APPLICATION OF STANDARD PLANS

This book is a compilation of Standard Plans prepared by the Colorado Department of Transportation for use on CDOT construction projects. Others who use the CDOT Standard Plans do so at their own risk.

These Standard Plans are essential contract documents as described in subsection 105.09 of CDOT's Standard Specifications for Road and Bridge Construction.

Standard Plans that are applicable to a specific project will be identified on the project plans and will not be physically attached to those plans. The designer who specifies any of these Standard Plans for a specific project accepts the responsibility of determining their applicability. Additional information concerning the Standards Plans are available in the CDOT Standard Specifications for Road and Bridge Construction book.

Standard Plans adopted or revised subsequent to the adoption of this book will be listed on the index of the project plans and will be physically included in the plans. New and Revised Standards Plans may be accessed on the Colorado Department of Transportation website: www.coloradodot.info/business/designsupport

These Standard Plans are adopted for use as of July 4, 2012.

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APPLICATION OF STANDARD PLANS

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COLORADO
DEPARTMENT OF TRANSPORTATION

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JULY 4, 2012

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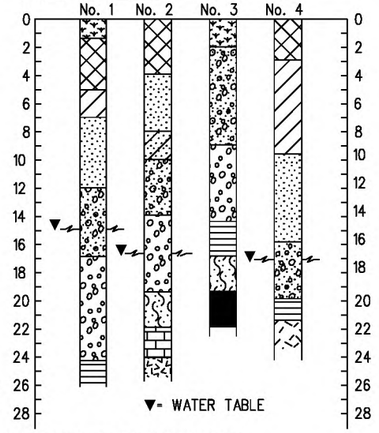
LEGEND

- TOPSOIL
- OVERBURDEN
- CLAY
- SILT
- SAND
- GRAVEL
- SHALE
- LIMESTONE
- SANDSTONE
- SOLID ROCK (IGNEOUS)
- SOLID ROCK (METAMORPHIC)
- COAL

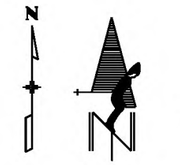
TEST HOLES



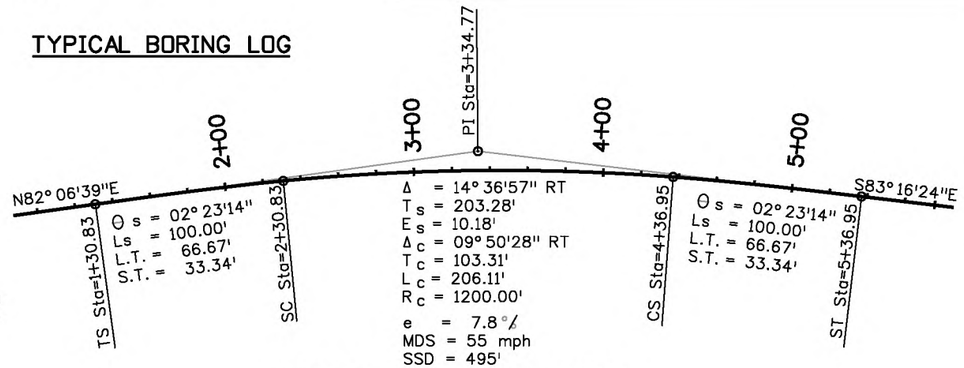
COMPOSITE MATERIALS ARE REPRESENTED BY COMBINATIONS OF THE ABOVE SYMBOLS, SUCH AS:

- SANDY CLAY

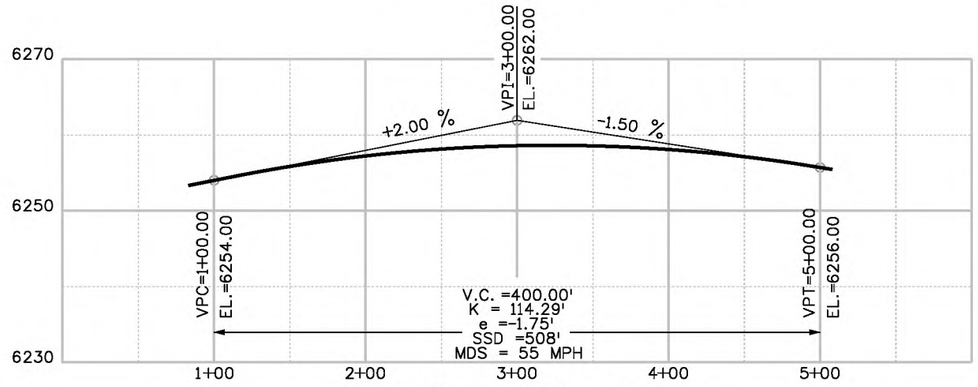
TYPICAL BORING LOG



NORTH ARROW



TYPICAL HORIZONTAL CURVE



TYPICAL VERTICAL CURVE

TERRAIN

- TERRAIN SINGLE SHOTS
- TOP OF CUT
- TOE OF FILL

ROADWAY

- GRAVEL ROAD OR DRIVEWAY
- INTERNATIONAL SYMBOL OF ACCESS
- SIDEWALK WITH RAMP
- EDGE OF PAVEMENT
- CENTERLINE OF DIRT ROAD

SURVEY/ROW

- SECTION CORNER
- QUARTER, SIXTEENTH, AND SECTION CORNERS
- PROTECT EXISTING MARKER
- SET EASEMENT MONUMENT
- TEMPORARY EASEMENT POINT
- RIGHT OF WAY MARKER
- BLM MARKER
- PROPERTY PIN
- NOAA MARKER
- QUARTER, SIXTEENTH, AND SECTION CORNERS
- FEDERAL MONUMENT
- WITNESS CORNER
- BENCH MARK
- USGS MARKER
- LOCAL OR PLSS MONUMENT
- SECONDARY CONTROL MONUMENT
- RIGHT OF WAY MARKER
- N 9.88 E 3.81 EL 0.00 — PROJECT CONTROL MONUMENT
- N 10.13 E 3.81 EL 0.00 — DENSIFICATION CONTROL MONUMENT
- N 10.38 E 3.81 EL 0.00 — HIGH ACCURACY REFERENCE NETWORK CONTROL MONUMENT
- PERMANENT, PROPERTY, SLOPE, & UTILITY EASEMENT LINE
- TEMPORARY EASEMENT LINE (EXISTING)
- PROPERTY BOUNDARY LINE (EXISTING AND PROPOSED)
- ACCESS CONTROL LINE
- BARRIER ACCESS CONTROL LINE
- RIGHT OF WAY LINE
- VIRGIN RIGHT OF WAY LINE (PROPOSED)
- CITY LIMIT LINE (EXISTING)
- COUNTY LINE (EXISTING)
- QUARTER SECTION LINE
- SECTION LINE
- SIXTEENTH SECTION LINE
- STATE LINE (EXISTING)
- TOWNSHIP LINE (EXISTING)

GENERAL NOTES

1. EXISTING FEATURES SHOWN AS SCREENED WEIGHT (LIGHT GRAY SCALE), EXCEPT AS NOTED WITH THE WORD (EXISTING). PROPOSED OR NEW FEATURES SHOWN AS FULL WEIGHT WITHOUT SCREENING, EXCEPT AS NOTED WITH THE WORD (PROPOSED).
2. THESE SYMBOLS ARE INTENDED TO EXPLAIN THE VARIOUS TOPOGRAPHIC FEATURES INVOLVED ON THE DESIGN PLAN SHEETS WHICH ARE PREPARED AT VARIOUS SCALES. NOTES ARE ADDED WHERE NECESSARY TO CLARIFY THE SYMBOL. A LEGEND IS PROVIDED IN THE PLANS FOR SYMBOLS NOT SHOWN ON THE STANDARD SYMBOLS SHEETS.
3. GUARDRAIL, CURB AND GUTTER, ETC., ARE REPRESENTED BY A SYMBOL WITH TYPE GIVEN BY NOTE.

CURB AND GUTTER

- BACK OF CURB
- TOP OF CURB
- FLOW LINE (℄)
- EDGE OF PAVEMENT
- CURB AND GUTTER
- CURB AND GUTTER-TYPE 2, 4 OR 6
- GUTTER
- CURB CUT
- CURB, GUTTER OR OTHER

GUARDRAIL

- GUARDRAIL END ANCHOR
- GUARD POST
- GUARDRAIL-TYPE 3 OR 6
- GUARDRAIL-TYPE 4 OR 7
- GUARDRAIL-TYPE 5 OR HANDRAIL
- GUARDRAIL-TYPE 3A DOUBLE OR TYPE 6 DOUBLE
- CABLE BARRIER

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ROCK, MASONRY OR MECHANICALLY STABILIZED WALL (FACE)

BRIDGE CURB

BRIDGE RAIL

BRIDGE RAIL-TYPE 3A

FLOW LINE CBC

STRUCTURES MISCELLANEOUS

STRUCTURE

MISCELLANEOUS BUILDING STRUCTURE (PRIMARY)

MISCELLANEOUS STRUCTURE (SECONDARY)

FOUNDATION OR PAD (CONCRETE OR BLOCK)

BUILDING STRUCTURES

RR TELEGRAPH POLE

RR SWITCH

RR GUY POLE

RR SIGNALS WITH OR WITHOUT GATE

RR CROSS BUCK SIGN

RR SIGNAL CONTROLLER CABINET

RR MISCELLANEOUS SYMBOL

RR TRACK CENTERLINE

RAILROAD

BOULDER UNDER 6FT

GEOLOGY MISC SYMBOL

MINESHAFT SYMBOL

ROCK OUTCROP

BOULDER FIELD OR ROCK OVERHANG

GEOLOGY

COMBINATION WIRE FENCE WITH GATE

CHAIN LINK FENCE WITH GATE

BARBED WIRE FENCE WITH GATE

SOUND OR BARRIER FENCE WITH GATE

DEER FENCE WITH GATE

WOOD FENCE WITH GATE

SNOW FENCE WITH GATE

PF PF PF PF PF PF PF

PLASTIC FENCE

SF SF SF SF SF SF SF

SF SF SF SF SF SF SF SF

SILT FENCE

DEBRIS FENCE

FENCE

DECIDUOUS TREE

DECIDUOUS SHRUB

TEETER TOTTER SYMBOL

SWING SET SYMBOL

CONIFEROUS TREE

CONIFEROUS SHRUB

MISCELLANEOUS TREES

BENCH

SPRINKLER HEAD

TREES GROVE

HEDGE OR SHRUB GROVE

EDGE OF WETLANDS

LANDSCAPING

HAZARD WASTE MONITORING WELL

ENVIRONMENTAL CONCERN SITE

EROSION LOG

ROCK CHECK DAM

CONCRETE WASHOUT STRUCTURE

DROP INLET EROSION PROTECTION

TEMPORARY BERM

SOIL RETENTION BLANKET

PIPE INLET EROSION PROTECTION

RIGID INLET PROTECTION

STORM DRAIN INLET PROTECTION

EROSION CHECK

EROSION LOG DITCH CHECK

SILT DIKE

SEDIMENT TRAP/ DEWATERING STRUCTURE

EXISTING WETLAND PATTERN

TEMPORARY SLOPE DRAIN

STABILIZED CONSTRUCTION ENTRANCE

LDA LDA LDA LDA LDA LDA

LIMITS OF DISTRUBED AREA

ENVIRONMENTAL CONCERN

HAZARDOUS WASTE SITE

NW NW NW NW NW NW NW NW

NOXIOUS WEED

ENVIRONMENTAL

SANITARY SEWER MANHOLE

SANITARY SEWER MISCELLANEOUS SYMBOL

SIZE, MATERIAL, OWNER

SANITARY SEWER PIPE

SANITARY SEWER PIPE MISCELLANEOUS

SANITARY SEWER

METAL CONCRETE

PIPE WITH END SECTION

HEADWALL

PIPE MISCELLANEOUS

PIPES

CHECK DAM UNDER 4 FT

HEADGATE 1

DIVERSION BOX SYMBOL

SPRING SYMBOL

FLOW GAUGE

MISCELLANEOUS WATERWAYS

DITCH WITH FLOW

EDGE OF WATER, CANALS, PONDS, STREAM OR RIVER

DITCHES AND WATERWAY

INLET TYPE 13

INLET TYPE C

INLET TYPE D

INLET VANE GRATE

INLET TYPE R XX FT LENGTH

STORM SEWER MANHOLE

MANHOLE EXISTING

STORM SEWER MISCELLANEOUS

STORM SEWER PIPE

STORM SEWER PIPE MISCELLANEOUS

STORM SEWER

WATER SPIGOT

WATER VALVE

WATER MANHOLE

FIRE HYDRANT

WATER METER

WATER WELL SYMBOL

SIZE, MATERIAL, OWNER

W W W W W W W

WATER LINE

W? W? W? W? W? W? W?

WATER MISCELLANEOUS LINE

WATER

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STANDARD PLAN NO.

M-100-1

PROPANE TANK
GAS JUNCTION BOX
GAS VAULT
GAS LINE MARKER OR AIR VENT
GAS METER LOW PRESSURE
GAS METER HIGH PRESSURE
GAS MISCELLANEOUS
GAS LIGHT
GAS VALVE HIGH OR LOW PRESSURE
— G — G — G — SIZE — G — G — G — G —
GAS LINE LOW PRESSURE
— G — HP — G — SIZE — HP — G — HP — G
GAS LINE HIGH PRESSURE
— PG — PG — PG — PG — PG — PG — PG —
PROPANE GAS LINE
— G? — G? — G? — G? — G? — G? — G? —
GAS LINES MISCELLANEOUS

GAS

OIL METER HIGH AND LOW PRESSURE
OIL VALVE HIGH AND LOW PRESSURE
OIL MISCELLANEOUS
— O — O — O — O — O — O — O —
OIL LINE LOW OR HIGH PRESSURE
— O? — O? — O? — O? — O? — O? — O? —
OIL MISCELLANEOUS LINE

OIL

GRAVE HEADSTONE SYMBOL
MAIL DROP BOX
FLAG POLE
TRASH BARREL POST
GRAVE SYMBOL
RADIO STATION ANTENNA
MISCELLANEOUS TOPOGRAPHY

MISCELLANEOUS TOPOGRAPHY

CAMPSITE MARKER
TRAILER ELECTRIC HOOKUP
TRAILER DUMP STATION
CAMPFIRE RING
TRAILER SEWER INLET
TRAILER WATER HOOKUP
CAMPSITE GRILL
CAMPSITE TABLE

CAMPING

LIGHT STANDARD
HIGH MAST LIGHT STANDARD
SPOT OR FLOOD LIGHT

LIGHTING

ELECTRICAL PEDESTAL OR PULL BOX
TRANSMISSION TOWER
WIND POWERED GENERATOR
RELOCATED LIGHT STANDARD
DECORATIVE LIGHT STANDARD
CATENARY POLE FOUNDATION
ELECTRICAL MANHOLE
POWER POLE
TRANSFORMER ON POLE
ELECTRICAL OUTLET
ELECTRICAL MISCELLANEOUS
GUY WIRE
ELECTRICAL VAULT OR TRANSFORMER
GUY POST
FIRE ALARM BOX
— E — E — E — E — E — E — E —
ELECTRICAL UNDERGROUND LINE
— E — OH — E — OH — E — OH — E —
ELECTRICAL OVERHEAD LINE
— E? — E? — E? — E? — E? — E? — E? —
ELECTRICAL MISCELLANEOUS LINE

ELECTRICAL

CABLE TV POLE
CABLE TV RISER
COMBINATION POLE-POWER,TELEPHONE
TV ANTENNA
TV MISCELLANEOUS
TV MANHOLE
— TV — TV — TV — TV — TV — TV — TV —
TV UNDERGROUND CABLE
— TV — OH — TV — OH — TV — OH — TV —
TV OVERHEAD CABLE
— TV? — TV? — TV? — TV? — TV? — TV? — TV? —
TV MISCELLANEOUS CABLE

TELEVISION

TELEPHONE GUY POLE
FIBER OPTIC CABLE MARKER
TELEPHONE MANHOLE
COMBINATION POLE-POWER
TELEPHONE MISCELLANEOUS
COMBINATION GUY POLE-POWER
— T — T — T — T — T — T — T —
TELEPHONE UNDERGROUND CONDUIT OR CABLE
— FO — FO — FO — FO — FO — FO — FO —
FIBER OPTICS UNDERGROUND CABLE
— T — OH — T — OH — T — OH — T —
TELEPHONE OVERHEAD LINE
— T? — T? — T? — T? — T? — T? — T? —
TELEPHONE MISCELLANEOUS LINE

TELEPHONE

FIBER MARKER DOME
FIBER MARKER SLATE
RWIS - REMOTE WEATHER SENSOR
VMS-BUTTERFLY
VMS-GROUND
VMS-CANTILEVER
VMS-SIGN BRIDGE
-ITS — ITS — ITS — ITS — ITS — ITS — ITS —
ITS CONDUIT

INTELLIGENT TRANSPORTATION SYSTEM

CENTER YELLOW SOLID DOUBLE
CENTER YELLOW SOLID BROKEN (NO PASS)
4 INCH WIDE
8 INCH WIDE
LANE LINE BROKEN
LANE DROP
CHANNELIZING OR EDGE LINE
4 INCH WIDE
8 INCH WIDE
DOTTED BROKEN
STOP LINE
- INTERNATIONAL SYMBOL OF ACCESS
R R - RAILROAD CROSSING
- BICYCLE PED ACCESS

TRAFFIC STRIPING

TRAVEL DIRECTION
BARRIER LIGHT
FLAGGER
G B CRY R Y
DELINEATOR-TYPE I
SEQUENCING ARROW PANEL
FLASHING BEACON
CRY-R BK2BK
Y-R BK2BK
Y-Y BK2BK
Y-Y BK2BK
CRY-CRY
CRY-CRY BK2BK
DELINEATOR-TYPE II
CRY-CRY-R BK2BK
Y-Y-R BK2BK
Y-Y-Y BK2BK
DELINEATOR-TYPE III
BUTTERFLY SIGN
HALF BUTTERFLY SIGN
IMPACT ATTENUATOR
SIGN ASSEMBLY
SINGLE POST SIGN
DOUBLE POST SIGN
SIGN-WITH FLASHING BEACON
ROAD CLOSURE GATE BEACON SYMBOL
ROAD CLOSURE GATE SYMBOL
DEER REFLECTORS
TRAFFIC CONTROL MISCELLANEOUS DEVICE
TRAFFIC CONTROL DEVICE

TRAFFIC CONTROL

SIGNAL SPAN WIRE POLE
DOUBLE MAST ARM POLE
LUMINAIRE
SIGNAL FACE
SIGNAL POLE WITH MAST ARM
SIGNAL FACE WITH BACKPLATE
SIGNAL CONTROLLER AND CABINET (4 FT)
TELEMETRY ANTENNA
PULL BOX
MICRODETECTOR
VIDEO DETECTION CAMERA
FIRE PREEMPTION UNIT AND TIMER
PEDESTRIAN SIGNAL FACE
PEDESTRIAN PUSH BUTTON
PEDESTAL POLE
PULL BOX SPECIAL
— TR — TR — TR — TR — TR — TR — TR —
TRAFFIC CONDUIT

TRAFFIC SIGNAL

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STANDARD SYMBOLS

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A

AAC	Aluminum Arch Culvert
AADT	Annual Average Daily Traffic
ABC	Aggregate Base Course
Abut	Abutment
ACM	Abestos Containing Materials
ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AE	Architect-Engineer, Architecture, Engineering
AEC	Architecture, Engineering and Construction
AGA	American Gas Association
Alt	Alternate
API	American Petroleum Institute
APL	Approved Products List
Approx	Approximate
APWA	American Public Works Association
AQCC	Air Quality Control Commission
ARE	Additional Requested Element (Design/Build Terminology)
AREMA	American Railway Engineering & Maintenance-of-Way Association
AHSTA	Ahead Station
ARA	Asphalt Rejuvenating Agent
ASBI	American Segmental Bridge Institute
ASD	Allowable Stress Design
ASOP	American Society of Photogrammetry
ASR	Alkali Silica Reactivity
ASSE	American Society of Sanitary Engineering, American Society of Safety Engineers
Asst	Assistant
ATB	Asphalt Treated Base
ATM	Active Traffic Management
AUTS	Actual Ultimate Tensile Strength

B

Bk to Bk	Back to Back
BEI	By Equal Increments
BM	Bench mark
BPF	Blows Per Foot
BAFO	Best and Final Offer
Bbl	Barrels
BC	Bolt Circle
Beg	Begin
Bk	Back
Bldg	Building
BLM	Bureau of Land Management
Blvd	Boulevard
BMP	Best Management Practice
BNSF	Burlington Northern & Santa Fe Railroad
Bott	Bottom
BP	Bearing Pressure
Brg	Bearing
Bk Sta	Back Station
BT	Beginning of Transition
Btwn	Between

C

℄	Centerline
C&G	Curb and Gutter
CA	Concrete Arch
CAC	Concrete Arch Culvert
CAD	Computer Aided Design, Computer Aided Drafting
CADD	Computer Aided Design and Drafting
CBC	Concrete Box Culvert
CBG	Concrete Box Girder
CBGC	Concrete Box Girder Continuous
CBGCP	Concrete Box Girder Continuous Prestressed
CBGP	Concrete Box Girder Prestressed
CBGS	Concrete Box Girder Segmented
CBR	California Bearing Ratio
CCR	Code of Colorado Regulations, as amended
CDTPG	Concrete Double-Tee Prestressed Girder
CE	Construction Engineering
CF	Cubic Feet
CFS	Cubic Feet per Second
CG	Center of Gravity
CHP	Colorado Highway Patrol
CI	Cast Iron or Concrete on Rolled I-Beam
CIC	Concrete on Rolled I-Beam Continuous
CICK	Concrete on Rolled I-Beam Continuous & Composite
CICKP	Concrete on Rolled I-Beam Continuous & Composite Prestressed
CIK	Concrete on Rolled I-Beam Composite
CIKP	Concrete on Rolled I-Beam Composite Prestressed
CIP	Cast-in-Place or Cost in Place
CIR	Cold In-Place Recycling
Clr	Clear
cm	Centimeters
CM	Corrugated Metal
CMAQ	Congestion Mitigation Air Quality
CMP	Corrugated Metal Pipe
CMU	Concrete Masonry Unit
COC	Certificate of Compliance
Col	Column
Comp	Composite
Conc	Concrete
Conn	Connection
Const	Construction
Const Jt	Construction Joint
Cont	Continuous
Corr	Corrugated
CPE	Corrugated Polyethylene Pipe
CPG	Concrete Prestressed Girder (Precast)
CPGC	Concrete Prestressed Girder Continuous (Precast)
CPT	Corrugated Polyethylene Tubing
CR	County Road
CRF	Concrete Rigid Frame
CS	Curve to Spiral, Commercial Standard, Concrete Slab
CSC	Concrete Slab Continuous
CSG	Concrete Slab & Girder (Poured in Place)
CSGC	Concrete Slab & Girder Continuous (Poured in Place)
CSGCP	Concrete Slab & Girder Continuous Prestressed (Poured in Place)
CSGP	Concrete Slab & Girder Prestressed (Poured in Place)
Csk	Countersunk
CSL	Cross Hole Sonic Logging
CSP	Corrugated Steel Pipe or Concrete Slab Prestressed
CSPC	Concrete Slab Prestressed Continuous
CTB	Cement Treated Base
CTR	Certified Test Reports
Ctr	Center
CY	Cubic Yards
CZ	Clear Zone

D

D	Degree of Curvature, or Density
DB	Design Build
DAS	Deformed Anchor Stud
dB	decibels
DBA	Deformed Bar Anchor
Dbl	Double

GENERAL NOTES

1. ABBREVIATIONS SHOULD BE UPPER AND LOWER CASE LETTERS EXCEPT WHERE ALL UPPER CASE LETTERS ARE REQUIRED.
   Const Jt = Construction Joint
2. ACRONYMS SHALL BE ALL UPPER CASE LETTERS.
   CBC = Concrete Box Culvert
3. ABBREVIATIONS SHALL BE USED ONLY WHEN THE WORDS CANNOT BE COMPLETELY SPELLED OUT DUE TO MULTIPLE FACTORS, SUCH AS A LACK OF SPACE ON THE SHEET.

Deg, °F, °C,	Degrees (Thermal) - Degrees Fahrenheit, Degrees Celsius
Dgn	Design or Microstation Drawing
DH	Design Height or Avg height for qty calculations
DHV	Design Hour Volume
DHW	Design High Water
DI	Ductile Iron
Dia	Diameter
DNR	Department of Natural Resources
DOW	Division of Wildlife (Colorado)
DRCOG	Denver Regional Council of Governments
DTD	Division of Transportation Development (CDOT)
DTM	Digital Terrain Model
Dwg	AutoCAD Drawing

E

e.g.	Exempli Gratia (For Example)
EA	Environmental Assessment
EATB	Emulsified Asphalt Treated Base
EB	Eastbound
EF	Each Face
Elev	Elevation
Engr	Engineer
EPA	Environmental Protection Agency
EPDM	Ethylene Propylene Diene Monomer-class rubber
Eq	Equal
ESAL	Equivalent Single Axle Load
Est	Estimate
ET	Ending of Transition
EVT	Event Point (InRoads Terminology)
EW	Each Way
E	Expansion Bearing
Exc	Excavation
Exp Jt	Expansion Joint
Ext	Exterior

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ACRONYMS AND ABBREVIATIONS

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M-100-2
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F

F	Fixed Bearing
FL	Flow Line
FAA	Federal Aviation Administration
FASB	Foamed Asphalt Stabilized Base
FCM	Fracture Critical Member
FDR	Full Depth Reclamation
Fed	Federal
FEMA	Federal Emergency Management Agency
FES	Flared End Section
FF	Far Face or Front Face
Fig	Figure
Fin	Finished
Fl	Floor
Flg	Flange
FM	Factory Mutual
FMM	Field Materials Manual
FPM	Feet Per Minute
FPS	Feet Per Second
FRA	Federal Railroad Administration
Freq	Frequency
FRP	Fiber Reinforced Polymer
FS	Planned Finish Surface
Ft	Feet
Ft Kip	Foot Kips
Ft Lb	Foot Pounds
FTA	Federal Transit Administration
Ftg	Footing
FWD	Falling Weight Deflectometer

G

Ga	Gage or Gauge
Gal	Gallons
Galv	Galvanized
Gd	Guided expansion bearing
Gir, G	Girder
GIS	Geographical Information System
GL	Girt Line
GPM	Gallons Per Minute
GPS	Global Positioning System
GRI	Geosynthetic Research Institute
GRS	Geosynthetic Reinforced Soil
GSI	Geosynthetic Institute

H

HAS	Headed Anchor Stud
HAZMAT	Hazardous Materials
HC	Horizontal Clearance
HCL	Horizontal Control Line
HCM	Highway Capacity Manual
Hd	Head
HDPE	High Density Polyethylene
HDPP	High Density Polypropylene
Hex Hd	Hexagonal Head
HID	High Intensity Discharge (Lamps)
HIR	Hot In-Place Recycling
HLMR	Highload Multi-Rotational
HMA	Hot Mix Asphalt
Horiz	Horizontal
HOV	High-Occupancy Vehicle
HP	Horsepower
HPC	High Performance Concrete
HS	High Strength
Ht	Height
HW	High Water
Hwy	Highway
Hyd	Hydraulic

I

ICEA	Insulated Cable Engineers Association
ID	Inside Diameter
IMP	Incident Management Plan
In. Kips	Inch Kips
In. Lb.	Inch Pounds
In.	Inches
Incl	Included
Int	Interior
Inv	Invert
IRI	International Roughness Index
ISO	International Organization for Standards
ITAA	Information Technology Association of America
ITS	Intelligent Transportation System
IVHS	Intelligent Vehicle Highway System

J

JB	Junction Box
JPCP	Jointed Plain Concrete Pavement
Jt	Joint

K

Kip	Thousand Pounds
KSF	kips per square foot
KSI	Kips per square inch
KW	Kilowatt

L

L	Length, Angle(steel)
Lb	Pounds
Lb/Ft	pound per foot
Lb/SY	Pounds per square yard
Lb-Ft	pound foot
LCCA	Life Cycle Cost Analysis
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LF	Linear Feet
LFD	Load Factor Design
LL	Liquid Limit
LLDPE	Linear Low-Density Polyethylene
LRFD	Load and Resistance Factor Design
LS	Lump Sum or Length of Spiral
Lt	Left
LTB	Lime Treated Base
LTDS	Required Long Term Design Strength
Lum	Luminaire

M

m	Meters
MA	Mobile Attenuator
Maint	Maintenance
MARV	Minimum Average Roll Value
Matl	Material
Max	Maximum
MBTA	Migratory Bird Treaty Act
MFBM	Thousand Foot Board Measure
Mfg	Manufactured or Manufacturer
MHT	Method of Handling Traffic
Mi	Mile
Min	Minimum
Misc	Miscellaneous
mm	Millimeters
MP	Milepost
MPH	Miles Per Hour
M_R	Resilient Modulus
MR	Modulus of Rupture

N

NAD	North American Datum
NAVD	North American Vertical Datum
NB	Northbound, Total Number of Blocks
N_{DES}	Recommended SuperPave™ Gyratory Design Revolution
NDT	Nondestructive Testing
NECA	National Electrical Contractors Association
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NF	Near Face
NFPA	National Fire Protection Association
NGS	National Geodetic Survey
NGVD	National Geodetic Vertical Datum of 1929
NHS	National Highway System
NICET	National Institute for Certification of Engineering Technologies
NIP	Nail in Place
NMAS	Nominal Maximum Aggregate Size
No	Number
Nom	Nominal
NPDES	National Pollutant Discharge Elimination System
NPT	National Pipe Thread
NS	Near Side
NTCIP	National Transportation Communications for ITS Protocol
NTP	Notice to Proceed
NTS	Not to Scale

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ACRONYMS AND ABBREVIATIONS

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STANDARD PLAN NO.
M-100-2

D

DC	Dn Center
DD	Dutside Diameter
DGFC	Dpen Grade Friction Course
DJT	Dn-the-Job Trainee or Dn-the-Job Training
Dpp Hand	Dpposite Hand
oz	Dunces

P

PC	Point of Curve
PCA	Portland Cement Association
PCBC	Concrete Box Culvert Precast
PCC	Point of Compound Curve
PCCP	Portland Cement Concrete Pavement
PDA	Pile Driving Analyzer
PE	Preliminary Engineering, or Professional Engineer or Permanent Easement
Ped	Pedestrian
PG	Profile Grade or Performance Grade
PGL	Profile Grade Line
PI	Point of Intersection
PL, Pl	Plate
PLS	Professional Land Surveyor
PM	Project Manager
PMBB	Plant Mix Bituminous Base
PMBP	Plant Mix Bituminous Pavement
PMSC	Plant Mix Seal Coat
POC	Point on Curve
POSS	Point of Slope Selection
POT	Point on Tangent
PPE	Personal Protective Equipment
PRC	Point of Reverse Curve
Proj	Project or Projection
psf	Pounds per square foot
psi	Pounds per square inch
PT	Point of Tangent
PTFE	Polytetrafluoroethylene
PTI	Post-Tensioning Institute
PUC	Public Utilities Commission
PVC	Poly Vinyl Chloride (pipe), Point of Vertical Curve
PVI	Point of Vertical Intersection
Pvmt	Pavement
PVT	Point of Vertical Tangency

Q

Q	Peak Discharge or Flow Volume
QA	Quality Assurance
QC	Quality Control
QMP	Quality Management Plan
QML	Qualified Manufacturers List

R

R	Radius
RA	Rubble Arch
RAC	Rubble Arch Culvert
rad	radians
RAP	Reclaimed Asphalt Pavement
RAS	Reclaimed Asphalt Shingles
RC	Reverse Crown
RCC	Roller Compacted Concrete
RCP	Reinforced Concrete Pipe
RCPC	Reinforced Concrete Pipe Culvert
Rdwy	Roadway
RE	Resident Engineer or Railroad Easement
Ref	Reference
Reinf	Reinforcing
Rem	Remove or Removal
Repl	Replace
Req	Required
Rev	Revised, Revision
RG	Riveted Plate Girder
RGC	Riveted Plate Girder Continuous
RL	Reinforcement Length
RME	Region Materials Engineer
rpm	Revolutions Per Minute
RSC	Rigid Steel Conduit
RSS	Reinforced Soil Slope
Rt	Right
RTD	Region Transportation Director or Regional Transportation District
RWIS	Road Weather Information System

S

SA	Steel Arch
SAC	Steel Arch Culvert
San	Sanitary
SB	Southbound
SBA	Small Business Administration
SBG	Steel Box Girder
SBGC	Steel Box Girder Continuous
SC	Spiral to Curve
Sch	Schedule
SCS	Spiral Curve Spiral
SDG	Steel Deck Girder
SDGC	Steel Deck Girder with Floor Beam System
SDGCK	Steel Deck Girder Continuous & Composite
SDI	Steel Decks Institute
SDT	Steel Deck Truss
Sdwk	Sidewalk
Sect	Section
SF	Square Feet
SH	State Highway
Shldr	Shoulder
SHPD	State Historic Preservation Office
SHRP	Strategic Highway Research Program
Sht	Sheet
SIGN	Overhead Sign
SIGNB	Overhead Sign-Butterfly
SIGNC	Overhead Sign-Cantilever
SIGND	Overhead Sign + Cantilever
Sim	Similar
SIP	Stay in Place
SJI	Steel Joists Institute
SLT	Steel Low Truss
SMA	Stone Matrix Asphalt
SN	Structural Number
Spa	Spaces or Spaced
Specs	Specifications
SpG	Specific Gravity
Spl	Splice
Sq In	Square Inches
Sq Mi	Square Miles
Sq	Square
SRW	Segmental Retaining Walls
SSE	Steel Stringer-Earth Filled
SSM	Steel Stringer-Metal Plank Deck
SSMC	Steel Stringer-Metal Plank Deck Continuous
SSPC	Society for Protective Coatings
SSS	Steel Stringer-Timber Deck
SSSC	Steel Stringer-Timber Deck Continuous
ST	Spiral to Tangent
St	Straight or Street
Sta	Station
Std	Standard
STG	Steel Thru Girder
Str	Structure, Structural
STT	Steel Thru Truss
SUSP	Suspension Bridge
SY	Square Yards
Sym	Symmetrical

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ACRONYMS AND ABBREVIATIONS

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STANDARD PLAN NO.

M-100-2

T

T&B	Top and Bottom
T&E	Threatened & Endangered Species
T	Tons
TAS	Threaded Anchor Stud
TBC	Timber Box Culvert
TC	Tangent to Curve
TCD	Traffic Control Devices
TCP	Traffic Control Plan
TD	Timber Stringer (Untreated) Concrete Deck
TDH	Total Dynamic Head
Temp	Temporary or Temperature
Thd	Thread
THHN	Thermoplastic High Heat-resistant Nylon coated (Insulation designation for wire)
THWN	Thermoplastic High Water-resistant Nylon coated (Insulation designation for wire)
TIG	Tungsten Inert Gas (Welding)
TLA	Timber Laminated Arch (Gluelam)
TLS	Timber Laminated Stringer(Gluelam)
TLT	Timber Low Truss
TM	Timber Stringer (Untreated) Metal Deck
TMP	Transportation Management Plan
Tot	Total
TPI	Threads per Inch
TS	Tangent to Spiral, Timber Stringer (Untreated) Timber Deck
TSLAB	Timber Slab
TTC	Timber Culvert
TTD	Timber Stringer-Concrete Deck
TTM	Timber Stringer- Metal Deck
TTS	Timber Stringer- Timber Deck
TTT	Timber Thru Truss
TUNC	Tunnel-Concrete Lined
TUNR	Tunnel-Thru Rock-No Lining
Typ	Typical

U

UG	Underground
UNC	Uniform National Coarse (screw thread)
UNCC	Utility Notification Center of Colorado
UNF	Uniform National Fine (screw thread)
UNO	Unless Noted Otherwise
UPRR	Union Pacific Railroad
UPS	Uninterruptible Power Supply
USACE	United States Army Corp of Engineers
USCS	Unified Soil Classification System
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service
USGS	US Geological Survey
Util	Utility or Utilities
UV	Ultraviolet

V

VC	Vertical Curve
VCP	Vitrified Clay Pipe
Veh	Vehicle
Vert	Vertical
VFA	Voids Filled With Asphalt
VMA	Voids in the Mineral Aggregate
VMS	Variable Message Sign
Vol	Volume
VPC	Vertical Point of Curvature
VPI	Vertical Point of Intersection
VPT	Vertical Point of Tengency

W

W/C	Water-Cement Ratio
WALL	Retaining Wall
WB	Westbound
WBS	Work Breakdown Structure
WF	Wide Flange (Steel section)
WG	Welded Girder
WGC	Welded Girder Continuous
WGCK	Welded Girder Continuous & Composite
WGCKP	Welded Girder Continuous, Composite Prestressed
WGK	Welded Girder Composite
WGKP	Welded Girder Composite Prestressed
WIMS	Weigh-In-Motion Station
WP	Work Point
WQCD	Water Quality Control Division (Colorado Department of Public Health and Environment)
WRI	Wire Reinforcement Institute
WS	Water Surface
WSN	Weighted Structural Number
Wt	Weight
WWF	Welded Wire Fabric, typically referred to very light gauge wire for crack control
WWR	Welded Wire Reinforcement

Y

Yd	Yard

SYMBOLS

400	#4 REBAR BENDING SHAPE
500	#5 REBAR BENDING SHAPE
600	#6 REBAR BENDING SHAPE
@	at
&	and
ϕ ⌀	Diameter
°, ', "	Degrees, Minutes, Seconds
', "	Feet, inches
#	Number or Pound
(E)	Epoxy Coated Rebar
(N)	Non-Epoxy Coated Rebar
GXX	Girder Label
°F	Fahrenheit
°C	Celsius
≈	Approximate
	Interstate Highway
	US Highway
	State Highway

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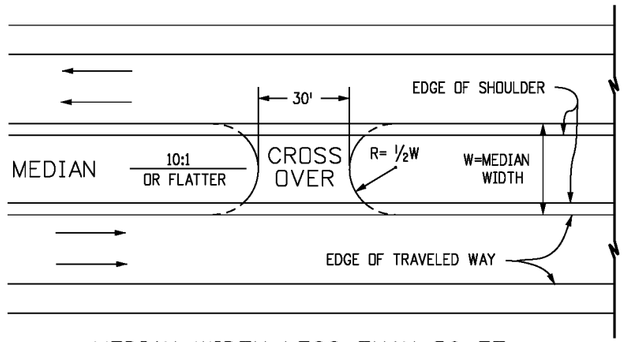
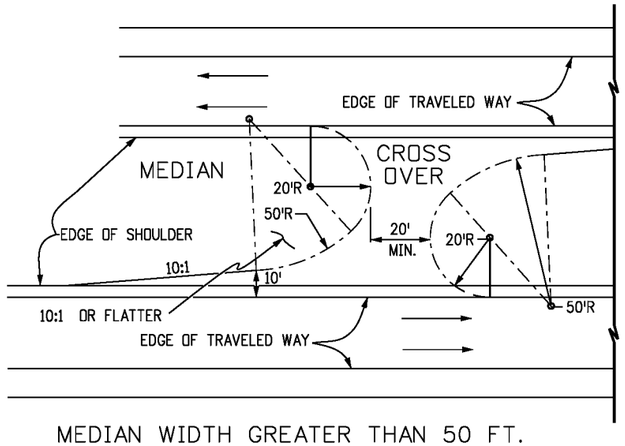
M-100-2



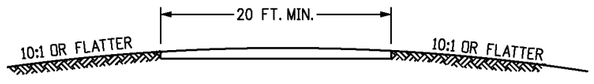
MEDIAN WIDTH LESS THAN 50 FT.



MEDIAN WIDTH GREATER THAN 50 FT.

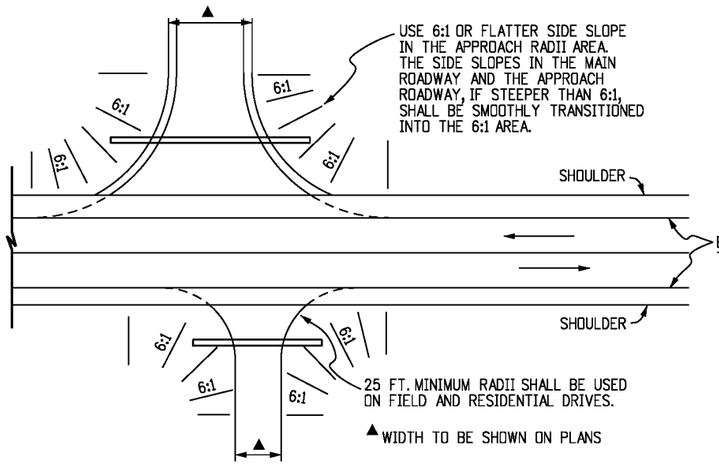
TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER

LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT



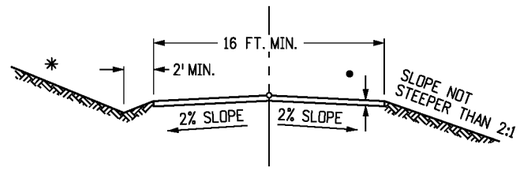
TYPICAL SECTION FOR MEDIAN CROSS OVER

ANY REQUIRED PIPE OR INLET FOR MEDIAN DRAINAGE SHALL HAVE A TRAVERSABLE DESIGN AS SPECIFIED ON THE PLANS



SIDE DRAINS SHALL BE LOCATED BEYOND THE CLEAR ZONE, OR WHEN WITHIN THE CLEAR ZONE, THEY SHALL BE INSTALLED WITH END SECTIONS CONFORMING TO A 6:1 SLOPE. FIFTY FT. RADII SHALL BE USED ON INTERSECTING ROADS, EXCEPT FOR FIELD AND RESIDENTIAL DRIVES OR UNLESS OTHERWISE SPECIFIED ON PLANS. RADII MAY BE VARIED TO SUIT FIELD CONDITIONS.

TYPICAL PLANS FOR SIDE APPROACH ROAD

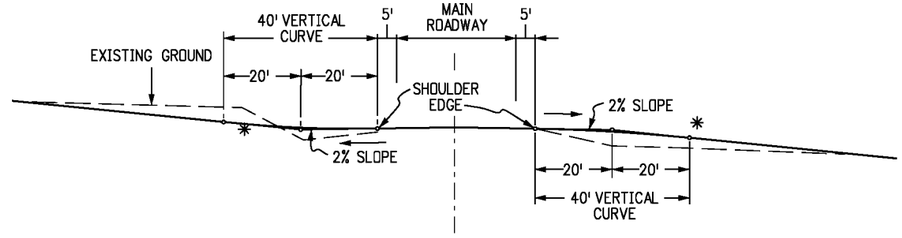


½ CUT SECTION ½ FILL SECTION

TYPICAL SECTION FOR APPROACH ROAD

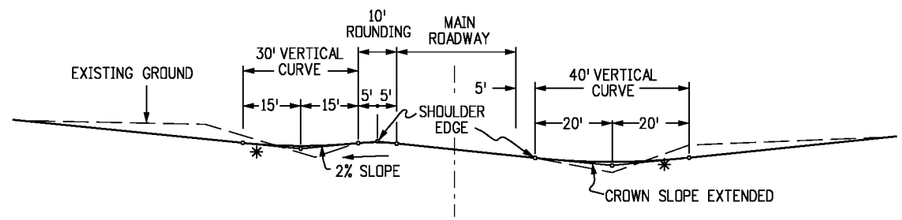
- ROAD APPROACHES WHICH REQUIRE HMA PAVEMENT, SHALL BE PLACED AS FOLLOWS:

  PUBLIC APPROACHES AND ENTRANCES TO BUILDINGS OR RESIDENCES SHALL BE PAVED 50 FT. OUT FROM EDGE OF SHOULDER OR TO THE RIGHT OF WAY LINE, WHICHEVER IS LESS. FIELD ENTRANCES SHALL BE PAVED 4 FT. OUT FROM EDGE OF SHOULDER. STABILIZATION THICKNESSES SHALL BE AS SHOWN ON THE PLANS.

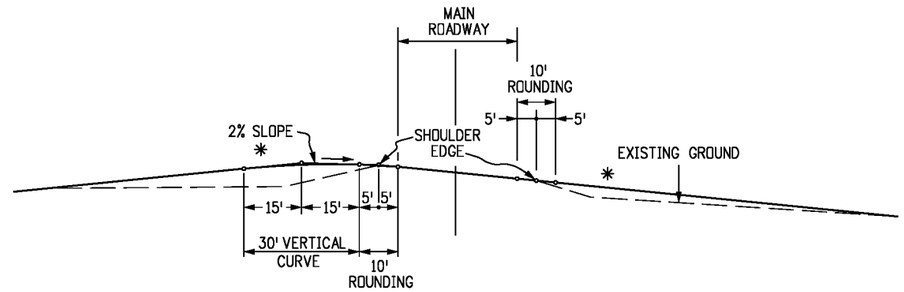


½ CUT SECTION ½ FILL SECTION

STANDARD CROWNED SECTION



SUPERELEVATED CUT SECTION



SUPERELEVATED FILL SECTION

VERTICAL ALIGNMENT SIDE APPROACH ROADS INTERSECTING MAIN ROADWAY

* TANGENT SLOPE NOT STEEPER THAN 8% BEYOND THE VERTICAL CURVE. THE SLOPE MAY BE STEEPER, IF REQUIRED, TO MEET EXISTING APPROACH SLOPE. HOWEVER, APPROACH ROAD SLOPE SHOULD NOT BE STEEPER THAN EXISTING SLOPE.

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APPROACH ROADS

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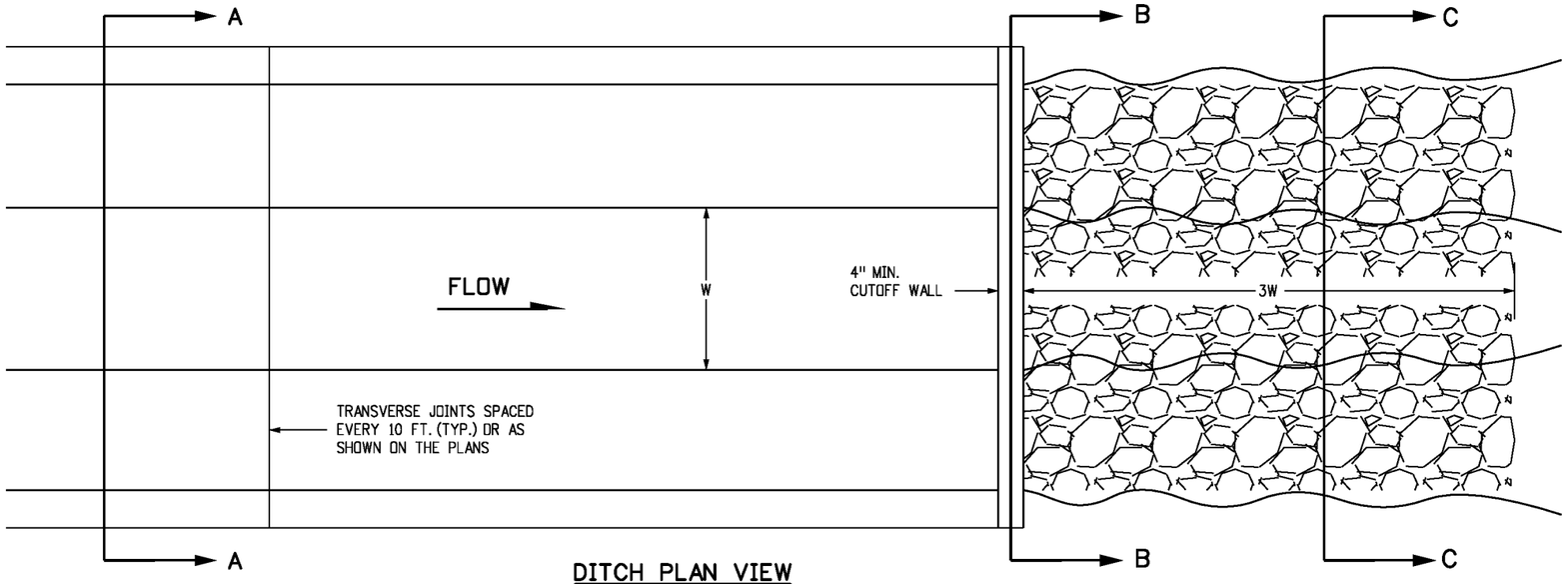
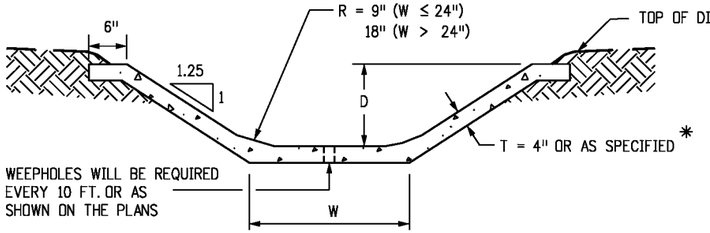
STANDARD PLAN NO.
M-203-1
Sheet No. 1 of 1



DITCH PLAN VIEW

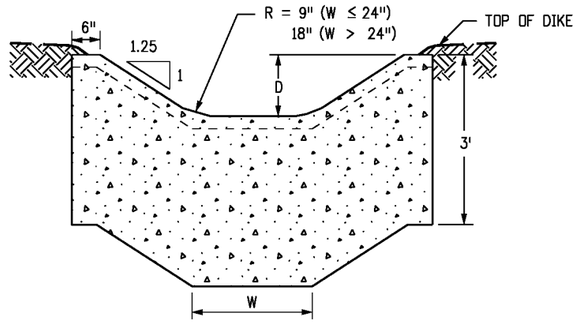
GENERAL NOTES

1. ALL DITCHES SHALL BE CONSTRUCTED TO THE LINES AND GRADES AS SHOWN ON THE PLANS, USING THE DITCH SECTION AS SHOWN ON THE PLANS, OR AS SPECIFIED BY THE ENGINEER.
2. CONCRETE LINING WILL BE PAID FOR AS CONCRETE SLOPE AND DITCH PAVING.
3. PROVIDE A CUTOFF WALL AND RIPRAP AT THE END OF CONCRETE-LINED DITCH.



SECTION A-A
CONCRETE-LINED DITCH

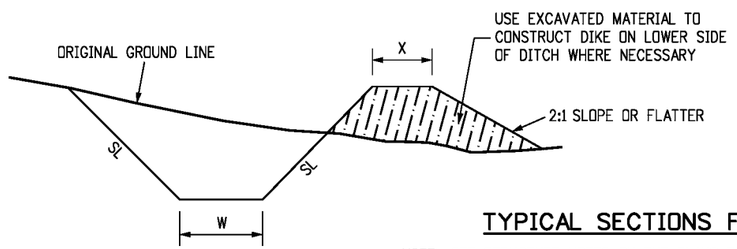
* FOR SECTIONS WHERE W ≤ 18"
AND D ≤ 18" USE T = 3"



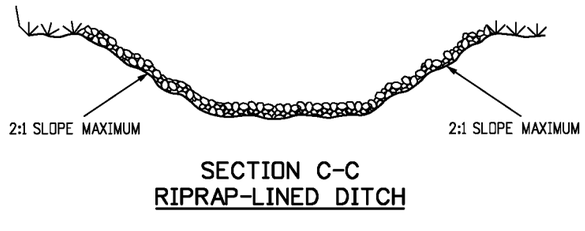
SECTION B-B
CUTOFF WALL

D	CU. YDS. PER 100 LIN. FT.				
	W (INCHES)				
(INCHES)	12	18	24	36	48
18	6.3 *	6.7 *	9.6	10.8	12.0
24	9.9	10.5	11.6	12.8	14.0
30	12.3	12.9	13.5	14.8	16.0
36	14.3	14.9	15.5	16.7	18.0
48			19.4	20.7	21.9

CONCRETE-LINED DITCH
QUANTITIES

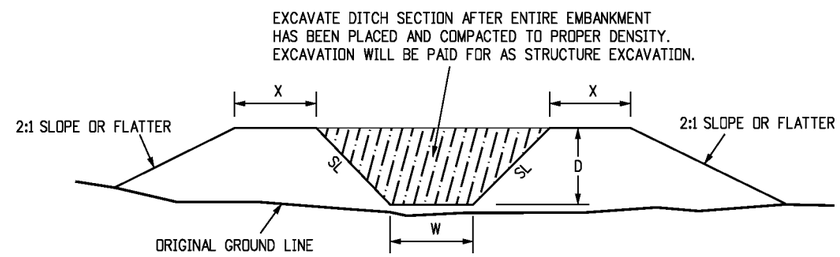


CUT SECTIONS



SECTION C-C
RIPRAP-LINED DITCH

RIPRAP GRADATION SHALL BE AS SPECIFIED IN THE CONTRACT.



EMBANKMENT SECTIONS

TYPICAL SECTIONS FOR DITCHES

NOTE: SEE STRUCTURE NOTES ON THE PLANS FOR DIMENSIONS W, D, AND SL.
DIMENSION X = W/2 WITH MINIMUM OF 2 FT. UNLESS OTHERWISE
SHOWN ON THE PLANS, W = 1 FT., SL = 2:1 OR FLATTER.

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DITCH TYPES

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STANDARD PLAN NO.
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Sheet No. 1 of 1

e max = 8% TABLE CONTINUES ON SHEET 2.

	V_d =15 mph			V_d =20 mph			V_d =25 mph			V_d =30 mph			V_d =35 mph			V_d =40 mph			V_d =45 mph			V_d =50 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)	
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	676-<932	31	46	1190-<1640	32	49	1720-<2370	34	51	2370-<3240	36	55	3120-<4260	39	58	3970-<5410	41	62	4930-<6710	44	67	5990-<8150	48	72	2.0
2.2	605-<676	34	51	1070-<1190	36	54	1550-<1720	38	57	2130-<2370	40	60	2800-<3120	43	64	3570-<3970	46	68	4440-<4930	49	73	5400-<5990	53	79	2.2
2.4	546-<605	37	55	959-<1070	39	58	1400-<1550	41	62	1930-<2130	44	65	2540-<2800	46	70	3240-<3570	50	74	4030-<4440	53	80	4910-<5400	58	86	2.4
2.6	496-<546	40	60	872-<959	42	63	1280-<1400	45	67	1760-<1930	47	71	2320-<2540	50	75	2960-<3240	54	81	3690-<4030	58	87	4490-<4910	62	94	2.6
2.8	453-<496	43	65	796-<872	45	68	1170-<1280	48	72	1610-<1760	51	76	2130-<2320	54	81	2720-<2960	58	87	3390-<3690	62	93	4130-<4490	67	101	2.8
3.0	415-<453	46	69	730-<796	49	73	1070-<1170	51	77	1480-<1610	55	82	1960-<2130	58	87	2510-<2720	62	93	3130-<3390	67	100	3820-<4130	72	108	3.0
3.2	382-<415	49	74	672-<730	52	78	985-<1070	55	82	1370-<1480	58	87	1820-<1960	62	93	2330-<2510	66	99	2900-<3130	71	107	3550-<3820	77	115	3.2
3.4	352-<382	52	78	620-<672	55	83	911-<985	58	87	1270-<1370	62	93	1690-<1820	66	99	2170-<2330	70	106	2700-<2900	76	113	3300-<3550	82	122	3.4
3.6	324-<352	55	83	572-<620	58	88	845-<911	62	93	1180-<1270	65	98	1570-<1690	70	105	2020-<2170	74	112	2520-<2700	80	120	3090-<3300	86	130	3.6
3.8	300-<324	58	88	530-<572	62	92	784-<845	65	98	1100-<1180	69	104	1470-<1570	74	110	1890-<2020	79	118	2360-<2520	84	127	2890-<3090	91	137	3.8
4.0	277-<300	62	92	490-<530	65	97	729-<784	69	103	1030-<1100	73	109	1370-<1470	77	116	1770-<1890	83	124	2220-<2360	89	133	2720-<2890	96	144	4.0
4.2	255-<277	65	97	453-<490	68	102	678-<729	72	108	955-<1030	76	115	1280-<1370	81	122	1660-<1770	87	130	2080-<2220	93	140	2560-<2720	101	151	4.2
4.4	235-<255	68	102	418-<453	71	107	630-<678	75	113	893-<955	80	120	1200-<1280	85	128	1560-<1660	91	137	1960-<2080	98	147	2410-<2560	106	158	4.4
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5.0	172-<193	77	115	314-<349	81	122	499-<542	86	129	727-<779	91	136	991-<1060	97	145	1310-<1390	103	155	1650-<1750	111	167	2040-<2160	120	180	5.0
5.2	154-<172	80	120	284-<314	84	126	457-<499	89	134	676-<727	95	142	929-<991	101	151	1230-<1310	108	161	1560-<1650	116	173	1930-<2040	125	187	5.2
5.4	139-<154	83	125	258-<284	88	131	420-<457	93	139	627-<676	98	147	870-<929	105	157	1160-<1230	112	168	1480-<1560	120	180	1830-<1930	130	194	5.4
5.6	126-<139	86	129	236-<258	91	136	387-<420	96	144	582-<627	102	153	813-<870	108	163	1090-<1160	116	174	1390-<1480	124	187	1740-<1830	134	202	5.6
5.8	115-<126	89	134	216-<236	94	141	358-<387	99	149	542-<582	105	158	761-<813	112	168	1030-<1090	120	180	1320-<1390	129	193	1650-<1740	139	209	5.8
6.0	105-<115	92	138	199-<216	97	146	332-<358	103	154	506-<542	109	164	713-<761	116	174	965-<1030	124	186	1250-<1320	133	200	1560-<1650	144	216	6.0
6.2	97-<105	95	143	184-<199	101	151	308-<332	106	159	472-<506	113	169	669-<713	120	180	909-<965	128	192	1180-<1250	138	207	1480-<1560	149	223	6.2
6.4	89-<97	98	148	170-<184	104	156	287-<308	110	165	442-<472	116	175	628-<669	124	186	857-<909	132	199	1110-<1180	142	213	1400-<1480	154	230	6.4
6.6	82-<89	102	152	157-<170	107	161	267-<287	113	170	413-<442	120	180	590-<628	128	192	808-<857	137	205	1050-<1110	147	220	1330-<1400	158	238	6.6
6.8	76-<82	105	157	146-<157	110	165	248-<267	117	175	386-<413	124	185	553-<590	132	197	761-<808	141	211	990-<1050	151	227	1260-<1330	163	245	6.8
7.0	70-<76	108	162	135-<146	114	170	231-<248	120	180	360-<386	127	191	518-<553	135	203	716-<761	145	217	933-<990	156	233	1190-<1260	168	252	7.0
7.2	64-<70	111	166	125-<135	117	175	214-<231	123	185	336-<360	131	196	485-<518	139	209	672-<716	149	223	878-<933	160	240	1120-<1190	173	259	7.2
7.4	59-<64	114	171	115-<125	120	180	198-<214	127	190	312-<336	135	202	451-<485	143	215	628-<672	153	230	822-<878	164	247	1060-<1120	178	266	7.4
7.6	54-<59	117	175	105-<115	123	185	182-<198	130	195	287-<312	138	207	417-<451	147	221	583-<628	157	236	765-<822	169	253	980-<1060	182	274	7.6
7.8	48-<54	120	180	94-<105	126	190	164-<182	134	201	261-<287	142	213	380-<417	151	226	533-<583	161	242	701-<765	173	260	901-<980	187	281	7.8
8.0	38-<48	123	185	76-<94	130	195	134-<164	137	206	214-<261	145	218	314-<380	155	232	444-<533	166	248	587-<701	178	267	758-<901	192	288	8.0

SUPERELEVATION NOTES

1. THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS RADIUS LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SUPERELEVATION RATE OF 8%. ALTERNATIVE MAXIMUM RATE OF SUPERELEVATION SHALL BE USED FOR CROWNED HIGHWAYS WHEN SPECIFIED ON THE PLANS.
2. VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR 2-LANE AND 4-LANE HIGHWAYS.
3. NUMBER OF LANES ROTATED:
   A. ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.
   B. TWO LANES ROTATED ARE TYPICAL FOR A FOUR-LANE HIGHWAY.
4. SPIRALS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPIRALS ARE PERMISSIBLE BUT NOT RECOMMENDED ABOVE THE HEAVY LINE. SPIRAL LENGTHS MAY BE ROUNDED TO MULTIPLES OF 50 FEET FOR CALCULATION CONVENIENCE.

e = SUPERELEVATION RATE

R - RADIUS OF CURVE

Vd - ASSUMED DESIGN SPEED

L - LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH

LN - TRAVEL LANE

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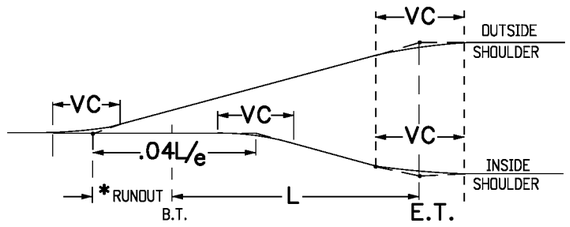
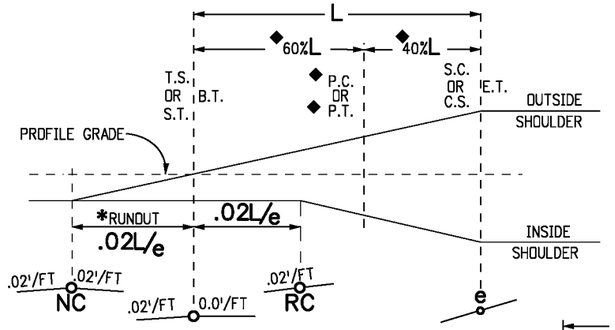
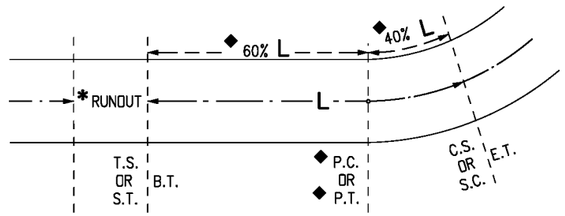
SUPERELEVATION
CROWNED AND DIVIDED
HIGHWAYS

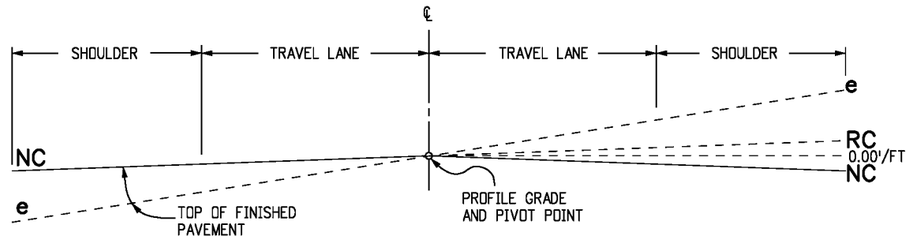
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-203-11
Sheet No. 1 of 3









VC - TO OBTAIN SMOOTH PROFILES ON PAVEMENT EDGES, VERTICAL CURVES MAY BE INSERTED AT THE ANGULAR BREAK POINTS. UNLESS RESTRAINING CONDITIONS EXIST, THE LENGTH OF VERTICAL CURVE SELECTED, IN FEET, SHOULD BE AT LEAST NUMERICALLY EQUAL TO THE DESIGN SPEED, AND NO MORE THAN $.04L/e$.

* RUNOUT LENGTH SHOULD USUALLY BE $.02L/e$. WHEN CONDITIONS ARE SUCH THAT THIS LENGTH IS NOT SUITABLE, THE DESIGNER SHALL CHOOSE ANOTHER LENGTH TO SUIT CONDITIONS.

○ = PIVOT

◆ = WHEN CURVE IS NOT SPIRALED.

e = MAXIMUM RATE OF SUPERELEVATION IN FEET (PER FOOT OF WIDTH) FOR THE GIVEN RADIUS OF CURVE AND DESIGN SPEED.

SUPERELEVATION DIAGRAMS FOR CROWNED HIGHWAYS

e max = 8% TABLE CONTINUED FROM SHEET 1.

	V_d =50 mph			V_d =55 mph			V_d =60 mph			V_d =65 mph			V_d =70 mph			V_d =75 mph			V_d =80 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)		
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	5990-<8150	48	72	7150-<9720	51	77	8440-<11500	53	80	9510-<12900	56	84	10700-<14500	60	90	12000-<16100	63	95	13300-<17800	69	103	2.0
2.2	5400-<5990	53	79	6450-<7150	56	84	7620-<8440	59	88	8600-<9510	61	92	9660-<10700	66	99	10800-<12000	69	104	12000-<13300	75	113	2.2
2.4	4910-<5400	58	86	5870-<6450	61	92	6930-<7620	64	96	7830-<8600	67	100	8810-<9660	72	108	9850-<10800	76	114	11000-<12000	82	123	2.4
2.6	4490-<4910	62	94	5370-<5870	66	100	6350-<6930	69	104	7180-<7830	73	109	8090-<8810	78	117	9050-<9850	82	123	10100-<11000	89	134	2.6
2.8	4130-<4490	67	101	4950-<5370	71	107	5850-<6350	75	112	6630-<7180	78	117	7470-<8090	84	126	8370-<9050	88	133	9340-<10100	96	144	2.8
3.0	3820-<4130	72	108	4580-<4950	77	115	5420-<5850	80	120	6140-<6630	84	126	6930-<7470	90	135	7780-<8370	95	142	8700-<9340	103	154	3.0
3.2	3550-<3820	77	115	4250-<4580	82	123	5040-<5420	85	128	5720-<6140	89	134	6460-<6930	96	144	7260-<7780	101	152	8130-<8700	110	165	3.2
3.4	3300-<3550	82	122	3970-<4250	87	130	4700-<5040	91	136	5350-<5720	95	142	6050-<6460	102	153	6800-<7260	107	161	7620-<8130	117	175	3.4
3.6	3090-<3300	86	130	3710-<3970	92	138	4400-<4700	96	144	5010-<5350	100	151	5680-<6050	108	162	6400-<6800	114	171	7180-<7620	123	185	3.6
3.8	2890-<3090	91	137	3480-<3710	97	146	4140-<4400	101	152	4710-<5010	106	159	5350-<5680	114	171	6030-<6400	120	180	6780-<7180	130	195	3.8
4.0	2720-<2890	96	144	3270-<3480	102	153	3890-<4140	107	160	4450-<4710	112	167	5050-<5350	120	180	5710-<6030	126	189	6420-<6780	137	206	4.0
4.2	2560-<2720	101	151	3080-<3270	107	161	3670-<3890	112	168	4200-<4450	117	176	4780-<5050	126	189	5410-<5710	133	199	6090-<6420	144	216	4.2
4.4	2410-<2560	106	158	2910-<3080	112	169	3470-<3670	117	176	3980-<4200	123	184	4540-<4780	132	198	5140-<5410	139	208	5800-<6090	151	226	4.4
4.6	2280-<2410	110	166	2750-<2910	117	176	3290-<3470	123	184	3770-<3980	128	193	4310-<4540	138	207	4890-<5140	145	218	5530-<5800	158	237	4.6
4.8	2160-<2280	115	173	2610-<2750	123	184	3120-<3290	128	192	3590-<3770	134	201	4100-<4310	144	216	4670-<4890	152	227	5280-<5530	165	247	4.8
5.0	2040-<2160	120	180	2470-<2610	128	191	2960-<3120	133	200	3410-<3590	140	209	3910-<4100	150	225	4460-<4670	158	237	5050-<5280	171	257	5.0
5.2	1930-<2040	125	187	2350-<2470	133	199	2820-<2960	139	208	3250-<3410	145	218	3740-<3910	156	234	4260-<4460	164	246	4840-<5050	178	267	5.2
5.4	1830-<1930	130	194	2230-<2350	138	207	2680-<2820	144	216	3110-<3250	151	226	3570-<3740	162	243	4090-<4260	171	256	4640-<4840	185	278	5.4
5.6	1740-<1830	134	202	2120-<2230	143	214	2550-<2680	149	224	2970-<3110	156	234	3420-<3570	168	252	3920-<4090	177	265	4460-<4640	192	288	5.6
5.8	1650-<1740	139	209	2010-<2120	148	222	2430-<2550	155	232	2840-<2970	162	243	3280-<3420	174	261	3760-<3920	183	275	4290-<4460	199	298	5.8
6.0	1560-<1650	144	216	1920-<2010	153	230	2320-<2430	160	240	2710-<2840	167	251	3150-<3280	180	270	3620-<3760	189	284	4140-<4290	206	309	6.0
6.2	1480-<1560	149	223	1820-<1920	158	237	2210-<2320	165	248	2600-<2710	173	260	3020-<3150	186	279	3480-<3620	196	294	3990-<4140	213	319	6.2
6.4	1400-<1480	154	230	1730-<1820	163	245	2110-<2210	171	256	2490-<2600	179	268	2910-<3020	192	288	3360-<3480	202	303	3850-<3990	219	329	6.4
6.6	1330-<1400	158	238	1650-<1730	169	253	2010-<2110	176	264	2380-<2490	184	276	2790-<2910	198	297	3240-<3360	208	313	3720-<3850	226	339	6.6
6.8	1260-<1330	163	245	1560-<1650	174	260	1910-<2010	181	272	2280-<2380	190	285	2690-<2790	204	306	3120-<3240	215	322	3600-<3720	233	350	6.8
7.0	1190-<1260	168	252	1480-<1560	179	268	1820-<1910	187	280	2180-<2280	195	293	2580-<2690	210	315	3010-<3120	221	332	3480-<3600	240	360	7.0
7.2	1120-<1190	173	259	1400-<1480	184	276	1720-<1820	192	288	2070-<2180	201	301	2470-<2580	216	324	2900-<3010	227	341	3370-<3480	247	370	7.2
7.4	1060-<1120	178	266	1320-<1400	189	283	1630-<1720	197	296	1970-<2070	207	310	2350-<2470	222	333	2780-<2900	234	351	3250-<3370	254	381	7.4
7.6	980-<1060	182	274	1230-<1320	194	291	1530-<1630	203	304	1850-<1970	212	318	2230-<2350	228	342	2650-<2780	240	360	3120-<3250	261	391	7.6
7.8	901-<980	187	281	1140-<1230	199	299	1410-<1530	208	312	1720-<1850	218	327	2090-<2230	234	351	2500-<2650	246	369	2970-<3120	267	401	7.8
8.0	758-<901	192	288	960-<1140	204	306	1200-<1410	213	320	1480-<1720	223	335	1810-<2090	240	360	2210-<2500	253	379	2670-<2970	274	411	8.0

R - RADIUS OF CURVE
Vd - ASSUMED DESIGN SPEED
L - LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH
NC - NORMAL CROWN SECTION
RC - REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE
VC - VERTICAL CURVE
LN - TRAVEL LANE

BT - BEGINNING OF TRANSITION
ET - ENDING OF TRANSITION
TS - TANGENT TO SPIRAL
ST - SPIRAL TO TANGENT
PC - POINT OF CURVATURE
PI - POINT OF INTERSECTION
PT - POINT OF TANGENT
CS - CURVE TO SPIRAL
SC - SPIRAL TO CURVE

SUPERELEVATION NOTES

1. THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS RADIUS LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SUPERELEVATION RATE OF 8%. ALTERNATIVE MAXIMUM RATE OF SUPERELEVATION SHALL BE USED FOR CROWNED HIGHWAYS WHEN SPECIFIED ON THE PLANS.
2. VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR 2-LANE AND 4-LANE HIGHWAYS.
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   A. ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.
   B. TWO LANES ROTATED ARE TYPICAL FOR A FOUR-LANE HIGHWAY.
4. SPIRALS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPIRALS ARE PERMISSIBLE BUT NOT RECOMMENDED ABOVE THE HEAVY LINE. SPIRAL LENGTHS MAY BE ROUNDED TO MULTIPLES OF 50 FEET FOR CALCULATION CONVENIENCE.

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SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS

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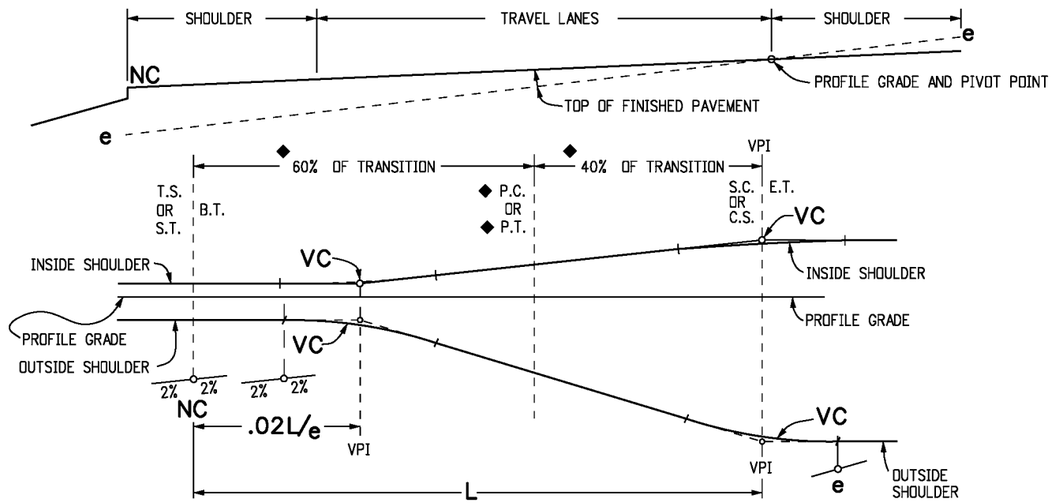
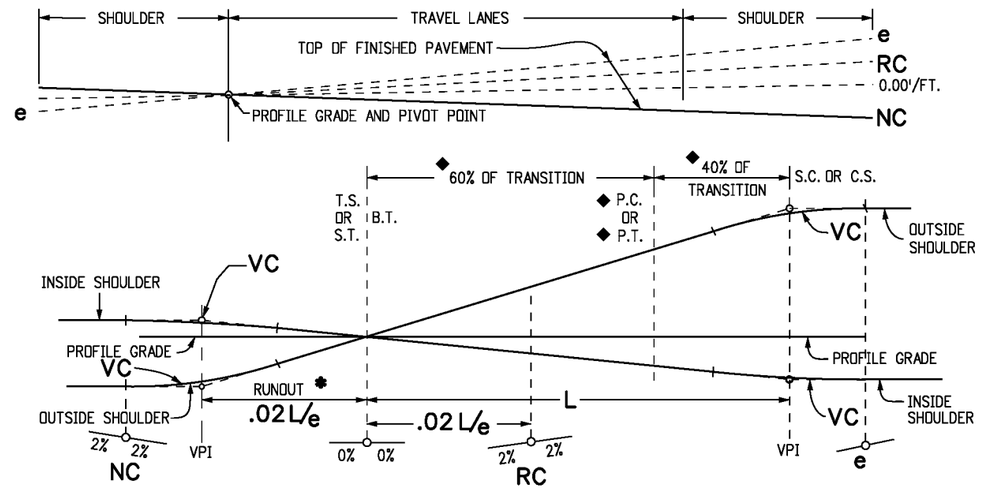
STANDARD PLAN NO.
M-203-11
Sheet No. 2 of 3



DIAGRAMMATIC PROFILE FOR SUPERELEVATION OF INSIDE LANES



DIAGRAMMATIC PROFILE FOR SUPERELEVATION OF OUTSIDE LANES

SUPERELEVATION DIAGRAMS FOR DIVIDED HIGHWAYS SHOULDER PIVOT

VC - TO OBTAIN SMOOTH PROFILES ON PAVEMENT EDGES, VERTICAL CURVES MAY BE INSERTED AT THE ANGULAR BREAK POINTS. UNLESS RESTRAINING CONDITIONS EXIST, THE LENGTH OF VERTICAL CURVE SELECTED, IN FEET, SHOULD BE AT LEAST NUMERICALLY EQUAL TO THE DESIGN SPEED, AND NO MORE THAN $.04L/e$.

R - RADIUS OF CURVE
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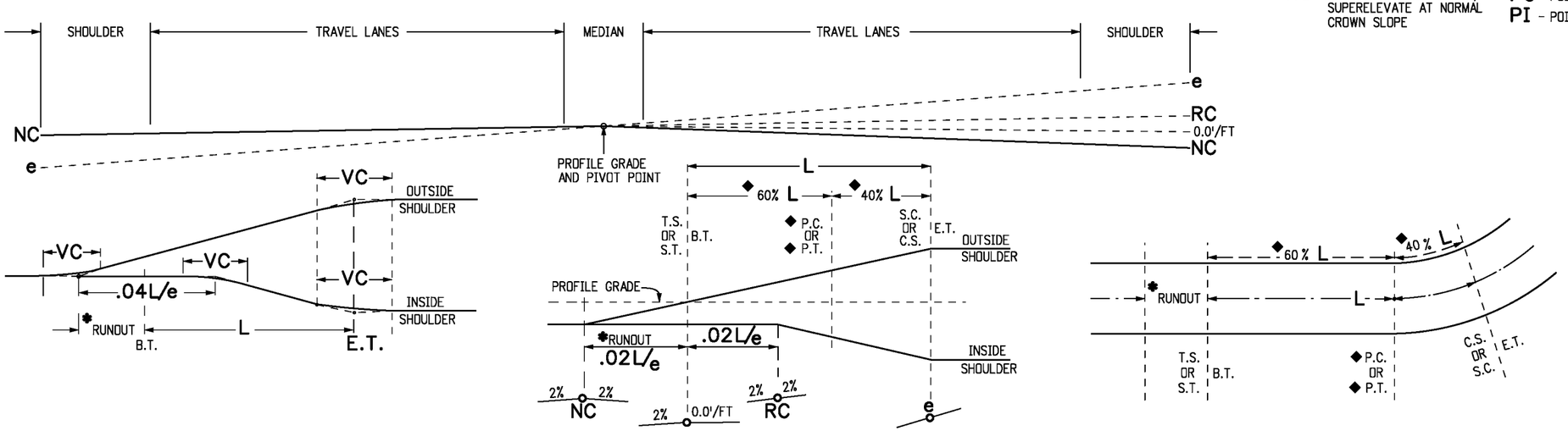
VC - VERTICAL CURVE
BT - BEGINNING OF TRANSITION
ET - ENDING OF TRANSITION
TS - TANGENT TO SPIRAL
ST - SPIRAL TO TANGENT
PC - POINT OF CURVATURE
PI - POINT OF INTERSECTION

PT - POINT OF TANGENT
CS - CURVE TO SPIRAL
SC - SPIRAL TO CURVE
LN - TRAVEL LANE



- o = PIVOT
- ◆ = WHEN CURVE IS NOT SPIRALED.
- e = MAXIMUM RATE OF SUPERELEVATION IN FEET (PER FOOT OF WIDTH) FOR THE GIVEN RADIUS OF CURVE AND DESIGN SPEED.
- ✱ RUNOUT LENGTH SHOULD USUALLY BE $.02L/e$. WHEN CONDITIONS ARE SUCH THAT THIS LENGTH IS NOT SUITABLE, THE DESIGNER SHALL CHOOSE ANOTHER LENGTH TO SUIT CONDITIONS.

SUPERELEVATION DIAGRAMS FOR DIVIDED HIGHWAY CENTER PIVOT

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Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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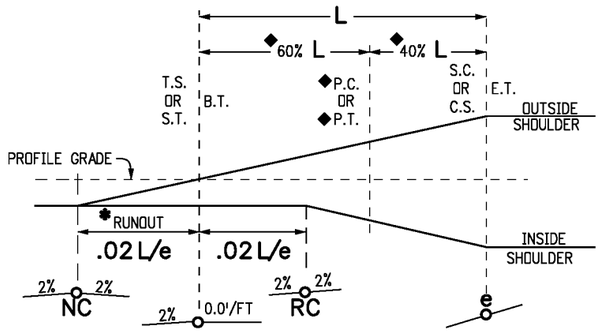
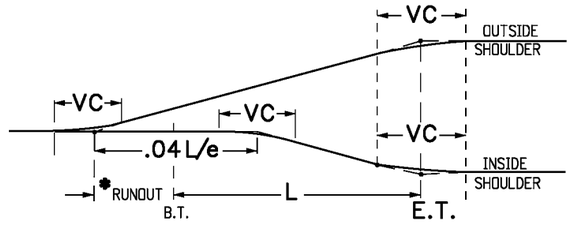
SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS

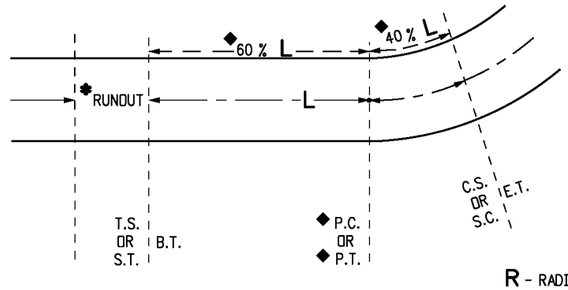
Issued By: Project Development Branch July 4, 2012

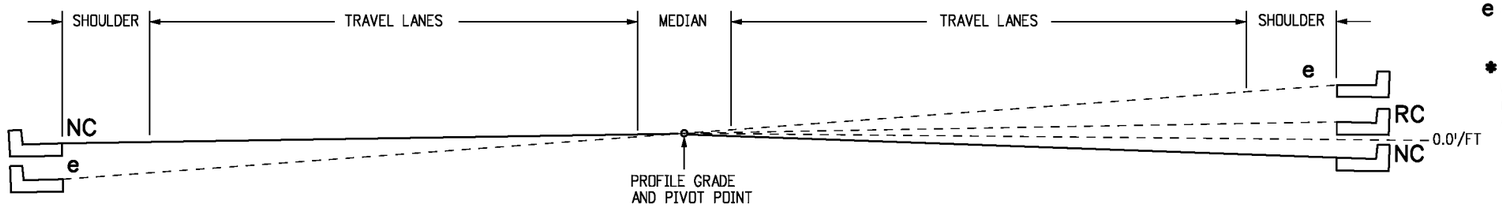
STANDARD PLAN NO.
M-203-11
Sheet No. 3 of 3





VC - TO OBTAIN SMOOTH PROFILES ON PAVEMENT EDGES, VERTICAL CURVES MAY BE INSERTED AT THE ANGULAR BREAK POINTS. UNLESS RESTRAINING CONDITIONS EXIST, THE LENGTH OF VERTICAL CURVE SELECTED, IN FEET, SHOULD BE AT LEAST NUMERICALLY EQUAL TO THE DESIGN SPEED, AND NO MORE THAN .04 L/e.





o = PIVOT

◆ = WHEN CURVE IS NOT SPIRALLED.

e = MAXIMUM RATE OF SUPERELEVATION IN FEET (PER FOOT OF WIDTH) FOR THE GIVEN RADIUS OF CURVE AND DESIGN SPEED.

✽ RUNOUT LENGTH SHOULD USUALLY BE .02 L/e WHEN CONDITIONS ARE SUCH THAT THIS LENGTH IS NOT SUITABLE, THE DESIGNER SHALL CHOOSE ANOTHER LENGTH TO SUIT CONDITIONS.

R - RADIUS OF CURVE
Vd - ASSUMED DESIGN SPEED
L - LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH
NC - NORMAL CROWN SECTION
RC - REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE
LN - TRAVEL LANE
VC - VERTICAL CURVE
BT - BEGINNING OF TRANSITION
ET - ENDING OF TRANSITION
TS - TANGENT TO SPIRAL
ST - SPIRAL TO TANGENT
PC - POINT OF CURVATURE
PI - POINT OF INTERSECTION
PT - POINT OF TANGENT
CS - CURVE TO SPIRAL
SC - SPIRAL TO CURVE

SUPERELEVATION DIAGRAMS

emax = 4%

IF THE CALCULATED RADIUS FALLS BETWEEN TWO RADII, GO TO THE NEXT LOWEST RADIUS VALUE.

	Vd =15 mph			Vd =20 mph			Vd =25 mph			Vd =30 mph			Vd =35 mph			Vd =40 mph			Vd =45 mph			Vd =50 mph			Vd =55 mph			Vd =60 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	506-<796	31	46	902-<1410	32	49	1340-<2050	34	51	1880-<2830	36	55	2490-<3730	39	58	3220-<4770	41	62	4040-<5930	44	67	4940-<7220	48	72	5950-<8650	51	77	7080-<10300	53	80	2.0
2.2	399-<506	34	51	723-<902	36	54	1110-<1340	38	57	1580-<1880	40	60	2120-<2490	43	64	2760-<3220	46	68	3480-<4040	49	73	4280-<4940	53	79	5180-<5950	56	84	6190-<7080	59	88	2.2
2.4	271-<399	37	55	513-<723	39	58	838-<1110	41	62	1270-<1580	44	65	1760-<2120	46	70	2340-<2760	50	74	2980-<3480	53	80	3690-<4280	58	86	4500-<5180	61	92	5410-<6190	64	96	2.4
2.6	201-<271	40	60	388-<513	42	63	650-<838	45	67	1000-<1270	47	71	1420-<1760	50	75	1930-<2340	54	81	2490-<2980	58	87	3130-<3690	62	94	3870-<4500	66	100	4700-<5410	69	104	2.6
2.8	157-<201	43	65	308-<388	45	68	524-<650	48	72	817-<1000	51	76	1170-<1420	54	81	1620-<1930	58	87	2100-<2490	62	93	2660-<3130	67	101	3310-<3870	71	107	4060-<4700	75	112	2.8
3.0	127-<157	46	69	251-<308	49	73	433-<524	51	77	681-<817	55	82	982-<1170	58	87	1370-<1620	62	93	1800-<2100	67	100	2290-<2660	72	108	2860-<3310	77	115	3530-<4060	80	120	3.0
3.2	105-<127	49	74	209-<251	52	78	363-<433	55	82	576-<681	58	87	835-<982	62	93	1180-<1370	66	99	1550-<1800	71	107	1980-<2290	77	115	2490-<2860	82	123	3090-<3530	85	128	3.2
3.4	88-<105	52	78	175-<209	55	83	307-<363	58	87	490-<576	62	93	714-<835	66	99	1010-<1180	70	106	1340-<1550	76	113	1720-<1980	82	122	2170-<2490	87	130	2700-<3090	91	136	3.4
3.6	73-<88	55	83	147-<175	58	88	259-<307	62	93	416-<490	65	98	610-<714	70	105	865-<1010	74	112	1150-<1340	80	120	1480-<1720	86	130	1880-<2170	92	138	2350-<2700	96	144	3.6
3.8	61-<73	58	88	122-<147	62	92	215-<259	65	98	348-<416	69	104	512-<610	74	110	730-<865	79	118	970-<1150	84	127	1260-<1480	91	137	1600-<1880	97	146	2010-<2350	101	152	3.8
4.0	42-<61	62	92	86-<122	65	97	154-<215	69	103	250-<348	73	109	371-<512	77	116	533-<730	83	124	711-<970	89	133	926-<1260	96	144	1190-<1600	102	153	1500-<2010	107	160	4.0

SUPERELEVATION NOTES

1. THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS RADIUS LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SUPERELEVATION RATE OF 4%. ALTERNATIVE MAXIMUM RATE OF SUPERELEVATION SHALL BE USED FOR STREETS WHEN SPECIFIED ON THE PLANS.
2. USE OF e_{max} = 4% SHOULD BE LIMITED TO URBAN CONDITIONS.
3. VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR TWO LANE AND FOUR LANE STREETS.
4. WHERE SIDE STREETS OR ROADS INTERSECT, THE RATE OF SUPERELEVATION MAY BE REDUCED TO FACILITATE A SMOOTH INTERSECTION OF THE PROFILE GRADES.
5. NUMBER OF LANES ROTATED:
   A. ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.
   B. TWO LANES ROTATED ARE TYPICAL FOR A FOUR-LANE HIGHWAY.
6. SPIRALS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPIRALS ARE PERMISSIBLE BUT NOT RECOMMENDED ABOVE THE HEAVY LINES. SPIRAL LENGTHS MAY BE ROUNDED TO MULTIPLES OF 50 FEET FOR CALCULATION CONVENIENCE.

Computer File Information		Sheet Revisions	
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Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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SUPERELEVATION STREETS

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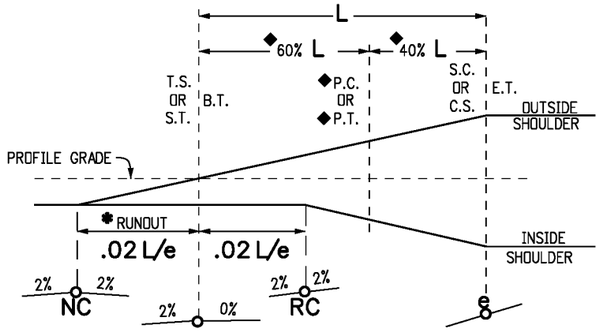
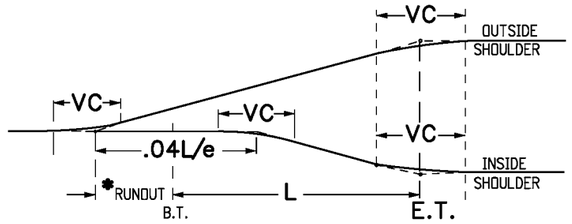
STANDARD PLAN NO.
M-203-12
Sheet No. 1 of 2





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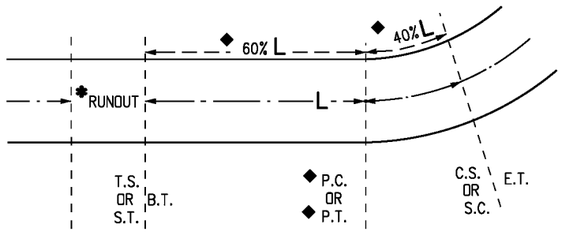

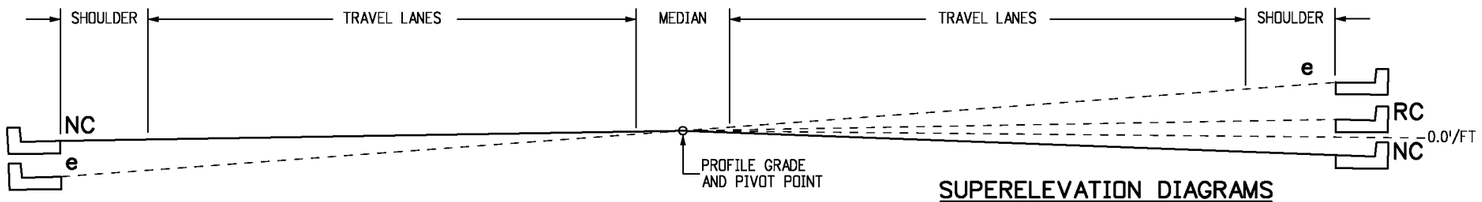

SUPERELEVATION DIAGRAMS

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emax = 6%

	Vd =15 mph			Vd =20 mph			Vd =25 mph			Vd =30 mph			Vd =35 mph			Vd =40 mph			Vd =45 mph			Vd =50 mph			Vd =55 mph			Vd =60 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)		
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	614-<868	31	46	1120-<1580	32	49	1630-<2290	34	51	2240-<3130	36	55	2950-<4100	39	58	3770-<5230	41	62	4680-<6480	44	67	5700-<7870	48	72	6820-<9410	51	77	8060-<11100	53	80	2.0
2.2	543-<614	34	51	991-<1120	36	54	1450-<1630	38	57	2000-<2240	40	60	2630-<2950	43	64	3370-<3770	46	68	4190-<4680	49	73	5100-<5700	53	79	6110-<6820	56	84	7230-<8060	59	88	2.2
2.4	482-<543	37	55	884-<991	39	58	1300-<1450	41	62	1790-<2000	44	65	2360-<2630	46	70	3030-<3370	50	74	3770-<4190	53	80	4600-<5100	58	86	5520-<6110	61	92	6540-<7230	64	96	2.4
2.6	430-<482	40	60	791-<884	42	63	1170-<1300	45	67	1610-<1790	47	71	2130-<2360	50	75	2740-<3030	54	81	3420-<3770	58	87	4170-<4600	62	94	5020-<5520	66	100	5950-<6540	69	104	2.6
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3.2	300-<341	49	74	566-<635	52	78	850-<944	55	82	1200-<1320	58	87	1600-<1760	62	93	2080-<2270	66	99	2600-<2840	71	107	3200-<3480	77	115	3860-<4200	82	123	4600-<4990	85	128	3.2
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3.6	209-<256	55	83	422-<498	58	88	673-<761	62	93	972-<1080	65	98	1320-<1460	70	105	1740-<1900	74	112	2190-<2390	80	120	2710-<2940	86	130	3290-<3560	92	138	3940-<4250	96	144	3.6
3.8	176-<209	58	88	358-<422	62	92	583-<673	65	98	864-<972	69	104	1190-<1320	74	110	1590-<1740	79	118	2010-<2190	84	127	2490-<2710	91	137	3040-<3290	97	146	3650-<3940	101	152	3.8
4.0	151-<176	62	92	309-<358	65	97	511-<583	69	103	766-<864	73	109	1070-<1190	77	116	1440-<1590	83	124	1840-<2010	89	133	2300-<2490	96	144	2810-<3040	102	153	3390-<3650	107	160	4.0
4.2	131-<151	65	97	270-<309	68	102	452-<511	72	108	684-<766	76	115	960-<1070	81	122	1310-<1440	87	130	1680-<1840	93	140	2110-<2300	101	151	2590-<2810	107	161	3140-<3390	112	168	4.2
4.4	116-<131	68	102	238-<270	71	107	402-<452	75	113	615-<684	80	120	868-<960	85	128	1190-<1310	91	137	1540-<1680	98	147	1940-<2110	106	158	2400-<2590	112	169	2920-<3140	117	176	4.4
4.6	102-<116	71	106	212-<238	75	112	360-<402	79	118	555-<615	84	125	788-<868	89	134	1090-<1190	95	143	1410-<1540	102	153	1780-<1940	110	166	2210-<2400	117	176	2710-<2920	123	184	4.6
4.8	91-<102	74	111	189-<212	78	117	324-<360	82	123	502-<555	87	131	718-<788	93	139	995-<1090	99	149	1300-<1410	107	160	1640-<1780	115	173	2050-<2210	123	184	2510-<2710	128	192	4.8
5.0	82-<91	77	115	169-<189	81	122	292-<324	86	129	456-<502	91	136	654-<718	97	145	911-<995	103	155	1190-<1300	111	167	1510-<1640	120	180	1890-<2050	128	191	2330-<2510	133	200	5.0
5.2	73-<82	80	120	152-<169	84	126	264-<292	89	134	413-<456	95	142	595-<654	101	151	833-<911	108	161	1090-<1190	116	173	1390-<1510	125	187	1750-<1890	133	199	2160-<2330	139	208	5.2
5.4	65-<73	83	125	136-<152	88	131	237-<264	93	139	373-<413	98	147	540-<595	105	157	759-<833	112	168	995-<1090	120	180	1280-<1390	130	194	1610-<1750	138	207	1990-<2160	144	216	5.4
5.6	58-<65	86	129	121-<136	91	136	212-<237	96	144	335-<373	102	153	487-<540	108	163	687-<759	116	174	903-<995	124	187	1160-<1280	134	202	1470-<1610	143	214	1830-<1990	149	224	5.6
5.8	51-<58	89	134	106-<121	94	141	186-<212	99	149	296-<335	105	158	431-<487	112	168	611-<687	120	180	806-<903	129	193	1040-<1160	139	209	1320-<1470	148	222	1650-<1830	155	232	5.8
6.0	39-<51	92	138	81-<106	97	146	144-<186	103	154	231-<296	109	164	340-<431	116	174	485-<611	124	186	643-<806	133	200	833-<1040	144	216	1060-<1320	153	230	1330-<1650	160	240	6.0

SUPERELEVATION NOTES

1. THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS RADIUS LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SUPERELEVATION RATE OF 6%. MAXIMUM RATE OF SUPERELEVATION SHALL BE USED FOR STREETS WHEN SPECIFIED ON THE PLANS.
2. VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR TWO LANE AND FOUR LANE STREETS.
3. WHERE SIDE STREETS OR ROADS INTERSECT, THE RATE OF SUPERELEVATION MAY BE REDUCED TO FACILITATE A SMOOTH INTERSECTION OF THE PROFILE GRADES.
4. NUMBER OF LANES ROTATED:
   A. ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.
   B. TWO LANES ROTATED ARE TYPICAL FOR A FOUR-LANE HIGHWAY.
5. SPIRALS ARE RECOMMENDED BELOW THE HEAVY LINE IN THE TABLES. SPIRALS ARE PERMISSIBLE BUT NOT RECOMMENDED ABOVE THE HEAVY LINES. SPIRAL LENGTHS MAY BE ROUNDED TO MULTIPLES OF 50 FEET FOR CALCULATION CONVENIENCE.

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	Date:	Comments
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(R-X)		

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SUPERELEVATION STREETS

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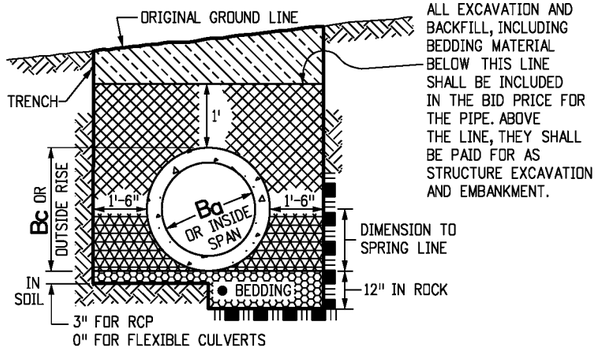
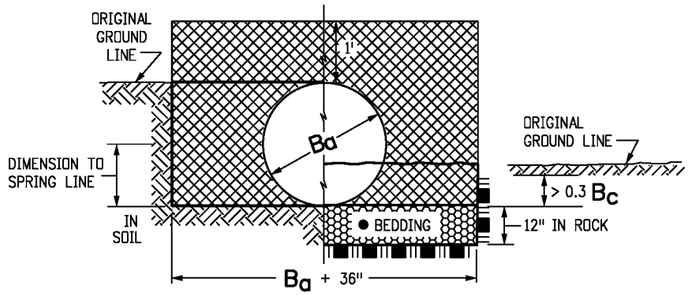
STANDARD PLAN NO.

M-203-12

Sheet No. 2 of 2



PIPE IN TRENCH

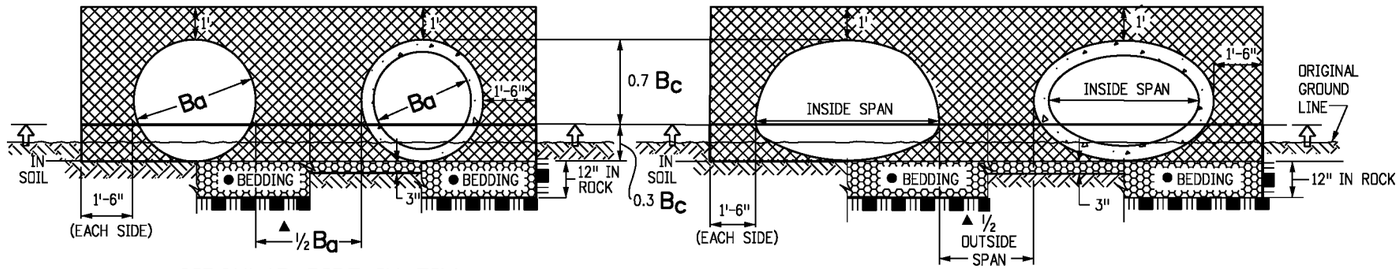


CIRCULAR PIPE

(WHERE ORIGINAL GROUND LINE IS BETWEEN 0.3 B_C AND B_C + 1 FT. ABOVE FLOWLINE)

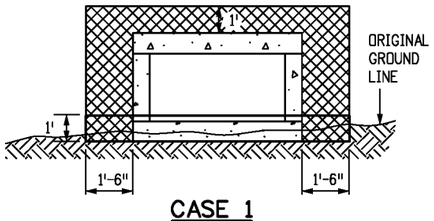
● THE BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OF LOOSE STRUCTURE BACKFILL, CLASS 1.

▲ WHEN TWO OR MORE CONDUITS ARE LAID SIDE-BY-SIDE, THEY SHALL BE PLACED SO THAT THEY ARE ½ OUTSIDE DIAMETER, OR ½ OUTSIDE SPAN, OR 3 FT. APART, WHICHEVER IS LESS. HOWEVER, IF END SECTIONS ARE USED, THE MINIMUM SPACING SHALL BE 1 FT. BETWEEN END SECTIONS.



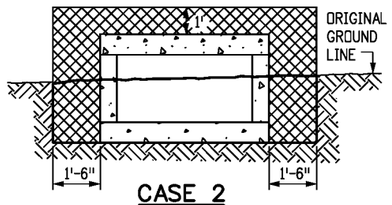
CIRCULAR PIPE IN FILL

ARCH OR ELLIPTICAL PIPE IN FILL



CASE 1

APPLIES WHEN THE ORIGINAL GROUND LINE IS LESS THEN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT. THE EMBANKMENT SHALL BE BUILT UP TO 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT AND THEN EXCAVATED TO THE BOTTOM OF THE BOX CULVERT. THIS EMBANKMENT AND EXCAVATION WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.

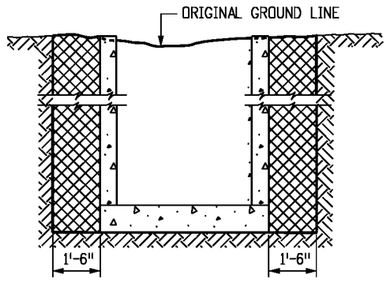


CASE 2

APPLIES WHEN THE ORIGINAL GROUND LINE IS MORE THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT.

CONCRETE BOX CULVERT

IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.



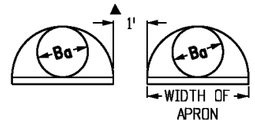
DROP INLETS AND DIVISION BOXES

GENERAL NOTES

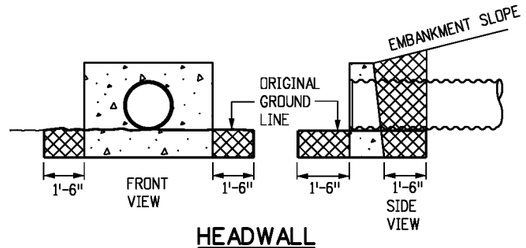
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THESE SHEETS WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. EXCAVATION FOR CHANNEL CHANGE OR CHANNEL IMPROVEMENT WILL BE EITHER UNCLASSIFIED EXCAVATION OR MUCK EXCAVATION AND WILL BE NOTED ON THE PLANS. EXCAVATION FROM THE CHANNEL FLOWLINE TO THE DEPTH REQUIRED FOR THE NEW STRUCTURE AND INCIDENTAL CHANNEL EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.
3. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09(b).
4. STRUCTURAL PLATE CULVERTS SHALL BE CONSTRUCTED AS SHOWN ON THE PLANS.
5. B_a EQUALS THE INSIDE DIAMETER OF A PIPE AND B_c EQUALS THE OUTSIDE DIAMETER OF A PIPE. FOR THIN WALLED PIPES, IT IS ASSUMED THAT $B_a = B_c$.
6. APPROXIMATE STRUCTURE EXCAVATION AND BACKFILL QUANTITIES, UP TO 1 FT. OVER THE PIPE WILL BE SHOWN ON THE PLANS, FOR INFORMATION ONLY.

LEGEND

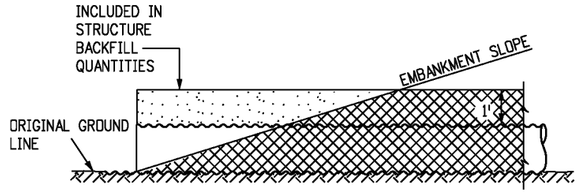
- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- STRUCTURE BACKFILL, CLASS 1
- EMBANKMENT MATERIAL
- EARTH
- ROCK
- BEDDING
- CONCRETE
- = WHEN FLOW LINE OF CULVERT IS LESS THAN 0.3 B_c BELOW THE ORIGINAL GROUND LINE, EMBANKMENT SHALL BE BUILT UP TO 0.3 B_c ABOVE THE FLOW LINE AND TRENCH EXCAVATED TO THE BOTTOM OF PIPE OR AS SHOWN.



CONDUIT WITH END SECTIONS



HEADWALL



END OF PIPE

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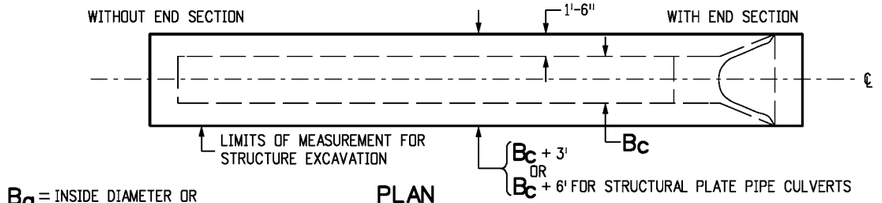
EXCAVATION AND BACKFILL FOR STRUCTURES

Issued By: Project Development Branch July 4, 2012

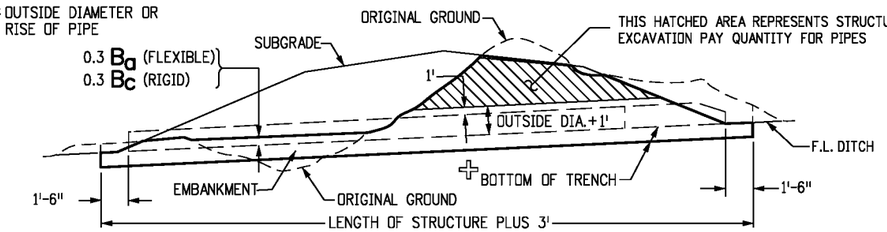
STANDARD PLAN NO.
M-206-1
Sheet No. 1 of 2



PLAN

B_a = INSIDE DIAMETER OR INSIDE SPAN OF PIPE

B_c = OUTSIDE DIAMETER OR RISE OF PIPE

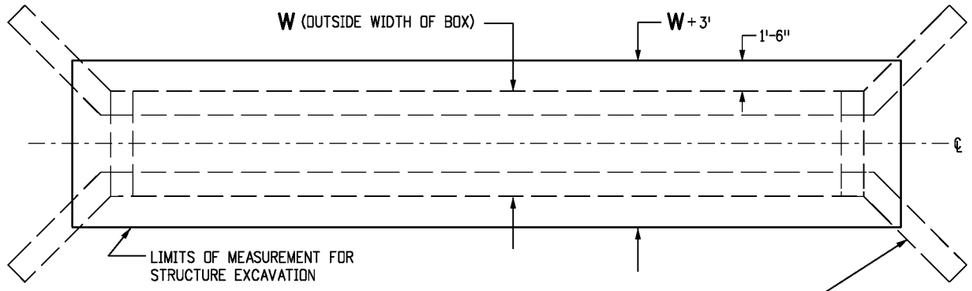


PROFILE

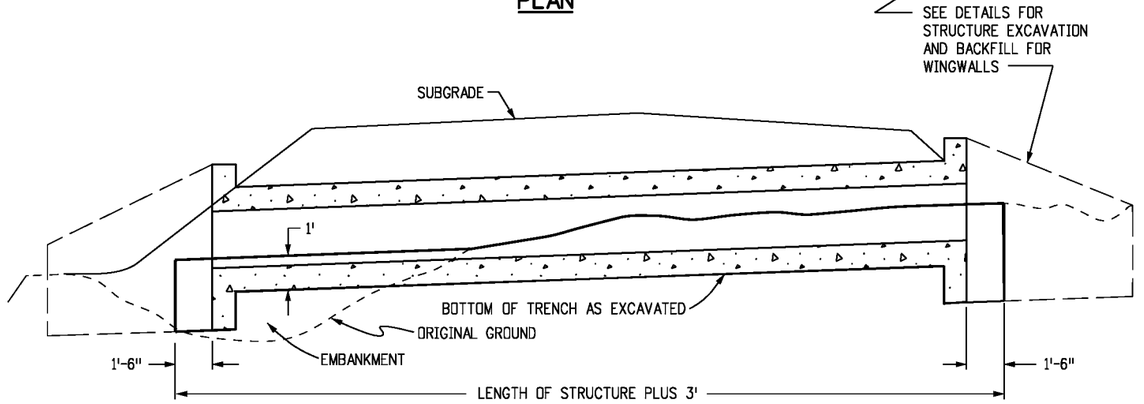
✙ FOR APPLICABLE LIMITS OF STRUCTURE EXCAVATION, SEE BEDDING DETAILS ON SHEET 1 OF THESE DETAILS.

STRUCTURE EXCAVATION UP TO 1 FT. ABOVE THE TOP OF THE PIPE SHALL BE INCLUDED IN THE BID PRICE OF THE PIPE.

STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS

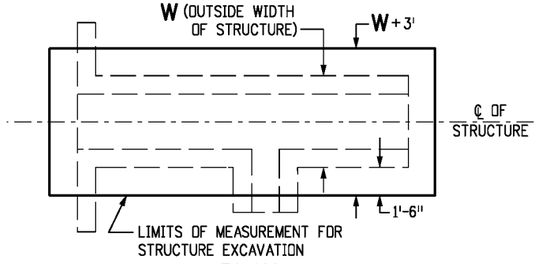


PLAN

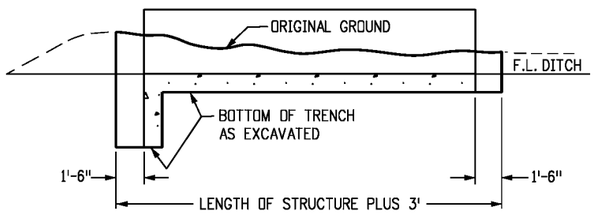


PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS

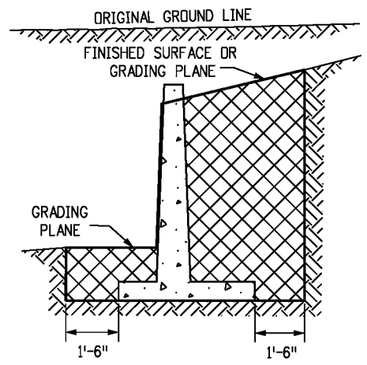


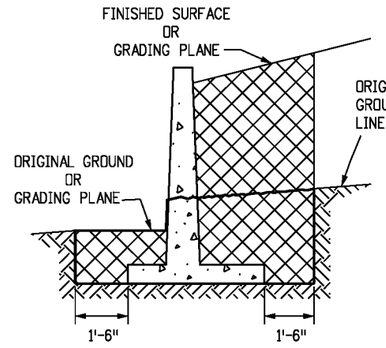
PLAN

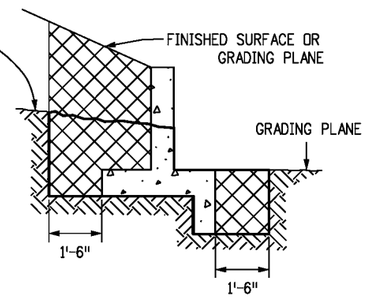


PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR DIVISION BOXES







WINGWALL

RETAINING WALL IN CUT & IN PARTIAL CUT

ANY ADDITIONAL EXCAVATION BEHIND THE LIMITS SHOWN SHALL BE FILLED WITH CLASS I BACKFILL MATERIAL. THE ADDITIONAL EXCAVATION AND BACKFILL WILL NOT BE MEASURED AND PAID FOR.

LEGEND

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- CONCRETE

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EXCAVATION AND BACKFILL FOR STRUCTURES

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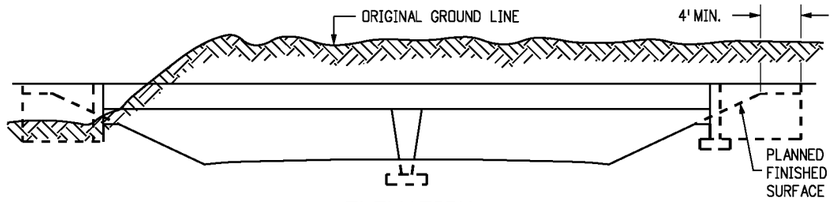
STANDARD PLAN NO.

M-206-1



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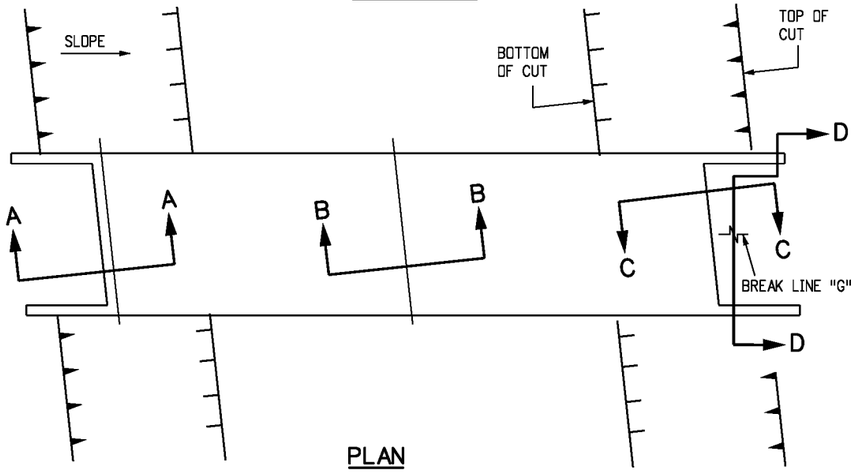
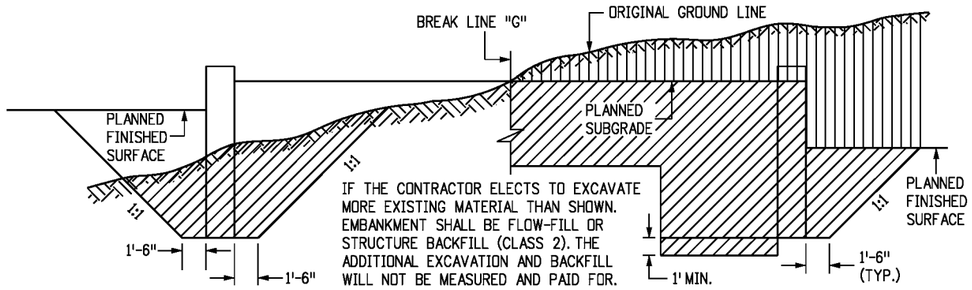


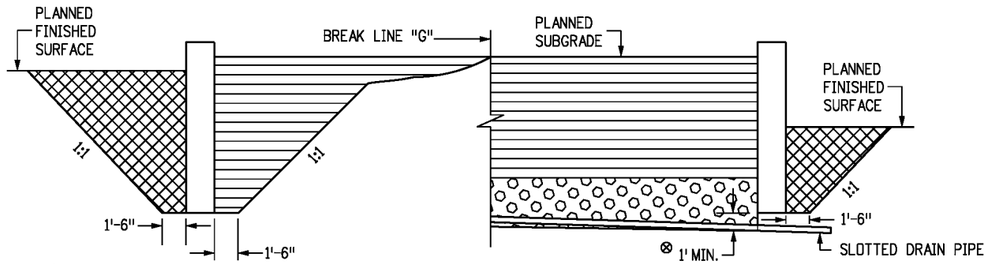
PLAN



▲ NEAR END OF WINGWALL

NEAR BACKFILL OF ABUTMENT

SECTION D-D (EXCAVATION)



▲ NEAR END OF WINGWALL

NEAR BACKFILL OF ABUTMENT

SECTION D-D (BACKFILL)

GENERAL NOTES

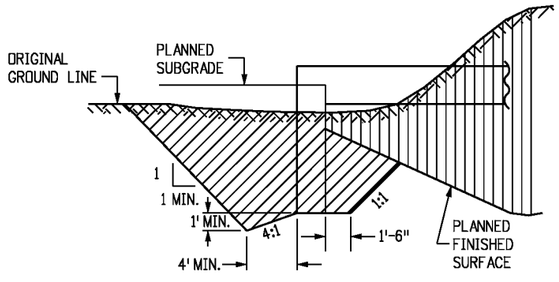
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THIS SHEET WILL BE SHOWN ON THE PLANS.
2. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING, IN CONFORMANCE WITH SUBSECTION 601.09(b).
3. STRUCTURE EXCAVATION FOR SLOPE PAVING NOT SHOWN.

LEGEND

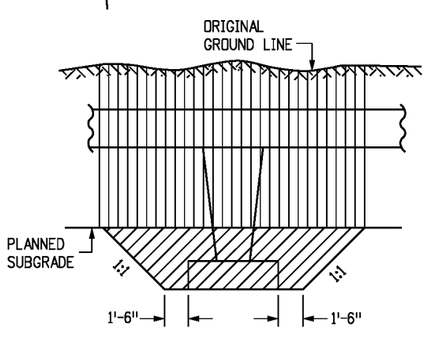
- UNCLASSIFIED EXCAVATION
- STRUCTURE EXCAVATION
- STRUCTURE BACKFILL (FLOW-FILL), OR STRUCTURE BACKFILL (CLASS 1) WITH MECHANICAL REINFORCEMENT AS SHOWN ON THE PLANS
- STRUCTURE BACKFILL CLASS 1
- FILTER MATERIAL

▲ FOR PURPOSES OF QUANTITY CALCULATIONS THIS TEMPLATE APPLIES TO END OF WINGWALL.

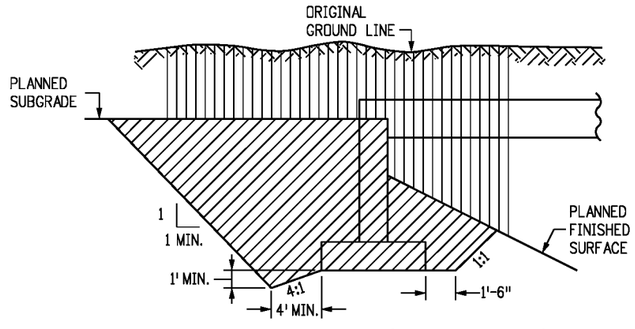
⊗ SLOPE TO DRAIN.



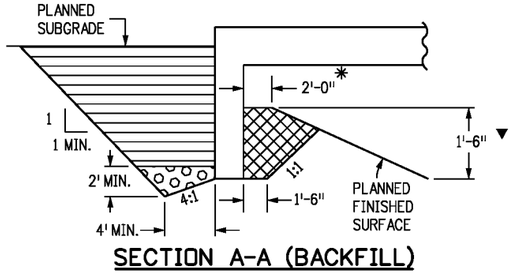
SECTION A-A (EXCAVATION)



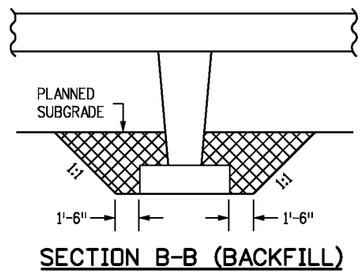
SECTION B-B (EXCAVATION)



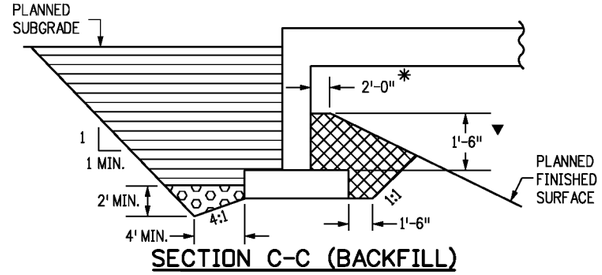
SECTION C-C (EXCAVATION)



SECTION A-A (BACKFILL)



SECTION B-B (BACKFILL)



SECTION C-C (BACKFILL)

* MINIMUM BERM DIMENSION

▼ MINIMUM EMBEDMENT OF ABUTMENT, IN STRUCTURE BACKFILL

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EXCAVATION AND BACKFILL FOR BRIDGES

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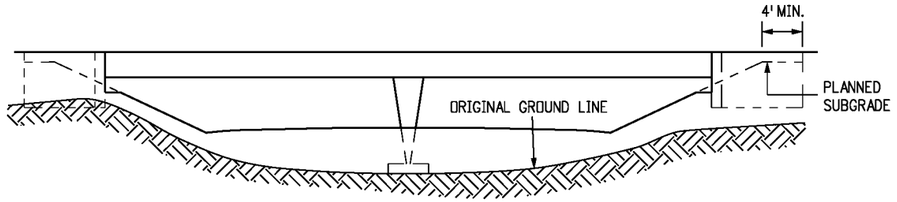
Sheet No. 1 of 2



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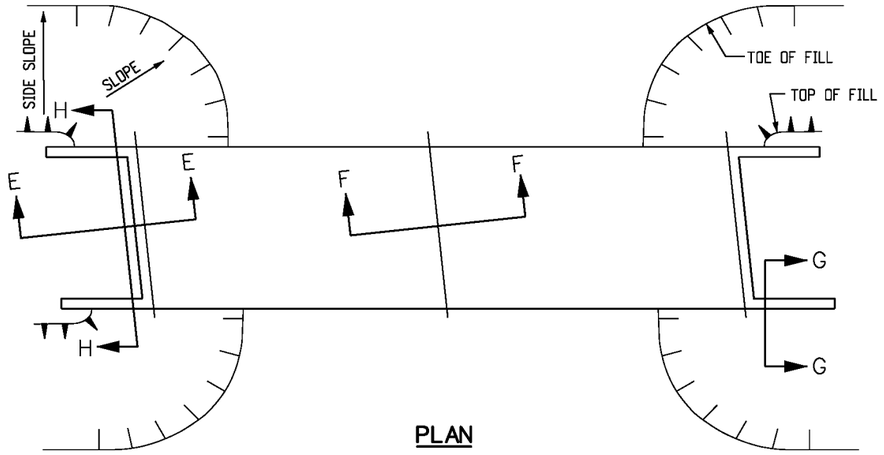
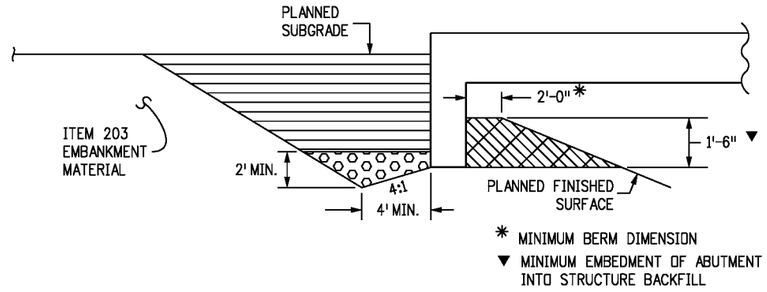
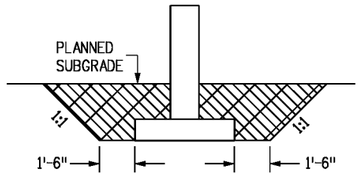


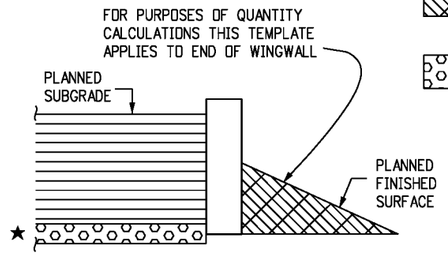
PLAN



SECTION E-E (BACKFILL)



SECTION F-F (BACKFILL)



SECTION G-G (BACKFILL)

★ FILTER MATERIAL IS ONLY USED IN AREA NEAR THE ABUTMENT AND NOT AT THE END OF THE WINGWALL

GENERAL NOTES

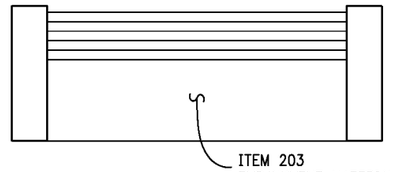
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THIS SHEET WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09.
3. STRUCTURE EXCAVATION FOR SLOPE PAVING NOT SHOWN.

LEGEND

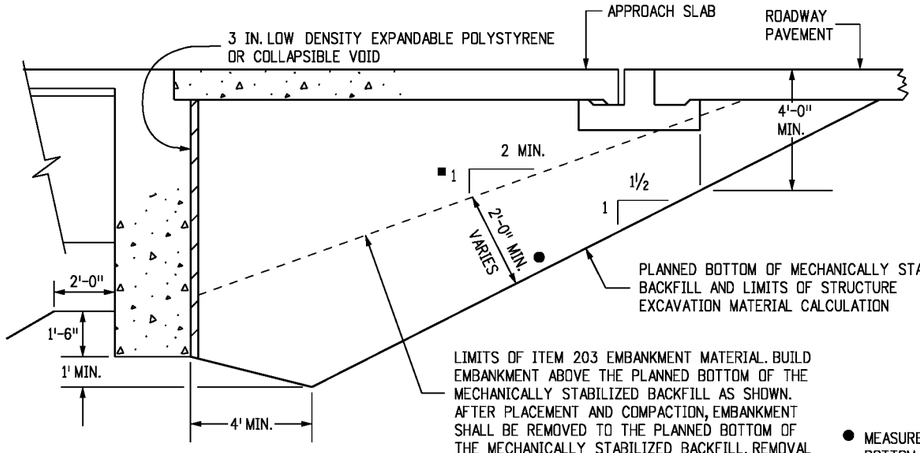
STRUCTURE BACKFILL (FLOW-FILL), OR STRUCTURE BACKFILL (CLASS 1) WITH MECHANICAL REINFORCEMENT AS SHOWN ON THE PLANS

STRUCTURE BACKFILL CLASS 2 (ON-SITE CLASS 2 MATERIALS MUST MEET CLASS 1 REQUIREMENTS)

FILTER MATERIAL



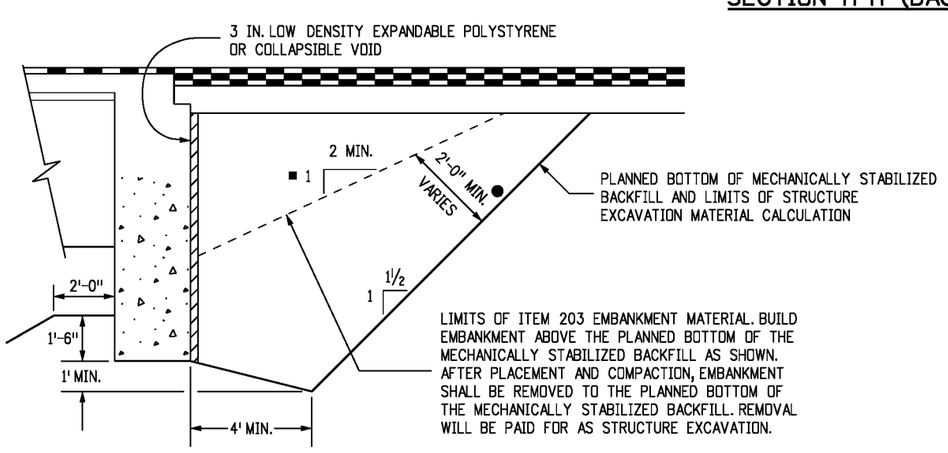
SECTION H-H (BACKFILL)



DETAIL 1
(WITH APPROACH SLAB)

● MEASURED PERPENDICULAR TO PLANNED BOTTOM OF MECHANICALLY STABILIZED BACKFILL.

■ PAYMENT BASED ON 2:1 SLOPE. ADDITIONAL QUANTITIES SHALL BE INCLUDED IN THE WORK.



DETAIL 2
(WITHOUT APPROACH SLAB)

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EXCAVATION AND BACKFILL FOR BRIDGES

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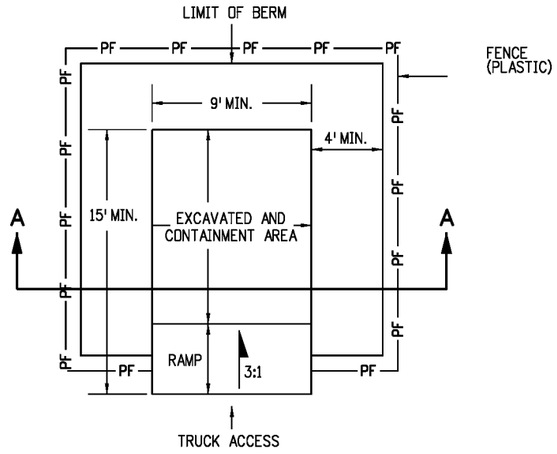
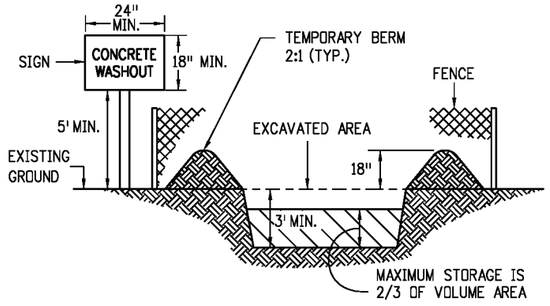
Sheet No. 2 of 2



PLAN VIEW

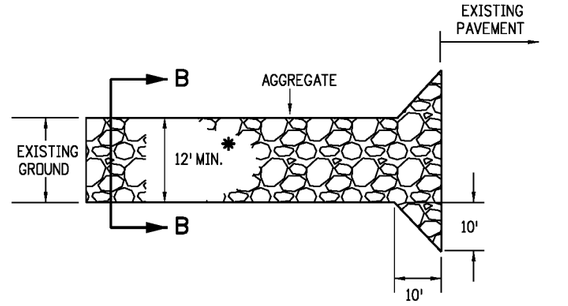


SECTION A-A

NOTES:

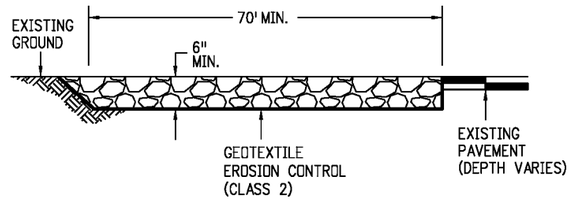
1. EROSION BALES MAY BE USED AS AN ALTERNATIVE FOR THE BERM.
2. A FENCE (PLASTIC) CONFORMING TO SUBSECTION 607.02 SHALL BE INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT AT THE OPENING.
3. THE CONCRETE WASHOUT SIGN SHALL HAVE LETTERS AT LEAST 3 INCHES HIGH AND CONFORM TO SUBSECTION 630.02.

CONCRETE WASHOUT STRUCTURE

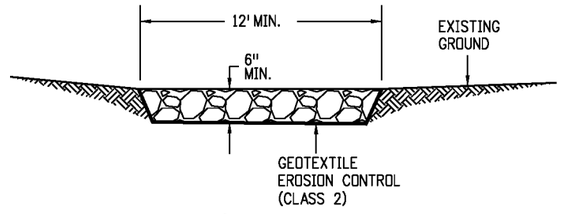


PLAN VIEW

* SHALL EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION.



ELEVATION SECTION



SECTION B-B

NOTES:

1. AGGREGATE FOR THE CONSTRUCTION ENTRANCE SHALL CONFORM TO SUBSECTION 208.02 (K).
2. THE CONTRACTOR SHALL PROTECT CURB AND GUTTER THAT CROSSES THE ENTRANCE FROM DAMAGE. PROTECTION OF THE CURB AND GUTTER WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

VEHICLE TRACKING PAD

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TEMPORARY EROSION CONTROL

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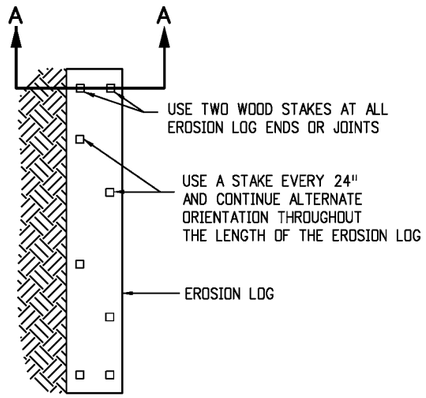
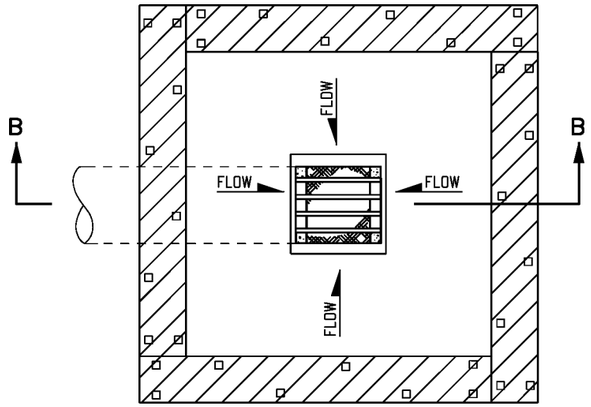
STANDARD PLAN NO.
M-208-1
Sheet No. 1 of 12



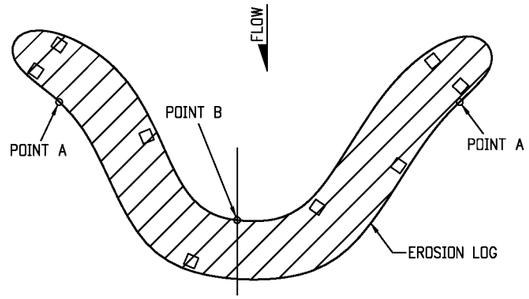
PLAN VIEW



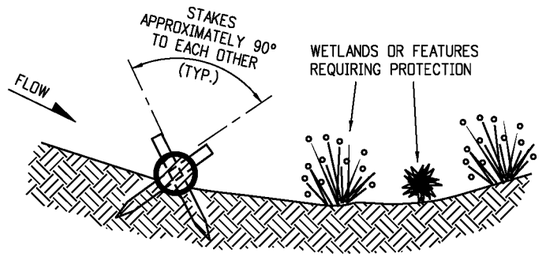
PLAN VIEW

NOTES

1. EROSION LOGS SHALL BE EMBEDDED 2 INCHES INTO THE SOIL.
2. STAKES SHALL BE EMBEDDED TO A MINIMUM DEPTH OF 12 INCHES.
3. EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.

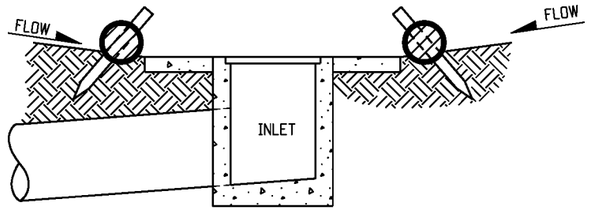


PLAN VIEW



SECTION A-A

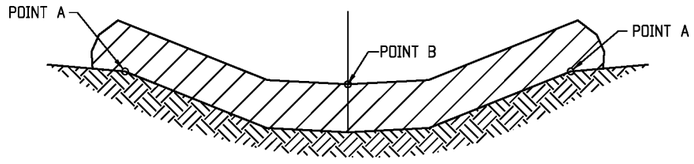
TYPICAL STAKE INSTALLATION



SECTION B-B

NOTE: LOCATE EROSION LOGS AT THE OUTSIDE EDGE OF THE CONCRETE APRON.

EROSION LOG FILTER AT DROP INLET



POINTS A SHALL BE HIGHER THAN POINT B.

ELEVATION

EROSION LOG DITCH INSTALLATION

EROSION LOG APPLICATIONS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
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Drawing File Name: 2080102012.dgn	(R-X)		
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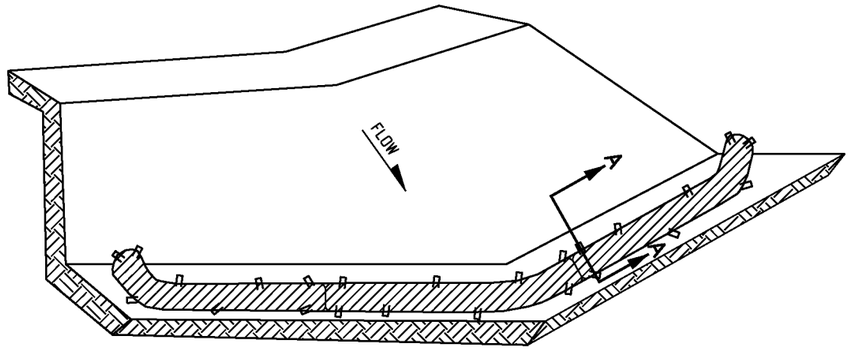
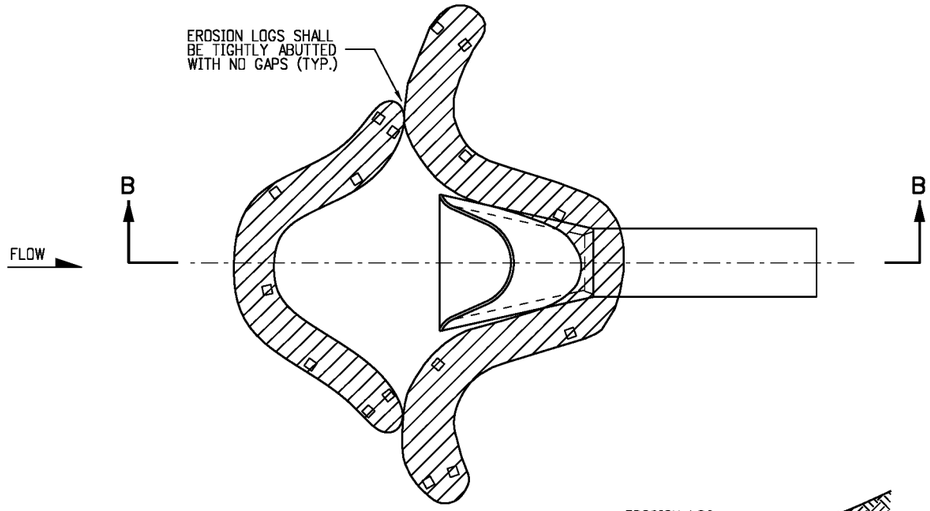
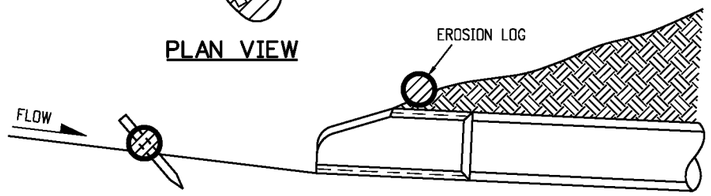


ISOMETRIC VIEW

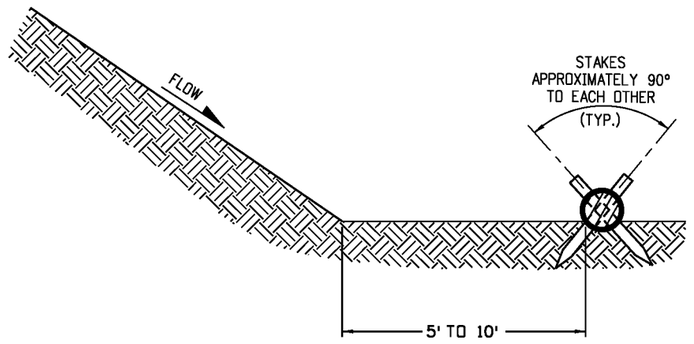


PLAN VIEW



SECTION B-B

EROSION LOG CULVERT INLET PROTECTION

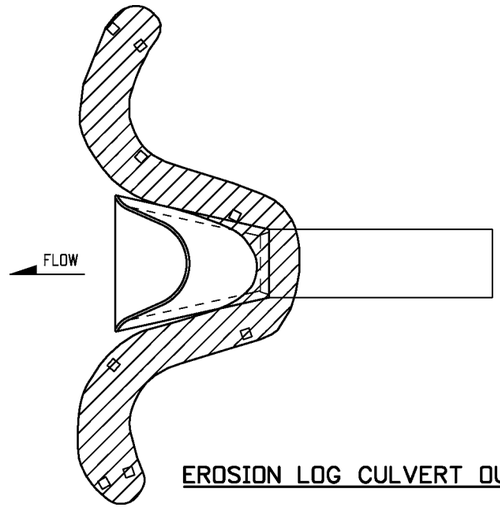


SECTION A-A

NOTES:

1. EROSION LOGS USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
2. EROSION LOGS SHALL BE PLACED ON THE CONTOUR, WITH ENDS FLARED UP SLOPE.

EROSION LOG TOE OF SLOPE PROTECTION



EROSION LOG CULVERT OUTLET PROTECTION

EROSION LOG APPLICATIONS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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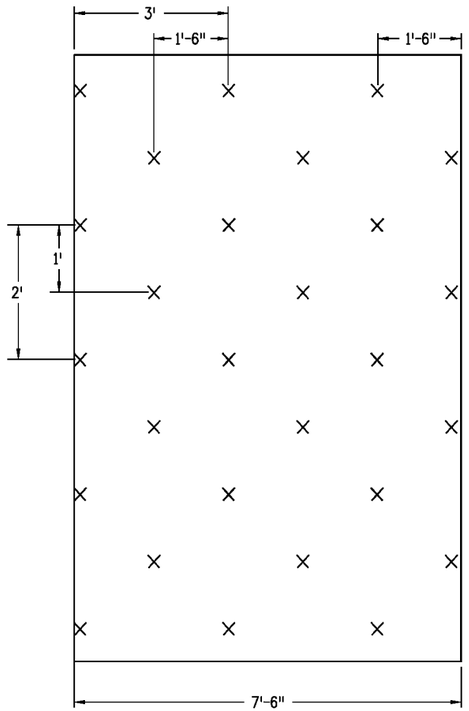
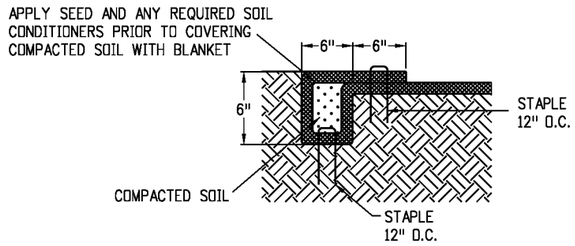


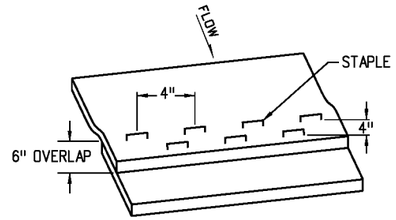
TYPICAL STAPLE PATTERN FOR CHANNEL APPLICATION

SEE SUBSECTION 216.05.



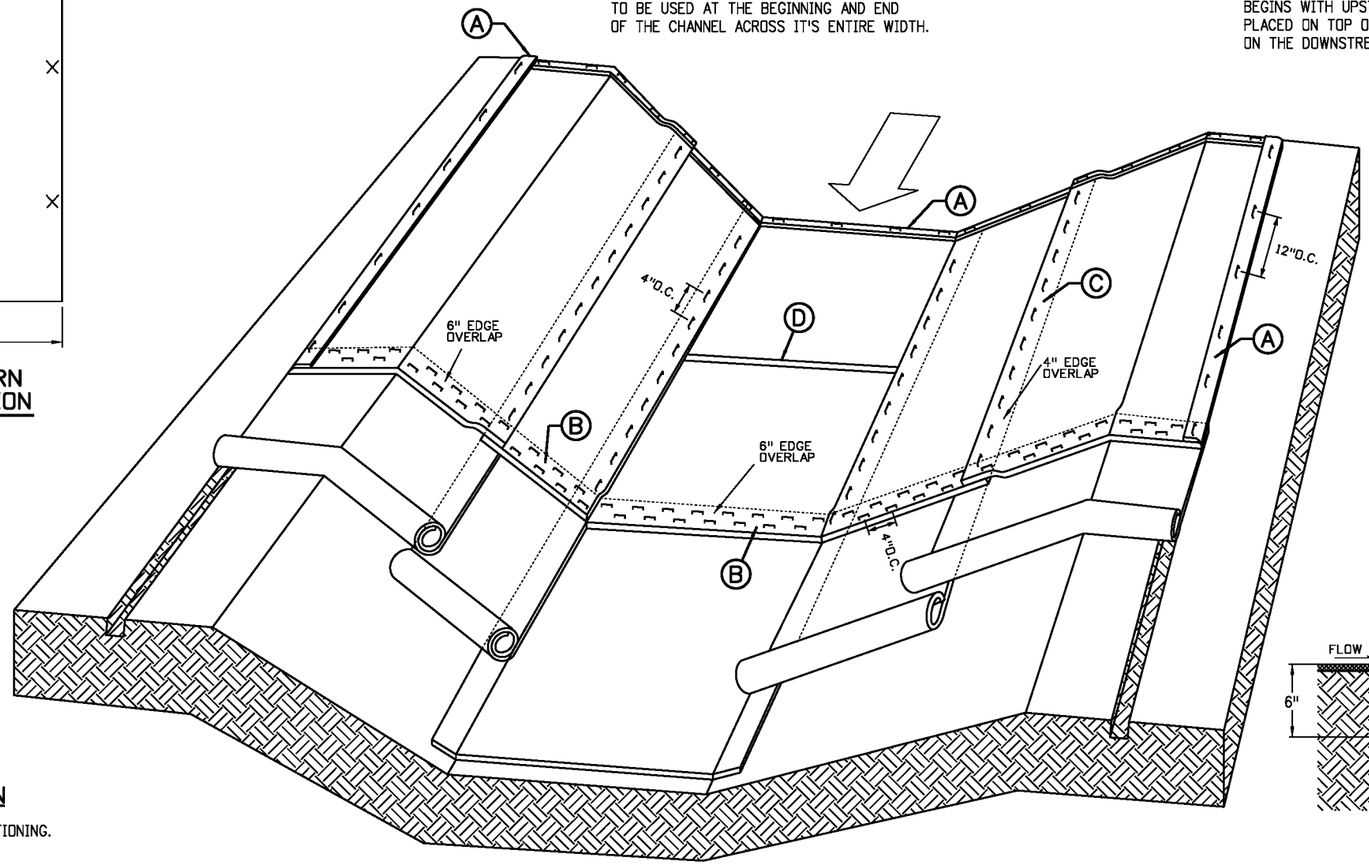
ANCHOR TRENCH SECTION (A)

TO BE USED AT THE BEGINNING AND END OF THE CHANNEL ACROSS IT'S ENTIRE WIDTH.



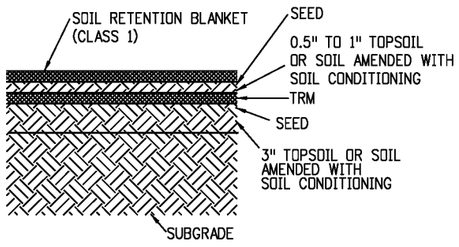
CONSECUTIVE ROLL OVERLAP SECTION (B)

TO BE USED WHEREVER ONE ROLL OF BLANKET ENDS AND ANOTHER BEGINS WITH UPSTREAM BLANKET PLACED ON TOP OF THE BLANKET ON THE DOWNSTREAM SIDE.



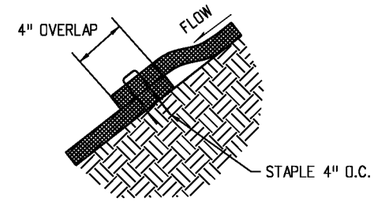
SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) CHANNEL APPLICATION

IN ACCORDANCE WITH SECTION 216.



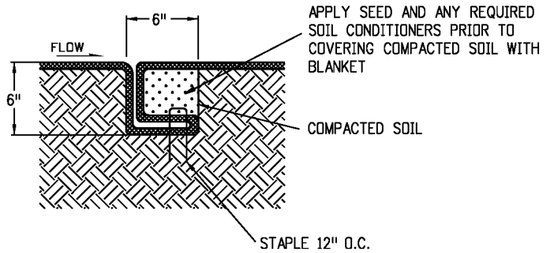
SOIL FILLED TRM APPLICATION

1. PLACE 3" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING.
2. APPLY SEED AND RAKE INTO SOIL.
3. INSTALL TRM.
4. PLACE 0.5" TO 1" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING.
5. APPLY SEED AND RAKE INTO SOIL.
6. INSTALL SOIL RETENTION BLANKET (CLASS 1).



SIDE SEAM OVERLAP SECTION (C)

TO BE USED FOR OVERLAP WHEN 2 WIDTHS OF BLANKET ARE APPLIED SIDE BY SIDE WITH THE UPHILL BLANKET PLACED ON TOP OF THE BLANKET ON THE DOWNHILL SIDE.



CHANNEL CHECK SLOT SECTION (D)

TO BE USED AT 30' INTERVALS IN CHANNEL FLOWLINE.

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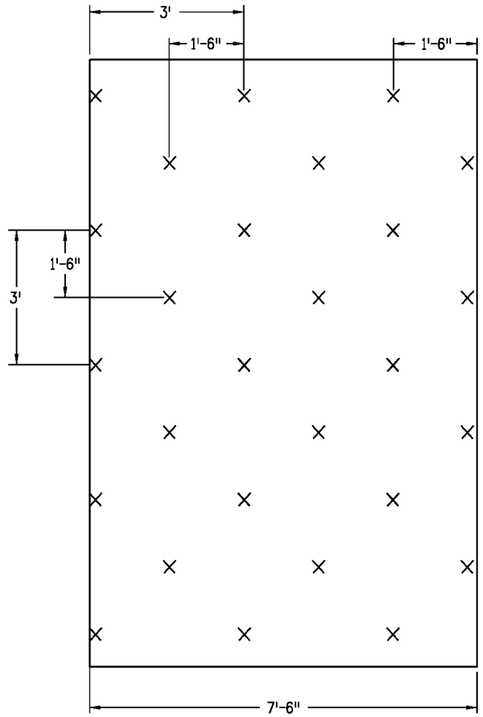
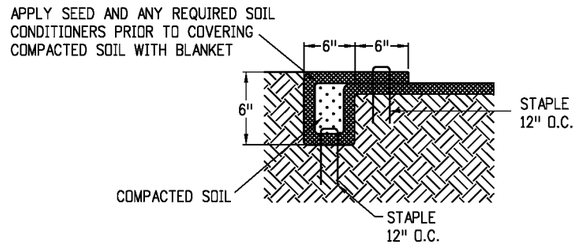


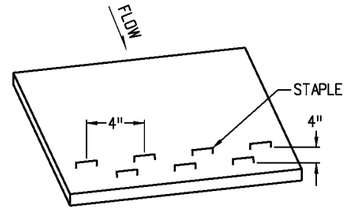
TYPICAL STAPLE PATTERN FOR SLOPE APPLICATION

SEE SUBSECTION 216.04.



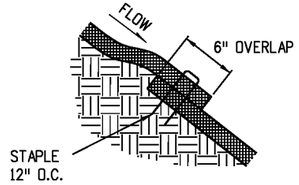
ANCHOR TRENCH SECTION (A)

TO BE USED AT THE UPSLOPE AND DOWNSLOPE ENDS OF BLANKET ACROSS THE ENTIRE WIDTH OF SLOPE UNLESS SLOPE RUNS INTO RECEIVING WATER. (SEE DOWNSLOPE END STAPLE CHECK).



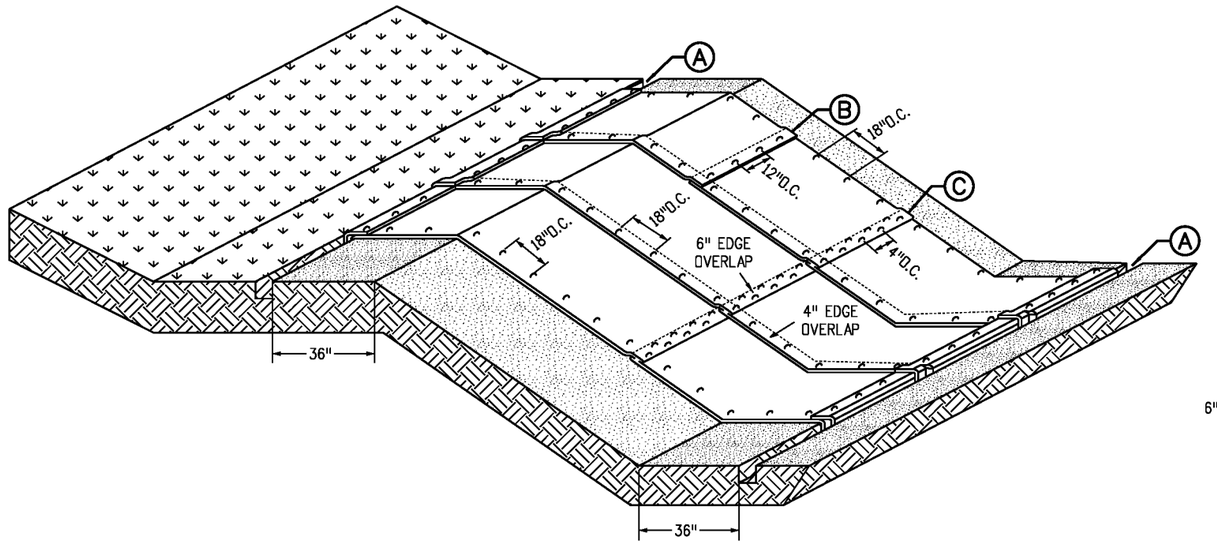
DOWNSLOPE END STAPLE CHECK

TO BE USED WHEN SLOPE RUNS INTO A RECEIVING WATER AND CANNOT BE EXTENDED 3 FEET BEYOND SLOPE.



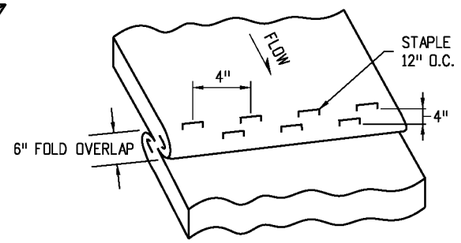
CONSECUTIVE ROLL OVERLAP SECTION (B)

TO BE USED WHEREVER ONE ROLL OF BLANKET ENDS AND ANOTHER BEGINS WITH THE UPHILL BLANKET PLACED ON TOP OF THE BLANKET ON THE DOWNHILL SIDE.



SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) SLOPE APPLICATION

IN ACCORDANCE WITH SECTION 216.



STAPLE CHECK SECTION (C)

NOTES:

1. Z SHAPED FOLD TO BE USED ON SLOPE EVERY 35 FEET MAXIMUM.
2. STAPLE CHECK LOCATIONS SHOULD BE AT LEAST 15 FEET FROM THE BOTTOM OF SLOPE.

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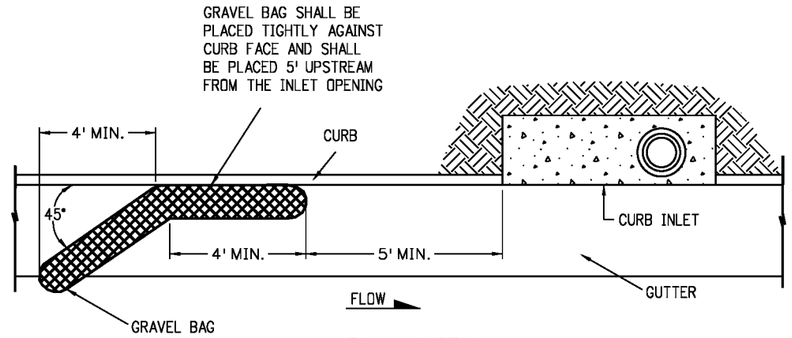
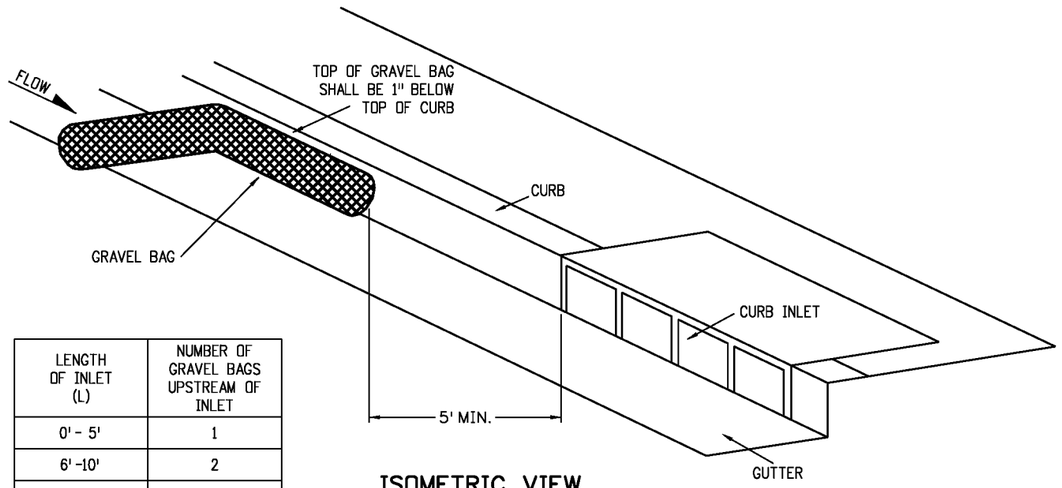
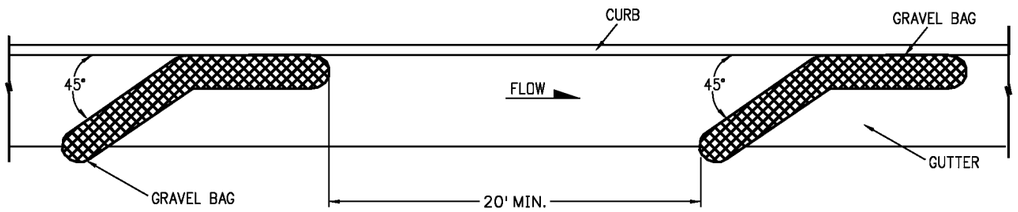


PLAN VIEW



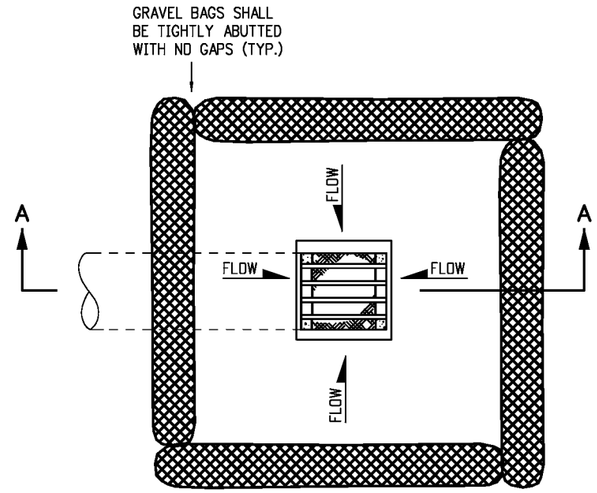
LENGTH OF INLET (L)	NUMBER OF GRAVEL BAGS UPSTREAM OF INLET
0' - 5'	1
6' -10'	2
L > 10'	3

ISOMETRIC VIEW

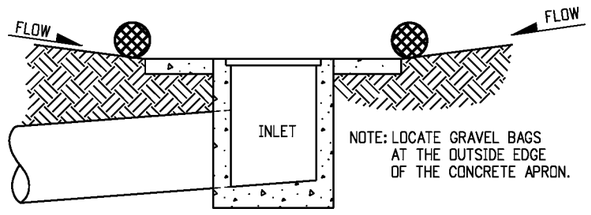


PLAN VIEW FOR MULTIPLE GRAVEL BAGS

GRAVEL BAG CURB CHECK



PLAN VIEW



SECTION A-A

GRAVEL BAG FILTER AT DROP INLET

GRAVEL BAG APPLICATIONS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
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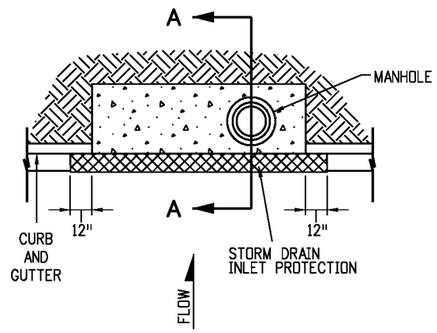

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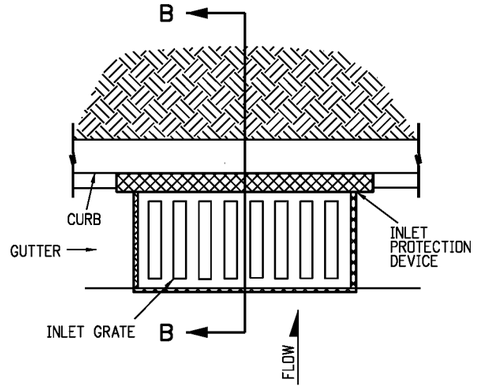

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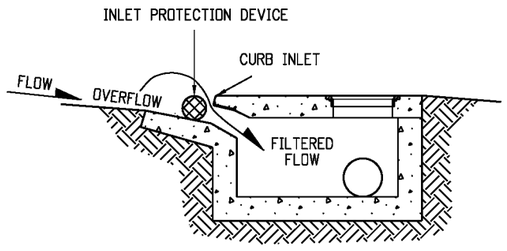
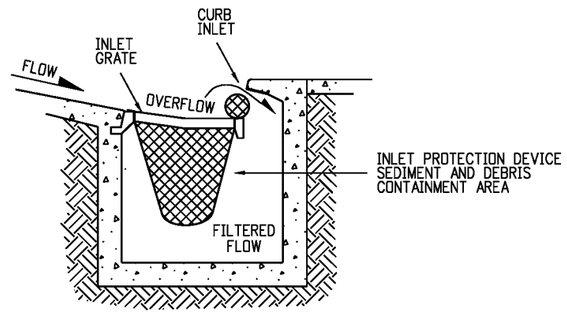


SECTION A-A

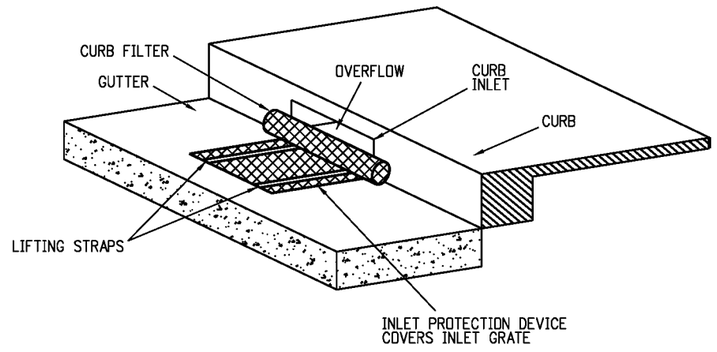
STORM DRAIN INLET PROTECTION (TYPE I)

INLET PROTECTION SHALL EXTEND 12 IN. PAST EACH END OF THE INLET.



SECTION B-B

STORM DRAIN INLET PROTECTION (TYPE II)
OPTION A



ISOMETRIC VIEW

STORM DRAIN INLET PROTECTION (TYPE II)
OPTION B

STORM DRAIN INLET PROTECTION

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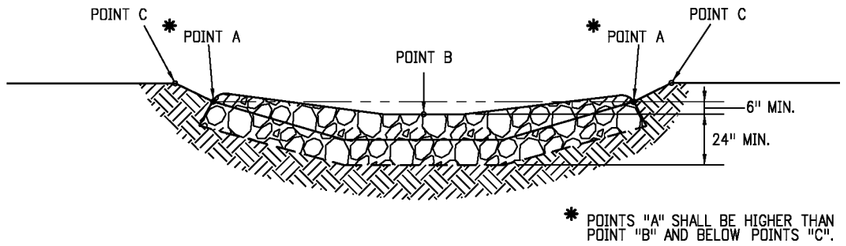
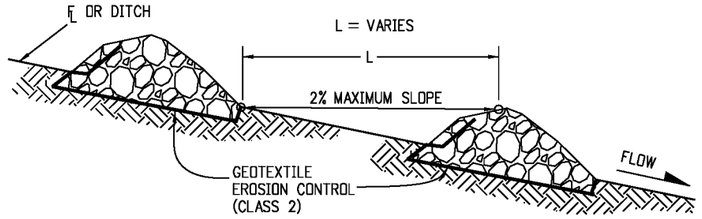
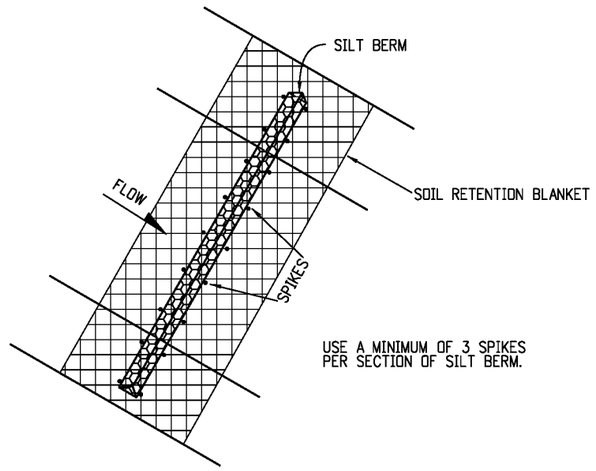


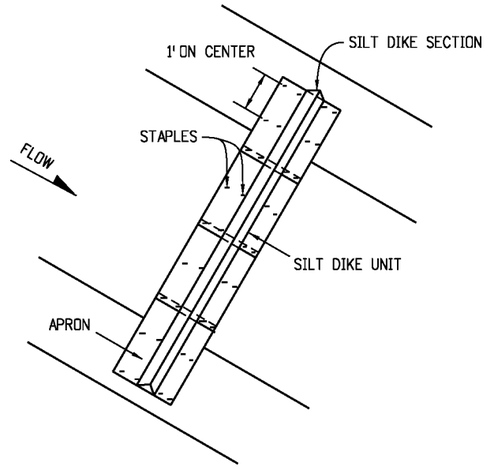
TYPICAL SECTION VIEW



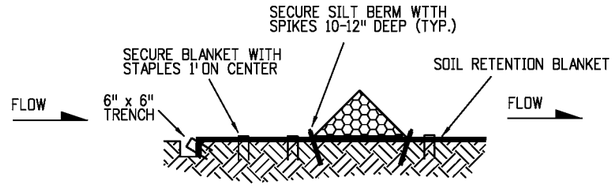
SECTION VIEW ALONG DITCH FLOWLINE



PLAN VIEW

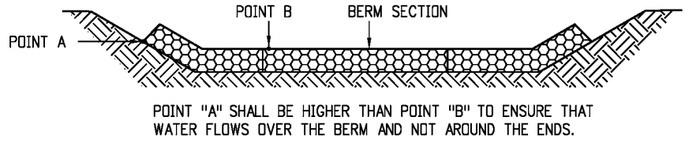


PLAN VIEW



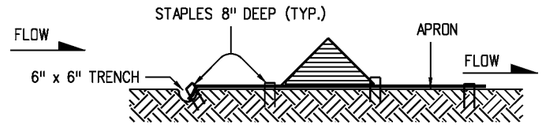
TYPICAL SECTION VIEW

NOTES:
1. ANCHOR SOIL RETENTION BLANKET INTO TRENCH WITH 8" MINIMUM STAPLES PLACED AT 1.5' INTERVALS ALONG EDGE.
2. FILL AND COMPACT TRENCH.
3. SECTIONS OF THE SILT BERM SHALL BE OVERLAPPED WITH NO GAPS.



