



City and County of Denver

Traffic Signal, Sign and Pavement Marking Standards

Department of Transportation and Infrastructure


February 2022

2022 TRAFFIC SIGNAL STANDARDS

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
CITY AND COUNTY OF DENVER
TRANSPORTATION DESIGN

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2022 TRAFFIC SIGNAL STANDARDS	
APPROVED:	
 _____ EMILY GLOECKNER, CITY TRAFFIC ENGINEER	2/24/2022 _____ DATE

2022 SIGN AND PAVEMENT MARKING STANDARDS

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
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TRANSPORTATION DESIGN

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2022 SIGN AND PAVEMENT MARKING STANDARDS	
APPROVED:	
	2/24/2022
EMILY GLOECKNER, CITY TRAFFIC ENGINEER	DATE

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TRAFFIC SIGNAL NOTES

GENERAL

1. ITEM NUMBER REFERS TO THE APPROPRIATE SECTION OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION – COLORADO DEPARTMENT OF TRANSPORTATION LATEST EDITION UNLESS SPECIFIED.
2. FOR WORK INVOLVING XCEL ENERGY, THE CONTRACTOR SHALL COMPLY WITH THE LATEST VERSION OF THE FRANCHISE AGREEMENT IN PLACE BETWEEN THE CITY & COUNTY OF DENVER AND XCEL ENERGY UNLESS OTHERWISE SPECIFIED. XCEL ENERGY SHALL PROVIDE POWER SOURCE WITHIN 10' OF TRAFFIC SIGNAL CABINET. TRAFFIC SIGNAL EQUIPMENT MUST BE APPROVED BY THE CITY AND COUNTY OF DENVER PRIOR TO ORDERING. THEREFORE ALL TRAFFIC SIGNAL AND TRAFFIC STREET LIGHT POLES SUBMITTALS, WITH THE EXCEPTION OF THE XCEL ENERGY OWNED STREET LIGHT POLES, SHALL BE MADE TO THE CITY & COUNTY OF DENVER DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE (DOTI) TRANSPORTATION OPERATIONS OR AS DESIGNATED BY THE ENGINEER. NO TRAFFIC SIGNAL EQUIPMENT, POLES/MAST ARMS, OR TRAFFIC STREET LIGHT POLES SHALL BE ORDERED UNTIL A SUBMITTAL HAS BEEN ACCEPTED FROM CITY & COUNTY OF DENVER DOTI TRANSPORTATION OPERATIONS. ALL TRAFFIC SIGNAL EQUIPMENT, POLES/MAST ARMS, AND TRAFFIC STREET LIGHTS SHALL BE WIRED INTO THE ELECTRIC METER. CITY & COUNTY OF DENVER OWNED STREET LIGHTING POLES AND FACILITIES SHALL COMPLY WITH THE CITY & COUNTY OF DENVER STREET LIGHTING DESIGN GUIDELINES AND DETAILS.
3. XCEL ENERGY TO REMOVE ONLY XCEL OWNED POLES AND EXISTING STREET LIGHTING. THE CONTRACTOR SHALL REMOVE ALL OTHER SIGNAL EQUIPMENT INCLUDING ALL CITY OWNED SIGNAL POLES WITH OR WITHOUT STREET LIGHTING, MAST ARMS, SPAN WIRE POLES, PEDESTAL POLES, SIGNAL HEADS, SPAN WIRE, PUSH BUTTONS, PULL BOXES, CONTROLLER CABINETS AND ALL FOUNDATIONS AS SHOWN ON THE PLANS. CONTRACTOR SHALL REPAIR ALL SIDEWALK AND OTHER CONCRETE AFTER REMOVALS OR AS DIRECTED AND APPROVED BY DENVER DOTI TRANSPORTATION OPERATIONS. XCEL ENERGY OWNED STREET LIGHTING POLES AND FACILITIES SHALL COMPLY WITH XCEL ENERGY STANDARDS AND DETAILS.
4. ALL SALVAGED SIGNAL EQUIPMENT REMOVED REMAINS THE PROPERTY OF THE CITY & COUNTY OF DENVER AND MUST BE DELIVERED TO DENVER DOTI TRANSPORTATION OPERATIONS AT 5440 ROSLYN STREET. COORDINATE WITH DOTI TRANSPORTATION OPERATIONS PROJECT INSPECTOR AT (720) 865-4000 PRIOR TO DELIVERY.
5. NO TRAFFIC SIGNAL SHALL BE TURNED ON OR TURNED OFF ON A FRIDAY OR PRIOR TO A HOLIDAY WITHOUT PRIOR AUTHORIZATION FROM DENVER DOTI TRANSPORTATION OPERATIONS (720) 865-4000. NO TRAFFIC SIGNAL SHALL BE TURNED ON WITHOUT PERMANENT SIGNING AND STRIPING. ALL TRAFFIC SIGNALS CONSTRUCTED SHALL SUCCESSFULLY COMPLETE THE TURN-ON CHECKLIST PRIOR TO TURN ON.

GENERAL (CONT.)

6. AT A MINIMUM, THE FOLLOWING ADDITIONAL EQUIPMENT SHALL BE REQUIRED FOR ALL NEW TRAFFIC SIGNALS:
 VEHICLE DETECTION:
 VIDEO DETECTION CAMERAS, ONE PER EACH APPROACH UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER. CONTACT DOTI FOR CURRENT VIDEO DETECTION CAMERA SPECIFICATIONS.
 PEDESTRIAN DETECTION:
 PEDESTRIAN PUSHBUTTONS, EIGHT PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER. CONTACT DOTI FOR CURRENT PEDESTRIAN DETECTION SPECIFICATIONS.
 ANCILLARY EQUIPMENT:
 CCTV, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 REAL-TIME TRAVELER DATA COLLECTION DEVICE, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 ETHERNET SWITCH, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 GATOR PATCH CONNECTION, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY THE CITY AND COUNTY OF DENVER DOTI ENGINEER.
 UNINTERRUPTIBLE POWER SUPPLY (UPS), ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 EMERGENCY VEHICLE PREEMPTION UNITS AND INTERFACE CARDS, ONE UNIT PER EACH APPROACH AND TWO FOUR-CHANNEL INTERFACE CARDS PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 POWER SOURCE AND ELECTRIC METER, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 FIELD TELEMETRY, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 CAT 6 CABLE, ONE PER EACH SIGNAL POLE UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
 CABINET AND CONTROLLER, ONE PER EACH INTERSECTION UNLESS OTHERWISE SPECIFIED BY CITY AND COUNTY DOTI ENGINEER.
 OVERHEAD SIGNAL INSTALLATION SHALL HAVE RETROREFLECTIVE BACKING PLATES. CONTACT DOTI FOR CURRENT ANCILLARY EQUIPMENT SPECIFICATIONS.
7. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN ADDRESSING INFORMATION FOR A TRAFFIC SIGNAL ELECTRIC METER: CONTACT CITY & COUNTY OF DENVER RIGHT OF WAY AT DENVER.ROW@DENVERGOV.ORG. THE CONTRACTOR SHALL COORDINATE WITH XCEL ENERGY AS NEEDED FOR TRAFFIC SIGNAL POWER SOURCE DESIGN.

HARDWARE

8. POLYCARBONATE SIGNAL HEADS ARE REQUIRED FOR ALL TRAFFIC SIGNALS AND PEDESTRIAN SIGNALS. ALL POLYCARBONATE HEADS SHALL BE DARK OLIVE GREEN IN CONFORMANCE WITH FEDERAL SPECIFICATION 14056.
9. BACKPLATES WITH AN ENGINEERING GRADE YELLOW RETRO-REFLECTIVE BORDER SHALL BE PROVIDED ON ALL OVERHEAD SIGNAL HEADS.
10. ALL HARDWARE INCLUDING SPACERS, ELBOWS, AND POLE PLATES SHALL BE PAINTED DARK OLIVE GREEN IN CONFORMANCE WITH FEDERAL SPECIFICATION 14056.
11. LIGHT EMITTING DIODE (LED) SIGNAL LENSES SHALL BE INSTALLED IN ALL SIGNAL INDICATIONS (RED, YELLOW, GREEN, AND WALK, DON'T WALK, AND COUNTDOWN PEDESTRIAN SIGNAL HEAD INDICATIONS).
12. CONTRACTOR SHALL INSTALL THE SIGNAL POLES AND PEDESTALS AT THE EXACT LOCATION AND ELEVATION AS SHOWN IN THE PLAN UNLESS AUTHORIZED BY THE ENGINEER. CONTRACTOR SHALL FIELD VERIFY THE LOCATIONS AND ELEVATIONS WITH THE CITY & COUNTY OF DENVER DOTI ENGINEER PRIOR TO START OF WORK.
13. PEDESTRIAN PUSH BUTTON SHALL BE IN COMPLIANCE WITH THE MUTCD. PUSH BUTTONS SHOULD BE LOCATED BETWEEN 1.5 AND 6' FROM THE EDGE OF THE CURB, SHOULDER, OR PAVEMENT.

CONSTRUCTION

14. ALL CONDUIT SHALL BE SCHEDULE 80 PVC OR HDPE. TWO 3-INCH CONDUITS SHALL BE BROUGHT INTO THE POLE BASE FOR ALL MAST ARM POLES. TWO 2-INCH CONDUITS OR ONE 3-INCH CONDUIT SHALL BE BROUGHT INTO THE POLE BASE FOR ALL SIGNAL POLES WITHOUT MAST ARM.
15. ONE PULL BOX TO BE INSTALLED AT LOCATIONS SHOWN AS (3H). CABINET CORNER PULL BOX SHALL BE A TYPE C PULL BOX AND THE POLE BOXES AT THE OTHER THREE CORNERS SHALL BE A TYPE B PULL BOX. DESIGNATE ON LID "TRAFFIC" FOR SIGNAL CABLES BY PHYSICALLY EMBOSSING, NOT PAINTING. PULL BOX FOR COMMUNICATION CONDUITS SHALL BE THE (3H) (COMM) AND CAN BE SPECIFIED ON THE PLAN AS (3H) (SPECIAL). COMMUNICATION PULL BOX LIDS SHALL BE DESIGNATED "TRAFFIC COMM" BY PHYSICALLY EMBOSSING, NOT PAINTING. SEE STD. DWG. NO. 16.1.7 FOR PULL BOX DIMENSIONS. A TYPE C PULL BOX SHALL TYPICALLY BE REQUIRED FOR THE CONTROL CABINET ("HOMERUN") CORNER UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
16. A SINGLE 3 INCH CONDUIT SHALL BE REQUIRED AND INSTALLED FROM THE TRAFFIC COMM PULL BOX TO THE TRAFFIC SIGNAL CONTROLLER CABINET. CONDUIT SHALL BE SCHEDULE 80 PVC CONDUIT.
17. INTERCONNECT CONDUIT PULL BOXES SHALL BE PLACED AT 500 FOOT MAXIMUM SPACING, OR OTHERWISE DIRECTED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
18. INSTALL WATER VALVE PULL BOX 3P AND 2 INCH SCHEDULE 80 PVC CONDUIT FOR LOOP DETECTION INTERCEPT WHERE SHOWN ON PLANS. SEE STD DWG NO 16.1.5.
19. ALL HOLES IN TRAFFIC SIGNAL POLES TO BE DRILLED OR SAWED. INSTALLING HOLES BY BURNING WITH A TORCH IS NOT APPROVED.
20. FOR MAST ARM MOUNTED SIGNAL HEADS, THE BOTTOM OF ALL OVERHEAD MOUNTED SIGNAL HEADS SHALL BE ON THE SAME HORIZONTAL PLANE AND HAVE A MINIMUM CLEARANCE OF 18' AND A MAXIMUM CLEARANCE OF 19' ABOVE THE CROWN OF PAVEMENT SURFACE, UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER.
21. FOR SPAN WIRED MOUNTED SIGNAL HEADS, THE BOTTOM OF ALL OVERHEAD MOUNTED SIGNAL HEADS SHALL BE ON THE SAME HORIZONTAL PLANE AND HAVE A MINIMUM CLEARANCE OF 16'-6" ABOVE THE CROWN OF PAVEMENT SURFACE, UNLESS OTHERWISE SPECIFIED BY CITY & COUNTY OF DENVER DOTI ENGINEER. ALL SPAN WIRE SHALL INCLUDE A BOTTOM WIRE OR WIND TETHER.
22. EXISTING SIGNAL FACES SHALL REMAIN VISIBLE AND ILLUMINATED UNTIL NEW SIGNALS ARE TURNED ON. BLOCKING OF EXISTING FACE BY NEW FACE WILL REQUIRE NEW FACE TO BE TEMPORARILY WIRED FOR ILLUMINATION.
23. ANCHOR BOLTS SHALL NOT BE TRIMMED UNTIL SIGNAL POLE BASE ELEVATION IS APPROVED BY CITY & COUNTY OF DENVER DOTI ENGINEER.

WIRING

24. ALL TRAFFIC SIGNAL WIRE CONNECTORS SHALL BE OF THE BUCHANAN CRIMP COMPRESSION TYPE WITH COPPER NONFERROUS CONNECTORS AND IDEAL WRAP-CAPS OR APPROVED EQUALS.
25. WIRE SPLICING IN THE PULL BOXES ARE NOT ALLOWED EXCEPT FOR THE LOOP WIRES. ALL LOOP WIRES SHALL BE SPLICED IN THE WATER VALVE TRAFFIC PULL BOXES.
26. THREE (3) SPARE CONDUCTORS SHALL BE PROVIDED TO EACH HAND HOLE AND TO THE END OF EACH MAST ARM.
27. ALL SOLDERLESS CONNECTORS SHALL BE USED.

SIGNING

28. OVERHEAD STREET NAME SIGNS TO BE FURNISHED AND INSTALLED ON EACH MAST ARM AS NOTED ON STD DWG NO 16.2.11. SIGN TO BE BOLTED ON 18 INCH TELES PAR (OR APPROVED EQUAL) EXTENSION WHICH CONNECTS TO MAST ARM BY USE OF ADAPTER SCREWED INTO HOUSING.
29. CONTRACTOR SHALL NOT REMOVE ANY REGULATORY TRAFFIC SIGNS UNLESS SPECIFIED ON PLANS. CITY & COUNTY OF DENVER DOTI ENGINEER TO BE NOTIFIED 48 HOURS PRIOR TO ANY SIGNING CHANGES AT (720) 865-4000.
30. ALL PERTINENT SIGNS AND PAVEMENT MARKINGS MUST BE IN PLACE AT THE TIME A TRAFFIC SIGNAL CHANGE IS MADE, SUCH AS A NEW SIGNAL TURN ON, AND OR CHANGES MADE TO EXISTING SIGNAL OPERATION.

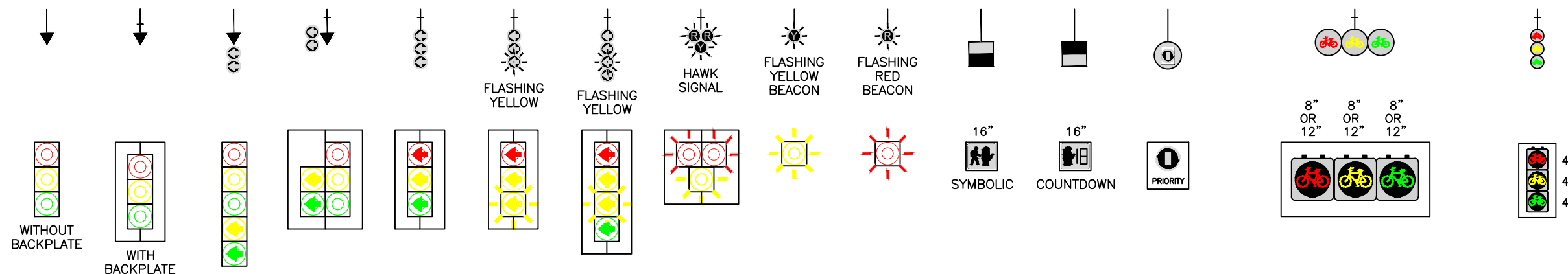
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TRAFFIC CONTROL DEVICE LEGEND

EXISTING		NEW
	CONTROLLER CABINET DOOR SHOWN ON RIGHT	
	POWER SOURCE – ELECTRIC UTILITY	
	PULL BOX – TRAFFIC	
	PULL BOX – TRAFFIC COMMUNICATIONS	
	WATER VALVE PULL BOX	
	LOOP DETECTOR (LENGTH AS SPECIFIED)	
	POLE – <u>W</u> OOD, <u>S</u> TEEL, <u>A</u> LUMINUM OR <u>P</u> EDESTAL	
	EMERGENCY VEHICLE PREEMPTIVE SYSTEM	
	DOWN GUY	
	UNDERGROUND CONDUIT	
	LUMINAIRE	
	PEDESTRIAN PUSH BUTTON, "WAIT FOR WALK SIGNAL" INDICATES LEFT OR RIGHT ARROW, PLACE NOTE NEAR SIGNAL POLE	
	VIDEO DETECTION CAMERA	
	RADIO ANTENNA	
	MICROWAVE DETECTOR	
	BLUETOOTH TRAFFIC MANAGEMENT SYSTEM	
	IOT DEVICE	

TRAFFIC CONTROL DEVICE LEGEND

EXISTING		NEW
	POLE MOUNTED SIGN	
	POST MOUNTED SIGN	
	SPAN WIRE MOUNTED SIGN	
	MAST ARM MOUNTED SIGN	
	CLOSED CIRCUIT TELEVISION CAMERA	
	BLANK OUT SIGN	
	VARIABLE MESSAGE SIGN	
	ELECTRIC METER	
	PEDESTAL OR SIDE BRACKET MOUNTED SIGNAL HEAD	
	PEDESTRIAN SIGNAL HEADS	
	MAST ARM MOUNTED LENGTH AND ORIENTATION AS NEEDED	
	SPAN-WIRE MOUNTED SIGNAL CLUSTER	



*ALL SIGNAL HEADS ARE 12" UNLESS OTHERWISE NOTED

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KEY NOTES

REMOVALS

- 1A REMOVE SIGNAL HEAD
- 1B REMOVE SIGNAL POLE
- 1D REMOVE SIGNAL CABINET, CONTROLLER, PULL BOXES AND WATER VALVE PULL BOXES
- 1E REMOVE MAST ARM
- 1F REMOVE SPAN WIRE, CABLE AND ALL ATTACHED SIGNAL HEADS AND EQUIPMENT
- 1G REMOVE PUSH BUTTON
- 1H ELECTRIC UTILITY COMPANY TO REMOVE EXISTING POLE
- 1J ELECTRIC UTILITY COMPANY TO REMOVE, RELOCATE OR RAISE EXISTING OVERHEAD POWERLINE
- 1K REMOVE AND REPLACE COMMUNICATIONS PULL BOX SUCH THAT NEW LID IS SEATED FLUSH WITH PROPOSED SIDEWALK OR FINISH SURFACE
- 1L REMOVE AND SALVAGE DETECTION CAMERA
- 1M REMOVE EXISTING POLE FOUNDATION TO MINIMUM DEPTH OF 1' BELOW FINISHED GRADE
- 1N REMOVE EXISTING PULL BOX (SPECIAL) FOR SIGNAL SYSTEM COMMUNICATIONS

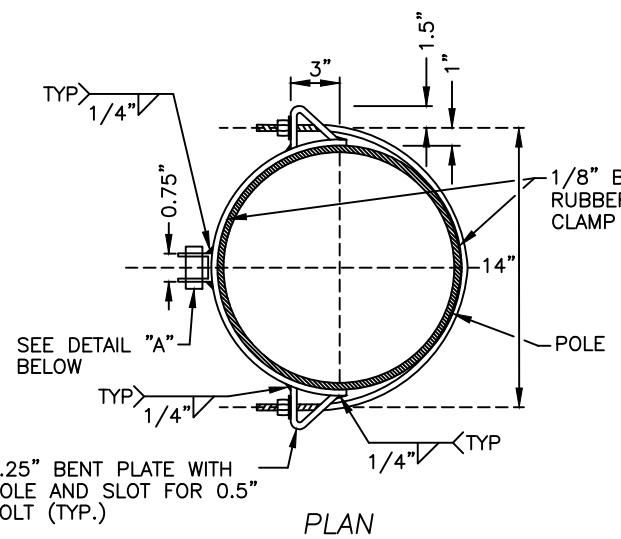
RESETS

- 2A RESET SIGNAL HEAD
- 2B RESET SIGNAL POLE
- 2C RESET SIGNAL CONTROLLER, CABINET AND ASSOCIATED EQUIPMENT
- 2D RESET PUSH BUTTON
- 2G RESET SPAN WIRE
- 2H RESET SPAN WIRE AND ALL ATTACHED SIGNAL EQUIPMENT
- 2J RESET DETECTOR
- 2K ELECTRIC UTILITY COMPANY TO RESET EXISTING POLE

INSTALLATIONS

- 3A INSTALL SIGNAL HEAD OR HEADS
- 3B INSTALL SIGNAL CABINET, CONTROLLER AND ASSOCIATED EQUIPMENT
- 3C INSTALL PUSH BUTTON
- 3D INSTALL CONDUIT
- 3D (2) INSTALL TWO 3-INCH CONDUITS
- 3E INSTALL SIGNAL POLE
- 3F INSTALL MAST ARM – (LENGTH AS SHOWN)
- 3G INSTALL SPAN WIRE
- 3H (COMM)/(SPECIAL) INSTALL PULL BOX MARKED "TRAFFIC COMM" ON LID
- 3H INSTALL ONE PULL BOX MARKED "TRAFFIC" ON LID
- 3J INSTALL LOOP DETECTOR
- 3K INSTALL CLOSED CIRCUIT CAMERA
- 3L ELECTRIC UTILITY COMPANY TO INSTALL POWER FEED. CONTRACTOR TO EXTEND TO SIGNAL CABINET
- 3N INSTALL LUMINAIRE
- 3P INSTALL WATER VALVE PULL BOX
- 3Q NO CHANGE
- 3S INSTALL STREET LIGHT STANDARD
- 3T INSTALL EMERGENCY VEHICLE PREEMPTION DETECTOR
- 3U INSTALL INTERCONNECT (SIZE & TYPE AS SHOWN)
- 3V INSTALL VIDEO DETECTION CAMERA (FLIR OR VIDEO)
- 3W INSTALL ELECTRIC METER
- 3X YOU ARE DETECTED (SIGN)

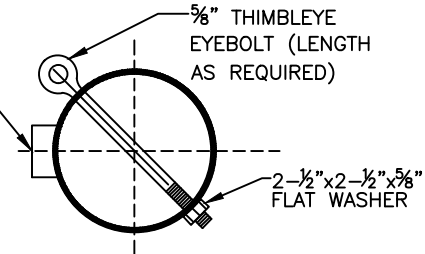
Computer File Information		Sheet Revisions		 <p>DENVER THE MILE HIGH CITY</p>	<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>KEY NOTES</p>	STANDARD DRAWING NO.
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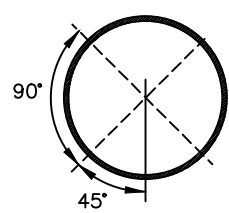
PLAN

3" CLOSE COUPLING FOR SIGNAL CABLE WEATHER HEAD (FOR MULTIPHASE INSTALLATIONS PROVIDE AN ADDITIONAL COUPLING ON POLE ADJACENT TO CONTROL CABINET)

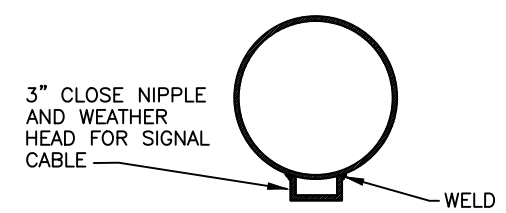
CONTRACTOR TO DRILL OR TORCH (IF APPROVED) ALL HOLES REQUIRED FOR COMPLETE SIGNAL INSTALLATION.



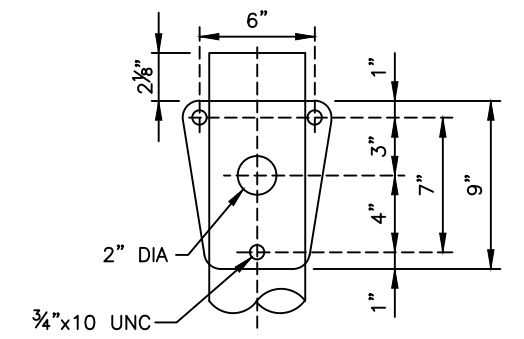
PERMANENT SPAN WIRE ATTACHMENT



SECTION A-A

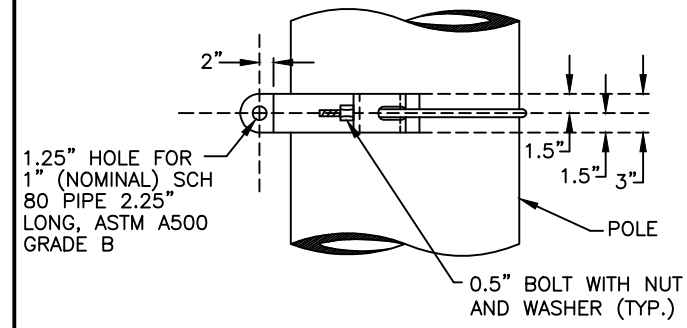


SECTION B-B

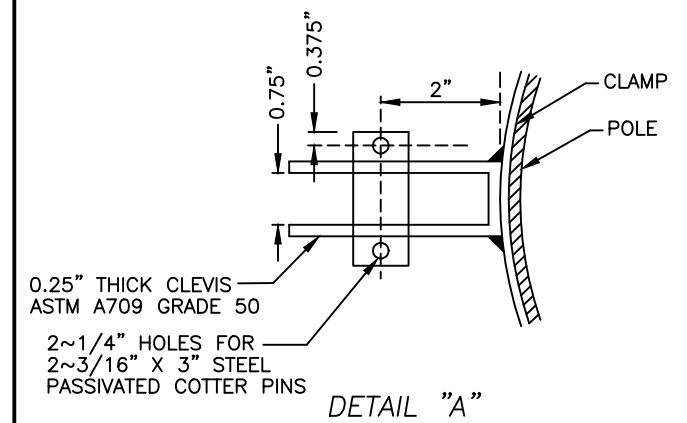


DETAIL "B"
LUMINAIRE POLE PLATE ATTACHMENT

NOTE:
SEE SECTION 614.10 (C) OF CDOT STANDARD SPECIFICATIONS FOR BONDING AND GROUNDING SPECIFICATIONS

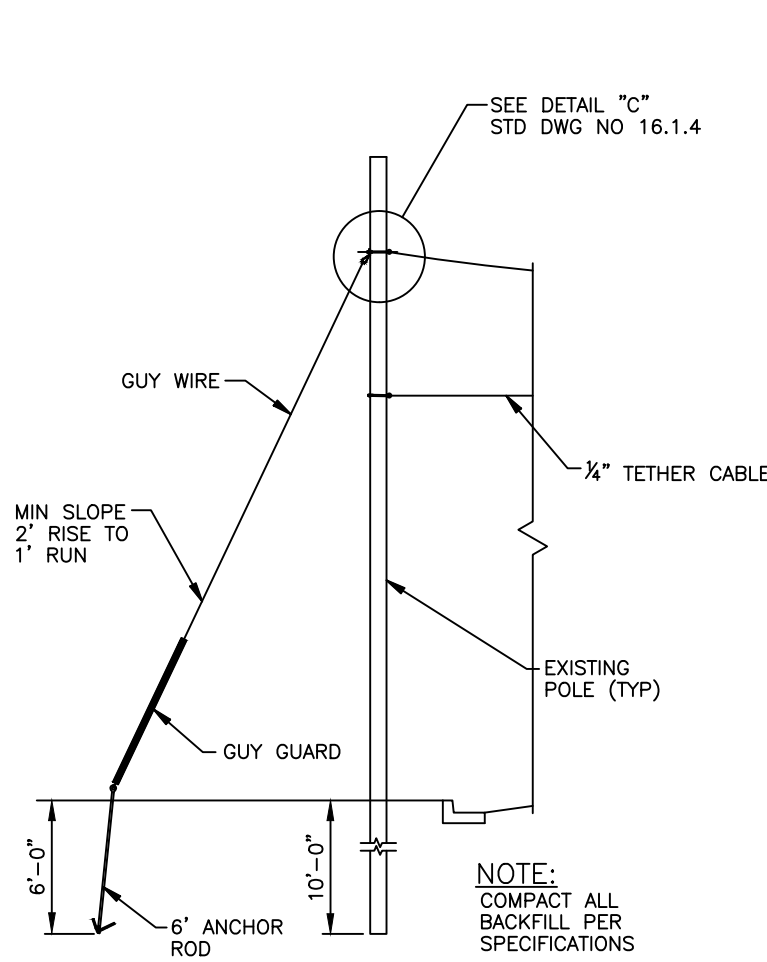


ELEVATION



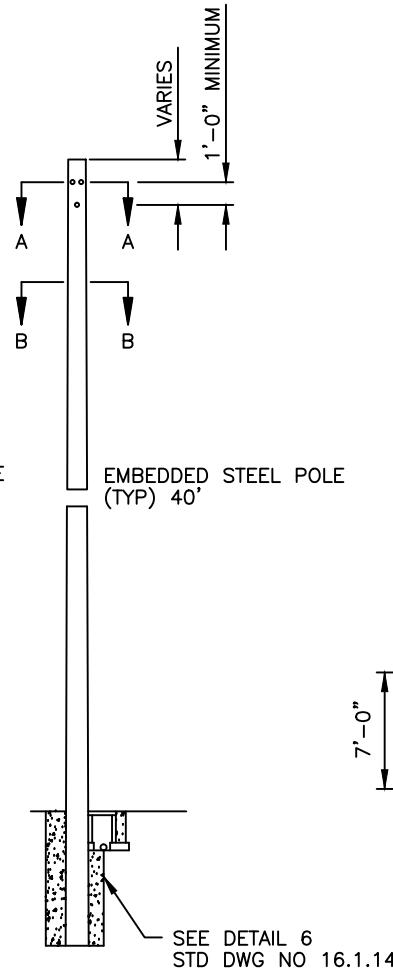
DETAIL "A"

TEMPORARY SPAN WIRE ATTACHMENT
(MAXIMUM SPAN = 100 FEET)

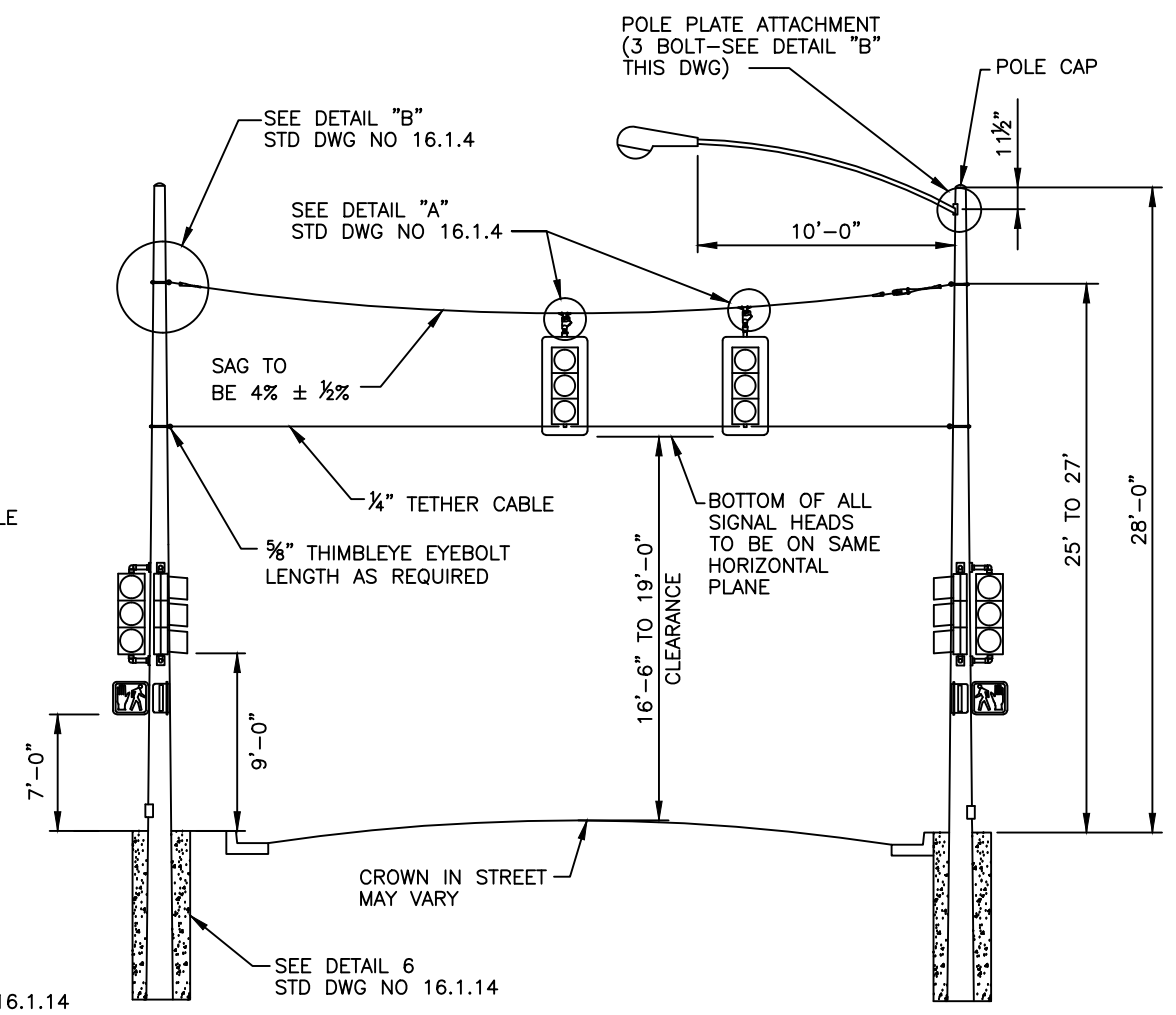


EXISTING STRAIN POLE WITH SPAN WIRE

NOTE:
COMPACT ALL BACKFILL PER SPECIFICATIONS



SEE DETAIL 6
STD DWG NO 16.1.14



STEEL POLE WITH SPAN WIRE FOR BOX DESIGN

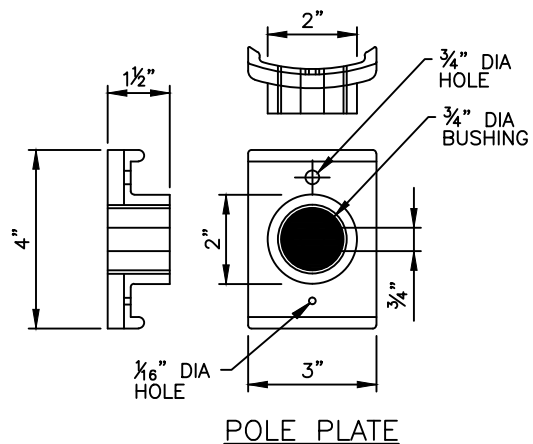
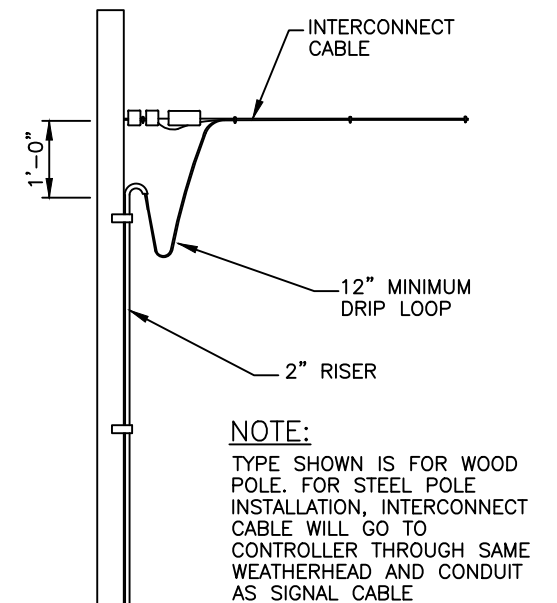
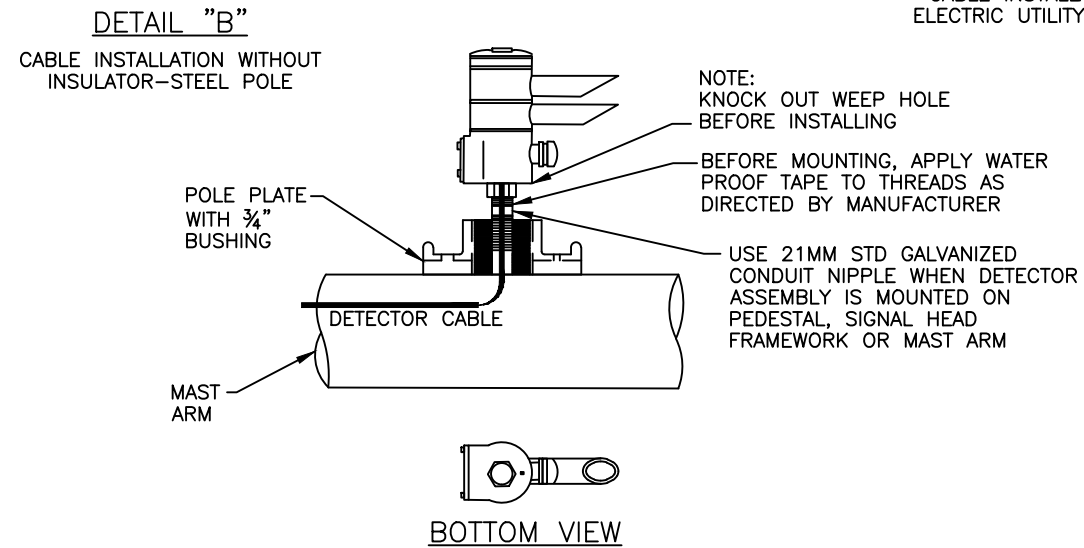
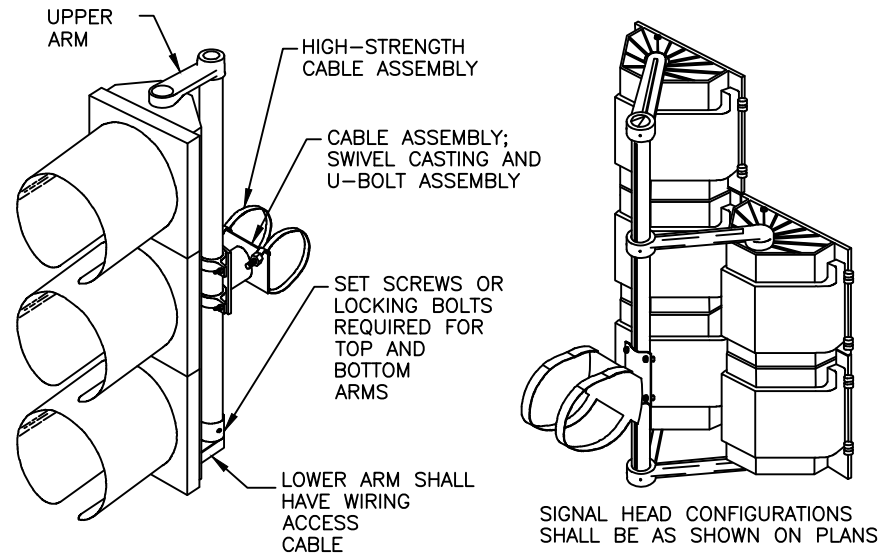
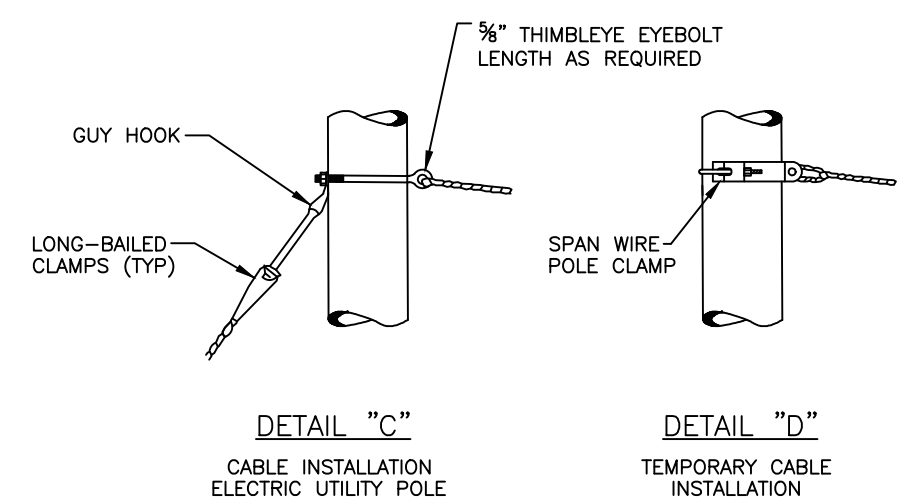
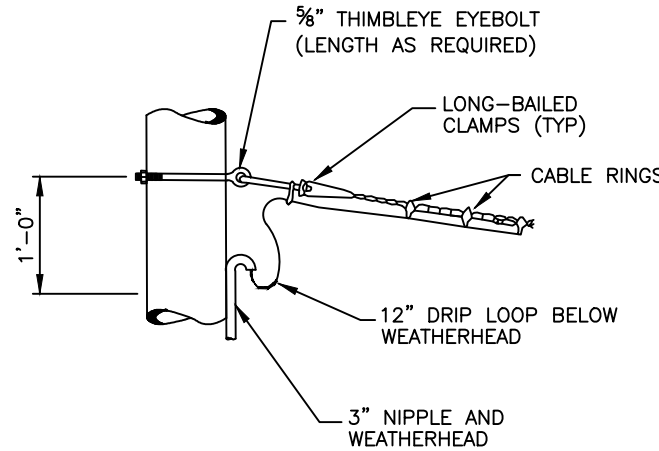
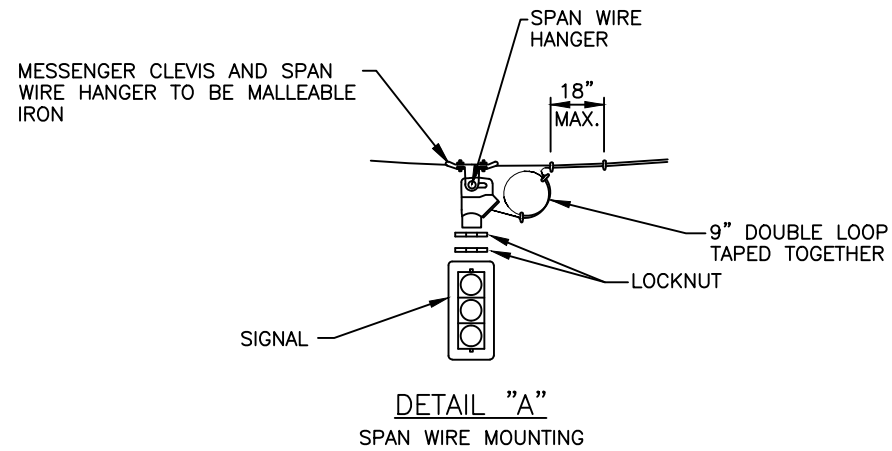
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Sheet Revisions	
Date:	Comments

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
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DENVER, CO 80202
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SPAN WIRE SIGNAL DESIGN
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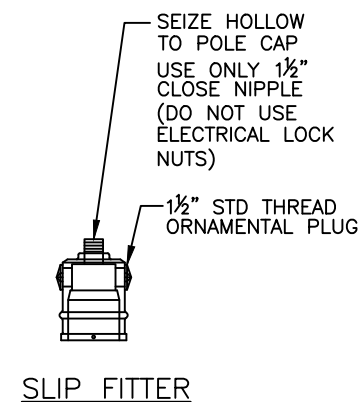
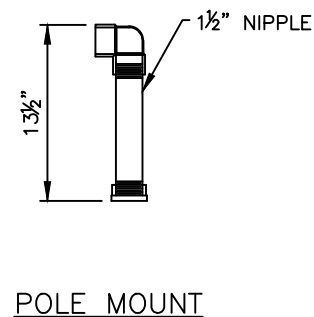
STANDARD DRAWING NO.
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HUB PLATE (PELCO SHOWN, MAY SUBSTITUTE APPROVED EQUAL)

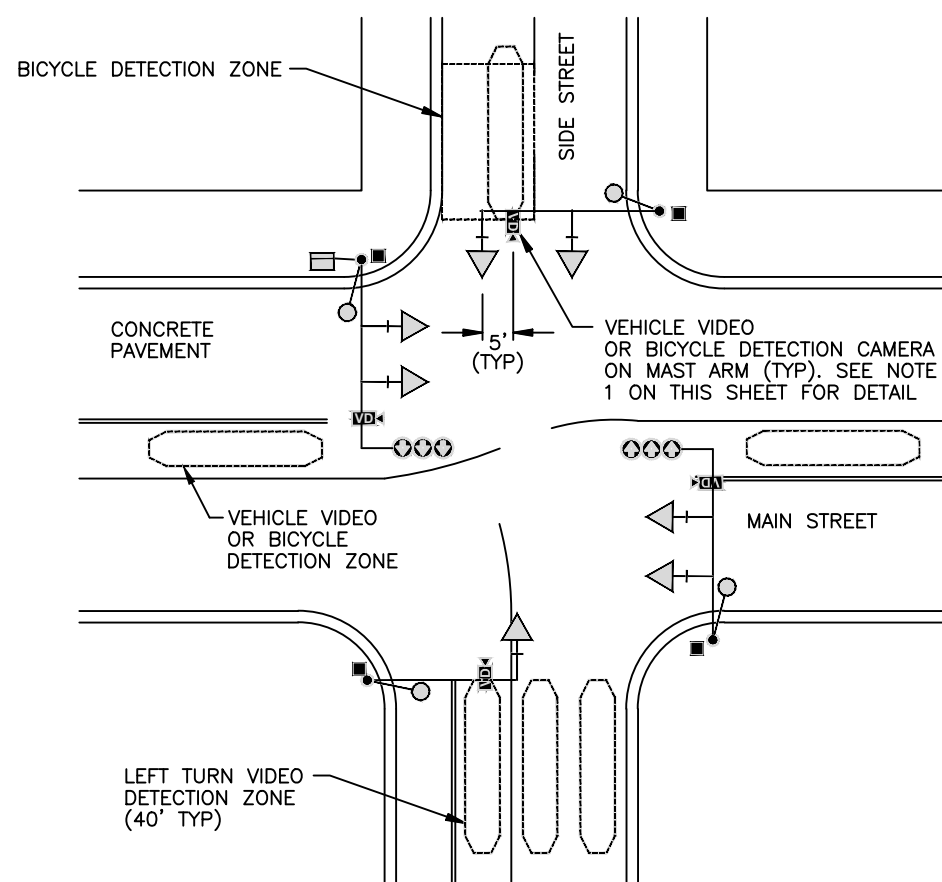
SE-4071 - HUB PLATE, UNIVERSAL, 1-1/2" NPS, ALUM W/ 15/16" DIA HOLE IN REAR

SE-4108 - HUB PLATE, UNIVERSAL, 1-1/2" NPS, ALUM W/ 1-1/2" DIA HOLE IN REAR

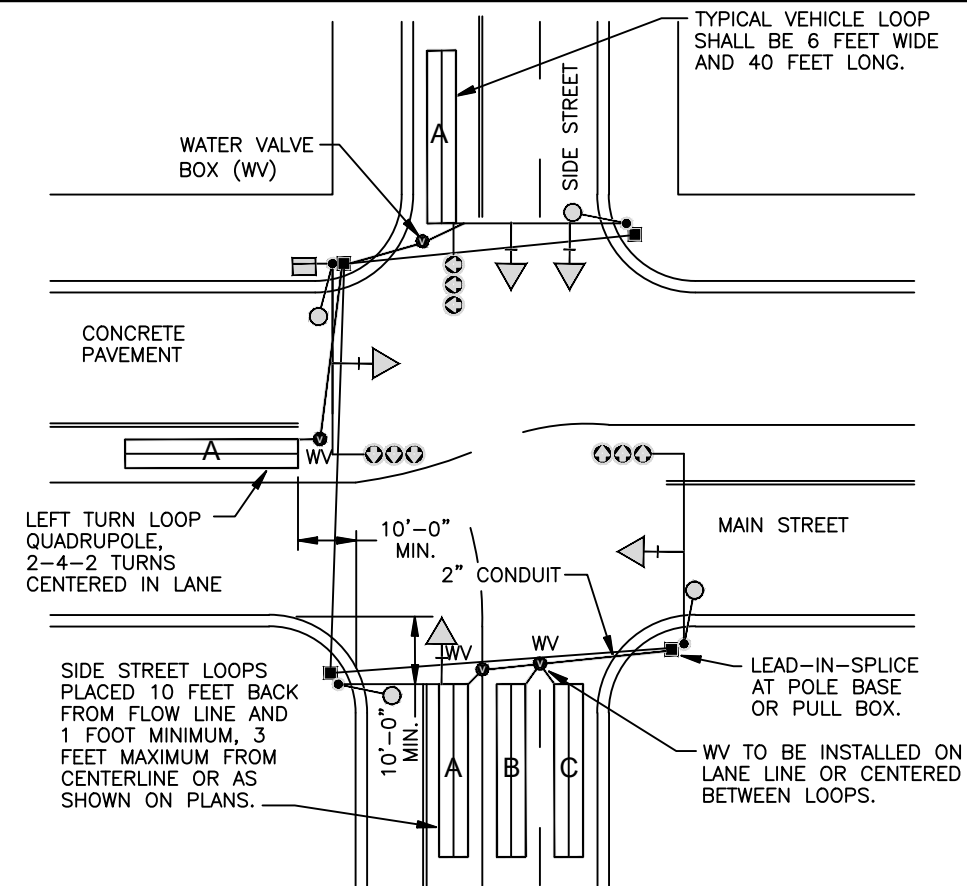


FIRE PRE-EMPTION DETECTION UNIT MASTARM MOUNTING

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	MOUNTING HARDWARE	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.4	
Full Path:						Sheet No. 07 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:			Issued By:		



TYPICAL VIDEO CAMERA LOCATION DETAIL



TYPICAL LOOP LOCATION DETAIL

GENERAL NOTES

1. TYPICAL VIDEO DETECTION CAMERA INSTALLATION ON THE MAST ARM SHALL BE APPROXIMATELY 5' FROM THE LEFT TURN SIGNAL INDICATION AND OVER THE LANE LINE. IF THERE ARE ADDITIONAL INFRASTRUCTURES SUCH AS REGULATORY SIGNS, THE VIDEO DETECTION CAMERA SHALL BE OVER THE LANE LINE AND BETWEEN THE REGULATORY SIGN AND THE THRU SIGNAL INDICATION UNLESS OTHERWISE SPECIFIED BY DENVER DOTI ENGINEER. SEE SHEET 16.1.9.2 FOR ADDITIONAL DETAILS.
2. LOOP DETECTORS SHALL BE INSTALLED WITH THE NUMBER OF TURNS OF WIRE AND IN THE CONFIGURATION SHOWN ON SCHEMATIC. A COMPLETE INSTALLATION CONSISTS OF A LOOP OR GROUP OF LOOPS INSTALLED IN THE ROADWAY, LEAD-IN CABLE, AND A DETECTOR UNIT INSTALLED IN A TRAFFIC SIGNAL CONTROLLER CABINET.
3. LOOP WIRES SHALL BE BROUGHT OUT TO THE NEAREST SIGNAL POLE OR PULL BOX AND EXISTING UNDERGROUND CONDUIT OR OVERHEAD MESSENGER WIRE USED FOR LEAD-IN CABLE TO CONTROL CABINET.
4. THE LOOP DETECTOR WIRES SHALL BE SPLICED TO THE LEAD-IN CABLE USING APPROVED WATER PROOF SPLICE DEVICES.
5. ALL LOOP WIRES SHALL BE CLEARLY IDENTIFIED AT THE CONNECTION POINT BY LETTERING FROM THE ROADWAY CENTER.
6. NO BACKER ROD OR FILLER MATERIAL SHALL BE USED IN THE SAW CUT.
7. THE SAW CUT SHALL BE MADE 3/8-INCHES WIDE AND A MINIMUM OF 3 INCHES DEEP. THE SLOT SHALL BE AS STRAIGHT AS POSSIBLE AND SHALL NOT VARY MORE THAN 1/2-INCH WHEN CHECKED WITH A 10 FOOT STRAIGHTEDGE. NO SAWING SHALL BE STARTED UNTIL LAYOUT OF LOOP IS CHECKED AND APPROVED BY THE ENGINEER'S REPRESENTATIVE.
8. SAW CUTS SHALL BE WASHED AND BLOWN DRY AND CLEANED PRIOR TO PLACEMENT OF WIRE. CORNERS OF LOOPS SHALL BE DRILLED 3-INCHES DEEP WITH 2-INCH DIAMETER. SEE DRILLED CORNER DETAIL.

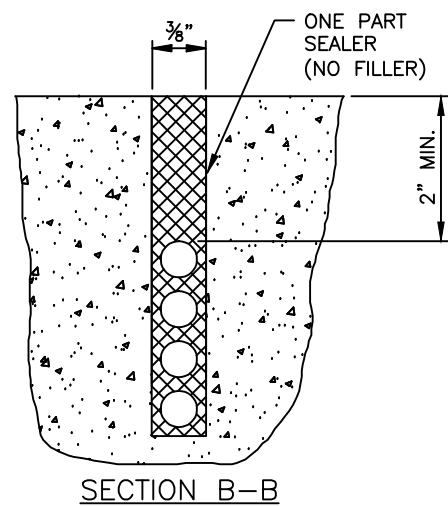
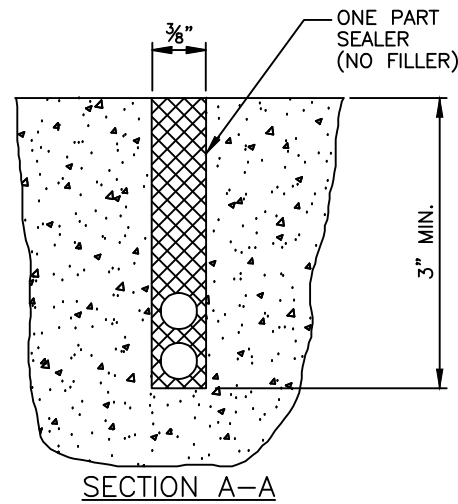
GENERAL NOTES (CONT.)

