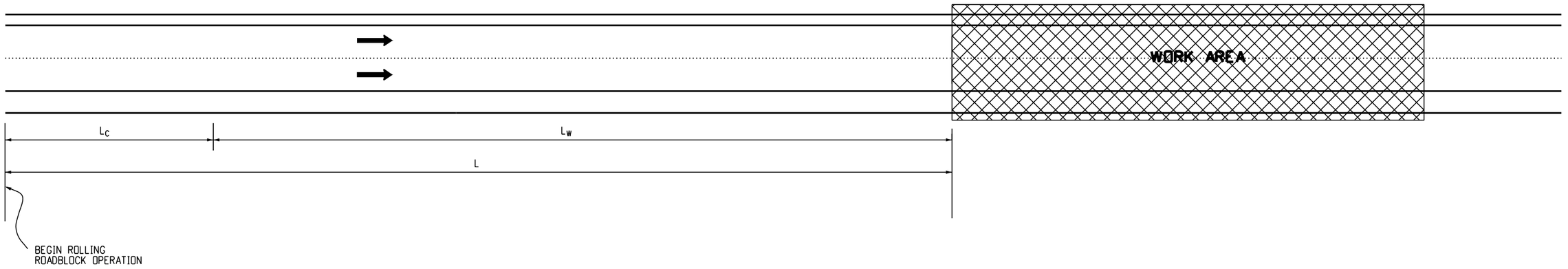
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Colorado Department of Transportation
Traffic Safety & Engineering Services
2829 West Howard Place
Denver, CO 80204
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Rolling Roadblocks For Traffic Control

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Standard Plan No.
S-630-7
Standard Sheet No. 2 of 3
Project Sheet Number:



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 speeds, 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 entrance 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(s) 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.

Legend

S_R = Regulatory speed, mph

S_P = Pacing speed, mph

T_W = Work duration, minutes

L = Total pacing distance, miles

$$= \frac{T_W}{60} S_P \left(\frac{S_P}{S_R - S_P} + 1 \right)$$

$$= L_C + L_W$$

L_C = Distance pace-setting law enforcement vehicles shall travel before the vehicles at regulatory speed have cleared the work area.

$$= \frac{\left(\frac{T_W}{60} \times S_P^2 \right)}{S_R - S_P}$$

L_W = Distance pace-setting law enforcement vehicles travel while construction work is performed.

$$= \left(\frac{T_W}{60} \times S_P \right)$$

F_{HV} = Heavy vehicle factor

$$= 1 + \left(\frac{P_T}{100} \times 0.50 \right)$$

P_T = % Trucks

Pacing Distances, L (miles)

S_R	S_P = 20 MPH PCPHPL <= 1,750					
	T_W (MIN.)					
	5	10	15	20	25	30
70	2.3	4.7	7.0	9.3	*	*
65	2.4	4.8	7.2	9.6	*	*
60	2.5	5.0	7.5	10.0	*	*
55	2.6	5.2	7.9	*	*	*
50	2.8	5.6	8.3	*	*	*

* Site-specific design required

Pacing Distances Notes:

T_W 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. T_W must include the time required to clear the roadway of equipment, materials, and personnel.

Demand volume may not exceed 1,750 PCPHPL without a site-specific design. Traffic counts can be obtained from the Region Traffic Engineer, or you may need to collect traffic counts. Hourly directional traffic volumes must be converted to PCPHPL using the following equation:

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