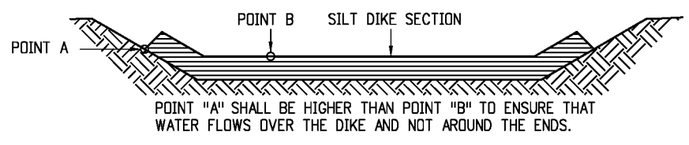
FRONT VIEW

SILT BERM-VELOCITY CHECKS



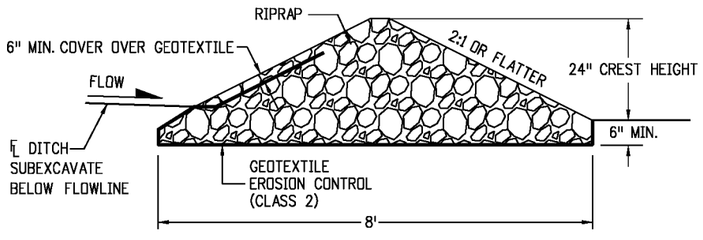
TYPICAL SECTION

NOTES:
1. ANCHOR APRON INTO TRENCH WITH 8" MINIMUM STAPLES PLACED AT 1.5' INTERVALS ALONG EDGE.
2. FILL AND COMPACT TRENCH.
3. THE APRON SHALL EXTEND A MINIMUM OF 2 FEET BEYOND EACH SIDE OF THE TRIANGLE.



FRONT VIEW

SILT DIKE-INSTALLATION



SECTION DETAIL

NOTES:
1. RIPRAP SIZE D_{50} = 6" OR AS SHOWN ON THE PLANS.
2. THE ENDS OF RIPRAP CHECK DAM SHALL BE A MINIMUM OF 6 IN. HIGHER THAN CENTER OF CHECK DAM.

ROCK CHECK DAM

DRAINAGE DITCH APPLICATIONS

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TEMPORARY EROSION CONTROL

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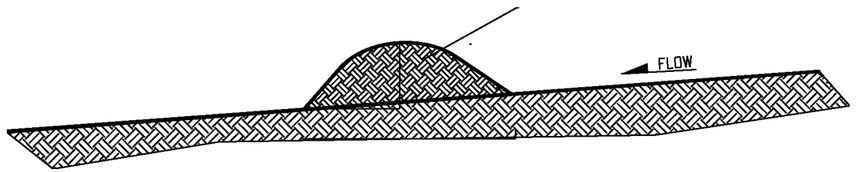
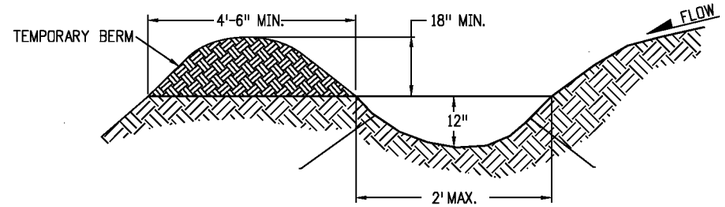


TEMPORARY BERM

NOTES:

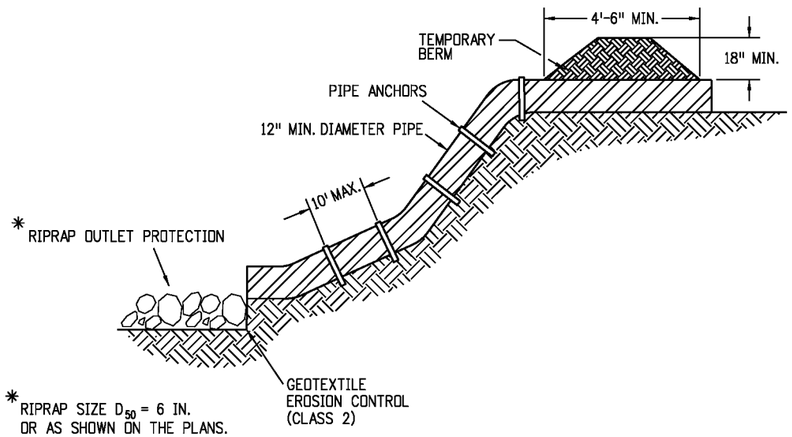
1. BERMS SHALL HAVE A HEIGHT OF 18 INCHES, SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM BASE WIDTH OF 4.5 FEET.
2. BERMS SHALL BE USED TO INTERCEPT AND DIVERT DRAINAGE TO A DESIGNATED OUTLET.
3. BERMS SHALL NOT BE USED WHERE DRAINAGE AREA EXCEEDS 10 ACRES.



TEMPORARY DIVERSION

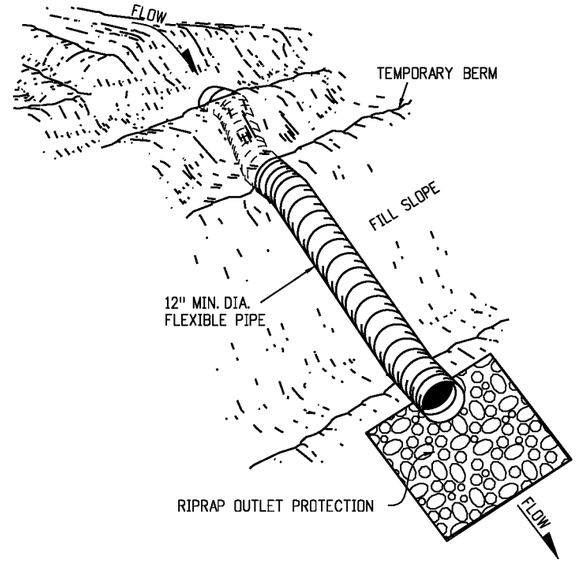
NOTES:

1. TEMPORARY DIVERSION DITCH SHALL BE CONSTRUCTED ACROSS THE SLOPE TO INTERCEPT RUNOFF AND DIRECT IT TO A STABLE OUTLET OR SEDIMENT TRAP.
2. USE IMMEDIATELY ABOVE A NEW CUT OR FILL SLOPE OR AROUND THE PERIMETER OF A DISTURBED AREA.
3. GRADIENT ALONG THE FLOW PATH SHALL HAVE A POSITIVE GRADE TO ASSURE DRAINAGE, BUT SHALL NOT BE SO STEEP AS TO RESULT IN EROSION DUE TO HIGH VELOCITY.



TEMPORARY SLOPE DRAIN

ANCHOR SIZE VARIES ACCORDING TO PIPE SIZE.



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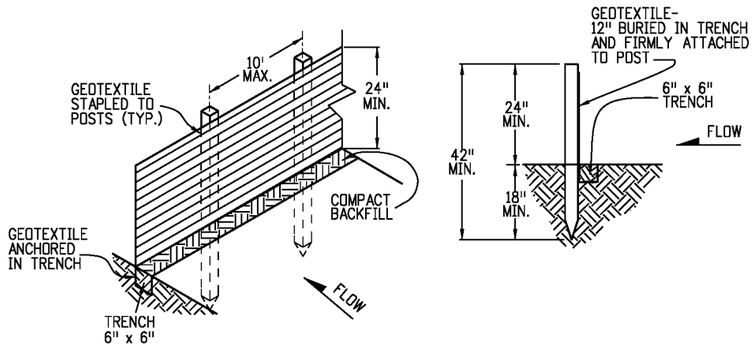


SILT FENCE

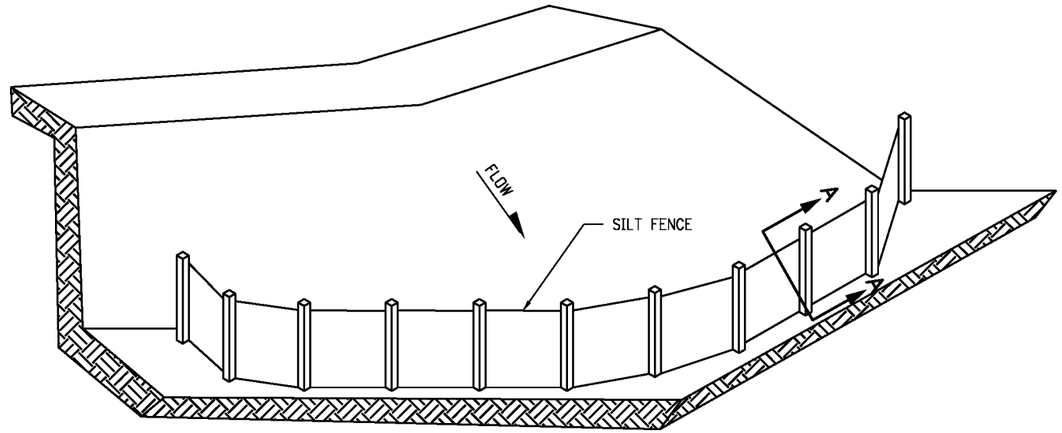
GEOTEXTILE SHALL BE ATTACHED TO WOOD POSTS WITH THREE OR MORE STAPLES PER POST.

STAPLES SHALL BE ½"

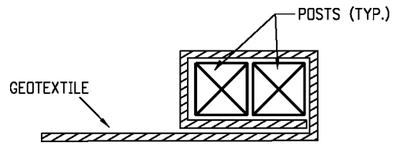
WOOD POST SHALL BE 1 ½" X 1 ½" NOMINAL.

NOTES

1. SILT FENCE SHALL HAVE A MAXIMUM DRAINAGE AREA OF ONE-QUARTER ACRE PER 100 FEET OF SILT FENCE LENGTH; MAXIMUM SLOPE LENGTH BEHIND BARRIER IS 100 FEET; MAXIMUM GRADIENT BEHIND THE BARRIER IS 2:1.
2. SILT FENCE USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
3. SILT FENCE SHALL BE PLACED ON THE CONTOUR, WITH ENDS FLARED UP SLOPE.

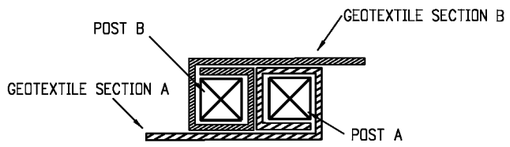


ISOMETRIC VIEW



END SECTION DETAIL (PLAN VIEW)

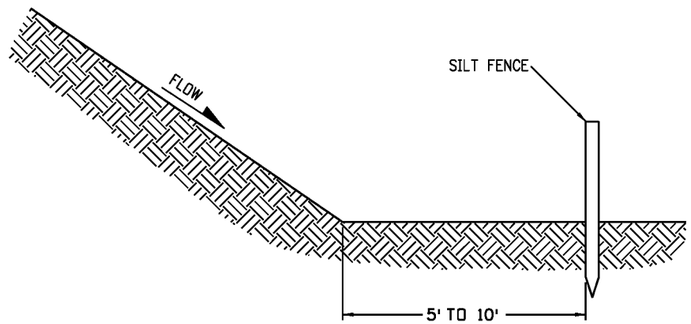
GEOTEXTILE SHALL BE FOLDED AROUND TWO POSTS ONE FULL TURN. SECURE GEOTEXTILE TO POST WITH THREE STAPLES MINIMUM.



JOINING SECTION DETAIL (PLAN VIEW)

FOLD GEOTEXTILE AROUND EACH POST ONE FULL TURN. SECURE GEOTEXTILE TO POST WITH THREE STAPLES MINIMUM.

POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.



SECTION A-A

TOE OF SLOPE PROTECTION

SILT FENCE APPLICATION

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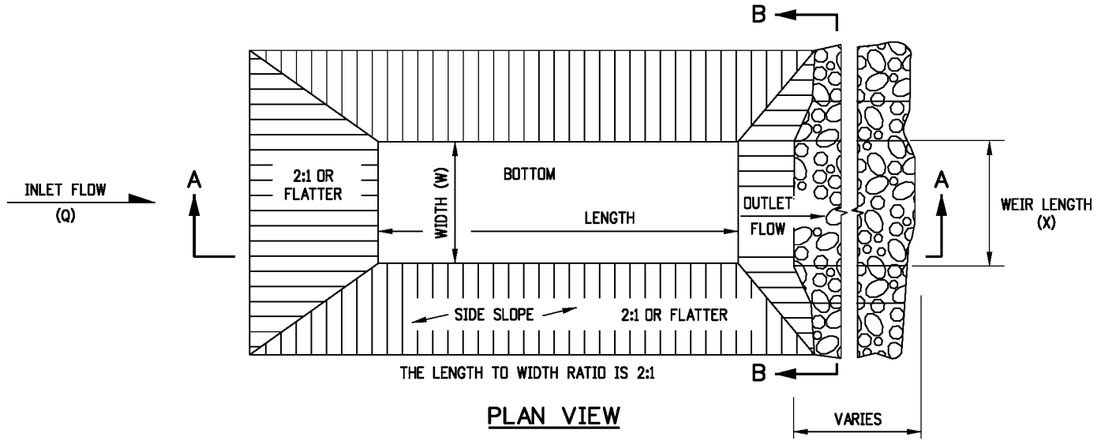
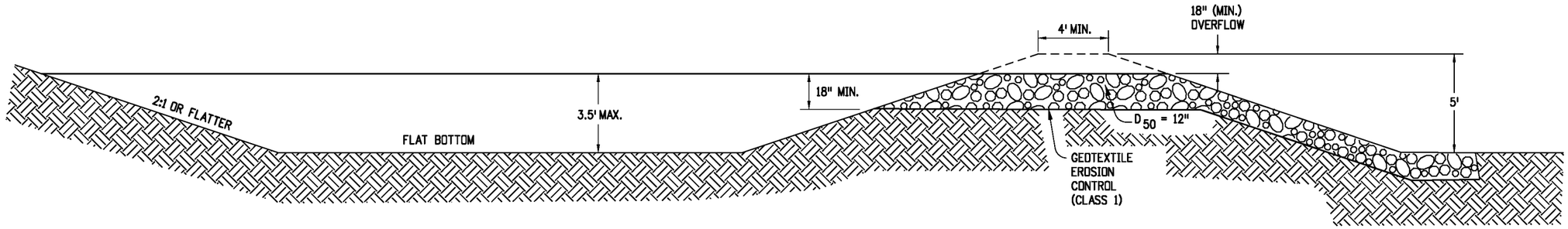


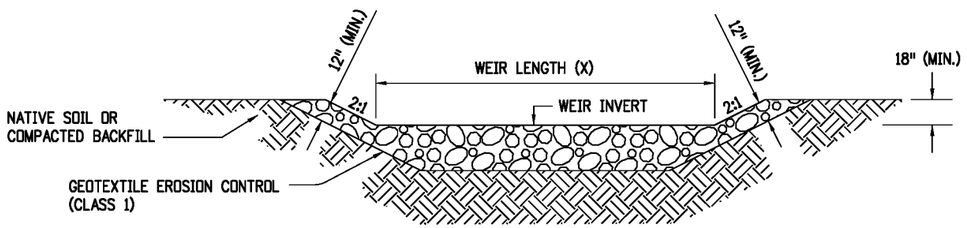
PLAN VIEW

NOTES

1. THE MAXIMUM DRAINAGE AREA IS 5 ACRES.
2. THE MAXIMUM STRUCTURE LIFE IS 2 YEARS.
3. THE STORAGE AREA IS 1800 CUBIC FEET PER ACRE.
4. THE MAXIMUM EMBANKMENT HEIGHT SHALL BE 5 FT. MEASURED ON THE DOWNSTREAM SIDE.
5. THE LENGTH/WIDTH RATIO MAY BE ADJUSTED TO MEET SITE CONDITIONS WHEN APPROVED BY THE ENGINEER.
6. WIDTH (W) OF SEDIMENT TRAP IS APPROXIMATELY EQUAL TO THE WEIR LENGTH (X).
7. SEDIMENT TRAP DESIGN SHALL BE APPROVED BY THE ENGINEER.



SECTION A-A



SECTION B-B

DRAINAGE AREA (ACRES)	WEIR LENGTH (FEET)
1	4
2	6
3	8
4	10
5	12

WEIR LENGTH TABLE

SEDIMENT TRAP

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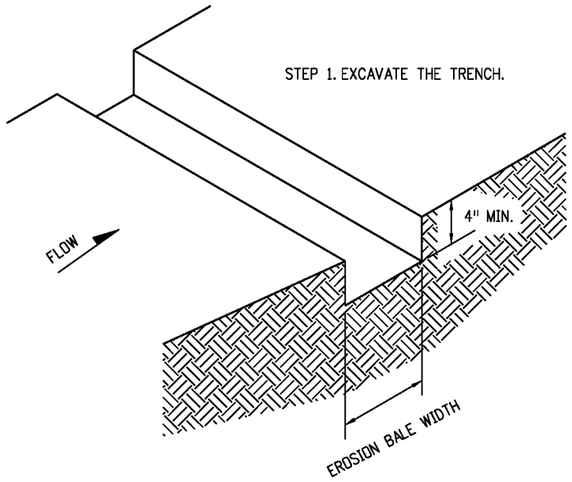
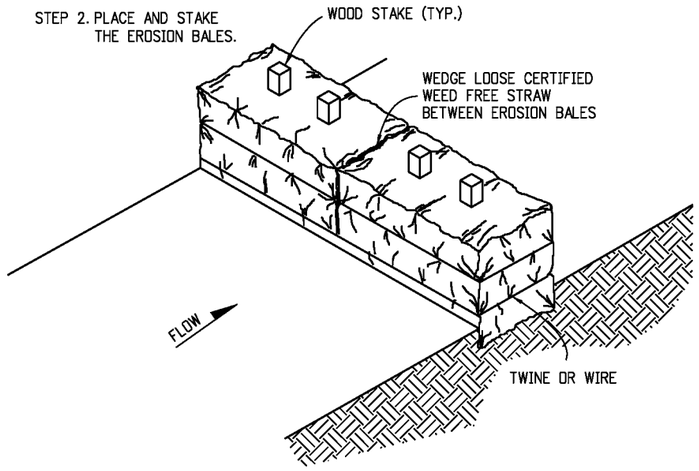
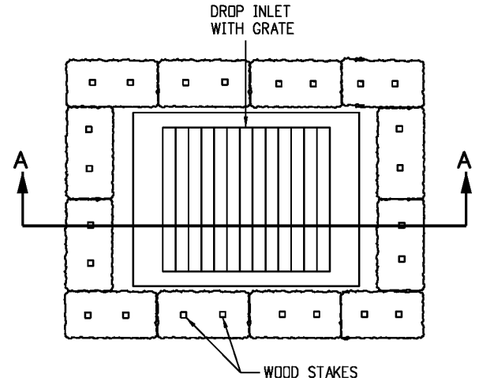


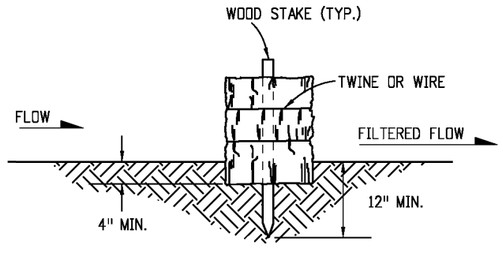


NOTES

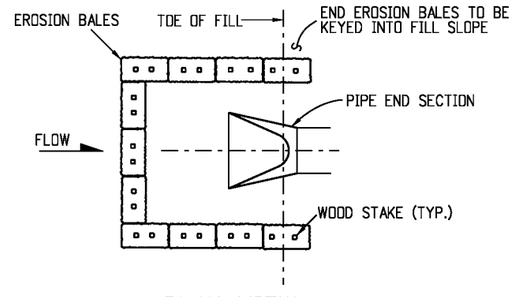
1. STAKES SHALL BE WOOD AND SHALL BE 2" X 2" NOMINAL.
2. EROSION BALES SHALL BE 18" X 18" X 36".
3. EROSION BALES SHALL BE ENTRENCHED 4 IN. MINIMUM INTO THE SOIL, THIGHTLY ABUTTED WITH NO GAPS, STAKED, AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER.



PLAN VIEW

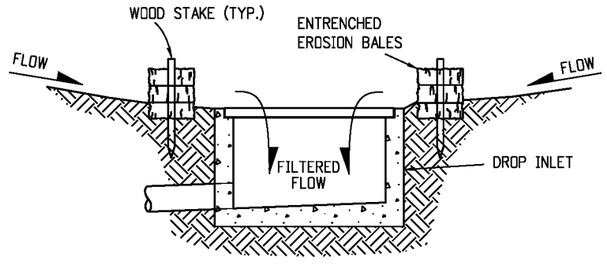


EROSION BALE TRENCHING AND STAKING



PLAN VIEW

EROSION BALE CULVERT INLET PROTECTION



SECTION A-A

EROSION BALE FILTER AT DROP INLET

EROSION BALE APPLICATIONS

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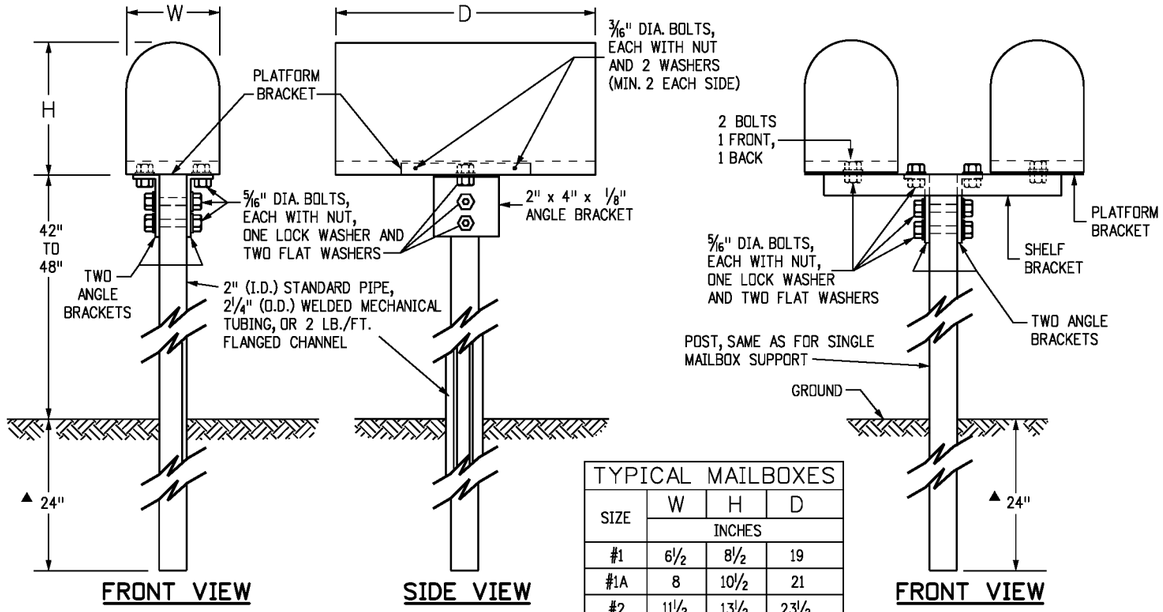
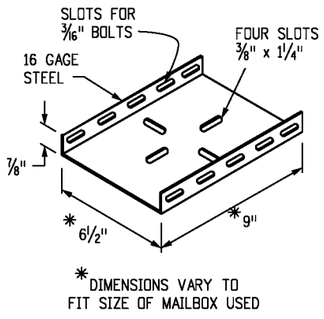


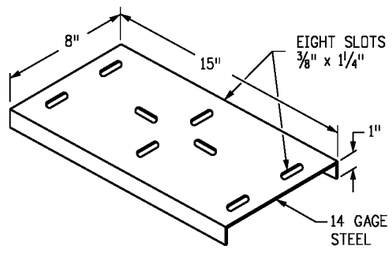
TYPICAL MAILBOXES			
SIZE	W	H	D
	INCHES		
#1	6½	8½	19
#1A	8	10½	21
#2	11½	13½	23½

▲ 30 IN. WITH POST MOUNTING SOCKET MAY BE USED, SEE DETAIL ON SHEET 2 OF 2.

SINGLE (TYPE 1) AND DOUBLE (TYPE 2) MAILBOX SUPPORTS



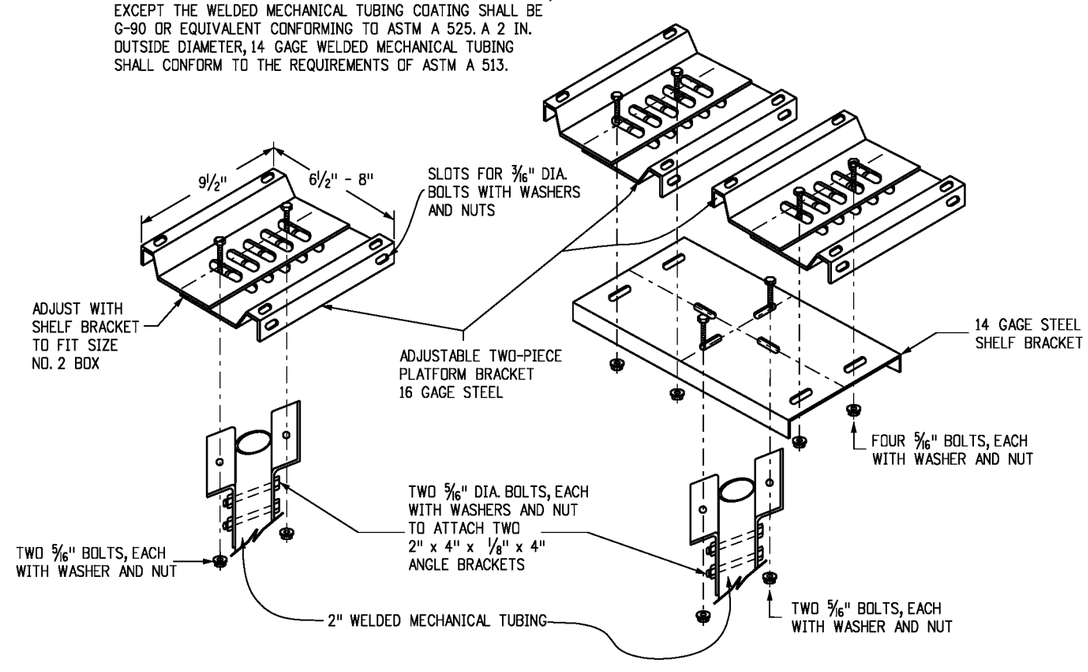
PLATFORM BRACKET



SHELF BRACKET

GENERAL NOTES

1. WHEN A MAILBOX TURNOUT IS REQUIRED, THE NECESSARY PAY QUANTITIES WILL BE SHOWN ON THE PLANS.
2. A SINGLE MAILBOX SHALL BE RESET AT THE FINAL DESIGNATED LOCATION ON A NEW TYPE 1 SUPPORT. TWO MAILBOXES RESET AT THE SAME LOCATION SHALL BE RESET ON ONE DOUBLE (TYPE 2) SUPPORT OR ON TWO SINGLE (TYPE 1) SUPPORTS AS DESIGNATED. THREE, FOUR, OR FIVE MAILBOXES SHALL BE RESET ON A MULTIPLE (TYPE 3) SUPPORT. AN EXISTING MAILBOX THAT IS MOUNTED ON A CANTILEVER SUPPORT SHALL BE RESET ON A CANTILEVER (TYPE 4) SUPPORT. ALL WORK AND MATERIALS SHALL BE INCLUDED IN THE UNIT BID PRICE FOR "RESET MAILBOX STRUCTURE (TYPE _)".
3. WHEN THE ENGINEER DETERMINES THAT THE EXISTING MAILBOX CAN NOT BE REUSED, A NEW METAL MAILBOX OF SIMILAR SIZE SHALL BE SUPPLIED AND ERECTED BY THE CONTRACTOR. A NEW PLASTIC MAILBOX CONFORMING TO POSTAL SERVICE SPECIFICATIONS MAY BE USED AS AN ALTERNATIVE WHEN APPROVED BY THE ENGINEER. AN EXISTING MAILBOX LARGER THAN A SIZE NO. 2 SHALL BE REPLACED WITH A NEW SIZE NO. 2 MAILBOX. THE COST OF SUPPLYING THE NEW MAILBOX WILL BE PAID FOR IN ACCORDANCE WITH SUBSECTION 109.04(b). EXCEPTION: A CUSTOM BUILT, RURAL-TYPE MAILBOX MAY BE RESET IF THE MAILBOX OWNER OBTAINS PRIOR WRITTEN APPROVAL FROM THE POSTMASTER.
4. THE ADDRESS INFORMATION THAT APPEARED ON THE ORIGINAL MAILBOX SHALL BE PLACED ON THE APPROACH SIDE OF THE REPLACEMENT MAILBOX. SIZE AND STYLE OF LETTERING AND MATERIALS ARE SUBJECT TO THE ENGINEER'S APPROVAL.
6. POSTS, BRACKETS, AND ALL MOUNTING HARDWARE SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232 AND M 111, EXCEPT THE WELDED MECHANICAL TUBING COATING SHALL BE G-90 OR EQUIVALENT CONFORMING TO ASTM A 525. A 2 IN. OUTSIDE DIAMETER, 14 GAGE WELDED MECHANICAL TUBING SHALL CONFORM TO THE REQUIREMENTS OF ASTM A 513.
6. EXACT DIMENSIONS OF ANGLES, PLATFORM AND SHELF BRACKETS, BOLT HOLES, SLOTS AND MULTIPLE MAILBOX SUPPORT COMPONENTS MAY VARY FROM THOSE SHOWN OR IMPLIED HEREIN SO THAT ALL COMPONENTS WILL FIT TOGETHER PROPERLY.
7. PLASTIC NEWSPAPER RECEPTACLES MAY BE REMOUNTED BELOW THE MAILBOX ON THE SUPPORT. PLASTIC NEWSPAPER RECEPTACLES SHALL BE MOUNTED IN THEIR INTENDED ORIENTATION USING A GALVANIZED U-BOLT AND HARDWARE OR OTHER MOUNTING SYSTEM APPROVED BY THE ENGINEER. ASSOCIATED COSTS WILL NOT BE PAID FOR SEPARATELY BUT WILL BE INCLUDED IN THE WORK.
8. ON ROADS WITH CURB AND GUTTER, THE MAILBOX SUPPORT SHALL BE LOCATED IN THE GROUND SO THE FRONT OF THE MAILBOX SHALL BE 8 IN. TO 12 IN. BACK FROM THE CURB FACE. THE HEIGHT SHALL BE 42 IN. TO 48 IN. MEASURED FROM THE GUTTER FLOW LINE TO THE BOTTOM OF THE MAILBOX.
9. ON ROADS WITH SIDEWALK ATTACHED TO CURB AND GUTTER, THE MAILBOX SUPPORT SHALL BE LOCATED IN THE GROUND BEHIND THE SIDEWALK. THE FRONT OF THE MAILBOX SHALL BE IN LINE WITH OR SLIGHTLY BEHIND THE EDGE OF THE SIDEWALK. THE MOUNTING HEIGHT SHALL BE 42 IN. TO 48 IN. ABOVE THE SIDEWALK.
10. THE GROUND SURROUNDING THE MAILBOX SUPPORTS SHALL BE FIRM, UNDISTURBED GROUND, OR WELL COMPACTED REGRADED SOIL. THE SUPPORTS ARE NORMALLY DRIVEN, BUT THEY MAY BE PLACED IN A DUG HOLE WITH WELL COMPACTED BACKFILL.
11. PROPRIETARY MAILBOX SUPPORT SYSTEMS LISTED ON THE CDOT APPROVED PRODUCTS LIST WILL BE ACCEPTED AS EQUIVALENT ALTERNATIVES.



SINGLE AND DOUBLE MAILBOX SUPPORTS ALTERNATIVE

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MAILBOX SUPPORTS

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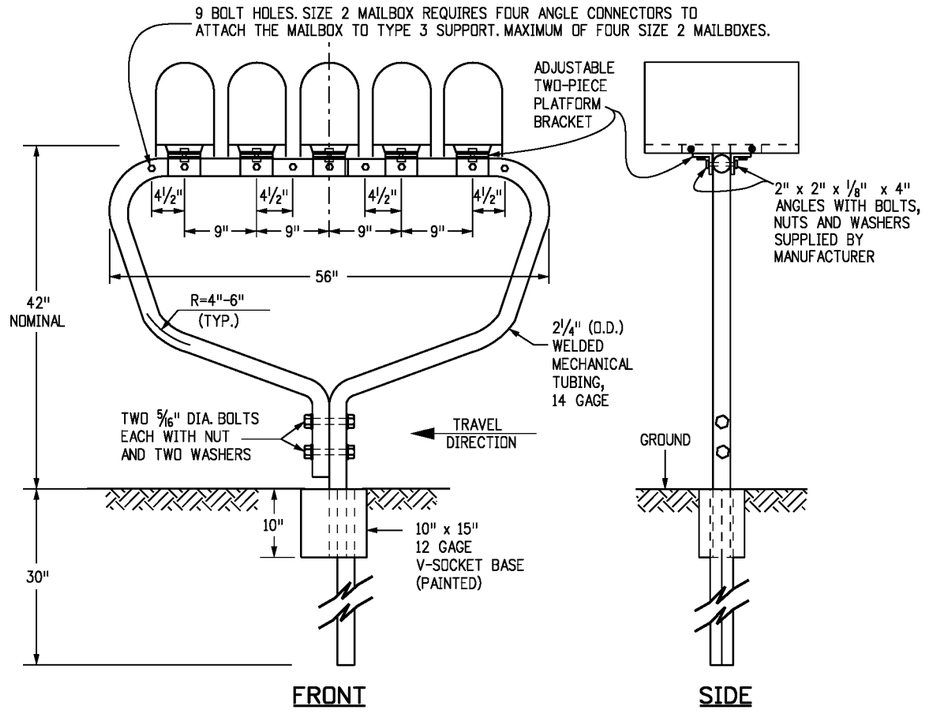
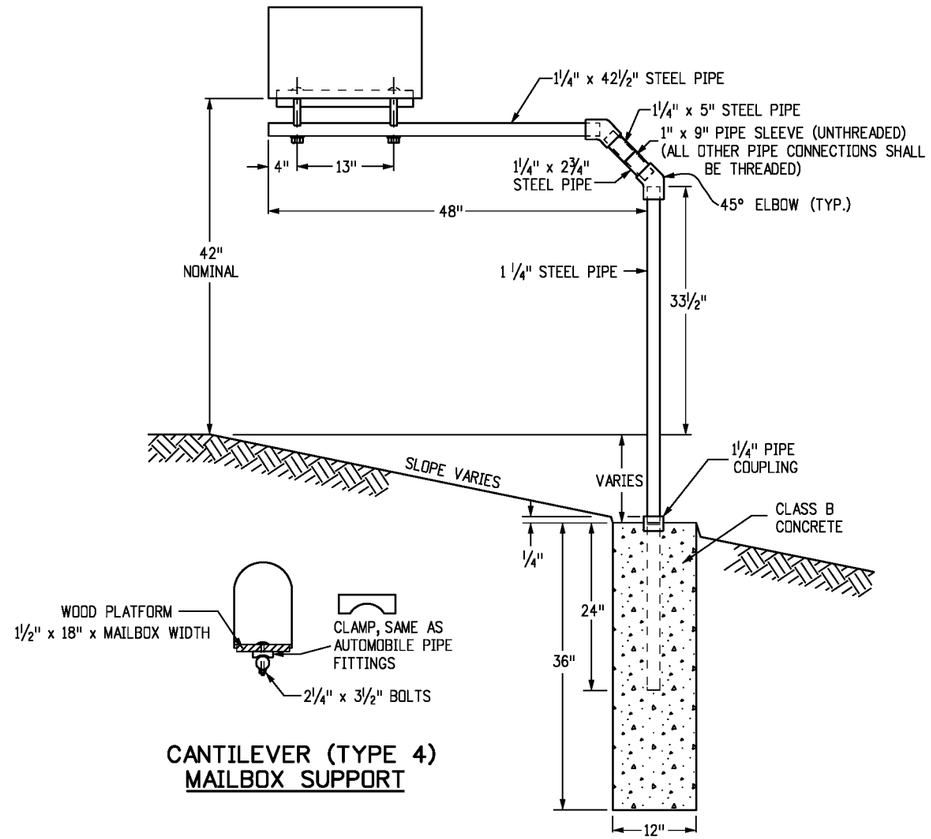
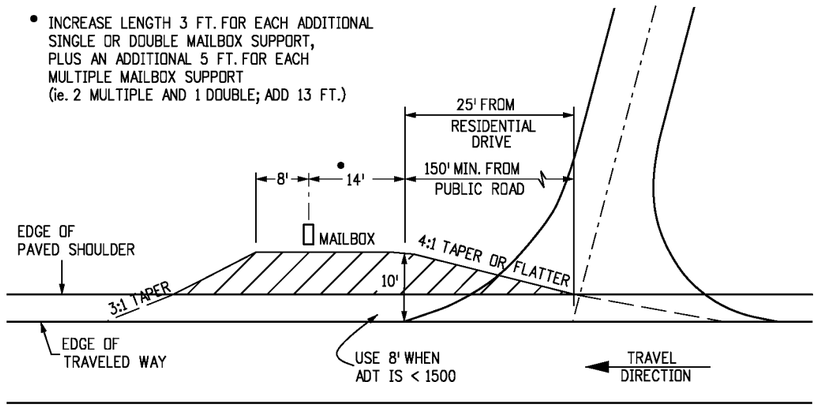


MULTIPLE (TYPE 3) MAILBOX SUPPORT
FOR 3, 4, OR 5 MAILBOXES OR APPROVED EQUAL

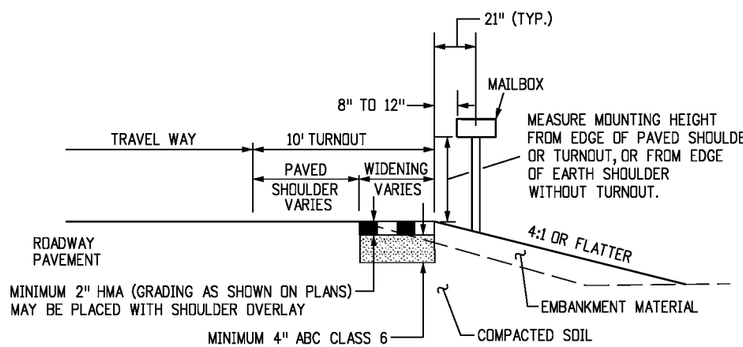
FIVE SIZE 1 MAILBOXES SHOWN



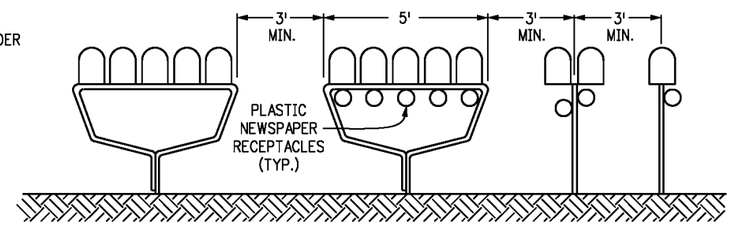
CANTILEVER (TYPE 4)
MAILBOX SUPPORT



MAILBOX TURNOUT



TURNOUT TYPICAL SECTION



SUPPORT SPACING

NOTE: SEE SHEET 1, GENERAL NOTE 7, FOR MOUNTING PLASTIC NEWSPAPER RECEPTACLES.

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MAILBOX SUPPORTS

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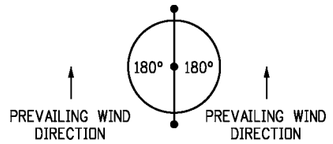
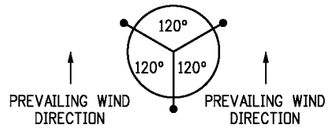
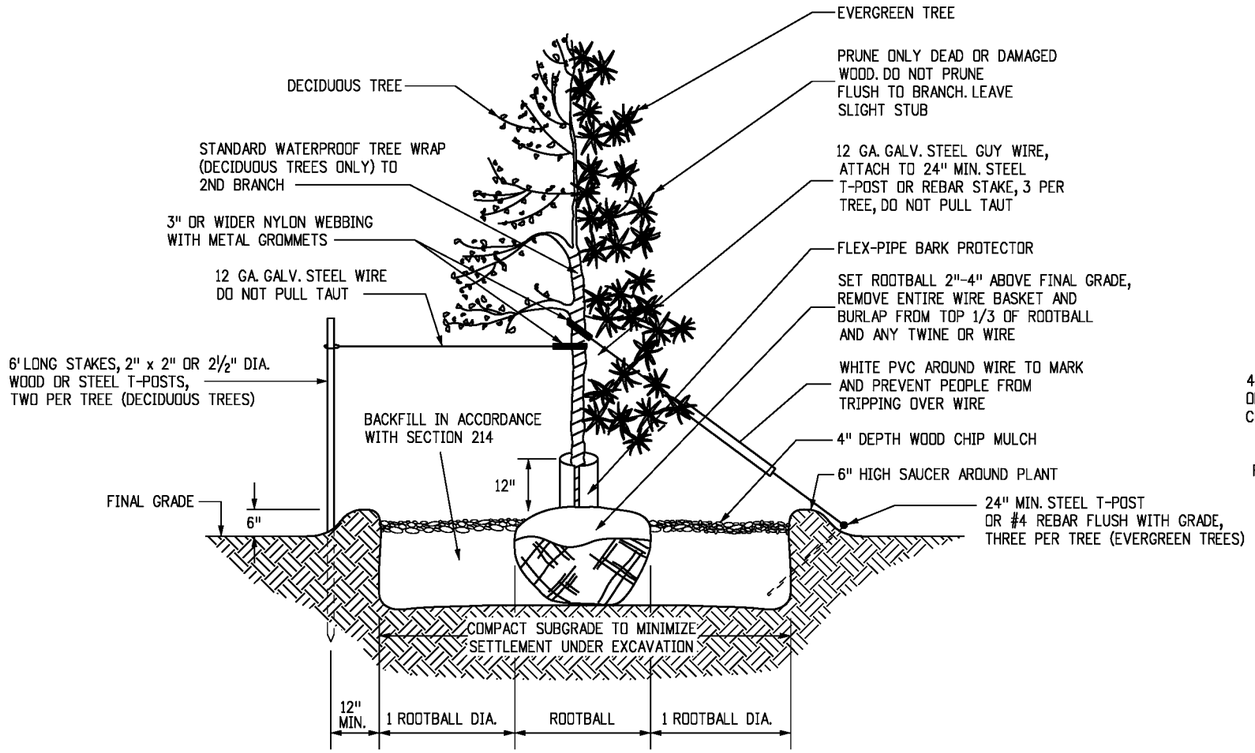


GUYING PATTERN FOR DECIDUOUS TREE PLANTING



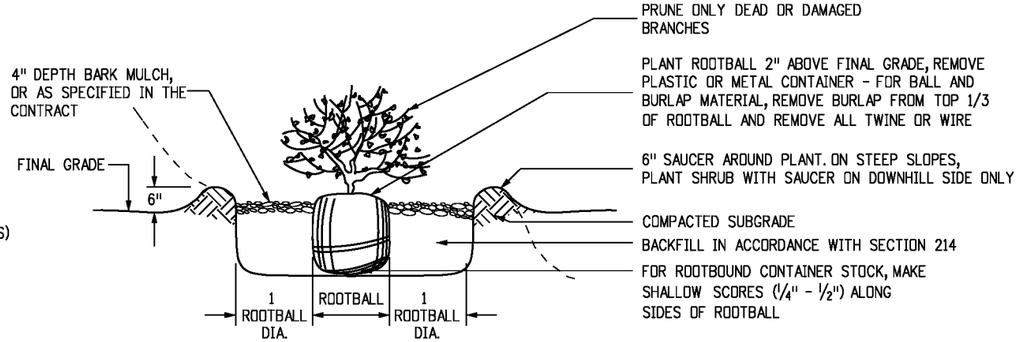
NOTE: FOR TREES ON 4:1 OR STEEPER SLOPES, PLACE TWO GUYS UPSLOPE AND ONE DOWN SLOPE. OTHERWISE, PLACE FOR PREVAILING WIND.

GUYING PATTERN FOR EVERGREEN TREE PLANTING



DECIDUOUS AND EVERGREEN TREE PLANTING AND GUYING DETAIL

(GUY AND STAKE DECIDUOUS TREES 2" AND LARGER CALIPER AND EVERGREEN TREES OVER 4' HEIGHT.)
NOT TO SCALE



SHRUB PLANTING DETAIL

NOT TO SCALE

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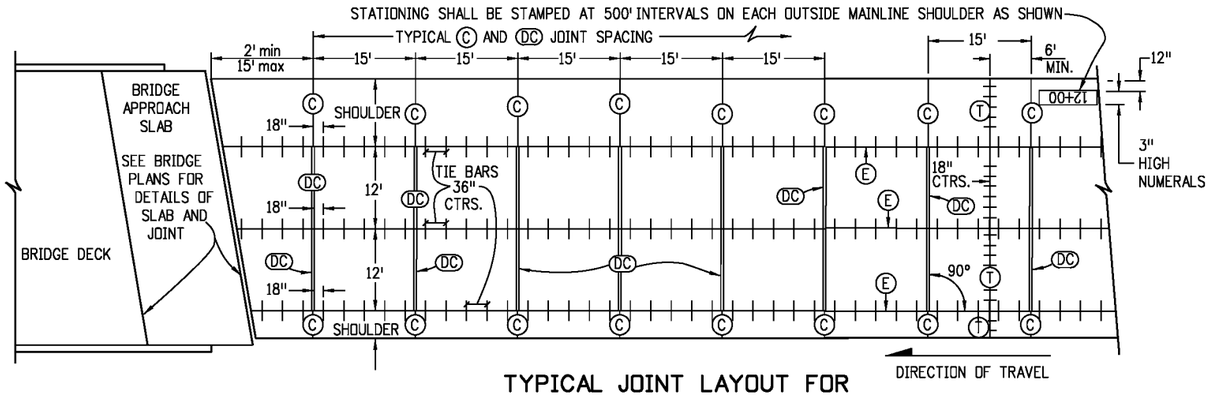
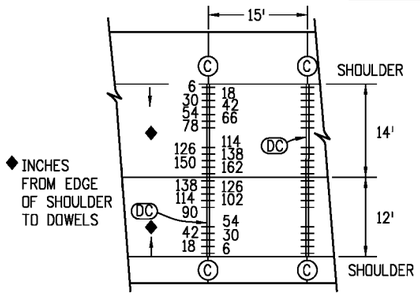


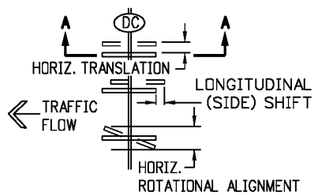
TYPICAL JOINT LAYOUT FOR CONCRETE ROADWAY WITH CONCRETE SHOULDERS

GENERAL NOTES

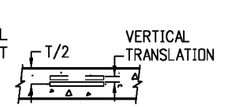
1. THIS STANDARD PLAN DOES NOT APPLY TO THIN CONCRETE OVERLAYS (WHITETOPPING).
2. LOCATE (T) JOINT AT A (C) JOINT OR A MINIMUM OF 6 FT. FROM A (C) JOINT.
3. THIS JOINT LAYOUT SHALL BE USED AS A STANDARD OF THE JOINT LAYOUT FOR THE PROJECT. IF THE CONTRACTOR PROPOSES VARIATIONS FROM THIS STANDARD OR THE PROJECT HAS UNUSUAL OR IRREGULAR CONDITIONS NOT COVERED HEREIN, THE CONTRACTOR SHALL PREPARE A PAVEMENT JOINT LAYOUT FOR APPROVAL BY THE ENGINEER. SLABS 14 FT. IN WIDTH SHALL BE CONSTRUCTED ONLY WHERE DESIGNATED ON THE PLANS.
4. ON MULTILANE DIVIDED HIGHWAYS, THE MULTILANE DIRECTIONAL PAVEMENT AND BOTH SHOULDERS SHALL BE PLACED WITH (E) LONGITUDINAL SAWED CONTRACTION JOINTS.
5. ON MULTILANE DIVIDED HIGHWAYS SEPARATED BY A CONCRETE BARRIER, A (D) JOINT SHALL BE CONSTRUCTED AT ONE OF THE BARRIER FACES.
6. (D) JOINTS SHALL BE CONSTRUCTED BETWEEN THE TWO OPPOSING DIRECTIONS OF TRAVEL ON A MULTILANE UNDIVIDED HIGHWAY WHEN ALL OF THE FOLLOWING APPLY:
   A. PAVEMENT IS CONTINUOUS ACROSS BOTH DIRECTIONS OF TRAVEL.
   B. THERE IS NO MEDIAN BARRIER.
   C. THE WIDTH OF THE PAVEMENT IN ONE DIRECTION IS GREATER THAN 80 FEET.
7. ON VARIABLE WIDTH SLABS, THE 2 FT. OR 4 FT. END OF SLAB WIDTH DIMENSION MAY VARY ±6 INCHES.
8. (L) JOINTS ARE TO BE USED WHEN A TRAFFIC LANE IS ADDED SEPARATELY, OR FOR TAPERS, OR FOR SPEED CHANGE LANES. ALTERNATIVE LONGITUDINAL JOINT LOCATIONS AT SPEED CHANGE LANES MAY BE USED IF APPROVED.
9. WHERE (DC) JOINTS ARE SHOWN IN THE SHOULDER, THE DOWEL BARS WILL BE PLACED ON 12" CENTERS STARTING 6" FROM THE ROADWAY (E) JOINT.



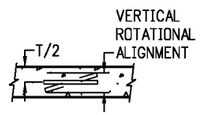
DOWEL BAR DETAIL FOR (DC) JOINT WITH 14 FT. AND 12 FT. LANES



PLAN VIEW
SHOWING HORIZ. TRANSLATION, LONGITUDINAL (SIDE) SHIFT AND HORIZ. ROTATIONAL ALIGNMENT



SECTION A-A
SHOWING VERTICAL TRANSLATION TOLERANCE



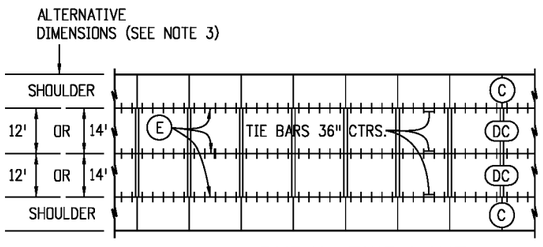
SECTION A-A
SHOWING VERTICAL ROTATIONAL ALIGNMENT

T IS PAVEMENT THICKNESS FROM PLANS

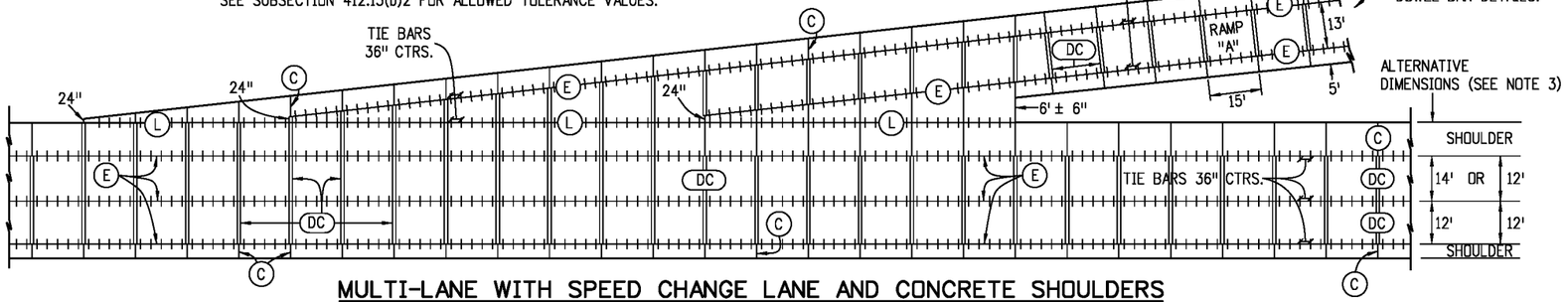
JOINT LEGEND
(SEE SHEET 5 FOR JOINT DETAILS)

- (C) TRANSVERSE CONTRACTION
- (D) LONGITUDINAL CONSTRUCTION
- (DC) DOWELED TRANSVERSE CONTRACTION
- (L) (E) LONGITUDINAL CONSTRUCTION OR LONGITUDINAL CONTRACTION
- (T) TRANSVERSE CONSTRUCTION

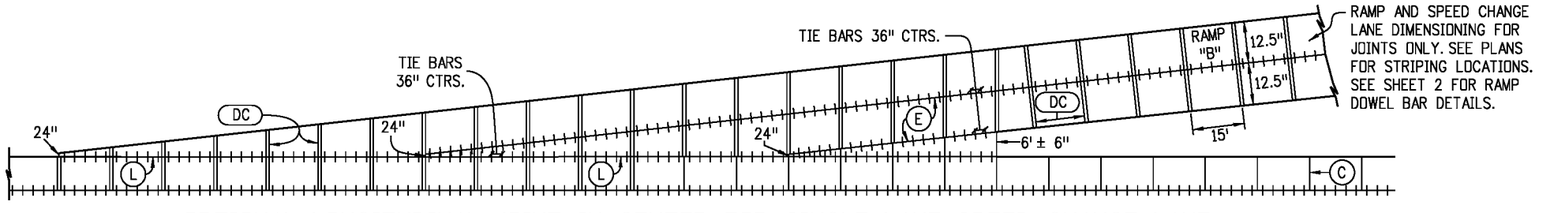
DETAILS ILLUSTRATING DOWEL PLACEMENT TOLERANCES
SEE SUBSECTION 412.13(b)2 FOR ALLOWED TOLERANCE VALUES.



RURAL TWO-LANE



MULTI-LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS



OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE SPEED CHANGE LANE

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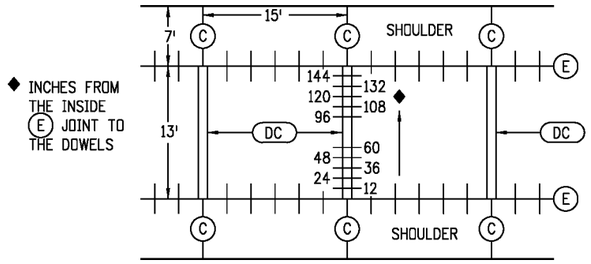
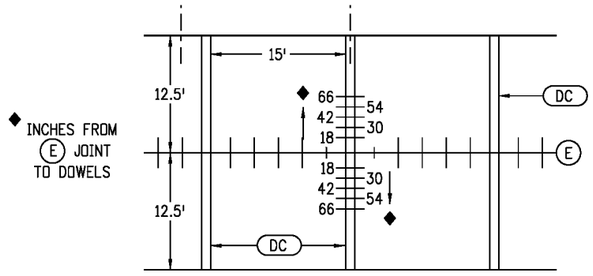


RAMP "A" DOWEL BAR DETAIL
FOR DC JOINT WITH A 13 FT. LANE

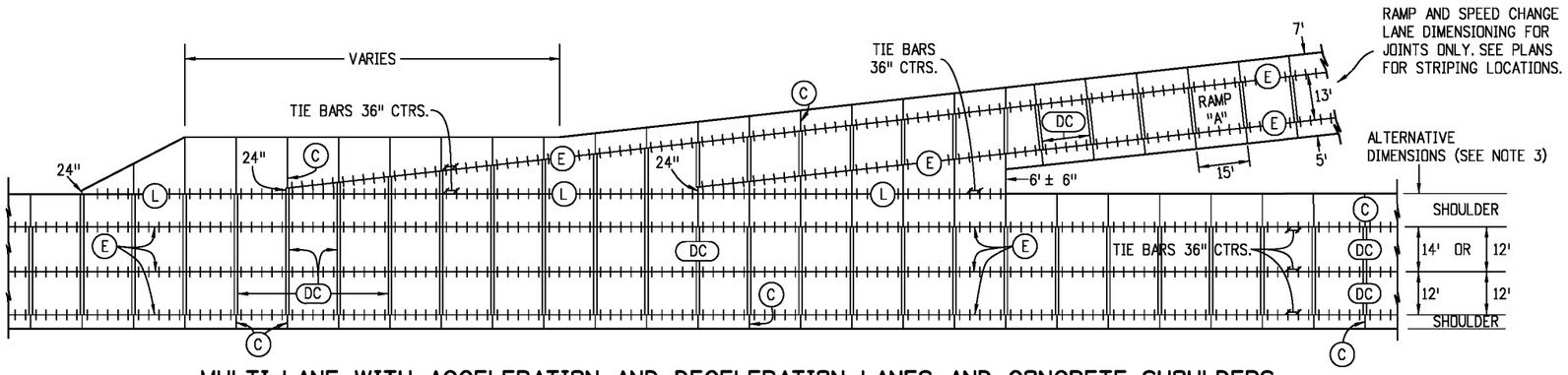


RAMP "B" DOWEL BAR DETAIL FOR DC JOINT
WITH CENTER LONGITUDINAL SPLIT LANE

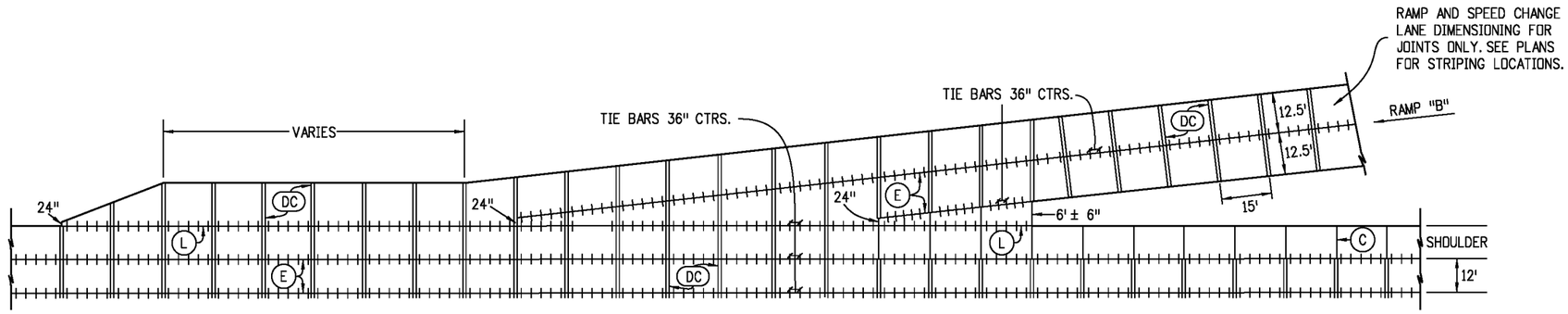
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- C — TRANSVERSE CONTRACTION
- D — LONGITUDINAL CONSTRUCTION
- DC — DOWELED TRANSVERSE CONTRACTION
- L, E — LONGITUDINAL CONSTRUCTION OR LONGITUDINAL CONTRACTION
- T — TRANSVERSE CONSTRUCTION



MULTI-LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS



OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE ACCELERATION AND DECELERATION LANE

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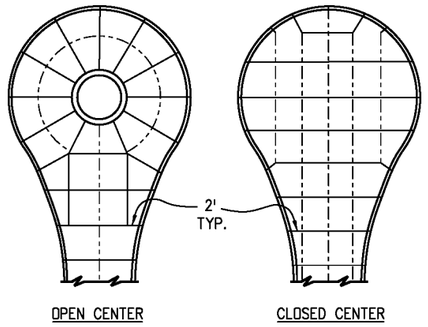


CUL-DE-SAC

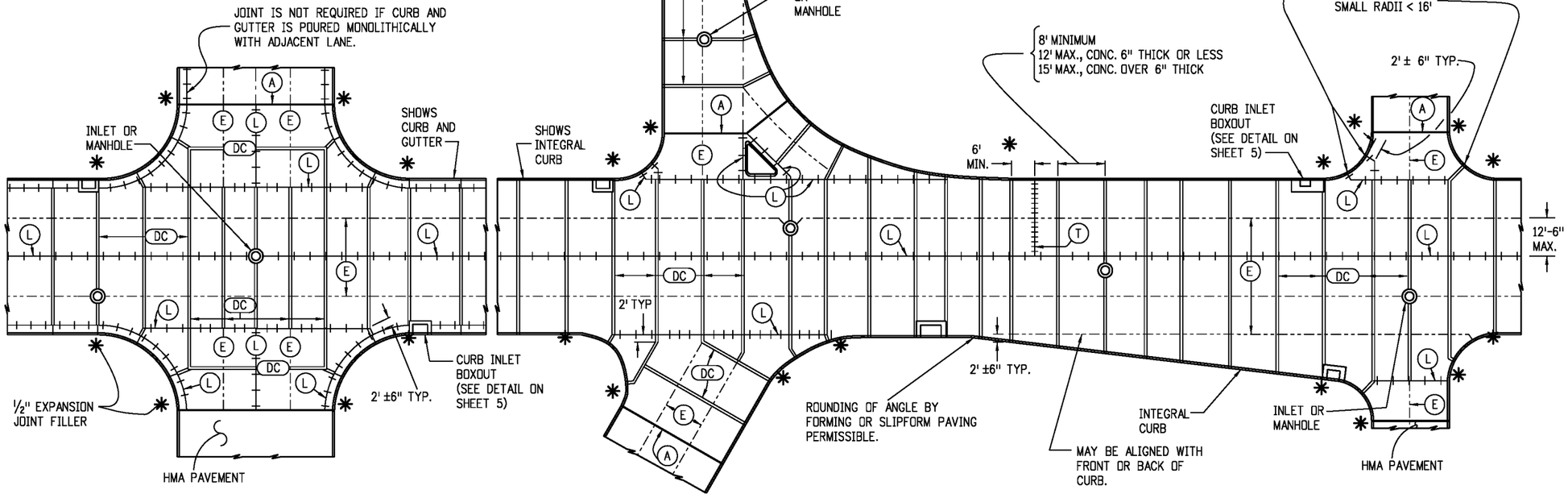
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- (A) EXPANSION
- (C) TRANSVERSE CONTRACTION
- (D) LONGITUDINAL CONSTRUCTION
- (DC) DOWELED TRANSVERSE CONTRACTION
- (E) LONGITUDINAL CONTRACTION
- (L) LONGITUDINAL CONSTRUCTION
- (T) TRANSVERSE CONSTRUCTION

NOTES

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE, AND HAVE A MAXIMUM SPACING OF 12 FT.-6 IN. (15 FT. IS PERMITTED WITH MONOLITHIC CURB AND GUTTER).
2. CONSTRUCT TRANSVERSE JOINTS PERPENDICULAR TO THE CENTERLINE OF PAVEMENT AND EXTEND THROUGH THE CURB OR CURB AND GUTTER.
3. * PLACE ½ IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES SHALL NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT PASSES LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.
7. LOCATE (T) JOINT AT A (DC) JOINT OR A MINIMUM OF 6 FT. FROM A (DC) JOINT.
6. THE ENGINEERS SHALL HAVE AN OPTION TO USE INDIVIDUAL DOWELS IN THE DC JOINT ON SHORT RUN (2' ± 6") TO CURB RADIUS RETURNS.



TYPICAL CURBED PAVEMENT JOINT LAYOUT

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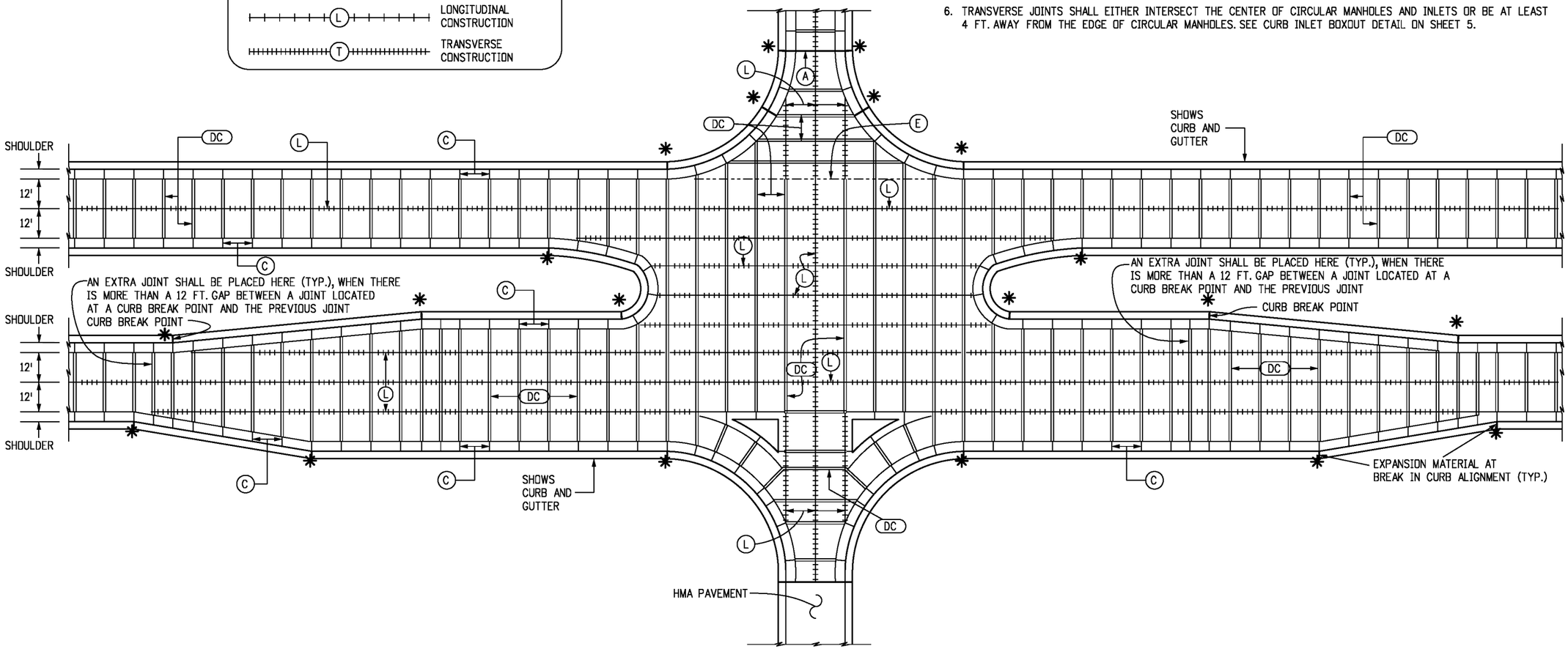
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- A — EXPANSION
- C — TRANSVERSE CONTRACTION
- D — LONGITUDINAL CONSTRUCTION
- DC — DOWELED TRANSVERSE CONTRACTION
- E — LONGITUDINAL CONTRACTION
- L — LONGITUDINAL CONSTRUCTION
- T — TRANSVERSE CONSTRUCTION

NOTES

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE, AND HAVE MAXIMUM SPACING OF 12 FT.-6 IN. (15 FT. IS PERMITTED WITH MONOLITHIC CURB AND GUTTER).
2. CONSTRUCT TRANSVERSE JOINTS PERPENDICULAR TO THE CENTERLINE OF PAVEMENT AND EXTEND THROUGH THE CURB OR CURB AND GUTTER.
3. * PLACE ½ IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES DO NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT WOULD PASS LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.



MULTI-LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

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Last Modification Date: 07/04/12 Initials: LTA	R-X		
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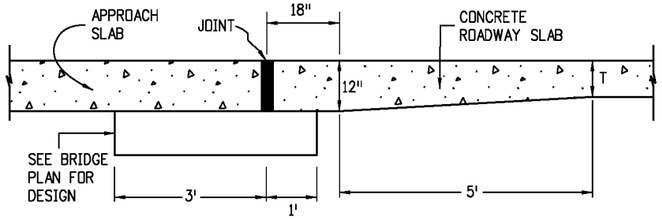
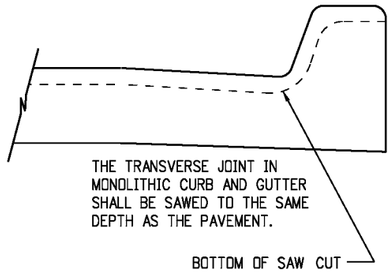


BRIDGE APPROACH



NOTE

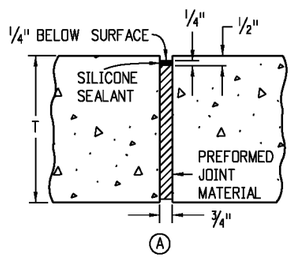
PAVEMENT THICKNESS (T), SHALL BE AS SHOWN ON THE PLANS.

PAVEMENT THICKNESS (T)	DOWEL BAR DIAMETER
T < 8 IN.	1 IN.
8 IN. ≥ T ≤ 10 IN.	1.25 IN.
10 IN. > T ≤ 15 IN.	1.50 IN.

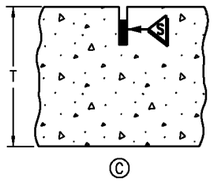
REINFORCING SIZE TABLE

TIE BAR SIZE IS NO. 5 WHEN PAVEMENT IS PLACED ON UNBOUND BASES.

TIE BAR IS NO. 6 WHEN PAVEMENT IS PLACED ON LIME TREATED SOIL, ASPHALT OR CEMENT TREATED, MILLED ASPHALT, OR RECYCLED ASPHALT BASES.

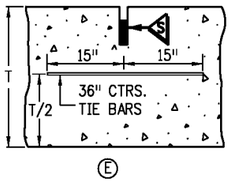


EXPANSION JOINT



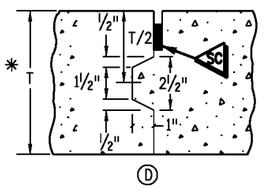
TRANSVERSE CONTRACTION JOINT

(TRANSVERSE WEAKENED PLANE JOINT)



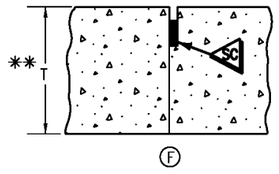
LONGITUDINAL CONTRACTION JOINT

(LONGITUDINAL WEAKENED PLANE JOINT)



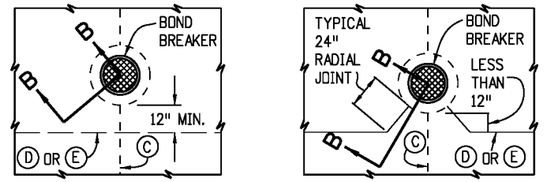
LONGITUDINAL CONSTRUCTION JOINT

* USE ONLY IF T ≥ 8 IN.
FORM ONLY FEMALE KEYWAY

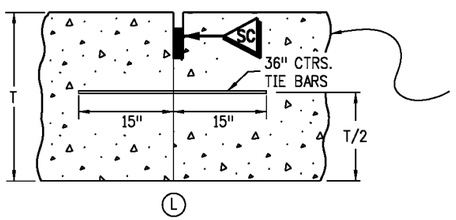


LONGITUDINAL CONSTRUCTION JOINT

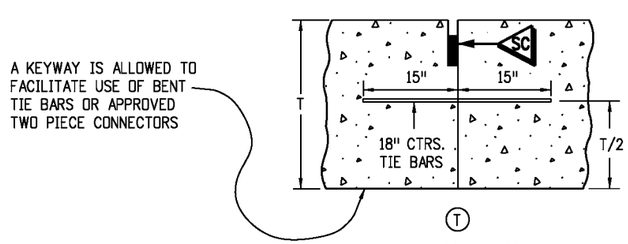
** USE ONLY IF T < 8 IN.



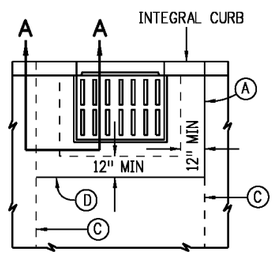
INLET OR MANHOLE CAST IN PAVEMENT



LONGITUDINAL CONSTRUCTION JOINT

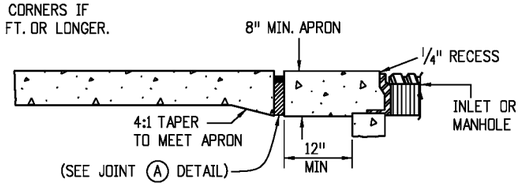


TRANSVERSE CONSTRUCTION JOINT

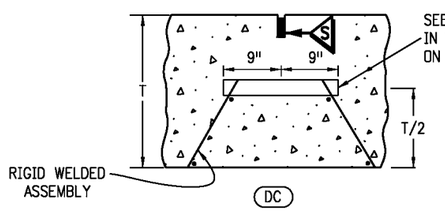


CURB INLET BOXOUT

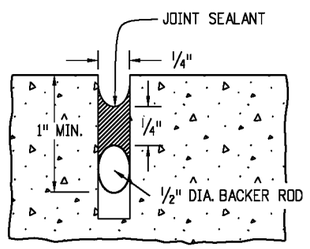
INSTALL TRANSVERSE JOINT AT BOTH BOXOUT CORNERS IF BOXOUT IS 8 FT. OR LONGER.



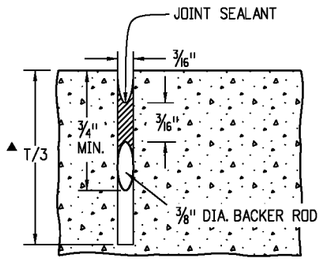
SECTION A-A



DOWELED TRANSVERSE CONTRACTION JOINT

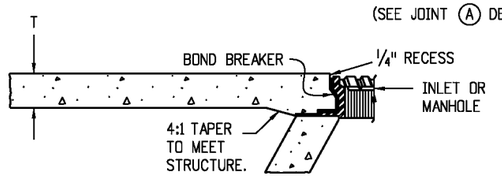


SEAL AT CONSTRUCTION JOINT SC



▲ SHALL BE 0.4T FOR LONGITUDINAL JOINTS ALONG SLABS 14 FT. IN WIDTH.

SAWED JOINT S



SECTION B-B

BOND BREAKER SHALL BE COMPOSED OF PLASTIC SHEET, BUILDING PAPER OR OTHER APPROVED MATERIAL THAT PREVENTS BONDING.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/24/12 Initials: LTA	R-X	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	R-X		Modified the Reinforcing Size Table.
Drawing File Name: 412010505.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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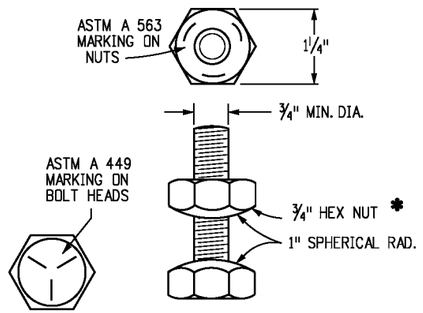
CONCRETE PAVEMENT JOINTS

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.
M-412-1
Sheet No. 5 of 5

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER **H** (FT.) WALL THICKNESS (IN.)						
IN.		0.109	0.138	0.168	0.188	0.218	0.249	0.280
60	12	47	68	90	100	100	100	100
66	12	43	62	81	93	100	100	100
72	12	39	57	75	86	100	100	100
76	12	36	52	69	79	95	100	100
84	12	34	49	64	73	88	100	100
90	12	31	45	60	68	82	97	100
96	12	29	43	56	64	77	91	100
102	18	28	40	52	60	73	86	94
108	18	26	38	50	57	69	81	88
114	18	25	36	47	54	65	77	84
120	18	23	34	45	51	62	73	80
126	18	22	32	42	49	59	69	76
132	18	21	31	40	46	56	66	72
138	18	20	29	39	44	54	63	69
144	18	19	28	37	43	51	61	66
150	24	19	27	36	41	49	58	64
156	24	18	26	34	39	47	56	61
162	24	17	25	33	38	46	54	59
168	24	17	24	32	36	44	52	57
174	24	16	23	31	35	42	50	55
180	24	15	22	30	34	41	48	53
186	24	15	22	29	33	40	47	51
192	24		21	28	32	38	45	50
198	30		20	27	31	37	44	48
204	30		20	26	30	36	43	47
210	30		19	25	29	35	41	45
216	30			25	28	34	40	44
222	30			24	27	33	39	43
228	30			23	27	32	38	42
234	30			23	26	31	37	41
240	30				25	31	36	40

TABLE I - 6 IN. x 2 IN. CORRUGATIONS
ROUND STEEL PIPE



PIPE BOLT AND NUT

✱ INSTALL CULVERT NUTS AS SHOWN. DO NOT INVERT.

NOTES:

1. NUTS MADE IN CONFORMANCE WITH ASTM A 194, GRADE 2 OR GRADE 2H, AND MARKED WITH THE GRADE SYMBOL ARE ACCEPTABLE EQUIVALENTS FOR ASTM A 563, GRADE C NUTS.
2. BOLTS SHALL BE PLACED LOOSE TO ALIGN PLATES, THEN TIGHTENED TO MAINTAIN STRUCTURE SHAPE.

PIPE SIZE ▽ SPAN x RISE	MIN. COVER	MIN. WALL THICKNESS	CORNER RADII	MAX. **H**
FT. - IN.	IN.			FT.
6- 1 x 4- 7	12	0.109	18	15
6- 4 x 4- 9	12	0.109	18	15
6- 9 x 4-11	12	0.109	18	14
7- 0 x 5- 1	12	0.109	18	14
7- 3 x 5- 3	12	0.109	18	13
7- 8 x 5- 5	12	0.109	18	13
7-11 x 5- 7	12	0.109	18	12
8- 2 x 5- 9	18	0.109	18	12
8- 7 x 5-11	18	0.109	18	11
8-10 x 6- 1	18	0.109	18	11
9- 4 x 6- 3	18	0.109	18	10
9- 6 x 6- 5	18	0.109	18	10
9- 9 x 6- 7	18	0.109	18	10
10- 3 x 6- 9	18	0.109	18	9
10- 8 x 6-11	18	0.109	18	9
10-11 x 7- 1	18	0.109	18	9
11- 5 x 7- 3	18	0.109	18	8
11- 7 x 7- 5	18	0.109	18	7
11-10 x 7- 7	18	0.109	18	7
12- 4 x 7- 9	30	0.109	18	6
12- 6 x 7-11	30	0.109	18	6
12- 8 x 8- 1	30	0.109	18	6
12-10 x 8- 4	30	0.109	18	6
13- 3 x 9- 4	30	0.109	31	13
13- 6 x 9- 6	30	0.109	31	12
14- 0 x 9- 8	30	0.109	31	12
14- 2 x 9-10	30	0.109	31	12
14- 5 x 10- 0	30	0.109	31	11
14-11 x 10- 2	30	0.109	31	11
15- 4 x 10- 4	30	0.109	31	11
15- 7 x 10- 6	30	0.109	31	11
15-10 x 10- 8	30	0.109	31	10
16- 3 x 10-10	30	0.138	31	10
16- 6 x 11- 0	30	0.138	31	10
17- 0 x 11- 2	30	0.138	31	10
17- 2 x 11- 4	30	0.138	31	10
17- 5 x 11- 6	30	0.138	31	9
17-11 x 11- 8	30	0.138	31	9
18- 1 x 11-10	30	0.168	31	9
18- 7 x 12- 0	30	0.168	31	9
18- 9 x 12- 2	30	0.168	31	9
19- 3 x 12- 4	30	0.168	31	8
19- 6 x 12- 6	30	0.168	31	8
19- 8 x 12- 8	30	0.168	31	7
19-11 x 12-10	30	0.168		7
20- 5 x 13- 0	36	0.188	31	7
20- 7 x 13- 2	36	0.188	31	6

TABLE II - 6 IN. x 2 IN. CORRUGATIONS
STEEL PIPE-ARCH ◪

◪ - PIPE-ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. USE ROUND PIPE WHEN **H** EXCEEDS 15 FT.

PIPE SIZE ▽ SPAN x RISE	MIN. COVER	MIN. WALL THICKNESS	CORNER RADII	MAX. **H**
FT. - IN.	IN.			FT.
6- 2 x 5- 0	21	0.100	27	15
6- 7 x 4-11	21	0.100	27	15
6- 7 x 5- 8	21	0.100	32	15
6-11 x 5- 9	21	0.100	32	15
7- 3 x 5-11	21	0.100	32	15
7- 9 x 6- 0	24	0.100	32	15
8- 1 x 6- 1	24	0.100	32	15
8- 5 x 6- 3	27	0.100	32	15
8-10 x 6- 4	27	0.100	32	15
9- 3 x 6- 5	27	0.100	32	15
9- 7 x 6- 6	27	0.100	32	15
9-11 x 6- 8	27	0.100	32	14
10- 3 x 6- 9	30	0.100	32	14
10- 9 x 6-10	30	0.100	32	13
11- 1 x 7- 0	30	0.100	32	13
11- 5 x 7- 1	33	0.100	32	12
11- 9 x 7- 2	33	0.100	32	12
12- 3 x 7- 3	33	0.100	32	12
12- 7 x 7- 5	33	0.100	32	12
12-11 x 7- 6	33	0.100	32	12
13- 1 x 8- 2	33	0.100	32	12
13- 1 x 8- 4	30	0.125	32	13
13-11 x 8- 5	30	0.125	32	13
14- 0 x 8- 7	30	0.125	32	13
13-11 x 9- 5	33	0.125	32	12
14- 3 x 9- 7	33	0.125	32	12
14- 8 x 9- 8	33	0.125	32	12
14-11 x 9-10	33	0.125	32	12
15- 4 x 10- 0	33	0.125	32	12
15- 7 x 10- 2	30	0.150	32	11
16- 1 x 10- 4	33	0.150	32	11
16- 4 x 10- 6	33	0.150	32	11
16- 9 x 10- 8	33	0.150	32	11
17- 0 x 10-10	33	0.150	32	10
17- 3 x 11- 0	33	0.150	32	10
17- 9 x 11- 2	30	0.175	32	10
18- 0 x 11- 4	33	0.175	32	10
18- 5 x 11- 6	33	0.175	32	10
18- 8 x 11- 8	33	0.175	32	9
19- 2 x 11- 9	30	0.200	32	9
19- 5 x 11-11	30	0.200	32	9
19-10 x 12- 1	33	0.200	32	9
20- 1 x 12- 3	33	0.200	32	9
20- 1 x 12- 6	33	0.200	32	9
20-10 x 12- 7	30	0.225	32	8
21- 1 x 12- 9	33	0.225	32	8
21- 6 x 12-11	33	0.225	32	8

TABLE III - 9 IN. x 2½ IN. CORRUGATIONS
ALUMINUM PIPE-ARCH ◪

H - HEIGHT OF COVER LIMIT. MAXIMUM HEIGHT OF FILL OVER THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

FILL HEIGHTS GREATER THAN MAXIMUM ALLOWED IN THE FILL HEIGHT TABLE REQUIRE SPECIAL DESIGN.

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER **H** (FT.) WALL THICKNESS (IN.)						
IN.		0.100	0.125	0.150	0.175	0.200	0.225	0.250
60	15	31	45	60	70	81	92	100
66	18	28	41	54	64	74	84	94
72	21	25	37	50	58	67	77	86
78	21	23	35	46	54	62	71	79
84	21	22	32	42	50	58	66	73
90	24	20	30	40	47	54	61	68
96	24	19	28	37	44	50	57	64
102	24	18	26	35	41	47	54	60
108	27	17	25	33	39	45	51	57
114	27	16	23	31	37	42	48	54
120	27	15	22	30	35	40	46	51
126	30	14	21	28	33	38	44	49
132	30	13	20	27	32	37	42	46
138	30		19	26	30	35	40	44
144	33	12	18	25	29	33	38	42
150	30		18	24	28	32	36	40
156	30		17	23	27	31	35	38
162	30			22	26	30	34	37
168	30			21	25	29	32	35
174	30			20	24	28	31	34
180	27				23	27	30	33
186	27				22	26	29	31
192	27					25	28	30
198	27					24	27	29
204	27					23	26	28
210	27						25	27
216	27							26
222	27							25
228	27							

TABLE IV - 9 IN. x 2½ IN. CORRUGATIONS
ROUND ALUMINUM PIPE

GENERAL NOTES

1. PIPE OR PIPE-ARCH WITH ENDS CUT TO FIT A SLOPE AND REPAIRED IN ACCORDANCE WITH SUBSECTION 707.09, SHALL BE REINFORCED AS SHOWN ON THE PLANS.
2. WHERE MULTIPLE PIPES ARE USED, THEY SHALL BE SPACED SO THAT ADJACENT SIDES OF THE PIPE SHALL BE AT LEAST ONE-HALF DIAMETER OR ONE-HALF SPAN APART TO PERMIT CAREFUL TAMPING OF THE BACKFILL MATERIAL, EXCEPT THAT THE CLEAR DISTANCE BETWEEN ADJACENT SIDES SHALL NOT BE MORE THAN 3 FT.
3. MINIMUM COVER FOR STRUCTURAL PLATE PIPE OR PIPE ARCH IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP. DURING CONSTRUCTION, ADEQUATE COVER SHALL BE PROVIDED TO PROTECT THE STRUCTURE FROM DAMAGE. THE COVER DURING CONSTRUCTION SHALL BE AT LEAST 1 FT.

▽ - PIPE ARCH WITH EQUAL PERIPHERY AND WITH SPAN AND RISE DIMENSIONS APPROXIMATELY EQUAL TO THOSE SPECIFIED ON THE PLANS WILL BE PERMITTED.

PIPE OR PIPE-ARCH CONFORMING TO SECTION 603 SHALL NOT BE SUBSTITUTED FOR STRUCTURAL PLATE PIPE OR PIPE-ARCH.

PIPE-ARCH DESIGN IS BASED ON CORNER BEARING PRESSURE ON THE SOIL OF 2 TONS PER SQUARE FT.

Computer File Information	
Creation Date: 07/04/12 Initials: DD	
Last Modification Date: 07/04/12 Initials: LTA	(R-X)
Full Path: www.coloradodot.info/business/designsupport	(R-X)
Drawing File Name: 510010101.dgn	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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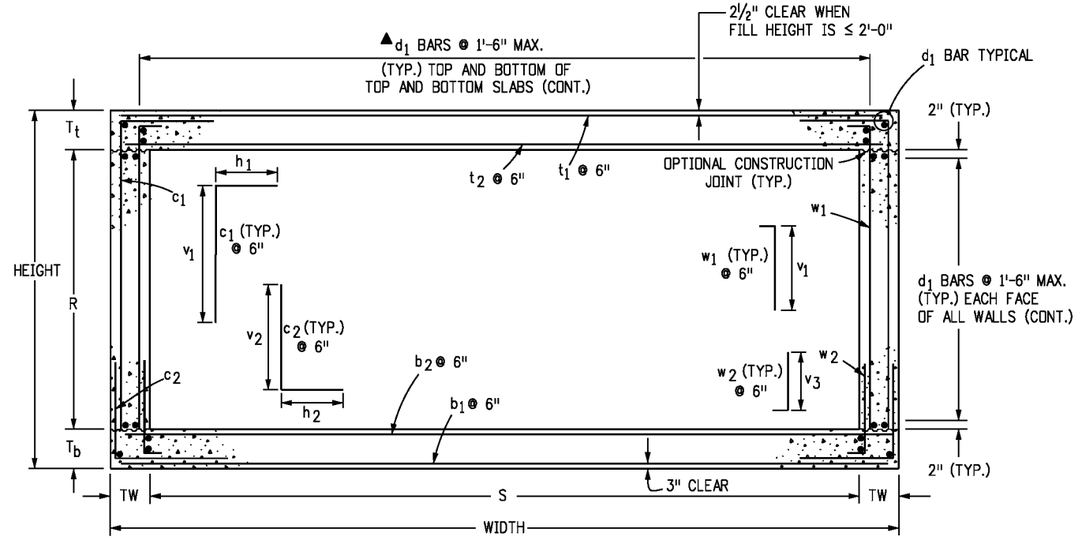
STRUCTURAL PLATE PIPE H-20 LOADING

Issued By: Project Development Branch July 4, 2012

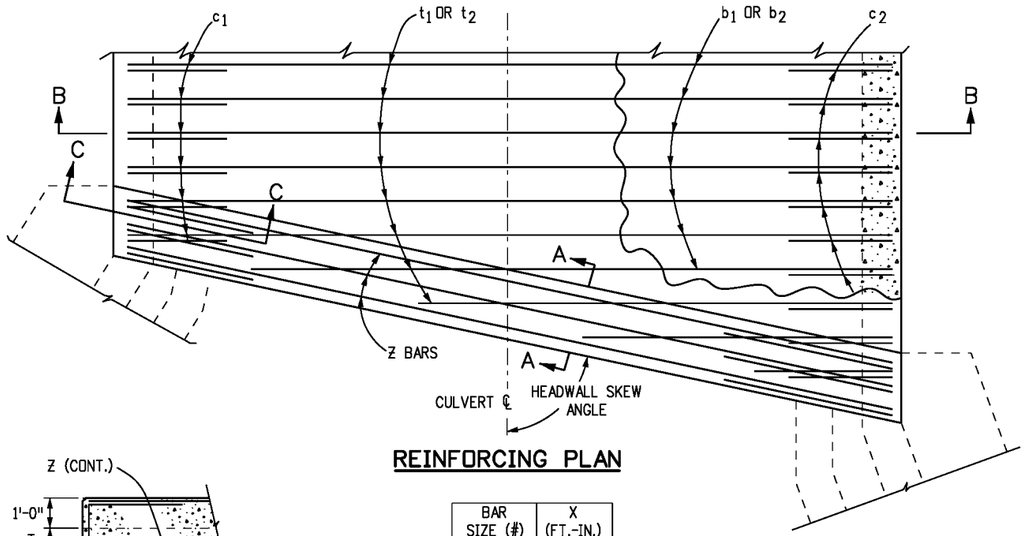
STANDARD PLAN NO.

M-510-1

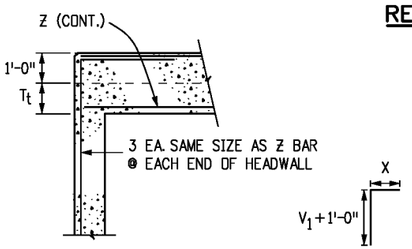
Sheet No. 1 of 1



SECTION B-B



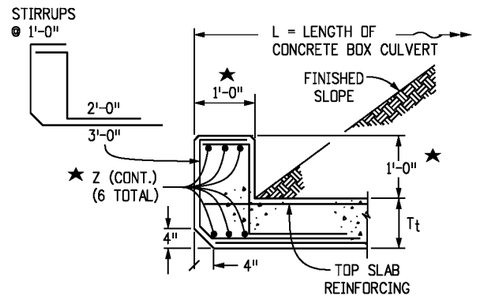
REINFORCING PLAN

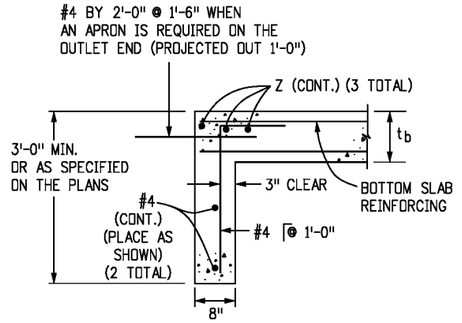


SECTION C-C

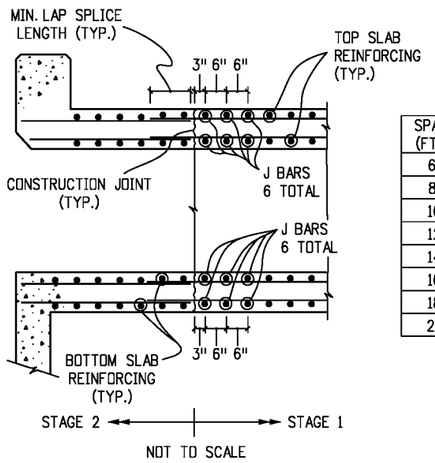
BAR SIZE (#)	X (FT.-IN.)
4	1-9
5	2-2
6	2-7
7	3-1
8	4-0
9	5-1
10	6-5
11	7-11

HEADWALL CORNER REINFORCING DETAIL





SECTION A-A



SPAN (FT.)	J BAR SIZE (#)
6	5
8	7
10	7
12	9
14	9
16	9
18	9
20	10

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS PERPENDICULAR TO THE ℄ OF THE BOX ONLY.

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'_c.
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-6"	1'-10"	2'-2"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-0"	1'-4"	1'-7"	1'-10"	2'-5"	3'-1"	3'-11"	4'-10"

11. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
13. ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
14. FILL HEIGHT IS THE DISTANCE MEASURED FROM TOP OF TOP SLAB TO TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.

▲ WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT., THE SPACING OF THE d_1 BARS IN THE BOTTOM OF THE TOP SLAB SHALL BE 6 IN. OR LESS. USE THE FOLLOWING EQUATION TO CALCULATE THE ADDITIONAL REINFORCING QUANTITY. WHERE S IS IN FEET:

ADDED REINFORCING, LBS./LIN FT. $= \left(\frac{S}{0.5} - \frac{S}{1.5}\right) \times 0.668 = 0.891\ S$

DESIGN DATA: 16TH EDITION OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES

SERVICE LOAD DESIGN METHOD

UNIT STRESSES: f_s = 24,000 psi., f_y = 60,000 psi., f'_c = 1,800 psi., f'_c = 4,500 psi., n = 8

LOADING DATA:

LIVE LOAD = AASHTO, HS 20-44 AND ALTERNATE MILITARY LOADING

DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.

DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.

FUTURE HMA OVERLAY = 48 LBS./SQ. FT. BASED ON 4 IN. THICKNESS

LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 16):

- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY ADDITIONAL STIRRUP LENGTH WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT OF GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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Drawing File Name: 601010102.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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SINGLE CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-601-1
Sheet No. 1 of 2

SINGLE CONCRETE BOX CULVERT DIMENSIONS & QUANTITIES (EXCLUDING HEADWALLS & TOEWALLS)

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES						d_1 ▲	DIMENSIONS					QUANTITIES	
S	R	HT.	WIDTH					t_1* & b_1	t_2	b_2	w_1* & w_2	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL
FT.	FT.	FT.-IN.	FT.-IN.	FT.-FT.	T_t	T_b	TW	#	#	#	#	#	#	NO.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	CU.YDS./LIN.FT.	LBS./LIN.FT.
6	7	8-5	7-8	0 TO 10	8	9	10	4	5	5	4	4	4	48	2-7	2-11	7-6	2-3	2-3	0.834	153
		8-7	7-8	>10 TO 15	8.5	10.5	10	4	5	5	4	4	4		2-7	3-1	7-6	2-4	2-4	0.882	154
		8-10	7-8	>15 TO 20	10	12.0	10	4	5	5	4	4	4		2-7	3-3	7-9	2-6	2-6	0.953	156
8	6	7-7.5	9-8	0 TO 10	9	10.5	10	4	6	6	4	4	4	52	3-4	2-10	6-7	2-4	2-4	0.952	184
		7-11	9-8	>10 TO 15	10.5	12.5	10	4	6	6	4	4	4		3-0	2-10	6-8	2-6	2-6	1.057	184
		8-3	9-8	>15 TO 20	12.5	14.5	10	4	7	7	4	4	4		3-2	2-11	6-10	2-8	2-8	1.176	207
	8	9-7.5	9-8	0 TO 10	9.0	10.5	10	4	6	6	4	5	4	60	4-5	3-5	8-7	2-4	2-4	1.076	224
		9-11	9-8	>10 TO 15	10.5	12.5	10	4	6	6	4	5	4		2-9	3-7	8-8	2-6	2-6	1.180	218
		10-3	9-8	>15 TO 20	12.5	14.5	10	4	6	6	4	5	4		2-9	3-9	8-10	2-8	2-8	1.299	221
	10	11-8	9-8	0 TO 10	9	11	10	4	6	5	5	5	5	64	2-9	2-9	10-7	2-10	2-10	1.214	253
		11-11	9-8	>10 TO 15	10.5	12.5	10	4	6	6	5	5	5		2-9	2-9	10-8	2-11	2-11	1.303	267
		12-3	9-11	>15 TO 20	12.5	14.5	11.5	4	6	6	5	5	5		2-11	5-1	10-10	3-1	3-1	1.536	282
10	6	7-10.5	11-8	0 TO 10	10.5	12.0	10	4	6	7	4	5	5	56	3-4	3-0	6-8	2-11	2-6	1.181	243
		8-3	11-8	>10 TO 15	12.5	14.5	10	4	7	7	4	5	4		3-4	2-11	6-10	3-1	2-8	1.343	248
		8-10	11-8	>15 TO 20	15.5	18.5	10	4	7	7	4	4	5		3-1	2-9	7-1	3-5	3-0	1.395	244
	8	9-10.5	11-8	0 TO 10	10.5	12.0	10	4	6	7	4	5	5	64	3-11	3-5	8-8	2-11	2-6	1.304	266
		10-3.5	11-8	>10 TO 15	13	14.5	10	4	7	7	4	5	5		4-1	3-6	8-11	3-1	2-8	1.484	282
		10-9	11-8	>15 TO 20	15.5	17.5	10	4	7	7	4	5	5		3-6	2-11	9-1	3-4	2-11	1.682	280
	10	11-11	11-8	0 TO 10	10.5	12.5	10	4	6	6	4	5	5	68	2-11	4-6	10-8	2-11	2-6	1.445	270
		12-3.5	11-8	>10 TO 15	12.5	15.0	10	4	7	7	5	6	5		3-4	4-10	10-10	3-7	3-2	1.608	354
		12-8	11-11	>15 TO 20	15.0	17.5	11.5	4	7	7	5	5	5		3-8	3-4	11-1	3-4	3-4	1.905	328
12	6	7-11	13-8	0 TO 8	10.5	12.5	10	4	7	7	4	6	5	60	3-11	3-8	6-8	3-4	2-6	1.341	306
		8-4	13-8	>8 TO 12	13	15	10	4	8	8	4	5	5		2-10	2-9	6-11	3-2	2-9	1.551	313
		8-9.5	13-8	>12 TO 16	15.5	18	10	4	8	8	4	5	5		3-6	2-9	7-1	3-5	3-0	1.783	319
		9-3.5	13-8	>16 TO 20	19.0	20.5	10	4	8	9	4	5	5		3-6	2-9	7-5	3-7	3-2	2.037	341
	8	9-11	13-8	0 TO 8	10.5	12.5	10	4	7	7	5	6	5	68	4-1	3-9	8-8	3-4	2-11	1.464	351
		10-4	13-8	>8 TO 12	13	15	10	4	8	8	4	6	5		3-4	2-9	8-11	3-6	2-9	1.675	358
		10-9.5	13-8	>12 TO 16	15.5	18	10	4	8	8	4	5	5		3-6	2-10	9-1	3-5	3-0	1.907	338
		11-3.5	13-8	>16 TO 20	18.5	21	10	4	8	8	4	5	5		3-6	3-0	9-4	3-8	3-3	2.160	342
	10	12-0	13-8	0 TO 8	11	13	10	4	7	7	4	6	5	72	5-3	4-4	10-8	3-5	2-7	1.630	360
		12-4.5	13-8	>8 TO 12	13	15.5	10	4	8	8	4	6	6		3-4	3-4	10-11	3-7	2-9	1.819	393
		12-9.5	13-9	>12 TO 16	15.5	18	10.5	4	8	8	4	6	5		4-3	3-2	11-1	3-10	3-0	2.070	390
		13-2	13-11	>16 TO 20	18	20	11.5	4	8	8	4	6	5		4-4	3-5	11-4	4-0	3-2	2.342	396
14	6	7-11.5	15-8	0 TO 6	11	12.5	10	4	8	8	5	6	6	68	4-3	4-0	6-9	3-4	2-11	1.507	408
		8-2	15-8	>6 TO 8	12	14	10	4	8	8	4	6	6		4-1	3-4	6-10	3-6	2-8	1.628	386
		8-5	15-8	>8 TO 10	13.5	15.5	10	4	8	8	4	6	5		3-4	2-9	6-11	3-7	2-9	1.773	368
		8-9	15-8	>10 TO 12	15.5	17.5	10	4	9	9	4	6	5		4-3	2-10	7-1	3-9	2-11	1.966	421
		9-4.5	15-8	>12 TO 16	19.5	21	10	4	9	9	4	5	5		3-6	2-10	7-5	3-8	3-3	2.329	400
		9-7.5	15-8	>16 TO 18	21	22.5	10	4	9	9	4	5	5		3-6	2-11	7-7	3-9	3-4	2.474	402
	8	10-0	15-8	0 TO 6	11	13	10	4	8	8	5	6	6	76	4-4	4-1	8-9	3-5	3-0	1.654	435
		10-2	15-8	>6 TO 8	12	14	10	4	8	8	4	6	6		4-2	3-7	8-10	3-6	2-8	1.751	410
		10-5.5	15-8	>8 TO 10	13.5	16	10	4	8	8	4	6	5		3-4	2-11	8-11	3-8	2-10	1.920	394
		10-10	15-8	>10 TO 12	15.5	18.5	10	4	9	9	4	6	5		4-3	2-11	9-1	3-10	3-0	2.138	444
		11-3.5	15-9	>12 TO 16	18.5	21	10.5	4	9	9	4	5	5		3-7	3-1	9-4	3-8	3-3	2.439	421
		11-6.5	15-8	>16 TO 18	20	22.5	10	4	9	9	4	5	5		3-6	3-1	9-6	3-9	3-4	2.549	419
	10	12-0	15-8	0 TO 6	11	13	10	4	8	8	5	6	6	80	4-10	4-4	10-9	3-5	3-0	1.778	455
		12-2.5	15-8	>6 TO 8	12	14.5	10	4	8	8	4	6	6		4-10	4-3	10-10	3-6	2-8	1.899	439
		12-5.5	15-9	>8 TO 10	13.5	16	10.5	4	8	8	4	6	6		3-4	3-5	10-11	3-8	2-10	2.082	426
		12-9.5	15-9	>10 TO 12	15.5	18	10.5	4	8	8	4	6	6		4-3	3-4	11-1	3-10	3-0	2.277	436
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16	6	8-2.5	17-9	0 TO 6	12.5	14	10.5	4	8	8	4	7	6	72	4-7	3-11	6-10	3-6	2-8	1.841	452
		8-5.5	17-11	>6 TO 8	13.5	16	11.5	4	8	8	5	7	6		3-10	3-5	6-11	3-8	3-3	2.057	463
		8-9	17-10	>8 TO 10	15.5	17.5	11	4	9	9	5	7	6		4-10	3-5	7-1	3-9	3-4	2.242	524
	8	10-3.5	17-9	0 TO 6	12.5	15	10.5	4	8	8	5	7	6	80	4-7	3-10	8-10	3-7	3-2	2.025	497
		10-6.5	17-10	>6 TO 8	14.0	16.5	11.0	4	9	9	4	7	6		3-8	3-4	9-0	4-2	2-10	2.189	522
		10-11	17-9	>8 TO 10	16.5	18.5	10.5	4	9	9	4	6	5		4-3	3-2	9-2	3-10	3-0	2.436	484
	10	12-4.5	17-8	0 TO 6	13.5	15	10	4	8	9	5	7	6	84	4-9	4-3	10-11	3-7	3-2	2.171	554
		12-8	17-9	>6 TO 8	15	17	10.5	4	9	9	4	6	6		4-3	3-4	11-1	3-9	2-11	2.401	515
		12-11	17-9	>8 TO 10	16.5	18.5	10.5	4	9	9	4	6	6		4-3	3-4	11-2	3-10	3-0	2.566	516
18	8	10-5	19-11	0 TO 5	13.5	15.5	11.5	4	8	9	5	7	7	84	5-2	4-5	8-11	4-1	3-2	2.351	588
		10-9	19-10	>5 TO 7	15.5	17.7	11	4	9	9	4	7	6		4-10	3-11	9-1	3-9	2-11	2.563	565
	10	12-6	19-10	0 TO 5	14	16	11	4	9	9	4	7	6	88	5-1	4-6	11-0	3-8	2-10	2.515	598
		12-9	19-11	>5 TO 7	15.5	17.5	11.5	4	9	9	4	7	6		5-0	4-5	11-1	3-10	2-11	2.738	597
20	8	10-3.5	22-0	0 TO 3	13.5	15	12	5	9	9	5	7	8	92	5-9	5-2	8-11	4-1	3-2	2.528	700
		10-9.5	22-2	>3 TO 6	16	17.5	13	4	9	9	4	7	7		5-5	4-9	9-2	4-3	2-11	2.934	646
		11-0.5	22-3	>6 TO 8	17	19.5	13.5	4	9	10	4	8	7		5-8	4-7	9-3	4-5	3-1	3.173	727
		11-5.5	22-2	>8 TO 10	19.5	22	13	4	10	10	4	7	6		5-0	4-4	9-4	4-2	3-4	3.481	702
	10	12-5.5	21-11	0 TO 3	15	15.5	11.5	4	9	9	5	7	7	96	5-4	4-11	11-1	4-1	3-2	2.773	692
		12-9	22-1	>3 TO 6	15	18	12.5	4	9	10	4	8	7		5-8	4-9	11-1	4-4	3-0	3.021	751
		13-0.5	22-1	>6 TO 8	17	19.5	12.5	4	10	10	4	8	7		5-7	4-7	11-3	4-5	3-1	3.259	792
		13-5.5	22-2	>8 TO 10	19.5	22	13	4	10	10	4	7	6		5-1	4-7	11-5	4-2	3-4	3.642	728

HEADWALL AND TOEWALL QUANTITIES

HEADWALL SKEW ANGLE	90° TO 75°			74° TO 60°			59° TO 45°		
SPAN - S	℄	STIRRUPS	REBAR QUANT.		STIRRUPS	REBAR QUANT.	℄	STIRRUPS	REBAR QUANT.
	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.
6	4	4	22.1	4	4	21.9	4	4	21.3
8	4	4	22.5	4	4	22.3	5	4	28.0
10	5	4	28.2	5	4	27.9	7	4	43.2
12	5	4	27.6	6	4	34.5	8	5	56.4
14	6	4	34.0	7	4	41.9	10	5	81.5
16	6	4	32.3	8	5	53.3	★	★	★
18	7	4	39.0	9	5	62.6	★	★	★
20	7	4	38.6	11	6	96.9	★	★	★
CONCRETE QUANTITY = 0.085 CU.YDS./LIN.FT.									

NOTES

1. QUANTITIES ARE PER LINEAR FOOT (OF HEADWALL) FOR ONE HEADWALL AND TOEWALL AND INCLUDE ALL HEADWALL AND TOEWALL REINFORCING STEEL. QUANTITY INCLUDED WAS CALCULATED PER 1 FT. STRIP. SKEW ANGLE MAY VARY. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.

★ 2. A SKEWED HEADWALL IS NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

3. FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.

4. WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT.-0 IN., ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (*), AND THE d_1 IN THE BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

5. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.

6. WHEN AN R (RISE) OF LESS THAN 6 FT. IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT. RISE (IF AVAILABLE ON THE TABLE).

▲ 7. THE SIZE OF d_1 BARS IS #4. THE NUMBER OF BARS REQUIRED IS LISTED.

Computer File Information	
Creation Date: 07/04/12 Initials: DD	
Last Modification Date: 07/04/12 Initials: LTA	(R-X)
Full Path: www.coloradodot.info/business/designsupport	(R-X)
Drawing File Name: 601010202.dgn	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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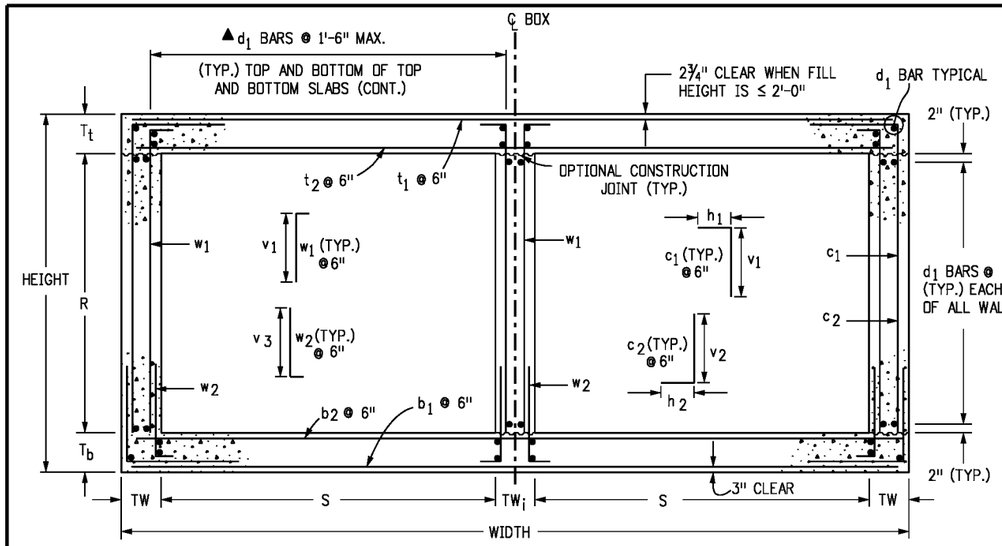
SINGLE CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

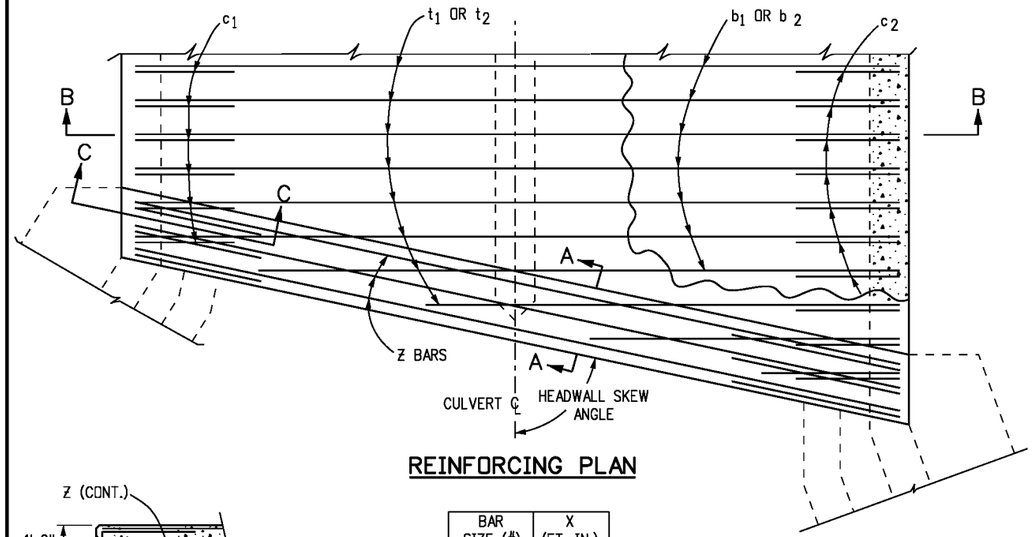
STANDARD PLAN NO.

M-601-1

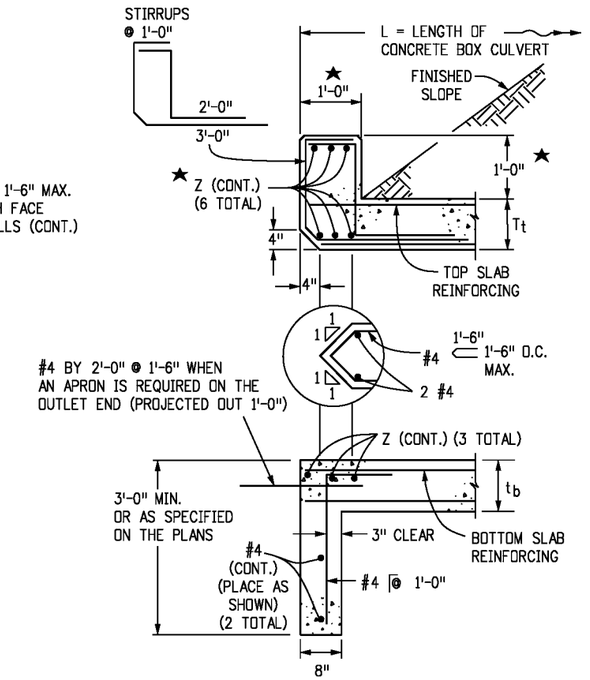
Sheet No. 2 of 2



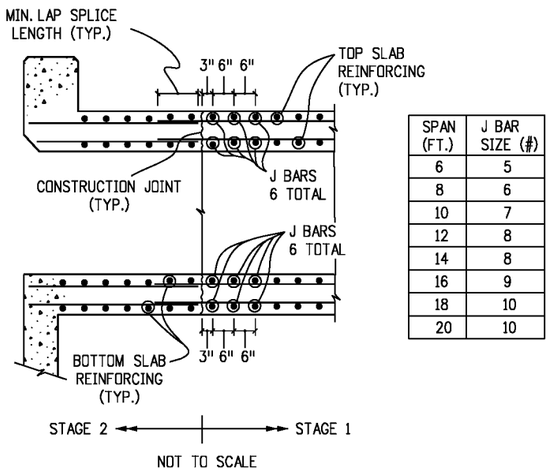
SECTION B-B



REINFORCING PLAN



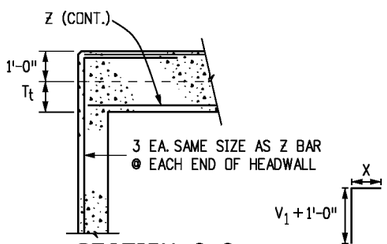
SECTION A-A



SPAN (FT.)	J BAR SIZE (#)
6	5
8	6
10	7
12	8
14	8
16	9
18	10
20	10

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS PERPENDICULAR TO THE ℄ OF THE BOX ONLY.



SECTION C-C

BAR SIZE (#)	X (FT.-IN.)
4	1-9
5	2-2
6	2-7
7	3-1
8	4-0
9	5-1
10	6-5
11	7-11

HEADWALL CORNER REINFORCING DETAIL

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'_c
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-6"	1'-10"	2'-2"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-0"	1'-4"	1'-7"	1'-10"	2'-5"	3'-1"	3'-11"	4'-10"

11. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
13. ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
14. FILL HEIGHT IS THE DISTANCE MEASURED FROM TOP OF TOP SLAB TO TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.

▲ WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT., THE SPACING OF THE d_1 BARS IN THE BOTTOM OF THE TOP SLAB SHALL BE 6 IN. OR LESS. USE THE FOLLOWING EQUATION TO CALCULATE THE ADDITIONAL REINFORCING QUANTITY. WHERE S IS IN FEET:

ADDED REINFORCING, LBS./LIN FT. = $2 \times \left(\frac{S}{0.5} - \frac{S}{1.5}\right) \times 0.668 = 1.781\ S$

DESIGN DATA: 16TH EDITION OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES

SERVICE LOAD DESIGN METHOD

UNIT STRESSES: f_s = 24,000 psi., f_y = 60,000 psi., f'_c = 1,800 psi., f'_c = 4,500 psi., n = 8

LOADING DATA:

LIVE LOAD = AASHTO, HS 20-44 AND ALTERNATE MILITARY LOADING

DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.

DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 120 LBS./CU. FT. HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.

FUTURE HMA OVERLAY = 48 LBS./SQ. FT. BASED ON 4 IN. THICKNESS

LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 16):

- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY ADDITIONAL STIRRUP LENGTH WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT OF GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

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DOUBLE CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

M-601-2

Sheet No. 1 of 2

DOUBLE CONCRETE BOX CULVERT DIMENSIONS & QUANTITIES (EXCLUDING HEADWALLS & TOEWALLS)

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES							d_1▲	DIMENSIONS					QUANTITIES	
S	R	HT.	WIDTH		T_t	T_b	TW & TW_1	t_1*	t_2	b_1	b_2	w_1* & w_2	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL
FT.	FT.	FT.-IN.	FT.-IN.	FT.-FT.				#	#	#	#	#	#	#	NO.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	CU.YDS./LIN.FT.	LBS./LIN.FT.
6	6	7-5	14-6	0 TO 10	8	9	10	5	5	5	4	4	4	4	74	2-7	2-7	6-6	2-3	2-3	1.316	248
		7-8	14-6	>10 TO 15	9	11	10	5	5	5	4	4	4	4		2-7	2-7	6-7	2-5	2-5	1.457	250
		7-11	14-6	>15 TO 20	11	12	10	5	4	5	4	4	4	4		2-7	2-7	6-9	2-6	2-6	1.585	241
	8	9-5	14-6	0 TO 10	8	9	10	5	5	5	4	4	4	4	86	2-7	2-7	8-6	2-3	2-3	1.502	272
		9-8	14-6	>10 TO 15	9	11	10	5	5	4	4	4	4	4		2-7	2-7	8-7	2-5	2-5	1.636	264
		9-11	14-6	>15 TO 20	11	12	10	5	4	5	4	4	4	4		2-7	2-7	8-9	2-6	2-6	1.770	263
	10	11-6	14-6	0 TO 10	8	10	10	4	5	4	4	4	5	5	92	2-9	2-9	10-6	2-9	2-4	1.731	299
		11-8	14-6	>10 TO 15	9	11	10	4	5	4	4	5	5	5		2-9	2-9	10-7	2-10	2-11	1.821	353
		12-0	14-10.5	>15 TO 20	11	13	11.5	4	4	5	4	5	5	5		2-11	2-11	10-9	3-0	3-0	2.167	360
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		8-6	18-6	>15 TO 20	14	16	10	6	5	6	5	4	4	4		2-7	2-7	7-0	2-11	2-11	2.269	344
	8	9-9	18-6	0 TO 10	10	11	10	6	5	6	4	4	4	5	102	2-7	2-9	8-8	2-10	2-5	1.940	357
		10-2	18-6	>10 TO 15	12	14	10	6	5	5	5	4	4	4		2-7	2-7	8-10	2-8	2-8	2.225	348
		10-6	18-6	>15 TO 20	14	16	10	6	5	6	5	4	4	4		2-7	2-7	9-0	2-11	2-11	2.454	368
10	6	7-7	22-6	0 TO 5	9	10	10	7	6	7	5	4	5	6	98	2-9	3-4	6-7	3-2	2-4	1.875	490
		8-1	22-6	>5 TO 10	12	13	10	7	5	7	5	4	4	5		2-7	2-9	6-10	3-0	2-7	2.292	435
		8-7	22-6	>10 TO 15	15	16	10	7	5	7	5	4	4	4		3-1	2-7	7-1	2-10	2-10	2.708	439
		9-1	22-6	>15 TO 20	18	19	10	7	6	7	6	4	5	5		3-6	2-9	7-4	3-6	3-1	3.125	512
	8	9-7	22-6	0 TO 5	9	10	10	7	6	7	5	4	5	6	110	2-9	3-4	8-7	3-2	2-4	2.060	519
		10-1	22-6	>5 TO 10	12	13	10	7	5	7	5	4	4	5		2-7	2-9	8-10	3-0	2-7	2.477	470
		10-7	22-6	>10 TO 15	15	16	10	7	5	7	5	4	4	4		3-1	2-7	9-1	2-10	2-10	2.894	465
		11-0	22-6	>15 TO 20	17	19	10	7	6	7	5	4	5	5		3-6	2-9	9-3	3-6	3-1	3.241	520
	10	11-8	22-6	0 TO 5	9	11	10	7	6	6	5	4	5	6	116	2-9	3-4	10-7	3-3	2-5	2.315	519
		12-1	22-6	>5 TO 10	12	13	10	6	5	7	5	4	5	5		2-9	2-9	10-10	3-0	2-7	2.662	487
		12-6	22-6	>10 TO 15	14	16	10	7	5	6	5	4	5	5		2-9	2-9	11-0	3-3	2-10	3.009	491
		13-0	22-10.5	>15 TO 20	17	19	11.5	7	5	7	5	5	5	5		3-8	2-11	11-3	3-6	3-6	3.606	582
12	6	7-9	26-6	0 TO 5	10	11	10	8	6	8	5	4	6	6	106	2-9	3-4	6-8	3-3	2-5	2.273	634
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		9-0	26-6	>10 TO 15	17	19	10	8	6	8	6	4	5	5		3-6	2-9	7-3	3-6	3-2	3.500	640
	8	9-10	26-6	0 TO 5	10	12	10	8	6	7	5	4	6	6	118	2-9	3-4	8-8	3-4	2-6	2.540	633
		10-5	26-6	>5 TO 10	14	15	10	7	6	8	6	4	4	5		2-7	2-9	9-0	3-2	2-9	3.113	607
		11-0	26-6	>10 TO 15	17	19	10	8	6	7	6	4	5	5		3-6	2-9	9-3	3-6	3-1	3.685	633
	10	11-11	26-6	0 TO 5	11	12	10	8	6	7	5	4	5	6	124	2-9	3-4	10-9	3-4	2-6	2.807	635
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		13-0	26-6	>10 TO 15	17	19	10	8	6	7	6	4	5	5		3-6	2-9	11-3	3-6	3-1	3.870	656
14	6	8-2	30-6	0 TO 5	13	13	10	8	6	8	6	4	5	6	122	2-9	3-4	6-11	3-5	2-7	3.003	722
		9-0	30-6	>5 TO 10	17	19	10	8	6	8	6	4	5	5		3-6	2-9	7-3	3-6	3-1	3.944	717
		9-2	30-6	>10 TO 12	19	19	10	8	6	8	6	4	5	5		3-6	2-9	7-5	3-6	3-1	4.133	718
	8	10-1	30-6	0 TO 5	12	13	10	8	6	8	6	4	5	6	134	2-9	3-4	8-10	3-5	2-7	3.094	753
		10-11	30-6	>5 TO 10	17	18	10	8	6	8	6	4	5	5		3-6	2-9	9-3	3-5	3-0	4.035	743
		11-2	30-6	>10 TO 12	19	19	10	8	6	8	6	4	5	5		3-6	2-9	9-5	3-6	3-1	4.318	746
	10	12-0	30-6	0 TO 5	12	13	10	8	6	8	6	4	5	6	140	2-9	3-4	10-10	3-5	2-7	3.279	772
		12-4	30-6	>5 TO 7	13	15	10	8	6	8	6	4	5	6		2-9	3-4	10-11	3-7	2-9	3.562	774
		13-1	30-6	>7 TO 12	18	19	10	8	6	8	6	4	5	5		3-6	2-9	11-4	3-6	3-1	4.409	768
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		10-9	34-6	>5 TO 7	16	17	10	9	7	9	7	4	5	5		3-6	2-9	9-2	3-4	3-0	4.255	987
		11-4	34-6	>7 TO 10	19	21	10	9	7	9	7	4	5	5		3-6	2-9	9-5	3-8	3-3	5.000	993
	10	12-1	34-6	0 TO 2	12	13	10	8	7	8	6	4	6	7	148	3-4	3-8	10-10	3-11	2-7	3.588	930
		12-5	34-6	>2 TO 5	14	15	10	9	7	9	6	4	6	6		3-4	3-4	11-0	3-7	2-9	4.014	1013
		12-10	34-6	>5 TO 7	16	18	10	9	7	8	6	4	6	5		4-3	2-9	11-2	3-10	3-0	4.546	957
18	6	8-5	38-6	0 TO 2	14	15	10	9	8	9	6	5	7	7	138	3-8	3-8	7-0	4-1	3-2	4.002	1179
		8-7	38-6	>2 TO 5	15	16	10	10	7	10	7	4	6	6		4-3	3-4	7-1	3-8	2-10	4.239	1229
		9-2	38-6	>5 TO 7	19	19	10	9	7	10	7	4	5	5		3-6	2-9	7-5	3-6	3-1	5.071	1125
	8	10-5	38-6	0 TO 2	14	15	10	9	8	9	7	4	7	7	150	3-8	3-8	9-0	4-1	2-11	4.187	1209
		10-9	38-6	>2 TO 5	15	18	10	10	7	9	7	4	6	6		4-3	3-4	9-1	3-10	3-0	4.662	1193
		11-2	38-6	>5 TO 7	19	19	10	9	7	10	7	4	5	5		3-6	2-9	9-5	3-6	3-2	5.256	1152
	10	12-7	38-6	0 TO 2	14	17	10	9	8	8	6	4	7	7	156	3-8	3-8	11-0	4-3	2-9	4.610	1151
		12-9	38-6	>2 TO 5	15	18	10	10	7	9	7	4	6	6		4-3	3-4	11-1	3-10	3-0	4.847	1222
		13-4	38-6	>5 TO 7	19	21	10	9	7	9	9	4	5	5		3-6	2-9	11-5	3-8	3-3	5.679	1214
20	6	8-7	42-6	0 TO 2	15	16	10	10	8	10	7	5	7	7	154	4-9	3-8	7-1	4-2	3-3	4.622	1487
		9-1	42-6	>2 TO 5	19	18	10	9	8	10	7	4	5	6		3-6	3-4	7-5	3-10	3-0	5.409	1300
	8	10-9	42-6	0 TO 2	15	18	10	10	8	9	7	4	7	6	166	4-9	3-4	9-1	4-4	3-0	5.069	1387
		11-0	42-6	>2 TO 5	18	18	10	10	8	10	7	4	5	6		3-6	3-4	9-4	3-10	3-0	5.463	1402
	10	12-8	42-6	0 TO 2	15	17	10	10	8	9	7	4	7	7	172	4-9	3-8	11-1	4-3	2-11	5.123	1437
		12-11	42-6	>2 TO 5	17	18	10	10	8	10	7	4	6	6		4-3	3-4	11-3	3-10	3-0	5.517	1456

HEADWALL AND TOEWALL QUANTITIES

HEADWALL SKEW ANGLE	90° TO 75°			74° TO 60°			59° TO 45°		
SPAN - S	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
FT.	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.
6	4	4	22.8	4	4	22.5	4	4	21.9
8	4	4	21.4	4	4	21.2	5	4	25.5
10	5	4	26.4	5	4	25.3	7	4	38.3
12	5	4	25.4	6	4	30.9	8	5	44.9
14	6	4	30.6	7	4	37.0	10	5	68.9
16	6	4	29.9	8	5	47.8	★	★	★
18	7	4	35.8	9	5	56.1	★	★	★
20	7	4	34.0	11	6	83.8	★	★	★
CONCRETE QUANTITY = 0.085 CU.YDS./LIN.FT.									

NOTES

1. QUANTITIES ARE PER LINEAR FOOT (OF HEADWALL) FOR ONE HEADWALL AND TOEWALL AND INCLUDE ALL HEADWALL AND TOEWALL REINFORCING STEEL. QUANTITY INCLUDED WAS CALCULATED PER 1 FT. STRIP. SKEW ANGLE MAY VARY. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.

★ 2. A SKEWED HEADWALL IS NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

3. FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.

4. WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT.-0 IN., ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (*), AND THE d_1 IN THE BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

5. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.

6. WHEN AN R (RISE) OF LESS THAN 6 FT. IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT. RISE (IF AVAILABLE ON THE TABLE).

▲ 7. THE SIZE OF d_1 BARS IS #4. THE NUMBER OF BARS REQUIRED IS LISTED.

Computer File Information	
Creation Date: 07/04/12 Initials: DD	
Last Modification Date: 07/04/12 Initials: LTA	(R-X)
Full Path: www.coloradodot.info/business/designsupport	(R-X)
Drawing File Name: 601020202.dgn	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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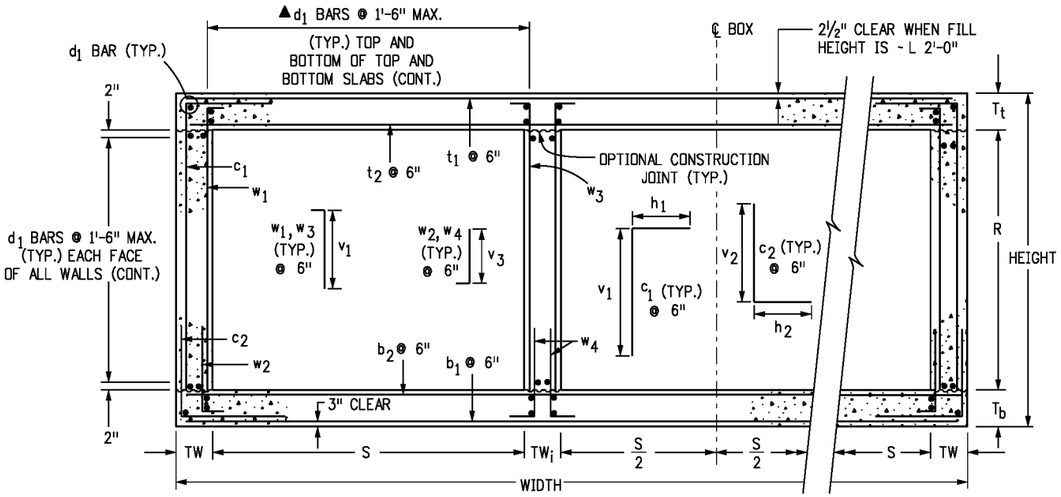
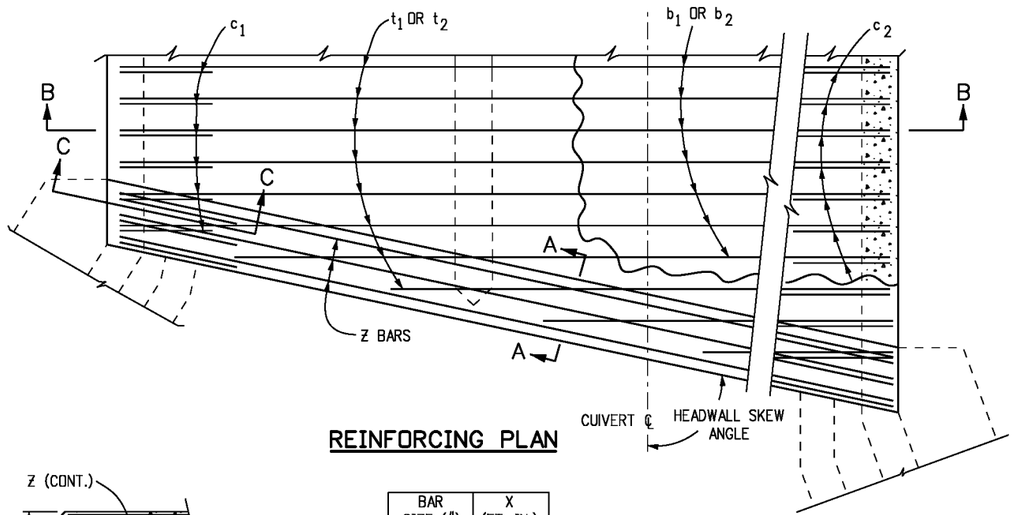
DOUBLE CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

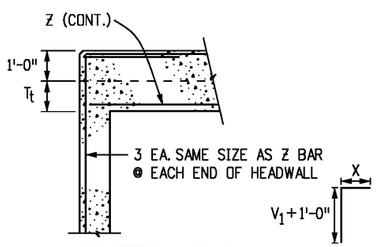
STANDARD PLAN NO.
M-601-2



SECTION B-B



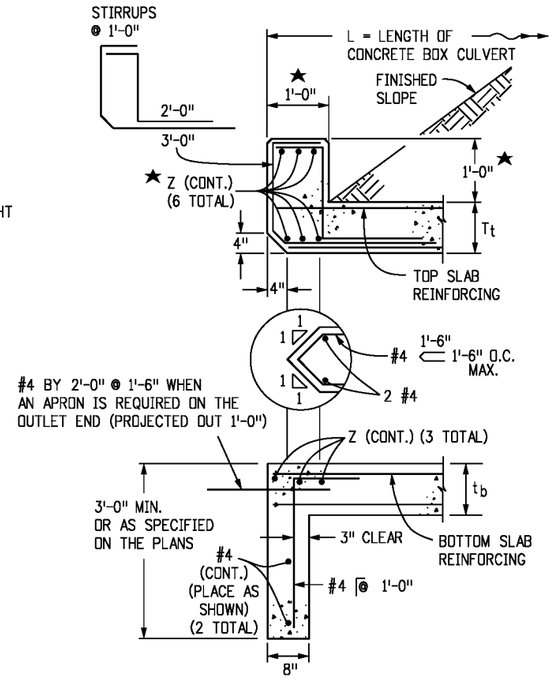
REINFORCING PLAN



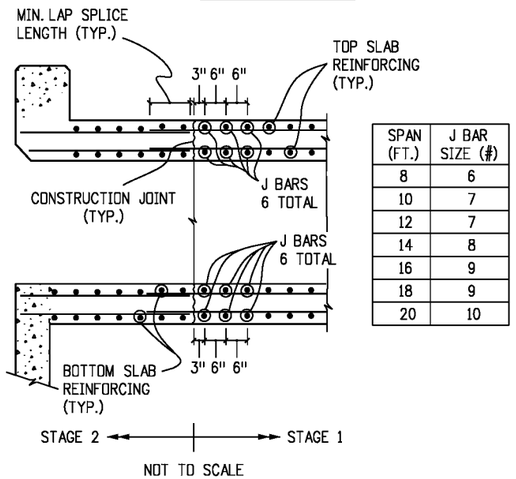
BAR SIZE (#)	X (FT.-IN.)
4	1-9
5	2-2
6	2-7
7	3-1
8	4-0
9	5-1
10	6-5
11	7-11

SECTION C-C

HEADWALL CORNER REINFORCING DETAIL



SECTION A-A



SPAN (FT.)	J BAR SIZE (#)
8	6
10	7
12	7
14	8
16	9
18	9
20	10

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS PERPENDICULAR TO THE ℄ OF THE BOX ONLY.

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'_c.
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-6"	1'-10"	2'-2"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-0"	1'-4"	1'-7"	1'-10"	2'-5"	3'-1"	3'-11"	4'-10"

11. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
13. ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
14. FILL HEIGHT IS THE DISTANCE MEASURED FROM TOP OF TOP SLAB TO TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.

▲ WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT., THE SPACING OF THE d_1 BARS IN THE BOTTOM OF THE TOP SLAB SHALL BE 6 IN. OR LESS. USE THE FOLLOWING EQUATION TO CALCULATE THE ADDITIONAL REINFORCING QUANTITY. WHERE S IS IN FEET:

ADDED REINFORCING, LBS./LIN FT. = $3 \times \left(\frac{S}{0.5} - \frac{S}{1.5}\right) \times 0.668 = 2.672\ S$

DESIGN DATA: 16TH EDITION OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES

SERVICE LOAD DESIGN METHOD

UNIT STRESSES: $f_s = 24{,}000$ psi., $f_y = 60{,}000$ psi., $f_c = 1{,}800$ psi., $f'_c = 4{,}500$ psi., $n = 8$

LOADING DATA:

LIVE LOAD = AASHTO, HS 20-44 AND ALTERNATE MILITARY LOADING

DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.

DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.

FUTURE HMA OVERLAY = 48 LBS./SQ. FT. BASED ON 4 IN. THICKNESS

LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 16):
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY ADDITIONAL STIRRUP LENGTH WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 16.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT OF GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

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Project Development Branch DD/LTA

TRIPLE CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-601-3
Sheet No. 1 of 2

TRIPLE CONCRETE BOX CULVERT DIMENSIONS & QUANTITIES (EXCLUDING HEADWALLS & TOEWALLS)

BOX SIZE			FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES								d_1 ▲	DIMENSIONS					QUANTITIES	
S	R	HT.	WIDTH		T_t	T_b	TW & TW_i	t_1*	t_2	b_1	b_2	w_1* & w_2	w_3* & w_4	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL
FT.	FT.	FT.-IN.	FT.-IN.	FT.-FT.				#	#	#	#	#	#	#	#	NO.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	FT.-IN.	CU.YDS./LIN.FT.	LBS./LIN.FT.
8	6	7-6.5	27-4	0 TO 8	8.5	10	10	6	6	6	4	4	4	5	6	128	2-9	3-4	6-6	2-9	2-5	2.301	526
		7-9.5	27-4	>8 TO 12	10	11.5	10	6	5	6	5	4	4	4	5		2-7	2-9	6-8	2-5	2-5	2.555	490
		8-1.5	27-4	>12 TO 16	12	13.5	10	6	5	6	5	4	4	4	5		2-7	2-9	6-9	2-8	2-8	2.892	495
		8-5.5	27-4	>16 TO 20	14	15.5	10	6	5	6	5	4	4	4	4		2-7	2-7	7-0	2-9	2-9	3.229	486
		8-9.5	27-4	>20 TO 26	16	17.5	10	6	6	6	5	4	4	4	5		3-1	2-7	7-2	3-4	2-11	3.567	529
		9-1	27-4	>26 TO 30	18	19	10	6	6	6	5	4	4	5	5		3-6	2-9	7-4	3-6	3-1	3.862	545
	8	9-6.5	27-4	0 TO 8	8.5	10	10	6	6	6	4	4	4	5	6	144	2-9	3-4	8-6	2-9	2-4	2.548	521
		9-9.5	27-4	>8 TO 12	10	11.5	10	6	5	6	5	4	4	4	5		2-7	2-9	8-8	2-10	2-5	2.801	524
		10-1.5	27-4	>12 TO 16	12	13.5	10	6	5	5	5	4	4	4	5		2-7	2-9	8-10	2-7	2-7	3.139	502
		10-5	27-4	>16 TO 22	14.5	16	10	6	5	6	5	4	4	4	4		2-7	2-7	9-0	2-11	2-11	3.561	523
		11-0.5	27-10	>22 TO 30	17.5	19	11.5	6	5	6	5	4	4	5	5		3-10	2-11	9-3	3-6	3-1	4.271	567
10	6	7-9.5	33-4	0 TO 8	10	11.5	10	7	6	7	5	4	4	5	5	140	2-9	2-9	6-8	2-10	2-6	2.953	678
		8-2.5	33-4	>8 TO 12	12.5	14	10	6	6	6	5	4	4	4	4		2-7	2-7	6-10	2-8	2-8	3.467	608
		8-6.5	33-4	>12 TO 16	14.5	16	10	7	6	6	6	4	4	4	4		2-7	2-7	7-0	2-11	2-11	3.879	656
		9-1.5	33-4	>16 TO 22	18	19.5	10	7	6	6	6	4	4	5	5		3-6	2-9	7-4	3-6	3-1	4.599	692
	8	9-7.5	33-4	0 TO 6	9	10.5	10	7	6	7	5	4	4	5	5	156	2-9	2-9	8-7	2-9	2-4	2.994	711
		9-9.5	33-4	>6 TO 8	10	11.5	10	7	6	7	5	4	4	5	5		2-9	2-9	8-8	2-11	2-5	3.200	728
		10-2.5	33-4	>8 TO 12	12.5	14	10	6	6	6	5	4	4	4	5		2-7	2-9	8-10	2-8	2-8	3.714	625
		10-6.5	33-4	>12 TO 16	14.5	16	10	6	6	6	6	4	4	4	4		2-7	2-7	9-0	2-9	2-9	4.126	651
		11-1.5	33-4	>16 TO 22	18	19.5	10	6	6	6	6	4	4	5	5		3-6	2-9	9-4	3-6	3-1	4.846	691
	10	11-9.5	33-4	0 TO 8	10	11.5	10	6	6	6	5	4	4	5	5	164	2-9	3-4	10-8	2-10	2-5	3.447	673
		12-2	33-4	>8 TO 12	12	14	10	6	5	6	5	4	4	5	5		2-9	2-9	10-10	3-1	2-8	3.909	665
		12-4.5	33-4	>12 TO 14	13.5	15	10	6	5	6	5	4	4	5	5		2-9	2-9	10-11	3-2	2-9	4.167	648
		12-6.5	33-6	>14 TO 16	14.5	16	10.5	6	6	6	5	4	4	5	5		2-10	2-10	11-0	3-3	2-10	4.450	677
		13-1	34-0	>16 TO 22	17.5	19.5	12	6	6	6	6	5	4	5	5		3-8	2-11	11-3	3-6	3-6	5.304	754
12	6	7-8.5	39-4	0 TO 4	9.5	11	10	7	6	7	5	4	5	5	6	152	2-9	3-4	6-7	2-10	2-10	3.229	816
		8-0.5	39-4	>4 TO 8	11.5	13	10	7	6	7	6	4	4	5	5		2-9	2-9	6-9	3-0	2-6	3.715	802
		8-3.5	39-4	>8 TO 10	13	14.5	10	7	6	7	6	4	4	5	5		2-9	2-9	6-11	3-1	2-8	4.079	807
		8-5.5	39-4	>10 TO 12	14.5	16	10	7	6	7	6	4	4	4	4		2-7	2-7	7-0	2-9	2-9	4.443	783
		9-0.5	39-4	>12 TO 16	17.5	19	10	7	7	7	6	4	4	5	5		3-6	2-9	7-3	3-6	3-1	5.172	862
		9-2.5	39-4	>16 TO 18	18.5	20	10	7	7	7	7	4	4	5	5		3-6	2-9	7-4	3-7	3-2	5.415	906
	8	9-9.5	39-4	0 TO 4	10	11.5	10	7	6	7	5	4	5	6	7	168	3-4	3-8	8-8	3-3	2-11	3.598	903
		10-0.5	39-4	>4 TO 8	11.5	13	10	7	6	7	6	4	4	5	5		2-9	2-9	8-9	3-0	2-8	3.962	840
		10-6.5	39-4	>8 TO 12	14.5	16	10	7	6	7	6	4	4	5	4		2-9	2-7	9-0	2-10	2-10	4.690	834
		11-2.5	39-4	>12 TO 18	18.5	20	10	7	7	7	6	4	4	5	5		3-6	2-9	9-4	3-7	3-2	5.662	899
	10	11-8.5	39-4	0 TO 4	10	11.5	10	7	6	7	5	4	5	6	7	176	3-4	3-8	10-6	3-4	2-10	3.845	945
		12-1	39-4	>4 TO 8	11.5	13.5	10	7	6	7	6	4	4	5	5		2-9	2-9	10-9	3-0	2-7	4.270	869
		12-6.5	39-4	>8 TO 12	14.5	16	10	7	6	7	6	4	4	5	5		2-9	2-9	11-0	3-3	2-10	4.937	877
		13-3	39-8	>12 TO 18	18.5	20.5	11	7	6	7	6	5	4	5	5		3-7	2-10	11-4	3-8	3-8	6.133	922
14	6	7-11	45-4	0 TO 4	11	12	10	7	7	8	6	4	5	6	7	176	3-4	3-8	6-8	3-4	2-11	3.959	1103
		8-4	45-4	>4 TO 8	13.5	14.5	10	8	7	8	6	4	4	5	5		2-9	2-9	6-11	3-1	2-8	4.658	1070
		8-11	45-4	>8 TO 12	17	18	10	8	7	8	7	4	4	5	5		3-6	2-9	7-3	3-7	3-0	5.638	1130
	8	9-11	45-4	0 TO 4	11	12	10	7	7	8	6	4	5	6	7	192	3-4	3-8	8-9	3-4	2-11	4.206	1148
		10-4.5	45-4	>4 TO 8	13.5	15	10	8	7	8	6	4	4	5	5		2-9	2-9	8-11	3-2	2-9	4.975	1106
		10-11.5	45-4	>8 TO 12	17	18.5	10	8	7	8	7	4	4	5	5		3-6	3-9	9-3	3-5	3-0	5.955	1169
	10	11-11	45-4	0 TO 4	11	12	10	7	7	8	6	4	5	6	7	200	3-4	3-8	10-9	3-4	2-11	4.453	1087
		12-4.5	45-4	>4 TO 8	13.5	15	10	8	7	8	6	4	4	6	5		3-4	2-9	10-11	3-2	2-9	5.222	1164
		12-11.5	45-4	>8 TO 12	17	18.5	10	8	7	8	7	4	4	6	5		4-3	2-9	11-3	3-5	3-0	6.202	1226
16	6	8-1.5	51-4	0 TO 4	12	13.5	10	8	7	8	6	4	5	6	7	188	3-4	3-4	6-10	3-5	3-0	4.781	1274
		8-5	51-4	>4 TO 6	14	15	10	8	7	9	7	4	4	6	6		3-4	3-4	7-0	3-7	2-9	5.335	1354
		8-8.5	51-4	>6 TO 8	15.5	17	10	8	7	8	7	4	4	5	5		3-6	2-9	7-1	3-4	2-11	5.890	1248
		9-0	51-4	>8 TO 10	17.5	18.5	10	8	8	9	7	4	4	5	5		3-6	2-9	7-3	3-6	3-0	6.444	1401
	8	10-1	51-4	0 TO 4	11.5	13.5	10	8	7	8	6	5	5	6	6	204	3-4	3-4	8-9	3-6	3-1	4.949	1324
		10-5	51-4	>4 TO 6	14	15	10	8	7	9	7	4	4	6	6		3-4	3-4	9-0	3-7	2-9	5.582	1393
		10-8.5	51-4	>6 TO 8	15.5	17	10	8	7	8	7	4	4	5	5		3-6	2-9	9-1	3-4	2-11	6.137	1283
		11-0	51-4	>8 TO 10	17	19	10	8	7	8	7	4	4	5	5		3-6	2-9	9-3	3-6	3-1	6.691	1287
	10	12-1	51-4	0 TO 4	12	13	10	8	7	8	6	4	5	7	7	212	3-8	3-8	10-10	4-11	3-0	5.195	1407
		12-5	51-4	>4 TO 6	14	15	10	8	7	8	7	4	4	6	6		3-4	3-4	11-0	3-7	2-9	5.829	1377
		12-8.5	51-4	>6 TO 8	15.5	17	10	8	7	8	7	4	4	6	6		4-3	3-4	11-1	3-9	2-10	6.444	1359
		13-0.5	51-4	>8 TO 10	17	19.5	10	8	7	8	7	4	4	6	5		4-3	2-9	11-3	3-6	3-1	7.017	1348
18	6	8-4	57-4	0 TO 4	13.5	14.5	10	9	8	9	7	4	5	7	7	200	3-8	3-8	6-11	3-7	3-2	5.695	1717
		8-8.5	57-4	>4 TO 6	15.5	17	10	9	8	9	7	4	4	6	6		4-3	3-4	7-1	3-9	2-11	6.492	1648
		9-1.5	57-4	>6 TO 8	18	19.5	10	9	8	9	7	4	4	5	5		3-6	2-9	7-4	3-6	3-1	7.377	1612
	8	10-4	57-4	0 TO 4	13.5	14.5	10	9	8	9	7	4	5	7	7	216	3-8	3-8	8-11	3-6	3-1	5.942	1684
		10-8	57-4	>4 TO 6	15.5	16.5	10	9	8	9	7	4	4	6	6		4-3	3-4	9-1	3-8	2-10	6.650	1685
		11-1	57-4	>6 TO 8	18	19	10	9	8	9	7	4	4	6	5		4-3	2-9	9-4	3-6	3-1	7.535	1665
	10	12-4.5	57-4	0 TO 4	13.5	15	10	9	8	9	7	4	5	7	7	224	3-8	3-8	10-11	4-1	3-2	6.278	1818
		12-8	57-4	>4 TO 6	15.5	16.5	10	9	8	9	7	4	4	6	6		4-3	3-4	11-1	3-8	2-10	6.897	1719
		13-1.5	57-4	>6 TO 8	18	19.5	10	9	8	9	7	4	4	6	6		4-3	3-4	11-4	3-11	3-1	7.870	1726
20	6	8-6.5	63-4	0 TO 4	14.5	16	10	9	8	9	7	4	5	8	7	224	4-1	3-8	7-0	4-2	3-3	6.703	1913
		8-10.5	63-6	>4 TO 6	16.5	18	10.5	9	8	10	8	4	4	7	6		4-9	3-4	7-2	3-11	3-0	7.539	2031
	8	10-6.5	63-4	0 TO 4	14.5	16	10	9	8	9	7	4	5	7	7	240	3-8	3-8	9-0	4-2	3-3	6.950	1931
		10-11	63-4	>4 TO 6	17	18	10	9	8	10	8	4	4	6	6		4-3	3-4	9-3	3-10	3-0	7.829	2037
	10	12-6.5	63-4	0 TO 4	14.5	16	10	9	8	9	7	4	5	8	7	248	4-1	3-8	11-0	4-2	3-3	7.197	2016
		12-11	63-4	>4 TO 6	17	18	10	9	8	10	8	4	4	7	7		4-9	3-8	11-3	4-5	3-0	8.076	2131

HEADWALL AND TOEWALL QUANTITIES

HEADWALL SKEW ANGLE	90° TO 75°			74° TO 60°			59° TO 45°		
SPAN - S	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
FT.	#	#	LBS./LIN.FT.	#	#	LBS./LIN.FT.		#	LBS./LIN.FT.
8	4	4	22.3	4	4	22.1	5	4	25.9
10	5	4	26.5	5	4	26.3	7	4	38.1
12	5	4	25.7	6	4	30.8	8	5	47.4
14	6	4	30.0	7	4	35.8	10	5	65.0
16	6	4	29.5	8	5	46.2	★	★	★
18	7	4	34.9	9	5	53.7	★	★	★
20	7	4	34.3	11	6	74.4	★	★	★
CONCRETE QUANTITY = 0.085 CU.YDS./LIN.FT.									

NOTES

1. QUANTITIES ARE PER LINEAR FOOT (OF HEADWALL) FOR ONE HEADWALL AND TOEWALL AND INCLUDE ALL HEADWALL AND TOEWALL REINFORCING STEEL. QUANTITY INCLUDED WAS CALCULATED PER 1 FT. STRIP. SKEW ANGLE MAY VARY. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.

★ 2. A SKEWED HEADWALL IS NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

3. FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.

4. WHEN THE FILL HEIGHT IS LESS THAN OR EQUAL TO 2 FT.-0 IN., ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (*), AND THE d_1 IN THE BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

5. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.

6. WHEN AN R (RISE) OF LESS THAN 6 FT. IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT. RISE (IF AVAILABLE ON THE TABLE).

▲ 7. THE SIZE OF d_1 BARS IS #4. THE NUMBER OF BARS REQUIRED IS LISTED.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
Full Path: www.coloradodot.info/business/designsupport	(R-X)		
Drawing File Name: 601030202.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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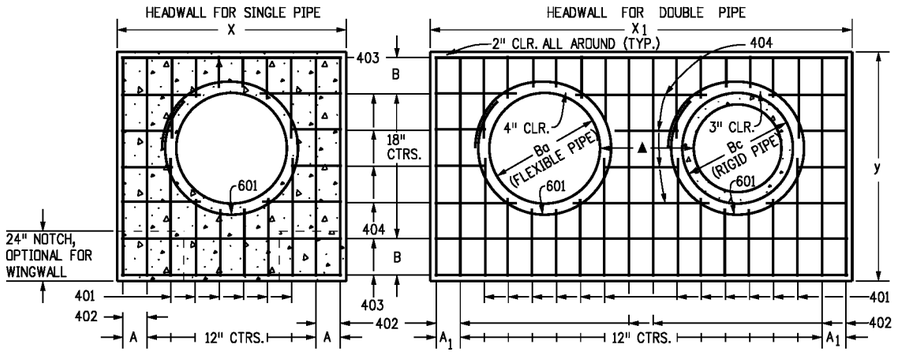
Project Development Branch DD/LTA

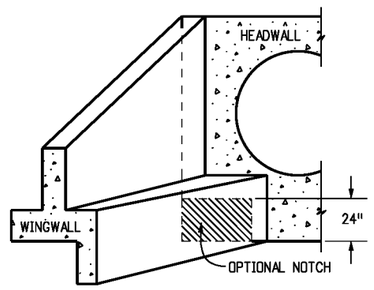
TRIPLE CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

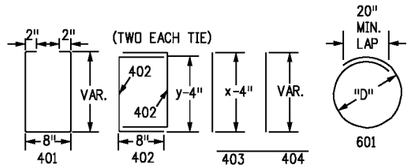
STANDARD PLAN NO.
M-601-3



TYPICAL BAR LAYOUT FOR CONCRETE HEADWALLS

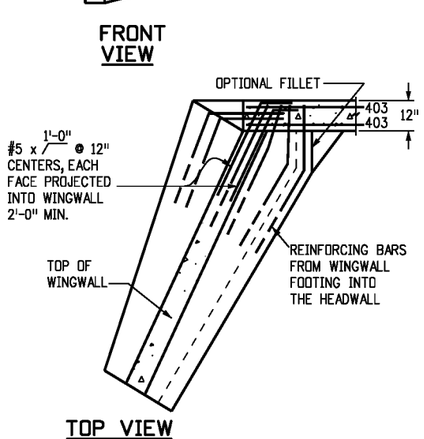


FRONT VIEW



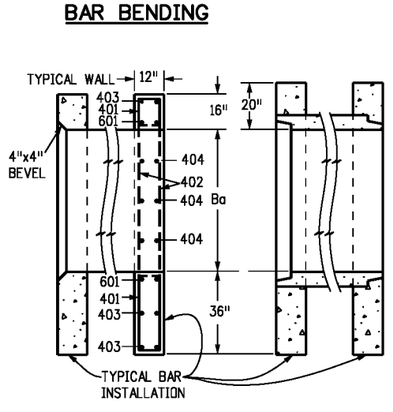
"D" = RIGID PIPE = Bc + 6"
FLEXIBLE PIPE = Ba + 8"
FLEXIBLE ARCH = SPAN + 8"
STRUCTURAL PLATE ARCH = RISE + 8"

BAR BENDING



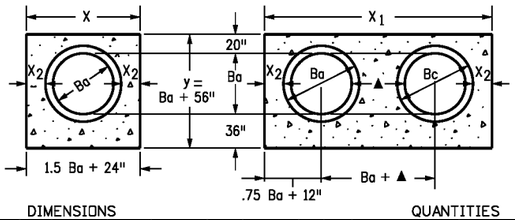
TOP VIEW

WINGWALL CONNECTION



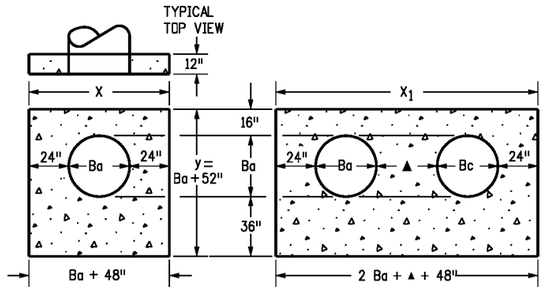
INLET OUTLET ENDS OF FLEXIBLE PIPE

INLET OUTLET ENDS OF RIGID PIPE



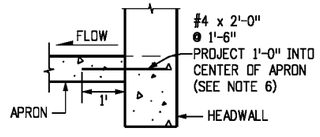
DIMENSIONS									QUANTITIES			
									CONCRETE		STEEL ■	
Ba IN.	Bc IN.	X FT.-IN.	A IN.	X_1 FT.-IN.	A_1 IN.	y FT.-IN.	B IN.	X_2 IN.	SGL CU. YD.	DBL CU. YD.	SGL LBS.	DBL LBS.
54	65	8-9	8½	15-6	7	9-2	17	20	2.12	3.55	209	364
60	72	9-6	7	17-0	10	9-8	11	21	2.35	3.99	236	414
66	79	10-3	11½	18-6	7	10-2	14	22	2.60	4.44	249	453
72	86	11-0	10	20-0	10	10-8	17	23	2.85	4.91	270	476
78	93	11-9	8½	21-3	11	11-2	11	24	3.11	5.29	306	527
84	100	12-6	7	22-6	7	11-8	14	25	3.38	5.68	333	572
90	107	13-3	11½	23-9	8½	12-2	17	26	3.66	6.08	335	593
96	114	14-0	10	25-0	10	12-8	11	27	3.94	6.48	379	649
102	121	14-9	8½	26-3	11½	13-2	14	28	4.24	6.89	400	664
108	128	15-6	7	27-6	7	13-8	17	29	4.54	7.30	424	707

HEADWALL FOR RIGID ROUND PIPE



DIMENSIONS								QUANTITIES			
								CONCRETE		STEEL ■	
Ba IN.	X FT.-IN.	A IN.	X_1 FT.-IN.	A_1 IN.	y FT.-IN.	B IN.	X_2 IN.	SGL CU. YD.	DBL CU. YD.	SGL LBS.	DBL LBS.
54	8-6	7	15-3	11½	8-10	15	2.19	3.81	211	358
60	9-0	10	16-6	7	9-4	18	2.38	4.25	217	396
66	9-6	7	17-9	8½	9-10	12	2.58	4.70	252	454
72	10-0	10	19-0	10	10-4	15	2.78	5.17	255	472
78	10-6	7	20-0	10	10-10	18	2.98	5.56	276	499
84	11-0	10	21-0	10	11-4	12	3.19	5.95	297	553
90	11-6	7	22-0	10	11-10	15	3.40	6.36	317	517
96	12-0	10	23-0	10	12-4	18	3.62	6.79	321	597
102	12-6	7	24-0	10	12-10	12	3.84	7.21	364	663
108	13-0	10	25-0	10	13-4	15	4.06	7.63	362	678

HEADWALL FOR FLEXIBLE ROUND PIPE



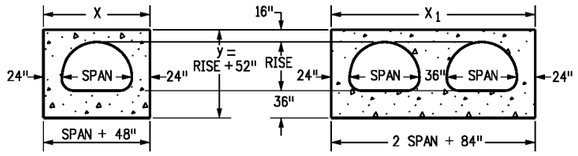
WHEN APRON IS REQUIRED

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B.
2. HEADWALL SHALL BE PERPENDICULAR TO THE PIPE ℄ UNLESS OTHERWISE SHOWN ON THE PLANS. TABULATED DIMENSIONS AND QUANTITIES MUST BE ADJUSTED FOR SKEWED INSTALLATIONS.
3. FOR WINGWALL DETAILS, SEE STANDARD PLAN M-601-20.
4. VOLUME OCCUPIED BY PIPE HAS BEEN DEDUCTED FROM STEEL AND CONCRETE QUANTITIES.
5. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
6. ALL REINFORCING BARS SHALL HAVE A 2 IN. MINIMUM CLEARANCE.

▲ WHEN TWO OR MORE PIPES ARE LAID SIDE BY SIDE, THEY SHALL BE PLACED SO THAT THE ADJACENT PIPES WILL BE ½ INSIDE DIAMETER APART, OR ½ INSIDE SPAN APART, OR 3 FT. APART (INCLUDING WALL THICKNESS), WHICHEVER IS LESS.

■ ADD 0.89 x (X OR X_1) (LB.) WHEN APRON IS REQUIRED.



DIMENSIONS										QUANTITIES			
										CONCRETE		STEEL ■	
EQUIV. Ba IN.	SPAN IN.	RISE IN.	X FT.-IN.	A IN.	X_1 FT.-IN.	A_1 IN.	y FT.-IN.	B IN.		SGL CU. YD.	DBL CU. YD.	SGL LBS.	DBL LBS.
72	81	59	10-9	8½	20-6	7	9-3	17½		2.72	5.10	250	467
78	87	63	11-3	11½	21-6	7	9-7	10½		2.85	5.34	275	531
84	95	67	11-9	8½	22-10	9	9-11	12½		3.08	5.79	290	547
90	103	71	12-7	7½	24-2	11	10-3	15		3.30	6.21	321	591
96	112	75	13-4	12	25-8	8	10-7	16½		3.52	6.65	314	606
102	117	79	13-9	8½	26-6	7	10-11	9½		3.63	6.86	356	672
108	128	83	14-8	8	28-4	12	11-3	11½		3.96	7.51	376	699

HEADWALL FOR FLEXIBLE PIPE ARCH

DIMENSIONS										QUANTITIES			
										CONCRETE		STEEL ■	
EQUIV. Ba IN.	SPAN FT.-IN.	RISE FT.-IN.	X FT.-IN.	A IN.	X_1 FT.-IN.	A_1 IN.	y FT.-IN.	B IN.		SGL CU. YD.	DBL CU. YD.	SGL LBS.	DBL LBS.
66	6-1	4-7	10-1	10½	19-2	11	8-11	15½		2.52	4.70	232	424
75	7-0	5-1	11-0	10	21-0	10	9-5	9½		2.80	5.25	282	509
84	7-11	5-7	11-11	9½	22-10	9	9-11	12½		3.08	5.79	291	540
93	8-10	6-1	12-10	9	24-8	8	10-5	15½		3.36	6.33	309	622
102	9-9	6-7	13-9	8½	26-6	7	10-11	9½		3.63	6.86	379	673
111	10-11	7-1	14-11	9½	28-10	9	11-5	12½		4.05	7.67	377	711
120	11-10	7-7	15-10	9	30-8	8	11-11	15½		4.36	8.28	395	731
132	12-10	8-4	16-10	9	32-8	8	12-8	11		4.75	9.03	441	839
141	14-1	8-9	18-1	10½	35-2	11	13-1	13½		5.17	9.86	448	931
150	15-4	9-3	19-4	12	37-8	8	13-7	16½		5.69	10.88	490	953
159	15-10	9-10	19-10	9	38-8	8	14-2	11		5.89	11.25	534	1019

HEADWALL FOR STRUCTURAL PLATE ARCH

SKEW ANGLE A°	90	85	80	75	70	65	60	55	50	45	40	35	30
FACTOR (cosecA°)	1.000	1.004	1.015	1.035	1.064	1.103	1.155	1.221	1.305	1.414	1.556	1.743	2.000

SKEW FACTOR TABLE

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Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
Full Path: www.coloradodot.info/business/designsupport	(R-X)		
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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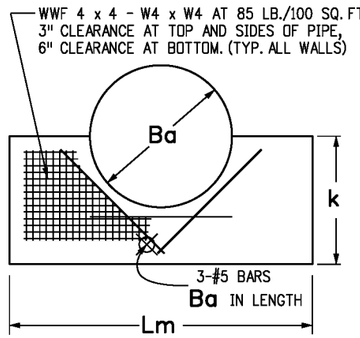
HEADWALL FOR PIPES

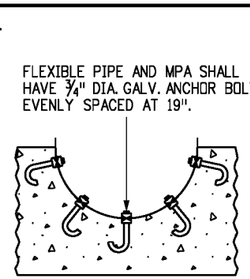
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

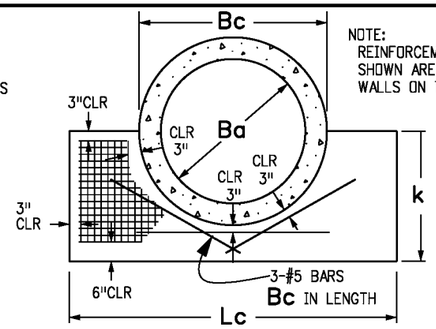
M-601-10

Sheet No. 1 of 1



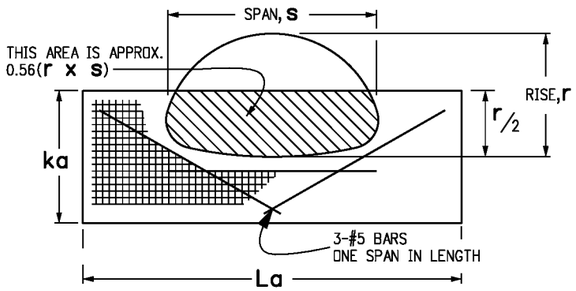


FLEXIBLE SINGLE PIPE



NOTE:
REINFORCEMENT CLEARANCES SHOWN ARE TYPICAL FOR ALL WALLS ON THIS SHEET.