9. AFTER SAW CUT IS CLEANED OF DEBRIS THE WIRE SHALL BE PLACED BY PUSHING IT INTO THE SLOT WITH A BLUNT NON-METALLIC OBJECT. A SCREWDRIVER OR OTHER SHARP TOOL SHALL NOT BE USED.
10. BEFORE THE LOOP SYSTEM IS SEALED THE LOOP SHALL BE CHECKED FOR ELECTRICAL CONTINUITY BY TESTING FOR INDUCED AC VOLTAGE, INDUCTANCE, AND RESISTANCE.
11. LOOPS SHALL BE SEALED USING SEALER AS DESCRIBED IN THE MATERIAL REQUIREMENTS AND SHOWN IN THE DETAILS.
12. WHEN POSSIBLE INSTALL LOOP UNDER CONCRETE PAVING BY STAKING WITH PLASTIC TENT STAKES OR REBAR CHAIRS AT THE DIRECTION OF THE ENGINEER.
13. LOOPS SHALL BE INSTALLED PRIOR TO FINAL LIFT OF ASPHALT.
14. PREFORMED LOOPS MAY BE USED AT THE DIRECTION OF THE ENGINEER.
15. BICYCLE DETECTION LOOPS SHALL BE LAID OUT AND INSTALLED IN THE SAME MANNER AS VEHICLE LOOPS.

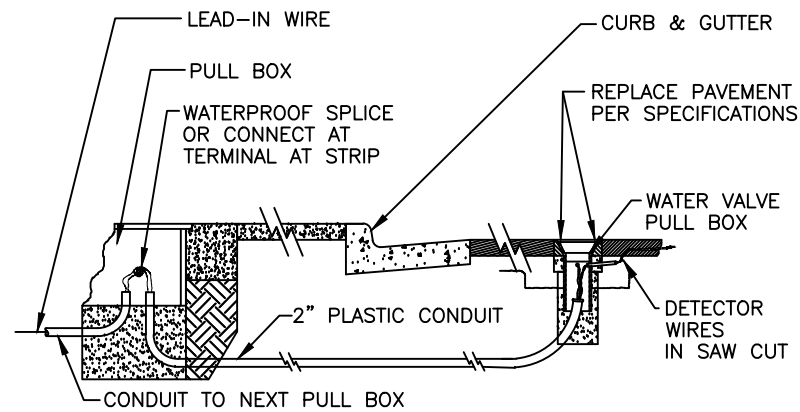
MATERIAL REQUIREMENTS

1. THE LOOP WIRE SHALL BE NO. 14 AWG, STRANDED SINGLE CONDUCTOR, CROSSLINKED POLYETHYLENE INSULATION WHICH IS PROTECTED BY A CONTINUOUS FLEXIBLE VINYL OR POLYETHYLENE PLASTIC TUBING.
2. LOOP LEAD-IN CABLE SHALL BE 4/C AWG#18 BELDING STYLE TWISTED PAIR COPPER WIRE SHIELDED WITH POLYETHYLENE JACKET AND INSULATION IN ACCORDANCE WITH 3M SPECIFICATION NO. 30003 OR APPROVED EQUAL.
3. ROADWAY LOOP EMBEDDING SEALER SHALL BE USED TO ENCAPSULATE THE LOOP WIRES. THE SEALER SHALL BE ONE PART COMPONENT SYSTEM WHICH IS PLACED UNDER PRESSURE USING A CONVENTIONAL CARTRIDGE GUN OR BULK HANDLING PUMP EQUIPMENT. SEALER SHALL HAVE A VISCOSITY WHICH WILL COMPLETELY ENCAPSULATE THE WIRES AND WILL REMAIN PERMANENTLY FLEXIBLE WITH AGE. SEALER SHALL BE APPROVED BY THE ENGINEER PRIOR TO BEGINNING WORK.

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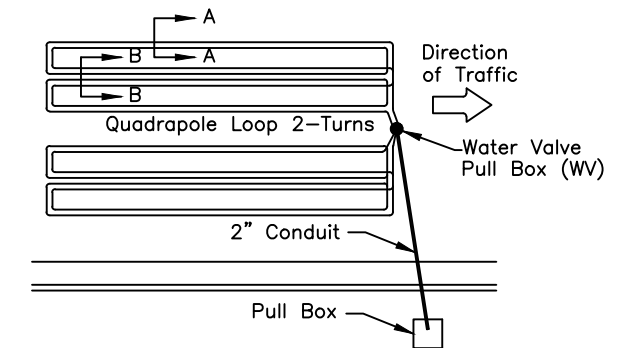


SAWED SLOT DETAILS

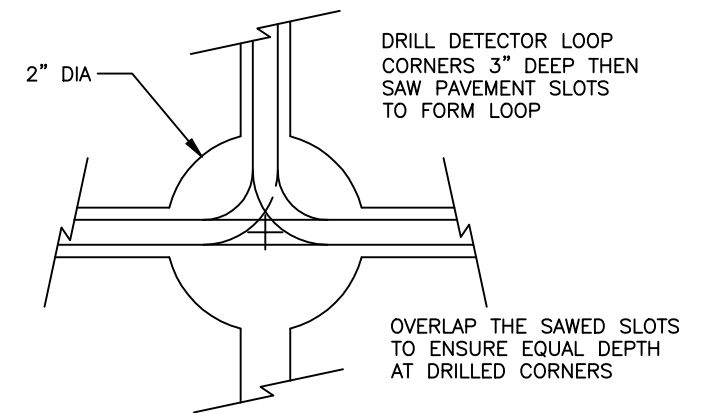


EACH PAIR OF LOOP LEAD-IN DETECTOR WIRES SHALL BE TWISTED 3 TURNS PER FOOT THROUGH CONDUIT.

LOOP DETECTOR LEAD-IN FOR WATER VALVE PULL BOX

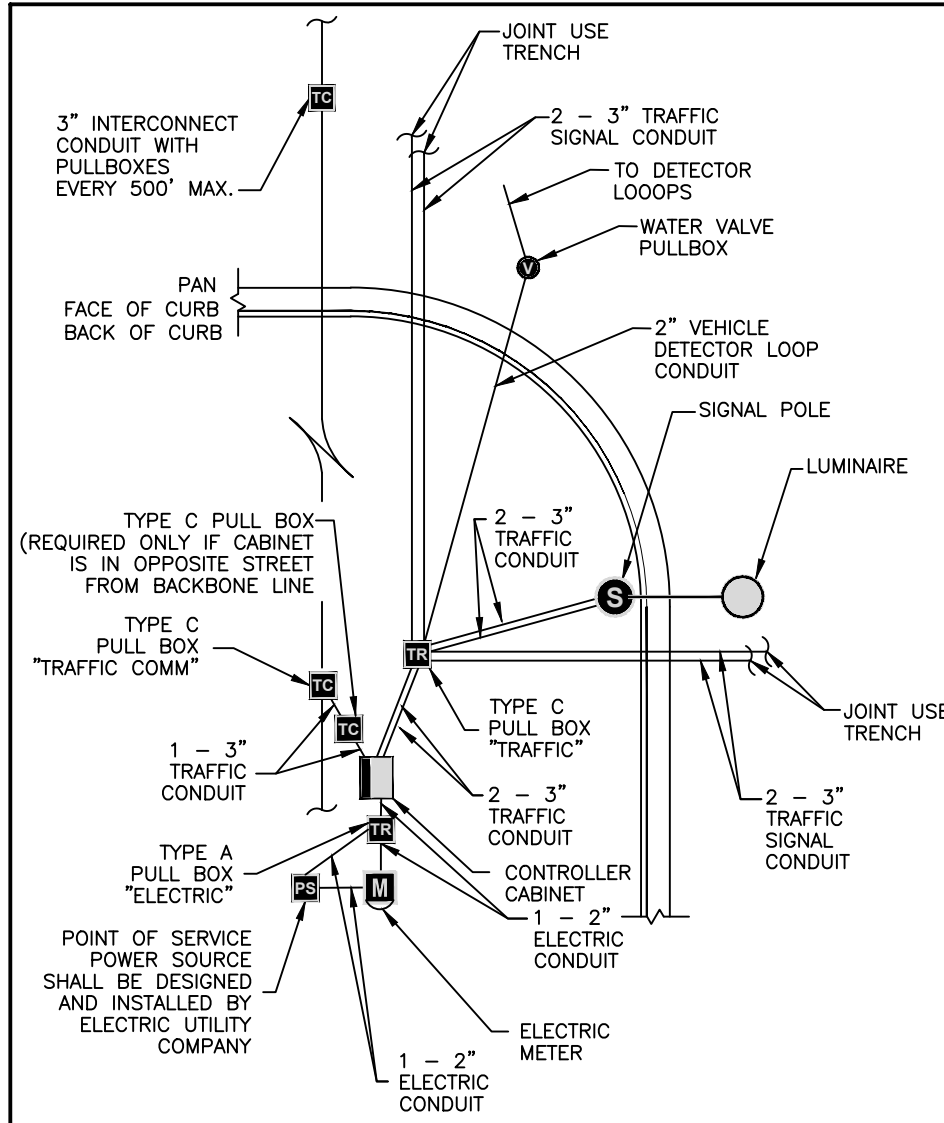


TYPICAL LOOP WIRING SCHEMATIC



DRILLED CORNER DETAIL

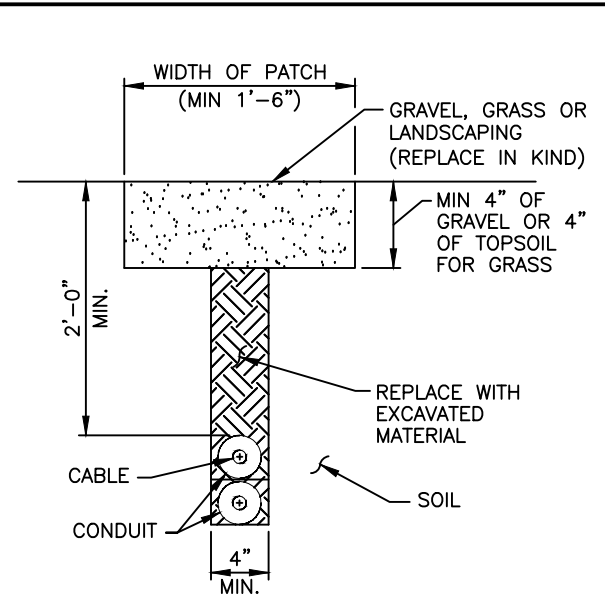
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Creation Date:	Initials:	Date:	Comments:			16.1.5.2	
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CAD Ver.:	Scale:	Units:					



POWER SOURCE AND CABINET CORNER DETAILS

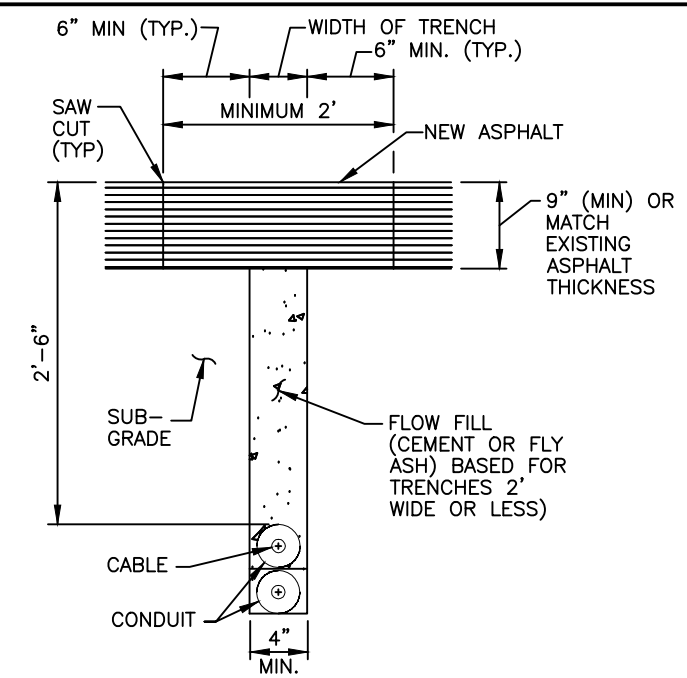
NOTES:

1. SEE CDOT STANDARDS M-613-01 AND S-614-10(C) & SECTION 613 OF CDOT SPECIFICATION FOR ROAD AND BRIDGE CONSTRUCTION.
2. WIRING FOR STREET LIGHT LUMINAIRES SHALL BE TAGGED PER STANDARD SPECIFICATIONS.
3. ALL POLES SHALL BE GROUNDED IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE (NEC).
4. ALL HDPE CONDUITS SHALL BE JOINED WITH THE APPROPRIATE HDPE COUPLINGS.
5. ALL ELECTRICAL SYSTEMS SHALL BE PROPERLY GROUNDED IN ACCORDANCE WITH THE SPECIFICATIONS. A 5/8" X 8' COPPER GROUND ROD SHALL BE INSTALLED IN ALL PULL BOXES. CONTROLLER CABINETS SHALL BE GROUNDED TO NEAREST TRAFFIC SIGNAL PULL BOX.
6. ALL CONDUITS AND POLES SHALL BE ELECTRICALLY BONDED WITH #10 COPPER WIRE AND CONTAIN A PULL STRING AND LOCATE WIRE. INTERCONNECT CONDUITS SHALL HAVE INSTALLED A SINGLE #14 INSULATED CONDUCTOR AND PULL TAPE (1250 LBS).
7. ALL HANDHOLES, VAULTS, CABINETS, AND SIGNAL EQUIPMENT SHOULD BE PLACED OUTSIDE OF PEDESTRIAN PATHS, LEVEL LANDINGS, AND CURB RAMPS UNLESS OTHERWISE APPROVED BY THE CITY & COUNTY OF DENVER DOT ENGINEER.



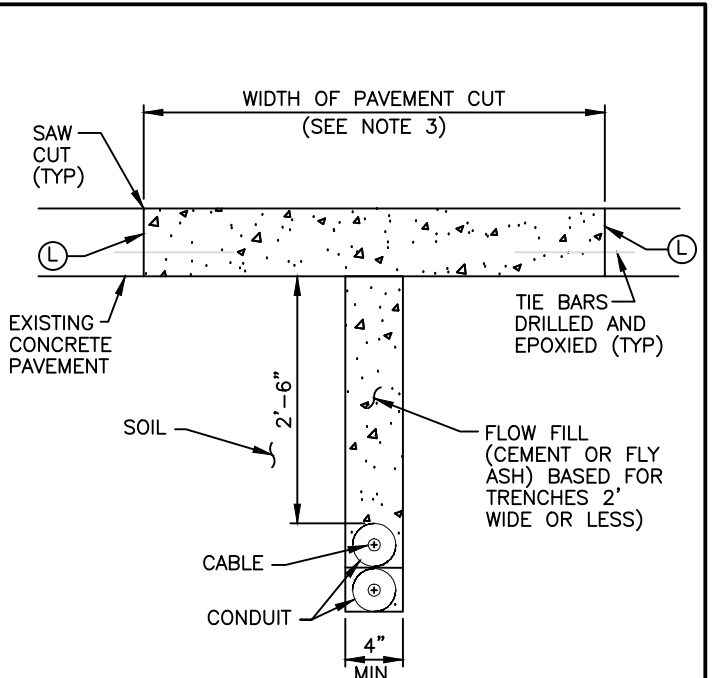
TRENCH PATCH (GRAVEL OR LANDSCAPED)

SEE CCD TRANSPORTATION STD DWG NO. 12.1 AND 12.4



TRENCH PATCH (ASPHALT)

SEE CCD TRANSPORTATION STD DWG NO. 12.0 AND 12.4

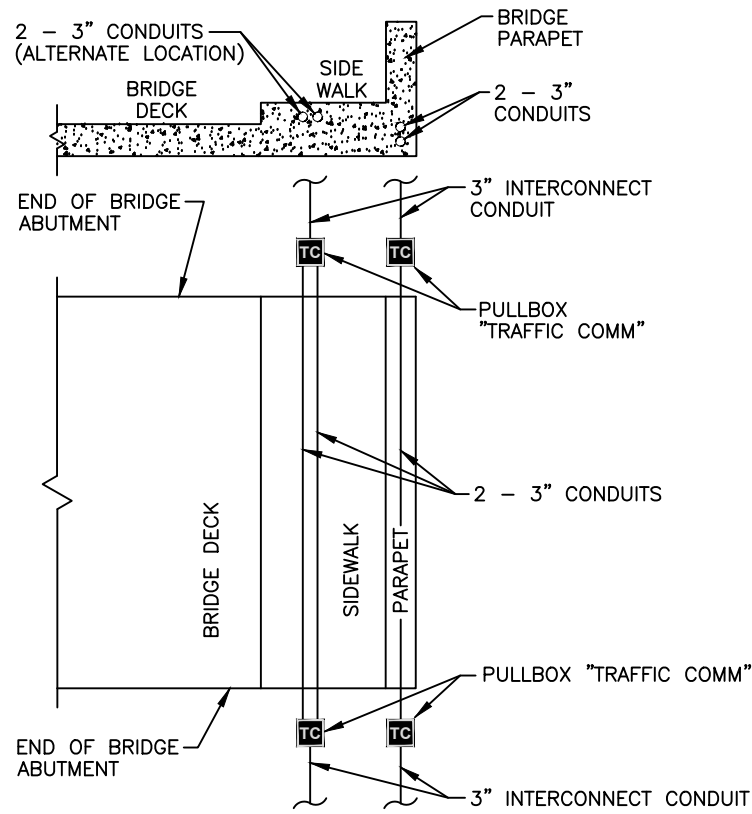


TRENCH PATCH (CONCRETE)

SEE CCD TRANSPORTATION STD DWG NO. 12.3 AND 12.4

NOTES:

1. WHEREVER POSSIBLE CONDUIT OR CABLE SHALL BE INSTALLED BY BORING, DRIVING OR ANY OTHER ACCEPTABLE MEANS UNDER CONCRETE UNITS AND OPEN CUTTING SHALL BE USED ONLY UNDER SPECIAL CIRCUMSTANCES AND ONLY AFTER APPROVAL BY THE CITY.
2. THIS DETAIL APPLIES TO ALL CONCRETE STREETS, ALLEYS, SIDEWALKS, CURBS, GUTTERS AND DRIVEWAYS.
3. FULL PANEL REPLACEMENT IS REQUIRED WHEN CUTTING OR TRENCHING INTO ANY CONCRETE PAVEMENT.
4. A CONSTRUCTION JOINT SHALL BE USED TO TIE THE CONCRETE PATCH TO EXISTING CONCRETE ON ALL SIDES EXCEPT WHERE LIMITS MATCH AN EXISTING TRANSVERSE CONSTRUCTION JOINT. TIE BARS SHALL BE ELIMINATED AT TRANSVERSE CONTRACTION JOINTS.
5. THE LIMITS OF CONCRETE PATCHING SHALL BE PERPENDICULAR OR PARALLEL TO THE CENTERLINE OF THE STREET. SKEWED TRENCHES ARE NOT PERMITTED.

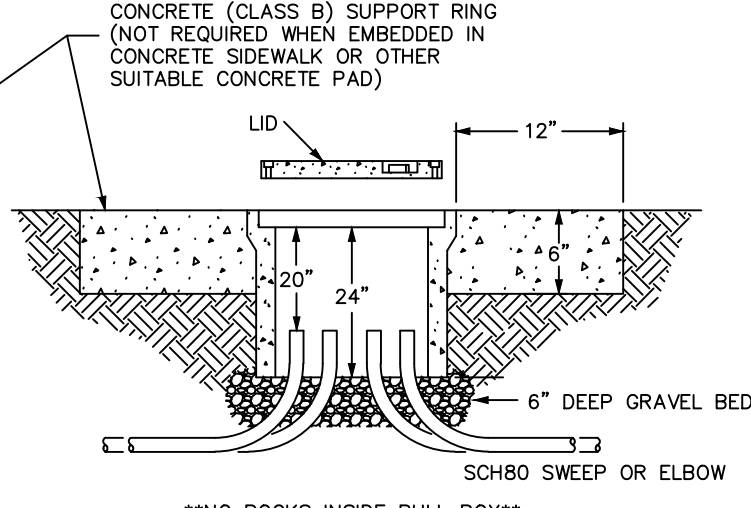
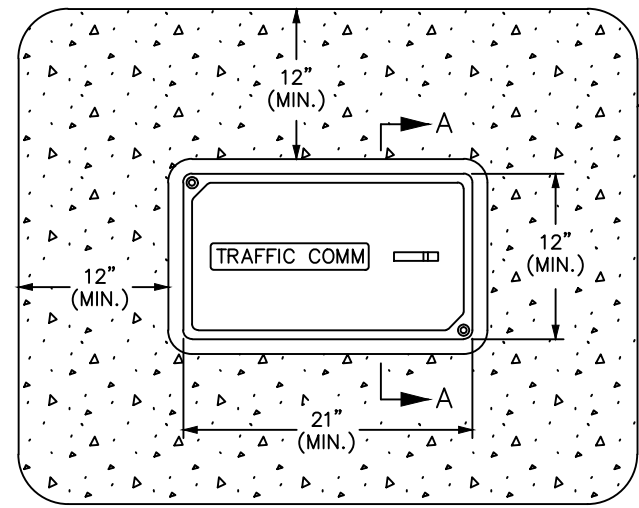
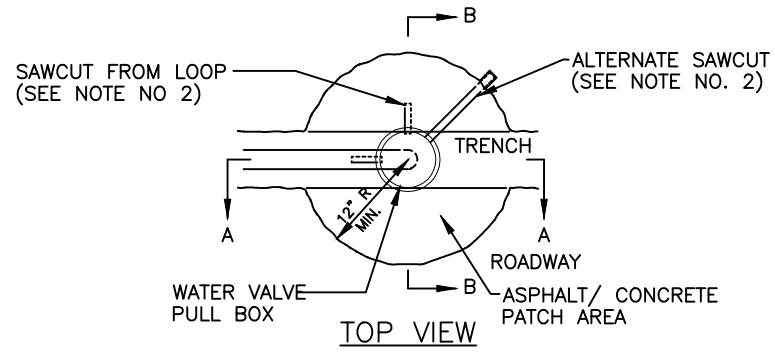


INTERCONNECT CONDUIT PLACEMENT ON BRIDGE

NOTE:

PULLBOXES SHALL BE PLACED AS CLOSE AS PRACTICAL TO THE ENDS OF THE BRIDGE AND BE FLUSH WITH SIDEWALK OR FINISHED GRADE SURFACE.

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Creation Date:	Initials:	Date:	Comments:			16.1.6	
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CAD Ver.:	Scale:	Units:			Issued By:		



PLAN VIEW

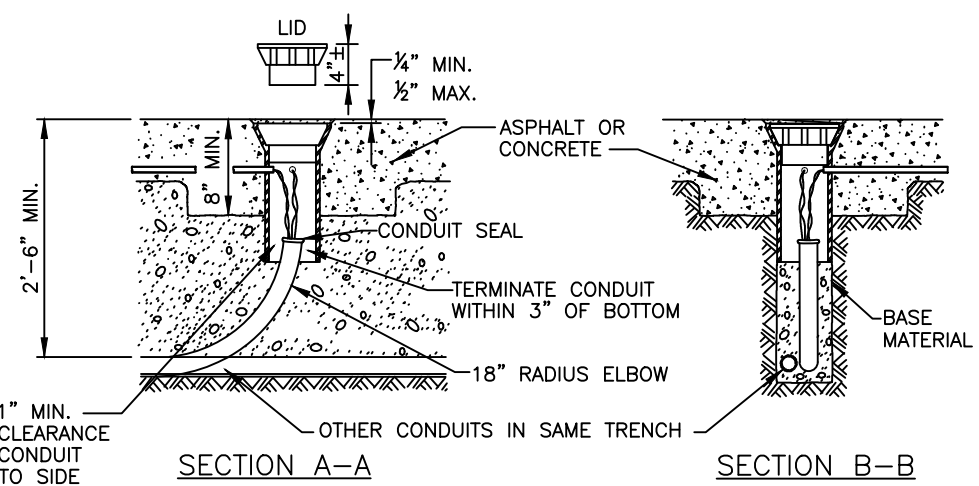
TYPICAL PULL OR SPLICE BOX

SECTION A-A

NO ROCKS INSIDE PULL BOX

NOTES:

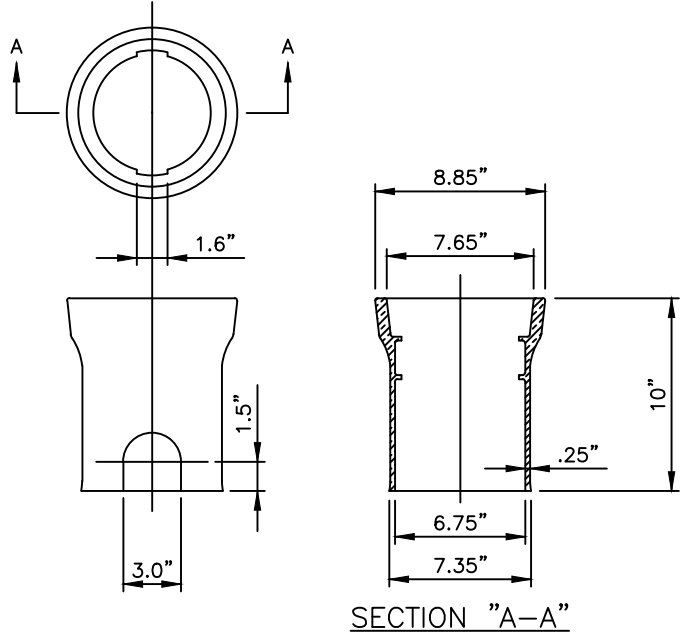
1. ALL PULL, COMMUNICATION, OR SPLICE BOXES SHALL BE LOCATED IN THE TREE LAWN OR OUT OF THE PEDESTRIAN ACCESS ROUTE (PAR/SIDEWALK) UNLESS APPROVED BY THE CCD DOTI ENGINEER, AND SHALL BE TRAFFIC RATED TO 22,500 PSI MINIMUM.
2. BOX DIMENSIONS ARE: 24"W X 36"L X 24"D OR WHEN NEEDED 36"W X 48"L X 24"D WITH 3" PVC CONDUIT FOR COMMUNICATIONS.
3. CONDUIT SHALL NOT EXCEED 4" INTO THE BOX LEAVING ADEQUATE ROOM FOR SPLICE ENCLOSURE AND OR SLACK OF FIBER OPTIC.
4. WHEN CONNECTING GRAY PVC TO HDPE (POLY) PIPE 2 PART EPOXY FOR PLASTICS SHALL BE USED.
5. AN EXPANSION JOINT SHALL BE INSTALLED BETWEEN CONCRETE AND PULL BOX.
6. ANY DEVIATION FROM THIS DETAIL DURING INSTALLATION WILL NEED TO BE DISCUSSED AND APPROVED BY THE CITY AND INSTRUCTION ON HOW TO PROCEED SHALL BE PROVIDED BY THE CITY.
7. INCLUDE 50 FEET MINIMUM OF FIBER SLACK IN ALL NEW COMMUNICATION BOXES, UNLESS BOX IS PRE-TERMINATED TAIL (GATOR PATCH)



SECTION A-A

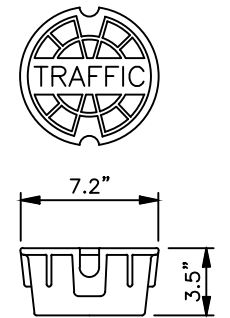
SECTION B-B

WATER VALVE PULL BOX FOR LOOP DETECTOR WIRE



SECTION "A-A"

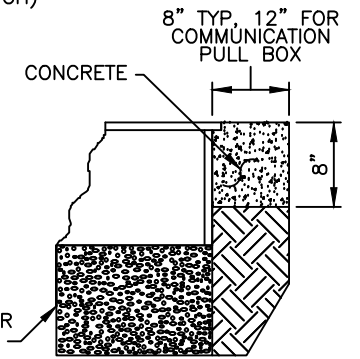
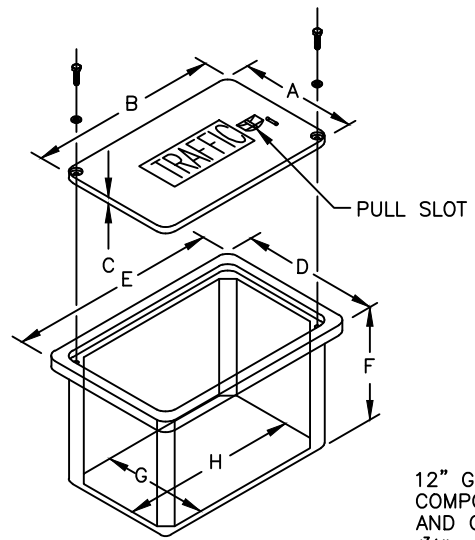
WATER VALVE PULL BOX



WATER VALVE PULL BOX LID

WATER VALVE PULL BOX NOTES:

1. WATER VALVE PULL BOX SHALL BE A WATER VALVE STEM TYPE PULL BOX MADE OF CAST IRON. THE PULL BOX ITSELF SHALL HAVE CAPABILITY OF ACCEPTING RISER RINGS FOR FUTURE OVERLAYS. THE LID SHALL BE CAST IRON OR STEEL AND HAVE THE WORD "TRAFFIC" PRINTED ON IT.
2. PULL BOXES SHALL HAVE 3/4" TO 1" DIAMETER HOLES DRILLED OR TORCHED 3" FROM TOP TO ACCEPT A LOOP DETECTOR WIRE FLEXIBLE VINYL OR POLYETHYLENE TUBING. THE NUMBER OF HOLES SHALL BE AS PER PLANS OR AS DIRECTED BY THE ENGINEER.
3. CARE SHALL BE TAKEN DURING BACK FILL COMPACTION TO PREVENT COLLAPSE OF THE TUBES.
4. 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.
5. PULL BOX IS TO BE LOCATED IN AN AREA OF THE STREET NOT HEAVILY TRAVELED, IF POSSIBLE, AND A MINIMUM OF 12" FROM THE CONCRETE GUTTER PAN.
6. IF HOT ASPHALT IS NOT AVAILABLE, A CONCRETE RING (12" MINIMUM RADIUS AND 8" MINIMUM DEPTH) MAY BE USED AT THE DIRECTION OF THE ENGINEER.



12" GRAVEL BASE FOR COMPOSITE PULLBOX AND CABINET BASE. (3/4" ROCK AGGREGATE)

PULL BOXES AND COVERS SHALL BE COMPLETELY MADE OF FIBERGLASS REINFORCED POLYMER CONCRETE DESIGNED TO ANSI/SCTE 77 2007 TIER 22 "SPECIFICATIONS FOR UNDERGROUND ENCLOSURES INTEGRITY".

PRECAST PULL BOX

DESCRIPTION	TABLE OF DIMENSIONS FOR PRECAST PULL BOX DIMENSIONS (IN.)								COMMENTS
	A	B	C	D	E	F	G	H	
TYPE A (ELECTRIC)	13-3/4"	23-1/4"	2"	15-1/2"	25"	12"	10-1/4"	19-1/4"	
TYPE B (TRAFFIC)	17-1/2"	30-1/2"	2"	19-1/4"	32-1/4"	12"	13-1/2"	26-1/2"	
TYPE C (COMM) OR (TRAFFIC)	22-1/4"	34-1/4"	2"	24"	36"	24"	19-3/4"	30-1/4"	
TYPE D (SPECIAL)	22-1/4"	46-1/2"	2"	30"	48"	18"			

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Creation Date:	Initials:	Date:	Comments:			16.1.7	
Full Path:						Sheet No. 11 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:				Issued By:	

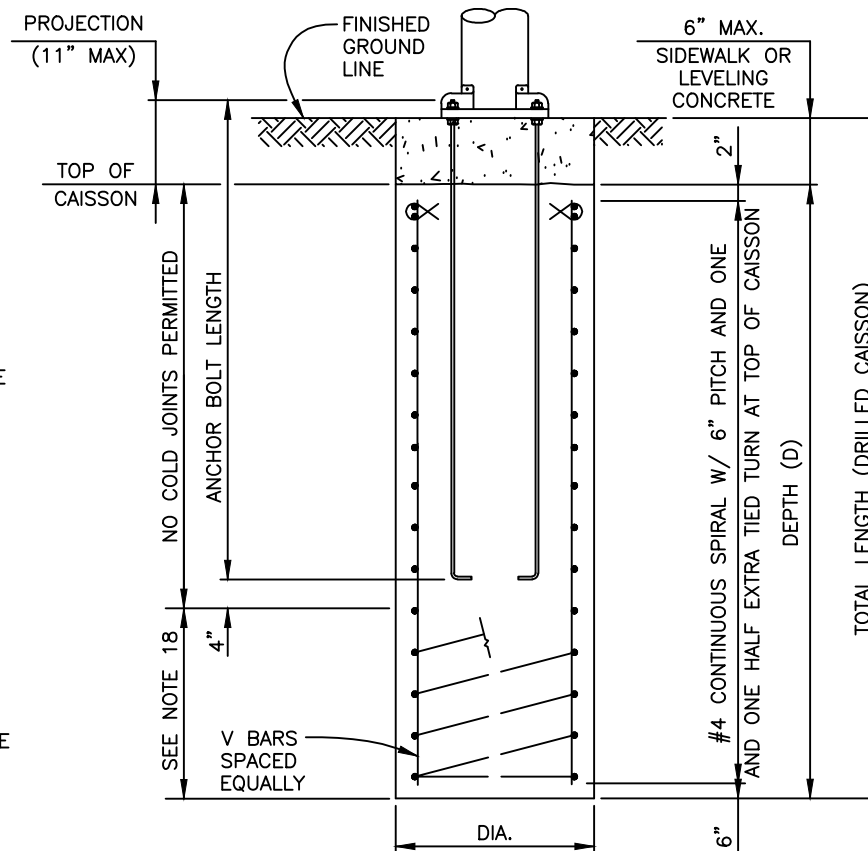
NOTES:

ANCHOR BOLTS

- (4) 2" DIAMETER ANCHOR BOLTS PER CAISSON WITH (2) 2" HEX AND (2) 2" WASHERS PER BOLT WITH THREADED END GALVANIZED TO AT LEAST 12" FROM END.
- LENGTH, THREAD LENGTH, HOOK LENGTH, AND DIAMETER OF EACH ANCHOR BOLT SHALL BE PER DETAIL 13 ON SHEET 16.1.10.2.
- ANCHOR BOLTS SHALL BE MEDIUM STRENGTH, MILD STEEL OR ALLOY STEEL WITH MINIMUM DESIGN YIELD STRENGTH OF ASTM F1554 GRADE 55, OR 55 KSI. ALLOY ANCHOR BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A193 GRADE B7. MEDIUM STRENGTH, MILD STEEL ANCHOR BOLTS SHALL CONFORM TO THE REQUIREMENTS OF A MODIFIED ASTM A36 (WITH 55 KSI YIELD STRENGTH), OR ASTM A572 GRADE 55.
- WELDED SPLICING OF A ROD MATERIAL FOR ANCHOR BOLTS WILL NOT BE PERMITTED.
- THREADS FOR ANCHOR BOLTS SHALL BE ROLLED OR CUT THREADS OF UNIFIED COARSE THREAD SERIES IN ACCORDANCE WITH ANSI B1.1. FOR ROLLED THREADS, THE DIAMETER OF THE UNTHREADED PORTION SHALL NOT BE LESS THAN THE MINIMUM PITCH DIAMETER NOR MORE THAN THE MAXIMUM MAJOR DIAMETER OF THE THREADS.
- ALL THREADS FOR BOLTS AND NUTS SHALL HAVE CLASS 2 FIT TOLERANCES IN ACCORDANCE WITH ANSI B1.1.

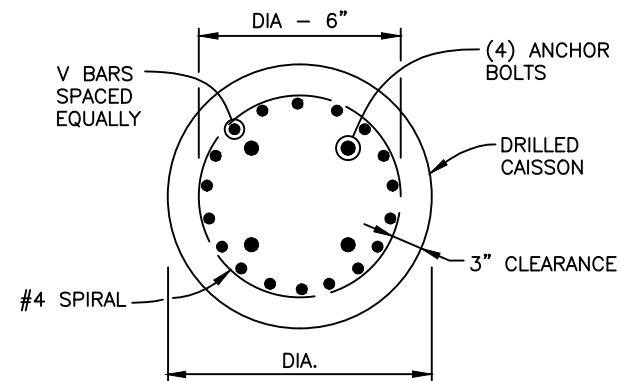
NUTS AND WASHERS

- NUTS FOR ALLOY STEEL ANCHOR BOLTS SHALL CONFORM TO ASTM A194 GRADE 2H OR ASTM A563, HEAVY HEX, GRADE DH CLASS 12. NUTS FOR MEDIUM STRENGTH, MILD STEEL ANCHOR BOLTS SHALL CONFORM TO ASTM A194 GRADE 2H OR ASTM A563, GRADE D OR BETTER. ALL THREADS FOR NUTS SHALL HAVE A CLASS 2B TOLERANCE IN ACCORDANCE WITH ANSI B1.1. WHEN NUTS ARE TO BE GALVANIZED, THE UNTAPPED BLANKS SHALL BE GALVANIZED PRIOR TO CUTTING THE THREADS.
- EXPOSED NUTS SHALL BE GALVANIZED OR COATED WITH A ZINC-RICH COATING IF THE ANCHOR BOLTS ARE NOT GALVANIZED.
- WASHERS INSTALLED WITH ANCHOR BOLTS OF ANY TYPE SHALL CONFORM TO THE REQUIREMENTS OF ASTM F436 AND SHALL HAVE THE SAME FINISH OR COATING AS THE BOLT AND NUT.



CAISSON PROFILE

FOUNDATION SCHEDULE						
MAST ARM LENGTH (FT.)	CAISSON DATA					
	DIA. (IN.)	DEPTH (D) (FT.)		BOLT CIRCLE DIA. (IN.)	V BARS	
		COHESIVE SOIL	COHESIONLESS SOIL		SIZE	TOTAL
20-40	36	12.0	10.0	20	#9	11
	48	11.0	10.0	20	#9	18
	54	11.0	9.0	20	#9	18
45-55	36	14.0	11.0	22	#9	11
	48	13.0	11.0	22	#9	18
	54	12.0	10.0	22	#9	18
60-70	48	15.0	12.0	25	#9	18
	54	14.0	12.0	25	#9	18
	60	14.0	11.0	25	#9	18
75	48	16.0	13.0	26.5	#9	18
	54	15.0	13.0	26.5	#9	18
	60	14.0	12.0	26.5	#9	18
40 (DBL ARM)	36	15.0	12.0	22	#9	11
	48	14.0	12.0	22	#9	18
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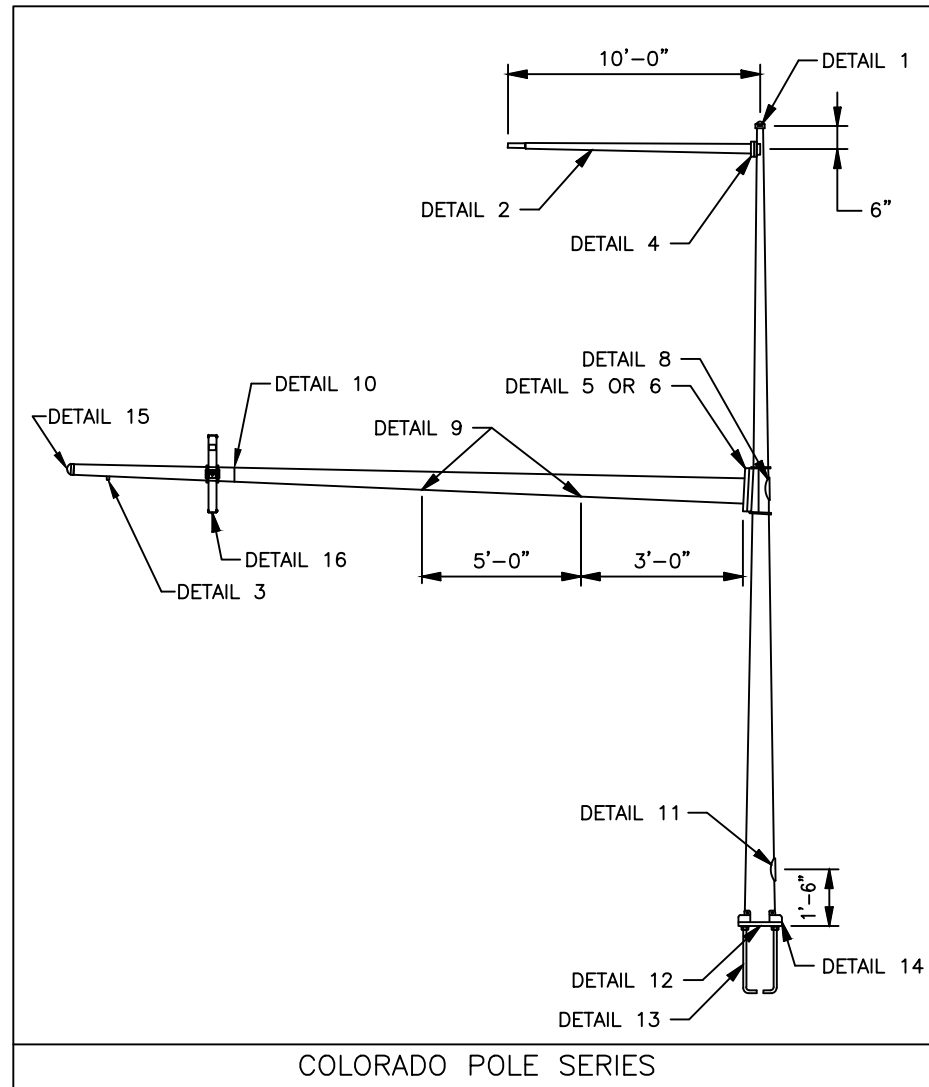


TRAFFIC SIGNAL POLE CAISSON

GENERAL NOTES

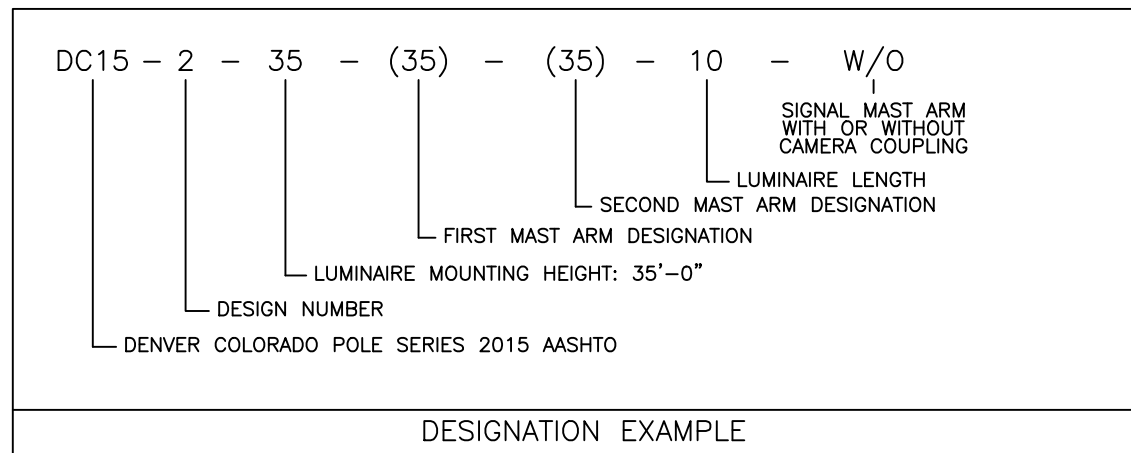
- DESIGN OF FOUNDATIONS IS BASED ON TRAFFIC SIGNAL POLE CONFIGURATIONS AND LOADS AND REACTIONS. REACTIONS PROVIDED BY THE MANUFACTURER FOR THE CITY & COUNTY OF DENVER. REFER TO CITY & COUNTY OF DENVER TRAFFIC STANDARD DRAWINGS FOR ANY ADDITIONAL TRAFFIC POLE INFORMATION.
- DESIGN CRITERIA: 2015 AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS, FIRST EDITION"
- AN ULTIMATE WIND VELOCITY OF 120 MPH HAS BEEN USED FOR THE DESIGNS HEREIN.
- ALL FOUNDATIONS ON THIS SHEET ARE FOR SINGLE MAST ARM POLES, EXCEPT AS NOTED.
- THE DESIGNS HEREIN ASSUME THAT SIGNALS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING SOIL PARAMETERS:
SOIL DENSITY $\gamma = 110$ LB./CU.FT.
SOIL COHESION = 750 LB./SQ.FT. 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
- 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
(F) CAVING SOILS
(G) GROUNDWATER
(H) EXPANSIVE SOILS
(I) TRASH
(J) BOTTOM OF CAISSON WILL EXTEND BELOW BOTTOM OF ANY ADJACENT BUILDING OR RETAINING WALL FOUNDATION
(K) SLOPES GREATER THAN 10%
- CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH.
- CAISSONS SHALL BE CONSTRUCTED WITH AIR ENTRAINED CDOT CLASS BZ CONCRETE IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS. REINFORCING STEEL SHALL BE GRADE 60.
- CAISSON CONCRETE SHALL REACH THE SEVEN DAY PREDICTED STRENGTH PRIOR TO INSTALLING THE SIGNAL STRUCTURE.
- FOUNDATION TO BE PROVIDED WITH 2 CONDUIT STUB OUTS (2 - 3"). DIRECTION TO BE DETERMINED BY CITY & COUNTY OF DENVER ENGINEER AND IS TO BE CONSIDERED AS PART OF THE FOUNDATION BID ITEM.
- BASE PLATE, NUTS AND NUT COVERS TO BE FURNISHED BY POLE MANUFACTURER. ANCHOR BOLTS ARE TO BE FURNISHED BY THE CONTRACTOR AND ARE INCLUDED IN THE COST OF THE FOUNDATION.
- FOUNDATION SHALL BE PAID BY THE FEET OF DEPTH DRILLED. USE OF THE SHORTER FOUNDATION FOR COHESIONLESS SOIL SHALL BE ALLOWED ONLY BY APPROVAL OF THE CCD TRAFFIC ENGINEER.
- PLUMBING OF POLES SHALL BE ACCOMPLISHED BY ADJUSTING NUTS AFTER LOADING OF MAST ARM.
- EACH END OF CAISSON TIES TO BE TERMINATED WITH A 135° HOOK AROUND A LONGITUDINAL BAR.
- DESIGN IS BASED ON A HORIZONTAL GROUND SURFACE CONDITION IN THE VICINITY OF THE CAISSON. CAISSONS SHOULD NOT BE INSTALLED AT SITES WITH A SLOPE EXCEEDING 10 PERCENT.
- LEVELING CONCRETE SHALL BE 4,000 PSI CLASS B AIR ENTRAINED CONCRETE.
- YIELD STRESS OF REINFORCING STEEL SHALL BE MINIMUM 60,000 PSI.
- COLD JOINT IS NOT ALLOWED UNLESS PRE-APPROVED BY THE CITY ENGINEER. COST FOR COLD JOINT IS CONSIDERED INCIDENTAL TO THE WORK.

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>SIGNAL POLE FOUNDATION</p> <p>Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.8	
Full Path:						Sheet No. 12 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					

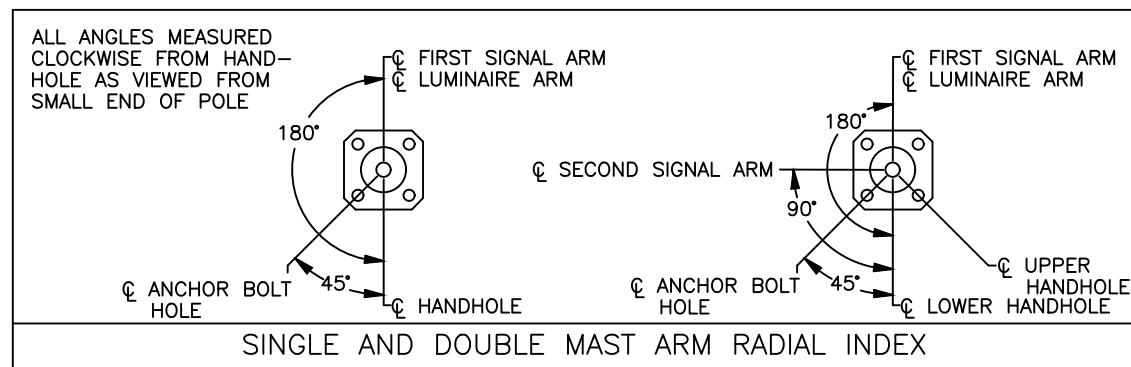


COLORADO POLE SERIES

MATERIAL DATA			
COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)	FINISH DATA
TAPERED SHAFTS	A595 GR. A OR A572	55	SYSTEM: CUSTOMER SPECIFIED BASE COAT: HOT-DIP GALVANIZED TO ASTM A123 PRIME COAT: HIGH BUILD EPOXY POWDER FINISH COAT: TGIC POWDER COLOR: GREEN SPEC: F-540AC
POLE BASE	A572	50	
SIGNAL ARM ATTACHMENT	A572	50	
LUM. ARM ATTACHMENT	A36	36	
CONNECTING BOLTS	A325	55	
ANCHOR BOLTS	F1554	55	
GALVANIZING-HARDWARE	F2329		



DESIGNATION EXAMPLE



SINGLE AND DOUBLE MAST ARM RADIAL INDEX

STANDARD DESIGN CRITERIA:

THE STANDARD SIGNAL MAST ARM TRAFFIC STRUCTURES SHOWN ON THESE DRAWINGS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE LOADING AND NOMINAL STRENGTH REQUIREMENTS OF THE 2015 AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, FIRST EDITION" SLTS-1 INCLUDING LATEST INTERIMS.

STRUCTURES HAVE BEEN DESIGNED FOR WIND LOADS USING AN ULTIMATE WIND VELOCITY OF 120 MPH WITH A MEAN RECURRENCE INTERVAL OF 1700 YEARS.

ALL STRUCTURES HAVE BEEN DESIGNED FOR A FATIGUE NATURAL WIND GUST YEARLY MEAN WIND VELOCITY OF 11.2 MPH AND A TRUCK INDUCED GUST PRESSURE OF 18.8 PSF.

FATIGUE CATEGORY II:
STRUCTURES WITH MITIGATION DEVICES HAVE BEEN DESIGNED FOR FATIGUE CATEGORY II LOADING WITHOUT GALLOPING LOADS.

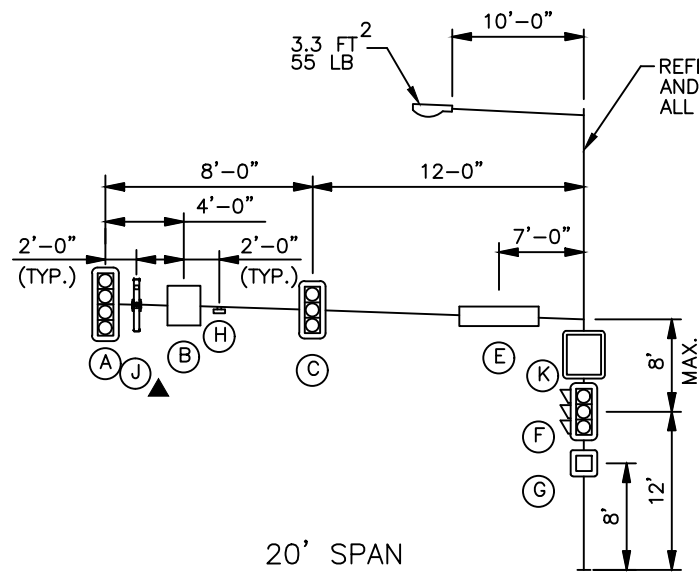
FATIGUE CATEGORY III:
STRUCTURES WITHOUT A MITIGATION DEVICE HAVE BEEN DESIGNED FOR FATIGUE CATEGORY III WITH GALLOPING LOADS. A MITIGATION DEVICE IS NOT REQUIRED FOR SINGLE AND DOUBLE MAST ARMS ON STRUCTURES MEETING ALL OF THE FOLLOWING CONDITIONS:

- ARM LENGTHS LESS THAN OR EQUAL TO 55 FEET
- OVER ROADWAYS WITH POSTED SPEED LIMITS LESS THAN OR EQUAL TO 35 MPH

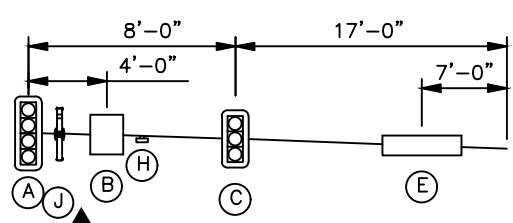
GENERAL NOTES:

DETAIL NUMBERS REFER TO STANDARD DRAWINGS 16.1.10.1 AND 16.1.10.2.