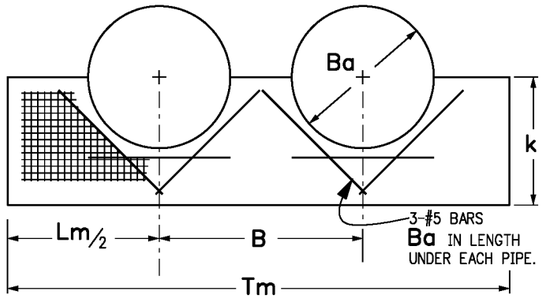
RIGID SINGLE PIPE



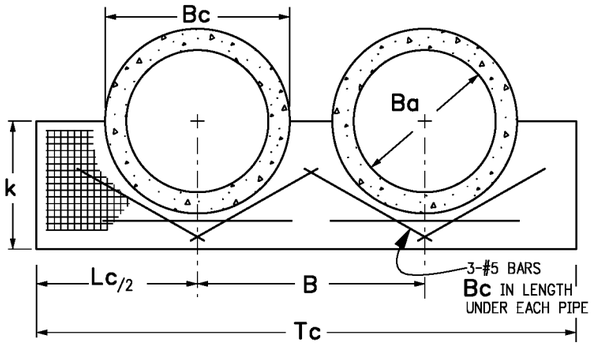
SINGLE MPA

GENERAL NOTES

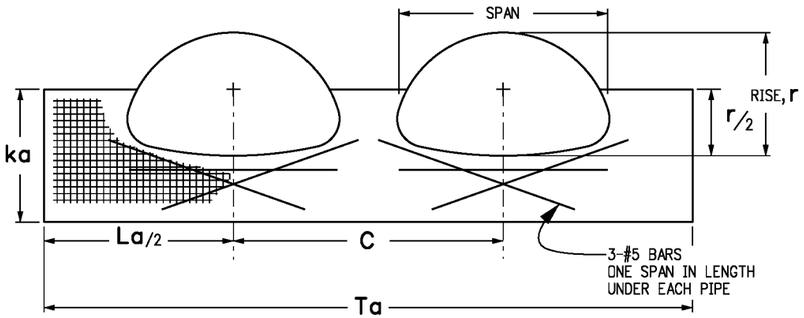
1. CONCRETE SHALL BE CLASS B.
2. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
3. IF A PRECAST HEADWALL IS USED, A PERMANENT EPOXY BOND, APPROVED BY THE ENGINEER, SHALL BE USED BETWEEN PIPE AND HEADWALL.
4. HEADWALL SHALL BE PERPENDICULAR TO THE CULVERT CENTERLINE UNLESS OTHERWISE SPECIFIED. TABULATED DIMENSIONS AND QUANTITIES SHALL BE ADJUSTED FOR SKEWED INSTALLATIONS.
5. HEADWALL ANCHOR BOLTS SHALL CONFORM TO AASHTO M 167 AND SHALL BE INCLUDED IN THE COST OF PIPE.
6. HEADWALL ANCHOR BOLTS SHALL BE USED ONLY WITH FLEXIBLE PIPE, BOTH ROUND AND ARCH.



FLEXIBLE DOUBLE PIPE



RIGID DOUBLE PIPE



DOUBLE MPA

RANGE OF EQUIV. DIAMS.	RANGE OF SPANS s	RANGE OF RISES r	ka	La	C	Ta	SINGLE CONCRETE CU. YDS.	SINGLE STEEL LBS.	DOUBLE CONCRETE CU. YDS.	DOUBLE STEEL LBS.
IN.										
36-42	39-47	30-36	36	94	71	165	0.72	26.2	1.22	49.8
42-48	48-59	31-41	41	118	89	207	1.04	36.5	1.77	68.7
54-60	60-71	40-51	51	142	107	249	1.53	52.2	2.61	97.2
60-75	72-83	44-69	69	166	119	285	2.49	78.3	4.14	142.0
72-81	84-95	63-72	72	190	131	321	2.93	93.1	4.76	166.5
84-90	96-107	69-76	76	214	143	357	3.42	110.1	5.45	194.6

∅ HEADWALL FOR METAL PIPE ARCH (MPA)

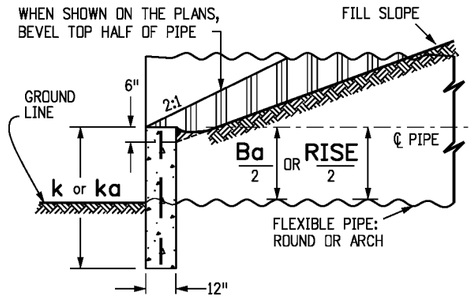
NOM. DIA. Ba	RCP O.D. Bc	k	Lm	Lc	B	Tm	Tc	FLEXIBLE PIPE SINGLE CONCRETE CU. YDS.	FLEXIBLE PIPE SINGLE STEEL LBS.	FLEXIBLE PIPE DOUBLE CONCRETE CU. YDS.	FLEXIBLE PIPE DOUBLE STEEL LBS.	RIGID PIPE SINGLE CONCRETE CU. YDS.	RIGID PIPE SINGLE STEEL LBS.	RIGID PIPE DOUBLE CONCRETE CU. YDS.	RIGID PIPE DOUBLE STEEL LBS.
IN.															
36	44	36	81	99	56	137	155	0.62	21.3	1.01	39.6	0.72	26.3	1.04	46.2
42	51	42	94	114	63	157	177	0.84	28.1	1.34	51.3	0.97	34.3	1.39	59.8
48	58	48	108	130	72	180	202	1.10	36.0	1.76	64.4	1.27	43.6	1.81	75.3
54	65	54	121	146	81	202	227	1.39	44.6	2.22	80.1	1.60	54.1	2.30	92.5
60	72	60	134	161	90	224	251	1.70	54.1	2.73	96.8	1.96	65.7	2.83	111.2
66	79	66	148	177	99	247	276	2.07	64.9	3.31	115.4	2.37	78.1	3.42	131.9
72	86	72	161	193	108	269	301	2.46	76.4	3.93	135.2	2.83	91.9	4.08	154.4
78	93	78	175	208	114	289	322	2.90	89.1	4.57	155.8	3.30	106.5	4.71	177.1
84	100	84	188	224	120	308	344	3.35	102.4	5.23	177.4	3.83	122.5	5.41	201.6
90	107	90	202	240	126	328	366	3.86	117.1	5.96	200.8	4.40	139.7	6.16	227.8
96	114	96	215	255	132	347	387	4.38	132.3	6.71	225.1	4.98	157.5	6.93	254.9

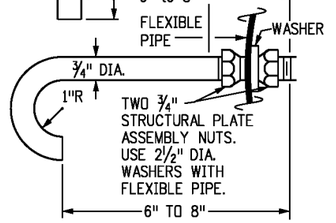
∅ NOTE: EACH LINE OF THE PIPE ARCH TABLE DESCRIBES A SINGLE HEADWALL THAT WILL ACCOMMODATE SEVERAL SIZES OF PIPE-ARCH. THE CONCRETE QUANTITIES IN THIS TABLE ARE BASED ON DEDUCTION OF CONCRETE FROM THE HEADWALL OF THE MEDIAN SIZE PIPE IN THE RANGE OF EQUIVALENT DIAMETERS SHOWN.

◪ ADJUST L, B, T, C, #5 BAR LENGTH AND QUANTITIES WHEN SKEW IS < 90°

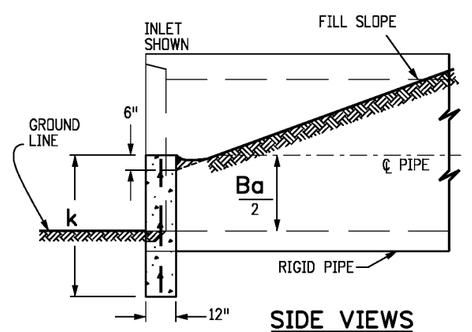
SKEW°	FACTOR
90	1.000
85	1.004
80	1.015
75	1.035
70	1.064
65	1.103
60	1.155
55	1.221
50	1.305
45	1.414
40	1.556
35	1.743
30	2.000

HEADWALL FOR ROUND PIPE



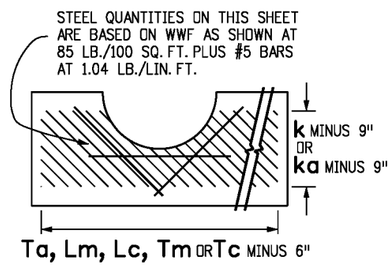


TYPICAL GALVANIZED ANCHOR BOLTS



SIDE VIEWS

STEEL QUANTITIES ON THIS SHEET ARE BASED ON WWF AS SHOWN AT 85 LB./100 SQ. FT. PLUS #5 BARS AT 1.04 LB./LIN. FT.



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TYPE "S" SADDLE HEADWALLS FOR PIPE

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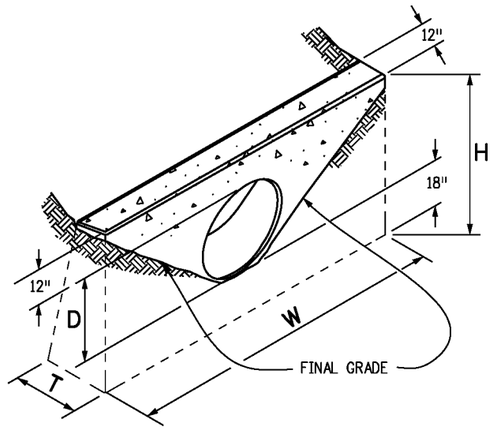
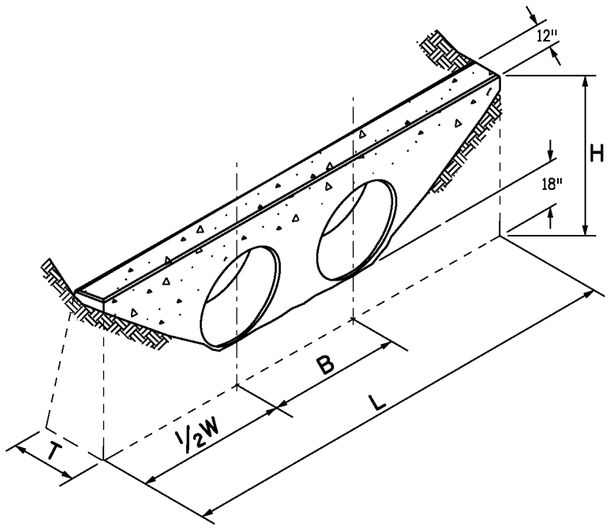
M-601-11
Sheet No. 1 of 1



SINGLE PIPE



DOUBLE PIPE

CONCRETE HEADWALL INSTALLATIONS

SEE STANDARD PLAN M-601-10 FOR REINFORCING DETAILS.

PIPE		PIPE DIAMETER (AND EQUIVALENT DIAMETER) (IN.)											
		18		24		30		36		42		48	
TYPE	MATERIAL	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE
CIRCULAR	RIGID	1.0	1.3	1.5	2.0	2.0	2.7	2.8	3.6	3.6	4.6	4.6	6.0
	FLEXIBLE	1.1	1.4	1.6	2.1	2.2	3.0	3.0	4.0	3.9	5.3	5.0	6.8
ELLIPTICAL	RIGID	23 x 14		30 x 19		38 x 24		45 x 29		53 x 34		60 x 38	
		0.9	1.2	1.3	1.6	1.7	2.2	2.3	2.9	2.9	3.7	3.5	4.4
ARCH	METAL	22 x 13		29 x 18		36 x 22		43 x 27		50 x 31		58 x 36	
		0.9	1.3	1.4	1.9	1.8	2.4	2.4	3.4	3.2	4.4	3.4	5.0

CONCRETE QUANTITIES FOR ONE CONCRETE HEADWALL (CUBIC YARDS)

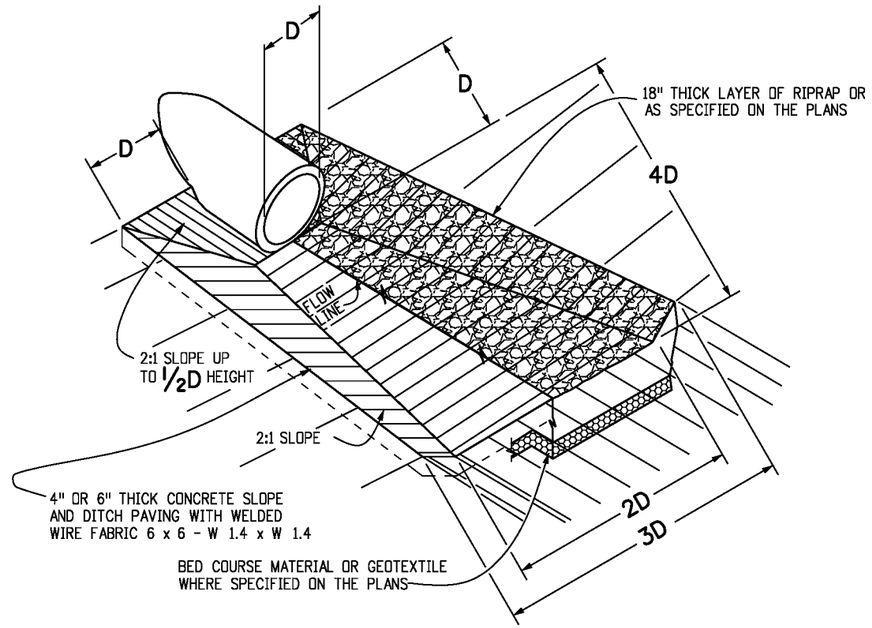
THICKNESS	MATERIAL	PIPE DIAMETER (IN.)					
		18	24	30	36	42	48
4"	CONCRETE	0.4	0.8	1.2			
6"	CONCRETE				2.6	3.6	4.7
18"	RIPRAP	2.0	3.5	5.4	7.8	10.7	13.9

PIPE OUTLET PAVING (CUBIC YARDS)

NOTE: VOLUME OCCUPIED BY PIPE HAS BEEN DEDUCTED.

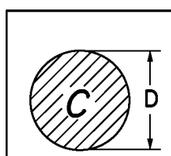
GENERAL NOTES

1. FOR SIZE AND LOCATION OF PIPES, SEE THE PLANS.
2. ALL CONCRETE SHALL BE CLASS B.
3. FOOTINGS IN ROCK SHALL BE POURED OUT TO ROCK AND NOT FORMED IN ACCORDANCE WITH SUBSECTION 601.09(b).
4. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
5. HEADWALL SHALL HAVE REINFORCING STEEL INSTALLED IN A PATTERN SIMILAR TO STANDARD PLAN M-601-10.
6. THE COST OF REINFORCING STEEL SHALL BE INCLUDED IN THE WORK UNLESS THE STEEL QUANTITIES ARE LISTED IN THE PLANS AND ARE PAID FOR SEPARATELY.



PIPE OUTLET PAVING

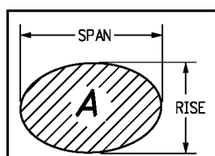
MAY BE USED WITH MULTIPLE PIPES.



CIRCULAR

D = PIPE DIAMETER (INSIDE)
H = D + 30"
W = 3D + 18"
T = 0.4 H (NEAREST IN.)
B = 1.5 D (30" MINIMUM)
L = W + B

TYPE OF PIPE — HEADWALL DIMENSIONS



ARCH OR ELLIPTICAL

D = EQUIVALENT CIRCULAR DIAMETER (INSIDE)
H = RISE + 30"
W = 3D + 18"
T = 0.4 H (NEAREST IN.)
B = 1.5 D (30" MINIMUM)
L = W + B

TYPE OF PIPE — HEADWALL DIMENSIONS

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HEADWALLS AND PIPE OUTLET PAVING

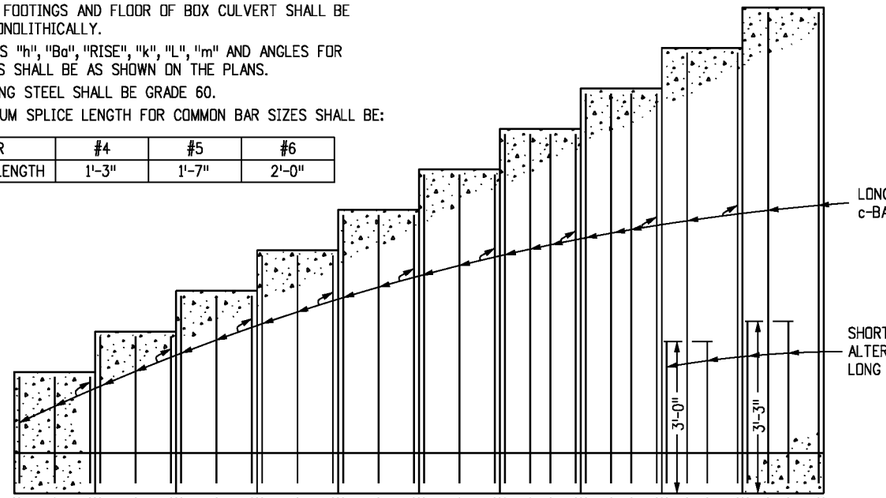
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-601-12
Sheet No. 1 of 1

GENERAL NOTES

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
2. WINGWALL FOOTINGS AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
3. DIMENSIONS "h", "Ba", "RISE", "k", "L", "m" AND ANGLES FOR WINGWALLS SHALL BE AS SHOWN ON THE PLANS.
4. REINFORCING STEEL SHALL BE GRADE 60.
5. THE MINIMUM SPLICE LENGTH FOR COMMON BAR SIZES SHALL BE:

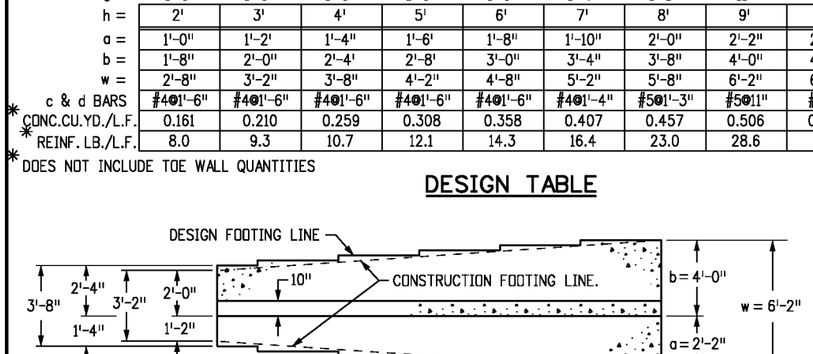
BAR	#4	#5	#6
SPLICE LENGTH	1'-3"	1'-7"	2'-0"



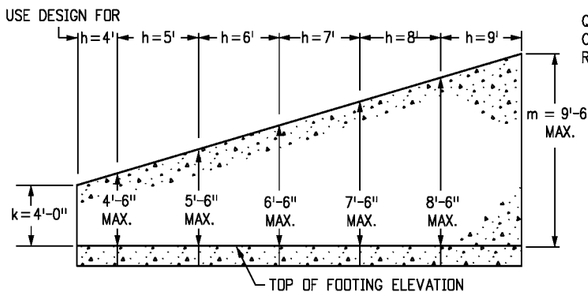
e =	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-4"	1'-3"	11"	9"	7" CTRS.
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'
a =	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"
b =	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"
c & d BARS	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-4"	#5@1'-3"	#5@11"	#6@9"	#6@7" CTRS.
* CONC.CU.YD./L.F.	0.161	0.210	0.259	0.308	0.358	0.407	0.457	0.506	0.556	0.604
* REINF. LB./L.F.	8.0	9.3	10.7	12.1	14.3	16.4	23.0	28.6	41.8	54.6

* DOES NOT INCLUDE TOE WALL QUANTITIES

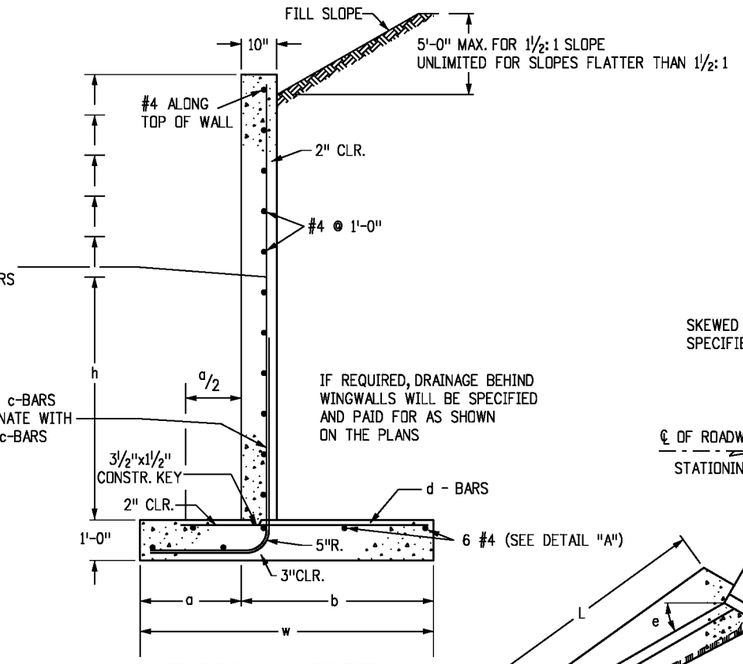
DESIGN TABLE



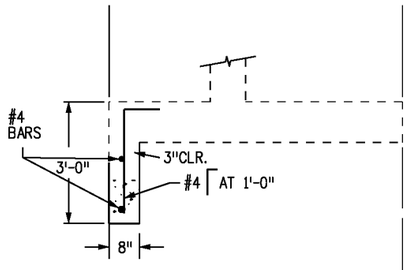
PLAN



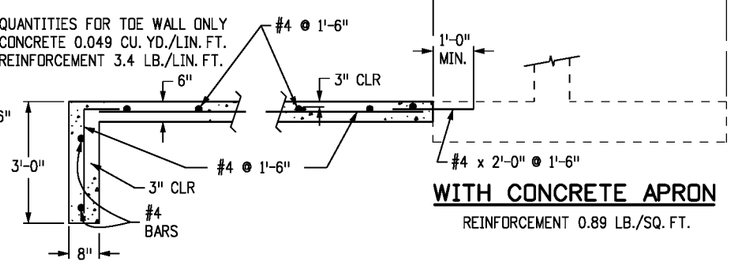
DESIGN EXAMPLE



TYPICAL SECTION



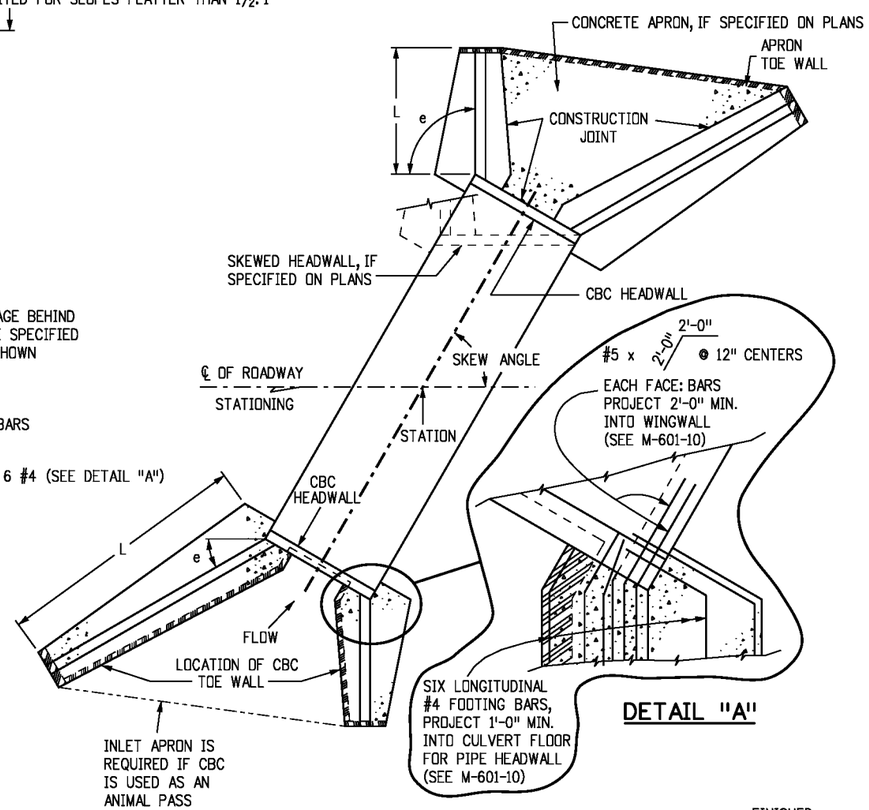
WITH TOE WALL



APRON TOE WALL

WITH CONCRETE APRON

REINFORCEMENT 0.89 LB./SQ. FT.



DETAIL "A"

TYPICAL CULVERT LAYOUT

DESIGN DATA:

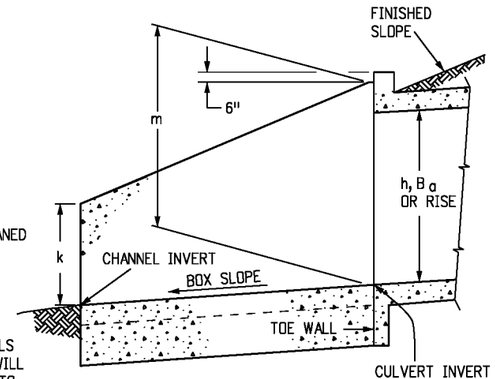
UNIT STRESSES: $f_s = 24{,}000$ PSI
$f_c = 1{,}200$ PSI
$n = 9$

EQUIVALENT FLUID PRESSURE = 36 LBS./CU. FT.
MAXIMUM TOE PRESSURE = 1 TON/SQ. FT.

ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE CONCRETE IS POURED.

WINGWALL AND APRON CONCRETE SHALL BE:
CONCRETE CLASS B, OR D (BOX CULVERT) FOR CBC's.
CONCRETE CLASS B, OR D (WALL) FOR PIPES.

LIVE LOAD SURCHARGE HAS NOT BEEN CONSIDERED. WALLS WITHIN h/2 OF THE EDGE OF THE ROADWAY SHOULDER WILL REQUIRE A SPECIAL DESIGN IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES.



BOX ELEVATION

m = h, B a OR RISE + (1'-4")
UNLESS OTHERWISE SHOWN ON PLANS

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WINGWALLS FOR PIPE OR BOX CULVERTS

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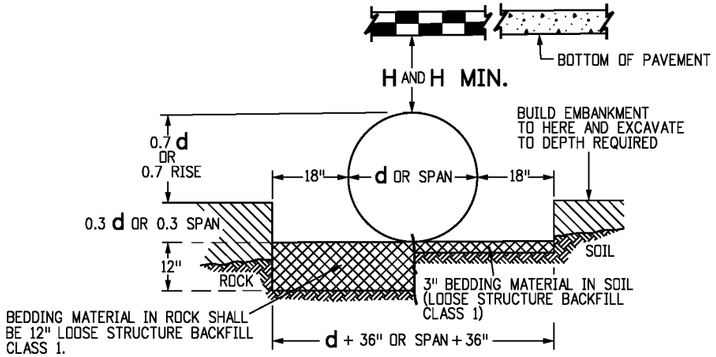
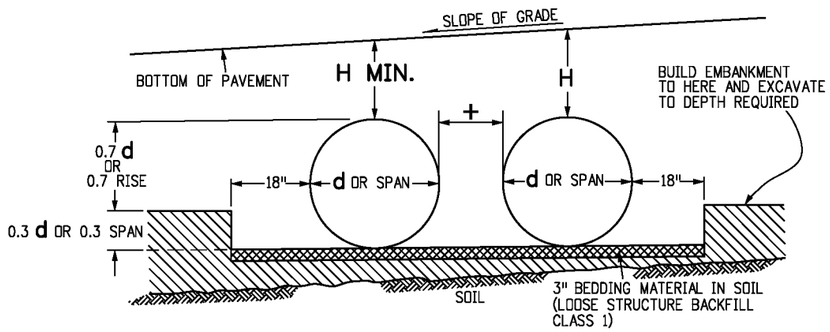


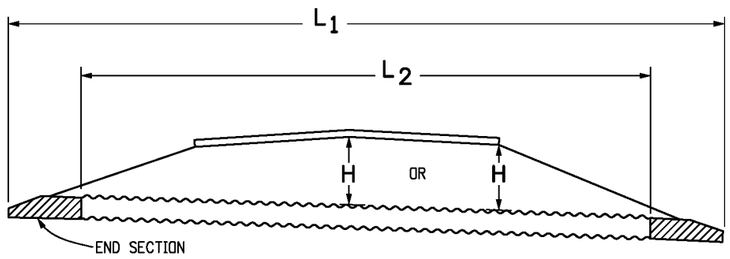
INSTALLATION OF METAL PIPE



INSTALLATION OF MULTIPLE METAL PIPES

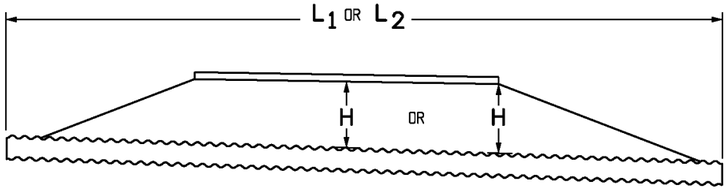
GENERAL NOTES

1. STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M36. ALUMINUM PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M196.
2. ADEQUATE COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE STRUCTURE FROM DAMAGE.
3. PIPE SHALL BE PLACED WITH LONGITUDINAL SEAMS AT THE SIDES OR QUARTER POINTS BUT NOT ALONG TOP OF VERTICAL AXIS.
4. STRUCTURAL PLATE PIPES OF EQUAL OR GREATER DIAMETER THAT CONFORM TO SECTION 510 MAY BE SUBSTITUTED FOR THE PIPES ON THESE SHEETS AT THE CONTRACTOR'S EXPENSE.
5. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
6. EXTENSIONS FOR CMP ARCH PIPE SHALL MATCH THE CORRUGATIONS, AND THE SPAN AND RISE DIMENSIONS OF THE PIPE TO BE EXTENDED.
7. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE BOTTOM OF THE POST MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE. THE HOLE FOR THE POST SHALL BE DRILLED INTO THE SOIL.
8. PIPE ARCH WITH EQUAL PERIPHERY AND WITH SPAN AND RISE DIMENSIONS APPROXIMATELY EQUAL TO THOSE SPECIFIED ON THE PLANS WILL BE PERMITTED.
9. PIPE ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. WHEN COVER EXCEEDS 11 FT. USE ROUND PIPE.
10. PIPE COVER GREATER THAN 90 FT. SHALL REQUIRE AN INVESTIGATION OF THE FOUNDATION MATERIAL.



METAL PIPE WITH END SECTIONS

NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.



METAL PIPE WITHOUT END SECTIONS

NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

	MINIMUM COVER (IN.) FOR INDICATED AXLE LOADS, kips			
PIPE SPAN (IN.)	18.0 - 50.0	50.0 - 75.0	75.0 - 110.0	110.0 - 150.0
12.0 - 42.0	24	30	36	36
48.0 - 72.0	36	36	42	48
78.0 - 120.0	36	42	48	48
126.0 - 144.0	42	48	54	54

MINIMUM COVER FOR CONSTRUCTION LOADS

LEGEND

H = HEIGHT OF COVER LIMIT, MAXIMUM ALLOWABLE HEIGHT OF FILL OVER THE TOP OF THE PIPE, EXCLUDING PAVEMENT THICKNESS.

H MIN. = THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER.

THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

THE MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE SUBGRADE FOR CONSTRUCTION LOADS.

L_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

L_2 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.

\+ = THE MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR ½ d , WHICHEVER IS GREATER, BUT NOT TO EXCEED 36".

CONVERSION OF NOMINAL GAGE TO THICKNESS					
GAGE NO.	16	14	12	10	8
ALUMINUM THICKNESS - IN.	0.060	0.075	0.105	0.135	0.164
GALVANIZED STEEL THICKNESS - IN.	0.064	0.079	0.109	0.138	0.168

ALLOWED WALL THICKNESS

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METAL PIPE

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DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	
		MAXIMUM HEIGHT OF COVER (FT.)	
		16	14
6	24	408	509
8	24	306	382
10	24	244	305

1-1/2" X 1/4" ROUND CORRUGATED STEEL ROUND PIPE

DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE				
		MAXIMUM HEIGHT OF COVER (FT.)				
		16	14	12	10	8
12	24	207	259			
15	24	165	207			
18	24	138	172	242		
21	24	118	148	207		
24	24	103	129	181		
30	24	82	103	145		
36	24	68	86	120	155	
42	24	58	73	103	133	163
48	36	51	64	90	103	142
54	36		57	80	93	126
60	36			72	84	114
66	36				77	103
72	36					94
78	36					84
84	36					72

2-2/3" X 1/2" ROUND CORRUGATED STEEL PIPE

DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE				
		MAXIMUM HEIGHT OF COVER (FT.)				
		16	14	12	10	8
48	36	59	74	104	134	164
54	36	52	65	92	119	146
60	36	47	59	83	107	131
66	36	42	53	75	97	119
72	36	39	49	69	89	109
78	36		45	63	82	101
84	36		42	59	76	93
90	36			55	71	87
96	36			51	66	81
102	36			48	62	77
108	36				59	72
114	36				56	68
120	36				53	65
126	42					62

3" X 1" ROUND CORRUGATED STEEL ROUND PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	MAXIMUM COVER (FT.)
17 X 13	15	24	16	13
21 X 15	18	24	16	12
24 X 18	21	24	16	13
28 X 20	24	24	16	12
35 X 24	30	24	16	12
42 X 29	36	24	16	12
49 X 33	42	24	14	12
57 X 38	48	36	12	12
64 X 43	54	36	12	12
71 X 47	60	36	10	12
77 X 52	66	36	8	12
83 X 57	72	36	8	12

2-2/3" X 1/2" ROUND CORRUGATED STEEL PIPE ARCH*

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	MAXIMUM COVER (FT.)
53 X 41	48	36	14	12
60 X 46	54	36	14	20
66 X 51	60	36	14	20
73 X 55	66	36	14	20
81 X 59	72	36	14	17
87 X 63	78	36	14	16
95 X 67	84	36	14	16
103 X 71	90	36	12	16
112 X 75	96	36	12	16
117 X 79	102	36	12	16

3" X 1" ROUND CORRUGATED STEEL PIPE ARCH*

* CORNER BEARING PRESSURE OF 2 TONS PER SQ. FT.

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METAL PIPE

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DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE				
		MAXIMUM HEIGHT OF COVER (FT.)				
		16	14	12	10	8
54	36	46	58	82	106	129
60	36		52	74	95	116
66	36		47	66	86	106
72	36			61	79	97
78	36			56	73	89
84	36			53	68	83
90	36				63	77
96	36				59	72
102	36				55	68
108	36					64

5" X 1" ROUND CORRUGATED STEEL PIPE

DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE			
		MAXIMUM HEIGHT OF COVER (FT.)			
		16	14	12	10
18	24	90	126		
21	24	77	108	181	
24	24	67	95	158	
30	24	54	75	126	
36	24	45	63	105	
42	24	38	54	90	
48	36	33	47	78	114
54	36	29	41	70	101
60	36		37	63	91
66	36		34	57	83
72	36			52	76
78	36			48	70
84	36			44	65
90	36				60
96	36				56
102	36				50

¾" X ¾" 7-1/2" ROUND CORRUGATED STEEL PIPE *

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	MAXIMUM COVER (FT.)
81 X 59	72	36	12	17
87 X 63	78	36	12	16
95 X 67	84	36	12	16

5" X 1" ROUND CORRUGATED STEEL PIPE ARCH *

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	MAXIMUM COVER (FT.)
20 X 16	18	24	16	16
23 X 19	21	24	16	15
27 X 21	24	24	16	13
33 X 26	30	24	16	13
40 X 31	36	24	16	14
46 X 36	42	24	12	13
53 X 41	48	36	12	13
60 X 46	54	36	12	20
66 X 51	60	36	12	20

¾" X ¾" 7-1/2" ROUND CORRUGATED STEEL PIPE *

* CORNER BEARING PRESSURE OF 2 TONS PER SQ. FT.

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METAL PIPE

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DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE				
		MAXIMUM HEIGHT OF COVER (FT.)				
		16	14	12	10	8
12	24	125	157			
15	24	100	125			
18	24	83	104			
21	24	71	89			
24	24	62	78	109		
27	24		69	97		
30	24		62	87		
36	24		51	73	94	
42	24			62	80	
48	36			54	70	85
54	36			48	62	76
60	36				52	64
66	36					52
72	36					43

2-2/3" X 1/2" ROUND CORRUGATED ALUMINUM ROUND PIPE

DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE				
		MAXIMUM HEIGHT OF COVER (FT.)				
		16	14	12	10	8
30	24	57	72	101	135	159
36	24	47	60	84	112	132
42	24	40	51	72	96	113
48	36	35	44	62	84	99
54	36	31	39	55	74	88
60	36	28	35	50	67	79
66	36	25	32	45	61	72
72	36	23	29	41	56	66
78	36		27	38	51	61
84	36			35	48	56
90	36			33	44	52
96	36			31	41	49
102	36				39	46
108	36				37	43
114	36					39
120	36					36

3" X 1" ROUND CORRUGATED ALUMINUM PIPE

DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE			
		MAXIMUM HEIGHT OF COVER (FT.)			
		16	14	12	10
18	24	43	61		
21	24	38	52	84	
24	24	33	45	73	
30	24	26	36	58	
36	24	21	30	49	69
42	24		25	41	59
48	36			36	51
54	36			32	46
60	36			29	41
66	36				37
72	36				34

3/4" X 3/4" 7-1/2 ROUND CORRUGATED ALUMINUM PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	MAXIMUM COVER (FT.)
17 X 13	15	24	16	13
21 X 15	18	24	16	12
24 X 18	21	24	16	13
28 X 20	24	24	16	12
35 X 24	30	24	16	12
42 X 29	36	24	16	12
49 X 33	42	24	14	12
57 X 38	48	36	12	12
64 X 43	54	36	12	12
71 X 47	60	36	10	12

2-2/3" X 1/2" ROUND CORRUGATED ALUMINUM PIPE ARCH*

DIAMETER (IN.)	MINIMUM COVER (IN.)	PIPE GAGE
		MAXIMUM HEIGHT OF COVER (FT.)
		16
6	24	247
8	24	185
10	24	148

1-1/2" X 1/4" ROUND CORRUGATED

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE	MAXIMUM COVER (FT.)
60 X 46	54	36	14	20
66 X 51	60	36	14	20
73 X 55	66	36	14	20
81 X 59	72	36	12	16
87 X 63	78	36	12	16
95 X 67	84	36	12	16
103 X 71	90	36	10	16
112 X 75	96	36	8	16

3" X 1" ROUND CORRUGATED ALUMINUM PIPE ARCH*

* CORNER BEARING PRESSURE OF 2 TONS PER SQ. FT.

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	MINIMUM COVER (IN.)	PIPE GAGE			
			MAXIMUM HEIGHT OF COVER (FT.)			
			16	14	12	10
20 X 16	18	24	16			
23 X 19	21	24	15			
27 X 21	24	24	13	13		
33 X 26	30	24	13	13	13	
40 X 31	36	24		13	13	
46 X 36	42	24			13	13
53 X 41	48	36			13	13
60 X 46	54	36			20	20
66 X 51	60	36				20

3/4" X 3/4" 7-1/2" ROUND CORRUGATED ALUMINUM PIPE ARCH*

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METAL PIPE

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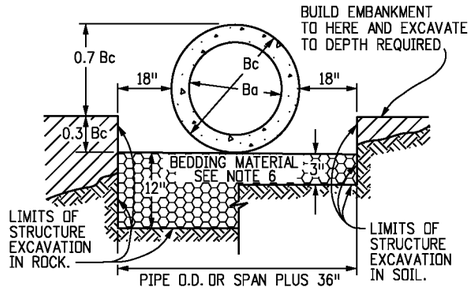


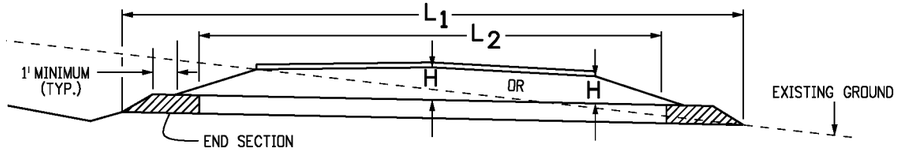
NOTE: Bc IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

PIPE INSTALLATION
(WITH 0.7 PROJECTION RATIO)

CIRCULAR (CIR)			VERTICAL ELLIPTICAL (VE)				HORIZONTAL ELLIPTICAL (HE)			
△ PIPE SIZE= *Ba* (INSIDE DIA)	WALL THICKNESS	0.3 *Bc* (OUTSIDE DIA)	SPAN	RISE	WALL THICKNESS	0.3 OUTSIDE RISE	SPAN	RISE	WALL THICKNESS	0.3 OUTSIDE RISE
IN.		FT.	IN.			FT.	IN.			FT.
12	2	0.40								
15	2-1/4	0.49								
18	2-1/2	0.58					23	14	2-3/4	0.49
21	2-3/4	0.66								
24	3	0.75					30	19	3-1/4	0.66
27	3-1/4	0.84					34	22	3-1/2	0.73
30	3-1/2	0.92					38	24	3-3/4	0.79
33	3-3/4	1.01								
36	4	1.10	29	45	4-1/2	1.35	45	29	4-1/2	0.95
42	4-1/2	1.28	34	53	5	1.58	53	34	5	1.10
48	5	1.45	38	60	5-1/2	1.78	60	38	5-1/2	1.23
54	5-1/2	1.62	43	68	6	2.00	68	43	6	1.38
60	6	1.80	48	76	6-1/2	2.23	76	48	6-1/2	1.53
66	6-1/2	1.97	53	83	7	2.43	83	53	7	1.68
72	7	2.15	58	91	7-1/2	2.65	91	58	7-1/2	1.83
78	7-1/2	2.32	63	98	8	2.85	98	63	8	1.98
84	8	2.50	68	106	8-1/2	3.08	106	68	8-1/2	2.13
90	8-1/2	2.68	72	113	9	3.28	113	72	9	2.25
96	9	2.85	77	121	9-1/2	3.50	121	77	9-1/2	2.40
102	9-1/2	3.02	82	128	9-3/4	3.69	128	82	9-3/4	2.54
108	10	3.20	87	136	10	3.90	136	87	10	2.68

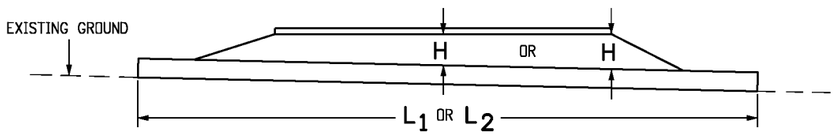
△ ALSO EQUIVALENT ROUND DIMENSION FOR ELLIPTICAL PIPE.

DIMENSIONS FOR REINFORCED CONCRETE PIPE
(FOR INFORMATION ONLY)

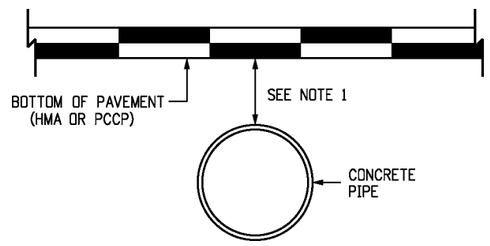


CONCRETE PIPE WITH END SECTIONS
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

H = MAXIMUM HEIGHT OF FILL OVER TOP OF PIPE, EXCLUDING PAVEMENT THICKNESS.
L_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 617 OR 624.
L_2 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.



CONCRETE PIPE WITHOUT END SECTIONS
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.



MINIMUM COVER FOR RIGID PIPE

GENERAL NOTES

REINFORCED CONCRETE PIPE

1. ADEQUATE COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE. THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR REINFORCED CONCRETE PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.
2. FILL HEIGHTS GREATER THAN MAXIMUM ALLOWED IN THE HEIGHTS OF FILL TABLE ON THIS SHEET REQUIRE SPECIAL DESIGN OF STRUCTURE.
3. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.
4. THE HEIGHTS OF FILL OVER TOP OF PIPE ARE BASED ON UNIT WEIGHT OF SOIL AT 135 LBS. PER CUBIC FT.
5. PIPE CLASS IS DETERMINED FROM 0.01 IN. CRACK D-LOAD.
6. BEDDING IS CLASS B (MODIFIED) (FROM CONCRETE PIPE DESIGN MANUAL-AMERICAN CONCRETE PIPE ASSOCIATION) WITH SETTLEMENT RATIO R = 0.0 $_{sd}$ (YIELDING BED). BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. LOOSE THICKNESS STRUCTURE BACKFILL CLASS 2. BEDDING MATERIAL FOR RIGID PIPE IN ROCK SHALL BE 12 IN. LOOSE THICKNESS STRUCTURE BACKFILL CLASS 1.
7. CHANGES IN DESIGN FACTORS REQUIRE COMPENSATING CHANGES IN PIPE DESIGN.
8. MINIMUM WALL THICKNESS DIMENSIONS ARE BASED ON AASHTO M 170 (WALL B) FOR CIRCULAR PIPE, AND AASHTO M 207 FOR ELLIPTICAL PIPE.
9. SPACING FOR MULTIPLE PIPE INSTALLATIONS SHALL CONFORM TO THE DETAILS SHOWN ON STANDARD PLAN M-206-1.
10. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL PIPE INSTALLATION SHALL BE USED.

NONREINFORCED CONCRETE PIPE

1. AT THE OPTION OF THE CONTRACTOR, NONREINFORCED CONCRETE PIPE CONFORMING TO AASHTO M 86 MAY BE USED IN LIEU OF REINFORCED CONCRETE PIPE FOR ALL SIZES 36 INCHES IN DIAMETER AND SMALLER. THE NONREINFORCED CONCRETE PIPE SHALL MEET THE SAME D-LOAD TO PRODUCE THE ULTIMATE LOAD UNDER THE THREE-EDGE BEARING METHOD AS SPECIFIED FOR REINFORCED CONCRETE PIPE IN CONFORMANCE WITH AASHTO M 170. THE CONTRACTOR SHALL PROVIDE WRITTEN CERTIFICATION OF CONFORMACE. THE WALL THICKNESS OF THE NONREINFORCED PIPE MAY BE INCREASED AS REQUIRED TO MEET D-LOAD REQUIREMENT.
2. ALL REQUIREMENTS FOR REINFORCED CONCRETE PIPE, EXCEPT THOSE REFERRING TO REINFORCEMENT, SHALL APPLY TO NONREINFORCED CONCRETE PIPE.

TYPE OF PIPE	HEIGHT OF FILL OVER TOP OF PIPE, H (FEET) CLASS OF PIPE (0.01 IN. CRACK D-LOAD)				
	CLASS CIR II CLASS VE II CLASS HE II 1000 D	CLASS CIR III CLASS VE III CLASS HE III 1350 D	CLASS CIR IV CLASS VE IV CLASS HE IV 2000 D	CLASS CIR V CLASS VE V ——— 3000 D	——— CLASS VE VI ——— 4000 D
CIRCULAR (CIR)	MIN. TO 18	MIN. TO 25	± 25 TO 37	± 37 TO 45	
VERTICAL ELLIPTICAL (VE)	MIN. TO 18	MIN. TO 25	± 25 TO 37	± 37 TO 45	± 45 TO 62
HORIZONTAL ELLIPTICAL (HE)	MIN. TO 18	MIN. TO 25	± 25 TO 37		

ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE
(ALL SIZES)

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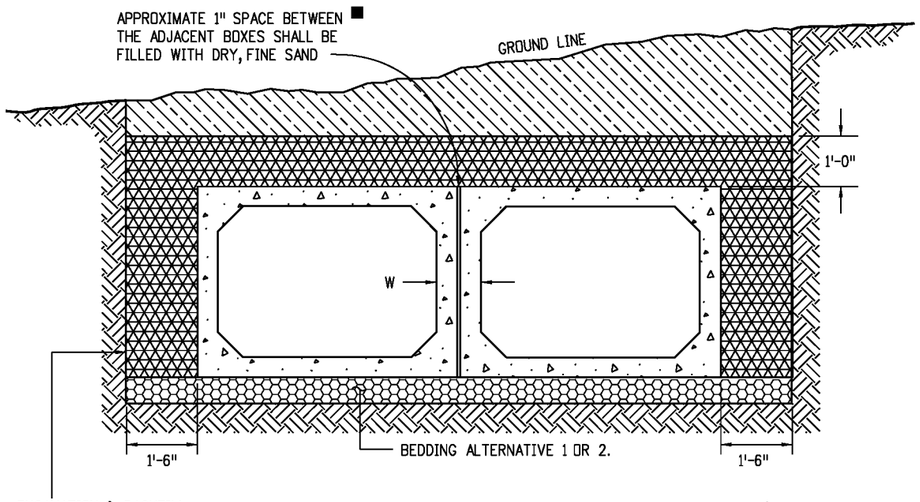
REINFORCED CONCRETE PIPE

Issued By: Project Development Branch on July 4, 2012

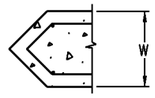
STANDARD PLAN NO.
M-603-2
Sheet No. 1 of 1



■ GROUT OR FOAM SEALENT SHALL BE USED WHEN SPECIFIED ON THE PLANS.

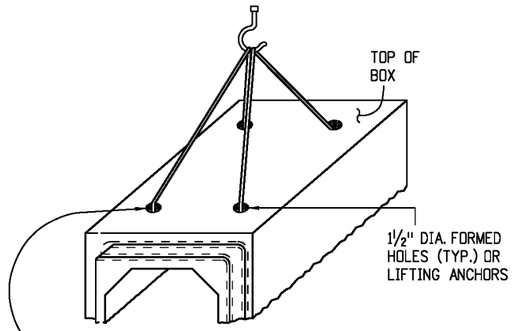
EXCAVATION & BACKFILL

(PARALLEL PRECAST BOX CULVERT INSTALLATION)

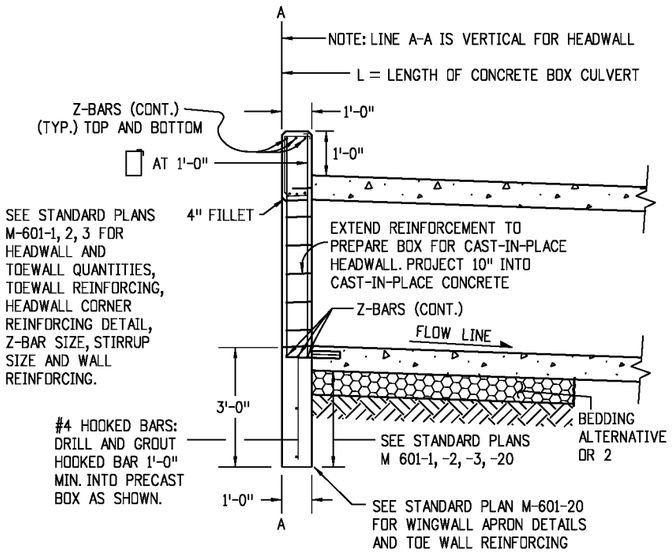


NOSE ANGLE DETAIL

SEE STANDARD PLANS M-601-2, AND 3 TYPICAL AT ADJACENT BOXES DRILL AND GROUT REINFORCING BARS (TYP.)

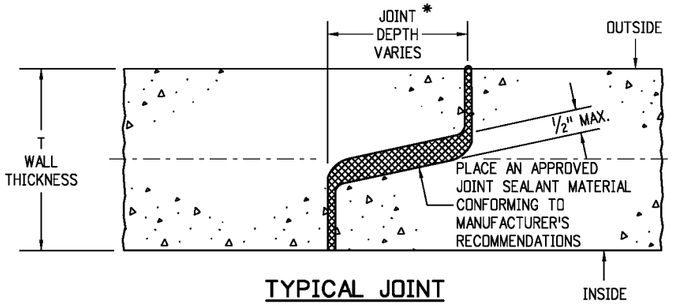


LIFTING



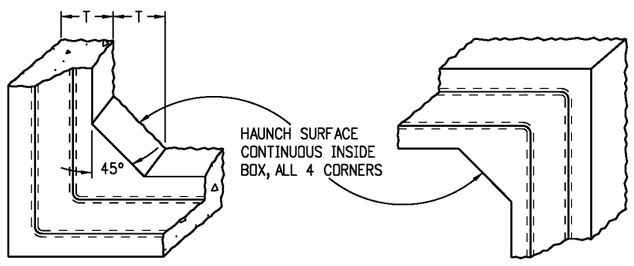
CULVERT END

(WITH HEADWALL)

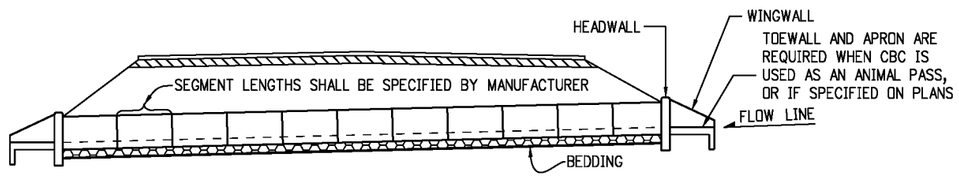


* MINIMUM JOINT DEPTH IS 4" BUT 75%T IS RECOMMENDED.

TYPICAL JOINT



CORNERS



TYPICAL CULVERT INSTALLATION

GENERAL NOTES

1. PRECAST CONCRETE BOX CULVERT SHALL CONFORM TO THE REQUIREMENTS OF THE FOLLOWING SPECIFICATIONS:

ITEM OR CONDITION	MIN. COVER	AASHTO	EQUIV. ASTM
2 FT. OR MORE COVER	2 FT.	M 259, TABLE 2	C 1433, TABLE 2
LESS THAN 2 FT. COVER	0 FT.	M 273, TABLE 2	C 1433, TABLE 2
PREFORMED JOINT MATERIAL	———	M 198, 6.1 OR 6.2	C 990, 6.1 OR 6.2
SPAN 20 FT. OR MORE	0 FT.	———	C 1577

   THE SPECIFICATIONS LISTED ABOVE SHOW REINFORCING PLACEMENT, EARTH COVER AND OTHER DETAILS NEEDED TO MANUFACTURE THE BOX CULVERTS.

   THE DESIGN FOR A PRECAST CONCRETE BOX WITH A SPAN LARGER THEN 12 FT. SHALL BE PROVIDED BY THE MANUFACTURER.

2. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS TO THE ENGINEER FOR INFORMATION ONLY, PRIOR TO FABRICATION.

3. BEDDING ALTERNATIVE 1 OR 2 IS REQUIRED:

   BEDDING ALTERNATIVE IS AT THE CONTRACTOR'S OPTION. BEDDING AND EXCAVATION FOR BEDDING WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

   BEDDING ALTERNATIVE 1 CONSISTS OF 6 IN. OF AGGREGATE BASE COURSE (CLASS 6) COMPACTED TO NOT LESS THAN 95% MAXIMUM DENSITY DETERMINED IN CONFORMANCE WITH AASHTO T 180.

   BEDDING ALTERNATIVE 2 CONSISTS OF AN 3 IN. THICK, MINIMUM, LEAN CONCRETE BASE. CEMENT CONTENT = 250 LBS./CU. YD.

   AGGREGATE GRADATION FOR ALTERNATIVE 2 BEDDING:

PASSING 2 IN. SIEVE	—	100%
PASSING NO. 4 SIEVE	—	20% TO 70%
PASSING NO. 200 SIEVE	—	5% TO 15%

4. CBC JOINTS USING RUBBER GASKETS SHALL MEET ASTM C1677.

5. CLASS 1 DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS WHICH DO NOT HAVE RUBBER GASKETS. THE GEOTEXTILE SHALL EXTEND A MINIMUM OF 1 FT. ON EACH SIDE OF JOINTS AND SHALL OVERLAP AND BE SECURELY ATTACHED FOR AT LEAST 1 FT. AT ITS ENDS. THE WRAP SHALL BE A SMOOTH FIT (NOT LOOSE OR STRETCHED) JUST PRIOR TO BACKFILL. THE GEOTEXTILE MATERIAL SHALL MEET THE APPLICABLE REQUIREMENTS OF SECTION 420. COST FOR GEOTEXTILE WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.

6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED. A LOAD-AND-RESISTANCE FACTOR DESIGN (LRFD) IS REQUIRED USING ASTM C 1577.

7. THE CONTRACTOR HAS THE OPTION OF PROVIDING A CBC WHICH MEETS ASTM C 1577 FOR SPANS LESS THAN 20 FT.

LEGEND

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, (CLASS 1)
- EMBANKMENT MATERIAL
- EARTH
- BEDDING
- CONCRETE

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PRECAST CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.
M-603-3
Sheet No. 1 of 1

LEGEND

H - HEIGHT OF COVER LIMIT, MAXIMUM ALLOWABLE HEIGHT OF FILL OVER THE TOP OF THE PIPE, EXCLUDING PAVEMENT THICKNESS.

FILL HEIGHTS AND DESIGN ASSUMPTIONS ARE BASED ON AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 4TH EDITION, SECTION 12, FOR 900 PSI LONG TERM STRENGTH OF HDPE, AND AASHTO T180 MINIMUM RELATIVE COMPACTION OF 95% OR 90%.

FILL HEIGHTS ARE BASED ON AASHTO'S M294, TYPE S PIPE WITH OUTER CORRUGATED WALL AND SMOOTH INNER LINEAR.

FILL HEIGHTS FOR INSTALLATION WITH HIGH WATER TABLE REQUIRE SPECIAL DESIGN. THE MAXIMUM HEIGHT IN HIGHWATER LOCATIONS SHOULD BE 15 FEET OR BASED ON AASHTO LRFD DESIGN SPECIFICATIONS.

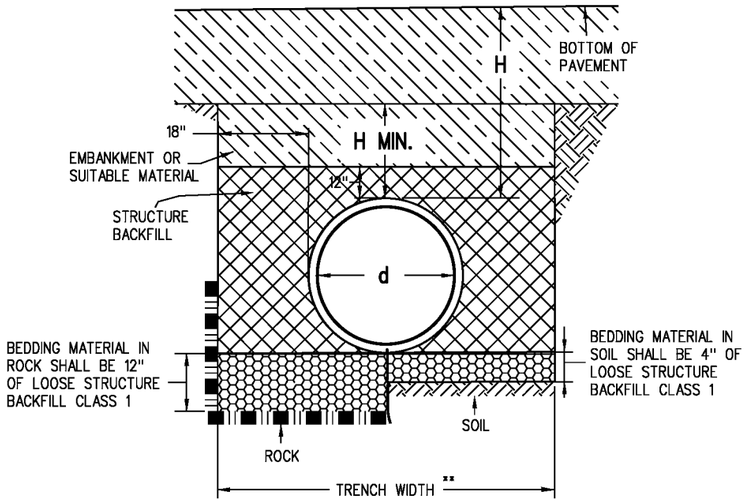
H MIN. - THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

THE MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE SUBGRADE DURING CONSTRUCTION. THE MINIMUM COVER IS BASED ON DUAL AXLE LOADS UP TO 50,000 POUNDS.

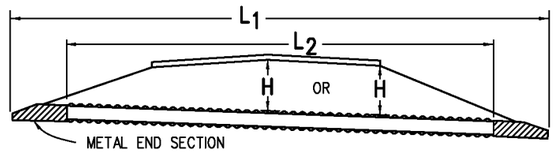
L_1 - LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

L_2 - LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.

+ - THE MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR **½ d**, WHICHEVER IS GREATER.

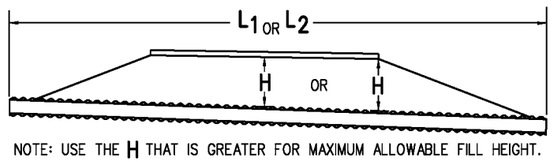


INSTALLATION OF PIPE



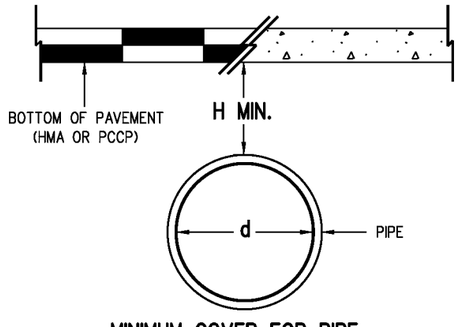
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

PIPE WITH END SECTIONS



NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

PIPE WITHOUT END SECTIONS



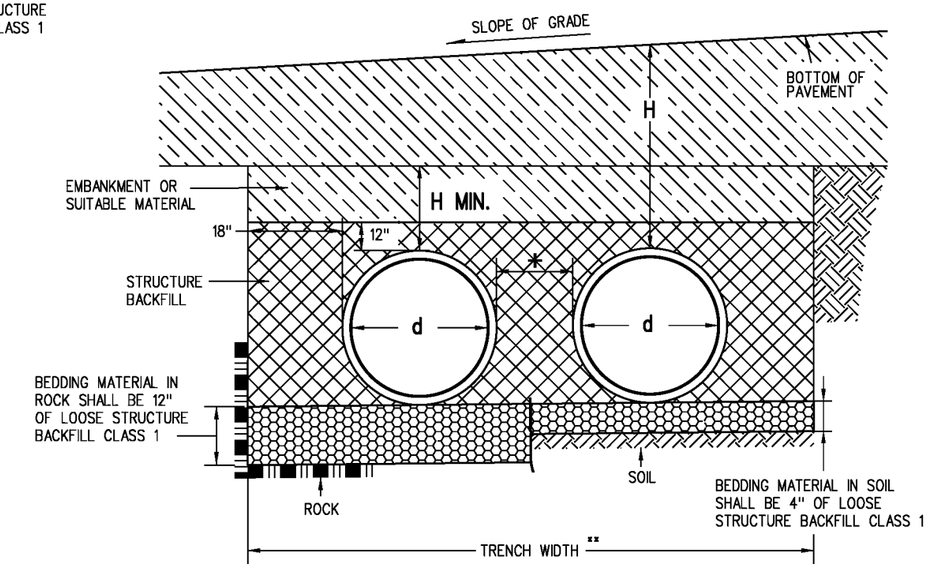
MINIMUM COVER FOR PIPE

PIPE DIAMETER, d (IN.)	MINIMUM HEIGHT OF COVER, H MIN. (FT.)	MAXIMUM HEIGHT OF COVER, H (FT.)	
		95% COMPACTION	90% COMPACTION
12	2	27	19
15	2	29	20
18	2	24	17
24	2	21	15
30	2	18	12
36	2	20	13
42	2	19	13
48	3	17	12
60	3	20	13

MINIMUM AND MAXIMUM COVER

GENERAL NOTES

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO M294, TYPE S FOR HIGH DENSITY CORRUGATED POLYETHYLENE PIPE (HDPE) WITH SMOOTH INNER SURFACE.
2. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
3. ADEQUATE COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE.
4. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE POST'S BOTTOM MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE. THE HOLE FOR THE POST SHALL BE DRILLED INTO THE SOIL.
5. STRUCTURE BACKFILL MATERIAL SHALL BE CLASS 1.
6. FOR PIPES 24 INCHES OR LESS IN DIAMETER, H MIN. MAY BE REDUCED TO ONE FOOT FOR LOW VOLUME APPROACH ROADS NOT ON STATE HIGHWAYS.



INSTALLATION OF MULTIPLE PIPES

** TRENCH WIDTH ASSUMES STABLE IN-SITU SIDE WALL

NOMINAL PIPE DIAMETER (IN.)	MINIMUM COVER (IN.) FOR INDICATED AXLE LOADS (KIPS)			
	18.0-50.0	50.0-75.0	75.0-110.0	110.0-150.0
24 - 36	24.0	30.0	36.0	36.0
42 - 48	36.0	36.0	42.0	48.0
54 - 60	36.0	36.0	42.0	48.0

AASHTO MINIMUM COVER FOR CONSTRUCTION LOADS

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CORRUGATED POLYETHYLENE PIPE (AASHTO M294)

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.

M-603-4

LEGEND

H - HEIGHT OF COVER LIMIT, MAXIMUM ALLOWABLE HEIGHT OF FILL OVER THE TOP OF THE PIPE, EXCLUDING PAVEMENT THICKNESS.

FILL HEIGHTS BASED ON AASHTO M304 PIPE WITH OUTER RIBBED WALL AND SMOOTH INNER WALL.

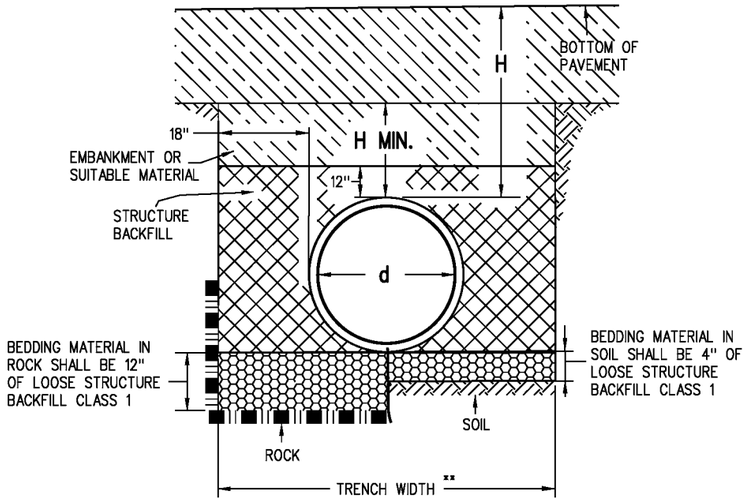
FILL HEIGHTS FOR INSTALLATION WITH HIGH WATER TABLE REQUIRE SPECIAL DESIGN. THE MAXIMUM HEIGHT IN HIGHWATER LOCATIONS SHOULD BE 15 FEET OR BASED ON AASTHO LRFD DESIGN SPECIFICATIONS.

H MIN. - THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

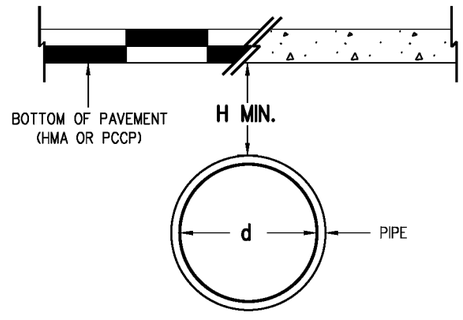
THE MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE SUBGRADE DURING CONSTRUCTION. THE MINIMUM COVER IS BASED ON DUAL AXLE LOADS UP TO 50,000 POUNDS.

L_1 - LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

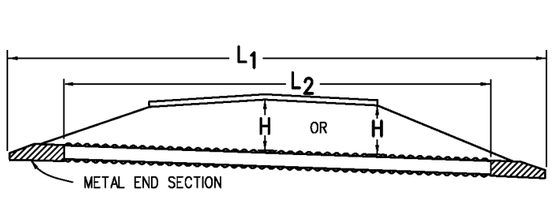
L_2 - LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.



INSTALLATION OF PIPE



MINIMUM COVER FOR PIPE



NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

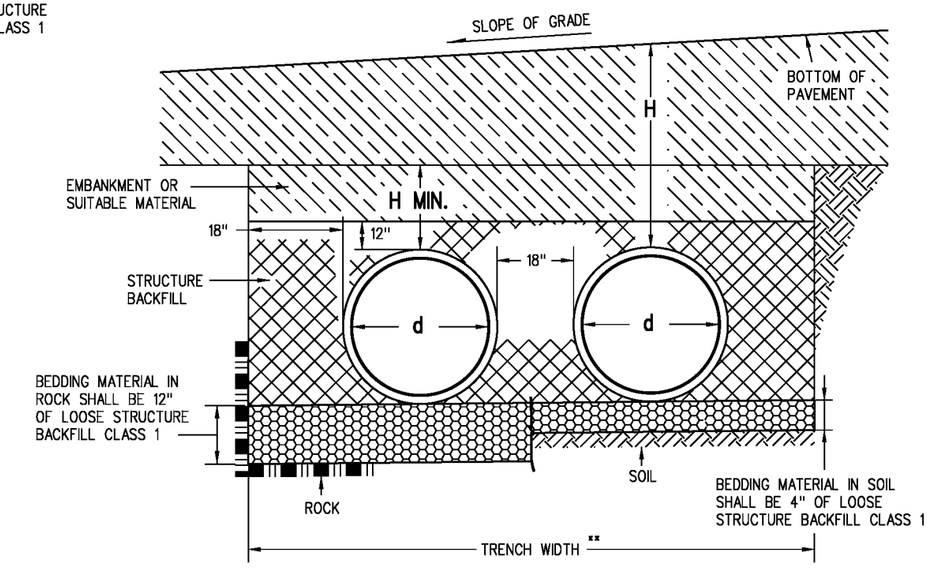
PIPE WITH END SECTIONS

PIPE DIAMETER, d (IN.)	MINIMUM HEIGHT OF COVER, H MIN. (FT.)	MAXIMUM HEIGHT OF COVER, H (FT.)	
		95% COMPACTION	90% COMPACTION
12	2	65	55
15	2	59	51
18	2	63	53
21	2	58	49
24	2	58	49
30	2	56	47
36	2	56	47

MINIMUM AND MAXIMUM COVER

GENERAL NOTES

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO M304 FOR POLYVINYL CHLORIDE (PVC) PROFILE WALL DRAIN PIPE WITH 46 PSI WALL STIFFNESS PER ASTM F949.
2. FOR PIPES WITH DIAMETERS OF 15 INCHES OR LESS, SOLID WALL PVC PIPES MEETING AASHTO M278 MAY BE USED.
3. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
4. ADEQUATE COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE.
5. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE POST'S BOTTOM MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE. THE HOLE FOR THE POST SHALL BE DRILLED INTO THE SOIL.
6. BACKFILL MATERIAL SHALL BE CLASS 1 FOR ONE FOOT ABOVE THE PIPE.
7. FOR PIPES 24 INCHES OR LESS IN DIAMETER, H MIN. MAY BE REDUCED TO ONE FOOT FOR LOW VOLUME APPROACH ROADS.



INSTALLATION OF MULTIPLE PIPES

** TRENCH WIDTH ASSUMES STABLE IN-SITU SIDE WALL

NOMINAL PIPE DIAMETER (IN.)	MINIMUM COVER (IN.) FOR INDICATED AXLE LOADS (KIPS)			
	18.0-50.0	50.0-75.0	75.0-110.0	110.0-150.0
24 - 36	24.0	30.0	36.0	36.0

AASHTO MINIMUM COVER FOR CONSTRUCTION LOADS

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POLYVINYL CHLORIDE (PVC) PIPE (AASHTO M304)

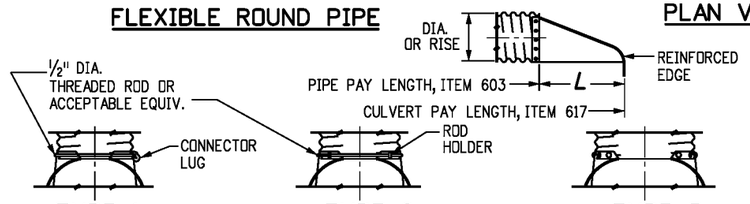
Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.

M-603-5

PIPE DIA.	THICKNESS	DIMENSIONS					
		A	B	H	L	W	T
		IN.					
12	0.064	6	6	6	21	24	34
18	0.064	8	10	6	31	36	46
21	0.064	9	12	6	36	42	52
24	0.064	10	13	6	41	48	58
30	0.079	12	16	8	51	60	70
36	0.079	14	19	9	60	72	94
42	0.109	16	22	11	69	84	106
48	0.109	18	27	12	78	90	112
54	0.109	18	30	12	84	102	124
60	0.109	18	33	12	87	114	136
66	0.109	18	36	12	87	120	142
72	0.109	18	39	12	87	126	148
78	0.109	18	42	12	87	132	154
84	0.109	18	45	12	87	138	160

FLEXIBLE ROUND PIPE



TYPE 1

FOR 18 IN. THRU 24 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY-FORMED PIPE UNLESS RECORRUGATED.

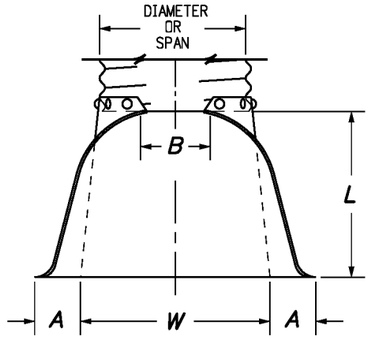
TYPE 2

FOR 30 IN. THRU 36 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY-FORMED PIPE UNLESS RECORRUGATED.

TYPE 3

FOR 42 IN. THRU 84 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS AND ALL SIZES WITH HELICAL CORRUGATIONS AND FOR ALL METAL PIPE ARCH CULVERTS. SHOP ATTACH A 24 IN. MIN. LENGTH OF ANNULAR PIPE WITH GALV. RIVETS OR BOLTS, SPOT WELDS, OR 2 IN. LONG SKIP WELDS ON 8 IN. CTRS. REPAIR BURNT GALVANIZING IN ACCORDANCE WITH SUBSECTION 707.09.

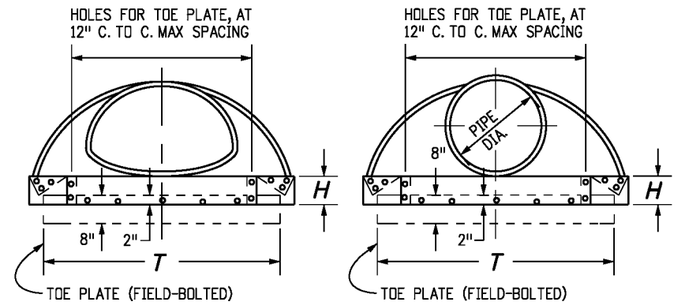
TYPICAL CONNECTIONS



PLAN VIEW

PIPE ARCH SPAN x RISE	THICKNESS	DIMENSIONS					
		A (±1")	B (MAX.)	H (±1")	L (±1.5")	W (±2")	T
		IN.					
21 x 15	0.064	7	10	6	23	36	46
24 x 18	0.064	8	12	6	28	42	52
28 x 20	0.064	9	14	6	32	48	58
35 x 24	0.079	10	16	6	39	60	70
42 x 29	0.079	12	18	8	46	75	85
49 x 33	0.109	13	21	9	53	85	103
57 x 38	0.109	18	26	12	63	90	108
64 x 43	0.109	18	30	12	70	102	120
71 x 47	0.109	18	33	12	77	114	132

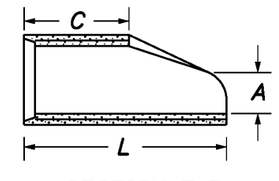
FLEXIBLE PIPE ARCH



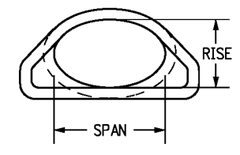
ELEVATIONS

GENERAL NOTES

1. DIMENSIONS OF END SECTIONS MAY VARY SLIGHTLY FROM THOSE SHOWN ON THE TABLES DUE TO DIFFERENT MANUFACTURERS' CONFIGURATIONS.
2. CONCRETE END SECTIONS SHALL BE FURNISHED WITH TONGUE OR GROOVE AS REQUIRED.
3. DESIGN LENGTH OF PIPE OR SIDE DRAIN IS BASED ON LENGTH OF END SECTION SHOWN IN TABLE. ANY ADDITIONAL PIPE REQUIRED TO PROVIDE THE DESIGN LENGTH SHALL BE FURNISHED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE PROJECT.
4. THE INSIDE CONFIGURATION AND THE JOINT OF CONCRETE END SECTION AND PIPE SHALL MATCH.
5. END SECTIONS FOR CMP ARCH PIPE SHALL MATCH THE DIMENSIONS OF THE PIPE SHOWN ON THE PLANS.
6. GALVANIZED TOE PLATE AS SHOWN IS REQUIRED ON END SECTIONS FOR CORRUGATED STEEL PIPE AND SHALL BE THE SAME THICKNESS AS END SECTIONS. TOE PLATE SHALL BE FIELD-BOLTED TO END SECTION WITH ⅜ IN. GALVANIZED BOLTS, NUTS AND WASHERS.
7. GALVANIZED STEEL SHALL CONFORM TO AASHTO M 111, M 218 OR M 232.
8. FOR TYPE SD END SECTIONS, BARS SHALL BE FABRICATED FROM NPS-3 GALVANIZED STEEL SCHEDULE 40 PIPE WHICH SHALL CONFORM TO ASTM A 53.
9. FOR A TYPE SD END SECTION, THE INSTALLATION OF ALTERNATIVE 1 OR ALTERNATIVE 2 END SECTION SHALL BE THE CONTRACTOR'S OPTION.
10. CONCRETE PIPE JOINT FASTENERS, WHERE SHOWN ON PLANS, SHALL BE INSTALLED SO THAT A MINIMUM OF 15 LINEAR FEET OF THE OUTLET END OF THE PIPE ARE MECHANICALLY LOCKED TOGETHER. END SECTION LENGTHS WHEN USED, SHALL BE INCLUDED IN THE 15 LF REQUIREMENT.
11. CONNECTIONS OF METAL END SECTIONS TO PLASTIC PIPE SHALL BE APPROVED BY THE ENGINEER. PLASTIC END SECTIONS SHALL NOT BE USED.
12. THE END SECTION STYLE, EITHER REGULAR OR SAFETY, SHALL BE AS SHOWN ON THE PLANS.

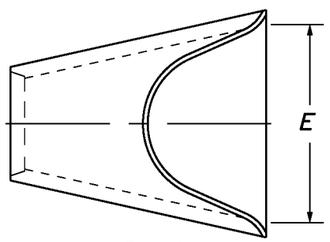


SECTION F-F



END VIEW

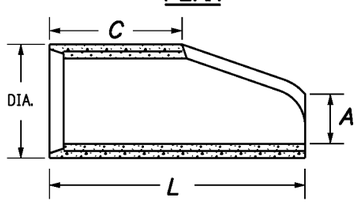
END SECTION AND CONNECTION DETAILS FOR ROUND AND ARCH METAL PIPES



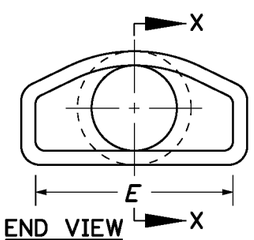
PLAN

PIPE I.D.	DIMENSIONS			
	A	C	L	E
	IN.			
18	10	48	78	36
24	10	48	78	48
30	14	36	96	60
36	18	36	96	72
42	24	36	96	78
48	28	24	96	84
54	30	36	96	90
60	36	36	96	96
72	34	20	96	108

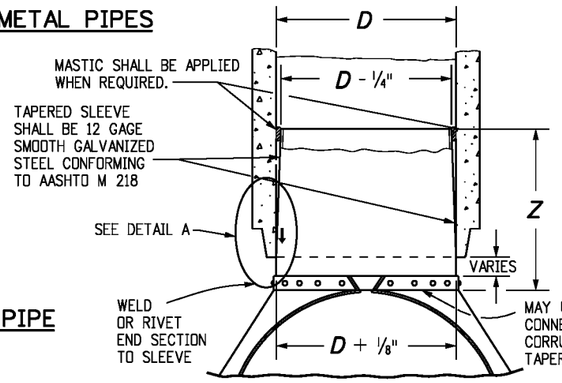
REINFORCED CONCRETE CIRCULAR PIPE



SECTION X-X



END SECTION FOR REINFORCED CONCRETE CIRCULAR PIPE

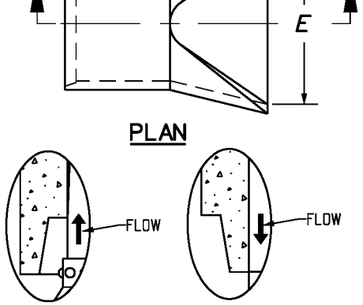


D	Z (MIN.)
IN.	
18 - 24	12
30 AND 36	16
42 AND LARGER	24

NOTE: METAL END SECTION SHALL BE FIRMLY WEDGED INTO PIPE END BEFORE BACKFILLING.

STEEL END SECTION FOR CONCRETE CIRCULAR PIPE

(ALTERNATIVE FOR CONCRETE END SECTION)



PLAN

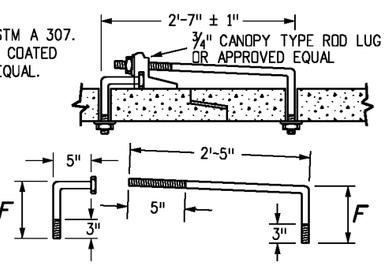
DETAIL A

PIPE DIAMETER	F
IN.	
18 - 30	5
36 - 42	6
48 - 60	7
72 - 84	9

EQUIVALENT CIRCULAR DIA.	DIMENSIONS						
	NOMINAL SPAN x RISE	A	C	L	E		
	IN.						
24	30	19	9	33	72	48	
30	38	24	10	18	72	60	
36	45	29	12	24	84	72	
42	53	34	16	36	96	78	
48	60	38	21	36	96	84	
54	68	43	26	36	96	90	
60	76	48	30	36	96	96	

END SECTION FOR REINFORCED CONCRETE ELLIPTICAL PIPE

¾" GALVANIZED ANCHOR BOLTS, NUTS AND WASHERS, MILD STEEL, ASTM A 307. ROD LUG SHALL BE GALVANIZED OR COATED WITH EPOXY PAINT OR APPROVED EQUAL.



CONCRETE JOINT FASTENER (TWO PER JOINT)

Computer File Information		Sheet Revisions	
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Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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Drawing File Name: 6010100102.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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CONCRETE AND METAL END SECTIONS

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

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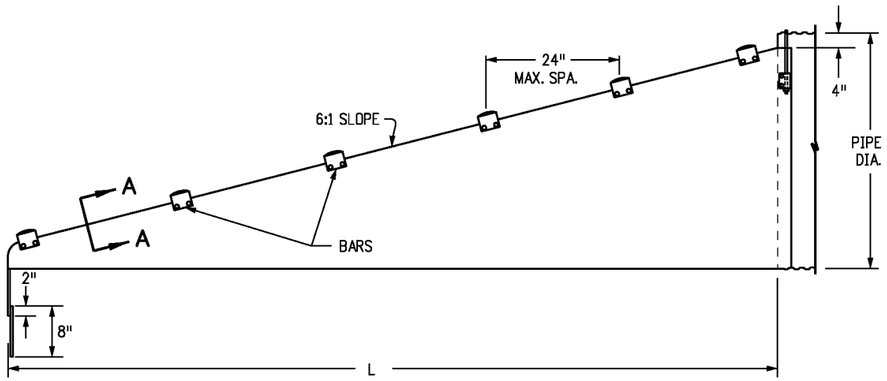
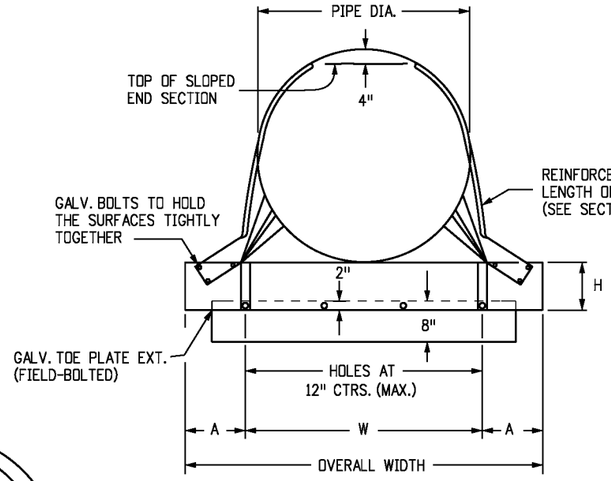


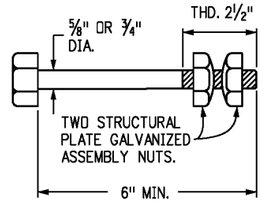
SIDE VIEW OF END SECTION - ALTERNATIVE 1



FRONT VIEW - ALTERNATIVE 1

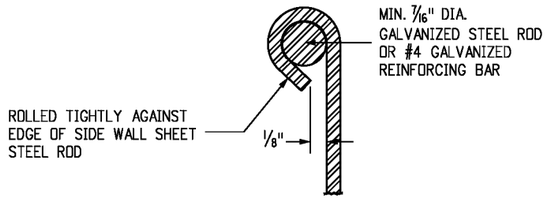
(BARS NOT SHOWN)

NOTE: ALL CUT OR WELDED SURFACES SHALL BE PROTECTED WITH ONE FULL BRUSH COAT OF ZINC RICH PAINT IN ACCORDANCE WITH SUBSECTION 707.09.

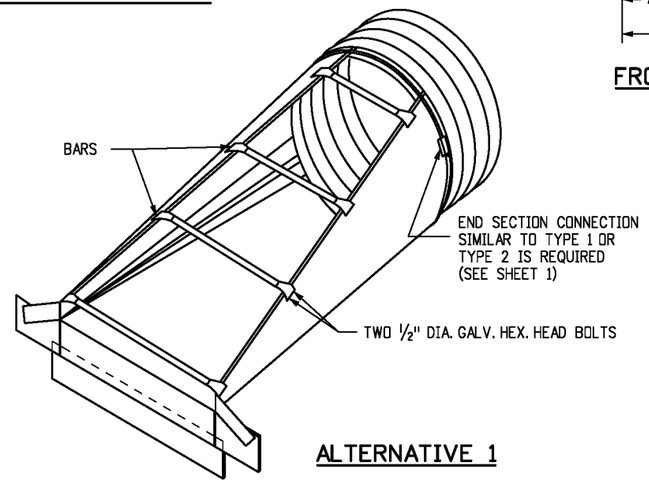


TYPICAL ANCHOR BOLT

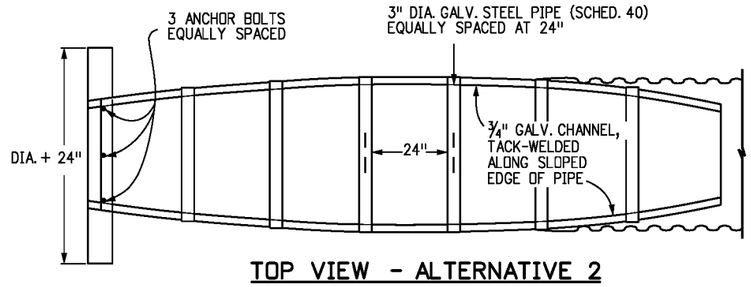
(GALVANIZED)



SECTION A-A



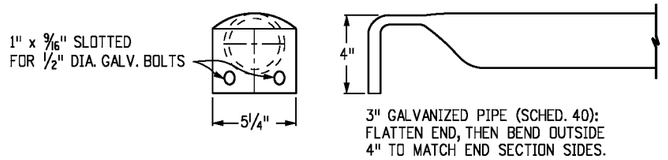
ALTERNATIVE 1



TOP VIEW - ALTERNATIVE 2

END SECTIONS FOR CIRCULAR PIPES

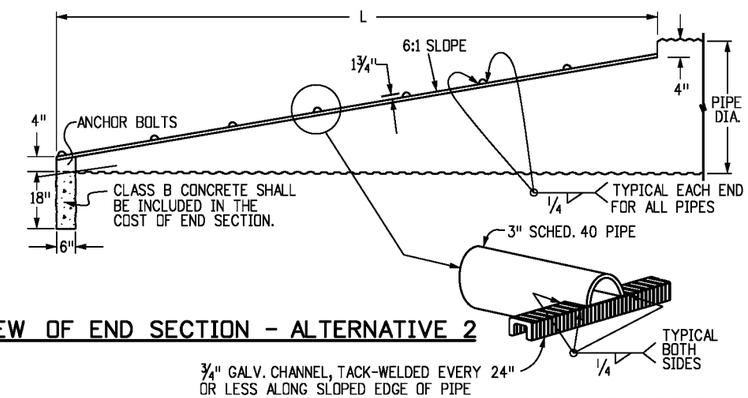
PIPE DIA. (IN.)	MIN. THICK (IN.)	DIMENSION (IN.)					
		A	H	W	OVERALL WIDTH	SLOPE	LENGTH (L)
15	.064	8	6	21	37	6:1	30
18	.064	8	6	24	40	6:1	48
21	.064	8	6	27	43	6:1	66
24	.079	8	6	30	46	6:1	84
30	.079	12	9	36	60	6:1	120
36	.109	12	9	42	66	6:1	156



BAR END DETAILS

(FOR ALTERNATIVE 1)

TYPE SD END SECTIONS FOR SIDE DRAIN



SIDE VIEW OF END SECTION - ALTERNATIVE 2

BAR END DETAIL

(FOR ALTERNATIVE 2)

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Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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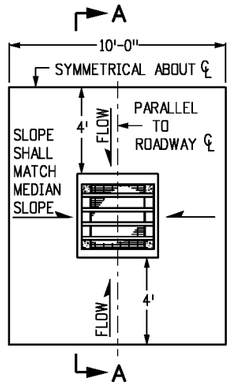
CONCRETE AND METAL END SECTIONS

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

M-603-10

Sheet No. 2 of 2

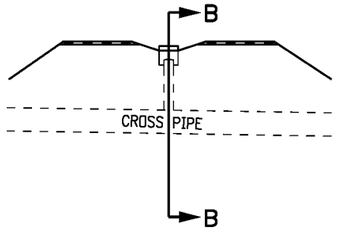


INLET WITH DITCH PAVING

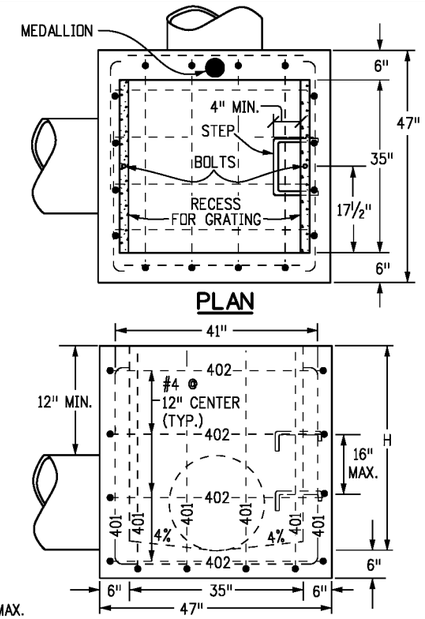
STEEL GRATE QUANTITIES

NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
4	S4 x 7.7 BEAM	40"	7.70	103
2	3½" x ¼" FLAT	26⅝"	2.98	13
2	3" x ¼" FLAT	26⅝"	2.55	12

TOTAL LBS. - 128

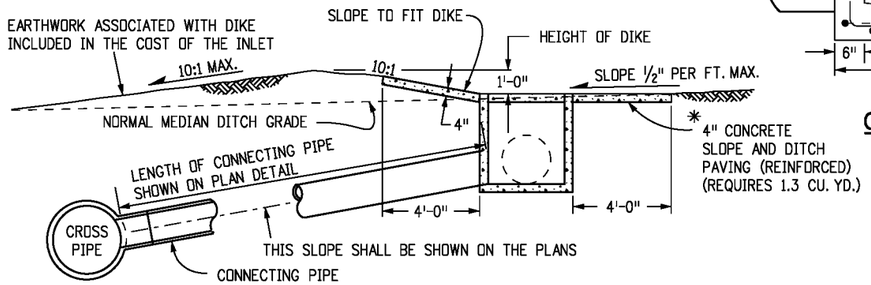


SECTION VIEW



PLAN

ELEVATION
CONCRETE INLET



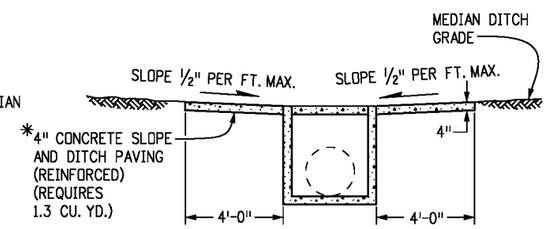
SECTION B-B

INLET CONNECTED TO A CROSS PIPE

SECTION A-A

INLET ON GRADE (FLOW FROM ONE DIRECTION)

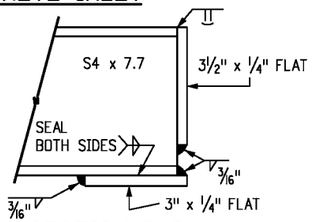
INLET CONNECTED TO A SKEWED CROSS PIPE



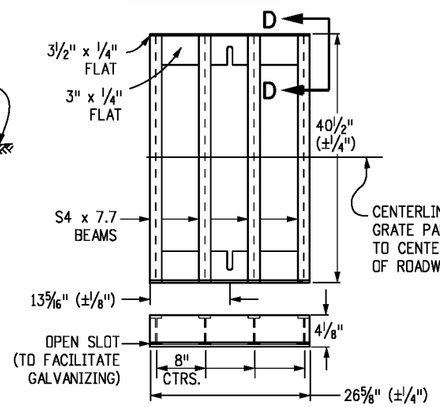
SECTION A-A

*CONCRETE SLOPE AND DITCH PAVING WILL BE REQUIRED WHEN SHOWN ON THE PLANS.

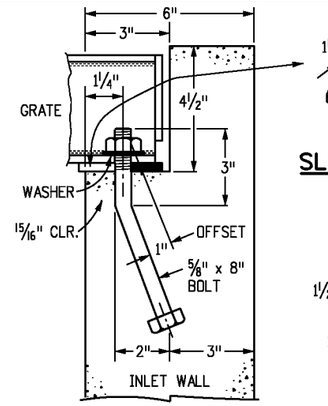
INLET AT BOTTOM OF VERTICAL CURVE (FLOW FROM TWO DIRECTIONS)



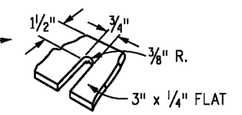
SECTION D-D



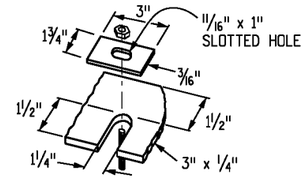
STANDARD INLET GRATE



GRATE INSTALLATION DETAIL



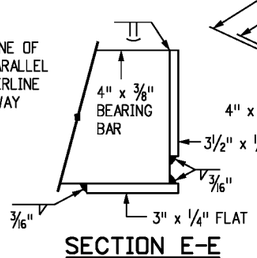
SLOT DETAIL



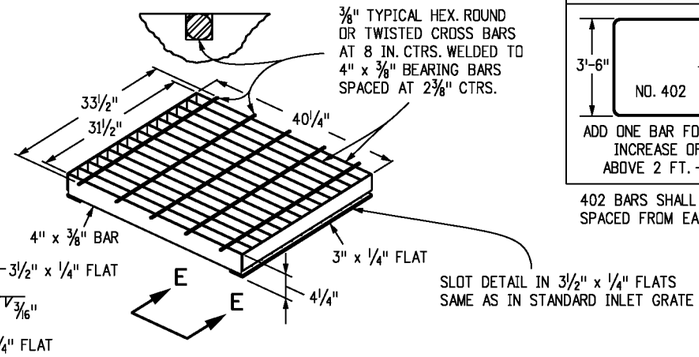
ALTERNATE SLOT AND HOLD DOWN PLATE DETAIL

GENERAL NOTES

1. INLET TYPE C IS NOT HS-20 RATED AND SHALL NOT BE PLACED IN PAVED ROADWAYS. THIS INLET SHALL BE USED ONLY OUTSIDE PAVED ROADWAYS.
2. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
3. REINFORCING BARS SHALL BE EPOXY COATED AND DEFORMED #4, AND SHALL HAVE A MINIMUM 2 IN. CLEARANCE. CUT OR BEND AROUND PIPES AS REQUIRED.
4. CONCRETE SLOPE AND DITCH PAVING SHALL BE IN ACCORDANCE WITH SECTION 507. REINFORCEMENT FOR CONCRETE SLOPE PAVING SHALL BE 6 X 6 - W1.4 X W1.4 OR 6 X 6 - W2.1 X W2.1.
5. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED, AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
6. THE STANDARD INLET GRATES SHALL BE USED ON ALL TYPE C INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
7. CLOSE MESH GRATES ARE RECOMMENDED WHERE FOOT TRAFFIC OR BICYCLE ROUTES ARE IN CLOSE PROXIMITY TO GRATE. THIS GRATE IS NOT ADA COMPLIANT OR BICYCLE FRIENDLY AND SHALL NOT BE PLACED DIRECTLY IN SIDEWALKS, CROSSWALKS OR BIKE PATHS.
8. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT. - 6 IN., AND SHALL CONFORM TO AASHTO M 199.
9. SEE STANDARD PLAN M-604-11, FOR REINFORCEMENT AROUND THE PIPE OPENING.
10. ALL INLETS SHALL HAVE A 4 IN. DIA. METAL MEDALLION WITH A "NO DUMPING DRAINS TO STREAM" MESSAGE ON IT. THE MEDALLION SHALL HAVE A FISH SYMBOL WITH A BLUE BACKGROUND. IT SHALL BE FIRMLY ATTACHED TO THE TOP OF THE INLET WITH A PERMANENT FASTENER.



SECTION E-E



CLOSE MESH GRATE

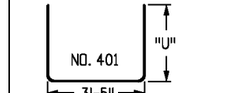
QUANTITIES FOR ONE INLET

H	CONCRETE (CU. YDS.)	STEEL (LBS.)	NO. STEPS REQ'D.
2'-6"	0.9	75	0
3'-0"	1.0	80	0
3'-6"	1.2	96	0
4'-0"	1.3	101	1
4'-6"	1.4	116	2
5'-0"	1.5	122	2
5'-6"	1.7	137	2
6'-0"	1.8	142	3
6'-6"	1.9	158	3
7'-0"	2.0	163	3
7'-6"	2.2	179	4
8'-0"	2.3	184	4
8'-6"	2.4	199	4
9'-0"	2.5	205	5
9'-6"	2.7	220	5
10'-0"	3.0	235	6
11'-6"	3.4	251	6

▼ PIPE INSIDE DIAMETER SHALL BE 30 IN. OR LESS. CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

BAR LIST FOR H = 2 FT.-6 IN. AND BENDING DIAGRAM

MARK	NO. REQ'D.	HEIGHT	LENGTH
401	2	2'-3"	7'-11"
401	6	2'-7"	8'-7"
402	3	"U"	15'-0"



"U" INCREASE DIMENSION 6 IN. FOR EACH 6 IN. INCREASE OF "H" ABOVE 2 FT.-6 IN.

ADD ONE BAR FOR EACH FT. INCREASE OF "H" ABOVE 2 FT. - 6 IN.

402 BARS SHALL BE EQUALLY SPACED FROM EACH OTHER.

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INLET, TYPE C

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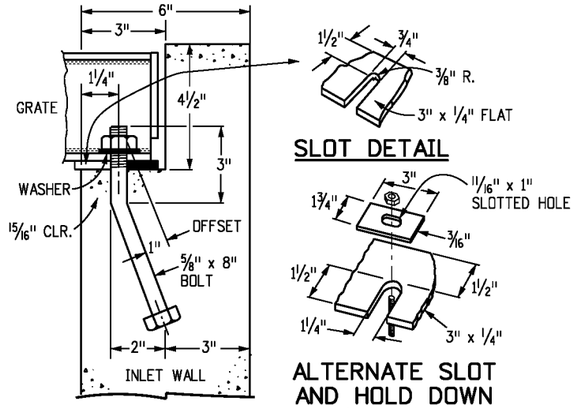
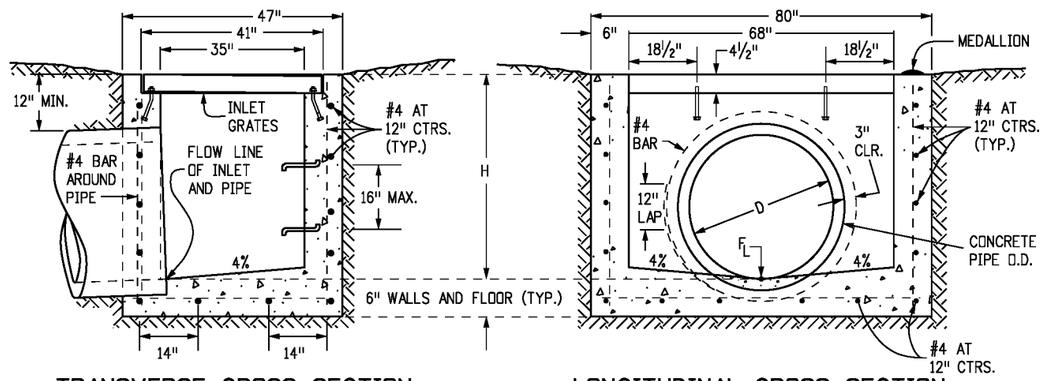


SLOT DETAIL

ALTERNATE SLOT AND HOLD DOWN PLATE DETAIL

GRATE INSTALLATION DETAIL



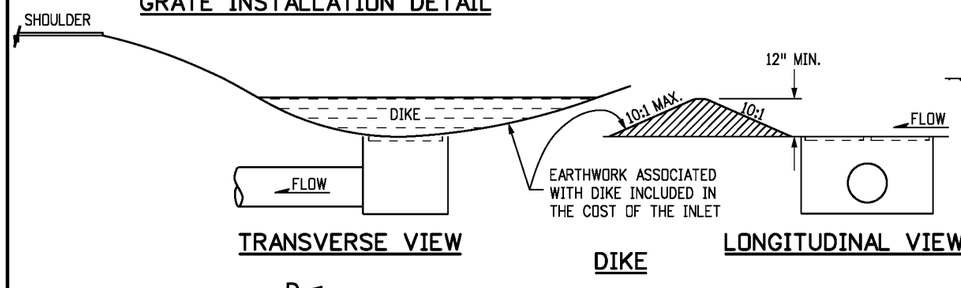
TRANSVERSE CROSS SECTION

LONGITUDINAL CROSS SECTION

LEVEL GRATE INSTALLATION

GENERAL NOTES

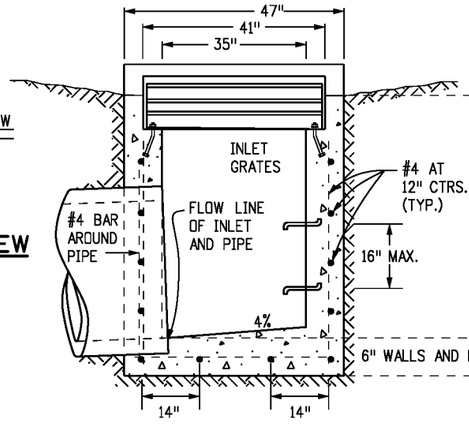
1. INLET TYPE D IS NOT HS-20 RATED AND SHALL NOT BE PLACED IN PAVED ROADWAYS. THIS INLET SHALL BE USED ONLY OUTSIDE PAVED ROADWAYS.
2. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
3. SEE PLANS FOR SIZE AND LOCATION OF PIPE.
4. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
5. STANDARD INLET GRATES SHALL BE USED ON ALL TYPE D INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
6. CLOSE MESH GRATES ARE RECOMMENDED WHERE FOOT TRAFFIC OR BICYCLE ROUTES ARE IN CLOSE PROXIMITY TO GRATE. THIS GRATE IS NOT ADA COMPLIANT OR BICYCLE FRIENDLY AND SHALL NOT BE PLACED DIRECTLY IN SIDEWALKS, CROSSWALKS OR BIKE PATHS.
7. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT.-6 IN. AND SHALL CONFORM WITH AASHTO M 199.
8. REINFORCING BARS SHALL BE EPOXY COATED AND DEFORMED #4, AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. CUT OR BEND BARS AROUND PIPE AS REQUIRED.
9. ALL INLETS SHALL HAVE A 4 IN. DIA. METAL MEDALLION WITH A "NO DUMPING DRAINS TO STREAM" MESSAGE ON IT. THE MEDALLION SHALL HAVE A FISH SYMBOL WITH A BLUE BACKGROUND. IT SHALL BE FIRMLY ATTACHED TO THE INLET'S SURFACE WITH A PERMANENT FASTENER.



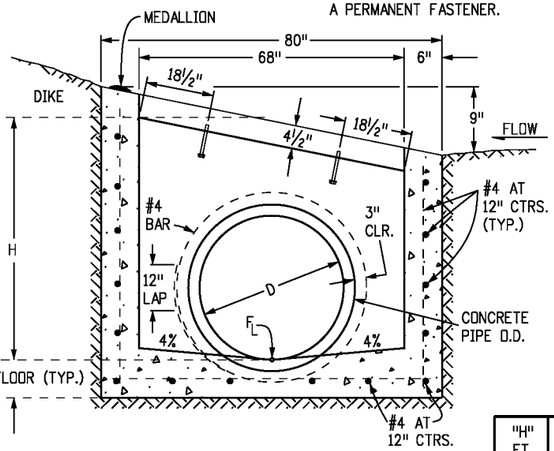
TRANSVERSE VIEW

LONGITUDINAL VIEW

DIKE

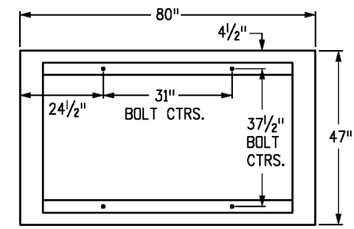


TRANSVERSE CROSS SECTION



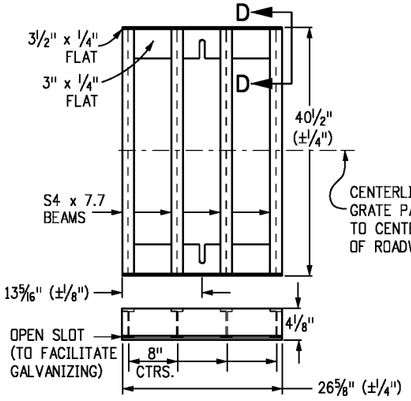
LONGITUDINAL CROSS SECTION

SLOPING GRATE INSTALLATION

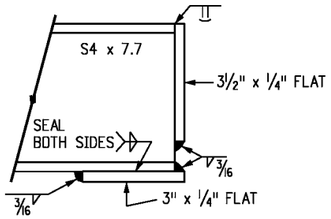


PLAN VIEW

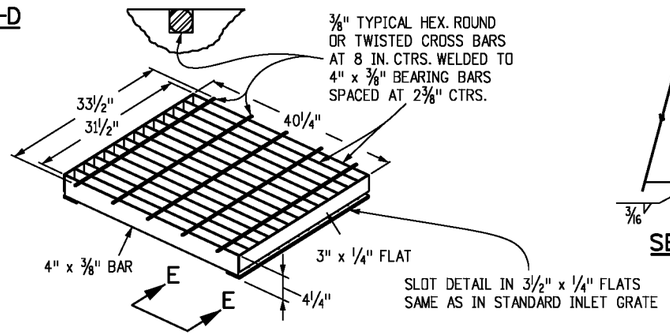
(SHOWING ANCHOR BOLT LAYOUT)



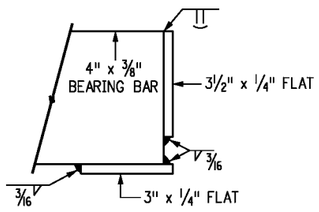
STANDARD INLET GRATE



SECTION D-D



CLOSE MESH GRATE



SECTION E-E

OUTLET PIPE INSIDE DIA. FT. - "D"	MIN. "H" FT.
1.5	3.0
2.0	3.5
2.5	4.0
3.0	4.5
3.5	5.0

TWO STEEL GRATE PER INLET QUANTITIES

NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
8	S4 x 7.7 BEAM	40"	7.70	206
4	3½" x ¼" FLAT	26⅝"	2.98	26
4	3" x ¼" FLAT	26⅝"	2.55	24

TOTAL LBS. - 256

"H" FT.	CONCRETE CU. YDS.	STEEL LBS.	CIRCULAR PIPE RANGE INSIDE DIA., IN. - "D"
3.0	1.5	127	18
3.5	1.7	149	18-24
4.0	1.9	157	18-30
4.5	2.0	179	18-36
5.0	2.2	187	18-42
5.5	2.4	208	18-42
6.0	2.6	215	18-42
6.5	2.8	236	18-42
7.0	2.9	243	18-42
7.5	3.1	264	18-42
8.0	3.3	271	18-42
8.5	3.5	292	18-42
9.0	3.6	299	18-42
9.5	3.8	320	18-42
10.0	4.0	327	18-42

▼ CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

QUANTITIES FOR ONE INLET

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INLET, TYPE D

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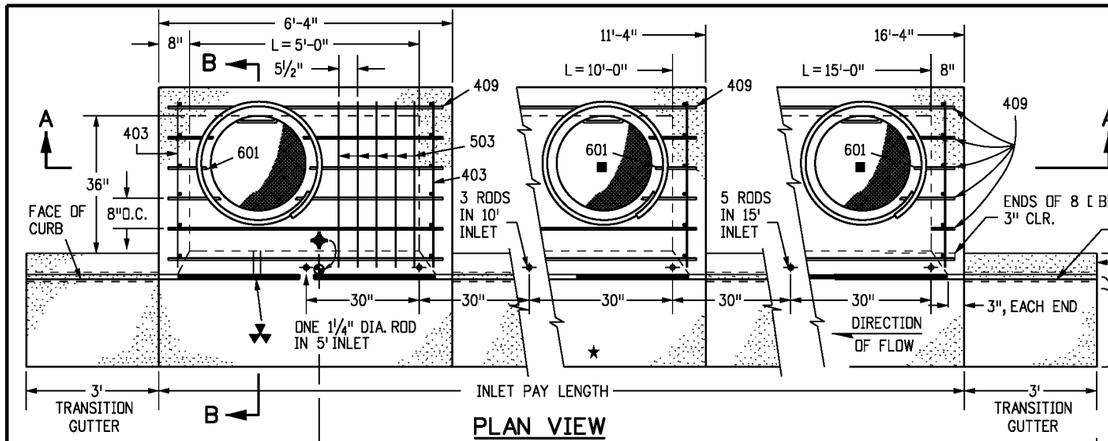
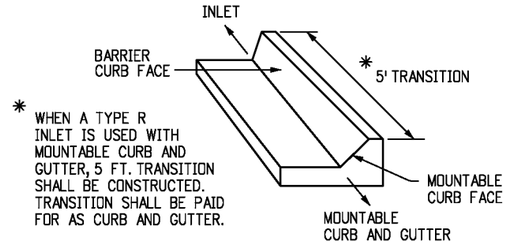


PLAN VIEW

★ FOR LENGTH (L) 10 FT. OR MORE, PROVIDE MAINTENANCE ACCESS AT BOTH ENDS WITH AN ADDITIONAL MANHOLE RING AND COVER. CUT REINFORCEMENT BAR ACCORDINGLY.

✦ STATION POINT AT MIDPOINT OF INLET ALONG FLOWLINE

✱ MEET SHAPE OF NORMAL BARRIER CURB AND GUTTER HERE.

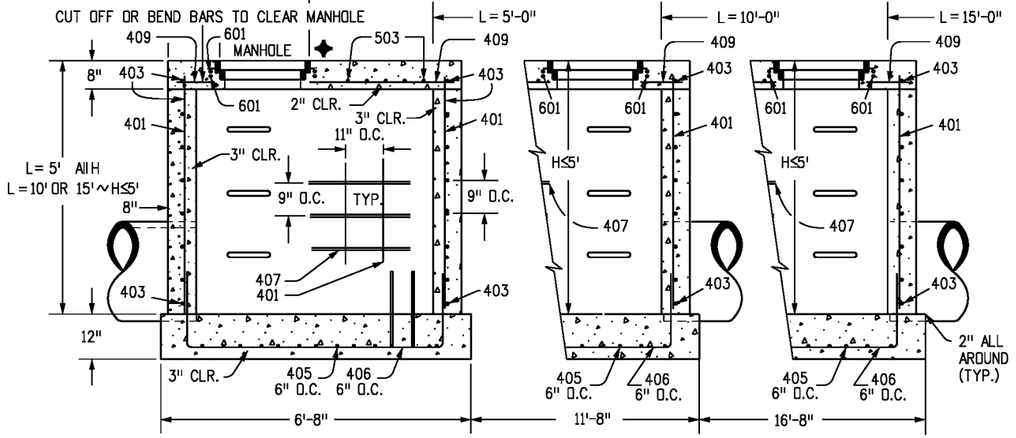


✱ WHEN A TYPE R INLET IS USED WITH MOUNTABLE CURB AND GUTTER, 5 FT. TRANSITION SHALL BE CONSTRUCTED. TRANSITION SHALL BE PAID FOR AS CURB AND GUTTER.

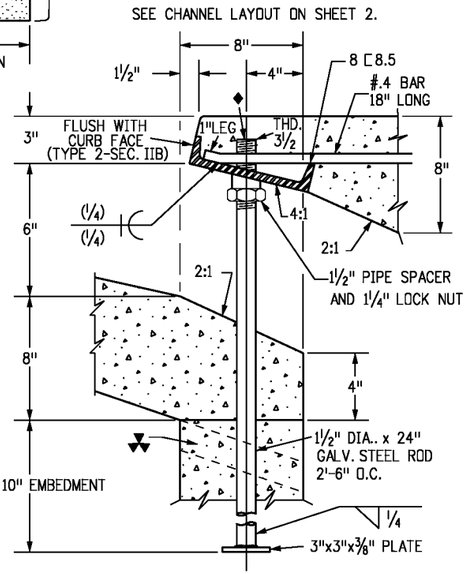
TRANSITION CURB

GENERAL NOTES:

SEE SHEET 2.

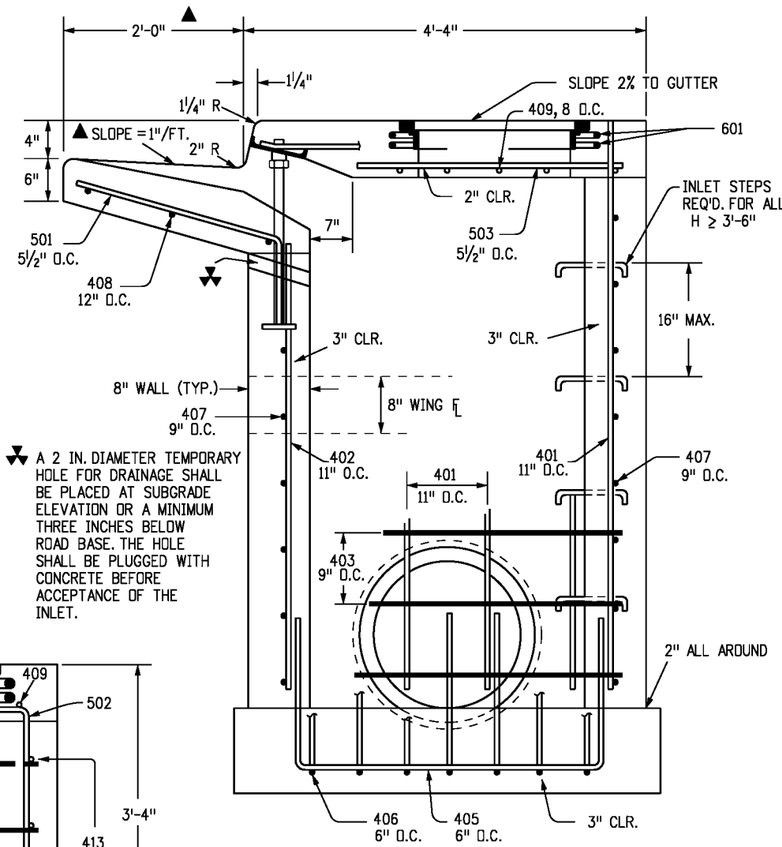


SECTION A-A REGULAR INLET



CURB FACE ASSEMBLY

◆ PLACE ENTIRE ASSEMBLY BEFORE POURING CONCRETE.

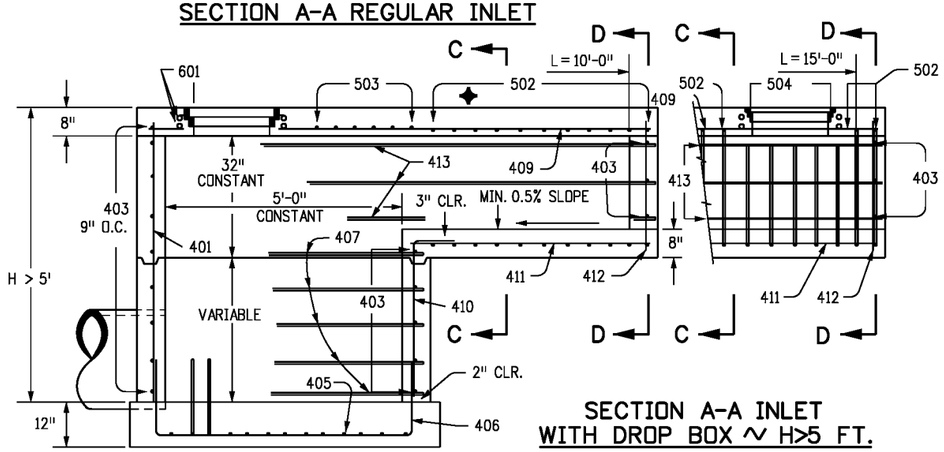


▲ FOR A 1'-0" PAN SLOPE 2" PER FT.

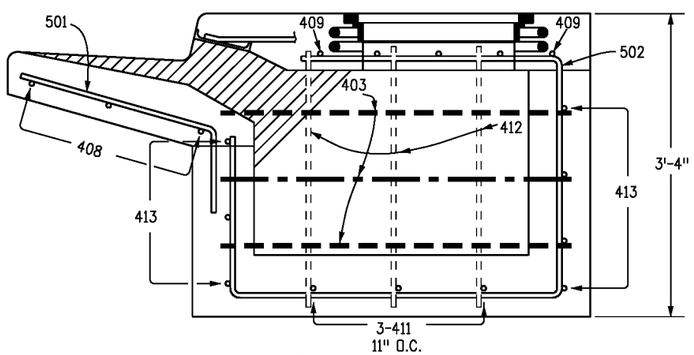
✱ A 2 IN. DIAMETER TEMPORARY HOLE FOR DRAINAGE SHALL BE PLACED AT SUBGRADE ELEVATION OR A MINIMUM THREE INCHES BELOW ROAD BASE. THE HOLE SHALL BE PLUGGED WITH CONCRETE BEFORE ACCEPTANCE OF THE INLET.

SECTION B-B END VIEW

NOTE: MANHOLE RING AND COVER, STATION POINT AND OUTFLOW PIPE SHALL BE LOCATED AT THE SAME END OF THE INLET.



SECTION A-A INLET WITH DROP BOX ~ H>5 FT.



SECTIONS C-C & D-D (DOTTED BARS ARE IN SECTION D-D)

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CURB INLET TYPE R

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MARK	BAR # OR SIZE	O.C. SPACING	TYPE	ALL INLETS L = 5 FT.		INLETS: H ≤ 5 FT. L = 10 FT.		INLETS: H ≤ 5 FT. L = 15 FT.		INLETS: H > 5 FT. L = 10 FT.		INLETS: H > 5 FT. L = 15 FT.	
				NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH	NO. REQ'D.	LENGTH
401	4	11"	II	15	*	21	*	26	*	11	*	11	*
402	4	11"	II	7	*	13	*	18	*	7	*	7	*
403	4	9"	II	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-0"	*	4'-0"
405	4	6"	VI	11	6'-10"	21	6'-10"	31	6'-10"	11	6'-10"	11	6'-10"
406	4	6"	VIII	7	8'-10"	7	13'-10"	7	18'-10"	7	8'-10"	7	8'-10"
407	4	9"	II	*	5'-10"	*	10'-10"	*	15'-10"	*	5'-10"	*	5'-10"
408	4	12"	II	3	6'-10"	3	11'-10"	3	16'-0"	3	11'-10"	3	16'-0"
409	4	8"	II	6	5'-10"	6	10'-10"	6	15'-10"	6	10'-10"	6	15'-10"
410	4	11"	VII							3		3	*
411	4	11"	II							3	5'-2"	3	10-2"
412	4	11"	II							3	2'-9"	3	2'-9"
413	4	9"	II							7	10'-10"	7	15'-10"
501	5	5½"	IV	11	3'-4"	22	3'-4"	33	3'-4"	22	3'-4"	33	3'-4"
502	5	5½"	III							11	11'-5"	17	11'-5"
503	5	5½"	II	5	3'-6"	16	3'-6"	27	3'-6"	6	3'-6"	6	3'-6"
504	5	5½"	IX									5	8'-4"
601	6	2½"	V	2	8'-10"	2	8'-10"	2	8'-10"	2	8'-10"	4	8'-10"
■8[8.5				1	5'-10"	1	10'-10"	1	15'-10"	1	10'-10"	1	15'-10"
				2 BARS, 1 RODS	——	4 BARS, 3 RODS	——	8 BARS, 5 RODS	——	4 BARS, 3 RODS	——	8 BARS, 5 RODS	——
						REGULAR INLETS				DROP BOX INLETS			

* VARIABLE REFER TO TABLE TWO.

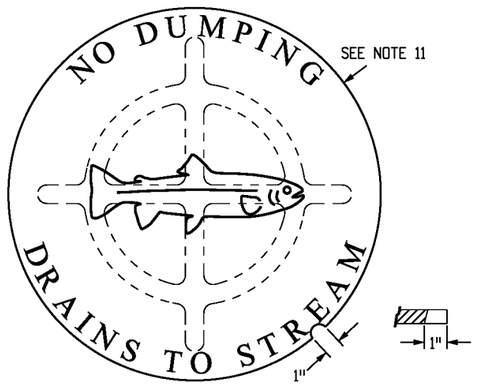
■ INCLUDE #4, 18 IN. BARS (SEE CHANNEL LAYOUT).

TABLE ONE ~ BAR LIST FOR CURB INLETS, TYPE "R"

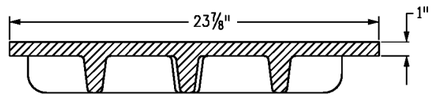
"H"	LENGTH 401	LENGTH 402	LENGTH 410	NO. REQ'D. REGULAR 403	NO. REQ'D. REGULAR 407	NO. REQ'D. DROP BOX 403	NO. REQ'D. DROP BOX 407	L = 5 FT. CONC. CU. YDS.	L = 5 FT. STEEL LBS.	L = 10 FT. CONC. CU. YDS.	L = 10 FT. STEEL LBS.	L = 15 FT. CONC. CU. YDS.	L = 15 FT. STEEL LBS.
3'-0"	2'-8"	1'-8"		10	7			3.2	285	5.3	497	7.4	706
3'-6"	3'-2"	2'-2"		10	7			3.4	305	5.7	528	7.9	747
4'-0"	3'-8"	2'-8"		12	9			3.7	326	6.0	559	8.4	786
4'-6"	4'-2"	3'-2"		12	9			3.9	334	6.4	571	8.8	803
5'-0"	4'-8"	3'-8"		14	11			4.1	354	6.7	602	9.3	844
5'-6"	5'-2"	4'-2"	3'-5"	16	13	15	6	4.4	375	6.0	607	7.4	850
6'-0"	5'-8"	4'-8"	3'-11"	16	13	16	6	4.6	382	6.2	616	7.6	860
6'-6"	6'-2"	5'-2"	4'-5"	18	15	18	8	4.8	402	6.4	637	7.8	880
7'-0"	6'-8"	5'-8"	4'-11"	20	17	19	10	5.0	423	6.6	654	8.0	897
7'-6"	7'-2"	6-2"	5'-5"	20	17	20	10	5.3	430	6.9	664	8.3	907
8'-0"	7'-8"	6'-8"	5'-11"	22	19	22	12	5.5	451	7.1	684	8.5	927
8'-6"	8'-2"	7'-2"	6'-5"	24	21	23	14	5.7	471	7.3	702	8.7	944
9'-0"	8'-8"	7'-8"	6'-11"	24	21	24	14	6.0	479	7.6	711	9.0	954
9'-6"	9'-2"	8'-2"	7'-5"	26	23	26	16	6.2	499	7.8	732	9.2	974
10'-0"	9'-8"	8'-8"	7'-11"	28	25	27	18	6.4	520	8.0	749	9.4	992
10'-6"	10'-2"	9'-2"	8'-5"	28	25	28	18	6.7	527	8.3	759	9.7	1001
11'-0"	10'-8"	9'-8"	8'-11"	30	27	30	20	6.9	547	8.5	779	9.9	1022

NOTES: FOR L = 5 FT., L = 10 FT., AND L = 15 FT.
REGULAR INLETS: TOTAL QUANTITIES NEEDED ARE OUTSIDE THE HEAVY BLACK LINE.
DROP BOX INLETS: TOTAL QUANTITIES NEEDED ARE INSIDE THE HEAVY BLACK LINE.
STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL CHANNEL.

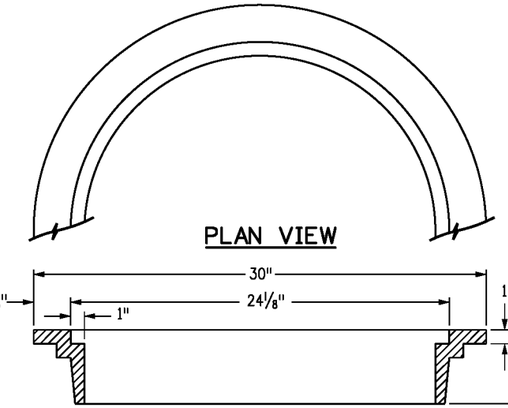
TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"



PLAN VIEW



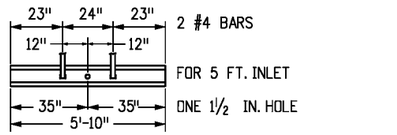
ELEVATION VIEW
MANHOLE COVER (TYP.)

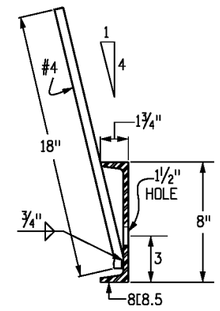


PLAN VIEW

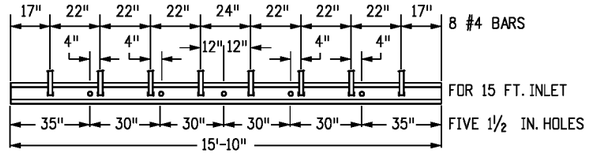
ELEVATION VIEW
MANHOLE RING (TYP.)

WEIGHTS: COVER = 125 LBS.
+ RING = 135 LBS.
TOTAL = 260 LBS.



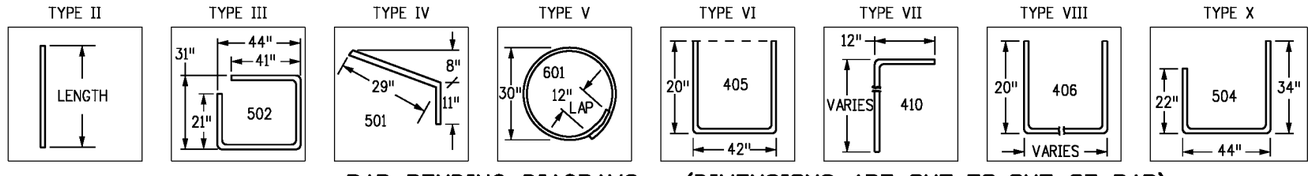


SECTION AT HOLE (TYP.)



CHANNEL LAYOUT DETAILS

SEE CURB FACE ASSEMBLY ON SHEET 1.



BAR BENDING DIAGRAMS ~ (DIMENSIONS ARE OUT-TO-OUT OF BAR)

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
2. CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 IN. THICK.
3. INLET STEPS SHALL BE IN CONFORMANCE WITH AASHTO M 199.
4. CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING.
5. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN. CURB AND GUTTER CORNERS SHALL BE FINISHED TO MATCH THE EXISTING CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
6. REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
7. DIMENSIONS AND WEIGHTS OF TYPICAL MANHOLE RING AND COVER ARE NOMINAL.
8. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
9. SINCE PIPE ENTRIES INTO THE INLET ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK. QUANTITIES INCLUDE VOLUMES OCCUPIED BY PIPES.
10. STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
11. ALL MANHOLE COVERS SHALL BE CAST WITH A "NO DUMPING DRAINS TO STREAM" MESSAGE AND A FISH SYMBOL. THE SURFACE OF THE MANHOLE COVER SHALL HAVE A NON-SLIP PATTERN.

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CURB INLET TYPE R

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M-604-12
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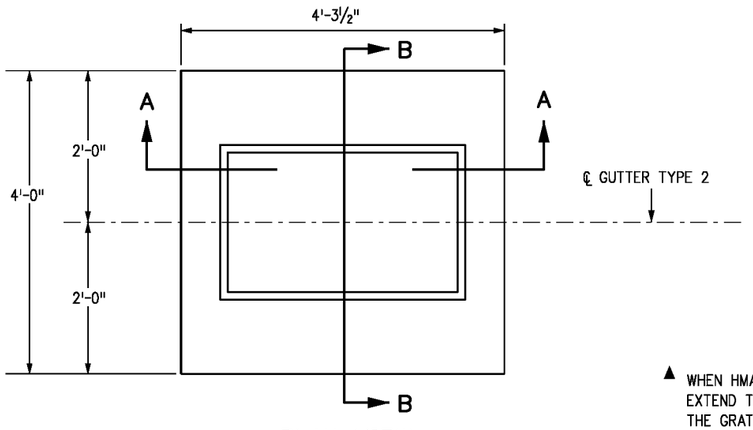
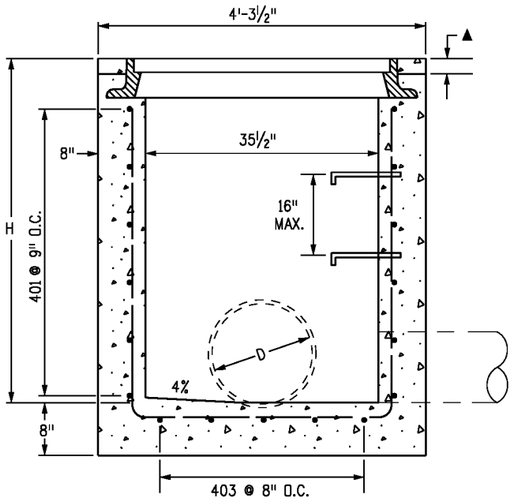


PLAN VIEW

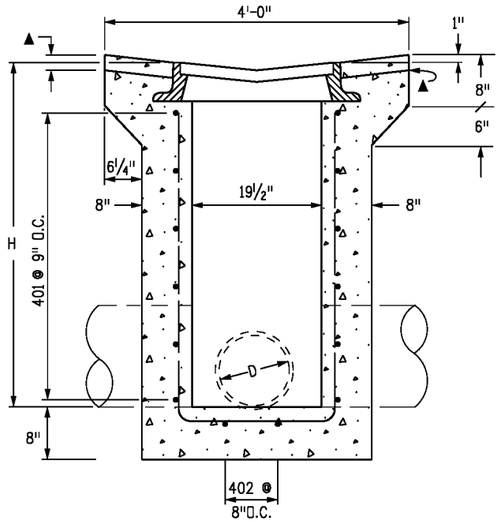
TYPE 13 INLET FOR GUTTER TYPE 2

▲ WHEN HMA MATERIAL IS TO EXTEND TO THE EDGE OF THE GRATING FRAME, CONCRETE MAY BE DEPRESSED.



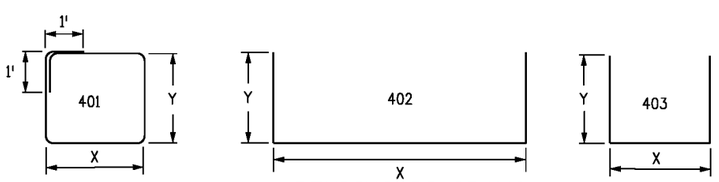
SECTION A-A

D MAX = 30 IN. FOR H >4 FT.



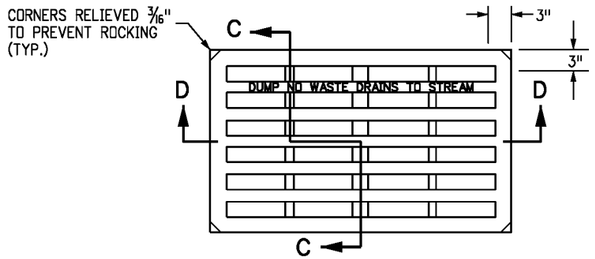
SECTION B-B

D MAX = 18 IN. FOR ALL H

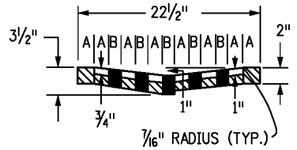


BENDING DIAGRAMS

ALL DIMENSIONS ARE OUT-TO-OUT OF BAR.

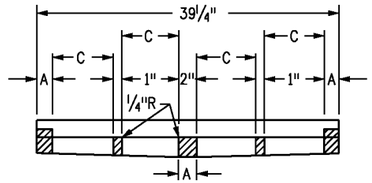


NO. 13 GRATE

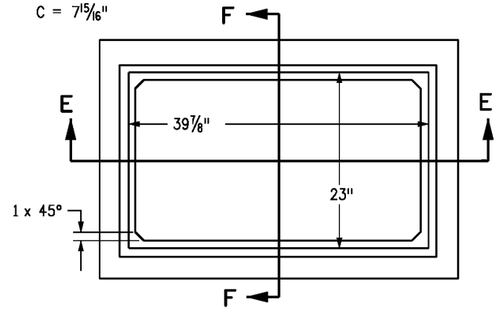


SECTION C-C

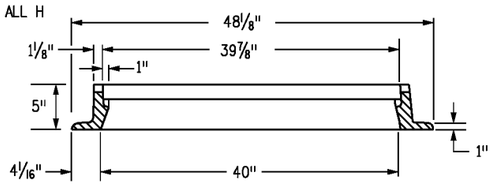
A = 1¾"
B = 1¹¹/₁₆"
C = 7¹⁵/₁₆"



SECTION D-D

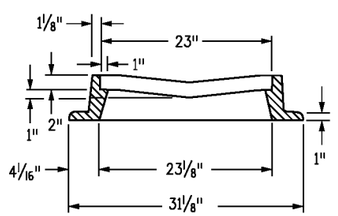


NO. 13 GRATING & FRAMES



SECTION E-E

APPROXIMATE WEIGHT = 590 LBS.



SECTION F-F

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
2. CAST-IN-PLACE CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES.
3. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
4. REINFORCING BARS SHALL BE DEFORMED #4 AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT.-6 IN. AND SHALL CONFORM TO AASHTO M 199.
6. ALL GRATES AND FRAMES SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06. GRATES AND FRAMES SHALL BE DESIGNED TO WITHSTAND HS 20 LOADING.
7. STATION POINT IS AT THE CENTER OF THE INLET.
8. GRATE SHALL HAVE "DUMP NO WASTE DRAINS TO STREAM" MESSAGE CAST ON SURFACE.

H	CONCRETE	REINFORCING STEEL	NO. OF 401 BARS REQ'D.	MAXIMUM PIPE I.D.	
				SEC. A-A	SEC. B-B
	CU. YDS.	θ LB.		IN.	IN.
3'-0"	1.3	72	4	18	18
3'-6"	1.5	76	4	24	18
4'-0"	1.6	90	5	30	18
4'-6"	1.8	104	6	30	18
5'-0"	1.9	109	6	30	18
5'-6"	2.1	122	7	30	18
6'-0"	2.2	136	8	30	18
6'-6"	2.4	141	8	30	18
7'-0"	2.5	154	9	30	18
7'-6"	2.7	168	10	30	18
8'-0"	2.8	173	10	30	18
8'-6"	3.0	187	11	30	18
9'-0"	3.1	200	12	30	18
9'-6"	3.3	205	12	30	18
10'-0"	3.4	219	13	30	18

θ INCLUDES 1% FOR OVERRUN.
NOTE: CONCRETE QUANTITIES INCLUDE VOLUME OCCUPIED BY PIPE.

QUANTITIES FOR ONE INLET

MARK	NO. REQ'D.	DIMENSIONS		LENGTH
		X	Y	
401	4	3'-6"	2'-2"	13'-4"
402	2	3'-4½"	* 2'-6½"	8'-5½"
403	5	2'-½"	* 2'-7"	7'-2½"

* ADD 6 IN. TO THIS DIMENSION FOR EACH 6 IN. INCREASE OF "H" OVER 3 FT.-0 IN.

BAR LIST FOR H = 3 FT.-0 IN.

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Drawing File Name: 6040130101.dgn	(R-X)		
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CONCRETE INLET TYPE 13

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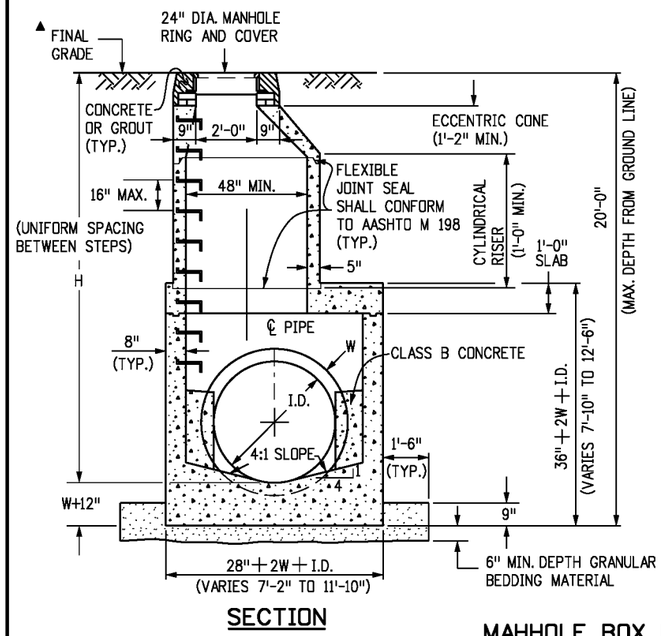
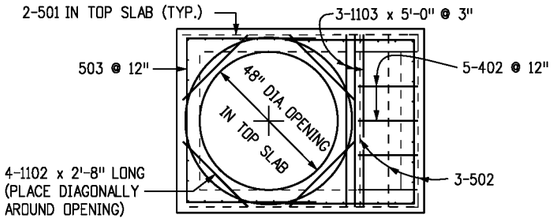
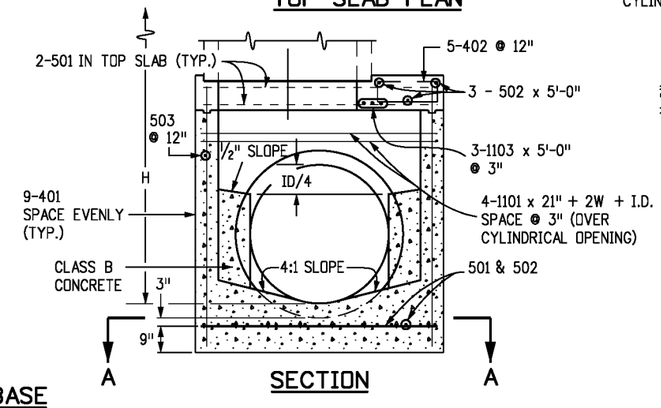
M-604-13



SECTION

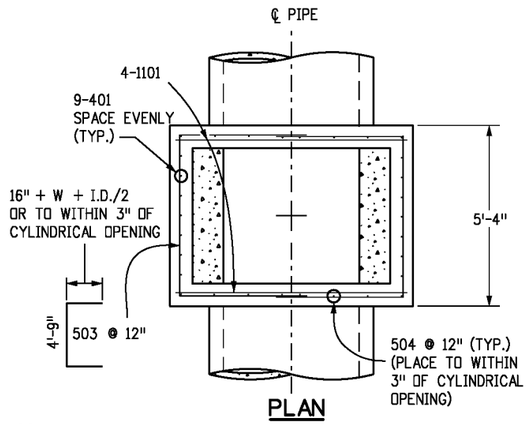


TOP SLAB PLAN

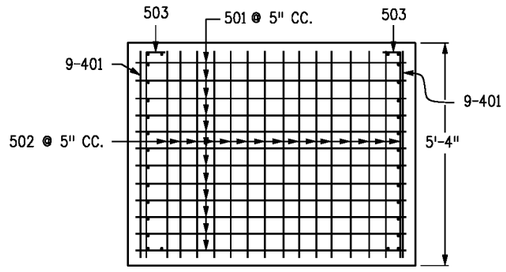


SECTION

MAHHOLE BOX BASE



PLAN



SECTION A-A
(STEEL IN BOTTOM OF BASE)

GENERAL NOTES

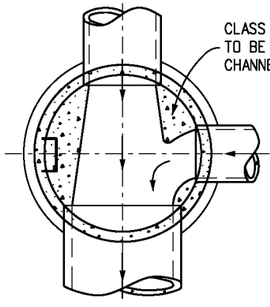
1. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK.
2. THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE. THE ECCENTRIC CONE MAY BE USED WHEN THE MANHOLE "H" HEIGHT IS AT LEAST 8 FT.
3. THE MANHOLE RING FRAME SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA. SEE DETAILS ON SHEETS 2 AND 3.
4. DESIGN OF BOX BASE IS BASED ON STRAIGHT RUNS OF PIPE OR CHANGE IN DIRECTION OF LESS THAN 45°. SPECIAL DESIGN IS REQUIRED FOR 45° OR GREATER.
5. PRECAST MANHOLES AND REINFORCEMENT SHALL CONFORM TO AASHTO M 199 (ASTM C 478).
6. CAST-IN-PLACE MANHOLES SHALL BE CLASS B CONCRETE.
7. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3 FT.-6 IN. AND SHALL CONFORM TO AASHTO M 199.
8. ALL REINFORCING STEEL SHALL BE GRADE 60 AND EPOXY COATED. VERTICAL STEEL SHALL BE PLACED AT CENTERLINE OF WALL. ALL BARS SHALL HAVE A 2 IN. MINIMUM CLEARANCE.
9. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION ADJUSTED FOR PIPE SIZE, SHAPE, SLOPE, AND DIRECTION OF FLOW. DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INVERTS OF SAME RELATIVE ELEVATION. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON THE PLANS.
10. FLOW CHANNELS AND INVERTS SHALL BE FORMED BY SHAPING WITH CLASS B CONCRETE OR APPROVED GROUT.
11. STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL SURFACE OF MANHOLE AND BE SATISFACTORILY PLUGGED.
12. THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.

▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.

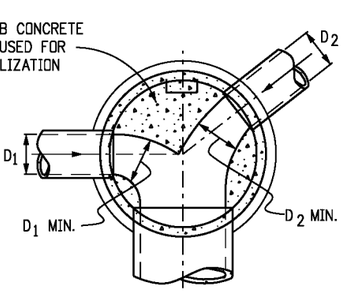
MARK	SIZE	TYPE	WT. #/FT.	BARS	I.D. 54"	60"	66"	72"	84"	96"	FORMULAS
401	4	I	0.668	NO. REQ'D.	18	18	18	18	18	18	401
				LENGTH	8'-1"	8'-8"	9'-3"	9'-10"	11'-0"	12'-2"	BAR LENGTH = 32" + 2W + I.D.
				WEIGHT *	97.2	104.2	111.2	118.2	132.3	146.3	
402	4	III	0.668	NO. REQ'D.	5	5	5	5	5	5	402
				LENGTH	5'-5"	6'-0"	6'-7"	7'-2"	8'-4"	9'-6"	BAR LENGTH = I.D. + 2W
				WEIGHT *	18.1	20.0	22.0	23.9	27.8	31.7	
501	5	I	1.043	NO. REQ'D.	17	17	17	17	17	17	501
				LENGTH	7'-5"	8'-0"	8'-7"	9'-2"	10'-4"	11'-6"	BAR LENGTH = 24" + I.D. + 2W
				WEIGHT *	131.5	141.8	152.2	162.5	183.2	203.9	
502	5	I	1.043	NO. REQ'D.	22	23	25	26	29	32	502
				LENGTH	5'-0"	5'-0"	5'-0"	5'-0"	5'-0"	5'-0"	NUMBER BARS REQ'D. = 3 + $\left(\frac{24+I.D.+2W}{@\ 5"}+1\right)$
				WEIGHT *	114.7	119.9	130.4	135.6	151.2	166.9	
503	5	II	1.043	NO. REQ'D.	16	16	18	18	20	24	503
				LENGTH	12'-10"	13'-5"	14'-0"	14'-7"	15'-9"	16'-11"	NUMBER BARS REQ'D. = $2\left(\frac{13+I.D.+2W}{@\ 12"}+1\right)$
				WEIGHT *	214.2	223.9	262.8	273.8	328.5	423.5	BAR LENGTH = 4'-9"+2(16+W+I.D./2)
504	5	I	1.043	NO. REQ'D.	12	14	14	16	18	20	504
				LENGTH	8'-1"	8'-8"	9'-3"	9'-10"	11'-0"	12'-2"	NUMBER BARS REQ'D. = $2\left(\frac{2W+I.D.-4}{@\ 12"}+1\right)$
				WEIGHT *	101.2	126.6	135.1	164.1	206.5	253.8	BAR LENGTH = 32"+2W+I.D.
1101	11	I	5.313	NO. REQ'D.	4	4	4	4	4	4	1101
				LENGTH	7'-2"	7'-9"	8'-4"	8'-11"	10'-1"	11'-3"	BAR LENGTH = 21" + I.D. + 2W
				WEIGHT *	152.3	164.7	177.1	189.5	214.3	239.1	
1102	11	I	5.313	NO. REQ'D.	4	4	4	4	4	4	BENDING
				LENGTH	2'-8"	2'-8"	2'-8"	2'-8"	2'-8"	2'-8"	TYPE I STRAIGHT
				WEIGHT *	56.7	56.7	56.7	56.7	56.7	56.7	
1103	11	I	5.313	NO. REQ'D.	3	3	3	3	3	3	TYPE II 4'-9" × 16"+W+I.D./2
				LENGTH	5'-0"	5'-0"	5'-0"	5'-0"	5'-0"	5'-0"	
				WEIGHT *	79.7	79.7	79.7	79.7	79.7	79.7	
* REINFORCING STEEL TOTAL					965.6	1,037.5	1,127.2	1,204.0	1,380.2	1,601.6	TYPE III 12" 12" 7" I.D.+2W-38"
CONCRETE - CUBIC YARDS - TOTAL					6.0	6.6	7.3	8.0	9.5	11.1	

NOTE: QUANTITIES ARE BASED ON SAME SIZE PIPE ENTRANCE TO AND EXIT FROM, BASE AND A 4 FT. MANHOLE ENTRANCE INTO TOP SLAB OF BASE.

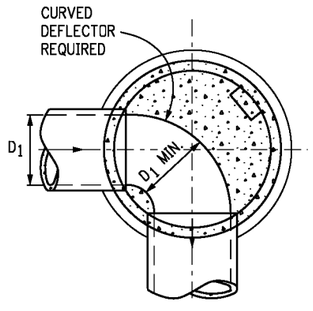
QUANTITIES FOR CONCRETE MANHOLE BOX BASE



THROUGH PIPE
ONE LATERAL



ANGLED LATERALS



SHARP ANGLE

TYPICAL CHANNELIZATION DETAILS

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MANHOLES

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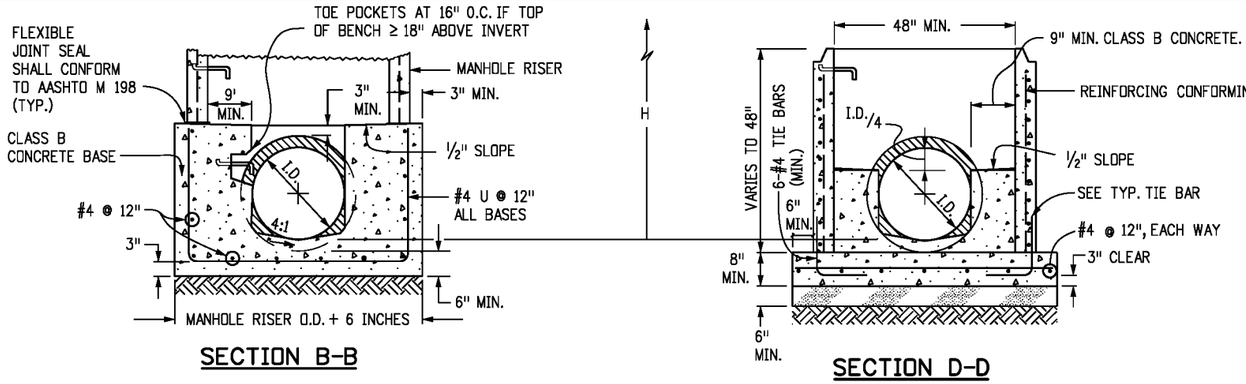
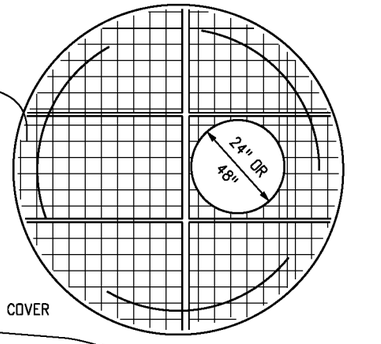
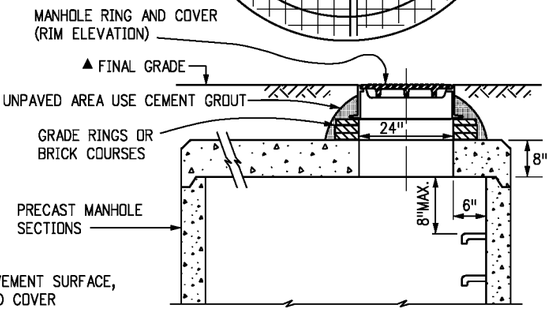


SECTION B-B

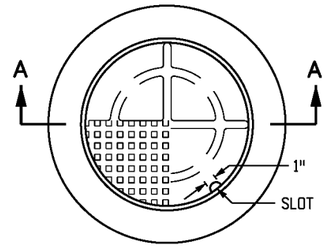
SECTION D-D

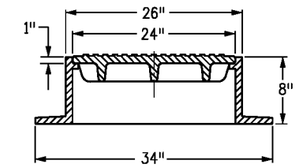




▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER ¼" MIN. TO ½" MAX.

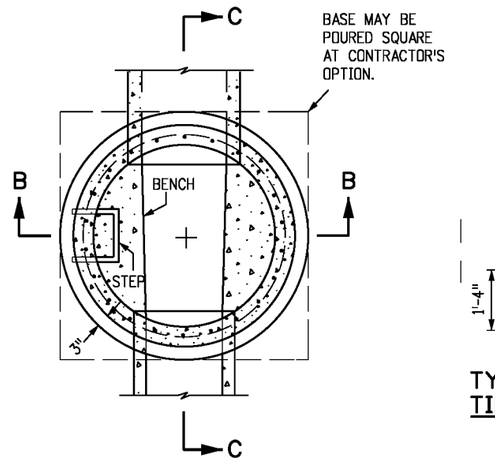
FLAT TOP SECTION DETAIL



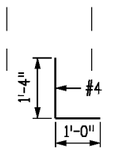


TOTAL WEIGHT: APPROXIMATELY 400 LBS. SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.

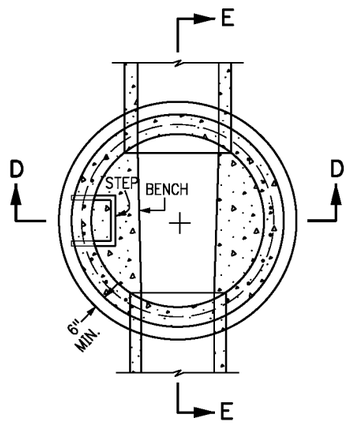
SECTION A-A
MANHOLE RING AND COVER



PLAN



TYPICAL TIE BAR



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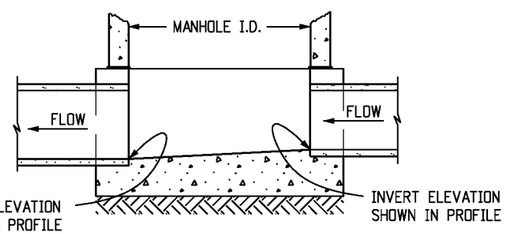
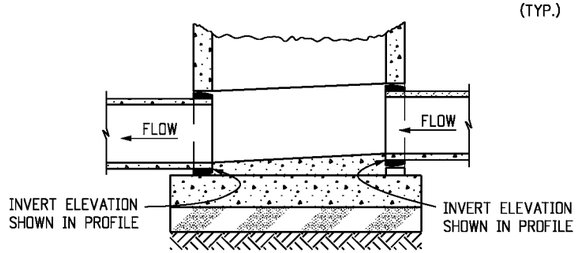
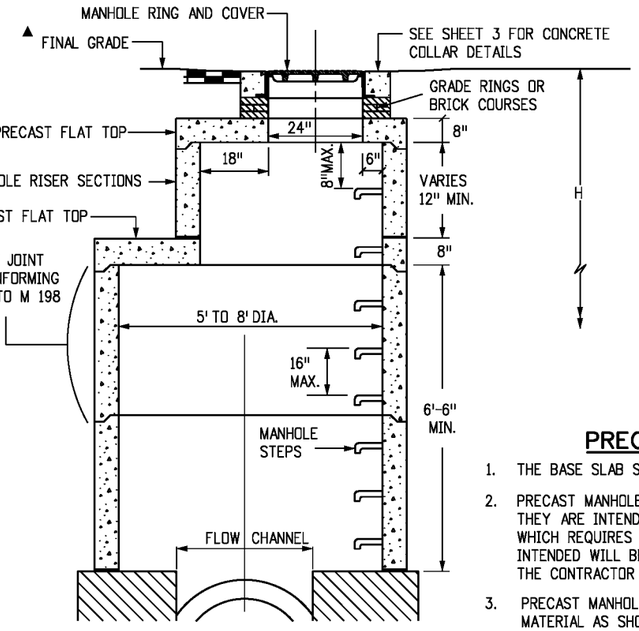


SECTION C-C
CAST-IN-PLACE SLAB BASE



SECTION E-E
PRECAST SLAB BASE



MANHOLE RISER DETAIL

LEGEND

- SUITABLE SUBGRADE
- GRANULAR BEDDING MATERIAL
- CONCRETE

PRECAST MANHOLE BASES NOTES:

1. THE BASE SLAB SHALL BE POURED MONOLITHICALLY WITH BOTTOM RISER SECTION.
2. PRECAST MANHOLE BASES SHALL FIT THE CONDITIONS AND LOCATIONS FOR WHICH THEY ARE INTENDED WITHOUT ANY FIELD MODIFICATIONS. ANY MANHOLE BASE WHICH REQUIRES FIELD CUTTING OR MODIFICATION IN ORDER TO FIT THE LOCATIONS INTENDED WILL BE REJECTED BY THE ENGINEER AND REMOVED AND REPLACED BY THE CONTRACTOR AT NO COST TO THE DEPARTMENT.
3. PRECAST MANHOLE BASES SHALL BE BEDDED ON AN APPROVED GRANULAR BEDDING MATERIAL AS SHOWN ABOVE.

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MANHOLES

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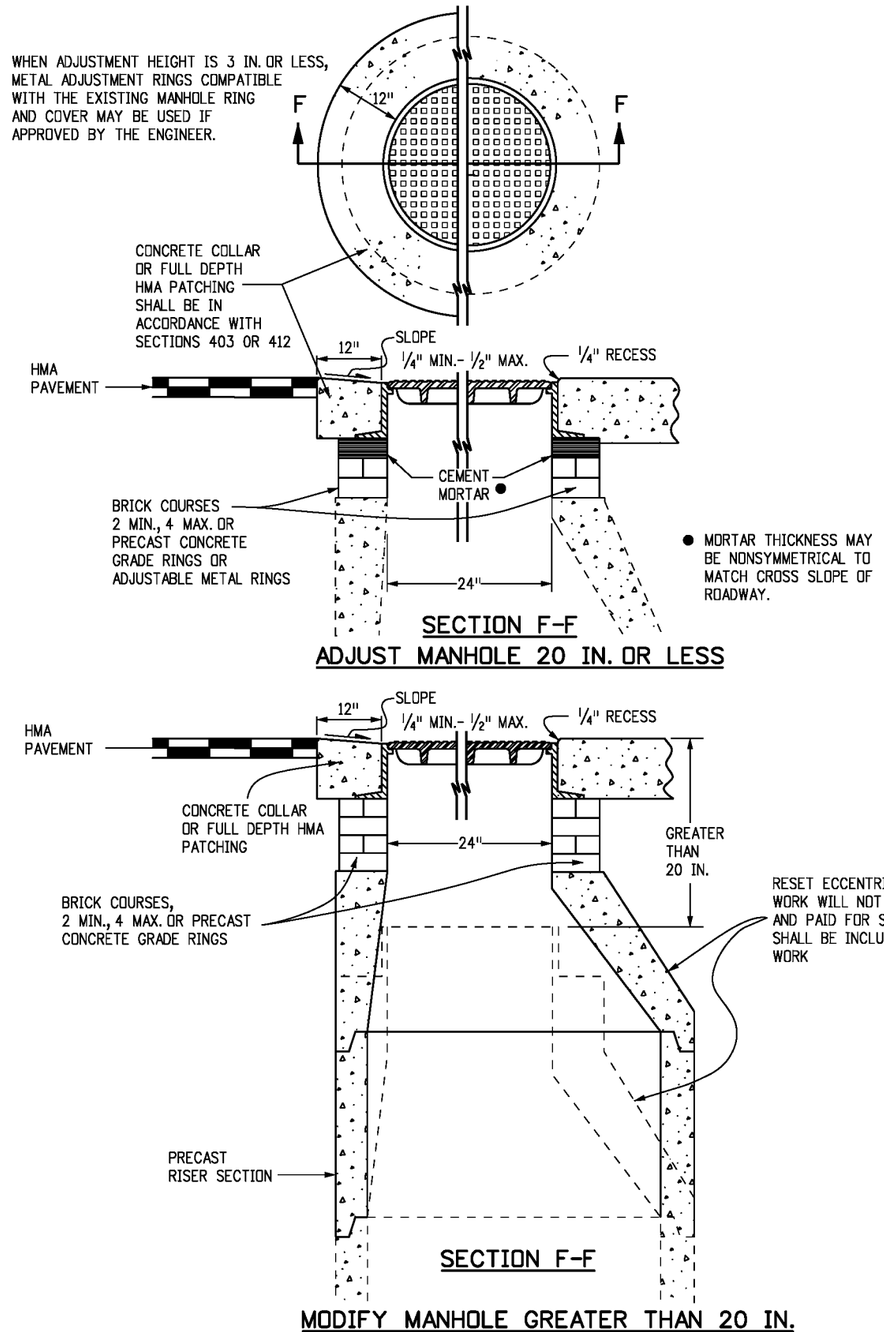
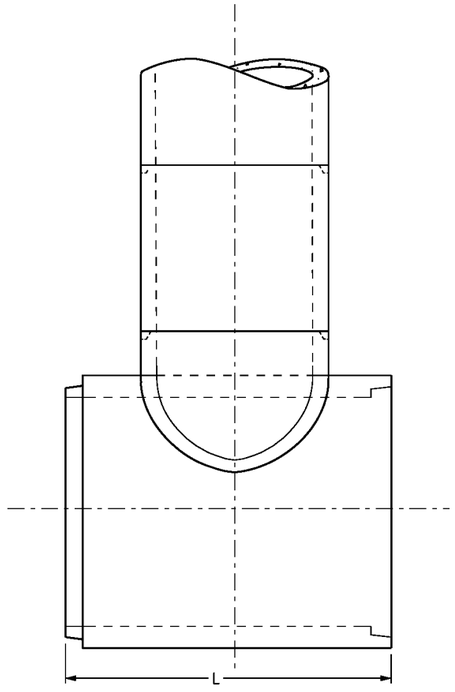
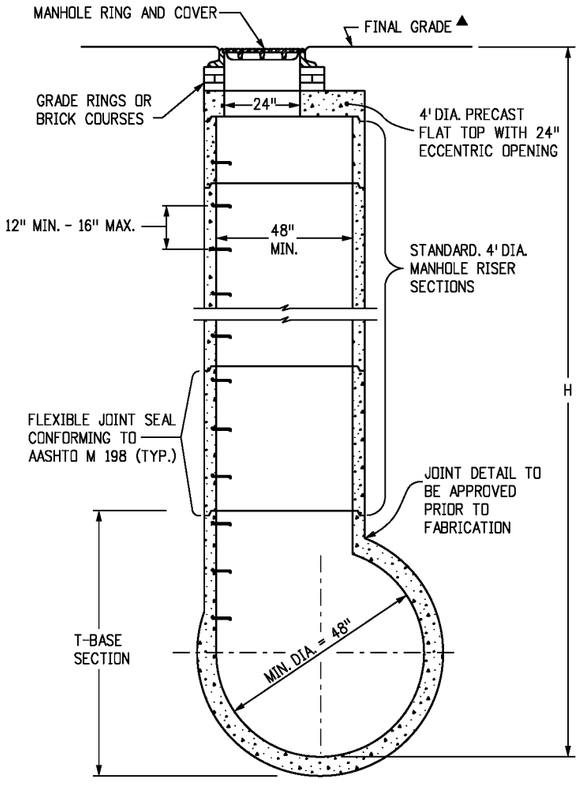


T-BASE MANHOLES NOTES

1. THE T-BASE SECTION SHALL BE SHOP-FABRICATED FOR DELIVERY TO THE CONSTRUCTION SITE AS A COMPLETE UNIT.
2. THESE DETAILS SHOW ONLY THE CONCEPTUAL AND STANDARD DIMENSIONAL REQUIREMENTS FOR TYPE T-BASE MANHOLES. THE CONTRACTOR SHALL FURNISH DETAILED SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION. THE DETAILS SHOWN HEREIN APPLY ONLY TO 48 IN. AND GREATER DIAMETER PIPES.
3. EXCEPT FOR CLASS OF PIPE, SPECIFICATIONS FOR THE MANHOLE SHALL BE THE SAME AS THOSE REQUIRED FOR THE ADJOINING PIPE.
4. THE T-BASE SECTION SHALL MAINTAIN ITS INTERNAL SHAPE AND FLOW AREA. GROUTING OR FILLING SHALL BE APPLIED SO AS TO NOT DISTURB THE NORMAL FLOW OR REDUCE THE AREA.



▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.