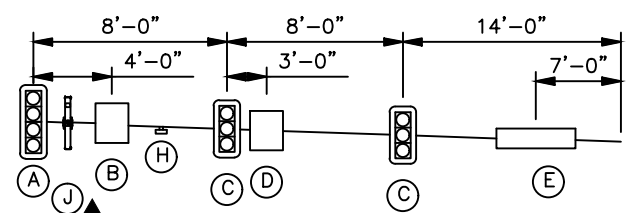
Computer File Information		Sheet Revisions		 DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	MAST ARM POLE LOADS SHEET 1		STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:		Issued By:		16.1.9.1	
Full Path:							Sheet No. 13 of 39	
Drawing File Name:								
CAD Ver.:	Scale:	Units:						



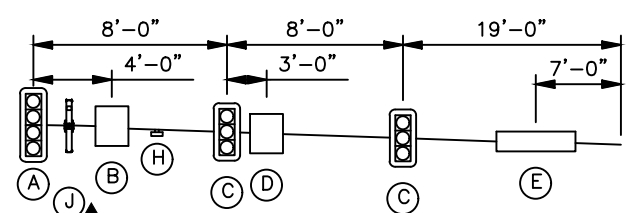
20' SPAN



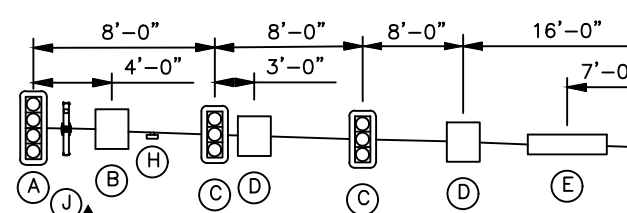
25' SPAN



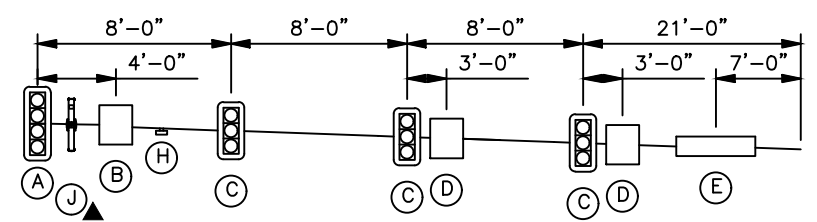
30' SPAN



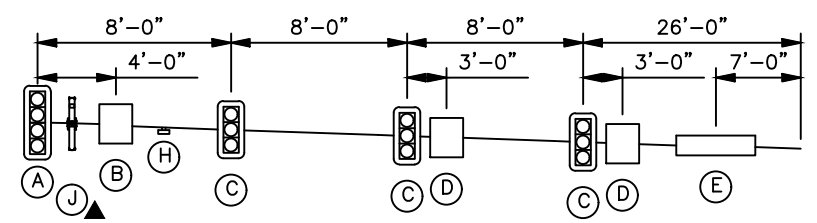
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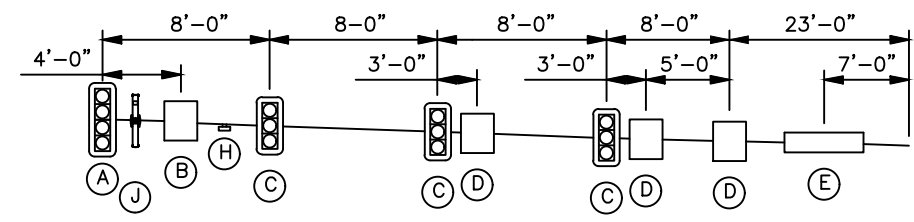
40' SPAN



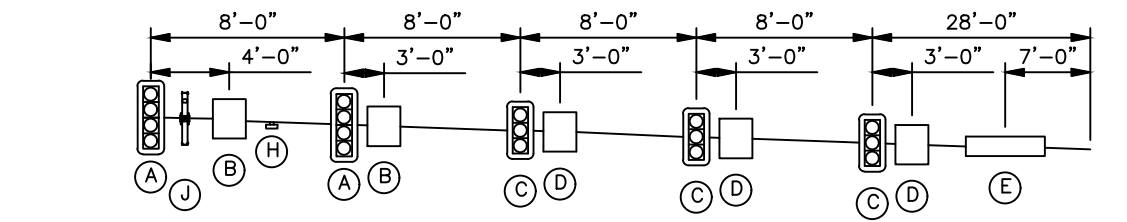
45' SPAN



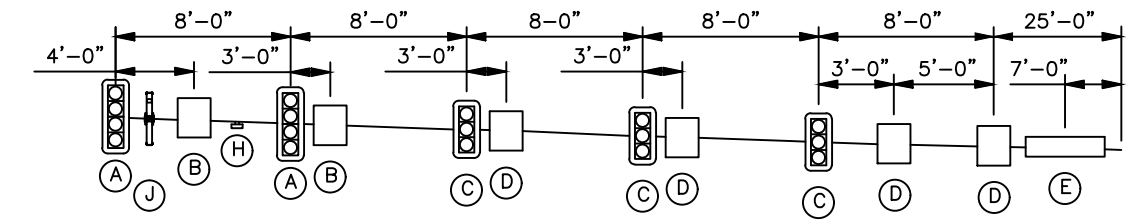
50' SPAN



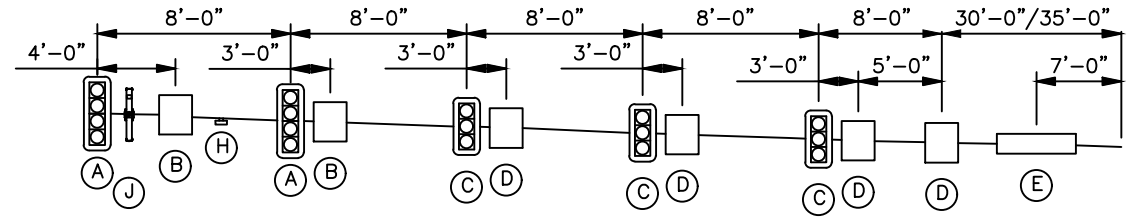
55' SPAN



60' SPAN



65' SPAN



70' & 75' SPAN

LOAD NOTES:

- DESIGN AND DETAILS INCLUDED IN THESE STANDARDS ARE BASED ON THE DEVICE SIZES, WEIGHTS, AND LOCATIONS SHOWN ON THIS DRAWING. ACTUAL SPACING, DEVICE NUMBER AND SPACING SHALL BE PER APPROVED SHOP DRAWINGS. IF DEVICE SIZES OR WEIGHTS ARE INCREASED OR SIGNAL HEAD SPACING IS REDUCED BELOW 8', THEN A SPECIAL DESIGN BY THE CONTRACTOR WILL BE REQUIRED.
- CAMERA (H) IS LOCATED BETWEEN END OF ARM SIGNAL (A) OR (C) AND PRECEDING INBOUND SIGNAL (B).
- A BLANK OUT SIGN ON THE MAST ARM MAY BE USED IN SUBSTITUTION FOR ONE (B) AND ONE (C) SIGN WITHIN 5 FEET OF THE BLANK OUT SIGN LOCATION.

DEVICE	DESCRIPTION	PROJ. AREA (FT ²)	WEIGHT (LBS)
(A)	12"-4 SEC. SIGNAL WITH RETROFLECTIVE BACKPLATE	11.00	60
(B)	30" X 36" REGULATORY SIGN	7.50	23
(C)	12"-3 SEC. SIGNAL WITH RETROFLECTIVE BACKPLATE	8.67	45
(D)	30" X 36" REGULATORY SIGN	7.50	23
(E)	22" X 108" STREET NAME SIGN	16.50	55
(F)	DUAL 12"-3 SEC. SIGNAL WITHOUT BACKPLATE	6.50	90
(G)	SINGLE 16" PED SIGNAL	4.50	60
(H)	CAMERA	1.00	20
(J)	MITIGATOR DAMPER DEVICE ▲	1.20	38
(K)	BLANK OUT SIGN	12.70	120

▲ NOT REQUIRED FOR ARMS LESS THAN OR EQUAL TO 55 FEET WITH DESIGN SPEEDS LESS THAN OR EQUAL TO 35 MPH (SEE STANDARD DESIGN CRITERIA ON 16.1.9.1)

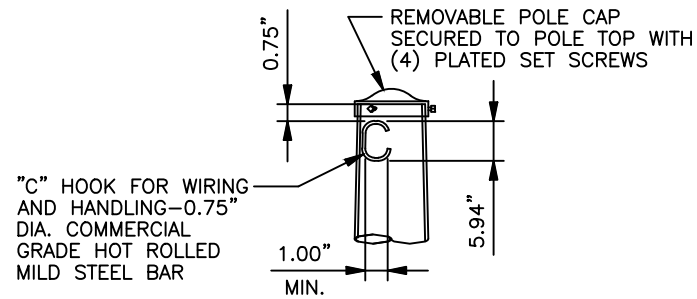
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CAD Ver.:	Scale: Units:

Sheet Revisions	
Date:	Comments:

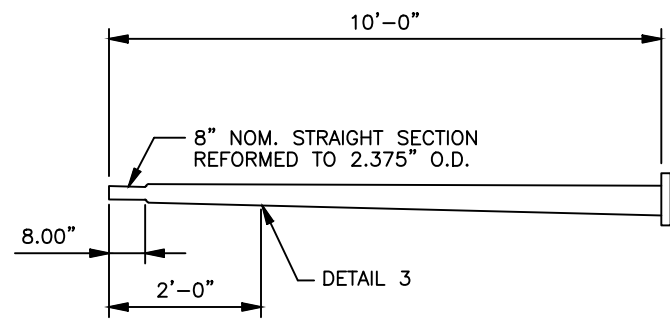
DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
 201 WEST COLFAX AVENUE
 DENVER, CO 80202
 PHONE: (720) 913-4501 FAX: (720) 913-4544

MAST ARM POLE LOADS
 SHEET 2
 Issued By:

STANDARD DRAWING NO.
 16.1.9.2
 Sheet No. 14 of 39



DETAIL 1 POLE TOP

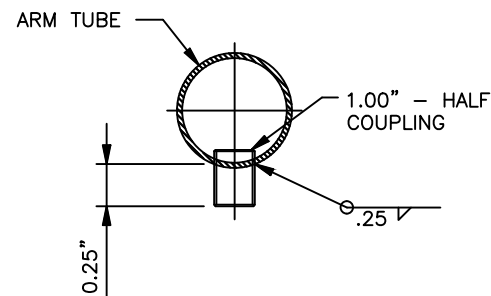


ARM RISE AFTER LOADING IS BETWEEN
-0° DEG. +2° DEG FROM THE HORIZONTAL.

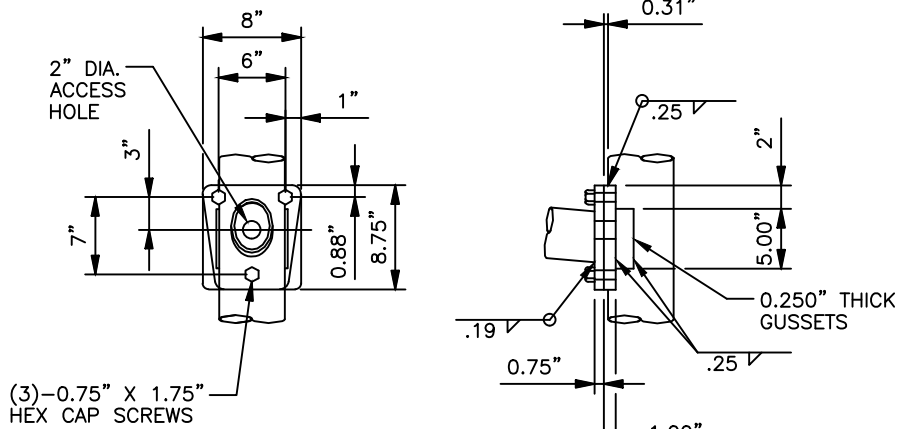
ARM SPAN "L" (FT)	FIXED END DIA. (IN)	FREE END DIA. (IN)	GA. 11
10	3.80	2.38	11

DETAIL 2 LUMINAIRE ARM DATA

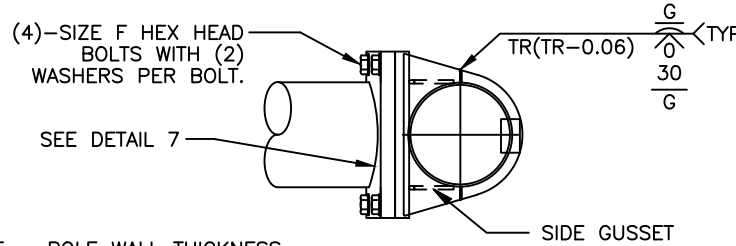
NOTE:
ONLY TO BE SUPPLIED
ON IDENTIFIED SIGNAL
MAST ARMS.



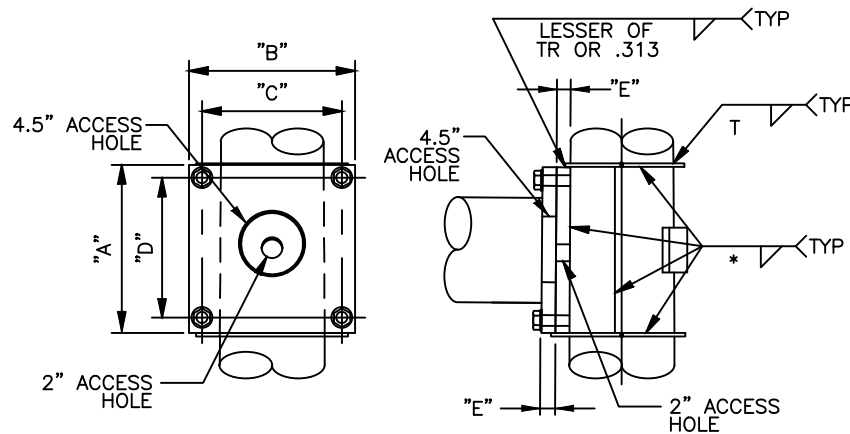
DETAIL 3 CAMERA COUPLING



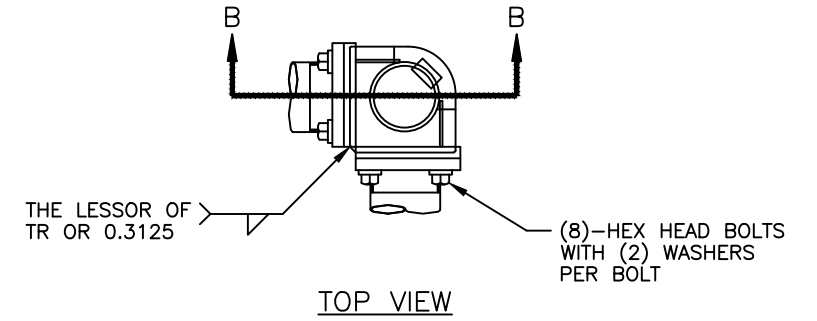
DETAIL 4 LUMINAIRE ARM ATTACHMENT



T = POLE WALL THICKNESS
TR = TOP & BOTTOM RING THICKNESS
TS = SIDE GUSSET THICKNESS
* = LESSER OF T, TS, OR .25



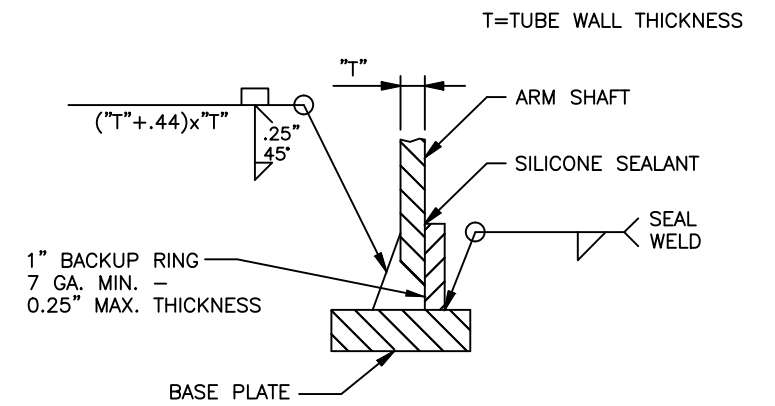
DETAIL 5 SIGNAL ARM ATTACHMENT



NOTE:
ALL WELDS ARE TYPICAL TO
DETAIL 5.



DETAIL 6 DOUBLE SIGNAL ARM ATTACHMENT



DETAIL 7 ARM PLATE WELD

NOTES:
SEE POLE DATA ON SHEET 16.1.11 FOR DIMENSIONS.

Computer File Information

Creation Date: Initials:
Full Path:
Drawing File Name:
CAD Ver.: Scale: Units:

Sheet Revisions

Date: Comments
06/22 REVISED ARM PLATE HOLE DIAMETER



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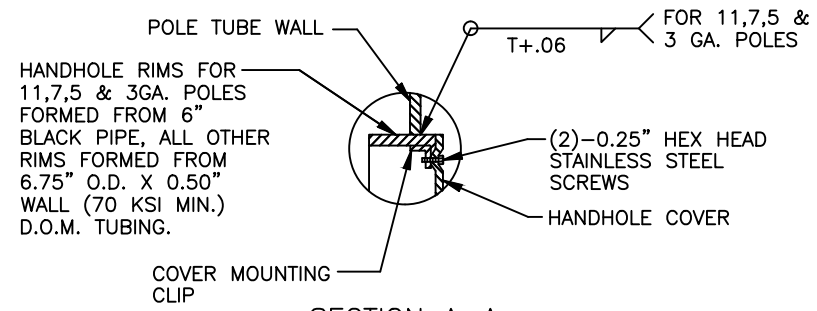
MOUNTING DETAILS
SHEET 1

Issued By:

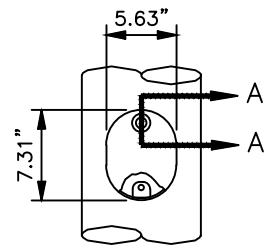
STANDARD DRAWING NO.

16.1.10.1

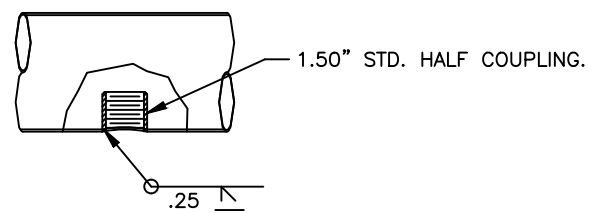
Sheet No. 15 of 39



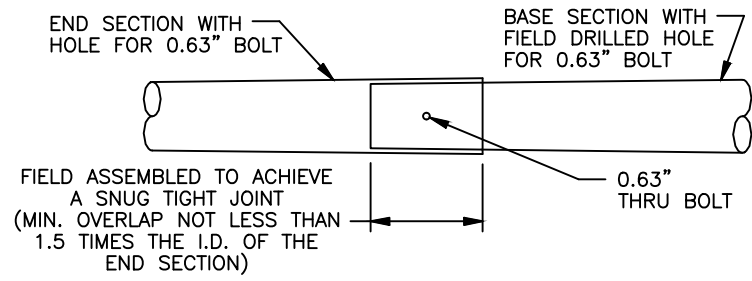
SECTION A-A



DETAIL 8 UPPER HANDHOLE

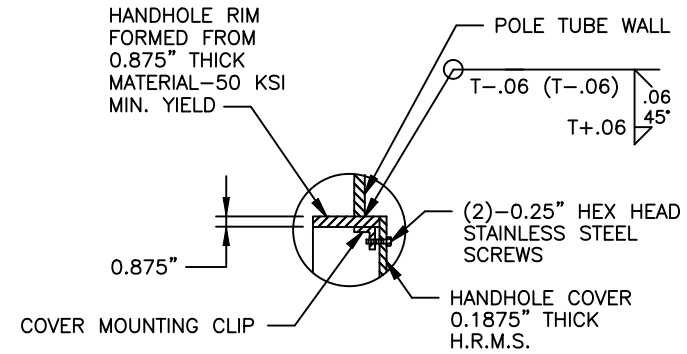


DETAIL 9 FLUSH COUPLING

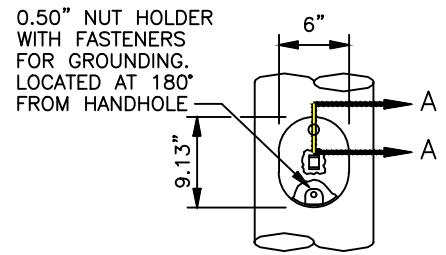


ITEM	BASE SECTION		END SECTION	
	LENGTH	GAUGE	LENGTH	GAUGE
45'	19.42'	.2500	28.15'	7
50'	19.54'	.2500	33.15'	7
55'	19.54'	.2812	38.15'	7
60'	24.89'	.3125	37.80'	7
65'	30.25'	.3125	37.44'	7
70'	35.61'	.3125	37.08'	7
75'	44.54'	.3438	33.15'	7

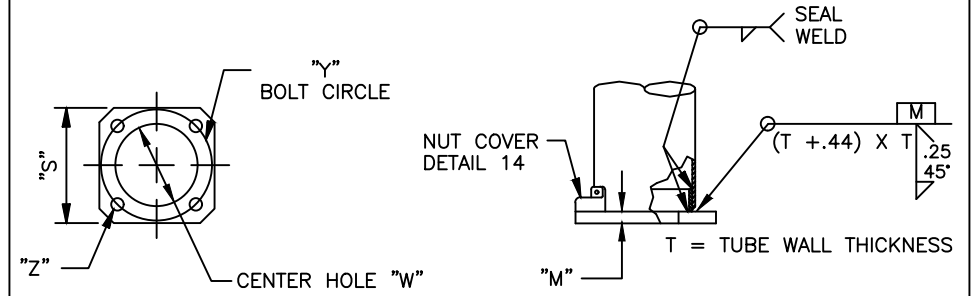
DETAIL 10 SIGNAL ARM SLIP JOINT



SECTION A-A



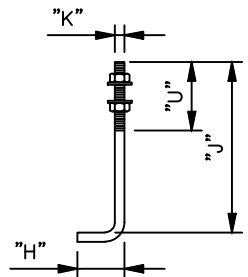
DETAIL 11 HANDHOLE



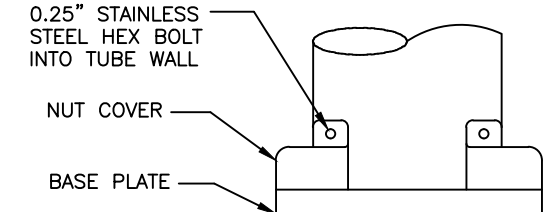
NOTE:
SEE POLE DATA ON SHEET 16.1.11 FOR DIMENSIONS.

DETAIL 12 POLE BASE

(4)-ANCHOR BOLTS WITH (2) HEX NUTS AND (2) WASHERS PER BOLT WITH THREADED END GALVANIZED TO AT LEAST 12".



DETAIL 13 ANCHOR BOLT



DETAIL 14 COVER NUT

REMOVABLE END CAP HELD IN PLACE WITH 4 STAINLESS STEEL SET SCREWS AND 2 STAINLESS STEEL THRU BOLTS.



DETAIL 15 SIGNAL ARM END CAP

Computer File Information	
Creation Date:	Initials:
Full Path:	
Drawing File Name:	
CAD Ver.:	Scale: Units:

Sheet Revisions	
Date:	Comments

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE

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DENVER, CO 80202

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

ISSUED BY:

MOUNTING DETAILS
SHEET 2

STANDARD DRAWING NO.
16.1.10.2
Sheet No. 16 of 39

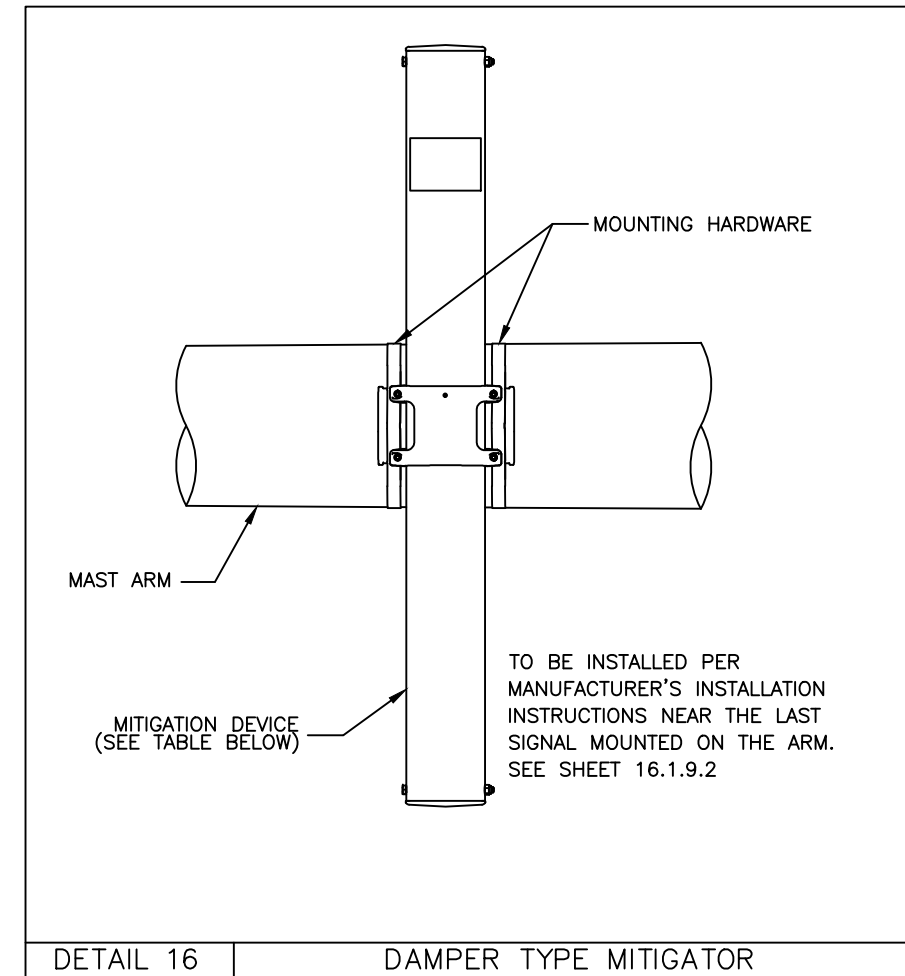
TABLE 1: POLE DATA

POLE SERIES	DESIGN NUMBER	SINGLE ARM SPAN (FT)	DOUBLE MAST ARMS		POLE TUBE				POLE BASE					ANCHOR BOLT			
			1st ARM SPAN (FT)	2nd ARM SPAN (FT)	BASE O.D. (IN)	TOP O.D. (IN)	LENGTH (FT)	THICK (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK "M" (IN)	CENTER HOLE "W" (IN)	HOLE "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "H" (IN)	THREAD LENGTH "U" (IN)
DC15	1	20, 25, 30, 35, & 40	N.A.	N.A.	15.50	10.60	35.00	.1875	21.00	20.00	2.00	13.00	2.25	2.00	84.00	6.00	10.00
DC15	2	45, 50 & 55	N.A.	N.A.	17.00	12.10	35.00	.2188	23.00	22.00	2.00	14.00	2.25	2.00	84.00	6.00	10.00
DC15	3	60, 65, & 70	N.A.	N.A.	19.50	14.60	35.00	.2500	26.00	25.00	2.00	14.00	2.25	2.00	84.00	6.00	10.00
DC15	4	N.A.	20 THRU 40	20 THRU 40	15.50	10.60	35.00	.2500	23.00	22.00	2.00	11.50	2.25	2.00	84.00	6.00	10.00
DC15	5	75'	N.A.	N.A.	19.50	14.60	35.00	.2500	27.50	26.50	2.00	15.00	2.25	2.00	84.00	6.00	10.00

MAXIMUM ARM LENGTH COMBINATION FOR DUAL CONFIGURATION ARE 40'-0" / 40'-0". ARM LENGTHS EXCEEDING THESE WILL REQUIRE A SPECIAL POLE DESIGN.

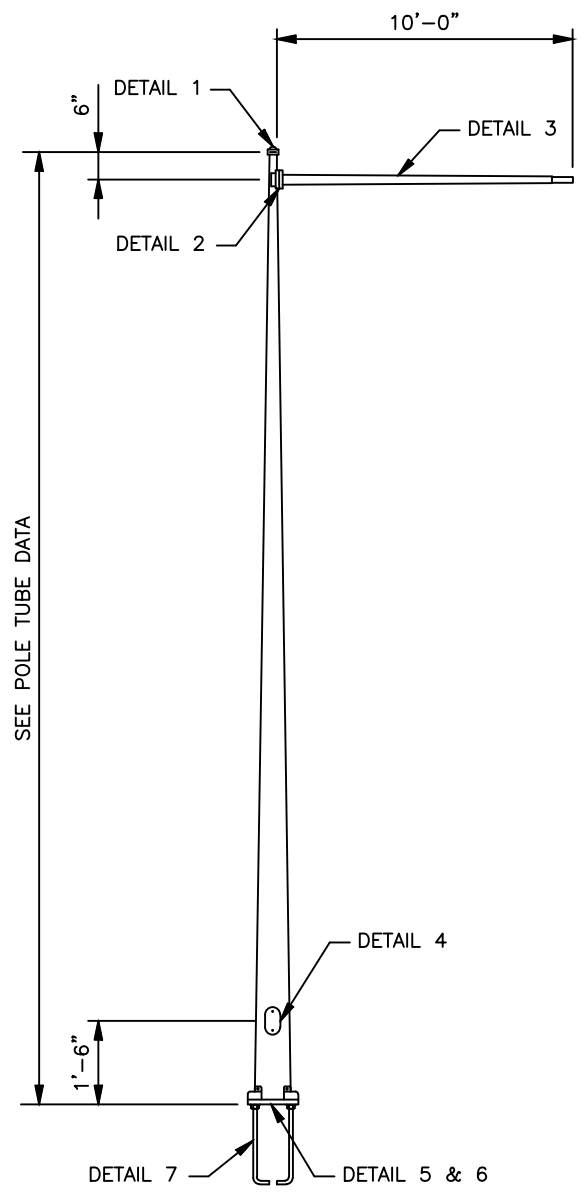
TABLE 2: SIGNAL ARM DATA

SIGNAL ARM TUBE				SIGNAL ARM SIMPLEX					
MAXIMUM ARM SPAN (FT)	FIXED END DIA. (IN)	SMALL END DIA. (IN)	GAUGE	A X B (IN)	C X D (IN)	THICKNESS "E" (IN)	BOLT SIZE "F" (IN)	GUSSET THICKNESS (IN)	ANGLE OF RISE IN ARM
20	9.00	6.20	7	21.75 X 21.75	18.00 X 18.00	2.00	1.50 X 3.75	0.375	0.00°
25	10.00	6.50	7	21.75 X 21.75	18.00 X 18.00	2.00	1.50 X 3.75	0.375	0.50°
30	12.00	7.80	5	21.75 X 21.75	18.00 X 18.00	2.00	1.50 X 3.75	0.375	0.50°
35	12.50	7.60	5	21.75 X 21.75	18.00 X 18.00	2.00	1.50 X 3.75	0.375	1.00°
40	13.00	6.90	3	21.75 X 21.75	18.00 X 18.00	2.00	1.50 X 3.75	0.375	1.50°
45	14.00	8.06	SEE DETAIL 10 SHEET 16.1.10.2	23.25 X 23.25	19.50 X 19.50	2.00	1.50 X 4.25	0.500	1.50°
50	15.00	8.36	SEE DETAIL 10 SHEET 16.1.10.2	23.25 X 23.25	19.50 X 19.50	2.00	1.50 X 4.25	0.500	1.50°
55	15.00	7.66	SEE DETAIL 10 SHEET 16.1.10.2	23.25 X 23.25	19.50 X 19.50	2.00	1.50 X 4.25	0.500	2.00°
60	15.75	7.71	SEE DETAIL 10 SHEET 16.1.10.2	26.25 X 26.25	22.50 X 22.50	2.00	1.50 X 4.25	0.500	2.00°
65	16.50	7.76	SEE DETAIL 10 SHEET 16.1.10.2	26.25 X 26.25	22.50 X 22.50	2.00	1.50 X 4.25	0.500	2.00°
70	17.25	7.81	SEE DETAIL 10 SHEET 16.1.10.2	26.25 X 26.25	22.50 X 22.50	2.00	1.50 X 4.25	0.500	2.50°
75	17.50	7.81	SEE DETAIL 10 SHEET 16.1.10.2	26.25 X 26.25	22.50 X 22.50	2.00	1.50 X 4.25	0.500	3.00°

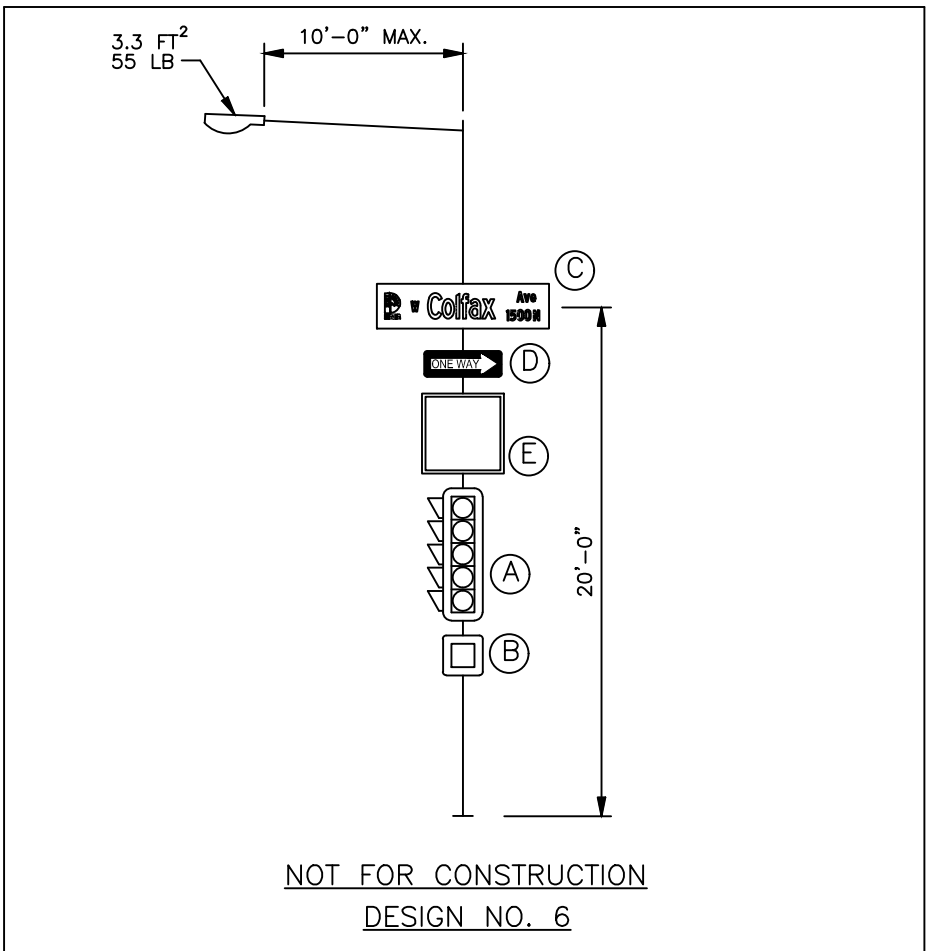
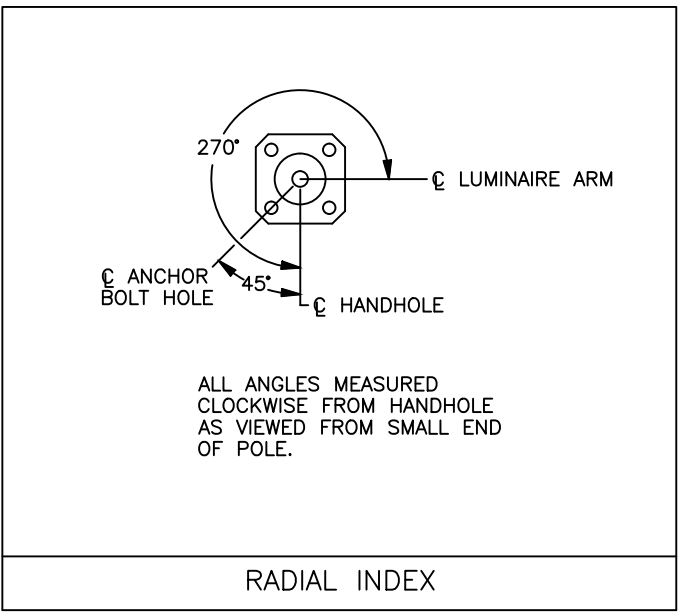


WHEN A MITIGATION DEVICE IS REQUIRED BY THESE STANDARDS (SEE SHEET 16.1.9.1), THE FOLLOWING TABLE SHALL BE FOLLOWED:

ARM LENGTH (FT)	ACCEPTABLE MITIGATION DEVICES
0-55	STOCKBRIDGE TYPE, FREY MAST ARM DAMPER, VALMONT TR-1 MITIGATOR, OR APPROVED EQUAL
>55	FREY MAST ARM DAMPER, VALMONT TR-1 MITIGATOR, OR APPROVED EQUAL



MATERIAL DATA		
COMPONENT	ASTM DESIGNATION	MIN. YIELD (KSI)
TAPERED SHAFTS	A595 GR. A	55
POLE BASE	A36	36
ARM ATTACHMENTS	A36	36
LUM. CONNECTING BOLTS	A325	
ANCHOR BOLTS	F1554	55
GALVANIZING-HARDWARE	F2329	
FINISH DATA		
SYSTEM:	CUSTOMER SPECIFIED	
BASE COAT:	HOT-DIP GALVANIZED TO ASTM A123	
PRIME COAT:	HIGH BUILD EPOXY POWDER	
FINISH COAT:	TGIC POWDER	
COLOR:	GREEN	
SPEC:	F-540AC	



DEVICE	DESCRIPTION	PROJ. AREA (FT²)	WEIGHT (LBS)
A	DUAL 12"-5 SEC. SIGNAL	28.9	150
B	SINGLE 16" PED SIGNAL	4.5	60
C	96" X 22" STREET NAME SIGN	14.67	50
D	36" X 12" ONE WAY SIGN	3.0	10
E	38" X 38" BLANK OUT SIGN	10.03	120

SIGNAL POLE DESIGN CRITERIA:

THE SIGNAL POLE WITHOUT MAST ARM STRUCTURES SHOWN ON THESE DRAWINGS HAVE BEEN DESIGNED IN ACCORDANCE WITH THE LOADING AND NOMINAL STRENGTH REQUIREMENTS OF THE 2015 AASHTO "LRFD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, FIRST EDITION" SLTS-1 INCLUDING LATEST INTERIMS.

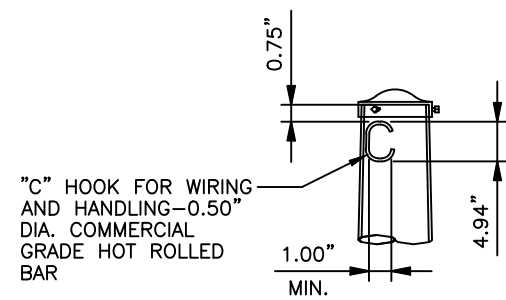
STRUCTURES HAVE BEEN DESIGNED FOR WIND LOADS USING AN ULTIMATE WIND VELOCITY OF 120 MPH WITH A MEAN RECURRENCE INTERVAL OF 1700 YEARS. IN ACCORDANCE WITH AASHTO SECTION 11.4, FATIGUE IS NOT CONSIDERED.

ADDITIONAL TRAFFIC SIGNS AND/OR MULTIPLE B.O.S. NOT LISTED ON DETAIL DESIGN NO. 6 AS SHOWN IN THIS SHEET WILL REQUIRE A SPECIAL DESIGN BY THE CONTRACTOR.

POLE DATA															
QTY.	POLE SERIES	DESIGN NUMBER	POLE TUBE				POLE BASE				ANCHOR BOLT				
			BASE O.D. (IN)	TOP O.D. (IN)	LENGTH (FT)	THICK (IN)	SQUARE "S" (IN)	BOLT CIRCLE "Y" (IN)	THK "M" (IN)	HOLE/SLOT "Z" (IN)	DIA. "K" (IN)	LENGTH "J" (IN)	HOOK "L" (IN)	THREAD (#/IN)	THREAD LENGTH "U" (IN)
	DC15	6	8.75	3.85	35.00*	0.1793	12.00	12.50	1.25	1.38 X 1.94	1.25	42.00	6.00	7.00	6.00

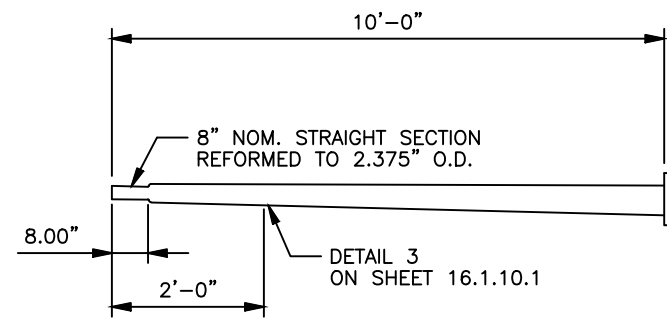
*SUBJECT TO APPROVAL OF THE DOTI ENGINEER, POLE LENGTH MAY BE REDUCED TO 30 FEET TO MITIGATE OVERHEAD CONFLICTS

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>SIGNAL POLE DETAILS NO MAST ARM SHEET 1</p> <p>Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.12.1	
Full Path:						Sheet No. 18 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					



DETAIL 1

POLE TOP

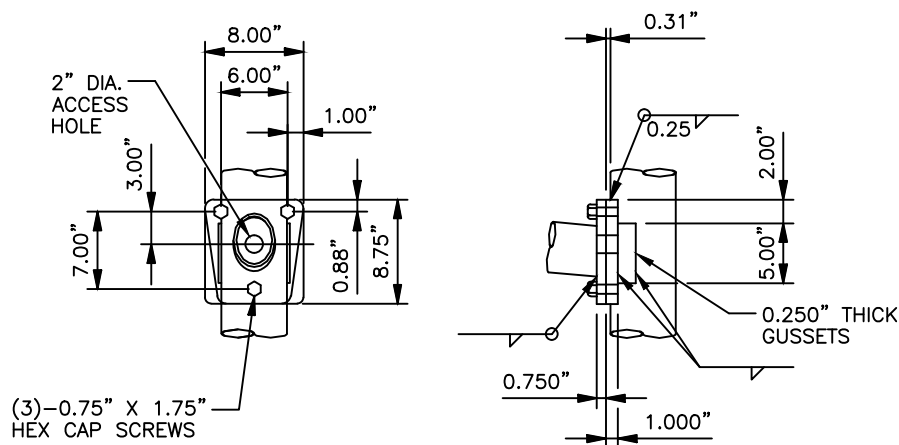


ARM RISE AFTER LOADING IS BETWEEN
-0° DEG. +2° DEG FROM THE HORIZONTAL.

NOTE: 4'-0" LUMINAIRE ARM MAY BE SUBSTITUTED FOR 10'-0"
LUMINAIRE ARM WHERE AN OVERHEAD CONFLICT MAY EXIST.
SUBSTITUTION SHALL BE SUBJECT TO APPROVAL BY THE CITY &
COUNTY OF DENVER DOTI ENGINEER

DETAIL 3

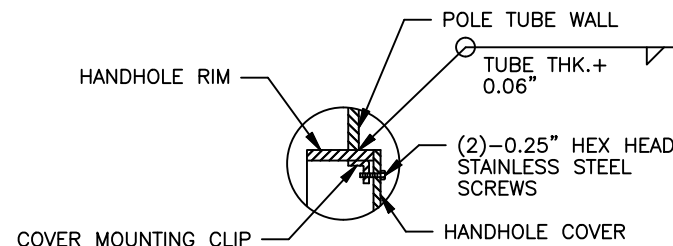
LUMINAIRE ARM ATTACHMENT



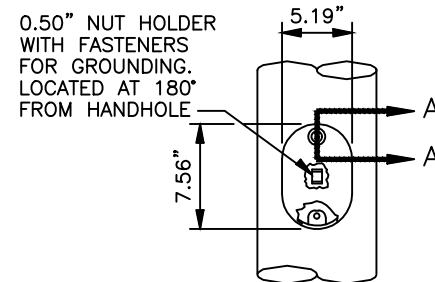
(3)-0.75" X 1.75"
HEX CAP SCREWS

DETAIL 2

LUMINAIRE ARM ATTACHMENT

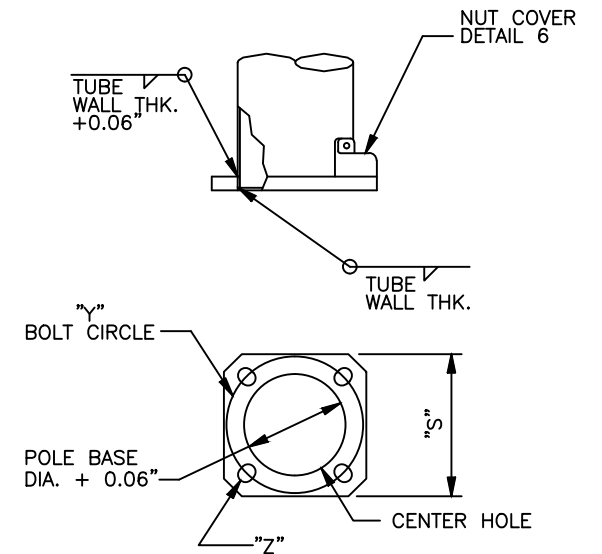


SECTION A-A



DETAIL 4

HANDHOLE

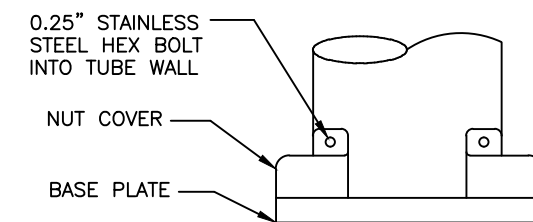


NOTE:

SEE POLE DATA ON SHEET 16.1.12.1 FOR DIMENSIONS.

DETAIL 5

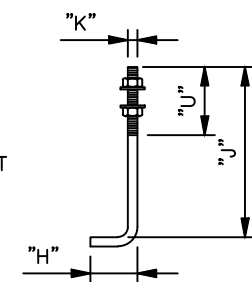
POLE BASE



DETAIL 6

NUT COVER

(4)-ANCHOR BOLTS WITH (2)
HEX NUTS AND (2) WASHERS
PER BOLT WITH THREADED
END GALVANIZED TO AT LEAST
12.00".



DETAIL 7

ANCHOR BOLT

Computer File Information

Creation Date: Initials:
Full Path:
Drawing File Name:
CAD Ver.: Scale: Units:

000

Sheet Revisions

Date:	Comments:



DEPARTMENT OF TRANSPORTATION
& INFRASTRUCTURE

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DENVER, CO 80202
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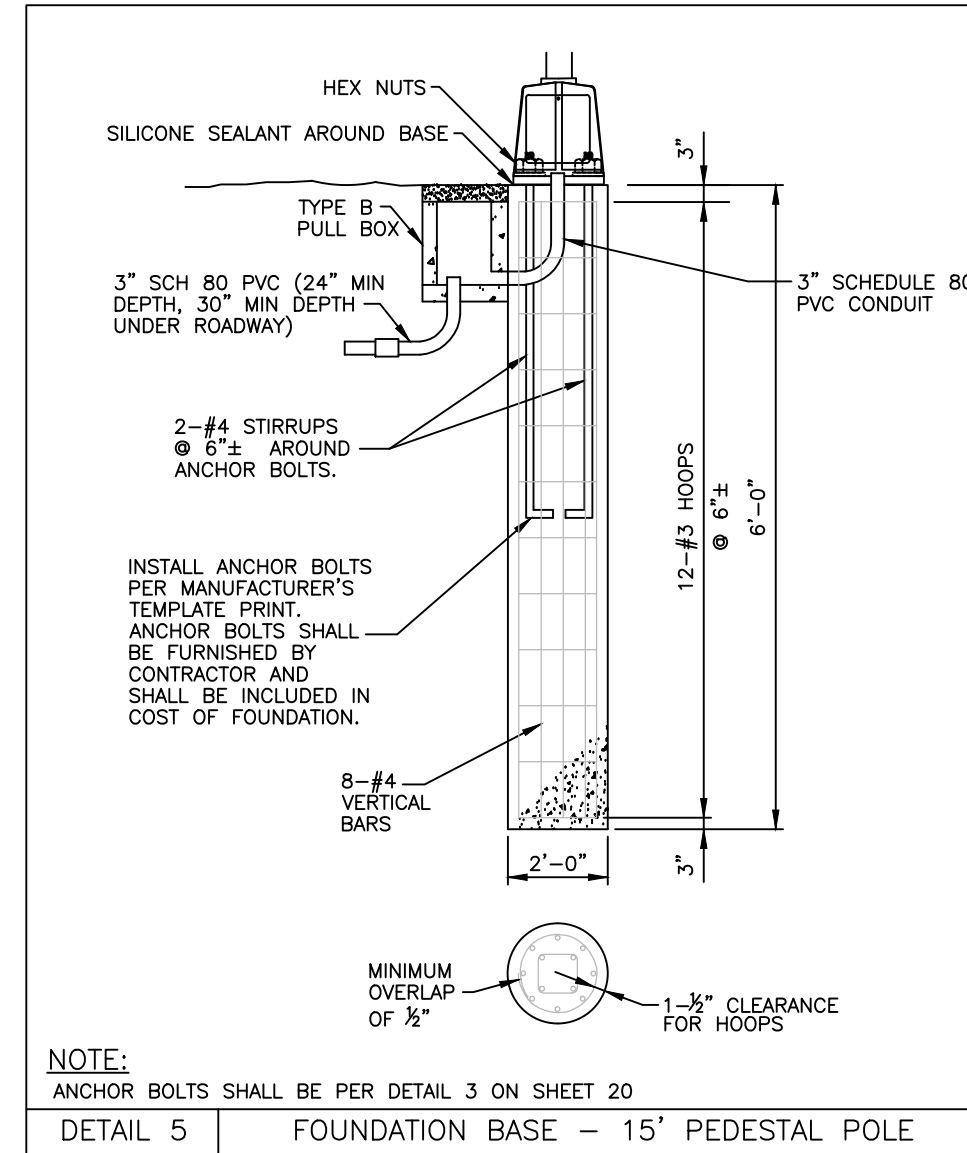
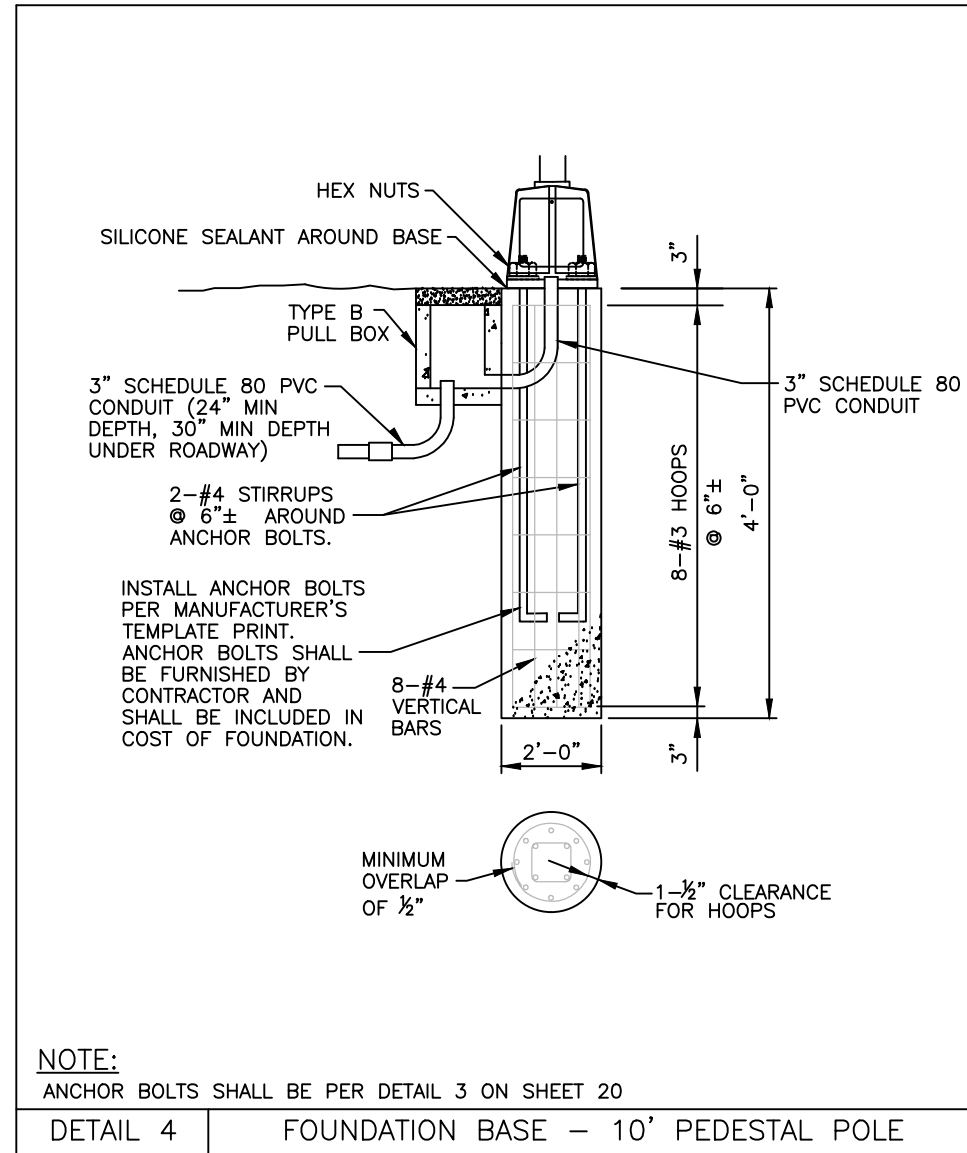
SIGNAL POLE DETAILS
NO MAST ARM
SHEET 2

Issued By:

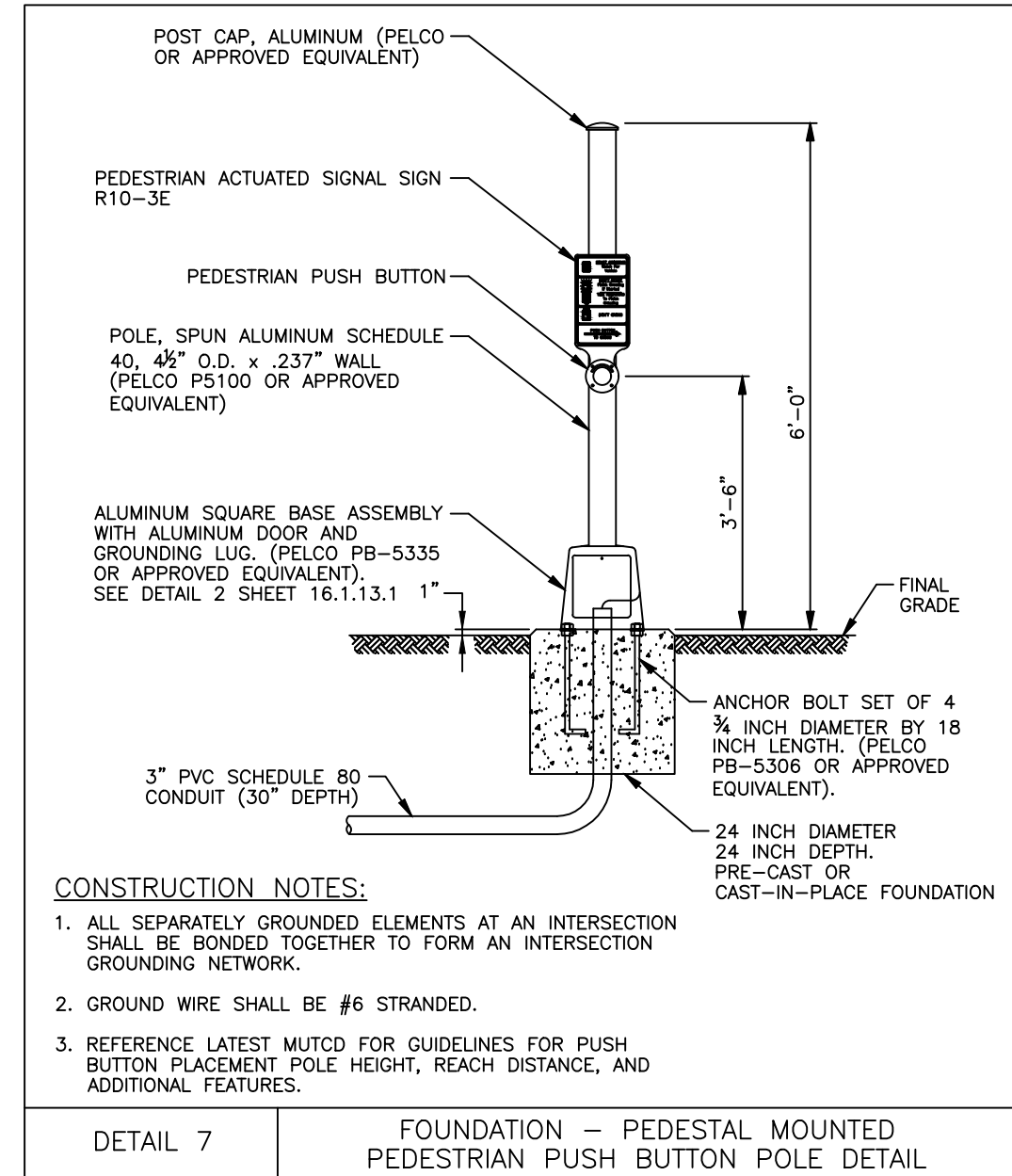
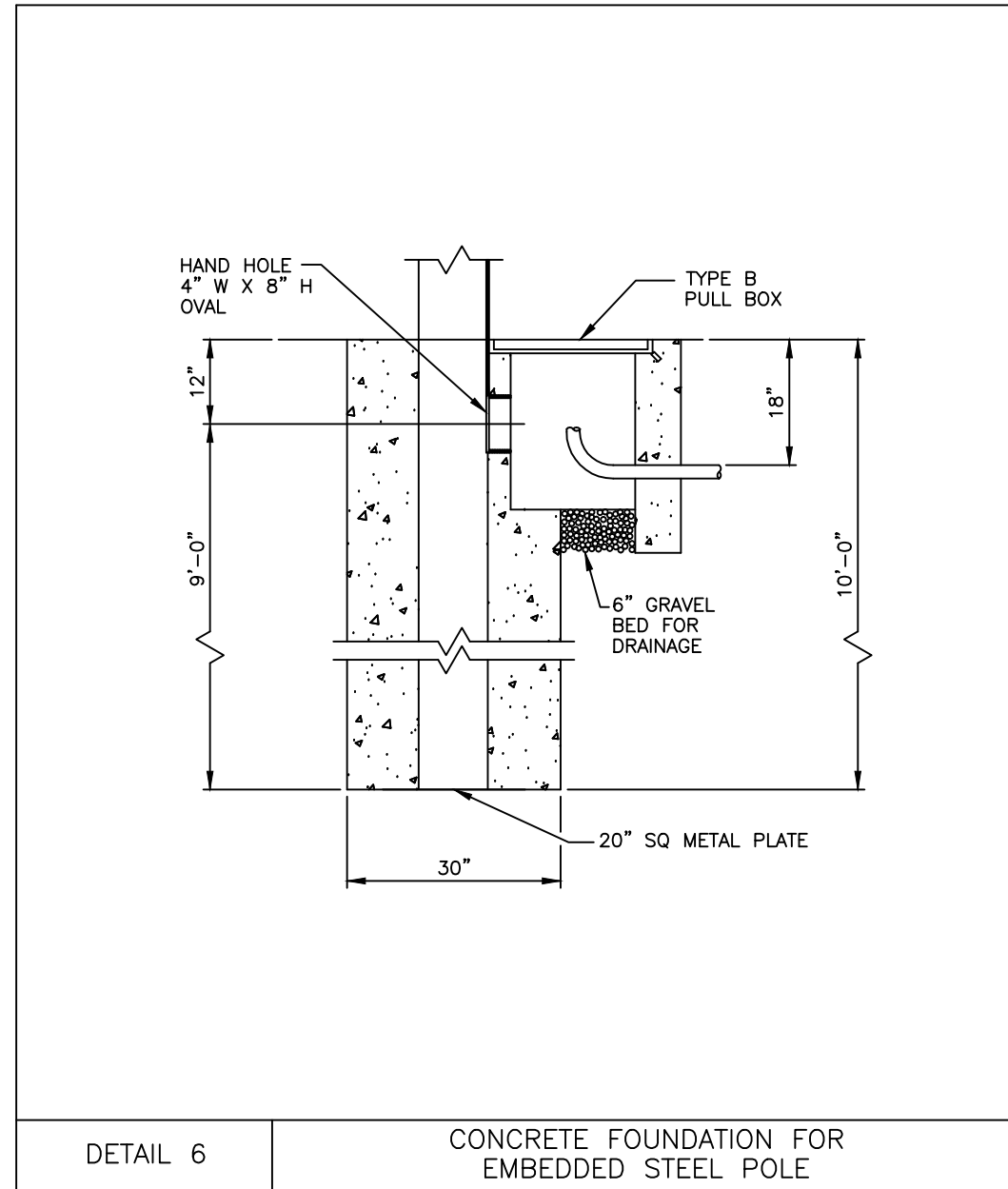
STANDARD DRAWING NO.

16.1.12.2

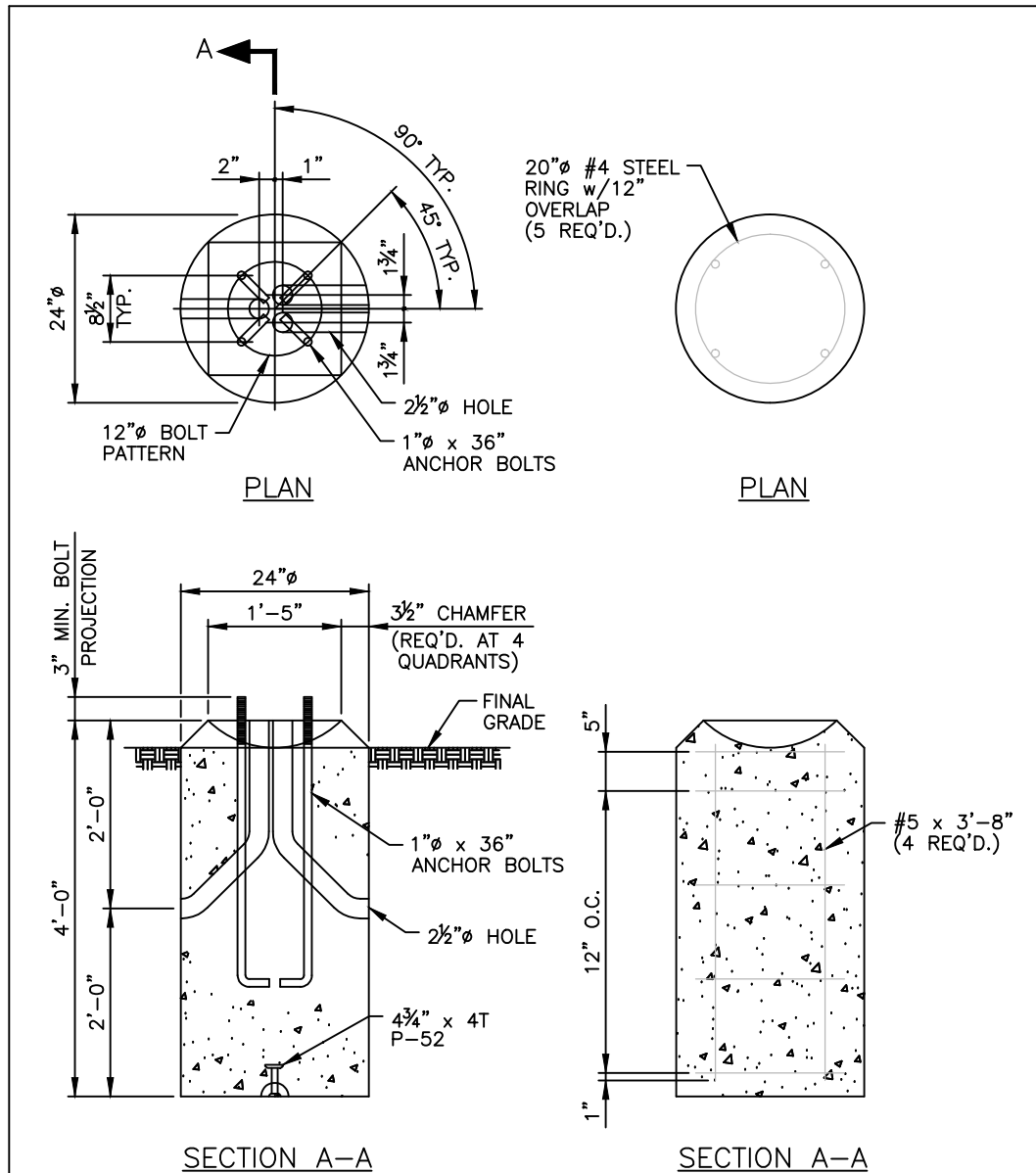
Sheet No. 19 of 39



Computer File Information		Sheet Revisions		 DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	PEDESTAL POLE DETAILS SHEET 2	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.13.2	
Full Path:						Sheet No. 21 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:				Issued By:	



Computer File Information		Sheet Revisions		 DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	PED PUSH POLE/FOUNDATION AND EMBEDDED STEEL POLE FOUNDATION DETAILS		STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:		Issued By:		16.1.14	
Full Path:							Sheet No. 22 of 39	
Drawing File Name:								
CAD Ver.:	Scale:	Units:						



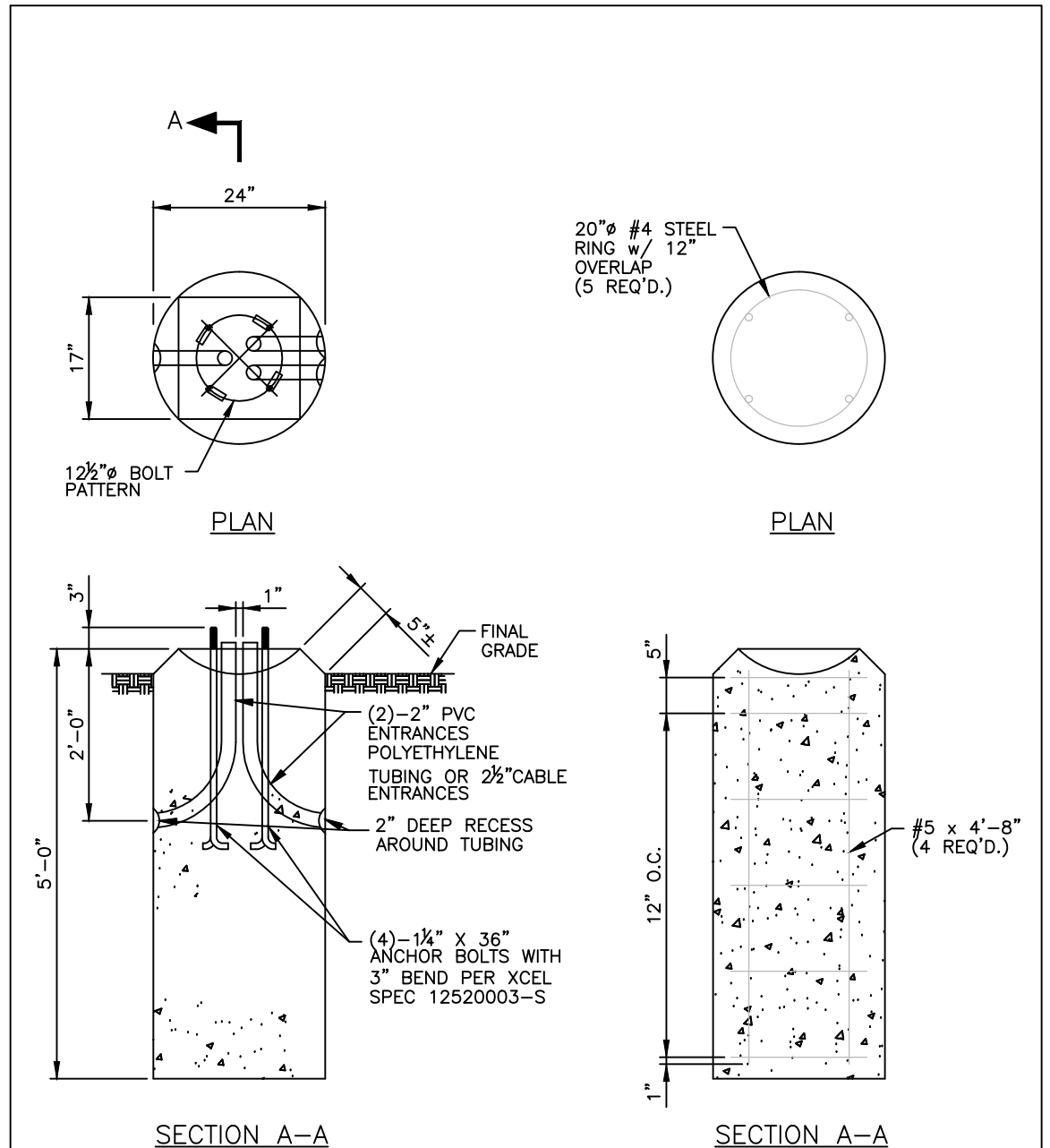
MATERIALS

- 4 - #5 VERTICAL REINFORCING BARS 3'-8" LONG.
- 5 - #4 HOOPS, 20" DIAMETER w/ 12" OVERLAP.
- 4 - 1" x 36" ANCHOR BOLTS w/ 3" BEND PER XCEL SPEC. 12520000-5.
- CONCRETE SHALL BE 6000 PSI. FINISH SHALL BE SMOOTH.
- CONCRETE VOLUME SHOULD BE APPROX. 0.459 CUBIC YARDS.
- 3 - 2" POLYETHYLENE TUBING OR 2 1/2" CABLE ENTRANCES.

DETAIL 8

STREET LIGHT POLE BASE

* FOR INFORMATION ONLY *



**PRECAST FOUNDATION
(NO MAST ARM)**

NOTE:

- TO BE USED ONLY ON XCEL OWNED TRAFFIC STREET LIGHT POLE (NO MAST ARM) AT A SIGNALIZED INTERSECTION. CITY OWNED TRAFFIC STREET LIGHT POLE (NO MAST ARM) FOUNDATION MUST FOLLOW STANDARD DETAIL SHEET 16.1.16.

DETAIL 9

PRECAST STREET LIGHT FOUNDATION WITH POLE MOUNTS
TRAFFIC SIGNAL POLE (NO MAST ARM)

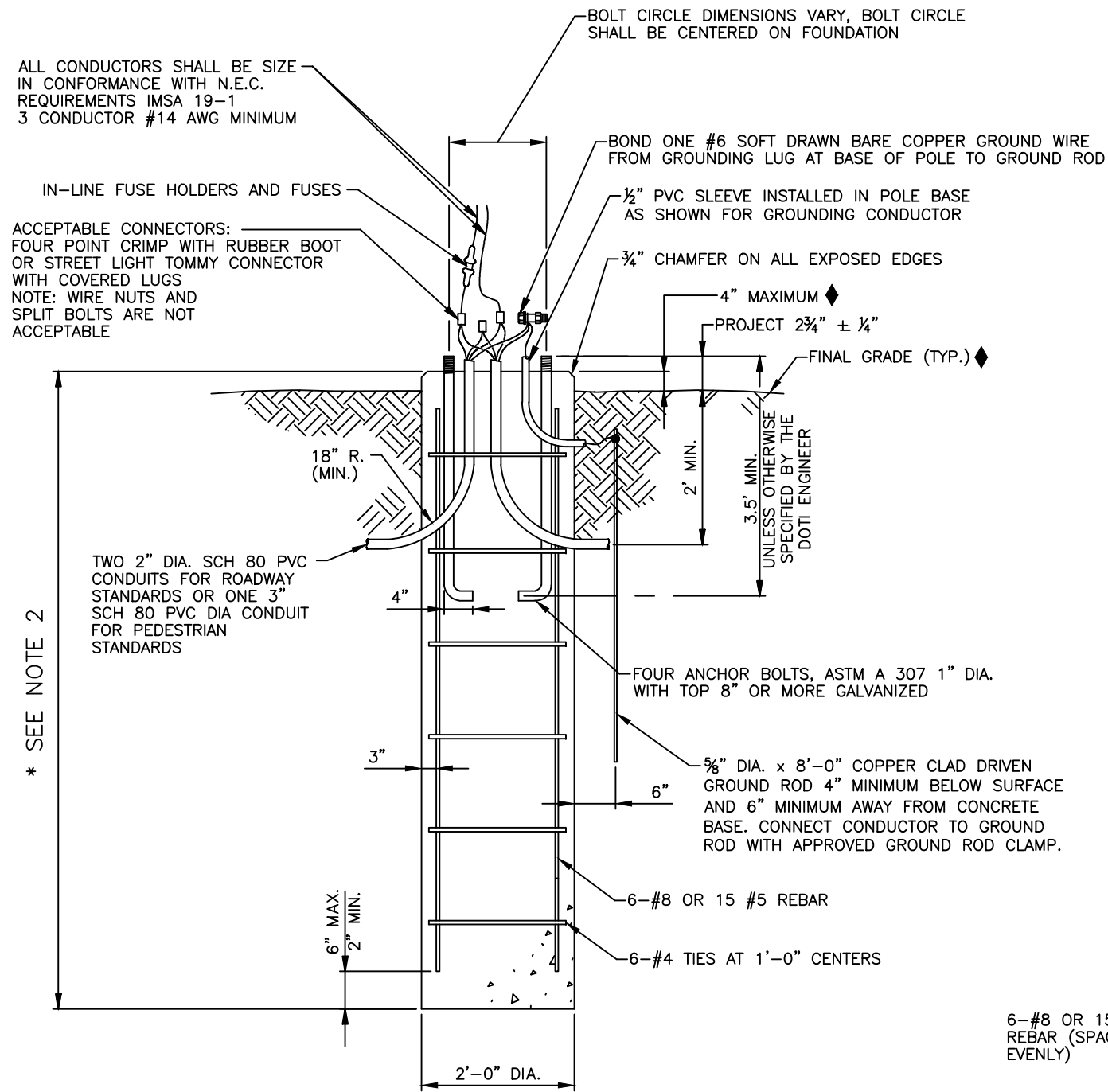
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CAD Ver.:	Scale: Units:

Sheet Revisions	
Date:	Comments

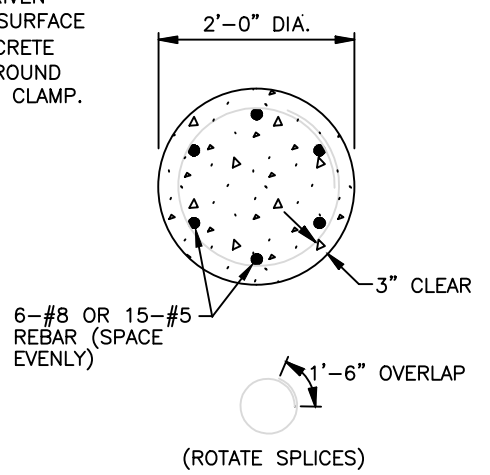
DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
201 WEST COLFAX AVENUE
DENVER, CO 80202
PHONE: (720) 913-4501 FAX: (720) 913-4544

FOUNDATIONS FOR:
XCEL FACILITIES AND
MID BLOCK STREET LIGHT POLES
Issued By:

STANDARD DRAWING NO.
16.1.15
Sheet No. 23 of 39



TRAFFIC SIGNAL LIGHT POLE – STEEL (NO MASTARM)



TYPICAL FOUNDATION SECTION

NOTES:

1. ALL FOUNDATION COMPONENTS SHALL FIT AND ACCOMMODATE THE REQUIREMENTS OF THE STREET LIGHT STANDARD AS PER STANDARD DETAIL SHEETS 16.1.12.1 AND 16.1.12.2.
- *2. FOUNDATION SHALL BE 7 FT. FOR LIGHT STANDARDS 20 FT. THRU 40 FT., AND 6 FT. FOR LESS THAN 20 FT.

THE FOUNDATION DEPTHS AND FACTORED CAPACITIES HEREIN ASSUME THAT SIGNALS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING SOIL PARAMETERS:

SOIL DENSITY γ = 110 LB./CU.FT.
 SOIL COHESION = 750 LB./SQ.FT. FOR MEDIUM STIFF COHESIVE SOIL WITH $N > 8$ (ASTM D1586 STANDARD PENETRATION TEST)
 SOIL ϕ ANGLE = 30° FOR MEDIUM DENSE COHESIONLESS SOIL WITH $N > 15$ (ASTM D1586 STANDARD PENETRATION TEST)
 SF = 1.25 FOR TORSIONAL RESISTANCE AND 3.0 FOR FLEXURAL RESISTANCE.

MAXIMUM LOADING OF THE ABOVE REFERENCED POLES WAS DETERMINED USING BROM'S OVERTURNING METHOD AND SHALL BE AS FOLLOWS:

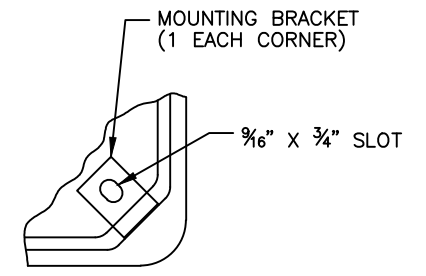
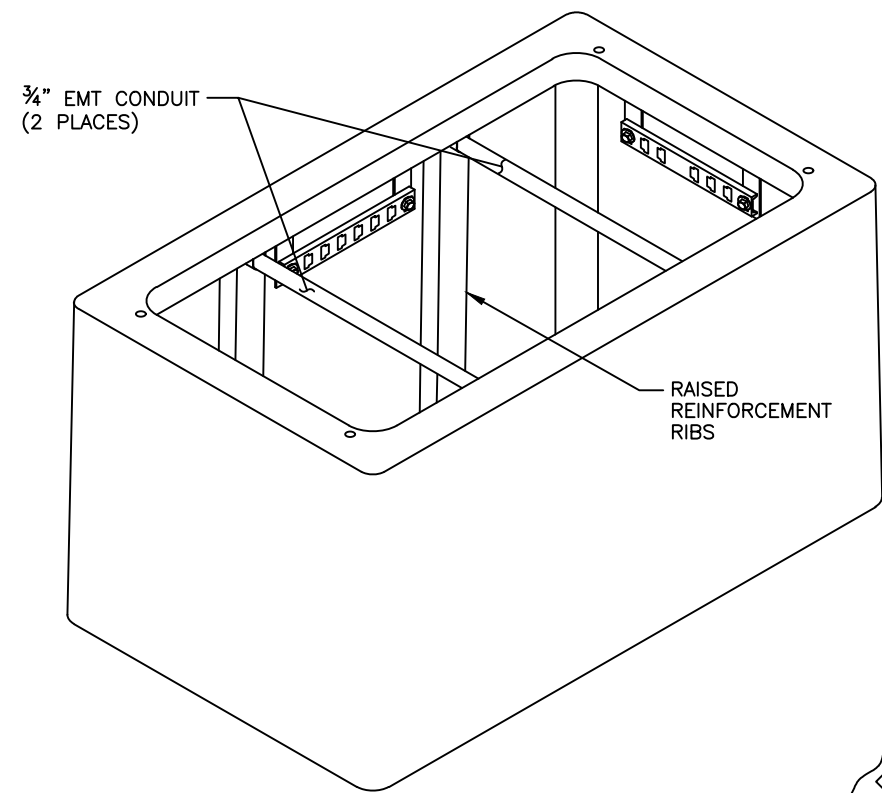
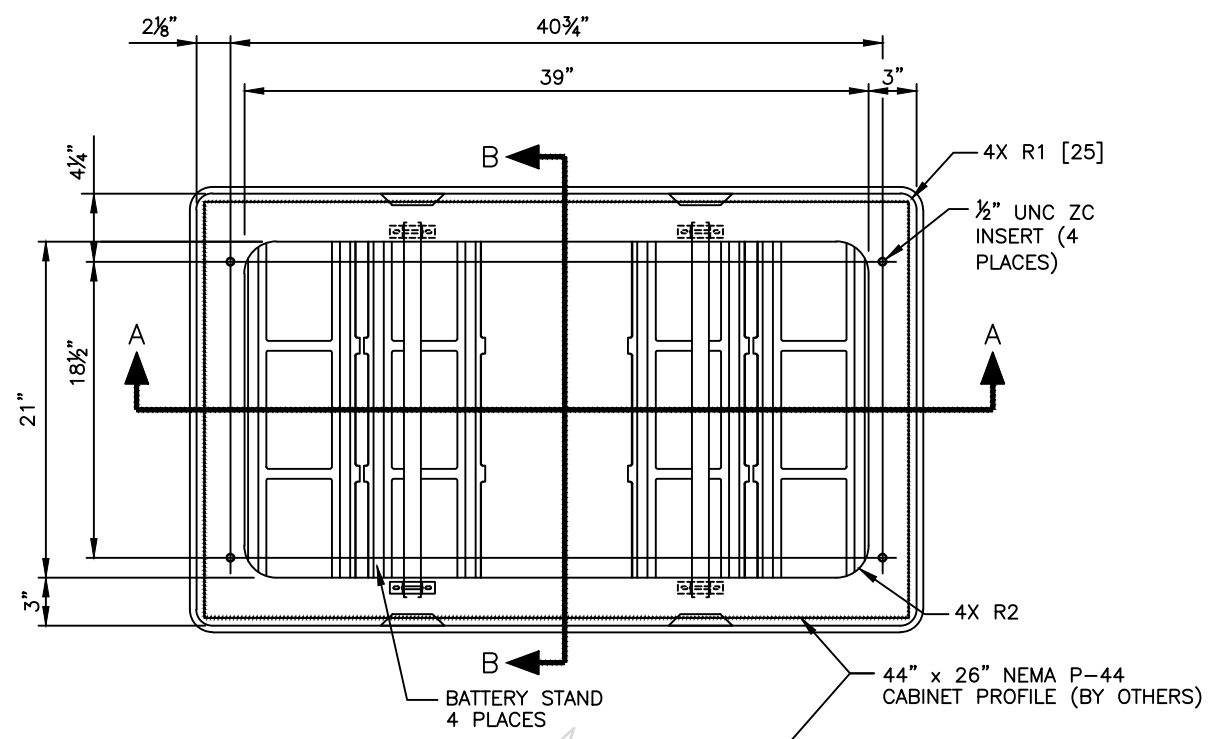
FOUNDATION DEPTH	6 FT	7 FT
MAXIMUM POLE HEIGHT (FT)	20	40
FACTORED FLEXURE CAPACITY ϕM_n (K-FT)	20	35
FACTORED SHEAR CAPACITY ϕV_n (K-FT)	2	3.5

3. CONCRETE SHALL BE AIR ENTRAINED CDOT CLASS BZ CONCRETE IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS. REINFORCING STEEL SHALL BE GRADE 60.
 4. FOUNDATIONS FOR LIGHT STANDARDS HIGHER THAN 40 FT. OR LIGHT STANDARDS WITH MULTIPLE LUMINAIRES OR BANNERS, OR VARYING SOIL OR WIND CONDITIONS, SHALL BE DESIGNED BY THE CONTRACTOR'S ENGINEER AND SHOWN ON THE PLANS.
- ◆ WHERE FOUNDATION IS LOCATED IN THE SIDEWALK, THE TOP OF THE FOUNDATION SHALL BE FLUSH WITH THE TOP OF THE SIDEWALK CONFORMING TO ADA REQUIREMENTS.

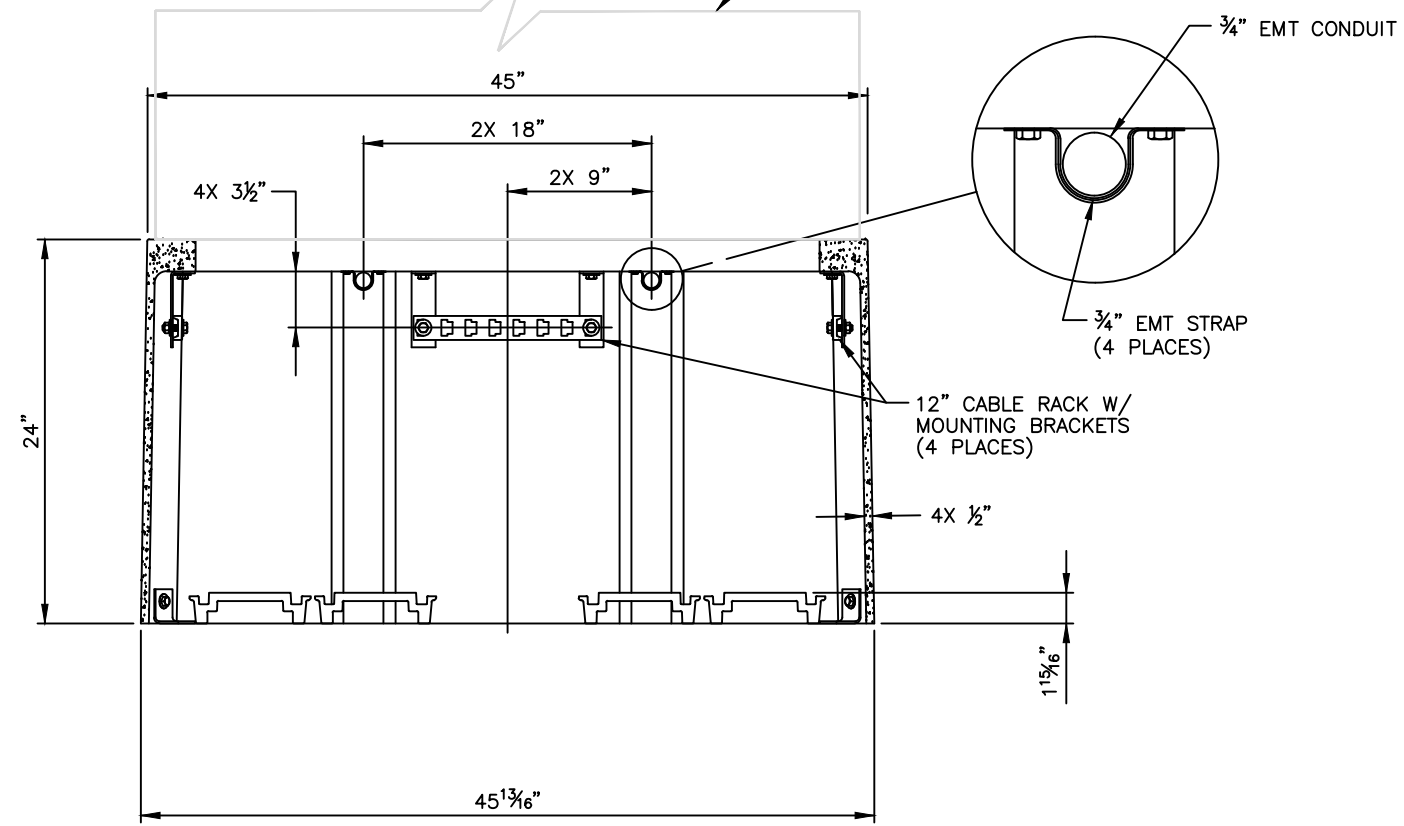
ALL CONDUCTORS SHALL BE SIZE IN CONFORMANCE WITH N.E.C. REQUIREMENTS IMSA 19-1 3 CONDUCTOR #14 AWG MINIMUM

IN-LINE FUSE HOLDERS AND FUSES
 ACCEPTABLE CONNECTORS:
 FOUR POINT CRIMP WITH RUBBER BOOT OR STREET LIGHT TOMMY CONNECTOR WITH COVERED LUGS
 NOTE: WIRE NUTS AND SPLIT BOLTS ARE NOT ACCEPTABLE

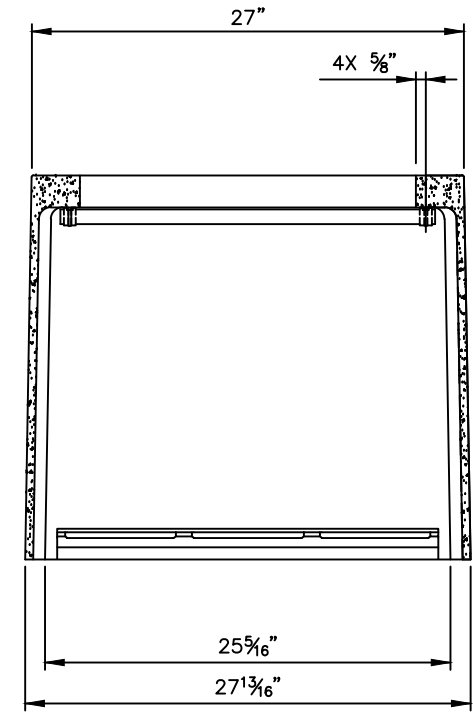
* SEE NOTE 2



VIEW B-B
4 PLACES



SECTION A-A

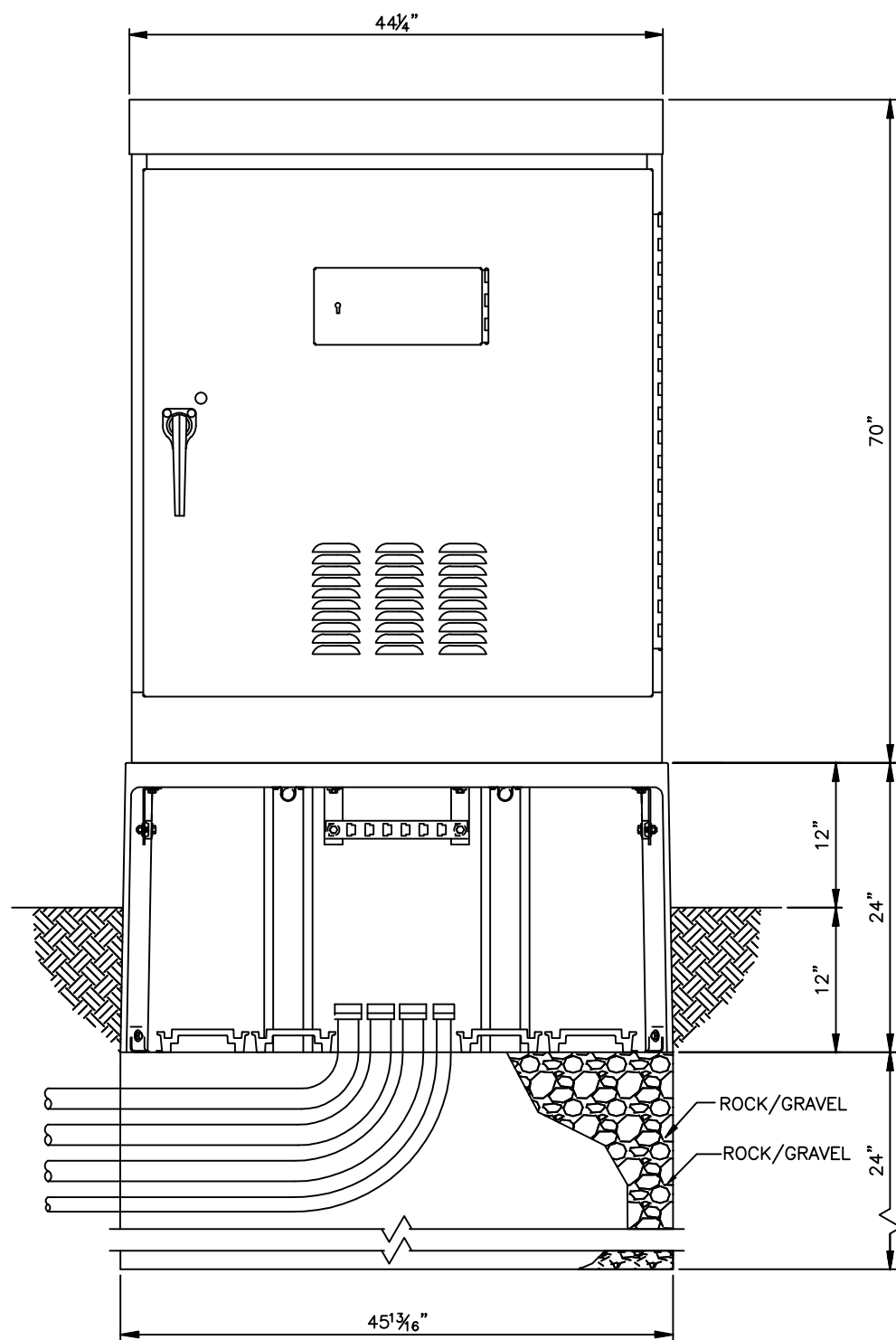


SECTION B-B

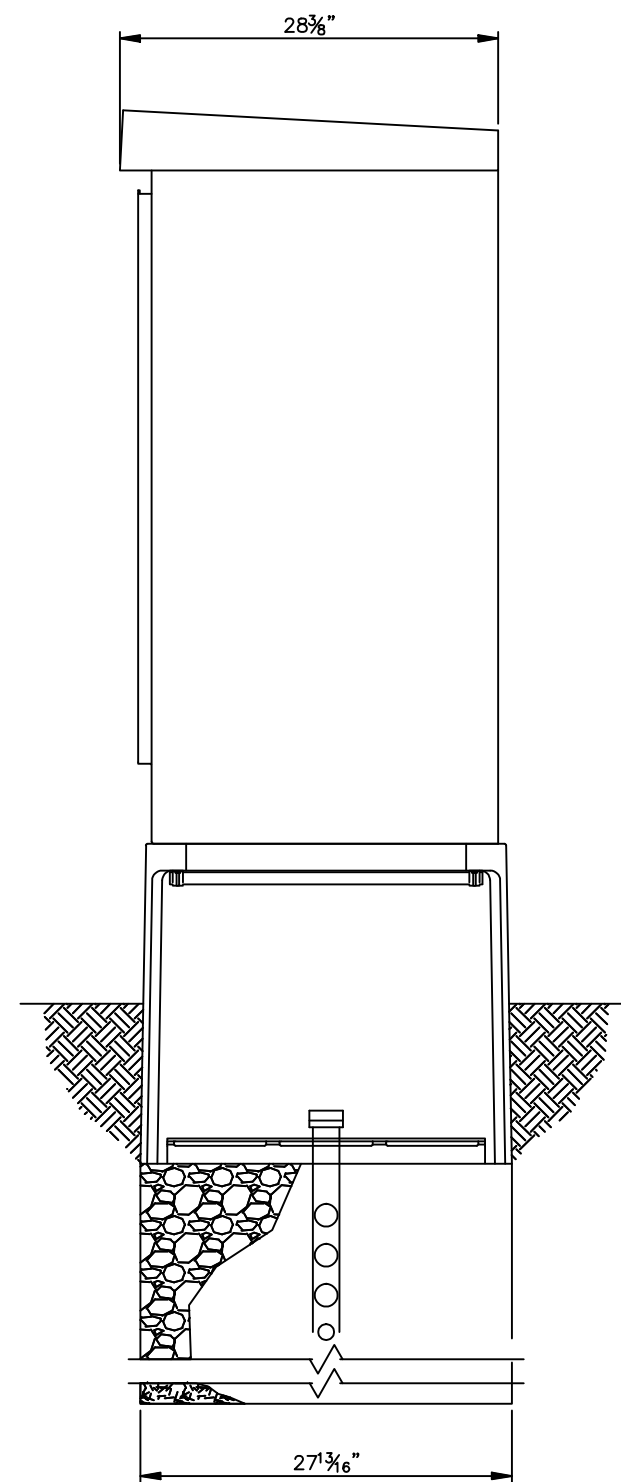
NOTES:

1. BASE DETAILS ARE FOR A NEMA P-44 CABINET ONLY.
2. BASE SHALL BE CONSTRUCTED FROM LIGHTWEIGHT POLYMER CONCRETE ONLY.
3. BASE SHALL MEET OR EXCEED ASTM D-2444 IMPACT RESISTANCE TESTING.
4. BASE SHALL MEET OR EXCEED ASTM METHOD D-543, SECTION 7, PROCEDURE 1 FOR CHEMICAL RESISTANCE.
5. BASE SHALL BE "UL" LISTED.

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Full Path:							
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CAD Ver.:	Scale:	Units:					Sheet No. 25 of 39

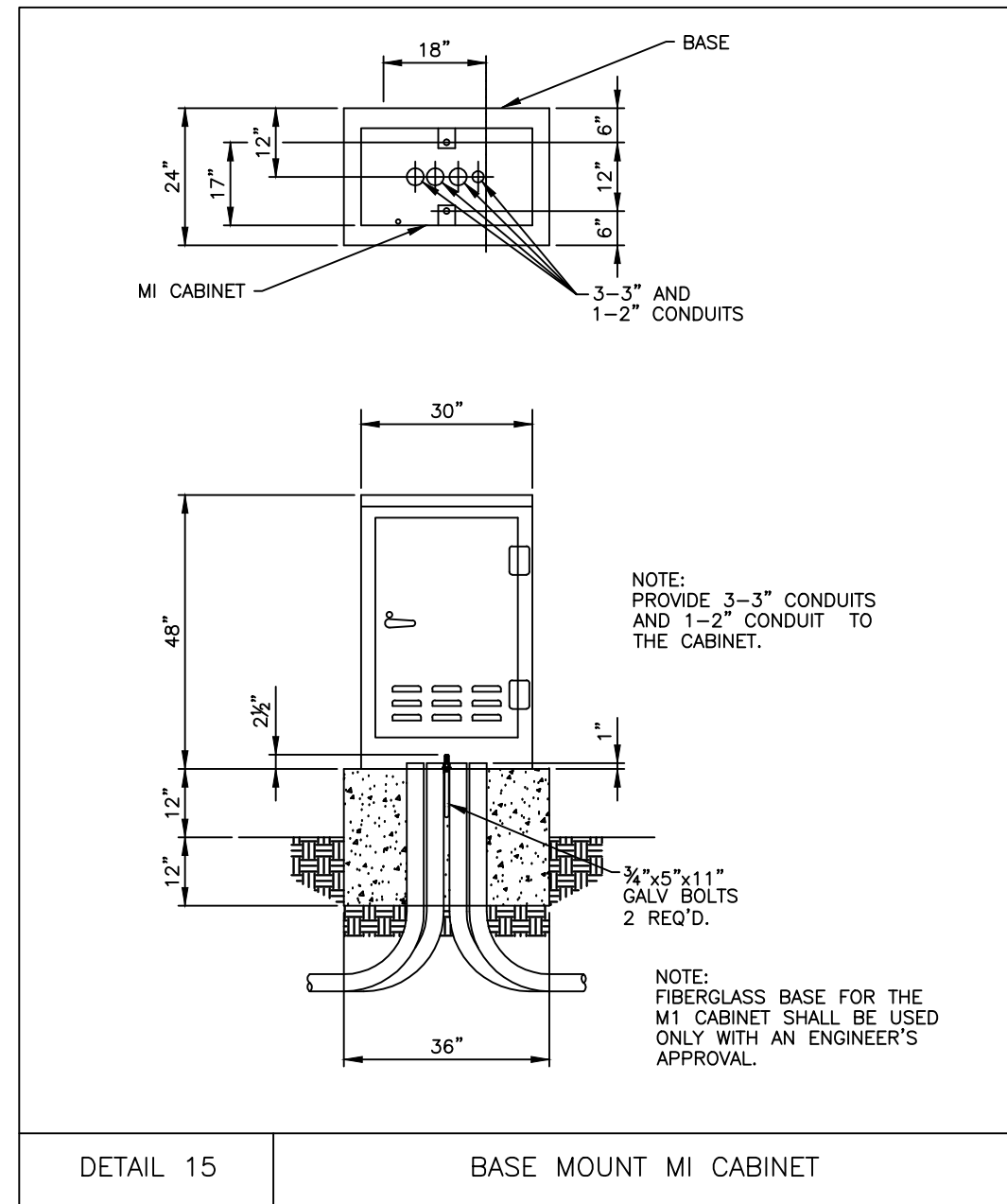
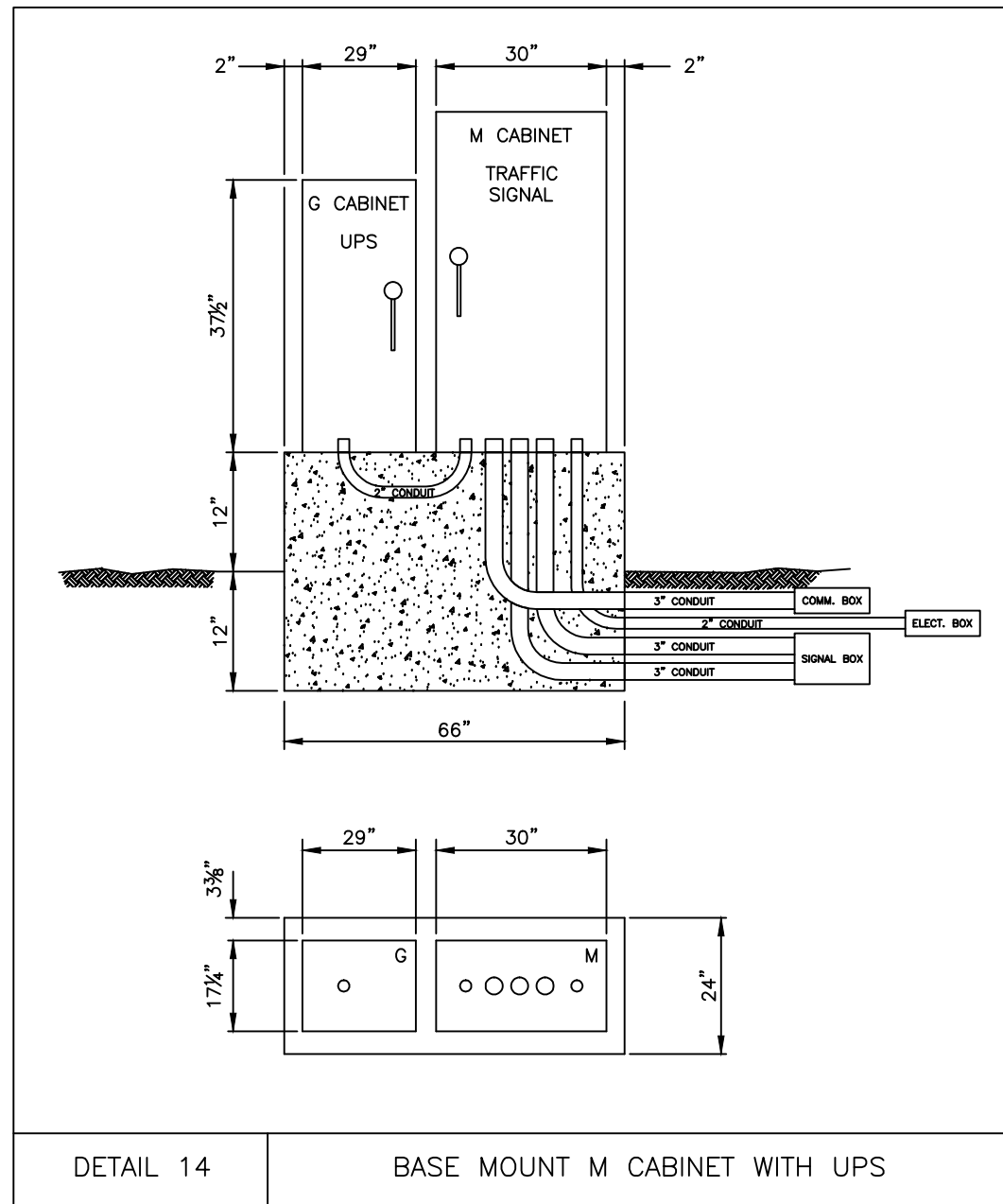


FRONT VIEW

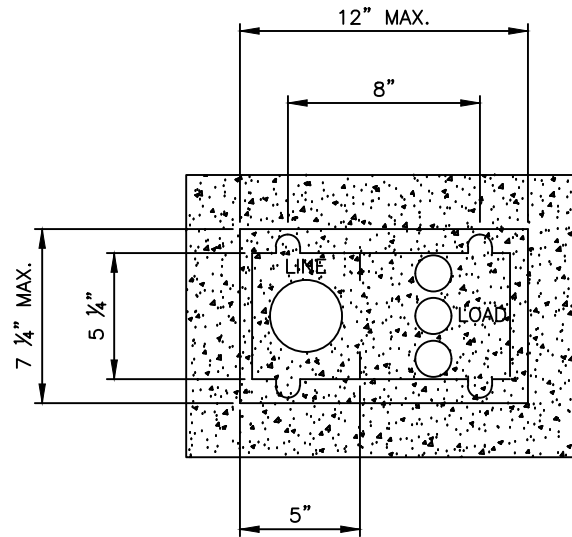
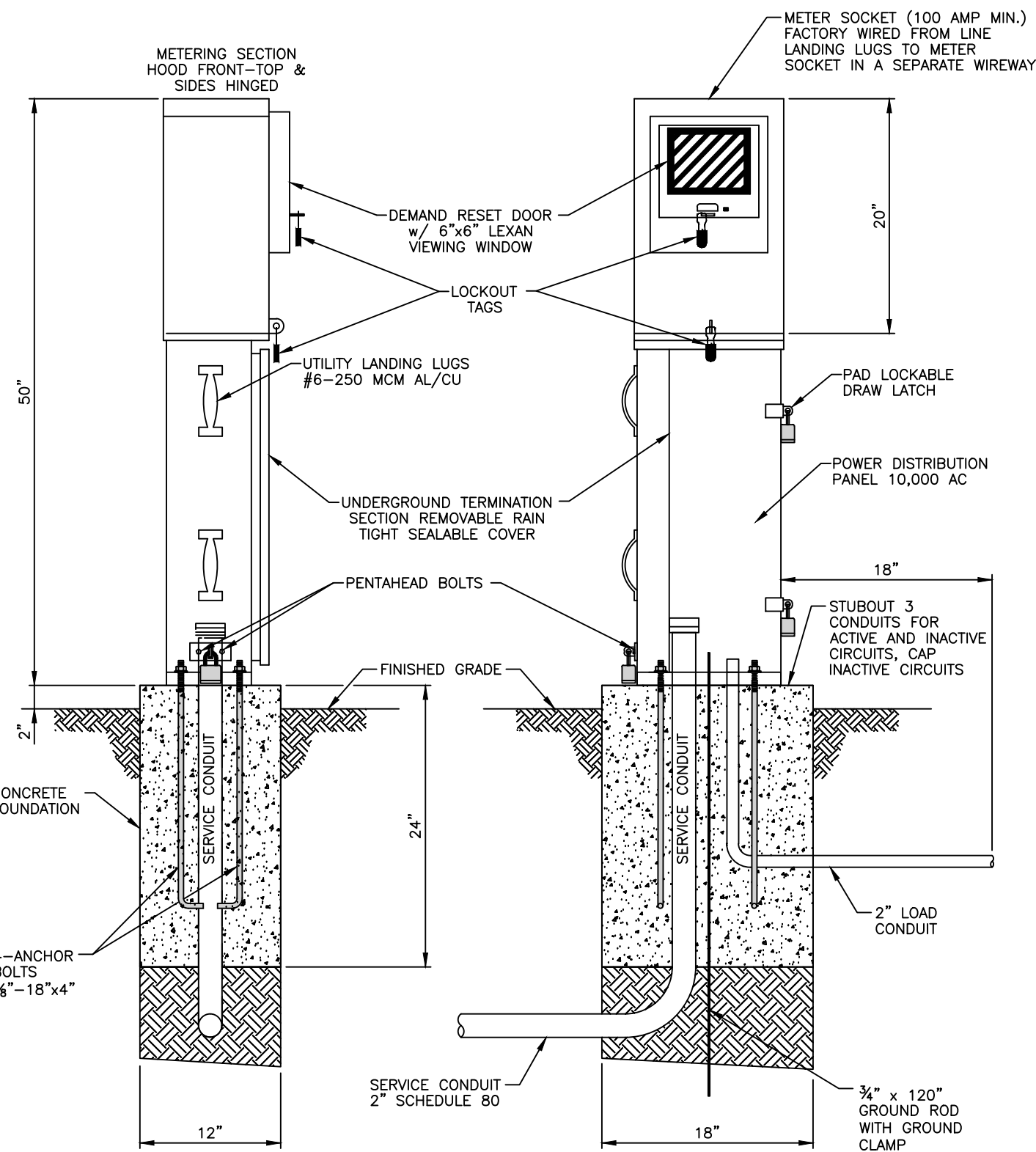


SIDE VIEW

Computer File Information		Sheet Revisions		 <p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>"P" CABINET & BASE SHEET 2</p> <p>Issued By:</p>	STANDARD DRAWING NO.
Creation Date:	Initials:	Date:	Comments:			16.1.17.2
Full Path:						Sheet No. 26 of 39
Drawing File Name:						
CAD Ver.:	Scale:	Units:				

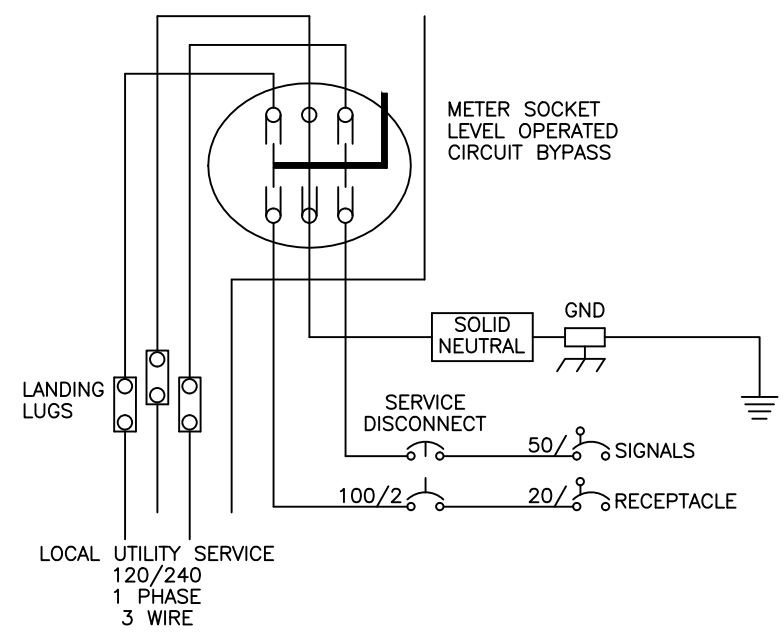


Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	"M" CABINET BASE	STANDARD DRAWING NO.
Creation Date:	Initials:	Date:	Comments:			16.1.18
Full Path:						Sheet No. 27 of 39
Drawing File Name:						
CAD Ver.:	Scale:	Units:			Issued By:	



BASE PLAN

- METER PEDESTAL CONSTRUCTION NOTES:**
- METER PEDESTAL SHALL BE UL LISTED "INDUSTRIAL CONTROL PANEL" PER UL 508.
 - METER PEDESTAL SHALL MEET THE ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE (EUSERC) GUIDELINES.
 - CONSTRUCTION SHALL BE NEMA 3R AND 12, RAIN TIGHT AND DUST TIGHT. ELECTRICALLY WELDED AND REINFORCED WHERE REQUIRED.
 - ALL NUTS, BOLTS, SCREWS AND HINGES SHALL BE STAINLESS STEEL.
 - NUTS, BOLTS AND SCREWS SHALL NOT BE VISIBLE FROM OUTSIDE OF METER PEDESTAL.
 - PHENOLIC NAME PLATES SHALL BE PROVIDED AS REQUIRED.
 - CIRCUIT BREAKERS SHALL BE CABLE IN-CABLE OUT WITH LINE ON TOP & LOAD ON THE BOTTOM. HANDLE POSITION UP="ON", MIDDLE="TRIPPED", DOWN="OFF".
 - A PLASTIC COVERED WIRING DIAGRAM SHALL BE ATTACHED TO THE INSIDE OF THE FRONT DOOR.
 - METER PEDESTAL SHALL BE FACTORY WIRED AND CONFORM TO REQUIRED NEMA STANDARDS.
 - 0.125" ALUMINUM SHEET
 - CONCRETE FOUNDATIONS INCLUDING EXCAVATION, BACKFILL, CONDUIT AND ANCHOR BOLTS, COMPLETE-IN PLACE, WILL BE CONSIDERED INCIDENTAL TO THE METER PEDESTAL.
 - ELECTRIC METER SHALL BE USED FOR TRAFFIC SIGNAL AND XCEL OPERATED STREET LIGHTS.
 - ELECTRIC METER INSTALLATION INSPECTION REQUIRED FOR COLD SEQUENCE AND PER NEC 90.2.