MANHOLE T-BASE

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MANHOLES

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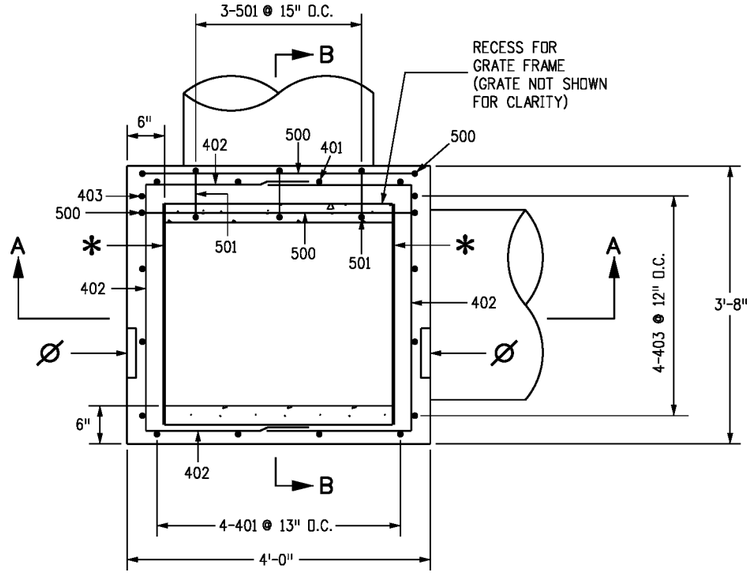
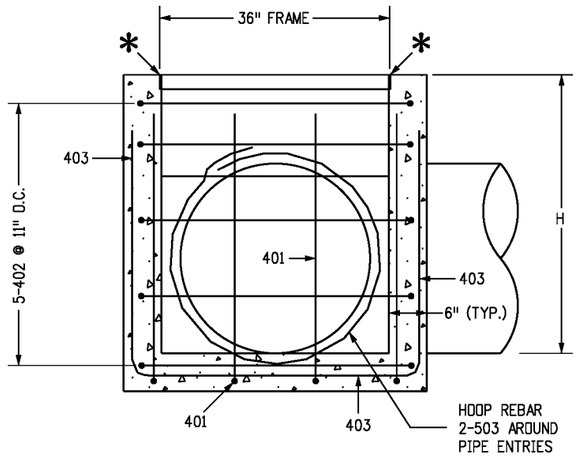


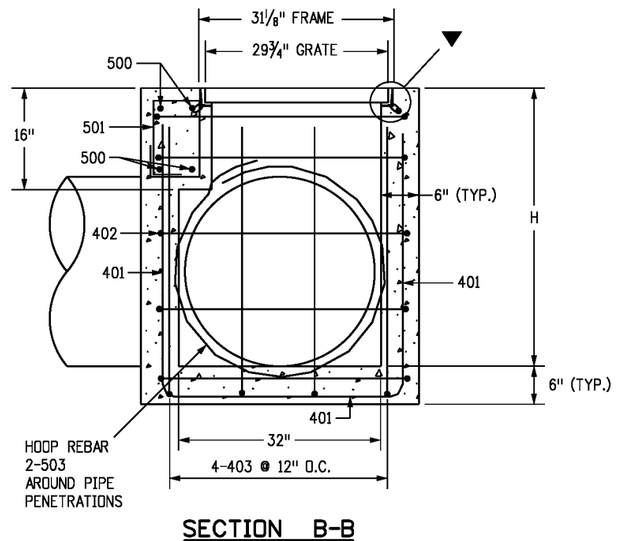
PLAN

GENERAL NOTES

1. FOR THE 32 INCH AND 36 INCH INSIDE INLET DIMENSIONS, THE ALLOWABLE PIPE I.D. IS 30 INCHES OR LESS. FOR THE 72 INCH INSIDE INLET DIMENSION, THE ALLOWABLE PIPE I.D. IS "H" MINUS 18 INCHES, OR LESS, UP TO A MAXIMUM OF 66 INCHES FOR "H" OF 7 FEET OR MORE.
2. ALL CONCRETE SHALL BE CLASS B.
3. INLET MAY BE CAST-IN-PLACE OR PRECAST.
4. REINFORCING BARS SHALL BE #4 UNLESS SHOWN OTHERWISE.
5. ALL REINFORCING BARS SHALL BE GRADE 40 AND EPOXY COATED. REINFORCING BARS SHALL HAVE A MINIMUM CLEARANCE OF 2 IN.
6. ALL EDGE DISTANCES NOT MARKED "CLEAR" ARE TO THE CENTERLINE OF THE BAR.
7. CUT OR BEND REINFORCING BARS AROUND PIPES AS REQUIRED.
8. STEPS SHALL BE REQUIRED WHEN THE INLET DEPTH "H" IS EQUAL TO OR GREATER THAN 4 FT. AND SHALL CONFORM TO AASHTO M 199.
9. THE INVERT OF THE BOX SHALL BE SLOPED TO DRAIN.
10. THE CONTRACTOR SHALL STAMP FLOW ARROWS INTO THE TOP SURFACE OF THE INLET BOX SIDEWALLS TO INDICATE THE DIRECTION OF RUNOFF. THE STAMPED ARROWS SHALL BE 6 IN. LONG, 1 IN. HIGH, AND $\frac{3}{8}$ IN. DEEP. FOR INLETS IN SUMP CONDITIONS, THE STAMPED FLOW ARROWS SHALL INDICATE THE PREDOMINATE DIRECTION OF RUNOFF FLOW.
11. A 4 IN. DIA. STAINLESS STEEL MEDALLION WITH "NO DUMPING DRAINS TO STREAM" OR SIMILAR MESSAGE SHALL BE FIRMLY ATTACHED TO TOP OF THE INLET SURFACE WITH A PERMANENT FASTENER. THE MEDALLION WILL HAVE A FISH SYMBOL AND BLUE COLOR BACKGROUND. ALTERNATIVELY, THIS MESSAGE MAY BE CAST WITH 1 IN. HEIGHT LETTERS INTO THE TOP OF THE INLET'S CONCRETE SURFACE OR SURROUNDING CONCRETE APRON. THE NO DUMPING MESSAGE SHALL BE ELIMINATED FOR INLETS LOCATED WITHIN THE SHOULDER OF CONTROLLED ACCESS FREEWAYS WHEN SPECIFIED IN THE PLANS.



SECTION A-A



SECTION B-B

LEGEND

▼ GRATE TO BE INSTALLED DURING CONSTRUCTION OF THE BOX WITH THE VANE GRATE BOLTED IN PLACE TO THE FRAME.

* TO FACILITATE REMOVAL OF THE GRATE, PLACE PLYWOOD 3 IN. x ¼ IN. x 31-⅜ IN. ALONG EDGE OF THE GRATE AS SHOWN.

⌀ FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.). FLOW →

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VANE GRATE INLET

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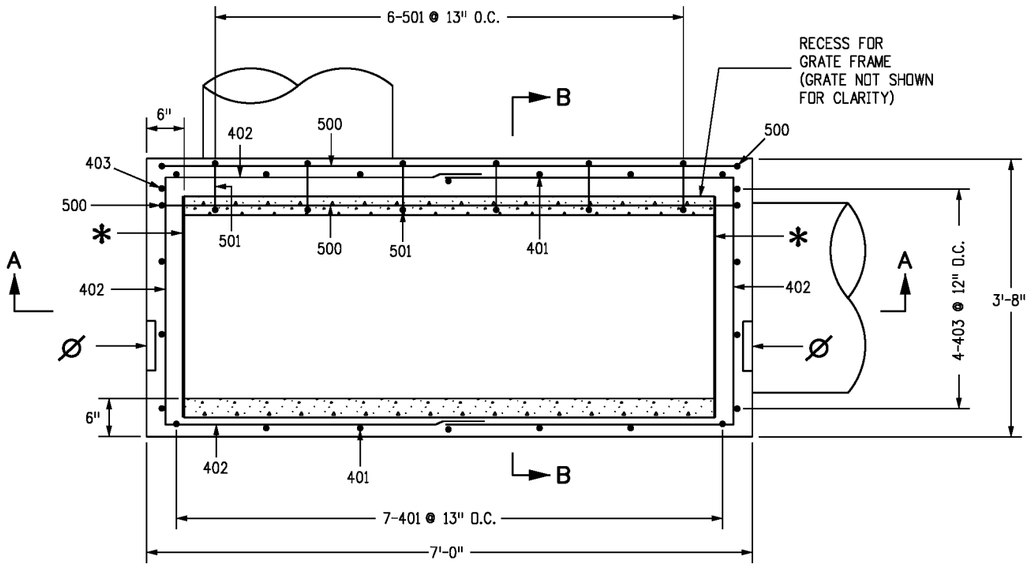
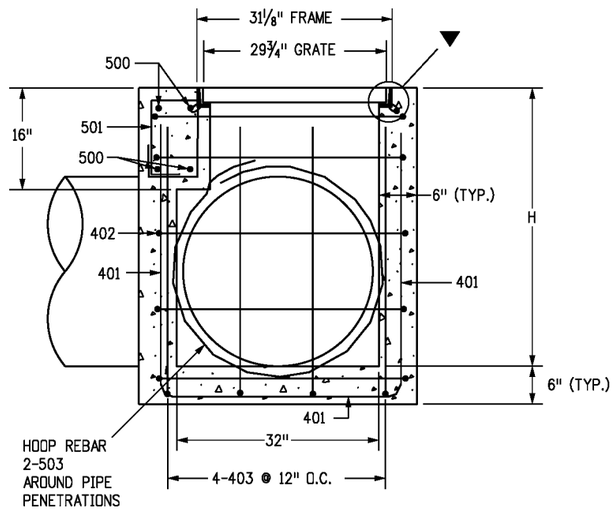


PLAN



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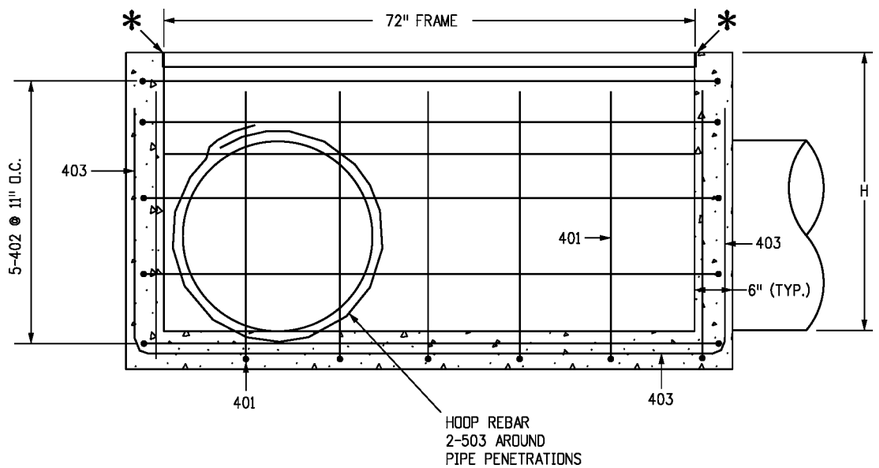

SECTION A-A

LEGEND

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* TO FACILITATE REMOVAL OF THE GRATE, PLACE PLYWOOD 3 IN. x ¼ IN. x 31-⅜ IN. ALONG EDGE OF THE GRATE AS SHOWN.

Ø FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.). FLOW →

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VANE GRATE INLET

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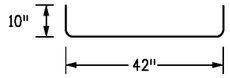

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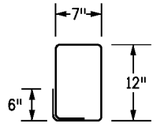

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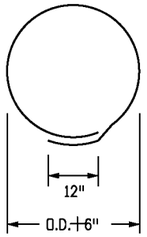

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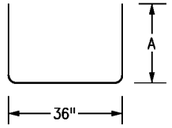
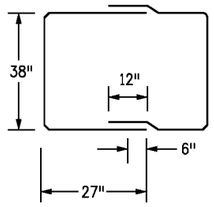


INCREASE DIMENSION "A" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

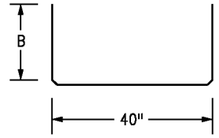
401



(2-402 BARS SHOWN TO INDICATE PROPER PLACEMENT)

ADD TWO BARS FOR EACH 6 IN. INCREASE OF "H" ABOVE 4 FT.

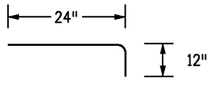
402



INCREASE DIMENSION "B" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

403

36 IN. INLET BOX BENDING DIAGRAM



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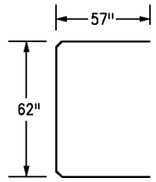

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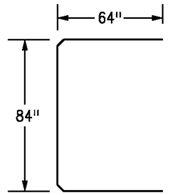


407

INLET APRON BENDING DIAGRAM FOR 36 IN. INLET

MARK	NO. REQ'D	LENGTH (EACH)
405	9	3'-0"
406	1	14'-8"
407	1	17'-8"

BAR LIST FOR CONCRETE APRON

(FOR INFORMATION ONLY)

MARK	NO. REQ'D	HEIGHT "A"	HEIGHT "B"	LENGTH (EACH)
500	4			5'-2"
501	3			4"-2"
503	4			10'-5"
401	4	3'-10"		10'-8"
402	10			7'-8"
403	4		4'-0"	11'-4"

BAR LIST FOR H = 4'-0" 36 IN. INLET

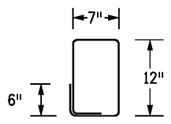
QUANTITIES FOR ONE 36 IN. INLET

H	NUMBER OF STEPS REQUIRED	CONC. CU. YD.	STEEL LBS.
4'-0"	1	1.3	180
4'-6"	2	1.5	186
5'-0"	2	1.6	201
5'-6"	2	1.7	207
6'-0"	3	1.8	222
6'-6"	3	1.9	227
7'-0"	3	2.1	243
7'-6"	4	2.2	248
8'-0"	4	2.3	263
8'-6"	4	2.4	269
9'-0"	5	2.5	285
9'-6"	5	2.7	289
10'-0"	5	2.8	306
10'-6"	6	2.9	310
11'-0"	6	3.0	326
11'-6"	6	3.1	331

NOTES

1. CONCRETE QUANTITY INCLUDES VOLUME OCCUPIED BY PIPES.
2. REINFORCING STEEL QUANTITY ASSUMES TWO 503 HOOPS FOR EACH 24 IN. PIPE.
3. BARS NUMBERED IN 400 SERIES INDICATES #4 SIZE BAR. BARS NUMBERED IN 500 SERIES INDICATES #5 SIZE BAR.
4. ALL REINFORCING BARS SHALL BE GRADE 40 AND EPOXY COATED.

500



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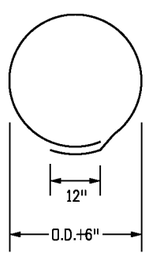

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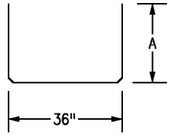
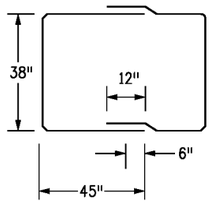


INCREASE DIMENSION "A" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

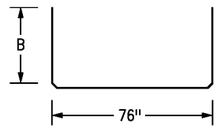
401



(2-402 BARS SHOWN TO INDICATE PROPER PLACEMENT)

ADD TWO BARS FOR EACH 6 IN. INCREASE OF "H" ABOVE 4 FT.

402



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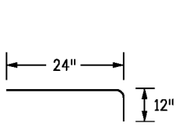
403

72 IN. INLET BOX BENDING DIAGRAM



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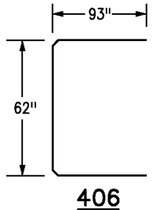

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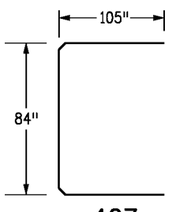

407

INLET APRON BENDING DIAGRAM FOR 72 IN. INLET

MARK	NO. REQ'D	LENGTH (EACH)
405	13	3'-0"
406	1	20'-8"
407	1	24'-6"

BAR LIST FOR CONCRETE APRON

(FOR INFORMATION ONLY)

MARK	NO. REQ'D	HEIGHT "A"	HEIGHT "B"	LENGTH (EACH)
500	4			8'-2"
501	6			4'-2"
503	4			10'-5"
401	7	3'-10"		10'-8"
402	10			10'-8"
403	4		4'-0"	14'-4"

BAR LIST FOR H = 4'-0" 72 IN. INLET

QUANTITIES FOR ONE 72 IN. INLET

H	NUMBER OF STEPS REQUIRED	CONC. CU. YD.	STEEL LBS.
4'-0"	1	2.1	253
4'-6"	2	2.3	260
5'-0"	2	2.4	282
5'-6"	2	2.6	289
6'-0"	3	2.8	310
6'-6"	3	3.0	318
7'-0"	3	3.2	339
7'-6"	4	3.3	346
8'-0"	4	3.5	369
8'-6"	4	3.7	376
9'-0"	5	3.9	397
9'-6"	5	4.1	405
10'-0"	5	4.2	426
10'-6"	6	4.4	433
11'-0"	6	4.6	455
11'-6"	6	4.8	462

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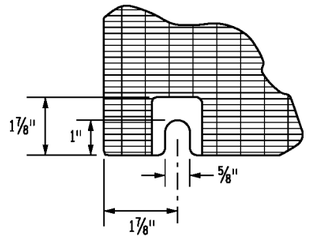
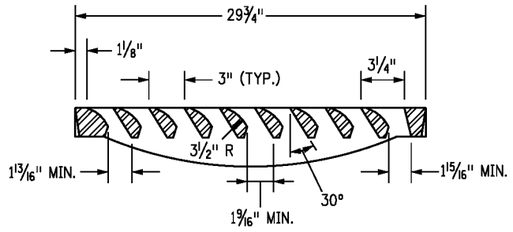
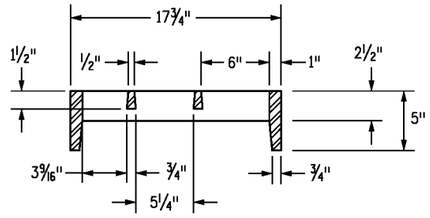


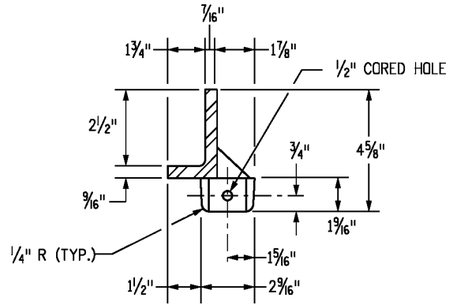
DETAIL A
BOLT SLOT AT CORNER (TYP.)



SECTION A-A



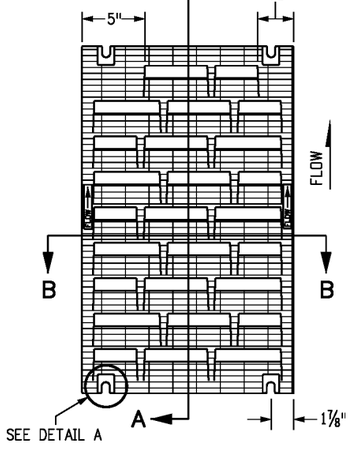
SECTION B-B



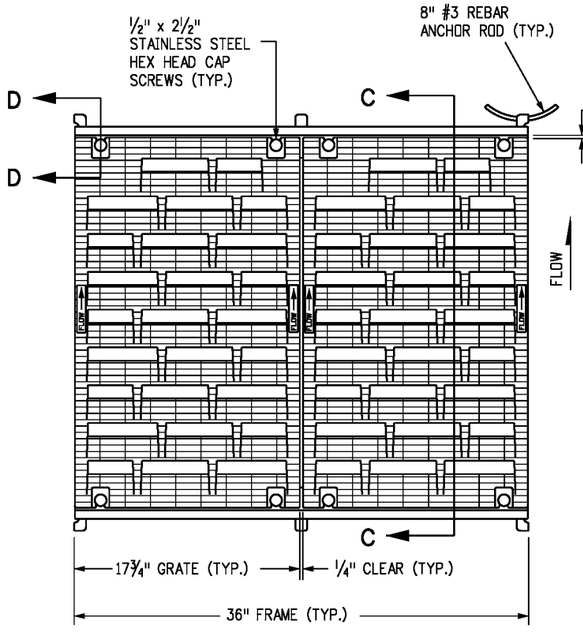
DETAIL B

NOTES

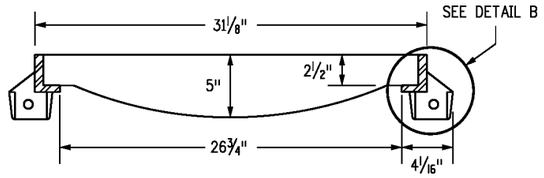
1. FREE OPEN AREA: 190 SQ. IN./GRATE.
2. MATERIAL: CAST GRAY IRON ASTM A-48 CLASS 35B.
3. FINISH: NO PAINT.
4. WEIGHT: GRATE 170 LBS. EACH; FRAME 29 LBS. EACH.
5. ALL REINFORCING BARS SHALL BE EPOXY COATED.



GRATE PLAN



MULTIPLE GRATE WITH FRAME PLAN



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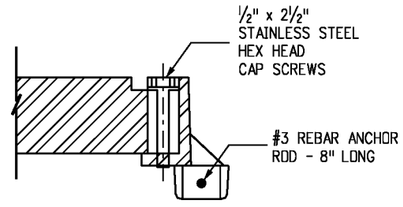

SECTION D-D

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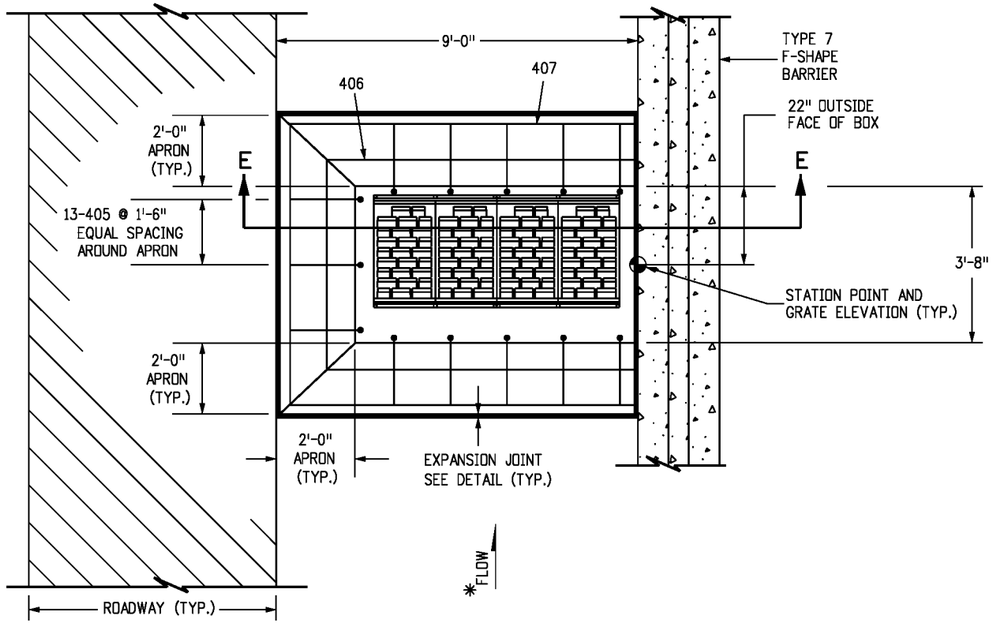
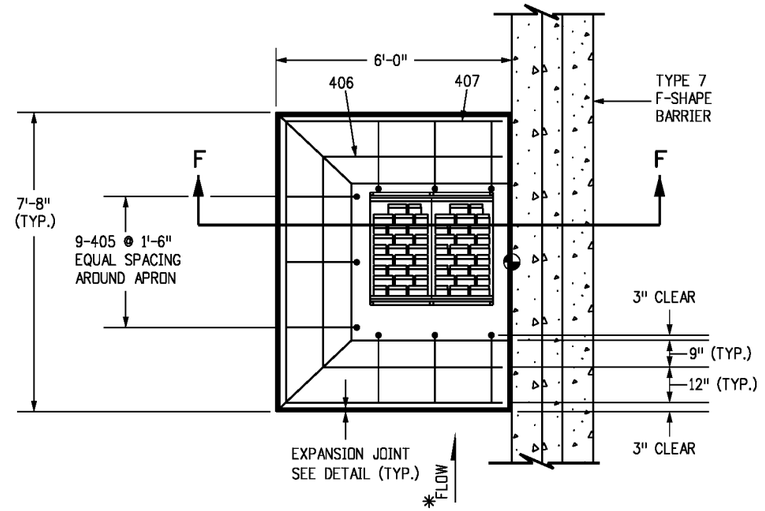
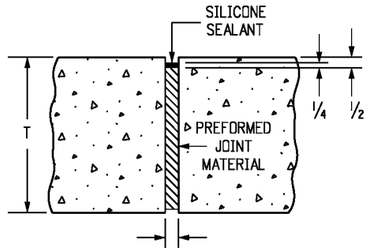


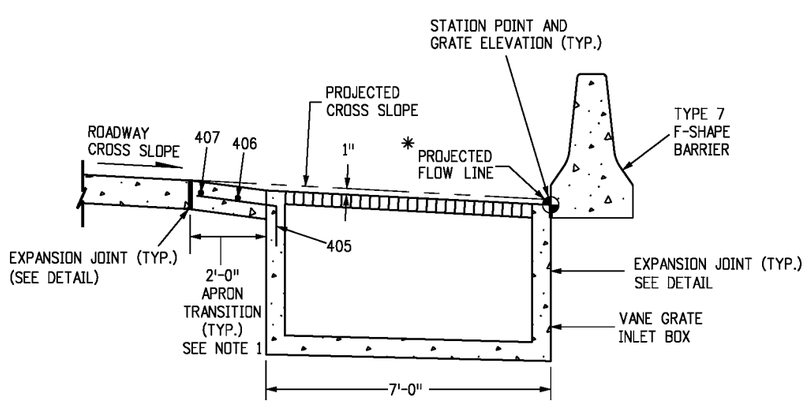
CONCRETE APRON FOR 72 IN. INLET



CONCRETE APRON FOR 36 IN. INLET



EXPANSION JOINT (TYP.)

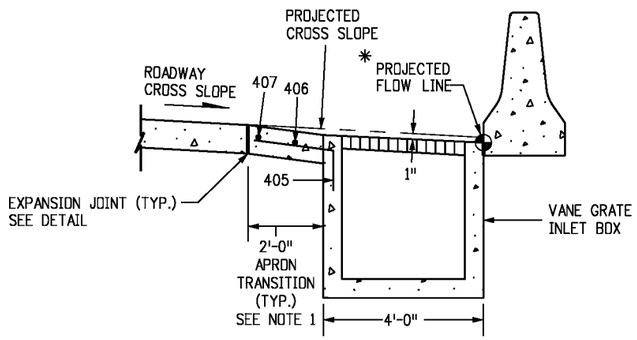


SECTION E-E

NOTES

1. A 2 FT. CONCRETE TRANSITION APRON SHALL BE CONSTRUCTED AS SHOWN AND SHALL BE KEYED INTO THE INLET.
2. CONCRETE APRON SHALL BE THE SAME THICKNESS AND TYPE AS THE SURROUNDING CONCRETE.
3. THE COST OF THE CONCRETE APRON SHALL BE INCLUDED THE COST OF THE INLET.

* IF THE INLET IS OFFSET FROM THE BARRIER, SLOPE THE APRON ADJACENT TO THE BARRIER TO DIRECT FLOW TOWARD THE GRATE.



SECTION F-F

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VANE GRATE INLET

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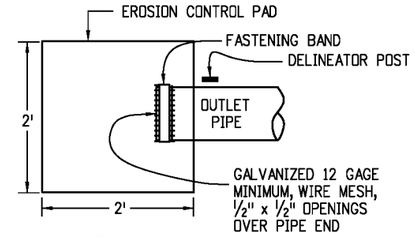
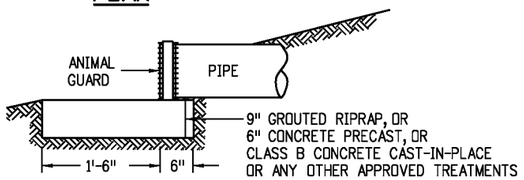
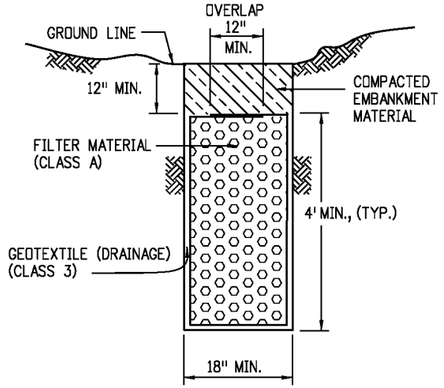


PLAN

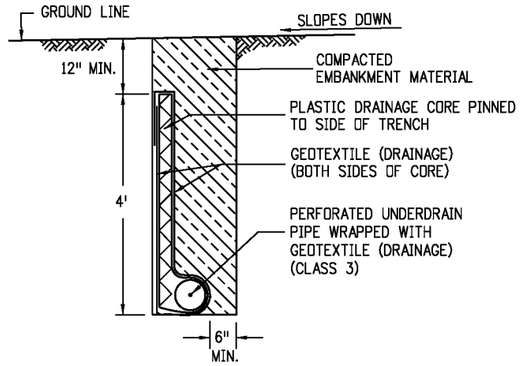


PROFILE

OUTLET PIPE END TREATMENT



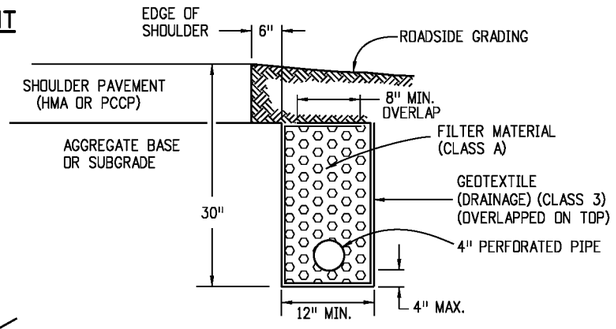
FRENCH DRAIN



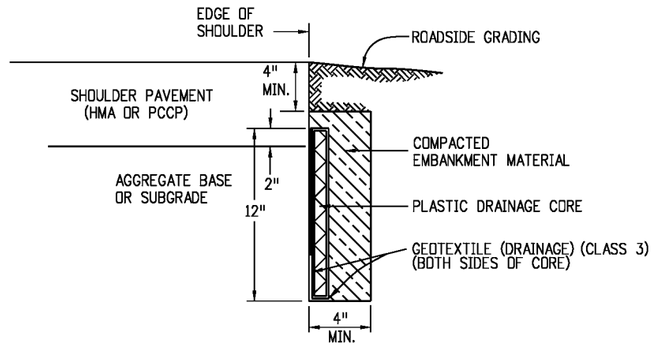
GEOCOMPOSITE UNDERDRAIN

GENERAL NOTES

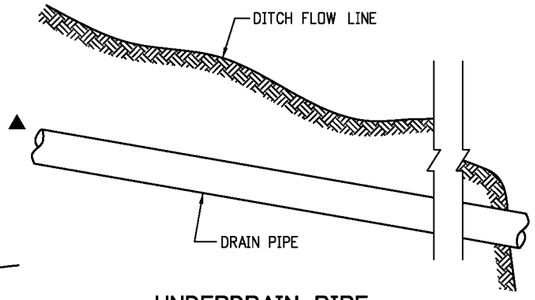
1. THE LOCATION AND GRADE OF SUBSURFACE DRAINS AND OUTLET PIPES WILL BE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
2. OUTLETS FOR THE EDGE DRAINS ARE TO BE SPACED AT MAXIMUM 600 FT. INTERVALS OR AS SHOWN ON THE PLANS. GEOCOMPOSITE OUTLET CONNECTIONS SHALL CONFORM TO MANUFACTURER'S RECOMMENDATIONS.
3. WHERE THE UNDERDRAIN PIPE OUTLETS ONTO A SLOPE OR DITCH, THE OUTLET PIPE END SHALL BE MARKED WITH A DELINEATOR POST, AND HAVE AN ANIMAL GUARD AND AN EROSION CONTROL PAD.
4. THE GEOCOMPOSITE SHALL BE SECURED TO THE WALL OR TO THE TRENCH SIDE TO PREVENT MOVEMENT DURING BACKFILLING.
5. DRAIN HOLES IN RETAINING WALL SHALL BE SPACED AT 10 FT. INTERVALS OR AS SHOWN ON THE PLANS.
6. STRUCTURE EXCAVATION AND BACKFILL LIMITS FOR RETAINING WALLS ARE SHOWN ON STANDARD PLAN M-206-1. ALL EXTRA EXCAVATION AND BACKFILL WORK NECESSARY TO COMPLETE RETAINING WALL, AGGREGATE, AND GEOCOMPOSITE DRAINS IS INCLUDED IN THE DRAIN WORK.
7. FILTER MATERIAL SHALL BE TAMPED WITH A LIGHT VIBRATORY TAMPER PRIOR TO OVERLAPPING THE GEOTEXTILE FABRIC.
8. THE EDGE DRAIN TRENCH SHALL BE CONSTRUCTED AFTER PLACEMENT OF THE AGGREGATE BASE AND SUBBASE.



PIPE EDGE DRAIN



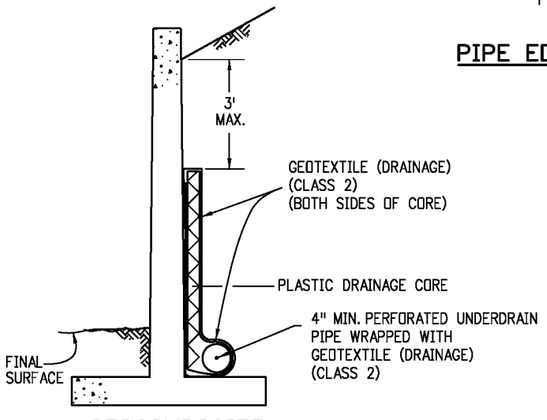
GEOCOMPOSITE EDGE DRAIN



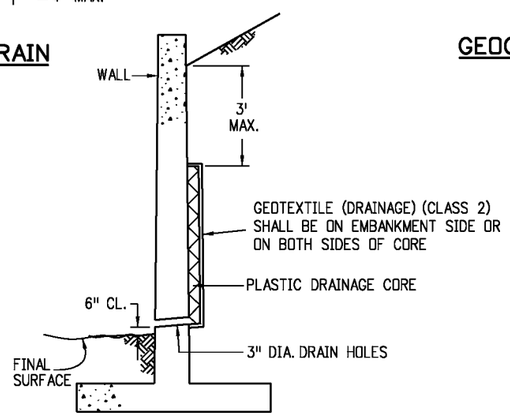
UNDERDRAIN PIPE

FLOWLINE OF PIPE SHALL FOLLOW ESTABLISHED GRADE AND NOT NATURAL SLOPE OF GROUND LINE.

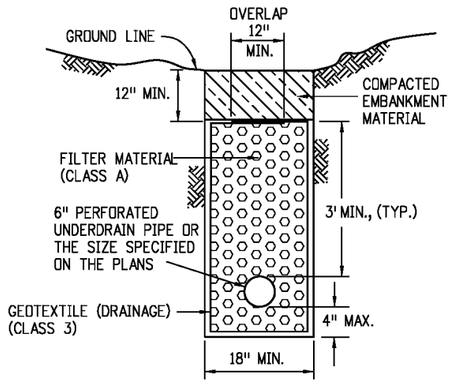
▲ THE SLOPE OF PERFORATED UNDERDRAIN PIPES AND NON-PERFORATED UNDERDRAIN PIPES SHALL BE UNIFORM.



GEOCOMPOSITE DRAIN WITH PIPE



GEOCOMPOSITE DRAIN WITHOUT PIPE



PIPE UNDERDRAIN

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SUBSURFACE DRAINS

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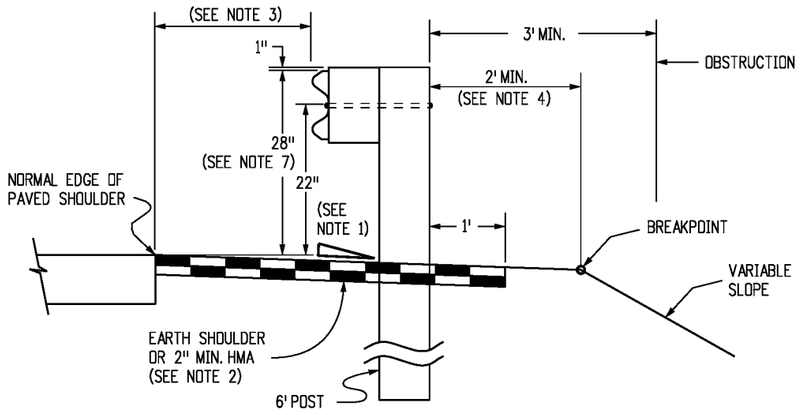
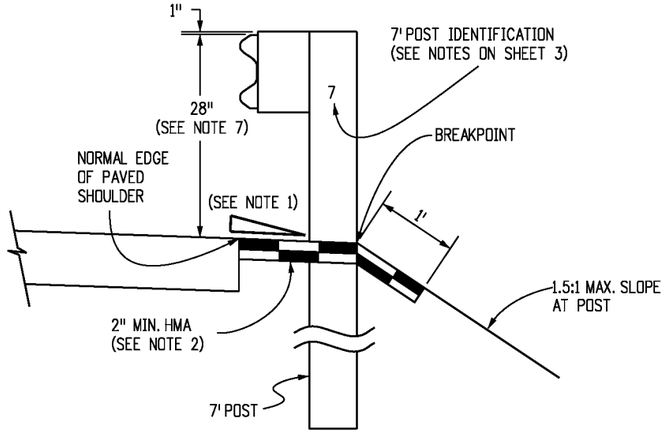
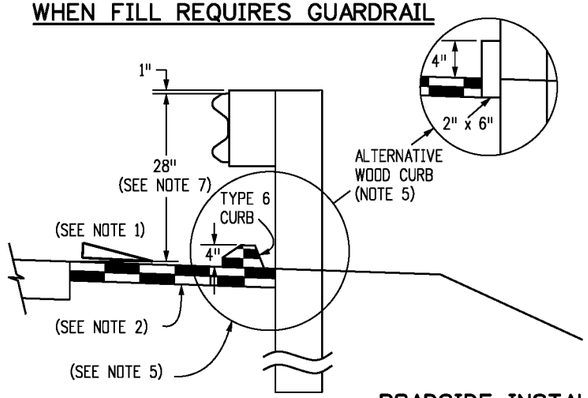


NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL

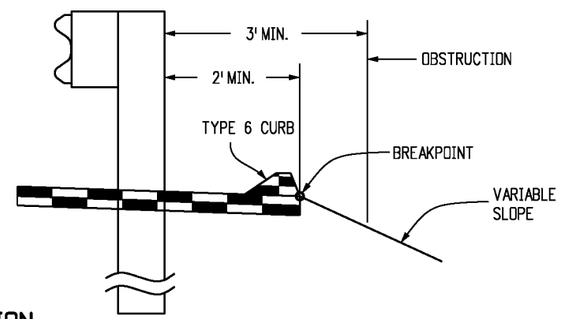


RESTRICTIVE ROADSIDE INSTALLATION WITH 7 FOOT GUARDRAIL POSTS

(SEE NOTE 4)

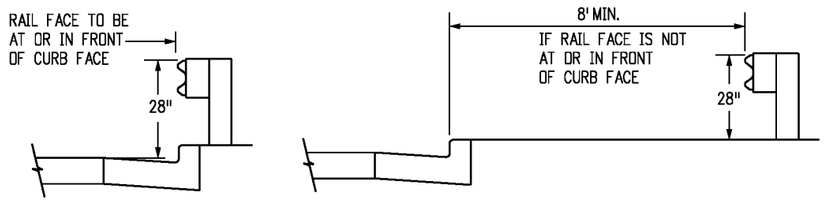


OPTION A



OPTION B

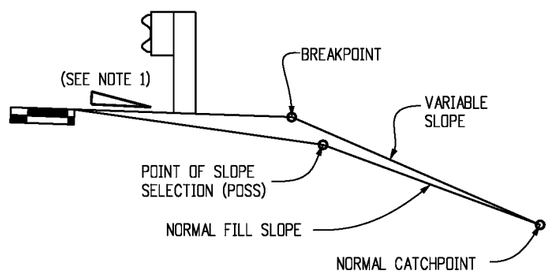
ROADSIDE INSTALLATION WITH EROSION CONTROL CURB



URBAN ROADSIDE INSTALLATION WITH CURB AND GUTTER

LOCATION	SPACING
ALL LOCATIONS EXCEPT BRIDGE RAIL LOCATIONS	6'-3"
BRIDGE OR STRUCTURE APPROACH	SEE SHEETS 11 & 19

NORMAL CENTER-TO-CENTER POST SPACING



EMBANKMENT WITH GUARDRAIL

(NOTE: THE CATCHPOINT REMAINS THE SAME AS THAT FOR "NORMAL" FILL SLOPE. FOR THE WIDER "Z" DISTANCES, THE VARIABLE SLOPE MAY "CATCH" AT THE POSS.)

GENERAL NOTES

1. RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
   A. FOR GUARDRAIL FACE 2 FT. OR LESS FROM THE NORMAL EDGE OF PAVED SHOULDER, CONTINUE THE RATE OF SLOPE OF THE NORMAL PAVED SHOULDER TO THE BREAKPOINT.
   B. FOR GUARDRAIL FACE MORE THAN 2 FT. FROM THE NORMAL EDGE OF THE PAVED SHOULDER, THE SLOPE SHALL BE 10:1 OR FLATTER.
2. WHEN SPECIFIED ON THE PLANS, EXTEND A 2 IN. MINIMUM THICKNESS PAVED SURFACE TO 1 FT. BEHIND THE GUARDRAIL POSTS OR TO THE EROSION CONTROL CURB AS SHOWN ON PLANS. ASPHALT CUTTING & PATCHING OR OTHER APPROVED METHOD SHALL BE USED TO MINIMIZE DAMAGE TO ALL PAVED SURFACES UNDER GUARDRAIL INSTALLATIONS. ALL REPAIRS TO THE PAVED AREA WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. A MINIMUM 3 IN. THICK FIBER REINFORCED CONCRETE PAVEMENT MAY ALSO BE USED FOR PAVING BENEATH THE GUARDRAIL. INSTALL THE POST IN A $\frac{1}{2}$ IN. OVERSIZED FORMED HOLE FOR GUARDRAIL RUNS AND TERMINALS AS DIRECTED. PAYMENT FOR THIS PAVED SURFACE WILL BE MADE UNDER A PAVEMENT OR CONCRETE PAY ITEM WITH QUANTITIES SHOWN ON THE PLANS.
3. THE MINIMUM GUARDRAIL OFFSET FROM PAVED SHOULDER EDGE SHALL BE:
   0 FT. FOR SHOULDERS 8 FT. OR WIDER
   2 FT. FOR SHOULDERS 6 FT. OR LESS

   THE GUARDRAIL OFFSET FROM PAVED INSIDE SHOULDER EDGE OF A DIVIDED HIGHWAY SHALL BE;
   0 FT. MINIMUM FOR SHOULDERS 6 FT. OR WIDER
   2 FT. DESIRABLE FOR 4 FT. SHOULDERS

   THE ABOVE 2 FT. GUARDRAIL TO SHOULDER OFFSET IS DESIRABLE BUT NOT REQUIRED FOR:
   A. FOR AN EXISTING HIGHWAY WITH A DESIGN SPEED LESS THAN 50 MPH, THE MINIMUM OFFSET IS 4 FT. FROM THE TRAVELED WAY.
   B. FOR A ONE-WAY ONE-LANE RAMP, AND WHERE ONE OR MORE OF THE FOLLOWING ARE TRUE:
      (1) THE NON-OFFSET GUARDRAIL BEGINS AT LEAST 100 FT. BEYOND RAMP NOSE.
      (2) THE NON-OFFSET GUARDRAIL IS NOT LOCATED ON THE RAMP EXIT OR ENTRANCE CURVE CONNECTION TO THE MAJOR HIGHWAY.
      (3) THE RAMP SHOULDERS ARE 4 FT. OR WIDER.

   USE OF GREATER THAN MINIMUM OFFSET DIMENSIONS IS ENCOURAGED TO MEET THE DESIRABLE GOAL OF PLACING THE GUARDRAIL AS FAR AS POSSIBLE FROM THE TRAVEL WAY, EVEN FOR SHORT DISTANCES, WHILE PROVIDING A SMOOTH CHANGE IN GUARDRAIL ALIGNMENT.
4. IF 2 FT. CANNOT BE PROVIDED BETWEEN THE BACK OF THE GUARDRAIL POST AND THE BREAKPOINT, USE 7 FT. GUARDRAIL POSTS. REFER TO THE "RESTRICTIVE ROADSIDE INSTALLATION" DETAIL.
5. WHEN SPECIFIED ON THE PLANS, INSTALL 4 IN. HIGH TYPE 6 CURB WITH ITS FACE AT OR BEHIND THE RAIL FACE. AS AN ALTERNATIVE WHEN SPECIFIED ON THE PLANS, INSTALL A 2 IN. x 6 IN. TREATED (AASHTO M 133) WOOD CURB. FASTEN WITH A 4 IN. LAG BOLT AND WASHER AT EACH WOOD POST, OR WITH A $\frac{1}{4}$ IN. DIA. BOLT WITH WASHER AND NUT AT EACH STEEL POST. IF THE 2 IN. x 6 IN. WOOD CURB IS SPECIFIED, IT WILL BE INCLUDED IN THE COST OF THE GUARDRAIL. IF APPROVED BY THE ENGINEER, A 2 IN. x 4 IN. TREATED WOOD CURB MAY BE SUBSTITUTED FOR THE 2 IN. x 6 IN. CURB AND SET ON TOP OF PAVEMENT SURFACE AND ATTACHED AS DESCRIBED ABOVE. NO SPLICING SHALL BE ALLOWED IN WOOD CURBS. ADJACENT BOARDS SHALL BE BUTTED TOGETHER AND BOLTED AT A POST LOCATION. JOINTS SHALL BE LOCATED AT THE POSTS.
6. SEE SHEET 6 FOR CURB TREATMENTS AT GUARDRAIL TERMINALS.
7. RESET GUARDRAIL IF THIS DIMENSION WILL BE LESS THAN 25 IN.
8. ALL W-BEAM SPLICES, AND SPLICES OF TERMINAL CONNECTORS TO W-BEAM SHALL BE LAPPED IN THE DIRECTION OF TRAFFIC UNLESS OTHERWISE NOTED.
9. MATERIAL TYPE AND SHAPE OF POSTS AND BLOCKS SHALL BE THE SAME THROUGHOUT THE PROJECT EXCEPT WHEN SPECIFIC POSTS AND BLOCKS ARE SPECIFIED, i.e. AT END ANCHORAGES AND BOX CULVERTS.
10. CONCRETE MAY BE READY-MIXED OR FIELD-MIXED AND SHALL CONSIST OF A MINIMUM OF 1 PART CEMENT TO 6 PARTS AGGREGATE BY VOLUME.

THE GENERAL NOTES ARE CONTINUED ON SHEET 2.

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GUARDRAIL TYPE 3 W-BEAM

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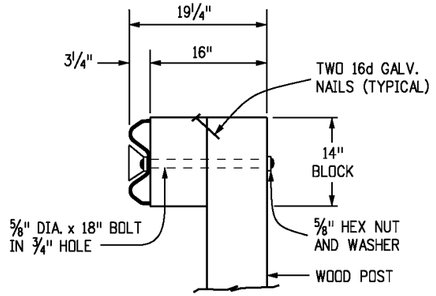
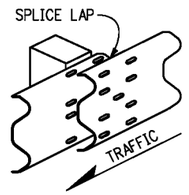
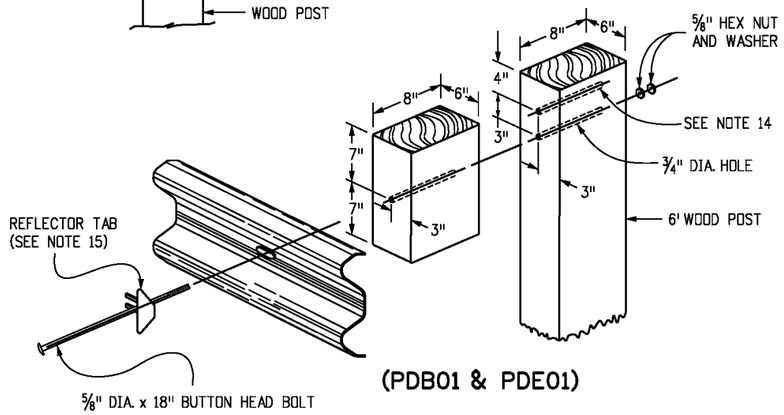


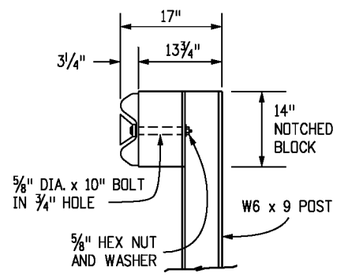


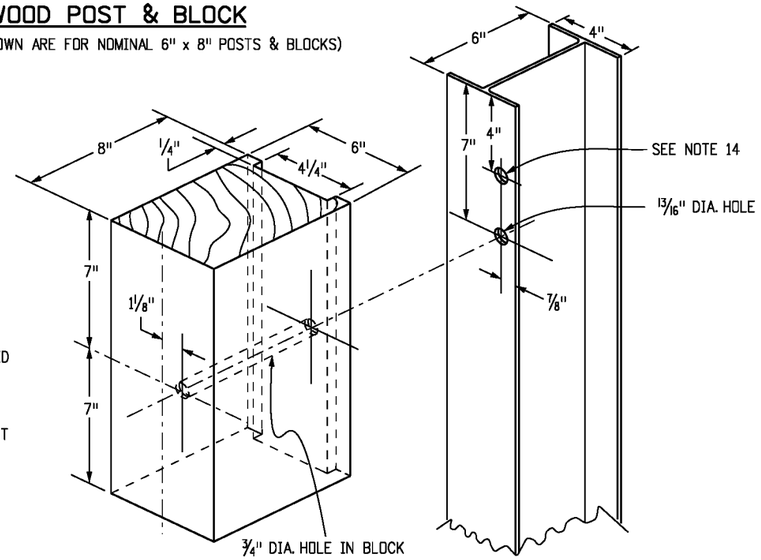


(PDB01 & PDE01)

WOOD POST & BLOCK

(DIMENSIONS SHOWN ARE FOR NOMINAL 6" x 8" POSTS & BLOCKS)





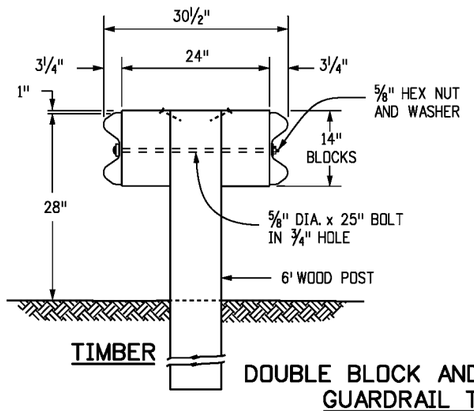
STEEL POST & NOTCHED BLOCK

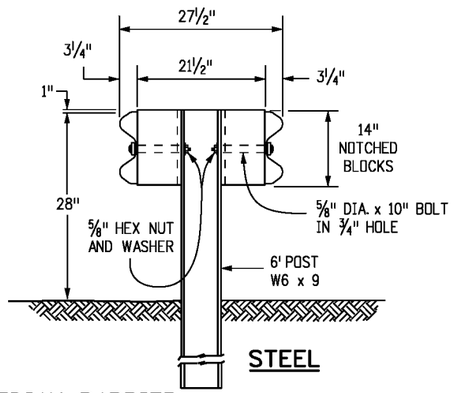
(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)

(PWE01)

GENERAL NOTES (CONTINUED FROM SHEET 1)

11. WHEN SPECIFIED IN THE CONTRACT, 7 FT. POSTS SHALL BE INSTALLED INSTEAD OF THE STANDARD 6 FT. POSTS. THE 7 FT. POSTS SHALL BE MARKED WITH THE NUMBER 7 TO ENSURE PERMANENT INDENTIFICATION. STEEL POSTS SHALL BE STAMPED PRIOR TO GALVANIZING. THE NUMBER 7 SHALL BE A MINIMUM 2 IN. TALL AND LOCATED AS SHOWN ON THE ELEVATION VIEW ON SHEET 1.
12. THE STANDARD 3 IN. X 1¾ IN. X 3/16 IN. RECTANGULAR WASHER USED UNDER POST BOLT HEADS IN THE PAST MAY REMAIN IN EXISTING INSTALLATIONS BUT SHALL NOT BE USED IN NEW CONSTRUCTION, REPAIRS, OR RESETTING OF RAIL, EXCEPT WHEN SPECIFICALLY IDENTIFIED ON THE STANDARD PLAN.
13. STANDARD GALVANIZED ROUND STEEL WASHERS SHALL BE USED UNDER ALL NUTS IN CONTACT WITH WOOD POSTS.
14. AN ADDITIONAL HOLE SHALL BE PROVIDED IN THE POSTS TO FACILITATE FUTURE RAISING OF THE RAIL ELEMENTS AND BLOCKS FOR OVERLAYS.
15. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT. INTERVALS (SEE SHEETS 5 AND 7 FOR EXCEPTIONS). RETROREFLECTOR TABS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. THE TABS SHALL BE MOUNTED SO THE BOLT SLOT FACES AWAY FROM TRAFFIC, AND THE RETROREFLECTOR SURFACE FACES THE APPROACHING TRAFFIC FOR ONE-WAY ROADS. FOR TWO-WAY ROADS, BOTH SIDES OF THE TABS SHALL BE RETROREFLECTIVE, SO THAT DELINEATION IS PROVIDED FOR BOTH DIRECTIONS OF TRAVEL. THE RETROREFLECTIVE SHEETING COLOR SHALL MATCH THE COLOR OF THE ADJACENT TRAVEL WAY EDGE LINE. SEE THE RETROREFLECTOR TAB DETAIL ON SHEET 3.
16. AT THE TIME OF INSTALLATION, WOOD POSTS OR BLOCKS WITH SEASONING CHECKS GREATER THAN ¼ IN. SHALL NOT BE USED WHEN THE CHECK EXTENDS THE FULL LENGTH OF THE PIECE.
17. WOOD BLOCKS SHALL BE CUT FROM THE SAME CROSS-SECTION, SPECIES, AND GRADE, AND SHALL RECEIVE THE SAME PRESERVATIVE TREATMENT AS THE POSTS WHEN WOOD POSTS ARE USED.
18. REFERENCES SUCH AS 00PDB01", 00PDE01", AND 00PWE01" IN THIS STANDARD PLAN SPECIFY HARDWARE DETAILS FROM 00A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" PREPARED BY THE AASHTO-AGC-ARTBA JOINT COOPERATIVE COMMITTEE.
19. NOTCHED RAIL BLOCKS MANUFACTURED FROM SYNTHETIC MATERIAL WILL BE ACCEPTED AS ALTERNATIVES TO WOOD NOTCHED BLOCKS FOR USE WITH STEEL POSTS PROVIDED THAT THE BLOCKS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL.
20. WOOD POSTS SHALL BE MADE OF TIMBER WITH AN EXTREME FIBER STRESS IN BENDING OF 1200 PSI STRESS GRADING AND POST DIMENSIONS SHALL CONFORM WITH THE RULES OF THE WEST COAST INSPECTION BUREAU, OR THE SOUTHERN PINE BUREAU, OR THE WESTERN WOOD PRODUCTS ASSOCIATION. TIMBER FOR POSTS SHALL BE EITHER ROUGH SAWN (UNPLANED) OR S4S (SURFACED FOUR SIDES) WITH NOMINAL DIMENSIONS INDICATED. ONLY ONE TYPE OF SURFACE FINISH SHALL BE USED FOR POSTS AND BLOCKS IN ANY ONE CONTINUOUS LENGTH OF GUARDRAIL.
21. GLULAM POSTS AND BLOCKS WILL BE ACCEPTED AS ALTERNATIVES PROVIDED THAT THE SUPPLIED MATERIALS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL.
22. PRESSURE TREATMENT OF POSTS AND BLOCKS SHALL CONFORM TO AASHTO M 133 EXCEPT THAT BLOCKS NEED NOT BE INCISED. PRESERVATION ASSAY RETENTION REPORTS SHALL BE SUBMITTED TO THE ENGINEER. THE CONTRACTOR SHALL CERTIFY THAT THE SPECIES AND GRADE MEET THE REQUIREMENTS OF THE CONTRACT.
23. W-BEAM AND THRIE-BEAM GUARDRAIL POSTS SHALL BE MANUFACTURED USING AASHTO M 270 (ASTM A 709) GRADE 36 STEEL UNLESS CORROSION RESISTANT STEEL IS REQUIRED, IN WHICH CASE THE POST SHALL BE MANUFACTURED FROM AASHTO M 270 (ASTM A 709) GRADE 50W STEEL. THE DIMENSIONS OF THE CROSS-SECTION SHALL CONFORM TO A W6 X 9 SECTION AS DEFINED IN AASHTO M 160 (ASTM A 6). W6 X 8.5 WIDE FLANGE STEEL POSTS ARE AN ACCEPTABLE ALTERNATIVE TO THE W6 X 9.
24. AFTER THE SECTION IS CUT AND ALL HOLES ARE DRILLED OR PUNCHED THE COMPONENT SHALL BE ZINC-COATED CONFORMING TO AASHTO M 111 (ASTM A 123) UNLESS CORROSION-RESISTANT STEEL IS USED. WHEN CORROSION-RESISTANT STEEL IS USED THE PORTION OF THE POST TO BE EMBEDDED IN SOIL SHALL BE ZINC-COATED CONFORMING TO AASHTO M 111 (ASTM A 123) AND THE PORTION ABOVE THE SOIL SHALL NOT BE ZINC-COATED, PAINTED OR OTHERWISE TREATED.
25. FIELD MODIFICATION TO RAIL ELEMENTS ONLY IS ALLOWED BY SAWING AND DRILLING OF HOLES. FLAME CUTTING IS NOT PERMITTED. POSTS SHALL NOT BE MODIFIED. COMPONENTS ON WHICH THE SPELTER COATING HAS BEEN DAMAGED SHALL BE EITHER REGALVANIZED OR RECOATED IN CONFORMANCE WITH AASHTO M 36, OR PAINTED WITH ONE FULL BRUSH COAT OF ZINC RICH PAINT CONFORMING TO MILITARY SPECIFICATION DOD-P-21035A.





DOUBLE BLOCK AND RAIL MEDIAN BARRIER
GUARDRAIL TYPE 3 (DOUBLE)

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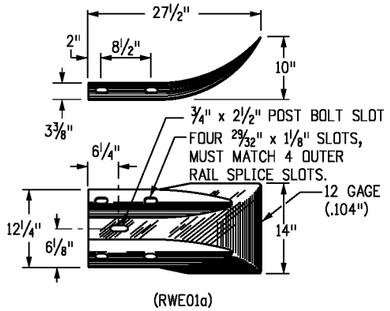
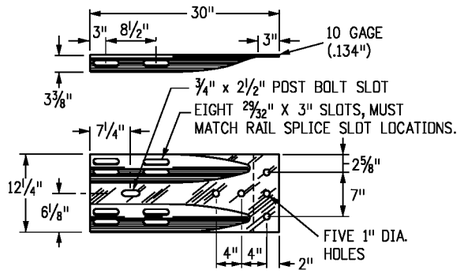
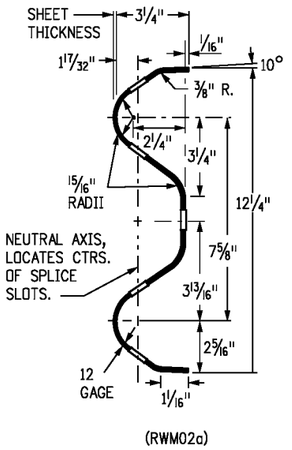


(RWE01a)

TERMINAL SECTION (FLARED)

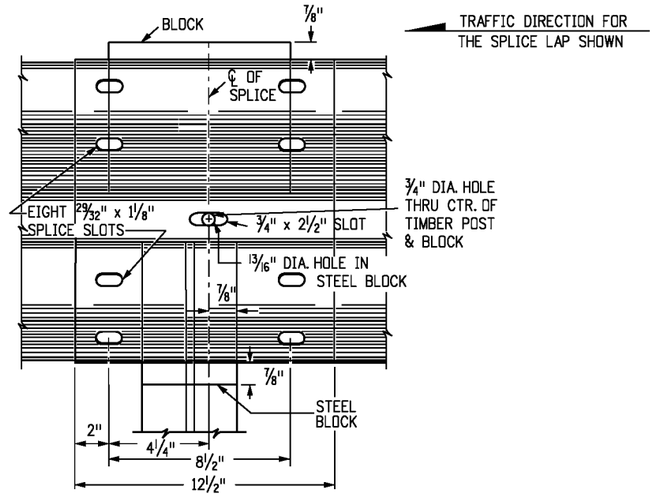


TERMINAL SECTION (CONNECTOR)

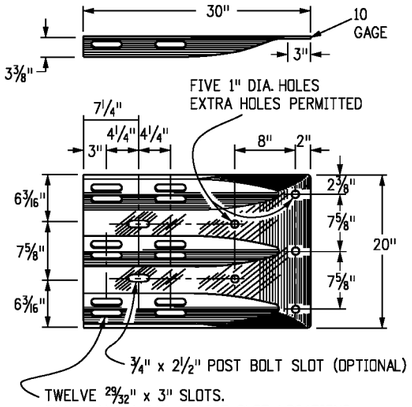


(RWM02a)

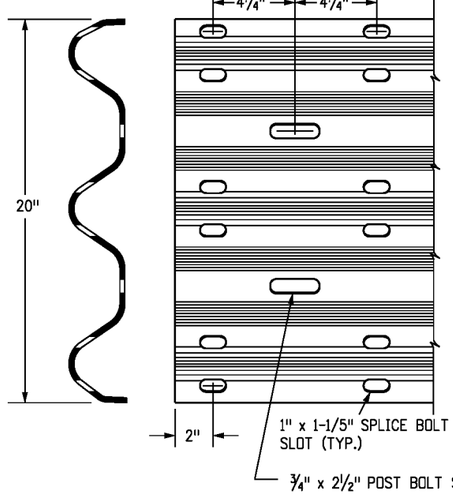
W-BEAM RAIL SECTION



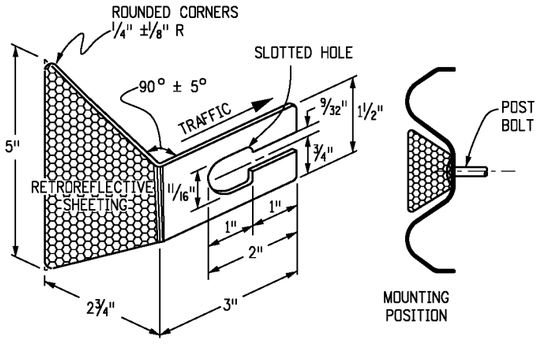
RAIL SPLICE



THRIE BEAM TERMINAL SECTION (CONNECTOR)

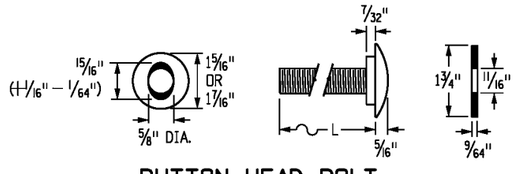


THRIE BEAM DETAIL



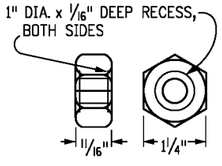
RETROREFLECTOR TAB

RETROREFLECTOR TABS SHALL BE MANUFACTURED FROM 12 TO 14 GAUGE STEEL. RETROREFLECTIVE SHEETING SHALL CONFORM TO ASTM D4956 TYPE III. SEE NOTE 7 ON SHEET 5



BUTTON HEAD BOLT WITH OVAL SHOULDER

WASHER

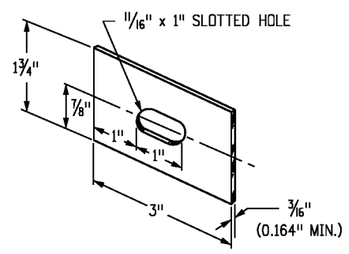


HEX NUT

PART	MATERIAL SPEC.	GALVANIZING SPEC.	CORROSION-RESISTANT SPEC.
W-BEAM RAIL & TERMINAL SECTIONS	AASHTO M 180, CLASS A OR B	AASHTO M 180, TYPE 1 OR 2	AASHTO M 180, TYPE 4
BASE PLATE	ASTM A 36	AASHTO M 111	N.A.
NUTS, BOLTS & STUDS FOR GENERAL USE	ASTM A 307	AASHTO M 232, CLASS C OR ASTM B 695 CLASS 50 TYPE 1	
HIGH STRENGTH BOLTS & NUTS	ASTM A 325		
HIGH STRENGTH STUDS & NUTS	ASTM A 449		
ROUND STEEL WASHERS	ASTM F 436		
RECTANGULAR WASHERS	AASHTO M 180		
OTHER FITTINGS	ASTM A 36	AASHTO M 111	

THE TABULATION OF GUARDRAIL WILL SPECIFY THE TYPE OF CORROSION PROTECTION: GALVANIZED OR CORROSION - RESISTANT STEEL.

STEEL POSTS SHALL HAVE THE SAME CORROSION PROTECTION AS SPECIFIED FOR THE METAL BEAM RAIL. PUNCHING, DRILLING, CUTTING, OR WELDING OF POSTS WILL NOT BE PERMITTED AFTER GALVANIZING.



(FWR03)

RECTANGULAR WASHER

(TO BE USED ONLY WHERE SPECIFIED.)

DIAMETER & TYPE (INCHES)	LENGTH L (INCHES)	THREAD LENGTH (INCHES)	INTENDED USE	AASHTO-AGC-ARTBA STANDARD NUMBER	NO. BOLTS, NUTS & WASHERS
⅝ BUTTON HEAD	1¼	FULL (1 1/32)	ALL RAIL SPLICES	FBB01	8 PER SPLICE*
OVAL	18	MIN. 2½	SINGLE BLOCK & POST (TIMBER)	FBB04	1 PER POST
SHLDR.	25	MIN. 2	DOUBLE BLOCK & POST (TIMBER)	FBB05	1 PER POST
	10	MIN. 2	FASTEN NOTCHED BLOCK TO STEEL POST	FBB03	1 PER BLOCK

* WASHERS NOT USED AT RAIL SPLICES

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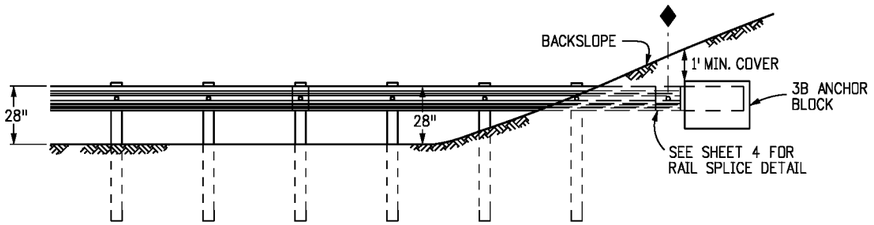
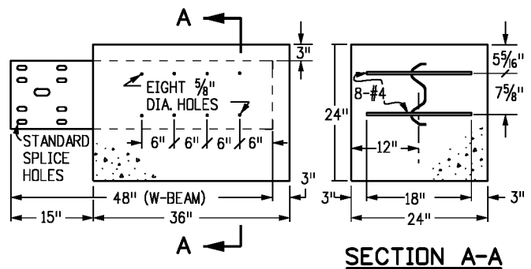


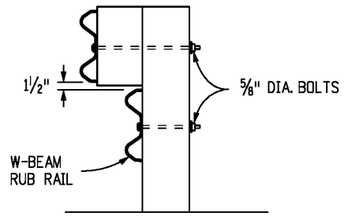
SEE TYPE 3B (RUB RAIL) PLAN VIEW FOR ALIGNMENT. THE 100 FT. FLARE LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

END ANCHORAGE TYPE 3B
(WITHOUT ROADSIDE DITCH AT GUARDRAIL)



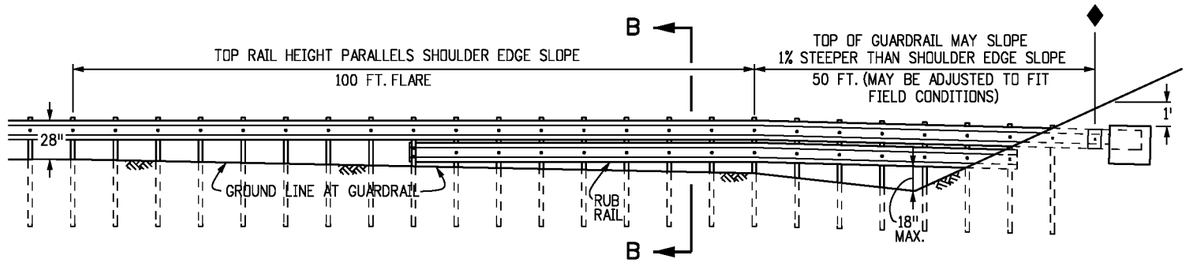
SECTION A-A

TYPE 3B ANCHOR BLOCK DETAIL

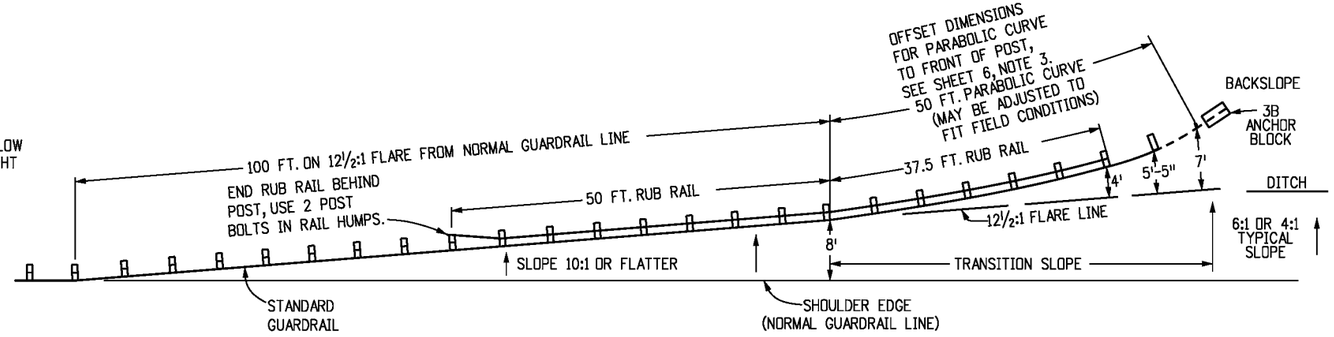


SECTION B-B

MOUNT A W-BEAM RUB RAIL 1-1/2 IN. BELOW THE TOP RAIL WHEN THE TOP RAIL HEIGHT EXCEEDS 30 IN. ABOVE THE GROUND



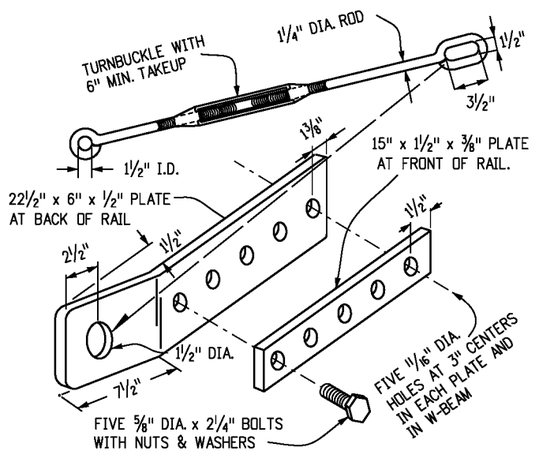
ELEVATION VIEW



PLAN VIEW

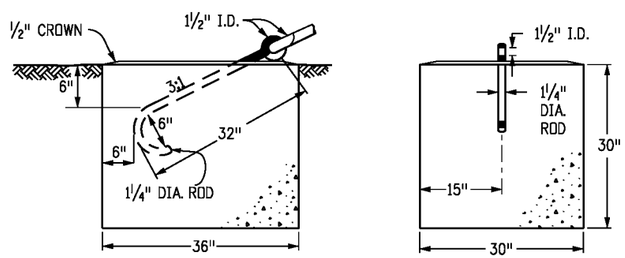
◆ END OF GUARDRAIL PAY LENGTH

END ANCHORAGE TYPE 3B (RUB RAIL)
(WITH ROADSIDE DITCH AT GUARDRAIL)



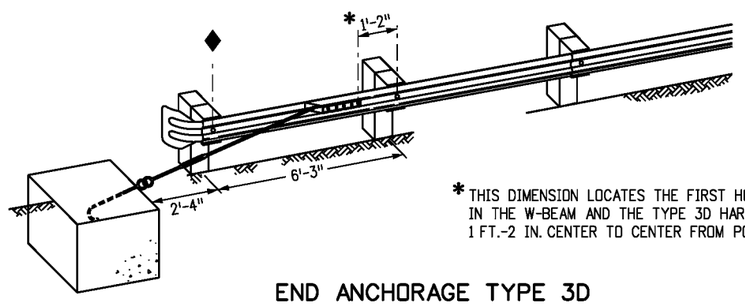
TYPE 3D HARDWARE DETAILS

NOTE: ALL PARTS SHALL BE GALVANIZED



FRONT END

TYPE 3D ANCHOR BLOCK DETAIL



* THIS DIMENSION LOCATES THE FIRST HOLE IN THE W-BEAM AND THE TYPE 3D HARDWARE. 1 FT.-2 IN. CENTER TO CENTER FROM POST BOLT HOLE.

END ANCHORAGE TYPE 3D DEPARTURE TERMINAL

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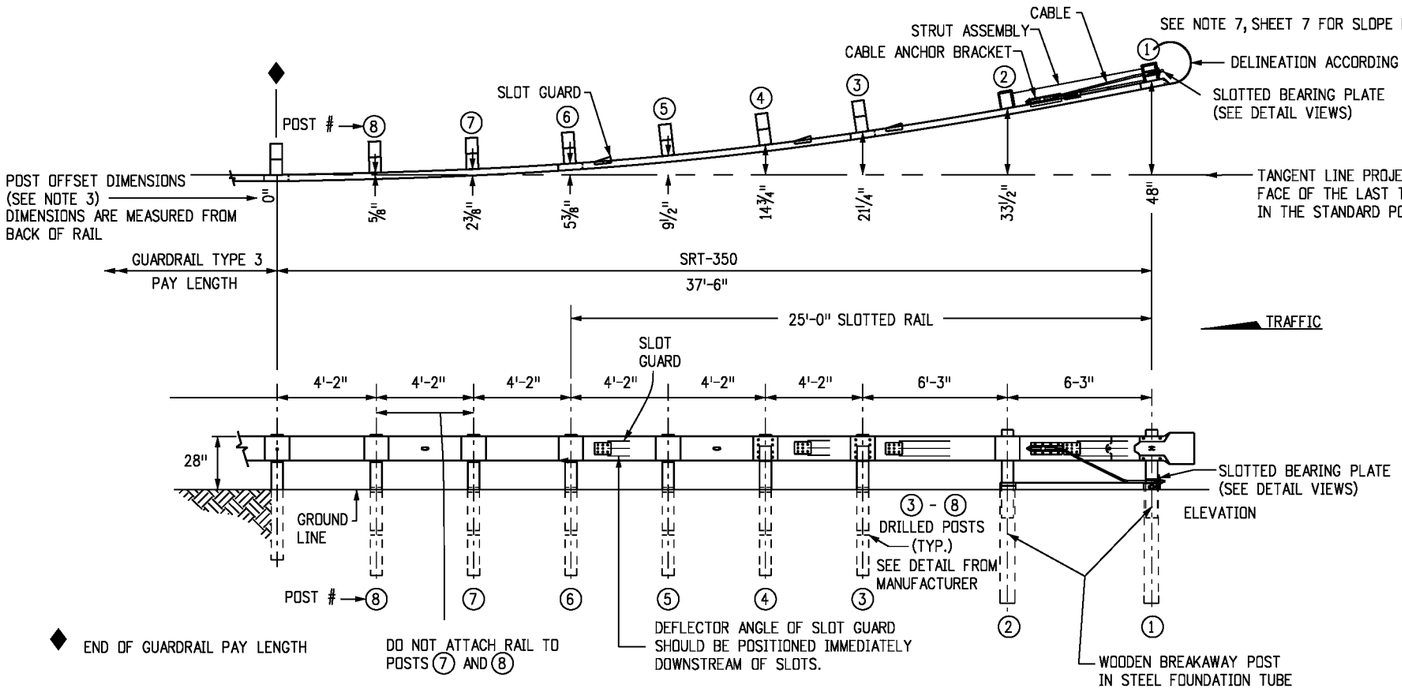
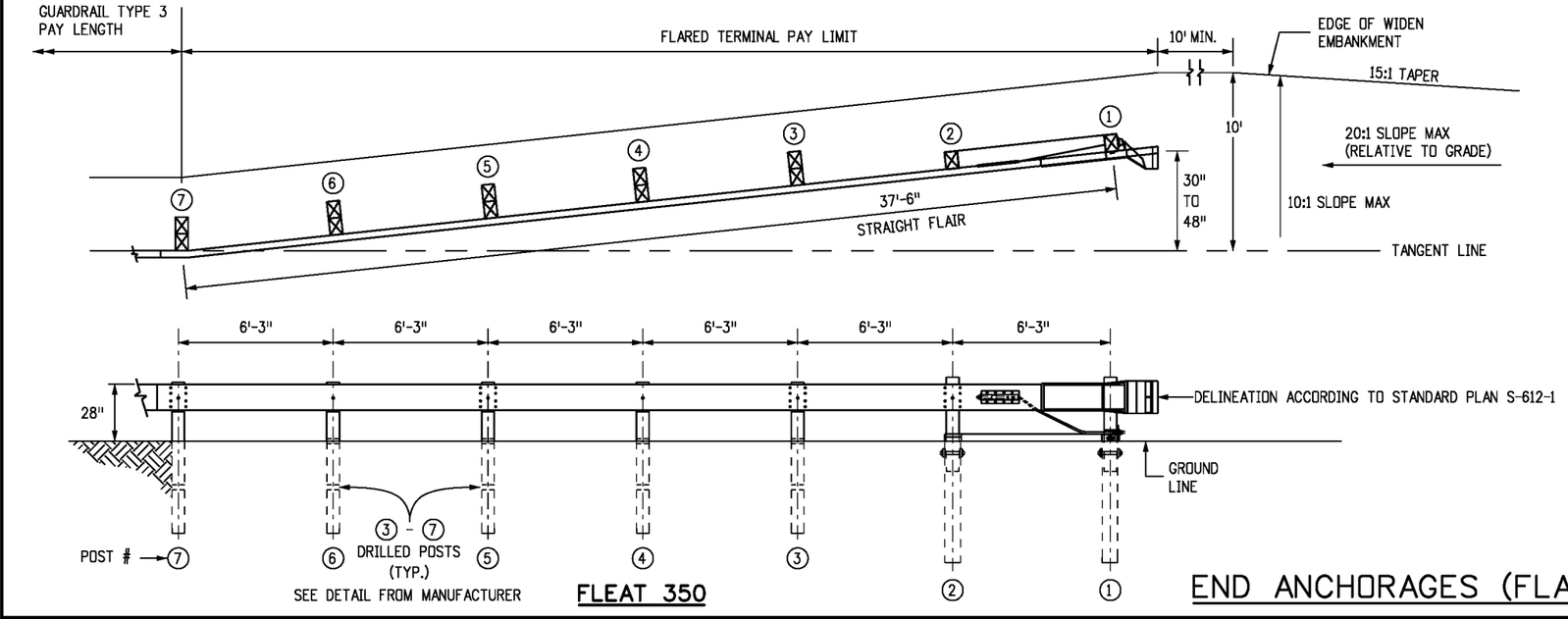
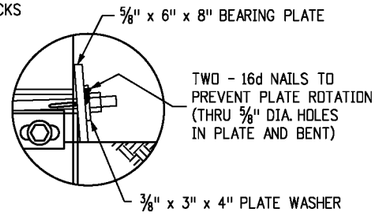


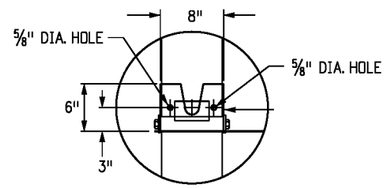
SLOTTED RAIL TERMINAL (SRT)



FLEAT 350



SRT DETAIL VIEW



PLACE SLOTTED BEARING PLATE WITH SLOT ORIENTED UP AS SHOWN.

SRT FRONT VIEW

SLOTTED BEARING PLATE DETAIL

NOTES

1. THE END ANCHORAGE (FLARED) SHALL BE THE SLOTTED RAIL TERMINAL (SRT-350), AS MANUFACTURED BY TRINITY INDUSTRIES, INC. (TELEPHONE #: 800-644-7976), OR THE FLEAT-350, AS MANUFACTURED BY ROAD SYSTEMS INC. (TELEPHONE #: 915-263-2435). ONE END ANCHORAGE (FLARED) SHALL INCLUDE ALL POST, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (FLARES) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO INSTALLATION OF THE DEVICE.
2. IN HEAVY SNOW LOCATIONS, TRIM POSTS 1 AND 2 FLUSH WITH RAIL TOP AND TREAT END WITH SEALANT, IN CONFORMANCE WITH AASHTO M 133.
3. THE POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF THE BLOCKOUTS FROM THE PROJECTED RAIL TANGENT LINE, EXCEPT AT THE FIRST TWO POSTS WHERE THE DIMENSION IS TO THE CENTER OF THE TRAFFIC FACE OF THE POST. OFFSET POINTS SHALL BE LOCATED BY CHORD MEASUREMENTS AT THE BACK OF THE RAIL AND BE EQUAL TO THE NOMINAL POST SPACINGS SHOWN. POSTS ARE TO BE SET APPROXIMATELY RADIAL TO THE RAILING AT EACH POST LOCATION.
4. THE SRT SLOTTED BEARING PLATE SHALL BE INSTALLED WITH THE SLOT FACING UP.
5. POSTS SHALL BE DRILLED FOR BREAKAWAY ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
6. SEE SHEETS 1, 3 AND 4 FOR STANDARD GUARDRAIL TYPE 3 AND INSTALLATION DETAILS.
7. RETRODREFLECTOR TABS SHALL NOT BE USED ON POSTS 1 THROUGH 8.
8. SRT PANELS SHALL BE SUPPLIED IN EITHER THREE 12 FT. - 6 IN. RAIL PANELS, OR ONE 25 FT. - 0 IN. AND ONE 12 FT. - 6 IN. RAIL PANELS.
9. SRT - STRAIGHT FLARED OPTION. SEE MANUFACTURER'S DETAILS.
10. HINGED BREAK AWAY (HBA) STEEL POSTS MAY BE USED AS AN ALTERNATIVE ON THE SRT FOR POSTS 2 THRU 8. SEE MANUFACTURER'S DETAILS.
11. HINGED BREAK AWAY (HBA) STEEL POSTS OR WELDED POSTS (PW) MAY BE USED AS AN ALTERNATIVE ON THE FLEAT FOR POSTS 3 THRU 7. SEE MANUFACTURER'S DETAILS.
12. DELINEATION SHALL BE APPLIED TO THE END PIECE, AND SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

END ANCHORAGES (FLARED)

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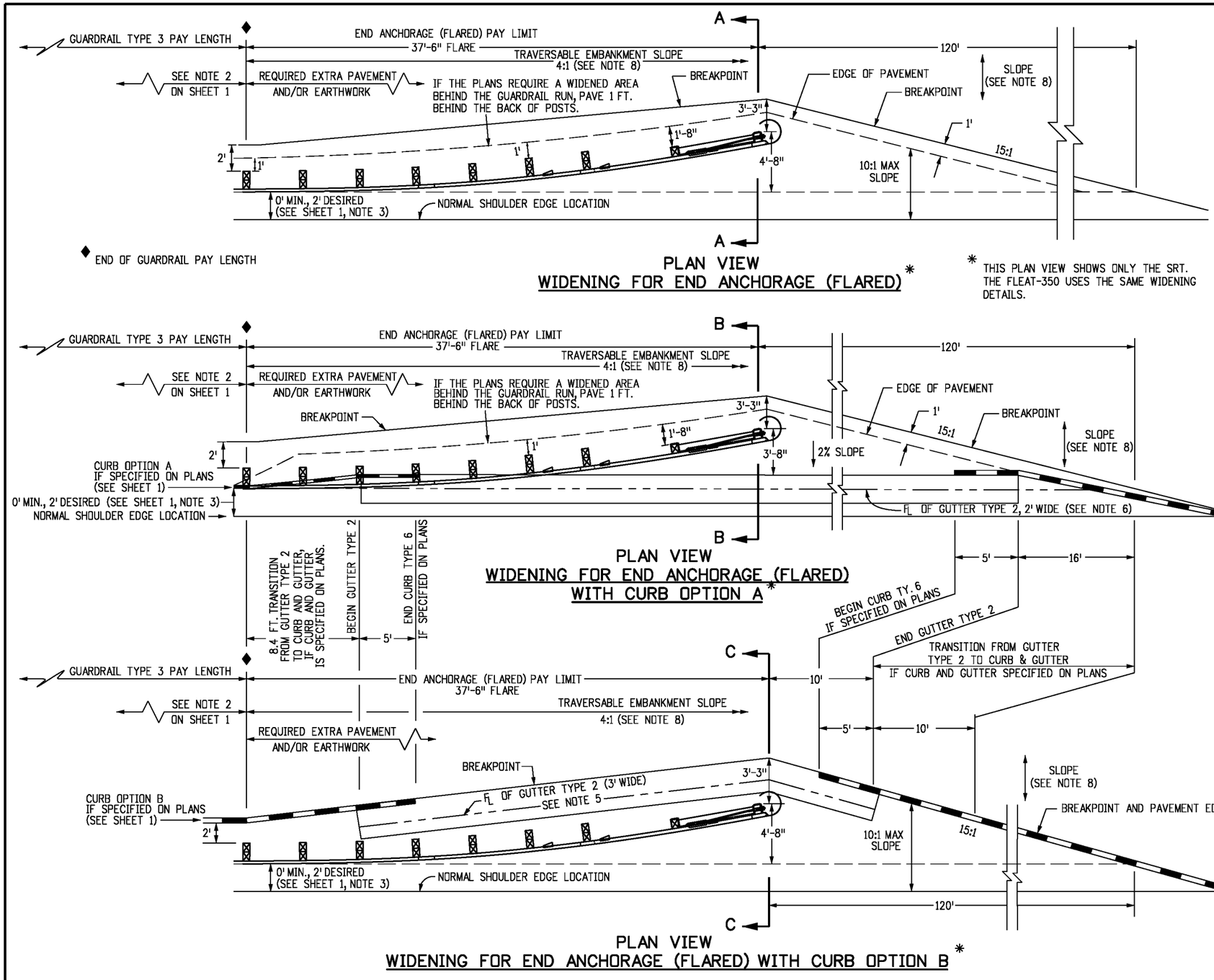

NOTES

1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 45 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLANS DO NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL BE CONSTRUCTED IN ACCORDANCE WITH SUBSECTION 203.07, AASHTO T 99.
2. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 70 SQ. YDS.) SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 403 OR 412 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 403 OR 412
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 403 OR 412 (SEE SHEET 1, NOTE 2 FOR PAVEMENT TYPES)
3. CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF AS DIRECTED BY THE ENGINEER.
4. WHEN OVERLAY PAVING, THE FINISHED SURFACE AT EACH POST SHALL NOT BE ABOVE THE TOP BREAKAWAY HOLE OR STRUT ASSEMBLY. THE WIDENED AREA AT THE FLARED END ANCHORAGE SHOULD NOT BE OVERLAYED UNLESS PAVEMENT CONDITIONS WARRANT IT BEING OVERLAYED. ANY OVERLAY PAVEMENT ABUTTING THE FLARED END ANCHORAGE SHALL BE TAPERED TO PREVENT A DROP IN THE PAVED SURFACE BELOW THE RAIL.
5. SEE SHEETS 1, 3 AND 4 FOR STANDARD TYPE 3 GUARDRAIL AND INSTALLATION DETAILS.
6. THE COST OF THE GUTTER WILL BE PAID FOR AS "GUTTER TYPE 2 (2 FT.)" FOR A LENGTH OF 134 FT. OR "GUTTER TY. 2 (3 FT.)" FOR A LENGTH OF 40 FT.
7. INLETS OR RUNDOWNS MAY BE USED INSTEAD OF THE GUTTER IF SPECIFIED ON THE PLANS. NO ADDITIONAL CURB SHALL BE ADDED IN THE VICINITY OF THE END ANCHORAGE.
8. 4:1 OR FLATTER SLOPES IN THE TRAVERSABLE AREA SHALL BE USED BEHIND THE END ANCHORAGE, AND IN ADVANCE OF POST (1). IF THIS IS NOT POSSIBLE, A MINIMUM 3:1 SLOPE MAY BE USED IF APPROVED BY THE ENGINEER.
9. THE WIDENED AREA, EXCEPT FOR CURB OPTION A, SHALL HAVE THE SAME GRADING AS THE ADJACENT GUARDRAIL: 10:1 OR FLATTER IF MORE THAN 2 FT. FROM SHOULDER OR SLOPE EQUAL TO ROADWAY SLOPE IF 2 FT. OR LESS FROM SHOULDER.
10. WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.

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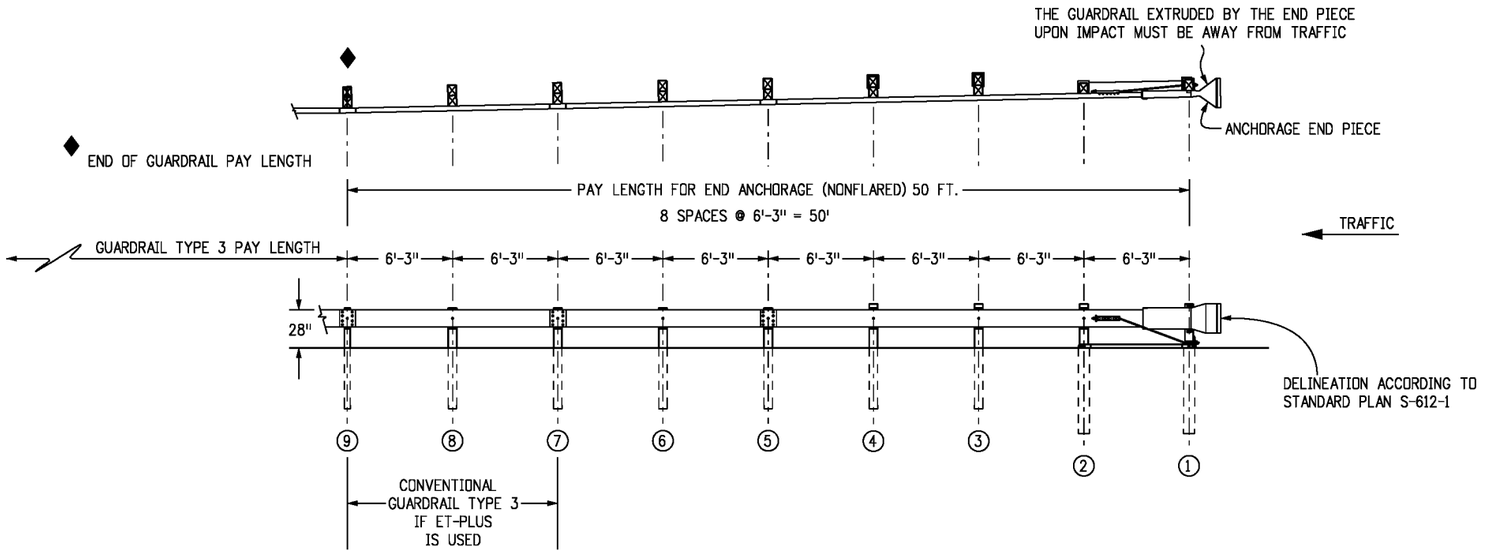
NOTES

1. THE END ANCHORAGE (NONFLARED) SHALL EITHER BE THE ET-PLUS AS MANUFACTURED BY TRINITY INDUSTRIES INC. (TEL. #: 800-644-7976), OR THE SKT GUARDRAIL AS MANUFACTURED BY ROAD SYSTEMS, INC. (TEL. #: 915-263-2435). THE END ANCHORAGE (NONFLARED) SHALL INCLUDE ALL POST, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (NONFLARED) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE DEVICE.
2. WOOD POSTS SHALL BE DRILLED FOR BREAKAWAY CONFORMING TO THE MANUFACTURER'S INSTRUCTIONS.
3. HINGED BREAK AWAY (HBA) STEEL POSTS MAY BE USED CONFORMING TO THE MANUFACTURER'S INSTRUCTIONS.
4. RETROREFLECTOR TABS SHALL NOT BE USED ON THE LAST SEVEN POSTS OF THE END ANCHORAGE (NONFLARED).
5. USE MANUFACTURER'S SPECIFIED STEEL FOUNDATION TUBE FOR POSTS (1) AND (2) FOR ET-PLUS AND SKT END ANCHORAGES (NONFLARED).
6. DELINEATION SHALL BE APPLIED TO THE END PIECE AND SHALL NOT BE PAID FOR SEPARATELY BUT BE INCLUDED IN THE COST OF THE WORK. SEE STANDARD PLAN S-612-1.



END ANCHORAGE (NONFLARED)

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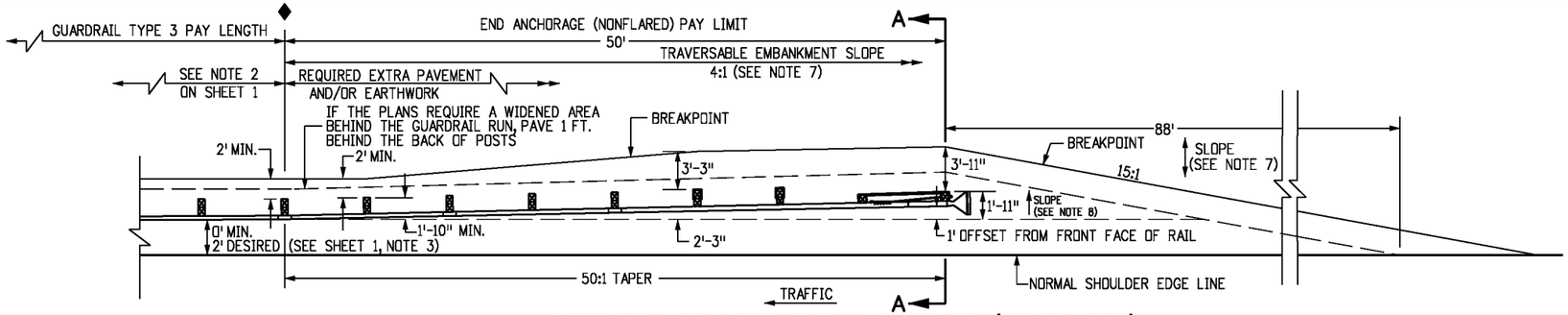
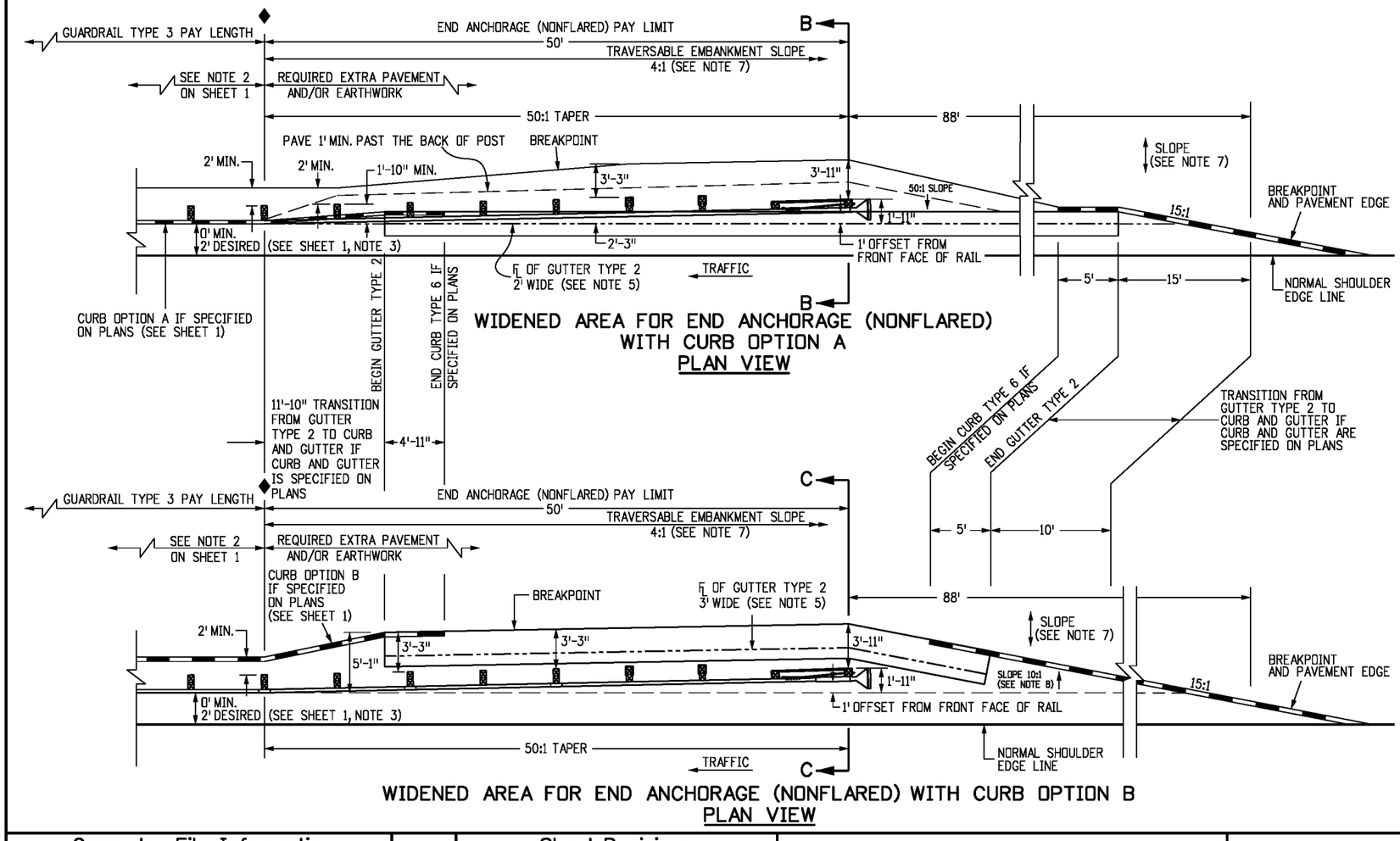


WIDENED AREA FOR END ANCHORAGE (NONFLARED)
PLAN VIEW

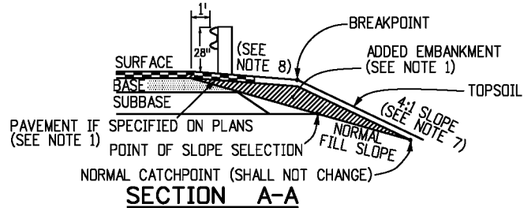


WIDENED AREA FOR END ANCHORAGE (NONFLARED) WITH CURB OPTION A
PLAN VIEW

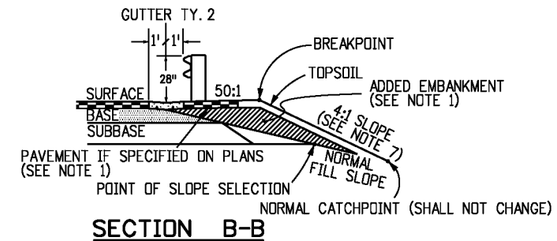
WIDENED AREA FOR END ANCHORAGE (NONFLARED) WITH CURB OPTION B
PLAN VIEW

NOTES

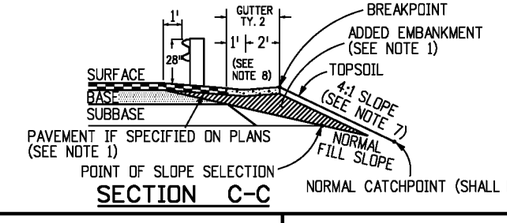
1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 25 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203.
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (NONFLARED) WHEN THE CONTRACT PLANS DOES NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL BE BE CONSTRUCTED IN ACCORDANCE WITH SUBSECTION 203.07, AASHTO T 99.
2. WHEN THE WIDENED AREA IS PAVED, PAYMENT FOR THE PAVEMENT (APPROX. 39 SQ. YDS.) SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 403 OR 412 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 403 OR 412.
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (NONFLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 403 OR 412, (SEE SHEET 1, NOTE 2 FOR PAYMENT TYPES).
3. WHEN OVERLAY PAVING, THE FINISHED SURFACE AT EACH POST SHALL NOT BE ABOVE THE TOP BREAKWAY HOLE OR STRUT ASSEMBLY. THE WIDENED AREA AT THE END ANCHORAGE (NONFLARED) SHALL NOT BE OVERLAYED UNLESS PAVEMENT CONDITIONS WARRANT IT BEING OVERLAYED. ANY OVERLAY PAVEMENT ABUTTING THE END ANCHORAGE (NONFLARED) SHALL BE TAPERED TO PREVENT A DROP IN THE PAVED SURFACE BELOW THE RAIL.
4. SEE SHEETS 1, 2 AND 3 FOR STANDARD TYPE 3 GUARDRAIL AND INSTALLATIONS DETAILS.
5. THE COST OF THE GUTTER WILL BE PAID FOR AS "GUTTER TYPE 2 (2 FT.)" FOR A LENGTH OF 111 FT., OR "GUTTER TY. 2 (3 FT.)" FOR A LENGTH OF 50 FT.
6. INLETS OR RUNDOWNS MAY BE USED INSTEAD OF THE GUTTER IF SPECIFIED ON THE PLANS. NO ADDITIONAL CURB SHALL BE ADDED IN THE VICINITY OF THE END TREATMENT.
7. 4:1 OR FLATTER SLOPES IN THE TRAVERSABLE AREA SHALL BE USED BEHIND THE END ANCHORAGE AREA, AND IN ADVANCE OF POST (1). IF THIS IS NOT POSSIBLE A MINIMUM 3:1 SLOPE MAY BE USED IF APPROVED BY THE ENGINEER.
8. THE WIDENED AREA, EXCEPT FOR CURB OPTION A, SHALL HAVE THE SAME GRADING AS BENEATH THE ADJACENT GUARDRAIL: 10:1 OR FLATTER IF MORE THAN 2 FT. FROM SHOULDER, OR SLOPE EQUAL TO ROADWAY SLOPE IF 2 FT. OR LESS FROM SHOULDER.
9. WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.
10. HINGED BREAK AWAY (HBA) STEEL POSTS MAY BE USED. SEE MANUFACTURER'S DETAILS.



SECTION A-A



SECTION B-B



SECTION C-C

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CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English	(R-X)		

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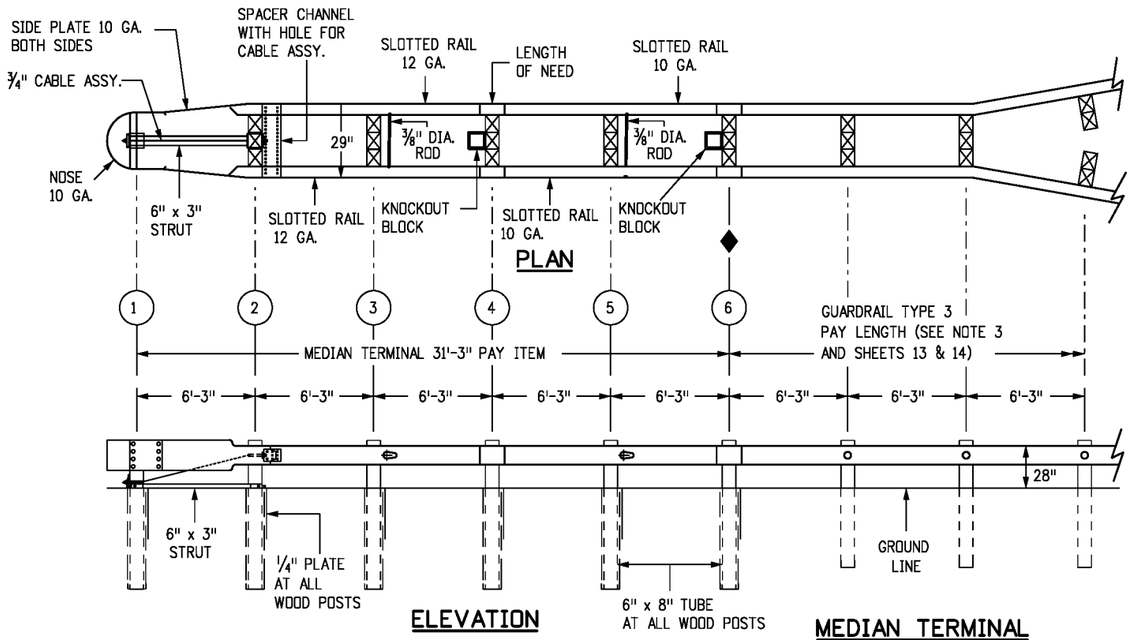
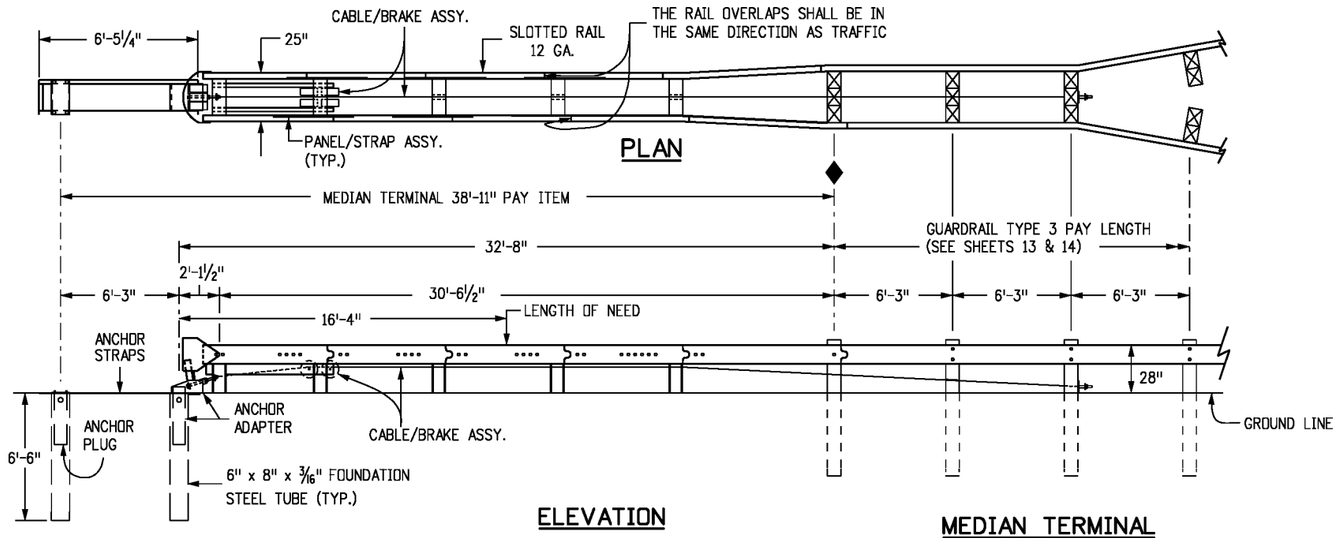


MEDIAN TERMINAL
(CAT OPTION)

◆ END OF GUARDRAIL PAY LENGTH

MEDIAN TERMINAL NOTES

1. THE MEDIAN TERMINAL SHALL BE THE CAT 350 AS MANUFACTURED BY TRINITY INDUSTRIES INC. (TEL #: 800-644-7976), OR THE BRAKEMASTER AS MANUFACTURED BY ENERGY ABSORPTION SYSTEMS, INC. AS DISTRIBUTED BY INTERWEST SAFETY SUPPLY (TEL #: 303-733-8447), OR THE FLEAT-MT MEDIAN TERMINAL AS MANUFACTURED BY ROAD SYSTEM INC. (TEL. #: 432-263-2435).
2. ONE MEDIAN TERMINAL SHALL INCLUDE ALL POSTS, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE DEVICE SHALL BE INSTALLED IN CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LISTS TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE DEVICE.
3. UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL BE INSTALLED FOR BIDIRECTIONAL TRAFFIC APPLICATION.
4. MEDIAN GUARDRAIL POSTS MAY BE STEEL OR WOOD.
5. EACH INSTALLATION SHALL BE SUPERVISED AND CERTIFIED AS CORRECT UPON COMPLETION BY A REPRESENTATIVE OF THE DEVICE MANUFACTURER OR BY AN EMPLOYEE OF THE CONTRACTOR WHO IS A CERTIFIED INSTALLER. THE CERTIFIED INSTALLER SHALL HAVE COMPLETED DEVICE TRAINING AND SHALL BE REGISTERED WITH THE MANUFACTURER AS A CERTIFIED INSTALLER.
6. DELINEATION, IF REQUIRED, SHALL BE APPLIED TO THE END PIECE AND WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. SEE STANDARD PLAN S-612-1.



MEDIAN TERMINAL
(BRAKEMASTER OPTION)

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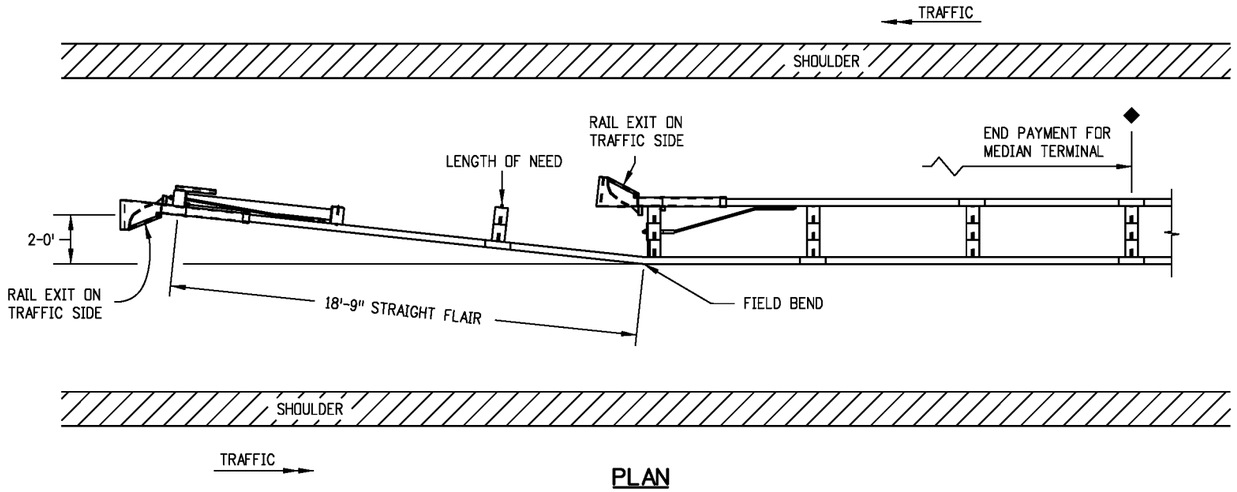
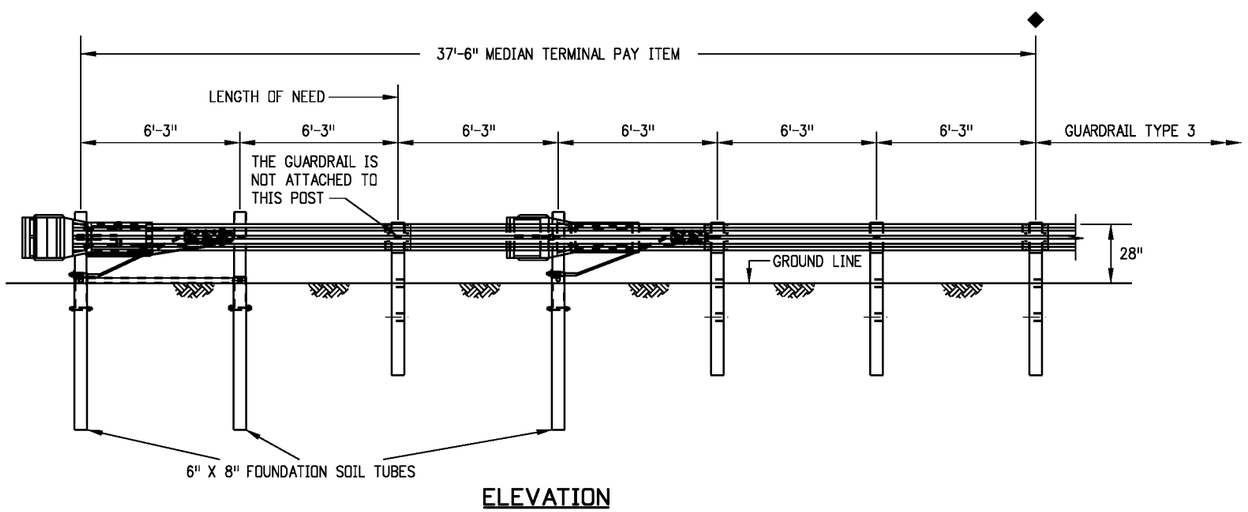


PLAN



ELEVATION

MEDIAN TERMINAL
(FLEAT-MT OPTION)

FLEAT- MT NOTES

1. THE FLEAT-MT MAY BE SELECTED AS A MEDIAN TERMINAL UNLESS OTHERWISE SHOWN IN THE PLANS.
2. BREAKAWAY POSTS ARE REQUIRED WITH THE FLEAT-MT.
3. THE SOIL TUBES SHALL NOT PROTRUDE MORE THAN 4 INCHES ABOVE GROUND (MEASURED ALONG A 5 FEET CORD). SITE GRADING MAY BE NECESSARY TO MEET THIS REQUIREMENT.
4. THE SOIL TUBES SHALL BE DRIVEN WITH AN APPROVED DRIVING HEAD AND NOT BE DRIVEN WITH THE POST IN THE TUBE. IF THE TUBES ARE PLACED IN DRILLED HOLES, THE BACKFILL MATERIAL MUST BE SATISFACTORILY COMPACTED TO PREVENT SETTLEMENT.
5. WHEN ROCK IS ENCOUNTERED DURING EXCAVATION, A 12 INCH DIA. POST HOLE, 20 INCH DEEP MAY BE USED IF APPROVED BY THE ENGINEER. GRANULAR MATERIAL SHALL BE PLACED IN THE BOTTOM OF THE HOLE APPROX. 2½ INCH DEEP TO PROVIDE DRAINAGE. THE SOIL TUBES SHALL BE FIELD CUT TO LENGTH, PLACED IN THE HOLE AND BACKFILLED WITH ADEQUATELY COMPACTED MATERIAL EXCAVATED FROM THE HOLE.
6. THE BREAKAWAY CABLE ASSEMBLY MUST BE TAUT. DO NOT TWIST THE CABLE WHEN TIGHTENING NUTS.

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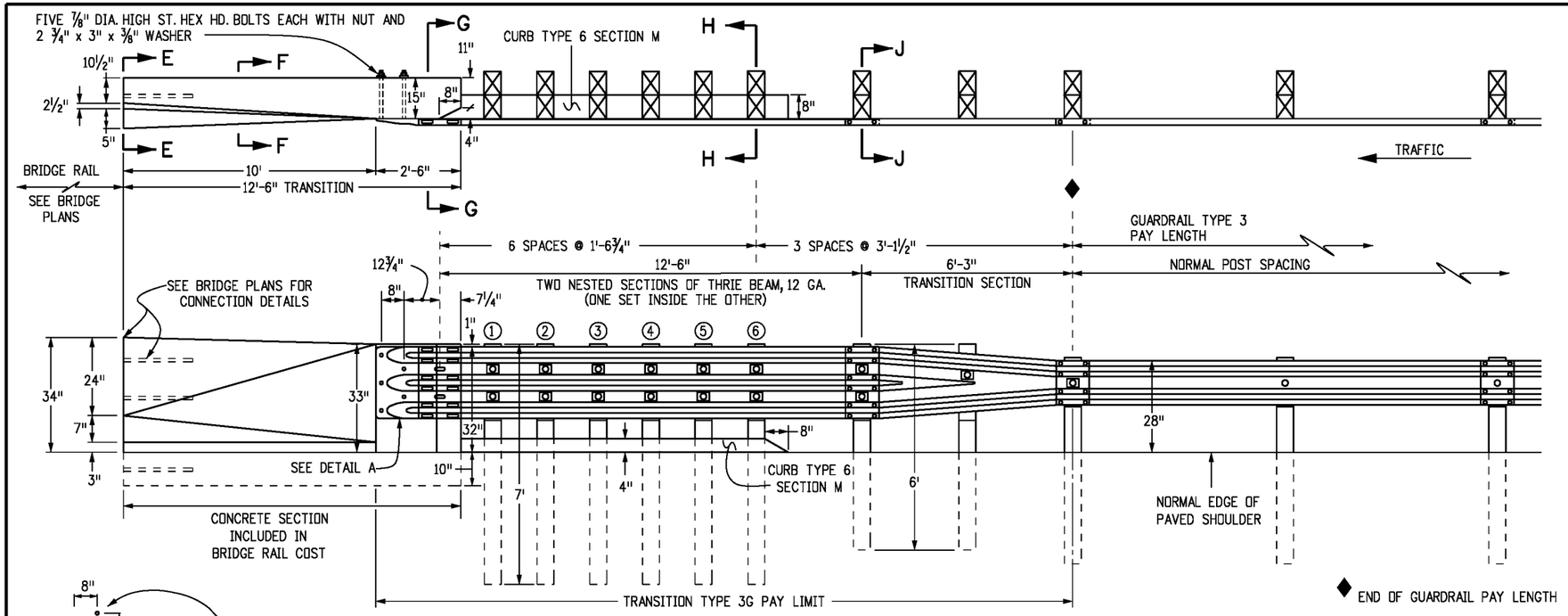
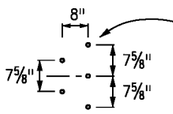
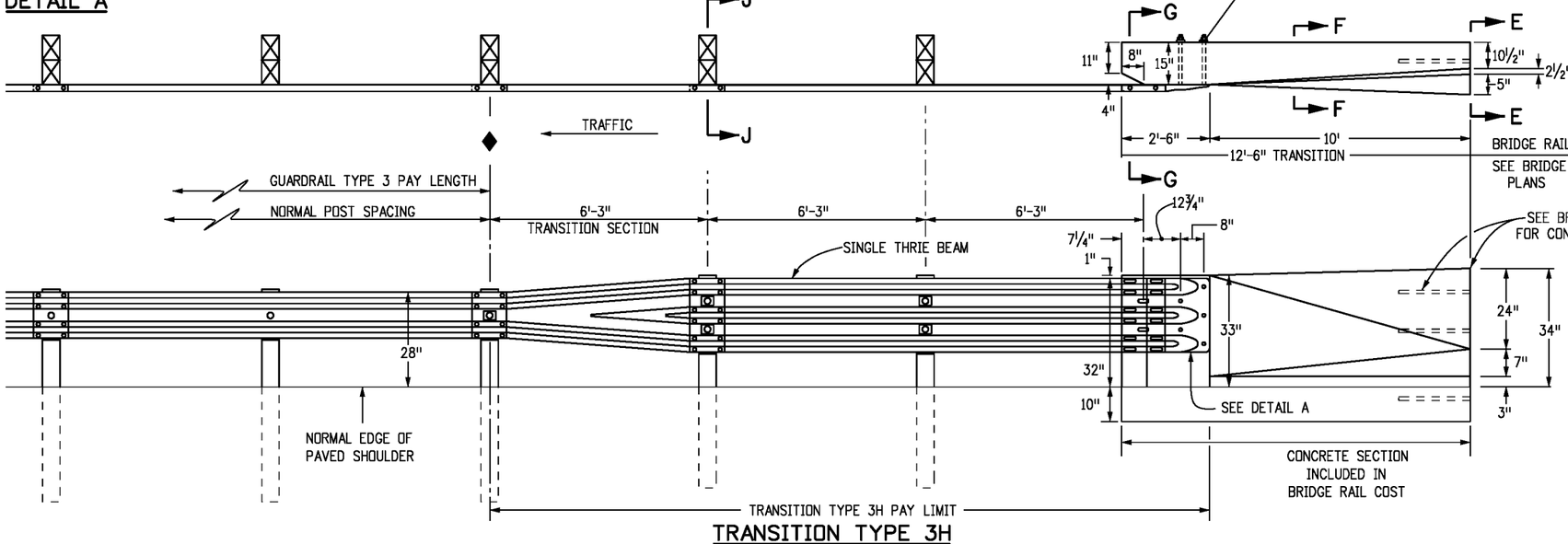


TRANSITION TYPE 3G



BOLT HOLE PATTERN: 1" DIA. HOLES DRILLED THROUGH CONCRETE, OR 1" INSIDE DIAMETER FULL DEPTH INSERTS PLACED BEFORE CONCRETE IS PLACED.

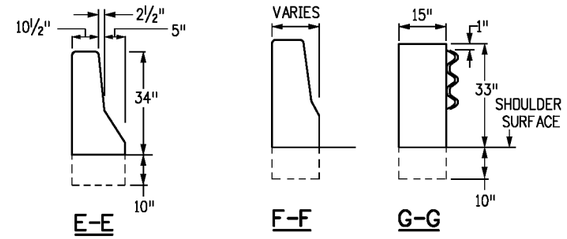
DETAIL A

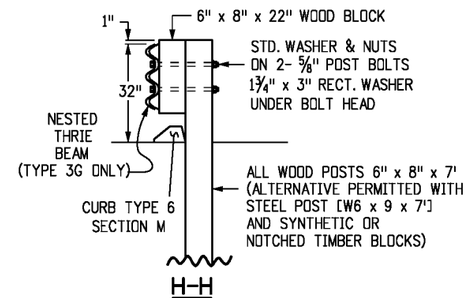


TRANSITION TYPE 3H

NOTES

1. TRANSITION TYPE 3G IS FOR USE AT BOTH ENDS OF BRIDGES ON TWO-WAY HIGHWAYS AND AT THE APPROACH END OF BRIDGES ON ONE-WAY HIGHWAYS.
2. TRANSITION TYPE 3H IS FOR USE AT THE TRAILING END OF BRIDGES ON ONE-WAY HIGHWAYS.
3. THE THRIE BEAM SECTION IN TRANSITIONS TYPES 3G AND 3H MAY BE SHOP BENT TO FIT CURVES THAT ARE GREATER THAN OR EQUAL TO A 10 FT. RADIUS. HOWEVER, THE 6 FT.-3 IN. TRANSITION SECTION SHALL NOT BE BENT.
4. A 12 FT.-6 IN. CONCRETE TRANSITION IS REQUIRED BETWEEN THE TYPE 3G OR 3H AND TYPE 7 BRIDGE RAIL. SEE STANDARD PLAN M-606-13 FOR THE TRANSITION BETWEEN TYPE 3 GUARDRAIL AND TYPE 7 GUARDRAIL.
5. TRANSITIONS TYPE 3G AND TYPE 3H ARE ALSO USED TO CONNECT TO TYPE 8 AND TYPE 10 BRIDGE RAIL. SEE BRIDGE PLANS FOR CONNECTION DETAILS.
6. BACKUP PLATE IS NOT REQUIRED AT POSTS ON TYPE 3G AND 3H.
7. ◘ THIS SYMBOL IN THE ELEVATION DRAWINGS SHOWS THE LOCATIONS WHERE A RECTANGULAR WASHER IS REQUIRED UNDER THE POST BOLT HEAD.
8. CURB TYPE 6 SECTION M, MAY BE ASPHALT OR CONCRETE. THE COST OF CURB IS INCLUDED IN THE WORK, UNLESS A SEPARATE PAY ITEM IS INCLUDED IN THE BID SCHEDULE.
9. POSTS ① THRU ⑥ ARE 7 FT. LONG. ALL OTHER POSTS SHALL BE STANDARD 6 FT. IN LENGTH UNLESS OTHERWISE SPECIFIED IN THE CONTRACT.
10. NOTCHED RAIL BLOCKS MANUFACTURED FROM SYNTHETIC MATERIAL WILL BE ACCEPTED AS ALTERNATIVES TO WOOD NOTCHED BLOCKS FOR USE WITH STEEL POSTS PROVIDED THAT THE BLOCKS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL. STEEL BLOCKS ARE NOT ALLOWED.





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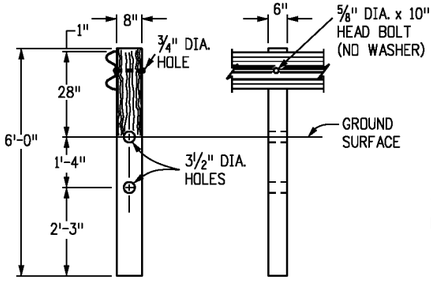
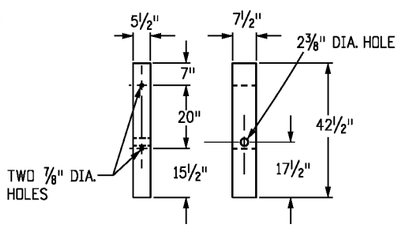


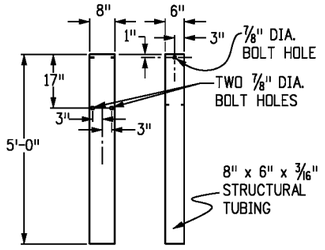
CONTROLLED RELEASING TERMINAL (CRT) POST ①



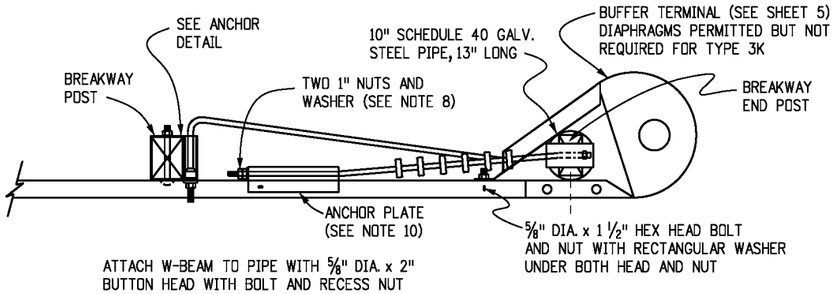
WOOD BREAKAWAY POST ②

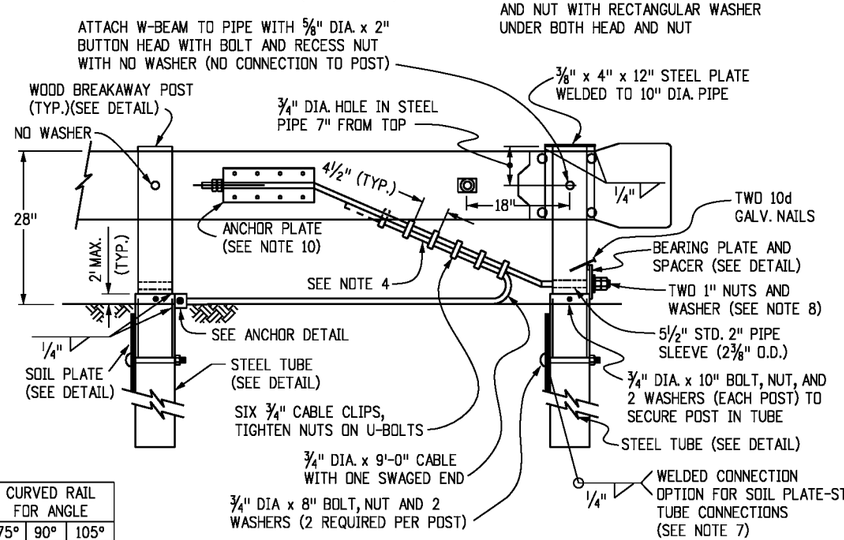
POST	DIMENSIONS	TYPE
①	6" x 8" x 6'	CRT
②	5 1/2" x 7 1/2" x 42 1/2"	BREAKAWAY

POSTS

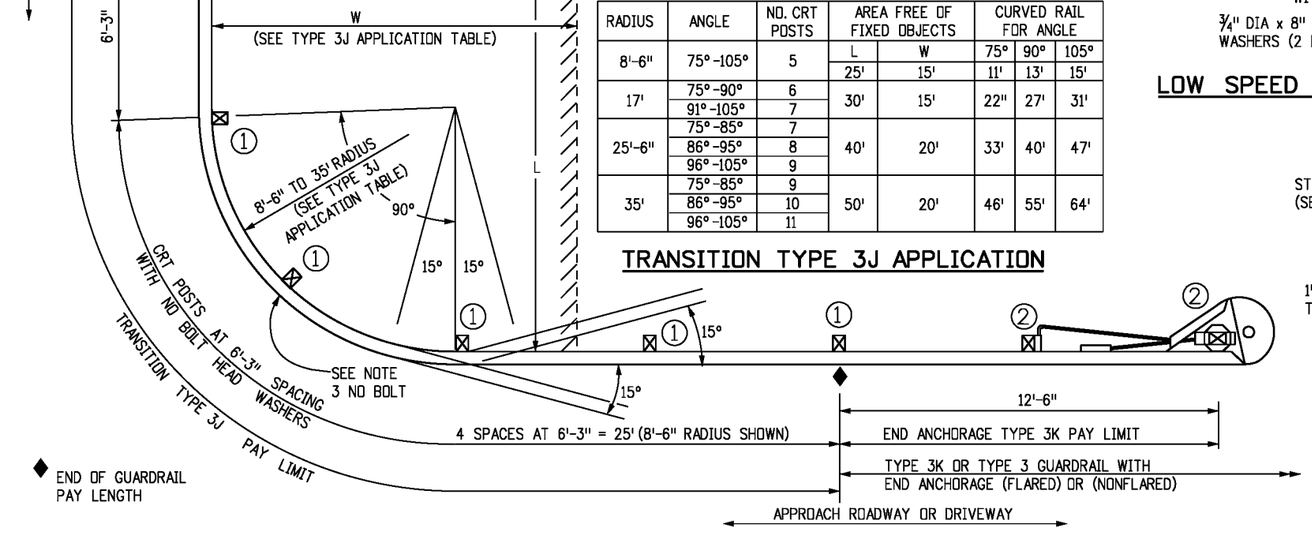


STEEL TUBE





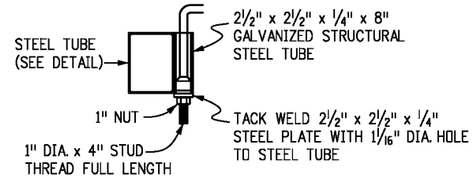
LOW SPEED TERMINAL - TYPE 3K



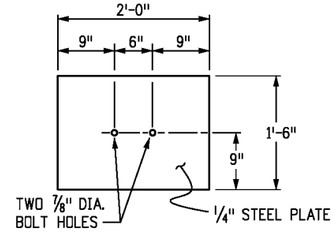
RADIUS	ANGLE	NO. CRT POSTS	AREA FREE OF FIXED OBJECTS		CURVED RAIL FOR ANGLE		
			L	W	75°	90°	105°
8'-6"	75°-105°	5	25'	15'	11'	13'	15'
17'	75°-90°	6	30'	15'	22'	27'	31'
	91°-105°	7					
25'-6"	75°-85°	7	40'	20'	33'	40'	47'
	86°-95°	8					
	96°-105°	9					
35'	75°-85°	9	50'	20'	46'	55'	64'
	86°-95°	10					
	96°-105°	11					

TRANSITION TYPE 3J APPLICATION

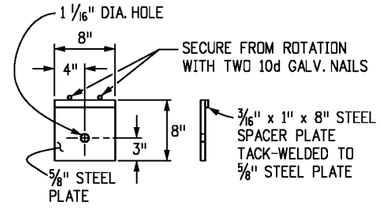
INTERSECTING ROADWAYS TRANSITION - TYPE 3J TRANSITION



ANCHOR DETAIL



SOIL PLATE



BEARING PLATE FOR STEEL TUBE

NOTES

1. APPLICATION: THE TRANSITION TYPE 3J MAY BE USED TO SHIELD HAZARDS AT THE INTERSECTION OF TWO ROADWAYS. TYPICAL APPLICATIONS INCLUDE, BUT ARE NOT LIMITED TO, THE FOLLOWING:
   A. CANAL SERVICE ROADS AT BRIDGE ENDS.
   B. INTERRUPTIONS IN GUARDRAIL RUNS BY INTERSECTING ROADWAYS, ETC..

   THE LOW SPEED (<45 MPH) END ANCHORAGE TYPE 3K SHALL BE USED ONLY ON DRIVEWAYS AND LOW SPEED SERVICE ROADS. WHEN AN APPROVED CRASH-TESTED END TREATMENT IS REQUIRED USE THE END ANCHORAGE (FLARED) OR (NONFLARED) WITH 37 FT.-6 IN. LENGTH.
2. GRADING AND PAVING FOR THE 3J & 3K SHALL MATCH THE GRADING AND PAVING OF THE GUARDRAIL TO WHICH THEY ARE ATTACHED, AND SHALL BE IN ACCORDANCE WITH SHEET ONE OF THIS STANDARD. MAXIMUM FILL SLOPE SHALL BE 2:1.
3. THE RAIL IS NOT BOLTED TO THE CRT POST AT THE CENTER OF THE CURVE FOR THE 8 FT.-6 IN., 17 FT., AND 25 FT.-6 IN. RADII. PLATES SHALL CONFORM TO ASTM A 36, AND THE STRUCTURAL TUBING TO ASTM A 500.
4. THE 3/4IN. GALVANIZED WIRE ROPE (CABLE) SHALL CONFORM TO AASHTO M 30 TYPE II.
5. PLATES SHALL CONFORM TO ASTM A 36, AND STRUCTURAL TUBING TO ASTM A 500. WELDING SHALL MEET ALL REQUIREMENTS OF THE AMERICAN WELDING SOCIETY.
6. ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN CONFORMANCE WITH ASTM A 123. POSTS SHALL NOT BE PUNCHED, DRILLED, CUT, OR WELDED AFTER GALVANIZING.
7. WHEN THE SOIL PLATE WELDED OPTION IS SELECTED, SOIL PLATE CONNECTION BOLT HOLES ARE NOT REQUIRED.
8. OUTSIDE NUT SHALL BE TORQUED AGAINST INSIDE NUT WITH THE CABLE INSTALLED TAUT BETWEEN THE ANCHOR PLATE AND FIRST POST.
9. ALL CURVED GUARDRAIL SHALL BE SHOP BENT.
10. SEE SHEET 5 FOR ANCHOR PLATE AND OTHER DETAILS.
11. THE STEEL TUBE MAY BE DRIVEN WITH WOOD POST INSERTED IF NO DAMAGE OCCURS TO THE POST OR BOLTS.

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GUARDRAIL TYPE 3 W-BEAM

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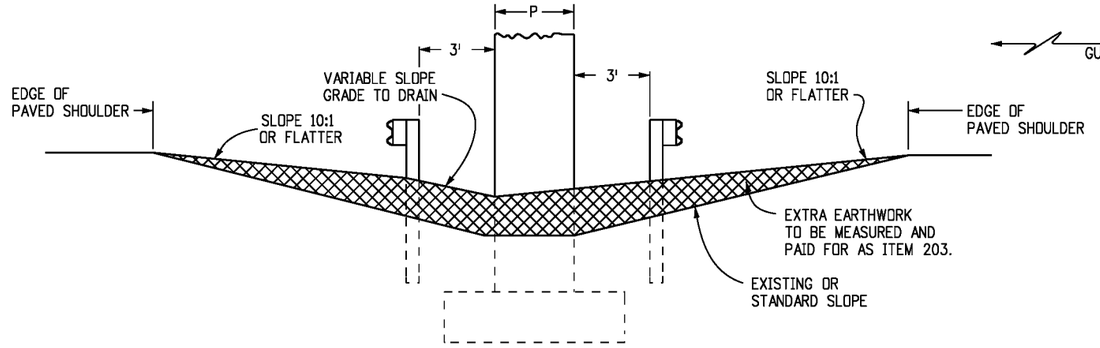
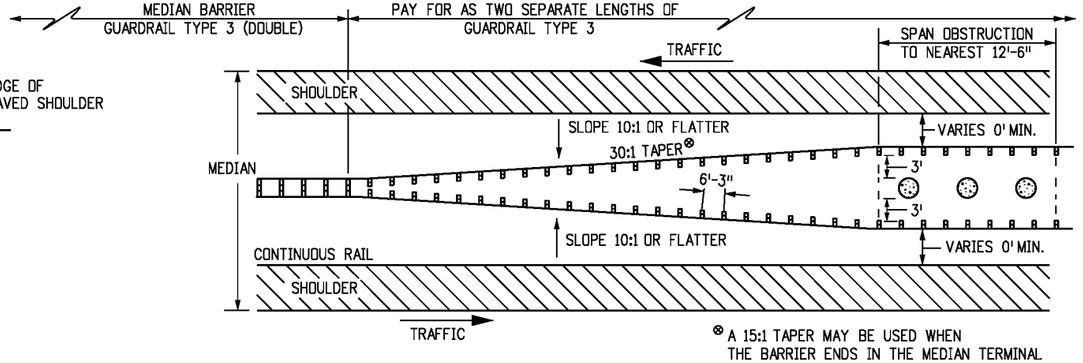
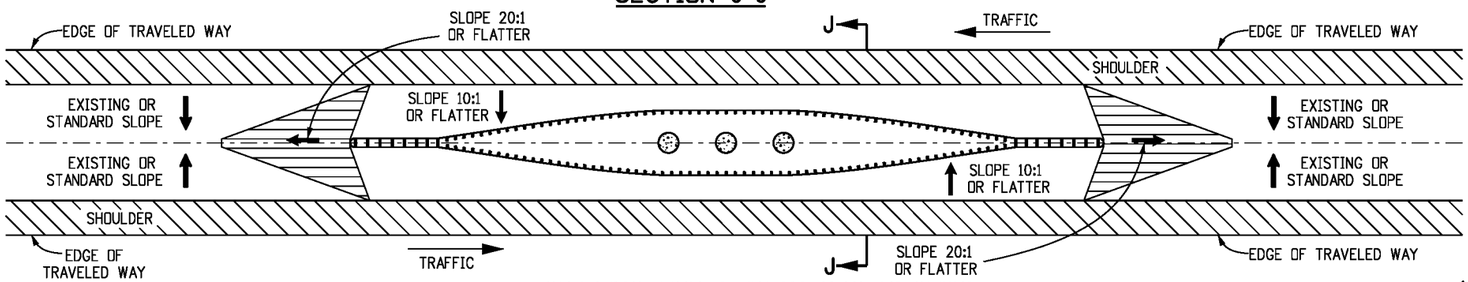


SECTION J-J



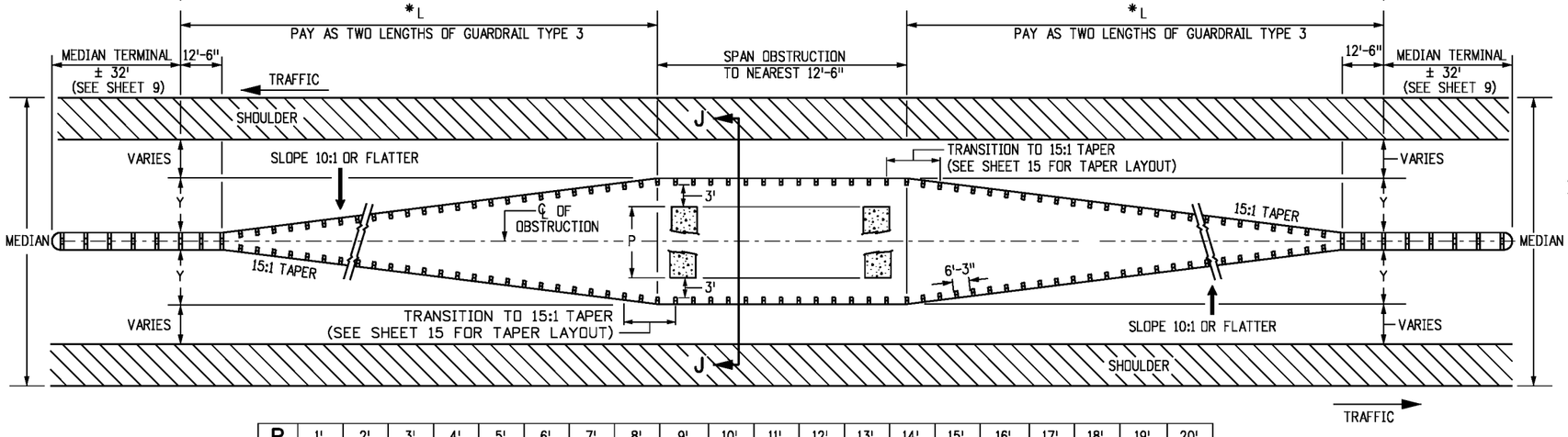
⊗ A 15:1 TAPER MAY BE USED WHEN THE BARRIER ENDS IN THE MEDIAN TERMINAL

OBSTRUCTION IN MEDIAN 30 FT. WIDE OR LESS



GRADING FOR MEDIAN OBSTRUCTION

◆ END OF GUARDRAIL PAY LENGTH



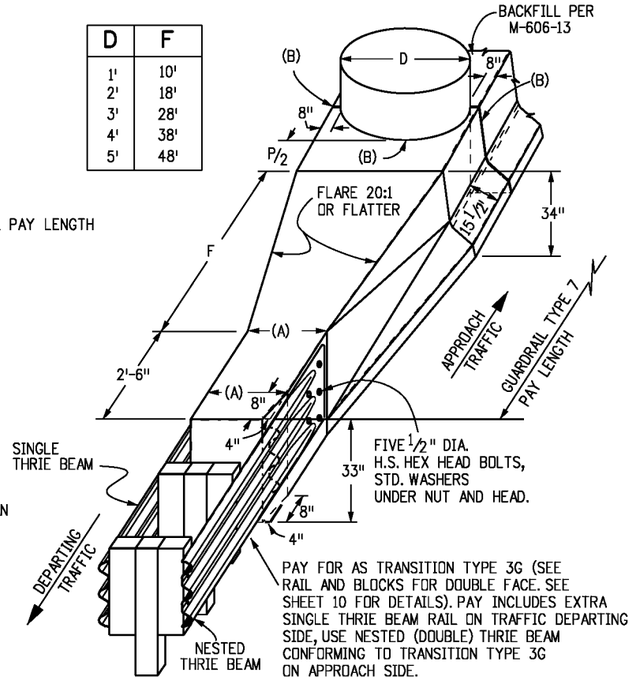
P	1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'
Y	4'-1"	4'-7"	5'-1"	5'-7"	6'-1"	6'-7"	7'-1"	7'-7"	8'-1"	8'-7"	9'-1"	9'-7"	10'-1"	10'-7"	11'-1"	11'-7"	12'-1"	12'-7"	13'-1"	13'-7"
L	75'	87'-6"		100'	112'-6"		125'		137'-6"	150'		162'-6"		175'		187'-6"	200'		212'-6"	225'

*L IS MEASURED ALONG FACE OF GUARDRAIL

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.

NOTE: FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 20 FT. IN MEDIANS USE SHEET 16.

D	F
1'	10'
2'	18'
3'	28'
4'	38'
5'	48'



(A). TIMBER POSTS 2 FT., STEEL POSTS 1 FT.-9½IN.

(B). ½ IN. PREFORMED JOINT MATERIAL

NARROW MEDIAN DETAIL

USUALLY LESS THAN 30 FT. WIDE MEDIAN
WITH ALL PAVED SURFACE

OBSTRUCTIONS IN MEDIANS

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Full Path: www.coloradodot.info/business/designsupport	(R-X)		
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GUARDRAIL TYPE 3 W-BEAM

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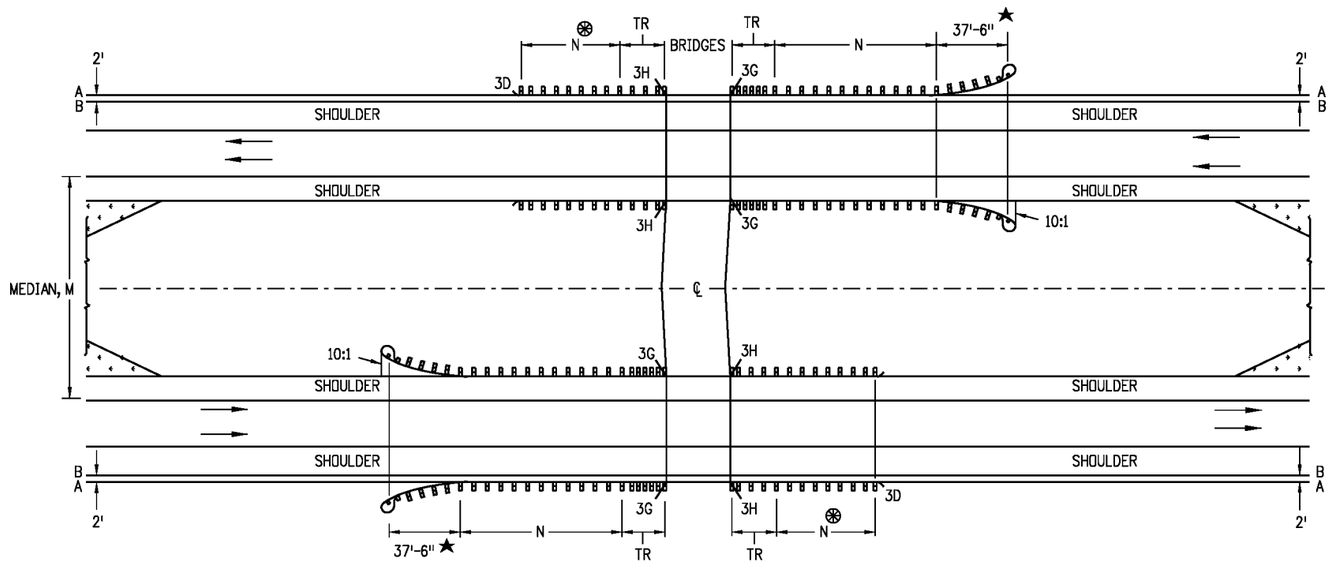

MULTILANE DIVIDED HIGHWAYS FOR STEEP EMBANKMENTS IN MEDIAN

NOTES:

1. MEDIAN BARRIERS TANGENT TO THE ROADWAY MAY BE USED WHERE THE SHOULDER SLOPES IN THE MEDIAN ARE STEEP.
2. BARRIER LENGTHS SHALL BE INCREASED TO ACCOUNT FOR STEEP EMBANKMENTS OR OTHER HAZARDS WITHIN CLOSE PROXIMITY OF BRIDGES.

⊛ — DO NOT CONSTRUCT THE TR AND GUARDRAIL ON THE TRAILING BRIDGE ENDS IF SITE CONDITIONS DO NOT WARRANT THE USE OF GUARDRAIL.

N — SHOWN ON PLANS. LENGTH TO SHIELD ALL HAZARDS IS BASED ON GUARDRAIL'S LENGTH OF NEED COMPUTATION. SEE AASHTO ROADWAY DESIGN GUIDE. THE MINIMUM SHALL BE 12 FT. - 6 IN., WHERE SITE CONDITIONS ALLOW. THE TOTAL LENGTH OF NEED WILL INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.

TR — 18 FT.-9 IN. FOR 3G AND 3H.

A — EDGE OF 8 FT. OR 10 FT. SHOULDER.

B — EDGE OF 6 FT. OR LESS SHOULDER.

★ — END ANCHORAGE CAN BE FLARED OR NONFLARED.

Computer File Information		Sheet Revisions	
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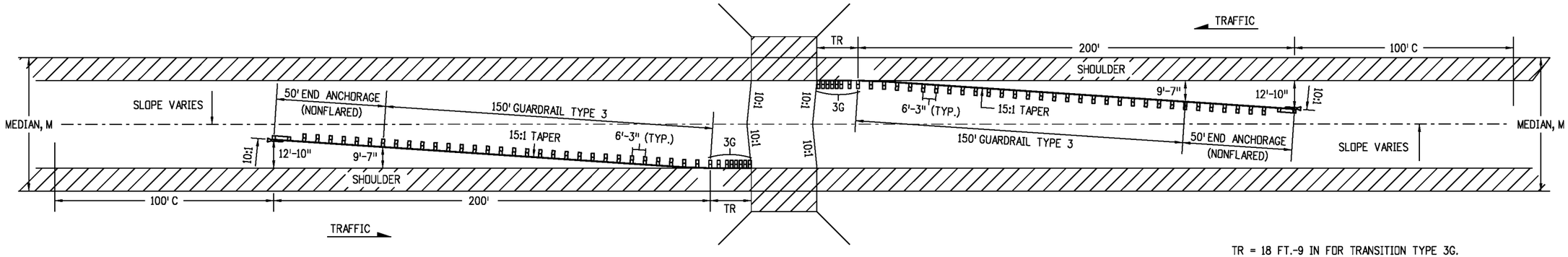
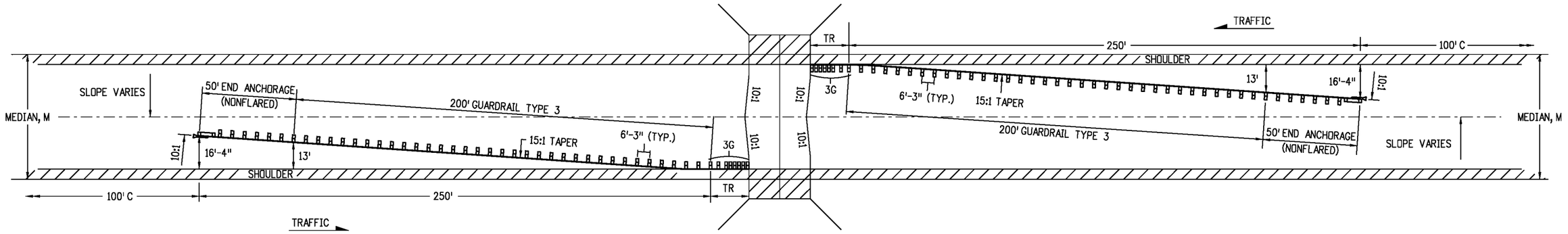
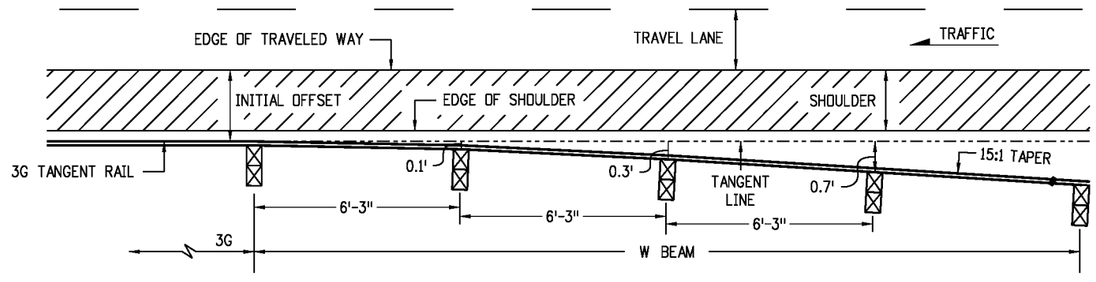


MEDIANS 60 FT. AND OVER WITH 10 FT. OR WIDER SHOULDERS.

TR = 18 FT.-9 IN FOR TRANSITION TYPE 3G.
C = CHANGE: 100 FT. TRANSITION TO NORMAL SLOPE.
M = WIDTH OF MEDIAN.



MEDIANS 60 FT. AND OVER WITH 4 to 8 FT. SHOULDERS.



TRANSITION TO TYPICAL 15:1 TAPER

NOTES:

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 18'-9" BASED ON POST OFFSET DIMENSIONS SHOWN.
2. SEE SHEET 14 FOR THE RIGHT SHOULDER GUARDRAIL LAYOUT.

MULTILANE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 60 FT. AND OVER WITH OPEN HAZARDS OR OBSTRUCTIONS)

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GUARDRAIL TYPE 3 W-BEAM

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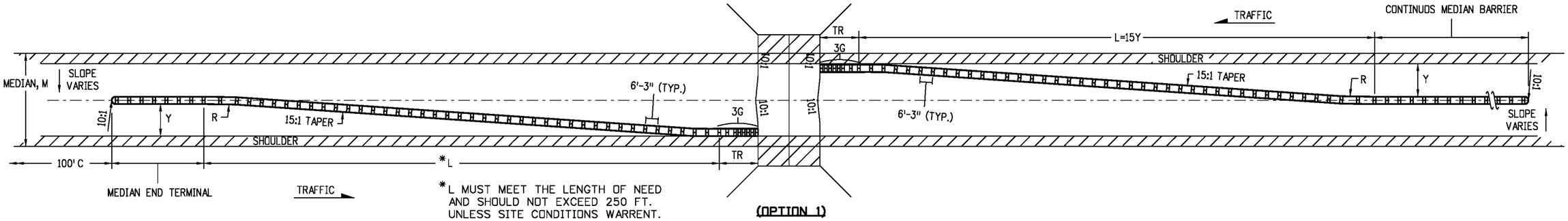
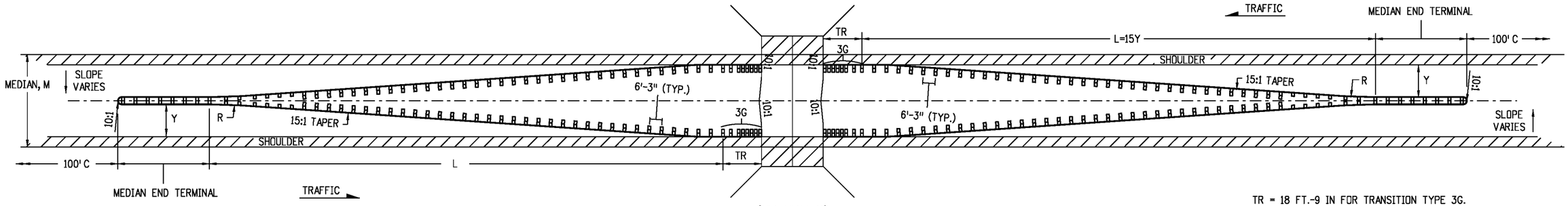
NOTES

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 18'-9" BASED ON POST OFFSET DIMENSIONS SHOWN.
2. THE OPTION 1 LAYOUT SHALL BE USED WHEN "Y" EXCEEDS 16 FEET OR WHEN MEDIAN BARRIER IS CONTINUOUS.
3. THE OPTION 2 LAYOUT SHALL BE USED WHEN "Y" IS 16 FEET OR LESS.
4. SEE SHEET 14 FOR RIGHT SHOULDER GUARDRAIL LAYOUT.

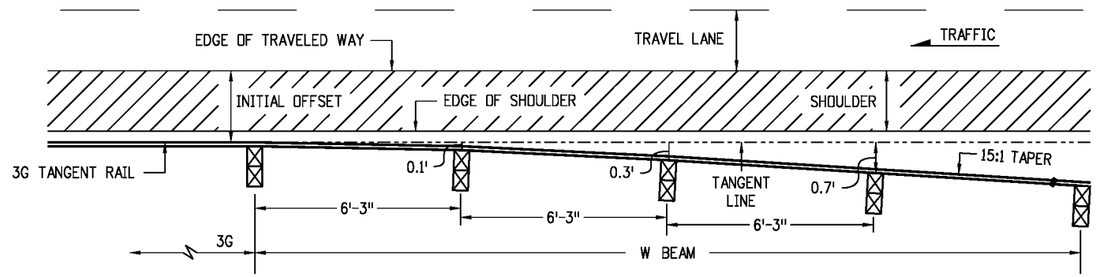


*L MUST MEET THE LENGTH OF NEED AND SHOULD NOT EXCEED 250 FT. UNLESS SITE CONDITIONS WARRENT.

(OPTION 1)



(OPTION 2)



TRANSITION TO TYPICAL 15:1 TAPER

TR = 18 FT.-9 IN FOR TRANSITION TYPE 3G.
C = CHANGE: 100 FT. TRANSITION TO NORMAL SLOPE.
M = WIDTH OF MEDIAN.
L = TOTAL LENGTH PAID AS GUARDRAIL TYPE 3.
Y = FINAL OFFSET AT END.

MULTILANE DIVIDED HIGHWAYS - (DEPRESSED MEDIANS, 21 - 59 FT. WITH OPEN HAZARDS OR OBSTRUCTIONS)

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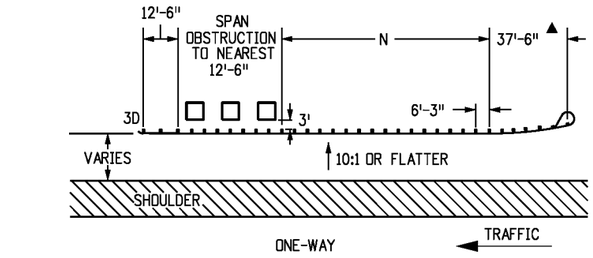
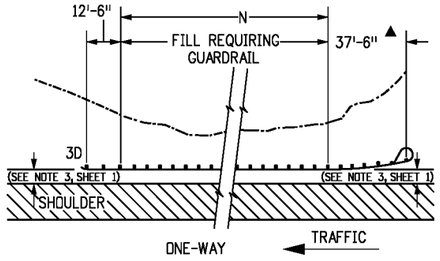
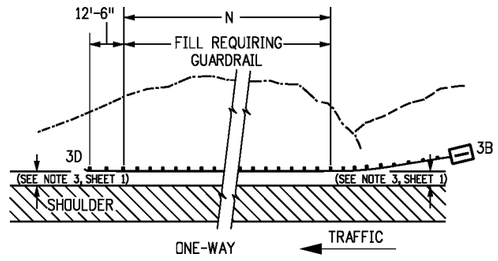
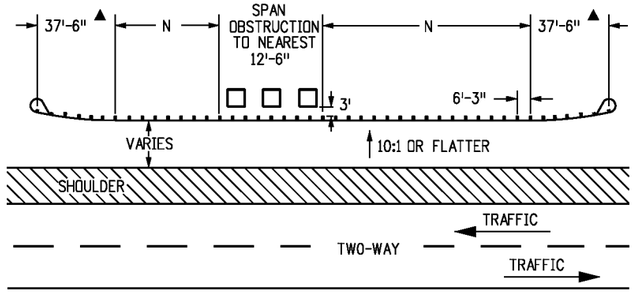
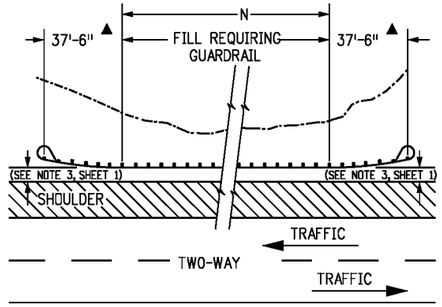




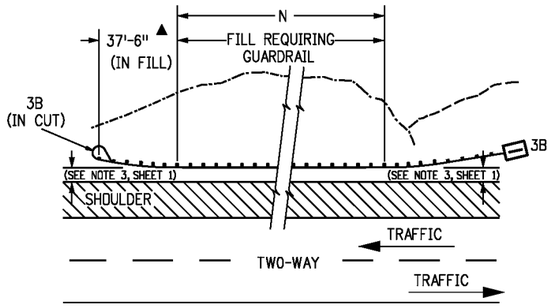




GUARDRAIL FOR ROADSIDE OBSTRUCTIONS



GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION

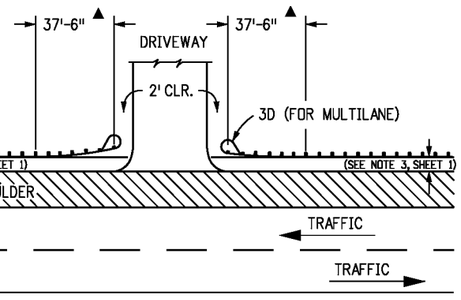


GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION

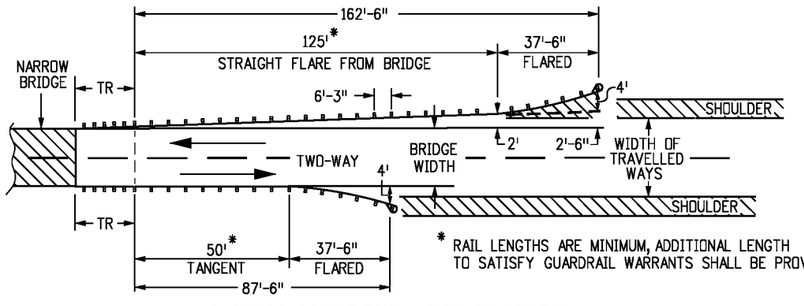
NOTES

1. THE TYPE 3G OR 3H TRANSITIONS (SEE SHEET 10) SHALL BE USED TO CONNECT A TYPE 3 W-BEAM TO TYPE 7 CONCRETE BARRIER OR TO A TYPE 7, 8, OR 10 BRIDGE RAIL. FOR A TRANSITION FROM A ROADWAY TYPE 3 W-BEAM TO A BRIDGE RAIL TYPE 3 WITH BACKING TUBES, THE TRANSITION TYPE 3L SHOWN ON SHEET 16 SHALL BE USED.
2. "TR" WILL BE 18 FT.-9 IN. FOR THE TRANSITIONS TYPE 3G AND 3H, AND 25 FT. FOR THE TRANSITION TYPE 3L.
3. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT. A TRAVERSABLE SLOPE SHALL BE PROVIDED BEHIND THE TERMINAL TO DIMENSION "N" PRIOR TO THE OBSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER.

▲ END ANCHORAGE CAN BE FLARED OR NONFLARED

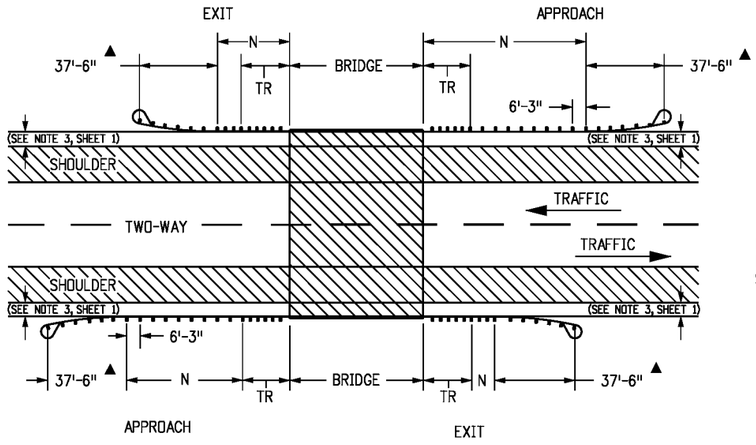


LAYOUT FOR DRIVEWAY APPROACH

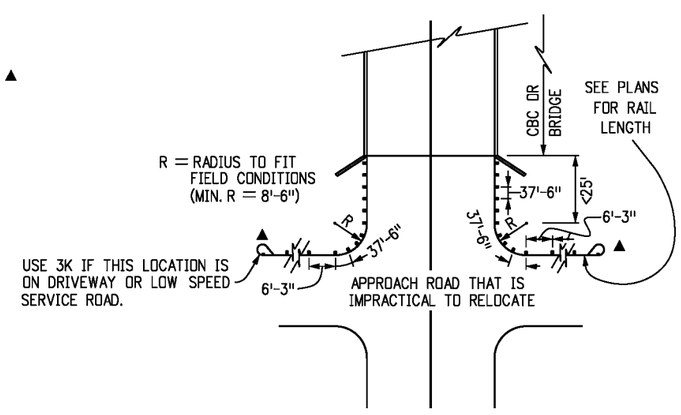


* RAIL LENGTHS ARE MINIMUM, ADDITIONAL LENGTH TO SATISFY GUARDRAIL WARRANTS SHALL BE PROVIDED

2-WAY NARROW APPLICATION



2-WAY NORMAL BRIDGE APPLICATION



GUARDRAIL TYPE 3 WITH BLOCKED OUT POSTS SPACED AT 3'-1½" FROM STRUCTURE AROUND CURVE.

INTERRUPTED STRUCTURE APPROACH

(USE TYPE 3J ON SHEET 11 WHEN PRACTICAL)

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GUARDRAIL TYPE 3 W-BEAM

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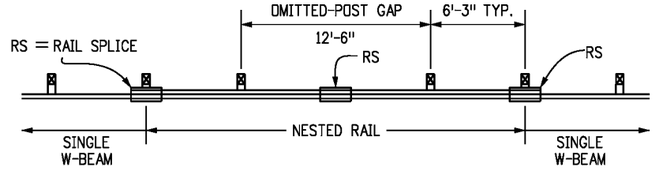
NOTES

1. FOR ONE OMITTED POST IN THE GUARDRAIL RUN, i.e. AT A PIPE CULVERT WITH MINIMUM COVER, SEE THE "NESTED RAIL AT ONE OMITTED POST" DETAIL ON THIS SHEET. THE W-BEAM RAILS SPANNING THE OMITTED-POST GAP SHALL BE DOUBLED (ONE RAIL NESTED IN THE OTHER), AND SHALL EXTEND A MINIMUM OF 6 FT.-3 IN. ON EITHER SIDE OF THE GAP. USING 12 FT.-6 IN. SECTIONS OF RAIL, AND DEPENDING ON THE SPLICE LOCATION, ONE OMITTED POST SECTION REQUIRES EITHER 25 FT. OR 37 FT. - 6 IN. OF NESTED RAIL.

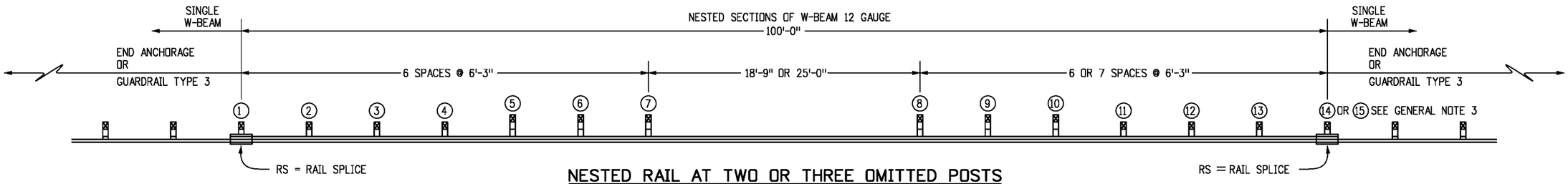
2. FOR TWO OR THREE OMITTED POSTS, SEE THE "NESTED RAIL AT TWO OR THREE OMITTED POSTS" DETAIL ON THIS SHEET. RAIL SPLICES IN THE 100 FT. NESTED SECTION MAY BE PLACED TO FACILITATE CONSTRUCTABILITY. HOWEVER ONLY ONE RAIL SPLICE MAY BE PLACED IN THE OMITTED POSTS SECTION, AND ONLY AT THE MIDPOINT OF THE 25 FT. LENGTH.