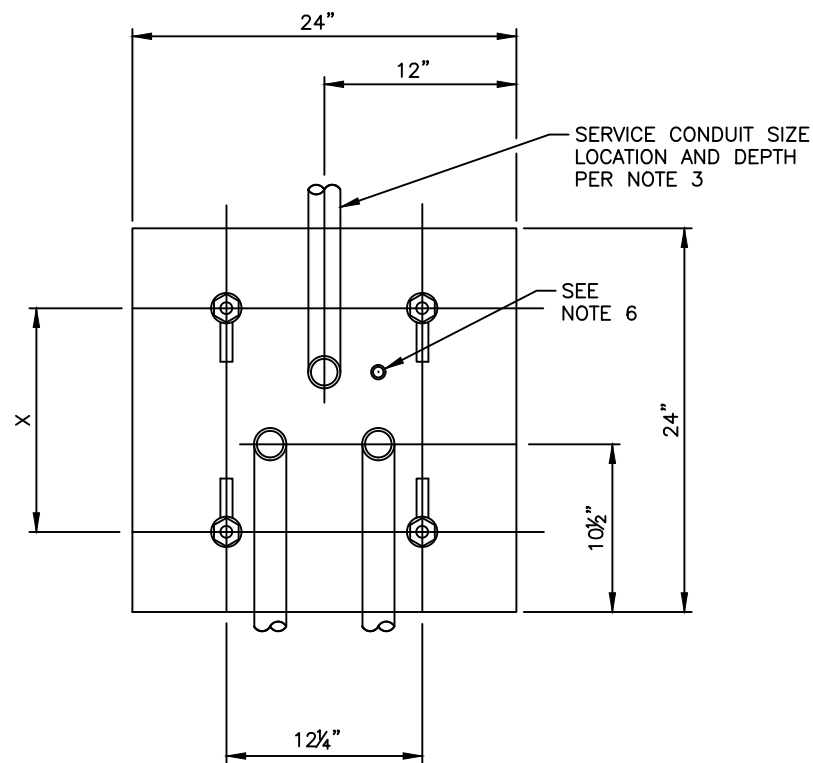


SERVICE EQUIPMENT WIRING DIAGRAM "A"

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	METER PEDESTAL CABINET DETAILS		STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:		Issued By:		16.1.19	
Full Path:							Sheet No. 28 of 39	
Drawing File Name:								
CAD Ver.:	Scale:	Units:						

METER PEDESTAL CABINET FOUNDATION DETAIL

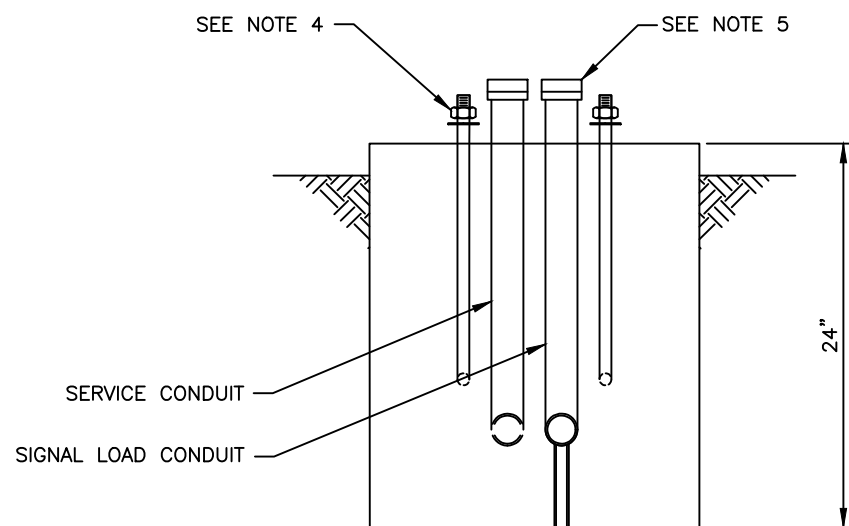
MAKE	X
TESCO	14"
MILBANK	14½"
MYERS	14¾"
PUP	14¼"



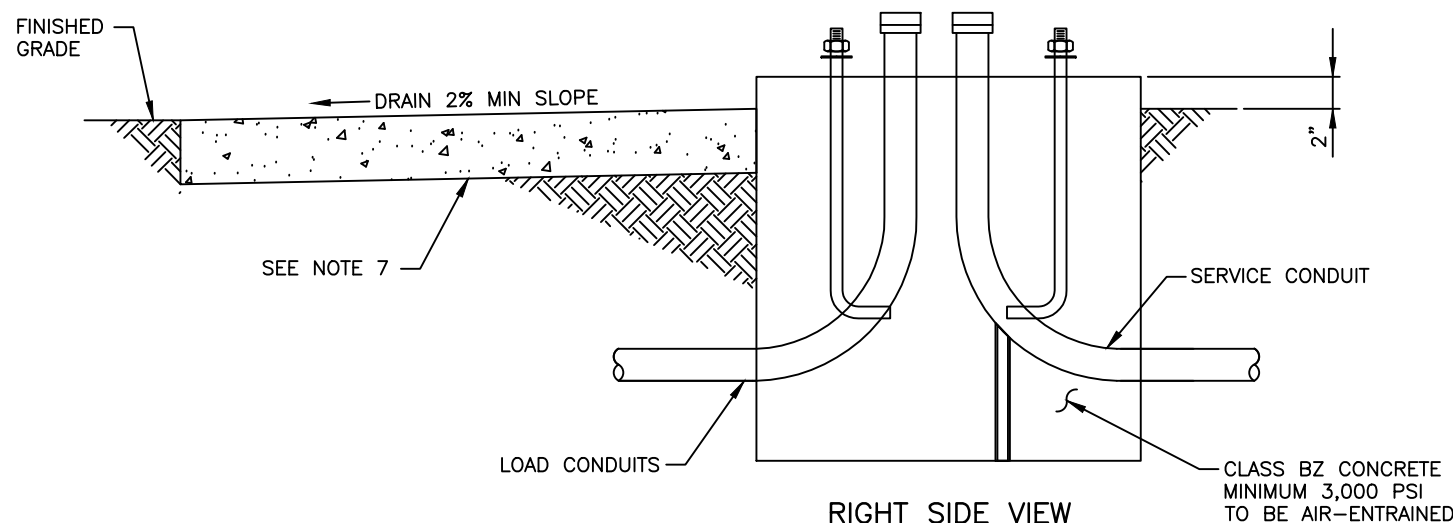
FOUNDATION PLAN

NOTES:

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



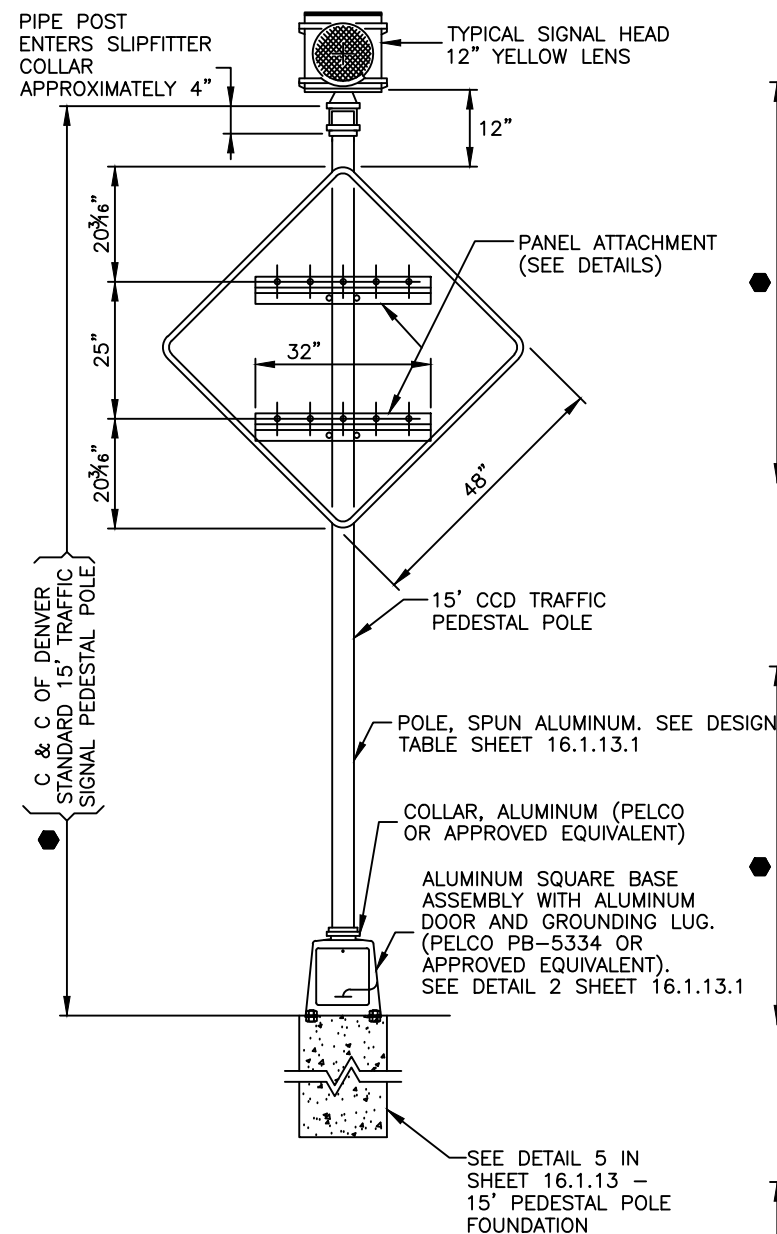
FRONT VIEW



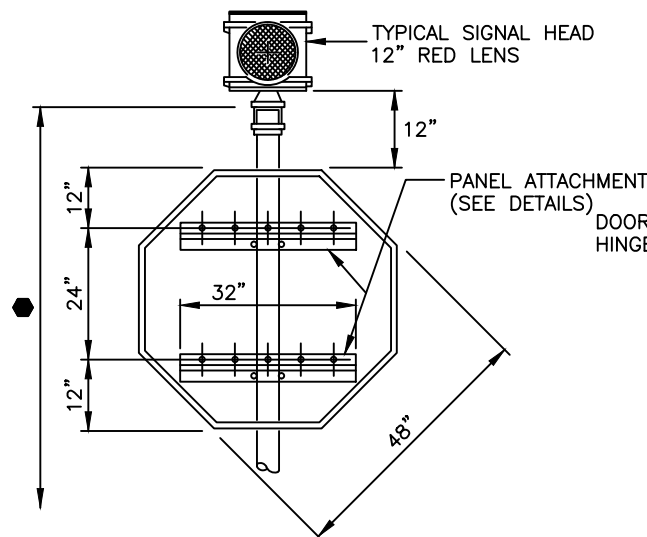
RIGHT SIDE VIEW

Computer File Information		Sheet Revisions		 DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	METER PEDESTAL CABINET FOUNDATION AND BASE		STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:		Issued By:		16.1.20	
Full Path:							Sheet No. 29 of 39	
Drawing File Name:								
CAD Ver.:	Scale:	Units:						

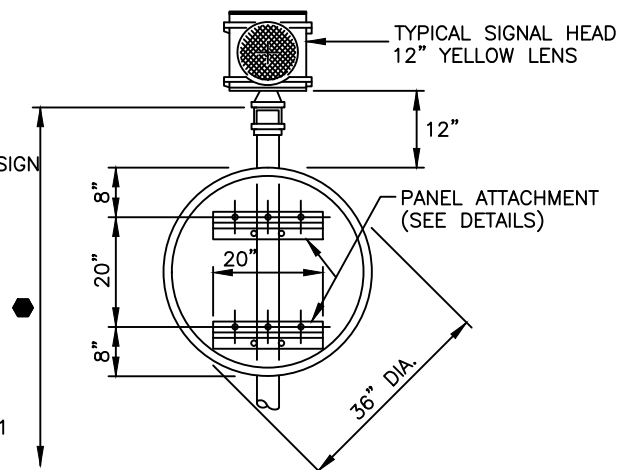
COMPLETE INSTALLATION WITH DIAMOND PANEL



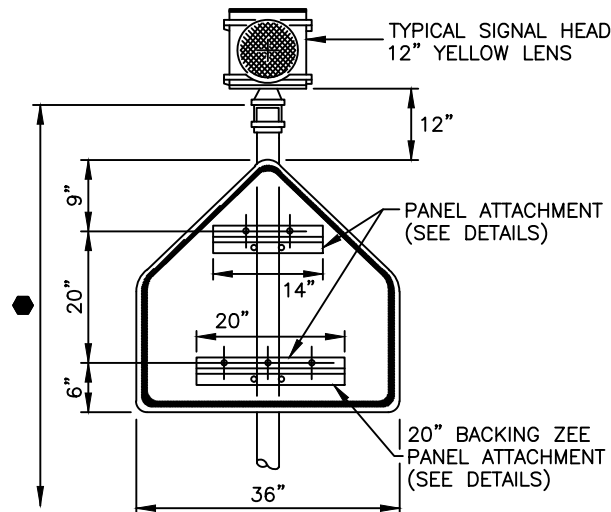
WITH OCTAGON PANEL



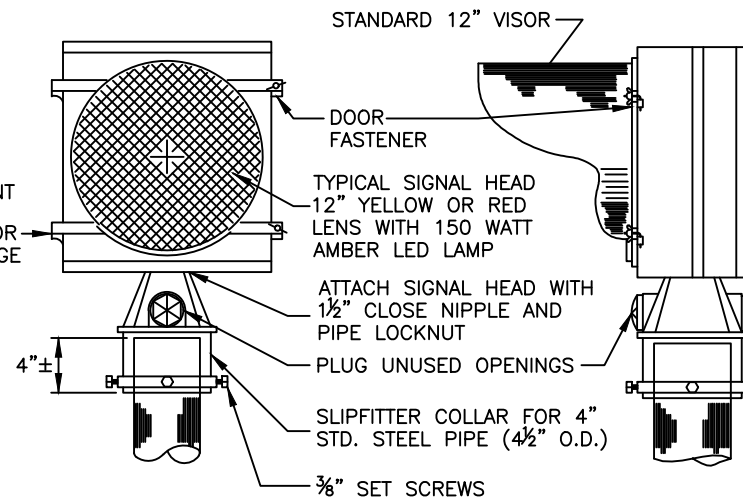
WITH CIRCLE PANEL



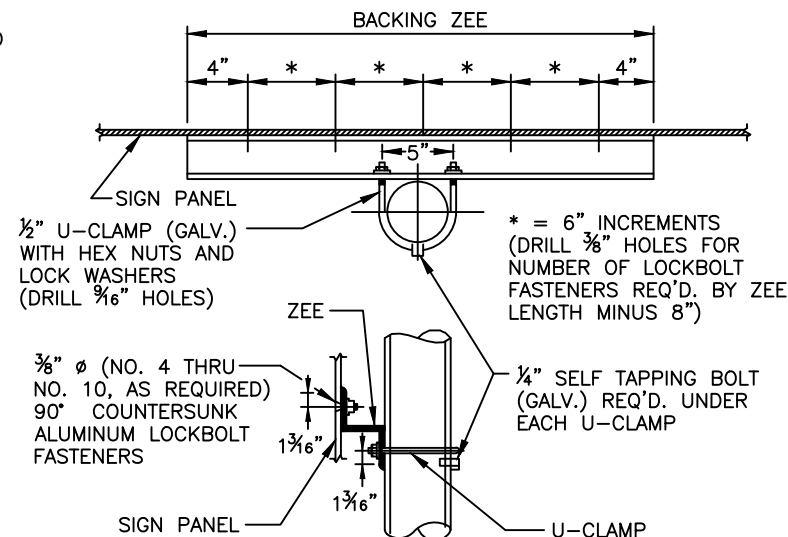
WITH PENTAGON PANEL



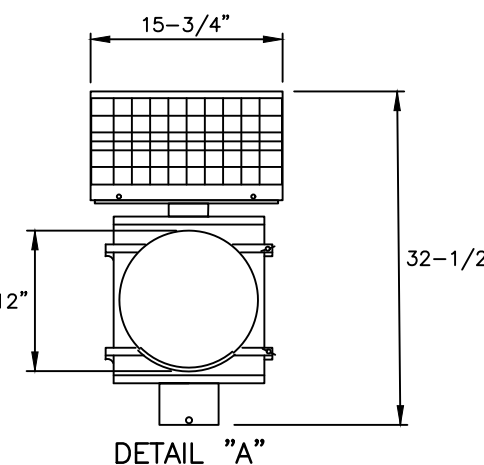
TYPICAL SIGNAL HEAD - 12 INCH LENS



TYPICAL PANEL ATTACHMENT DETAILS



TYPICAL SOLAR POWERED SIGNAL HEAD



GENERAL NOTES

- ALL SIGNS PANELS USED ON FLASHING BEACONS ARE CLASS II AND SHALL BE FABRICATED IN ACCORDANCE WITH:
 - PANELS SHALL BE SINGLE SHEET ALUMINUM 0.100 MINIMUM THICKNESS.
 - BACKING ZEES ARE 3 IN. X 2 IN. 2.33 LBS PER FT. ALUMINUM.
 - 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.
 - BOLTS, U-CLAMPS, NUTS AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
- INSTALLATION DESIGN CONFORMS WITH AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS" AND SHALL BE FABRICATED IN ACCORDANCE WITH:
 - STEEL PIPE, POST ANCHOR PLATES AND BREAK-AWAY PLATES SHALL CONFORM TO AASHTO M270 (ASTM A709) GRADE 36.
 - HIGH STRENGTH BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM-A325 AND SHALL BE GALVANIZED OR CADMIUM PLATED.
 - 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.
 - ALL WELDING IS TO BE CONTINUOUS AND IN ACCORDANCE WITH CURRENT AWS SPECIFICATIONS.
 - A "KEEPER PLATE" OF THIN (28 GAUGE) 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.
 - FLASHING BEACON POLE SHALL BE THE CITY AND COUNTY OF DENVER DOTI TRANSPORTATION OPERATIONS STANDARD PEDESTAL POLE. POLE SHALL BE THE STANDARD 15' POLE WITH THE SQUARE ALUMINUM POLE BASE. FOUNDATION FOR THE PEDESTAL POLE BASE SHALL BE THE 6' DEEP POLE FOOTING FOR THE 15' PEDESTAL POLE (SEE DETAIL 5 IN SHEET 16.13).
- FLASHING BEACON CAN BE INSTALLED WITH SOLAR POWERED SIGNAL HEADS. REFER TO DETAIL "A".

WITH PANELS NOT ILLUSTRATED

- 48" CIRCLE (12" YELLOW LENS)
VERTICAL SPACING: 10 1/2"-27"-10 1/2"
BACKING ZEES: 20"
- 48" PENTAGON (12" YELLOW LENS)
VERTICAL SPACING TOP TO BOTTOM: 12"-25 3/4"-9"
- 24" x 48" RECTANGLE (12" YELLOW LENS) (SCHOOL SPEED LIMIT)
VERTICAL SPACING: 12"-24"-12"
BACKING ZEES: 20"

TYPICAL ELEVATION FACING TRAFFIC

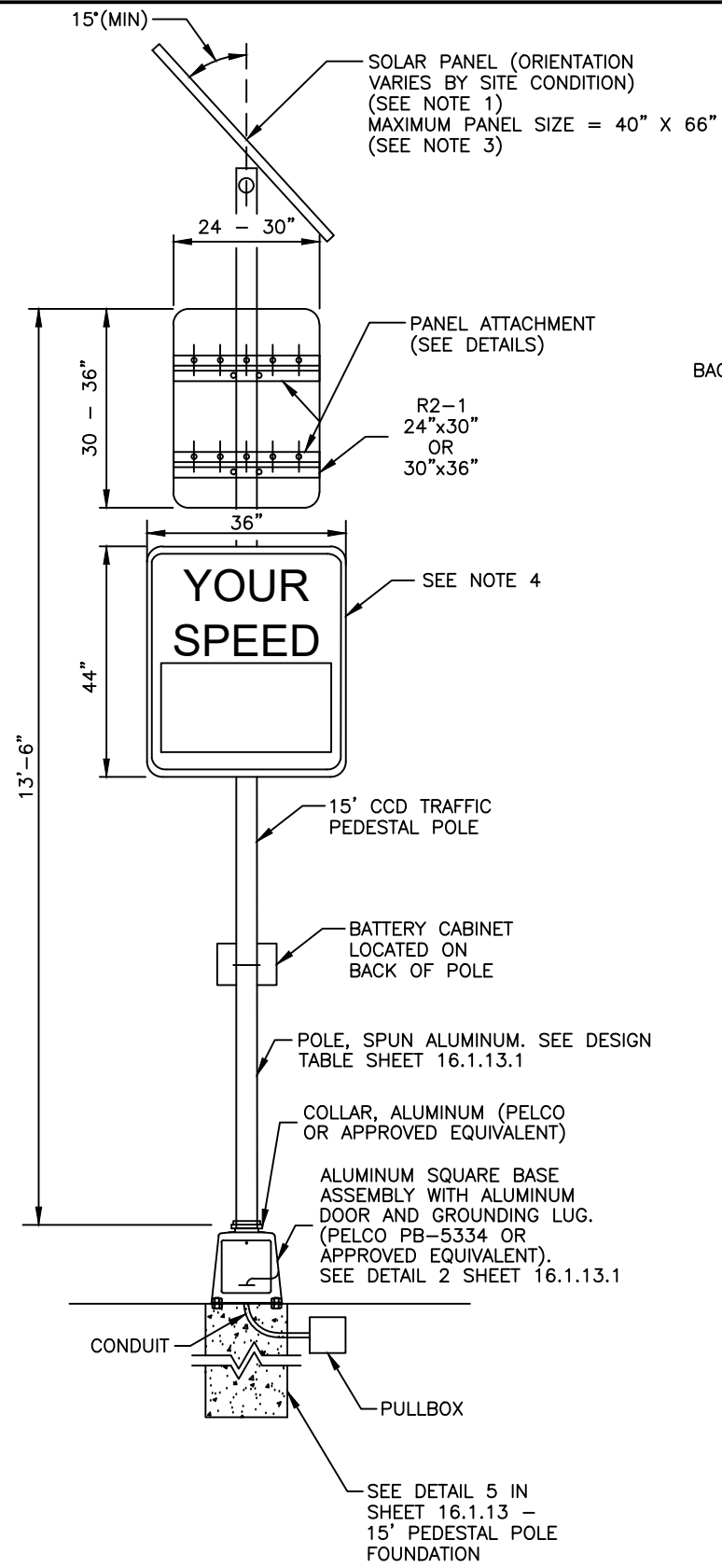
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Creation Date:	Initials:
Full Path:	
Drawing File Name:	
CAD Ver.:	Scale: Units:

Sheet Revisions	
Date:	Comments

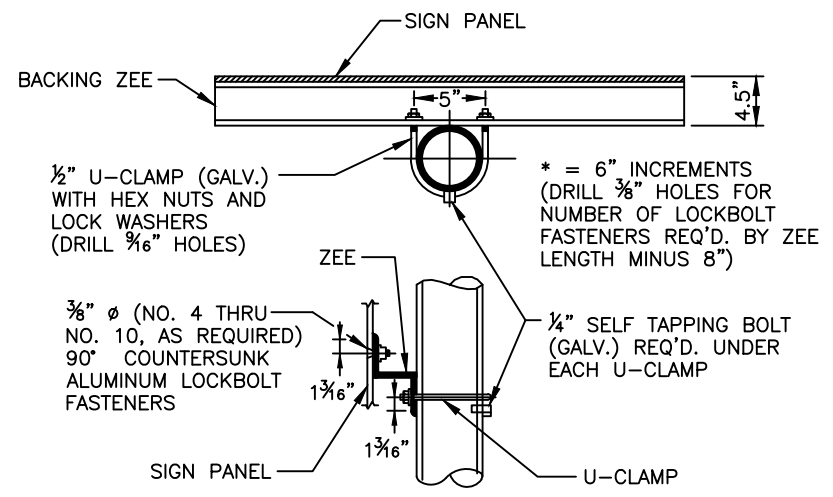
DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE
201 WEST COLFAX AVENUE
DENVER, CO 80202
PHONE: (720) 913-4501 FAX: (720) 913-4544

FLASHING BEACON DETAIL
Issued By:

STANDARD DRAWING NO.
16.1.21
Sheet No. 30 of 39



TYPICAL ELEVATION FACING TRAFFIC



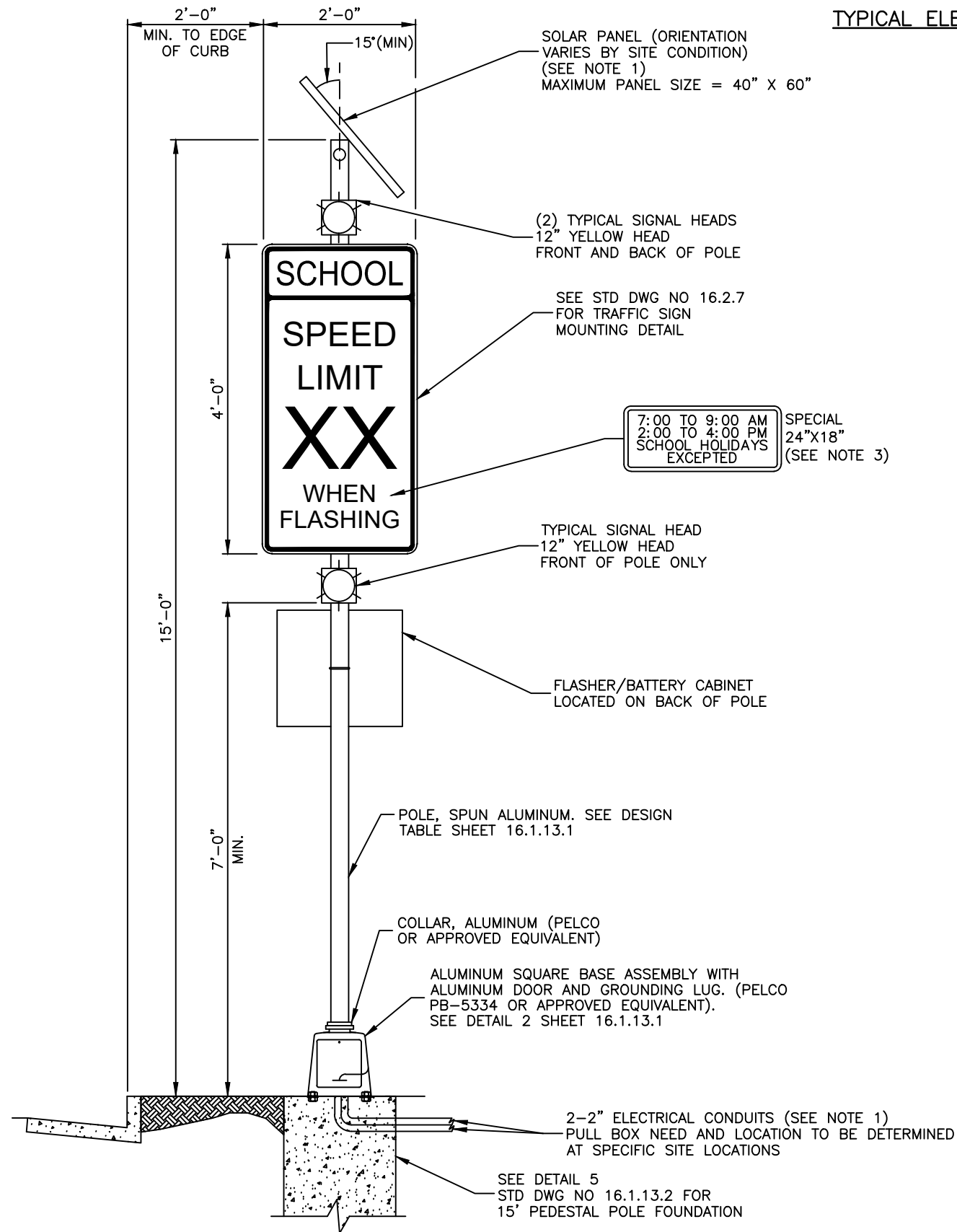
TYPICAL PANEL ATTACHMENT DETAILS

GENERAL NOTES

1. INSTALLATION DESIGN CONFORMS WITH AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORT 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 BE SAW CUT; METAL SHALL NOT PROJECT BEYOND THE PLATE OF THE PLATE FACE ON BREAK-AWAY PLATES.
 - D. ALL WELDING IS TO BE CONTINUOUS AND IN ACCORDANCE WITH CURRENT AWS SPECIFICATIONS. A "KEEPER PLATE" OF THIN (28 GAUGE) 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.
 - E. DRIVER FEEDBACK SIGN POLE SHALL BE MOUNTED ON THE CITY AND COUNTY OF DENVER DOTI TRANSPORTATION OPERATIONS STANDARD PEDESTAL POLE. POLE SHALL BE STANDARD 15' POLE PEDESTAL POLE BASE SHALL BE THE 6' DEEP POLE FOOTING FOR 15' PEDESTAL POLE (SEE DETAIL 5 IN SHEET 16.13).
 - F. BOLTS, U-CLAMPS, NUTS AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
2. DESIGN WIND VELOCITY = 120 MPH
3. AS DETERMINED AT EACH SPECIFIC SITE LOCATION, FOR POWER, EITHER SOLAR PANEL OR HARD-WIRE ELECTRICAL CONNECTION SHALL BE MADE.
4. DRIVER FEEDBACK SIGN MESSAGE, COLORS AND PROGRAMMING SHALL CONFORM TO MUTCD.

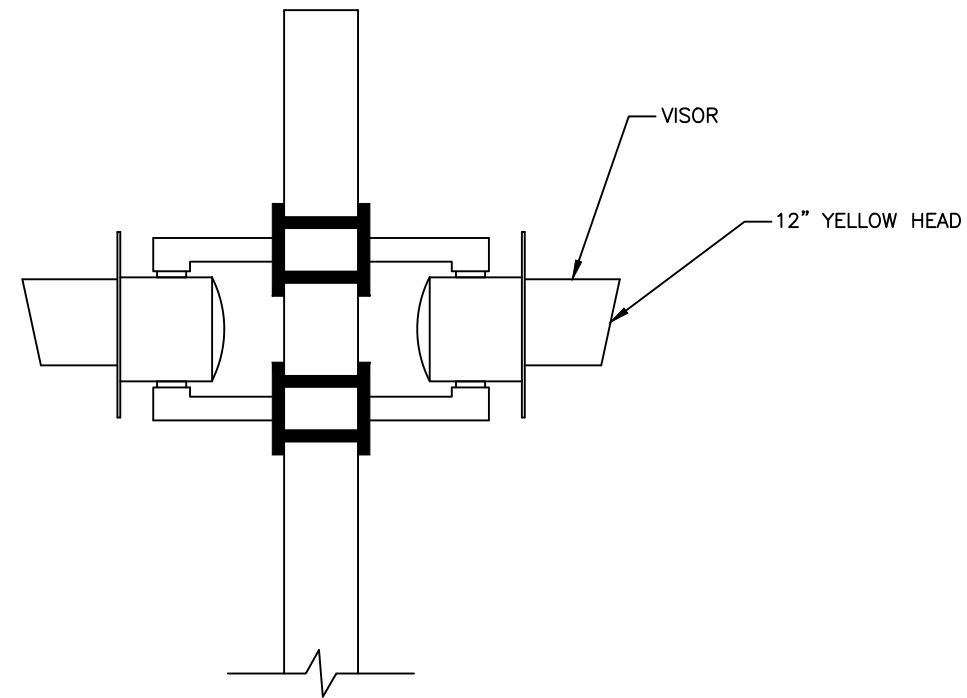
Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	DRIVER FEEDBACK SIGN DETAILS	STANDARD DRAWING NO.
Creation Date:	Initials:	Date:	Comments:			16.1.22
Full Path:						Sheet No. 31 of 39
Drawing File Name:						
CAD Ver.:	Scale:	Units:			Issued By:	

TYPICAL ELEVATION FACING TRAFFIC



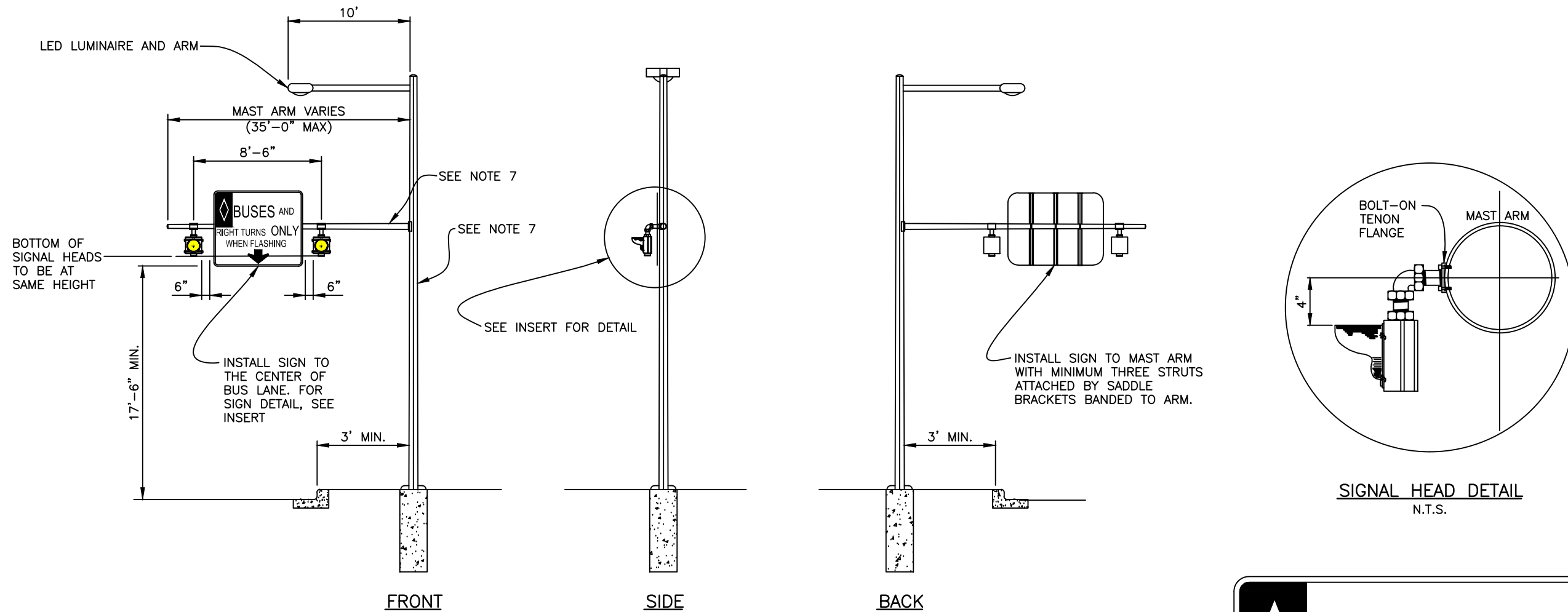
NOTES

1. AS DETERMINED BY THE ENGINEER AT EACH SPECIFIC SITE LOCATION, FOR POWER, EITHER SOLAR PANEL OR HARD-WIRE ELECTRICAL CONNECTION SHALL BE MADE.
2. AS DETERMINED AT EACH SPECIFIC SITE LOCATION, EITHER DIRECTIONAL ANTENNA OR HARD-WIRE TRAFFIC SIGNAL CONNECTION SHALL BE MADE.
3. TEMPORARY SIGN PLACARD TO BE INSTALLED OVER S5-1 "WHEN FLASHING" TEXT UNTIL BEACONS ARE OPERATIONAL.
4. THIS SIGN INSTALLATION HAS BEEN DESIGNED FOR A 120 MPH WIND VELOCITY.



TYPICAL SIGNAL HEAD SECTION - 12" LENS

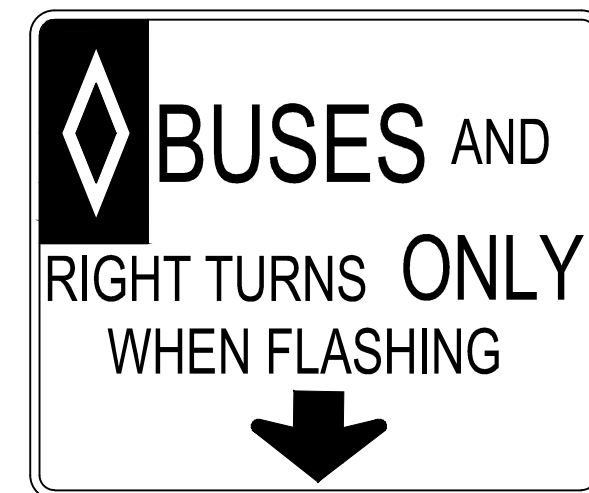
Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	FLASHING BEACON & SIGN	STANDARD DRAWING NO.
Creation Date:	Initials:	Date:	Comments:			16.1.23
Full Path:						Sheet No. 32 of 39
Drawing File Name:					Issued By:	
CAD Ver.:	Scale:	Units:				



BUS LANE SIGN & SIGNAL FLASHER:
20'-35' MAST ARM DESIGN
N.T.S.

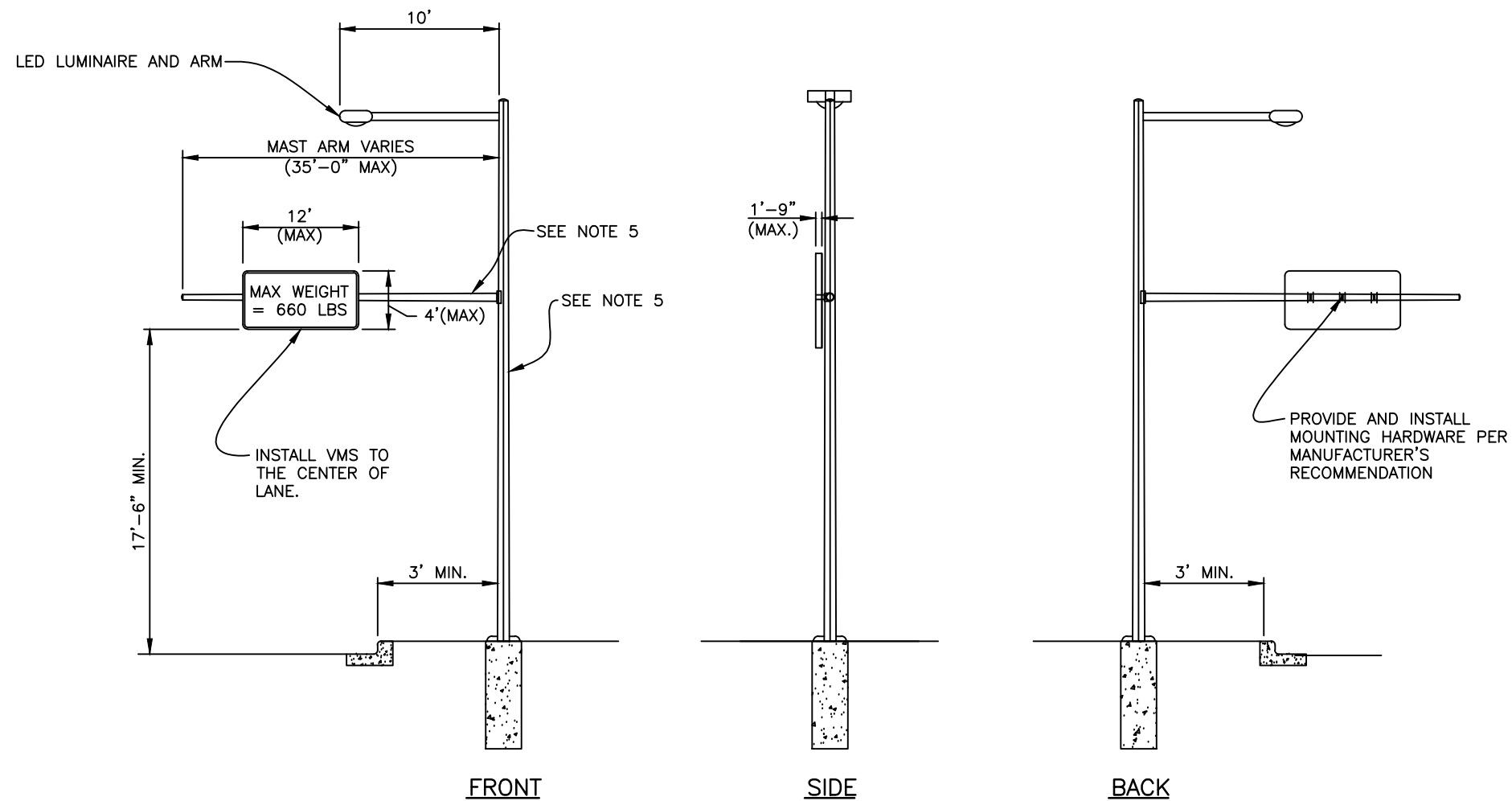
BUS FLASHER SIGN & SIGNAL NOTES:

1. INSTALL CABLE (5 CONDUCTOR #14 AWG) IMSA TO SIGNAL BOX, FM. (BY CCD)
2. FLASHER WORK SHALL BE PERFORMED BY A QUALIFIED SIGNAL CONTRACTOR.
3. INSTALL NEW 12" YELLOW LED FLASHERS (2 EACH)
4. CONTACT TRAFFIC OPERATIONS AT 720-865-4000 FOR SIGN SPECIFICATIONS.
5. CONTRACTOR TO FURNISH AND INSTALL POLES
6. DURING MOUNTING OF SIGN PANEL, NO TRAFFIC WILL BE ALLOWED IN THE AFFECTED LANE
7. REFER TO STANDARD DRAWING NUMBERS 16.1.8 THROUGH 16.1.11 FOR FOUNDATION POLE AND MAST ARM DETAILS. FLASHING BEACON & SIGN POLE AND MAST ARM ARE DESIGNED FOR FATIGUE CATEGORY I WITH GALLOPING (WITHOUT A MITIGATION DEVICE)



BUS FLASHER SIGN DETAIL

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	BUS FLASHER SIGN DETAIL	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.24.1	
Full Path:						Sheet No. 33 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:			Issued By:		



VARIABLE MESSAGE SIGN DETAIL (VMS)

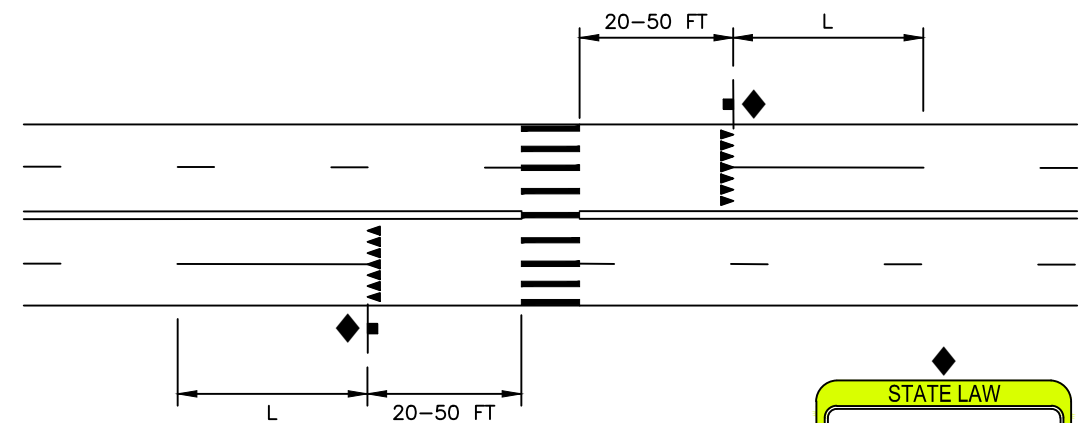
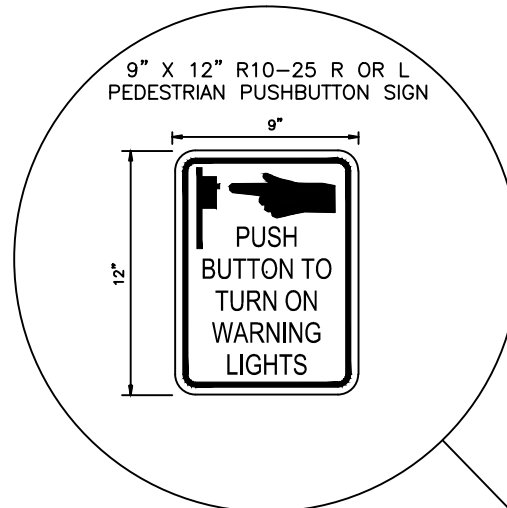
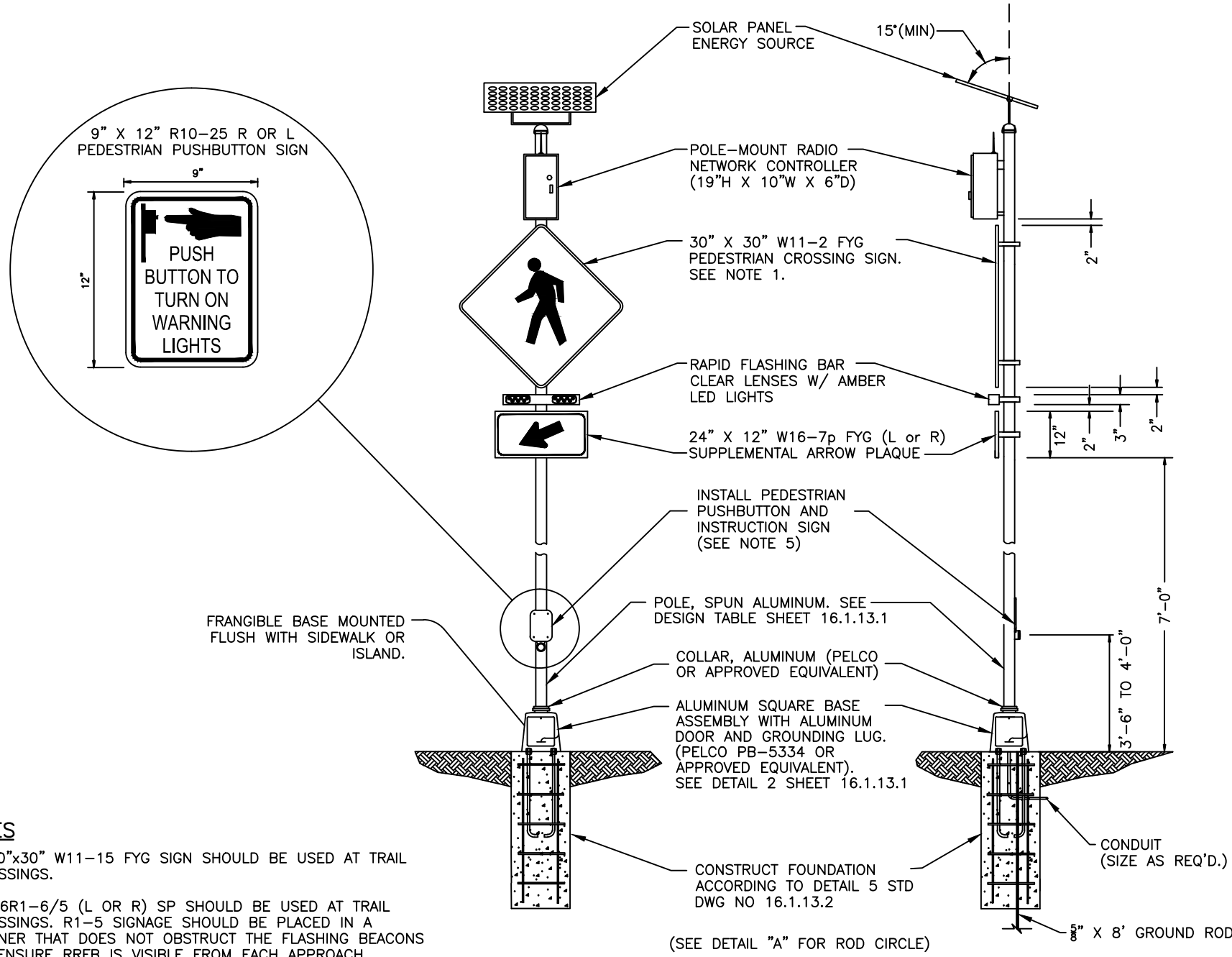
VARIABLE MESSAGE SIGN NOTES:

1. INSTALL CABLE (5 CONDUCTOR #14 AWG) IMSA TO SIGNAL BOX, FM. (BY CCD)
2. CONTACT TRAFFIC OPERATIONS AT 720-865-4000 FOR SIGN SPECIFICATIONS.
3. CONTRACTOR TO FURNISH AND INSTALL POLES
4. DURING MOUNTING OF SIGN PANEL, NO TRAFFIC WILL BE ALLOWED IN THE AFFECTED LANE
5. REFER TO STANDARD DRAWING NUMBERS 16.1.8 THROUGH 16.1.11 FOR FOUNDATION POLE AND MAST ARM DETAILS. VARIABLE MESSAGE SIGN POLE AND MAST ARM ARE DESIGNED FOR FATIGUE CATEGORY I WITH GALLOPING (WITHOUT A MITIGATION DEVICE)

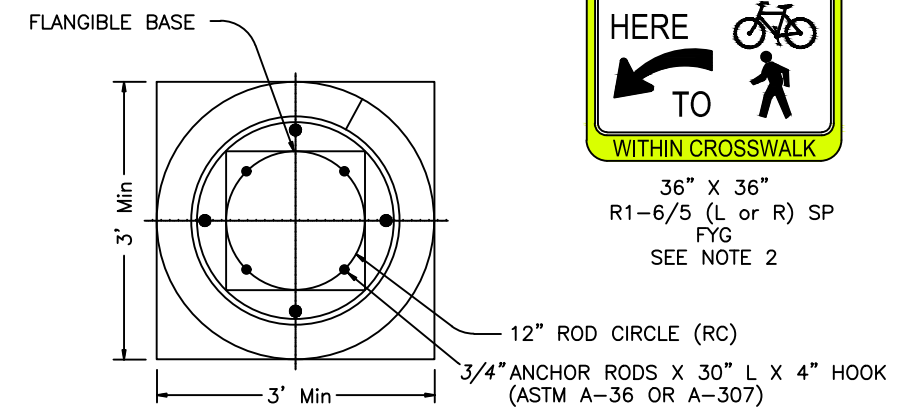
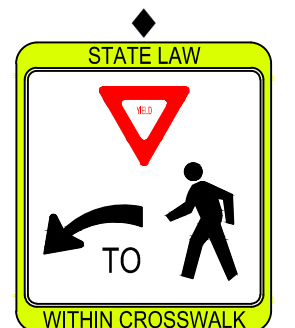
Computer File Information		Sheet Revisions		 DENVER THE MILE HIGH CITY	DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	VARIABLE MESSAGE SIGN DETAIL Issued By:	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments				16.1.24.2	
Full Path:		06/22	REVISED VMS PANEL SIZE				Sheet No. 34 of 39	
Drawing File Name:								
CAD Ver.:	Scale:	Units:						

**RECTANGULAR RAPID FLASHING BEACON SYSTEM
PEDESTRIAN PEDESTAL INSTALLATION (ONE SIDED)**

**SIGNS AND YIELD LINES AT
UNSIGNALIZED MIDBLOCK CROSSWALKS**



POSTED SPEED	L
30 MPH	140 FT
35 MPH	185 FT
40 MPH	335 FT



- NOTES**
1. A 30"x30" W11-15 FYG SIGN SHOULD BE USED AT TRAIL CROSSINGS.
 2. A 36R1-6/5 (L OR R) SP SHOULD BE USED AT TRAIL CROSSINGS. R1-5 SIGNAGE SHOULD BE PLACED IN A MANNER THAT DOES NOT OBSTRUCT THE FLASHING BEACONS TO ENSURE RRFB IS VISIBLE FROM EACH APPROACH.
 3. R1-5(MOD) AND R1-6/5SP SIGNAGE SHALL ONLY BE USED FOR MULTILANE APPROACHES
 4. IN ORDER TO MEET ADA AND MUTCD REQUIREMENTS, PUSH BUTTON MAY BE REQUIRED TO BE MOUNTED ON PED POLE. REFERENCE PUSH BUTTON POLE DETAIL 7 ON SHEET 16.14.1. PUSH BUTTON MAY BE WIRED OR WIRELESS.