3. POST (15) REQUIRED WHEN TWO POSTS ARE OMITTED FOR THE 18 FT.-9 IN. LENGTH.

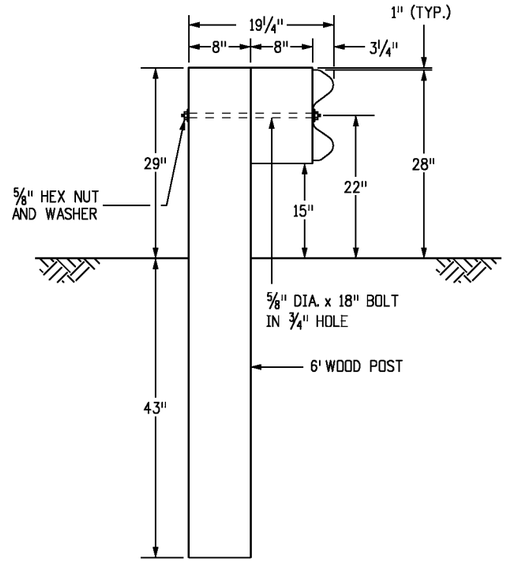
4. ONLY TIMBER POSTS AND BLOCKS ARE ALLOWED FOR WEAKENED POSTS 5 THROUGH 10.



NESTED RAIL AT ONE OMITTED POST

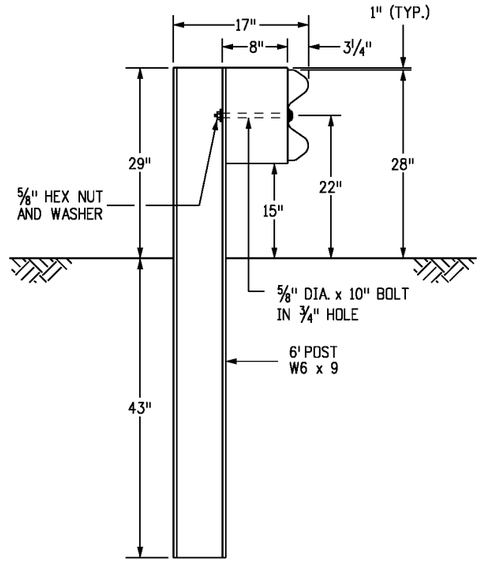


NESTED RAIL AT TWO OR THREE OMITTED POSTS



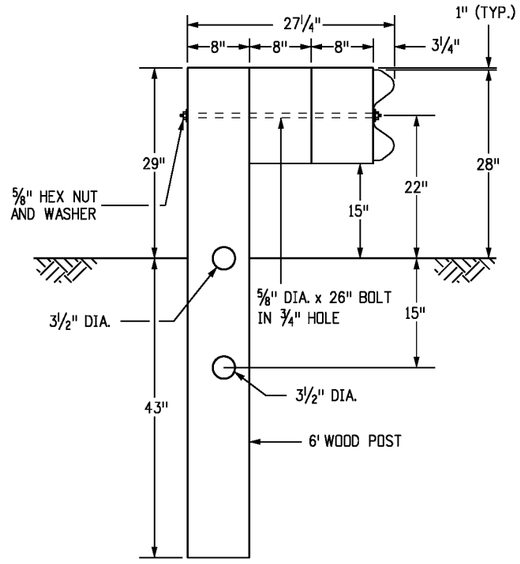
TIMBER

POSTS (1) - (4) AND (11) - (15)



STEEL

POSTS (1) - (4) AND (11) - (15)



TIMBER

POSTS (5) - (10)

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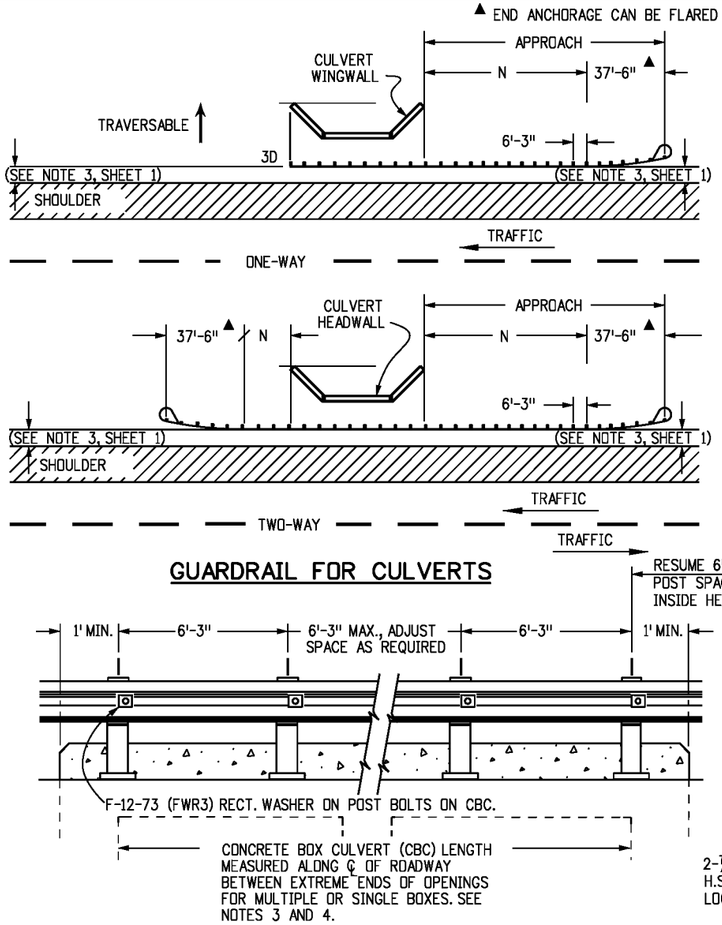
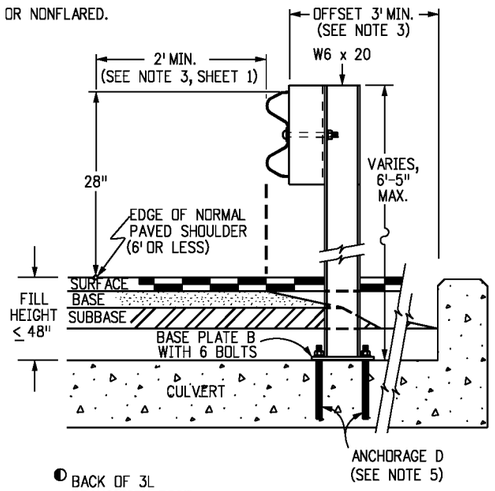
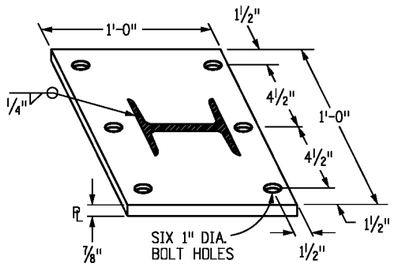
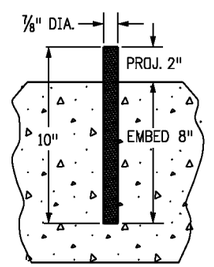


GUARDRAIL FOR CULVERTS





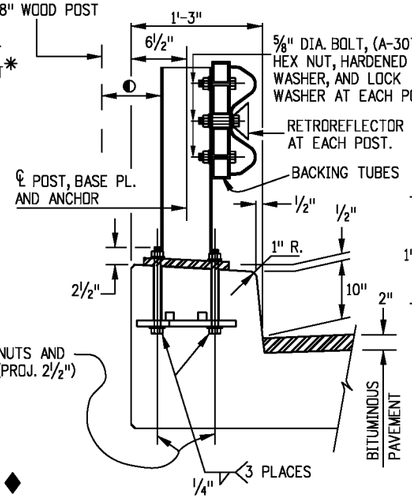
BASE PLATE B
(FOR INSIDE MOUNT)

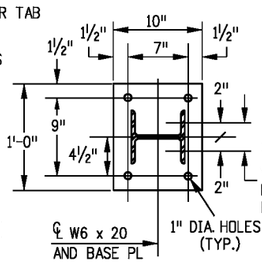


ANCHORAGE D
(FOR INSIDE MOUNT)

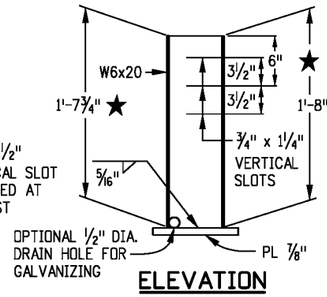
◐ BACK OF 3L TRANSITION POST 5.75" STEEL POST OR 8" WOOD POST

INSIDE MOUNT ON CBC





PLAN

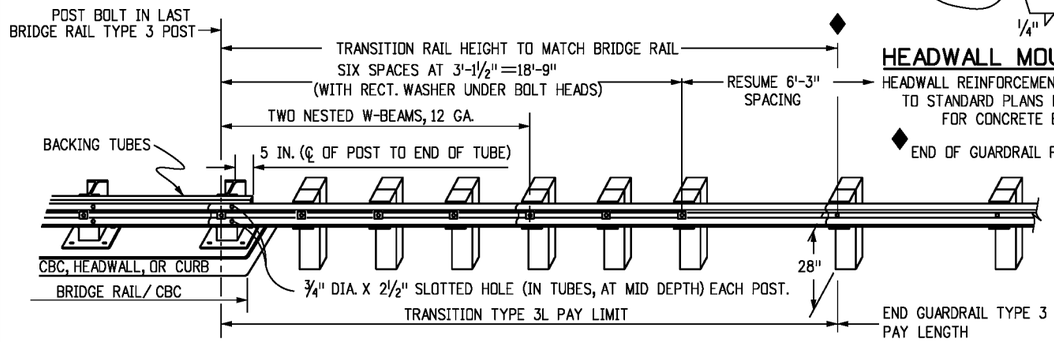


ELEVATION

HEADWALL MOUNT POST DETAIL

RAIL PLACEMENT FOR INSIDE OR HEADWALL MOUNT

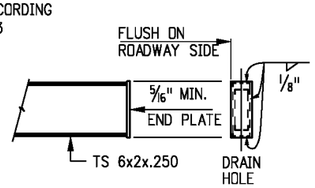
✱ USE 3L TRANSITION AT BOTH APPROACH AND EXIT ENDS OF BRIDGE RAIL TYPE 3 (HEADWALL MOUNT)



TRANSITION TYPE 3L AND GUARDRAIL TYPE 3 APPROACH

HEADWALL MOUNT ON CBC

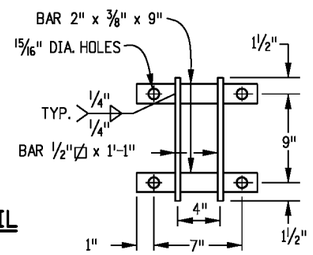
HEADWALL REINFORCEMENT SHALL BE ACCORDING TO STANDARD PLANS M-601-1, 2, AND 3 FOR CONCRETE BOX CULVERTS.



BACKING TUBES END DETAIL

(FOR HEADWALL MOUNT)

TUBES SHALL BE CONTINUOUS. NEITHER BOLTED NOR WELDED SPLICES WILL BE ALLOWED.



● ANCHOR DETAIL
(FOR HEADWALL MOUNT)

NOTES

1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND WINGWALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 15. THE GUARDRAIL TYPE 3 SHALL CONTINUE ACROSS THE CULVERT AS SHOWN ON THIS SHEET.
2. RIGHT SHOULDER BOX CULVERT TREATMENT IS SHOWN ON THIS SHEET FOR CULVERTS 20 FT. OR LESS IN LENGTH.
3. GUARDRAIL ACROSS CULVERTS WITH A LENGTH OF 20 FT. OR LESS SHALL BE AS FOLLOWS:
   A. FILL HEIGHT AT GUARDRAIL POST 48 IN. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE AS GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POST LESS THAN 48 IN. AND BLOCK FACE TO HEADWALL OFFSET OF 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT AS GUARDRAIL TYPE 3.
   C. FILL HEIGHT AT GUARDRAIL POST 48 IN. OR LESS AND BLOCK FACE TO HEADWALL OFFSET LESS THAN 3 FT: CONSTRUCTION ACCORDING TO HEADWALL MOUNT DETAILS AND PAYMENT AS BRIDGE RAIL TYPE 3.
4. GUARDRAIL ACROSS CULVERTS WITH LENGTH GREATER THAN 20 FT. SHALL BE AS FOLLOWS:
   A. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE FOR STANDARD GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR LESS: CONSTRUCTION AND PAYMENT IN ACCORDANCE WITH THE CONTRACT BRIDGE PLANS. WHEN BLOCK FACE TO HEADWALL OFFSET IS 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT AS GUARDRAIL TYPE 3.
5. ANCHORAGE D: SIX BOLTS FOR BASE PLATE "B" WITH INSIDE MOUNT. THE BOLTS SHALL BE 7/8 IN. DIA X 10 IN. HIGH STRENGTH RODS THREADED FULL LENGTH AND ALL GALVANIZED. RODS SHALL BE CAST-IN-PLACE FOR A NEW STRUCTURE. FOR AN EXISTING STRUCTURE, THE RODS SHALL BE INSTALLED IN 1-1/4 IN. DIA HOLES WITH NON-SHRINK GROUT OR EPOXY CONFORMING TO ASTM C 881.
6. TYPE 3L POSTS SHALL BE STEEL OR WOOD TO MATCH POSTS USED ON THE APPROACH GUARDRAIL.
7. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.
8. ALL BRIDGE RAIL TYPE 3 BACKING TUBES SHALL BE FABRICATED FROM ASTM A 500 GRADE B. ALL POSTS, BASE PLATES, AND ANCHOR BOLTS SHALL BE FABRICATED FROM ASTM A 36 STEEL. THE ABOVE MATERIAL, W-BEAM, AND ALL ANCHOR BOLTS AND MISCELLANEOUS BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH SECTION 509. CONCRETE, REINFORCING STEEL, AND STRUCTURAL STEEL ELEMENTS SHALL BE IN ACCORDANCE WITH SECTIONS 601, 602, AND 509, RESPECTIVELY.
9. POST ANCHORS, ENCASED IN CONCRETE, SHALL BE ASTM A 36 STEEL, AND NEED NOT BE GALVANIZED.
10. PRIOR TO FABRICATION OF BRIDGE RAIL, THREE SETS OF WORKING DRAWINGS WHICH COMPLY WITH THE REQUIREMENTS OF SECTION 105 SHALL BE SUBMITTED TO THE ENGINEER FOR INFORMATION ONLY.
11. IF HEADWALL MOUNT GUARDRAIL IS USED, SEE STANDARD PLAN M-601, AND NOTES BELOW:
    A. ALL ITEMS ABOVE TOP OF CBC HEADWALL WILL BE MEASURED AND PAID FOR AS LINEAR FEET OF BRIDGE RAIL TYPE 3.
    B. HEADWALL MOUNTING OF RAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

★ FOR STANDARD 12 IN. HEADWALL WITH NO PAVEMENT, THE POST HEIGHT SHALL BE 1 FT.- 6 IN. ADJUST POST HEIGHT FOR PAVEMENT THICKNESS.

● ONE ANCHOR ASSEMBLY SHALL BE PLACED FOR EACH RAIL POST.

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GUARDRAIL TYPE 3 W-BEAM

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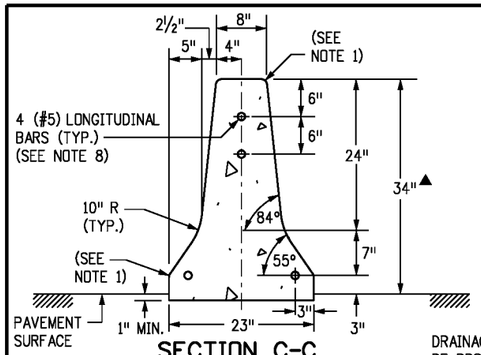
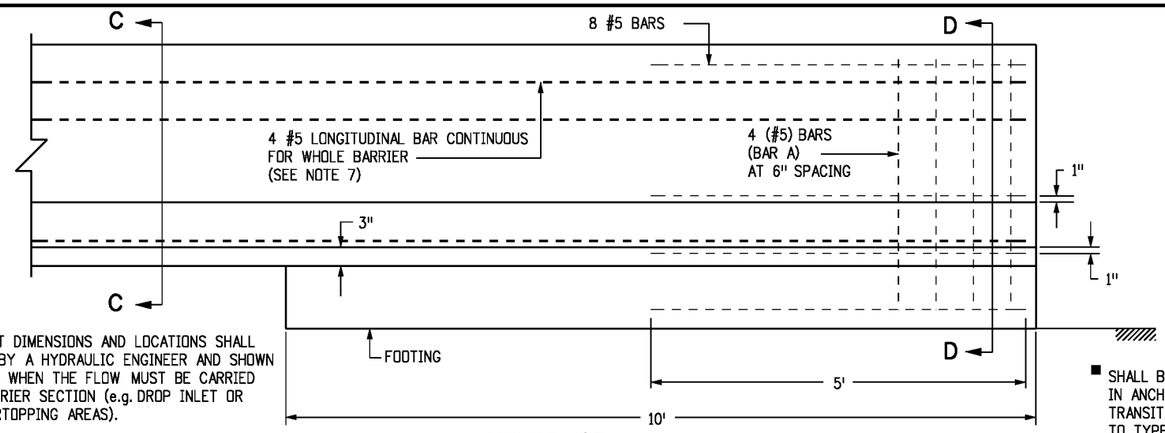


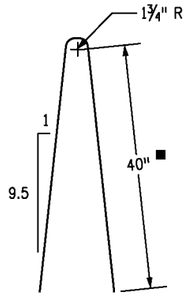
SECTION C-C
STYLE CA
CONCRETE BARRIER (TYP.)

DRAINAGE SLOT DIMENSIONS AND LOCATIONS SHALL BE PROVIDED BY A HYDRAULIC ENGINEER AND SHOWN ON THE PLANS WHEN THE FLOW MUST BE CARRIED ACROSS A BARRIER SECTION (e.g. DROP INLET OR CULVERT OVERTOPPING AREAS).

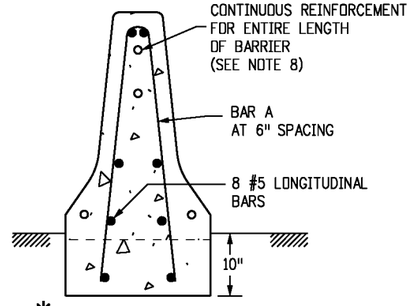


ANCHORAGE

BARRIER ELEVATION VIEW INCLUDING REINFORCED ANCHORAGE AT END
(FOR ANCHORAGE THAT TRANSITIONS TO BRIDGE RAIL OR THRIE BEAM, SEE SHEET 2)

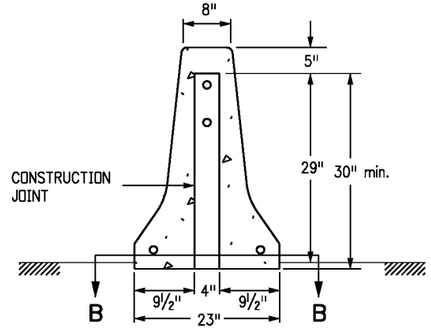


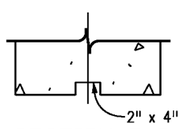
BAR A (#5)



*SECTION D-D
ANCHORAGE

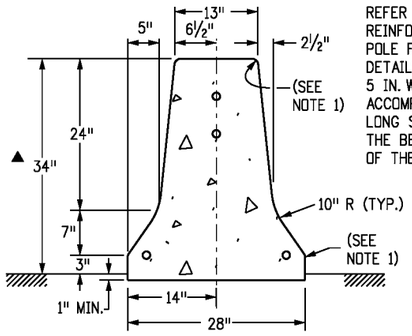
■ SHALL BE 38 IN. IN ANCHORAGE THAT TRANSITIONS FROM TYPE 7 TO TYPE 3G-THRIE BEAM (SEE SHEET 2)





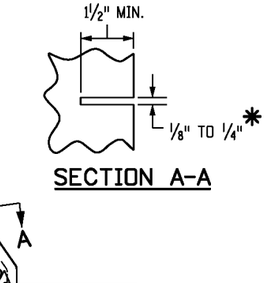
SECTION B-B
CONSTRUCTION JOINT *

* SEE STYLE CA DETAIL FOR TYPICAL DIMENSIONS.



STYLE CL
BARRIER FOR MOUNTED LIGHT POLES

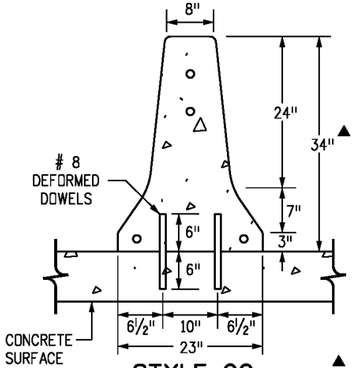
REFER TO THE PLANS FOR THE REINFORCING, WIRING, AND LIGHT POLE FOUNDATION INSTALLATION DETAILS. THE TRANSITION TO THIS 5 IN. WIDER SECTION SHALL BE ACCOMPLISHED IN ONE 10 FT. LONG SEGMENT OF BARRIER AT THE BEGINNING AND THE END OF THE RUN OF LIGHT POLES.



SECTION A-A

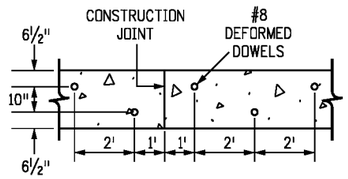
TRANSVERSE CONTRACTION JOINTS *

FORMED OR SAWED TRANSVERSE CONTRACTION JOINTS ARE REQUIRED AT 20 FT. INTERVALS OR THE INTERVALS SHALL MATCH THE CONCRETE PAVEMENT JOINTS FOR INSTALLATIONS ON TOP OF THE CONCRETE ROADWAY PAVEMENT.

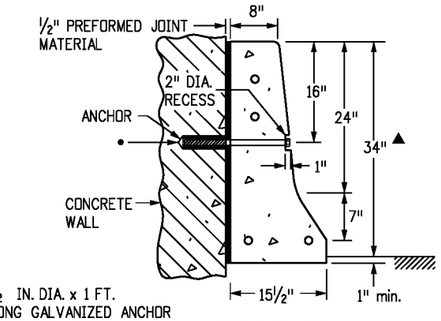


STYLE CC
BARRIER DOWELLED TO CONCRETE SURFACE

▲ IN FUTURE OVERLAYS, AN OVERALL MINIMUM HEIGHT OF 31 IN. IS REQUIRED.

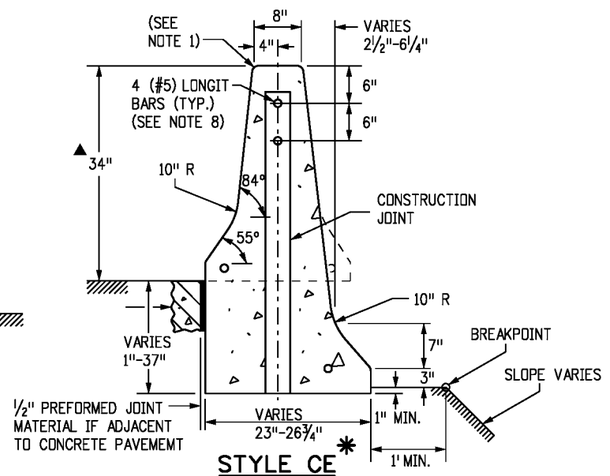


DOWEL PLACEMENT LAYOUT
FOR STYLE CC BARRIER (PLAN VIEW)



• ½ IN. DIA. x 1 FT. LONG GALVANIZED ANCHOR BOLT AND WASHER, MECHANICALLY FASTENED AT 2 FT. - 6 IN. CENTERS. USE ONLY WHEN CALLED FOR ON PLANS.

STYLE CD
BARRIER AGAINST WALL



STYLE CE *
BARRIER FOR OFFSET ROADWAYS

GENERAL NOTES

1. ALL EDGES SHALL BE ROUNDED WITH A 1 IN. RADIUS EXCEPT AS SHOWN.
2. THE BARRIER SHALL BE ANCHORED AT THE ENDS AND AT INTERRUPTIONS WITH THE 10 FT. REINFORCED ANCHORAGE. THE FOOTING AND END BARRIER MAY BE MONOLITHIC OR THE BARRIER MAY BE CONNECTED TO THE 10 IN. DEEP FOOTING USING TEN #8 REBAR DOWELS (10 IN. LONG) SET TWO IN LINE AT 24 IN. SPACING.
3. BARRIER MAY BE CAST-IN-PLACE, SLIP FORMED, OR PRECAST (SEE STANDARD PLAN M-606-14).
4. BARRIER FOUNDATION SHALL BE PAVEMENT, OR COMPACTED AGGREGATE BASE, OR EMBANKMENT MATERIAL.
5. NO FOOTING IS REQUIRED (TYP.) EXCEPT FOR 10 FT. ANCHORAGE.
6. CONSTRUCTION JOINTS SHALL BE USED ON ALL BARRIER TYPES SHOWN, AT THE END OF THE DAY'S POUR OR AFTER ANY INTERRUPTION LONGER THAN 30 MINUTES. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS POURED.
7. REINFORCING STEEL IN ANCHORAGE SHALL BE GRADE 60 EPOXY COATED DEFORMED BARS.
8. CONTINUOUS LONGITUDINAL REINFORCEMENT SHALL BE EITHER GRADE 60 EPOXY COATED DEFORMED BARS OR WIRE STRAND WITH MINIMUM ULTIMATE TENSILE STRENGTH OF 28,000 LBS. AND CLASS C GALVANIZING ACCORDING TO ASTM A 603.
9. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 10 FT. LONG SEGMENT OF BARRIER.
10. CONCRETE SHALL BE CLASS D.
11. ADDITIONAL MATERIAL FOR BARRIER EMBEDMENT GREATER THAN 1 IN. WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
12. EPOXY COATED LONGITUDINAL REBAR SHALL HAVE A MINIMUM LAP SPLICE OF 38 IN. WIRE STRAND LONGITUDINAL REINFORCEMENT SHALL BE BUTT WELDED OR MECHANICALLY SPLICED TO MAINTAIN 100 PERCENT OF THE MINIMUM REQUIRED TENSILE STRENGTH.
13. ALL INCIDENTAL WORK AND MATERIAL SUCH AS DOWELS, GROUT, ANCHORS, BOLTS, PINS, JOINT MATERIAL, EXCAVATION FOR BASES, CONTINUOUS LONGITUDINAL REINFORCEMENT, SHALL BE INCLUDED IN THE COST OF GUARDRAIL.
14. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.

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GUARDRAIL TYPE 7 F-SHAPE BARRIER

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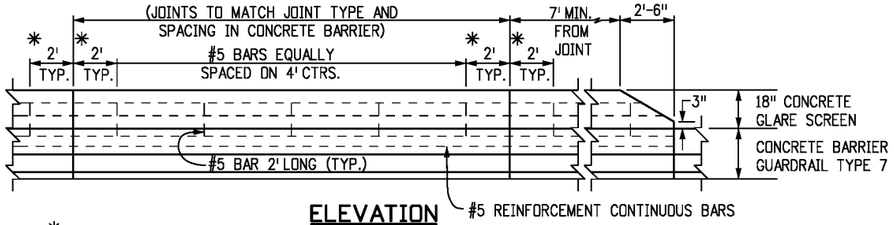
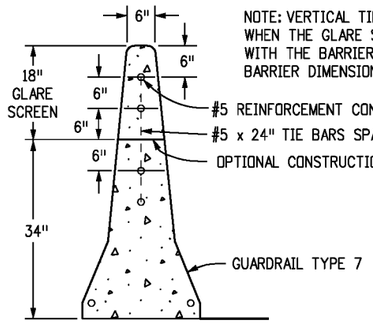


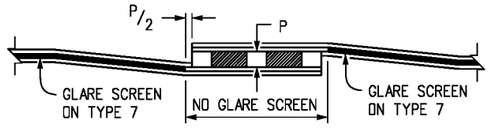
ELEVATION

* 2 FT. IS TYPICAL FOR CAST-IN-PLACE BARRIERS.
1 FT. IS TYPICAL FOR PRECAST BARRIERS.
THE MINIMUM ACCEPTABLE DIMENSION IS 6 IN.

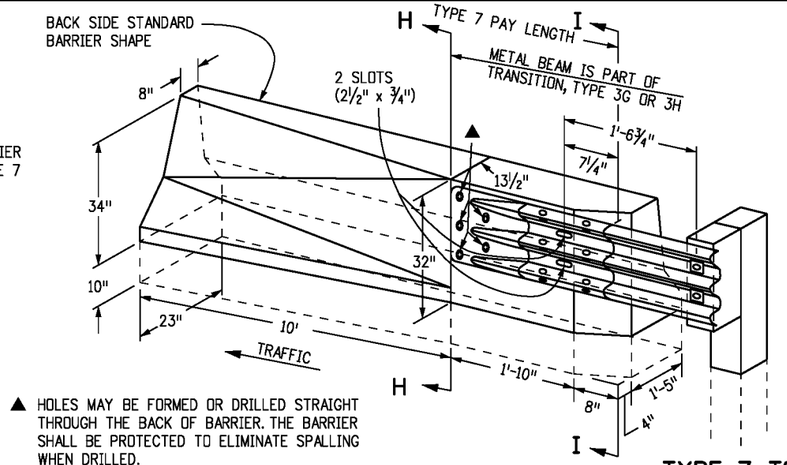


NOTE: VERTICAL TIE BARS ARE NOT REQUIRED WHEN THE GLARE SCREEN IS POURED MONOLITHICALLY WITH THE BARRIER. SEE SHEETS 1 AND 2 FOR BARRIER DIMENSIONS.

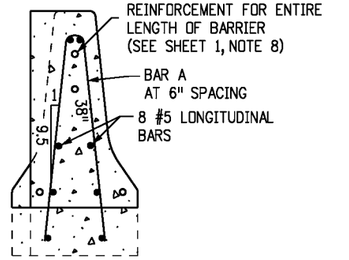
CONCRETE GLARE SCREEN



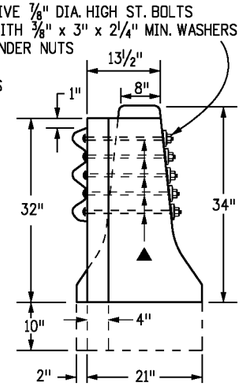
GLARE SCREEN AT MEDIAN OBSTRUCTIONS



▲ HOLES MAY BE FORMED OR DRILLED STRAIGHT THROUGH THE BACK OF BARRIER. THE BARRIER SHALL BE PROTECTED TO ELIMINATE SPALLING WHEN DRILLED.



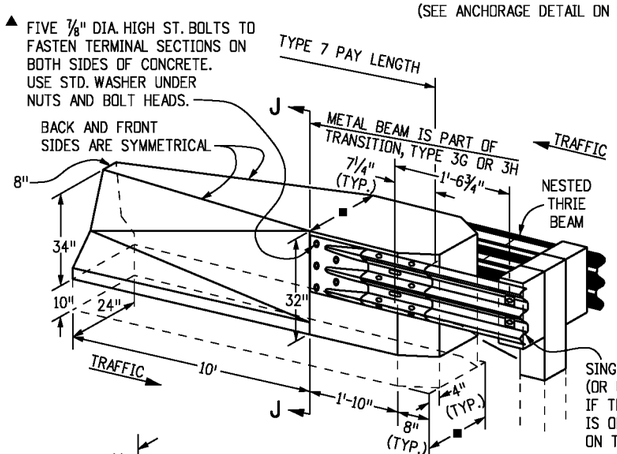
SECTION H-H

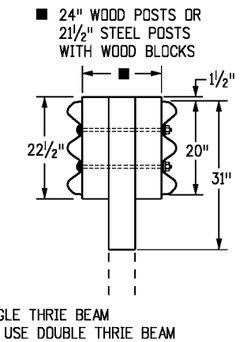


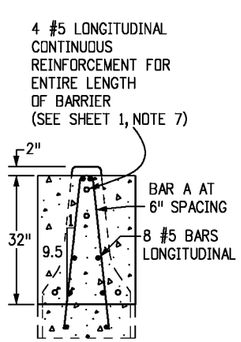
SECTION I-I

TYPE 7 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE

(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)



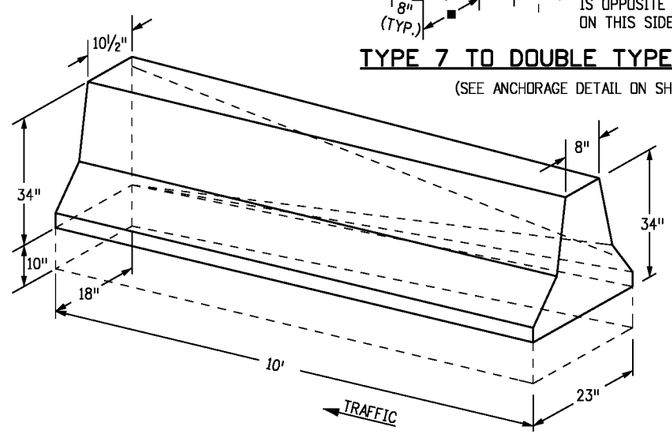


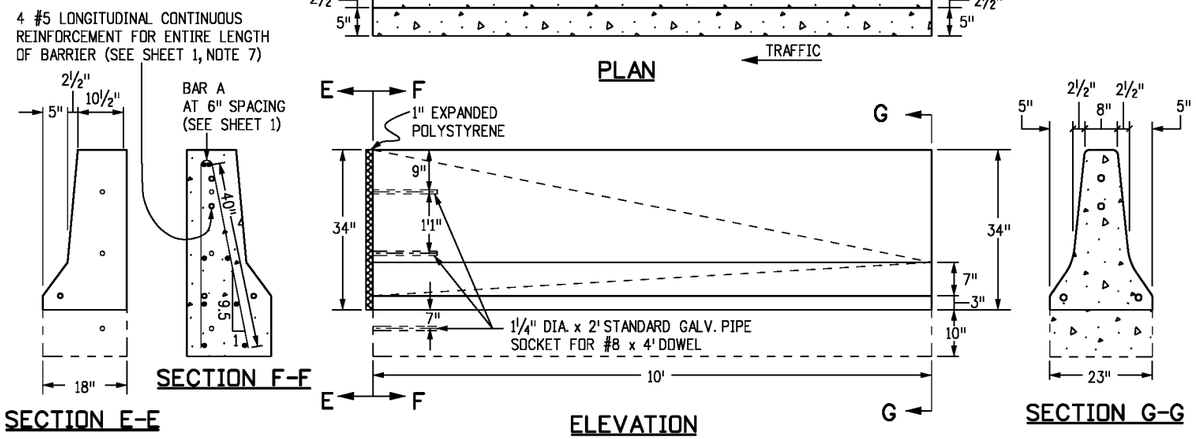


SECTION J-J

TYPE 7 TO DOUBLE TYPE 3G TRANSITION AND ANCHORAGE

(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)





PLAN

SECTION F-F

SECTION E-E

ELEVATION

SECTION G-G

THIS SECTION PROVIDES A TRANSITION FOR THE SHAPE OF THE BRIDGE RAIL TYPE 7 TO THE ROADWAY GUARDRAIL TYPE 7. MEASURED AND PAID FOR AS GUARDRAIL TYPE 7.
(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)

BRIDGE RAIL TYPE 7 TO ROADWAY SHOULDER TYPE 7 TRANSITION AND ANCHORAGE

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GUARDRAIL TYPE 7 F-SHAPE BARRIER

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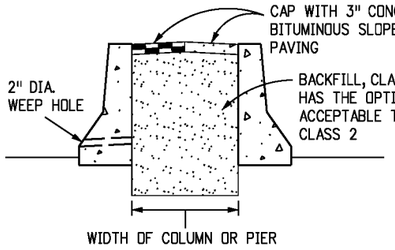
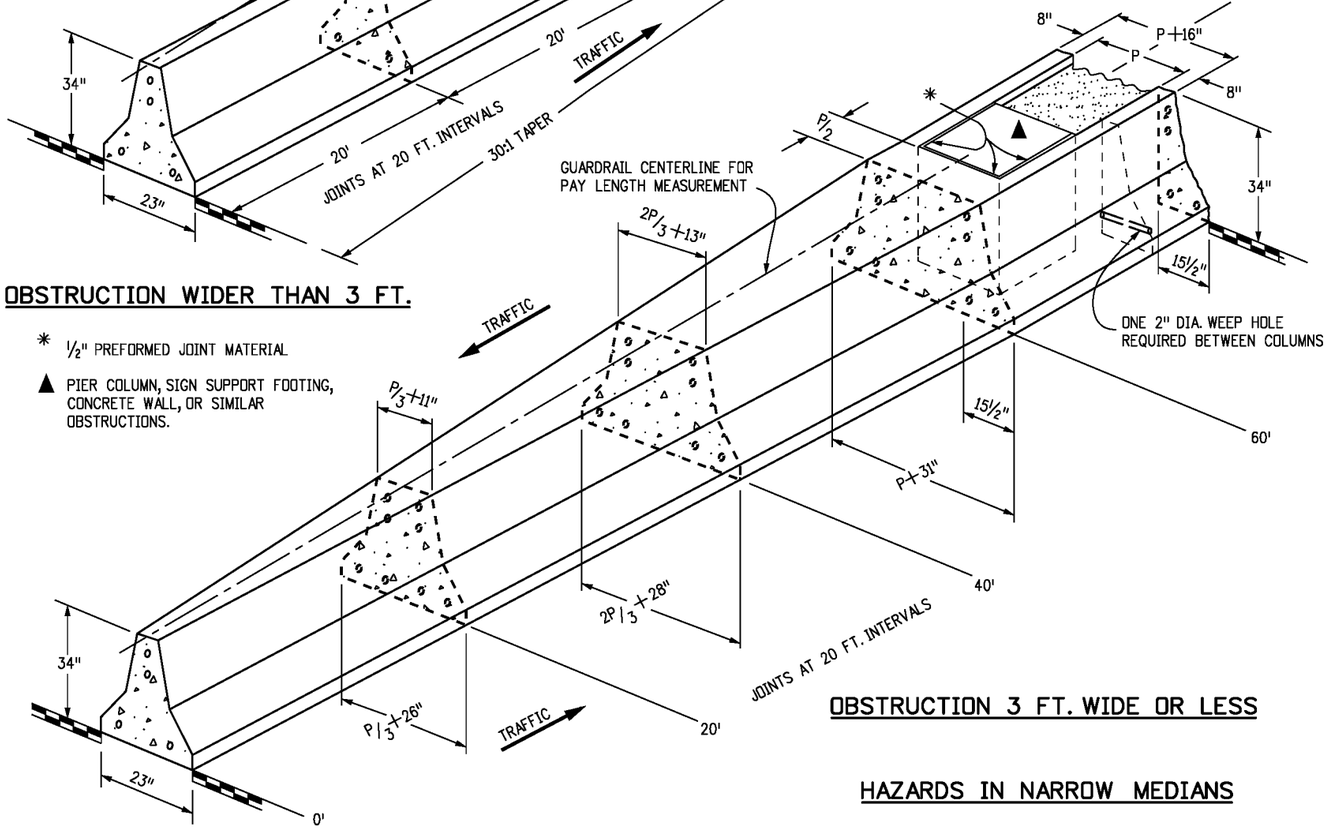


TREATMENT BETWEEN COLUMNS OR OBSTRUCTIONS

OBSTRUCTION WIDER THAN 3 FT.



* ½" PREFORMED JOINT MATERIAL

▲ PIER COLUMN, SIGN SUPPORT FOOTING, CONCRETE WALL, OR SIMILAR OBSTRUCTIONS.

OBSTRUCTION 3 FT. WIDE OR LESS

HAZARDS IN NARROW MEDIANS

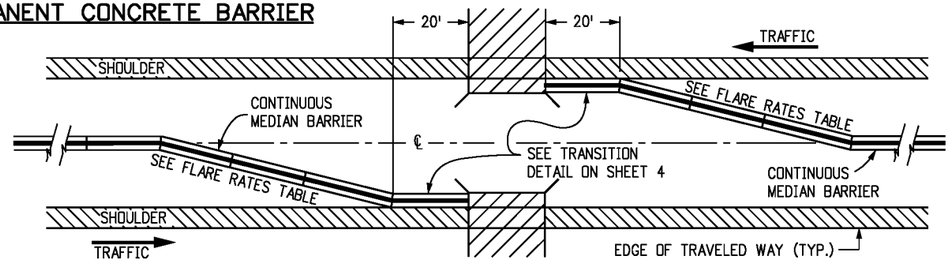
DESIGN SPEED (MPH)	SHY LINE OFFSET (FT.)*	FLARE RATE FOR BARRIER INSIDE SHY LINE	FLARE RATE FOR BARRIER OUTSIDE SHY LINE
80	12	30:1	20:1
75	10	30:1	20:1
70	9	30:1	20:1
60	8	26:1	18:1
55	7	24:1	16:1
50	6.5	21:1	14:1
45	6	18:1	12:1
40	5	16:1	10:1
30	4	13:1	8:1

* THE SHY LINE OFFSET IS MEASURED FROM THE EDGE OF THE TRAVELED WAY.

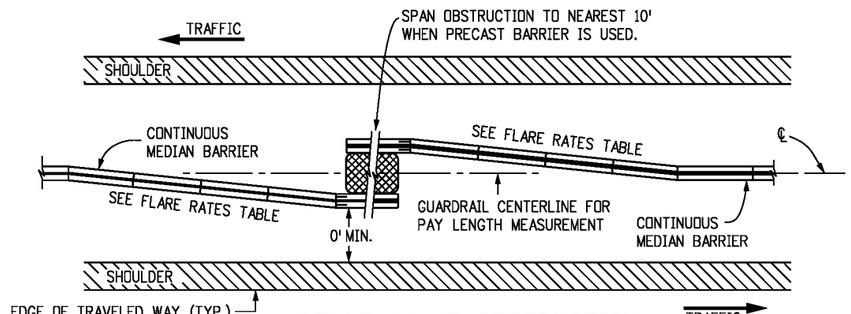
TABLE OF FLARE RATES FOR PERMANENT CONCRETE BARRIER

NOTES

1. THE MEDIAN IN THESE APPLICATIONS SHALL BE PAVED ON A SLOPE CONTINUED FROM THE ADJACENT PAVED SHOULDER OR A 10:1 OR FLATTER SLOPE.
2. THE PAY LENGTH FOR BARRIER ON BOTH SIDES OF AN OBSTRUCTION WILL BE DETERMINED BY ONE LINEAR MEASUREMENT ALONG THE GUARDRAIL CENTERLINE. THE BACKFILL AND CAP BETWEEN COLUMNS OR OBSTRUCTIONS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
3. GUARDRAIL BETWEEN COLUMNS OR OBSTRUCTIONS MAY BE STYLES CD OR CA AS SHOWN ON THE PLANS.

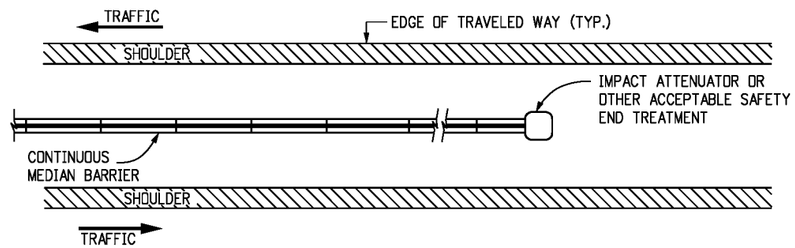


BRIDGE APPROACH



STYLE CA AT OBSTRUCTION

(OBSTRUCTION NOT SUITABLE FOR TYPE CD)



MEDIAN BARRIER END TREATMENT

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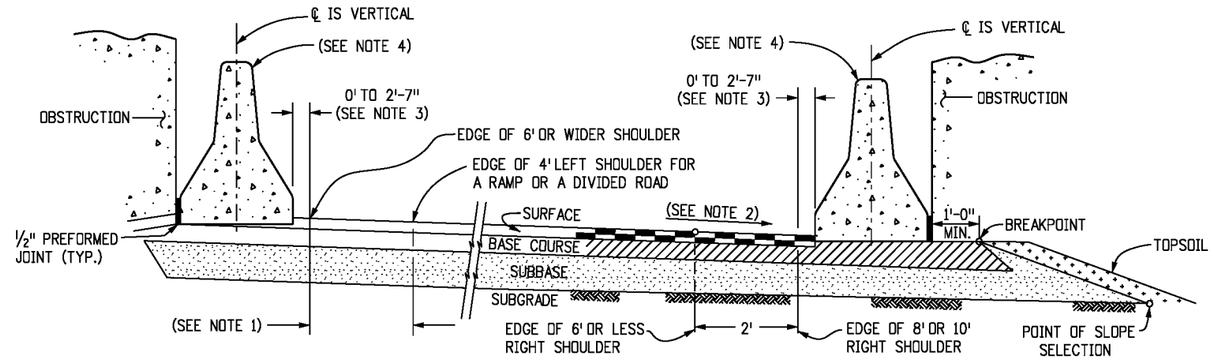
Project Development Branch DD/LTA

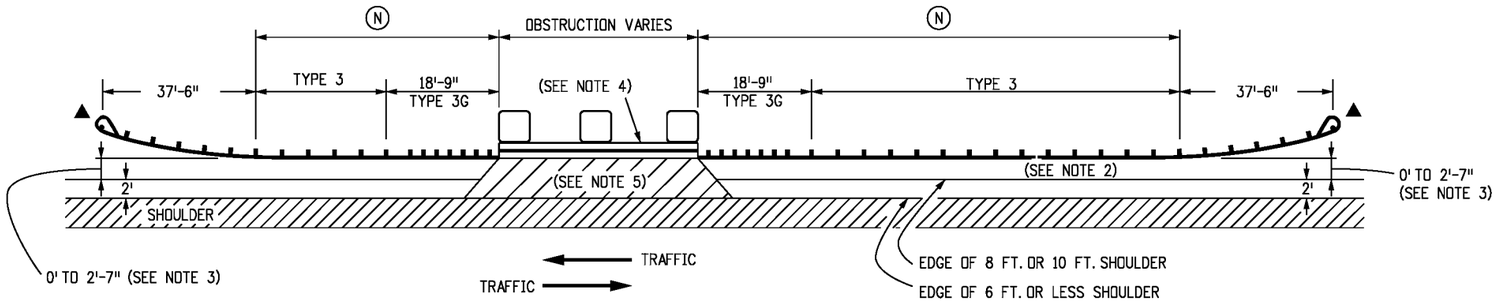
GUARDRAIL TYPE 7 F-SHAPE BARRIER

Issued By: Project Development Branch July 4, 2012

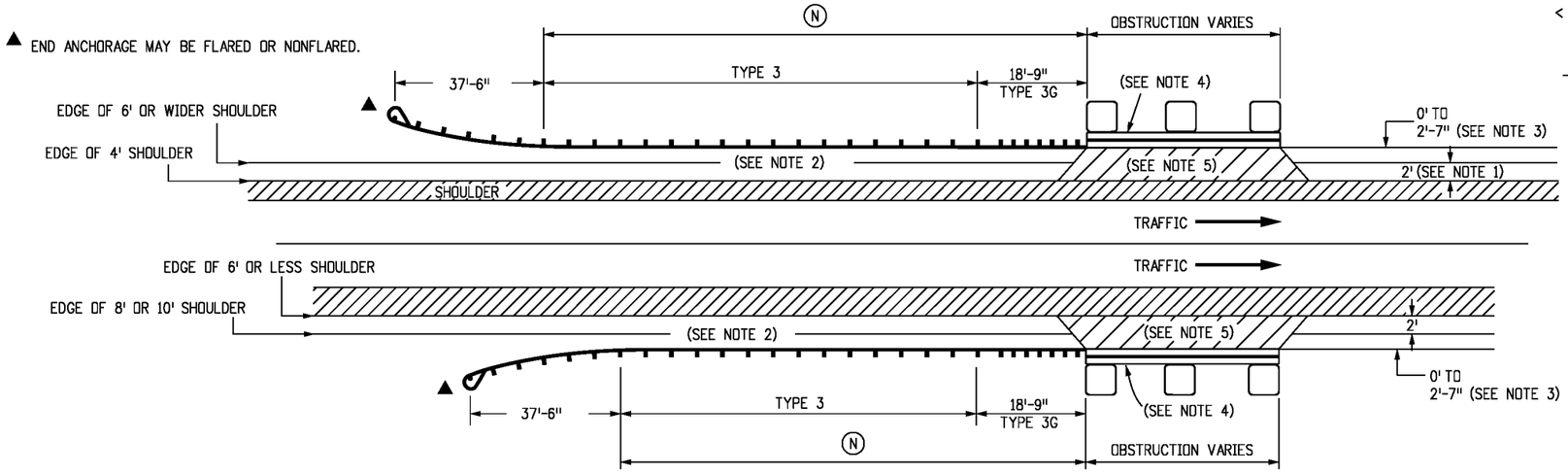
STANDARD PLAN NO.
M-606-13
Sheet No. 3 of 4



TYPE 7 ON LEFT AND RIGHT SHOULDERS AT OBSTRUCTIONS



2-LANE 2-WAY ROADS

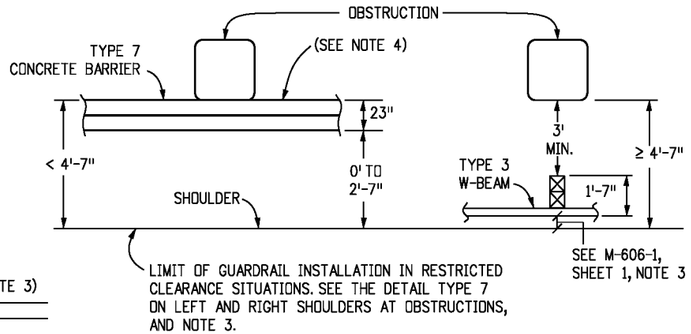


DIRECTIONAL ROADWAYS AND RAMPS

NOTES

1. TWO FT. IS DESIRABLE FOR THIS DIMENSION WITH A 4 FT. LEFT SHOULDER. THE MINIMUM IS 0 FT., WHICH IS ACCEPTABLE FOR 6 FT. OR WIDER SHOULDERS.
2. RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
   A. FOR GUARDRAIL FACE 2 FT. OR LESS FROM THE NORMAL EDGE OF PAVED SHOULDER, CONTINUE THE RATE OF SLOPE OF THE NORMAL PAVED SHOULDER TO THE BREAKPOINT.
   B. FOR GUARDRAIL FACE MORE THAN 2 FT. FROM THE NORMAL EDGE OF THE PAVED SHOULDER, THE SLOPE SHALL BE 10:1 OR FLATTER.
3. IF THE DISTANCE FROM THE EDGE OF SHOULDER TO THE OBSTRUCTION EXCEEDS 4 FT.-7 IN., TYPE 3-W BEAM GUARDRAIL MAY BE SPECIFIED ON THE PLANS INSTEAD OF TYPE 7 (SEE PLANS, AND DETAIL BELOW).
4. STYLE CA BARRIERS ARE SHOWN. STYLE CD MAY BE USED AS APPROPRIATE. SEE SHEET 2 FOR TYPE 7 TO SINGLE TYPE 3G TRANSITION.
5. THE AREA BETWEEN SHOULDER AND THE TYPE 7 SHALL BE PAVED. PAYMENT FOR THE PAVED SURFACE WILL BE MADE UNDER A PAVEMENT PAY ITEM, HMA OR CONCRETE, WITH QUANTITIES SHOWN ON THE PLANS.

(N) THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND AS SHOWN ON THE PLANS. MINIMUM SHALL BE 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW.



HAZARDS ON ROADSIDES

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Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
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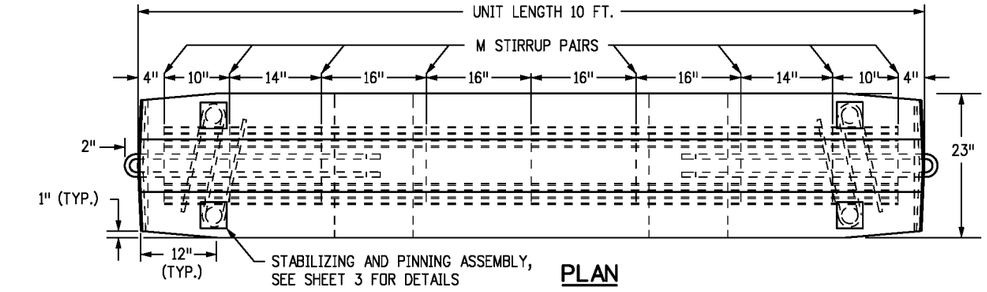
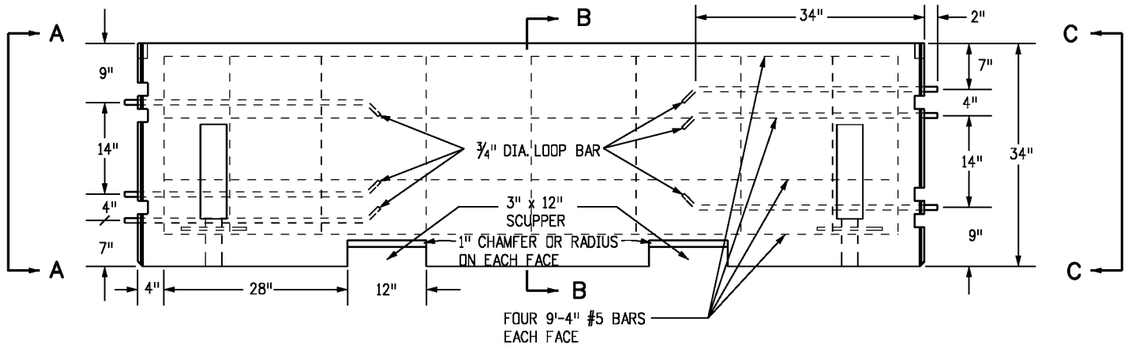
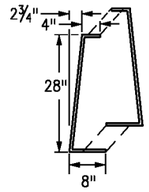


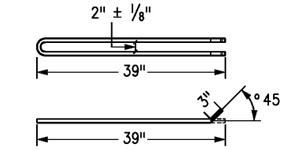
PLAN



ELEVATION BARRIER



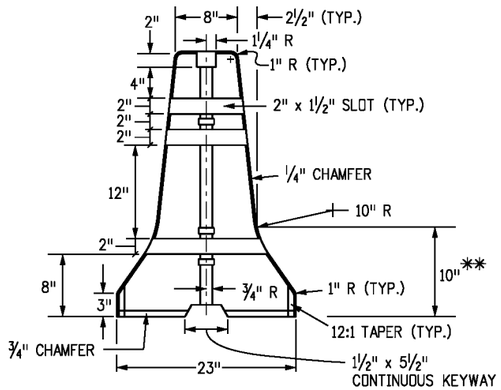
STIRRUP "M" #5 REBAR PAIR



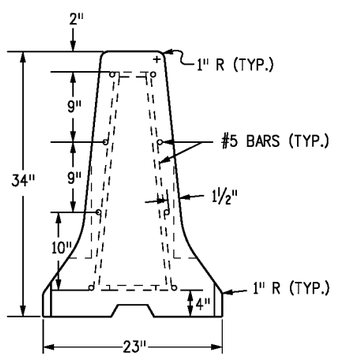
LOOP BAR BENDING DETAIL
(ASTM A36)
(HOT-DIP GALVANIZED
AFTER FABRICATION)

GENERAL NOTES

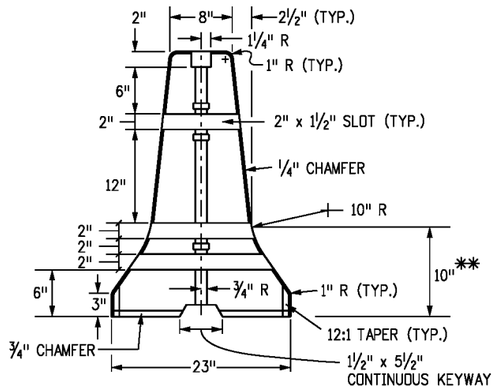
1. ALL STEEL REINFORCING SHALL BE 2 IN. CLEAR OF THE NEAREST SURFACE OF CONCRETE UNLESS OTHERWISE SHOWN. REINFORCING STEEL SHALL BE GRADE 40 MINIMUM.
2. CONCRETE SHALL BE CLASS D.
3. ALL PERMANENT PRECAST BARRIERS USED TO REPLACE OTHER CONCRETE BARRIERS, SHALL BE IN NEW CONDITION, UNDAMAGED, AND WITH NO REPAIRS.
4. FOR TEMPORARY INSTALLATIONS, INSTALL WITH A MINIMUM 4 FT. DISTANCE FROM THE CENTERLINE OF THE CONCRETE BARRIER TO ANY OBSTRUCTIONS BEHIND IT. FOR TEMPORARY INSTALLATIONS WITH LESS THAN A 4 FT. MINIMUM DISTANCE, STABILIZATION PINS SHALL BE USED ON EACH BARRIER UNIT ADJACENT TO, AND WITHIN 10 FT. OF BOTH SIDES OF THE OBSTRUCTION. SEE SHEET 3 FOR STABILIZATION PINNING DETAILS.
5. THE FLARE RATE FOR TEMPORARY INSTALLATIONS SHALL BE 10:1 OR FLATTER UNLESS OTHERWISE APPROVED BY THE ENGINEER FOR PERMANENT INSTALLATIONS. SEE THE FLARE RATES TABLE ON STANDARD M-606-13, SHEET 3.
6. STABILIZATION PINS SHALL BE USED TO ANCHOR EACH 10 FT. UNIT IN ALL PERMANENT INSTALLATIONS. SEE SHEET 3 FOR STABILIZATION PINNING DETAILS.
7. FOR ALL PERMANENT INSTALLATIONS THAT REQUIRE END ANCHORAGES. SEE STANDARD PLAN M-606-13, SHEET 1, FOR ANCHORAGE DETAILS.
8. THE MONTH AND YEAR THE PRECAST TYPE 7 CONCRETE BARRIER WAS MANUFACTURED SHALL BE MOLDED INTO ONE END OF EACH 10 FT. BARRIER UNIT.
9. APPROVED NON-SHRINK GROUT SHALL BE USED FOR GROUTING OVER ALL PINS AND GROUTING OF SCUPPERS.
10. WHEN HYDRAULIC ANALYSIS ALLOWS, SCUPPERS MAY NOT BE NEEDED ON:
    A. MEDIAN INSTALLATION WITH INLET DRAINAGE.
    B. SHOULDER BARRIER ON HIGH EDGE OF A SUPERELEVATED SHOULDER.
    C. MEDIAN BARRIER ON A CREST VERTICAL CURVE.
    D. PERMANENT BARRIER, IF SPECIFIED ON PLANS.
11. ALL INCIDENTAL WORK AND MATERIALS SUCH AS CONNECTING PINS, ANCHORS BOLTS, GROUT, AND EXCAVATION FOR END ANCHORAGE, WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE WORK.
12. ONE IN. DIAMETER THREADED INSERTS MAY BE CAST-IN-PLACE TO FACILITATE LIFTING FOR TEMPORARY BARRIER APPLICATIONS ONLY.
13. RETROREFLECTORIZATION IS REQUIRED ON BARRIERS. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.



SECTION A-A

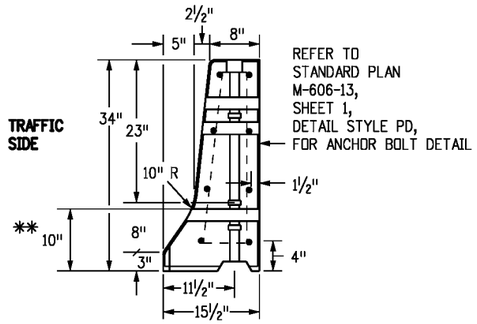


SECTION B-B

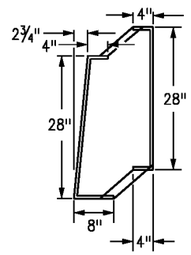


SECTION C-C

** DIMENSIONS MARKED ARE TO THE INTERSECTION POINT OF THE BARRIER SLOPES. CONSTRUCT THE 10 IN. RADIUS TO PROVIDE A SMOOTH TRANSITION BETWEEN THE SLOPES.



NARROW BASE
SHOULDER BARRIER



NARROW BASE
STIRRUP "M" #5 REBAR PAIR

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PRECAST TYPE 7 CONCRETE BARRIER

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STANDARD PLAN NO.
M-606-14
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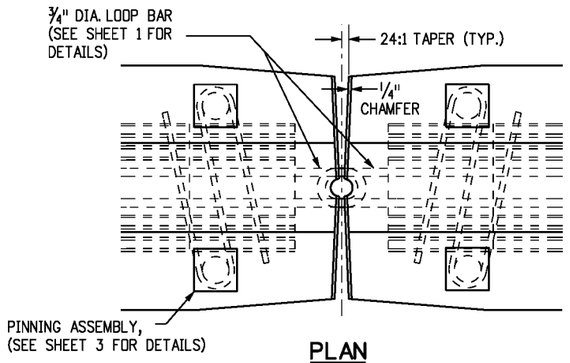
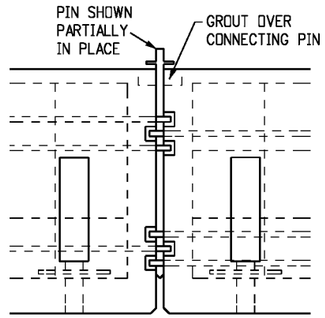


PLAN

SHOWN PRIOR TO PIN INSTALLATION.

FOR DETAILS NOT SHOWN,
SEE SECTION VIEWS A-A, B-B AND C-C
ON SHEET 1.

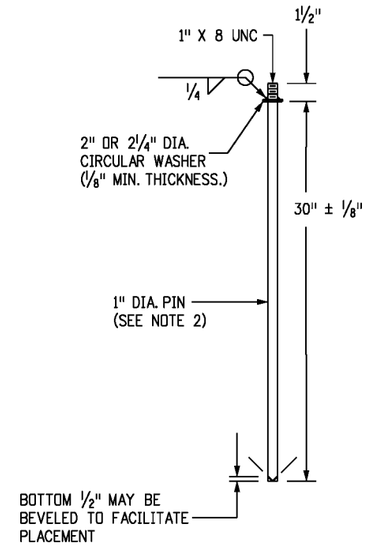


ELEVATION

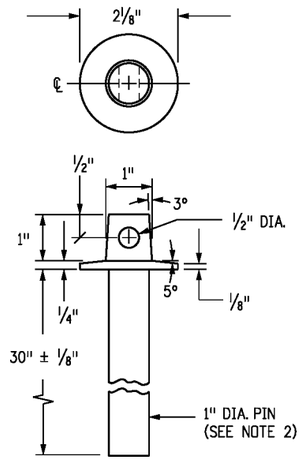
FOR DETAILS NOT SHOWN,
SEE SECTION VIEWS A-A, B-B, AND C-C
ON SHEET 1

NOTES

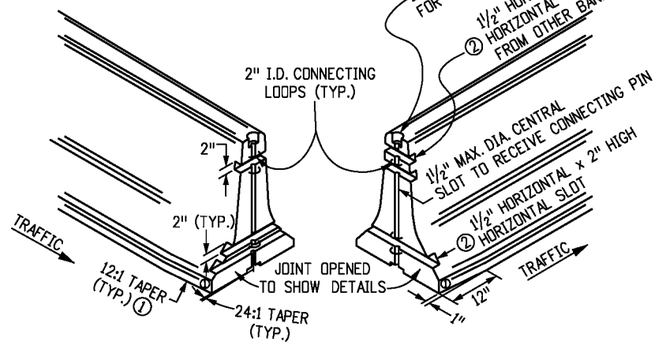
1. WASHERS SHALL BE FORGED AS AN INTEGRAL PART OF THE PIN, OR SHALL BE WELDED AS SHOWN.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
3. IF AN ALTERNATIVE TOP CONFIGURATION IS USED FOR LIFTING, THE LIFTING PIN SHALL BE PROVIDED. PINS SHALL CONFORM TO CRITICAL DIMENSIONS (PIN LENGTH DIAMETER).
4. PINS SHALL CONFORM TO ASTM A449.
5. APPROVED NON-SHRINK GROUT SHALL BE USED FOR GROUTING OVER ALL PINS, AND GROUTING OF SCUPPERS.
6. BOTH ENDS OF THE BARRIER SHALL HAVE A 24:1 TAPER IN EACH DIRECTION FROM THE CENTER PIN RECESS TO IT'S OUTER EDGE TO FACILITATE PLACEMENT ON CURVES.
7. JOINTS BETWEEN CAST-IN-PLACE GUARDRAIL TYPE 7 AND PERMANENT INSTALLATION PRECAST TYPE 7 CONCRETE BARRIER SHALL INCLUDE ALL REGRESSES AND LOOPS IN THE CAST-IN-PLACE END, ALONG WITH THE PIN TO COMPLETE THE TYPICAL PRECAST TYPE 7 CONCRETE BARRIER JOINT.



CONNECTING PIN DETAIL



ALTERNATIVE PIN DETAIL



JOINT STYLE

① A 1 IN. BY 12 IN. TAPER IS REQUIRED AT THE BOTTOM OF ALL FOUR CORNERS OF THE BARRIER SECTIONS TO ELIMINATE SNAGGING OF SNOW PLOW BLADES. THE TAPER IS OPTIONAL ON PERMANENT INSTALLATIONS.

② THE HORIZONTAL SLOTS SHALL BE 1½ IN. IN DEPTH AT THE CENTER OF THE BARRIER AND MAY DECREASE IN DEPTH AT THE EDGE OF THE BARRIER DUE TO THE (24:1) TAPER.

DETAILS FOR PIN AND LOOP CONNECTION

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PRECAST TYPE 7 CONCRETE BARRIER

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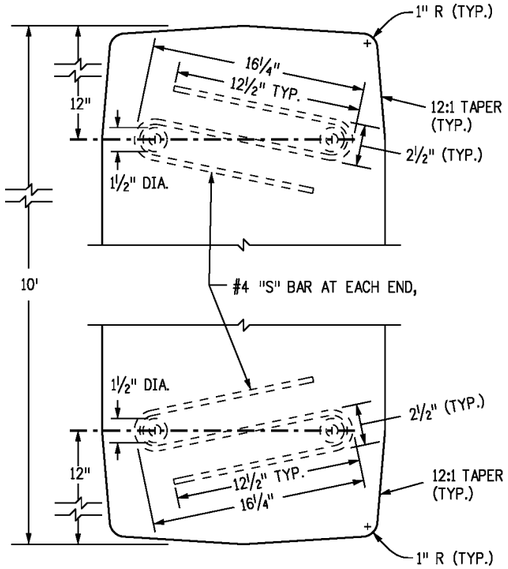
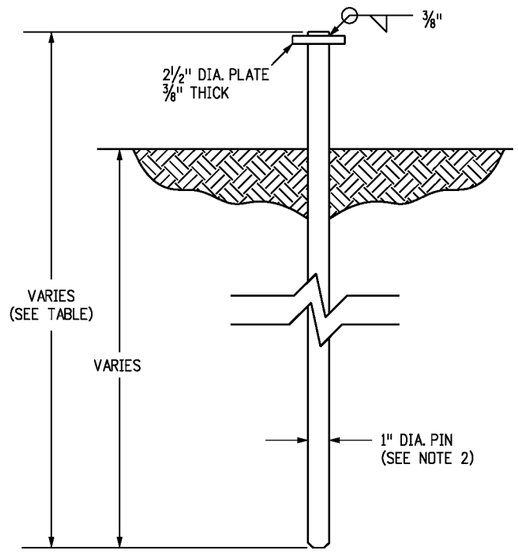
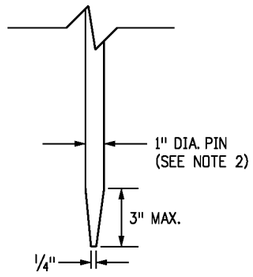


PLAN VIEW OF S BAR ENDS



STABILIZATION PIN

(ASTM A 36 STEEL)



OPTIONAL TAPERED END PIN

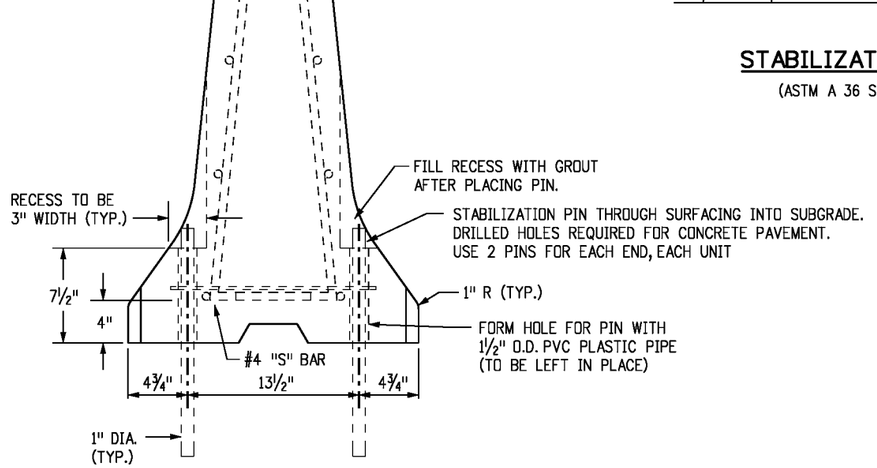
(SEE NOTE 4)

NOTES

1. SEE SHEET 1 FOR REINFORCEMENT AND OTHER DETAILS NOT SHOWN HERE.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION
3. FOR TERMINAL ANCHORING OF THE PERMANENT INSTALLATION OF PRECAST TYPE 7 CONCRETE BARRIER, SEE THE END ANCHORAGE DETAIL ON STANDARD PLAN M-606-13, SHEET 1.
4. AN OPTIONAL 3 IN. MAXIMUM TAPERED END POINT MAY BE PROVIDED ON THE STABILIZATION PIN TO FACILITATE DRIVING.

ROAD SURFACE	PIN LENGTH
CONCRETE	2 FT.-6 IN.
HMA	3 FT.
SOIL	3 FT.-6 IN.

TABLE OF STABILIZATION PIN LENGTHS



ELEVATION VIEW WITH PINS

DETAILS FOR STABILIZATION OF PERMANENT OR TEMPORARY PINNED PRECAST TYPE 7 CONCRETE BARRIER

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STANDARD PLAN NO.

M-606-14

GENERAL NOTES

1. ALL MATERIAL DIMENSIONS AND WEIGHTS ON THIS STANDARD ARE NOMINAL UNLESS OTHERWISE INDICATED.

2. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A WOOD POST FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF 1/2 IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7 1/2 FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

   A METAL LINE POST SHALL BE INSTALLED A MAXIMUM OF EVERY 500 FT. ALONG A WOOD POST FENCE. THE METAL POST SHALL BE WITHIN 1 FT. OF THE NEAREST WOOD POST, AND SHALL BE TIED TO EACH STRAND WITH A WIRE CLAMP.

3. DIMENSIONS SHOWN FOR "STANDARD" AND "ALTERNATIVE" APPLY FOR BOTH WOOD AND METAL POST FENCE.

4. FENCE WIRE SHALL BE ENDED, DOUBLE WRAPPED AND TIED OFF AT END POSTS, ANGLE POSTS AND LINE BRACE POSTS. FENCE TO BE CONTINUED SHALL THEN BE RESTARTED IN THE SAME MANNER.

5. FENCE WIRE SHALL BE PLACED ON EITHER ROAD OR FIELD SIDE OF POSTS, DEPENDING ON LOCAL CONDITIONS, i.e. ON CURVES, THE WIRE SHALL BE PLACED ON THE SIDE OF THE POST WHICH WILL RESULT IN THE LEAST TENSION ON FENCE TIES. THIS WILL ALSO APPLY WHERE WIND DRIFT, TUMBLE WEEDS OR OTHER CONDITIONS WOULD EXERT UNUSUAL PRESSURE AGAINST THE WIRE. WHERE POSSIBLE, WIRE SHOULD BE PLACED ON THE LIVESTOCK SIDE OF THE POSTS.

6. WHERE STEEL POSTS ARE SPECIFIED, EVERY FIFTH POST SHALL BE WOOD, WHEN SPECIFIED ON THE PLANS.

7. RIGHT OF WAY FENCES SHALL BE CONSTRUCTED APPROXIMATELY 6 IN. INSIDE THE BOUNDARY OF THE RIGHT OF WAY AS SHOWN ON THE PLANS, OR AS STAKED.

8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RE-ESTABLISHING DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY IN ACCORDANCE WITH SUBSECTION 625.08 OF THE STANDARD SPECIFICATIONS.

WOOD POSTS:

ALL LINE POSTS SHALL HAVE A MINIMUM DIAMETER OF 4 IN. AND BE A MINIMUM OF 6 FT.-0 IN. LONG.

ALL END, CORNER, INTERSECTION AND BRACE POSTS SHALL HAVE A MINIMUM DIAMETER OF 5 IN. AND BE 7 FT. IN LENGTH.

WOOD POSTS HAVING NONUNIFORM CROSS SECTION SHALL BE SET WITH THE LARGER DIAMETER END IN THE GROUND.

FENCE WIRE SHALL BE STAPLED TO WOOD POSTS OR TIED TO METAL POSTS AS SHOWN MARKED ✚ ON BARBED WIRE OR COMBINATION WIRE FENCE DETAILS. STAPLES SHALL BE NO. 9 WIRE MINIMUM, AND AT LEAST 1 1/2 IN. LONG.

METAL POSTS:

ALL POSTS AND BRACES SHALL BE THE TYPES AND WEIGHTS SHOWN OR ACCEPTABLE EQUIVALENTS, AND SHALL BE IN ACCORDANCE WITH AASHTO M 281. HOLES SHALL BE PROVIDED IN END, CORNER, AND GATE POSTS AS DETAILED.

CORNER AND LINE BRACE POSTS:

TYPE: 2 1/2 IN. x 2 1/2 IN. x 1/4 IN. STRUCTURAL STEEL ANGLES
WEIGHT: 4.10 LBS./LIN. FT.
LENGTH: 6 FT.-6 IN. MIN.
NUMBER OF BRACES: TWO

LINE POSTS:

TYPE: "STUDDED TEE" OR "U"
WEIGHT: 1.33 LBS./LIN. FT. (WITHOUT ANCHOR)
LENGTH: 6 FT.-0 IN. MINIMUM
ANCHOR: SECURELY FASTENED, WITH BEARING SURFACE SUFFICIENT TO RESIST MOVEMENT OF POST. WEIGHT: 0.67 LB.

METAL END POSTS AND GATE POSTS:

TYPE: 2 1/2 IN. x 2 1/2 IN. x 1/4 IN. STRUCTURAL STEEL ANGLES
WEIGHT: 4.10 LBS./LIN. FT.
NUMBER OF BRACES: ONE
LENGTH: END, 6 FT.-6 IN. MINIMUM. PANEL GATE, 7 FT.-0 IN. MINIMUM.

BRACES: (FOR CORNER, END OR LINE BRACE POSTS)

TYPE: 2 IN. x 2 IN. x 1/4 IN. STRUCTURAL STEEL ANGLES
WEIGHT: 3.19 LBS./LIN. FT.
LENGTH: SAME AS CORNER AND END POSTS USED.

FOOTINGS OR BASES:

CONCRETE SHALL BE CLASS B.
CONCRETE WITH LIGHTWEIGHT AGGREGATES CONFORMING TO AASHTO M 195 (ASTM C 330) WILL BE PERMITTED.

ALTERNATIVES: (CONTRACTOR'S OPTION)

END, CORNER AND LINE BRACE POSTS

TYPE	I.D.	O.D.	WEIGHT	WALL THICKNESS
	INCHES	INCHES	LB/FT.	INCHES
1. STD. GALV. PIPE	2 1/2	2 7/8	5.79 ± 5%	0.203
2. H.S. COLD ROLLED PIPE	2 1/2	2 7/8 ± 0.16	4.64 ± 5%	0.160 ± 5%

LENGTHS SHALL BE 6 FT.-6 IN. MINIMUM

BRACES:

TYPE: 1 3/8 IN. O.D. TUBULAR STEEL WITH 2 1/2 IN. BRACE BAND, HINGE BOLT AND 1 3/8 IN. I.D. RAIL END; ALL GALVANIZED.
WEIGHT: 16 LBS/LIN. FT. ± 5%
LENGTH: 6 FT.-6 IN. MINIMUM.

BARBED WIRE:

ZINC-COATED STEEL BARBED WIRE SHALL CONFORM TO AASHTO M 280, (ASTM A 121), 12-1/2 GAGE WITH CLASS 1 COATING, OR ALUMINUM-COATED STEEL BARBED WIRE CONFORMING TO ASTM A 585 TYPE 1.

WOVEN WIRE MESH:

WOVEN WIRE USED IN COMBINATION WIRE FENCE SHALL BE GALVANIZED AND CONFORM TO AASHTO M 279, (ASTM A 116) COATING CLASS 1, AND THE FOLLOWING:

STANDARD WOVEN WIRE FIELD FENCE, STYLE OR DESIGN NO.	ALTERNATIVE 4 IN. X 4 IN. WIRE "V" MESH
832-6-11* 32 IN. WIDTH 0.65 LBS/LIN.FT.	34 IN. WIDTH - 0.75 LBS/LIN.FT.
726-6-11* 26 IN. WIDTH 0.55 LBS/LIN.FT.	26 IN. WIDTH - 0.54 LBS/LIN.FT.
	CROSS WIRES-1 STRAND-14-1/2 GAGE MIN. HORIZONTAL-2 STRAND-12-1/2 GAGE

* 12-1/2 GAGE WOVEN WIRE FENCE FABRIC (832-6-12-1/2 OR 726-6-12-1/2) MAY BE USED WHEN SPECIFIED IN THE CONTRACT.

ALL FENCE WIRE TIES, CLIPS, CLAMPS, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M 232.

DRIVEWAY GATES (SINGLE):

HEIGHT: 42 IN.
WEIGHT: NOT LESS THAN 90 LBS. COMPLETE WITH LATCH AND HINGES.
WIDTH OF GATE OPENING: 16 FT.-0 IN. MINIMUM TO 20 FT.-0 IN. MAXIMUM.
GATE FRAME: 1 IN. I.D. STANDARD GALVANIZED PIPE OR ACCEPTABLE EQUIVALENT AND SHALL BE OF ALL WELDED CONSTRUCTION.

WOVEN WIRE SHALL ENCLOSE THE GATE FRAME AS SHOWN AND SHALL BE THE SAME WOVEN WIRE DESIGN AS THE FENCE, OR AS APPROVED BY THE ENGINEER.

ALTERNATIVE DRIVEWAY GATES (SINGLE PANEL):

WEIGHT: GALVANIZED STEEL, 75 LBS.
HEIGHT: APPROXIMATELY 42 IN. (5 PANELS),
WIDTH OF GATE OPENING: 16 FT.-0 IN. MINIMUM TO 20 FT.-0 IN. MAXIMUM.

GATES SHALL BE OF RIVETED CONSTRUCTION AS FOLLOWS:
MINIMUM FOUR NO. 10 RIVETS AT EACH RIGHT ANGLE CONNECTION AND WHERE DIAGONAL BRACES CONNECT TO HORIZONTAL PANELS.

MINIMUM THREE NO. 10 RIVETS WHERE DIAGONAL BRACES CONNECT TO TOP AND BOTTOM PANELS.

WALK GATES:

HEIGHT: APPROXIMATELY 42 IN. (5 PANELS)
WEIGHT: GALVANIZED STEEL, 16 LBS.; TEMPERED ALUMINUM, 10 LBS.
WIDTH OF GATE OPENING: 3 FT.-0 IN. MINIMUM.

ALTERNATIVE WALK GATES:

HEIGHT: 42 IN.
WEIGHT: NOT LESS THAN 18 LBS. COMPLETE WITH LATCH AND HINGES.
WIDTH OF GATE OPENING: 3 FT.-0 IN. MINIMUM.
GATE FRAME: 3/4 IN. I.D. STANDARD GALVANIZED PIPE OR ACCEPTABLE EQUIVALENT AND SHALL BE OF ALL-WELDED CONSTRUCTION.

WOVEN WIRE SHALL BE OF THE SAME CONSTRUCTION DESIGNATED FOR DRIVEWAY GATE.

ALTERNATIVE EQUIVALENT STANDARD METAL GATES OTHER THAN SHOWN WILL BE ACCEPTABLE SUBJECT TO THE ENGINEER'S APPROVAL.

IN LIEU OF GALVANIZED FINISH ON GATE FRAMES, CADMIUM-PLATED PIPE OR ALUMINUM PAINTING WILL BE ACCEPTED.

LATCHES AND HINGES:

GALVANIZED STEEL OR ALUMINUM OF STANDARD MANUFACTURE. HINGES SHALL BE PLACED AS SHOWN TO PREVENT THEFT.

IN LIEU OF STANDARD MAKE LATCHES, THE CONTRACTOR MAY USE AN ELECTRO-GALVANIZED CHAIN, EYEBOLT AND SNAPHOOK TYPE LATCH.

EYEBOLT, CHAIN AND SNAPHOOK ASSEMBLY SHALL BE SECURED TO LATCH SIDE OF GATE. GATE CLOSURE MAY BE ACCOMPLISHED BY WRAPPING CHAIN AROUND END POST AND SNAPPING HOOK INTO CHAIN.

WOOD STAYS:

WOOD STAYS SHALL BE UNTREATED NATIVE TIMBER. STAY DIMENSIONS SHALL BE 2 IN. x 2 IN. NOMINAL MINIMUM (1 1/2 IN. x 1 1/2 IN.).
WOOD STAYS MAY BE STAPLED, OR DRILLED AND TIED WITH WIRE.
METAL STAYS MAY BE TIED TO THE BOTTOM WIRE.

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WIRE FENCES AND GATES

Issued By: Project Development Branch July 4, 2012

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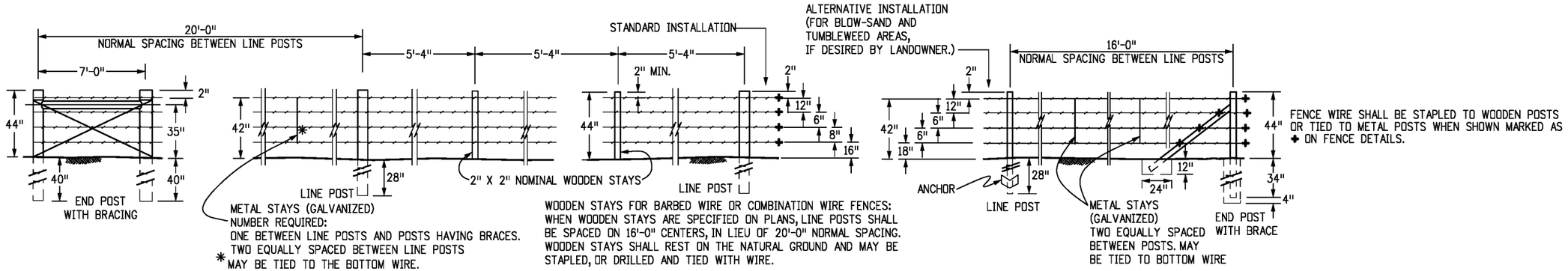
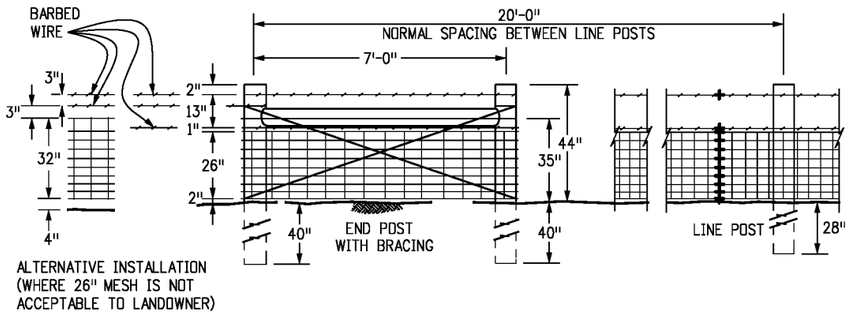
M-607-1

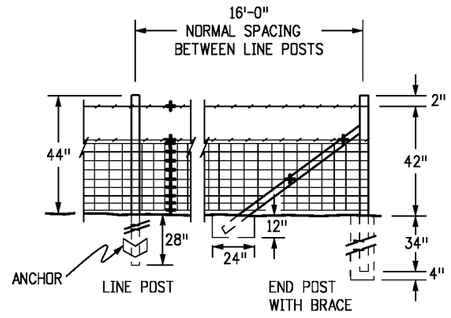


BARBED WIRE FENCE WITH WOODEN POSTS

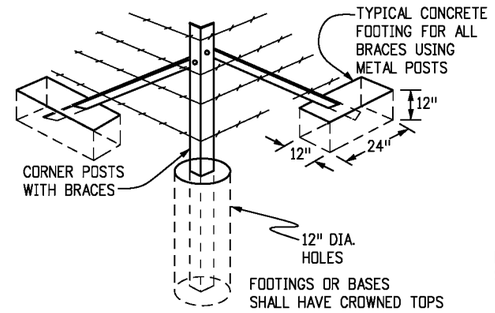
BARBED WIRE FENCE WITH METAL POSTS



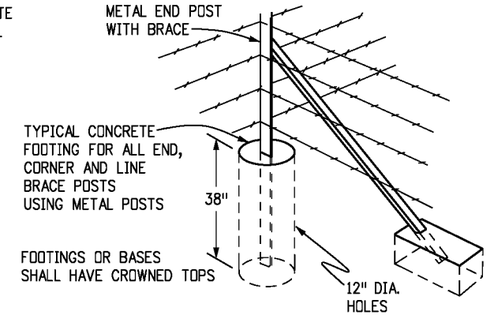
COMBINATION WIRE FENCE WITH WOODEN POSTS



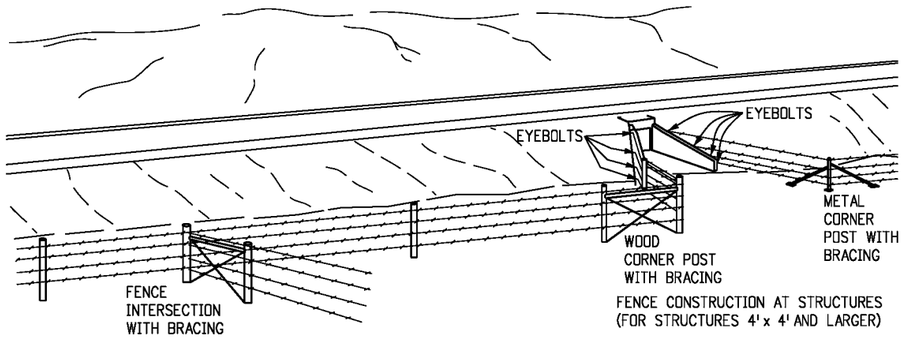
COMBINATION WIRE FENCE WITH METAL POSTS



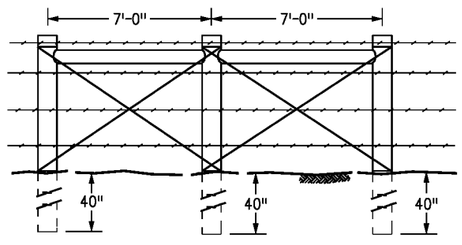
TYPICAL CORNER POST INSTALLATION

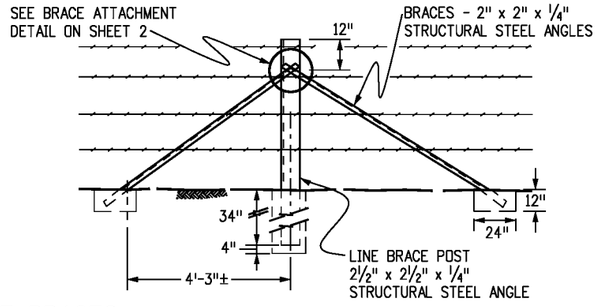


TYPICAL INSTALLATION AT FENCE INTERSECTIONS



FENCE CONSTRUCTION AT STRUCTURES
(FOR STRUCTURES 4' x 4' AND LARGER)





NOTES

1. AT ALL STRUCTURES OF 4 FT. x 4 FT. AND LARGER, THE FENCE SHALL END AT THE EYEBOLTS IN THE WINGS OF THE STRUCTURE. WHERE THE TYPE OF STRUCTURE PROHIBITS THE USE OF EYEBOLTS, AN END POST WITH BRACE SHALL BE USED.
2. EYEBOLTS SHALL BE MADE OF ½ IN. ROUND BARS WITH A MINIMUM OF 6 IN. OF BODY LENGTH EMBEDDED (HOOKED OR BENT) IN FRESH CONCRETE.
3. FOR EYEBOLTS IN EXISTING CONCRETE, THE ½ IN. ROUND BARS SHALL BE DEFORMED AND GROUTED INTO DRILLED HOLES.
4. EYEBOLTS SHALL HAVE A MINIMUM OF 1 IN. INSIDE EYE DIAMETER.
5. EYEBOLTS SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. EYEBOLTS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

LINE BRACES

WHEN GATES, ANGLES, CORNERS OR INTERSECTING FENCES ARE NOT REQUIRED, LINE BRACES SHALL BE SPACED AS FOLLOWS:
METAL POSTS - 800 FT. INTERVALS
WOOD POSTS - 1,400 FT. INTERVALS

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WIRE FENCES AND GATES

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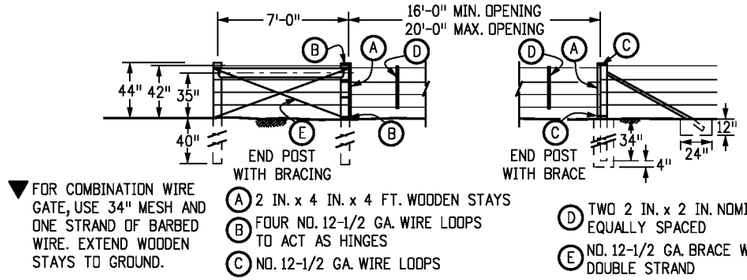
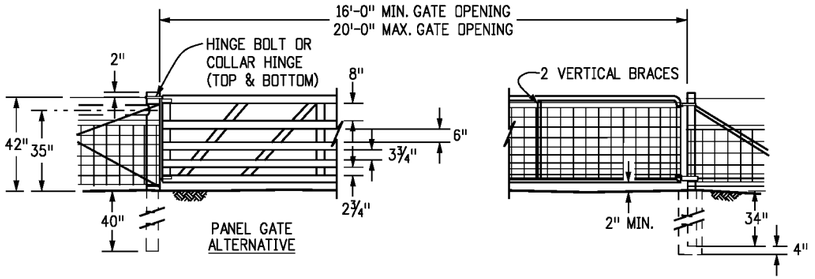


▼ FOR COMBINATION WIRE GATE, USE 34" MESH AND ONE STRAND OF BARBED WIRE. EXTEND WOODEN STAYS TO GROUND.

(A) 2 IN. x 4 IN. x 4 FT. WOODEN STAYS
(B) FOUR NO. 12-1/2 GA. WIRE LOOPS TO ACT AS HINGES
(C) NO. 12-1/2 GA. WIRE LOOPS
(D) TWO 2 IN. x 2 IN. NOMINAL WOODEN STAYS EQUALLY SPACED
(E) NO. 12-1/2 GA. BRACE WIRE, DOUBLE STRAND

WOODEN POSTS **METAL END POSTS**

▼ BARBED WIRE GATE

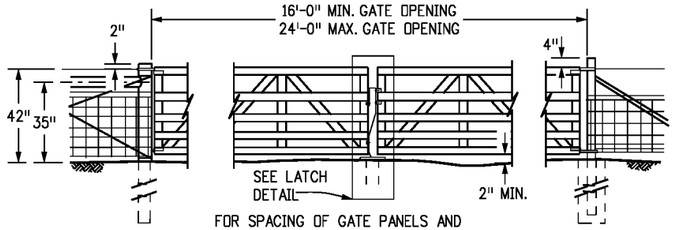


WOODEN POSTS (16'-0" MAX.)

METAL END POSTS (20'-0" MAX.)

DRIVEWAY GATES

(METAL AND WOOD END POSTS SHALL BE BRACED SAME AS FOR BARBED WIRE GATES)

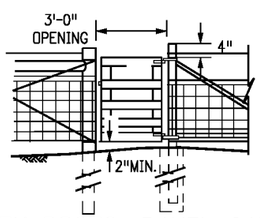


FOR SPACING OF GATE PANELS AND LENGTH OF POSTS, SEE DETAIL ABOVE.

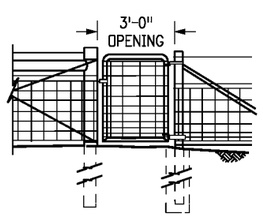
WOODEN POSTS **PANEL GATE POSTS**

TWIN DRIVEWAY GATES

(METAL AND WOOD END POSTS SHALL BE BRACED SAME AS FOR BARBED WIRE GATES)



FOR LENGTH OF POSTS AND SPACING OF WIRE AND GATE PANELS, SEE DRIVEWAY GATE DETAIL ABOVE.



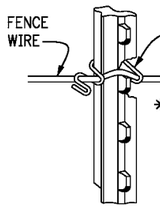
WOODEN POSTS **PANEL GATE POSTS**

WALK GATE

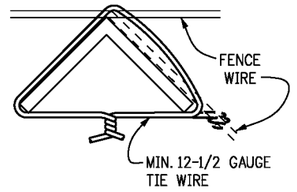
WOODEN POSTS **METAL END POSTS**

ALTERNATIVE WALK GATE

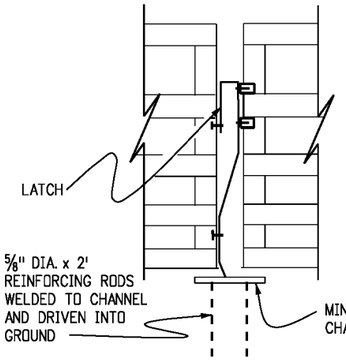
(METAL AND WOOD END POSTS SHALL BE BRACED SAME AS FOR BARBED WIRE GATES)



TIES FOR "STUDDED TEE" OR "U" POSTS



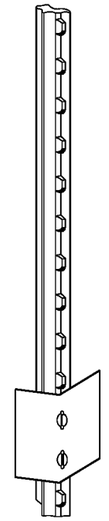
TIES FOR ANGLE POSTS FENCE WIRE TIES



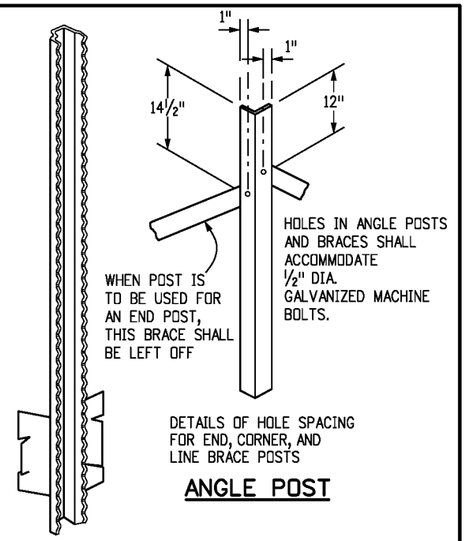
LATCH DETAIL

BORE A ⅜" x 2" HOLE IN EACH POST AND BRACE TO RECEIVE THE PINS. WRAP THE ENDS OF THE BRACES TIGHTLY WITH SEVERAL TURNS OF 12-½ GA. SMOOTH GALV. WIRE TO PREVENT SPLITTING OR NOTCH POST AND NAIL WITH 40d COMMON NAILS.

CROSS BRACE DOWELING DETAIL



STUDDED "TEE" LINE POST

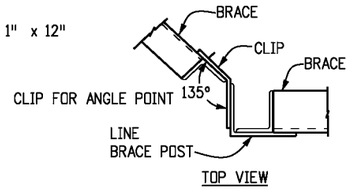


DETAILS OF HOLE SPACING FOR END, CORNER, AND LINE BRACE POSTS

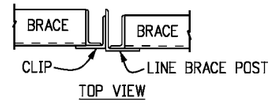
ANGLE POST

"U" LINE POST

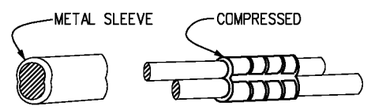
TYPICAL METAL POSTS



TOP VIEW

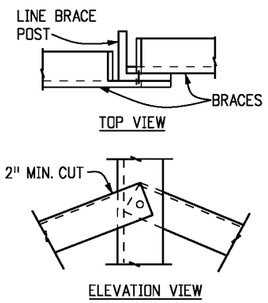


TOP VIEW

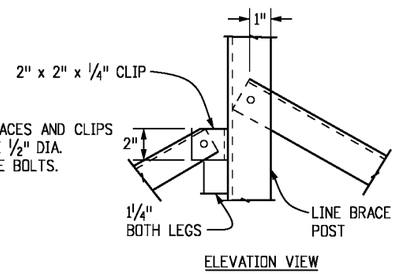


SPLICING SLEEVE SHALL BE APPROVED BY THE ENGINEER

WIRE SPLICE



⌀ BRACE ATTACHMENT DETAIL



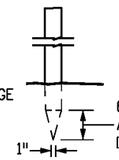
HOLES IN POSTS, BRACES AND CLIPS SHALL ACCOMMODATE ½" DIA. GALVANIZED MACHINE BOLTS.

ELEVATION VIEW

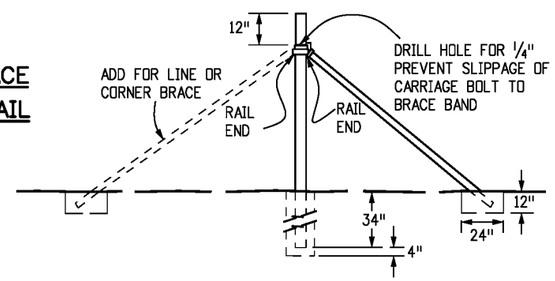
⌀ ALTERNATIVE BRACE ATTACHMENT DETAIL

⌀ ALTERNATIVE ATTACHMENT METHODS, ACCEPTABLE TO THE ENGINEER, MAY BE USED.

WOODEN POSTS MAY BE DRIVEN IN LIEU OF SETTING AND TAMPING, AT THE OPTION OF THE CONTRACTOR. DRIVING METHODS SHALL NOT DAMAGE POST.



POST POINTING



ALTERNATIVE POST

(FOR END, CORNER OR LINE BRACE POSTS)

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WIRE FENCES AND GATES

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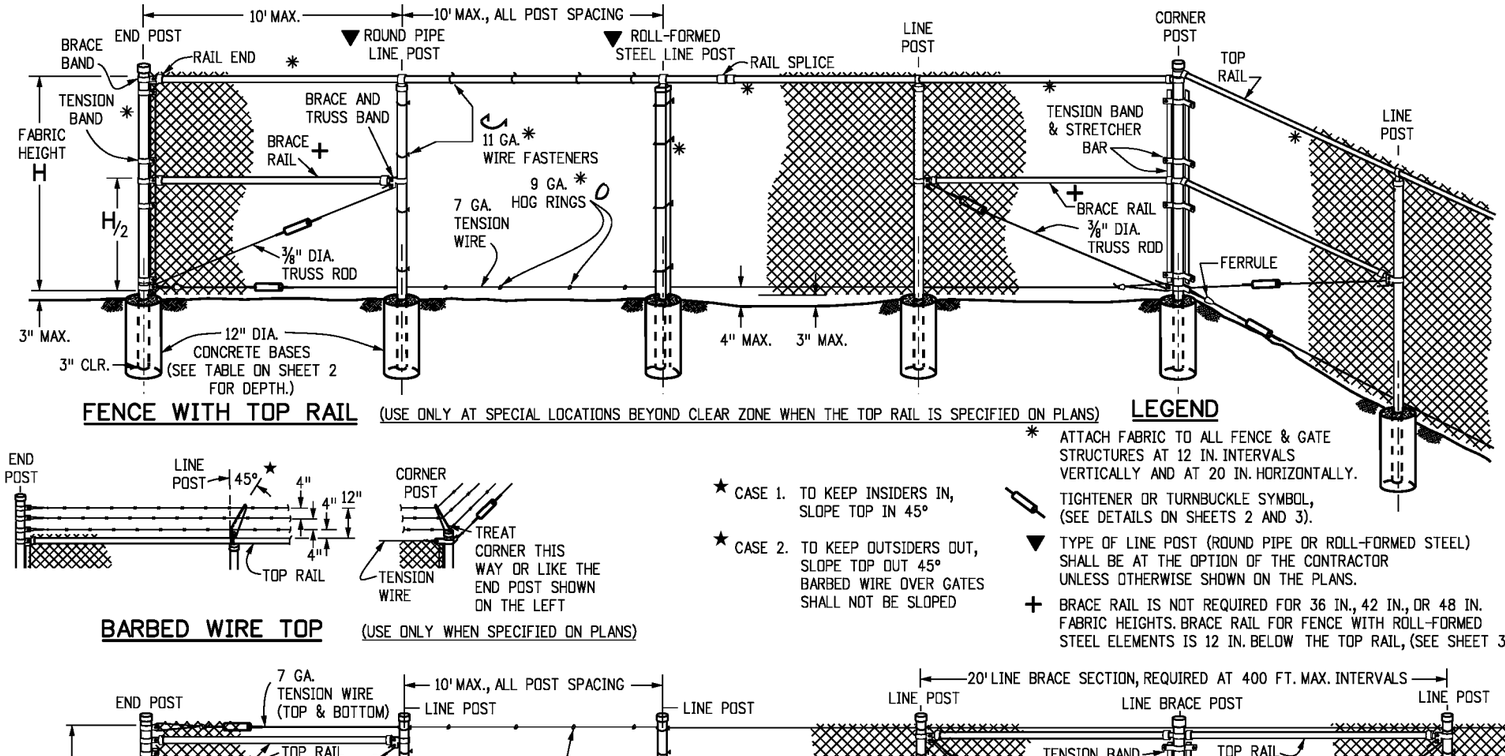


FENCE WITH TOP RAIL

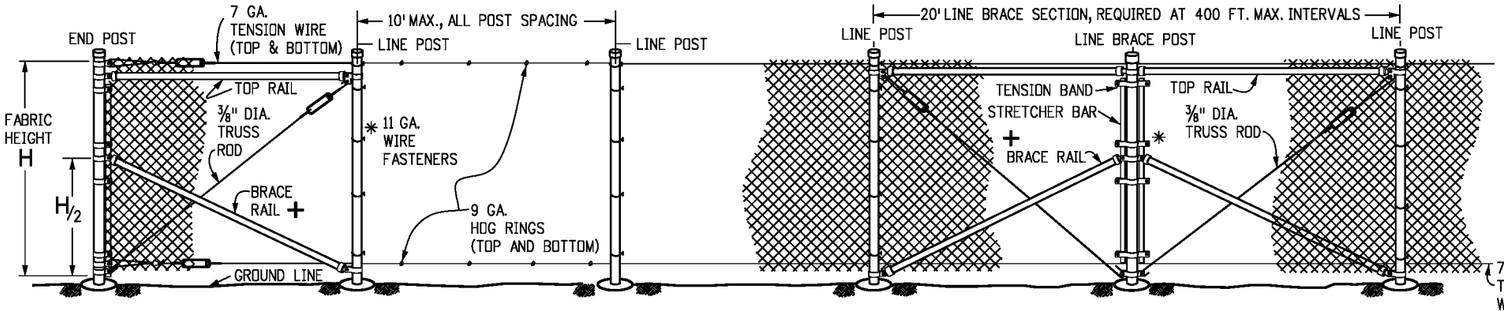
(USE ONLY AT SPECIAL LOCATIONS BEYOND CLEAR ZONE WHEN THE TOP RAIL IS SPECIFIED ON PLANS)

BARBED WIRE TOP

(USE ONLY WHEN SPECIFIED ON PLANS)

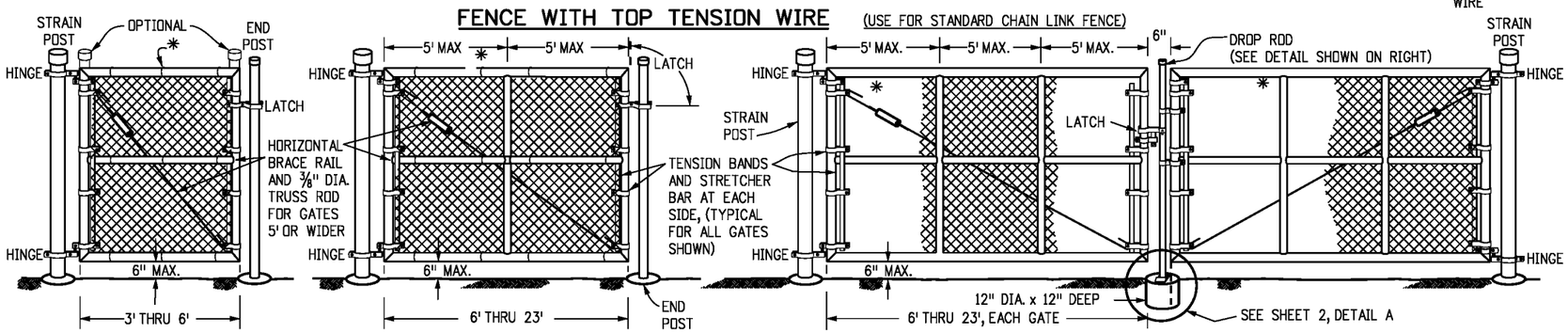
LEGEND

- ✱ ATTACH FABRIC TO ALL FENCE & GATE STRUCTURES AT 12 IN. INTERVALS VERTICALLY AND AT 20 IN. HORIZONTALLY.
- ★ CASE 1. TO KEEP INSIDERS IN, SLOPE TOP IN 45°
- ★ CASE 2. TO KEEP OUTSIDERS OUT, SLOPE TOP OUT 45° BARBED WIRE OVER GATES SHALL NOT BE SLOPED
- TIGHTENER OR TURNBUCKLE SYMBOL, (SEE DETAILS ON SHEETS 2 AND 3).
- ▼ TYPE OF LINE POST (ROUND PIPE OR ROLL-FORMED STEEL) SHALL BE AT THE OPTION OF THE CONTRACTOR UNLESS OTHERWISE SHOWN ON THE PLANS.
- \+ BRACE RAIL IS NOT REQUIRED FOR 36 IN., 42 IN., OR 48 IN. FABRIC HEIGHTS. BRACE RAIL FOR FENCE WITH ROLL-FORMED STEEL ELEMENTS IS 12 IN. BELOW THE TOP RAIL, (SEE SHEET 3).

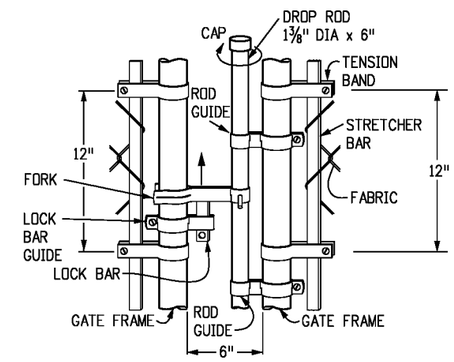


FENCE WITH TOP TENSION WIRE

(USE FOR STANDARD CHAIN LINK FENCE)



WALK GATE | SINGLE GATE | DOUBLE GATE



TYPICAL DROP ROD ASSEMBLY

GENERAL NOTES

1. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION, OR SECONDARY LINE CROSSES A FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRIC CODE. A GROUND SHALL ALSO BE INSTALLED A MAXIMUM OF EVERY 500 FT. ALONG THE FENCE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF ½ IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7½ FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE FENCE.
2. H (HEIGHT OF FABRIC) SHALL BE AS SHOWN ON THE PLANS. FABRIC IS AVALIABLE IN THE FOLLOWING HEIGHTS: 36 IN., 42 IN., 48 IN., 60 IN., 72 IN., 84 IN., 96 IN., 108 IN., 120 IN., AND 144 IN.
3. CHAIN LINK FENCE SHALL CONFORM TO AASHTO M 181.
4. CHAIN LINK FABRIC SHALL BE 2 IN. MESH NO. 9 GAGE GALVANIZED OR ALUMINUM COATED WIRE SECURELY FASTENED TO TENSION WIRE, LINE POSTS, RAILS, BRACES AND STRETCHER BARS SPACED AS SHOWN HEREON. WIRE FASTENERS AND TIE CLIPS SHALL BE NO. 11 GAGE (W&M) GALVANIZED STEEL WIRE OR NO. 7 GAGE (B&S) ALUMINUM WIRE, AND HOG RINGS SHALL BE NO. 9 GAGE, ALL IN CONFORMANCE WITH ASTM F 626.
5. STEEL POSTS, RAILS AND GATE FRAMES SHALL CONFORM TO AASHTO M 181 TYPE 1, GRADE 1 OR GRADE 2.
6. AT THE CONTRACTOR'S OPTION, PIPE USED FOR FENCE CONSTRUCTION SHALL CONFORM TO THE DIMENSIONS AND WEIGHTS FOR EITHER "ORDINARY PIPE" OR "ALTERNATIVE PIPE" AS SHOWN ON SHEET 2. "ALTERNATIVE PIPE" SHALL BE HIGH STRENGTH STEEL PIPE CONFORMING TO FEDERAL SPECIFICATION RR-F-191/3C.
7. TENSION WIRE SHALL BE CONTINUOUS BETWEEN END OR CORNER POST AND LINE BRACE POST. A TURNBUCKLE OR OTHER APPROVED TIGHTENING DEVICE SHALL BE USED FOR EACH CONTINUOUS SPAN OF TENSION WIRE.
8. TENSION WIRE SHALL CONFORM TO AASHTO M 181.
9. CONCRETE FOOTINGS SHALL HAVE TOPS CROWNED AT GROUND LEVEL AND SHALL BE CLASS B. CONCRETE WITH LIGHTWEIGHT AGGREGATE CONFORMING TO AASHTO M 195, MAY BE SUBSTITUTED.
10. TERMINATION OF FENCE AT BRIDGES OR OTHER STRUCTURES SHALL BE AS SHOWN ON THE PLANS.
11. CHAIN LINK FABRIC UP TO 5 FT. HIGH SHALL BE KNUCKLED AT THE TOP AND BOTTOM SELVAGES. FABRIC OVER 5 FT. HIGH SHALL BE TWISTED AND BARBED ON THE TOP SELVAGE AND KNUCKLED ON THE BOTTOM SELVAGE.
12. FENCE MAY BE CONSTRUCTED WITH EITHER ROUND PIPE OR ROLL-FORMED STEEL COMPONENTS. THE CONTRACTOR SHALL STATE AT THE PRECONSTRUCTION CONFERENCE, THE TYPE OF CONSTRUCTION AND TYPE OF LINE POST TO BE USED THROUGHOUT THE PROJECT.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RE-ESTABLISHING DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY IN ACCORDANCE WITH SUBSECTION 625.08 OF THE STANDARD SPECIFICATIONS.

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CHAIN LINK FENCE

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-607-2
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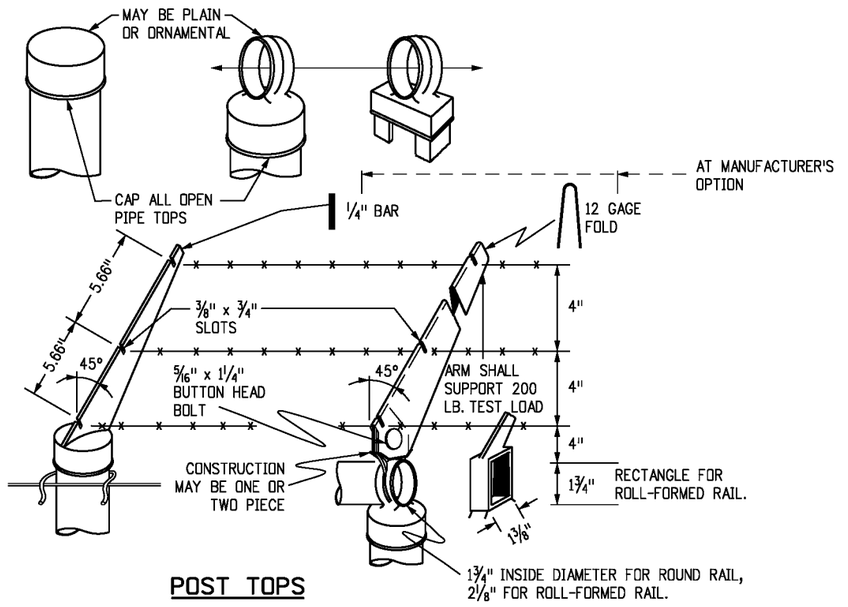
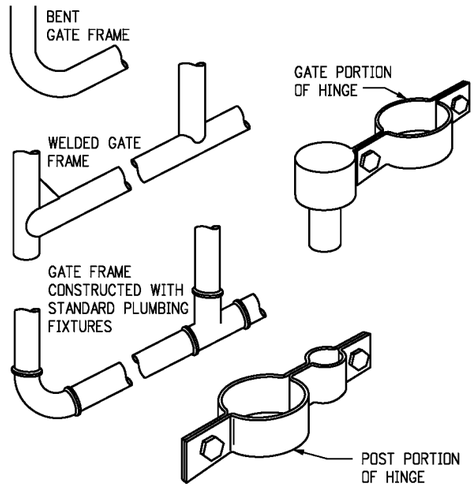
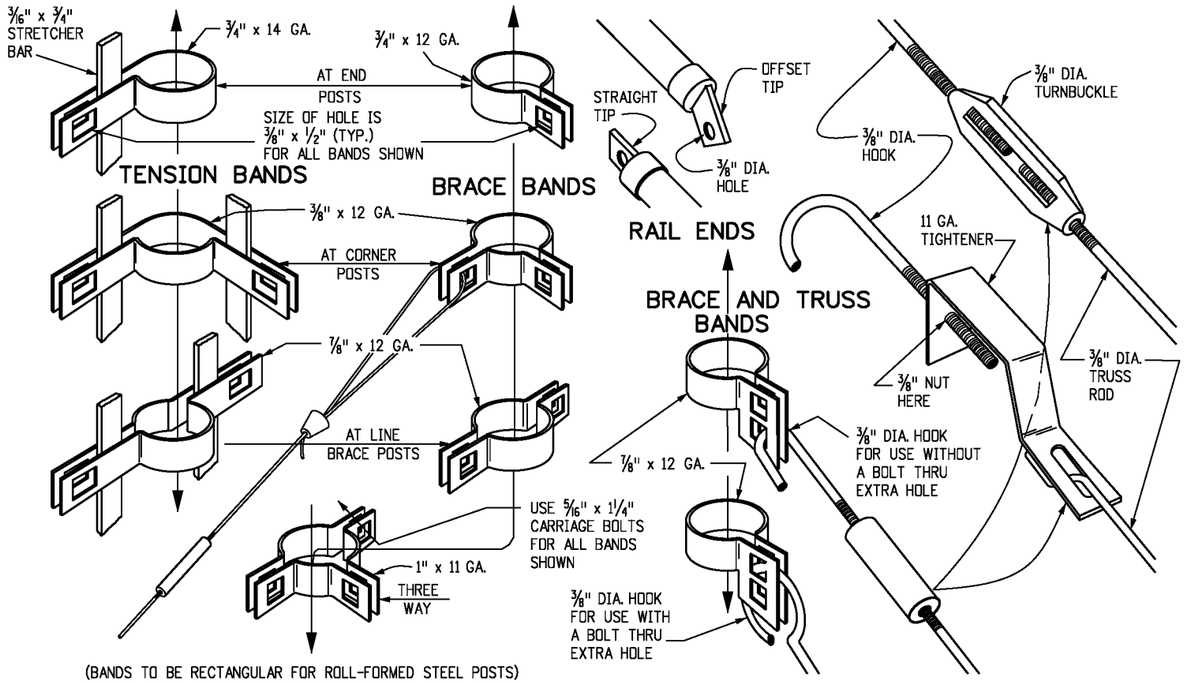


POST TOPS



GATE FRAMES & HINGE



BANDS, RAIL ENDS & TIGHTENERS (DIMENSIONS SHOWN ARE MINIMUMS)

FENCE MATERIAL

FABRIC HEIGHT	END, CORNER AND LINE BRACE POSTS		LINE POSTS		TOP & BRACE RAILS	
H	ROUND PIPE I.D.	ROLL-FORMED STEEL	ROUND PIPE I.D.	ROLL-FORMED STEEL	ROUND PIPE I.D.	ROLL-FORMED STEEL
FEET	INCHES		INCHES		INCHES	
3 THRU 6	2.5	3.5 x 3.5	1.5	1.875 x 1.625	1.25	1.25 x 1.625
> 6 THRU 8	2.5	3.5 x 3.5	2.0	1.875 x 1.625	1.25	1.25 x 1.625
> 8 THRU 12	2.5	3.5 x 3.5	2.0	2.250 x 1.625	1.25	1.25 x 1.625

FABRIC HEIGHT	△ CONCRETE BASE			
	DEPTH	DIA.	DEPTH	DIA.
H				
FEET	INCHES		INCHES	
3 THRU 4	34	12	28	12
> 4 THRU 12	40	12	40	12

△ ALL POSTS 3 IN CLEAR FROM BOTTOM OF CONCRETE BASE

ORDINARY PIPE

NOMINAL I.D.	O.D.	WALL THICK.	WEIGHT
INCHES			LB/FT
1.25	1.660	0.140	2.27
1.50	1.900	0.145	2.72
2.00	2.375	0.154	3.65
2.50	2.875	0.203	5.79
3.00	3.500	0.216	7.58
3.50	4.000	0.226	9.11
4.00	4.500	0.237	10.79
5.00	5.563	0.258	14.62
6.00	6.625	0.280	18.97
8.00	8.625	0.322	28.55

ALTERNATIVE PIPE

NOMINAL I.D.	O.D.	WALL THICK.	WEIGHT
INCHES			LB/FT
1.25	1.660	0.111	1.836
1.50	1.900	0.120	2.281
2.00	2.375	0.130	3.117
2.50	2.875	0.160	4.640

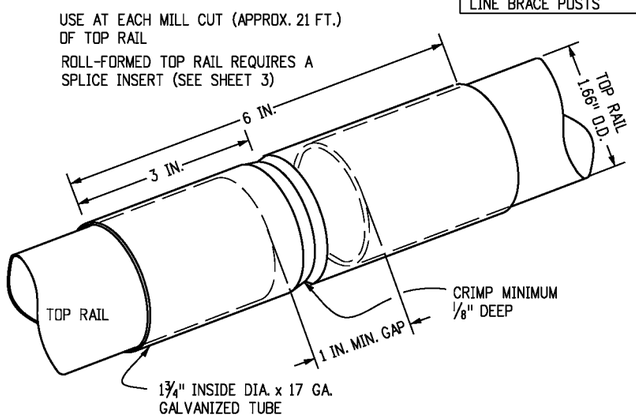
GATE MATERIAL

GATE FRAME WIDTH	STRAIN POST		△ CONCRETE BASE	
	ROUND I.D.	ROLL-FORMED	DEPTH	DIA.
FEET	INCHES		INCHES	
3 THRU 6	2.5	3.5 x 3.5	36	12
> 6 THRU 13	3.5		42	12
> 13 THRU 18	6.0		48	18
> 18 THRU 23	8.0		48	24

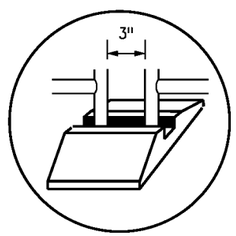
GATE FRAME		FRAME PIPE	BRACING PIPE
WIDTH	HEIGHT	I.D.	I.D.
FEET		INCHES	
3 THRU 8	3 THRU 6	1.25	1.25
> 8 THRU 23	6	1.50	1.25
> 8 THRU 23	> 6 THRU 12	1.50	1.50

ROLL-FORMED STEEL

PART	SIZE	THICK.	WEIGHT
	INCHES	GAGE	LB/FT
TOP & BRACE RAILS	1.250 x 1.625	14	2.08
LINE POST (H: 3FT - 6FT)	1.875 x 1.625	12	2.75
LINE POST (H: > 6FT - 8FT)	1.875 x 1.625	11	3.36
LINE POST (H: > 8FT - 12FT)	2.250 x 1.625	11	4.02
END, CORNER & LINE BRACE POSTS	3.50 x 3.50	10	7.59



RAIL SPLICE



DROP ROD IS OPTIONAL IF GATE FRAMES EXTEND DOWN TO CENTER REST. USE LATCH SHOWN FOR WALK OR SINGLE GATE.

DETAIL A TYPICAL CENTER REST

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CHAIN LINK FENCE

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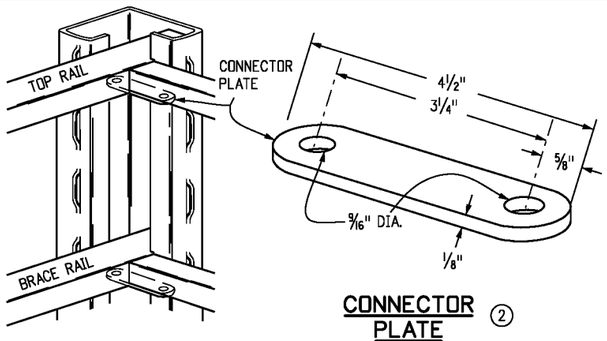
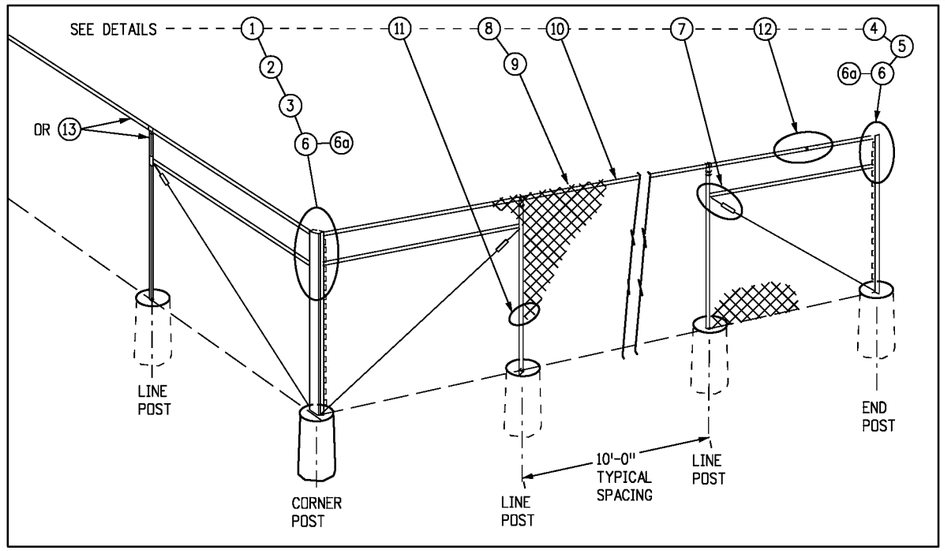
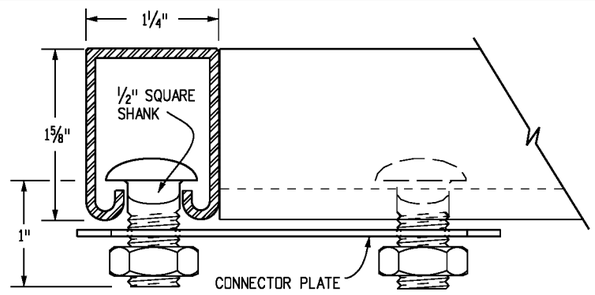


CORNER POST TREATMENT ①

CONNECTOR PLATE ②

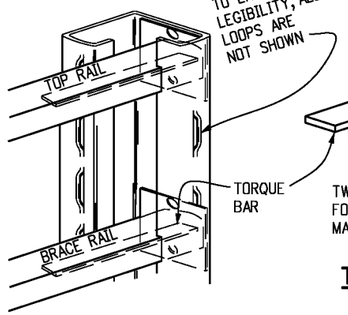


KEY TO DETAILS

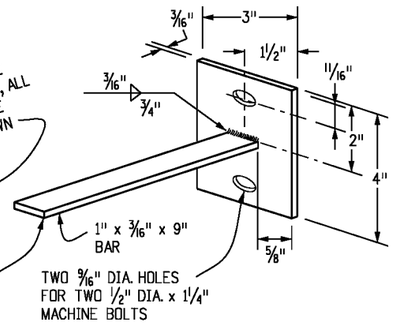


RAIL (SHOWING CORNER ASSEMBLY) ③

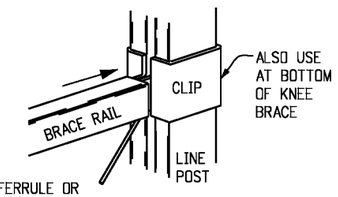
14 GAGE ROLL-FORMED STEEL, 20 FT. LENGTHS, 1.40 LB. PER LIN. FT.

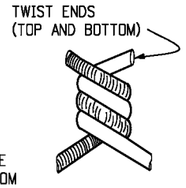


END POST TREATMENT ④

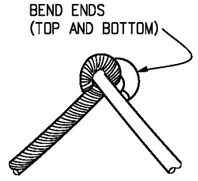


TORQUE BAR ⑤



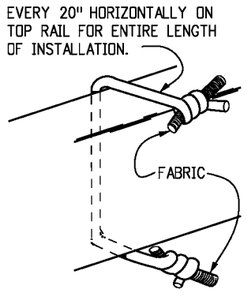


BARBED SELVAGE ⑧

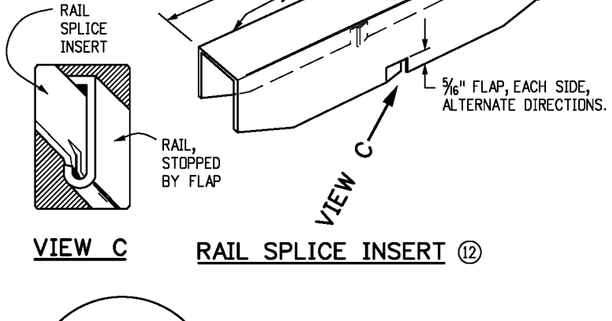


KNUCKLED SELVAGE ⑨

ALTERNATIVE, USE ONLY WHEN CALLED FOR ON THE PLANS

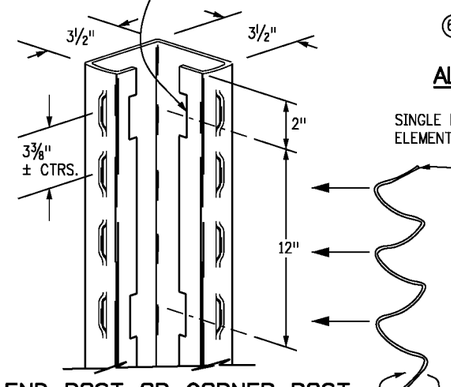


WIRE FASTENER ⑩



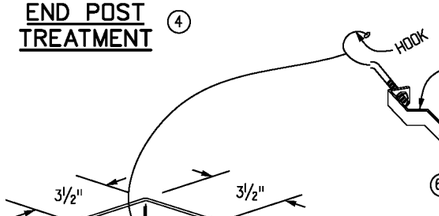
VIEW C

RAIL SPLICE INSERT ⑫

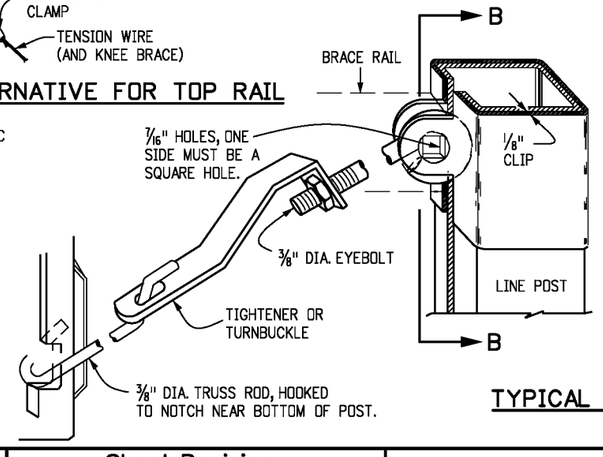


END POST OR CORNER POST ⑥

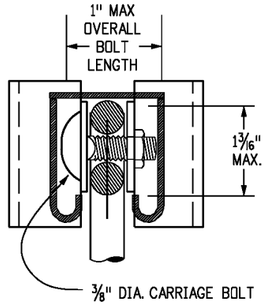
10 GAGE ROLL-FORMED STEEL, 5.10 LB. PER LINEAR FT.



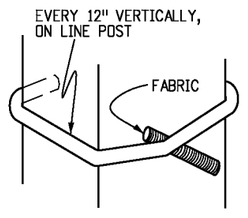
ALTERNATIVE FOR TOP RAIL



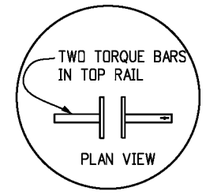
TYPICAL BRACING ⑦



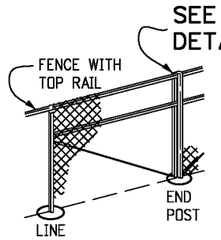
SECTION B-B

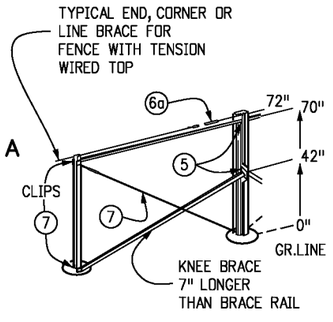


TIE CLIP ⑪



DETAIL A





LINE BRACE (ONE HALF SHOWN) ⑬

400 FT. INTERVALS

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CHAIN LINK FENCE

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STANDARD PLAN NO.

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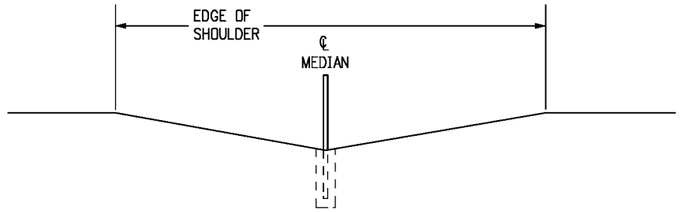
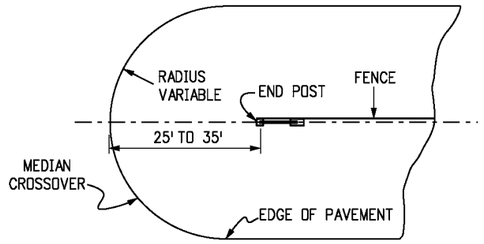
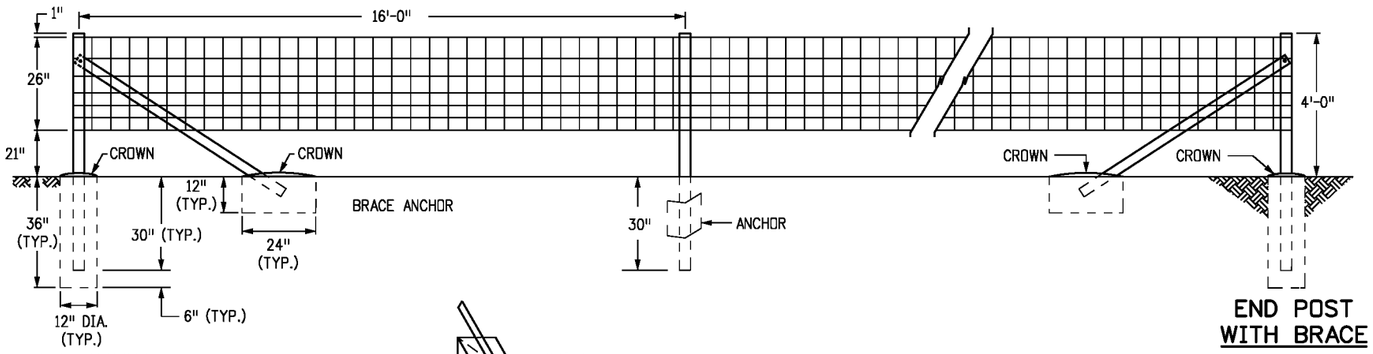
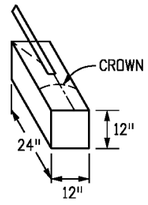




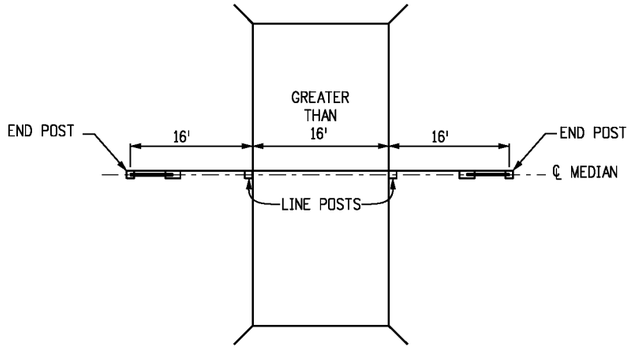


END POST WITH BRACE

END POST WITH BRACE



SKETCH OF BRACE ANCHOR



LOCATION OF BARRIER FENCE AT BOX CULVERTS WITH NO FILL

SPECIFICATIONS

END POSTS:
- TYPE: 2½" x 2½" x ¼" STRUCTURAL STEEL ANGLES
- WEIGHT: 4.10 LBS. PER LIN. FT. NOMINAL (RAW)
- LENGTH: 6'-6" MINIMUM
- NO. OF BRACES: ONE

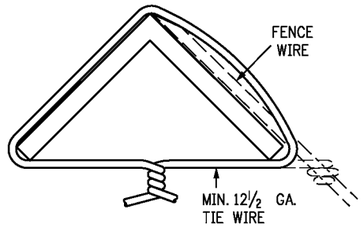
LINE POSTS:
- TYPE: "STUDDED TEE" OR "U" POST
- WEIGHT: 1.33 LBS. PER LIN. FT. NOMINAL WITHOUT ANCHOR. (RAW)
- LENGTH: 6'-6" MINIMUM
- ANCHOR: SECURELY FASTENED, WITH BEARING SURFACE SUFFICIENT TO RESIST MOVEMENT OF POST. WGT. 0.67 LBS. MINIMUM

BRACES:
- TYPE: 2" x 2" x ¼" STRUCTURAL STEEL ANGLES
- WEIGHT: 3.19 LBS. PER LIN. FT. NOMINAL (RAW)
- LENGTH: 6'-6" MINIMUM

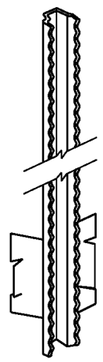
WOVEN WIRE FENCE FABRIC:
- STYLE OR DESIGN NUMBER: 726 - 6 - 12½

TIES:
- END POSTS: EACH HORIZONTAL WIRE OF WOVEN WIRE FABRIC TO BE WRAPPED AROUND POST AND FASTENED IN ADDITION TO TWO TIE WIRES.
- LINE POSTS: MINIMUM THREE TIES PER POST FOR WOVEN WIRE FABRIC

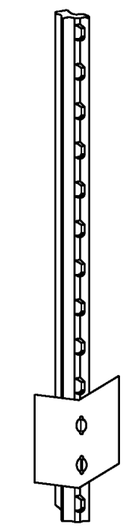
TIES FOR "STUDDED TEE" OR "U" POSTS



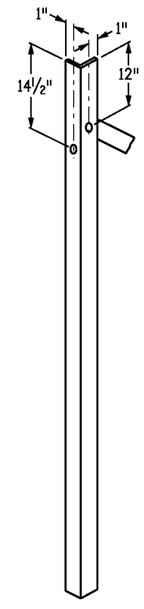
END POST TIE



"U" LINE POST



"STUDDED TEE" LINE POST



END POST WITH BRACING

NOTE: HOLES IN END POSTS AND BRACES SHALL ACCOMMODATE ½" DIA. GALVANIZED MACHINE BOLTS.

GENERAL NOTES

1. ALL POSTS AND BRACES SHALL BE OF THE TYPES AND WEIGHTS SHOWN ON THIS SHEET OR ACCEPTABLE EQUIVALENTS, ALL IN CONFORMANCE WITH AASHTO M 281. HOLES TO BE PROVIDED IN END POSTS AS DETAILED. ADDITIONAL END POSTS SHALL BE SUPPLIED FOR PULL BRACE POSTS WHEN REQUIRED BY THE ENGINEER.
2. LINE BRACE POSTS SHALL BE INSTALLED EVERY 800 FT. OR LESS WHERE THE FENCING IS CONTINUOUS. THE COST SHALL BE INCLUDED IN THE WORK. SEE STANDARD PLAN M-607-1.
3. WOVEN WIRE FENCE FABRIC, USED AS SHOWN, SHALL BE GALVANIZED (ZINC-COATED) CLASS 1 AND CONFORM TO AASHTO M 279 (ASTM A 116).
4. CONCRETE FOOTINGS SHALL HAVE TOPS CROWNED AT GROUND LEVEL AND SHALL BE CLASS B. CONCRETE WITH LIGHT WEIGHT AGGREGATE, CONFORMING TO AASHTO M 195 (ASTM C 330) WILL BE PERMITTED. THE COST OF THE CONCRETE SHALL BE INCLUDED IN THE WORK.
5. ON CURVES, FENCE WIRE SHALL BE PLACED ON SIDE OF POST WHICH WILL RESULT IN THE LEAST AMOUNT OF TENSION ON FENCE TIES.
6. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF ½ IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7½ FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

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BARRIER FENCE

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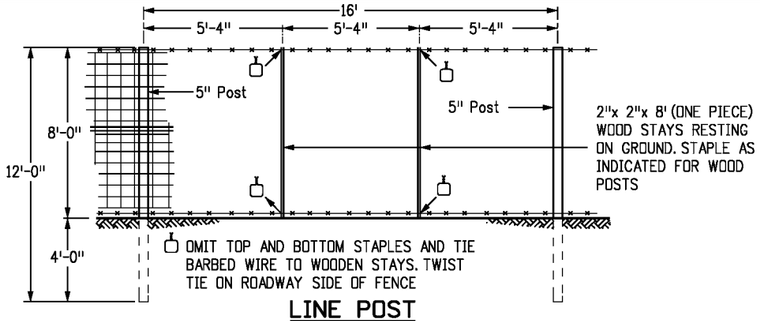
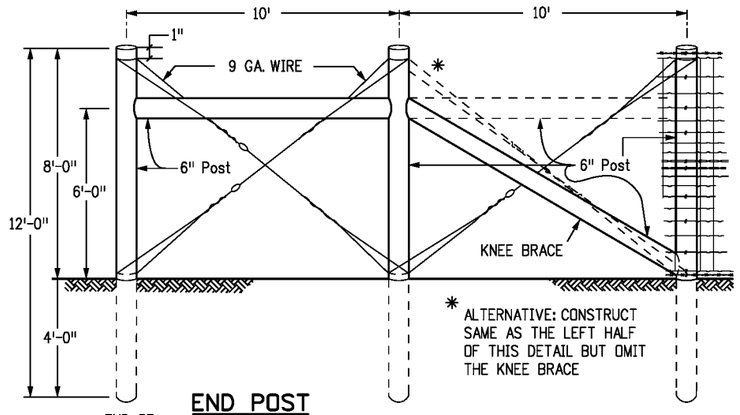
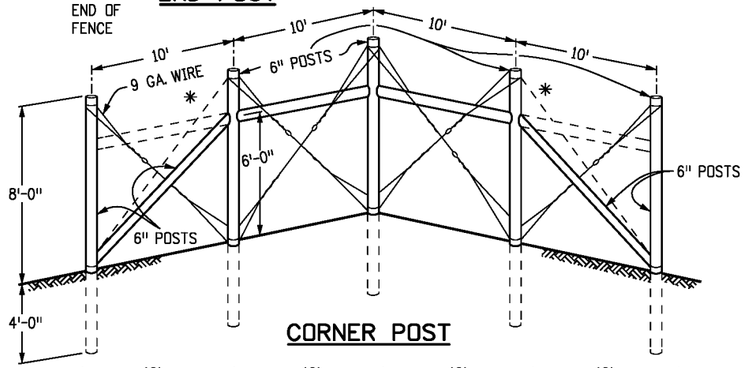


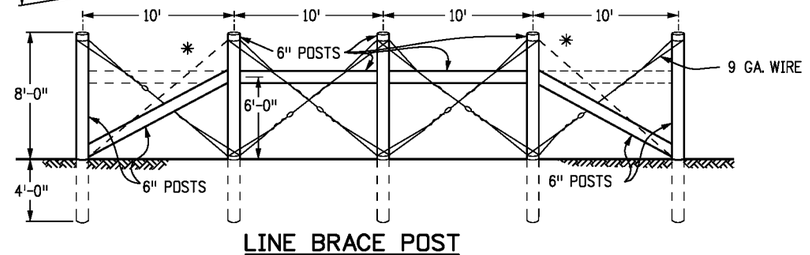
LINE POST



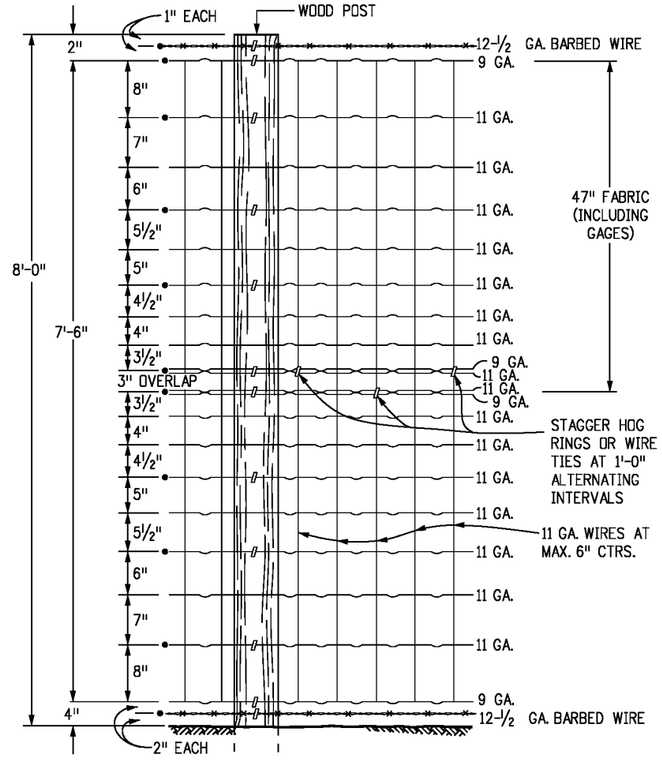
END POST



CORNER POST

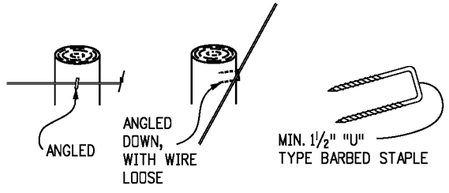


LINE BRACE POST

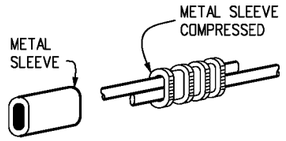


•FENCE WIRE SHALL BE STAPLED TO WOOD POSTS AND STAYS

DEER FENCE WIRE FABRIC

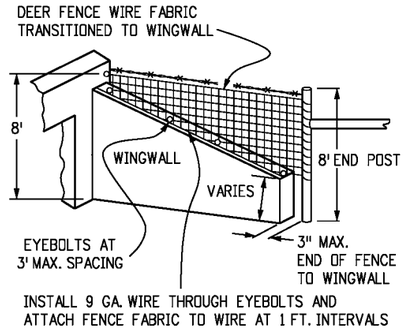


TYPICAL STAPLING

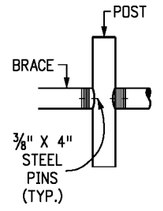


USE A SPLICING SLEEVE APPROVED BY THE ENGINEER

WIRE SPLICE



DEER FENCE TO WINGWALL



BORE A 3/8" X 2" HOLE IN EACH BRACE AND POST TO RECEIVE THE PINS. WRAP THE ENDS OF THE BRACES WITH SEVERAL TURNS OF 12-1/2 GAGE SMOOTH GALV. WIRE TO PREVENT SPLITTING. OR: NOTCH POST AND NAIL WITH 40d COMMON NAILS

CROSS BRACE DOWELING

GENERAL NOTES

1. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF 1/2 IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7 1/2 FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
2. END POST, CORNER POST, AND LINE BRACE POST SHALL BE ASSEMBLED AND PAID FOR BY THE UNIT. ALL WORK AND MATERIAL ASSOCIATED WITH EACH ASSEMBLY SHALL BE INCLUDED IN THE UNIT PRICE FOR THAT ASSEMBLY.
3. LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER AND LINE BRACE POSTS ARE NOT SPECIFIED.
4. ALL LINE POSTS SHALL BE 5 IN. MIN. DIA. AND 12 FT. LONG. ALL END, CORNER AND LINE BRACE POSTS SHALL BE 6 IN. MIN. DIA. AND 12 FT. LONG. ALL POSTS AND BRACES SHALL BE TREATED IN ACCORDANCE WITH SUBSECTION 710.07.
5. WOODEN STAYS SHALL BE UNTREATED NATIVE TIMBER. BOTTOM ENDS OF STAYS SHALL REST ON THE NATURAL GROUND AND SHALL BE WIRED AND STAPLED AS SHOWN.
6. BARBED WIRE SHALL BE DOUBLE WRAPPED AND TIED OFF AT END POSTS, CORNER POSTS AND LINE BRACE POSTS. WOVEN WIRE SHALL BE SINGLE WRAPPED AND TIED OFF. THE REST OF FENCE SHALL BE RESTARTED IN LIKE MANNER.
7. FENCE WIRE MAY BE PLACED ON EITHER THE ROAD SIDE OR THE FIELD SIDE OF POSTS, DEPENDING ON LOCAL CONDITIONS; i.e., ON CURVES, THE WIRE SHOULD BE PLACED ON THE SIDE WHICH WOULD RESULT IN THE LEAST AMOUNT OF TENSION ON THE STAPLES. THIS ALSO APPLIES WHERE WIND DRIFT OR OTHER CONDITIONS WOULD EXERT UNUSUAL PRESSURE AGAINST THE WIRE.
8. WHERE CONCRETE STRUCTURES ARE USED AS DEER PASSES, THE FENCE SHALL END AT EYEBOLTS IN WINGS OF THE STRUCTURE. EYEBOLTS IN FRESH CONCRETE SHALL BE 1/2 IN. ROUND BARS AND EMBEDDED A MINIMUM OF 6 IN. WITH A HOOKED OR BENT END. IN EXISTING CONCRETE, THE 1/2 IN. ROUND BARS SHALL BE DEFORMED AND GROUTED INTO DRILLED HOLES. EYEBOLTS SHALL HAVE A MINIMUM OF 1 IN. INSIDE EYE DIAMETER AND SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR. COST OF EYEBOLTS SHALL BE INCLUDED IN THE CONTRACT PRICE FOR FENCING.
9. WOVEN WIRE FENCE FABRIC SHALL CONFORM TO AASHTO M 279 (ASTM A 116) DESIGN NO. 1047-6-1 WITH CLASS 1 COATING.
10. STEEL BARBED WIRE SHALL CONFORM TO AASHTO M 280 (ASTM A 121) 12-1/2 GAGE WITH CLASS 1 COATING.
11. ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232.
12. DEER GATE AND TOP BRACES SHALL BE PAINTED WITH GREEN PAINT ACCORDING TO SUBSECTION 708.03 AND COLOR NO. 14109 OF FEDERAL STANDARD 595B.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RE-ESTABLISHING DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY IN ACCORDANCE WITH SUBSECTION 625.08 OF THE STANDARD SPECIFICATIONS.

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DEER FENCE AND GATES

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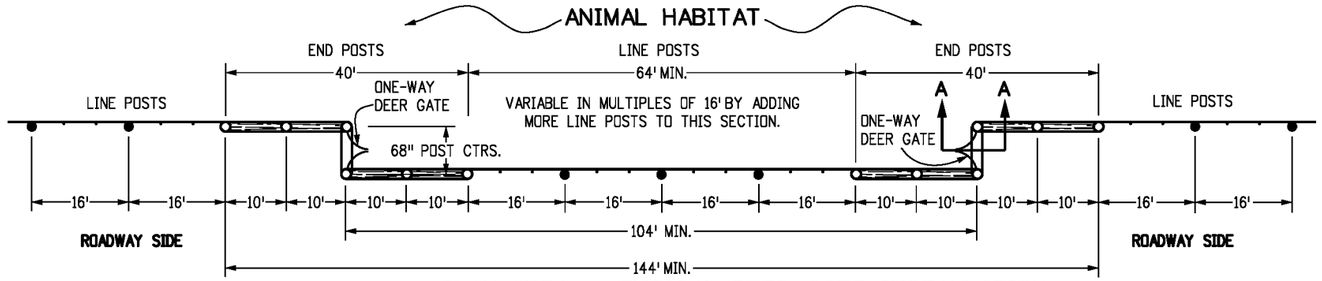


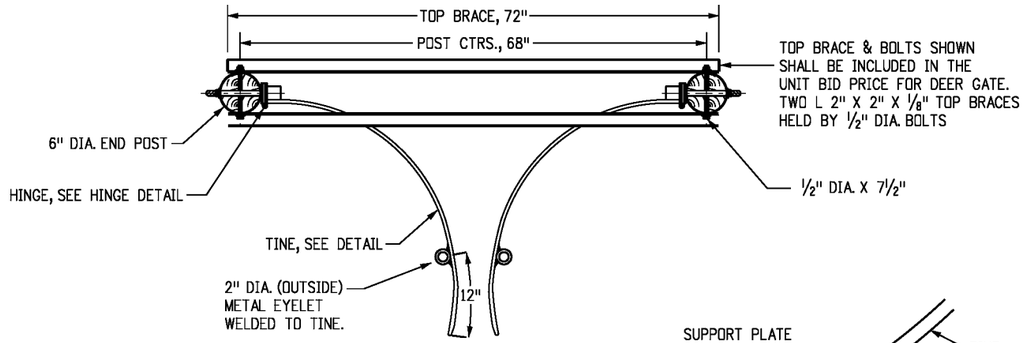
PLAN VIEW - TYPICAL DEER GATE INSTALLATION

LEGEND

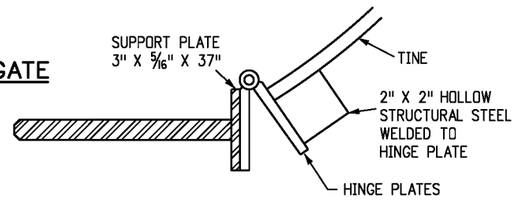
- =LINE POST
- =WOODEN STAY
- =END POST
- =BRACE

NOTES

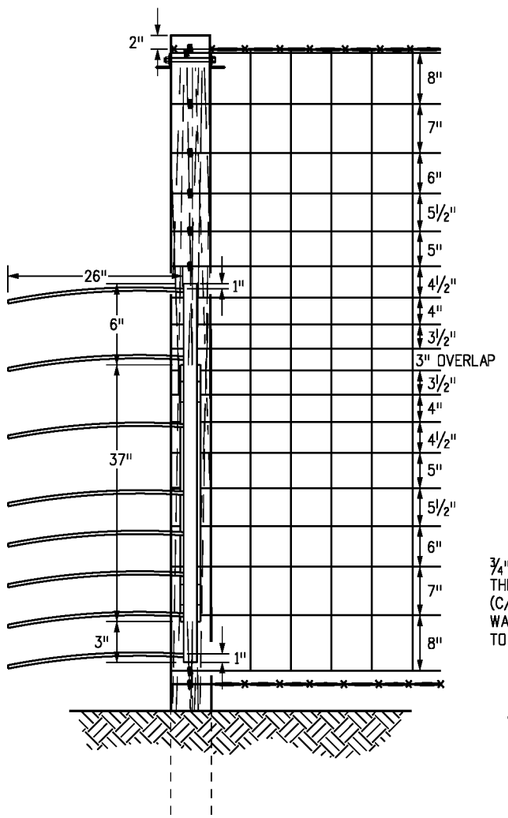
1. SIX IN. DOUBLE ACTING SPRING DOOR HINGE WITH FLAT BUTTON TIPS CUT IN TWO SHALL BE USED AS A SINGLE SWING HINGE AND BE PROVIDED WITH A GREASING NIPPLE AND WELDED TO SUPPORT PLATE.
2. TINES SHALL BE MOLDED IN ONE PIECE OF STEEL (AASHTO M 169, GRADE 1050), WITH NO WELDS ALLOWED.
3. GAP CLOSURE: EXCEPT FOR DEER GATES, CONSTRUCT FENCE WITHOUT OPENINGS OR GAPS, ESPECIALLY AT STRUCTURES, CLIFFS, AND IRREGULAR GROUND. WHEN A 6 IN. OR LARGER GAP EXISTS BELOW THE NORMAL BOTTOM FENCE WIRE, CLOSE THE GAP ACCORDING TO THE CLOSURE DETAIL. ALL EXTRA MATERIAL USED FOR GAP CLOSURES OF ANY TYPE OR LOCATION SHALL BE INCLUDED IN THE UNIT BID PRICE FOR THE FENCE.



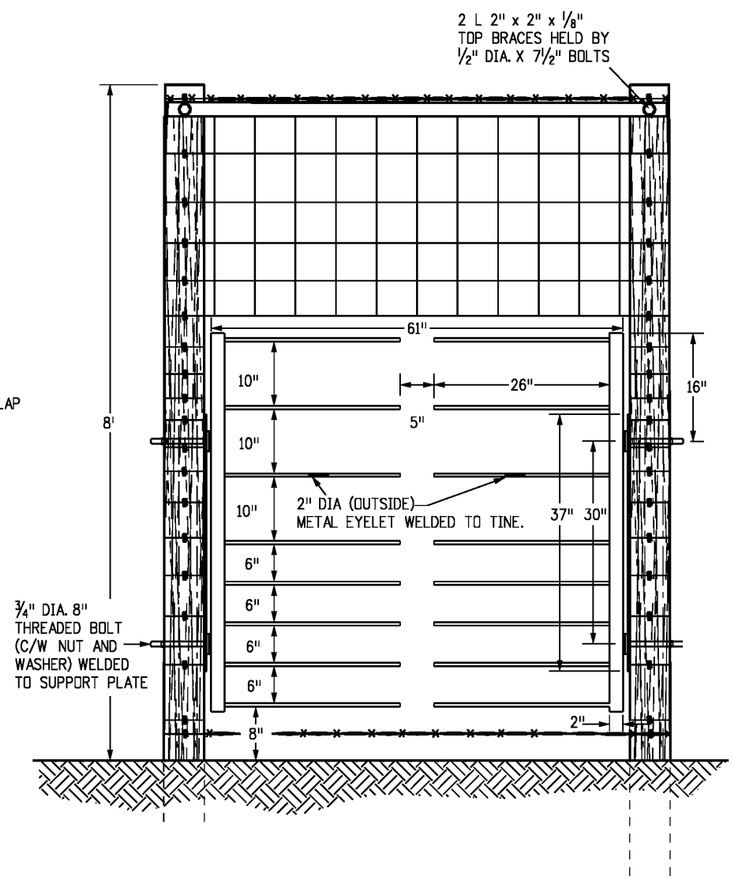
TOP VIEW - DEER GATE



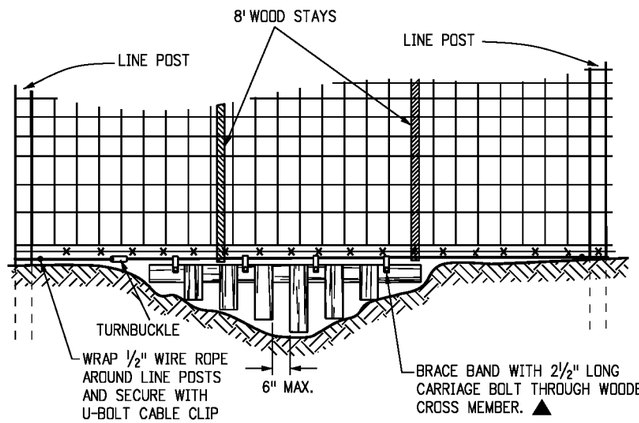
TYPICAL HINGE DETAIL



SECTION A-A

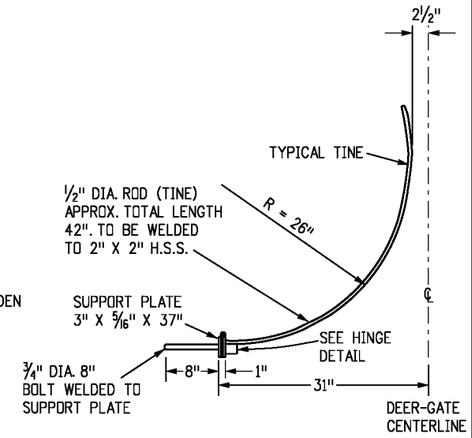


FRONT VIEW - DEER GATE



GAP CLOSURE

▲ SEE CHAIN LINK FENCE STANDARD PLAN FOR HARDWARE DETAILS.



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DEER FENCE AND GATES

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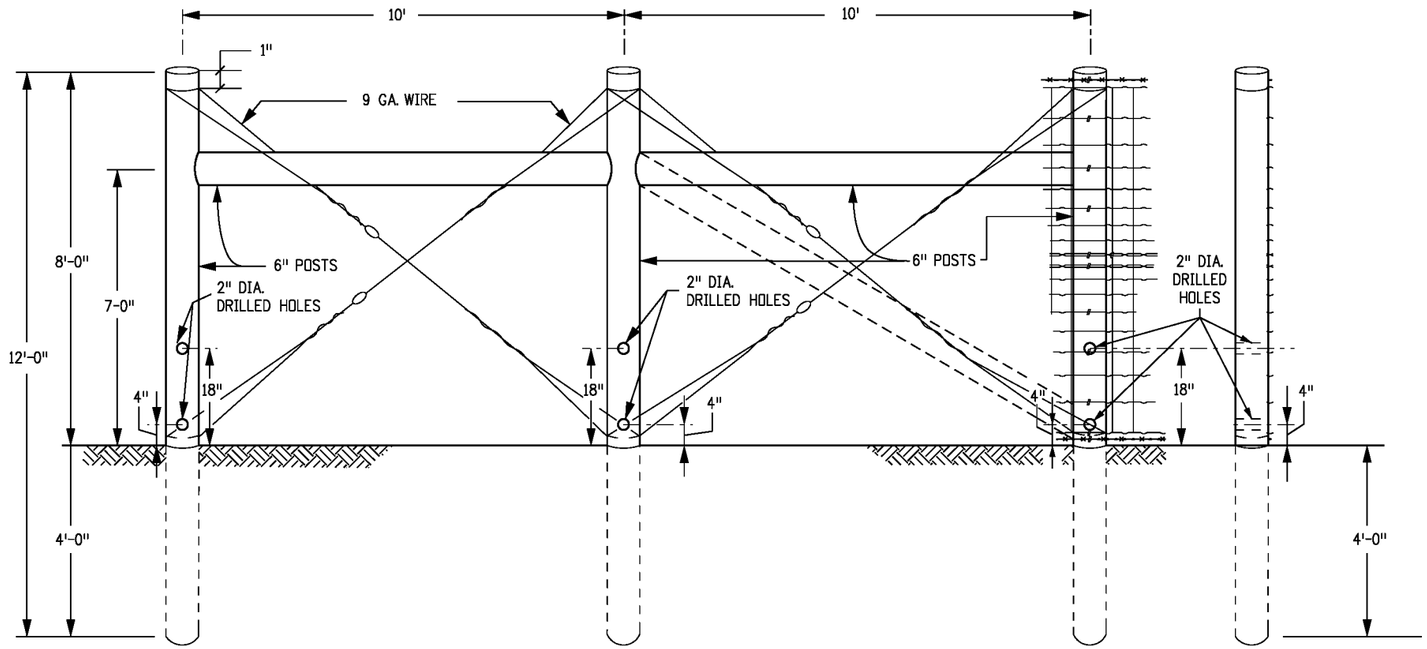
NOTES

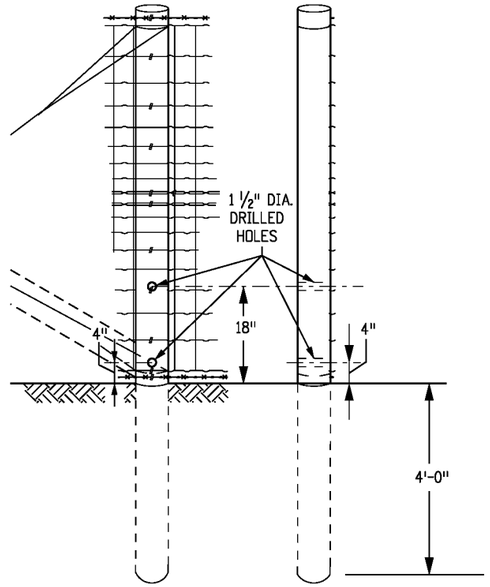
1. LOCATIONS OF DEER FENCE IN THE CLEAR ZONE SHALL BE SHOWN IN THE PLANS.
2. POSTS WITHIN THE CLEAR ZONE SHALL BE DRILLED.
3. DRILL HOLES PERPENDICULAR TO THE ROADWAY.
4. KNEE BRACE SHALL BE OMITTED FROM ANY END POST OR CORNER POST WITHIN THE CLEAR ZONE.



FRONT VIEW

SIDE VIEW

END POST AND CORNER POST



SIDE VIEW

5 IN. LINE POST

MODIFIED FOR PLACEMENT WITHIN ROADWAY CLEAR ZONE

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DEER FENCE AND GATES

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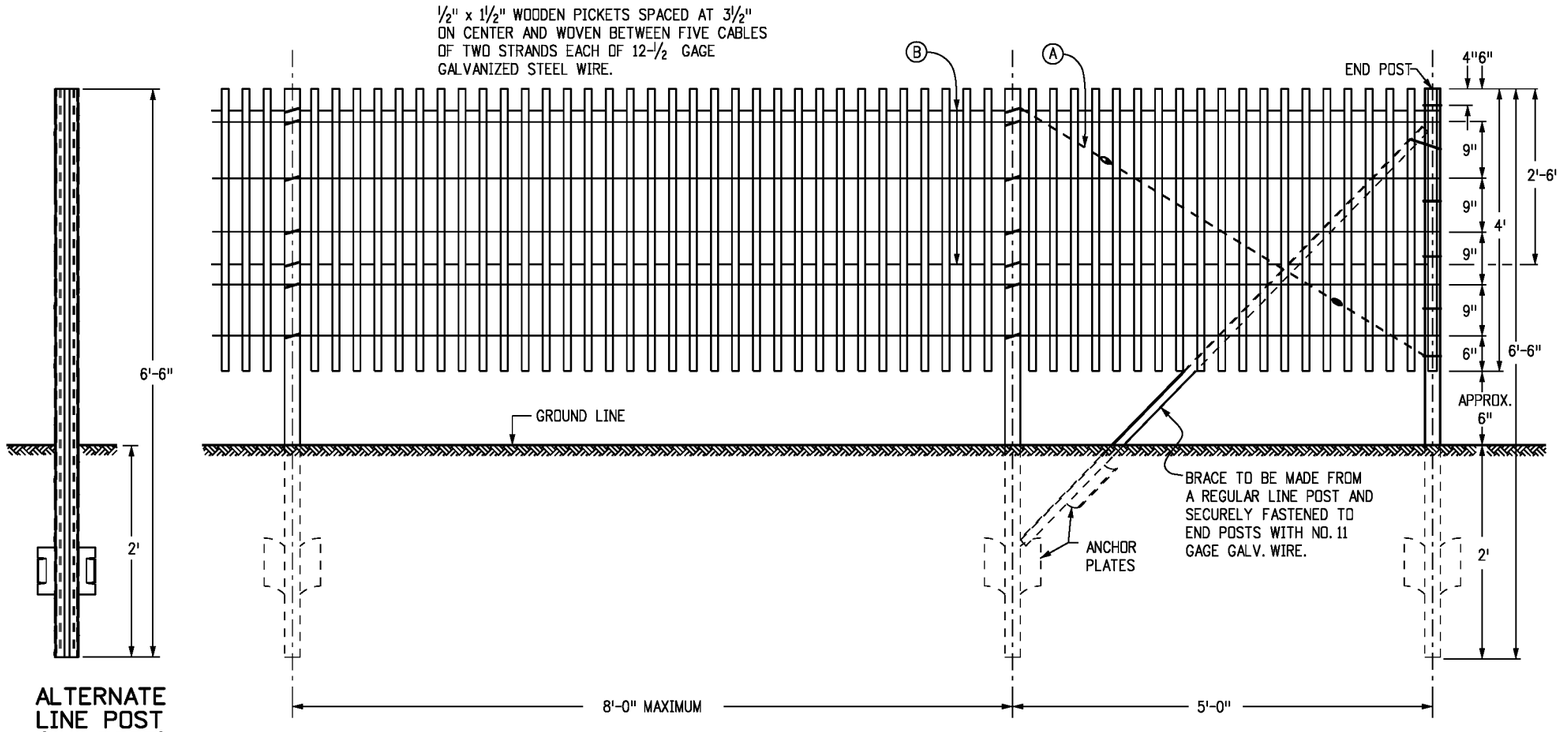
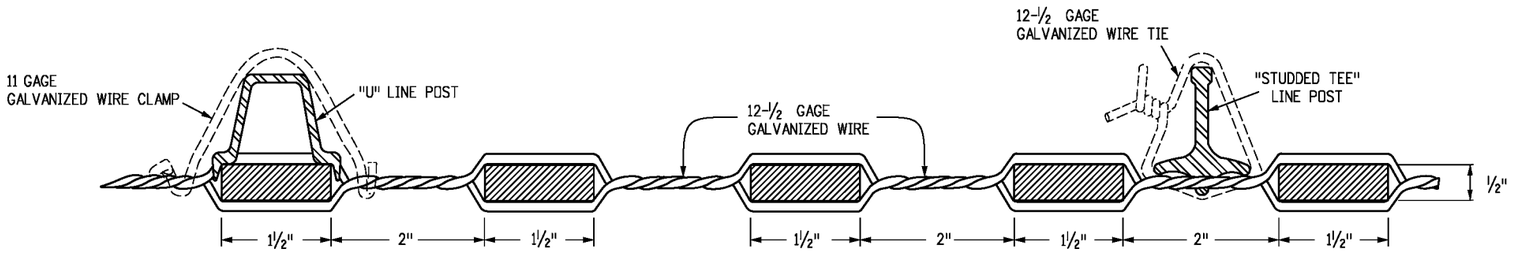


ALTERNATE LINE POST ("U" POST)

FRONT ELEVATION OF PICKET SNOW FENCE

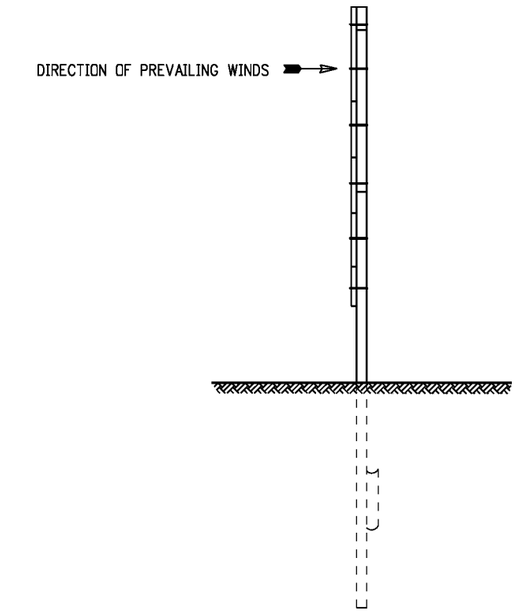


TYPICAL SECTIONS THROUGH SNOW FENCE POST AND PICKETS

NOTE: OTHER SECTIONS OF STEEL POSTS HAVING EQUAL WEIGHT AND EQUIVALENT STRENGTH MAY BE USED IN LIEU OF EITHER OF THESE SECTIONS SHOWN.

GENERAL NOTES

1. WIRE-BOUND PICKET FENCE, CONFORMING TO ASTM F 537, SHALL BE STRETCHED TIGHT AND SECURELY FASTENED TO ALL POSTS WITH 11 GAGE GALVANIZED STEEL WIRE CLAMPS OR 12-½ GAGE GALVANIZED STEEL WIRE TIES.
2. ALL FENCE POSTS COMPLETE WITH ANCHOR PLATE, SHALL BE HOT-DIPPED GALVANIZED CONFORMING TO AASHTO M 281. LINE POSTS (WITHOUT ANCHOR) SHALL WEIGH AT LEAST 1.33 LBS. PER LIN. FT. (RAW). SUITABLE ANCHOR PLATES SHALL BE SECURELY FASTENED TO EACH LINE POST AND SHALL WEIGH 0.67 LB. NOMINAL.
3. IN GENERAL, SNOW FENCE SHALL BE PLACED 100 TO 150 FT. FROM THE CENTERLINE OF ROADWAY. HOWEVER, THE SPECIFIC LOCATION ON EACH PROJECT WILL BE SHOWN ON THE PLANS, OR AS DETERMINED BY THE ENGINEER.
4. SNOW FENCE MAY BE PLACED IMMEDIATELY IN FRONT OF THE RIGHT OF WAY FENCE ON THE HIGHWAY SIDE WHEN SUCH LOCATION IS SUITABLE. THIS WILL AVOID TRAPPING OF WEEDS AND DEBRIS BETWEEN THE FENCES. IN SUCH INSTALLATIONS THE SNOW FENCE SHALL NOT BE TIED OR FASTENED TO THE RIGHT OF WAY FENCE.
5. FENCE SHALL BE SECURELY BRACED AT EACH END PANEL WITH A REGULAR LINE POST AND 1 DIAGONAL CABLE CONSISTING OF 2 STRANDS OF TWISTED WIRE. EACH STRAND TO CONSIST OF TWO 12-½ GAGE GALVANIZED WIRES (A).
6. LINE BRACE POSTS SHALL BE INSTALLED EVERY 400 FT. OR LESS WHERE THE FENCING IS CONTINUOUS AND SHALL NOT BE PAID FOR SEPARATELY BUT BE INCLUDED IN THE WORK.
7. TWO HORIZONTAL WIRES (B) SHALL BE STRUNG BEHIND THE PICKETS FOR THE FULL LENGTH OF THE FENCE. EACH HORIZONTAL WIRE SHALL CONSIST OF TWO 12 GAGE TWISTED GALVANIZED WIRES. EACH HORIZONTAL WIRE SHALL BE FASTENED SECURELY TO EACH FENCE POST BY MEANS OF 11 GAGE WIRE CLAMPS OR 12-½ GAGE WIRE TIES.



END ELEVATION

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PICKET SNOW FENCE

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GENERAL NOTES

1. STEEL LIGHT STANDARDS SHALL HAVE AN 8 IN. OUTSIDE DIAMETER AT THE BASE WITH A 3/16 IN. MINIMUM WALL THICKNESS, AND A UNIFORM TAPER THROUGHOUT. LIGHT STANDARDS SHALL BE ROUND OR TWELVE OR MORE SIDED, AND FABRICATED IN ACCORDANCE WITH SECTIONS 613 AND 715.
2. A CERTIFICATE OF COMPLIANCE (C.O.C) SHALL BE SUBMITTED TO THE ENGINEER AFTER FABRICATION OF THE LIGHT STANDARDS. THE C.O.C. SHALL BE SUBMITTED IN ACCORDANCE WITH SUBSECTION 106.12.
3. THE GATE ARM SHALL BE FABRICATED FROM HIGH STRENGTH RECTANGULAR FIBERGLASS AND 6061-T6 RECTANGULAR ALUMINUM TUBING. THE MAXIMUM ARM LENGTH SHALL BE 40 FT. THE FIBERGLASS/ALUMINUM GATE SHALL BE SUPPLIED BY SAFETRAN, B&B ELECTRONIC, OR AN APPROVED EQUIVALENT.
4. THE CONTRACTOR SHALL SURVEY THE CROSS SECTION OF THE ROADWAY, DETERMINE EACH GATE ARM LENGTH, AND SUBMIT THIS INFORMATION TO THE ENGINEER BEFORE ORDERING MATERIAL. THE LOCATION OF THE ROAD CLOSURE GATES AND THE REQUIRED MOUNTING HEIGHT OF THE GATE ARM PIVOT SHALL BE VERIFIED BY THE CONTRACTOR AND SUBMITTED TO THE ENGINEER.
5. A BREAKAWAY SHEAR PIN BASE IS REQUIRED FOR THE LIGHTWEIGHT ALUMINUM/FIBERGLASS ARMS. WHEN EXCESSIVE FORCE IS APPLIED TO THE GATE ARMS EQUIPPED WITH THE SHEAR PIN BASE, THE PIN SHALL SHEAR, AND THE ARM SHALL THEN SWING 45 DEGREES HORIZONTALLY AND DROP FREE OF THE GATE OPERATOR, MINIMIZING DAMAGE TO THE VEHICLE AND THE GATE.
6. THE HEIGHTS OF THE GATE ARM GUIDES WERE DETERMINED FOR A 29 FT. TALL TAPERED LIGHT STANDARD WITH A BASE DIAMETER OF 8 IN. AND A TOP DIAMETER OF 4 IN. GUIDE LOCATIONS MAY BE ADJUSTED FOR VARIOUS GATE ARM LENGTHS AND WARNING LIGHT SPACINGS. THE HEIGHT OF THE GATE ARM OVER THE ROADWAY SHALL BE 3 FT. - 7 IN. TO 4 FT. - 7 IN. FROM THE BOTTOM OF THE ARM TO THE ROADWAY.
7. THE WORM GEAR WINCH AND CABLE SHALL BE MANUFACTURED BY DUTTON-LAINSON, MFR. MODEL NO. WG2000, WITH A 7/32" THICK CABLE, AND A PULL CAPACITY OF 2000 LBS.
8. WHEN THE GATE IS FULLY RAISED, THE NUT AND WASHER SHALL FIT SNUGLY AGAINST THE OUTSIDE OF THE REAR CHANNEL AND BE PADLOCKED IN PLACE. THE CONTRACTOR SHALL SUPPLY ONE HEAVY, WEATHERPROOF PADLOCK WITH TWO KEYS FOR EACH GATE ARM PIVOT. INFORMATION ON THE KEY TYPE REQUIREMENTS WILL BE PROVIDE BY THE ENGINEER. PAIRED PIVOTS FOR DIVIDED HIGHWAYS SHALL BE KEYED ALIKE.
9. ELECTRICAL CONNECTION TO THE POWER SOURCE SHOWN ON THE PLANS WILL BE PAID FOR BY FORCE ACCOUNT. IF NO POWER SOURCE IS AVAILABLE, OMIT THE LUMINAIRE AND USE BATTERY OR SOLAR PANEL POWER FOR THE LED LIGHTS AS APPROVED BY THE ENGINEER.
10. GATE WARNING LIGHTS SHALL BE RED LED (TYPE B) HIGH INTENSITY. THE LIGHT AT THE END OF THE ARM NEAR THE CENTERLINE OF THE ROADWAY SHALL BE STEADY BURN. THE OTHER TWO LIGHTS SHALL FLASH AT THE RATE REQUIRED BY THE "MUTCD". SPACING OF THE LIGHTS SHALL VARY BASED ON ROADWAY WIDTH AND GATE ARM LENGTH. THE CONTRACTOR SHALL DETERMINE THE SPACING AND SUBMIT THE LED LAYOUT TO THE ENGINEER FOR VERIFICATION PRIOR TO PLACEMENT.
11. GALVANIZING: THE STEEL LIGHT STANDARDS, MAST ARMS, DROP GATE PIVOTS, SUPPORTS, GUIDES, AND ALL ASSOCIATED HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 715. ALL ROUGH EDGES AND BURRS SHALL BE GROUNDED SMOOTH PRIOR TO GALVANIZING.
12. BOLTED CONNECTIONS: ALL BOLTS SHALL CONFORM TO ASTM A 307, GRADE A, UNLESS DESIGNATED AS HS (HIGH STRENGTH). HS BOLTS SHALL CONFORM TO ASTM A 325. AFTER THE ROAD CLOSURE GATE IS ASSEMBLED, ALL EXPOSED BOLT THREADS SHALL BE PAINTED WITH TWO COATS OF ALUMINUM PAINT. THE ALUMINUM PAINT SHALL MEET THE REQUIREMENTS OF SUBSECTION 708.04.
13. FIELD ASSEMBLY: IN SOME INSTALLATIONS, THE CONNECTION PLATES FOR THE LUMINAIRE ARMS MAY REQUIRE MODIFICATION TO ALLOW THE PIVOT SLEEVE TO SLIP OVER. ALL DAMAGE TO THE GALVANIZING SHALL BE REPAIRED WITH TWO COATS OF ALUMINUM PAINT.

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ROAD CLOSURE GATE

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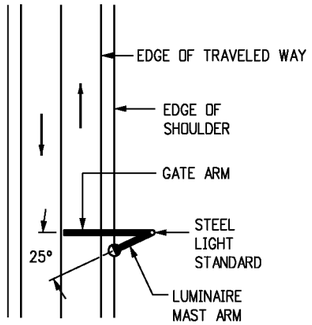
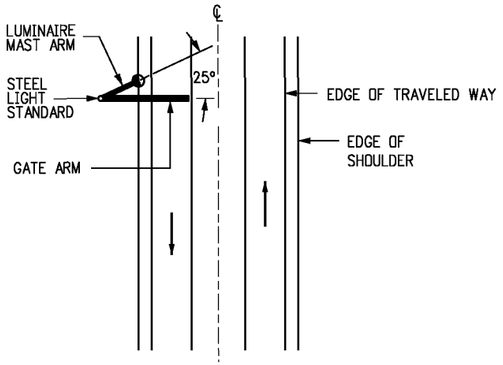
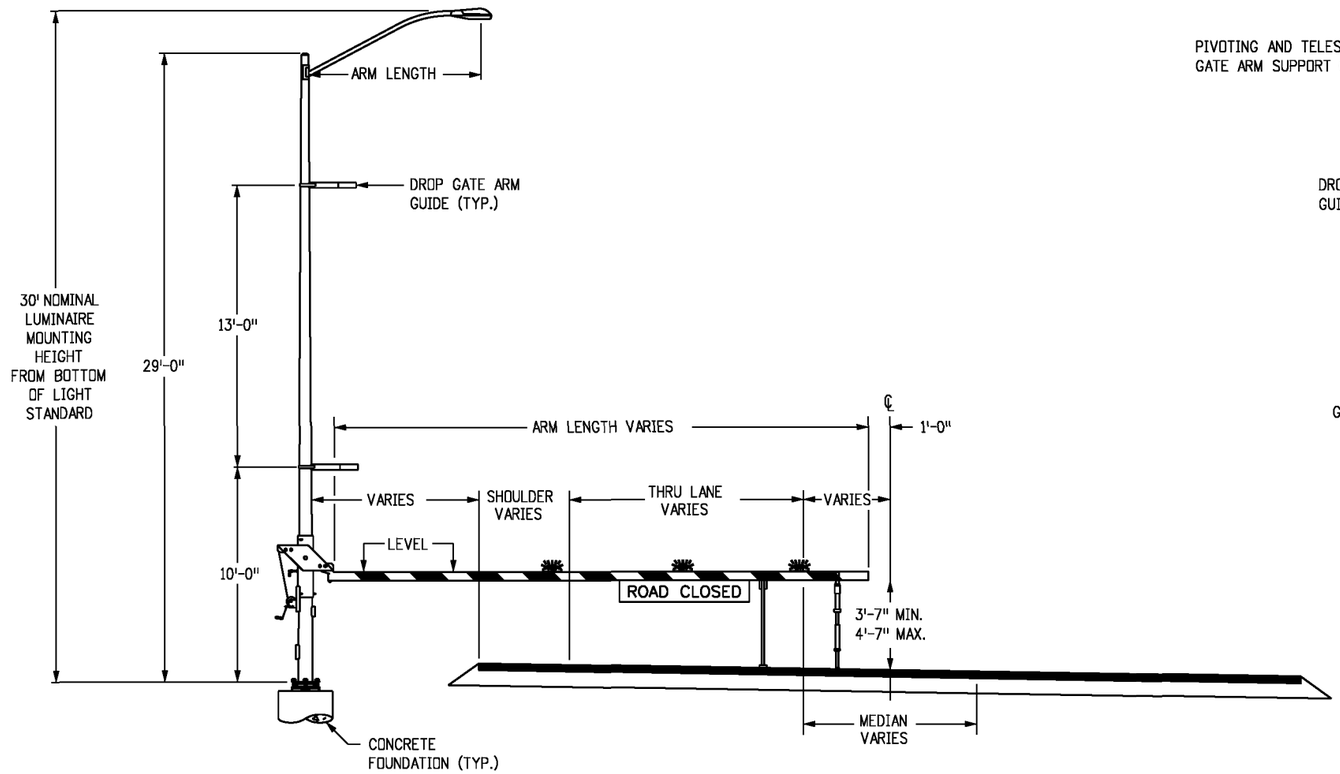


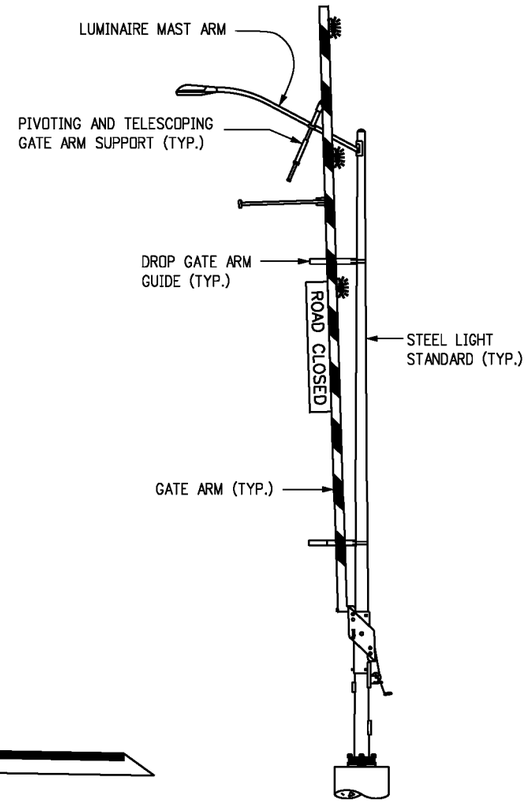
TWO-WAY HIGHWAY
(ONE GATE REQUIRED)



TWO-LANE DIVIDED HIGHWAY WITH MEDIAN
(ONE GATE REQUIRED)



TYPICAL LOWERED POSITION



TYPICAL RAISED POSITION

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ROAD CLOSURE GATE

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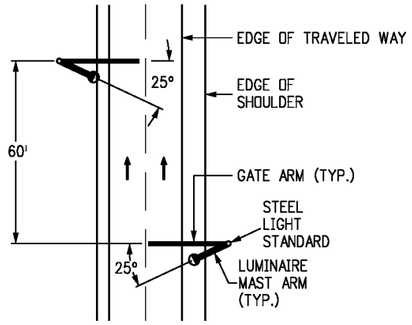
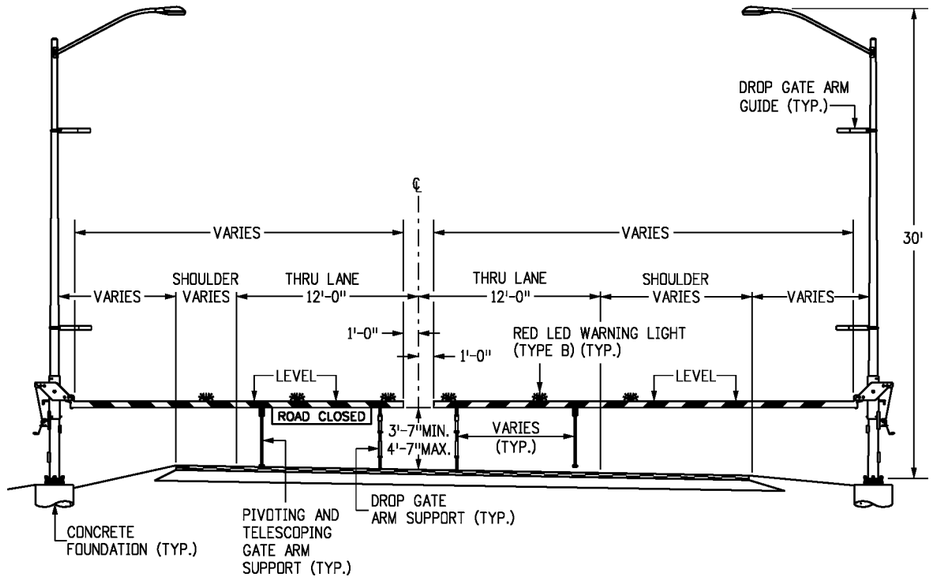


DIVIDED HIGHWAY INSTALLATION

(TWO GATES REQUIRED)



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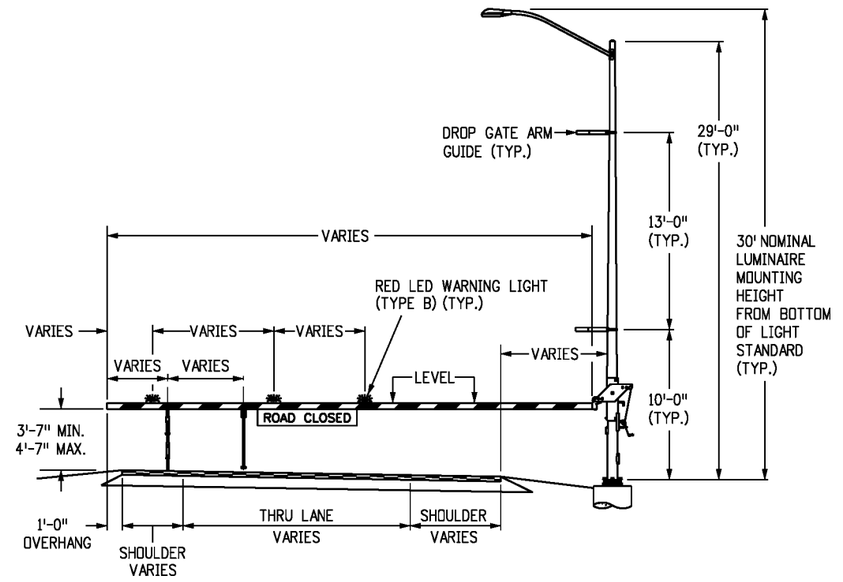

LUMINAIRE AND GATE

(RAMP LOCATIONS)

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ROAD CLOSURE GATE

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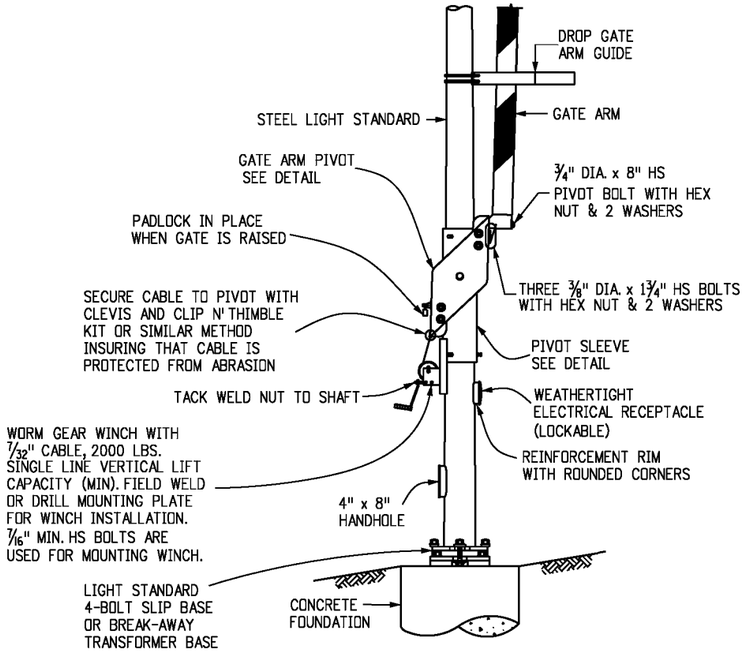
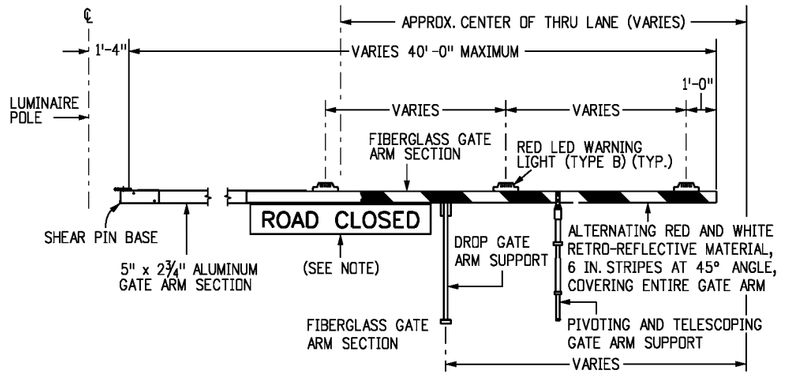
STANDARD PLAN NO.
M-607-15

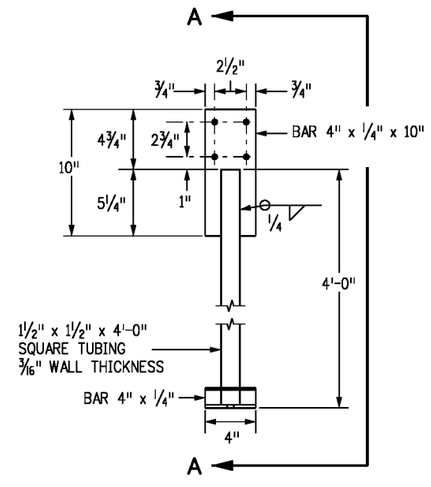


PIVOT ASSEMBLY



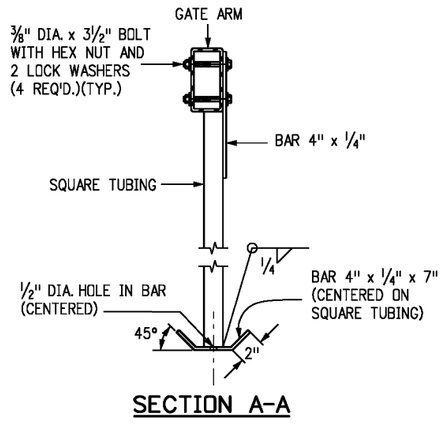
DROP GATE DETAIL

NOTE: PLACE THE BLACK AND WHITE "ROAD CLOSED" SIGN IN THE CENTER OF THE THROUGH LANE. THE SIGN LETTERS WILL BE 6" IN HEIGHT.



DROP GATE ARM SUPPORT DETAIL

GATE ARM AND BOLTS NOT SHOWN.



SECTION A-A

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ROAD CLOSURE GATE

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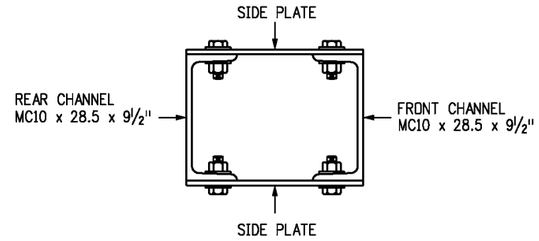
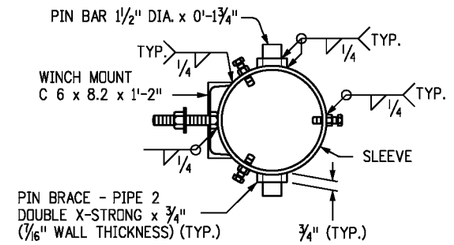


TOP VIEW



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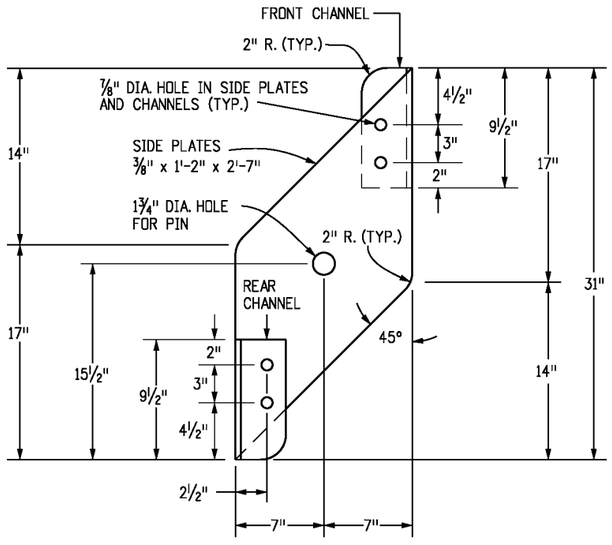
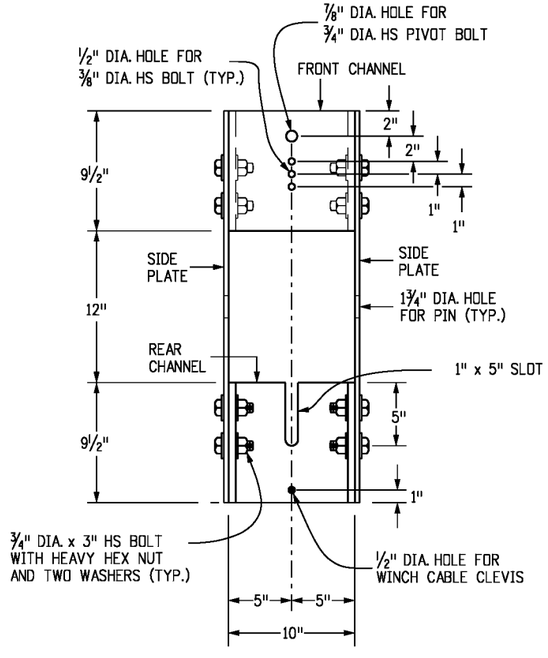
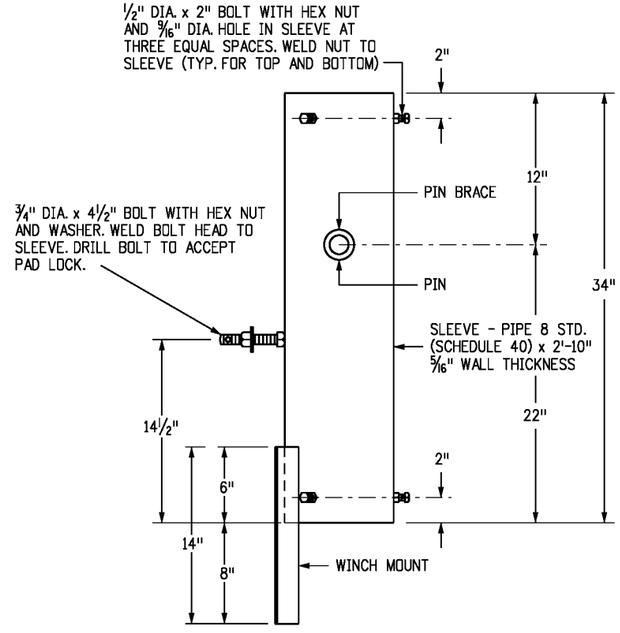


SIDE VIEW



FRONT VIEW

GATE ARM PIVOT SIDE PLATE DETAIL



SIDE VIEW

PIVOT SLEEVE DETAIL

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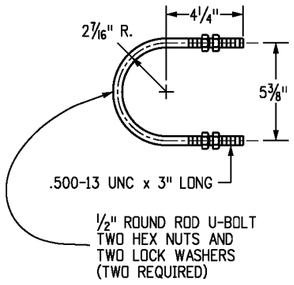
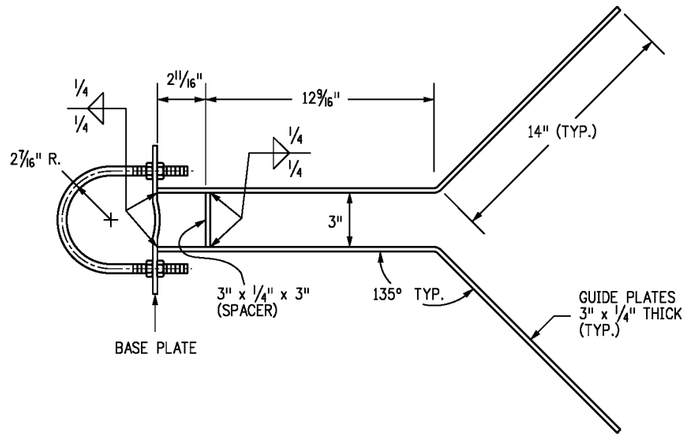
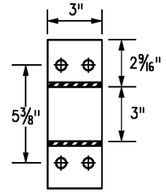
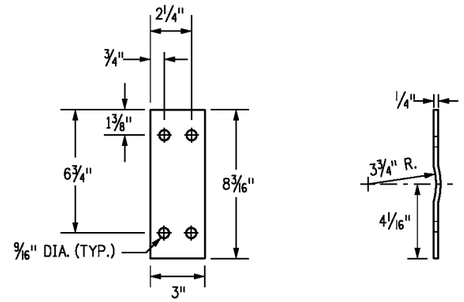


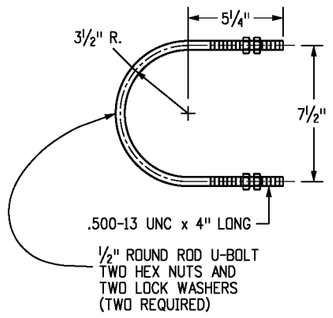


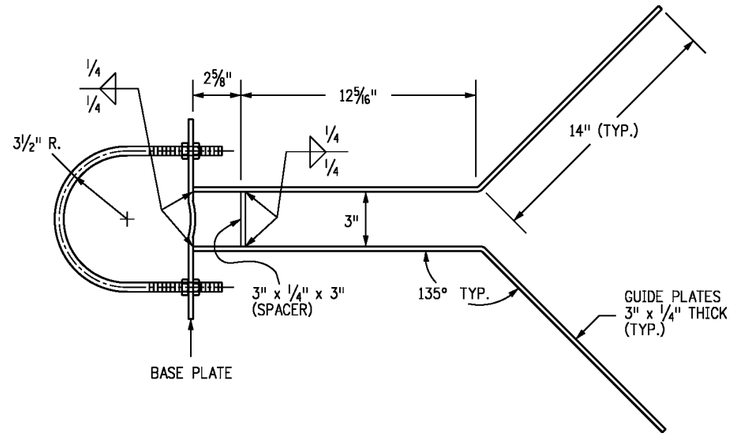
TOP GATE ARM GUIDE



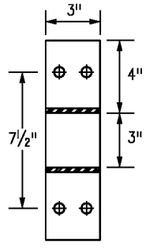


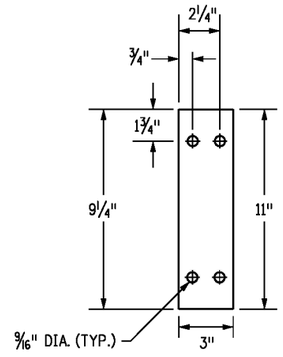
TOP BASE PLATE DETAILS

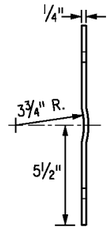




BOTTOM GATE ARM GUIDE







BOTTOM BASE PLATE DETAILS

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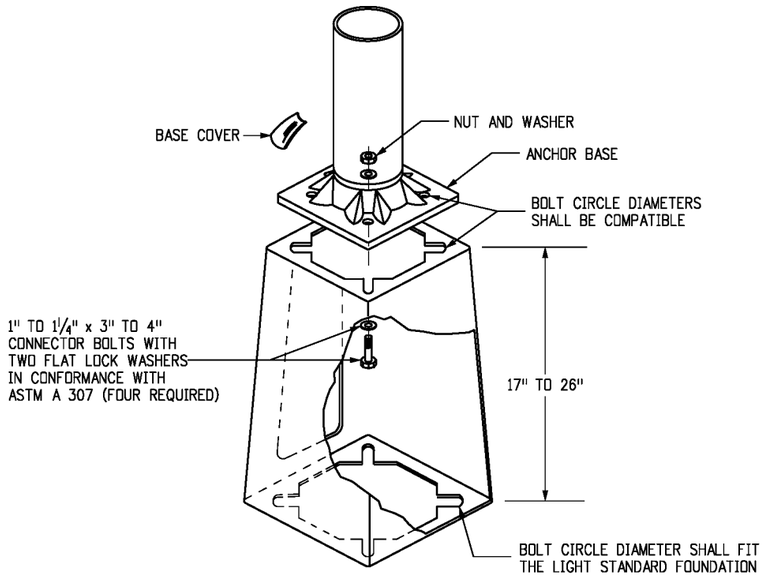
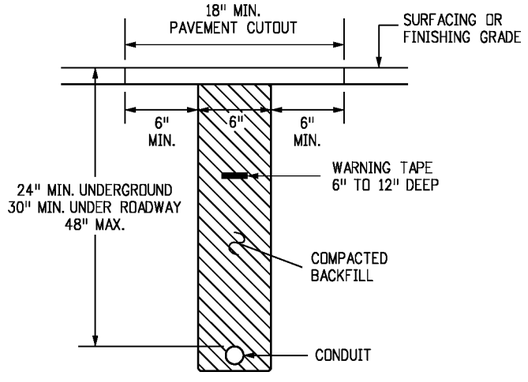


TYPICAL BREAK-AWAY TYPE TRANSFORMER BASE DETAIL

NOTES:

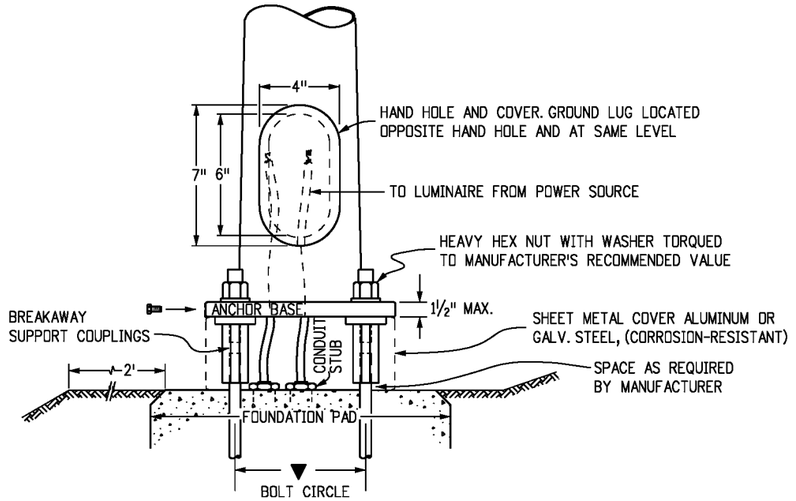
1. HARDWARE SHALL CONFORM TO MANUFACTURER'S REQUIREMENTS.
2. A HAND HOLE IS NOT REQUIRED IN POLE IF A BREAK-AWAY TRANSFORMER BASE IS USED.



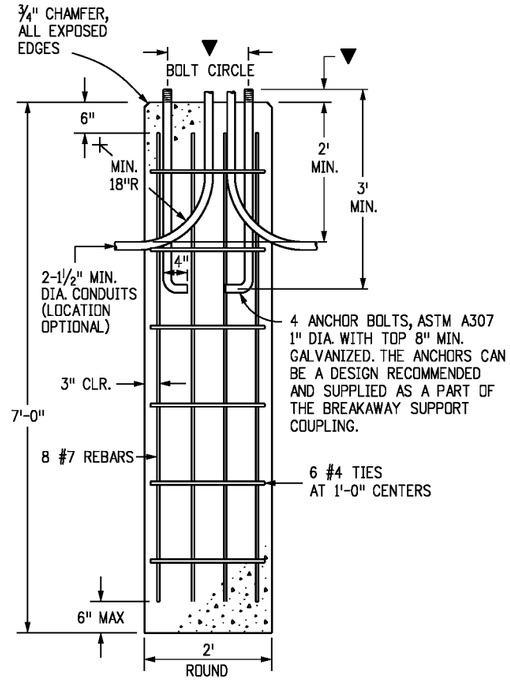
TYPICAL CONDUIT BURIAL SECTION

NOTES:

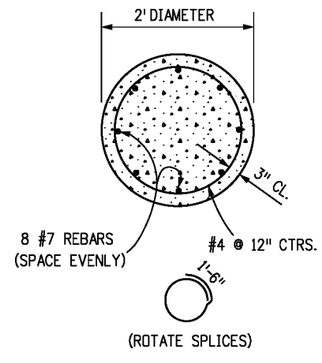
1. THE CONTRACTOR SHALL COORDINATE TRENCHING WITH OTHER UNDERGROUND UTILITIES, RAMP METERING, AND IRRIGATION. THE CONTRACTOR SHALL USE COMMON TRENCHES AT ALL ROAD CROSSINGS WHERE POSSIBLE.
2. ONE #14 AWG LOCATE WIRE AND A NYLON PULL STRING IN ALL EMPTY CONDUITS.



BREAK-AWAY SUPPORT COUPLING



TYPICAL CONCRETE FOUNDATION



TYPICAL FOUNDATION SECTION

FOUNDATION NOTES

▼ 1. SEE POLE SUPPLIER DETAILS FOR BOLT CIRCLE AND PROJECTION.

2. ALL BREAKAWAY SUPPORT COUPLINGS SHALL MEET THE BREAKAWAY REQUIREMENTS STATED IN THE LATEST EDITION OF AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS".
3. BREAKAWAY SUPPORT COUPLINGS SHALL BE INSTALLED IN CONFORMANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL HAVE A COUPLING MANUFACTURER'S REPRESENTATIVE ON THE PROJECT PRIOR TO CONSTRUCTION TO INSTRUCT THE CONTRACTOR AND PROJECT PERSONNEL IN THE PROPER INSTALLATION OF THE BREAKAWAY SUPPORT COUPLINGS.
4. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN PLACE CONCRETE.
5. CONCRETE SHALL BE CLASS B.
6. EACH LIGHT STANDARD SHALL BE WIRED WITH A BREAKAWAY FUSED CONNECTOR AND BE GROUNDED AS STATED IN THE SPECIFICATIONS.
7. LIGHT STANDARDS SHALL NOT BE PLACED IN DITCHES OR OTHER LOW AREAS. EMBANKMENT AND BACKFILL SHALL BE COMPACTED IN CONFORMANCE WITH SECTION 203.
8. THE PHYSICAL SHAPES OF THE POLE CAPS, BRACKETS, AND CONCRETE PULL BOXES SHALL BE CONSIDERED APPROXIMATE AS SHOWN.
9. ALL NUTS, BOLTS, STUDS AND WASHERS SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232 (ASTM A 153).

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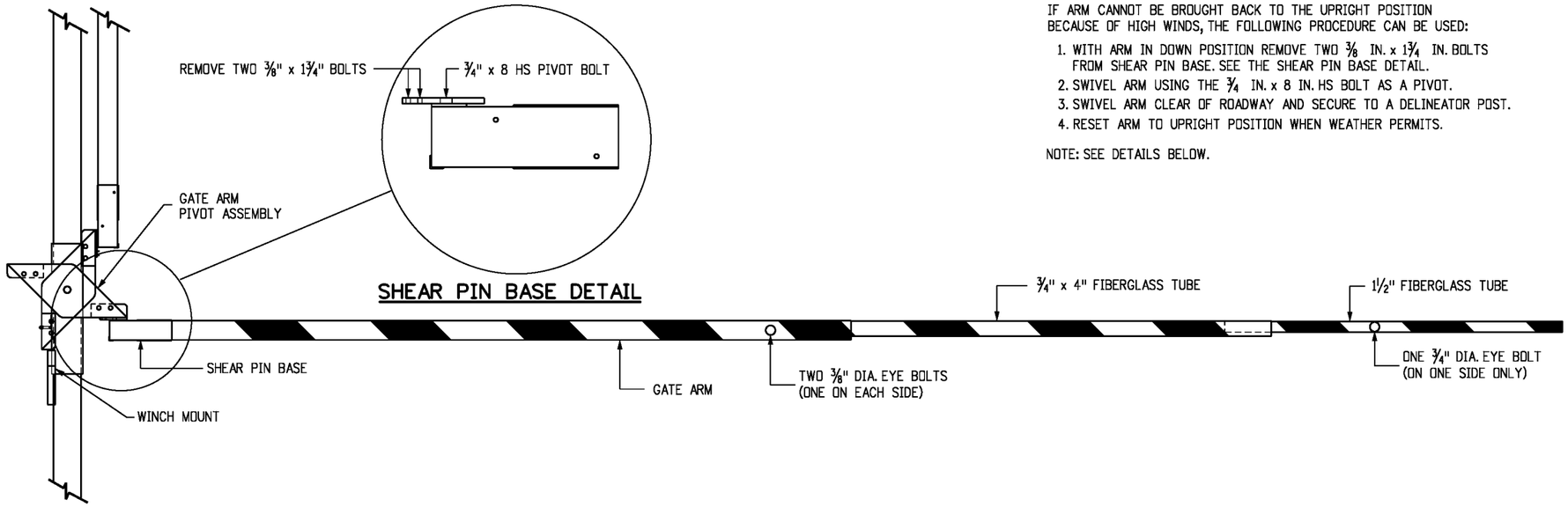
HIGH WIND STOWING PROCEDURE

IF ARM CANNOT BE BROUGHT BACK TO THE UPRIGHT POSITION BECAUSE OF HIGH WINDS, THE FOLLOWING PROCEDURE CAN BE USED:

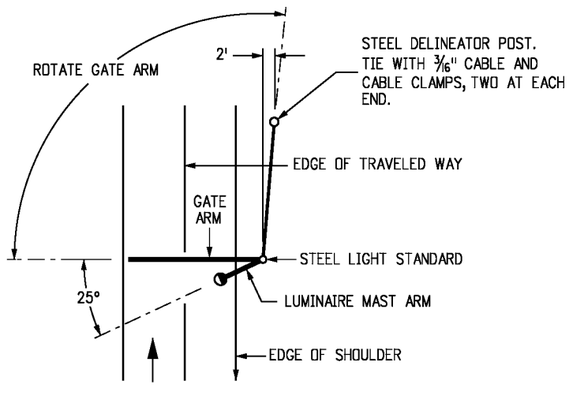
1. WITH ARM IN DOWN POSITION REMOVE TWO 3/8 IN. x 1 3/4 IN. BOLTS FROM SHEAR PIN BASE. SEE THE SHEAR PIN BASE DETAIL.
2. SWIVEL ARM USING THE 3/4 IN. x 8 IN. HS BOLT AS A PIVOT.
3. SWIVEL ARM CLEAR OF ROADWAY AND SECURE TO A DELINEATOR POST.
4. RESET ARM TO UPRIGHT POSITION WHEN WEATHER PERMITS.

NOTE: SEE DETAILS BELOW.

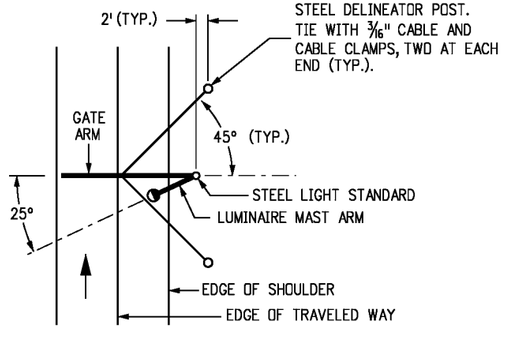


SHEAR PIN BASE DETAIL

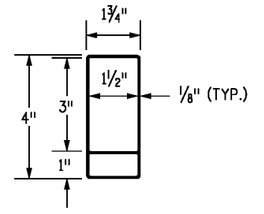
GATE ARM PROFILE



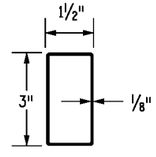
DETAIL FOR HIGH WIND STOW POSITION



DETAIL TO SECURE GATE IN HIGH WIND



SECTION 1 3/4 IN. x 4 IN. FIBERGLASS TUBE



SECTION 1 1/2 IN. x 3 IN. FIBERGLASS TUBE

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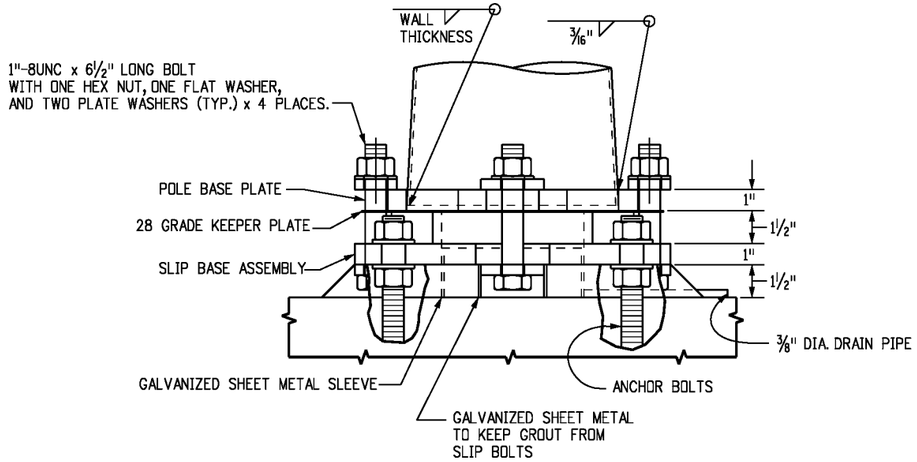


BREAK-AWAY BASE (FOR INFORMATION ONLY)

NOTES

1. POLE BASE PLATE SHALL CONFORM TO ASTM A 572, GRADE 42.
2. BOTTOM PLATE OF SLIP BASE ASSEMBLY SHALL CONFORM TO ASTM A 572, GRADE 50.
3. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION IN CONFORMANCE WITH ASTM A 123. ALL CONTACT AREAS OF THE STRUCTURAL STEEL SHALL BE FREE OF GALVANIZING BEADS AND RUNS.
4. SLIP BASE CONNECTING HARDWARE SHALL CONFORM TO ASTM A 325, AND SHALL BE ELECTROPLATED CADMIUM IN CONFORMANCE WITH ASTM B 766 TYPE NS.
5. KEEPER PLATE SHALL CONFORM TO ASTM A 653, GRADE 33, AND COATING G 90.

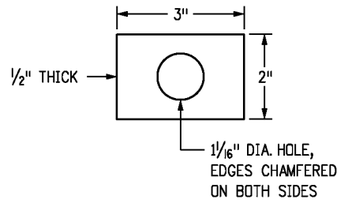
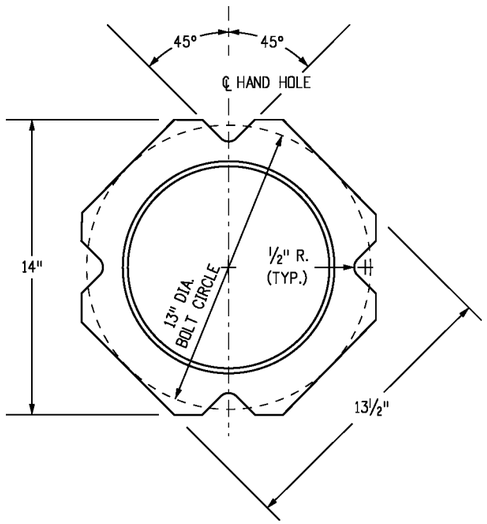
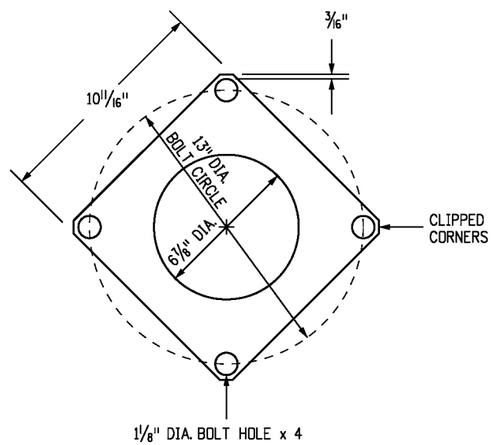


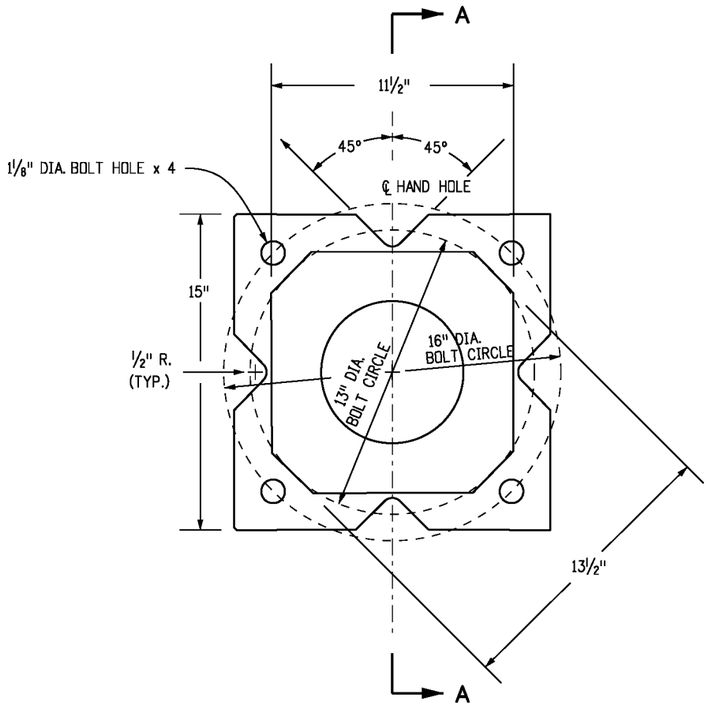
PLATE WASHER



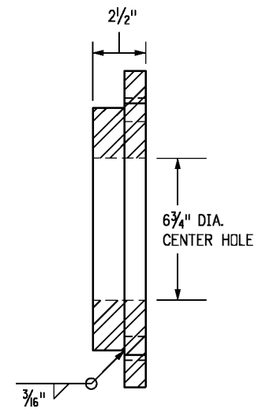
LIGHT STANDARD BASE PLATE



28 GRADE KEEPER PLATE



SLIP BASE ASSEMBLY



SECTION A-A

OPTIONAL BREAK-AWAY TYPE BASE

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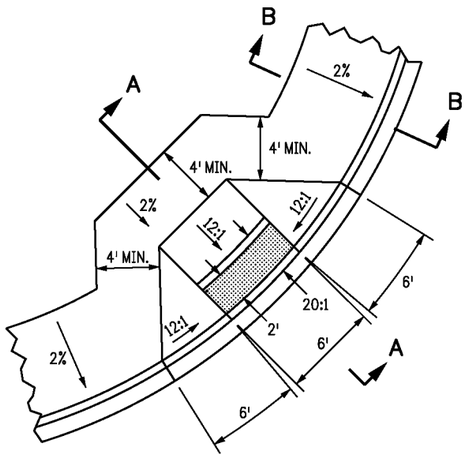
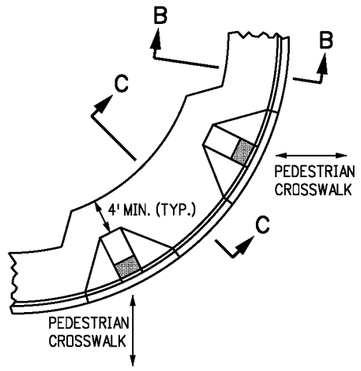


SIDEWALK RAMP TYPE 1A



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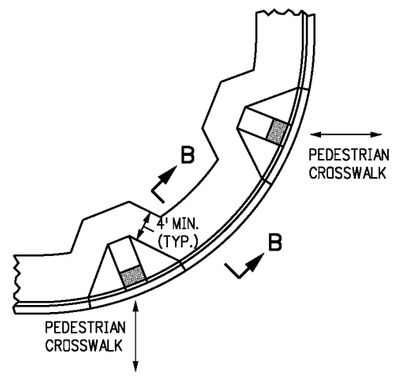
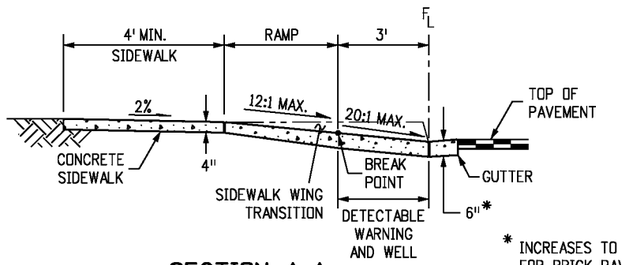


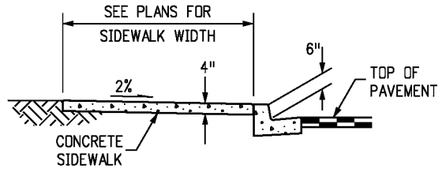
SIDEWALK RAMP TYPE 1C

GENERAL NOTES

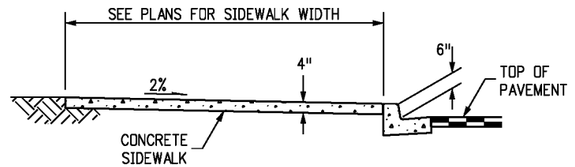
1. THE DETECTABLE WARNINGS SHALL BE INSTALLED AT SIDEWALK TO STREET TRANSITIONS. THEY SHALL HAVE A TRUNCATED DOME SURFACE. THE DOMES SHALL BE IN A SQUARE GRID PATTERN.
2. ALL DETECTABLE WARNING AREAS SHALL START A MINIMUM OF 6 IN. FROM THE FLOW LINE OF THE CURB AND NOT BE MORE THAN A MAXIMUM OF 8 IN. FROM ANY POINT ON THE FLOW LINE OF THE CURB. ALL DETECTABLE WARNING AREAS SHALL BE 2 FT. IN LENGTH AND COVER THE COMPLETE WIDTH OF THE RAMP AREA ONLY.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER. THE DETECTABLE WARNING SLOPES SHALL BE 20:1 OR FLATTER.
4. MINIMUM SIDEWALK WIDTH IS 4 FT.
5. DO NOT INSTALL DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS IN FRONT OF THE RAMP ACCESS AREAS.
6. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB ADJACENT TO THE RAMP AREAS SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE CURB RAMP.
7. DETECTABLE WARNINGS SHALL MEET SECTION 705 OF THE USDOT ADA STANDARDS FOR TRANSPORTATION FACILITIES.



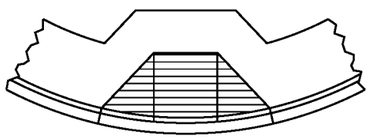
SECTION A-A



SECTION B-B

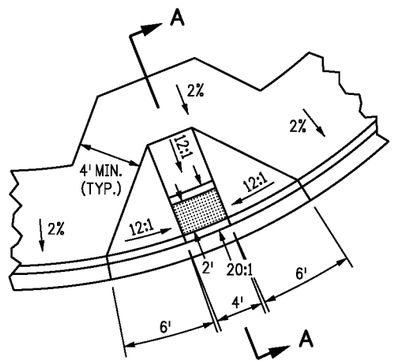


SECTION C-C



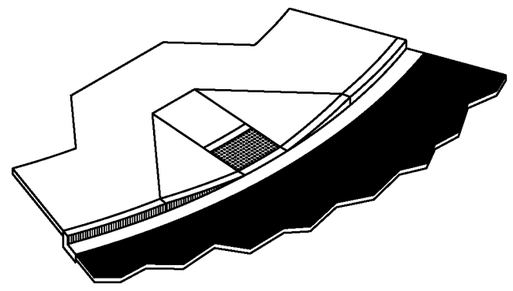
RAMP PAY AREA

FOR SIDEWALK RAMP
TYPES 1A, 1B, 1C, 1D.

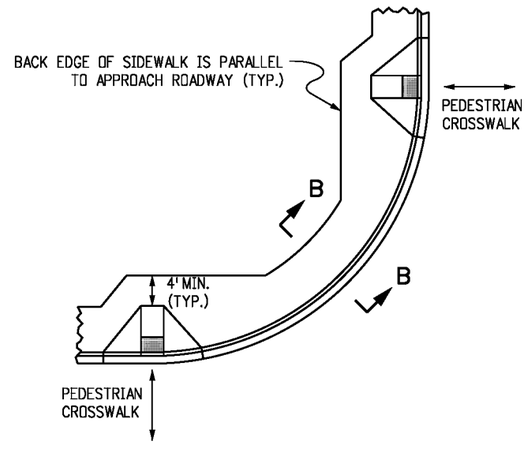


RAMP DETAIL

FOR SIDEWALK RAMP
TYPES 1B, 1C, 1D.



ISOMETRIC VIEW



SIDEWALK RAMP TYPE 1D

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DD		Date:	Comments
Last Modification Date: 07/04/12 Initials: LTA	(R-X)		
Full Path: www.coloradodot.info/business/designsupport	(R-X)		
Drawing File Name: 608010106.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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CURB RAMPS

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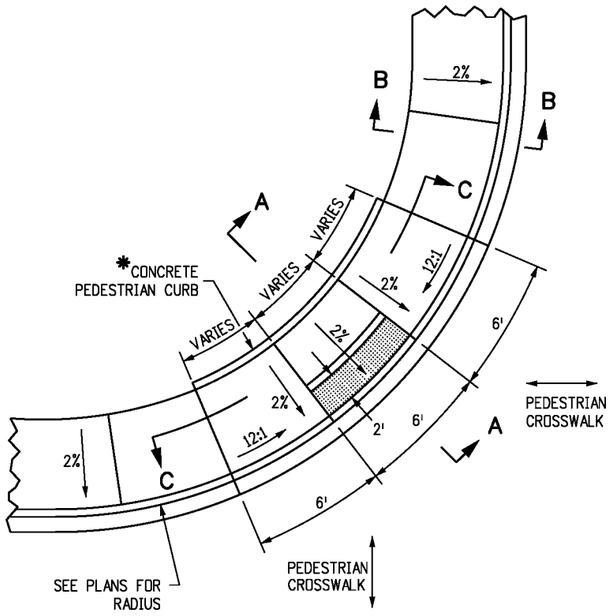
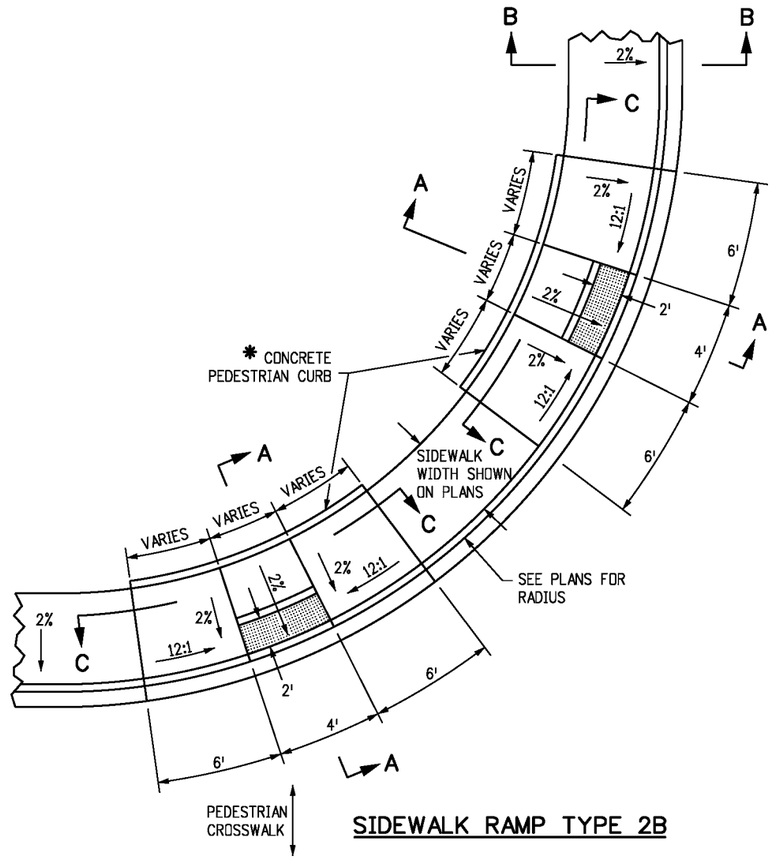


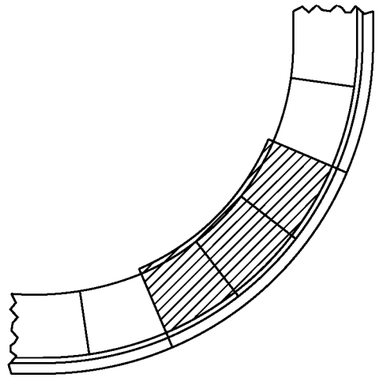
SIDEWALK RAMP TYPE 2A



SIDEWALK RAMP TYPE 2B

NOTES

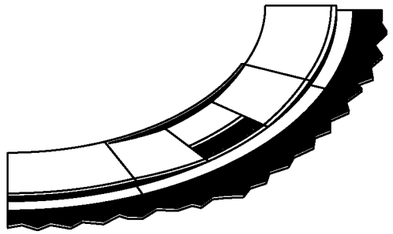
1. SIDEWALK RAMP TYPE 2A MAY BE USED IN MID-BLOCK.



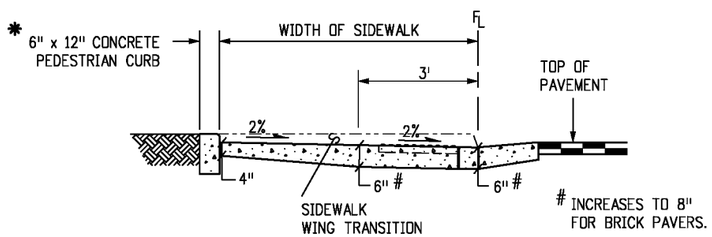
RAMP PAY AREA

FOR SIDEWALK RAMP TYPES 2A AND 2B.

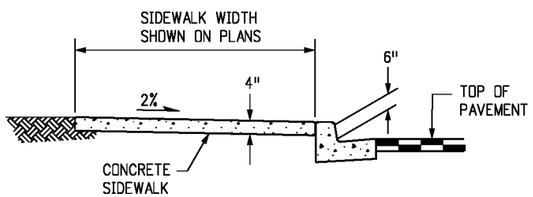
*INCLUDES CONCRETE PEDESTRIAN CURB AS SHOWN.



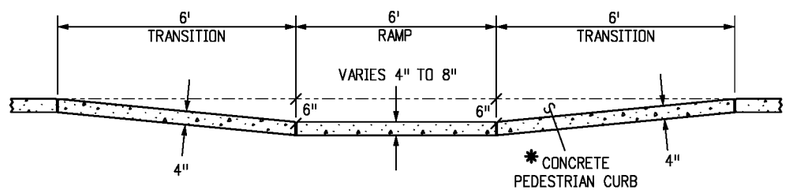
ISOMETRIC VIEW



SECTION A-A



SECTION B-B



SECTION C-C

Computer File Information		Sheet Revisions	
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Full Path: www.coloradodot.info/business/designsupport	(R-X)		
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CURB RAMPS

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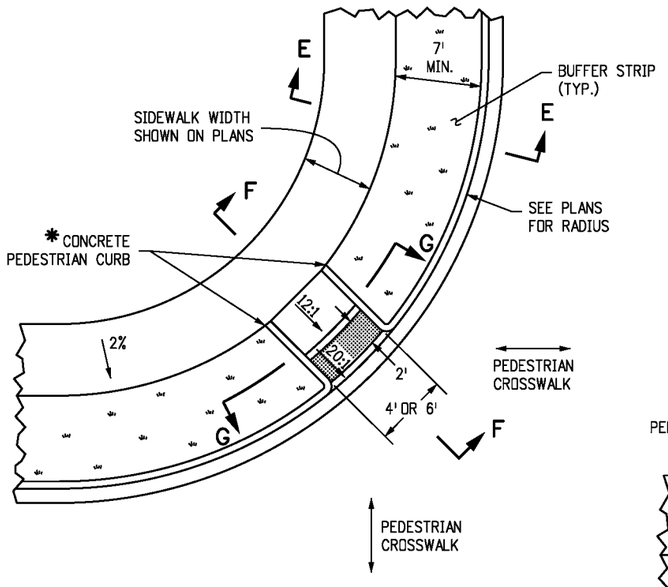
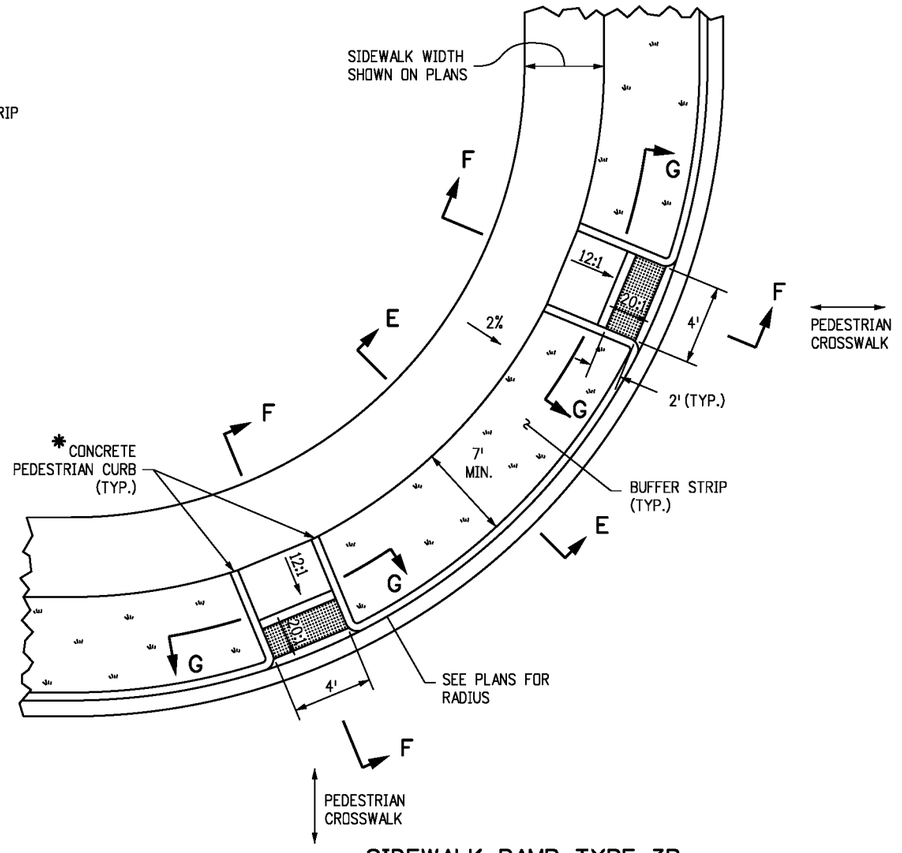


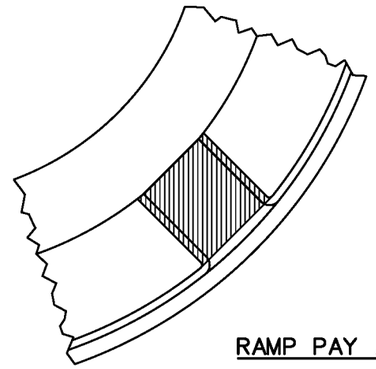
SIDEWALK RAMP TYPE 3A



SIDEWALK RAMP TYPE 3B

NOTES

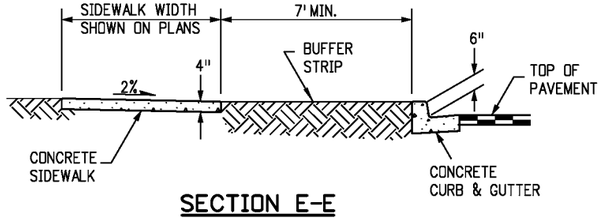
1. SIDEWALK RAMP TYPE 3A MAY BE USED IN MID-BLOCK.



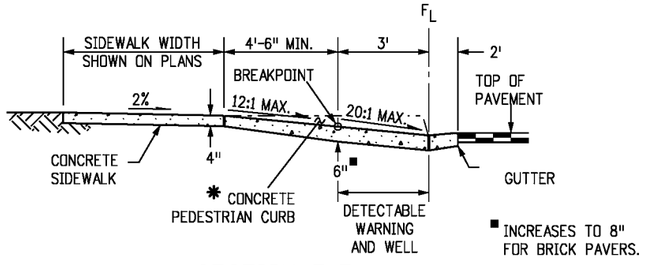
RAMP PAY AREA

FOR SIDEWALK RAMP TYPES 3A AMD 3B.

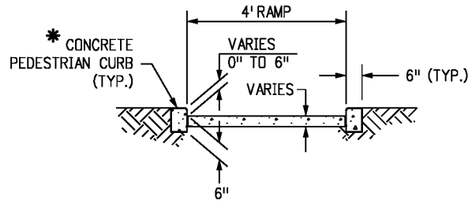
* INCLUDES CONCRETE PEDESTRIAN CURB AS SHOWN.



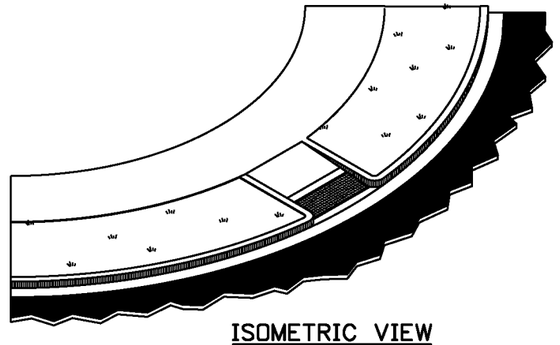
SECTION E-E



SECTION F-F



SECTION G-G



ISOMETRIC VIEW

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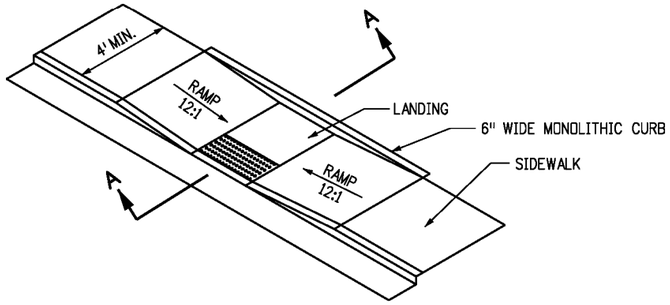
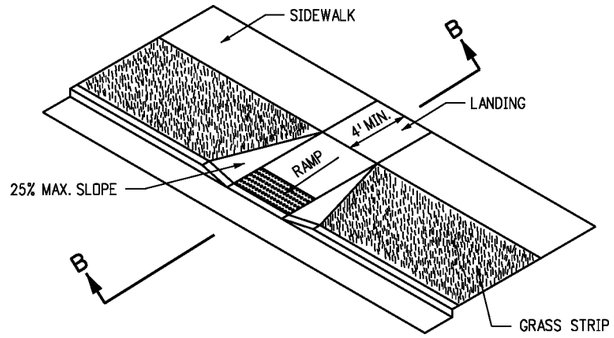


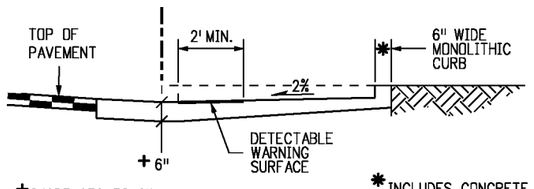
PARALLEL SIDEWALK RAMP



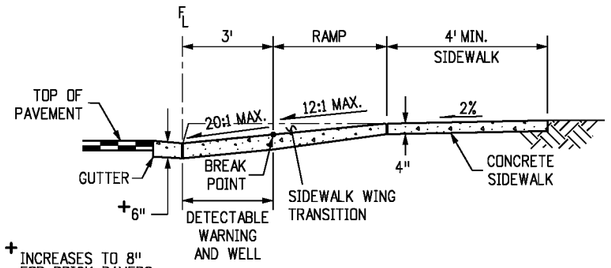
PERPENDICULAR PEDESTRIAN RAMP

NOTES

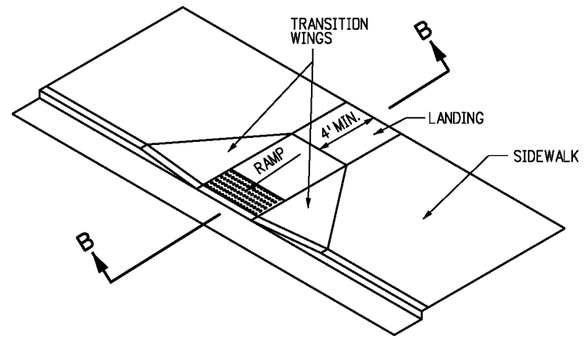
1. PERPENDICULAR AND PARALLEL PEDESTRIAN RAMPS SHOWN ON THIS DRAWING ARE ACCEPTABLE FOR USE AT MID-BLOCK INSTALLATIONS.
2. SITE CONDITIONS WILL VARY. CONFIGURATION OF RAMPS, LANDINGS, AND TRANSITIONS MAY BE CHANGED BUT THEY MUST MEET THE DIMENSIONS AND SLOPES SHOWN HERE. THE USE OF FLARES, CURBWALLS, ETC. ARE AT THE DISCRETION OF THE ENGINEER.
3. PROVIDE DETECTABLE WARNING SURFACE FOR FULL WIDTH OF CURB CUT. SEE "PLAN VIEW OF DETECTABLE WARNING" DETAIL ON SHEET 5 FOR DETECTABLE WARNING SURFACE DIMENSIONS.
4. LOCATE CURB CUT WITHIN CROSSWALK.
5. RAMP GRADE BREAK MUST BE PERPENDICULAR TO THE RUNNING SLOPE.



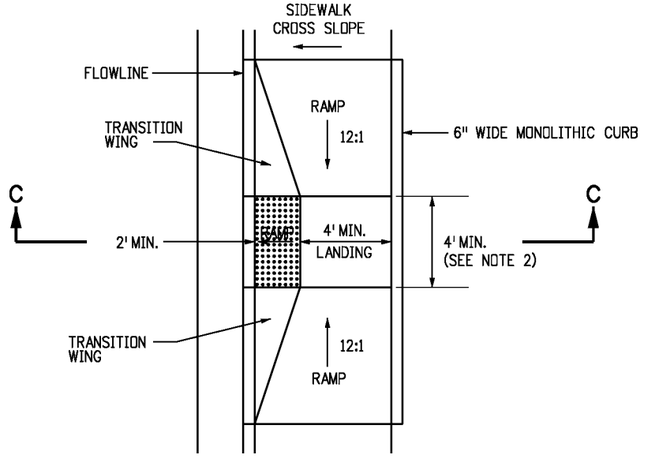
SECTION A-A



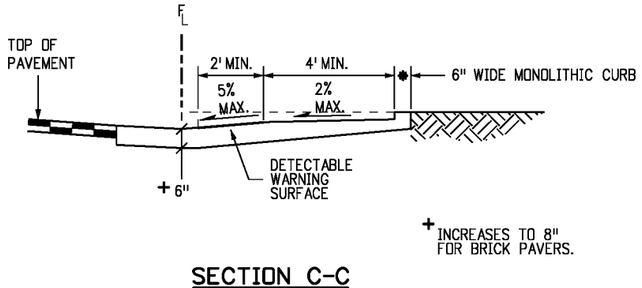
SECTION B-B



PERPENDICULAR PEDESTRIAN RAMP WITHIN SIDEWALK



PEDESTRIAN ACCESS RAMP WITHIN SIDEWALK



SECTION C-C

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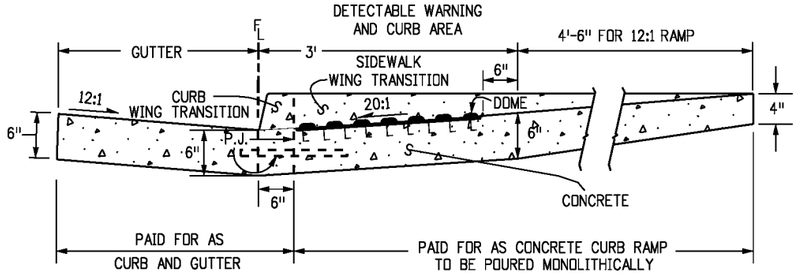
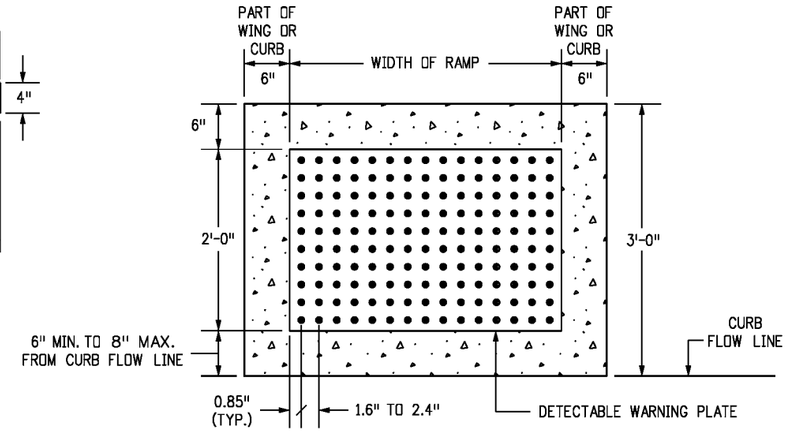


DETAIL FOR TYPES 1 AND 3 CURB RAMPS

P.J. = PERMISSIBLE JOINT WITH EPOXY-COATED DEFORMED NO. 4 BY 18 IN. BARS CONFORMING TO AASHTO M 284 AT 18 IN. SPACING.

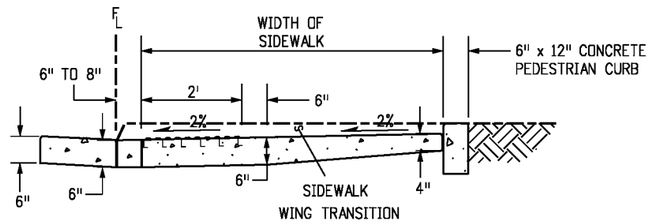
SIDE CROSS SECTION VIEW OF DETECTABLE WARNING, CURB, AND GUTTER



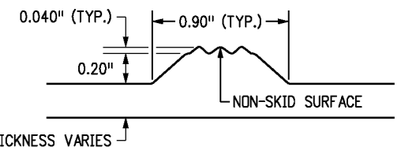
PLAN VIEW OF DETECTABLE WARNING

NOTES

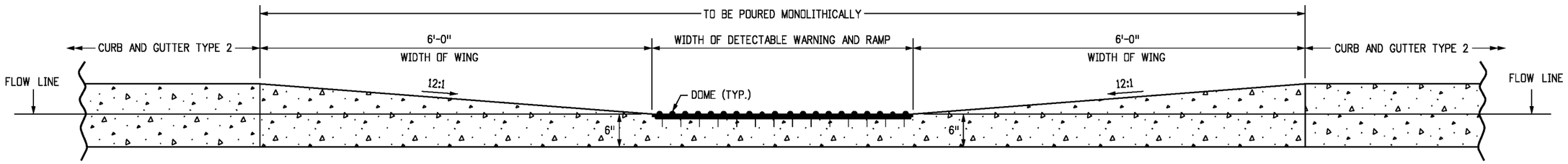
1. THE TRUNCATED DOME PLATE SHALL BE EMBEDDED IN THE CONCRETE CURB RAMP WHILE CONCRETE IS PLASTIC.
2. THE TRUNCATED DOME PLATE TO BE USED SHALL BE ON THE CDOT APPROVED PRODUCT LIST.
3. WHEN DETECTABLE WARNING SURFACE IS CUT, GRIND OFF REMAINING PORTION OF ANY CUT DOMES. SEAL ALL CUT PANEL EDGES TO PREVENT WATER DAMAGE.



DETAIL FOR TYPE 2 CURB RAMP



ELEVATION VIEW OF DETECTABLE WARNING PLATE



FRONT SECTION VIEW OF DETECTABLE WARNING, CURB, AND GUTTER

CURB RAMP WITH A TRUNCATED DOME SURFACE PLATE

Computer File Information		Sheet Revisions	
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Drawing File Name: 608010506.dgn	(R-X)		
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CURB RAMPS

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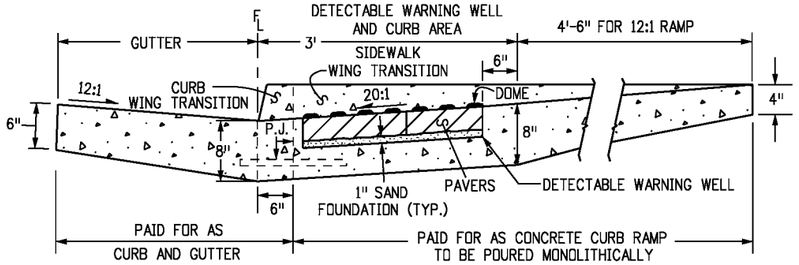
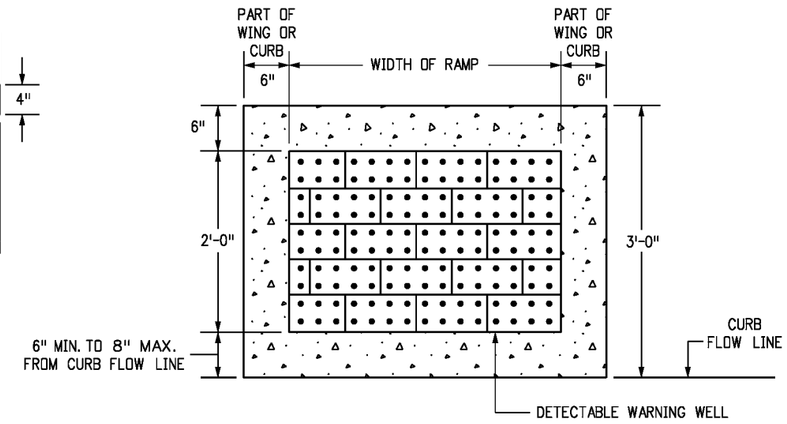


DETAIL FOR TYPES 1 AND 3 CURB RAMPS

P.J. = PERMISSIBLE JOINT WITH EPOXY-COATED DEFORMED NO. 4 BY 18 IN. BARS CONFORMING TO AASHTO M 284 AT 18 IN. SPACING.

SIDE CROSS SECTION VIEW OF DETECTABLE WARNING, WELL, CURB, AND GUTTER

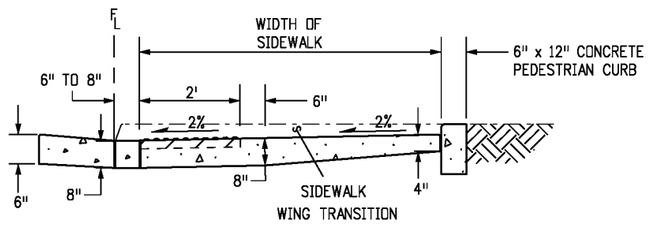


PLAN VIEW OF DETECTABLE WARNING AND WELL

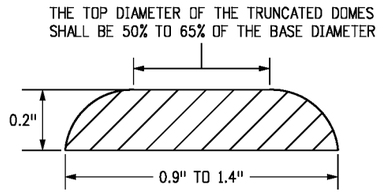
(PAVERS NOT DRAWN TO SCALE)

NOTES

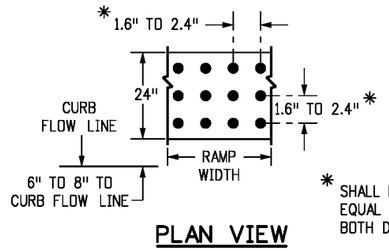
1. THE DETECTABLE WARNINGS SHALL BE BE MADE OF PAVERS WITH A TRUNCATED DOME SURFACE.
2. THE TOP OF THE DRAINAGE WEEP HOLE SHALL BE LOCATED AT THE LOWEST POINT OF THE DETECTABLE WARNING WELL.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER. THE DETECTABLE WARNING AND WELL AREA SLOPES SHALL BE 20:1 OR FLATTER.



DETAIL FOR TYPE 2 CURB RAMP

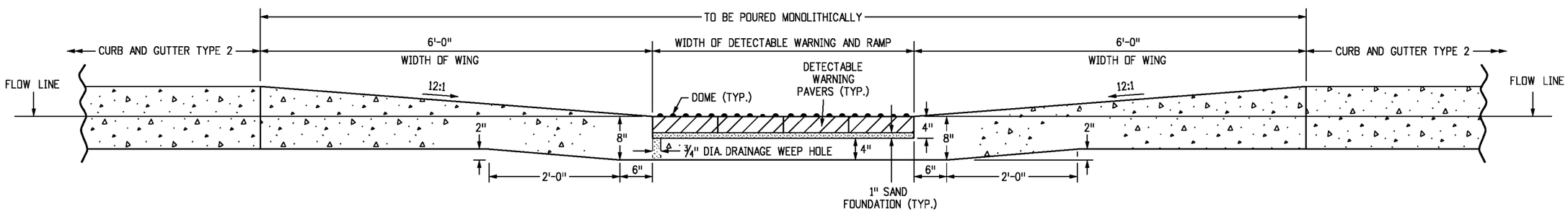


ELEVATION VIEW OF SINGLE DOME



PLAN VIEW

DOME AND DETECTABLE WARNING DETAILS



FRONT SECTION VIEW OF DETECTABLE WARNING, WELL, CURB, AND GUTTER

CURB RAMP WITH DOME PAVER OPTION

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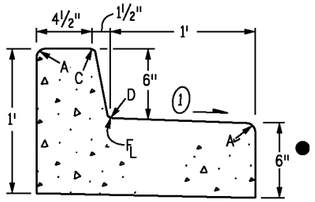
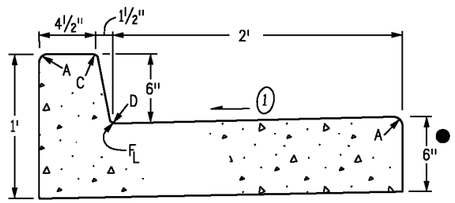
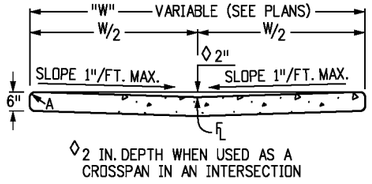


CURB AND GUTTER TYPE 2
(SECTION IB)
(6 IN. BARRIER - 1 FT. GUTTER)

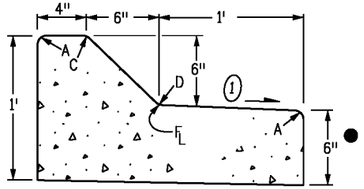


CURB AND GUTTER TYPE 2
(SECTION IIB)
(6 IN. BARRIER - 2 FT. GUTTER)

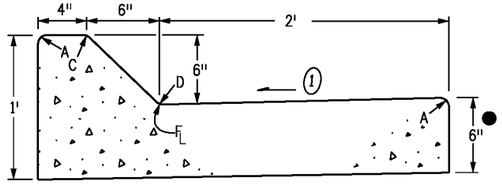


◊ 2 IN. DEPTH WHEN USED AS A CROSSPAN IN AN INTERSECTION

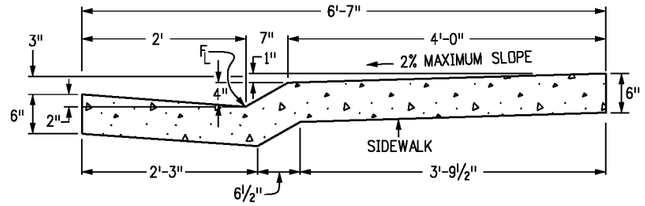
GUTTER TYPE 2



CURB AND GUTTER TYPE 2
(SECTION IM)
(6 IN. MOUNTABLE - 1 FT. GUTTER)



CURB AND GUTTER TYPE 2
(SECTION IIM)
(6 IN. MOUNTABLE - 2 FT. GUTTER)



CURB AND GUTTER TYPE 2
(SECTION MS)
(4 IN. MOUNTABLE WITH SIDEWALK)

GENERAL NOTES

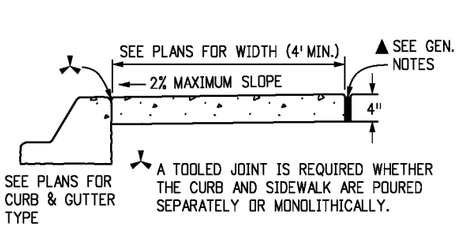
1. ON ROADWAY CURVES WITH A RADIUS OF 1,900 FT. OR LESS, CURBS AND GUTTERS ARE TO BE PLACED ON THE ARC OF THE CURVE, UNLESS OTHERWISE NOTED ON THE PLANS. A MAXIMUM CHORD LENGTH OF 10 FT. MAY BE USED WHEN THE CURVE RADIUS IS GREATER THAN 1,900 FT.
2. CONCRETE SHALL BE CLASS B.
3. PROFILE GRADE OF CURBS AND GUTTERS SHALL BE LOCATED AT THE FLOW LINE.
4. CURB TYPE 4 (KEY-WAY) MAY BE USED IN LIEU OF CURB AND GUTTER TYPE 2 (SECTIONS IB AND IM) UNLESS OTHERWISE SPECIFIED ON THE PLANS.
5. GUTTER CROSS SLOPES MAY BE ADJUSTED TO FACILITATE DRAINAGE FOR PROFILE GRADES AS SHOWN ON THE PLANS.
6. THICKNESS OF CURB AND GUTTER SECTION SHALL MATCH CONCRETE PAVEMENT THICKNESS IF SHOWN ON THE PLANS. CURB AND GUTTER SHALL BE CLASS P CONCRETE IF PLACED MONOLITHICALLY WITH CONCRETE PAVEMENT.
7. INCREASE SIDEWALK THICKNESS TO 6 IN. AT LOCATIONS SHOWN ON THE PLANS.
8. MINIMUM SIDEWALK WIDTH IS 4 FT.

▲ EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE ½ IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE.

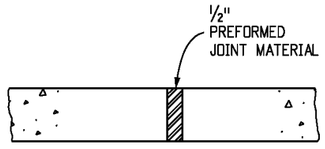
(1) GUTTER CROSS SLOPES SHALL BE ½ IN./FT. WHEN DRAINING AWAY FROM CURB AND 1IN./FT. WHEN DRAINING TOWARD CURB.

● WHEN TIE BARS ARE REQUIRED, THE GUTTER THICKNESS SHALL BE INCREASED TO THE PAVEMENT THICKNESS (T). BARS SHALL BE EPOXY-COATED #4 CONFORMING TO AASHTO M 284 AND SPACED AT 3 FT. INTERVALS. THEY SHALL BE INSERTED T/2 AND 1#2 LENGTH INTO THE GUTTER.

LEGEND FOR RADII
A = 1/8" TO 1/4"
B = 1"
C = 1½"
D = 1½" TO 2"



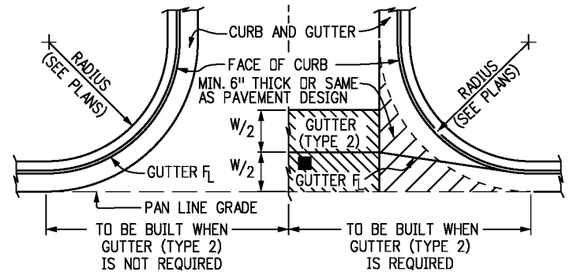
CONCRETE SIDEWALK



NOTES: 1. EXPANSION JOINTS SHALL BE PLACED IN THE SIDEWALK AT INTERVALS OF NOT MORE THAN 500 FT.

2. EXPANSION JOINTS MAY BE SEALED WHEN SPECIFIED ON THE PLANS.

SIDEWALK EXPANSION JOINT



▨ THIS AREA SHALL BE POURED MONOLITHICALLY WITH CURB AND GUTTER AND PAID FOR AS "CONCRETE PAVEMENT".

■ FLOW LINE LOCATION WILL BE ESTABLISHED BY W/2 SHOWN ON PLANS.

CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTION

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Drawing File Name: 609010104.dgn	(R-X)		
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CURB, GUTTERS, AND SIDEWALKS

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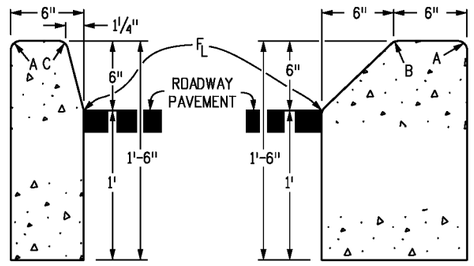
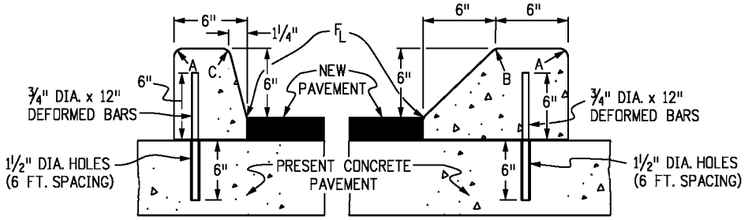


CURB TYPE 2
(SECTION B)
6 IN. BARRIER

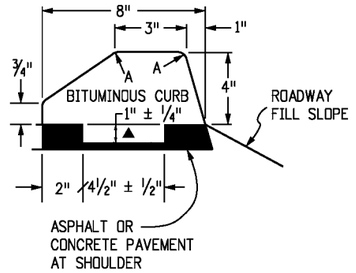
CURB TYPE 2
(SECTION M)
6 IN. MOUNTABLE

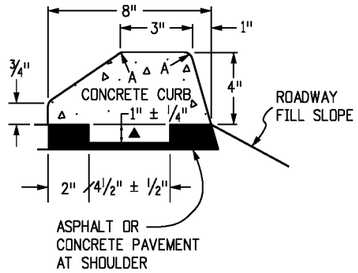


¾" DIA. x 12" DEFORMED REINFORCING BARS AT 6 FT. SPACING SHALL BE GROUTED IN 1¼" DIA. HOLES IN EXISTING CONCRETE. GROUT SHALL CONSIST OF 2 PARTS CLEAN SAND AND 1 PART CEMENT. COST OF INSTALLATION SHALL BE INCLUDED IN THE PRICE BID FOR CURB.

CURB TYPE 4
(SECTION B)
6 IN. BARRIER

CURB TYPE 4
(SECTION M)
6 IN. MOUNTABLE

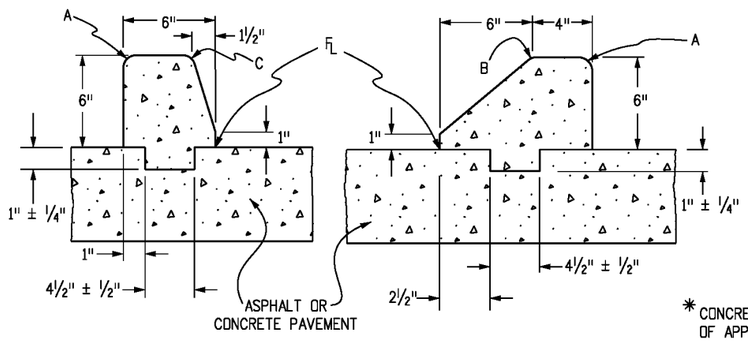




CURB TYPE 6
(SECTION M)
4 IN. MOUNTABLE

NOTE: BITUMINOUS OR CONCRETE * UNLESS OTHWISE SPECIFIED ON THE PLANS.

▲ KEY-WAY MAY BE OMITTED WHEN PLACED UNDER GUARDRAIL.

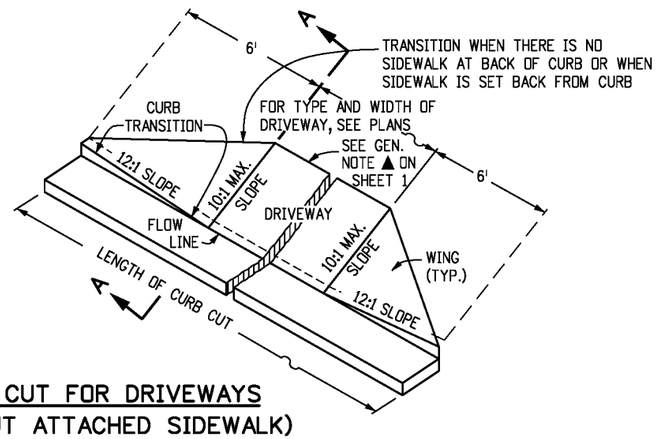


(SECTION B) **(SECTION M)**

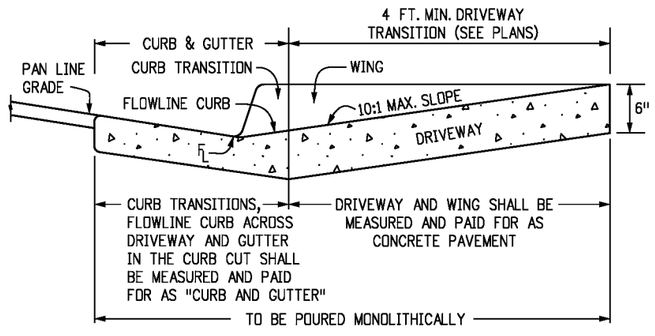
CURB TYPE 4 (KEY-WAY)*

LEGEND FOR RADII
A = 1/8 TO 1/4"
B = 1"
C = 1½"
D = 1½" TO 2"

* CONCRETE CLASS B SHALL CONTAIN 1.5 POUNDS PER CUBIC YARD OF APPROVED POLYPROPYLENE FIBERS AND MAY HAVE A NOMINAL AGGREGATE SIZE OF ⅜ IN.

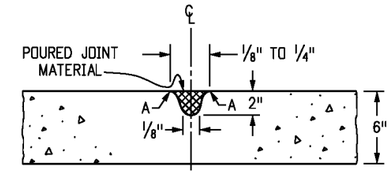


CURB CUT FOR DRIVEWAYS
(WITHOUT ATTACHED SIDEWALK)



SECTION A-A

CONCRETE PAVEMENT (DRIVEWAYS)



NOTE: RECOMMENED JOINT SPACING IS EVERY 8 FOOT ALONG THE WIDTH AND LENGTH OF DRIVEWAY. FOR DRIVEWAYS WIDER THAN 12 FEET, JOINTS ARE REQUIRED.

TRANSVERSE CONTRACTION JOINT
FOR CONCRETE PAVEMENT (DRIVEWAYS)

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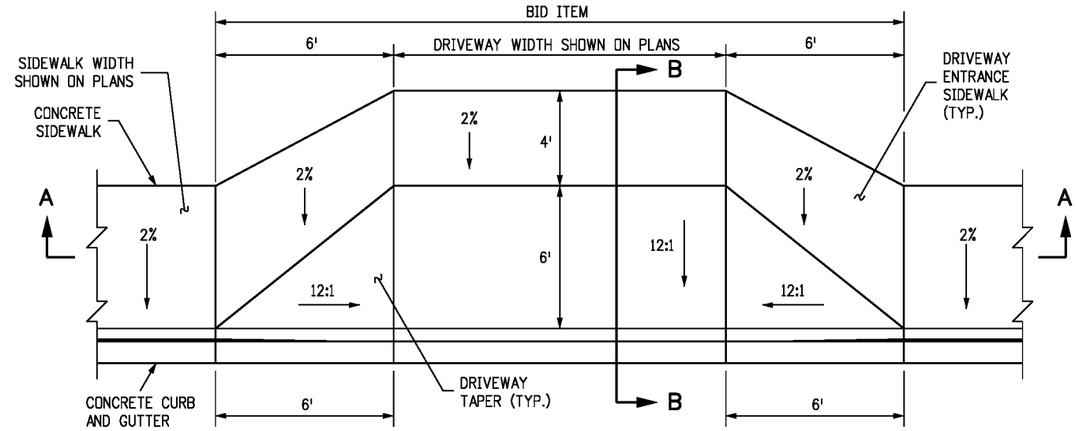
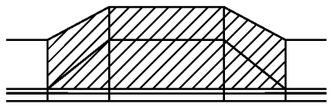
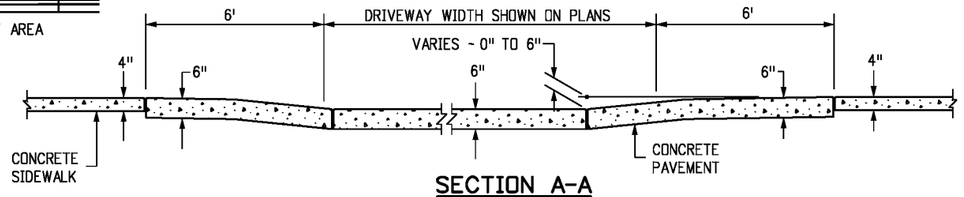
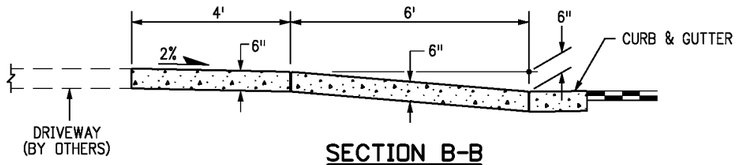


CONCRETE DRIVEWAY ENTRANCE TYPE 1

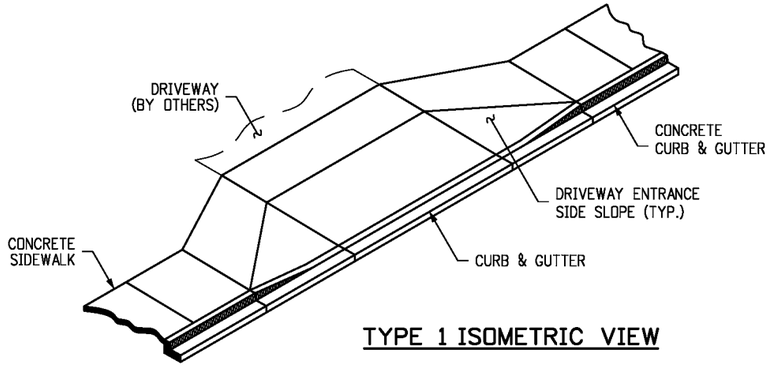




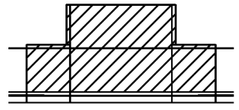
SECTION A-A

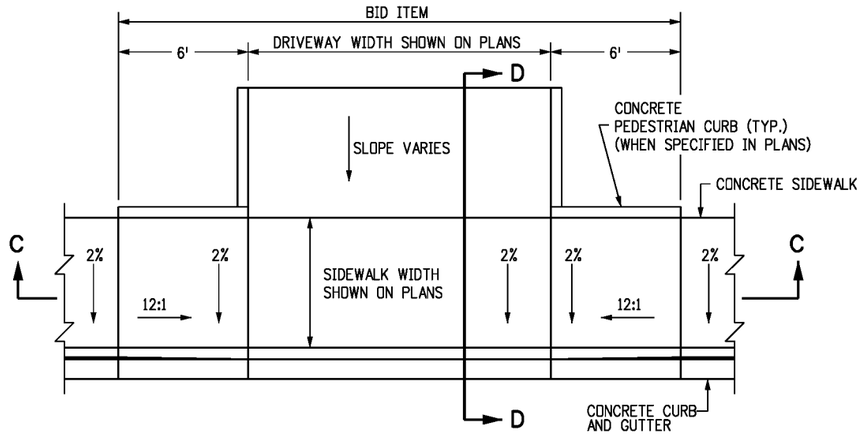


SECTION B-B

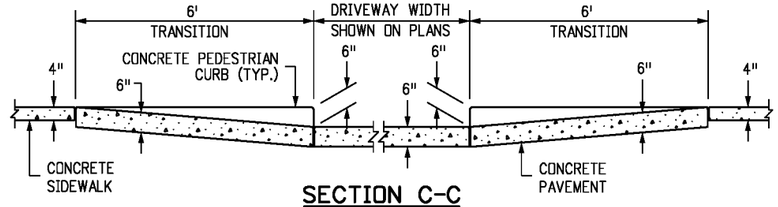


TYPE 1 ISOMETRIC VIEW

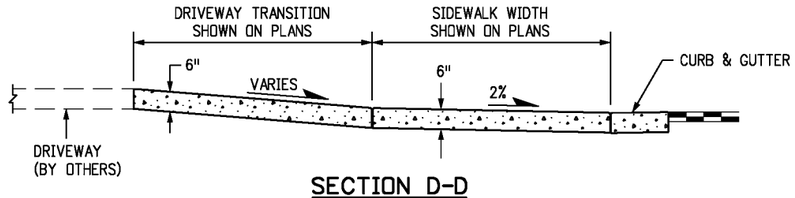




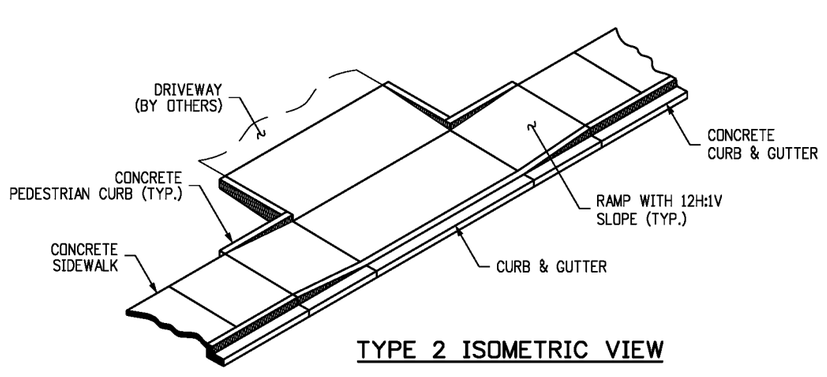
CONCRETE DRIVEWAY ENTRANCE TYPE 2



SECTION C-C



SECTION D-D



TYPE 2 ISOMETRIC VIEW

NOTES

1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.
2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.
4. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE PAVEMENT.

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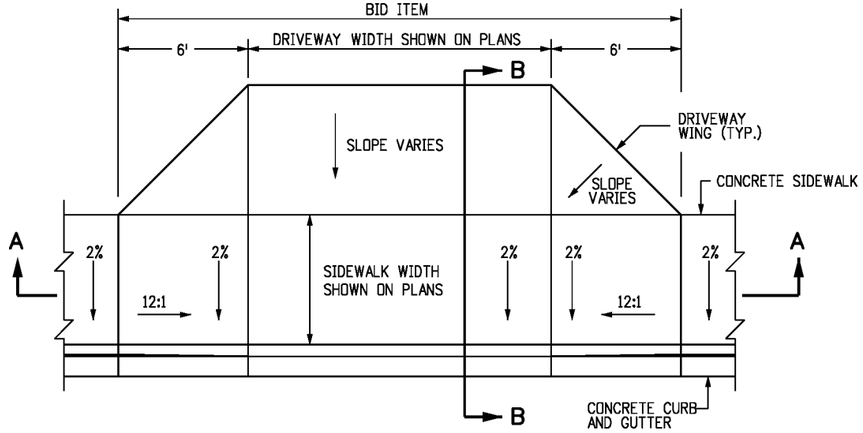
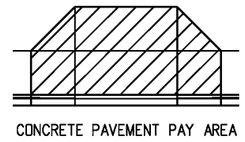
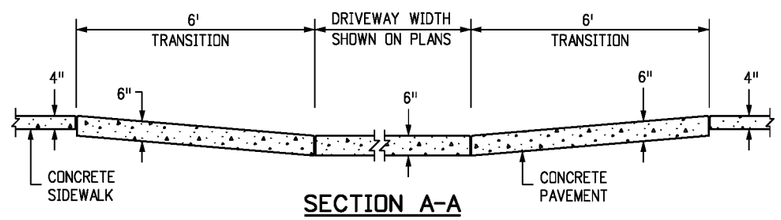


CONCRETE DRIVEWAY ENTRANCE TYPE 3

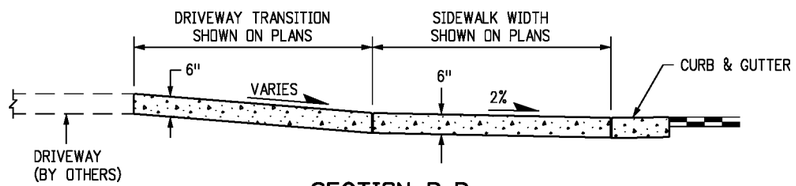

CONCRETE PAVEMENT PAY AREA

NOTES

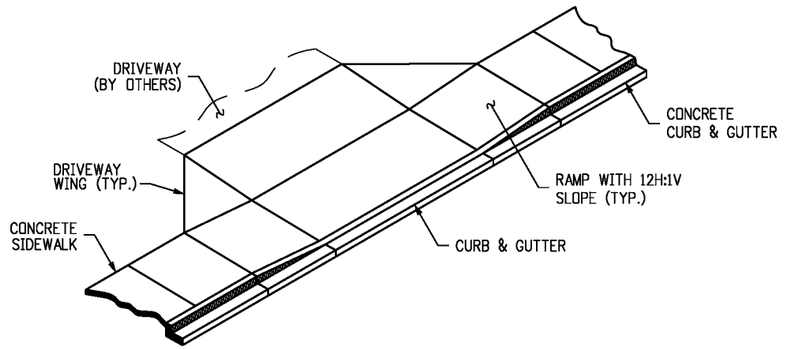
1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE DRIVEWAY RAMP ACCESS AREAS.
2. FOR THE CURB AND GUTTER SHOWN, SEE PLANS FOR CURB TYPE.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER.



SECTION A-A



SECTION B-B



TYPE 3 ISOMETRIC VIEW

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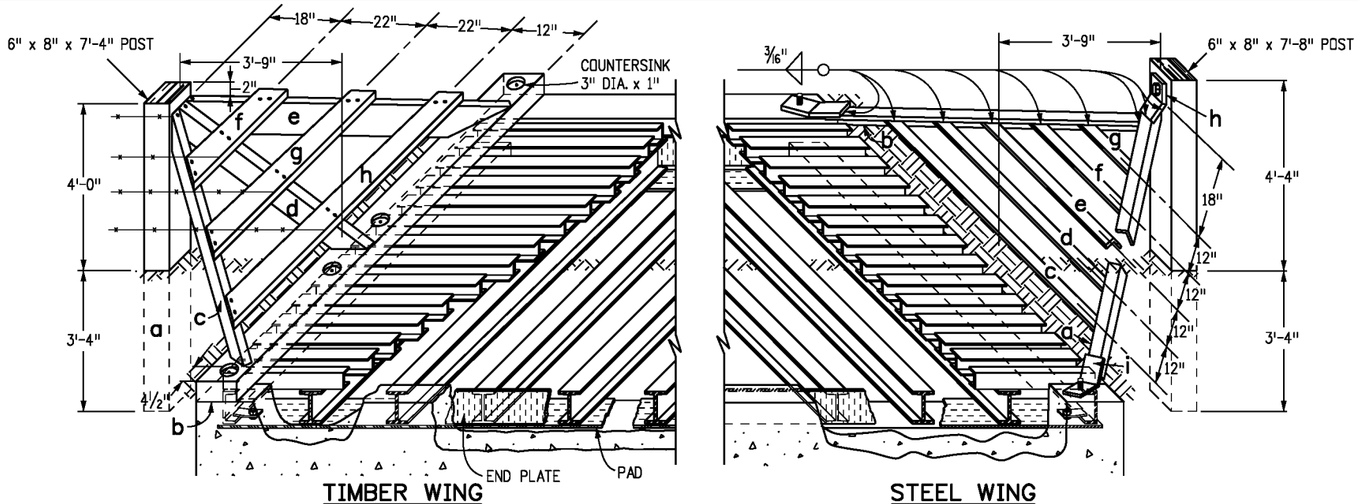
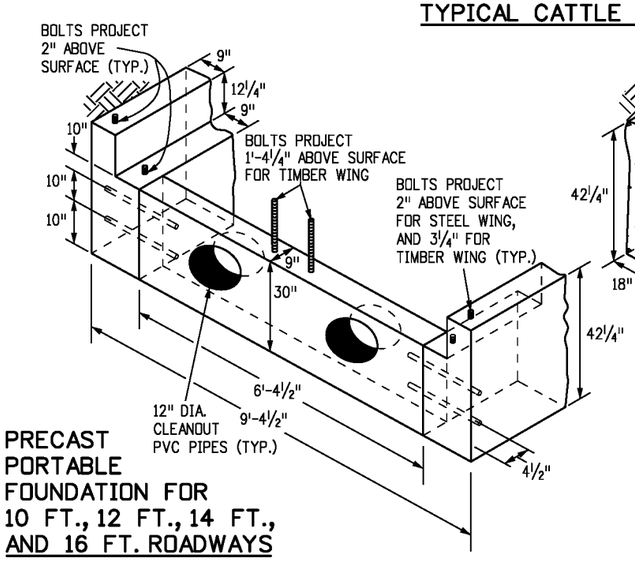


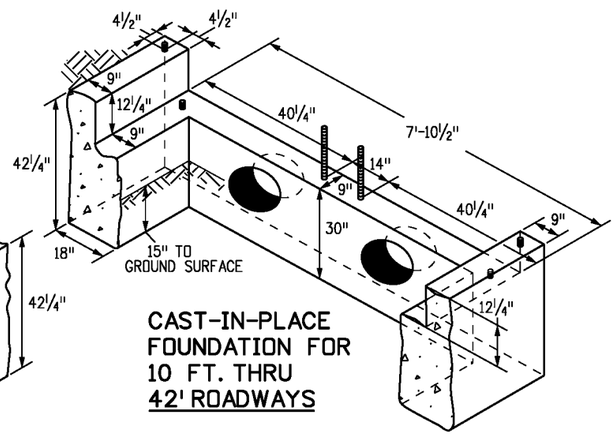
TIMBER WING

STEEL WING

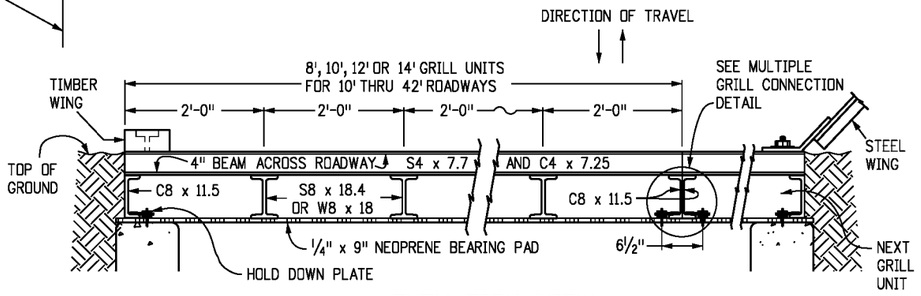
TYPICAL CATTLE GUARD INSTALLATIONS



PRECAST PORTABLE FOUNDATION FOR 10 FT., 12 FT., 14 FT., AND 16 FT. ROADWAYS



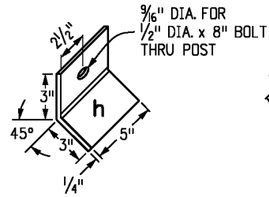
CAST-IN-PLACE FOUNDATION FOR 10 FT. THRU 42' ROADWAYS

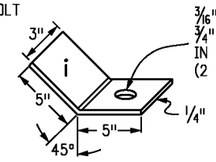


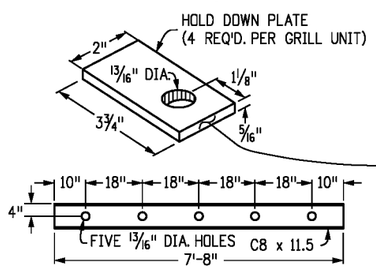
ELEVATION VIEW

GENERAL NOTES

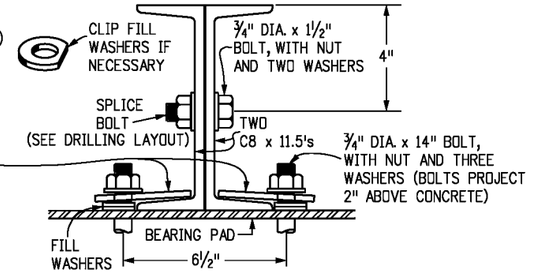
1. CONCRETE SHALL BE CLASS B. FOUNDATION MAY BE CAST-IN-PLACE OR PRECAST.
2. REINFORCING BARS SHALL BE #4, GRADE 60.
3. ALL TIMBER SHALL BE TREATED IN CONFORMANCE WITH ASSHTO M 133 AND AWPA C14.
4. WING POSTS MAY BE MADE FROM 8 IN. ROUND NATIVE TIMBER.
5. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND PAINTED WITH ALUMINUM PAINT IN ACCORDANCE WITH SECTION 509. ALL HARDWARE SHALL BE GALVANIZED IN CONFOMRANCE WITH AASHTO M 111 OR PAINTED WITH ZINC-RICH PAINT MEETING MILITARY SPECIFICATION DOD-P-21035
6. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36.
7. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
8. WHEN A CATTLE GUARD IS TO BE INSTALLED IN IMPERVIOUS MATERIAL, ADEQUATE DRAINAGE SHALL BE PROVIDED TO INSURE AGAINST POSSIBLE SUBGRADE DAMAGE. DRAINAGE DETAILS SHALL BE AS SHOWN ON THE PLANS. AN OUTLET PIPE MAY BE CONSIDERED.
9. TYPE OF WING (TIMBER OR STEEL) SHALL BE STEEL UNLESS OTHERWISE SHOWN ON THE PLANS.
10. STRUCTURE EXCAVATION AND STRUCTURE BACKFILL WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.



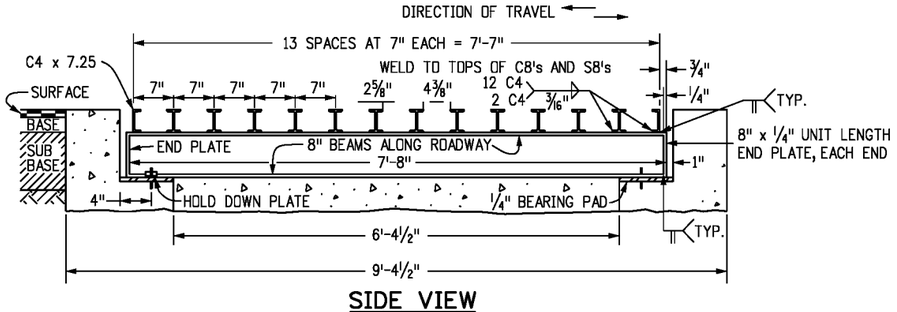




DRILLING LAYOUT



MULTIPLE GRILL UNIT CONNECTION



SIDE VIEW

WELDED GRILL CROSS SECTIONS

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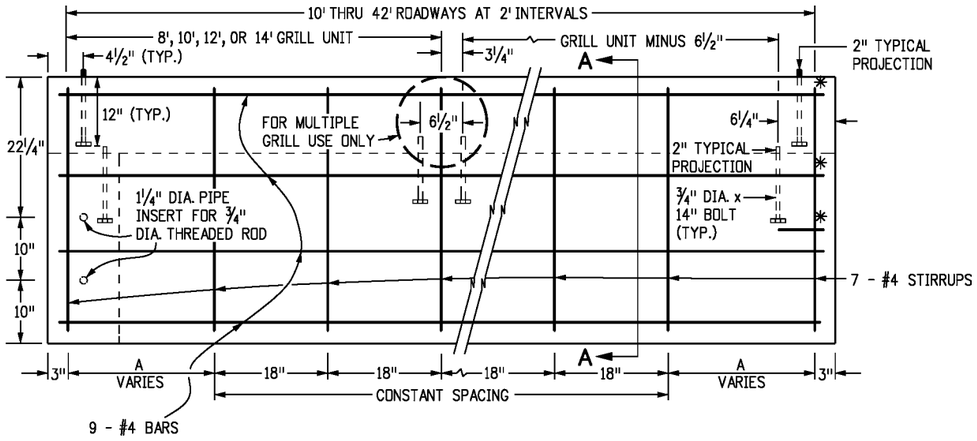


PRECAST PORTABLE FOUNDATION

CAST-IN-PLACE FOUNDATION

ELEVATION OF FOUNDATION

* WHEN CAST IN PLACE, LONGITUDINAL BARS EXTENDING FROM AND INTO THE LATERAL SUPPORT SHALL BE BENT 90° WITH A 2 IN. RADIUS AND CONTINUE PERPENDICULARY 10 IN. FROM THE BEND

a - 6" x 8" x 7'-4"
b - 4" x 8" x 9'-4½"
c - 2" x 6" x 6'-7"
d - 2" x 6" x 5'-8"
e - 2" x 6" x 6'-7"
f - 2" x 6" x 2'-5"
g - 2" x 6" x 4'-4"
h - 2" x 6" x 6'-2"
16d NAILS (GALV.) - 2 LB.

ONE TIMBER WING

a - 2" x 2" x ¼" x 79" b - 2" x 2" x ¼" x 79" c - 2" x 2" x ¼" x 84"	63.26 LBS.
d - 1½" x 1½" x ¼" x 69" e - 1½" x 1½" x ¼" x 55" f - 1½" x 1½" x ¼" x 40" g - 1½" x 1½" x ¼" x 25"	36.86 LBS.
h - 5" x 6" x ¼" x BAR - 2.13 LBS.	
i - TWO 3" x 10" x ¼" x BARS - 4.25 LBS.	
6" x 8" x 7'-8" TIMBER POST	
TOTAL LBS. STEEL = ~106.5	

ONE STEEL WING

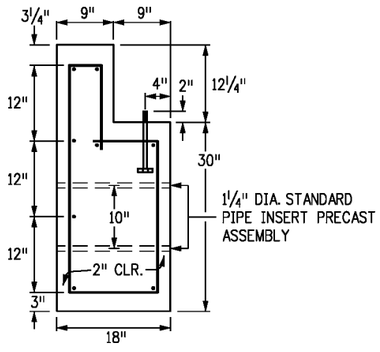
WING QUANTITIES

ROADWAY WIDTH (FT.)	USE GRILL UNITS (FT.)	PRECAST		CAST-IN-PLACE		A (IN.)	TOTAL GRILL WEIGHT (LBS.)
		CONCRETE (CU. YD.)	REINF. STEEL (LBS.)	CONCRETE (CU. YD.)	REINF. STEEL (LBS.)		
10 12	10 12	5.6 6.5	295 342	5.6 6.5	316 364	24 18	1946 2328
14 16	14 8 8	7.4 8.1	378 414	7.4 8.1	399 435	21 24	2170 3128
18 20	8 10 10 10			9.0 9.8	482 518	18 21	3434 3806
22 24	10 12 12 12			10.6 11.5	553 601	24 18	4274 4656
26 28	12 14 14 14			12.3 13.1	636 672	21 24	5038 5420
30 32	10 10 10 10 12 10			13.9 14.8	719 755	18 21	5838 6220
34 36	12 10 12 12 12 12			15.5 16.4	790 838	24 18	6602 6984
38 40 42	12 14 12 14 12 14 14 14 14			17.3 18.0 18.9	873 909 956	21 24 18	7366 7748 8130

FOUNDATION QUANTITIES

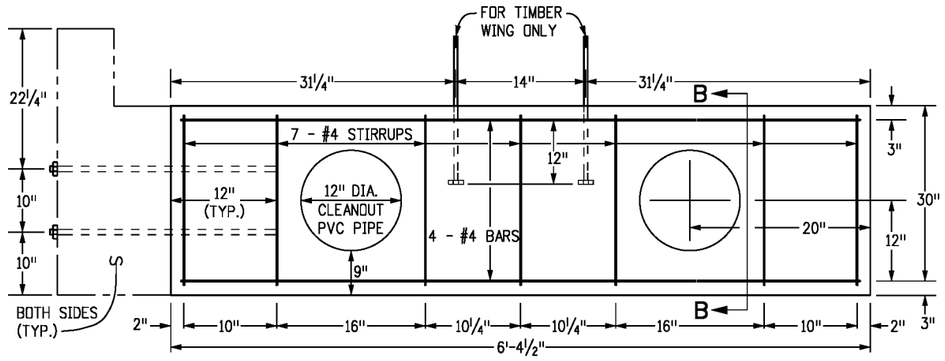
SIZE	WEIGHT (LBS.)
8'	1564
10'	1946
12'	2328
14'	2710

WELDED GRILL UNITS

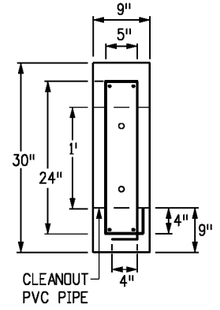


END SECTION OF FOUNDATION

SECTION A-A



ELEVATION OF LATERAL SUPPORT



LATERAL SUPPORT

SECTION B-B

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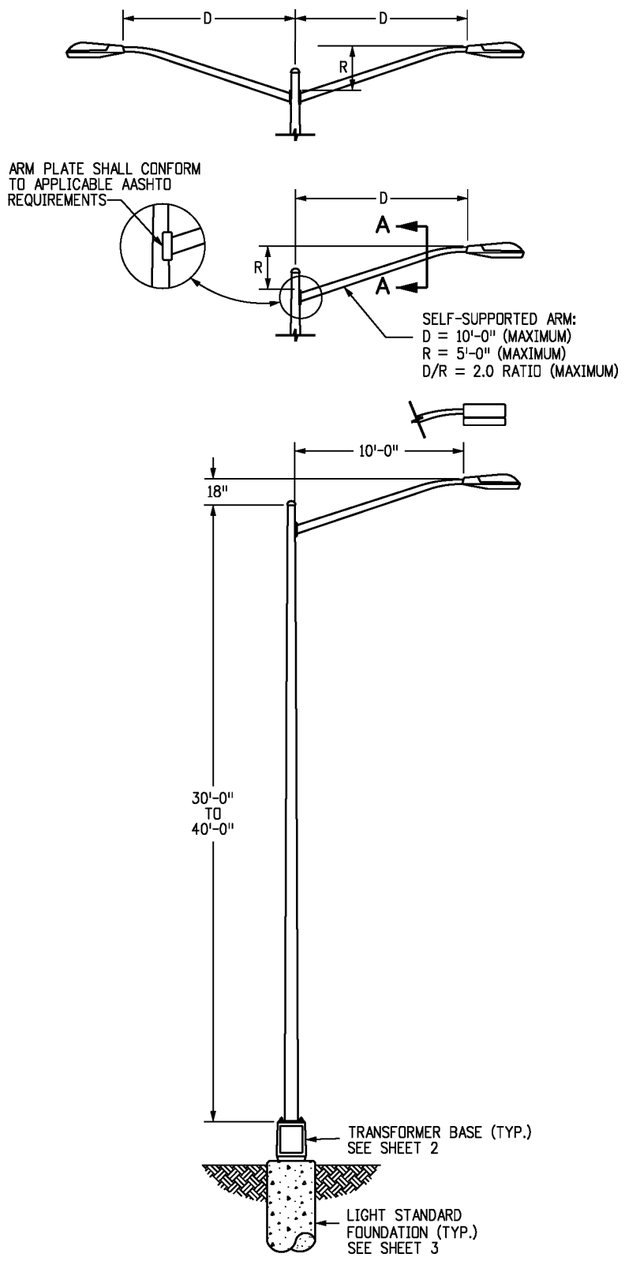
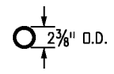
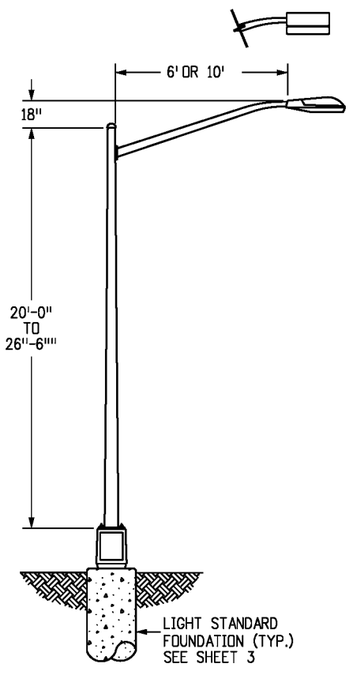


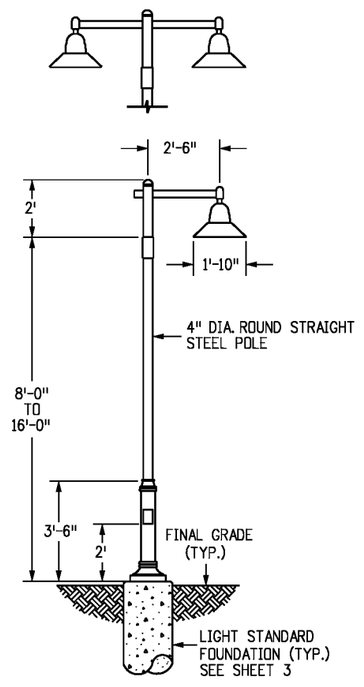
30 FT. TO 40 FT. STANDARD



SECTION A-A



20 FT. TO 26 FT.-6 IN. STANDARD



10 FT. TO 18 FT. STANDARD

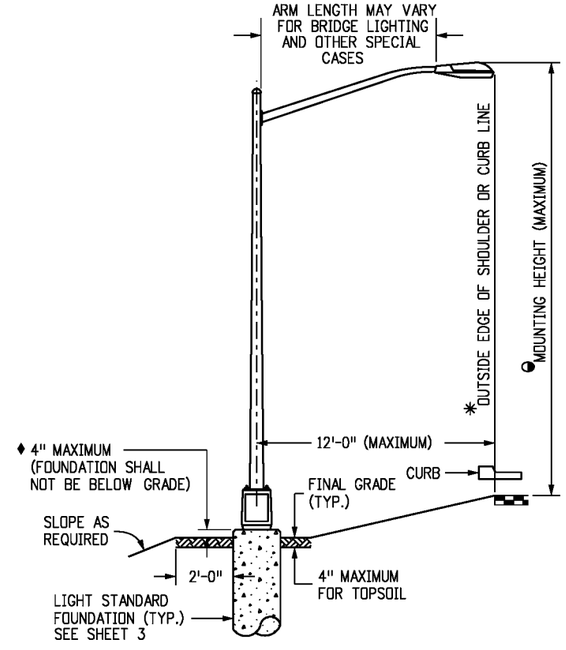
GENERAL NOTES

1. LUMINAIRES WITH LAMPS RATED MORE THAN 3200 LUMENS SHALL BE IESNA FULL CUTOFF DISTRIBUTION.
2. FLAT LENS IS REQUIRED ON ALL INSTALLATIONS, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT.
3. PHOTOELECTRIC CONTROLS SHALL BE LOCATED AT THE LIGHTING CONTROL CENTER. SEE SHEET 4 DETAILS FOR ADDITIONAL INFORMATION.
4. LIGHT STANDARDS SHALL NOT BE PLACED IN DITCHES OR OTHER LOW AREAS. EMBANKMENT AND BACKFILL SHALL BE COMPACTED IN ACCORDANCE WITH SECTION 203.
5. POLE CAPS ARE REQUIRED.

● POLE ASSEMBLY SHALL BE SUPPLIED IN SUFFICIENT LENGTH TO ACCOMMODATE MOUNTING HEIGHT.

* FINAL LOCATION OF THE LUMINAIRES SHALL BE APPROVED BY THE ENGINEER.

♦ 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.



LIGHT STANDARD LOCATION

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ROADWAY LIGHTING

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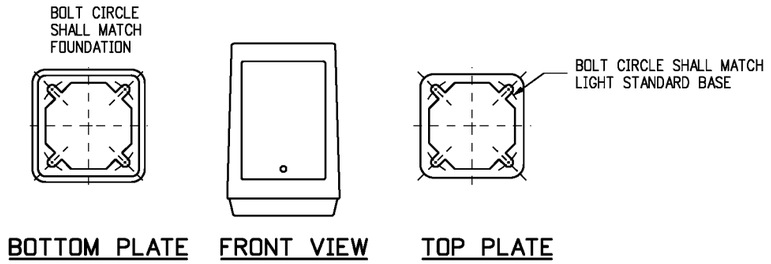
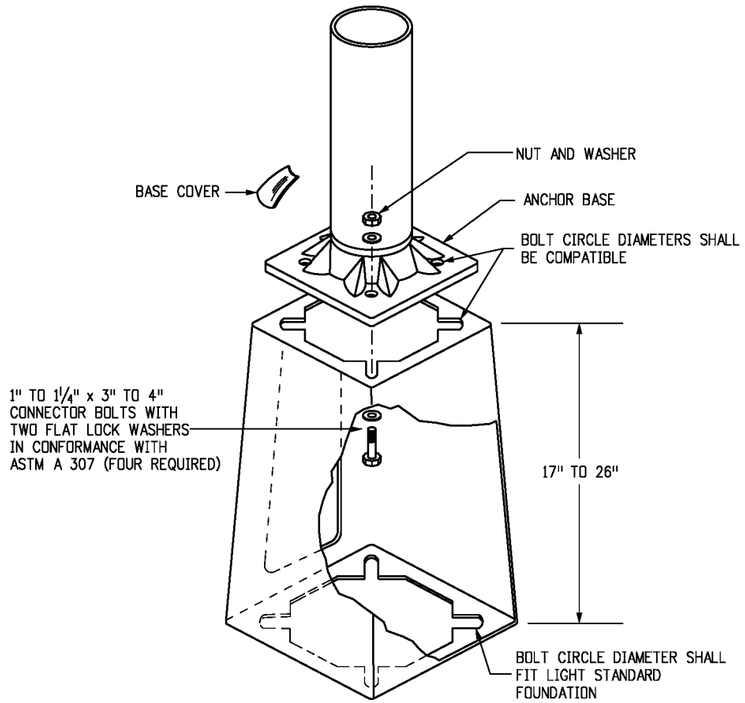


NOTE: MATCH EXISTING BREAKAWAY TRANSFORMER BASE AS CLOSELY AS POSSIBLE.



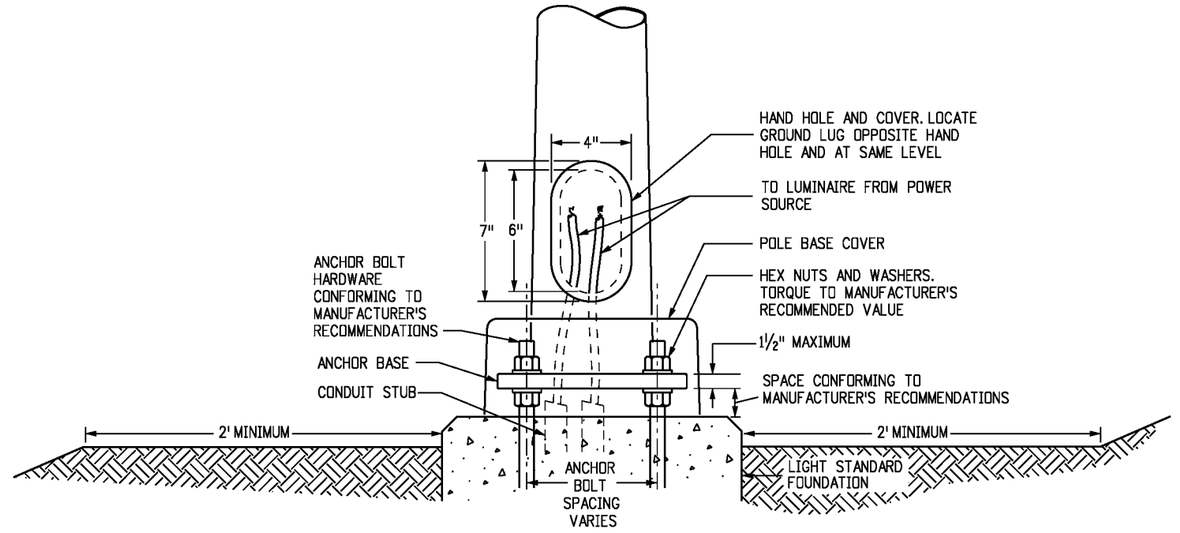
TYPICAL BREAK-AWAY TYPE TRANSFORMER BASE DETAIL

NOTES:

1. HARDWARE SHALL CONFORM TO MANUFACTURER'S REQUIREMENTS.
2. A HAND HOLE IS NOT REQUIRED IN POLE IF A BREAK-AWAY TRANSFORMER BASE IS USED.

NOTES

1. BREAK-AWAY TRANSFORMER BASES MAY BE OMITTED AND THE POLES MOUNTED DIRECTLY ON THE LIGHT STANDARD FOUNDATION, BUT ONLY WHERE DESIGNATED ON THE PLANS.
2. ALL BREAK-AWAY TRANSFORMER BASES SHALL CONFORM TO AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS".
3. LIGHT STANDARD FOUNDATIONS MAY BE PRECAST CONCRETE OR CAST-IN-PLACE CONCRETE.
4. LIGHT STANDARDS SHALL BE WIRED WITH BREAKAWAY FUSED CONNECTORS AND BE GROUNDED IN ACCORDANCE WITH THE SPECIFICATIONS.



TYPICAL NON-BREAKAWAY BASE DETAIL

FOR USE ONLY OUTSIDE CLEAR ZONE OR IN PROTECTED INSTALLATIONS.

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ROADWAY LIGHTING

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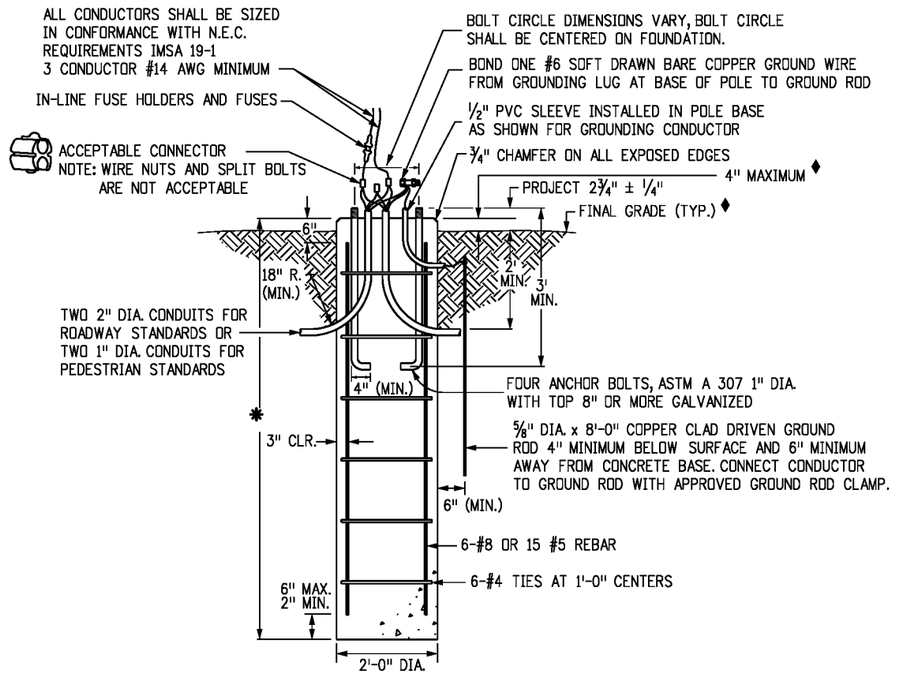
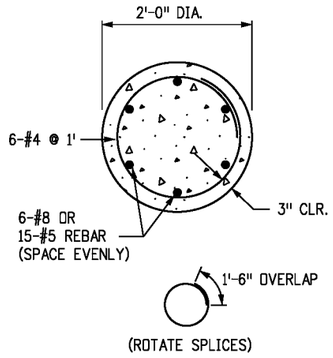
NOTES

1. DIMENSIONS FOR THE TRANSFORMER BASE, ANCHOR BASE AND ANCHOR BOLTS ARE VARIABLE FOR THE HEIGHT OF THE LIGHT STANDARD AND THE MAST ARM CONFIGURATION. ALL COMPONENTS SHALL FIT AND ACCOMMODATE THE REQUIREMENTS OF THE LIGHT STANDARD SUPPLIED.
2. ✱ FOUNDATION SHALL BE 7 FT. FOR LIGHT STANDARDS 20 FT. THRU 40 FT., AND 6 FT. FOR LIGHT STANDARDS LESS THAN 20 FT.
3. LIGHT STANDARD FOUNDATION DEPTH IS BASED ON A MAXIMUM POLE HEIGHT OF 40 FT. IN STIFF CLAY WITH N > 8 OR MEDIUM SAND WITH N > 15 AS DETERMINED BY ASTM D 1586 STANDARD PENETRATION TEST.
4. CONCRETE SHALL BE CLASS B.
5. 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.

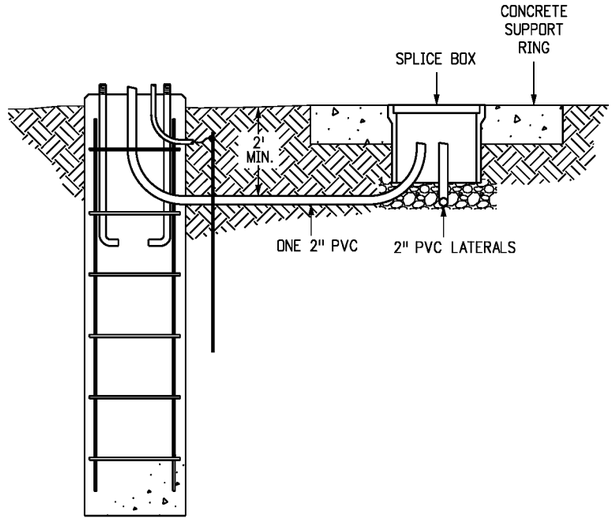
♦ WHERE FOUNDATION IS LOCATED IN THE SIDEWALK, THE TOP OF THE FOUNDATION SHALL BE FLUSH WITH THE TOP OF THE SIDEWALK CONFORMING TO ADA REQUIREMENTS.



TYPICAL CONCRETE LIGHT STANDARD FOUNDATION



TYPICAL FOUNDATION SECTION



ALTERNATIVE CONCRETE LIGHT STANDARD FOUNDATION WITH SPLICE BOX

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ROADWAY LIGHTING

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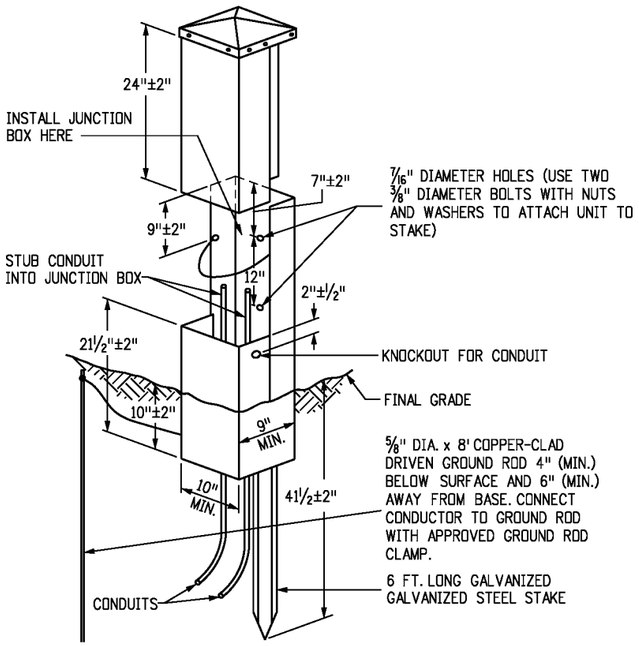
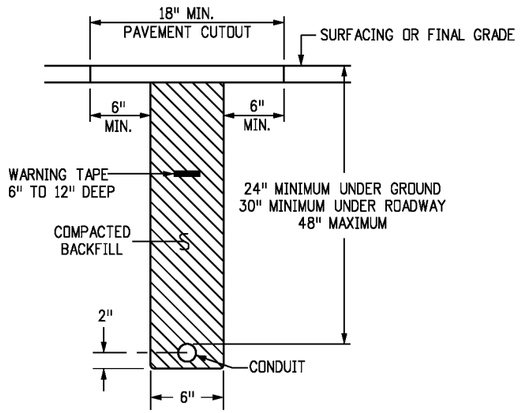


SECONDARY SERVICE PEDESTAL

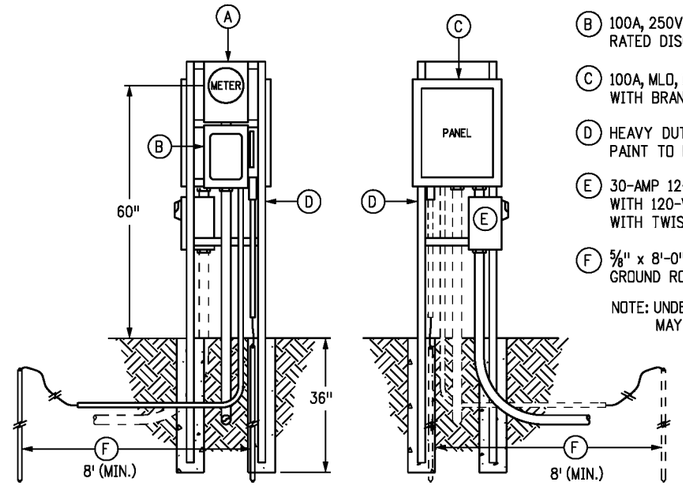
(FRONT VIEW WITH COVER LIFTED)



SECTION-TYPICAL CONDUIT BURIAL

NOTES:

1. CONTRACTOR SHALL COORDINATE TRENCHING WITH OTHER UNDERGROUND UTILITIES, RAMP METERING AND IRRIGATION. CONTRACTOR SHALL USE COMMON TRENCHES AT ALL ROAD CROSSINGS WHERE POSSIBLE.
2. ONE #14 AWG LOCATE WIRE AND A NYLON PULL STRING IN ALL EMPTY CONDUITS.



FRONT ELEVATION REAR ELEVATION
LIGHTING CONTROL CENTER (PEDESTAL)

PEDESTAL COMPONENT LIST

(A) 125A, 120/240V, NEMA 3R METER HOUSING CONFORMING TO UTILITY PROVIDER REQUIREMENTS.

(B) 100A, 250V, HEAVY DUTY, 2-POLE, NEMA 3R, SERVICE ENTRANCE RATED DISCONNECT SWITCH WITH GROUND AND NEUTRAL BARS.

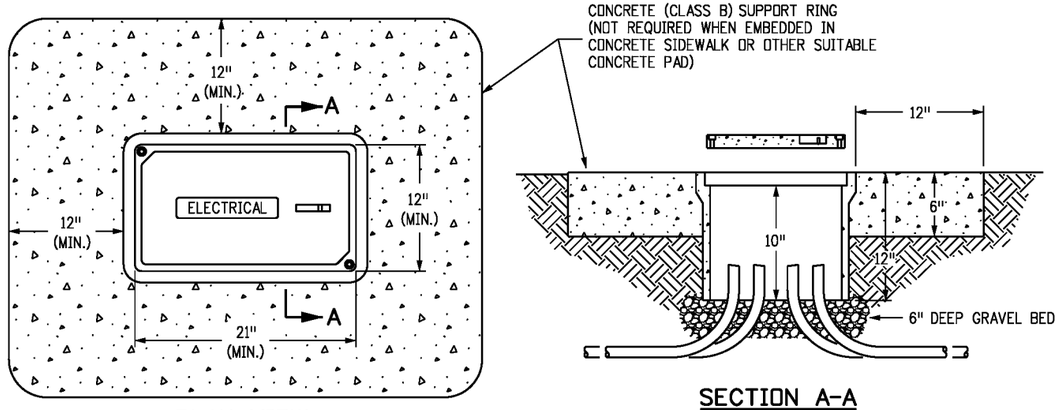
(C) 100A, MLO, 120/240V-1ø-3W, 8-SPACE, NEMA 3R LOAD CENTER WITH BRANCH BREAKERS AS LISTED ON THE PANEL SCHEDULE.

(D) HEAVY DUTY, GALVANIZED C-CHANNEL TYPE RACKING SET IN CONCRETE. PAINT TO MATCH PANEL COLOR.

(E) 30-AMP 12-POLE ELECTRICALLY HELD LIGHTING CONTACTOR FURNISHED WITH 120-VOLT COIL AND NEMA 3R 120V PHOTO ELECTRIC CONTROL WITH TWIST-LOCK RECEPTACLE BASE.

(F) 5/8" x 8'-0" COPPER-CLAD DRIVEN GROUND ROD WITH APPROVED GROUND ROD CLAMP.

NOTE: UNDERGROUND COMBINATION METER/SERVICE PANEL ASSEMBLY MAY BE USED IF APPROVED BY ENGINEER.



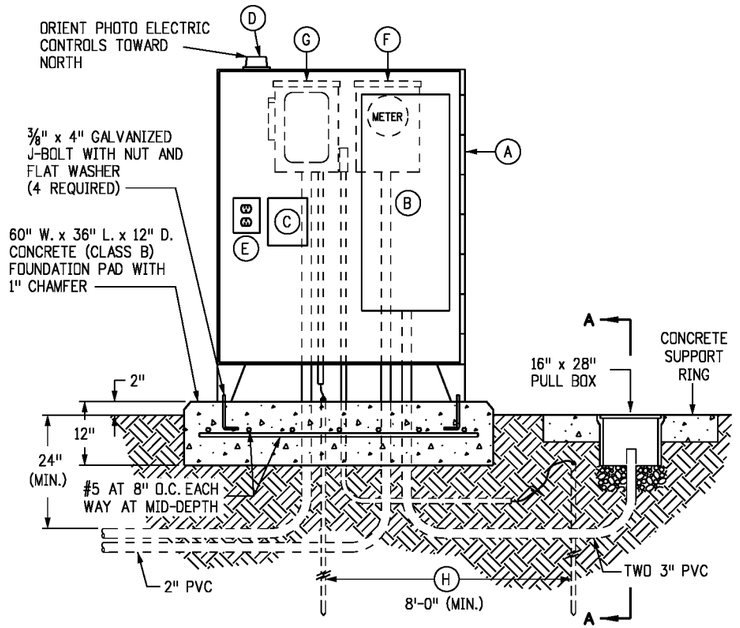
PLAN VIEW

SECTION A-A

TYPICAL PULL OR SPLICE BOX

NOTES:

1. ALL PULL OR SPLICE BOXES SHALL BE TRAFFIC RATED 20,000 PSI MINIMUM.
2. BOX DIMENSIONS SHOWN ARE FOR 2 IN. CONDUITS MAXIMUM. FOR CONDUITS LARGER THAN 2 IN. REFER TO N.E.C. SECTION 314.28A FOR BOX SIZE REQUIREMENTS.



LIGHTING CONTROL CENTER (CABINET)

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, 100-AMP MLO 120V/240V 1ø 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 CONTACTOR FURNISHED WITH 120-VOLT COIL AND NUMBER OF POLES REQUIRED. INSTALL INSIDE CABINET.

(D) NEMA 3R 120V PHOTOELECTRIC CONTROL WITH 3-PRONG TWIST-LOCK RECEPTACLE BASE. INSTALL THE BASE INSIDE THE CABINET. THE PHOTOELECTRIC CONTROL SHALL BE MOUNTED ON TOP OF THE CABINET AND ORIENTED NORTHWARD TO MINIMIZE THE SUN'S INTERFERENCE.

(E) 20-AMP GFCI MAINT. RECEPTACLE IN A 1-GANG BACK BOX WITH COVER. INSTALL INSIDE THE CABINET.

(F) 125A, 120/240V, METER HOUSING CONFORMING TO THE UTILITY PROVIDER'S REQUIREMENTS.

(G) NEMA 3R, 100-AMP, 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.

(H) 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.

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ROADWAY LIGHTING

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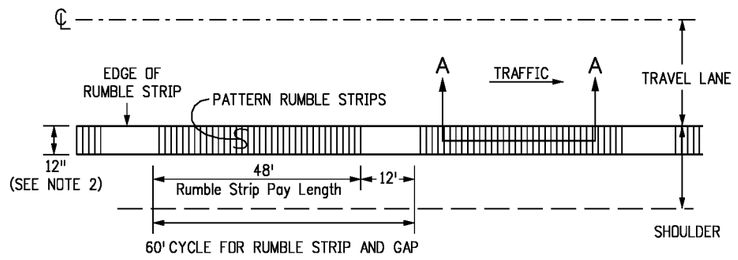
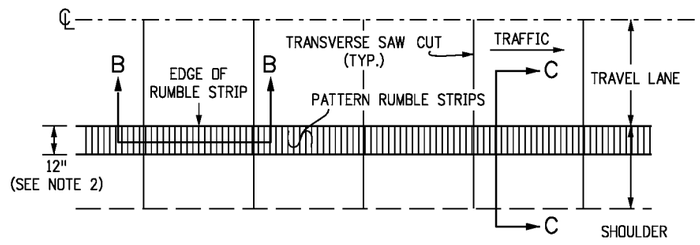
GENERAL NOTES

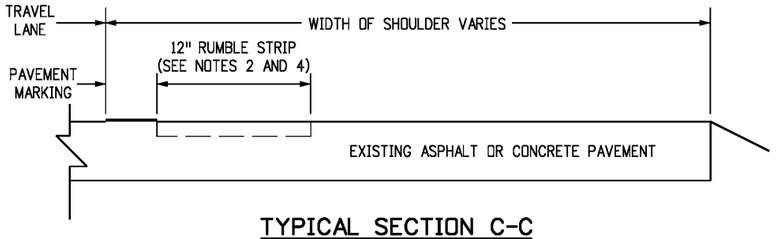
1. RUMBLE STRIPS SHALL BE OMITTED AT TURN AND AUXILIARY LANES, ROAD APPROACHES, RESIDENCES, 250 FT. BEFORE ROAD INTERSECTIONS, AND OTHER INTERRUPTIONS AS DIRECTED BY THE ENGINEER.
2. RUMBLE STRIPS MAY BE INSTALLED BY GRINDING, ROLLING, OR FORMING ON CONCRETE PAVEMENT, AND BY GRINDING ONLY ON HMA PAVEMENT. RUMBLE STRIP WIDTH SHALL BE 12 IN. FOR GRIND-IN AND 18 IN. FOR FORMED OR ROLLED.
3. MINIMIZE THE DISTANCE BETWEEN RUMBLE STRIP AND EDGE LINE ON CONCRETE PAVEMENTS WITH 14 FT. WIDE SLABS.
4. BEGIN RUMBLE STRIPS ON THE OUTSIDE EDGE OF THE TRAVEL LANE EDGE LINE.
5. DO NOT INSTALL RUMBLE STRIPS ON SHOULDERS LESS THAN 6 FT. WIDE WHEN GUARDRAIL IS PLACED ALONG THE EDGE OF THE SHOULDER.
6. APPLY THE 60 FT. GAP PATTERN WHEN RUMBLE STRIPS (GRIND-IN) ARE INSTALLED IN CONCRETE PAVEMENT.



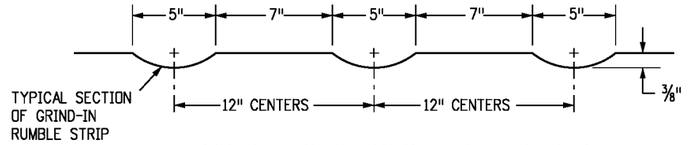
INTERMITTENT RUMBLE STRIP
TWO-LANE ROADWAY (HMA)



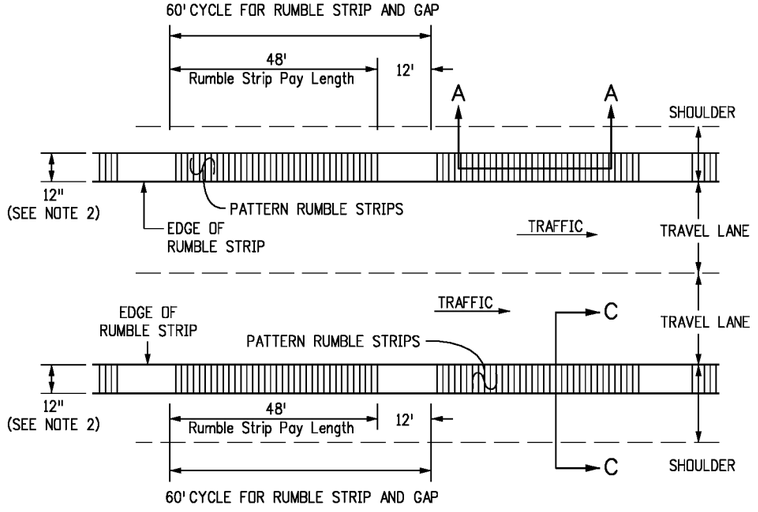
CONTINUOUS RUMBLE STRIP
TWO-LANE ROADWAY (CONCRETE)



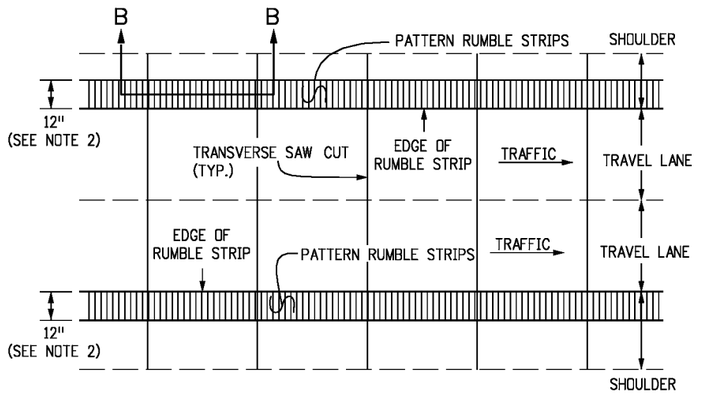
TYPICAL SECTION C-C



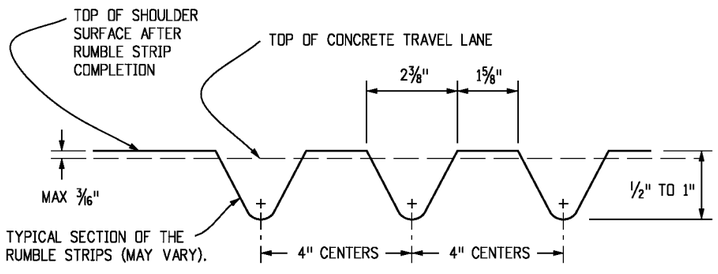
TYPICAL SECTIONS A-A AND B-B
FOR GRIND-IN RUMBLE STRIP
ON EXISTING HMA OR CONCRETE PAVEMENT



INTERMITTENT RUMBLE STRIP
FOUR-LANE DIVIDED ROADWAY (HMA)



CONTINUOUS RUMBLE STRIP
FOUR-LANE DIVIDED ROADWAY (CONCRETE)



TYPICAL SECTION B-B
FOR FORMED OR ROLLED ON CONCRETE PAVEMENTS ONLY

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RUMBLE STRIPS

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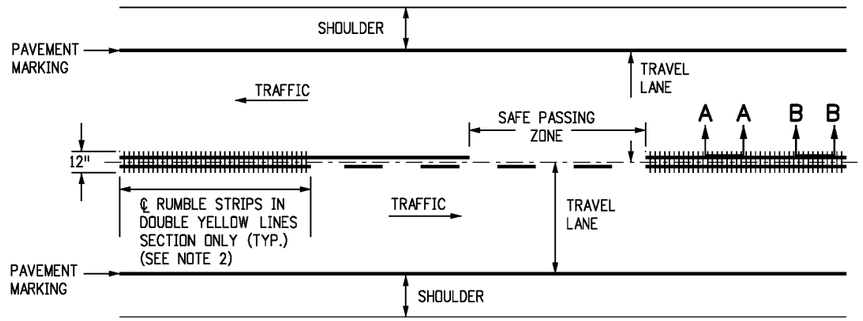
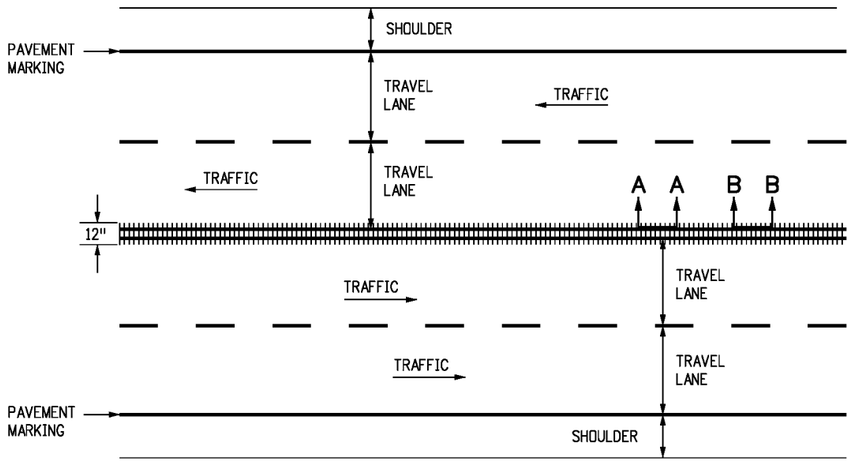


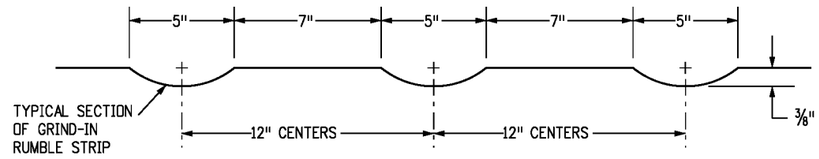
TWO LANE HIGHWAY (HMA AND CONCRETE) CONTINUOUS CENTER LINE RUMBLE STRIPS



FOUR LANE UNDIVIDED HIGHWAY (HMA AND CONCRETE) CONTINUOUS CENTER LINE RUMBLE STRIPS

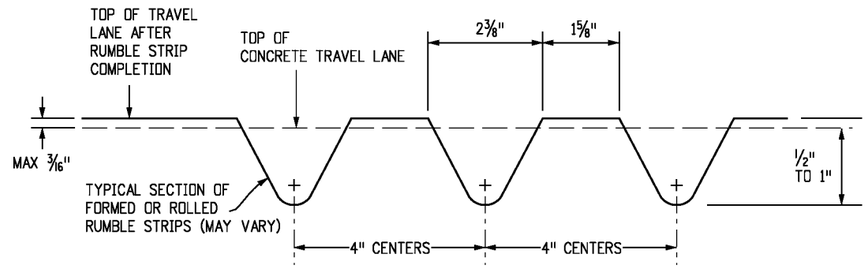
NOTES

1. RUMBLE STRIP WIDTH SHALL BE 12 IN. FOR GRIND-IN, FORMED, OR ROLLED.
2. CENTERLINE RUMBLE STRIPS MAY BE CONTINUOUS THROUGH PASSING ZONES AS DETERMINED BY THE ENGINEER AND SHOWN ON THE PLANS.