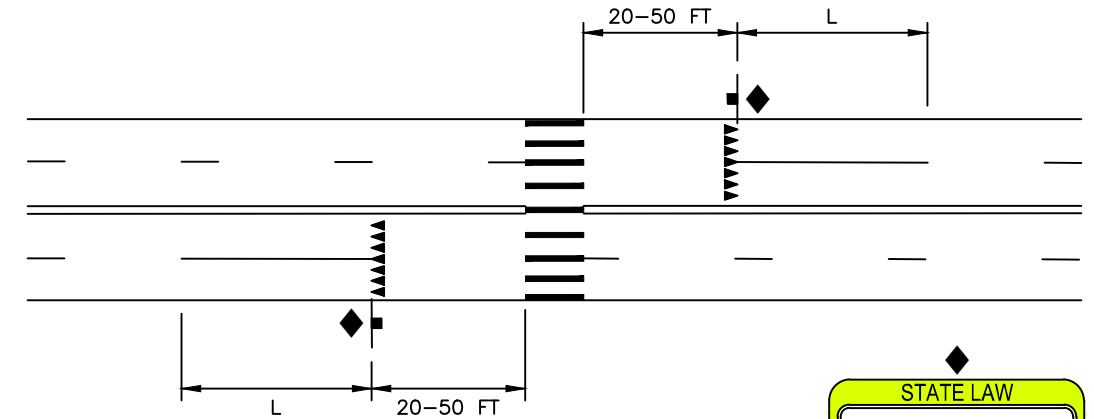
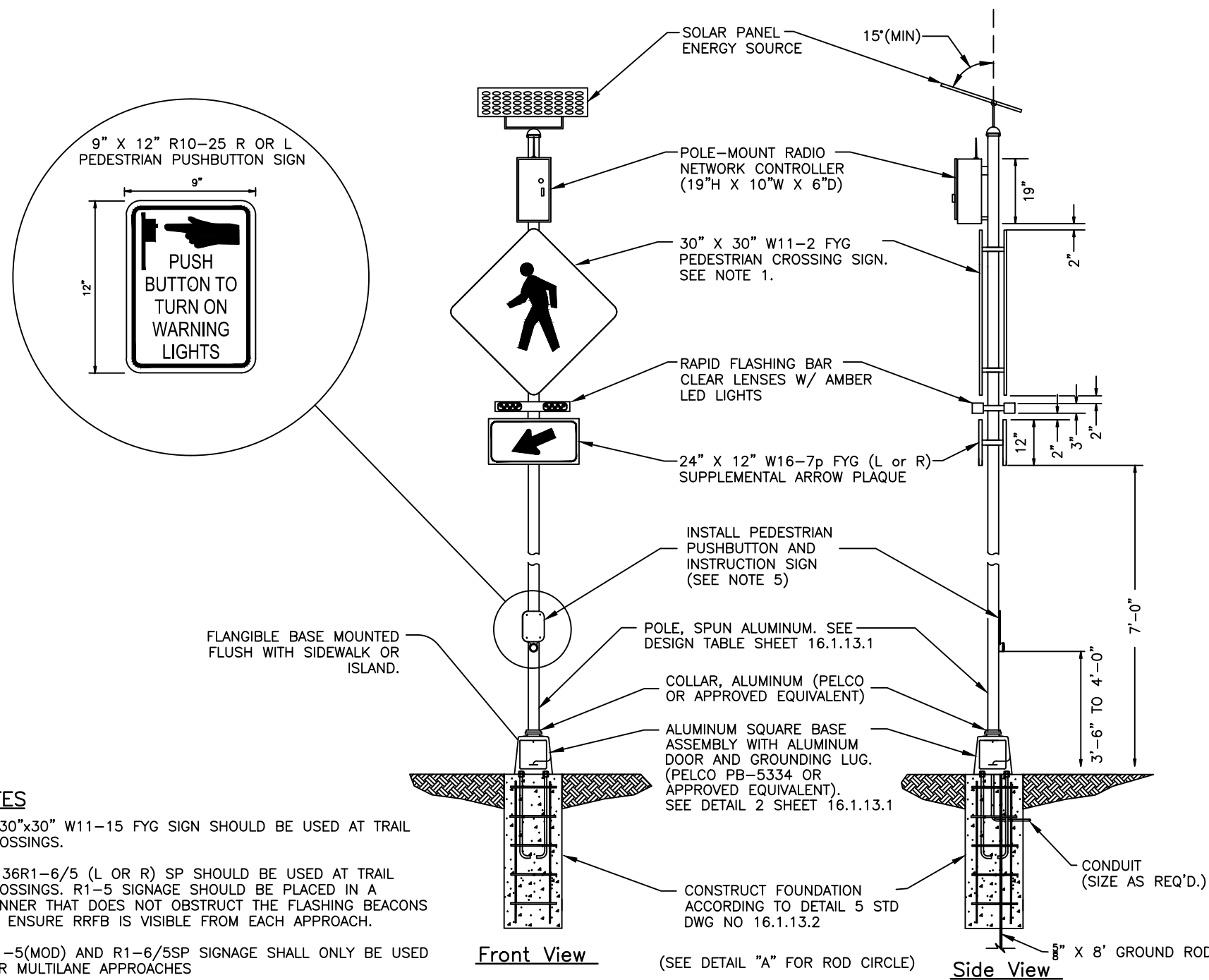
Front View

Side View

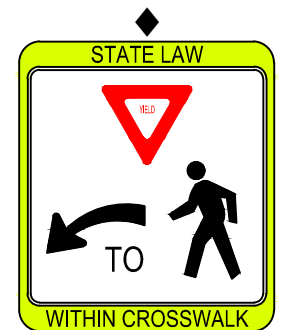
DETAIL "A"
 ROD CIRCLE

**RECTANGULAR RAPID FLASHING BEACON SYSTEM
PEDESTRIAN PEDESTAL INSTALLATION (TWO SIDED)**

**SIGNS AND YIELD LINES AT
UNSIGNALIZED MIDBLOCK CROSSWALKS**

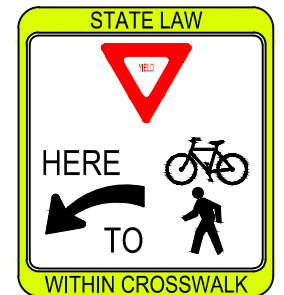


POSTED SPEED	L
30 MPH	140 FT
35 MPH	185 FT
40 MPH	335 FT

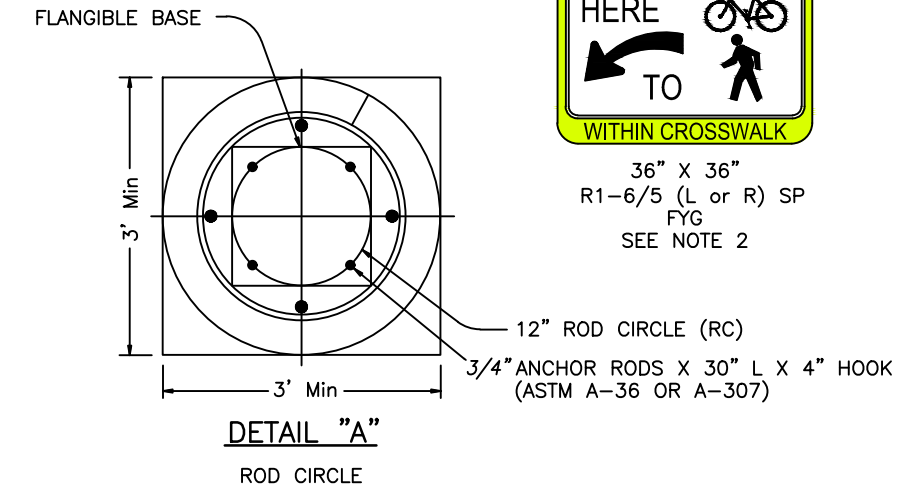


36" X 36"
R1-5mod (L or R)
FYG
SEE NOTE 3

OR



36" X 36"
R1-6/5 (L or R) SP
FYG
SEE NOTE 2



- NOTES**
1. A 30"x30" W11-15 FYG SIGN SHOULD BE USED AT TRAIL CROSSINGS.
 2. A 36R1-6/5 (L OR R) SP SHOULD BE USED AT TRAIL CROSSINGS. R1-5 SIGNAGE SHOULD BE PLACED IN A MANNER THAT DOES NOT OBSTRUCT THE FLASHING BEACONS TO ENSURE RRFB IS VISIBLE FROM EACH APPROACH.
 3. R1-5(MOD) AND R1-6/5SP SIGNAGE SHALL ONLY BE USED FOR MULTILANE APPROACHES
 4. IN ORDER TO MEET ADA AND MUTCD REQUIREMENTS, PUSH BUTTON MAY BE REQUIRED TO BE MOUNTED ON PED POLE. REFERENCE PUSH BUTTON POLE DETAIL 7 ON SHEET 16.14.1. PUSH BUTTON MAY BE WIRED OR WIRELESS.

Computer File Information		Sheet Revisions		<p align="center">DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	RRFB DETAIL & SIGN SHEET 2	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.25.2	
Full Path:						Sheet No. 36 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					

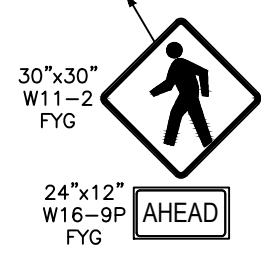
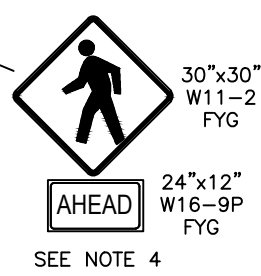
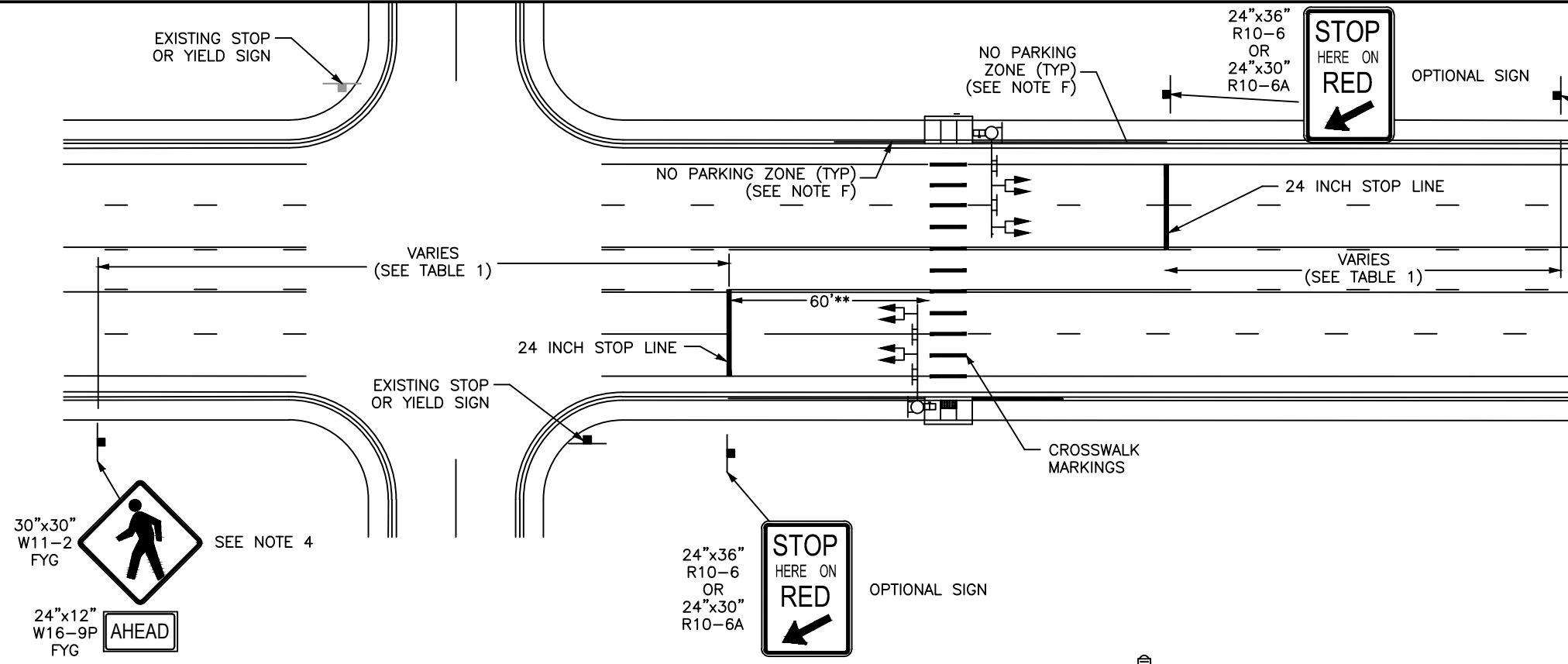
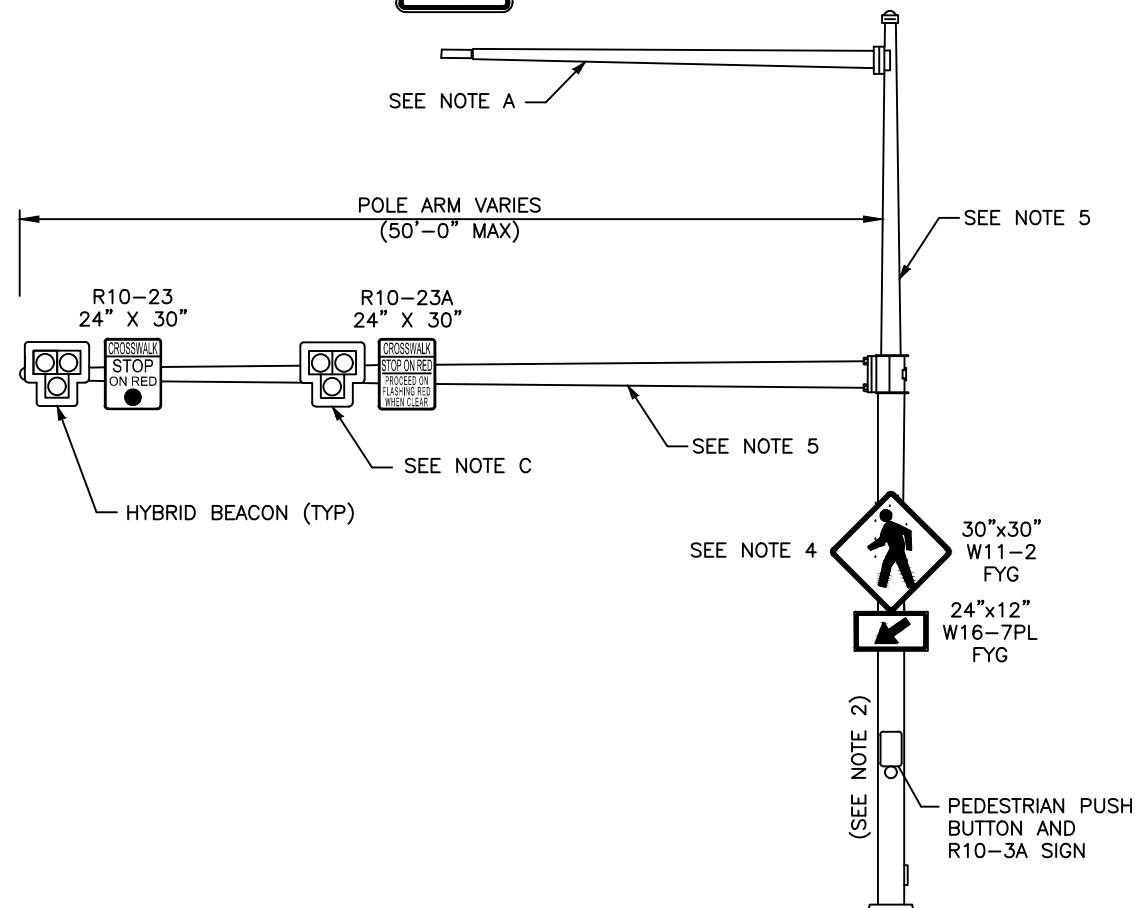


TABLE 1
GUIDELINES FOR ADVANCE PLACEMENT OF PEDESTRIAN CROSSING WARNING SIGNS

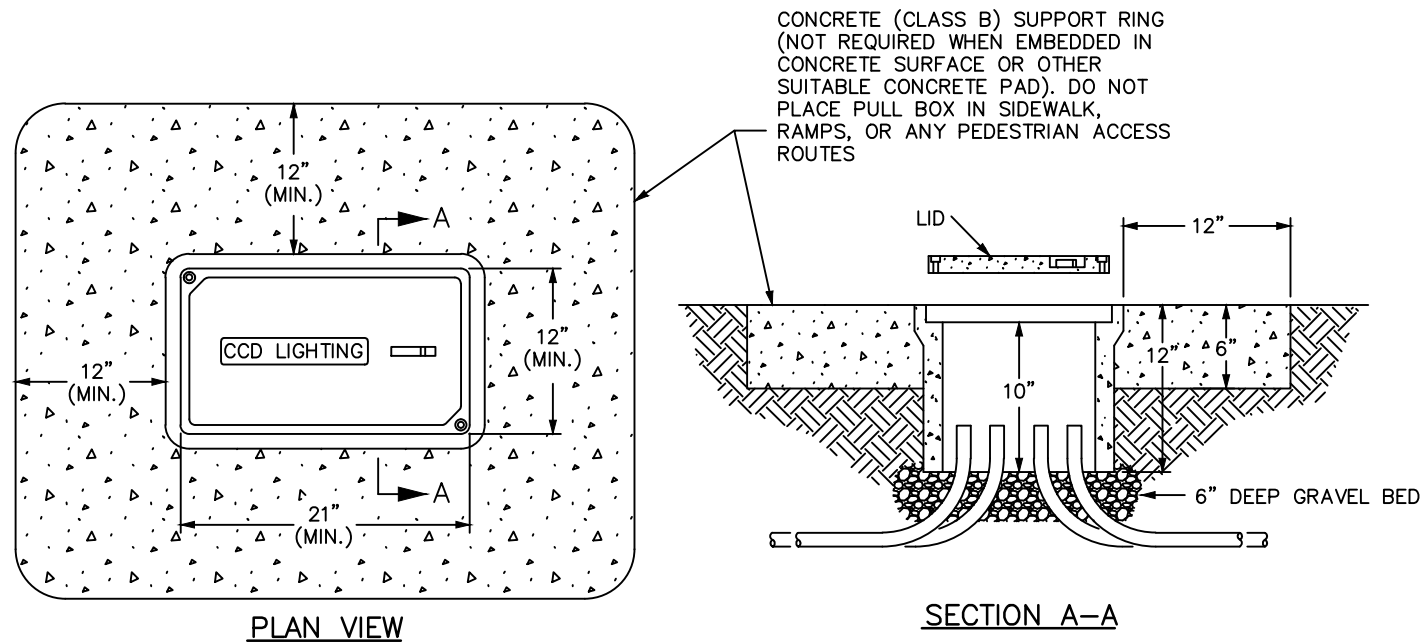
POSTED SPEED	MINIMUM ADVANCE PLACEMENT DISTANCE
20-35 MPH	100 FT
40 MPH	125 FT
45 MPH	175 FT
50 MPH	250 FT

- NOTES**
- DO NOT PLACE RETROREFLECTIVE TAPE ON HYBRID BEACON BACKPLATES.
 - INCREASE MOUNTING HEIGHT OF W11-2 SIGN AND W16-7PL PLAQUE IF BLOCKED BY OTHER SIGNS OR OBSTRUCTIONS.
 - SEE SHEET 16.2.1 FOR CROSSWALK MARKING DETAILS.
 - A 30"x30" W11-15 FYG SIGN SHOULD BE USED AT TRAIL CROSSINGS.
 - REFER TO STANDARD DRAWING NUMBERS 16.1.8 THROUGH 16.1.11 FOR FOUNDATION CROSSING POLE AND MAST ARM DETAILS. HAWK POLE AND MAST ARM ARE DESIGNED FOR FATIGUE CATEGORY I WITH GALLOPING (WITHOUT A MITIGATION DEVICE).

- DESIGN-ONLY NOTES**
- INSTALL STREET LIGHTING UNLESS DIRECTED OTHERWISE BY CITY TRAFFIC ENGINEER.
 - PROVIDE REQUIRED SCHOOL CROSSING SIGNING AND PAVEMENT MARKINGS AT SCHOOL CROSSWALKS.
 - CENTER HYBRID BEACON OVER EACH THRU LANE.
 - REMOVE TWO-WAY LEFT TURN LANE AND INSTALL DOUBLE YELLOW LINES WHEN REQUIRED BY CITY TRAFFIC ENGINEER.
 - INTERCONNECT SIGNAL TO CCD NETWORK. COORDINATE NEW PEDESTRIAN HYBRID BEACON WITH ADJACENT TRAFFIC SIGNALS ON BOTH SIDES.
 - PLACE NO PARKING SIGNS TO PROHIBIT PARKING BETWEEN THE STOP BAR AND CROSSWALK, AND 20 FT BEYOND THE CROSSWALK ON BOTH APPROACHES. NO ACCESSES ARE ALLOWED IN THIS AREA.
 - MEET MINIMUM TRAFFIC SIGNAL SPACING REQUIREMENTS.
 - PLACE HYBRID BEACON ASSEMBLIES ON A SINGLE OR TWO SEPARATE MAST ARMS.
 - POLE MUST BE INSTALLED WITHIN 5' OF RAMP PER ADA REQUIREMENTS.
 - HAWK SIGNAL SHALL BE DESIGNED AND CONSTRUCTED TO INCLUDE ALL EQUIPMENT OF A FULL SIGNAL: CAMERA, CCTV, ETHERNET SWITCH, CONTROLLER, UPS, AND ANY OTHER REQUIRED ITEMS NOT EXPLICITLY LISTED HERE.
- **VARIES BASED ON LOCATION. ACTUAL DISTANCE TO BE DETAILED ON PLANS OR AS DIRECTED BY CCD DOTI TRANSPORTATION. MINIMUM OF 40'.



- LEGEND**
- 12" DIAMETER HYBRID BEACON
 - MAST ARM SIGNAL POLE
 - MAST ARM OR SIGNAL POLE MOUNTED SIGN
 - COUNTDOWN PEDESTRIAN SIGNAL HEAD WITH PUSH BUTTON AND SIGN
 - DETECTABLE WARNING SURFACE
 - GROUND MOUNT SIGN



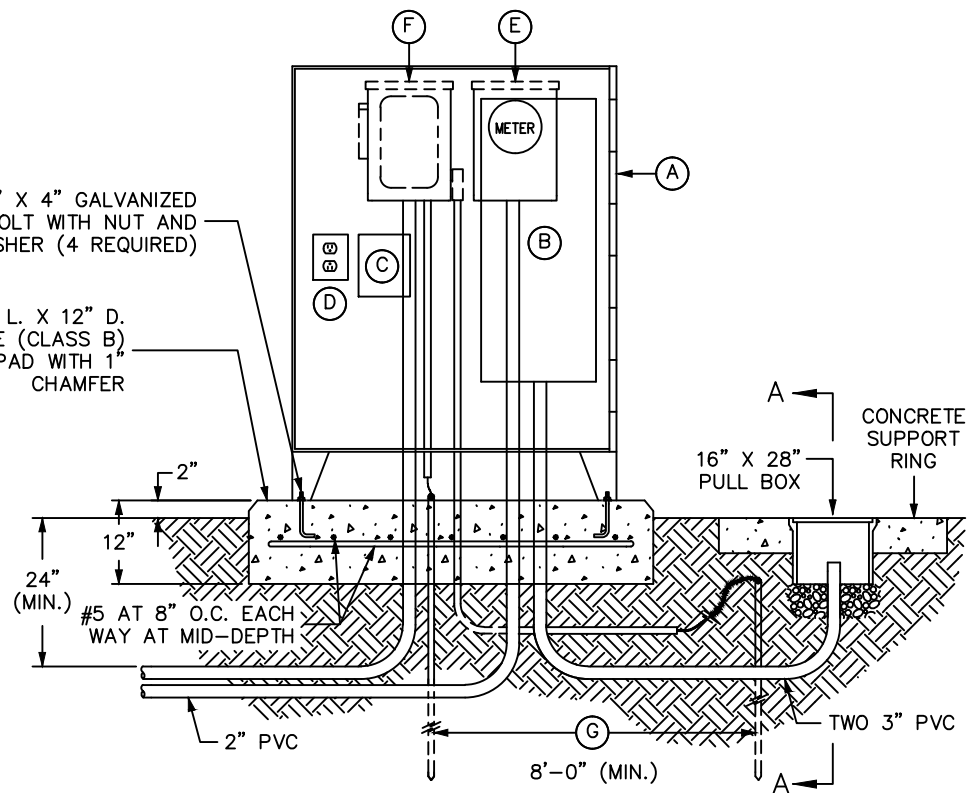
TYPICAL PULL OR SPLICE BOX

NOTES:

1. ALL PULL OR SPLICE BOXES SHALL BE TRAFFIC RATED 22,500 PSI MINIMUM.
2. BOX DIMENSIONS SHOWN ARE FOR 2 INCH CONDUITS MAXIMUM. FOR CONDUITS LARGER THAN 2 IN. REFER TO N.E.C. SECTION 314.28A FOR BOX SIZE REQUIREMENTS.
3. PULL BOX SHALL BE PER DETAIL 16.1.7.

NOTE:

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



LIGHTING CONTROL CENTER (CABINET)
(IN BUSINESS IMPROVEMENT DISTRICT ONLY)

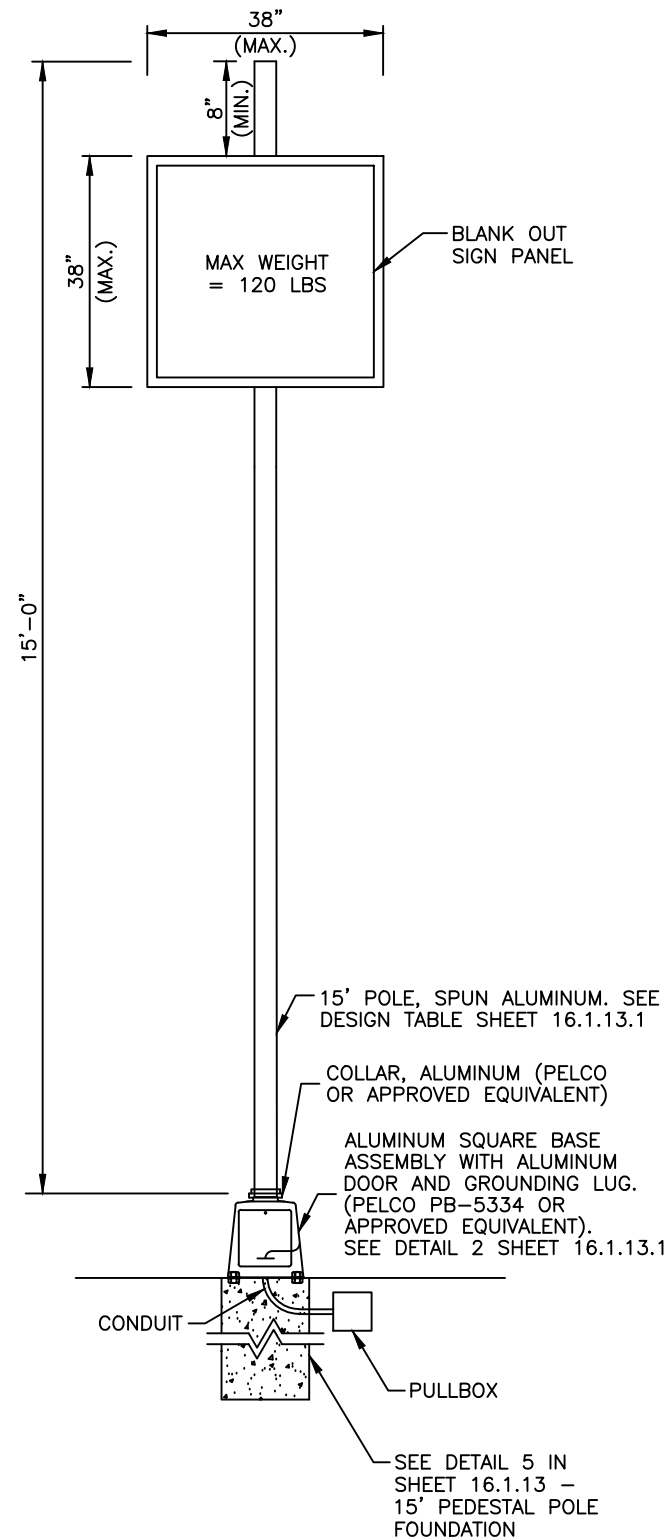
CABINET COMPONENT LIST

- (A) 30 IN W. X 48 IN. H. X 12 IN D. NEMA 3R HINGED ENCLOSURE WITH 6 IN. LEGS ANCHORED TO THE CONCRETE FOUNDATION PAD. THE BACK OF THE CABINET SHALL BE LOCATED 6 IN. MAXIMUM FROM THE EDGE OF THE CONCRETE PAD.
- (B) NEMA 1, 100A, MLO, 120/240V-1φ-3W LOAD CENTER (SEE PANEL SCHEDULE). MINIMUM SPACES AS REQUIRED PLUS A MINIMUM OF TWO AVAILABLE SPACES FOR FUTURE USE. INSTALL IN CABINET WITH FULL-SIZE GROUND, COVER, AND BRANCH BREAKERS AS LISTED ON THE SCHEDULE.
- (C) ELECTRICALLY HELD LIGHTING CONTRACTOR FURNISHED WITH 120-VOLT COIL AND NUMBER OF POLES REQUIRED. INSTALL INSIDE CABINET.
- (D) 20-AMP GFCI MAINT. RECEPTACLE IN A 1-GANG BACK BOX WITH COVER. INSTALL INSIDE THE CABINET.
- (E) 125A, 120/240V, METER HOUSING CONFORMING TO THE UTILITY PROVIDER'S REQUIREMENTS.
- (F) NEMA 3R, 100A, 2-POLE FUSED DISCONNECT, UL LISTED FOR SERVICE EQUIPMENT AND FRN FUSES AS SHOWN ON ONE-LINE DIAGRAM WITH NEUTRAL AND GROUND BARS. MOUNTED ON BACK SIDE OF ENCLOSURE.
- (G) 5/8" X 8'-0" COPPER-CLAD DRIVEN GROUND ROD WITH APPROVED GROUND ROD CLAMP.

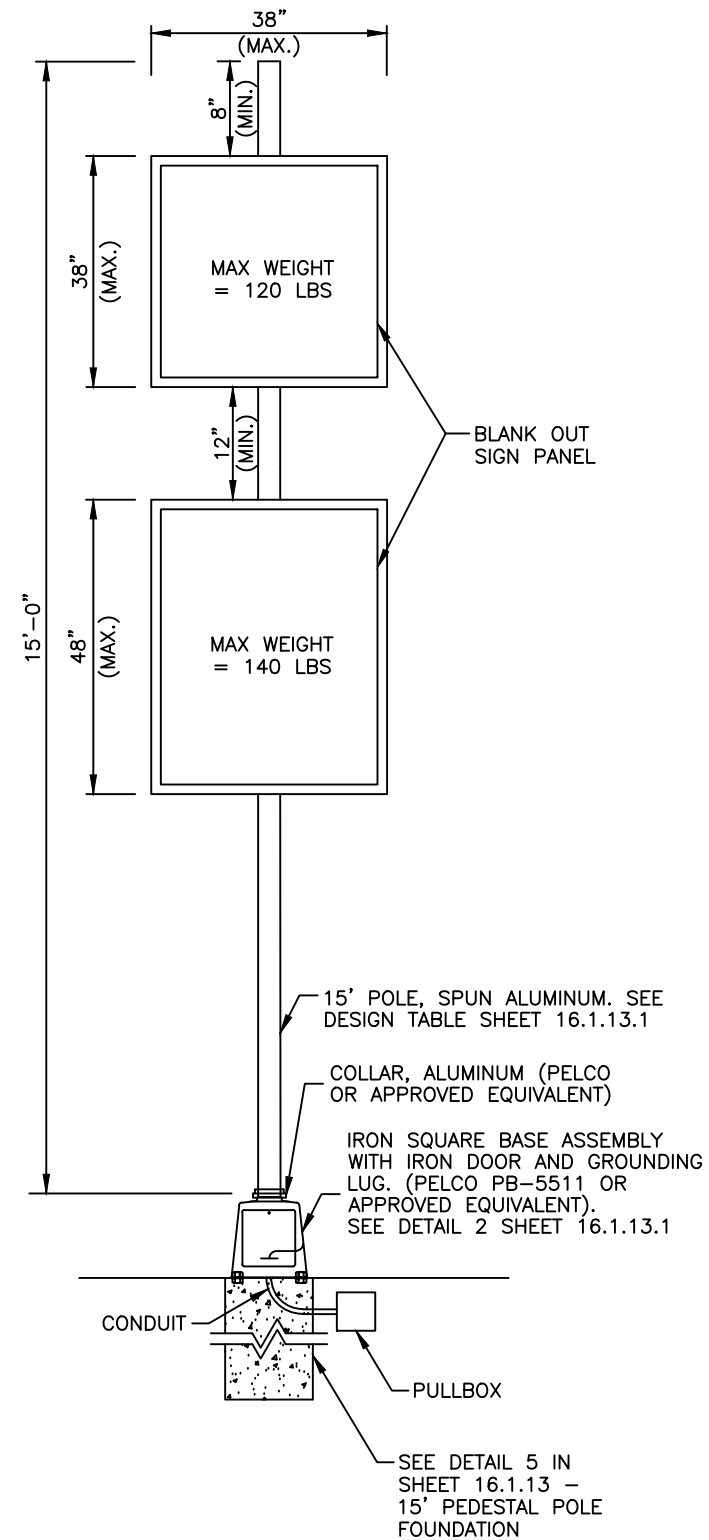
NOT SHOWN IN THE DETAIL:

1. VOLTAGE SURGE ARRESTOR, 650V A.C. TO GROUND MAX.
2. "HAND-OFF-AUTO" KEY SWITCH. KEYED FOR AGENCY RESPONSIBLE FOR THE MAINTENANCE OF THE SYSTEM.

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>LIGHTING CONTROL CABINET & PULL BOX DETAIL</p> <p>Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.27	
Full Path:						Sheet No. 38 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					



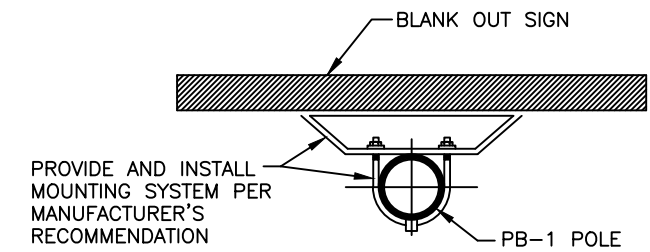
SINGLE BLANK OUT SIGN DETAIL



DOUBLE BLANK OUT SIGN DETAIL

NOTES:

1. HARD-WIRE ELECTRICAL CONNECTIONS SHALL BE MADE FOR POWER.
2. SINGLE SIDED INSTALLATION DETAILS ARE SHOWN IN THESE DRAWINGS. BACK-TO-BACK SIGNS ARE PERMISSIBLE.
3. DESIGN EXTREME PEAK WIND VELOCITY = 120 MPH @ 1700 YEARS RECURRENCE.
4. STANDARD BLANK OUT SIGN DESIGN IS BASED ON THE MAXIMUM SIGN DIMENSIONS AND MINIMUM SPACING SHOWN ON THESE DRAWINGS. ADDITIONAL SIGNS, LARGER SIGNS, OR REDUCED SPACING WILL REQUIRE A SPECIAL DESIGN BY THE CONTRACTOR.

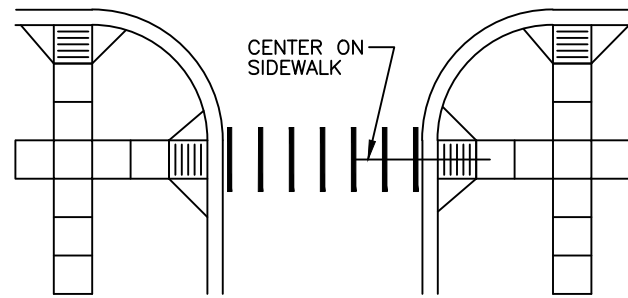


TYPICAL ATTACHMENT DETAILS

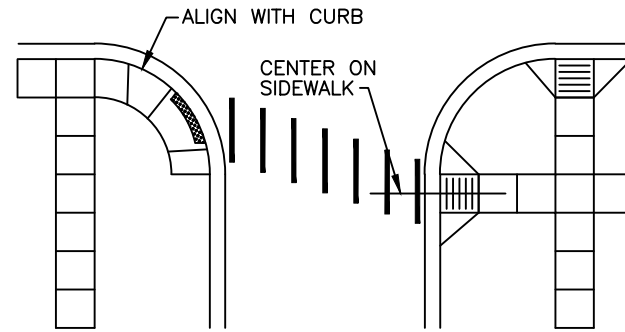
Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>BLANK OUT SIGN DETAILS</p> <p>Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.1.28	
Full Path:						Sheet No. 39 of 39	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					

TYPICAL CROSSWALK LAYOUT PROCEDURES

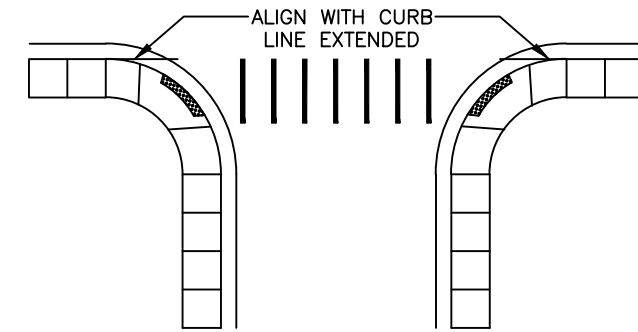
1. SETBACK SIDEWALKS



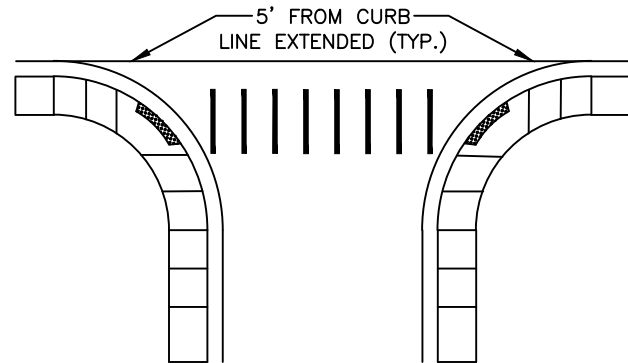
2. SETBACK SIDEWALK ONE SIDE
ATTACHED SIDEWALK OTHER SIDE



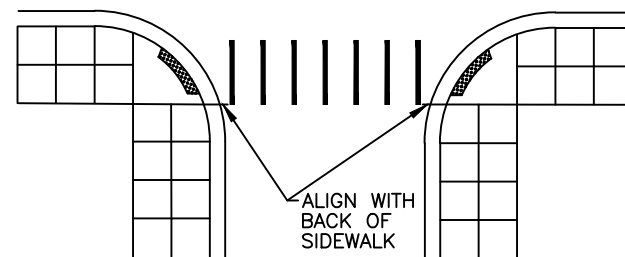
3. ATTACHED SIDEWALK
5' TO 15' CORNER RADII



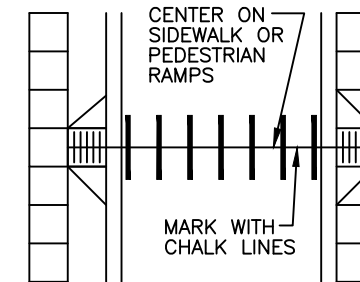
4. ATTACHED SIDEWALK
20' TO 30' CORNER RADII



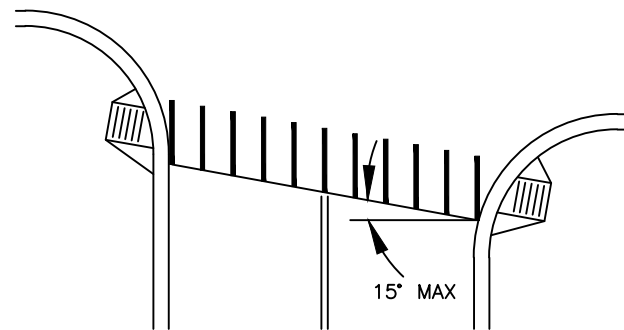
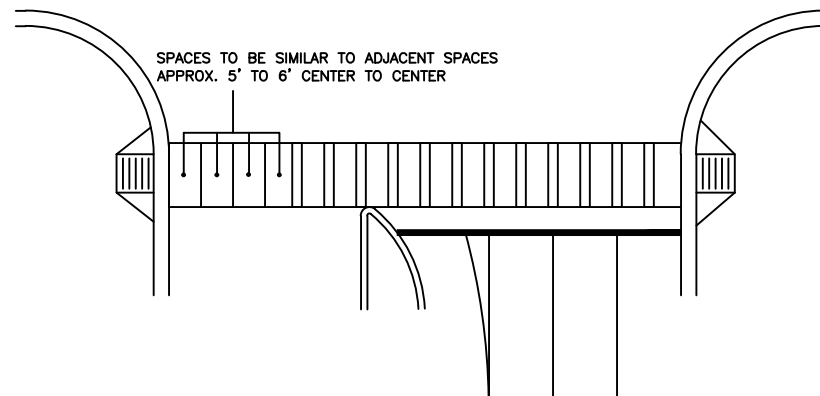
5. ATTACHED SIDEWALK WIDER THAN 10'



6. MID-BLOCK CROSSWALK



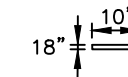
7. INSTALL STOP LINE 4' IN ADVANCE OF AND
PARALLEL TO THE NEAREST CROSSWALK LINE
UNLESS OTHERWISE SHOWN



EXAMPLE:
TYPICAL CROSSWALK BAR LAYOUT
FOR SKEWED CROSSWALK

NOTES:

1. CROSSWALK BAR DIMENSIONS



USE 18" WIDTH FOR CROSSWALK BARS.

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

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

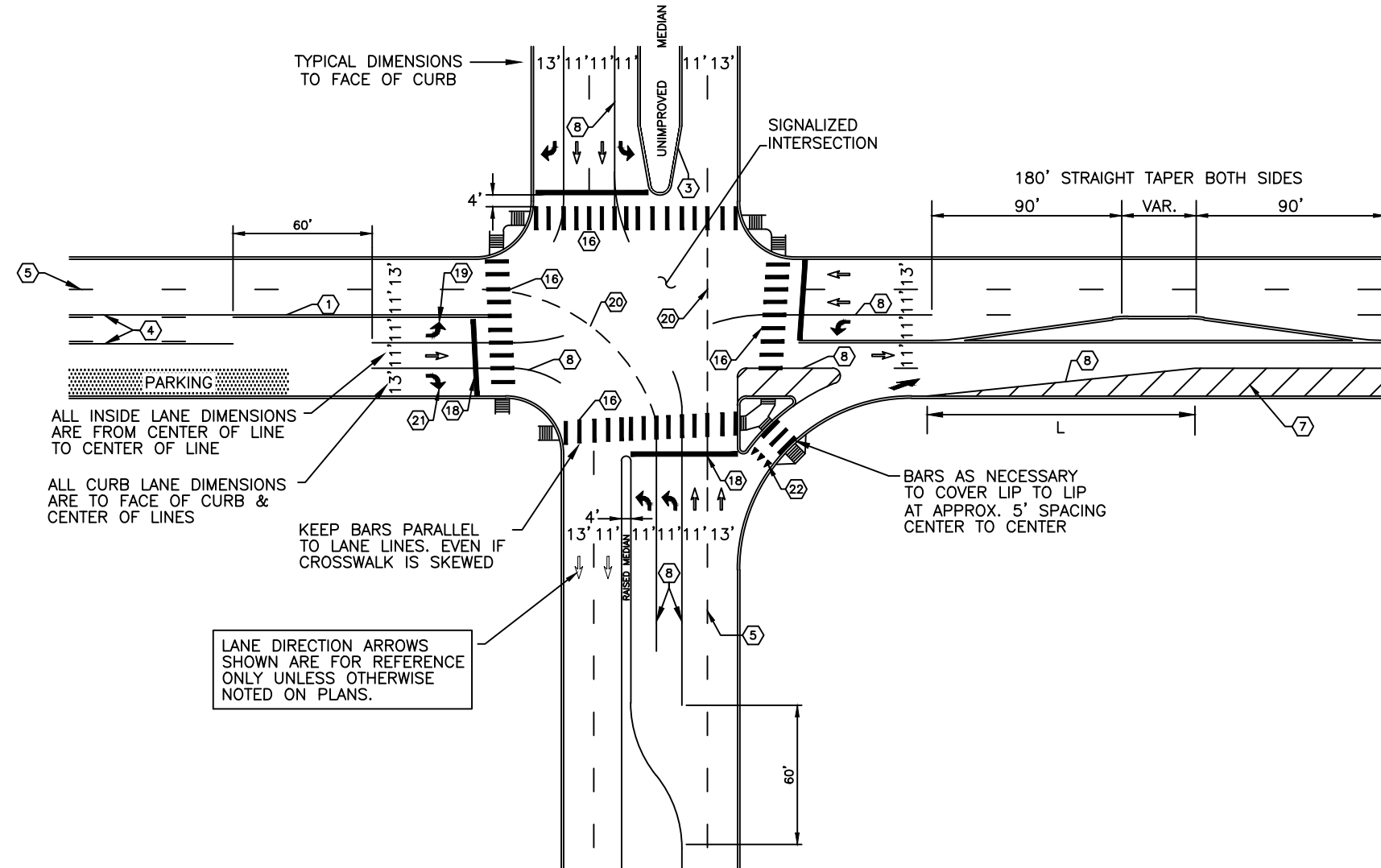
4. ADJUST ALIGNMENT IF NECESSARY TO
ALIGN PROPERLY WITH PEDESTRIAN RAMPS.
CROSSWALKS SHOULD CENTER ON
PEDESTRIAN RAMPS WHEN POSSIBLE.

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

6. DIRECTION RAMPS SHALL BE USED ON
ALL NEW RAMPS UNLESS APPROVED BY
THE CITY ENGINEER.

Computer File Information		Sheet Revisions		 DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	TYPICAL CROSSWALK LAYOUT DETAILS	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.2.1	
Full Path:						Sheet No. 01 of 18	
Drawing File Name:							
CAD Ver.:	Scale:	Units:			Issued By:		

TYPICAL PAVEMENT MARKING EXAMPLES



PAVEMENT MARKING LEGEND AND NOTES

A. TRAFFIC LANE PAVEMENT MARKINGS

MODIFIED EPOXY PAVEMENT MARKING MATERIAL SHALL BE USED UNLESS OTHERWISE APPROVED BY CCD DOTI TRANSPORTATION OPERATIONS

CONCRETE ROADWAY SURFACE:
INLAID THERMO-PLASTIC OR CONTRAST TAPE
PAVEMENT MARKING MATERIAL SHALL BE USED FOR 5, 9, 20 UNLESS OTHERWISE APPROVED BY CCD DOTI TRANSPORTATION OPERATIONS

- ① 4" DOUBLE YELLOW CENTERLINE WITH 4" SEPARATION
- ② 4" SKIP YELLOW CENTERLINE, 10' LINE, 30' GAP
- ③ 4" SOLID YELLOW TWO WAY LEFT EDGE LINE
- ④ 4" SOLID YELLOW OUTSIDE WITH 4" SKIP YELLOW INSIDE, 10' LINE, 30' GAP, AND 4" SEPARATION TWO-WAY LEFT-TURN LANE
- ⑤ 4" SKIP WHITE LANE LINE, 10' LINE, 30' GAP
- ⑥ 8" SOLID WHITE RIGHT EDGE LINE OR TURN LANE LINE
- ⑦ 8" SOLID WHITE 45° DIAGONAL CROSSHATCH AT 15' SPACING
- ⑧ 8" SOLID WHITE RIGHT EDGE LINE OR TURN LANE LINE
- ⑨ 8" DASHED WHITE LINE, 3' DASH WITH 9' GAP
- ⑩ 8" DASHED WHITE LINE, 2' DASH WITH 6' GAP

B. SPECIALTY MARKINGS - MATERIAL SHALL BE REFLECTORIZED PREFORMED THERMO-PLASTIC (MIN. 90 MIL THICKNESS) FULL WIDTH WITHOUT SEAMS UNLESS OTHERWISE SPECIFIED. INSTALL ONLY WHEN SHOWN ON PLANS.

- ⑬ 18" X 10' WHITE CROSSWALK BAR, 18" OR 24" ON STATE HWY
- ⑭ 24" WHITE STOP LINE
- ⑮ LEFT TURN ARROW
- ⑯ RIGHT TURN ARROW
- ⑰ YIELD LINE PER DETAILS ON THIS SHEET

C. ANY FINAL PAVEMENT MARKING QUANTITIES SHALL INCLUDE REMOVAL OF ANY CONFLICTING, PREVIOUS OR DETOUR MARKINGS AS NECESSARY.

D. ALL OTHER PROVISIONS OF "CITY AND COUNTY OF DENVER STANDARDS AND SPECIFICATIONS; AND "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", STATE DEPARTMENT OF HIGHWAYS, STATE OF COLORADO, CURRENT EDITION SHALL APPLY.

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

NOTES:

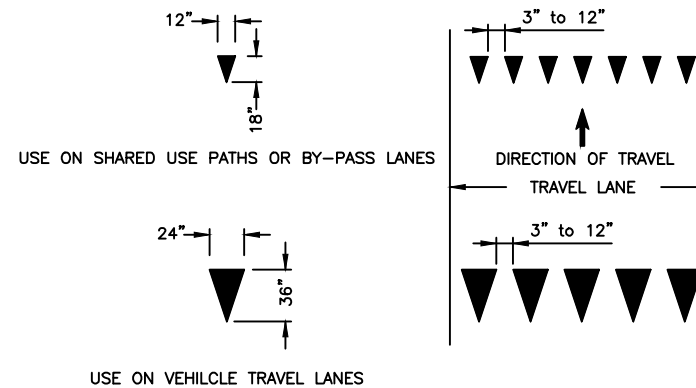
1. CALCULATING TAPER LENGTHS:

SPEED 40 MPH OR LESS $L = WS^2/60$

SPEED 45 MPH OR GREATER $L = WS$

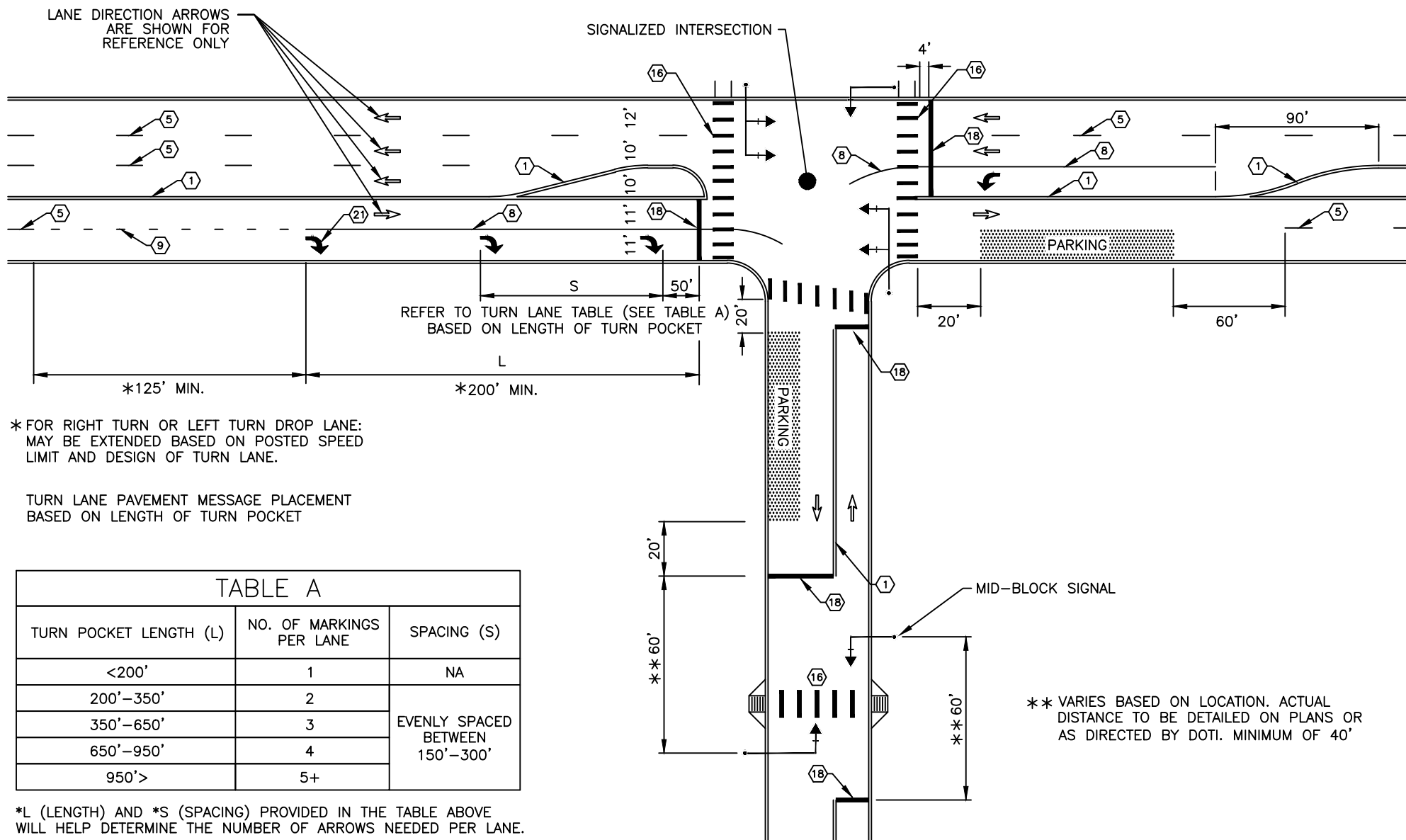
WHERE "L" IS TAPER LENGTH IN FEET, "W" IS WIDTH OF OFFSET IN FEET, AND "S" IS POSTED SPEED LIMIT IN MPH.

YIELD LINE DETAILS



Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	PAVEMENT MARKING DETAILS SHEET 1 Issued By:	STANDARD DRAWING NO.
Creation Date:	Initials:	Date:	Comments:			16.2.2.1
Full Path:						Sheet No. 02 of 18
Drawing File Name:						
CAD Ver.:	Scale:	Units:				

TYPICAL PAVEMENT MARKING EXAMPLES



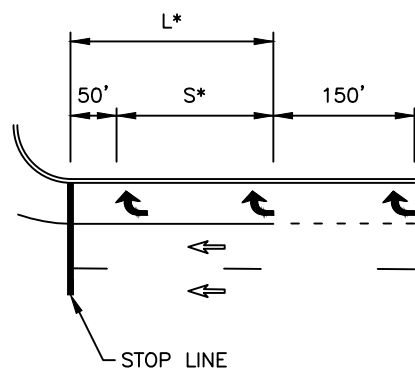
* FOR RIGHT TURN OR LEFT TURN DROP LANE: MAY BE EXTENDED BASED ON POSTED SPEED LIMIT AND DESIGN OF TURN LANE.