TYPICAL SECTIONS A-A AND B-B

FOR GRIND-IN RUMBLE STRIP
ON EXISTING ASPHALT OR CONCRETE PAVEMENT



TYPICAL SECTION B-B

FOR FORMED OR ROLLED ON CONCRETE PAVEMENTS ONLY

DETAILS FOR CENTER LINE RUMBLE STRIPS

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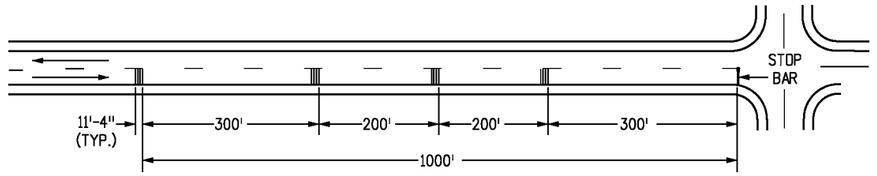
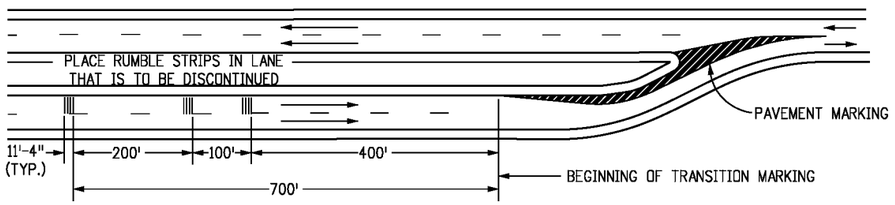
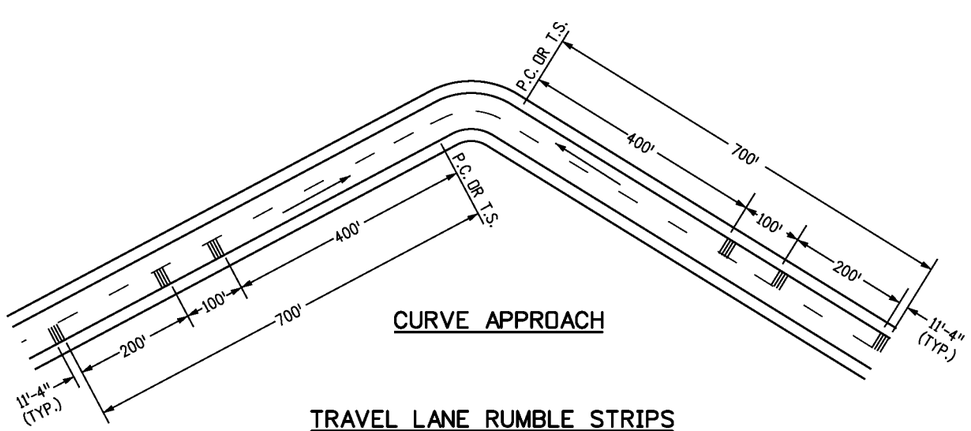


STOP SIGN APPROACH

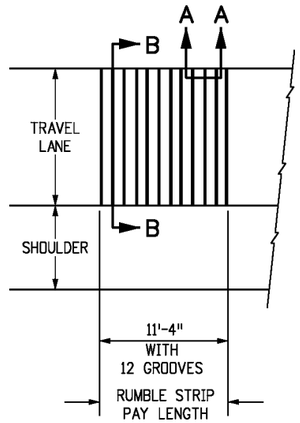


LANE REDUCTION TRANSITION

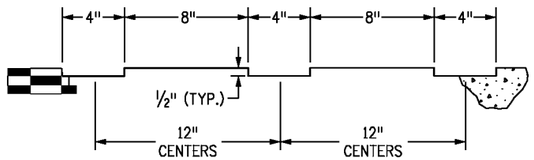


CURVE APPROACH

TRAVEL LANE RUMBLE STRIPS

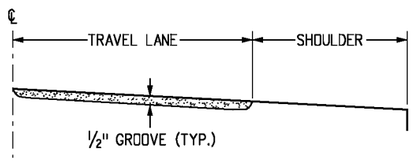


TYPICAL RUMBLE STRIP CLUSTER



RUMBLE STRIP GROOVES IN HMA OR CONCRETE SURFACE
12 STRIPS PER CLUSTER TYPICAL

SECTION
A-A
(GROOVED)

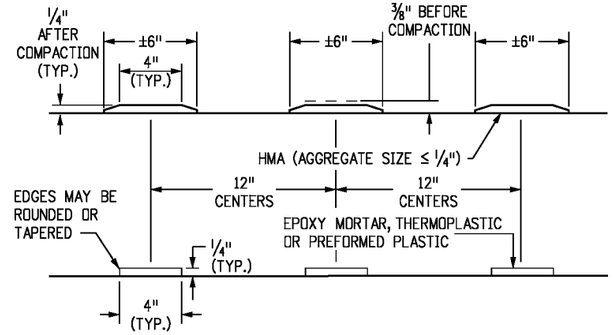


SECTION
B-B
(GROOVED)

PERMANENT GROOVED RUMBLE STRIPS

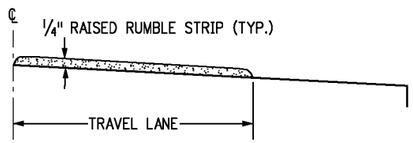
NOTES

1. GROOVED RUMBLE STRIP SKEW OR CLUSTER SPACING SHALL BE MODIFIED TO AVOID LOCATING A GROOVE ON A CONCRETE PAVEMENT TRANSVERSE JOINT.
2. PERMANENT TRAVEL LANE RUMBLE STRIPS SHALL BE THE GROOVE DESIGN, AND MAY BE CUT IN EXISTING, NEW HMA, OR CONCRETE PAVEMENT. THE GROOVES MAY BE CUT BY SAWING, GRINDING, OR OTHER METHOD AS APPROVED.
3. TEMPORARY RUMBLE STRIPS SHOULD NORMALLY BE THE RAISED DESIGN. THEY MAY BE GROOVES IF LOCATED IN A PAVEMENT THAT WILL BE REMOVED OR COVERED WITH A PAVEMENT COURSE BEFORE COMPLETION OF THE PROJECT. TYPICAL USES OF TEMPORARY RUMBLE STRIPS ARE FOR LANE CLOSURES OR ALIGNMENT CHANGES IN CONSTRUCTION ZONES.
4. THE HMA (RAISED RUMBLE STRIPS) SHALL BE PLACED ON A CLEAN, TACK COATED TREATED PAVEMENT IN ⅜ IN. HIGH FORMS. THE FORMS SHALL BE REMOVED AND THE ASPHALT COMPACTED BY ROLLING ALONG THE STRIPS. EPOXY MORTAR SHALL BE FORMED, TROWELED, AND LEVELED WITH A ROLLER AND THE TOP EDGES ROUNDED, THERMOPLASTIC STRIPS SHALL BE APPLIED BY THE EXTRUSION PROCESS. PREFORMED PLASTIC SHALL BE INSTALLED IN CONFORMANCE WITH THE INSTRUCTIONS OF THE MANUFACTURER.



PREFORMED PLASTIC STRIPS SHALL BE SPACED ON 12 IN. CENTERS AND MAY VARY FROM THE 4 IN. TYPICAL WIDTH.
12 STRIPS PER CLUSTER TYPICAL

SECTION
A-A
(RAISED)



SECTION
B-B
(RAISED)

TEMPORARY RAISED RUMBLE STRIPS

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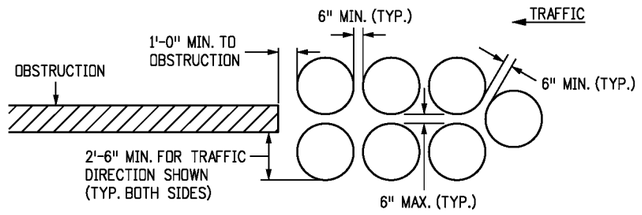

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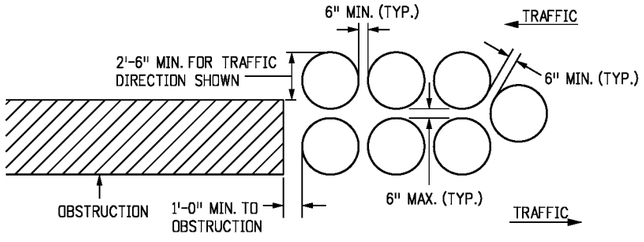
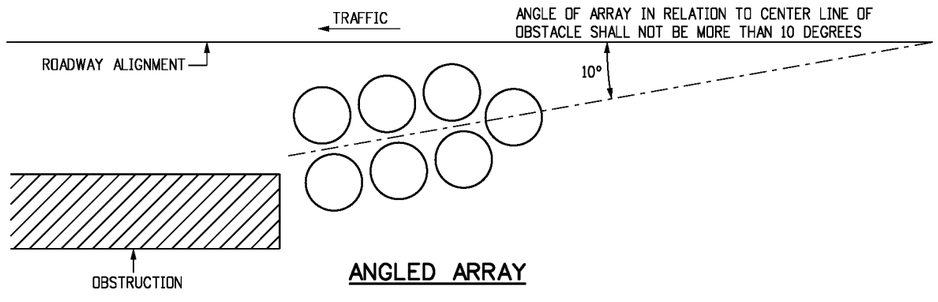


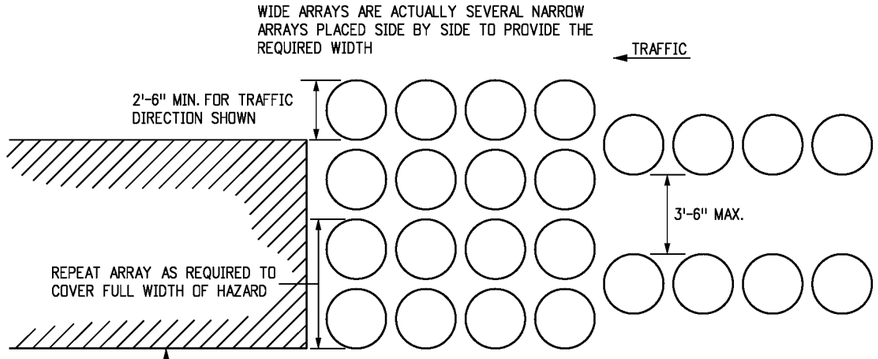
BIDIRECTIONAL



ANGLED ARRAY

GENERAL NOTES

1. SAND SHALL BE MIXED WITH 5% SALT BY WEIGHT.
2. WHEN ARRAYS ARE PLACED ON STRUCTURES WHERE THE VIBRATIONS FROM MOVING TRAFFIC MAY CAUSE THE MODULES TO SHIFT, STEEL OR FORMED-IN-PLACE HMA HALF-RINGS MAY BE PLACED ON THE DOWNHILL SIDE OF THE MODULES TO PREVENT MOVEMENT. NAILS OR BOLTS MAY BE PLACED THROUGH THE BOTTOM OF THE OUTER CONTAINER INTO THE ROADWAY TO PREVENT MODULE MOVEMENT.
3. OFFSET THE ARRAY TO AVOID IMPACT TO THE REAR MODULE FROM WRONG-WAY VEHICLES.
4. ARRAYS SHALL NOT BE PLACED ON SLOPES WITH LATERAL OR HORIZONTAL GRADES OF 5% OR GREATER.
5. CURBS AND RAISED ISLANDS SHALL BE NO MORE THAN 4 IN. HIGH.
6. FOUNDATION PADS SHALL BE FLAT AND MADE OF 6 IN. THICK CONCRETE OR HMA.
7. INTERMIXING OF DIFFERENT BRANDS OF MODULES ARE ACCEPTABLE, IF THE MODULES ARE FHWA APPROVED, AND THE ARRAY MEETS THE DESIGN CRITERIA.
8. ARRAY CONFIGURATION MAY VARY IN LAYOUT AND SAND WEIGHT (LBS) PROVIDED THEY CONFORM TO MANUFACTURER'S DETAILS.



WIDE HAZARD PROTECTION

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SAND BARREL ARRAYS

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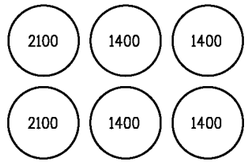

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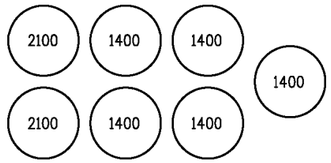

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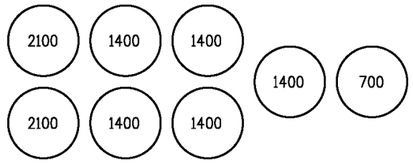

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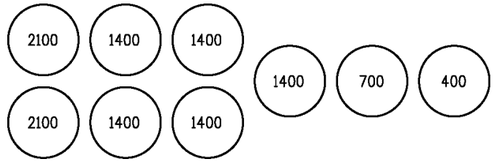

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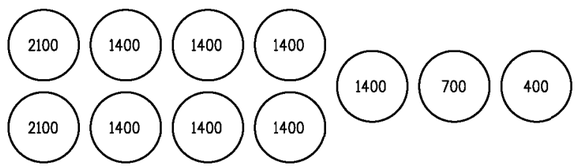

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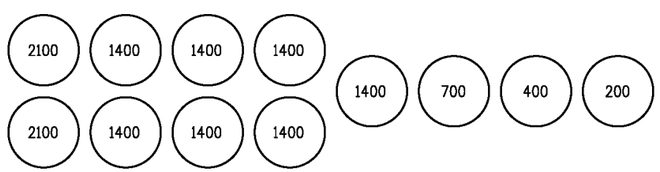
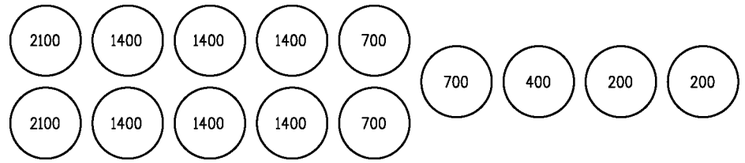


DESIGN SPEED 50 MPH

NOTES

1. SAND WEIGHT (LBS) IN MODULES IS DENOTED BY THE NUMBERS IN THE ARRAY DETAILS.
2. ARRAY CONFIGURATION MAY VARY IN LAYOUT AND SAND WEIGHT (LBS) PROVIDED THEY CONFORM TO MANUFACTURER'S DETAILS.



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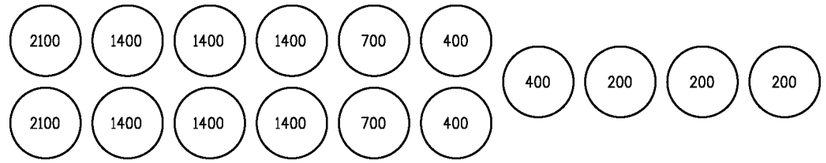

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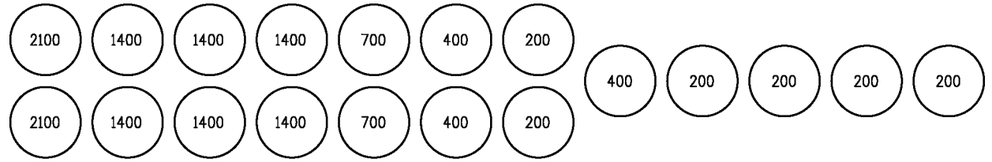

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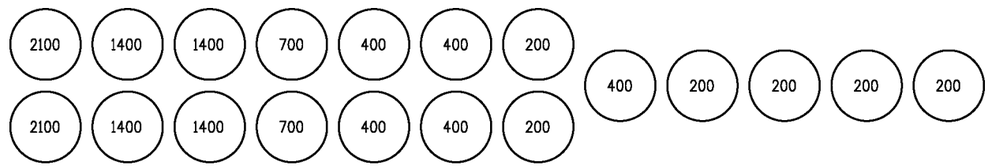

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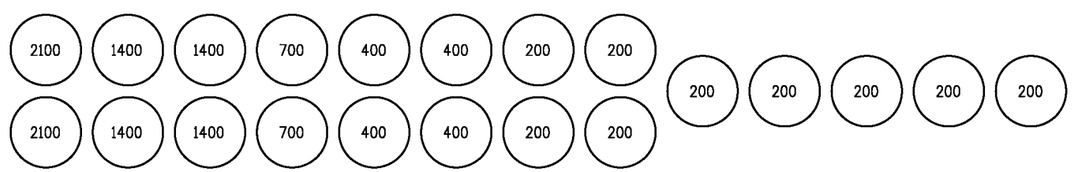

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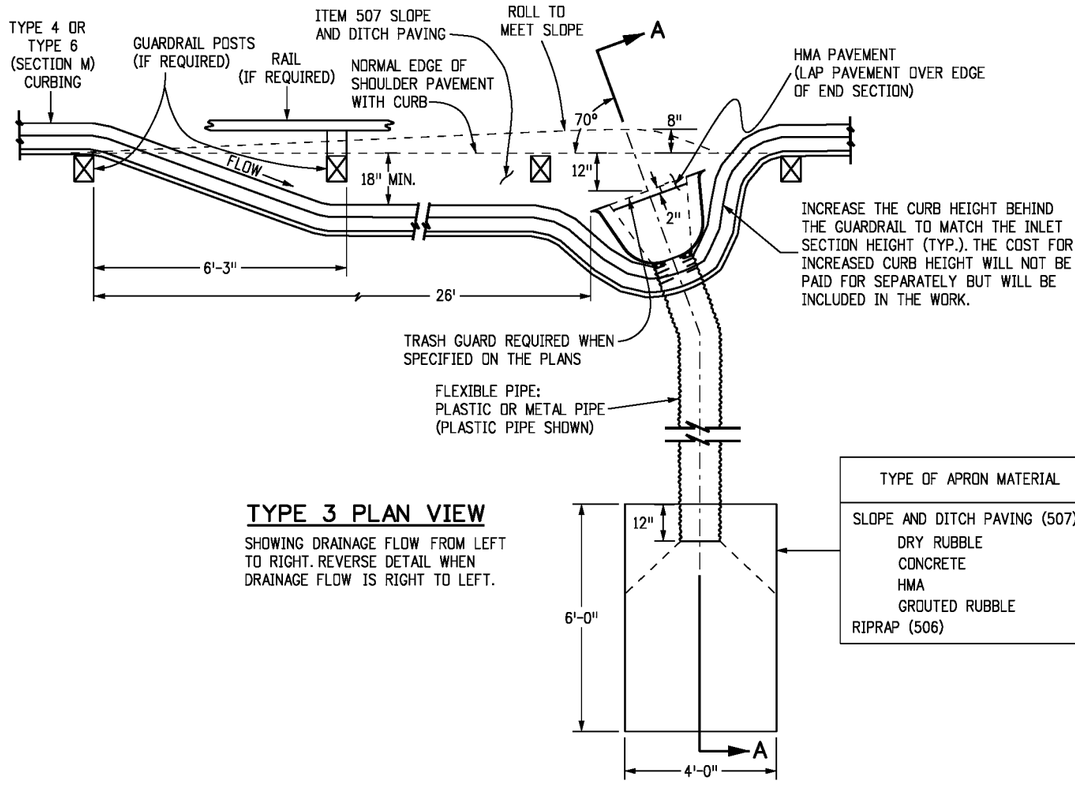


TYPE 3 PLAN VIEW

SHOWING DRAINAGE FLOW FROM LEFT TO RIGHT. REVERSE DETAIL WHEN DRAINAGE FLOW IS RIGHT TO LEFT.

TYPE OF APRON MATERIAL	THICKNESS IN.
SLOPE AND DITCH PAVING (507)	
DRY RUBBLE	6
CONCRETE	4
HMA	4
GROUTED RUBBLE	4
RIPRAP (506)	9 (MIN.)

GENERAL NOTES

1. IF THE EMBANKMENT PROTECTOR IS LOCATED IN THE BOTTOM OF A VERTICAL CURVE, FLARE THE CURB ON EACH SIDE OF THE INLET TO ALLOW FOR FLOW FROM BOTH DIRECTIONS.
2. DETAILS OF GUARD RAIL INSTALLATION ARE SHOWN IN STANDARD PLAN M-606-1.
3. THE END SECTION-TO-PIPE STUB JOINT FOR CORRUGATED METAL PIPE SHALL BE IN ACCORDANCE WITH THE TYPE 3 TYPICAL CONNECTION DETAILED IN STANDARD PLAN M-603-10. THE TYPE 1 OR TYPE 2 TYPICAL CONNECTIONS ARE NOT ACCEPTABLE. (AS AN OPTION, THE END SECTION MAY BE CONNECTED DIRECTLY TO A SECTION OF PIPE). JOINTS BETWEEN THE STUB AND PIPE, OR SECTIONS OF PIPE, SHALL BE IN ACCORDANCE WITH SECTION 603. CONNECTIONS FOR PLASTIC PIPE SHALL PROVIDE A FIRM DIRECT CONNECTION SIMILAR TO THE TYPE 3. PLASTIC END SECTIONS ARE NOT ALLOWED. ALL PLASTIC PIPE JOINTS SHALL BE AS RECOMMENDED BY THE PIPE MANUFACTURER AND APPROVED BY THE ENGINEER.
4. PLASTIC PIPE SHALL CONFORM TO AASHTO M 294 TYPE C.
5. DETAILS OF BITUMINOUS CURBING ARE SHOWN IN STANDARD PLAN M-609-1.
6. STRUCTURE BACKFILL MATERIAL SHALL NOT BE USED WITH THE EMBANKMENT PROTECTOR (TYPE 3). EMBANKMENT MATERIAL SHALL BE USED WITH CONSTRUCTION REQUIREMENTS IN ACCORDANCE WITH SECTION 203. PAYMENT FOR THIS EMBANKMENT MATERIAL SHALL BE INCLUDED IN THE PAY ITEM FOR EMBANKMENT PROTECTOR (TYPE 3).

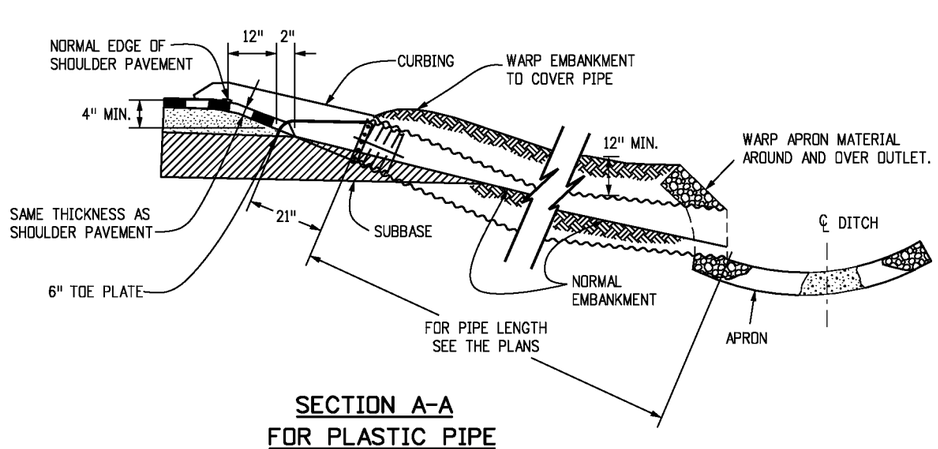
PAYMENT FOR THE QUANTITIES SHOWN ON THE PLANS FOR THIS WORK SHALL BE AS FOLLOWS:

506 OR 507 - PAY ITEMS AS SPECIFIED ON THE PLANS.

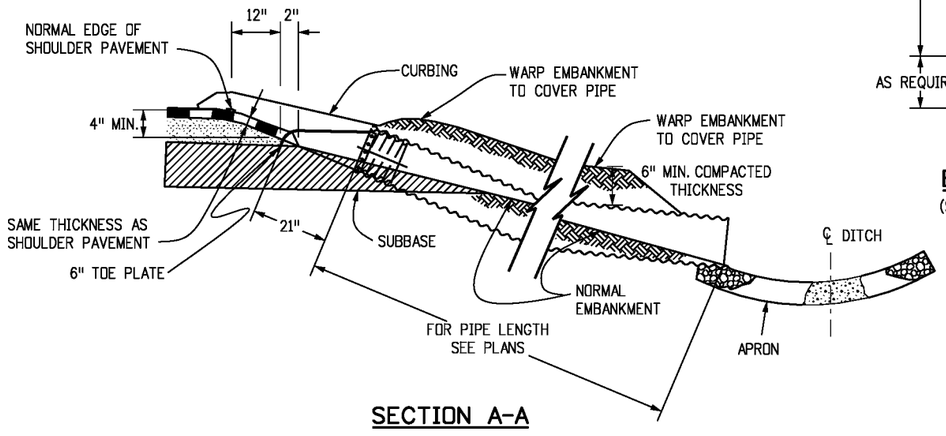
609 - CURB, TYPE 4 OR TYPE 6 (SECTION M) .....LINEAR FT.

615 - EMBANKMENT PROTECTOR (TYPE 3) .....EACH
NOTE: THIS PAYMENT INCLUDES THE END SECTION, THE TRASH GUARD (WHEN SPECIFIED ON THE PLANS), PIPE CONNECTION, STRUCTURE EXCAVATION, EMBANKMENT MATERIAL AND ANY EXTRA WORK REQUIRED TO MODIFY OTHER PAY ITEMS.

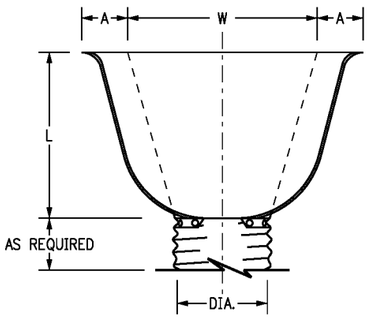
603 - 12 IN. TO 18 IN. PIPE .....LINEAR FT.



SECTION A-A
FOR PLASTIC PIPE



SECTION A-A
FOR METAL PIPE



END SECTION OF STUB
(SEE STANDARD M-603-10, SHEET 2 OF 2 FOR DIMENSIONS)

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EMBANKMENT PROTECTOR TYPE 3

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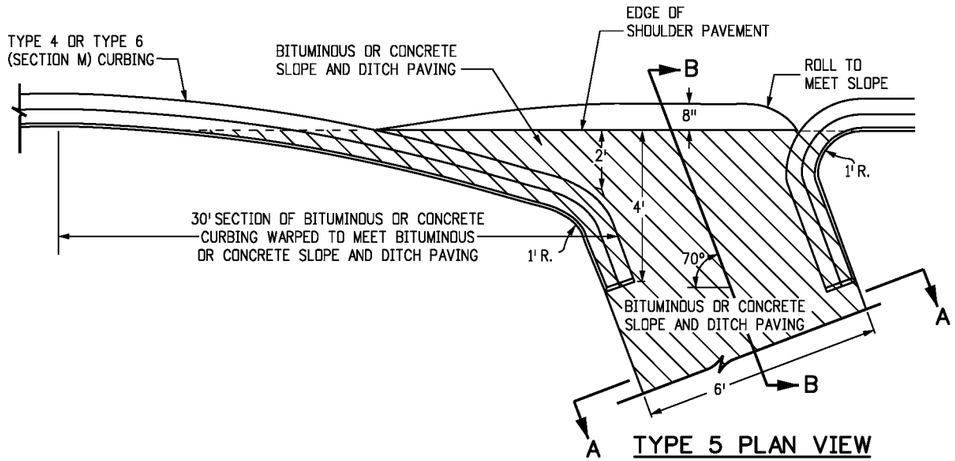
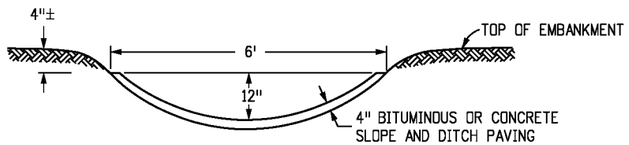
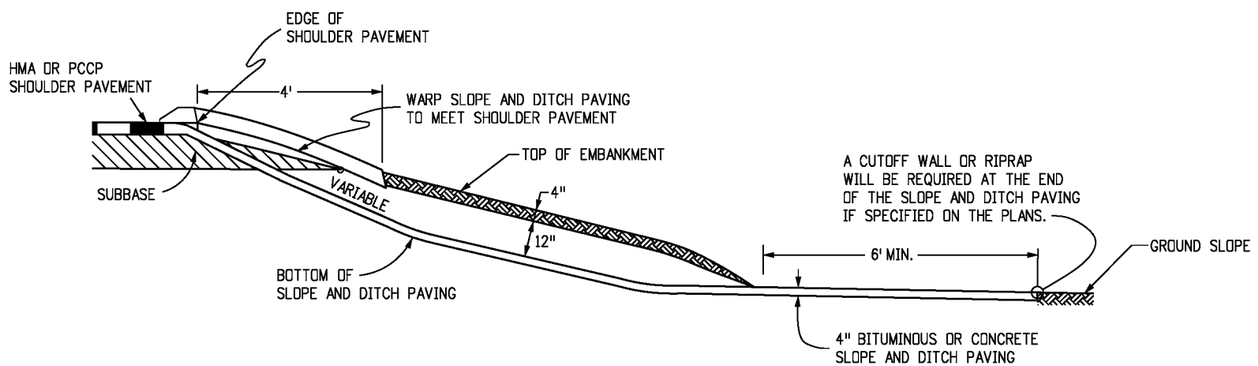


TYPE 5 PLAN VIEW



SECTION A-A



SECTION B-B

(WITH 4 IN. BITUMINOUS OR CONCRETE SLOPE AND DITCH PAVING)

GENERAL NOTES

1. IF THE EMBANKMENT PROTECTOR IS LOCATED IN THE BOTTOM OF A SAG VERTICAL CURVE, FLARE THE CURB ON EACH SIDE OF THE INLET TO ALLOW FOR FLOW FROM BOTH DIRECTIONS.
2. DETAILS OF CURBING ARE SHOWN IN STANDARD PLAN M-609-1.
3. STRUCTURE BACKFILL MATERIAL SHALL NOT BE USED IN THIS WORK. EMBANKMENT MATERIAL SHALL BE USED WITH CONSTRUCTION REQUIREMENTS IN ACCORDANCE WITH SECTION 203. EMBANKMENT MATERIAL WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE PAY ITEM FOR EMBANKMENT PROTECTOR (TYPE 5).
4. PAYMENT FOR THE QUANTITIES SHOWN ON THE PLANS FOR THIS WORK SHALL BE AS FOLLOWS:

   507 - BITUMINOUS SLOPE AND DITCH PAVING (ASPHALT) ..... TON

   507 - CONCRETE SLOPE AND DITCH PAVING ..... CU. YD.

   609 - CURB, TYPE 4 OR TYPE 6 (SECTION M) ..... LINEAR FT.

   615 - EMBANKMENT PROTECTOR (TYPE 5) ..... EACH
   NOTE: THIS PAYMENT INCLUDES THE STRUCTURE EXCAVATION, ANY OTHER EARTHWORK, AND ANY EXTRA WORK REQUIRED TO MODIFY OTHER PAY ITEMS.

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EMBANKMENT PROTECTOR TYPE 5

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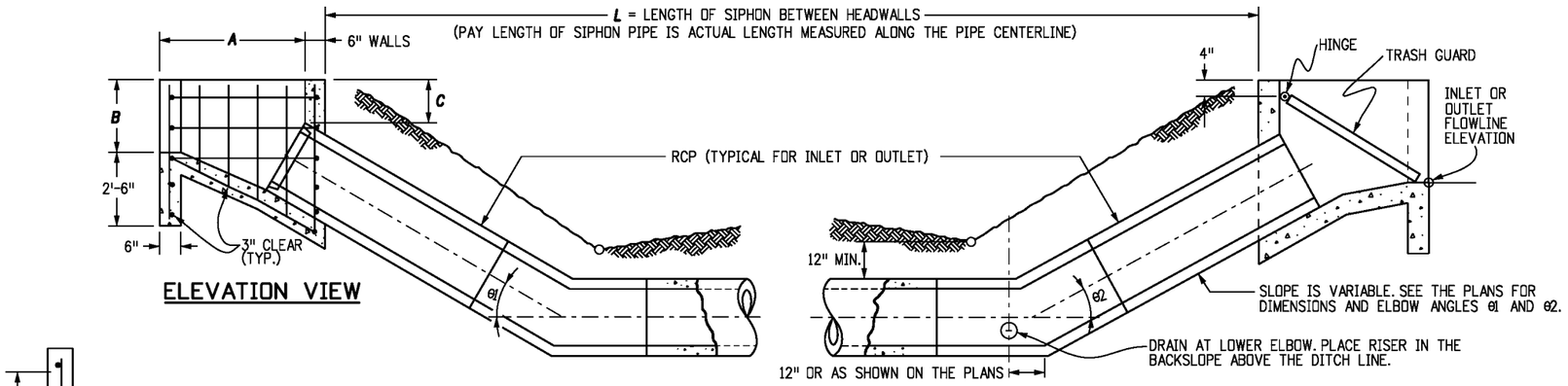
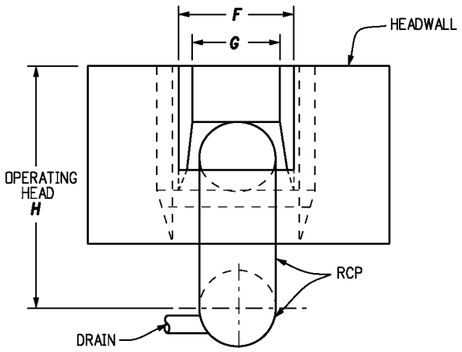
STANDARD PLAN NO.

M-615-2

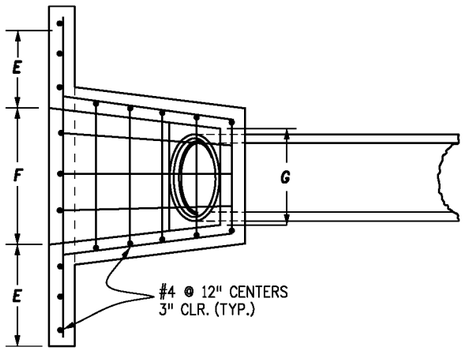
Sheet No. 1 of 1



ELEVATION VIEW



END VIEW



PLAN VIEW

PIPE DIAMETER	DIMENSIONS					
IN.	A	B	C	E	F	G
12	2'-6"	1'-6"	0'-9"	1'-6"	2'-0"	1'-6"
18	3'-9"	2'-0"	1'-2"	2'-3"	3'-0"	2'-1"
24	5'-0"	2'-6"	1'-6"	3'-0"	4'-0"	2'-8"
30	6'-3"	3'-0"	1'-11"	3'-9"	5'-0"	3'-3"
36	7'-6"	3'-6"	2'-3"	4'-6"	6'-0"	3'-10"

HEADWALL DIMENSIONS

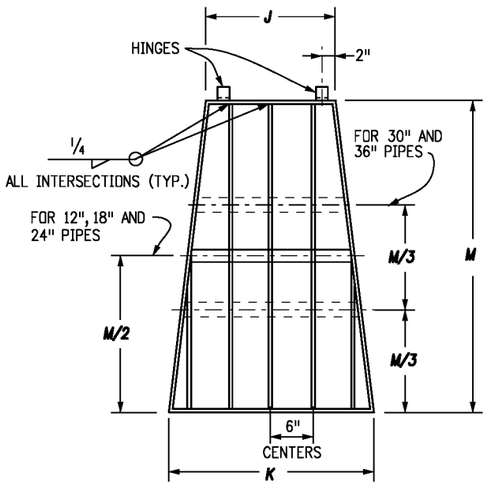
PIPE DIAMETER	CONCRETE	REINFORCED STEEL
IN.	CU. YDS.	LBS.
12	0.62	55
18	1.17	88
24	1.92	146
30	2.72	203
36	3.74	275

HEADWALL QUANTITIES

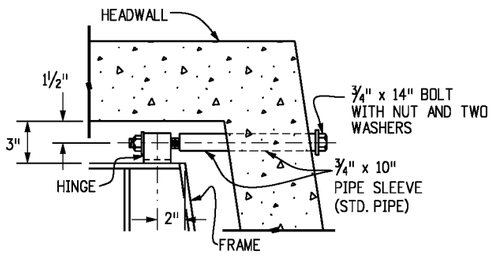
QUANTITIES FOR ONE HEADWALL AFTER DEDUCTION FOR PIPE.

GENERAL NOTES

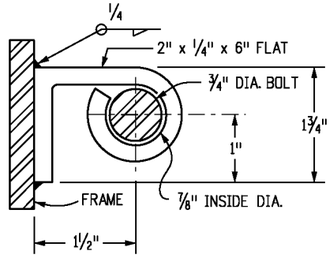
1. SIPHON DRAIN, VALVE AND VALVE BOX, AND TRASH GUARDS ARE TO BE PROVIDED ONLY WHEN CALLED FOR ON THE PLANS.
2. CONCRETE SHALL BE CLASS B.
3. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
4. THE LOCATION, SIZE, PIPE MATERIAL AND GOVERNING DIMENSIONS OF SIPHONS WILL BE SHOWN ON THE PLANS.
5. TO DETERMINE WALL THICKNESS OR CLASS FOR SIPHON PIPE, SEE APPROPRIATE TABLES ON STANDARD PLAN M-603-2.
6. COST OF JOINT SEALERS, GASKETS, FITTINGS AND CONNECTIONS SHALL BE INCLUDED IN THE BID PRICE FOR SIPHON PIPE.
7. TRASH GUARDS AND APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 111.



TRASH GUARD DETAILS



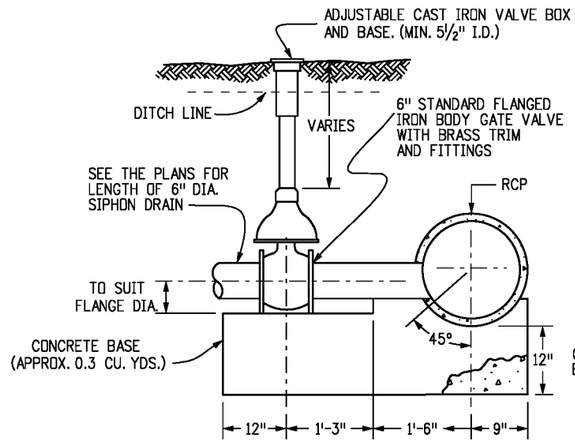
HINGE ASSEMBLY



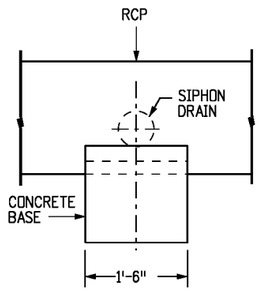
HINGE

PIPE DIAMETER	BAR AND BRACE SIZE	NO. OF BRACES	DIMENSIONS			WEIGHT
INCHES		EACH	J	K	M	LBS.
12	⅜" x 2"	1	1'-0"	1'-6"	2'-6"	35.1
18	⅜" x 2"	1	1'-7"	2'-6"	3'-10"	74.4
24	⅜" x 2"	1	2'-2"	3'-6"	5'-2"	120.5
30	⅜" x 2½"	2	2'-9"	4'-6"	6'-6"	235.9
36	⅜" x 2½"	2	3'-4"	5'-6"	7'-10"	317.6

TRASH GUARD DIMENSIONS AND QUANTITIES



ELEVATION VIEW



PARTIAL END VIEW

DRAIN DETAILS

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INVERTED SIPHON

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M-616-1
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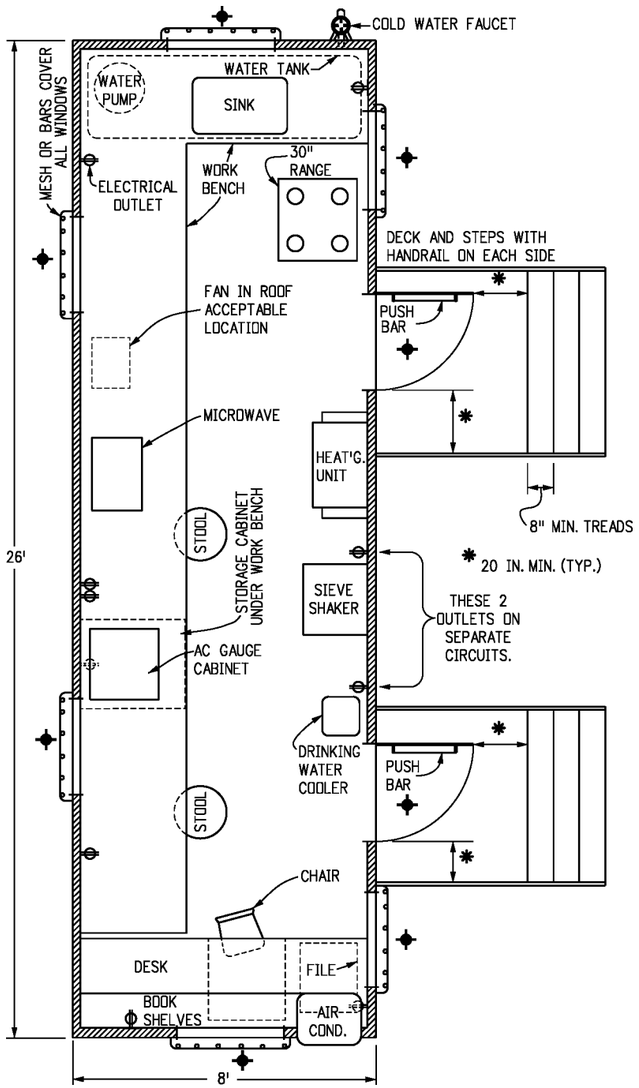

FLOOR PLAN

GENERAL NOTES

1. CLASS 1 FIELD LABORATORIES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODES SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 26 FT. LONG x 8 FT. WIDE OUTSIDE, 7 FT.-6 IN. HEIGHT INSIDE.
3. **WINDOWS:** A MINIMUM OF 4, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.
4. **DOORS:** TWO, EQUIPPED WITH DEADBOLT LOCKS, 36 IN. x 80 IN., INSULATED STEEL WITH A SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, HEAVY DUTY DOOR CLOSER, AND PULL HANDLE MOUNTED ABOVE PUSH BAR. EACH DOOR SHALL HAVE A SET OF STEPS WITH DECK, AND HANDRAILS. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **FLOOR:** ADEQUATE INSULATION UNDER THE FLOOR. FLOOR COVERING SHALL BE SKID RESISTANT.
6. **HEATING:** FURNACE, 41,000 BTU, FORCED AIR TYPE.
7. **AIR CONDITIONING:** ONE, 8,300 BTU MINIMUM.
8. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 HZ, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD LABORATORY EQUIPMENT. ALL TRAILERS CONSTRUCTED AFTER JULY 1, 2006 SHALL HAVE AN APPROPRIATELY SIZED CIRCUIT BREAKER TO HANDLE THE LOAD OF ALL LABORATORY AND ENVIRONMENTAL EQUIPMENT OPERATING AT ONE TIME. PROVIDE A SEPARATE ELECTRICAL CIRCUIT TO SUPPLY POWER TO THE ASPHALT CONTENT GAUGE AND THE OUTLET IN THE STORAGE CABINET UNDER THE WORK BENCH.
9. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING DIRECTLY OVER ALL WORK BENCH AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
10. **VENT FAN:** ONE, GENERAL VENTILATION WITH 500 CFM CAPACITY AND TWO-SPEED SWITCH. MOUNTED IN THE ROOF OR AT TOP OF WALL NEAR THE RANGE. THE THREE FANS AND TWO WORK BENCH GRILLES PREVIOUSLY REQUIRED MAY BE RETAINED IN THOSE CLASS 1 FIELD LABORATORIES PURCHASED BEFORE THE DATE OF THIS STANDARD.
11. **FURNITURE:** ONE, TWO-DRAWER, LEGAL SIZE FILE CABINET BUILT INTO DESK AREA. DESK SHALL BE BUILT-IN WITH ONE CENTER DRAWER. ONE DESK CHAIR WITH ROLLERS. TWO STOOLS FOR WORK AREA WITH HEIGHT COMPATIBLE WITH WORK BENCHES. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
12. **BOOK SHELVES:** MINIMUM 10 LINEAR FT. LONG AND 10 IN. DEEP, BUILT OVER DESK AREA. TOP SHELF SHALL BE AT LEAST 14 IN. BELOW CEILING.
13. **WORK BENCHES:** 30 IN. WIDE x 36 IN. HIGH WITH A DURABLE WORKING SURFACE SUCH AS FORMICA.
14. **STORAGE CABINETS:** TWO, ONE BUILT-IN UNDER THE WORK BENCH WITH A 28 IN. x 28 IN. LOCK EQUIPPED DOOR, WITH ELECTRICAL OUTLET INSIDE. ONE REMOVABLE, WITH OPEN BOTTOM, LOCK EQUIPPED TO SECURE CABINET TO TOP OF WORK BENCH, LARGE ENOUGH TO COVER A 22 IN. x 18 IN. x 18 IN. HIGH ASPHALT CONTENT (AC) GAUGE.
15. **SINK:** ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 ½ IN. EQUIPPED WITH SPRAY NOZZLE, ONE COMBINATION (MIXING) HOT AND COLD WATER FAUCET AND ONE SINGLE COLD WATER FAUCET. ALL FAUCETS SHALL BE EQUIPPED WITH STANDARD HOSE THREAD SPIGOTS. DRAINS SHALL HAVE NO TRAP.
16. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
17. **TESTING WATER SUPPLY:** ONE HUNDRED GALLON WATER CAPACITY, VENTED, WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, MINIMUM 30 PSI DELIVERY PRESSURE. ONE COLD WATER FAUCET WITH BACK FLOW PREVENTER LOCATED OUTSIDE OF TRAILER. WATER PIPES SHALL BE LOCATED SO THEY ARE UNEXPOSED AND PROTECTED FROM DAMAGE. WATER SHALL BE SUPPLIED BY THE CONTRACTOR. USE POTABLE WATER ONLY.
18. **TELEPHONES:** TWO TELEPHONES. TWO PRIVATE LINES (1FB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND A FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FAX. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ-11 JACKS (TWO WIRE PAIRS PER JACK). TWO AT EACH END OF THE TRAILER. LOCATIONS WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE TELEPHONE LINE.
19. **FIRE EXTINGUISHER:** ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
20. **SIEVE SHAKER:** ONE MOTOR DRIVEN STANDARD PORTABLE SHAKER INCLUDING:

    A. A SAFETY SHIELD ON DRIVE BELT.
    B. AN ADJUSTABLE TIMED - ON/OFF SWITCH LOCATED NEAR THE SHAKER.
    C. ADAPTERS TO HANDLE EITHER 8 IN. OR 12 IN. SIEVES.

    THE SHAKER SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES AS WELL AS 12 IN. SIEVES, AND SHALL BE MOUNTED 24 IN. ABOVE THE FLOOR IN A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

    THE SIEVE SHAKER SHALL BE A RO-TAP, ENDOCOTT FROM SOILTEST, SS-12R FROM GILSON OR APPROVED EQUAL. THE SHAKER SHALL BE SECURELY BOLTED TO A RIGID AND STURDY SURFACE.
21. **RANGE:** 30 IN. KITCHEN RANGE, ELECTRIC OR GAS, HAVING FOUR SURFACE BURNERS AND A 3.5 CU. FT. OVEN WITH REINFORCED OVEN RACKS.
22. **FORCED AIR OVEN:** IF A FORCED AIR OVEN IS REQUIRED, THE LOCATION WHERE THE OVEN IS PLACED SHALL HAVE A MINIMUM 3 IN. DIAMETER PIPE INSTALLED AND VENTED TO THE OUTSIDE. (SEE M-620-2, SHEET 2 OF 2, GENERAL NOTE 27 FOR MORE REQUIREMENTS.)
23. **MICROWAVE OVEN:** ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.
24. **ELECTRONIC BALANCE:** THE BALANCE SHALL COMPLY WITH AASHTO M 231 FOR GENERAL PURPOSE, CLASS G2 BALANCES, AND THE FOLLOWING:

    A. POWER: 115 VAC
    B. MODEL: TOP LOADING
    C. CAPACITY: MINIMUM OF 35 LBS.
    D. READABILITY AND SENSITIVITY: 0.0005 LB.
    E. ACCURACY: 0.001 LB. OR 0.1%
    F. DISPLAY PANEL SHALL BE EQUIPPED WITH THE FOLLOWING:
    LED DISPLAY ON/OFF KEY, PRINT KEY, RE-ZERO KEY, WEIGHING MODE KEY, SAMPLE % KEY, SERIAL RS-232C I/O PORT, AND A CALIBRATION SWITCH.
    G. WEIGHING MODES: GRAMS, POUNDS, AND PERCENT OF TARGET MASS (WEIGHT).
    H. WEIGHING SURFACE DIMENSION: MINIMUM OF 9 IN. WIDE BY 12 IN. DEEP.
    I. BASE: SHALL HAVE ADJUSTABLE LEVELING FEET AND A LEVEL VIAL ATTACHED.

    THE BALANCE SHALL BE EQUIPPED WITH AN UNDERHOOK WEIGHING DEVICE AND ONE COPY OF THE OWNER'S MANUAL.
25. **SECURITY:** THIS SYMBOL ✛ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.
26. THE REQUIREMENTS LISTED HEREIN ARE INTENDED TO MEET THE NEEDS OF THE CDOT TESTING PERSONNEL CONCERNING TESTING FACILITIES. THERE IS NO INTENT TO SPECIFY ANY STRUCTURAL PORTIONS OF THE LABORATORY EXCEPT AS NEEDED TO SATISFACTORILY PERFORM THE REQUIRED TESTING OF MATERIALS. THE CONTRACTOR MAY SUBSTITUTE CLASS 2 FIELD LABORATORY FOR CLASS 1 FIELD LABORATORY.

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FIELD LABORATORY CLASS 1

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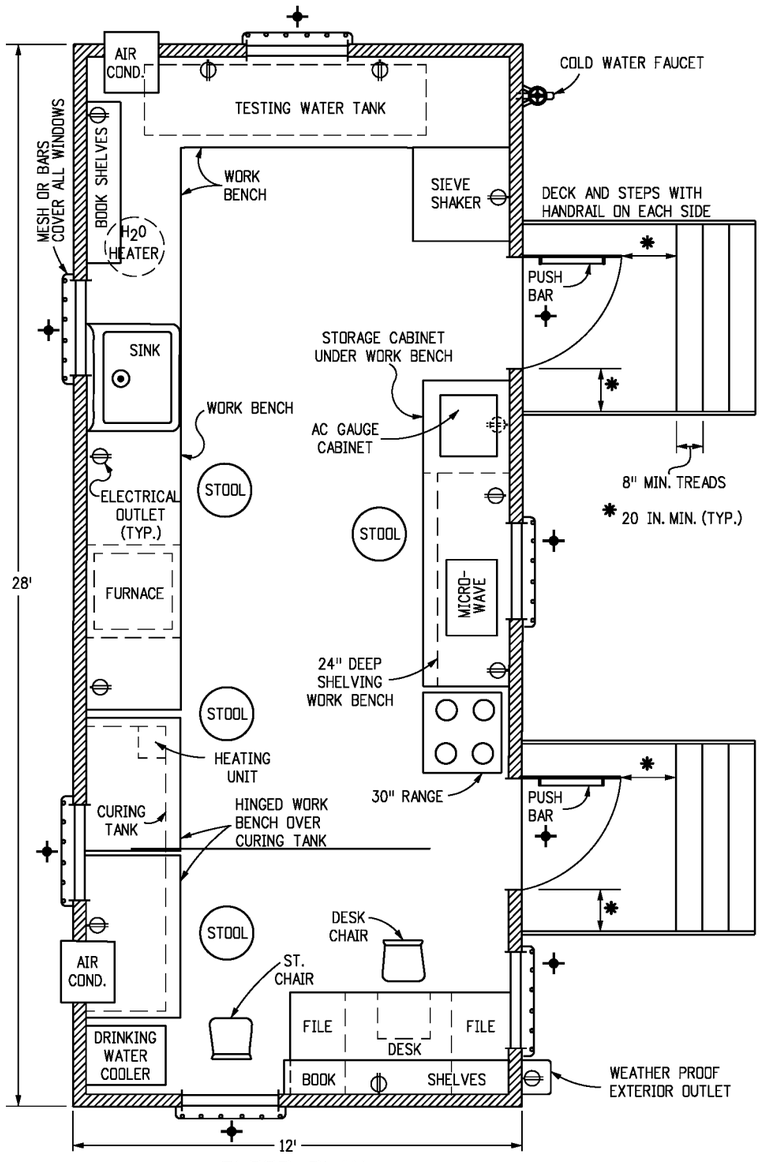

FLOOR PLAN

GENERAL NOTES

1. CLASS 2 FIELD LABORATORIES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODE SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 28 FT. LONG x 12 FT. WIDE OUTSIDE, 7 FT.-6 IN. HEIGHT INSIDE.
3. **WINDOWS:** SIX, 30 IN x 27 IN., CAPABLE OF OPENING AND LOCKING.
4. **DOORS:** TWO, EQUIPPED WITH DEADBOLT LOCKS, 36 IN. x 80 IN., INSULATED STEEL WITH SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, HEAVY DUTY DOOR CLOSER, AND PULL HANDLE MOUNTED ABOVE PUSH BAR. EACH DOOR SHALL HAVE A SET OF STEPS WITH DECK, AND HANDRAILS. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **FLOOR:** ADEQUATE INSULATION UNDER THE FLOOR. FLOOR COVERING SHALL BE SKID RESISTANT.
6. **HEATING:** FURNACE, 55,000 BTU, FORCED AIR TYPE.
7. **AIR CONDITIONING:** TWO, 8,300 BTU MINIMUM.
8. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 HZ, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD LABORATORY EQUIPMENT. ALL TRAILERS CONSTRUCTED AFTER JULY 1, 2006 SHALL HAVE AN APPROPRIATELY SIZED CIRCUIT BREAKER TO HANDLE THE LOAD OF ALL LABORATORY AND ENVIRONMENTAL EQUIPMENT OPERATING AT ONE TIME. PROVIDE A SEPARATE ELECTRICAL CIRCUIT TO SUPPLY POWER TO THE ASPHALT CONTENT GAUGE AND THE OUTLET IN THE STORAGE CABINET UNDER THE WORK BENCH.
9. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING DIRECTLY OVER ALL WORK BENCH AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
10. **VENT FAN:** ONE, GENERAL VENTILATION WITH 800 CFM CAPACITY AND 2 SPEED SWITCH. MOUNTED IN THE ROOF OR AT TOP OF WALL NEAR THE RANGE.
11. **FURNITURE:** TWO, TWO-DRAWER, LEGAL SIZE FILE CABINETS BUILT INTO DESK AREA. DESK SHALL BE BUILT-IN WITH ONE CENTER DRAWER. ONE DESK CHAIR WITH ROLLERS, ONE STRAIGHT CHAIR, AND FOUR STOOLS FOR WORK AREA WITH HEIGHT COMPATIBLE WITH WORK BENCHES. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
12. **BOOK SHELVES:** A MINIMUM OF 10 LINEAR FT. LONG BUILT OVER DESK AREA AND 8 LINEAR FT. LONG BUILT OVER WORK BENCH. ALL SHELVES SHALL BE 10 IN. DEEP. TOP SHELF SHALL BE AT LEAST 14 IN. BELOW CEILING.
13. **WORK BENCHES:** 30 IN. DEEP x 36 IN. HIGH WITH A DURABLE WORKING SURFACE SUCH AS FORMICA.
14. **STORAGE CABINETS:** TWO, ONE BUILT-IN UNDER THE WORK BENCH WITH A 28 IN. x 28 IN. LOCK EQUIPPED DOOR, WITH ELECTRICAL OUTLET INSIDE. ONE REMOVABLE, WITH OPEN BOTTOM, LOCK EQUIPPED TO SECURE CABINET TO TOP OF WORK BENCH, AND LARGE ENOUGH TO COVER A 22 IN. x 18 IN. x 18 IN. HIGH ASPHALT CONTENT (AC) GAUGE.
15. **SINK:** ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6½ IN. EQUIPPED WITH SPRAY NOZZLE, ONE COMBINATION (MIXING) HOT AND COLD WATER FAUCET AND ONE SINGLE COLD WATER FAUCET. ALL FAUCETS SHALL BE EQUIPPED WITH STANDARD HOSE THREAD SPIGOTS. DRAIN SHALL HAVE NO TRAP.
16. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
17. **TESTING WATER SUPPLY:** 300 GALLON WATER CAPACITY, IN ONE OR MORE TANKS LOCATED ALONG THE TRAILER END OR ALONG BOTH SIDES OF THE TRAILER END, VENTED WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, MINIMUM 30 PSI DELIVERY PRESSURE. TEN GALLON ELECTRIC WATER HEATER. ONE COLD WATER FAUCET WITH BACK FLOW PREVENTER LOCATED ON OUTSIDE OF TRAILER. WATER PIPES SHALL BE LOCATED SO THEY ARE UNEXPOSED AND PROTECTED FROM DAMAGE. WATER SHALL BE SUPPLIED BY THE CONTRACTOR. USE POTABLE WATER ONLY.
18. **TELEPHONES:** TWO TELEPHONES. TWO PRIVATE LINES (IFB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FAX. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ-11 JACKS (TWO WIRE PAIRS PER JACK). TWO AT EACH END OF THE TRAILER. LOCATIONS WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE LINE.
19. **FIRE EXTINGUISHER:** ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
20. **RANGE:** 30 IN. KITCHEN RANGE, ELECTRIC OR GAS, HAVING FOUR SURFACE BURNERS AND A 3.5 CU. FT. OVEN WITH REINFORCED OVEN RACKS.
21. **MICROWAVE OVEN:** ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.
22. **SECURITY:** THIS SYMBOL ✦ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.
23. **SIEVE SHAKER:** ONE MOTOR DRIVEN STANDARD PORTABLE SHAKER INCLUDING:
    A. A SAFETY SHIELD ON DRIVE BELT.
    B. AN ADJUSTABLE TIMED - ON/OFF SWITCH LOCATED NEAR THE SHAKER.
    C. ADAPTERS TO HANDLE EITHER 8 IN. OR 12 IN. SIEVES.

    THE SHAKER SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES AS WELL AS 12 IN. SIEVES, AND SHALL BE MOUNTED 24 IN. ABOVE THE FLOOR IN A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

    THE SIEVE SHAKER SHALL BE A RO-TAP, ENDOCOTT FROM SOILTEST, SS-12R FROM GILSON OR APPROVED EQUAL. THE SHAKER SHALL BE SECURELY BOLTED TO A RIGID, STURDY SURFACE.
24. **ELECTRONIC BALANCE:** THE BALANCE SHALL COMPLY WITH ASSHTO M 231 FOR GENERAL PURPOSE, CLASS G2 BALANCES, AND THE FOLLOWING:
    A. POWER: 115 VAC
    B. MODEL: TOP LOADING
    C. CAPACITY: MINIMUM OF 35 LBS.
    D. READABILITY AND SENSITIVITY: 0.0005 LB.
    E. ACCURACY: 0.001 LB. OR 0.1%
    F. DISPLAY PANEL: SHALL BE EQUIPPED WITH THE FOLLOWING: LED DISPLAY, ON/OFF KEY, PRINT KEY, RE-ZERO KEY, WEIGHING MODE KEY, SAMPLE % KEY, SERIAL RS- 232C PORT, AND A CALIBRATION SWITCH.
    G. WEIGHING MODES: GRAMS, POUNDS, AND PERCENT OF TARGET MASS (WEIGHT).
    H. WEIGHING SURFACE DIMENSION: MINIMUM OF 9 IN. WIDE BY 12 IN. DEEP.
    I. BASE: SHALL HAVE ADJUSTABLE LEVELING FEET AND A LEVEL VIAL ATTACHED.

    THE BALANCE SHALL BE EQUIPPED WITH AN UNDERHOOK WEIGHING DEVICE AND ONE COPY OF THE OWNER'S MANUAL.
25. **RECORDING THERMOMETER:** RECORDING THERMOMETER FOR CURING TANKS SHALL BE EITHER ELECTRICAL OR MECHANICAL TYPE.
    A. THE ELECTRICAL RECORDING THERMOMETER SHALL BE EQUIPPED WITH THE FOLLOWING:
    (1) 120 VAC/60 Hz WITH A MINIMUM 3 FT. LONG POWER CORD.
    (2) MINIMUM 6 IN. DIAMETER CIRCULAR PAPER CHART WITH A BOX OF BLANK CHARTS.
    (3) A SELECTABLE TEMPERATURE SCALE WITH ONE SCALE THAT HAS A RANGE FROM 50° F. TO 120° F.
    (4) A SELECTABLE CHART SPEED WITH ONE SPEED OF 24 HOURS AND ONE SPEED OF 7 DAYS. THE SPEED ACCURACY SHALL BE ± 1.5%.
    (5) THE DISPLAY SHALL BE A MINIMUM 3 DIGIT LED WITH A MINIMUM DIGIT SIZE OF 0.5 IN.
    (6) THE TEMPERATURE ACCURACY OF THE MONITOR SHALL BE ± 1° F
    (7) THE MONITOR SHALL HAVE A CHART ADVANCE BUTTON, A TIME POINTER, A PEN ADJUST BUTTON, AND A TEMPERATURE ADJUST KNOB.

    THE RECORDING PEN SHALL BE AN INK TYPE WITH A SPARE PEN INCLUDED.

    THE TEMPERATURE PROBE SHALL BE SUBMERSIBLE TYPE J THERMOCOUPLE WITH A 15 FT. MINIMUM CORD LENGTH.

    B. THE MECHANICAL RECORDING THERMOMETER SHALL BE EQUIPPED WITH THE FOLLOWING:
    (1) MINIMUM 3 IN. DIAMETER PRESSURE SENSITIVE PAPER CHART WITH A BOX OF BLANK CHARTS.
    (2) THE STEM OF THE THERMOMETER SHALL BE A MINIMUM OF 12 IN. LONG.
    (3) THE THERMOMETER SHALL BE A KEY TYPE, WINDING MODEL CAPABLE OF 7 DAY, 24 HOUR RECORDING.
    (4) THE DRIVE MECHANISM SHALL BE CAPABLE OF OPERATING BEYOND ITS FULL RECORDING RANGE BY A MINIMUM OF 20%.
    (5) THE THERMOMETER SHALL BE CAPABLE OF OPERATING FROM 0° F TO 200° F.
    (6) THE CLOCK MECHANISM ACCURACY SHALL BE A MINIMUM OF 2% OF THE FULL-SCALE RANGE BEING USED.
    (7) THE RECORDING RANGE SHALL BE A MINIMUM OF 20° F TO 220° F.

    THE RECORDING THERMOMETER SHALL BE MOUNTED IN SUCH A WAY THAT A MINIMUM 8 IN. OF THE STEM IS IMMERSED IN THE CURING TANKS AND IS EASILY ACCESSIBLE TO CHANGE THE RECORDING TEMPERATURE CHARTS.
26. THE REQUIREMENTS LISTED HEREIN ARE INTENDED TO MEET THE NEEDS OF THE CDOT TESTING PERSONNEL CONCERNING TESTING FACILITIES. THERE IS NO INTENT TO SPECIFY ANY STRUCTURAL PORTIONS OF THE SUBJECT LABORATORY EXCEPT AS NEEDED TO SATISFACTORILY PERFORM THE REQUIRED TESTING OF MATERIALS.

THE GENERAL NOTES ARE CONTINUED ON SHEET 2.

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FIELD LABORATORY CLASS 2

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-620-2
Sheet No. 1 of 2

GENERAL NOTES (CONTINUED FROM SHEET 1)

27. **FORCED AIR CONVECTION OVEN:** REQUIRED ON PROJECTS WITH 5,000 OR MORE TONS OF HMA OR WHEN SPECIFIED IN THE PLANS. THE FORCED AIR OVEN REPLACES THE RANGE. THE OVEN SHALL BE RATED TO AT LEAST 1500 WATTS INCLUDING:

    1. AT LEAST ONE BLOWER TO CIRCULATE AIR INSIDE WITHOUT DISTURBING FINE GRAINED SOILS PLACED IN THE OVEN.
    2. A MINIMUM INTERIOR CAPACITY OF 4.8 CUBIC FEET.
    3. AN EXHAUST CHAMBER ADAPTER TO CONNECT TO A 3 INCH PIPE WHICH SHALL BE VENTED TO THE OUTSIDE.
    4. AT LEAST TWO ADJUSTABLE SHELVES.
    5. AN OVER-TEMPERATURE PROTECTION DEVICE.
    6. AN ELECTRONIC CONTROL SYSTEM WITH DIGITAL TEMPERATURE READ-OUT AND DIGITAL TEMPERATURE SET POINTS TO PRECISELY READ AND SET THE OVEN TEMPERATURE.

    THE OVEN SHALL HAVE A TEMPERATURE RANGE FROM 104 °F TO 464 °F AND HAVE A UNIFORM TEMPERATURE OF ± 3 °F AT 230 °F.

    THE OVEN SHALL BE CAPABLE OF MAINTAINING A CONSTANT TEMPERATURE, ± 5 °F, THROUGHOUT ITS TEMPERATURE RANGE.

    THE OVEN HEATING ELEMENTS SHALL NOT BE ALLOWED TO OPERATE WITHOUT THE BLOWER.

    THE FIELD LABORATORY SHALL BE EQUIPPED WITH A SEPARATE ELECTRICAL CIRCUIT TO SUPPLY POWER TO THE FORCED CONVECTION OVEN.

    IN ADDITION TO THE ABOVE FORCED AIR CONVECTION OVEN, A HOT PLATE CONFORMING TO THE FOLLOWING SHALL BE PROVIDED:

    1. TWO BURNER, PORTABLE, ELECTRICAL "CAL-ROD" OR "RANGETTE" TYPE.
    2. AT LEAST ONE BURNER SHALL BE RATED A MINIMUM OF 800 WATTS.
    3. EACH HOT PLATE SHALL BE EQUIPPED WITH AN ON-OFF INDICATOR LIGHT.

28. **CURING TANK:** MINIMUM 95 GALLON CAPACITY WITH A CIRCULATING PUMP WITH A 120 GPH RATING. TANK CAPACITY WILL INCREASE FOR LARGE CONCRETE PROJECTS WHEN SPECIFIED IN THE PLANS.

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FIELD LABORATORY CLASS 2

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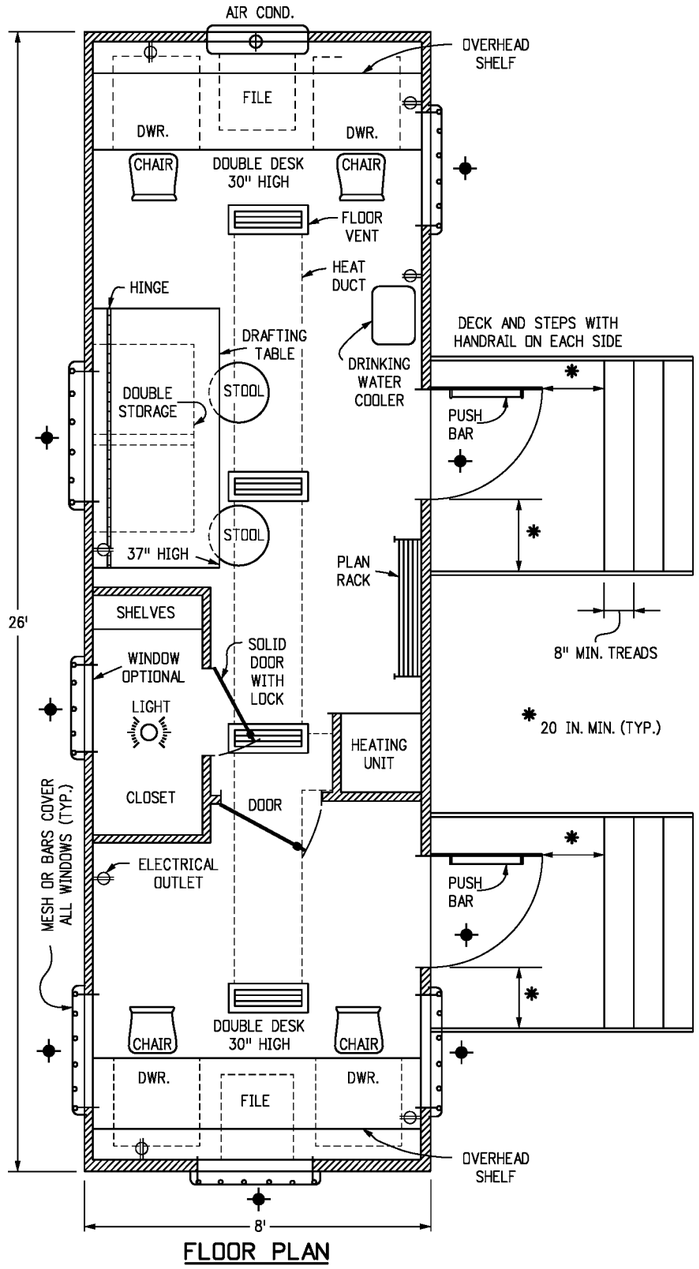
STANDARD PLAN NO.
M-620-2



FLOOR PLAN

GENERAL NOTES

1. CLASS 1 FIELD OFFICES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODE SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 26 FT. LONG x 8 FT. WIDE OUTSIDE, 7 FT.-6 IN. HEIGHT INSIDE.
3. **WINDOWS:** A MINIMUM OF 4, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.
4. **OUTSIDE DOORS:** TWO, REINFORCED WITH DEADBOLT LOCKS. DECK, STEPS, AND HANDRAILS AT EACH DOOR. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **HEATING:** A THERMOSTAT CONTROLLED FORCED AIR UNIT WITH A MINIMUM INPUT CAPACITY OF 200 BTU PER SQUARE FT. OF FLOOR AREA.
6. **AIR CONDITIONING:** ONE, 8,300 BTU MINIMUM.
7. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.
8. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING OVER ALL DRAFTING TABLES AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
9. **DESKS:** ONE 30 IN. x FULL INSIDE WIDTH x 30 IN. HIGH, AT EACH END OF THE TRAILER, SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER PEDESTAL. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.
10. **DRAFTING TABLES:** ONE 26 IN. x 72 IN. HINGED BOARD WITH DOUBLE STORAGE BELOW. SLOPE BOARD 12:1 DOWN TO 37 IN. HEIGHT AT FRONT EDGE.
11. **FURNITURE:** FOUR CHAIRS WITH ROLLERS AND TWO DRAFTING STOOLS. EACH OF APPROPRIATE HEIGHT. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
12. **PLAN STORAGE:** A PLAN RACK OR FILE FOR FULL SIZE PLANS.
13. **CLOSET:** A LOCKED STORAGE AREA OF 15 SQ. FT.
14. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
15. **TELEPHONES:** TWO TELEPHONES. TWO PRIVATE LINES (1FB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND A FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FACSIMILE MACHINE. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ-11 JACKS (TWO WIRE PAIRS PER JACK), TWO AT EACH END OF THE TRAILER. LOCATIONS WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE TELEPHONE LINE.
16. **FIRE EXTINGUISHER:** ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
17. **SECURITY:** THIS SYMBOL ✛ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.

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FIELD OFFICE CLASS 1

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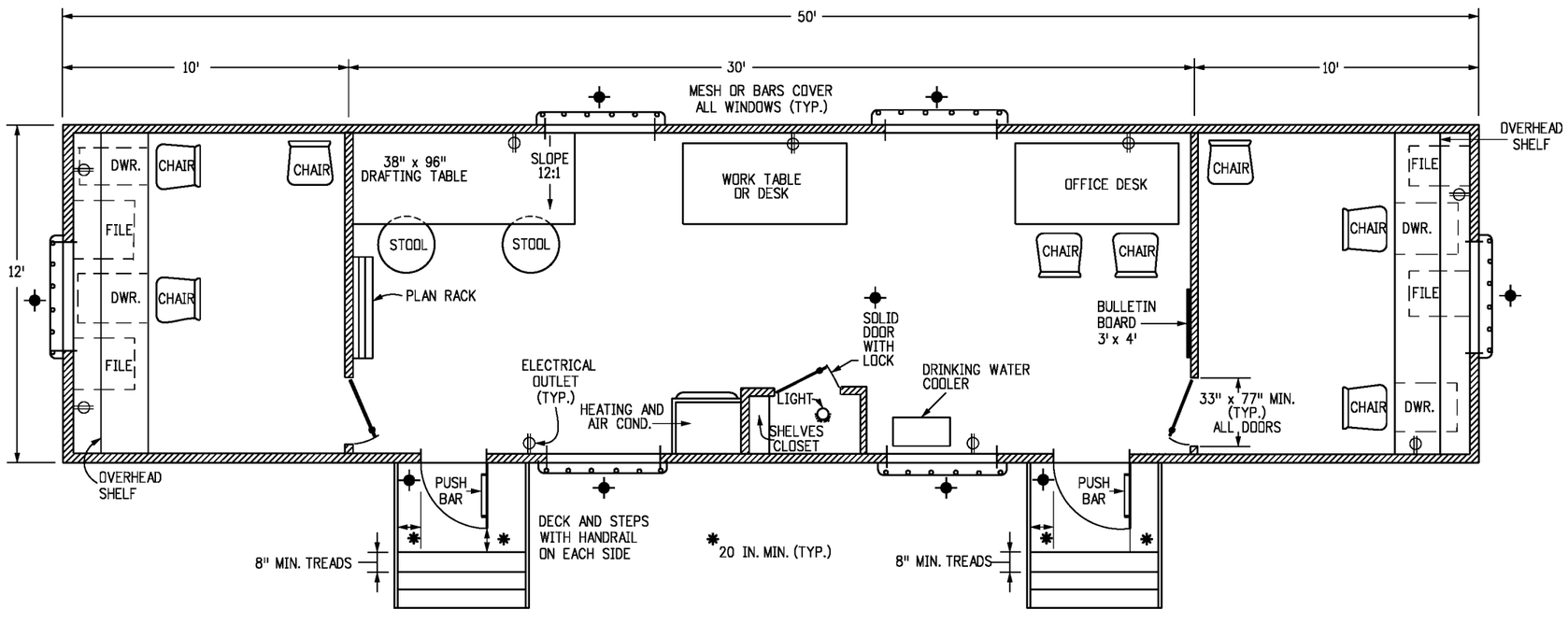
STANDARD PLAN NO.
M-620-11
Sheet No. 1 of 1

GENERAL NOTES

1. CLASS 2 FIELD OFFICES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, BUILT TO THE UNIFORM BUILDING CODE SERIES OF CODES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 50 FT. LONG x 12 FT. WIDE OUTSIDE, 7 FT.-6 IN. HEIGHT INSIDE.
3. **WINDOWS:** A MINIMUM OF 6, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.
4. **DOORS:** TWO INSIDE DOORS, MAY BE LOCATED EITHER TO ONE SIDE OR AT CENTER OF PARTITION. ONE CLOSET DOOR. TWO OUTSIDE DOORS SHALL BE REINFORCED AND HAVE DEADBOLT LOCKS. DECK, STEPS, AND HANDRAILS AT EACH OUTER DOOR. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **HEATING & AIR CONDITIONING:** THREE TON CAPACITY AIR CONDITIONING AND 80,000 BTU CAPACITY HEATING, CONNECTED TO DUCTING & THERMOSTAT CONTROLLED.
6. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.
7. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING OVER ALL DRAFTING TABLES AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
8. **DESKS:** ONE 30 IN. x FULL INSIDE WIDTH x 30 IN. HIGH AT EACH END OF THE TRAILER, SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER PEDESTAL. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.
9. **DRAFTING TABLE:** ONE 38 IN. x 96 IN. TABLE, SLOPED 12:1 TO 37 IN. HEIGHT AT FRONT EDGE OR WITH PROVISION FOR ADJUSTING THE SLOPE.
10. **WORK TABLE:** ONE 72 IN. x 36 IN. TABLE. THE TOP OF THE TABLE SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.
11. **OFFICE DESK:** ONE 72 IN. x 36 IN. DESK WITH SIX DRAWERS AND ONE CENTER PEN DRAWER. THE TOP OF THE DESK SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.
12. **FURNITURE:** EIGHT CHAIRS WITH ROLLERS AND TWO DRAFTING STOOLS. EACH OF APPROPRIATE HEIGHT. ONE WORK TABLE OR DESK. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
13. **PLAN STORAGE:** A PLAN RACK OR FILE FOR FULL SIZE PLANS.
14. **CLOSET:** A LOCKED STORAGE AREA OF 15 SQ. FT.
15. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
16. **TELEPHONES:** THREE, 2-LINE TELEPHONES. FOUR PRIVATE LINES (IFB) WITH TOUCH TONE SERVICE. TWO LINES ARE FOR TELEPHONE SERVICES, WITH ROLL-OVER CAPABILITY FOR THE THREE TELEPHONES. ONE LINE SHALL BE USED FOR THE COMPUTER, AND ONE LINE SHALL BE USED FOR THE FACSIMILE MACHINE. TRAILER WIRING SHALL INCLUDE 9 RJ-11 JACKS, ONE JACK EACH FOR A TWO-LINE TELEPHONE, A COMPUTER LINE, AND A FACSIMILE MACHINE LINE AT EACH END OF THE OFFICE, AND IN THE CENTER AREA OF THE OFFICE.
17. **FIRE EXTINGUISHER:** TWO, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
18. **SECURITY:** THIS SYMBOL ⌖ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.



FLOOR PLAN

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FIELD OFFICE CLASS 2

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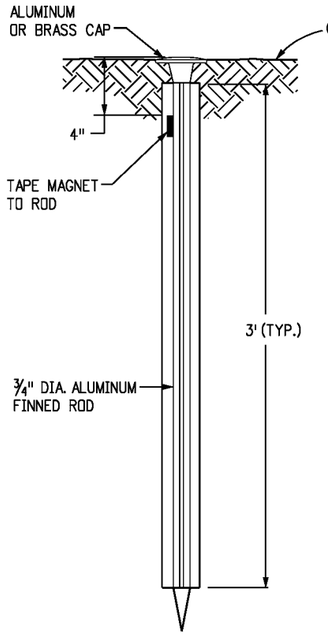
STANDARD PLAN NO.
M-620-12
Sheet No. 1 of 1



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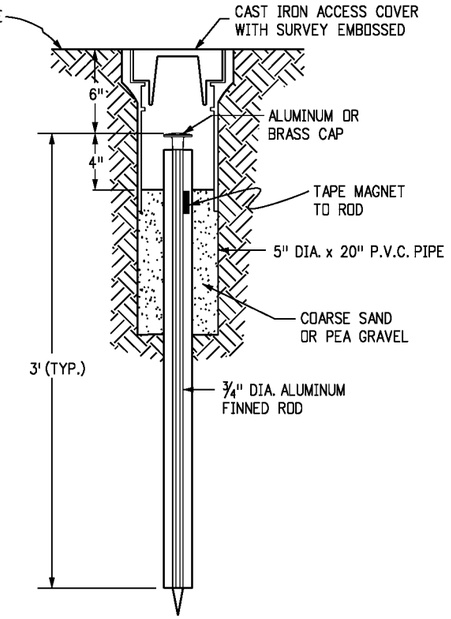
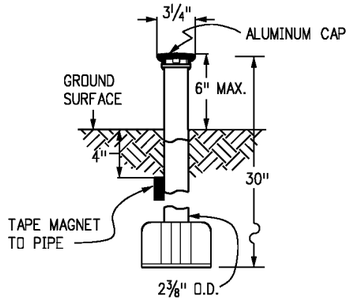


TYPE 1A MONUMENT

INCLUDES MONUMENT BOX



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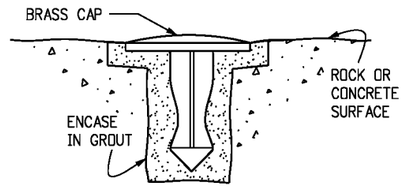
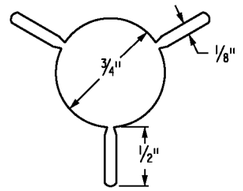
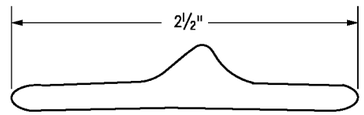


TYPE 5 MONUMENT

ALUMINUM CAP AND TYPE 5(S)
DETAILS SHOWN ON SHEET 2



SECTION A-A



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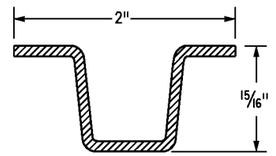
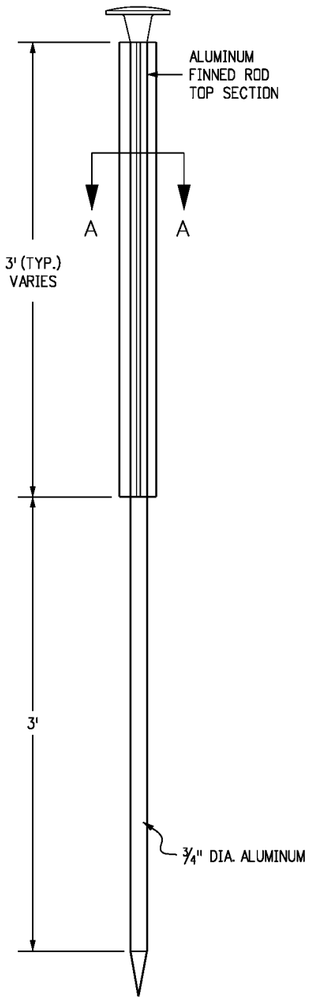
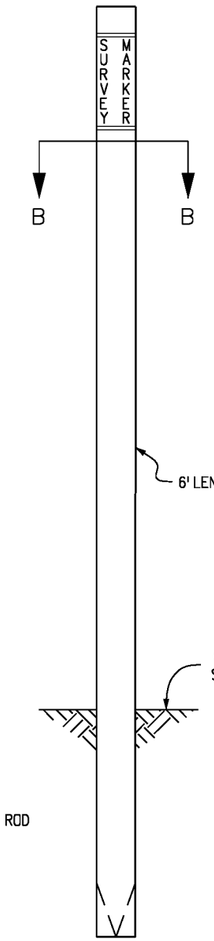
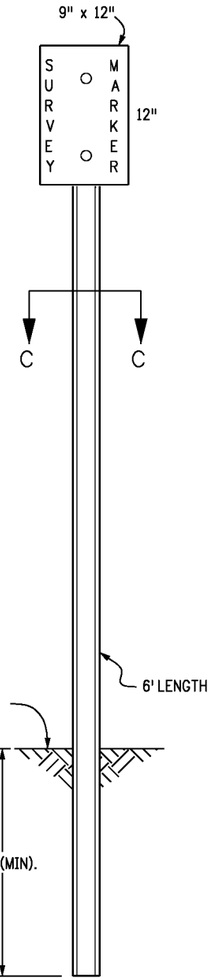


DELINEATOR POST
SECTION C-C



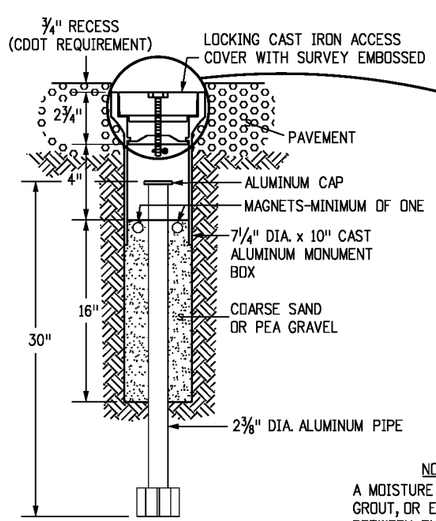




TYPE 2 MONUMENT

TYPE 2A INCLUDES MONUMENT BOX

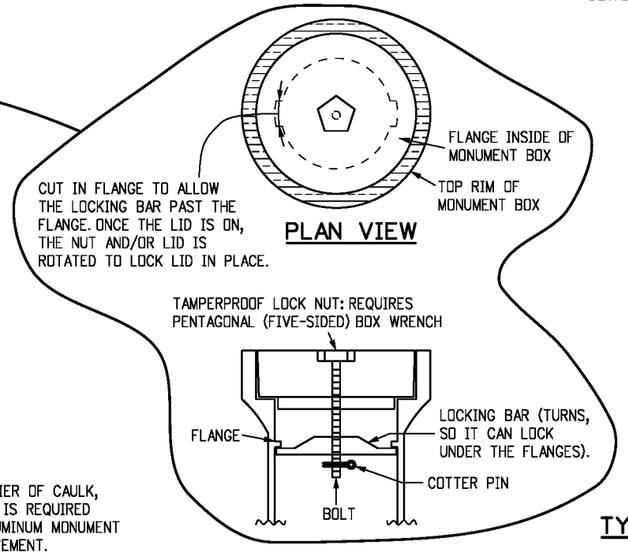
WITNESS POSTS



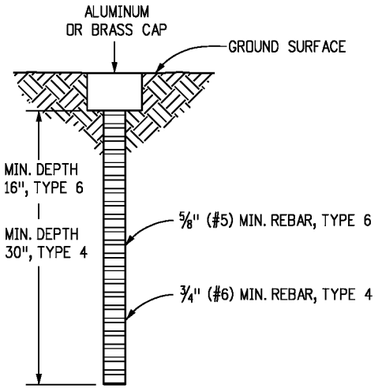
TYPE 3A MONUMENT

ROADWAY INSTALLATION
INCLUDES MONUMENT BOX

NOTE:
A MOISTURE BARRIER OF CAULK, GROUT, OR EPOXY IS REQUIRED BETWEEN THE ALUMINUM MONUMENT BOX AND THE PAVEMENT.



LOCKING CAST IRON ACCESS COVER



TYPE 4 AND TYPE 6 MONUMENT

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SURVEY MONUMENTS

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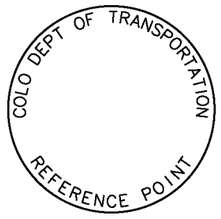
STANDARD PLAN NO.
M-629-1
Sheet No. 1 of 2



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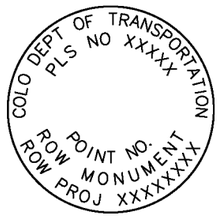

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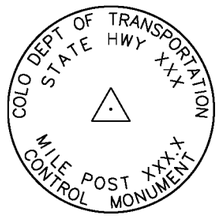

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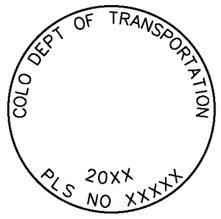
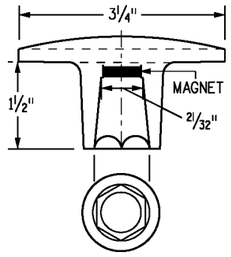
MONUMENT CAP



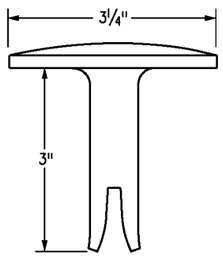
ALIQUOT CORNER
MONUMENT CAP

ALUMINUM CAP

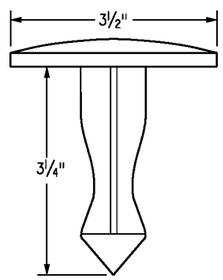
NOTE: A BLANK CAP MAY BE SUBSTITUTED IF THE APPROPRIATE CAP SHOWN ABOVE IS NOT AVAILABLE. IF A BLANK CAP IS USED, ALL INFORMATION NORMALLY INCLUDED ON THE APPROPRIATE STANDARD CAP, SHALL BE STAMPED ON THE BLANK CAP ALONG WITH SPECIFIC PROJECT INFORMATION SUCH AS PROJECT NO., DATE, POINT NO., ETC..



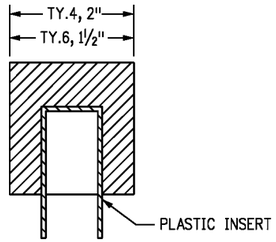
ALUMINUM CAP
USED WITH ALUMINUM ROD



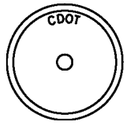
ALUMINUM CAP
TYPE 5
FOR PLACING IN EXISTING
CONCRETE OR ROCK

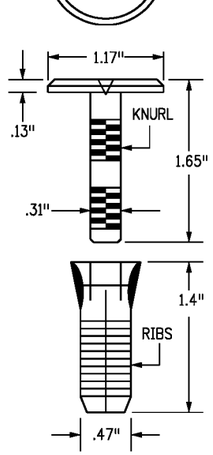


BRASS CAP
TYPE 5
FOR PLACING IN EXISTING
CONCRETE OR ROCK



ALUMINUM CAP





COPPER ALLOY CAP
TYPE 5(S)
FOR PLACING IN EXISTING
SIDEWALK, CURB, OR GUTTER

MONUMENT APPLICATION

CAP TYPE	MONUMENT TYPE									
	1	1A	2	2A	3	3A	4	5	5(S)	6
REFERENCE	X	X						X	X	X
ROW	X	X						X	X	
CONTROL			X	X				X	X	
ALIQUOT CORNER	X	X			X	X	X	X		
PERMANENT EASEMENT								X	X	X
PROJECT POINTS								X	X	X
WITNESS POST* (REQUIRED)	X		X	X	X			X		

ALL MONUMENTATION MATERIALS WILL BE FURNISHED BY CDOT

THE MONUMENT TYPE SHALL MEET THE MINIMUM STANDARDS AS DETERMINED BY THE COLORADO STATE BOARD OF REGISTRATION FOR PROFESSIONAL LAND SURVEYORS RULES (STATE BOARD RULES).
THE CDOT SURVEY COORDINATOR SHALL APPROVE ALL EXCEPTIONS FOR STAMPING MONUMENTS DIFFERING FROM THE STANDARDS.

TYPE 1 AND TYPE 1A ALUMINUM FINNED ROD MONUMENTS

THIS MONUMENT SHALL BE USED FOR ROW OR REFERENCE MONUMENTS OR MAY BE USED FOR AN ALIQUOT CORNER MONUMENT. WHEN USED AS AN ALIQUOT CORNER MONUMENT, INSTALLATION AND RECORD FILING REQUIREMENTS SHALL BE AS STATED FOR TYPE 3 AND TYPE 3A MONUMENTS.
MONUMENTS SHALL BE INSTALLED BY ATTACHING THE PROPER SIZE TIP TO ONE END OF A SECTION OF FINNED ROD, AND A 3 IN. LONG X ¾ IN. DIA. STAINLESS STEEL ADAPTER TO THE OTHER END. THE DRIVER IS THEN PLACED OVER THE STAINLESS STEEL ADAPTER FOR THE HAMMER TO CONTACT. TYPE 1 MONUMENTS SHALL USE A MINIMUM 3 FT. SECTION OF FINNED ROD. WHEN SUBSURFACE ROCK OR CONCRETE IS ENCOUNTERED LESS THAN 3 FT. BELOW THE GROUND SURFACE, THE ROD SHALL BE EMBEDDED IN THE ROCK OR IN CONCRETE AT LEAST 6 IN. AND GROUTED IN PLACE. THE ROD MAY BE SHORTENED TO ACCOMMODATE THE CONDITIONS.
WHEN UNSTABLE SOIL CONDITIONS ARE ENCOUNTERED, ADDITIONAL SECTIONS OF ROD SHALL BE ADDED TO ACHIEVE STABILITY. HORIZONTAL AND VERTICAL STABILITY ARE REQUIRED.
TYPE 1A MONUMENT INCLUDES MONUMENT BOX. A LOCKING CAST IRON ACCESS COVER SHALL BE INSTALLED WHEN THE MONUMENT IS LOCATED IN THE ROADWAY PAVEMENT.

TYPE 2 AND TYPE 2A ALUMINUM FINNED ROD MONUMENTS

THIS MONUMENT SHALL BE USED FOR HORIZONTAL AND VERTICAL CONTROL MONUMENTS. WHEN UNSTABLE SOIL CONDITIONS ARE ENCOUNTERED, ADDITIONAL SECTIONS OF ROD SHALL BE ADDED TO ACHIEVE STABILITY. HORIZONTAL AND VERTICAL STABILITY ARE REQUIRED. IN MOST SOIL CONDITIONS THE TYPE 2 MONUMENT IS EMBEDDED 6 FT. INTO THE GROUND.
THE MONUMENT SHALL BE INSTALLED BY FIRST ATTACHING THE PROPER SIZE TIP TO A 3 FT. LONG X ¾ IN. DIA. ROD, THEN DRIVING THE ROD AT LEAST 30 IN. INTO THE GROUND. ADDITIONAL 3 FT. LONG X ¾ IN. FINNED ROD SECTIONS SHALL BE ADDED AND DRIVEN FLUSH WITH THE GROUND UNTIL THE MONUMENT IS IN A STABLE POSITION. THE FINS ARE BENT OVER USING PLIERS TO ACCOMMODATE INSTALLING THE CAP. THE CAP IS FIRMLY SEATED ONTO THE LAST FINNED SECTION OF ROD USING A DEAD BLOW SLEDGE HAMMER.
TYPE 2A MONUMENT INCLUDES MONUMENT BOX. A LOCKING CAST IRON ACCESS COVER SHALL BE INSTALLED WHEN THE MONUMENT IS LOCATED IN THE ROADWAY PAVEMENT.

TYPE 3 AND TYPE 3A ALUMINUM PIPE MONUMENTS

THIS MONUMENT SHALL BE USED FOR AN ALIQUOT CORNER MONUMENT. THE INSTALLATION OF THIS MONUMENT AND RECORD FILING SHALL BE DONE IN ACCORDANCE WITH THE STATE BOARD RULES. ALSO REFER TO THE CDOT SURVEY MANUAL AND THE BUREAU OF LAND MANAGEMENT REQUIREMENTS FOR MONUMENT INSTALLATION. THE LAND SURVEYOR'S LICENSE NUMBER AND THE YEAR SHALL BE STAMPED ON THE CAP.
TYPE 3A MONUMENT INCLUDES MONUMENT BOX. A LOCKING CAST IRON ACCESS COVER SHALL BE INSTALLED WHEN THE MONUMENT IS LOCATED IN THE ROADWAY PAVEMENT.

TYPE 4 ALUMINUM MONUMENT

THIS MONUMENT MAY BE INSTALLED IN LIEU OF REPLACING THE ENTIRE MONUMENT WHEN REBAR IS IN PLACE AT AN ALIQUOT CORNER LOCATION. REFER TO THE STATE BOARD RULES. A MINIMUM 2 IN. DIA. CAP SHALL BE USED ON ¾ IN. (#6) REBAR.

TYPE 5 BRASS/ALUMINUM CAP MONUMENT

THIS MONUMENT MAY BE INSTALLED IN LIEU OF ALL OTHER CDOT MONUMENTS, WHEN THE POSITION IS LOCATED IN CONCRETE OR STABLE ROCK FORMATION.

TYPE 5(S) COPPER ALLOY CAP MONUMENT - SMALL

THIS MONUMENT MAY BE INSTALLED IN LIEU OF A TYPE 5 MONUMENT, WHEN THE POSITION IS LOCATED IN A CONCRETE SIDEWALK, CURB OR GUTTER, OR WHEN SETTING A TYPE 5 WOULD COMPROMISE THE INTEGRITY OF THE RECEIVING STRUCTURE.

STAMPING REQUIREMENTS:

- "RP", WHEN THE APPLICATION IS A REFERENCE POINT.
- "ROW", POINT NUMBER, "LS", AND REGISTRATION NUMBER WHEN THE APPLICATION IS A ROW POINT.
- "CP" AND A UNIQUE IDENTIFIER PROVIDED BY THE REGION SURVEY COORDINATOR, WHEN THE APPLICATION IS A CONTROL POINT.
- "PE", POINT NUMBER, "LS", AND REGISTRATION NUMBER, WHEN THE APPLICATION IS A PERMANENT EASEMENT POINT.
- "PP" AND POINT NUMBER, WHEN THE APPLICATION IS A PROJECT POINT.

TYPE 6 ALUMINUM MONUMENT

THIS MONUMENT SHALL BE USED FOR PERMANENT EASEMENTS, PROJECT BENCH MARKS, PROJECT POINTS, AND REFERENCES. AN ALUMINUM CAP WITH A MINIMUM DIAMETER OF 1 ½ IN., SHALL BE USED ON ⅝ IN. (#5) MINIMUM REBAR.

* WITNESS POSTS

THE WITNESS POST WILL BE SUPPLIED BY CDOT AND INSTALLATION SHALL BE INCLUDED IN THE WORK. IT SHALL BE DRIVEN WITHIN 1 FT. OF THE MONUMENT WHEN POSSIBLE. A DELINEATOR POST WITH A 9 IN. X 12 IN. METAL SIGN PANEL MAY BE USED IN LIEU OF THE PLASTIC POST. THIS POST SHALL CONFORM TO STANDARD PLAN S-612-1. A REQUIRED WITNESS POST MAY BE OMITTED WITH THE APPROVAL OF THE ENGINEER IF THE WITNESS POST LOCATION IS WITHIN A TRAVELED WAY, DRIVEWAY, OR ACCESS OPENING.

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SURVEY MONUMENTS

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STANDARD PLAN NO.
M-629-1
Sheet No. 2 of 2

S STANDARDS

SPACING FOR DELINEATOR POSTS ON HORIZONTAL CURVES

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

✱ ON CONVENTIONAL ROADWAYS OMIT THE "THIRD SPACE" AND DOUBLE THE SPACING "ON THE CURVE" AND "IN ADVANCE OF AND BEYOND THE CURVE" (300' MAX.)

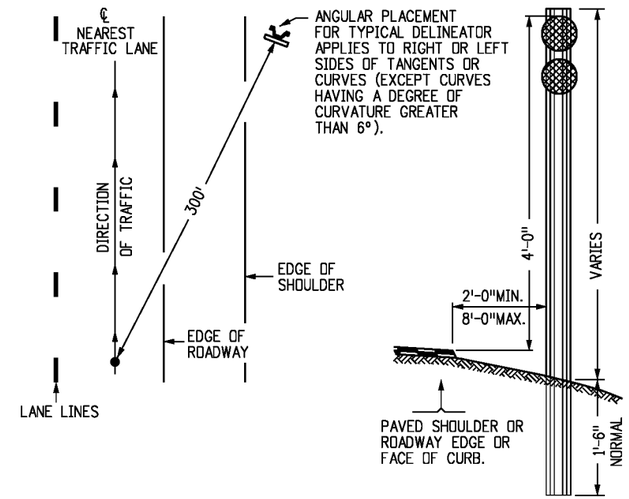
● SPACING FOR CURVES NOT SHOWN MAY BE COMPUTED FROM THE FORMULA: $S = 3\sqrt{R-50}$

SPACING IN ADVANCE OF AND BEYOND THE CURVE IS: FIRST SPACE = 2S, SECOND SPACE = 3S AND THIRD SPACE = 6S. SPACES SHOULD NOT BE LESS THAN 20 FT. OR GREATER THAN 300 FT.

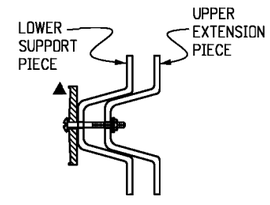
RESIDUAL SPACE AFTER "ON CURVE" SPACING IS APPLIED, SHALL BE DIVIDED EQUALLY AMONG ALL OF THE "ON CURVE" SPACES SO THAT THE LAST DELINEATOR FALLS AT THE P.T. OR C.S. OF THE CURVE.

GENERAL NOTES

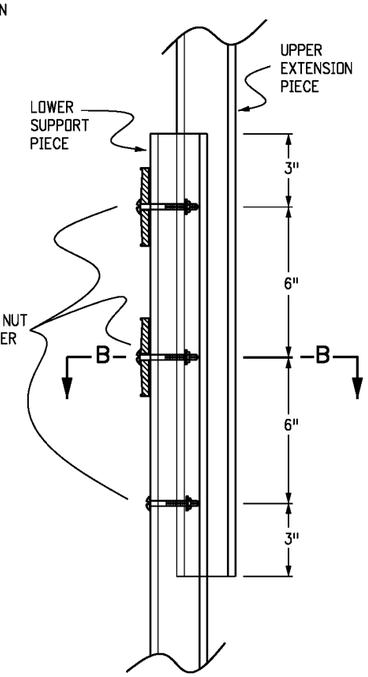
1. SEE THE TABULATION OF QUANTITIES INCLUDED IN THE PLANS FOR THE NUMBERS AND LOCATIONS OF DELINEATORS REQUIRED.
2. THE COLOR OF DELINEATORS SHALL, IN ALL CASES, CONFORM TO THE COLOR OF EDGE LINES, EXCEPT:
   A. RED, GREEN AND BLUE DELINEATORS
   B. TYPE III DELINEATORS (3 YELLOW).
3. THE COLOR OF DELINEATOR POSTS AND ALL SPECIAL MOUNTING BRACKETS SHALL BE INTERSTATE GREEN.
4. DELINEATORS ARE MANDATORY ON ALL ROADWAYS ON THE STATE HIGHWAY SYSTEM. THEY ARE OPTIONAL WHERE FIXED SOURCE LIGHTING IS IN OPERATION: HOWEVER, ALL CONCRETE BARRIER AND TYPE 3 GUARDRAIL SHALL HAVE REFLECTORS OR SUPPLEMENTAL TABS.
5. TYPE I (YELLOW) DELINEATORS ARE MANDATORY ON THE LEFT SIDE OF EXPRESSWAY ROADWAYS (MEDIAN).
6. RED DELINEATORS MAY BE INSTALLED ON THE REVERSE SIDE OF ANY DELINEATOR AND/OR A SEPARATE POST ON ONE-WAY ROADWAYS OR RAMPS WHERE INVESTIGATION SHOWS A NEED FOR WRONG-WAY MOVEMENT PROTECTION.
7. TYPE III (3-YELLOW) DELINEATORS ARE TO BE INSTALLED TO WARN OF THE EXISTENCE OF OBJECTS NOT ACTUALLY IN THE ROADWAY BUT THAT MAY BE SO CLOSE TO THE EDGE OF THE ROADWAY THAT THEY NEED A MARKER. THESE INCLUDE UNDERPASS PIERS, BRIDGE ABUTMENTS, HANDRAILS, AND CULVERTS HEADS. THE INSIDE EDGE OF THE MARKER SHALL BE IN LINE WITH THE INNER EDGE OF THE OBSTRUCTION.
8. INTERCHANGE RAMPS SHALL BE DELINEATED ON THE RIGHT SIDE, THE LEFT SIDE, OR BOTH SIDES WITH TYPE I DELINEATORS OF THE APPROPRIATE COLOR (CRYSTAL OR YELLOW) AS ILLUSTRATED ON SHEET NUMBER 3.
9. FRONTAGE ROAD DELINEATORS ARE NOT TO BE INSTALLED WHERE THEY MIGHT BE MISLEADING TO MAINLINE TRAFFIC.
10. SPACING OF DELINEATORS FOR TUNNELS AND SNOW SHEDS SHALL BE AS SHOWN ON THE PLANS.
11. WHERE PRACTICABLE THE APPROACH ENDS OF ISLANDS AND MEDIANS SHOULD BE DELINEATED.
12. NORMAL SPACING WILL BE 528 FEET FOR TANGENT SECTIONS AND A 200 FOOT MINIMUM WILL APPLY TO A "LAST SPACE". (MAXIMUM SPACING IS ALSO 528 FEET.) AT ALL OTHER LOCATIONS, SUCH AS A & D LANES, RAMPS, WIDTH TRANSITIONS AND TURN LANES A "LAST SPACE" SHOULD NOT BE LESS THAN 50% OF THE SPACING SHOWN FOR THAT LOCATION.
13. TYPE II DELINEATORS SHALL BE INSTALLED AT 100 FOOT SPACING ON ALL ACCELERATION LANES AND TAPERS, DECELERATION LANES AND TAPERS, AND LANE TRANSITIONS INVOLVING PAVEMENT WIDTH REDUCTIONS IN THE DIRECTION OF TRAFFIC. TYPE II DELINEATORS ARE NOT REQUIRED FOR REDIRECT TAPERS, FOR TRAFFIC MOVING IN THE DIRECTION OF WIDER PAVEMENT OR ON THE SIDE OF THE ROADWAY WHERE THE ALIGNMENT IS NOT AFFECTED BY THE LANE REDUCTION. TYPE II (YELLOW) DELINEATORS SHALL ONLY BE USED WHEN A RAISED OR DEPRESSED MEDIAN IS PRESENT. FOR WIDTH TRANSITIONS WHERE TRAFFIC MOVES IN THE DIRECTION OF WIDER PAVEMENT, THE NORMAL SPACING SHALL BE ADJUSTED SO THERE IS A DELINEATOR AT EACH OF THE ANGLE POINTS OF THE WIDTH TRANSITION.
14. TYPE I DELINEATORS SHALL BE INSTALLED AT 100 FOOT SPACING ON INTERCHANGE RAMP TANGENT SECTION AND BY THE SPACING TABLE ON RAMP CURVES. SPACING "IN ADVANCE OF AND BEYOND CURVE" DOES NOT APPLY TO RAMP CURVES.
15. FOR SPACING ON A CURVE THAT FOLLOWS A TANGENT SECTION WITH SPACES SHORTER THAN THOSE SHOWN IN THE CURVE SPACING TABLE: MODIFY THE TABLE SO THAT THE CURVE SPACING IS NO GREATER THAN THE TANGENT SPACING,
16. WHERE GUARDRAIL INTRUDES INTO THE SPACE BETWEEN THE PAVEMENT EDGE AND THE LINE OF DELINEATORS, PLACE THE DELINEATORS IMMEDIATELY ABOVE OR BEHIND THE RAIL FACE, AND DELINEATOR SPACING SHALL BE THE SAME BEHIND THE RAIL FACE.
17. WHEN NORMAL SPACING FALLS ON AN INTERSECTING ROADWAY, DRIVEWAY, ETC. THE DELINEATOR MAY BE MOVED EITHER DIRECTION A DISTANCE NOT EXCEEDING ONE-QUARTER OF THE NORMAL SPACING.
18. THE ANGULAR PLACEMENT FOR ALL DELINEATORS SHOULD BE BY THE "TRAFFIC ORIENTING" METHOD: AIM THE FACE OF THE DELINEATOR AT THE CENTERLINE OF THE NEAREST LANE OF APPROACHING TRAFFIC AT A POINT 300 FEET AWAY (OR AS DIRECTED BY THE ENGINEER FOR SPECIAL OR LOCATIONS AND CURVES HAVING A DEGREE OF CURVATURE GREATER THAN 6 DEGREES).



TYPICAL DELINEATOR PLACEMENT



SECTION B-B



TYPICAL DOUBLE HEIGHT INSTALLATION

POST NOTES

1. POSTS SHALL BE A UNIFORM FLANGED CHANNEL SECTION (U-SHAPE) MADE FROM HOT ROLLED STRUCTURAL STEEL, RE-ROLLED RAIL STEEL, OR NEW BILLET STEEL, HAVING A MINIMUM YIELD STRENGTH OF 30,000 PSI AND A MINIMUM TENSILE STRENGTH OF 50,000 PSI.
2. POSTS SHALL BE SET IN DRILLED OR EXCAVATED HOLES, PLACED PLUMB AND FIRMLY TAMPED IN PLACE; OR MAY BE DRIVEN PLUMB.
3. A MINIMUM OF 3 HOLES OF 3/16" DIAMETER, SPACED AS SHOWN, ARE REQUIRED FOR ALL DELINEATOR POSTS.

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

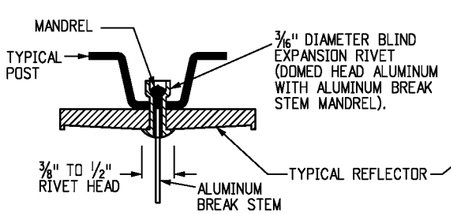
DOUBLE HEIGHT POSTS

4. THE LOWER SECTION OF THE 2-POST COMBINATION SHALL BE INSTALLED ACCORDING TO THE SAME PLACEMENT SPECIFICATIONS AS A TYPICAL SINGLE POST INSTALLATION.

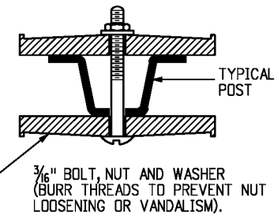
▲ 5. REFLECTORS SHALL BE MOUNTED AT THE CONNECTION OF THE POSTS AND AT THE TOP OF THE UPPER POST IN ACCORDANCE WITH THE APPROPRIATE CONFIGURATION FOR THE APPLICATION.

6. THE LENGTH OF THE UPPER EXTENSION PIECE SHALL NOT EXCEED 7 FEET.

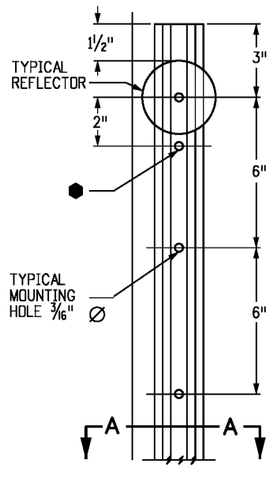
TYPICAL INSTALLATION SINGLE DIRECTION



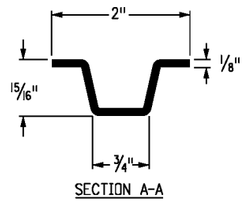
TYPICAL INSTALLATION BACK - TO - BACK



TYPICAL DELINEATOR FABRICATION DETAILS



TYPICAL 1,12# DELINEATOR POST



SECTION A-A

ALLOWABLE TOLERANCE DIMENSION:

1" AND UP	± 1/8"
1/2" TO 1"	± 1/16"
1/2" AND BELOW	± 1/32"

WEIGHT:

MINUS 3 1/2% OF THE WEIGHT OF ANY ONE POST.

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DELINEATOR INSTALLATIONS

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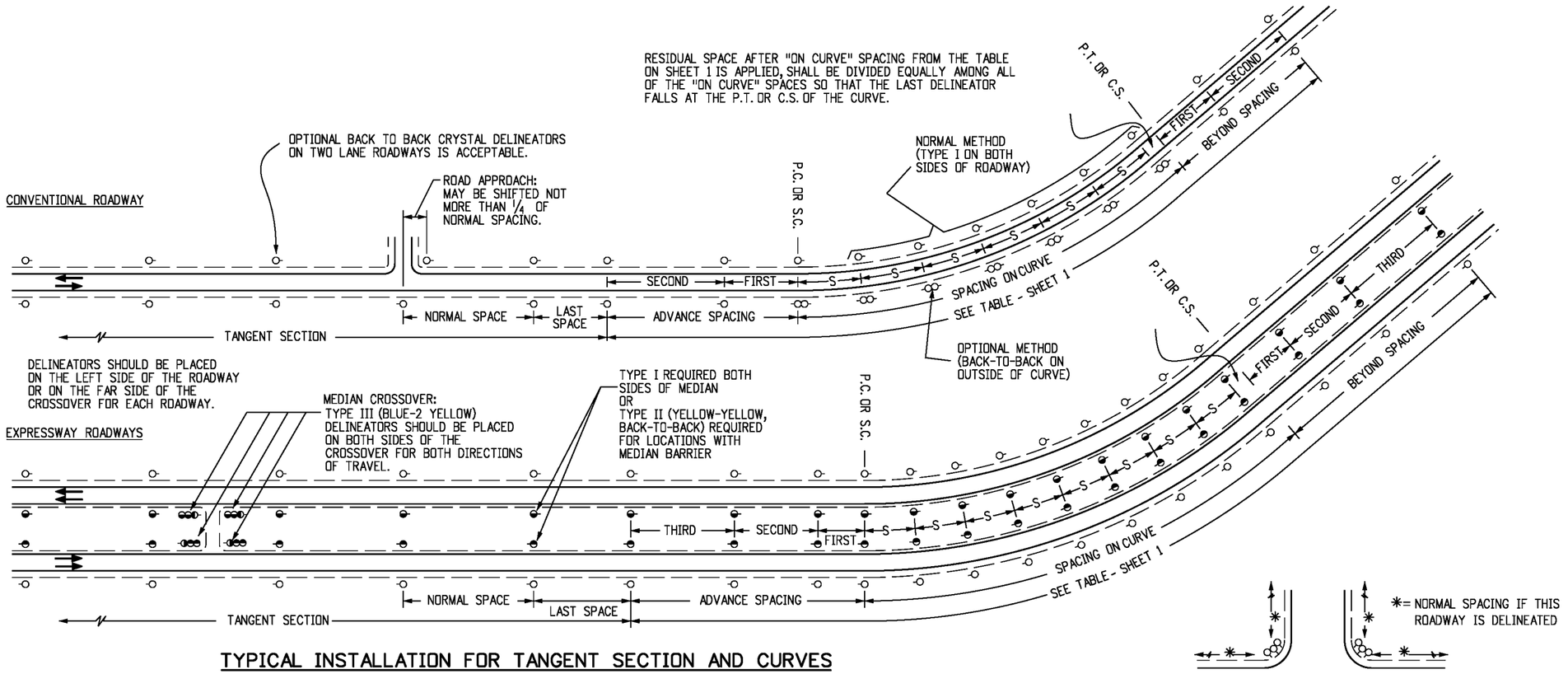
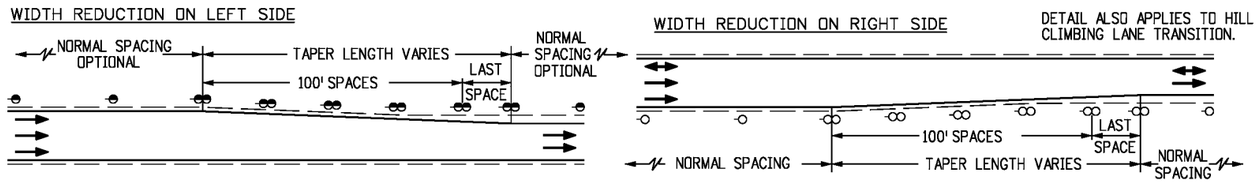
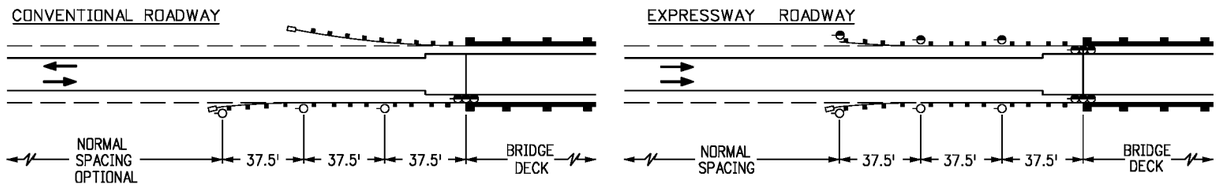


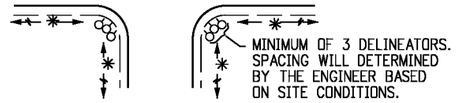
TYPICAL INSTALLATION FOR TANGENT SECTION AND CURVES



TYPICAL INSTALLATION FOR LANE TRANSITION



TYPICAL INSTALLATION FOR BRIDGE APPROACHES



TYPICAL INSTALLATION FOR MINOR INTERSECTION

DELINEATOR SYMBOLS AND TYPICAL CONFIGURATION

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

BRIDGE NOTES

1. WHERE CURB TO CURB WIDTH OF BRIDGE IS EQUAL TO OR GREATER THAN ROADWAY WIDTH PLUS USABLE SHOULDER WIDTH, USE THE TYPE III DELINEATOR (3 YELLOW) ONLY AND OMIT ALL THE TYPE I DELINEATORS.
2. FOR GUARD RAIL INSTALLATIONS WHERE APPROACH END IS NOT FLARED, PLACE A TYPE III DELINEATOR (3 YELLOW) IMMEDIATELY IN ADVANCE OF APPROACH END.
3. ALL TYPE I DELINEATORS ARE TO BE MOUNTED ABOVE OR IMMEDIATELY BEHIND GUARD RAIL AND ARE NOT A CONSTANT DISTANCE FROM THE ROADWAY.

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DELINEATOR INSTALLATIONS

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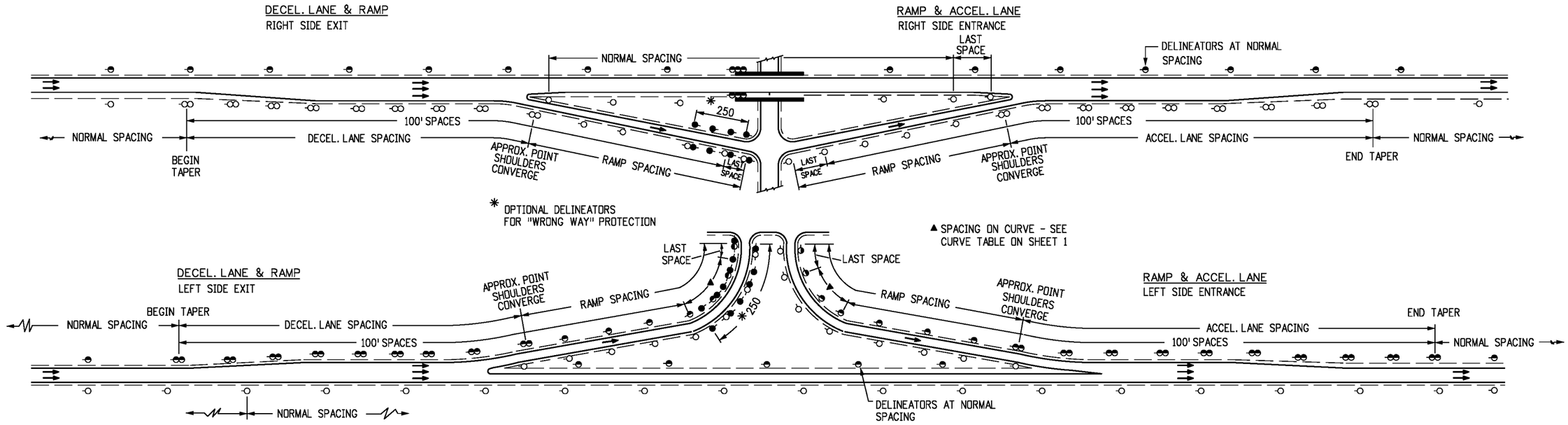
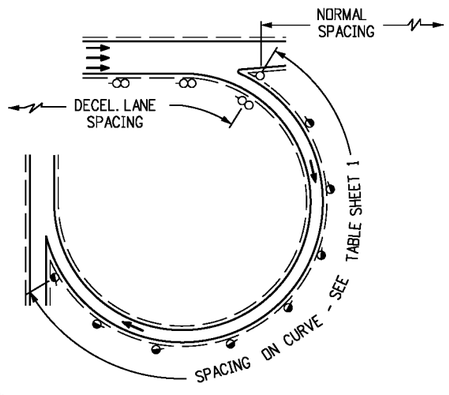


TYPICAL INSTALLATION FOR INTERCHANGES

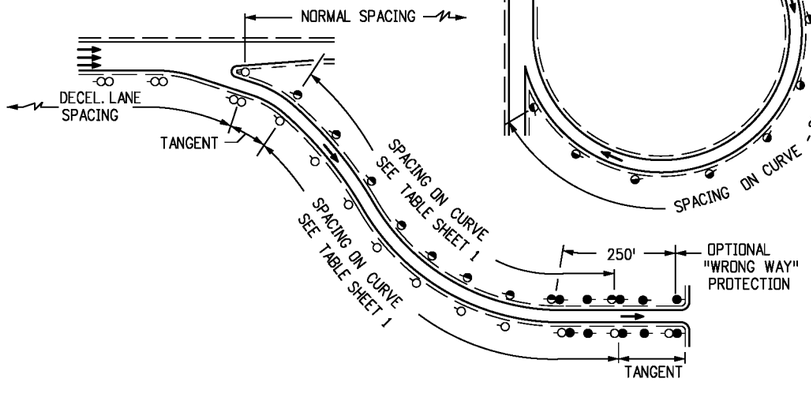
NOTE

"SPACING IN ADVANCE OF AND BEYOND CURVE" (1ST., 2ND. & 3RD. SPACES) AS SHOWN IN THE SPACING TABLE ON SHEET 1 SHALL NOT APPLY TO RAMP CURVES

CLOVERLEAF CURVE



CURVE & REVERSE CURVE



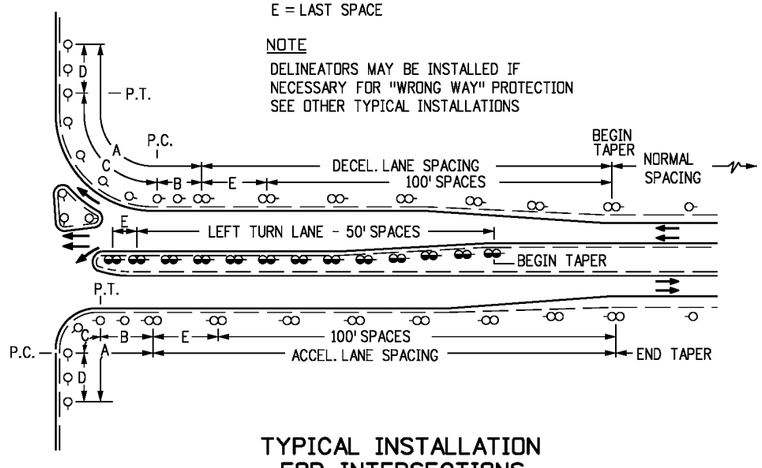
TYPICAL INSTALLATION FOR RAMP CURVES

LEGEND

A = SEE CURVE SPACING TABLE
B = ADVANCE SPACES (FIRST & SECOND)
C = SPACING ON CURVE
D = BEYOND SPACES (FIRST & SECOND)
E = LAST SPACE

NOTE

DELINEATORS MAY BE INSTALLED IF NECESSARY FOR "WRONG WAY" PROTECTION SEE OTHER TYPICAL INSTALLATIONS

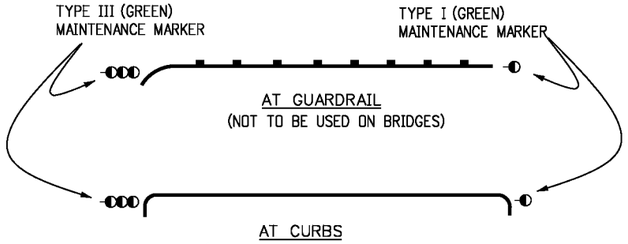


TYPICAL INSTALLATION FOR INTERSECTIONS

WITH ACCEL. & DECEL. LANES

TYPE III (BLUE) MAINTENANCE MARKER

AT BRIDGE JOINTS



MAINTENANCE MARKER LOCATIONS FOR OBSTRUCTIONS

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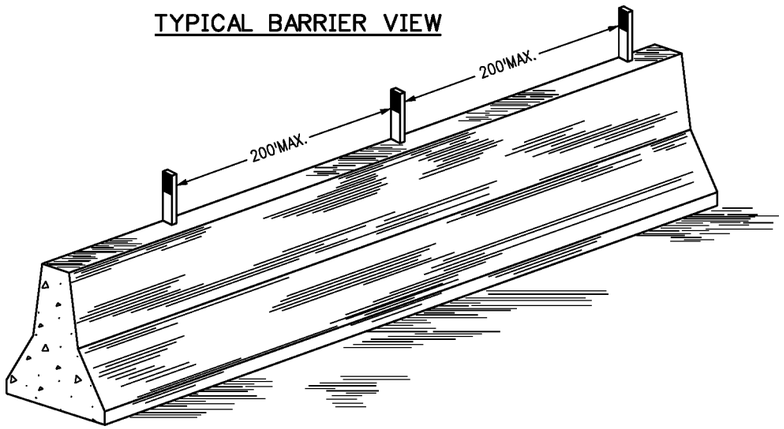
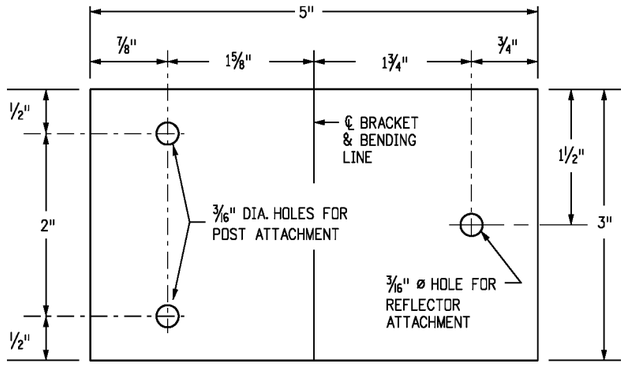
TYPICAL BARRIER VIEW

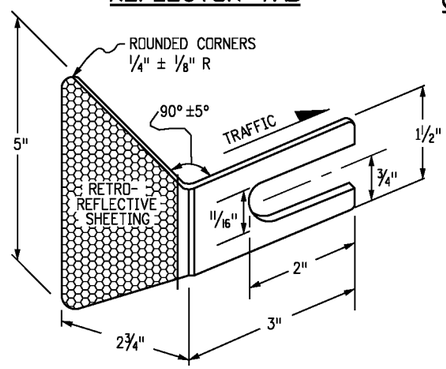


TYPICAL REFLECTOR DETAILS FOR CONCRETE BARRIER

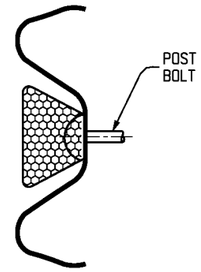
PLAN VIEW



REFLECTOR TAB



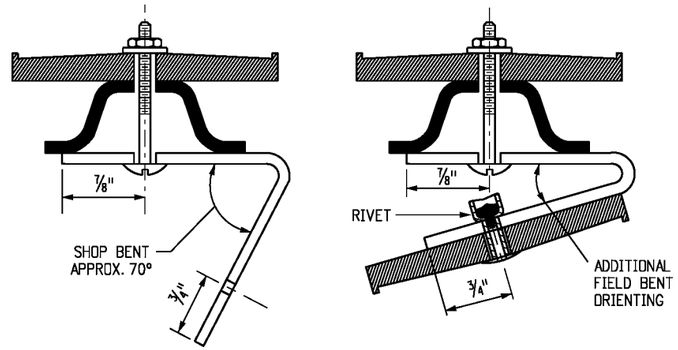
MOUNTING POSITION ON GUARD RAIL TYPE 3



TYPICAL GUARDRAIL REFLECTOR TAB

SEE THE APPROPRIATE GUARDRAIL STANDARD PLANS FOR REFLECTOR TAB FABRICATION AND PLACEMENT DETAILS.

TYPICAL ADJUSTABLE REFLECTOR BRACKET



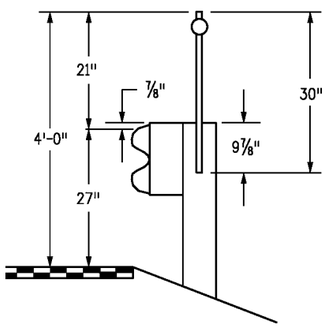
TYPICAL BRACKET FABRICATION DETAILS

BRACKET NOTES

1. THE ADJUSTABLE REFLECTOR BRACKET IS TO BE USED TO "TRAFFIC ORIENT" BACK-TO-BACK DELINEATORS USED ON CURVES.
2. REFLECTOR BRACKETS SHALL BE FABRICATED FROM EITHER GALVANIZED STEEL NOT LESS THAN 16 GAGE, OR ALUMINUM NOT LESS THAN 0.100 INCH THICKNESS.
3. BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
4. ALL BRACKET HOLES ARE 3/16 IN. DIAMETER AND DELINEATOR POSTS REQUIRE AN ADDITIONAL HOLE 2 IN. BELOW THE TOP HOLE PROVIDED IN THE POST.
5. SHOP BEND THE BRACKET APPROX. 70 DEGREES AS SHOWN, ATTACH TO THE DELINEATOR POST WITH 3/16 IN. BOLTS AND FIELD BEND AS NECESSARY TO TRAFFIC ORIENT. THEN THE BRACKET REFLECTOR CAN BE ATTACHED WITH A 3/16 IN. BLIND EXPANSION RIVET OR A BOLT.
6. BURR THE THREADS OF ALL BOLTS TO PREVENT NUT LOOSENING OR VANDALISM.

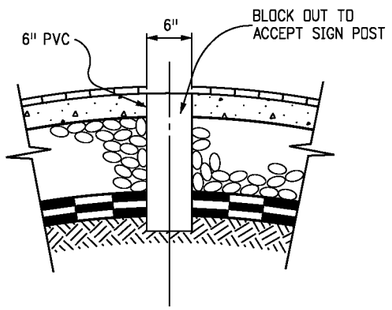
BARRIER REFLECTOR NOTES

1. BARRIER REFLECTORS, REGARDLESS OF TYPE, SHALL MEET THE RETROREFLECTIVE QUALTITIES SPECIFIED IN SECTION 713 OF THE STANDARD SPECIFICATIONS FOR DELINEATOR REFLECTORS, AND BE PAID FOR AS DELINEATOR (TYPE _) (BARRIER) (EACH). USE OF THESE REFLECTORS IS MANDATORY.
2. THE COLOR OF REFLECTIVE SURFACE SHALL MATCH THE COLOR OF THE ADJACENT EDGE LINE.
3. CONCRETE SURFACE PREPARATION, ADHESIVE, AND METHOD OF APPLICATION SHALL BE AS RECOMMENDED BY THE REFLECTOR MANUFACTURER.
4. UNLESS OTHERWISE NOTED IN THE PLANS OR DIRECTED BY THE ENGINEER, A 200 FOOT MAXIMUM TANGENT AND CURVE SPACING APPLIES TO BARRIER REFLECTORS.
5. TOP MOUNT REFLECTORS ARE STANDARD. SIDEMOUNT BARRIER REFLECTORS OR 6 INCH WIDE REFLECTOR STRIPS MAY BE REQUIRED IF SPECIFIED IN THE PLANS.
6. MEDIAN BARRIER REFLECTORS SHALL BE TYPE II (YELLOW-YELLOW, BACK-TO-BACK).
7. FOR A TWO-WAY ROADWAY BARRIER, REFLECTORS SHALL BE TYPE II (CRYSTAL-CRYSTAL, BACK-TO-BACK).
8. FOR TEMPORARY CONCRETE BARRIER, RELFECTORS SHALL BE INSTALLED THAT MEET THE MINIMUM REQUIREMENTS OF STANDARD TYPICAL DELINEATOR INSTALLATIONS, EXCEPT THE MAXIMUM SPACING SHALL BE 50 FT., AND THEY WILL NOT BE PAID FOR, BUT ARE INCLUDED IN THE WORK.



TYPICAL GUARDRAIL POST MOUNT DELINEATORS

POST MOUNT DELINEATORS SHALL BE ATTACHED BY A METHOD APPROVED BY THE ENGINEER OR A METHOD REQUIRED BY THE DEVICE MANUFACTURER.



TYPICAL SLEEVE INSTALLATION FOR MEDIAN DELINEATOR POSTS

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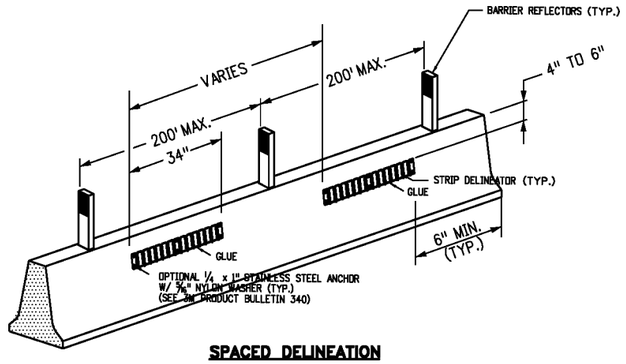
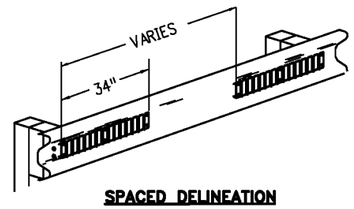
TYPICAL INSTALLATION DETAIL FOR CONCRETE BARRIERS

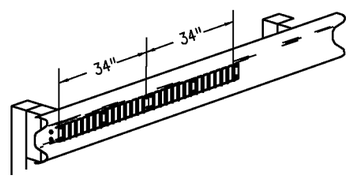


SPACED DELINEATION

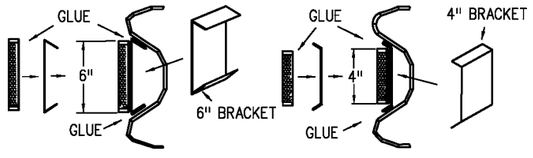
TYPICAL INSTALLATION DETAIL FOR GUARDRAIL TYPE 3



SPACED DELINEATION



CONTINUOUS DELINEATION



ATTACHMENT DETAILS

TYPICAL STRIP DELINEATOR INSTALLATION

1. THIS DEVICE SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS. IT IS THE RESPONSIBILITY OF THE INSTALLER TO CONTACT THE MANUFACTURER REPRESENTATIVE WHENEVER THERE IS A QUESTION REGARDING APPLICATION PROCEDURES OR SUBSTRATE CONDITIONS.
2. THE COLOR OF THE REFLECTIVE SURFACE SHALL MATCH THE COLOR OF THE ADJACENT ROADWAY EDGE LINE.
3. AT TIME OF INSTALLATION, CONTACTING SURFACE SHALL BE DRY AND MOISTURE-FREE.
4. AFTER DELINEATOR INSTALLATION, SURFACES SHOULD STAY DRY WITHOUT RAIN IN THE FORECAST FOR AT LEAST 8 HOURS.
5. SURFACE PREPARATION, BRACKETS AND GLUE (OR EQUIVALENT) SHALL BE INCLUDED IN THE COST OF EACH DELINEATOR STRIP.

CONCRETE BARRIER REFLECTOR NOTES

1. CONCRETE SURFACE PREPARATION, ADHESIVE, AND METHOD OF APPLICATION SHALL BE AS RECOMMENDED BY THE REFLECTOR MANUFACTURER.
2. TO ASSURE A STRAIGHT LEVEL APPLICATION, SNAP A CHALK LINE ACROSS THE BARRIER.
3. FOR MOUNTING THE STRIP DELINEATORS TO CONCRETE BARRIER, INCLUDING THE BRACKETS, USE 3M WINDO-WELD SUPER FAST URETHANE GLUE OR EQUIVALENT APPLIED AT 60 DEGREES FAHRENHEIT IN DRY WEATHER IS RECOMMENDED. THIS PRODUCT IS AVAILABLE IN STANDARD CAULKING TUBE AND SHOULD BE APPLIED TO THE BRACKETS AND PANELS WITH A CONSTRUCTION STYLE CAULKING GUN, AND/OR USE $\frac{1}{4}$" X 1" STAINLESS STEEL ANCHOR WITH $\frac{5}{16}$" NYLON WASHER, AS SPECIFIED IN 3M PRODUCT BULLETIN 340.
4. UNLESS OTHERWISE NOTED IN THE PLANS OR DIRECTED BY THE ENGINEER, A 200-FOOT MAXIMUM TANGENT AND CURVE SPACING APPLIES TO BARRIER REFLECTORS ALONG THE TOP OF THE BARRIER.

W-BEAM GUARDRAIL NOTES

1. TWO DIFFERENT STYLES OF DELINEATOR MOUNTING BRACKETS ARE AVAILABLE. THERE IS ONE TYPE FOR THE 4" DELINEATOR AND ANOTHER FOR THE 6" DELINEATOR. THE BRACKETS MUST BE MATCHED TO FIT THE EXACT 4" OR 6" WIDE DELINEATOR PANELS. SIZE OF THE DELINEATOR PANELS SHALL BE SPECIFIED IN THE PLANS.
2. IN SNOWPLOW AREAS, USE THE 4" PANELS THAT WILL RECESS INTO THE W-BEAM GUARDRAIL, WHICH PROTECTS IT FROM THE SNOWPLOW DAMAGE.
3. METAL GUARDRAIL SHALL BE WIRE BRUSHED/SANDED, THEN CLEANED WITH ISOPROPYL ALCOHOL WHERE THE BRACKETS WILL ADHERE TO THE GUARDRAIL.
4. FOR MOUNTING THE STRIP DELINEATORS TO GUARDRAIL, INCLUDING THE BRACKETS, THE USE OF 3M WINDO-WELD SUPER FAST URETHANE GLUE OR EQUIVALENT APPLIED AT 60 DEGREES FAHRENHEIT IN DRY WEATHER IS RECOMMENDED. THIS PRODUCT IS AVAILABLE IN STANDARD CAULKING TUBE AND SHOULD BE APPLIED TO THE BRACKETS AND PANELS WITH A CONSTRUCTION STYLE CAULKING GUN, AS SPECIFIED IN BY 3M PRODUCT BULLETIN 340.
5. MUST USE MINIMUM THREE BRACKETS PER PANEL CORRESPONDING TO THE PRE-DRILLED DELINEATOR HOLES.

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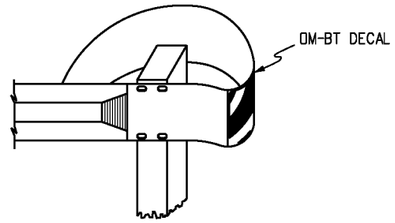
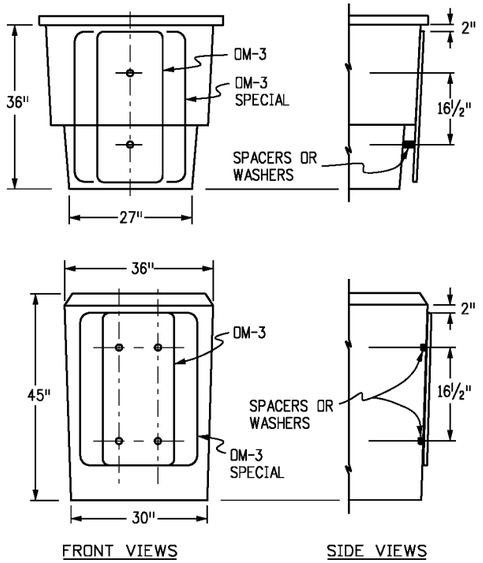
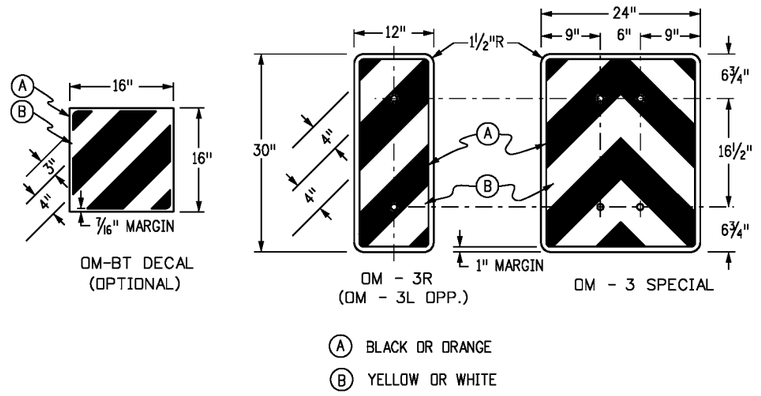


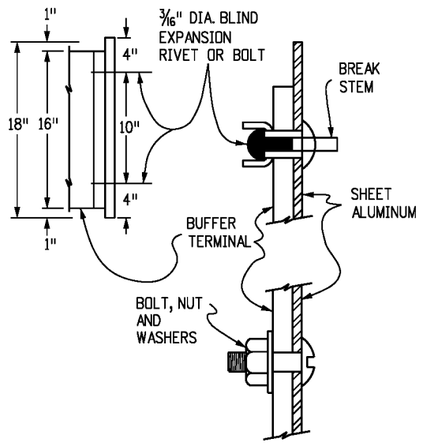
BUFFER TERMINALS (BT)



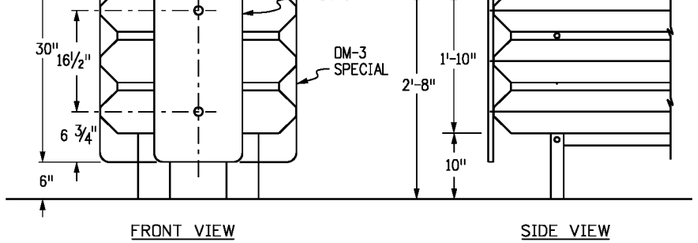
IMPACT ATTENUATOR (SAND FILLED)



SUPPLEMENTAL DELINEATION DETAILS



BUFFER PANEL ATTACHMENT DETAILS



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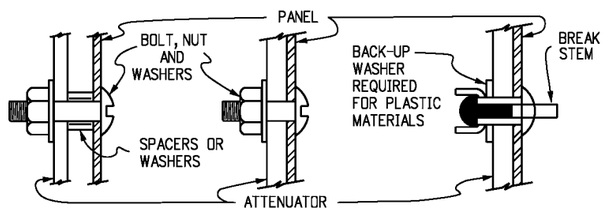

ATTENUATOR PANEL ATTACHMENT DETAILS

SUPPLEMENTAL PANEL NOTES

1. ALL SUPPLEMENTAL DELINEATION PANELS SHALL BE SINGLE SHEET ALUMINUM, 0.080" MINIMUM THICKNESS.
2. A) PANELS SHALL BE FASTENED DIRECTLY TO THE IMPACT ATTENUATOR WITH 2 OR 4-3/16 IN. DIA. BLIND EXPANSION RIVETS, OR 2 OR 4-3/16 IN. BOLTS, NUTS AND WASHERS.
   B) EXPANSION RIVETS SHALL BE DOMED HEAD ALUMINUM WITH ALUMINUM BREAK STEM MANDREL, AND SHALL HAVE A BACK-UP WASHER WHEN USED WITH PLASTIC MATERIALS.
   C) BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
   D) SPACERS, OR SPACING WASHERS SHALL BE USED AS NECESSARY FOR SAND FILLED ATTENUATORS.
3. OM-BT DECAL (BUFFER TERMINAL OBJECT MARKER) SHALL BE PRESSURE SENSITIVE REFLECTIVE SHEETING AND SHALL BE APPLIED DIRECTLY TO THE GUARDRAIL END TREATMENT (FLARED OR NON-FLARED).
4. RETROREFLECTIVE SHEETING SHALL CONFORM TO ASTM D4956, TYPE III. THE SHEETING SHALL BE YELLOW FOR PERMANENT INSTALLATIONS.
   OM-BT DECAL AND OM-3 PANELS SHALL HAVE YELLOW SHEETING BACKGROUND WITH STENCIL BLACK STRIPES.
   THE SHEETING FOR TEMPORARY (CONSTRUCTION ZONE) INSTALLATIONS SHALL BE AS FOLLOWS:
   OM-BT DECAL AND OM-3 PANELS SHALL HAVE ALTERNATING ORANGE AND WHITE REFLECTORIZED STRIPES.
5. SUPPLEMENTAL DELINEATION PANELS OR PRESSURE SENSITIVE RETROREFLECTIVE SHEETING DECALS SHALL BE INCLUDED IN THE COST OF THE GUARDRAIL END ANCHOR OR THE IMPACT ATTENUATOR ITEM.

SUPPLEMENTAL DELINEATION FOR GUARD RAIL
BUFFER TERMINALS AND IMPACT ATTENUATORS

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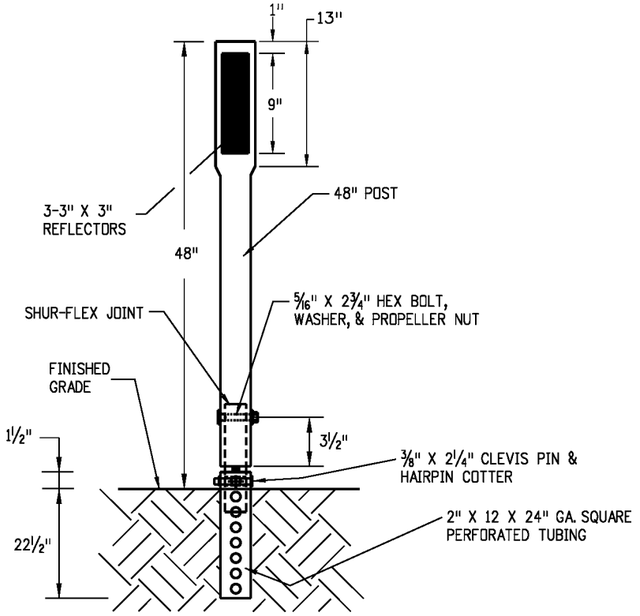
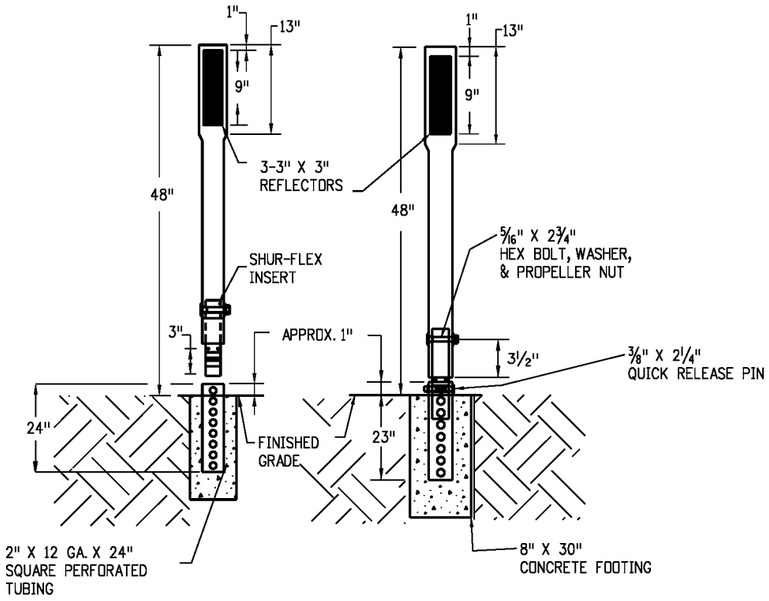


TYPICAL CONDITIONS



SOFT SOIL CONDITIONS

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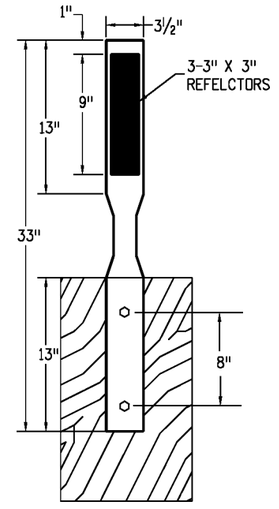
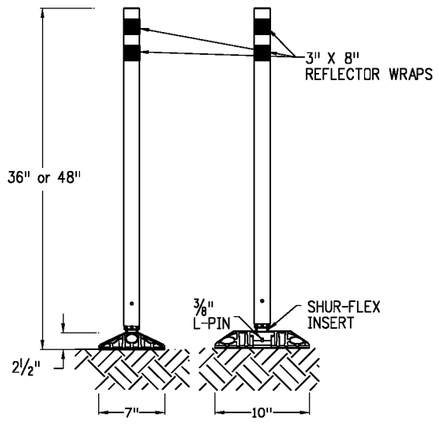
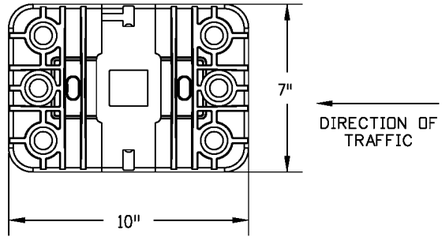


POST MOUNTED

GUARDRAIL MOUNTED





SURFACE MOUNTED

GENERAL NOTES

1. FLEXIBLE,33", IMPACT RESISTANT, DELINEATOR POSTS, COMPRISED OF RUBBER COMPOSITE, INCLUDING, 80% BY VOLUME, POST COMSUMER RECYLED HDPE, WITH A BRIGHT WHITE, PREMIUM U.V. INHIBITED, CO-EXTRUDED HDTP SHELL.
2. THE TOP OF TUBULAR POSTS SHALL BE PERMANENTLY CLOSED TO PREVENT MOISTURE OR DEBRIS FROM ENTERING.
3. THE SIDE OF THE POST FACING TRAFFIC, UPON WHICH THE DELINEATOR IS TO BE MOUNTED. SHALL HAVE A FLAT SURFACE WITH MINIMUM DIMENSIONS OF 3 1/4" INCHES IN WIDTH BY 13 INCHES IN LENGTH. THE TEXTURE OF THE PROJECTED SURFACE SHALL BE SMOOTH AND SUITABLE FOR THE ADHERENCE OF REFLECTIVE SHEETING WITHOUT PREPARATION OTHER THAN WIPING WITH A CLEAN CLOTH DAMPENED WITH MINERAL SPIRITS TO REMOVE OIL-TYPE CONTAMINANTS.
4. THE BOTTOM OF THE POST SHALL HAVE A MINIMUM 13 INCH LENGTH FLAT MOUNTING SURFACE WITH MINIMUM DIMENSION OF 3 1/4 INCHES IN WIDTH.
5. THE WIDTH OF THE POST AT ANY POINT (EXCLUDING THE BASE, IF ANY) SHALL BE A MAXIMUM OF 4 1/8 INCHES.
6. THE OUTSIDE DIAMETER OF THE TUBULAR POST SHALL BE A MAXIMUM OF 2 3/8 INCHES.

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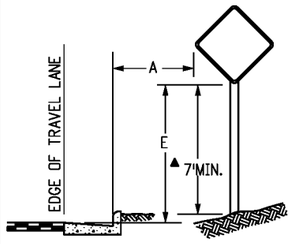
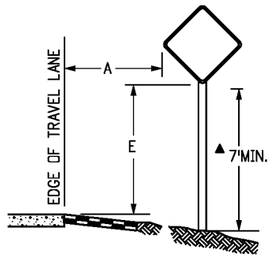
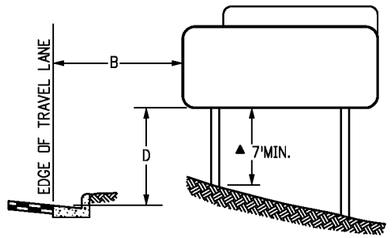
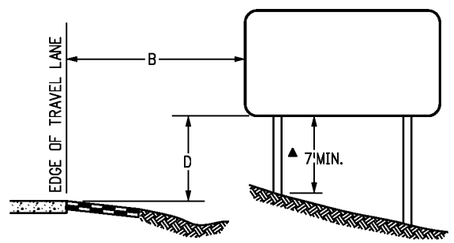
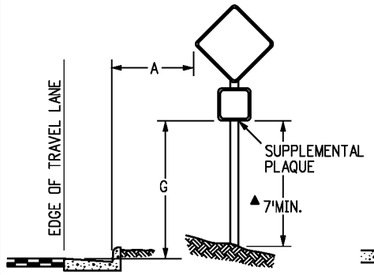
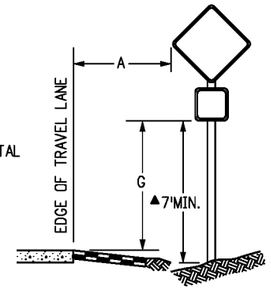




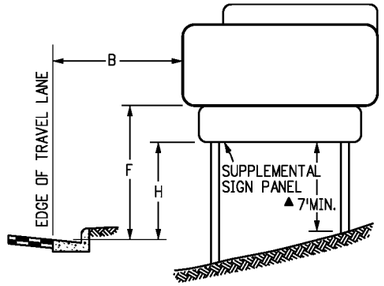


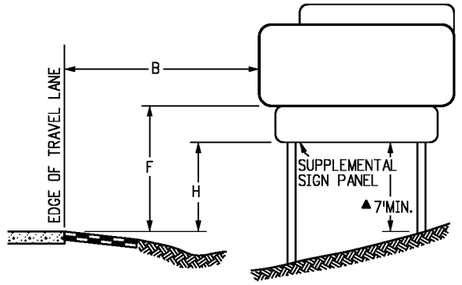




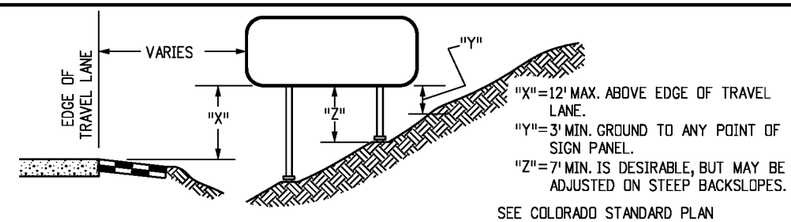


WARNING SIGN PLACEMENT





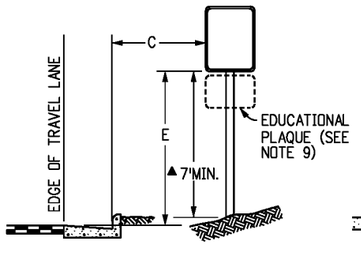
CLASS III SIGN PLACEMENT

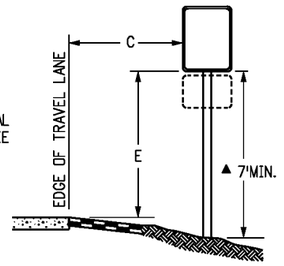


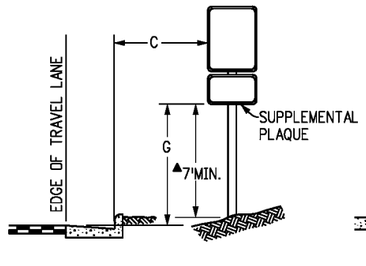
"X"=12' MAX. ABOVE EDGE OF TRAVEL LANE.
"Y"=3' MIN. GROUND TO ANY POINT OF SIGN PANEL.
"Z"=7' MIN. IS DESIRABLE, BUT MAY BE ADJUSTED ON STEEP BACKSLOPES.

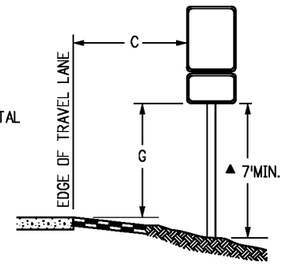
SEE COLORADO STANDARD PLAN S-614-21 FOR ADDITIONAL INFORMATION.

CLASS III SIGNS, PANEL GROUND CLEARANCE

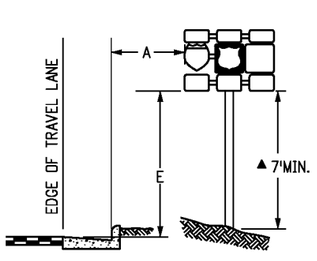


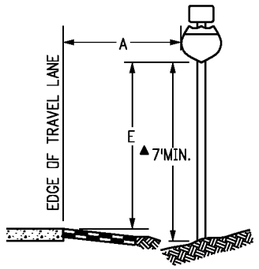




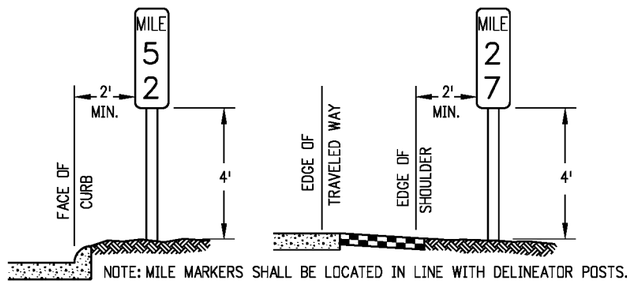


REGULATORY, RECREATIONAL AND CULTURAL INFORMATION SIGN PLACEMENT





ROUTE MARKER ASSEMBLY PLACEMENT



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

MILE MARKER PLACEMENT

GENERAL NOTES

1. THE ENGINEER WILL ESTABLISH GRADES AND LOCATIONS FOR ALL SIGN POSTS IN ACCORDANCE WITH DETAILS SHOWN ON THE PLANS.
2. SPECIAL CARE SHALL BE TAKEN IN SIGN LOCATION TO ENSURE AN UNOBSTRUCTED VIEW OF EACH SIGN.
3. MINIMUM POST EMBEDMENT SHALL BE 3 FT. FOR U-2 POSTS AND 4 IN. X 4 IN. TIMBER POSTS, AND 5 FT. FOR 6 IN. X 6 IN. TIMBER POSTS. FOR FOOTING DEPTH SEE THE APPLICABLE STANDARD.
4. MINIMUM LATERAL PLACEMENT IS MEASURED FROM FACE OF CURB OR FROM ANY SURFACE PREPARED FOR NORMAL OR EMERGENCY TRAVEL OF VEHICLES.
5. NORMAL LATERAL PLACEMENT IS MEASURED FROM THE EDGE OF TRAVEL LANE.
6. IN URBAN AREAS A LATERAL CLEARANCE OF 1 FT. FROM THE CURB FACE IS PERMISSIBLE WHERE SIDEWALK WIDTH IS LIMITED OR WHERE EXISTING POLES ARE CLOSE TO THE CURB.
7. ▲ A 7 FT. MINIMUM POST LENGTH SHALL BE MAINTAINED FROM BOTTOM OF SIGN PANEL TO THE GROUND OR THE TOP OF THE FOOTING.
8. TYPICAL POST MOUNTING HEIGHTS FROM GROUND TO BOTTOM OF SIGN PANEL ARE 7, 8 OR 9 FEET. OTHER HEIGHTS MAY BE REQUIRED WHEN SIGNS ARE MOUNTED ON STEEPER FILL OR CUT SLOPES.
9. "EDUCATIONAL PLAQUES" FOR SYMBOL SIGNS WILL NOT BE CONSIDERED WHEN DETERMINING VERTICAL PLACEMENT.
10. WHEN LATERAL PLACEMENT IS 30 FT. OR MORE FOR SIGNS WITHOUT A SUPPLEMENTAL PANEL, VERTICAL PLACEMENT D MAY BE REDUCED TO 5 FT. WHEN LATERAL PLACEMENT IS 30 FT. OR MORE FOR SIGNS WITH A SUPPLEMENTAL PANEL, VERTICAL PLACEMENT E DOES NOT APPLY - USE ONLY VERTICAL PLACEMENT H.
11. NORMAL ANGULAR PLACEMENT IS 0 DEG. SIGNS CLOSER THAN 30 FT. SHOULD BE TURNED SLIGHTLY AWAY TO MINIMIZE SPECULAR REFLECTION. SIGNS PLACED 30 FT. OR MORE SHOULD GENERALLY BE TURNED TOWARD THE ROAD.
12. THE EXIT PANEL IS MOUNTED ON THE RIGHT HAND SIDE FOR RIGHT HAND EXITS AND THE LEFT SIDE FOR LEFT HAND EXITS.
13. POST SHALL BE INSTALLED PLUMB, VERTICAL DEVIATION SHALL NOT EXCEED ½ IN. IN 10 FT.

PLACEMENT TABLES

LATERAL PLACEMENT		
KEY	ALL CLASSES OF STREETS AND HIGHWAYS	
	MINIMUM	NORMAL
*A	2'-0" & NOTE NO.4	15'-0"PLUS CURB OR SHOULDER WIDTH
*B	2'-0" & NOTE NO.4	30'-0" OR MORE INCLUDES CURB OR SHOULDER
*C	2'-0" & NOTE NO.4	6'-0"PLUS CURB OR SHOULDER WIDTH OR IF NONE 15'-0"

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

* SEE NOTE NO. 6

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GROUND SIGN PLACEMENT

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STANDARD PLAN NO.
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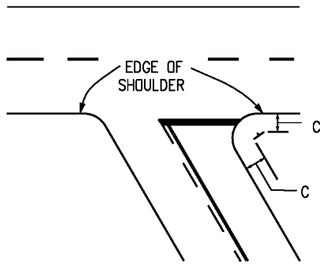
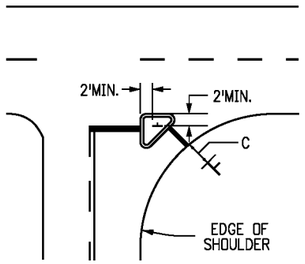


ACUTE ANGLE INTERSECTION



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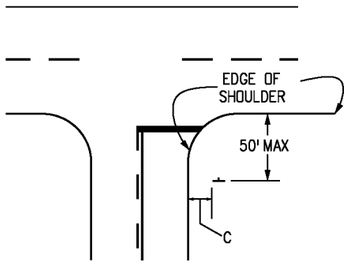

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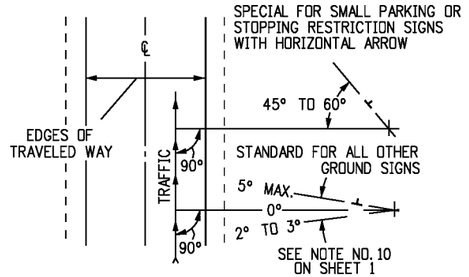
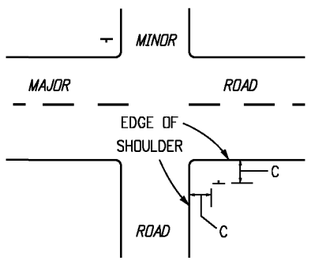


NORMAL ANGULAR PLACEMENT IS 0°. SIGNS CLOSER THAN 30 FT. SHOULD BE TURNED SLIGHTLY AWAY TO MINIMIZE SPECULAR REFLECTION. SIGNS PLACED 30' OR MORE SHOULD GENERALLY BE TURNED TOWARD THE ROAD.