TURN LANE PAVEMENT MESSAGE PLACEMENT BASED ON LENGTH OF TURN POCKET

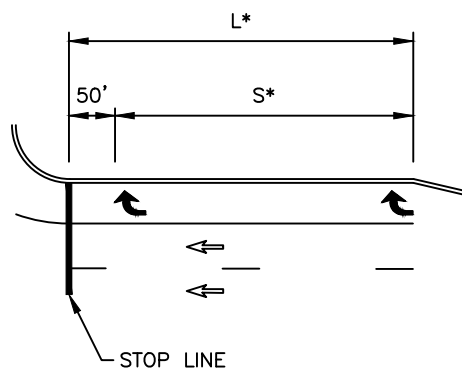
TABLE A		
TURN POCKET LENGTH (L)	NO. OF MARKINGS PER LANE	SPACING (S)
<200'	1	NA
200'–350'	2	EVENLY SPACED BETWEEN 150'–300'
350'–650'	3	
650'–950'	4	
950'>	5+	

*L (LENGTH) AND *S (SPACING) PROVIDED IN THE TABLE ABOVE WILL HELP DETERMINE THE NUMBER OF ARROWS NEEDED PER LANE.

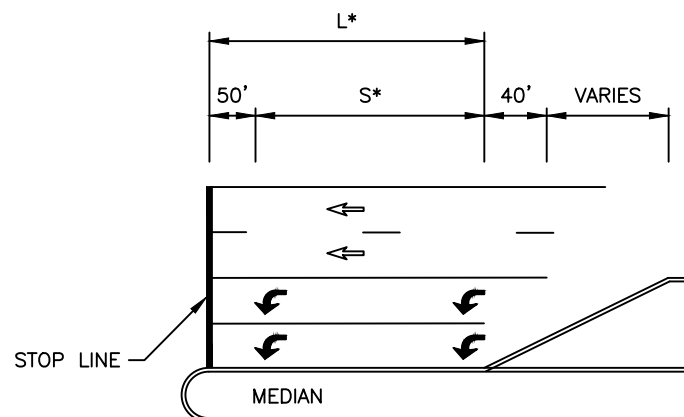
LANE DROP



POCKET LANE



DOUBLE TURNING



PAVEMENT MARKING LEGEND AND NOTES

A. TRAFFIC LANE PAVEMENT MARKINGS

MODIFIED EPOXY PAVEMENT MARKING MATERIAL SHALL BE USED UNLESS OTHERWISE APPROVED BY DOTI TRANSPORTATION OPERATIONS

CONCRETE ROADWAY SURFACE:
INLAID THERMO-PLASTIC OR CONTRAST TAPE
PAVEMENT MARKING MATERIAL SHALL BE USED FOR (5)(9)(20)
UNLESS OTHERWISE APPROVED BY DOTI TRANSPORTATION OPERATIONS

- (1) 4" DOUBLE YELLOW CENTERLINE WITH 4" SEPARATION
- (2) 4" SKIP YELLOW CENTERLINE, 10' LINE, 30' GAP
- (3) 4" SOLID YELLOW TWO WAY LEFT EDGE LINE
- (4) 4" SOLID YELLOW OUTSIDE WITH 4" SKIP YELLOW INSIDE, 10' LINE, 30' GAP, AND 4" SEPARATION TWO-WAY LEFT-TURN LANE
- (5) 4" SKIP WHITE LANE LINE, 10' LINE, 30' GAP
- (6) 8" SOLID WHITE RIGHT EDGE LINE OR TURN LANE LINE
- (7) 8" SOLID WHITE 45° DIAGONAL CROSSHATCH AT 15' SPACING
- (8) 8" SOLID WHITE RIGHT EDGE LINE OR TURN LANE LINE
- (9) 8" DASHED WHITE LINE, 3' DASH WITH 9' GAP
- (20) 8" DASHED WHITE LINE, 2' DASH WITH 6' GAP

B. SPECIALTY MARKINGS – MATERIAL SHALL BE REFLECTORIZED PREFORMED THERMO-PLASTIC (MIN. 90 MIL THICKNESS) FULL WIDTH WITHOUT SEAMS UNLESS OTHERWISE SPECIFIED

- (16) 18" X 10' WHITE CROSSWALK BAR, 18" OR 24" ON STATE HWY
- (18) 24" WHITE STOP LINE, ONLY WHEN SHOWN ON PLANS
- (19) LEFT TURN ARROW
- (21) RIGHT TURN ARROW

C. ANY FINAL PAVEMENT MARKING QUANTITIES SHALL INCLUDE REMOVAL OF ANY CONFLICTING, PREVIOUS OR DETOUR MARKINGS AS NECESSARY.

D. ALL OTHER PROVISIONS OF "CITY AND COUNTY OF DENVER STANDARDS AND SPECIFICATIONS: AND "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", STATE DEPARTMENT OF HIGHWAYS, STATE OF COLORADO, CURRENT EDITION SHALL APPLY.

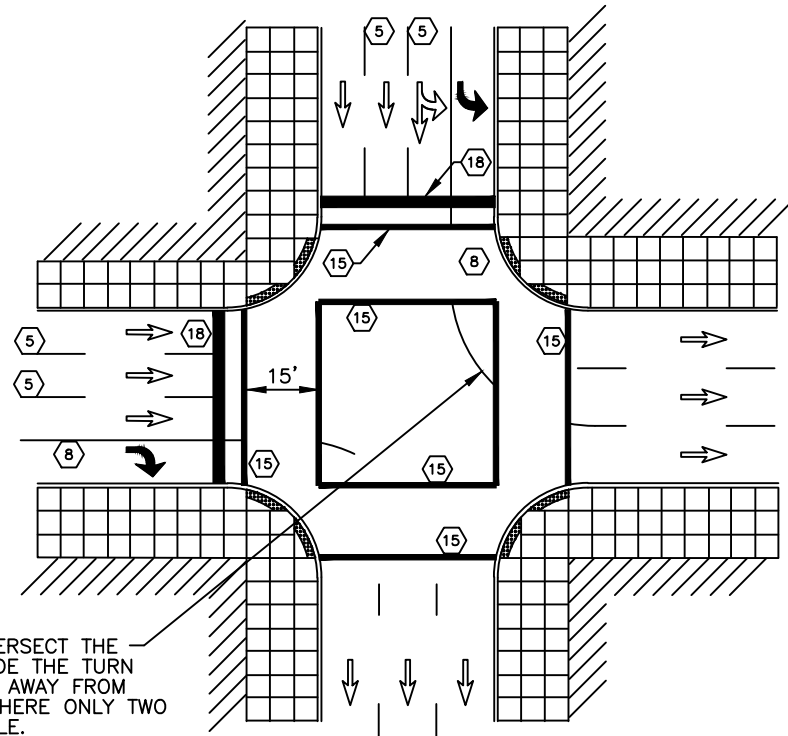
E. ALL REMOVALS SHALL BE BY GRINDING, SANDBLASTING OR WATER BLASTING METHODS PROVIDED THAT THE PAVEMENT SURFACE SHALL NOT BE MATERIALLY DAMAGED. THE PAVEMENT MARKINGS SHALL BE REMOVED TO THE EXTENT THAT THEY SHALL NOT BE VISIBLE UNDER DAY OR NIGHT CONDITIONS.

NOTES:

1. THE SPACING IN TABLE A APPLIES TO LEFT & RIGHT TURN LANES.
2. WHEN ONE (1) ARROW IS USED, IT SHALL BE PLACED AT THE BEGINNING OF THE FULL WIDTH TURN LANE, OTHERWISE USE TABLE A FOR ARROW PLACEMENT.

Computer File Information		Sheet Revisions		<p style="text-align: center;">DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p style="text-align: center;">PAVEMENT MARKING DETAILS SHEET 2</p> <p style="text-align: right;">Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.2.2.2	
Full Path:						Sheet No. 03 of 18	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					

**SPECIALTY PAVING CROSSWALK
PAVEMENT MARKING DETAILS**

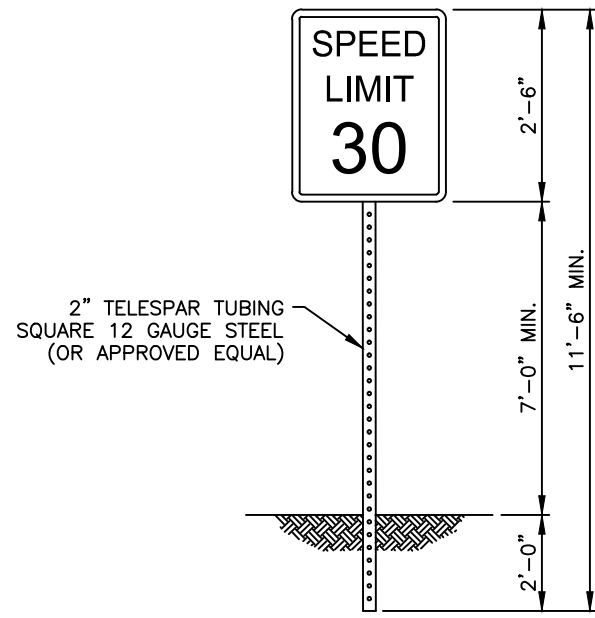


TURN LANE LINE SHOULD INTERSECT THE LANE LINE WHICH WILL PROVIDE THE TURN LANE WITH TWO LANES GOING AWAY FROM THE INTERSECTION, EXCEPT WHERE ONLY TWO THROUGH LANES ARE AVAILABLE.

PAVEMENT MARKING LEGEND AND NOTES

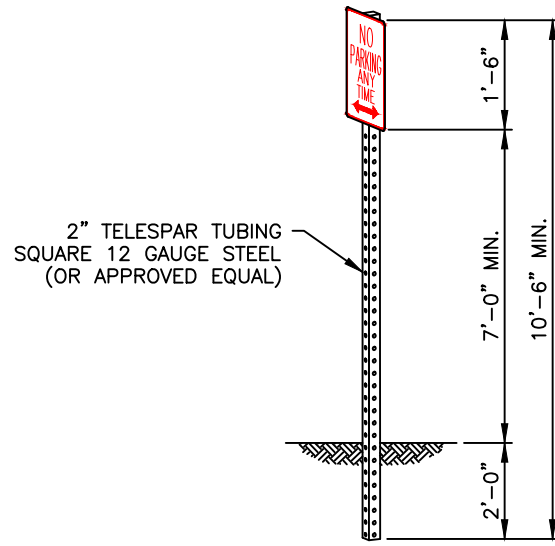
- A. TRANSVERSE MARKINGS ONLY TO BE USED IN SITUATIONS WHERE STANDARD CONTINENTAL CROSSWALKS CANNOT BE INSTALLED SUCH AS IN AREAS OF BRICK/SPECIALTY PAVING DOWNTOWN.
- B. TRAFFIC LANE MARKINGS – MATERIAL SHALL BE MODIFIED EPOXY MARKING MATERIAL UNLESS OTHERWISE SPECIFIED.
 - ⑤ 4" SKIP WHITE LANE LINE, 10' LINE, 30' GAP
 - ⑧ 8" SOLID WHITE RIGHT EDGE LINE OR TURN LANE LINE
- C. SPECIALTY MARKINGS – MATERIAL SHALL BE REFLECTORIZED PREFORMED THERMO-PLASTIC FULL WIDTH WITHOUT SEAMS UNLESS OTHERWISE SPECIFIED
 - ⑮ 18" WHITE TRANSVERSE CROSSWALK LINE
 - ⑱ 24" WHITE STOP LINE, ONLY WHEN SHOWN ON PLANS.
- D. ANY FINAL PAVEMENT MARKING QUANTITIES SHALL INCLUDE REMOVAL OF ANY CONFLICTING, PREVIOUS OR DETOUR MARKINGS AS NECESSARY.
- E. ALL OTHER PROVISIONS OF "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", STATE DEPARTMENT OF HIGHWAYS, STATE OF COLORADO, CURRENT EDITION SHALL APPLY.
- F. ALL REMOVALS SHALL BE BY GRINDING, SANDBLASTING OR WATER BLASTING METHODS PROVIDED THAT THE PAVEMENT SURFACE SHALL NOT BE MATERIALLY DAMAGED. THE PAVEMENT MARKINGS SHALL BE REMOVED TO THE EXTENT THAT THEY SHALL NOT BE VISIBLE UNDER DAY OR NIGHT CONDITIONS.

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>SPECIALTY PAVING CROSSWALK PAVEMENT MARKING DETAILS</p> <p>Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.2.4	
Full Path:						Sheet No. 05 of 18	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					



ELEVATION

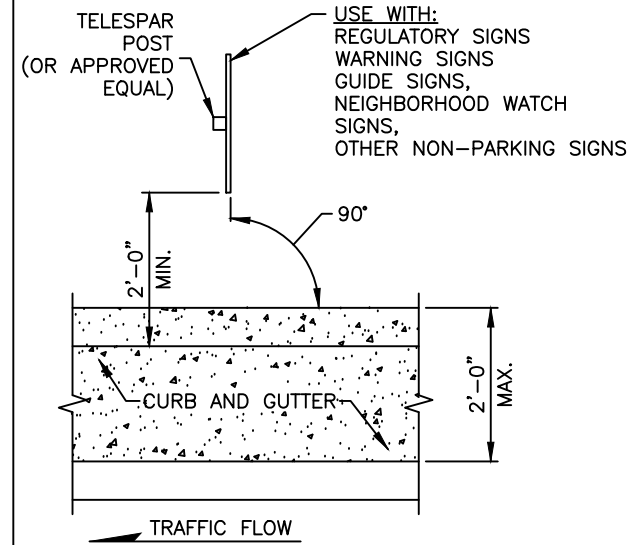
OTHER REGULATORY OR WARNING SIGNS



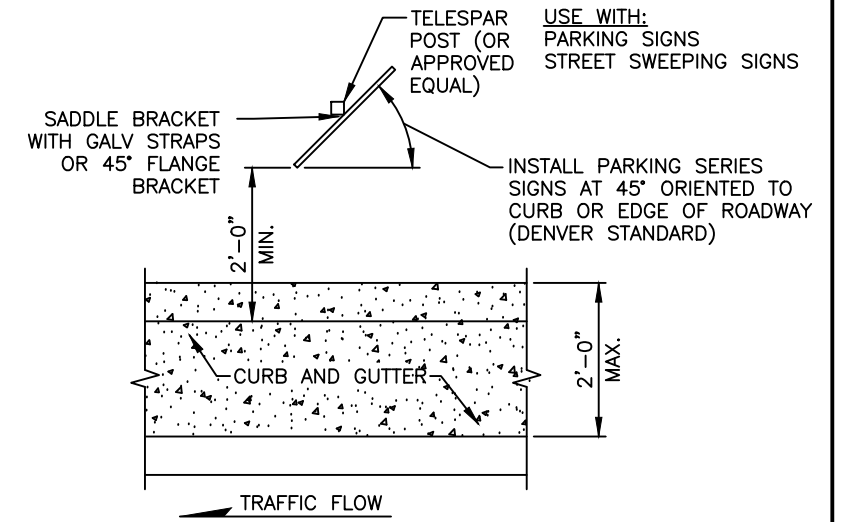
ELEVATION

PARKING SIGNS

ROADSIDE SIGN INSTALLATION



PLAN



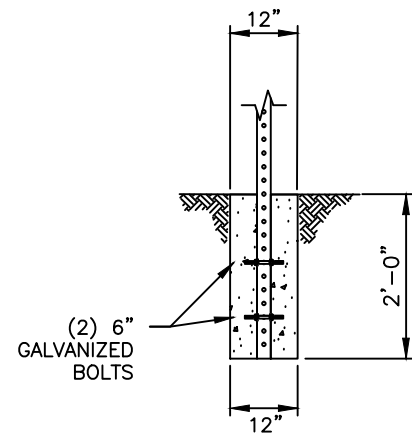
PLAN

NOTE:

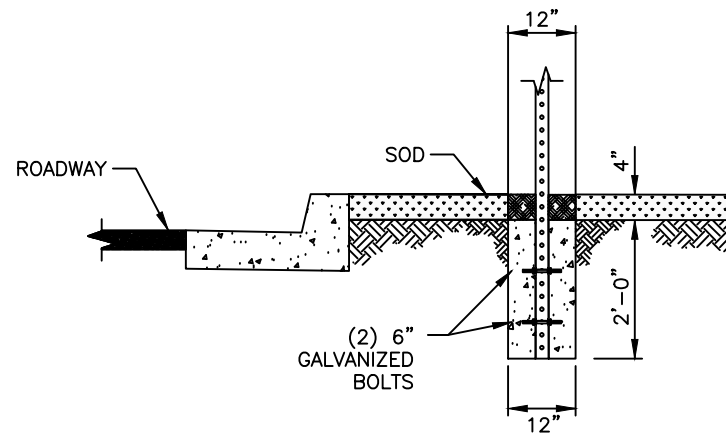
SIGNS: ALL SIGNS SHALL BE FABRICATED FROM ASTM TYPE XI, 4000 SERIES SIGN FACE SHEETING MATERIAL. ALL SIGNS ARE 0.080 GAUGE, 6061-T6 OR 5052-H38 ALUMINUM ALLOY, TREATED WITH ALONDINE 1200 CONVERSION COATING, 3/8 INCH DIAMETER HOLES PUNCHED, CENTERED ON TOP AND BOTTOM, HORIZONTAL AXIS WITH STANDARD 1-1/2 INCH RADIUS CORNERS. ALL IMAGING SHALL BE ACCOMPLISHED WITH A MATCH COMPONENT SYSTEM WITH ACRYLIC FILM THAT MATCHES THE WARRANTY OF THE BASE REFLECTIVE SHEETING. INKS SHALL NOT BE PERMITTED FOR IMAGING.

NOTE:

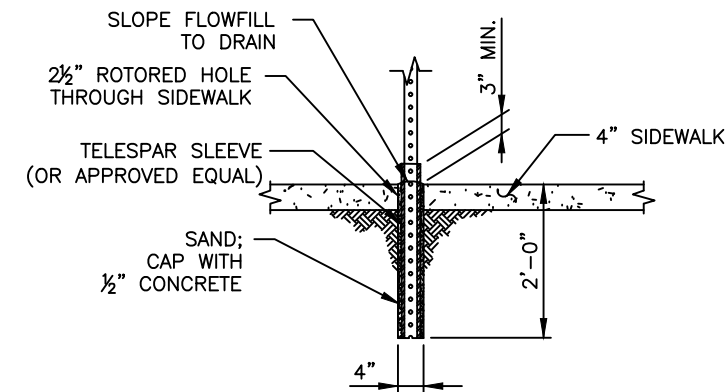
POSTS SHOULD BE INSTALLED TO PROVIDE 4' MINIMUM CLEAR WIDTH ALONG EXISTING SIDEWALK PATH FOR ADA COMPLIANCE.



DETAIL 1
MOUNTED IN DIRT



DETAIL 2
MOUNTED IN SOD/VEGETATION

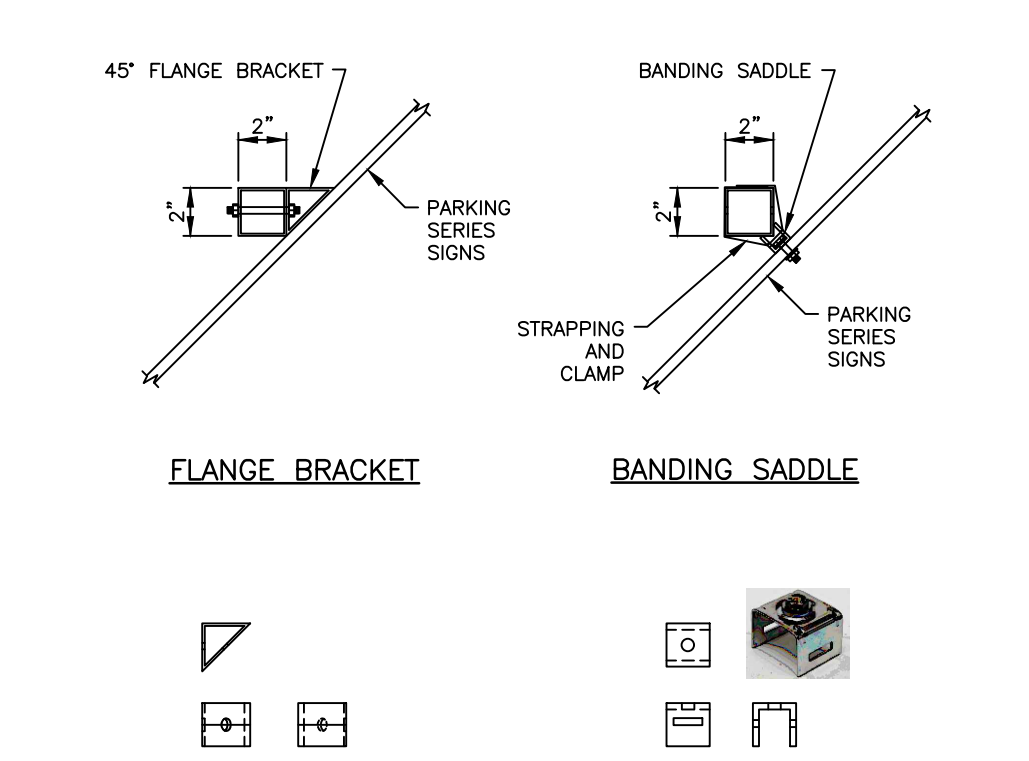
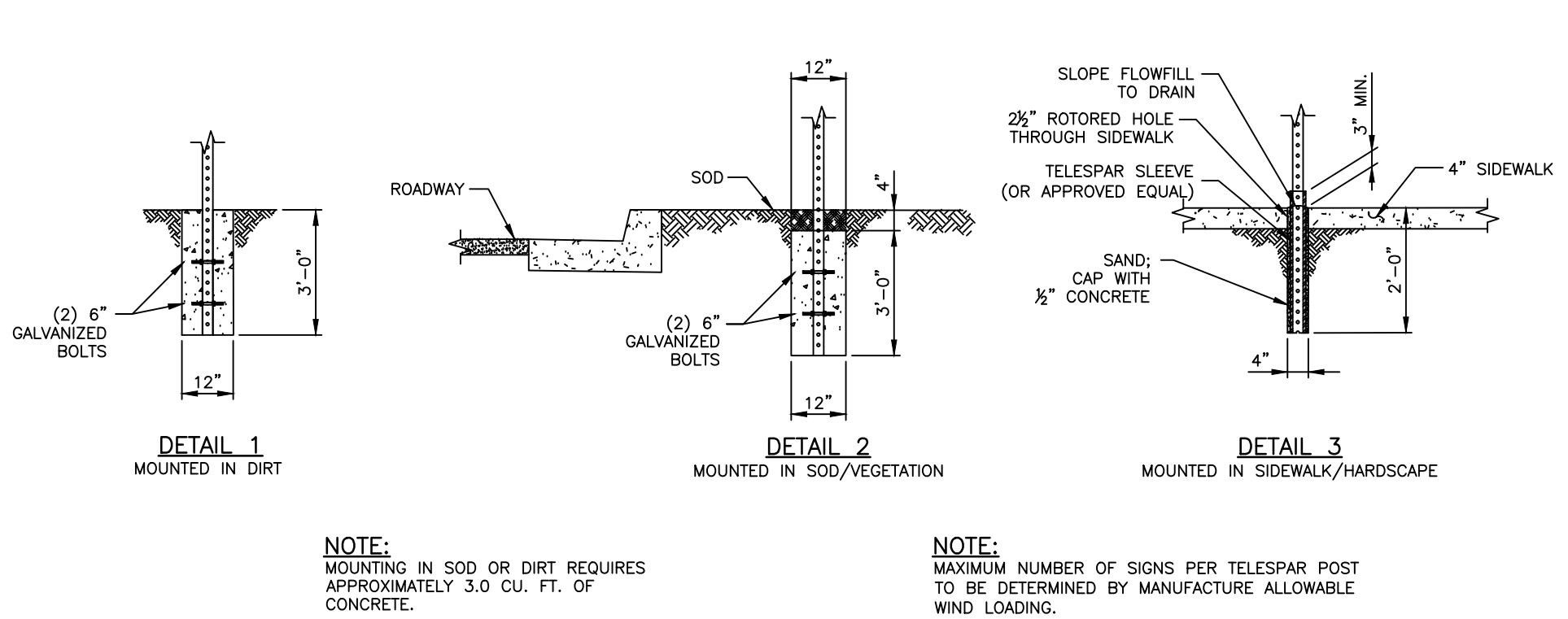
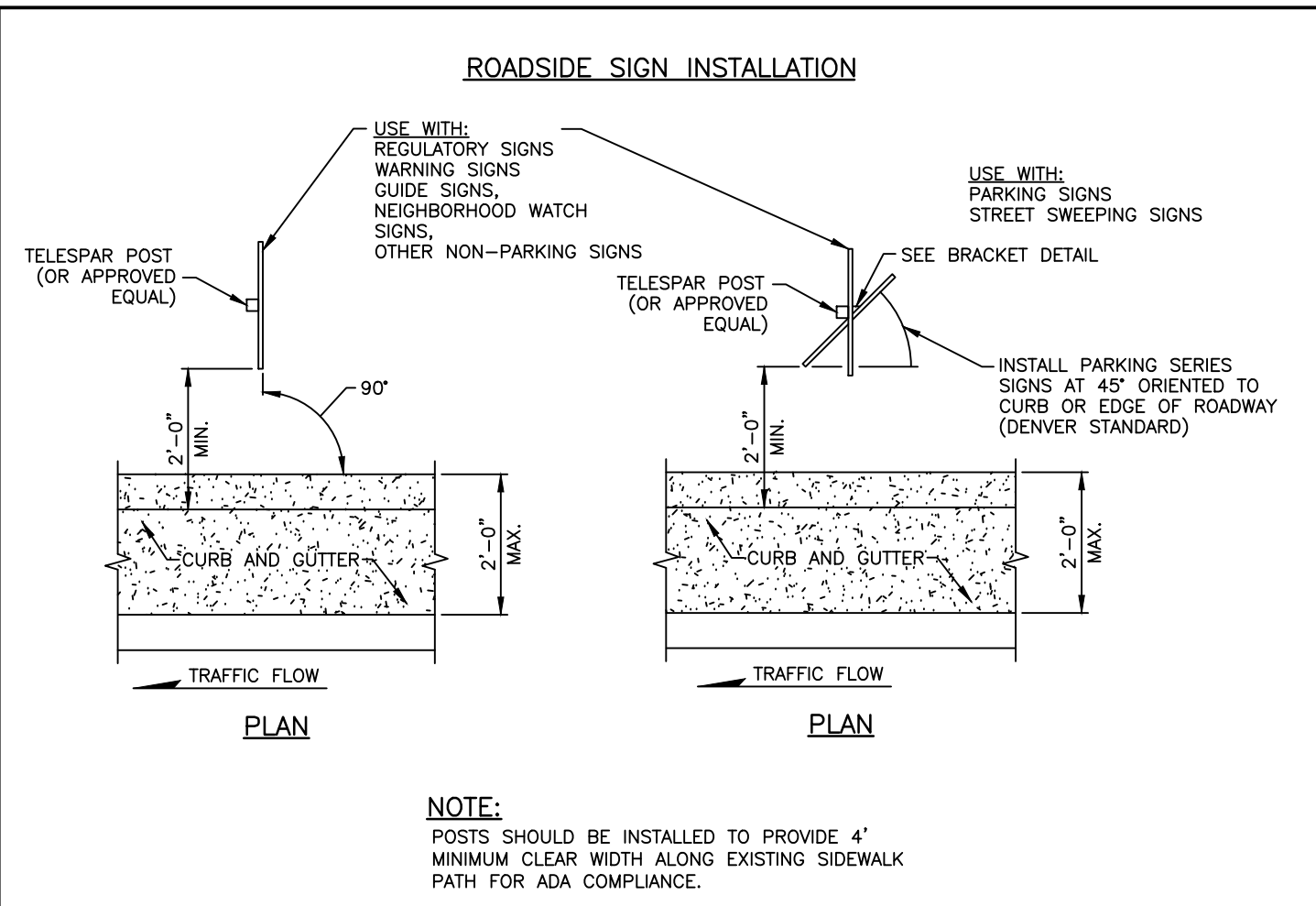
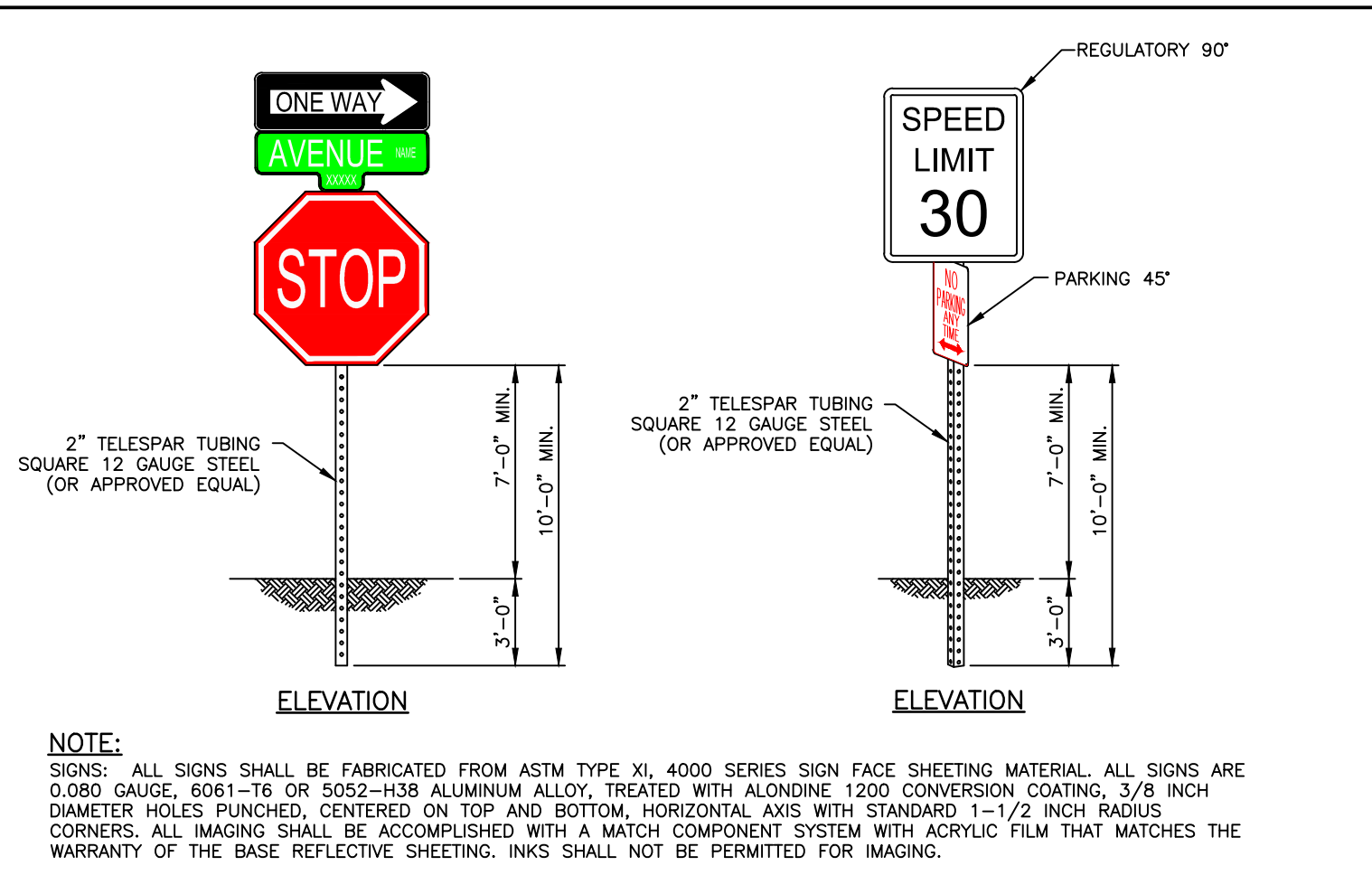


DETAIL 3
MOUNTED IN SIDEWALK/HARDSCAPE

NOTE:

MOUNTING IN SOD OR DIRT REQUIRES APPROXIMATELY 2.0 CU. FT. OF CONCRETE OR AS APPROVED.

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Creation Date:	Initials:	Date:	Comments:			16.2.5	
Full Path:						Sheet No. 06 of 18	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					



Computer File Information	
Creation Date:	Initials:
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Drawing File Name:	
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Sheet Revisions	
Date:	Comments:

DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE

201 WEST COLFAX AVENUE
 DENVER, CO 80202

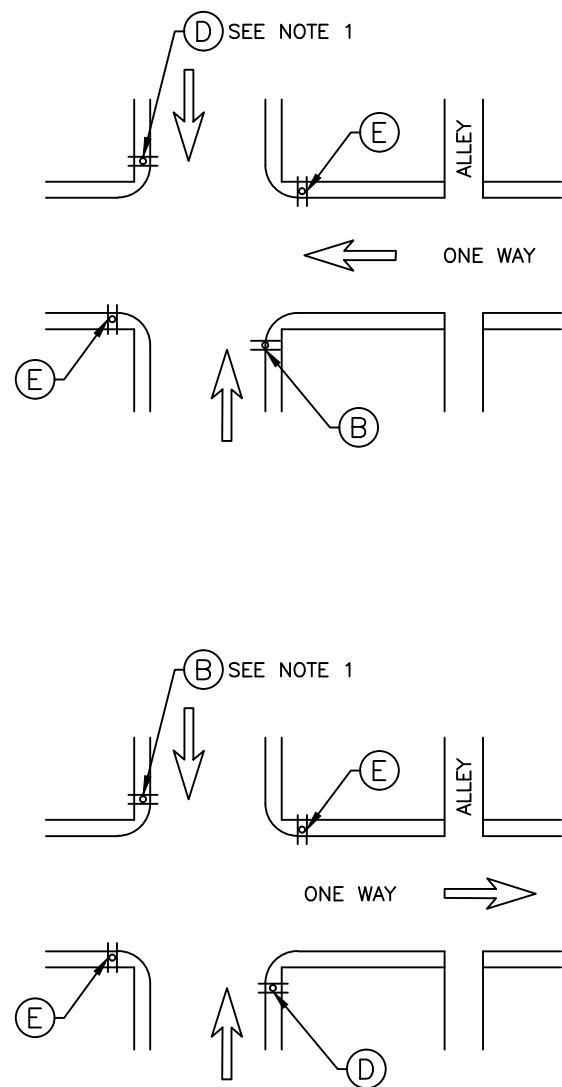
PHONE: (720) 913-4501 FAX: (720) 913-4544

DENVER
THE MILE HIGH CITY

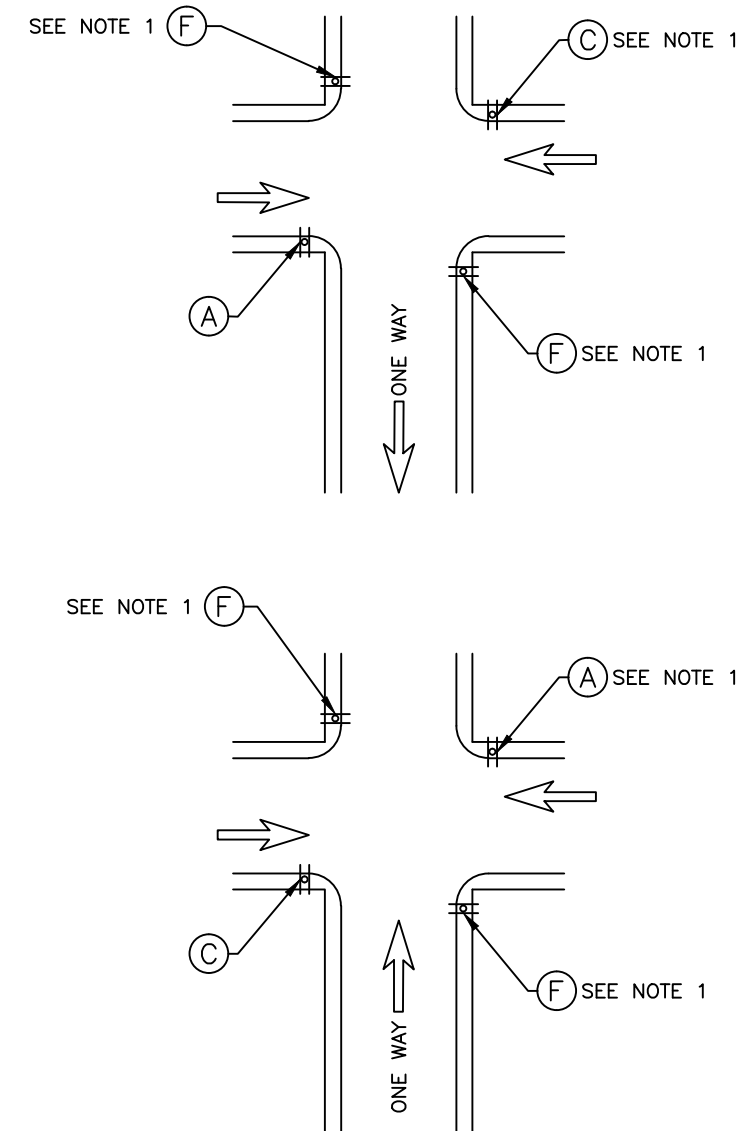
MULTIPLE SIGN POST MOUNTING DETAILS

Issued By:

STANDARD DRAWING NO.
16.2.6
Sheet No. 07 of 18

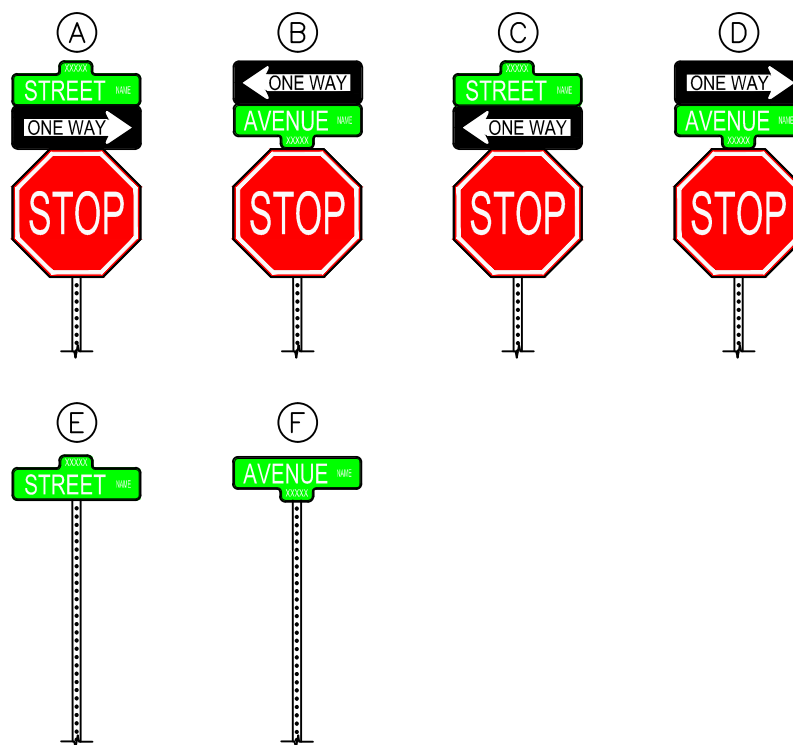


STANDARD SIGN PLACEMENT FOR STOP CONTROLLED INTERSECTIONS ALONG (EAST-WEST) ONE WAY STREETS



STANDARD SIGN PLACEMENT FOR STOP CONTROLLED INTERSECTIONS ALONG (NORTH - SOUTH) ONE WAY STREETS

SIGN SCHEDULE

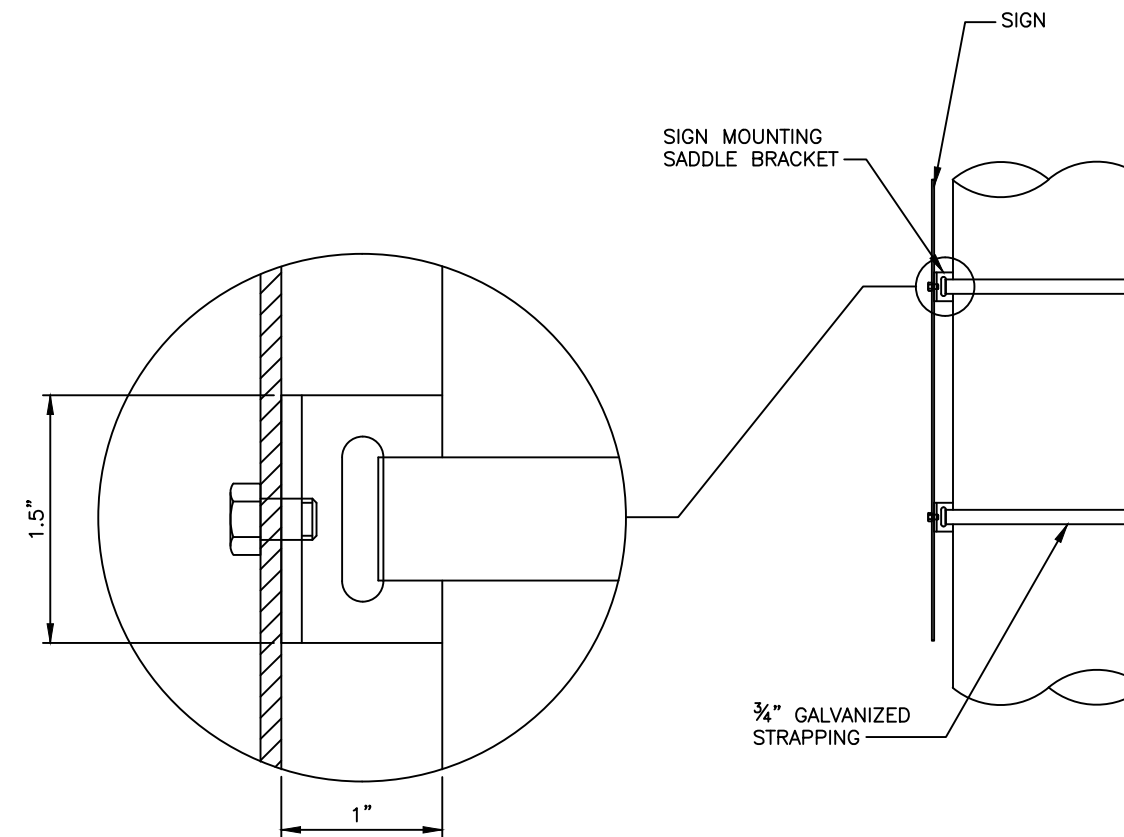
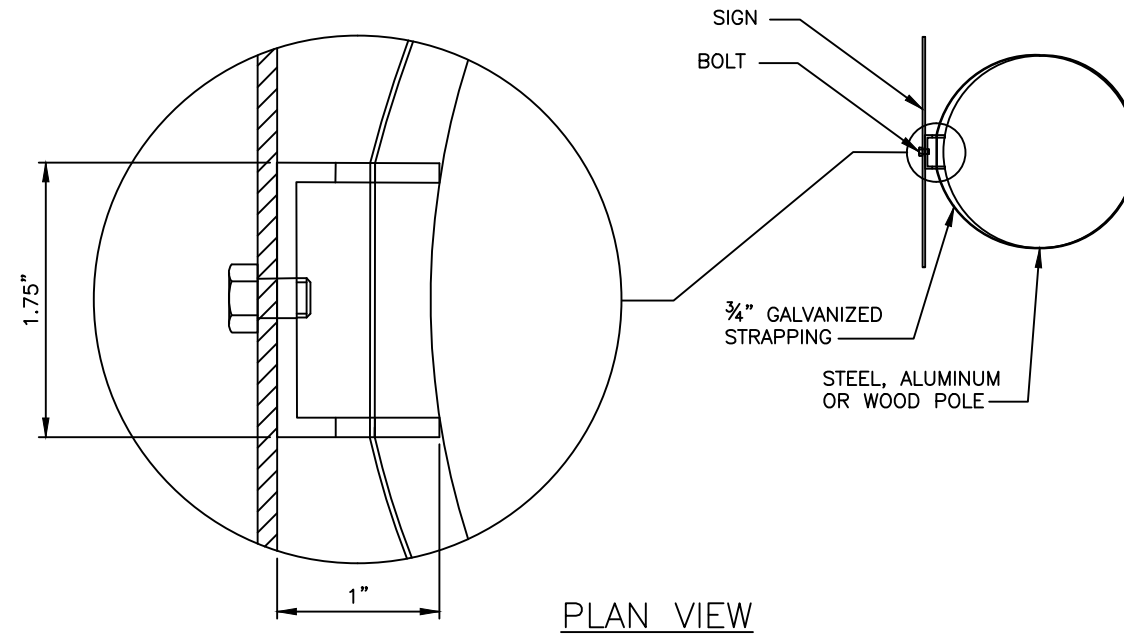


NOTES:

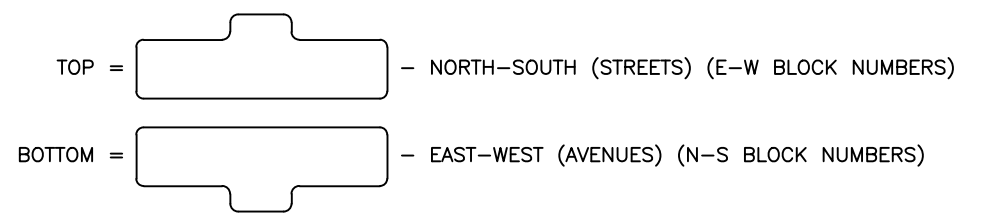
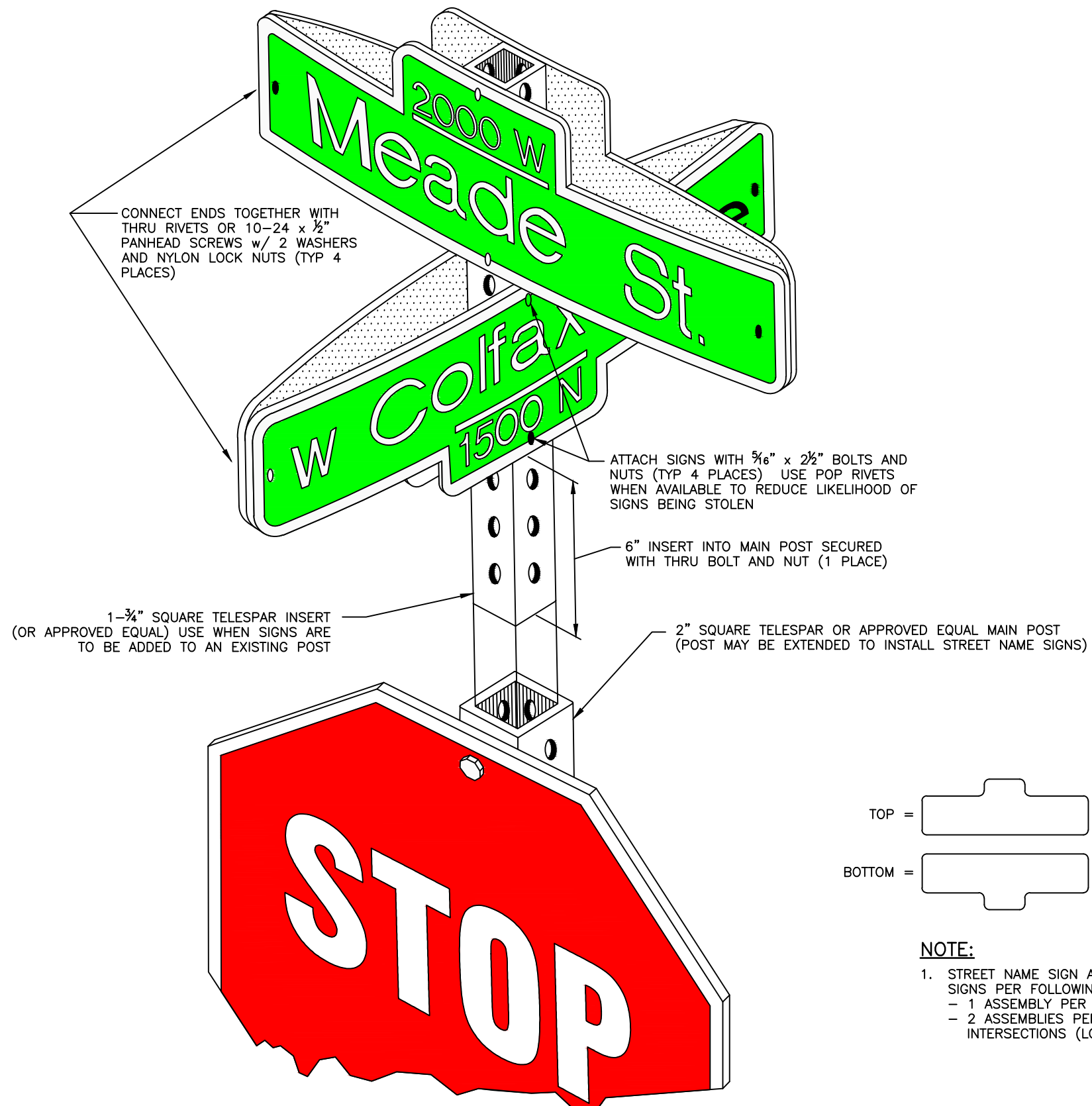
- ONE WAY AND STREET NAME SIGNS SHOULD BE INSTALLED WITH BACK TO BACK SIGN PANELS. (STOP SIGNS ARE NOT REQUIRED TO BE BACK TO BACK - SEE SHEET 16.2.10)

Computer File Information		Sheet Revisions		<p>DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544</p>	<p>ONE-WAY SIGN PLACEMENT DETAILS</p> <p>Issued By:</p>	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.2.7	
Full Path:						Sheet No. 08 of 18	
Drawing File Name:							
CAD Ver.:	Scale:	Units:					

MOUNTING DETAIL FOR ADDING SIGNS TO EXISTING UTILITY POLES

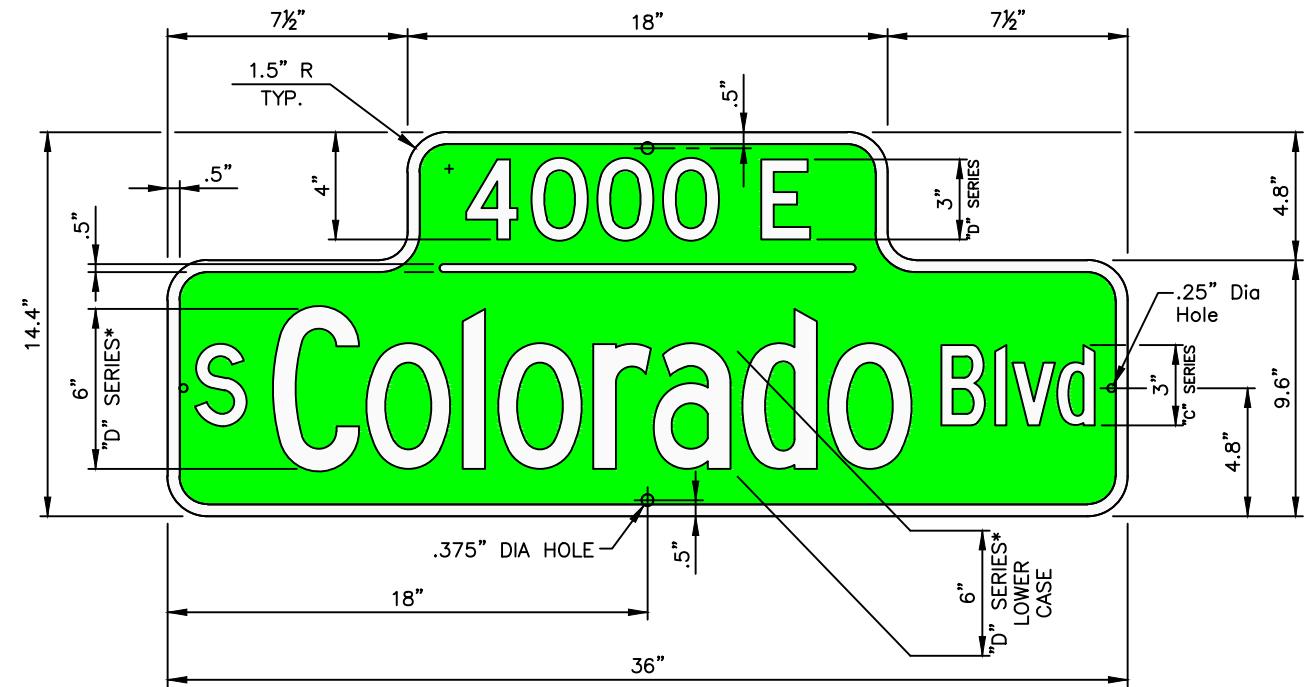
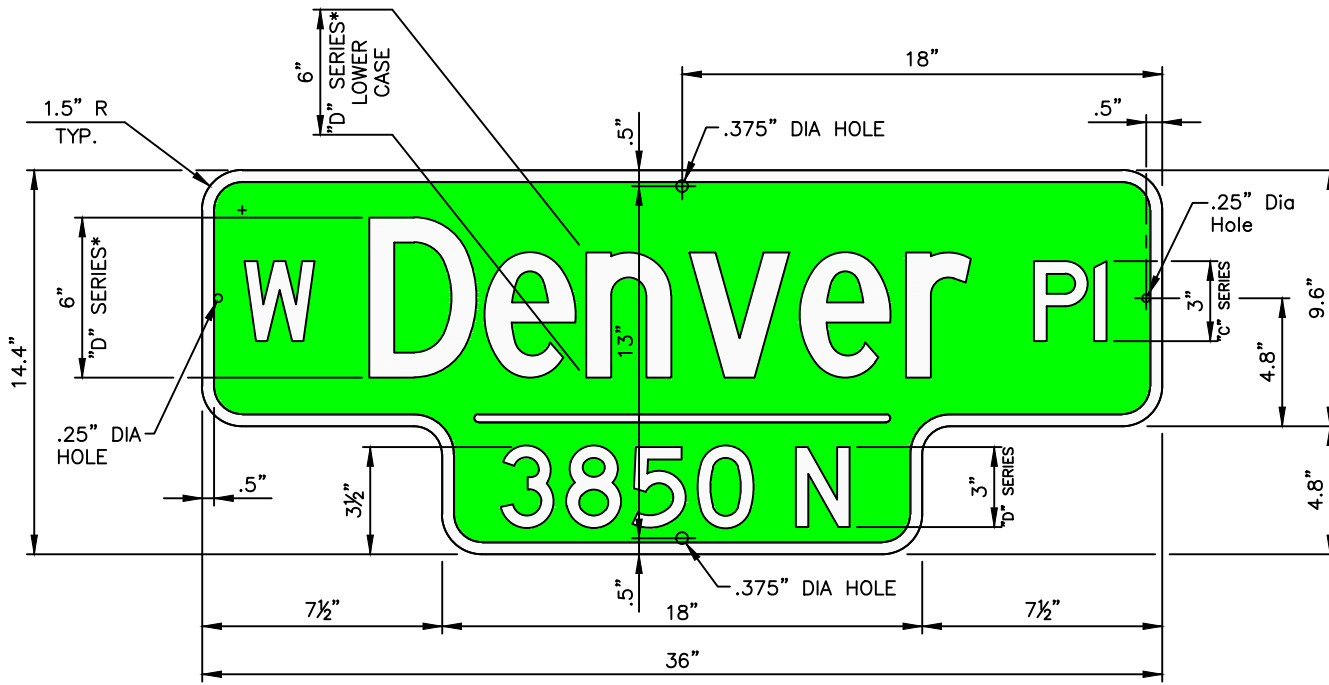


Computer File Information		Sheet Revisions		 DENVER THE MILE HIGH CITY	DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	TRAFFIC SIGN UTILITY POLE MOUNTING DETAIL Issued By:	STANDARD DRAWING NO.
Creation Date:	Initials:	Date:	Comments:				16.2.8
Full Path:							Sheet No. 09 of 18
Drawing File Name:							
CAD Ver.:	Scale:	Units:					



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

Computer File Information		Sheet Revisions		 DENVER THE MILE HIGH CITY DEPARTMENT OF TRANSPORTATION & INFRASTRUCTURE 201 WEST COLFAX AVENUE DENVER, CO 80202 PHONE: (720) 913-4501 FAX: (720) 913-4544	GROUND MOUNT STREET NAME SIGN INSTALLATION DETAIL Issued By:	STANDARD DRAWING NO.	
Creation Date:	Initials:	Date:	Comments:			16.2.9	
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* LETTER SERIES WILL VARY DEPENDING ON NUMBER OF LETTERS IN STREET NAME (SEE EXAMPLES BELOW)

NOTE: STROKE WIDTH OF LETTERS SHOWN ON THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY AND IS NOT INTENDED TO REPRESENT CORRECT STROKE WIDTH FOR SPECIFIED LETTER SERIES OR LETTER TO LETTER SPACING

GROUND MOUNT STREET NAME SIGN NOTES:

1. ALL GROUND MOUNT STREET NAME SIGNS SHALL BE FABRICATED FROM ASTM TYPE XI, 4000 SERIES SIGN FACE SHEETING MATERIAL OR APPROVED EQUAL. ALL SIGN PLATES SHALL BE 0.08 GAUGE, 6061-T6 OR 5052-H38 ALUMINUM ALLOY, TREATED WITH ALONDINE 1200 CONVERSION COATING, AND WITH 0.375 INCH DIAMETER HOLES PUNCHED CENTERED ON TOP AND BOTTOM OF HORIZONTAL AXIS AND 0.5 INCHES FROM THE TOP AND BOTTOM EDGES (MEASURED TO CENTER OF HOLE). SIGN PANELS SHALL HAVE ROUNDED CORNERS (1.5 INCH RADIUS ON OUTSIDE CORNERS AND 0.875" RADIUS ON INSIDE CORNERS). ALL IMAGING SHALL BE ACCOMPLISHED WITH A MATCH COMPONENT SYSTEM WITH ACRYLIC FILM MATCHING THE WARRANTY OF THE BASE REFLECTIVE SHEETING. INKS SHALL NOT BE PERMITTED FOR IMAGING.
2. ALL SIGN POSTS FOR INSTALLING GROUND MOUNT STREET NAME SIGNS SHALL BE MINIMUM 2.0 INCH BY 2.0 INCH GALVANIZED SQUARE STEEL POSTS WITH PRE-DRILLED 3/8" MOUNTING HOLES; TELESPAR OR APPROVED EQUAL.
3. ALL MOUNTING BOLTS SHALL BE ZINC OR CADMIUM PLATED.
4. ALL GROUND MOUNT STREET NAME SIGNS SHALL BE MOUNTED SO AS TO HAVE 7.0 FEET MINIMUM VERTICAL CLEARANCE ABOVE SIDEWALK GRADE AND 2.0 FEET MINIMUM LATERAL CLEARANCE FROM FACE OF CURB OR EDGE OF ROADWAY.
5. GROUND MOUNT STREET NAME SIGNS MAY BE INSTALLED ABOVE EXISTING STOP SIGNS OR ONE-WAY SIGNS ON UTILITY POLE WITH THE CONDITION THAT STREET NAME SIGN MOUNTING HEIGHT DOES NOT EXCEED 12.5 FEET ABOVE GRADE.
6. ALL SIGN FACE SHEETING MATERIAL SHALL BE REFLECTORIZED AND AFFIXED TO ONE SIDE OF SIGN BLANK ONLY. SHEETING MATERIAL SHALL COMPLY WITH F.H.W.A. STANDARDS ESTABLISHED FOR A.S.T.M. TYPE XI SHEETING, A HIGH INTENSITY SHEETING WITH ENCAPSULATED LENS (HI-INTENSITY GRADE). ALL MANUFACTURERS STANDARDS FOR SURFACE PREPARATION, SHEETING ADHESION, AND EDGE SEALING SHALL BE MET.
7. A MINIMUM 10-YEAR MANUFACTURER'S WARRANTY FOR THE RETRO-REFLECTIVITY AND PERFORMANCE OF THE SIGN FACE SHEETING MATERIALS SHALL BE PROVIDED TO THE CITY TRAFFIC ENGINEER.
8. THE PREFIX E AND W (FOR STREETS EAST AND WEST OF BROADWAY) AND N AND S (FOR STREETS NORTH AND SOUTH OF ELLSWORTH AVENUE) SHALL BE USED ON ALL STREET NAME SIGNS. THE PREFIX SHALL BE CENTERED BETWEEN THE EDGE OF THE GREEN FIELD AND THE STREET NAME.
9. ON NUMBERED STREETS, THE SUFFIX FOLLOWING THE NUMBER SHALL BE LOWER CASE LETTERS.
10. ALL TEXT SHALL UTILIZE STANDARD HIGHWAY GOTHIC FONT OR APPROVED EQUIVALENT.

6 OR LESS LETTERS IN STREET NAME:

6" D SERIES*



36"



7 OR 8 LETTERS IN STREET NAME:

6" C SERIES*



36"



9 OR MORE LETTERS IN STREET NAME:

6" B SERIES*



42"



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Sheet Revisions

Date:	Comments:



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 201 WEST COLFAX AVENUE
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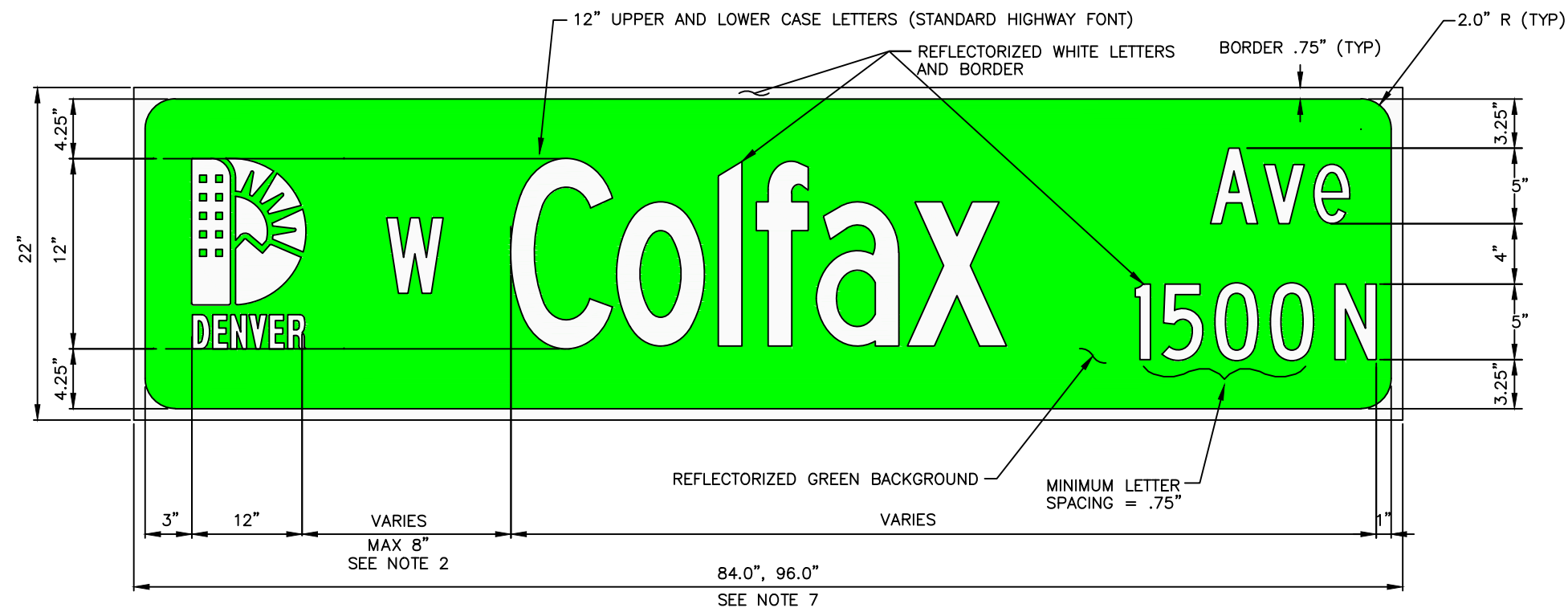
GROUND MOUNT STREET NAME SIGN DETAIL

Issued By: _____

STANDARD DRAWING NO.

16.2.10

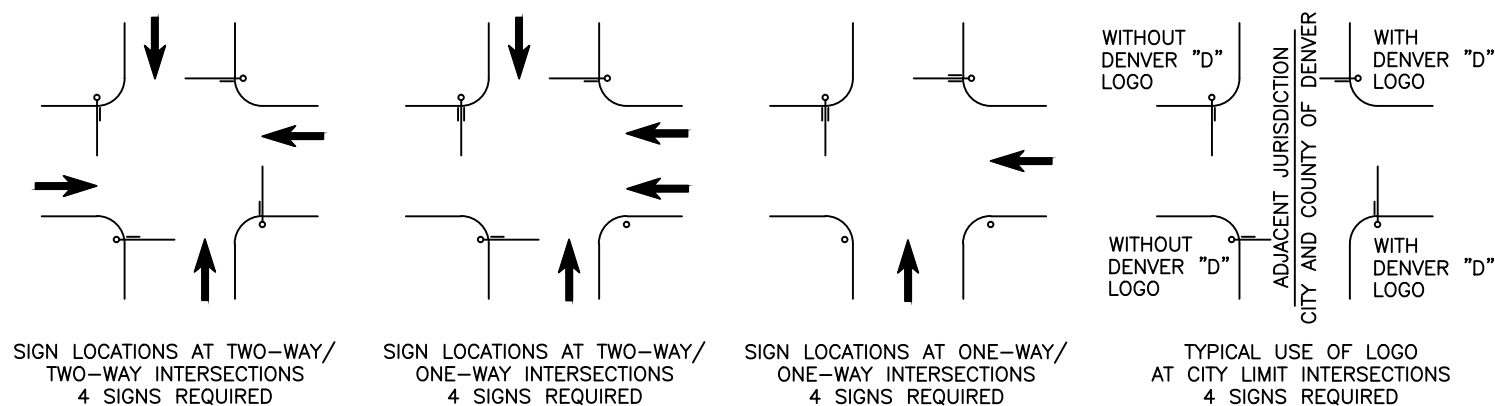
Sheet No. 11 of 18



OVERHEAD STREET NAME SIGN NOTES:

1. ALL OVERHEAD STREET NAME SIGNS SHALL BE FABRICATED USING WHITE RETRO-REFLECTIVE SHEETING MATERIALS AS BACKGROUND WITH LETTERS AND BORDER FORMED BY GREEN TRANSPARENT ELECTRO-CUT FILM APPLIED OVER THE BACKGROUND MATERIAL THROUGH A PRESSURE SENSITIVE ADHESION PROCESS. THE CITY OF DENVER "D" LOGO IS TO BE MADE USING THE SAME SHEETING MATERIAL .THE LOGO MAY BE FABRICATED SEPARATELY AND THEN ADDED TO THE SIGN AS AN OVERLAY USING THE SAME ADHESION PROCESS APPROVED BY THE SHEETING MATERIAL MANUFACTURER. THE SHEETING MATERIAL AND TRANSPARENT ELECTRO-CUT FILM SHALL CONFORM TO THE FOLLOWING PRODUCT SPECIFICATIONS:
 - A. U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, STANDARD SPECIFICATIONS FOR TYPE XI SIGN FACE SHEETING, A VERY-HIGH INTENSITY MICRO-PRISMATIC SHEETING DESIGNED TO PROVIDE REFLECTIVE HIGH SIGN FACE RETRO-REFLECTIVITY FOR OVERHEAD SIGNS THAT ARE TO BE VIEWED BY DRIVERS AT DISTANCES OF 1000 FEET OR LESS. ELECTRO-CUT FILM USED IN CONJUNCTION WITH THE TYPE XI SHEETING MATERIAL SHALL BE ELECTRO-CUT FILM #1177C OR AN EQUIVALENT APPROVED BY THE ENGINEER.
 - B. THE ASTM TYPE XI SHEETING MATERIAL AND TRANSPARENT ELECTRO-CUT FILM USED SHALL INCLUDE A WARRANTY WHICH GUARANTEES AN EFFECTIVE FIELD PERFORMANCE LIFE OF AT LEAST 12 YEARS.
2. THE PREFIX E AND W (FOR STREETS EAST AND WEST OF BROADWAY) AND N AND S (FOR STREETS NORTH AND SOUTH OF ELLSWORTH AVENUE) SHALL BE USED ON ALL STREET NAME SIGNS. THE PREFIX SHALL BE CENTERED BETWEEN THE DENVER "D" LOGO AND THE STREET NAME.
3. STREET NAME SIGNS TO BE BOLTED ON TELES PAR OR APPROVED EQUAL EXTENSION WHICH CONNECTS TO MAST ARM BY USE OF ADAPTER SCREWED INTO COUPLING. SIGN SHALL BE INSTALLED LEVEL TO THE GROUND. SIGN SHALL BE FREE OF ANY HORIZONTAL OR VERTICAL DEFORMATION OR DISTORTIONS.
4. ALL STREET NAME SIGNS SHALL USE THE DENVER "D" LOGO EXCEPT IN NEIGHBORING JURISDICTIONS AT TYPICAL CITY LIMIT INTERSECTIONS OR AS APPROVED BY CCD DOTI ENGINEER. SEE TYPICAL SNS LOCATIONS DETAILS.
5. ALL MOUNTING BOLTS FOR STREET NAME SIGNS SHALL BE ZINC OR CADMIUM PLATED.
6. USE FHWA STANDARD HIGHWAY FONT
7. PLATE LENGTH MAY BE EXTENDED TO MAXIMUM LENGTH OF 108" FOR LONGER STREET NAMES.
8. ON NUMBERED STREETS, THE SUFFIX FOLLOWING THE NUMBER SHALL BE LOWER CASE LETTERS.

TYPICAL STREET NAME SIGN PLACEMENT LOCATIONS



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Creation Date:	Initials:	Date:	Comments:			16.2.11	
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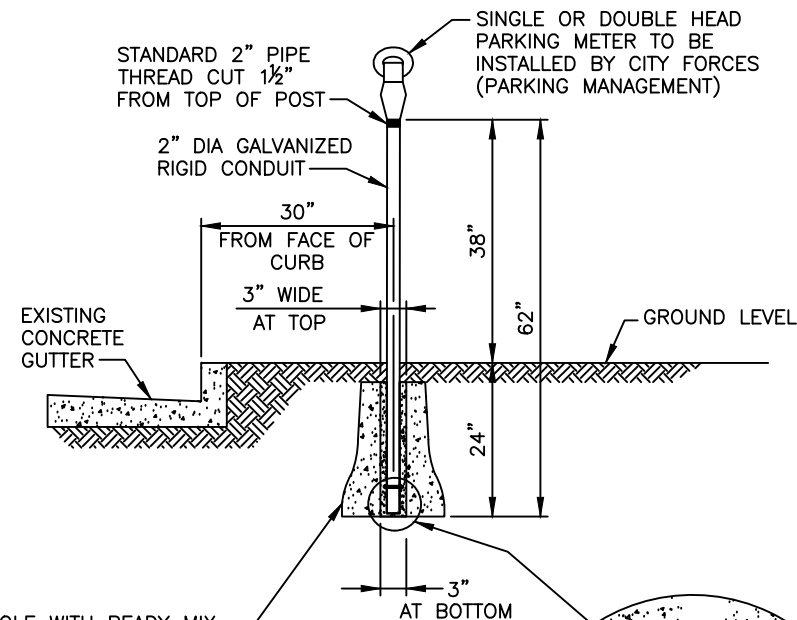


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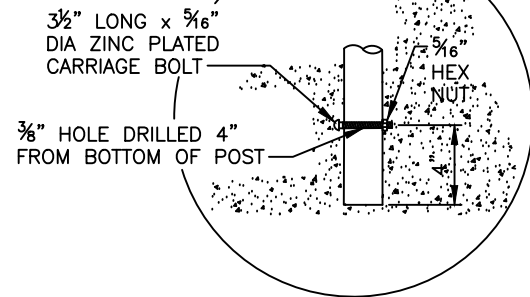
1. STREET N-ME TEXT SH-LL BE 2.75 POINT HIGHW-Y "D" FONT.
2. -LL OTHER TEXT SH-LL BE 2.75 POINT HIGHW-Y "C" FONT.

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Creation Date:	Initials:	Date:	Comments				16.2.12
Full Path:							Sheet No. 13 of 18
Drawing File Name:							
C-D Ver.:	Scale:	Units:					

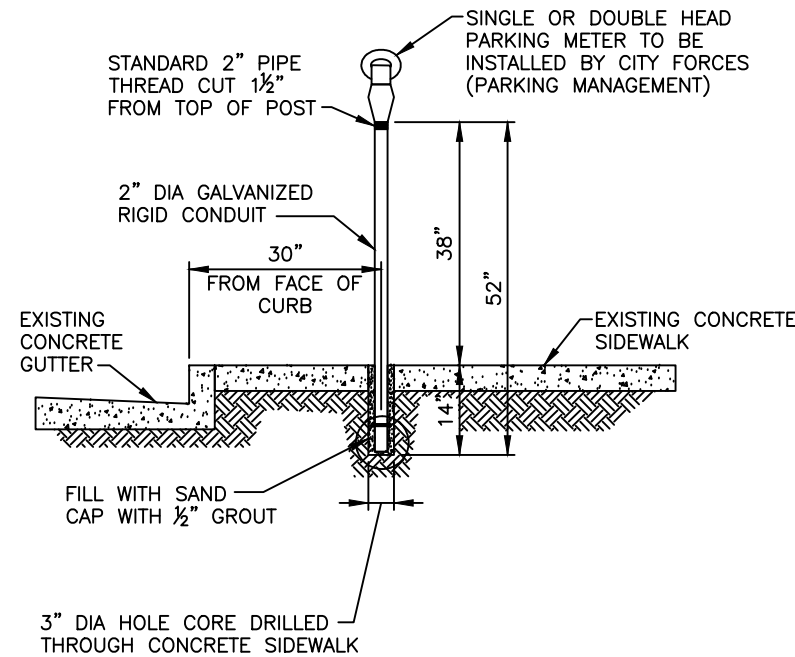
**PARKING METER POST
INSTALLATION IN DIRT/SOD**



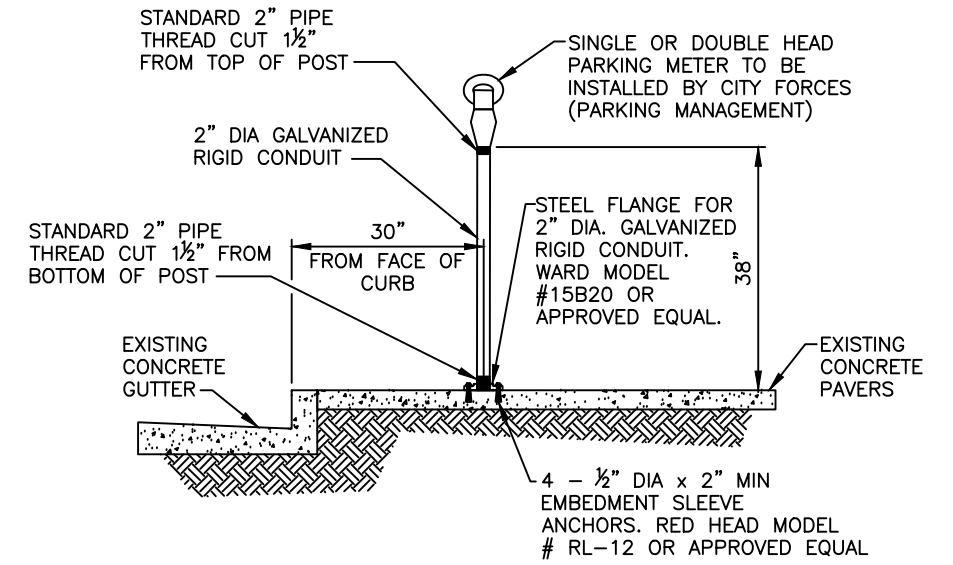
FILL HOLE WITH READY MIX CONCRETE MEETING ASTM C387 "STANDARD SPECIFICATION FOR PACKAGED, DRY, COMBINED MATERIALS FOR MORTAR AND CONCRETE" WITH A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI. MIX PER MANUFACTURER'S INSTRUCTIONS. INSERT POST AND SECURE AS PLUMB.



**PARKING METER POST
INSTALLATION IN CONCRETE**



**PARKING METER POST
INSTALLATION WITH FLANGE**



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Creation Date:	Initials:	Date:	Comments:			16.2.13	
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18" x 18" END OF ROADWAY MARKERS USING RED RETROREFLECTIVE SHEETING (FHWA TYPE 7, 8, OR 9)

PER MUTCD 2C.66.02 OBJECT MARKER TYPE 4

PER MUTCD 2B.67.02 RETROREFLECTION WHITE & RED

18" x 18" END OF ROADWAY MARKERS USING RED RETROREFLECTIVE SHEETING (FHWA TYPE 7 MINIMUM)

SEE DETAIL TYPE 1 FOR MOUNTING DETAIL

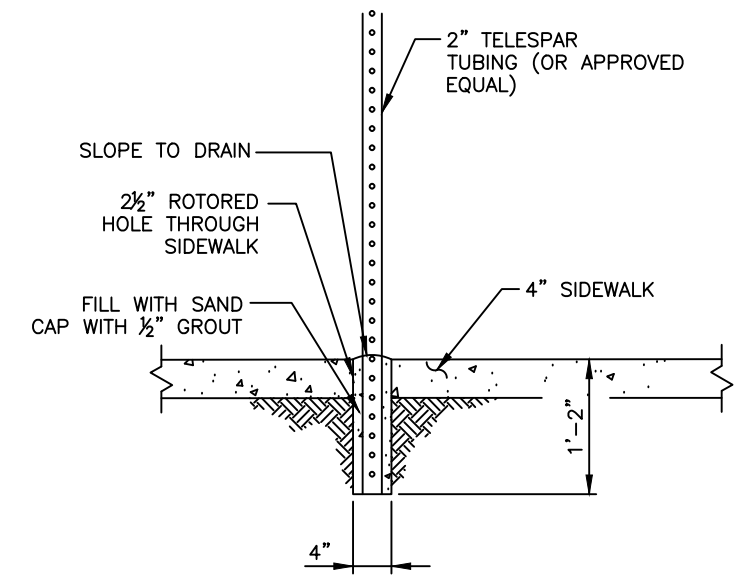
SEE DETAIL TYPE 1A FOR MOUNTING DETAIL

SEE DETAIL TYPE 1 FOR MOUNTING DETAIL

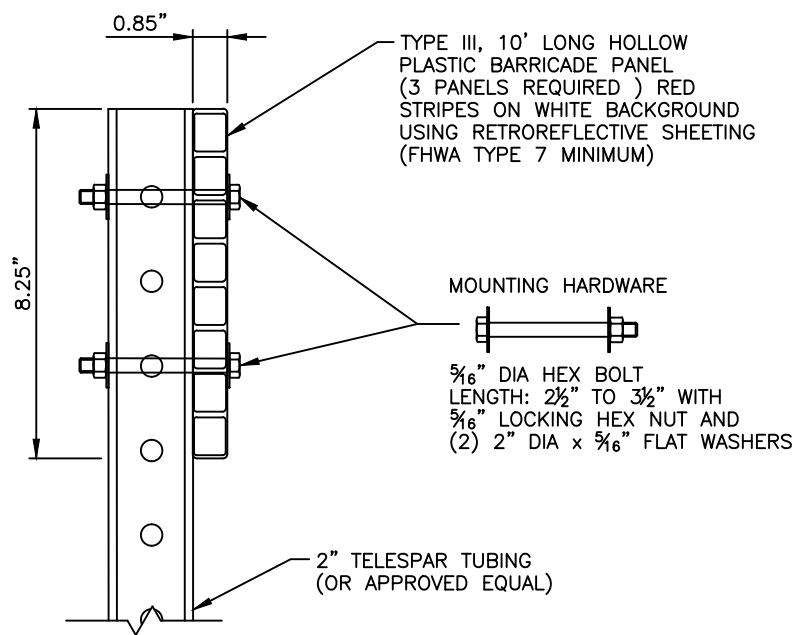
MATERIALS REQUIRED:

- (3) TYPE III, 10' LONG HOLLOW PLASTIC PANELS.
- (2) 18 OM4-3 (END OF ROADWAY MARKER) 18" SIDE
- (5) 2" X 2" PRE - DRILLED STEEL SIGN POST, 8'-6" LONG PLUS CONCRETE AND MOUNTING HARDWARE

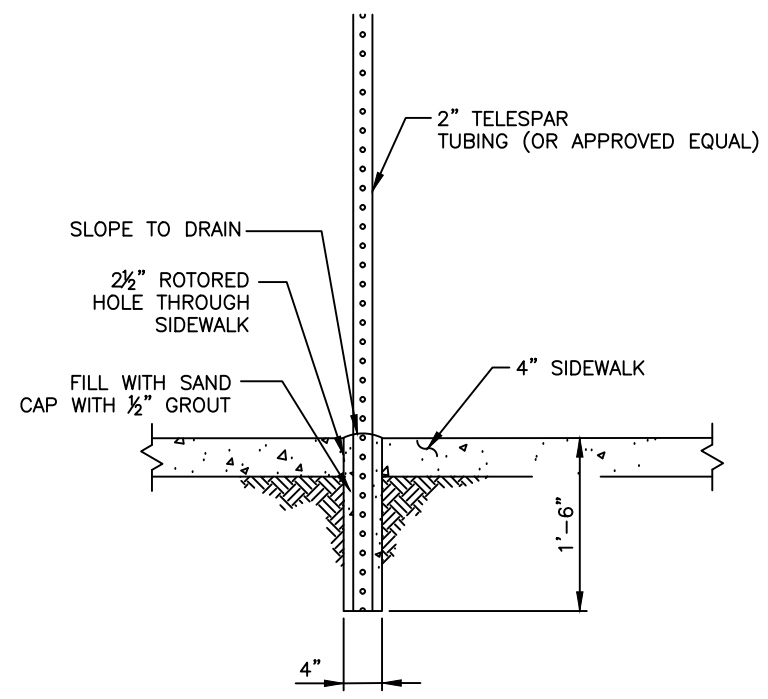
ELEVATION - END OF ROADWAY TYPE III BARRICADE DETAIL



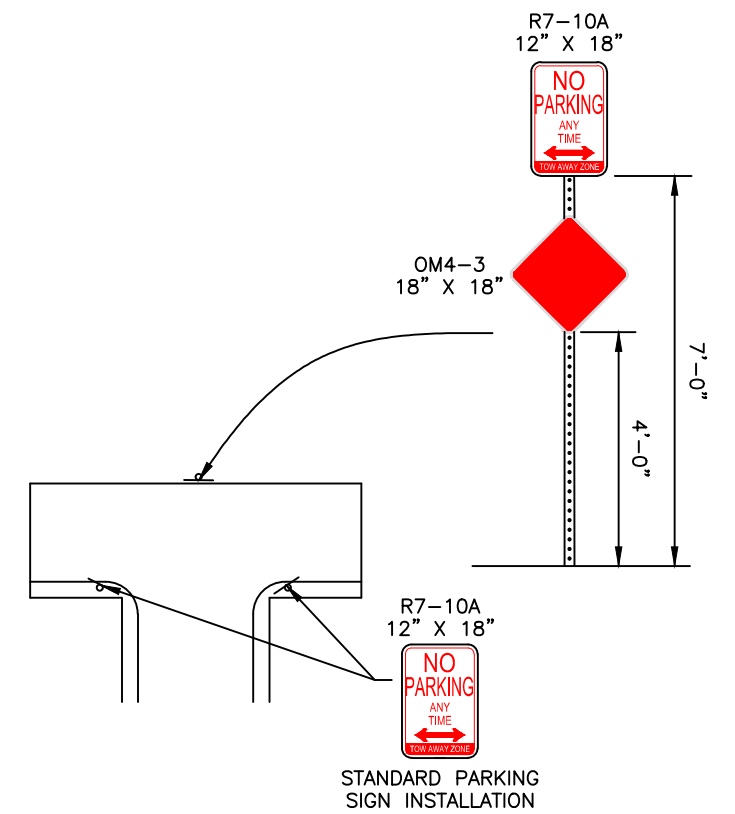
DETAIL - TYPE 1



SECTION A

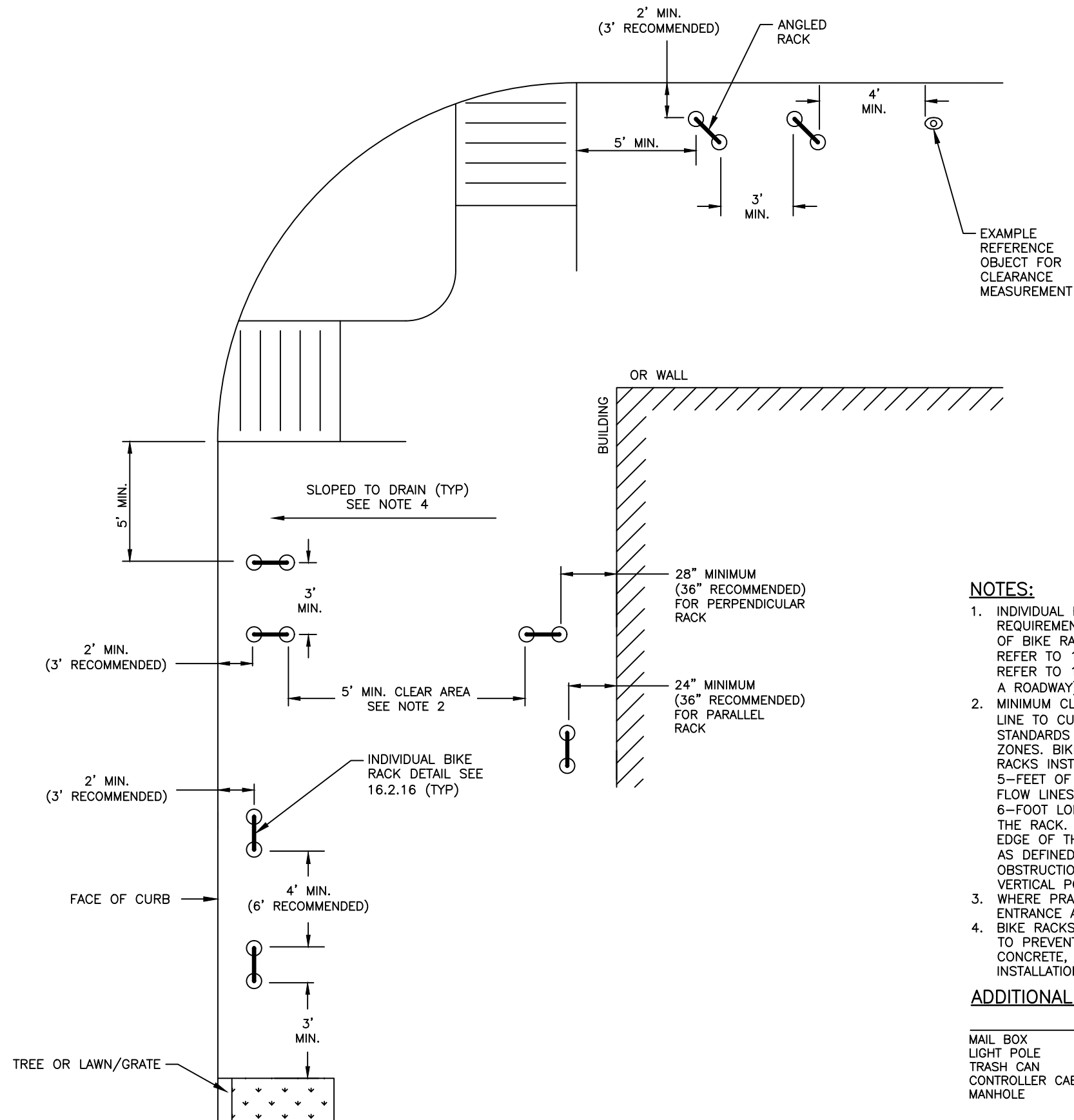


DETAIL - TYPE 1A



HAMMER HEAD END OF ROADWAY

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CAD Ver.:	Scale:	Units:					



NOTES:

- INDIVIDUAL BIKE RACKS ARE PRESENTED TO ILLUSTRATE GENERAL REQUIREMENTS FOR THE HORIZONTAL POSITION AND CONFIGURATION OF BIKE RACKS INSTALLED ABOVE THE CURB (NOT ON A ROADWAY). REFER TO 16.2.16 FOR INDIVIDUAL BIKE RACK INSTALLATION DETAILS. REFER TO 16.2.17 FOR BIKE RACK INSTALLED BELOW THE CURB (ON A ROADWAY).
- MINIMUM CLEAR AREA SHALL BE 8' WHERE DISTANCE FROM PROPERTY LINE TO CURB LINE IS 21' OR GREATER. SEE TRANSPORTATION STANDARDS AND DETAILS STANDARD DRAWING 13.2 SIDEWALK CLEAR ZONES. BIKE RACK SHALL NOT IMPEDE PEDESTRIAN TRAFFIC. BIKE RACKS INSTALLED ADJACENT TO PEDESTRIAN AREA SHALL MAINTAIN 5-FEET OF CLEAR AREA (MINIMUM) THAT PRESERVES PEDESTRIAN FLOW LINES AND MANEUVERABILITY. CLEAR AREA SHALL ASSUME A 6-FOOT LONG BIKE (TYPICAL BIKE) IS PARKED AT THE CENTER OF THE RACK. CLEAR AREA SHALL BE MEASURED FROM THE OUTSIDE EDGE OF THE TYPICAL BIKE TIRE TO THE NEXT NEAREST OBSTRUCTION AS DEFINED BY THE AMERICAN DISABILITY ASSOCIATION (ADA). OBSTRUCTIONS COULD INCLUDE BIKE RACKS, A RAISED CURB, A VERTICAL POST, ETC.
- WHERE PRACTICAL, INSTALL BIKE RACK WITHIN 50-FEET OF BUILDING ENTRANCE AND WITH A CLEAR LINE-OF-SIGHT.
- BIKE RACKS SHALL BE INSTALLED AT LOCATIONS GRADED TO DRAIN TO PREVENT ACCUMULATION OF SURFACE WATER AND PAVED WITH CONCRETE, MASONRY PAVERS, OR OTHER HARDENED, RIGID MATERIAL. INSTALLATION NOTES ARE PROVIDED ON 16.2.16.

ADDITIONAL MINIMUM CLEARANCE REQUIREMENTS

4 FEET:		10 FEET:
MAIL BOX	SIGN POST	RTD BUS STOP
LIGHT POLE	STREET FURNITURE	OTHER VERTICAL OBSTRUCTION
TRASH CAN	DRIVEWAY	
CONTROLLER CABINET	LOADING ZONE	
MANHOLE	UTILITY METER	

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NOTES:

1. DESIGN AND MANUFACTURER SHALL BE IN ACCORDANCE WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC).
2. INVERTED-U SHAPE SHALL BE FORMED FROM ONE SEGMENT OF STEEL PIPE USING METHODOLOGY THAT MAINTAINS THE STRUCTURAL INTEGRITY OF THE STEEL PIPE.
3. ALTERNATE BIKE RACKS SHALL BE ACCEPTED BY DENVER DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE (DOTI) PRIOR TO INSTALLATION.

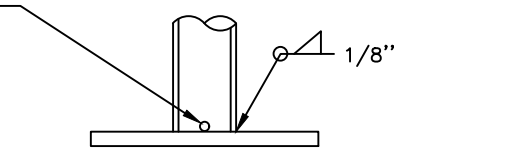
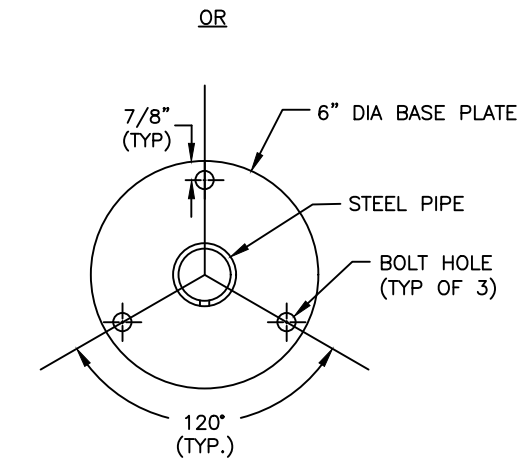
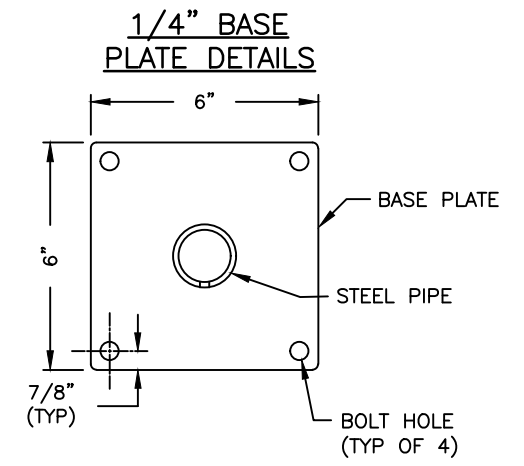
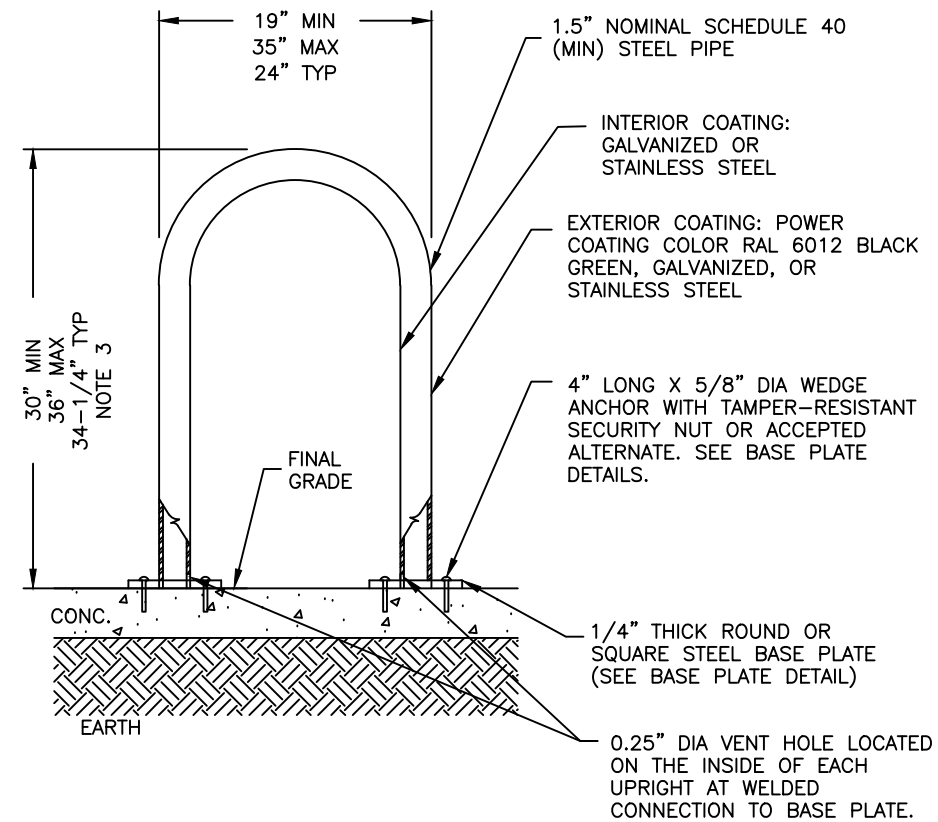
INSTALLATION NOTES FOR BIKE RACKS MOUNTED TO CONCRETE OR CONCRETE PAVERS:

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

INSTALLATION NOTES FOR BIKE RACKS MOUNTED TO CONCRETE FOUNDATION BENEATH MASONRY PAVERS

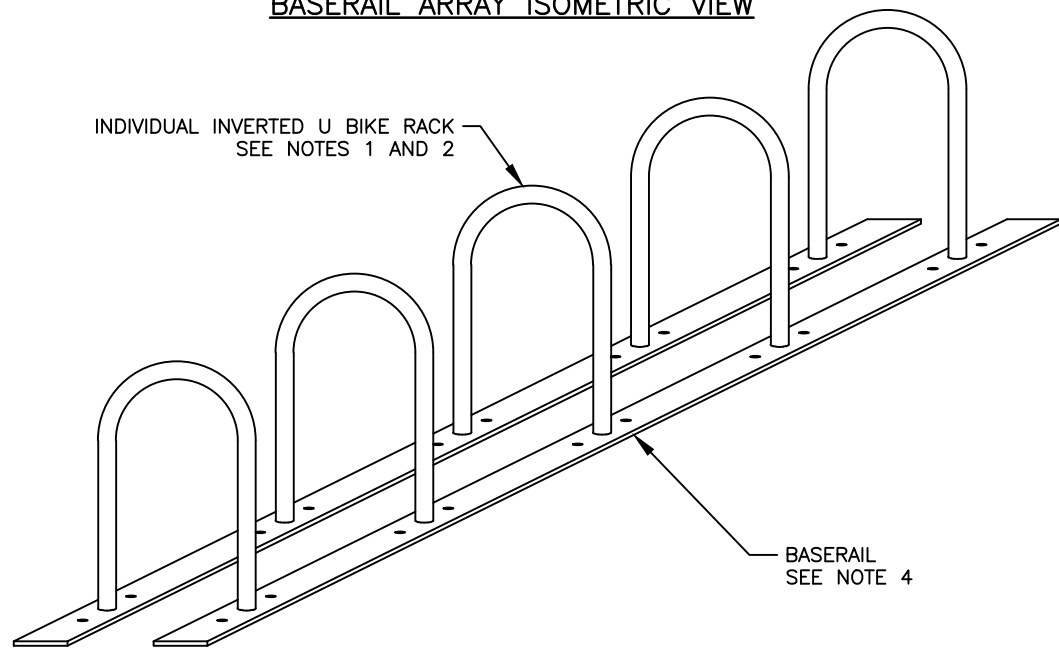
1. REMOVE MASONRY PAVER AND BEDDING MATERIAL AND PRESERVE FOR REINSTALLATION.
2. CONSTRUCT UNREINFORCED CONCRETE FOOTING OR UNREINFORCED CONCRETE SLAB TO SUPPORT BIKE RACK. CONCRETE SHALL BE 5,000 PSI COMPRESSIVE STRENGTH (28-DAY STRENGTH).
 - a. CONCRETE FOOTINGS SHALL BE 12-INCHES DIAMETER AND 24-INCHES DEEP (MINIMUM). ONE CONCRETE FOOTING SHALL BE CONSTRUCTED FOR EACH BIKE RACK BASE PLATE.
 - b. ALTERNATIVELY, CONSTRUCT A 4-INCH-THICK UNREINFORCED CONCRETE SLAB THAT EXTENDS 1-FOOT (MINIMUM) OUTSIDE FOOTPRINT OF BIKE RACK ON ALL SIDES.
 - c. EXCAVATE SUBGRADE AS NECESSARY TO MAINTAIN TOP OF CONCRETE FOUNDATION AT BOTTOM OF BEDDING MATERIAL. DISPOSE OF EXCESS EXCAVATED MATERIAL AT ACCEPTED OFF-SITE LOCATION.
3. MOUNT BIKE RACK TO CONCRETE USING INSTRUCTIONS PROVIDED THIS SHEET.
4. REPLACE BEDDING MATERIAL.
5. REINSTALL MASONRY PAVERS. MASONRY PAVERS SHALL BE CUT TO ACCOMMODATE BIKE RACK (1/2-INCH INSTALLATION TOLERANCE).

INDIVIDUAL INVERTED U BIKE RACK

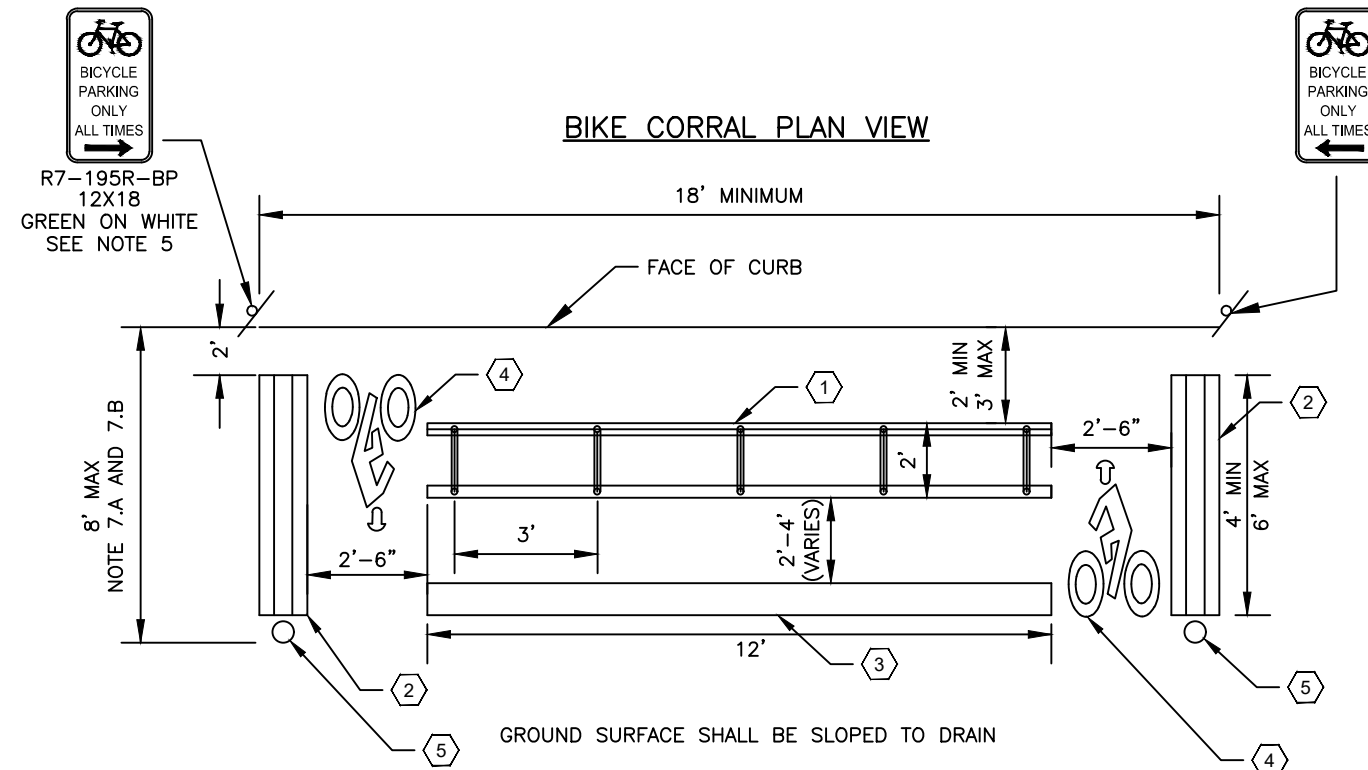


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BASERAIL ARRAY ISOMETRIC VIEW



BIKE CORRAL PLAN VIEW



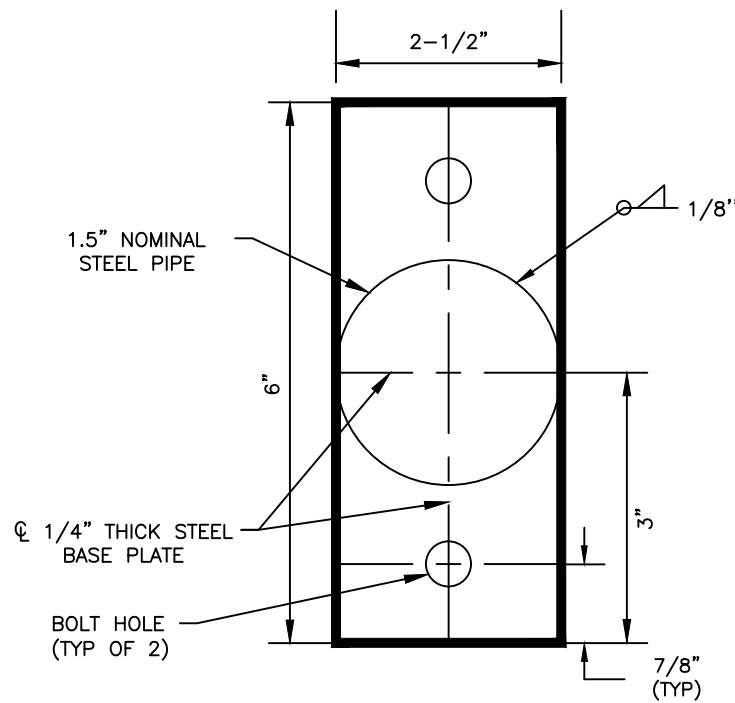
LEGEND:

- ① INVERTED U RACK BASERAIL ARRAY
- ② RECYCLED RUBBER CURB STOP OR APPROVED EQUAL
- ③ 8" WIDE WHITE THERMOPLASTIC CHANNELIZING LINE
- ④ 2'x4' WHITE THERMOPLASTIC PREFORMED BIKE SYMBOL
- ⑤ TWO WHITE OR YELLOW, 36" TO 48" TALL SURFACE MOUNTED CANDLESTICK DELINEATORS WITH TWO 3"-WIDE REFLECTIVE WHITE OR YELLOW BANDS. INSTALL IN ACCORDANCE WITH MANUFACTURER INSTRUCTIONS.

NOTES:

1. FIVE INVERTED U RACKS MAY BE INSTALLED IN ONE BASERAIL ARRAY.
2. INDIVIDUAL INVERTED U BIKE RACK SHALL BE CONSISTENT WITH 16.2.16 EXCEPT BASE PLATE SHALL BE MODIFIED TO ACCOMMODATE RAIL INSTALLATION (SEE DETAIL THIS SHEET). INVERTED U BIKE RACK SHALL BE MOUNTED TO BASERAIL WITH 4 5/8-INCH DIAMETER GALVANIZED STEEL CARRIAGE BOLTS WITH NUT AND WASHER INSTALLED ON THE UNDERSIDE OF THE BASERAIL.
3. BASERAIL ARRAY SHALL BE FIRMLY MOUNTED TO ASPHALT OR CONCRETE USING 6 4-INCH LONG 5/8-INCH DIAMETER BOLTS AND FEMALE THREADED DROP-IN ANCHOR SLEEVES. SPACE ANCHORS EVENLY ALONG BASERAIL.
4. BASERAIL SHALL CONSIST OF MILD STEEL STRUCTURAL C-SHAPE (CHANNEL SHAPE) C3x1.4x3/16. BASERAIL SHALL BE HOT-DIP GALVANIZED FOLLOWING FABRICATION.
5. SIGNS SHALL BE INSTALLED IN ACCORDANCE WITH DENVER STANDARD DRAWING 16.2.5 AND BE MOUNTED ON A 2" TELESPAR POLE WITH A 7'-0" MINIMUM CLEARANCE TO FINISHED GRADE. LEGEND AND BORDER OF THE BICYCLE PARKING AREA SIGN SHALL BE GREEN ON A RETROREFLECTORIZED WHITE BACKGROUND.
6. INSTALLATION OF BIKE PARKING BELOW THE CURB IS ACCEPTABLE AT THE FOLLOWING GENERAL LOCATIONS:
 - A. CENTRAL BUSINESS DISTRICT DOWNTOWN STREETS
 - B. ROADWAYS CLASSIFIED AS COLLECTOR STREETS THAT ARE DESIGNATED BIKEWAYS
 - C. ROADWAYS CLASSIFIED AS LOCAL STREETS
7. INSTALLATION OF BIKE PARKING BELOW THE CURB SHALL ADHERE TO THE FOLLOWING SITE-SPECIFIC REQUIREMENTS:
 - A. TRAVEL LANE WIDTH (BUS AND HEAVY TRUCK ROUTES) - INSTALLATION OF BIKE PARKING SHALL NOT REDUCE TRAVEL LANE WIDTH BELOW 11 FEET. A TRUCK ROUTE IS CONSIDERED ANY ROADWAY WITH AT LEAST 2-PERCENT TRUCK USE.
 - B. TRAVEL LANE WIDTH (OTHER) - INSTALLATION OF BIKE PARKING SHALL NOT REDUCE TRAVEL LANE WIDTH BELOW 11 FEET.
 - C. RTD BUS STOP BIKE PARKING SHALL BE AT LEAST 20 FEET AHEAD OF SIGN AND 45 FEET BEHIND SIGN OR 65 FEET BEHIND SIGN WHERE ARTICULATED BUSES ARE USED.
 - D. INTERSECTIONS - BIKE PARKING SHALL NOT BE INSTALLED WITHIN 20 FEET OF CURB RAMPS, STOP SIGNS, OR INTERSECTIONS WITHOUT WRITTEN PERMISSION OF DENVER DEPARTMENT OF TRANSPORTATION AND INFRASTRUCTURE (DOTI) TRANSPORTATION DESIGN.
 - E. DRIVEWAYS - BIKE PARKING SHALL NOT BE INSTALLED WITHIN 5 FEET OF DRIVEWAYS OR ALLEYS.
 - F. FIRE HYDRANTS - BIKE PARKING SHALL NOT BE INSTALLED WITHIN 10 FEET OF A FIRE HYDRANT.
 - G. ROW INFRASTRUCTURE - BIKE PARKING SHALL NOT BE INSTALLED WITHIN 5 FEET FROM TRAFFIC CONTROL CABINETS, UTILITY BOX COVERS, MANHOLE COVERS, VALVE BOX COVERS, POLICE/FIRE CALL BOX, OR OTHER EMERGENCY FACILITIES.
 - H. EXISTING CURBLANE USES - ON-STREET BIKE PARKING SHALL NOT CONFLICT WITH LOADING ZONES, CAR SHARE, DISABILITY PARKING SPACES, OR OTHER PERMITTED CURBLANE USES.

BASE PLATE DETAIL FOR INSTALLATION ON BASERAIL



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