ANGULAR PLACEMENT



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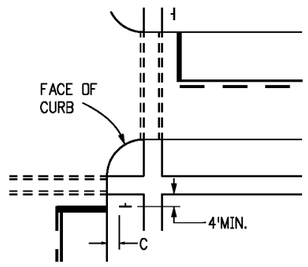
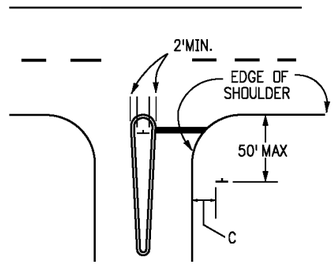


URBAN INTERSECTION



DIVISIONAL ISLAND

TYPICAL LOCATIONS-STOP SIGNS AND YIELD SIGNS

PLACEMENT TABLES

LATERAL PLACEMENT		
KEY	ALL CLASSES OF STREETS AND HIGHWAYS	
	MINIMUM	NORMAL
*A	2'-0" & NOTE NO.4	15'-0"PLUS CURB OR SHOULDER WIDTH
*B	2'-0" & NOTE NO.4	30'-0" OR MORE INCLUDES CURB OR SHOULDER
*C	2'-0" & NOTE NO.4	6'-0"PLUS CURB OR SHOULDER WIDTH OR IF NONE 15'-0"

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

* SEE NOTE NO. 6 ON SHEET 1

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	Sheet Revisions	
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GROUND SIGN PLACEMENT

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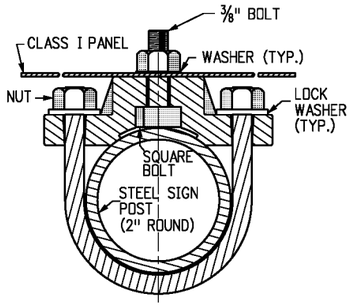
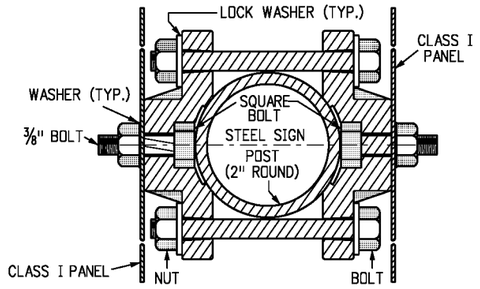
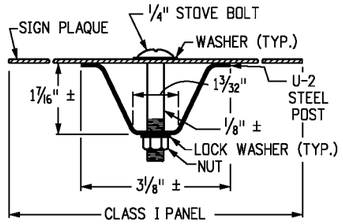
TYPICAL SINGLE BRACKET



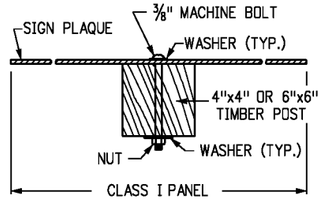
TYPICAL BACK TO BACK



TYPICAL ROUND STEEL POLE SECTION



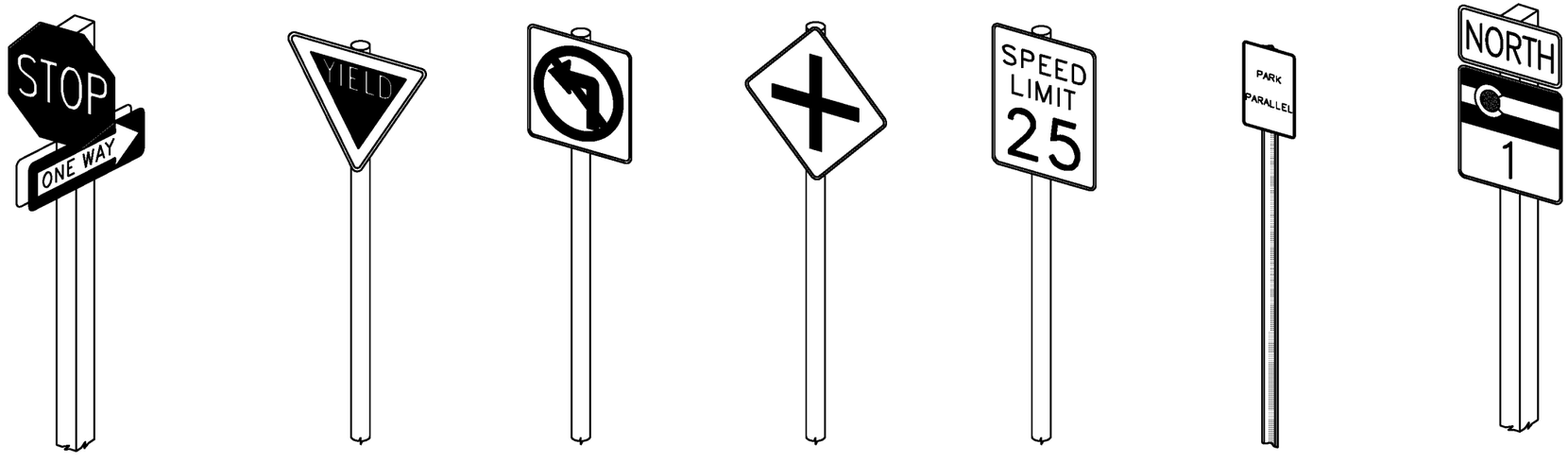
TYPICAL U-2 POST SECTION



TYPICAL TIMBER POST SECTION

GENERAL NOTES

1. CLASS I SIGN PANELS ARE ALL THOSE THAT DO NOT REQUIRE BACKING ZEES. CLASS I PANELS SHALL GENERALLY BE 0.100" MINIMUM THICKNESS SINGLE SHEET ALUMINUM, BUT 0.080" THICKNESS MAY BE USED FOR SIGN PANELS WHERE BOTH THE HORIZONTAL AND VERTICAL DIMENSIONS ARE LESS THAN 36 IN.
2. CLASS I SIGN PANELS SHALL BE FASTENED TO THE U-2 POST WITH 2-1/4 IN. STOVE BOLTS AND TO TIMBER POSTS WITH 2-3/8 IN. MACHINE BOLTS. SEE STANDARD PLANS S-614-20 AND S-614-22 FOR EXCEPTIONS.
3. A WASHER SHALL BE PLACED BETWEEN THE BOLT HEAD AND THE FACE OF THE SIGN PANEL. A 1 1/2 IN. DIA. WASHER SHALL BE PLACED UNDER THE NUT ON THE BACK OF THE TIMBER POST.
4. BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
5. ALL SIGNS SHALL BE FABRICATED USING RETROREFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE AS DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.
6. FOR SIGN PLACEMENT SEE STANDARD PLAN S-614-1.
7. U-2 POSTS MAY ONLY BE USED FOR DELINEATORS, MILE MARKERS AND STRUCTURE NUMBER PLAQUES. "U" SHAPE STEEL POSTS SHALL BE A UNIFORM FLANGED CHANNEL SECTION MADE FROM HOT ROLLED STRUCTURAL STEEL, RE-ROLLED RAIL STEEL, OR NEW BILLET STEEL HAVING A MINIMUM YIELD STRENGTH OF AT LEAST 30,000 PSI, AND A MINIMUM TENSILE STRENGTH OF AT LEAST 50,000 PSI. U" SHAPE POSTS SHALL WEIGH 2 LBS/FT, EXCEPT THAT A MILL TOLERANCE OF MINUS 3 1/2% OF THE WEIGHT OF ANY ONE POST WILL BE ALLOWED. "U" SHAPE POSTS SHALL HAVE 5/16 IN. HOLES DRILLED OR PUNCHED ON 1IN. OR 2 IN. CENTERS FOR THE TOP 4 FEET OF THE POST AS A MINIMUM, WITH THE FIRST HOLE 1 1/2 IN. FROM THE TOP OF THE POST. COLOR OF POSTS SHALL BE INTERSTATE GREEN.
8. VERTICAL SPACING BETWEEN PANELS ON THE SAME POST SHALL BE 1 IN. TO 1 1/2 IN.



TYPICAL CLASS I GROUND SIGNS

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CLASS I SIGNS

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STANDARD PLAN NO.
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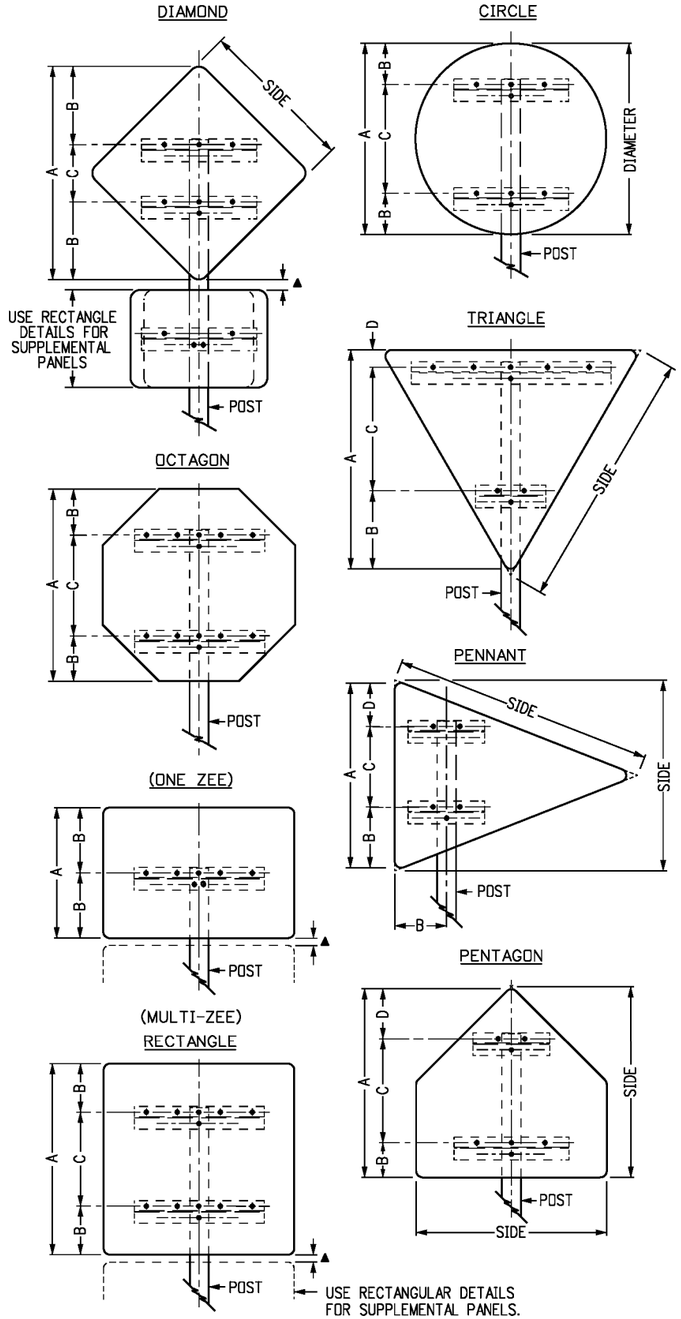
Sheet No. 1 of 1

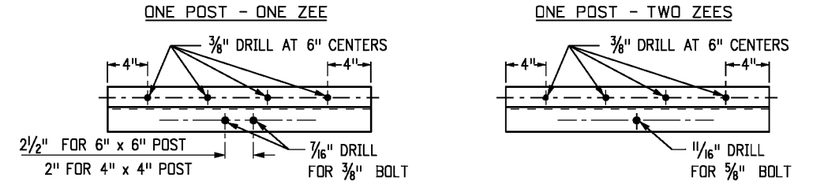


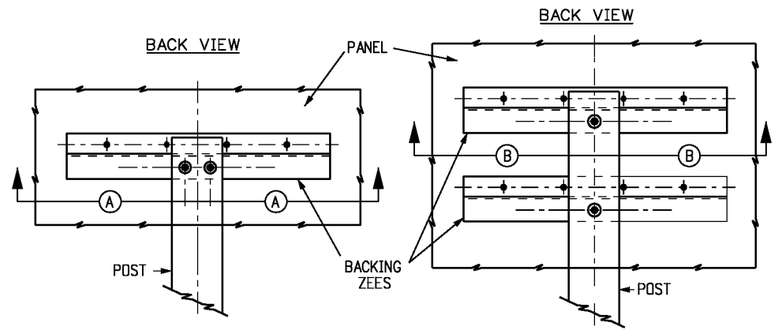
TYPICAL PANEL DETAILS

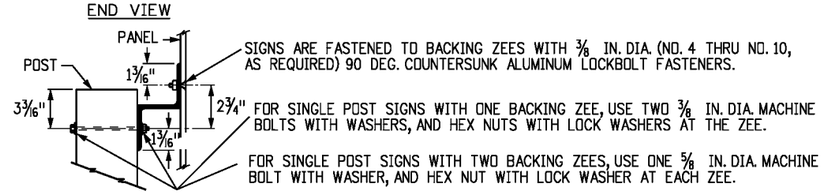
CLASS II PANEL MOUNTING DATA (* TIMBER POSTS)

SIGN TYPE	A	B	C	D	POST SIZE
DIAMOND, 36" SIDES	49 1/16"	14 1/32"	21"	--	6" x 6"
48" SIDES	65 3/8"	20 5/16"	25"	--	6" x 6"
60" SIDES	81 1/2"	25 3/4"	30"	--	6" x 6"
TRIANGLE. 36" SIDES	29 3/16"	14 3/16"	9"	6"	4" x 4"
48" SIDES	38 5/16"	14 9/16"	18	6"	4" x 4"
60" SIDES	48"	20"	22"	6"	6" x 6"
OCTAGON, 36" x 36"	36"	9"	18"	--	6" x 6"
48" x 48"	48"	12"	24"	--	6" x 6"
CIRCLE. 36" DIAMETER	36"	8"	20"	--	6" x 6"
PENNANT, 48" x 36" SIDES	34"	10 3/4"	15"	8 1/4"	4" x 4"
64" x 48" SIDES	45"	12 1/2"	21 1/2"	11"	6" x 6"
PENTAGON, 36" SIDES	35"	6"	20"	9"	4" x 4"
48" SIDES	46 3/4"	9"	25 3/4"	12"	6" x 6"
RECTANGLE					
WIDTH / HEIGHT					
36" / 24"	24"	12"	--	--	4" x 4"
48" / 24"	24"	12"	--	--	6" x 6"
36" to 60" / 30"	30"	9"	12"	--	6" x 6"
36" to 60" / 36"	36"	9"	18"	--	6" x 6"
36" to 60" / 42"	42"	9"	24"	--	6" x 6"
36" to 60" / 48"	48"	12"	24"	--	6" x 6"
48" / 54"	54"	12"	30"	--	6" x 6"
48" to 60" / 60"	60"	12"	36"	--	6" x 6"
SUPPLEMENTAL PANELS					
RECTANGLE, 24" x 18"	18"	9"	--	--	4"x4"or 6"x6"
48" x 18"	18"	9"	--	--	6" x 6"
24" x 24"	24"	12"	--	--	6" x 6"
36" x 24"	24"	12"	--	--	6" x 6"
48" x 36"	36"	9"	18"	--	6" x 6"

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







TYPICAL BACKING ZEES

GENERAL NOTES

1. CLASS II SIGN PANELS ARE THOSE THAT REQUIRE AT LEAST ONE, BUT NO MORE THAN TWO BACKING ZEES (THESE WILL BE SIGN PANELS THAT ARE LESS THAN 72 IN. IN HEIGHT), UNLESS THEY ARE ATTACHED TO A CLASS III ASSEMBLY. ALL CLASS II PANELS SHALL BE 0.100 IN. MINIMUM THICKNESS SINGLE SHEET ALUMINUM.
2. Z-BAR LENGTH SHALL BE 3 IN. (±1/2 IN.) SHORT OF THE EDGE OF THE SIGN ON BOTH SIDES.
3. FOR TUBULAR STEEL POST INFORMATION SEE STANDARD PLAN 614-8.
4. BACKING ZEES ARE 3 IN. x 2 11/16 IN. x 2.33, 6061-T6 ALUMINUM ALLOY WEIGHING 2.33 LBS. PER FOOT.
5. FOR SIGN PLACEMENT SEE STANDARD PLAN S-614-1.
6. ALL SIGNS SHALL BE FABRICATED USING RETROREFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE AS DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.
7. BOLTS, NUTS AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
8. ▲ VERTICAL SPACING BETWEEN PANELS SHALL BE 1 IN. TO 1 1/2 IN.
9. WASHERS ON THE TIMBER POST SHALL BE 1 1/2 IN. DIA.

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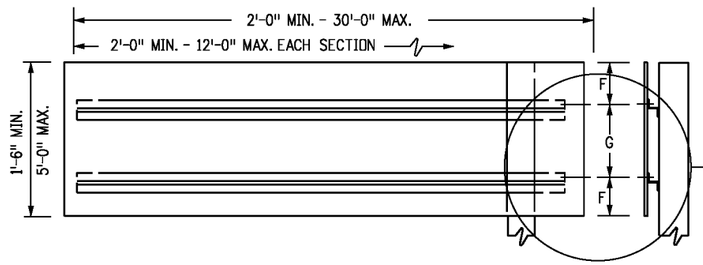
Safety & Traffic Engineering Branch KCM/KEN

CLASS II SIGNS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-614-3
Sheet No. 1 of 1

HORIZONTAL SECTIONS



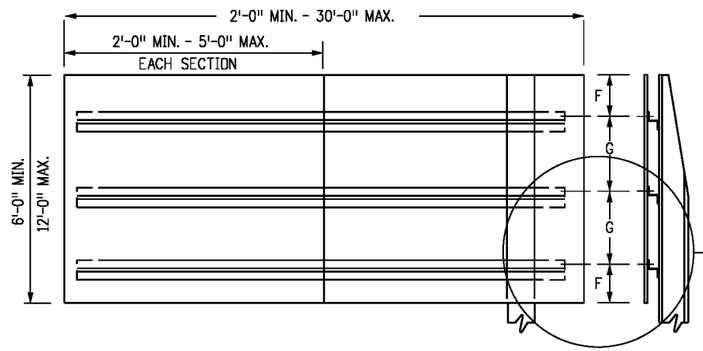
SECTIONS REQUIRED

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

*NUMBER OF SECTIONS SHALL NOT EXCEED MAXIMUM SHOWN IN TABLE

SEE TYPICAL DETAIL ON SHEET 2

VERTICAL SECTIONS



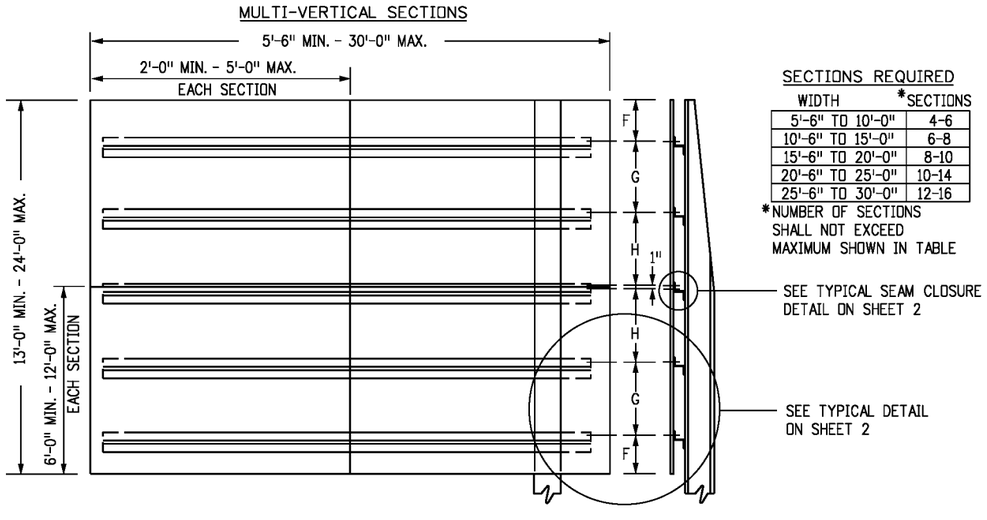
SECTIONS REQUIRED

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

*NUMBER OF SECTIONS SHALL NOT EXCEED MAXIMUM SHOWN IN TABLE

SEE TYPICAL DETAIL ON SHEET 2

MULTI-VERTICAL SECTIONS



SECTIONS REQUIRED

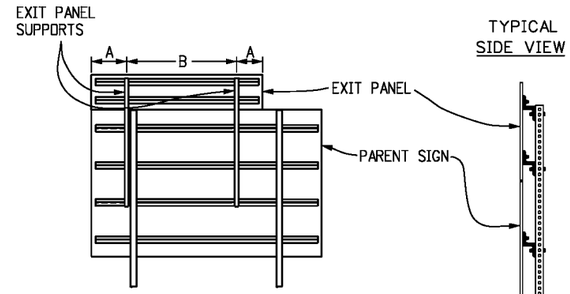
WIDTH	*SECTIONS
5'-6" TO 10'-0"	4-6
10'-6" TO 15'-0"	6-8
15'-6" TO 20'-0"	8-10
20'-6" TO 25'-0"	10-14
25'-6" TO 30'-0"	12-16

*NUMBER OF SECTIONS SHALL NOT EXCEED MAXIMUM SHOWN IN TABLE

SEE TYPICAL SEAM CLOSURE DETAIL ON SHEET 2

SEE TYPICAL DETAIL ON SHEET 2

TYPICAL PANEL ELEVATIONS



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

TYPICAL EXIT PANEL INSTALLATION FOR GROUND SIGNS

EXIT PANEL NOTES

1. THE EXIT PANEL SHALL BE MOUNTED WITH TWO SUPPORTS. RIGHT HAND EXITS REQUIRE THE EDGE OF THE EXIT PANEL TO BE MOUNTED EVEN WITH THE RIGHT EDGE OF THE PARENT SIGN. LEFT HAND EXITS REQUIRE THE LEFT EDGE OF THE EXIT PANEL TO BE MOUNTED EVEN WITH THE LEFT EDGE OF THE PARENT SIGN.
2. THE SUPPORTS SHALL BE SQUARE STEEL TUBING A MINIMUM WIDTH OF 2-1/4" WITH 7/16" INCH HOLES PUNCHED OR DRILLED ON 1" CENTERS ALONG THE LENGTH OF EACH SIDE WHILE MAINTAINING A MINIMUM SECTION MODULUS OF 0.499 CUBIC INCHES. THE STEEL MUST HAVE A MINIMUM YIELD STRESS OF 33 KSI. ALTERNATELY, ZEE BAR MAY USED FOR THE SUPPORT MEMBERS WITH 7/8" HOLES PUNCHED WHERE NEEDED.
3. THE SUPPORTS SHALL BE FASTENED TO THE BACKING ZEE USING 3/8" BOLTS.
4. THE EXIT PANEL SUPPORT MAY BE MOVED 6" IF IT CONFLICTS WITH THE PARENT SIGN SUPPORT.
5. EXIT PANEL MOUNTING WILL BE PAID FOR AS PART OF THE CLASS III SIGN PANEL.
6. EXIT PANEL SUPPORTS SHALL BE ATTACHED TO A MINIMUM OF THREE BACKING ZEES.

GENERAL NOTES

1. CLASS III SIGN PANELS ARE ALL THOSE WHERE A SINGLE PANEL REQUIRES 3 OR MORE BACKING ZEES (THESE WILL BE SIGN PANELS THAT ARE 72 IN. OR MORE IN HEIGHT) AND ANY PANELS THAT ARE PART OF A CLASS III ASSEMBLY SUCH AS EXIT PANELS. ALL CLASS III PANELS SHALL BE 0.125 IN. MINIMUM THICKNESS SHEET ALUMINUM.
2. SEE THE APPLICABLE STANDARDS FOR SIGN PLACEMENT, FOOTING DETAILS AND POST SPACING TABLES.
3. A 3/8 IN. 90° COUNTERSUNK HUCKBOLT AND COLLAR SHALL BE USED TO FASTEN THE SIGN PANEL TO THE BACKING ZEE. A HEX-HEAD BOLT WITH NUT AND WASHERS SHALL BE USED TO FASTEN THE BACKING ZEE TO A TIMBER POST OR TO A STEEL POST.
4. A FLAT WASHER SHALL BE PLACED BETWEEN THE BOLT HEAD AND THE POST FLANGE. A LOCK WASHER SHALL BE PLACED UNDER THE NUT ON A STEEL POST OR A BACKING ZEE. A 1 1/2" DIAMETER WASHER SHALL BE PLACED UNDER THE BOLT HEAD ON A TIMBER POST.
5. ALL EXPOSED SIGN PANEL SECTION JOINTS, EXCEPT THE MULTI-VERTICAL SECTIONS HORIZONTAL SEAM, SHALL BE COVERED ON THE BACKSIDE OF THE SIGN PANEL WITH AN ALUMINUM CLOSURE STRIP. CLOSURE STRIPS SHALL BE RIVETED OR TAPED. SEE FABRICATIONS NOTES.
6. SECTIONS ILLUSTRATED BASED ON UTILIZING 12' X 5' STOCK. 4' WIDE STOCK MAY BE USED WITH APPROPRIATE ADJUSTMENT IN NUMBER OF SECTIONS.
7. ALL SIGNS SHALL BE FABRICATED USING RETROREFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE AS DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.

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CLASS III SIGNS

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STANDARD PLAN NO.
S-614-4
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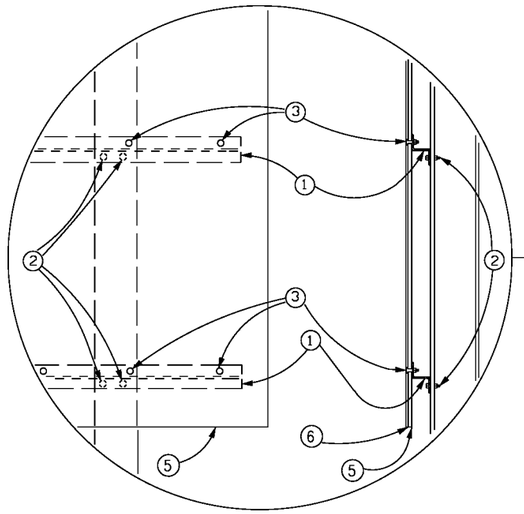
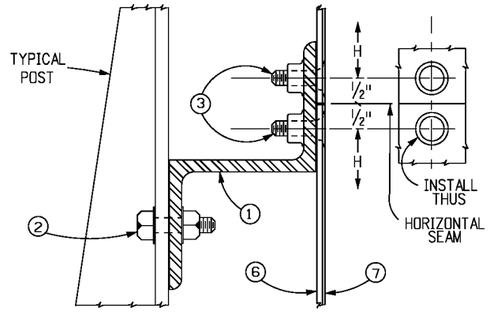
FABRICATION NOTES

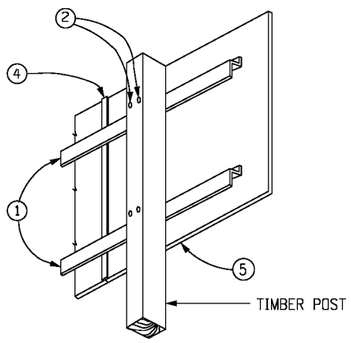
1. BACKING ZEE. SEE "ZEE SPACING TABLE" ON SHEET 3. ALUMINUM ALLOY 6061-T6. EACH ZEE TO BE PROVIDED WITH A 9/16 IN. X 2 IN. HORIZONTAL SLOT FOR EACH POST MOUNTING BOLT.
2. 3/8 IN. HEX-HEAD BOLT WITH NUT AND WASHERS; 2 PER BACKING ZEE PER POST REQUIRED. WASHERS ON POST SHALL BE 1 1/2 IN. DIA.
3. 3/8 IN. (NO. 6) 90 DEG. COUNTERSUNK HUCKBOLT WITH COLLAR.
4. 2 IN. X 0.025 IN. ALUMINUM CLOSURE STRIP RIVETED ABOVE THE TOP Z AND BELOW THE BOTTOM Z OR ALUMINUM CLOSURE STRIPS ATTACHED ABOVE, BETWEEN, AND BELOW THE ZEES WITH A VERY HIGH BOND (VHB) DOUBLE ACRYLIC FOAM TAPE, OR APPROVED EQUIVALENT. MANUFACTURER'S RECOMMENDATIONS SHALL BE ADHERED TO FOR THIS APPLICATION.
5. SHEET ALUMINUM: 0.125 IN. MINIMUM THICKNESS.
6. ADHESIVES SHALL BE CLASS I OR CLASS II ADHESIVES OF ASTM D4956.
7. BACKING ZEES SHALL EXTEND TO THE EDGE OF THE PANEL ON 6 FT., 7 FT. & 8 FT. WIDE SIGNS.



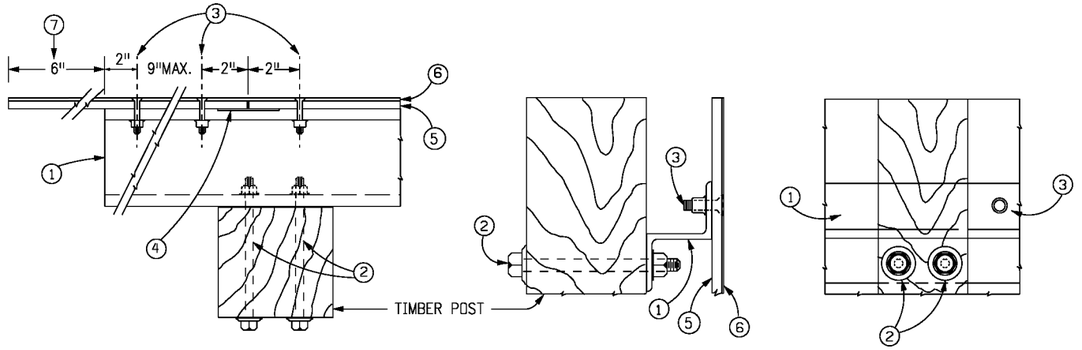
TYPICAL ELEVATION DETAIL



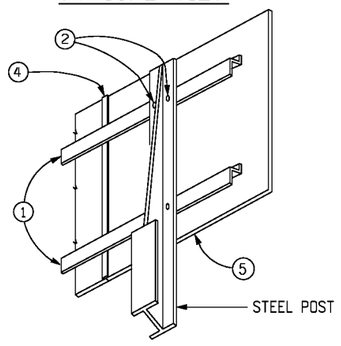
TYPICAL DETAIL
SEAM CLOSURE ZEE
(MULTIPLE-VERTICAL SECTIONS, HORIZONTAL SEAMS)



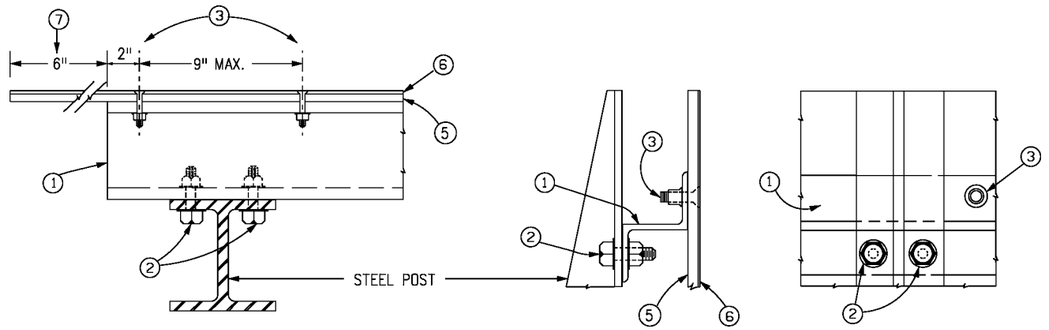
TYPICAL VIEW



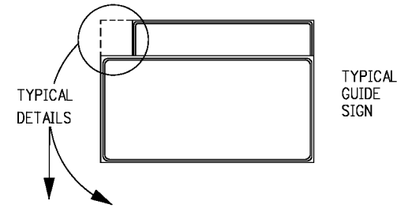
TYPICAL TIMBER POST INSTALLATION
PANEL FABRICATION AND MOUNTING DETAILS

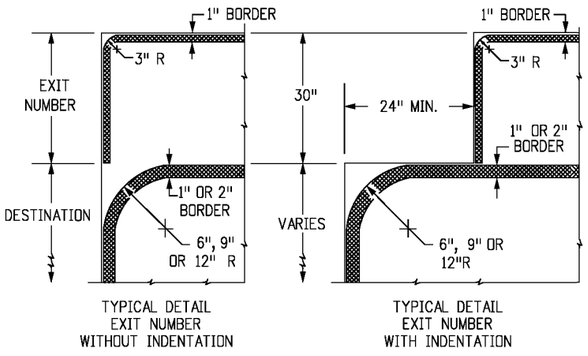


TYPICAL VIEW



TYPICAL STEEL POST INSTALLATION
PANEL FABRICATION AND MOUNTING DETAILS





TYPICAL BORDER DETAILS
WITH EXIT NUMBER

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POST SPACING TABLE
FOR SHEET ALUMINUM SIGN PANELS

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

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

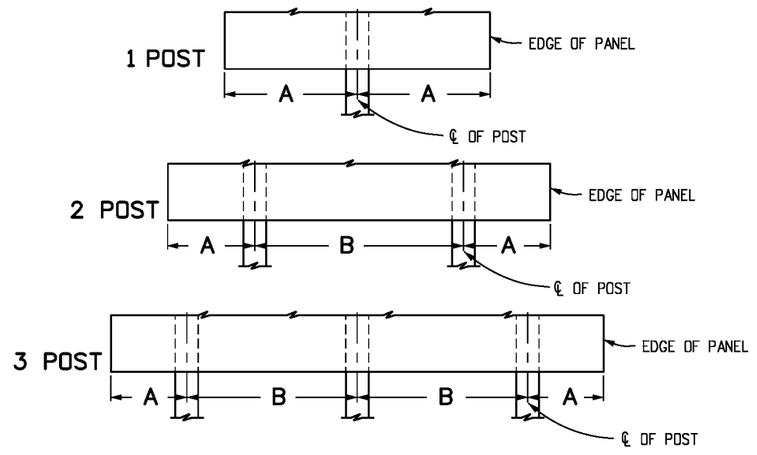
(1) BACKING ZEE SHALL EXTEND TO THE EDGE OF THE PANEL, EXCEPT FOR EXIT PANELS ATTACHED BY SQUARE STEEL TUBING.

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

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

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

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



TYPICAL POST SPACING

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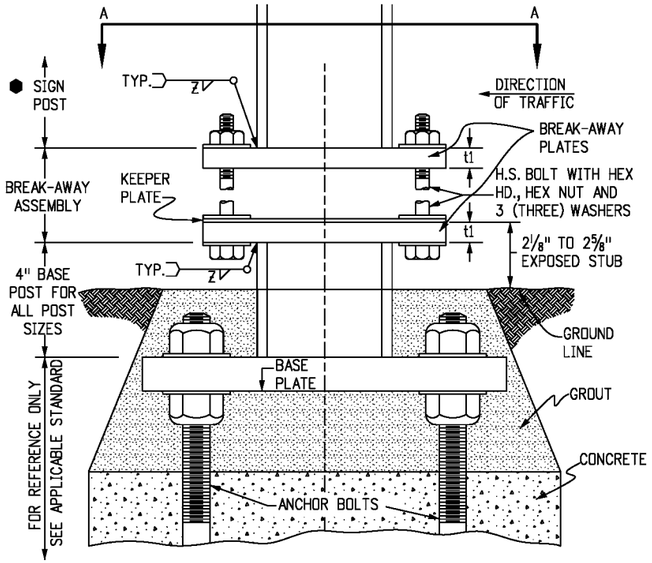
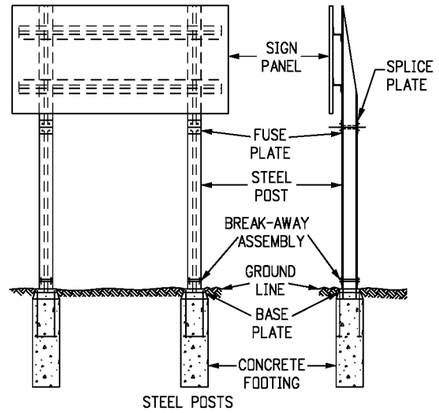
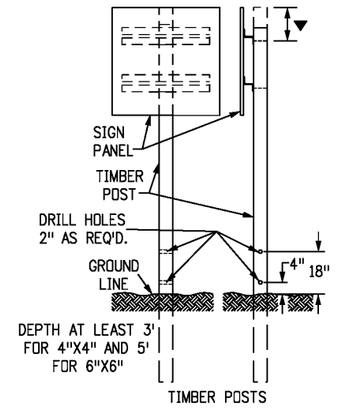
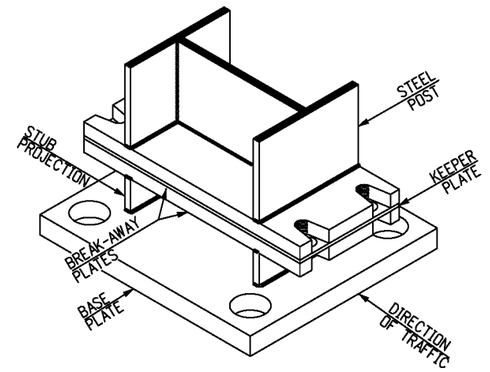


TYPICAL ELEVATION
STEEL POST ASSEMBLY

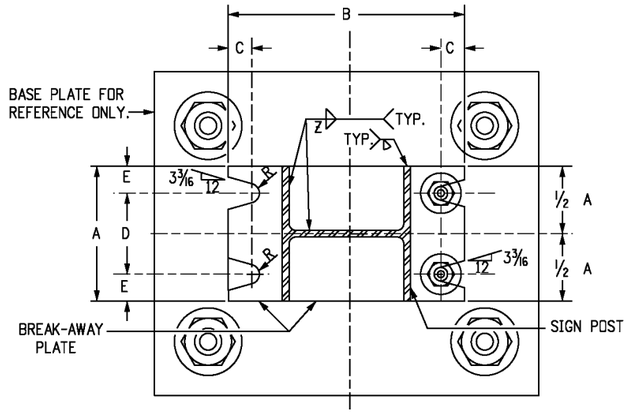




TYPICAL BREAK-AWAY SIGN SUPPORT INSTALLATIONS



TYPICAL PROJECTED VIEW
STEEL POST ASSEMBLY



SECTION A-A

GENERAL NOTES

1. DESIGN CONFORMS WITH AASHTO "SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS".
2. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M270 (ASTM A709) GRADE 36 AND SECTIONS 509 AND 614 OF THE STANDARD SPECIFICATIONS.
3. STEEL FUSE PLATES AND SPLICE PLATES SHALL CONFORM TO AASHTO M270 (ASTM A709) GRADE 36.
4. ALL STRUCTURAL STEEL INCLUDING FUSE AND SPLICE PLATES SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A123 AFTER FABRICATION. STEEL POSTS SHALL BE STAMPED WITH THEIR SIZE.
5. ALL HIGH STRENGTH BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM-A325. WASHERS USED IN THE BREAK-AWAY PLATE AND FUSE PLATE ASSEMBLIES SHALL BE OF SUFFICIENT STRENGTH TO PREVENT ANY DEFLECTION OR CUPPING INTO THE SLOTTED GROOVES UNDER BOLT TORQUING.
6. ALL BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED AS PER ASTM-A153 OR ASTM-A164.
7. ALL HOLES IN FUSE PLATE AND POST FLANGE ON WHICH IT MOUNTS, SHALL BE DRILLED. ALL OTHERS MAY BE DRILLED OR SUB-PUNCHED AND REAMED.
8. ALL STEEL CUTS SHALL PREFERABLY BE SAW CUTS; HOWEVER, FLAME CUTTING WILL BE PERMITTED PROVIDED ALL EDGES ARE GROUND. REMOVE ALL BURRS. METAL SHALL NOT PROJECT BEYOND THE PLANE OF THE PLATE FACE.
9. A "KEEPER PLATE" OF 28-GAGE GALVANIZED SHEET METAL, FABRICATED TO MATCH BREAK-AWAY PLATE DIMENSIONS BUT WITH HOLES RATHER THAN SLOTS, SHALL BE USED TO PREVENT BOLT LOOSENING DUE TO WIND VIBRATION.
10. HIGH STRENGTH BOLTS IN THE BREAK-AWAY ASSEMBLY SHALL BE TIGHTENED ONLY TO THE TORQUE SHOWN IN THE TABLE. DO NOT OVERTIGHTEN.
11. TIMBER POSTS SHALL BE IN ACCORDANCE WITH SECTION 614 OF THE STANDARD SPECIFICATIONS AS TO SIZE, ALTERNATE SIZE, GRADE, SPECIES, TREAMENT, AND BREAK-AWAY.
12. FOR ALL BASE PLATE AND FOOTING WORK SEE STANDARD PLAN S-614-6.
13. FOR ADDITIONAL INFORMATION, REFER TO "TABULATION OF SIGNS" AND CROSS SECTIONS FOR CLASS III SIGNS" INCLUDED IN THE PLANS.
14. TIMBER POST SHALL BE FLUSH WITH TOP OF SIGN PANEL FOR DIRECT MOUNT AND 3⅜6 IN. MINIMUM ABOVE BOLT FOR BACKING ZEE MOUNT. IN NO CASE SHALL A BACKING ZEE BE PLACED BELOW THE FUSE PLATES.
15.
16. SIGN POST PAY LENGTH IS FROM THE UPPER BREAK-AWAY PLATE TO THE TOP OF THE "COPE". THE 4-INCH "BASE POST" AND THE LOWER "BREAK-AWAY PLATE" ARE PAID FOR AS PART OF THE FOOTING. THE UPPER "BREAK-AWAY PLATE" AND ALL NUTS, BOLTS, WASHERS AND KEEPER PLATE FOR FASTENING THE BREAK-AWAY PLATES ARE PAID FOR AS A PART OF THE POST.

BOLTING PROCEDURE FOR BREAK-AWAY PLATE ASSEMBLY

1. ASSEMBLE THE POST TO THE STUB WITH BOLTS, WITH ONE FLAT WASHER ON THE TOP OF THE UPPER BREAK-AWAY PLATE AND ONE BELOW THE LOWER BREAK-AWAY PLATE, AND ONE FLAT WASHER AND A KEEPER PLATE BETWEEN THE BREAK-AWAY PLATES.
2. TIGHTEN ALL BOLTS TO A "SNUG TIGHT" CONDITION WITH A 12 IN. TO 15 IN. WRENCH, TO BED THE WASHERS AND CLEAN THE BOLT THREADS. THEN LOOSEN EACH BOLT IN TURN, AND RETIGHTEN IN A SYSTEMATIC ORDER TO THE PRESCRIBED TORQUE (SEE BREAK-AWAY PLATE DATA TABLES).
3. BURR THREADS AT JUNCTION WITH NUT TO PREVENT NUT LOOSENING.

BREAK-AWAY PLATE DATA TABLE

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

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BREAK-AWAY SIGN SUPPORT DETAILS FOR GROUND SIGNS

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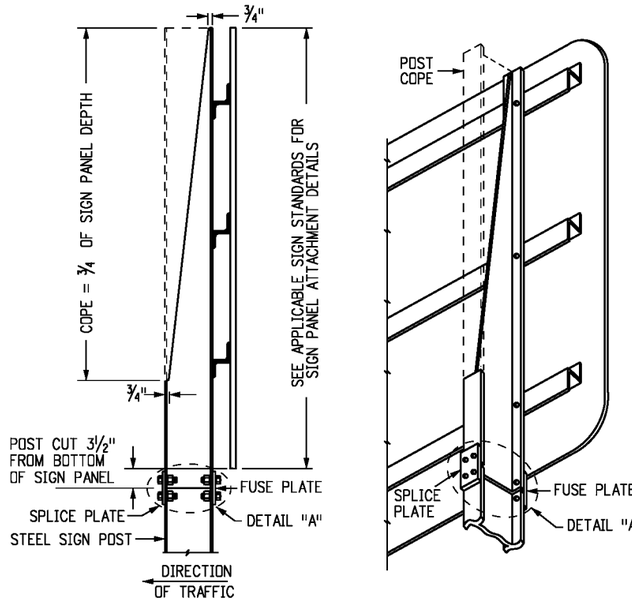
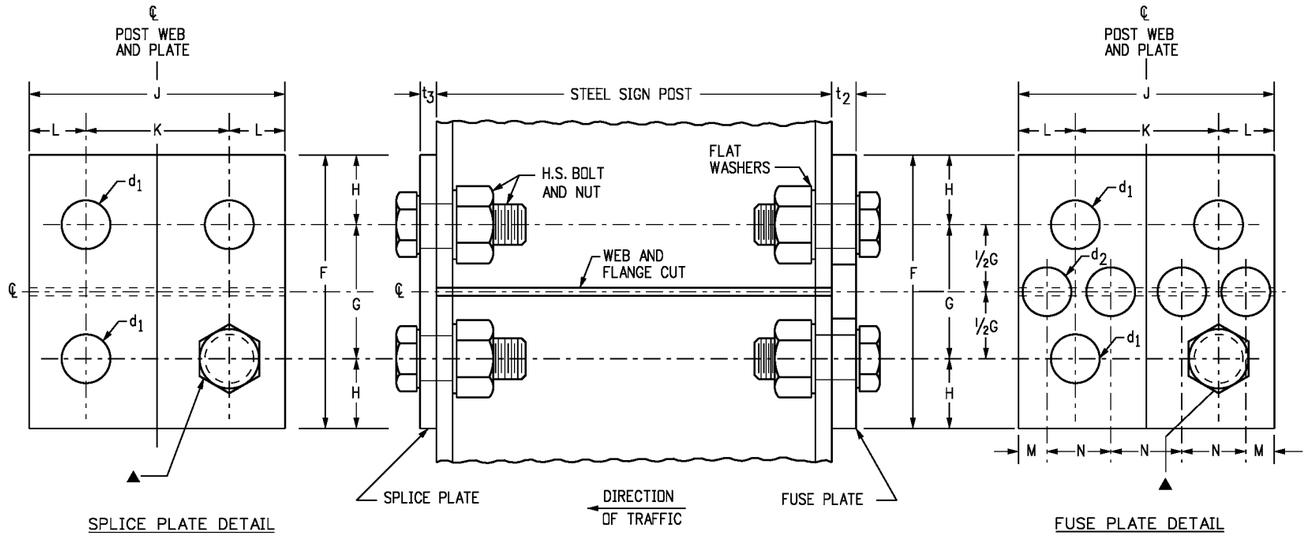


TYPICAL SIDE VIEW
FUSE PLATE AND POST COPE

TYPICAL PROJECTED VIEW
FUSE PLATE AND POST COPE



▲ HOLE DIAMETER = d_1
USE HIGH STRENGTH BOLTS WITH HEX HEAD AND HEX NUT, WITH ONE FLAT WASHER UNDER EACH

TYPICAL FUSE AND SPLICE PLATE HINGE DETAILS

FUSE AND SPLICE PLATE HINGE DATA TABLE

SIZE / POST	F	G	H	J	K	L	M	N	d_1	d_2	t_2	t_3	BOLT SIZE	FABRICATION NOTES
W 12 X 26	6"	3"	1½"	6½"	3½"	1½"	13/16"	1⅝"	13/16"	1⅝"	½"	7/16"	¾" ØX 2½"	ALL HOLES IN FUSE PLATE AND POST FLANGE HOLES ON WHICH IT MOUNTS SHALL BE DRILLED. ALL OTHERS MAY BE PUNCHED. BURR THREADS AT JUNCTION WITH NUT TO PREVENT NUT LOOSENING. ASTM-A441, ASTM-572 GRADE 50, OR ASTM-A588 MAY BE SUBSTITUTED FOR AASHTO M270 (ASTM A709) GRADE 36 AT THE OPTION OF THE FABRICATOR. STEEL USED SHALL HAVE AN ULTIMATE TENSILE STRENGTH NOT TO EXCEED 80 KSI.
W 10 X 26	6"	3"	1½"	5¾"	2¾"	1½"	13/16"	1⅜"	13/16"	1⅛"	½"	7/16"	¾" ØX 2½"	
W 10 X 22	6"	3"	1½"	5¾"	2¾"	1½"	13/16"	1⅜"	13/16"	1⅛"	½"	⅜"	¾" ØX 2½"	
W 8 X 21	5½"	2½"	1½"	5¼"	2¾"	1¼"	¾"	1¼"	13/16"	1"	½"	⅜"	¾" ØX 2½"	
W 8 X 18	5"	2½"	1¼"	5¼"	2¾"	1¼"	¾"	1¼"	11/16"	1 1/16"	⅜"	⅜"	⅝" ØX 2½"	
W 6 X 15	5"	2½"	1¼"	6"	3½"	1¼"	¾"	1½"	11/16"	1¼"	⅜"	¼"	⅝" ØX 2½"	
W 6 X 12	4¼"	2"	1⅛"	4"	2¼"	⅞"	½"	1"	9/16"	¾"	¼"	¼"	½" ØX 1¾"	

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BREAK-AWAY SIGN SUPPORT DETAILS FOR GROUND SIGNS

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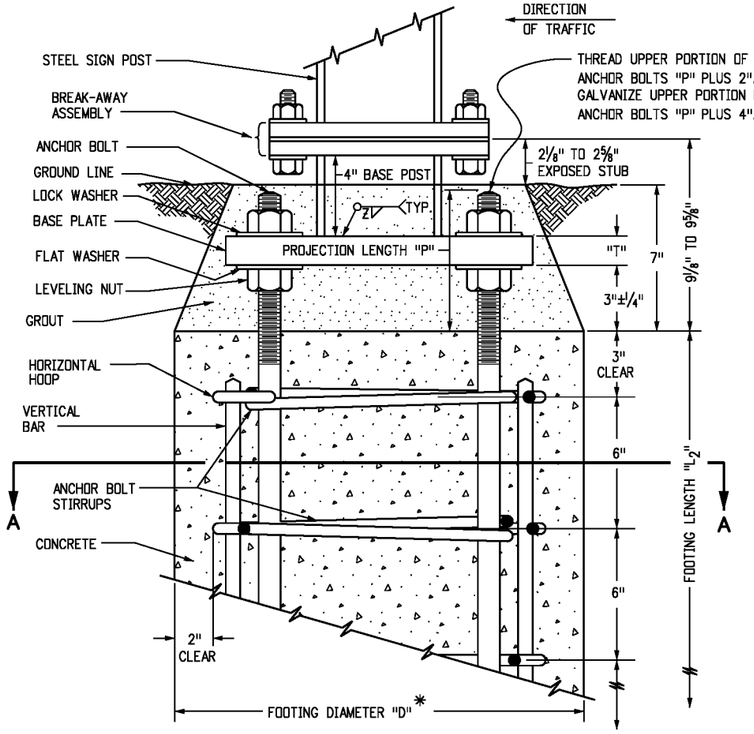
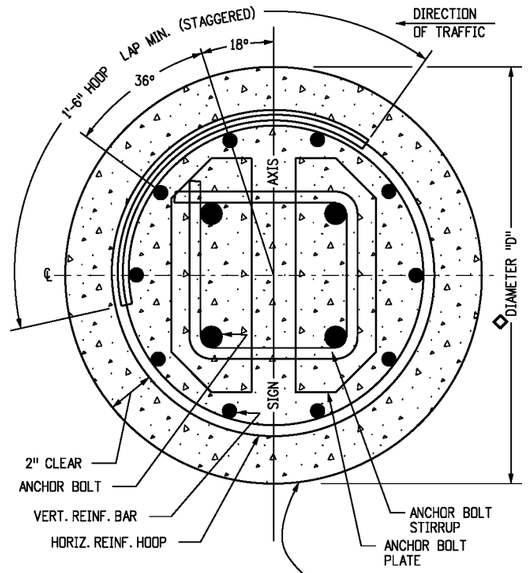
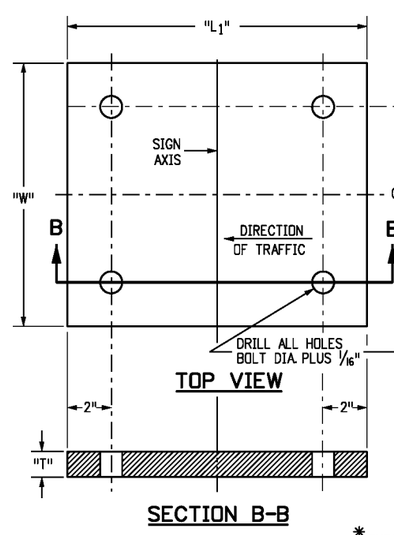


TYPICAL CONCRETE FOOTING ASSEMBLY



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

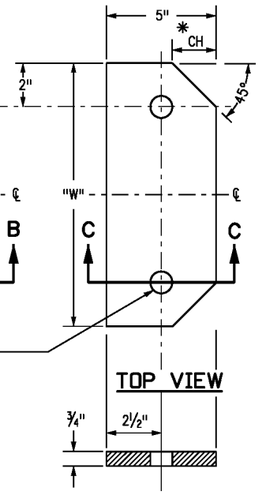
SECTION A-A



TOP VIEW

BASE PLATE TYPICAL DETAILS

SECTION B-B

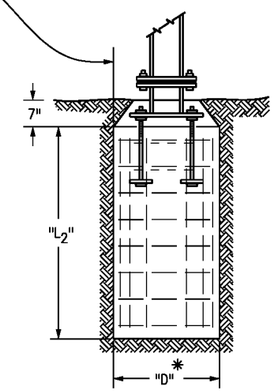


TOP VIEW

BOLT PLATE TYPICAL DETAILS

SECTION C-C

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



TYPICAL FOOTING INSTALLATION

CONCRETE FOOTING TABLE

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

* FOR MULTI-DIRECTIONAL BREAKAWAY ONLY: TYPE 1 THRU TYPE 6 FOOTINGS REQUIRE A 6 IN. INCREASE IN DIAMETER ("D") TO ACCOMMODATE ANCHORS SHOWN ON THE DETAILS INCLUDED IN THE PLANS. ALSO, HORIZONTAL REINFORCING HOOP DIAMETER WILL BE INCREASED TO MAINTAIN A 2 IN. CLEARANCE FROM THE FOOTING SIDES. VERTICAL BARS AND OTHER STRUCTURAL DATA REMAIN THE SAME. TYPE 7 FOOTINGS REQUIRE NO CHANGES.

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CONCRETE FOOTINGS AND SIGN ISLANDS FOR CLASS III SIGNS

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STANDARD PLAN NO.
S-614-6
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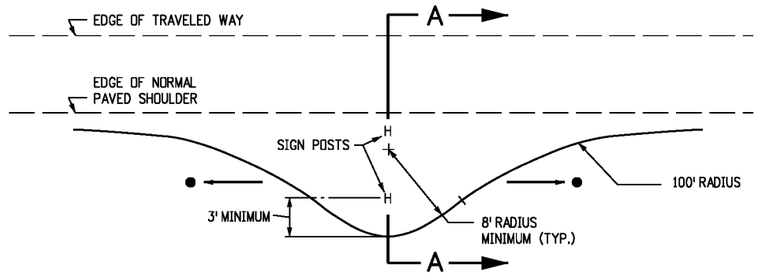
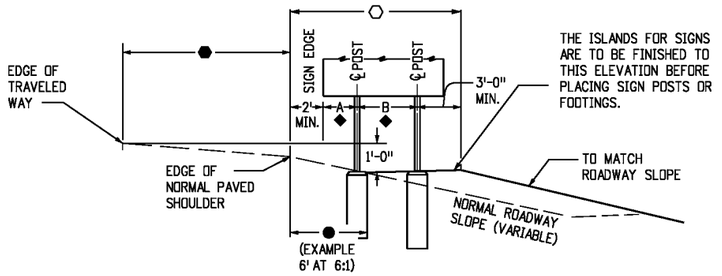
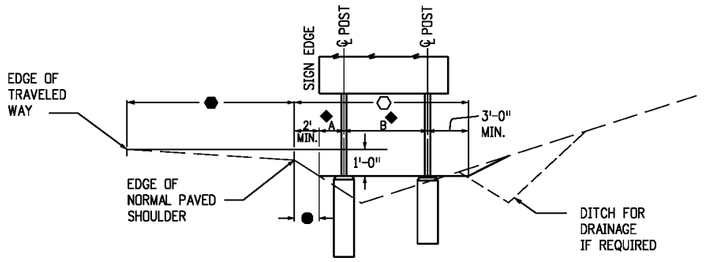


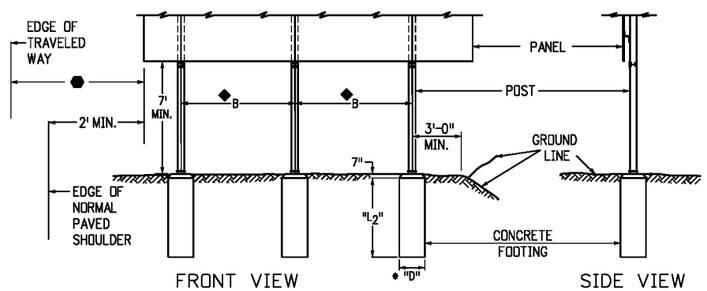
TYPICAL SIGN ISLAND PLAN



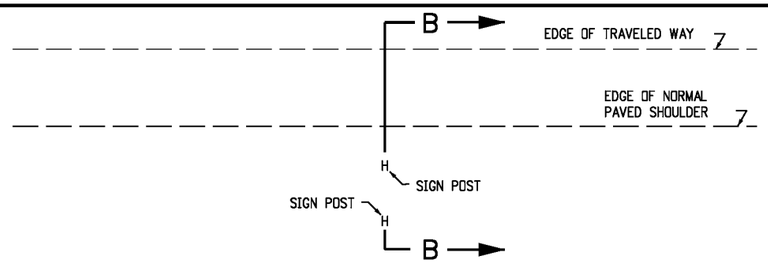
TYPICAL FILL SECTION A-A



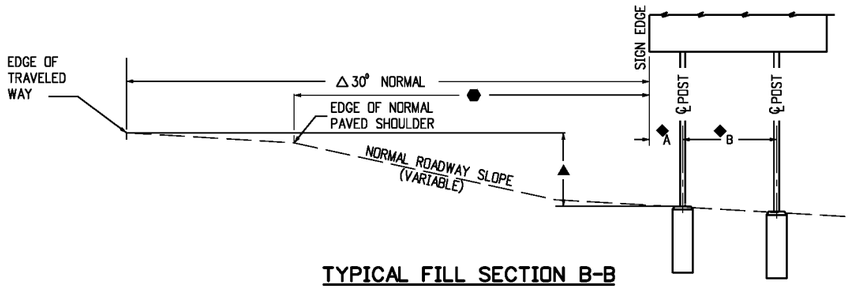
TYPICAL CUT SECTION A-A



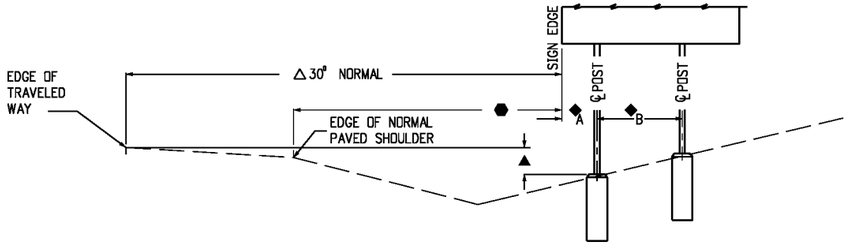
TYPICAL SIGN ISLAND ELEVATIONS



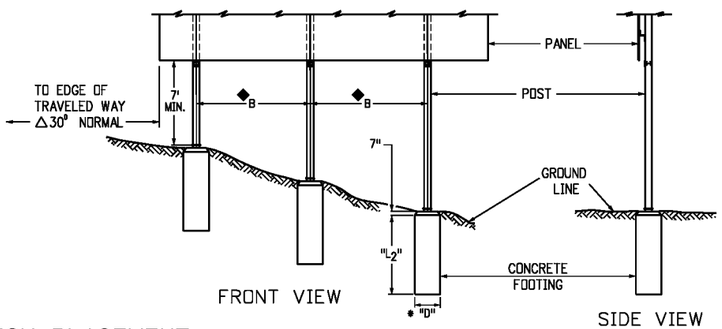
NORMAL CLEARANCE PLAN



TYPICAL FILL SECTION B-B



TYPICAL CUT SECTION B-B



TYPICAL ELEVATIONS

DETAILS OF SIGN PLACEMENT

GENERAL NOTES

1. ALL CONCRETE IS TO BE CLASS "BZ". GROUT SHALL CONFORM TO "JOINT MORTAR".
2. USE AASHTO M270 (ASTM A709) GRADE 36 STEEL FOR BASE PLATES AND BOLT PLATES. USE ASTM-A307 STEEL FOR ANCHOR BOLTS.
3. USE GRADE 60 FOR REINFORCING STEEL VERTICAL BARS, HORIZONTAL HOOPS, AND ANCHOR BOLT STIRRUPS.
4. FOR ALL STEEL WORK ABOVE THE BASE PLATE, AND FOR ANGULAR PLACEMENT OF SIGNS, SEE APPLICABLE STANDARDS INCLUDED IN THE PLANS.
5. FOR ADDITIONAL INFORMATION, REFER TO "TABULATION OF SIGNS" AND "CROSS SECTIONS FOR CLASS III SIGNS" INCLUDED IN THE PLANS.
6. ◆ FOR "A" AND "B" DIMENSIONS. SEE COLORADO STANDARD PLAN S-614-4.
7. ● THE SIGN ISLAND SIDE SLOPE PARALLEL TO THE ROADWAY SHALL BE 6:1 OR FLATTER. sEE TYPICAL SECTIONS.
8. ⬡ THE SIGN ISLAND SIDE SLOPE PARALLEL TO THE ROADWAY SHALL BE 6:1 OR FLATTER. sEE TYPICAL SECTIONS.
9. ⬢ VARIABLE DIMENSIONS. SEE CROSS SECTIONS.
10. ▲ VARIABLE FOOTING ELEVATIONS. SEE CROSS SECTIONS FOR PLACEMENT.
11. △ THE LATERAL PLACEMENT MAY BE REDUCED TO A MINIMUM OF 2 FT. FROM THE EDGE OF NORMAL PAVED SHOULDER TO FIT FIELD CONDITIONS WHEN 30 FT. FROM THE EDGE OF THE TRAVELED WAY IS NOT FEASIBLE. SEE THE CROSS SECTIONS AND/OR TYPICAL GROUND SIGN PLACEMENT STANDARD.
12. EMBANKMENT FOR SIGN ISLANDS IS TO BE COMPACTED AS REQUIRED UNDER ITEM 203 OF THE STANDARD SPECIFICATIONS.
13. FOR ANGULAR PLACEMENT OF SIGNS, SEE COLORADO STANDARD PLAN S-614-1.
14. THE 4-INCH "BASE POST" AND LOWER "BREAK-AWAY PLATE" SHALL BE PAID FOR AS PART OF THE FOOTING.

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CONCRETE FOOTINGS AND SIGN ISLANDS FOR CLASS III SIGNS

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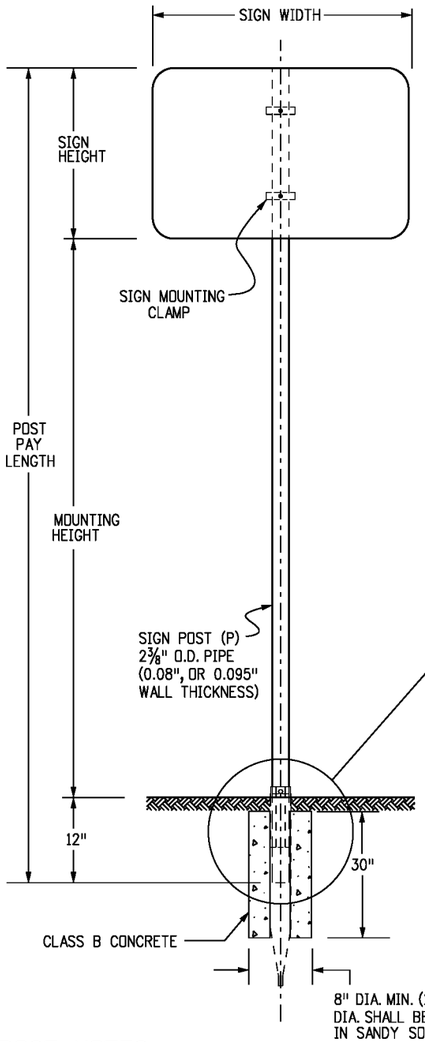
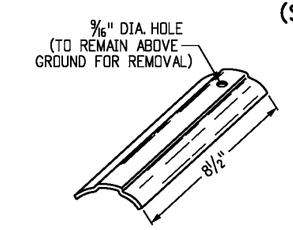
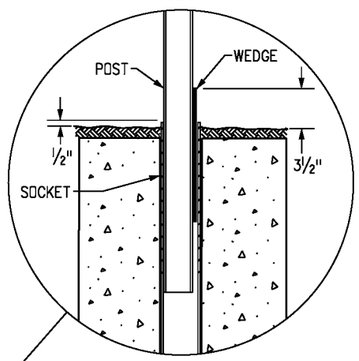
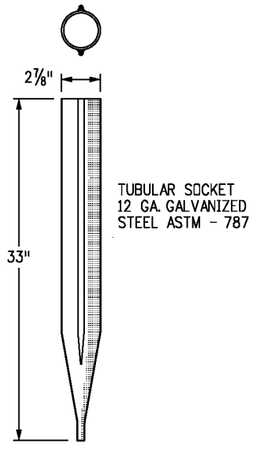
STANDARD PLAN NO.
S-614-6
Sheet No. 2 of 2

TUBULAR STEEL POSTS
(SOCKET SYSTEM) (SINGLE OR DOUBLE POST)









POST NOTES

THE POST MAY BE PRE-PUNCHED WITH ⅜" DIA. HOLES AND THE SIGN MOUNTED DIRECTLY TO THE POST, OR AN APPROVED MOUNTING CLAMP MAY BE USED TO MOUNT THE SIGN TO THE POST. IF THE POST IS PRE-PUNCHED, THE HOLES SHALL BE SPACED THE FOLLOWING DISTANCES FROM THE TOP:
1", 3", 10", 16", 21", 23", 24", 27", 33", 37", 39", AND 45"

SIGNPOST SELECTION GUIDE (90 MPH WIND LOAD DESIGN)

7' MOUNTING HEIGHT

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

8' MOUNTING HEIGHT

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

9' MOUNTING HEIGHT

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

▼ SEE CHART NOTE 4.

CHART NOTES

1. TYPICAL POST MOUNTING HEIGHTS FROM GROUND TO BOTTOM OF SIGN PANEL ARE 7, 8 OR 9 FEET. OTHER HEIGHTS MAY BE REQUIRED WHEN SIGNS ARE MOUNTED ON STEEPER FILL OR CUT SLOPES.
2. FOR SIGNS MOUNTED ON TWO POSTS, THE MINIMUM DISTANCE BETWEEN POSTS SHALL BE 2 FEET AND THE MAXIMUM DISTANCE SHALL BE 8 FEET. DISTANCE FROM POST TO EDGE OF SIGN PANEL(S) SHALL BE 0 TO 4 INCHES. WHEN BACKING ZEES ARE USED, POSTS SHALL BE INSTALLED WITH A MINIMUM OF 2 INCHES TO THE EDGE OF THE BACKING ZEE.
3. ALL SIGN PANELS GREATER THAN 60 INCHES IN WIDTH MUST BE MOUNTED ON TWO POSTS TO PREVENT TURNING.
4. THE POST SIZES SHOWN ARE THE MINIMUM SIZES REQUIRED. TWO P1 POSTS MAY BE SUBSTITUTED WHERE ONE P2 POST IS INDICATED. P2 POSTS MAY SUBSTITUTED FOR P1 POSTS WHEN DIRECTED BY THE ENGINEER.

GENERAL NOTES

1. SIGNS BETWEEN 37 IN. AND 60 IN. WIDTH WITH ONE POST INSTALLATION REQUIRE A T OR U SIGN SUPPORT BRACKET IN ADDITION TO THE BACKING ZEE REQUIREMENTS. WHEN DIRECTED BY THE ENGINEER, SIGN PANELS LESS THAN 48 IN. IN WIDTH MAY ATTACHED DIRECTLY TO T OR U BRACKETS WITHOUT ZEES.
2. U-BRACKETS MAY BE USED FOR MULTIPLE SIGN INSTALLATIONS.
3. FOR BACKING ZEE REQUIREMENTS AND DETAILS, SEE STANDARD PLANS S-614-3 AND S-614-4.

POST SPECIFICATIONS

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

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

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TUBULAR STEEL SIGN SUPPORT DETAILS

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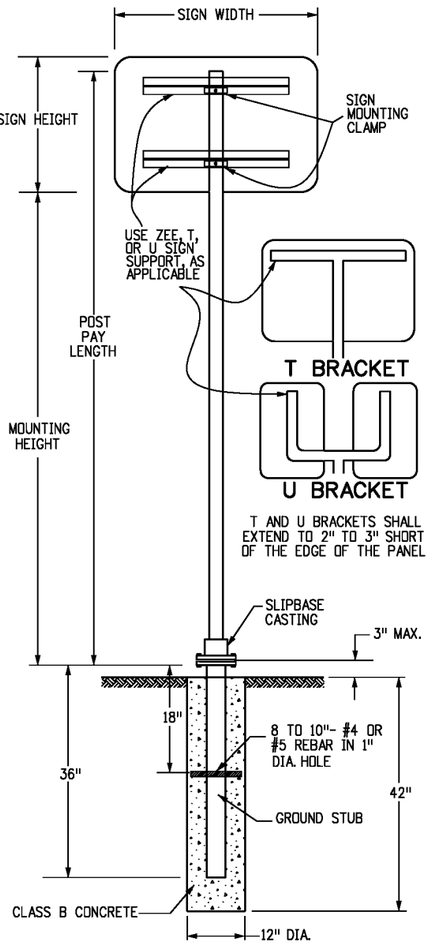
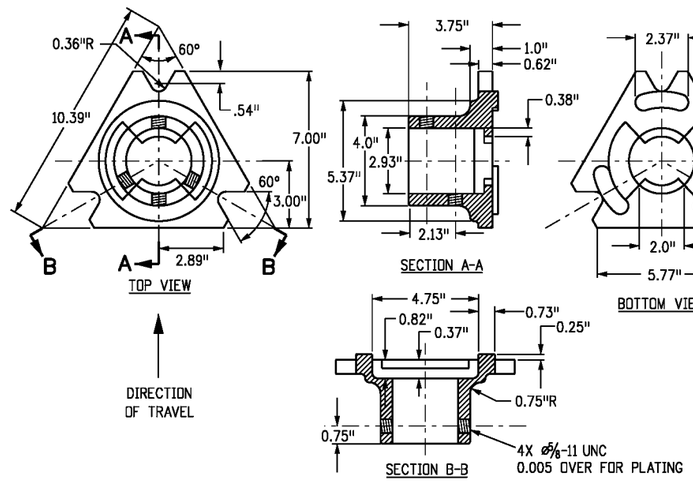
STANDARD PLAN NO.
S-614-8
Sheet No. 1 of 5

TUBULAR STEEL POSTS
(WITH SLIPBASE)
(SINGLE OR DOUBLE POST)

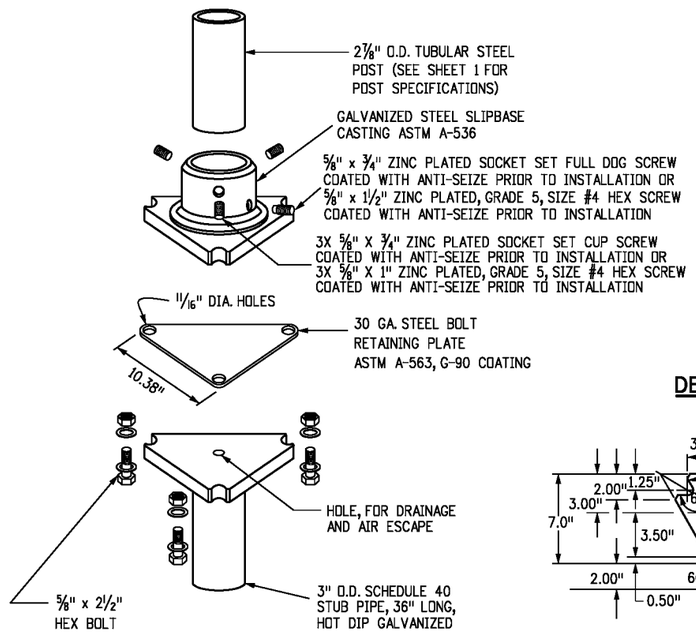


GENERAL NOTE

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



SLIPBASE CASTING

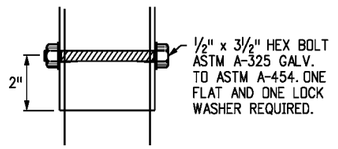


TYPICAL ASSEMBLY

DIMENSIONS FOR MOUNTING CLAMP (ALL DIMENSION ARE IN INCHES)

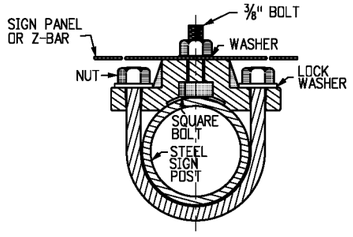
STANDARD PIPE SIZE	A	B	C	D	E	F	G	K	L	R_1	R_2
2	3 3/4	2 3/4	1 1/2	1 1/8	1/2	3/16	1	2 11/16	1 7/32	1 1/4	1 3/16
2 1/2	4 1/4	3 1/4	2	1 1/4	1/2	1/4	1	3 3/16	1 15/32	1 1/2	1 7/16

T AND U BRACKET ATTACHMENT

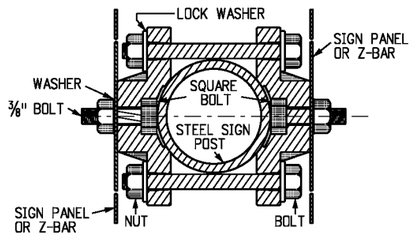


DETAIL "A"

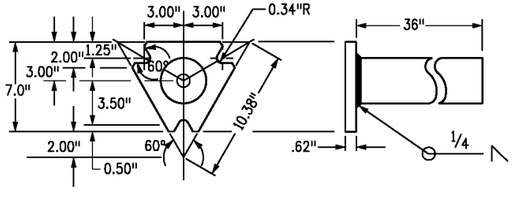
TYPICAL SINGLE BRACKET



TYPICAL BACK TO BACK



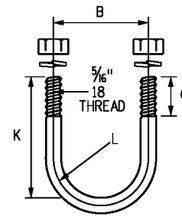
DETAILS FOR SIGN PANEL ATTACHMENT



SLIPBASE STUB POST

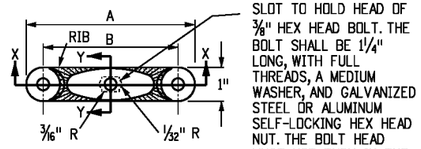
PIPE CLAMP CASTING

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

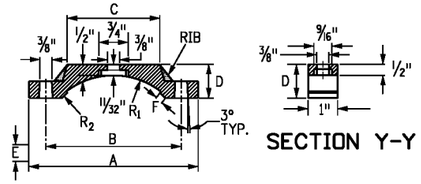


U-BOLT TO BE MADE IN ACCORDANCE WITH STANDARD MANUFACTURING PROCEDURE. 1/4" OR 5/18" DIAMETER STOCK IS PERMISSIBLE. AMERICAN STANDARD REGULAR SEMI-FINISHED HEX NUTS AND SPRING LOCKWASHERS.

U-BOLT



SLOT TO HOLD HEAD OF 3/8" HEX HEAD BOLT. THE BOLT SHALL BE 1 1/4" LONG, WITH FULL THREADS, A MEDIUM WASHER, AND GALVANIZED STEEL OR ALUMINUM SELF-LOCKING HEX HEAD NUT. THE BOLT HEAD MUST NOT TURN IN THE SLOT.



SECTION X-X

SECTION Y-Y

MOUNTING CLAMP FOR SOCKET OR SLIPBASE

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: SCL		Date:	Comments
Last Modification Date: 07/04/12 Initials:	R-X		
Full Path: www.coloradodot.info/library/traffic/traffic-s-standard-plans	R-X		
Drawing File Name: S-614-08_2of5.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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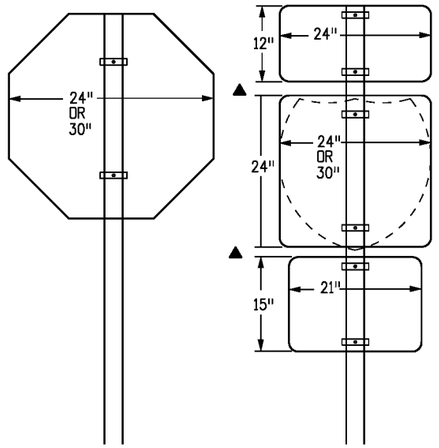

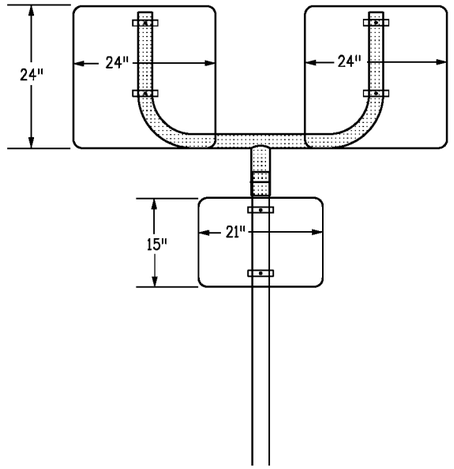

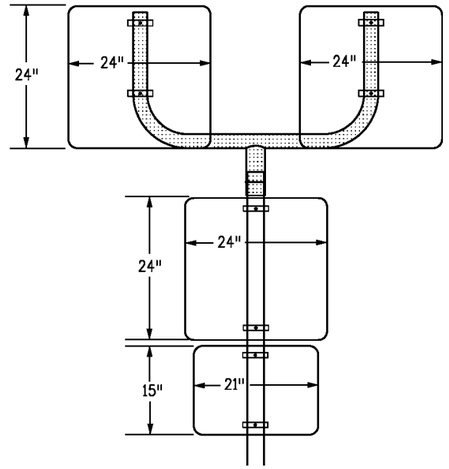

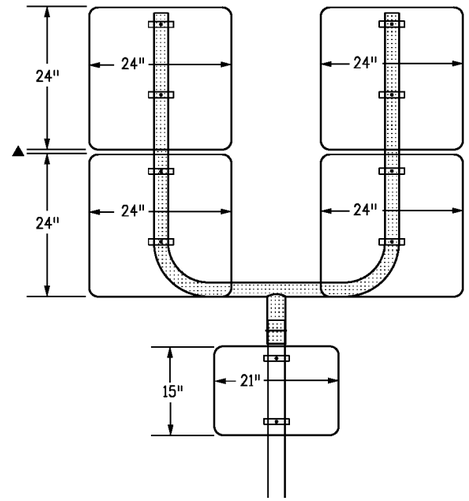

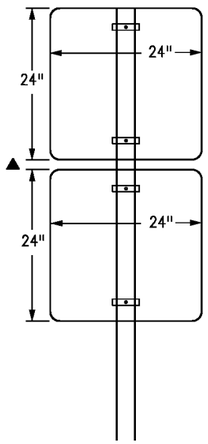

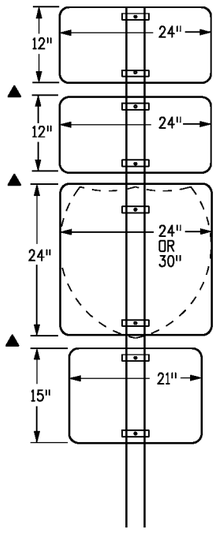

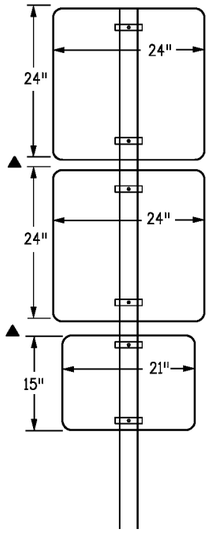

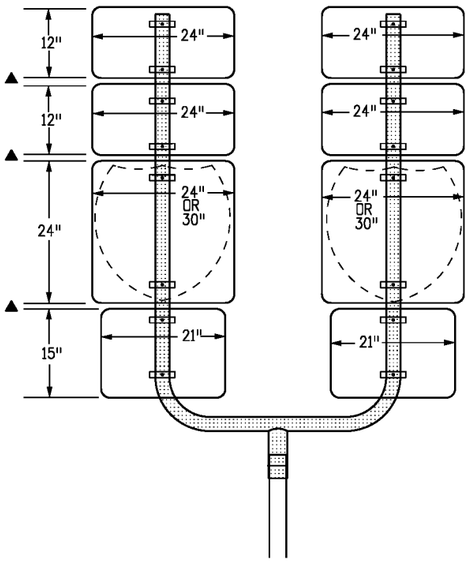

CLASS I SIGN COMBINATIONS (DIRECT ATTACHMENT)

▲ SEE NOTE 6 ON SHEET 4

CLASS I SIGN COMBINATIONS USING U-BRACKETS

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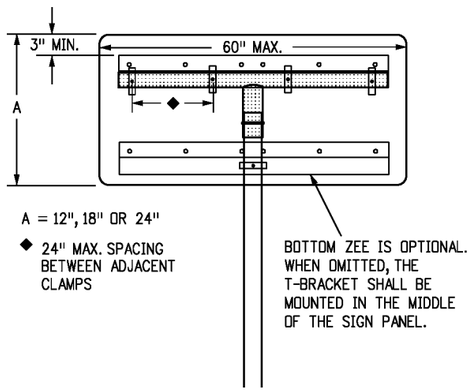
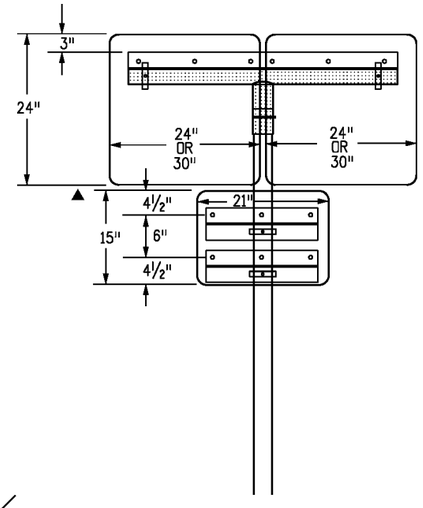
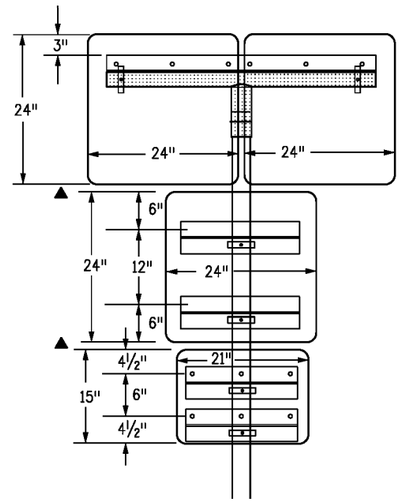
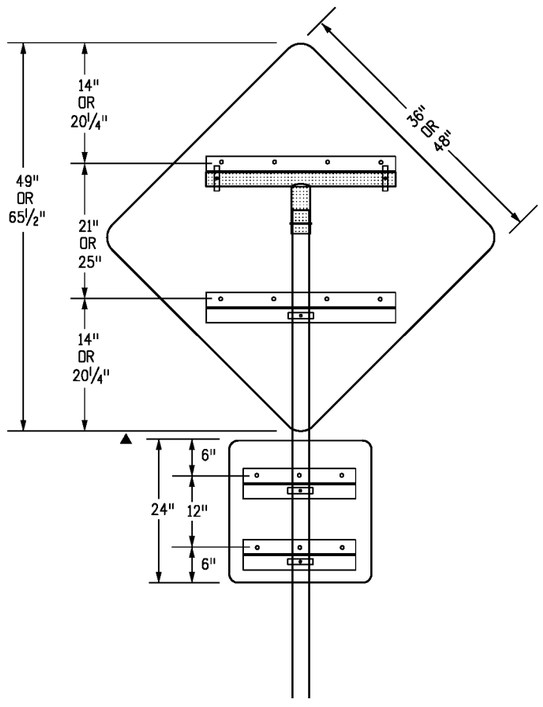
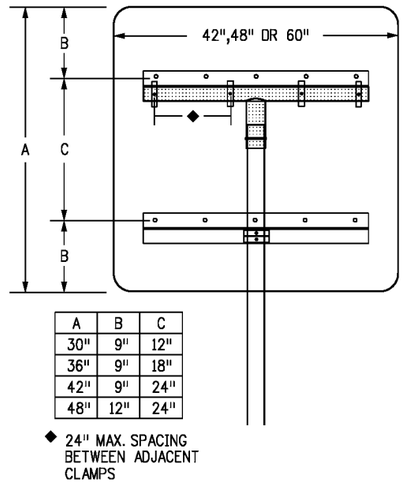










A	B	C
30"	9"	12"
36"	9"	18"
42"	9"	24"
48"	12"	24"

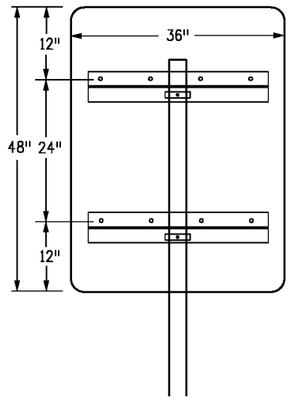
◆ 24" MAX. SPACING BETWEEN ADJACENT CLAMPS

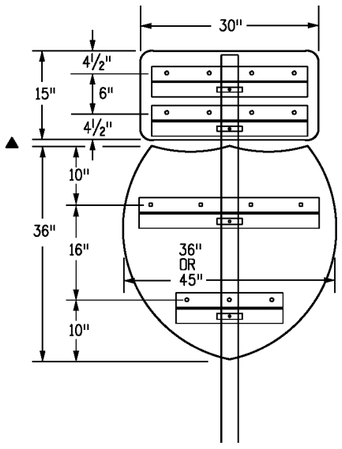
CLASS II SIGN COMBINATIONS USING T-BRACKETS WITH Z-BAR

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

GENERAL NOTES

1. Z-BAR LENGTH SHALL BE 3 IN. (± ½ IN.) SHORT OF THE EDGE OF THE SIGN OR ROW OF SIGNS ON BOTH SIDES. THE ACCOMPANYING TABLE GIVES THE Z-BAR LENGTH FOR MOST TYPICAL PANEL COMBINATIONS.
2. FIRST AND LAST HOLES SHALL BE 2 IN. FROM EDGE OF Z-BAR. THE HOLES IN BETWEEN SHALL BE 6 IN. TO 8 IN. APART.
3. T AND U BRACKETS SHALL TERMINATE 2 IN. TO 3 IN. FROM EDGE OF SIGN PANEL. WHEN A ZEE IS CONNECTED TO A T-BRACKET, THEY SHALL BE THE SAME LENGTH EXCEPT WHEN THE ZEE MUST EXTEND BEYOND THE MAXIMUM LENGTH OF A T-BRACKET.
4. TWO MOUNTING CLAMPS ARE REQUIRED ON ZEES WHERE THERE IS ONLY ONE ZEE FOR THE PANEL AND THE ZEE IS ATTACHED TO ONLY ONE POST.
5. ZEES SHALL BE ATTACHED TO T-BRACKETS AND U-BRACKETS WITH U-BOLTS OR MOUNTING CLAMPS.
6. ▲ VERTICAL SPACING BETWEEN SIGN PANELS SHALL BE 1IN. TO 1½ IN. TYPICAL.
7. IN SPECIAL CASES U-BRACKETS MAY BE USED TO MOUNT SIGNS THAT FACE DIFFERENT DIRECTIONS. THE ENGINEER SHALL DETERMINE THE ORIENTATION OF THE SIGN PANELS AND VERIFY THAT THE MAXIMUM ALLOWABLE WIND LOADS FOR THE POST ARE NOT EXCEEDED.





SINGLE POST CLASS II SIGNS USING Z-BAR

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Drawing File Name: S-614-08_4of5.dgn	R-X		
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TUBULAR STEEL SIGN SUPPORT DETAILS

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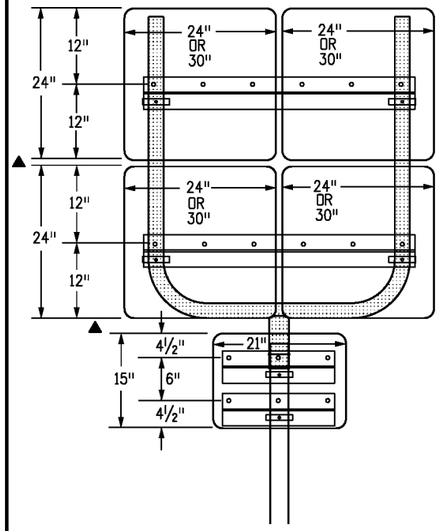
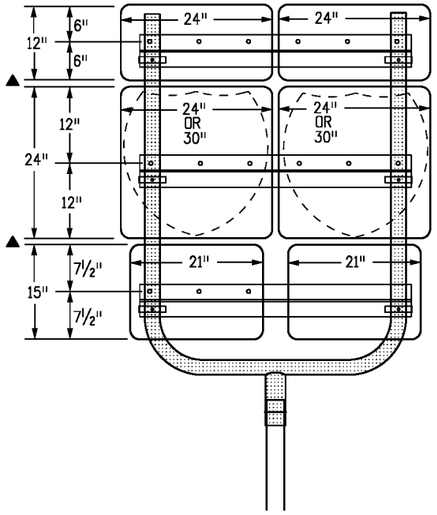
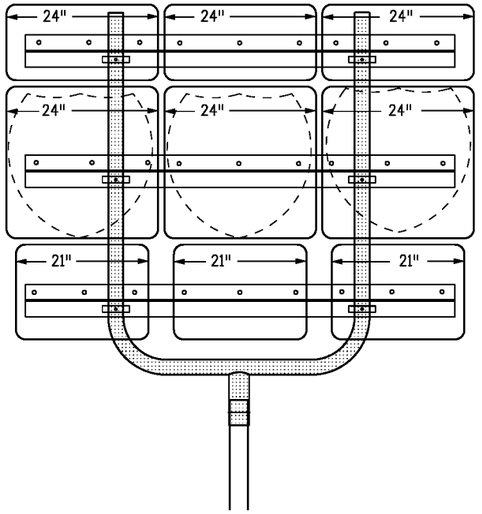
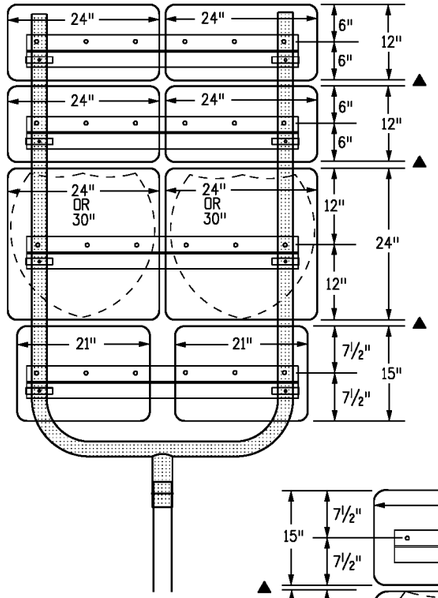
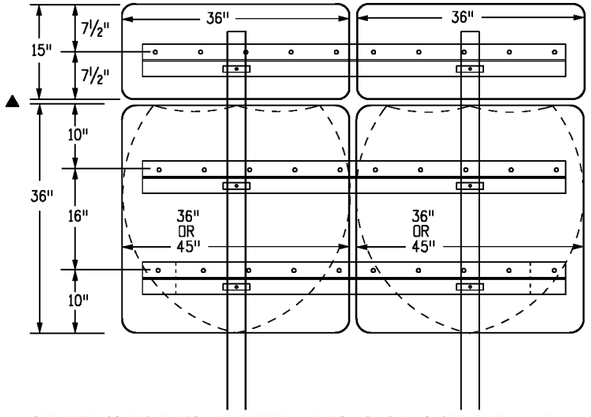




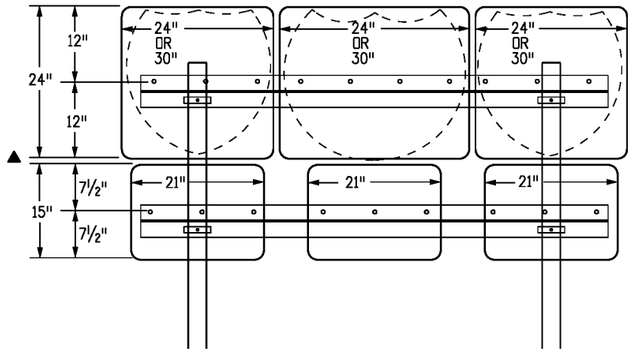


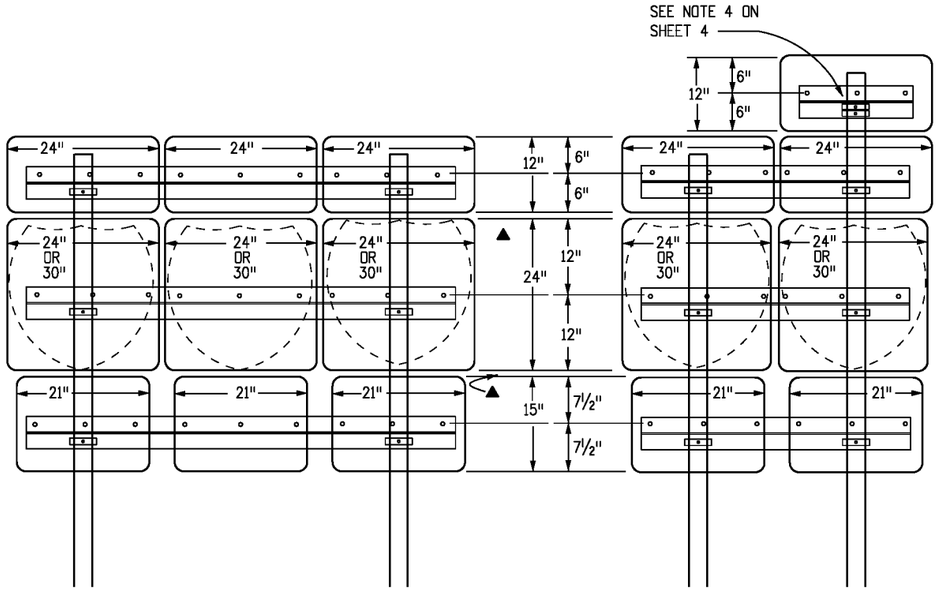


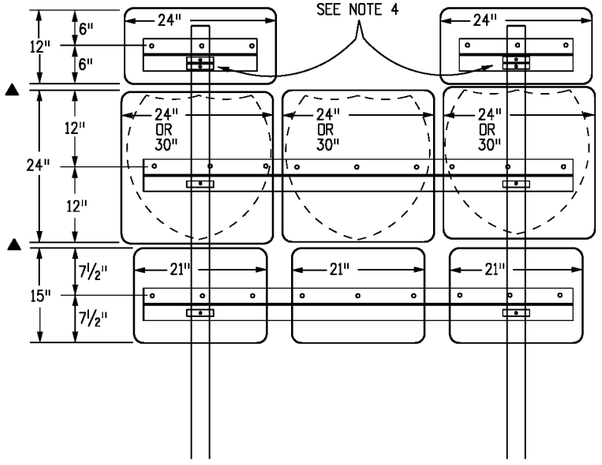
CLASS II SIGN COMBINATIONS USING U-BRACKETS



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







▲ SEE NOTE 6 ON SHEET 4

CLASS II SIGN COMBINATIONS USING TWO POSTS

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Drawing File Name: S-614-08_5of5.dgn	R-X		
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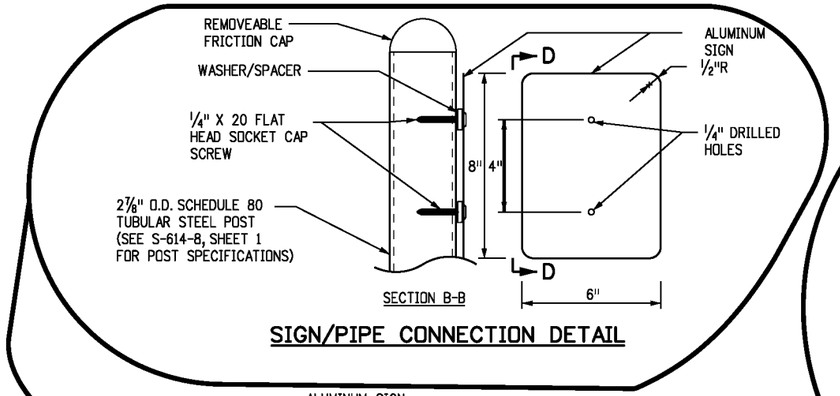
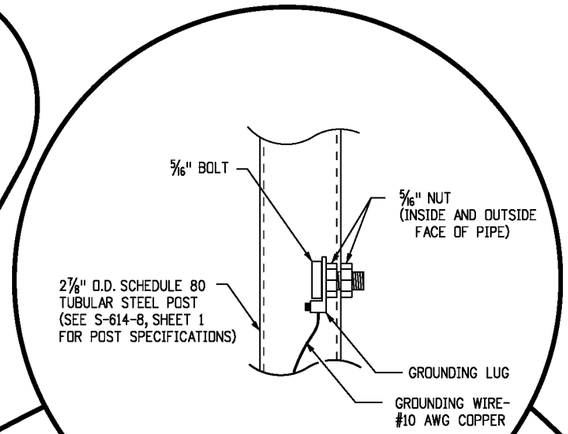
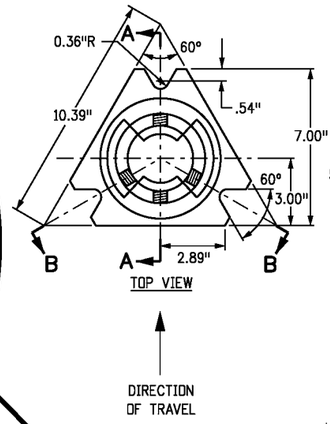
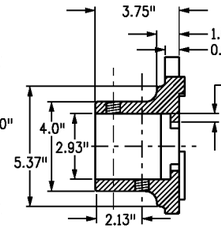


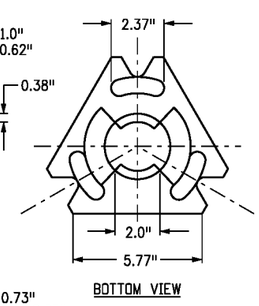
SIGN/PIPE CONNECTION DETAIL

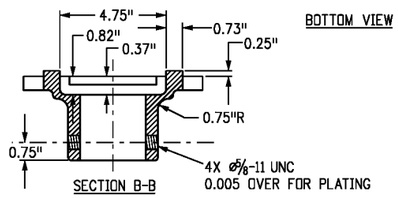


GROUND WIRE/PIPE CONNECTION DETAIL

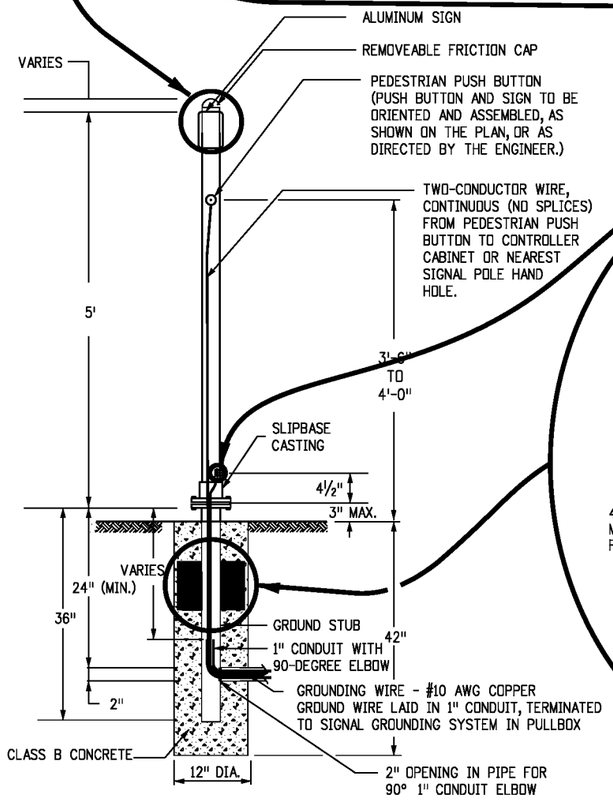




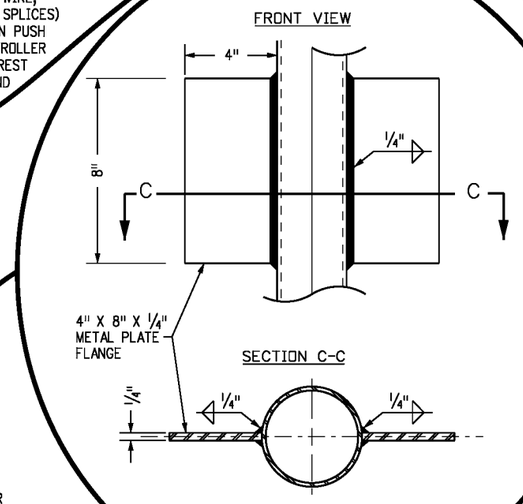




SLIPBASE CASTING



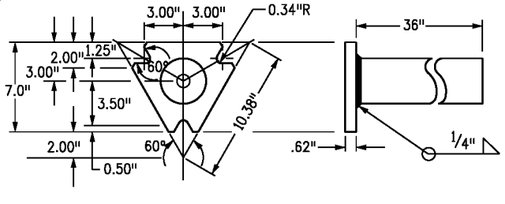
TUBULAR STEEL POSTS WITH SLIPBASE (SINGLE POST)



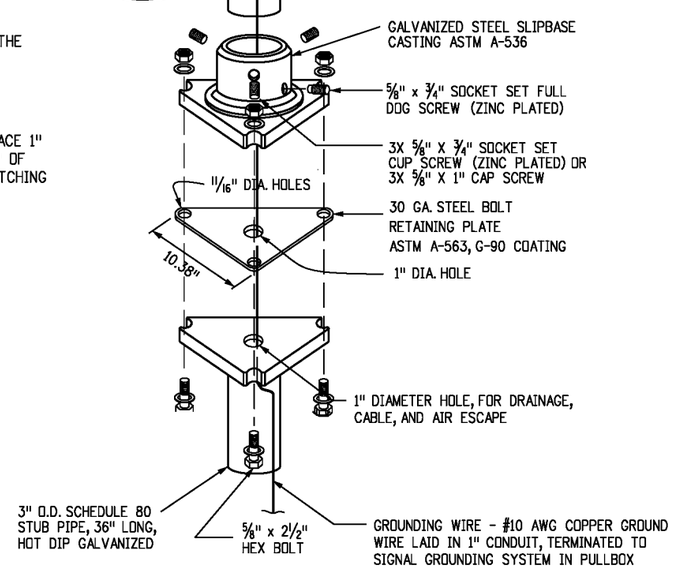
POST ANCHOR DETAILS

GENERAL NOTE

1. THE CONTRACTOR SHALL INSTALL THE POSTS PER THE MANUFACTURER'S RECOMMENDATIONS WITHOUT ADDITIONAL COMPENSATION.
2. ALL POSTS SHALL BE GALVANIZED, AND PAINTED WITH THE COLOR, AS SPECIFIED IN THE PLANS.
3. PUSH BUTTONS SHALL BE ADA COMPLIANT.
4. CONCRETE SHALL BE SAW CUT TO A NEAT LINE TO PLACE 1" CONDUIT. BACK FILL THE TRENCH WITH FLOW FILL, TOP OF TRENCH SHALL BE CONCRETE, CLASS B, AT A DEPTH MATCHING SURROUNDING DEPTH OF CONCRETE.



SLIPBASE STUB POST



TYPICAL SLIPBASE ASSEMBLY

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PEDESTRIAN PUSH BUTTON POST ASSEMBLY

Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-614-9
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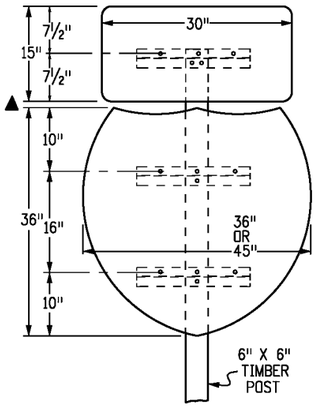
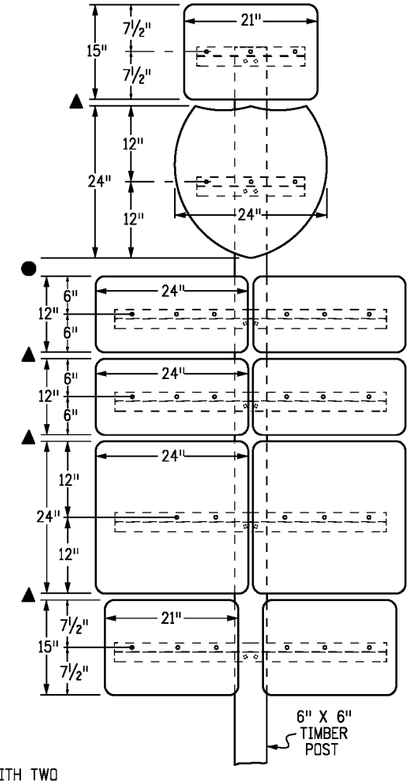
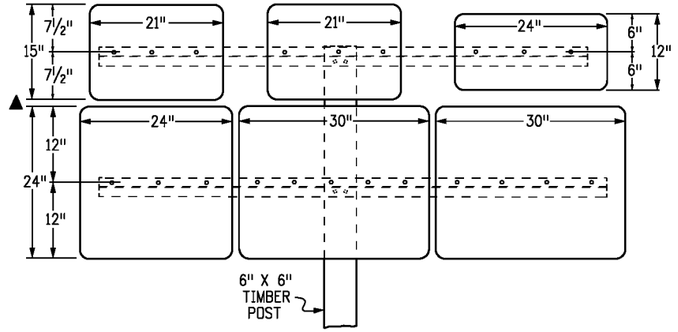


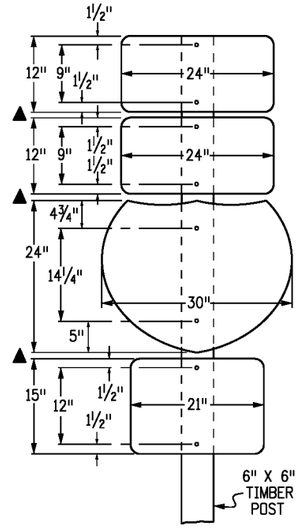


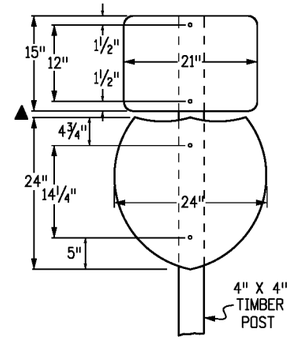


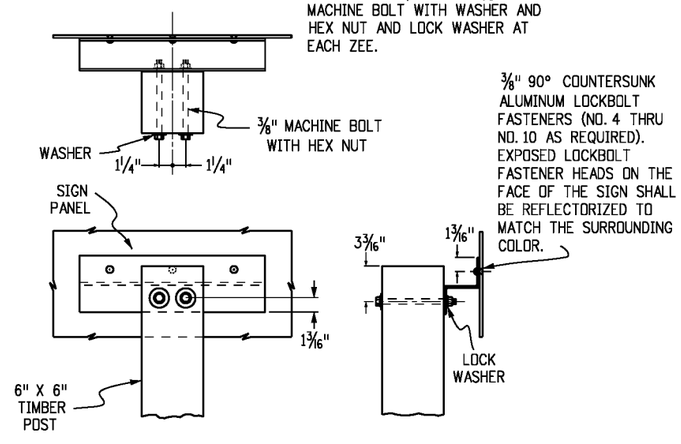
PANEL COMBINATIONS	ZEE LENGTH
21", 24", 30", 36", 45"	*
24" & 24"	43"
24" & 30"	49"
30" & 30"	55"
36" & 36"	67"
45" & 36"	76"
24" & 24" & 24"	68"
24" & 24" & 30"	74"
24" & 30" & 24"	74
30" & 24" & 30"	80"
24" & 30" & 30"	80"
30" & 30" & 30"	86"

NOTES:

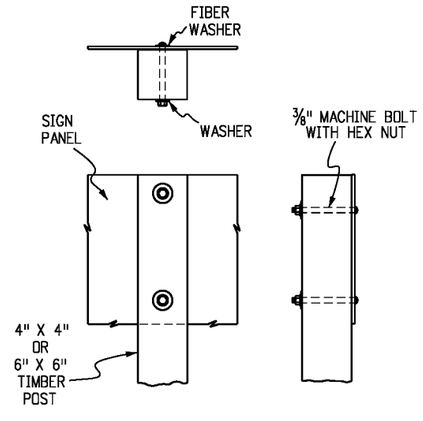
1. HOLE SPACING SHALL BE COUNTED FROM LEFT TO RIGHT LOOKING AT THE BACK OF SIGN WITH FIRST AND LAST HOLES 2 IN. FROM EDGE OF THE Z-BAR. HOLES IN BETWEEN SHALL BE 6 IN TO 8 IN APART.
2. * Z-BAR LENGTH SHALL BE 3 IN. (± ½ IN.) SHORT OF THE EDGE OF THE SIGN ON BOTH SIDES.
3. SUPPLEMENTAL PANELS SHALL BE CENTERED RELATIVE TO THE PRIMARY PANELS. Z-BAR LENGTHS FOR SUPLLEMENTAL PANEL GROUPS MAY BE ADJUSTED TO FIT.







CLASS II MARKER
ASSEMBLY INSTALLATION



CLASS I MARKER
ASSEMBLY INSTALLATION

GENERAL NOTES

1. FOR SIGN PLACEMENT, SEE "TYPICAL GROUND SIGN PLACEMENT" STANDARD.
2. ROUTE MARKERS SHALL BE SINGLE SHEET ALUMINUM 0.100 IN. MINIMUM THICKNESS.
3. TIMBER POSTS SHALL BE 4"X4" OR 6"X6" AS NOTED IN THE "TABULATION OF SIGNS" AND SHALL COMFORM TO STANDARD DRESSED (S4S) SIZES.
4. FOR TUBULAR STEEL POST INFORMATION, SEE STANDARD PLAN S-614-8.
5. BACKING ZEES ARE 3 IN. X 2 IN. X 11/16 IN. 2.33 6061-T6 ALUMINUM ALLOY WEIGHING 2.33 LBS. PER FOOT.
6. ALL SIGNS SHALL BE FABRICATED USING RETROREFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE AS DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.
7. ▲ VERTICAL SPACING BETWEEN PANELS SHALL BE 1 IN. MINIMUM TO 1½ IN. MAXIMUM.
8. ● VERTICAL SPACING BETWEEN GROUPS OF PANELS SHALL BE 4 IN.
9. BOLTS, NUTS, AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
10. ZEE LENGTH AND HOLE SPACING FOR AUXILIARY MARKERS TO BE THE SAME AS FOR CORRESPONDING ROUTE MARKERS.
11. WASHERS ON TIMBER POSTS SHALL BE 1½ IN. DIA.

Computer File Information			Sheet Revisions	
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Full Path: www.coloradodot.info/library/traffic/traffic-s-standard-plans		(R-X)		
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		

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MARKER ASSEMBLY INSTALLATIONS

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STANDARD PLAN NO.
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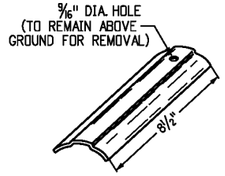
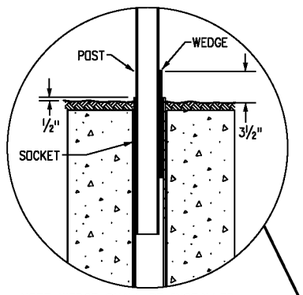
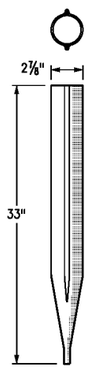


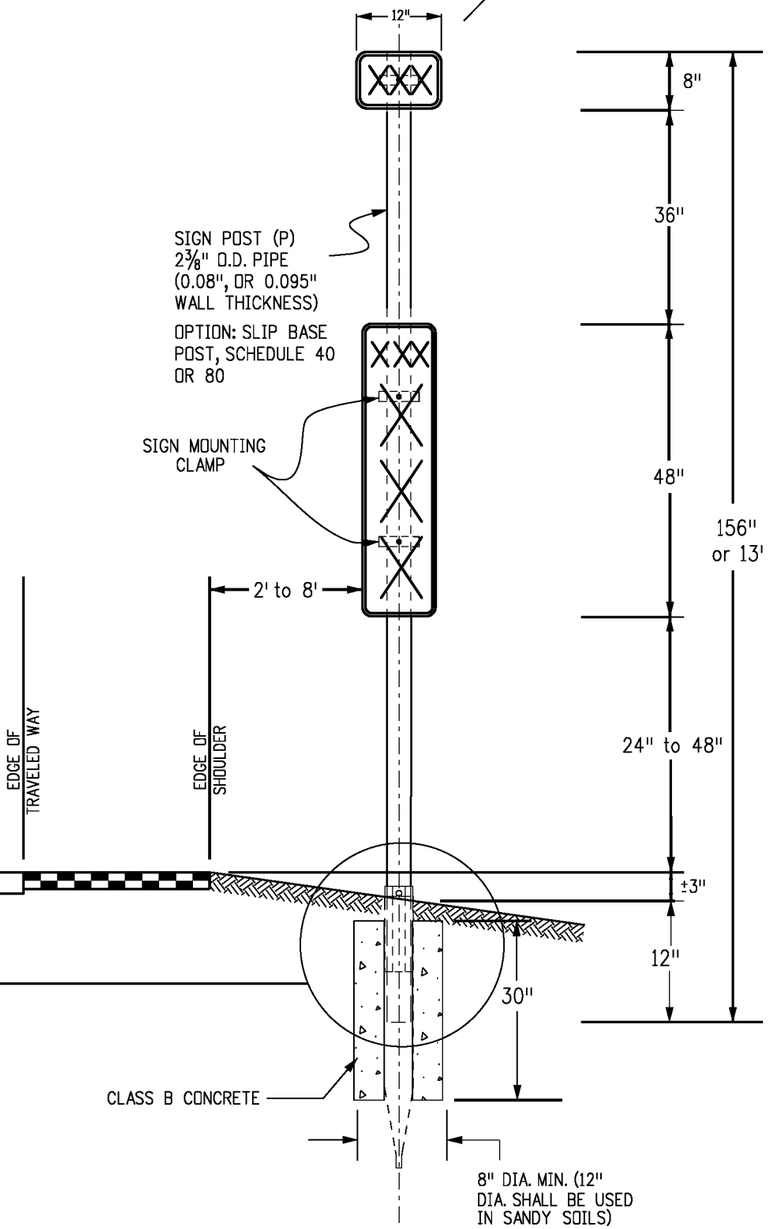
WEDGE
11 GA. GALVANIZED STEEL
ASTM A-526 G-90

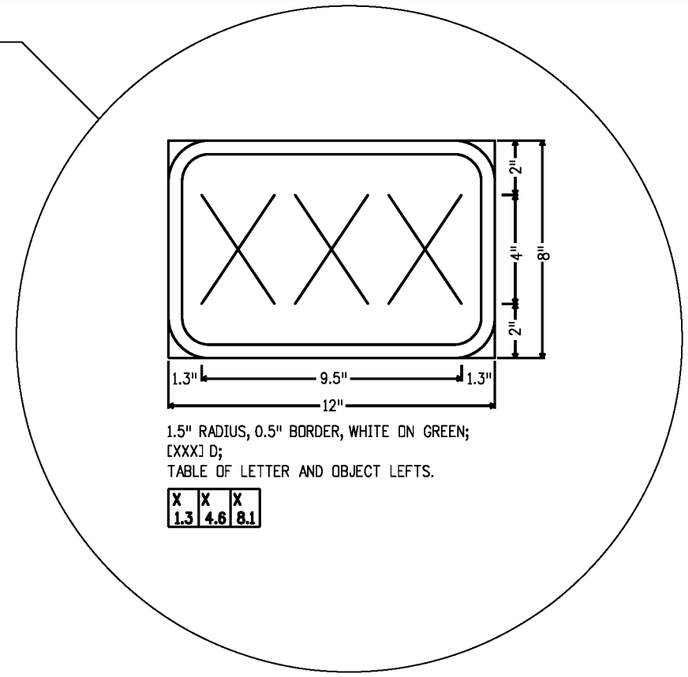


NOTE: WEDGE SHALL BE INSTALLED
ON SIDE OF POST FACING TRAFFIC.



TUBULAR SOCKET
12 GA. GALVANIZED
STEEL ASTM - 787





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MILEPOST SIGN DETAIL FOR HIGH SNOW AREAS

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STANDARD PLAN NO.
S-614-11
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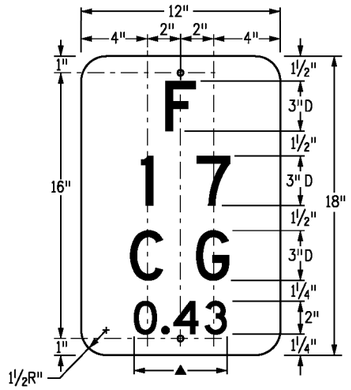
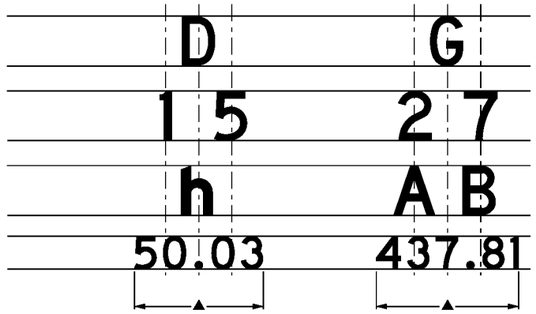


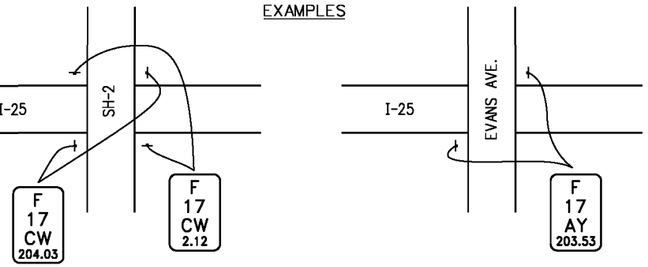
STRUCTURE IDENTIFICATION PANEL

EXAMPLES

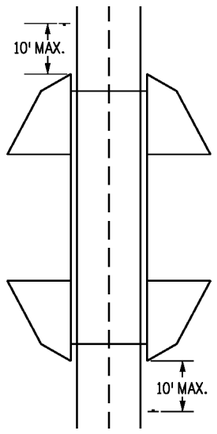


▲OPTICALLY CENTER
REQUIRED REFERENCE POINT

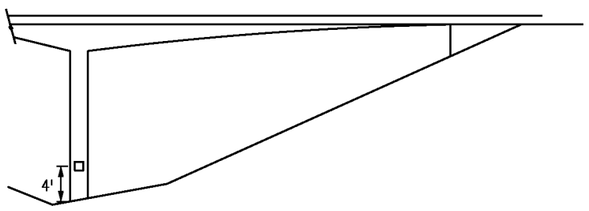
EXAMPLES



HWY SYSTEM LOCATION



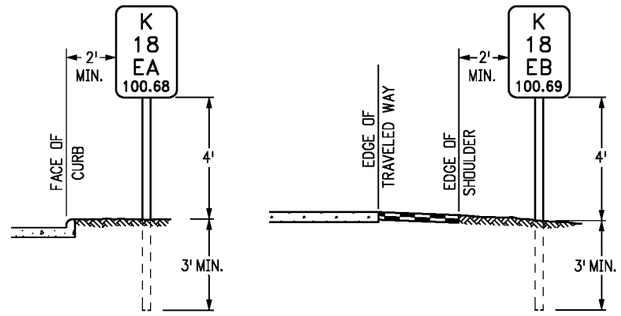
LOCATION DETAIL



STRUCTURE NUMBER LOCATION
ON PIERS

GENERAL NOTES

1. SIGN PANEL SHALL BE FABRICATED FROM SINGLE SHEET ALUMINUM 0.080 IN. MINIMUM THICKNESS.
2. WHEN SIGN PANELS ARE NOT ATTACHED TO THE STRUCTURE, THEY SHALL BE FASTENED TO U-POSTS OR TO 2 IN. TUBULAR STEEL POSTS (P POSTS) IN ACCORDANCE WITH STANDARDS FOR CLASS I SIGNS. SEE STANDARD PLANS S-614-2 AND S-614-8 FOR DETAILS.
3. THE STRUCTURE NUMBER IS SHOWN ON THE PLANS.
4. ALL SIGNS SHALL BE FABRICATED USING RETROREFLECTIVE SHEETING CONFORMING TO ASTM D4956, TYPE I MINIMUM. THE SIGN SHALL HAVE WHITE REFLECTIVE SHEETING BACKGROUND WITH BLACK LETTERS.
5. STRUCTURE NUMBER IDENTIFICATION SIGN WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
6. IN ADDITION TO THE REQUIREMENTS STATED ABOVE, STRUCTURE NUMBERS FOR HIGHWAYS PASSING UNDER CROSSROADS ARE TO BE PLACED AT THE FOLLOWING POINTS USING TWO ½ IN. WIDE STAINLESS STEEL BANDS AND STAINLESS STEEL FLARED LEG BRACKETS WITH HEX HEAD BOLTS (BAND - IT D315 OR EQUIVALENT):
   - A) FOR STRUCTURES OF THREE OF MORE SPANS, THE STRUCTURE NUMBER SHALL BE MOUNTED, FACING TRAFFIC, ON THE OUTSIDE FACE OF THE END COLUMN OF THE RIGHT HAND PIER.
   - B) FOR TWO SPAN STRUCTURES, THE STRUCTURE NUMBER SHALL BE MOUNTED, FACING TRAFFIC, ON THE OUTSIDE FACE OF EACH END COLUMN OF THE CENTER PIER.
   - C) FOR OVERHEAD SIGNS, THE STRUCTURE NUMBER SHALL BE MOUNTED DIRECTLY ON THE POST OR THE OUTSIDE POST OF A TWO-POST STRUCTURE.
7. THE STRUCTURE REFERENCE POINTS (MILE POINT) IN THE FIELD LOG OF STRUCTURES SHOW THREE PLACES AFTER DECIMAL POINT. THE LAST DIGIT IS TO BE DROPPED ON THIS PANEL (DO NOT ROUND OFF).
8. THIS STRUCTURE IDENTIFICATION SHALL BE DISPLAYED ON ALL STATE HIGHWAYS BUT NOT ON OFF-SYSTEM CROSSROADS.



VERTICAL AND LATERAL PLACEMENT DETAILS

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STRUCTURE NUMBER INSTALLATION

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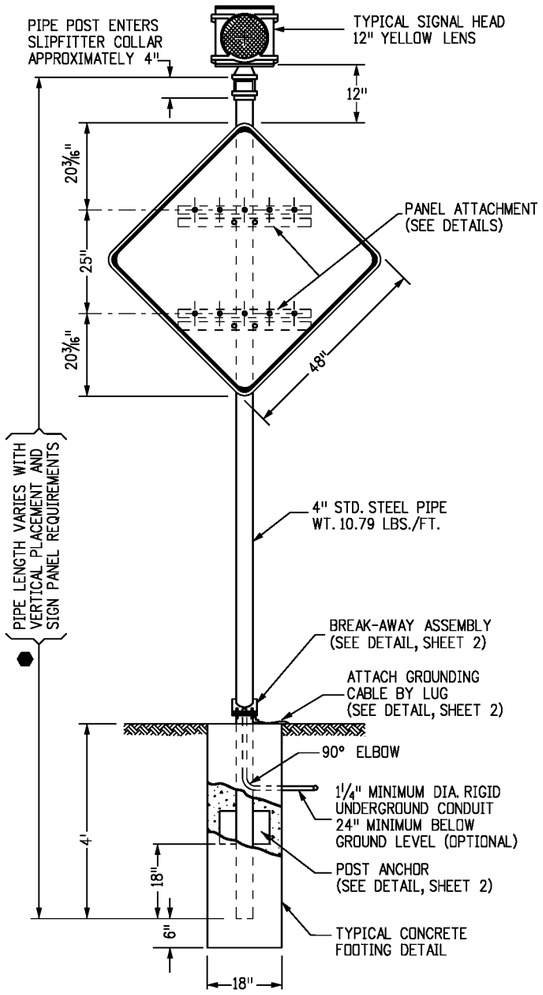
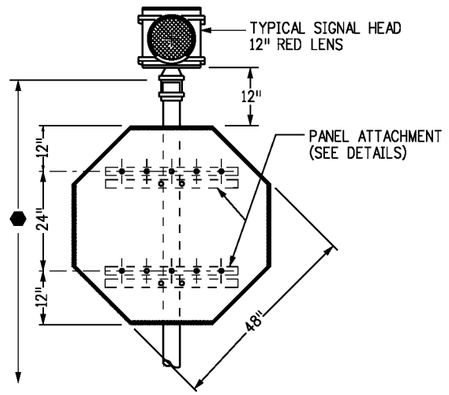
STANDARD PLAN NO.
S-614-12
Sheet No. 1 of 1

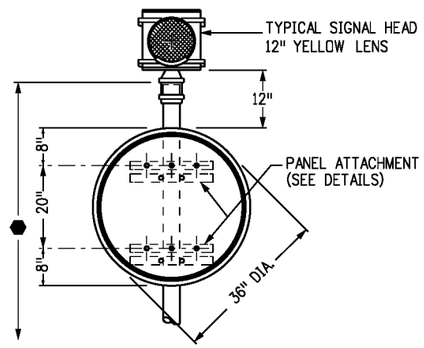
COMPLETE INSTALLATION
WITH DIAMOND PANEL



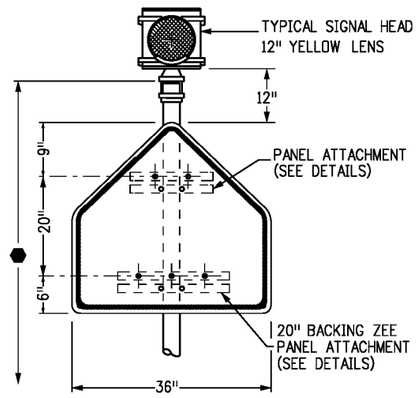
WITH OCTAGON PANEL



WITH CIRCLE PANEL



WITH PENTAGON PANEL



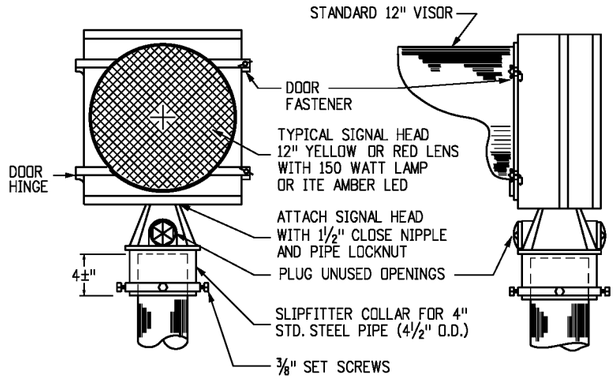
WITH PANELS NOT ILLUSTRATED

48" CIRCLE (12" YELLOW LENS)
VERTICAL SPACING: 10½"-27"-10½"
BACKING ZEES: 20"

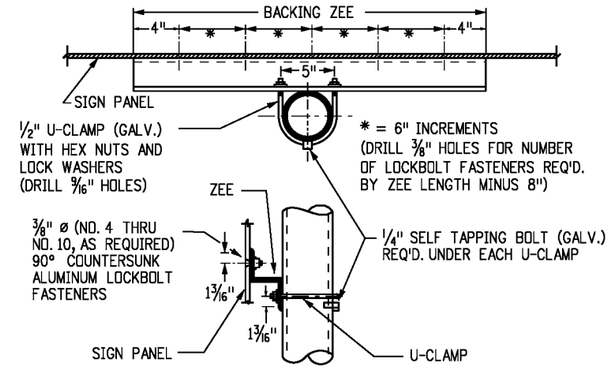
48" PENTAGON (12" YELLOW LENS)
VERTICAL SPACING TOP TO BOTTOM: 12"-25¾"-9"

24" X 48" RECTANGLE (12" YELLOW LENS) (SCHOOL SPEED LIMIT)
VERTICAL SPACING: 12"-24"-12"
BACKING ZEES: 20"

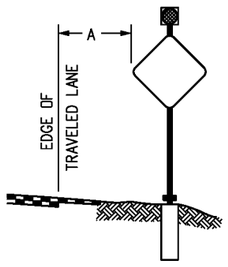
TYPICAL ELEVATION FACING TRAFFIC



TYPICAL SIGNAL HEAD - 12 INCH LENS



TYPICAL PANEL ATTACHMENT DETAILS



LATERAL PLACEMENT ("A")

NORMAL LATERAL PLACEMENT "A" FOR WARNING SIGNS IS 12' PLUS CURB OR SHOULDER WIDTH.

NORMAL LATERAL PLACEMENT "A" FOR REGULATORY SIGNS IS 6' PLUS CURB OR SHOULDER WIDTH, OR IF NONE 12' FROM EDGE OF PAVEMENT.

2' SHALL BE CONSIDERED MINIMUM EXCEPT THAT IN URBAN AREAS 1' FROM THE CURB FACE IS PERMISSIBLE WHERE SIDEWALK WIDTH IS LIMITED OR WHERE EXISTING POLES ARE CLOSE TO THE CURB.

REFER TO COLORADO STANDARD PLAN S-614-1 FOR VERTICAL PLACEMENT REQUIREMENTS.

TYPICAL SIGN PLACEMENT

GENERAL NOTES

1. ALL SIGN PANELS USED ON FLASHING BEACONS ARE CLASS II AND SHALL BE FABRICATED IN ACCORDANCE WITH:
   A. PANELS SHALL BE SINGLE SHEET ALUMINUM 0.100 MINIMUM THICKNESS.
   B. BACKING ZEES ARE 3 IN. X 2 11/16 IN. 2.33 LBS. PER FT. ALUMINUM.
   C. ALL SIGNS SHALL BE FABRICATED USING RETROREFLECTIVE SHEETING CONFORMING TO ASTM D4956. THE TYPE SHALL BE DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.
   D. BOLTS, U-CLAMPS, NUTS AND METAL WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
2. INSTALLATION DESIGN CONFORMS WITH AASHTO "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS" AND SHALL BE FABRICATED IN ACCORDANCE WITH:
   A. STEEL PIPE, POST ANCHOR PLATES AND BREAK-AWAY PLATES SHALL CONFORM TO AASHTO M270 (ASTM A709) GRADE 36.
   B. HIGH STRENGTH BOLTS, NUTS AND WASHERS SHALL CONFORM TO ASTM-A325 AND SHALL BE GALVANIZED OR CADMIUM PLATED.
   C. HOLES SHALL BE DRILLED AND CUTS SHALL PREFERABLY BE SAW CUTS; HOWEVER, FLAME CUTTING WILL BE PERMITTED PROVIDED ALL EDGES ARE GROUND. METAL SHALL NOT PROJECT BEYOND THE PLANE OF THE PLATE FACE ON BREAK-AWAY PLATES.
   D. ALL WELDING IS TO BE CONTINUOUS AND IN ACCORDANCE WITH CURRENT AWS SPECIFICATIONS.
   E. A "KEEPER PLATE" OF THIN (28 GAGE) GALVANIZED SHEET METAL, FABRICATED TO MATCH BREAK-AWAY PLATE DIMENSIONS BUT WITH HOLES RATHER THAN SLOTS, SHALL BE USED TO RESTRAIN BOLT LOOSENING DUE TO WIND VIBRATION.
- F. PIPE LENGTH VARIES WITH VERTICAL PLACEMENT, MINIMUM GROUND CLEARANCE (7 FT.+) AND THE SIGN PANEL REQUIRED. IT WILL BE AS SHOWN ON THE PLANS, OR AS DETERMINED BY CROSS-SECTION, OR AS DIRECTED BY THE ENGINEER FOR EACH LOCATION (MAXIMUM LENGTH IS APPROXIMATELY 20 FT.-10 IN. AND MINIMUM LENGTH IS APPROXIMATELY 15 FT.-4 IN. IF LENGTH IS NOT SPECIFIED SUPPLY MAXIMUM - MAY REQUIRE FIELD CUT TO CONFORM TO TYPICAL SIGN PLACEMENT DETAILS).
3. CONCRETE FOOTINGS FOR FLASHING BEACON INSTALLATIONS SHALL CONFORM TO "DRILLED CAISSONS" AND "STRUCTURAL CONCRETE" (CLASS "BZ").

GENERAL NOTES CONTINUED ON SHEET 2.

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FLASHING BEACON AND SIGN INSTALLATIONS

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STANDARD PLAN NO.
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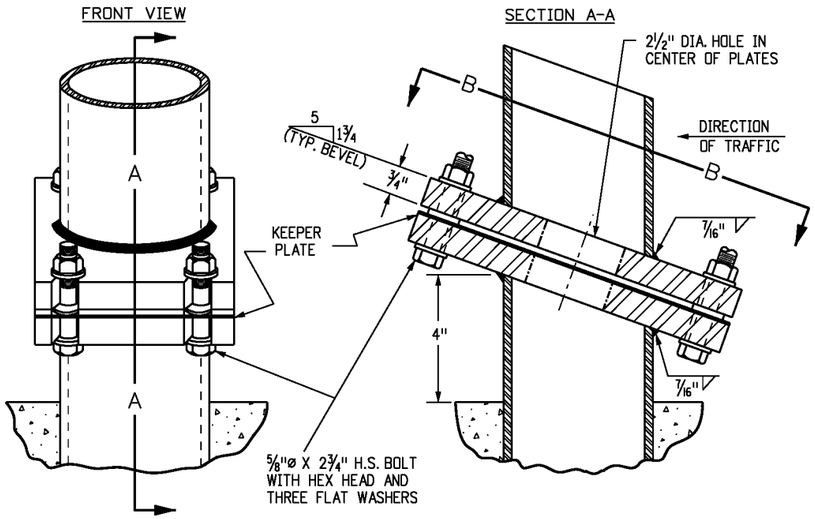
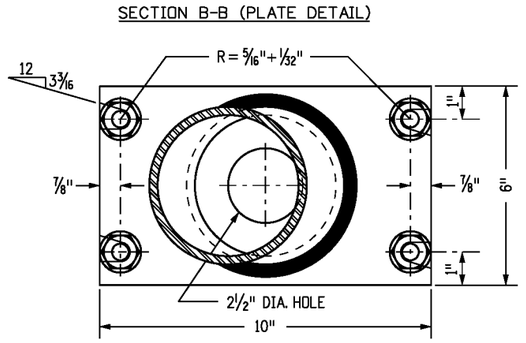
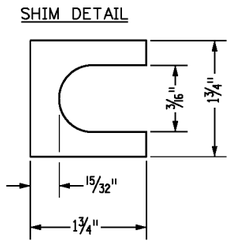


BREAK-AWAY ASSEMBLY BOLTING PROCEDURE

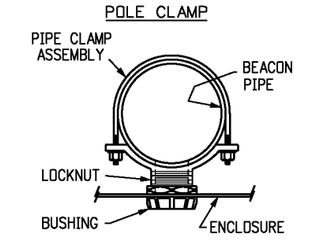
1. ASSEMBLE POST TO FOOTING WITH BOLTS- ONE FLAT WASHER ON EACH BOLT TOP AND BOTTOM, AND ONE FLAT WASHER AND THE KEEPER PLATE BETWEEN THE BREAK-AWAY PLATES. USE BRASS SHIMS TO PLUMB THE POST.
2. TIGHTEN ALL BOLTS TO MAXIMUM POSSIBLE WITH A 12 TO 15 INCH PIPE WRENCH TO BED WASHERS AND SHIMS TO CLEAN BOLT THREADS, THEN LOOSEN EACH BOLT IN TURN AND RETIGHTEN IN A SYSTEMATIC ORDER TO 450 INCH-POUNDS TORQUE.
3. BURR THREADS AT JUNCTION WITH NUT USING A CENTER PUNCH TO PREVENT NUT LOOSENING.

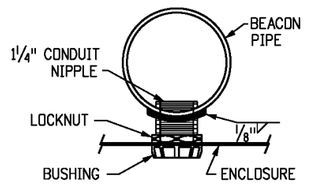




FURNISH TWO (2) .012 IN.± THICK AND TWO (2) .032 IN.± THICK SHIMS.

SHIMS SHALL BE FABRICATED FROM BRASS SHIMS STOCK OR STRIP CONFORMING TO ASTM-B 36.





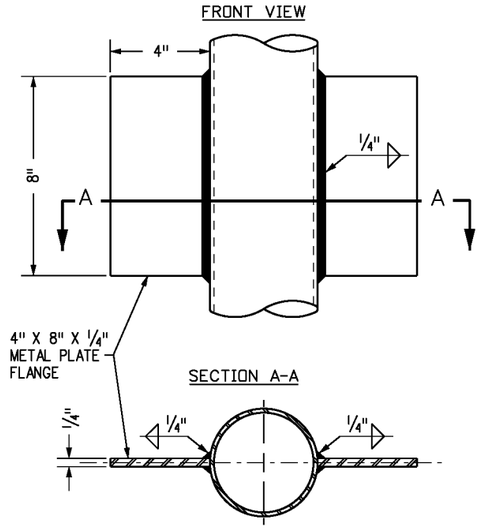
(NOTE: WELD VARIES WITH CONDUIT OR NIPPLE WALL THICKNESS.)

TYPICAL PIPE ATTACHMENTS

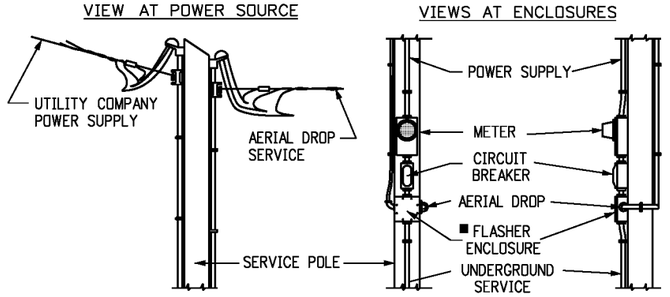
GENERAL NOTES (CONTINUED)

4. ALL ELECTRICAL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST REQUIREMENTS OF THE NEC, NEMA, UL OR EIA WHEREVER APPLICABLE; THE COLORADO PUC AND ANY LOCAL CODES OR ORDINANCES WHICH MAY APPLY; AND THE FOLLOWING:
   - A. THE CONTRACTOR IS TO PROVIDE ALL NECESSARY WIRING WITHIN THE BEACON AND FROM THERE TO THE POWER SOURCE PROVIDED BY THE UTILITY COMPANY. THE UTILITY COMPANY WILL MAKE THE CONNECTION WITH THE CONTRACTOR'S WIRING.
   - B. THE ELECTRICAL SERVICE BETWEEN THE POWER SOURCE AND THE FLASHING BEACON SHALL BE UNDERGROUND UNLESS AN AERIAL DROP IS AUTHORIZED BY THE ENGINEER. ALL WIRING EXCLUDING THE AERIAL DROP WIRE SHALL BE IN CONDUIT.
   - C. THE "FLASHER" SHALL BE HOUSED IN A SUITABLE ENCLOSURE ON THE UTILITY POLE AT THE POWER SOURCE UNLESS THE ENGINEER DIRECTS THAT THE ENCLOSURE BE MOUNTED ON THE BEACON PIPE OR THAT THE DEVICE MAY BE CONTAINED WITHIN THE SIGNAL HEAD ITSELF.
   - D. A SUITABLE ENCLOSURE FOR THE FLASHER SHALL BE IN ACCORDANCE WITH "A RAIN TIGHT JUNCTION BOX OR CAN, APPROXIMATELY 8 IN. X 8 IN. X 4 IN., SURFACE MOUNT, WITH A FLANGED SCREW ATTACHED COVER, AND FABRICATED FROM NOT LESS THAN 16 GAGE GALVANIZED STEEL".
   - E. A BUILT-IN RADIO INTERFERENCE SUPPRESSION DEVICE AND A PHOTOCELL SENSOR TYPE SIGNAL LAMP DIMMER SHALL BE PROVIDED FOR EACH FLASHING BEACON.
   - F. BEACONS SHALL FLASH AT A RATE OF NOT LESS THAN 50 AND NOT MORE THAN 60 TIMES PER MINUTE.
5. WHEN SPECIFIED IN THE PLANS, A PEDESTAL BASE INSTALLATION (AS DETAILED ON SHEET 3) MAY BE USED IN PLACE OF THE BREAKAWAY BASE SHOWN ON THIS SHEET.

TYPICAL BREAK-AWAY ASSEMBLY DETAILS



POST ANCHOR DETAILS



NOTES

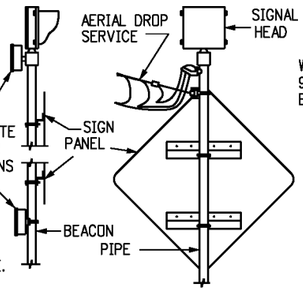
LOCATION AND CONFIGURATION OF ELECTRICAL EQUIPMENT IS DIAGRAMATIC ONLY (USE ANY METHOD COMPLYING WITH THE GENERAL NOTES).

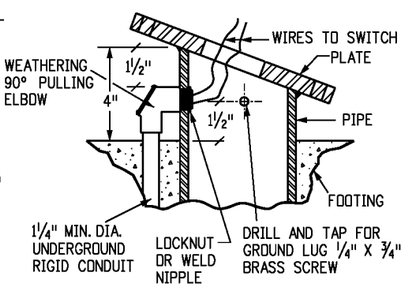
▲ EXISTING GROUND AT SERVICE POLE; OTHERWISE PULL THRU CONDUIT OR ATTACH TO CONDUIT AND TAP OFF UNDERGROUND.

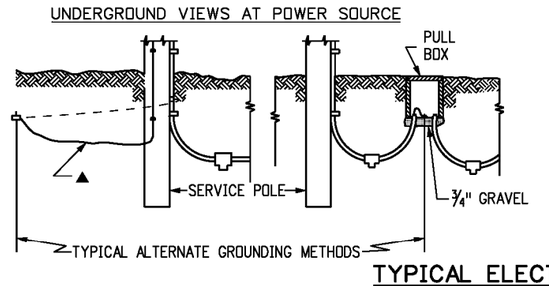
● DRILL AND TAP PIPE FOR 1/4" ROUND ROUND HEAD BRASS SCREW, ¾" LONG, FOR GROUND LUG.

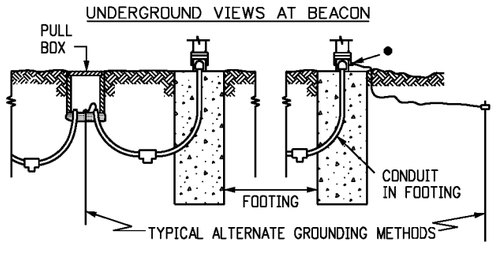
■ PROVIDE WEEP HOLE WITH AERIAL DROP SERVICE

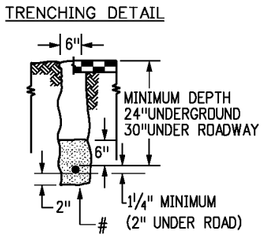
BEDDING MATERIAL FOR CONDUIT SHALL BE PLACED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.











TYPICAL ELECTRICAL SERVICE DETAIL

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Last Modification Date: 07/04/12 Initials:	R-X		
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Drawing File Name: S-614-14_2of3.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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Safety & Traffic Engineering Branch KCM/KEN

FLASHING BEACON AND SIGN INSTALLATIONS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
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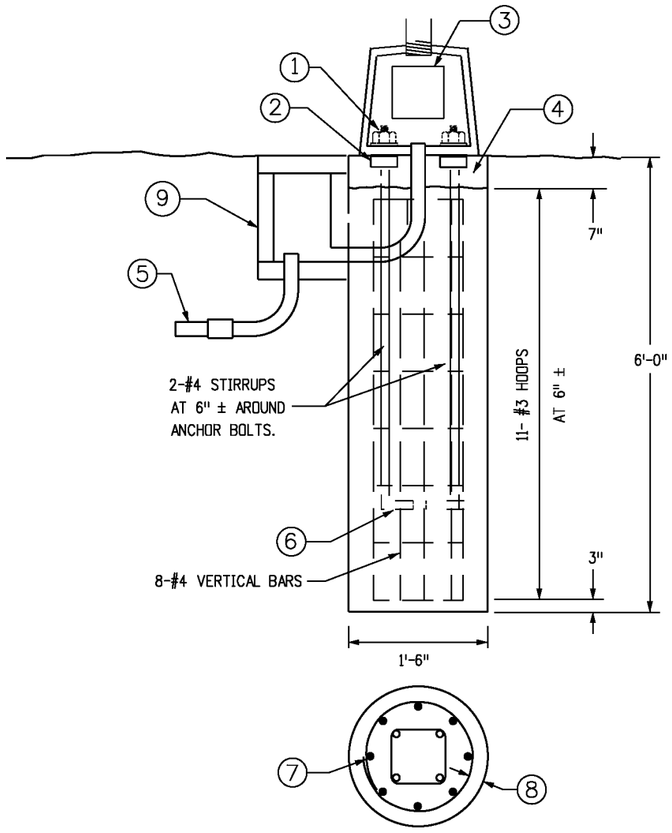
Sheet No. 2 of 3



ALTERNATE PEDESTAL BASE INSTALLATION

GENERAL NOTES

1. POLE AND PEDESTAL MUST BE DESIGNED TO MEET THE REQUIREMENTS OUTLINED IN THE "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS LUMINAIRES AND TRAFFIC SIGNALS", PUBLISHED BY AASHTO, FOR A WIND VELOCITY OF 100 MPH. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO, IN ACCORDANCE WITH SECTION 105.02 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.

DESIGN DATA

THE DESIGNS HEREIN ASSUME THAT FLASHING BEACONS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING SOIL PARAMETERS:

- SOIL DENSITY v = 110 LB./CU.FT.
- SOIL COHESION = 750 LB./SQ.FT. FOR MEDIUM STIFF COHESIVE SOIL
- SOIL ø ANGLE = 30 DEG. FOR MEDIUM DENSE COHESIONLESS SOIL
- SF = 3.0 FOR FLEXURAL RESISTANCE

CONTACT THE ENGINEER IF THE FLASHING BEACON WILL NOT BE INSTALLED WITHIN THE ROADWAY PRISM OR IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:

A) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.
B) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG.
C) THE FOUNDATION SOILS ARE NOT HOMOGENOUS.
D) FIRM BEDROCK IS ENCOUNTERED.
E) A HIGH GROUNDWATER TABLE IS ENCOUNTERED.
F) LARGE BOULDERS ARE ENCOUNTERED.

FOOTING DESIGN IS BASED ON 100 MPH WIND LOAD ON A 48 IN. X 48 IN. DIAMOND SIGN PANEL MOUNTED 9 FT. ABOVE THE GROUND, WITH A 24 IN. X 24 IN. RECTANGULAR PLAQUE UNDERNEATH AND A FLASHING BEACON 12 IN. ABOVE. IF A SIGN CONFIGURATION IS PROPOSED THAT EXCEEDS THESE DIMENSIONS, THE FOOTING DESIGN MUST BE ENGINEERED AND SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO.

FOOTING NOTES

1. HEX NUTS
2. SQUARE NUTS
3. HAND HOLE SHALL BE PROVIDED.
4. 4 IN. MIN. NON-SHRINKABLE GROUT OVER ROUGH FOUNDATION
5. SCHEDULE 80 PVC (24 IN. MIN. DEPTH, 30 IN. MIN. DEPTH UNDER ROADWAY) CONDUIT STUB FROM PULL BOX TO POLE SHALL BE 1-1/4" MIN. DIAMETER.
6. INSTALL ANCHOR BOLTS (FURNISHED WITH POLE) PER MANUFACTURER'S TEMPLATE PRINT (FURNISHED WITH ORDER)
7. MINIMUM OVERLAP OF 12 IN.
8. 1-1/2 IN. CLEARANCE FOR HOOPS
9. PULL BOX

CAISSON DESIGNS REQUIRE THAT THE CAISSON BE FOUNDED IN COMPACT SAND, CLAY OR SANDY CLAY. IF, BY VISUAL INSPECTION OF THE HOLE, OTHER MATERIAL IS PRESENT, THE CAISSON DESIGN SHALL BE MODIFIED AS DETERMINED BY THE ENGINEER.

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FLASHING BEACON AND SIGN INSTALLATIONS

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STANDARD PLAN NO.
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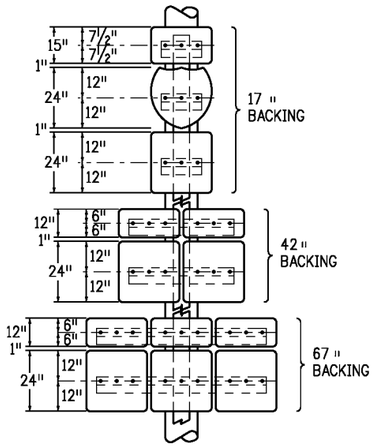
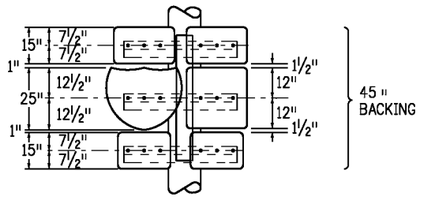
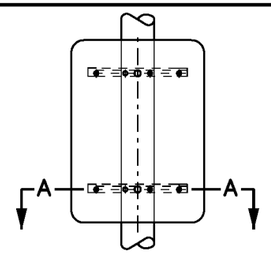
Sheet No. 3 of 3







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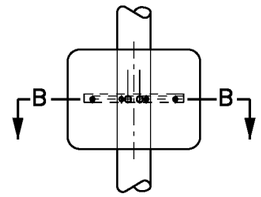

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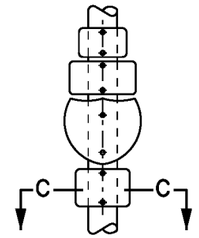

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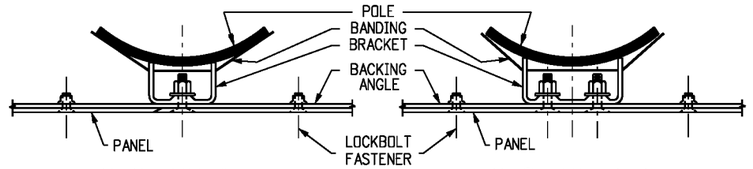
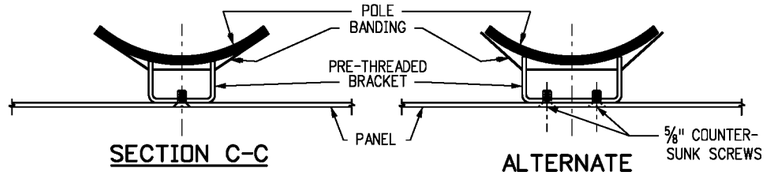


SECTION A-A

SECTION B-B

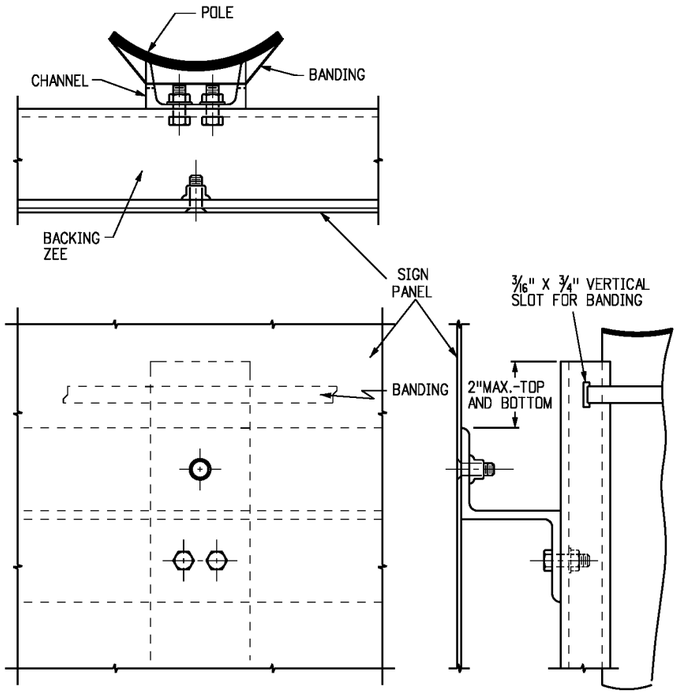


SECTION C-C

ALTERNATE
SECTION C-C

GENERAL NOTES

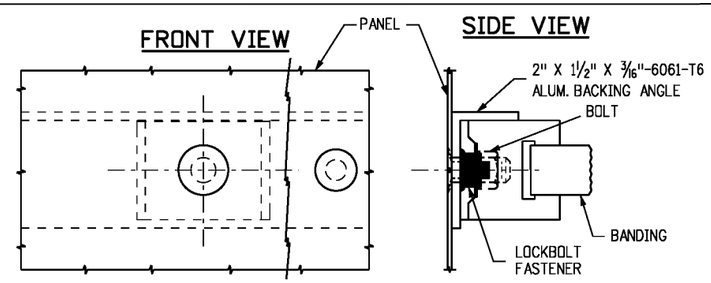
1. SIGNS SHALL BE LOCATED IN ACCORDANCE WITH THE DETAILS SHOWN ON THE PLANS. SPECIAL CARE SHALL BE TAKEN TO ENSURE AN UNOBSTRUCTED VIEW OF EACH SIGN.
2. BRAND-NAME ATTACHMENT HARDWARE AND BANDING MATERIAL TO BE APPROVED BY THE ENGINEER.
3. FOR SIGN PANEL FABRICATION, MOUNTING HEIGHT AND HOLE SPACING FOR BACKING ZEES, SEE APPLICABLE STANDARD.
4. ALL BOLTS, NUTS AND METAL WASHERS, UNLESS MADE OF STAINLESS STEEL, SHALL BE GALVANIZED OR CADMIUM PLATED.
5. ALL HOLES SHALL BE DRILLED OR PUNCHED.
6. BANDING SHALL BE ½ IN X .025 (MIN.) STAINLESS STEEL, ROUND-EDGE STRAP WITH AN ULTIMATE BREAKING STRENGTH OF 1500 LBS. (MIN.). THERE SHALL BE A MINIMUM OF TWO BANDS PER PANEL OR ASSEMBLY EXCEPT WHERE A SINGLE BACKING ANGLE IS USED.
7. PANELS OF 36 IN. OR GREATER WIDTH MUST HAWE BACKING MEMBERS IN ADDITION TO BRACKETS. CLASS II PANELS OF LESS THAN 36 IN. WIDTH AND CLASS I PANELS OF GREATER THAN 24 IN. WIDTH SHOULD USE PRE-THREADED BRACKETS SIMILAR TO ALTERNATE SECTION C-C (2 SCREWS).

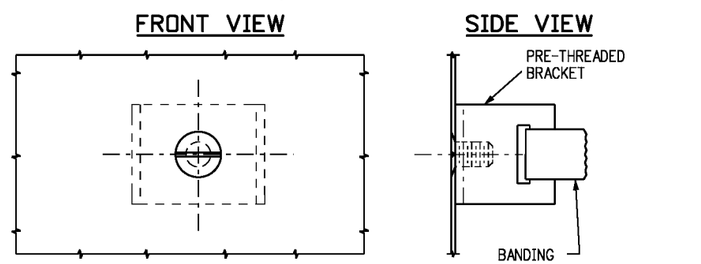


FABRICATION NOTES

1. HORIZONTAL AND VERTICAL MEMBERS TO BE THE SAME MATERIAL AS THE SIGN PANEL.
2. VERTICAL MEMBER TO BE 3 IN. X 1.420 LBS. 6061-T6 ALUMINUM CHANNEL BONDED TO THE POLE WITH A MINIMUM OF TWO BANDS.
3. HORIZONTAL MEMBERS TO BE 3 IN. X 2 11/16 IN 2.33 IN. BACKING ZEES, FASTENED TO VERTICAL MEMBER WITH ⅜ IN. MACHINE BOLTS WITH HEX NUT.
4. SIGN PANELS TO BE FASTENED TO HORIZONTAL MEMBERS WITH ⅜ IN. - 90 COUNTERSUNK LOCKBOLT FASTENERS.
5. VERTICAL SPACING BETWEEN GROUPS OF PANELS IN ONE MARKER ASSEMBLY SHALL BE 4 IN.

TYPICAL POLE MOUNT INSTALLATION
FOR CLASS II MARKER ASSEMBLY





FABRICATION NOTES

1. SHAPES OTHER THAN THE BRACKETS OR BACKING ANGLE SHOWN MAY BE USED.
2. MAXIMUM SPACING BETWEEN PANELS IN ONE ASSEMBLY SHALL BE 1 IN.
3. PANELS MAY BE INSTALLED BACK-TO-BACK ON THE SAME BANDS.
4. IN NO CASE SHALL BOLTS OF LESS THAN 5/16 IN. DIA. BE USED FOR ANY PORTION OF THE ASSEMBLY.
5. ONLY FIBER WASHERS MAY BE USED ON THE FACE OF THE SIGN PANEL.

TYPICAL POLE MOUNT INSTALLATION
FOR CLASS I AND II SIGN PANELS

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TYPICAL POLE MOUNT SIGN INSTALLATION

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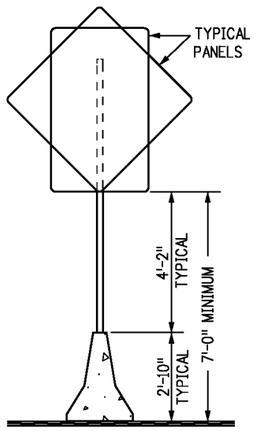


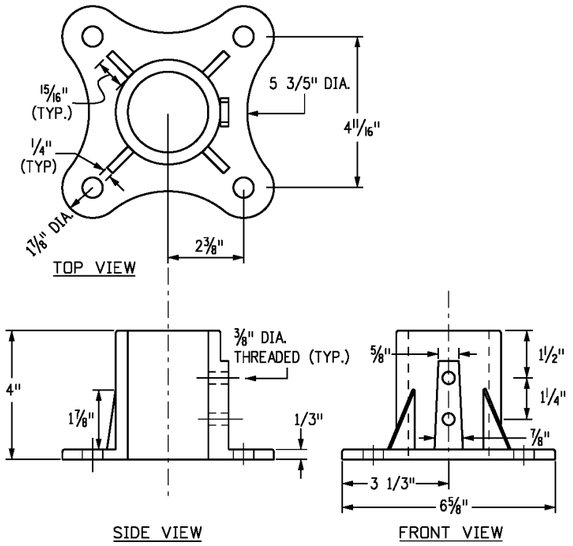
TYP. ELEVATION

POST SELECTION TABLE
(90 MPH WIND LOAD DESIGN)

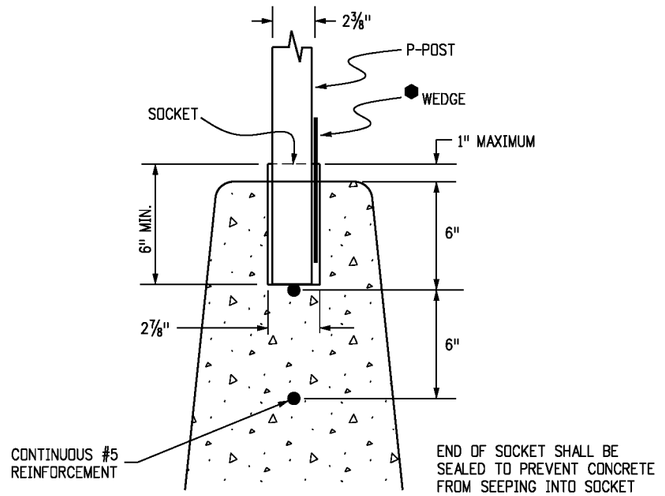
SIGN PANEL HEIGHT	SIGN PANEL WIDTH 1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"
1'-6"	P	P	P	P	P	P	P1	P1
2'-0"	P	P	P	P	P	P	P1	P1
2'-6"	P	P	P	P	P1	P1	P1	P1
3'-0"	P	P	P	P	P1	P1	P1	P1
3'-6"	P	P	P1	P1	P1	P1	P1	P1
4'-0"	P	P	P1	P1	P1	P1	P1	P1
4'-6"	P1	P1	P1	P1	P1	P1	P1	P1
5'-0"	P1	P1	P1	P1	P1	P1	P1	P1
5'-6"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

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

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



SURFACE MOUNT CASTING DETAIL

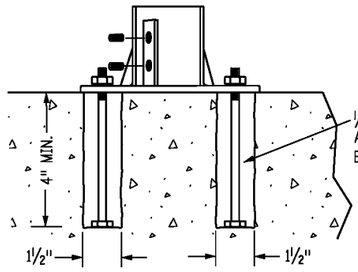


FRONT VIEW

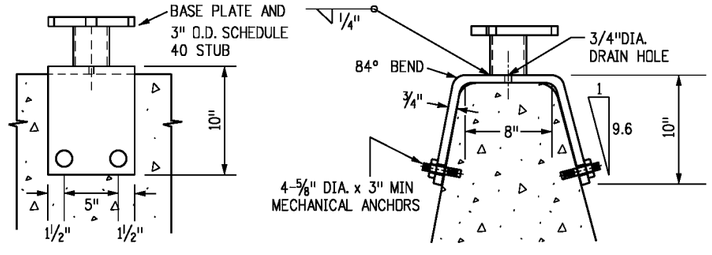
SOCKET SYSTEM (P POST ONLY)

GENERAL NOTES

1. FOR DETAILS OF GUARD RAIL-TYPE 7 CONCRETE BARRIER (CAST-IN-PLACE AND/OR PRECAST), SEE STANDARD PLANS M-606-13 AND M-606-14.
2. FOR SIGN PANEL FABRICATION DETAILS, SEE STANDARD PLANS S-614-2, S-614-3 AND S-614-4.
3. ● SOCKET SYSTEMS AND SLIP BASES SHALL BE ASSEMBLED ACCORDING TO STANDARD PLAN S-614-8.
4. BARRIER WALLS SHALL BE SUPPORTED TO PREVENT DEFORMATION DURING PLACEMENT OF SLIPBASE STUB OR SOCKET ON CAST-IN-PLACE INSTALLATIONS.
5. THE ENGINEER SHALL ESTABLISH LOCATIONS FOR ALL SIGN POSTS IN ACCORDANCE WITH DETAILS SHOWN ON THE PLANS.
6. ALL SIGN POSTS SHALL BE MOUNTED PLUMB.
7. BOLTS, NUTS, WASHERS AND ANCHOR BOLTS SHALL CONFORM TO ASTM A307. THEY SHALL ALL BE GALVANIZED IN ACCORDANCE WITH ASTM A153 OR ASTM A164.
8. ALL STEEL CUTS SHALL PREFERABLY BE SAW CUTS; HOWEVER, FLAME CUTTING WILL BE PERMITTED PROVIDED ALL EDGES ARE GROUND.
9. MOUNTING SYSTEM FOR EACH SIGN LOCATION SHALL BE AS SHOWN ON THE PLANS.
10. ALL WELDING IS TO BE IN ACCORDANCE WITH AWS SPECIFICATIONS OF CURRENT ISSUE AND SHALL BE CONTINUOUS.
11. ANCHOR BOLTS FOR RETRO-FIT INSTALLATION MAY BE "HEADED" BOLTS OR "ALL THREAD" ROD WITH HEX HEAD NUT AND LOCKWASHER (DRILLED AND FILLED WITH APPROVED EPOXY GROUT IN 2 IN. HOLES FOR 7/8 IN., AND 1 1/2 IN. HOLES FOR 1/2 IN.).
12. RETRO-FIT INSTALLATION PROCEDURE SHALL NOT BE USED ON NEW CONSTRUCTION WITHOUT APPROVAL OF THE ENGINEER.
13. SIGN PANELS, MOUNTED ON CONCRETE BARRIER, SHALL NOT ENCROACH THE TRAVELED WAY.

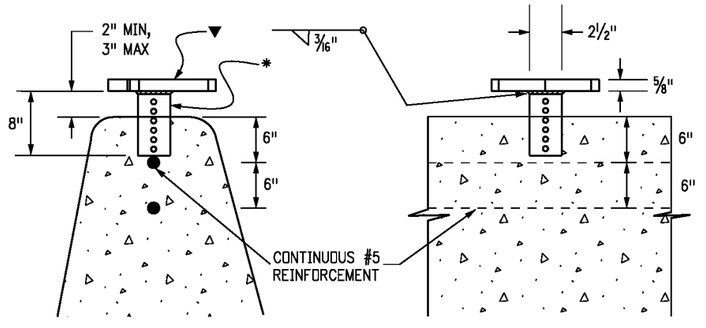


SURFACE MOUNT CASTING (P POST ONLY)



SADDLE BRACKET (P1 & P2 POSTS)

RETRO-FIT CONCRETE BARRIER INSTALLATION



▼ BASE PLATE SHALL BE 5/8" ASTM A-36, 441 OR 572 STEEL PLATE. SEE STANDARD PLAN S-614-8 FOR DIMENSIONS.

* BASE STUB SHALL BE 2 1/2" SQUARE 10 GAGE PERFORATED TUBING, FABRICATED AND GALVANIZED CONFORMING TO ASTM A-153

SLIPBASE BARRIER STUB (P1 & P2 POSTS)

CAST-IN-PLACE CONCRETE BARRIER INSTALLATION

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CONCRETE BARRIER SIGN POST INSTALLATIONS

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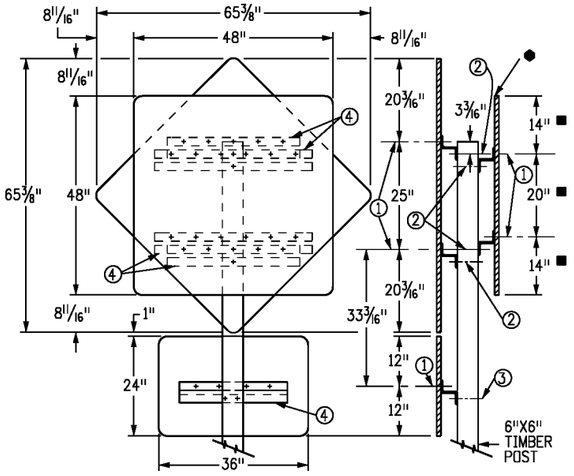
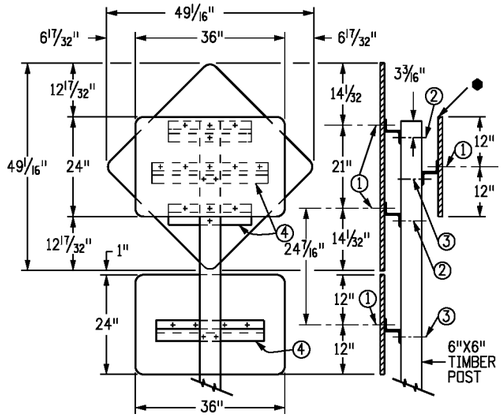
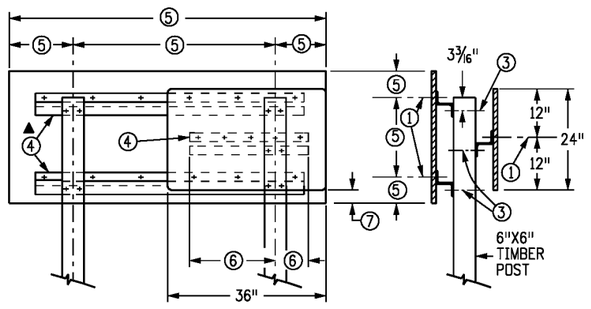
Sheet No. 1 of 1



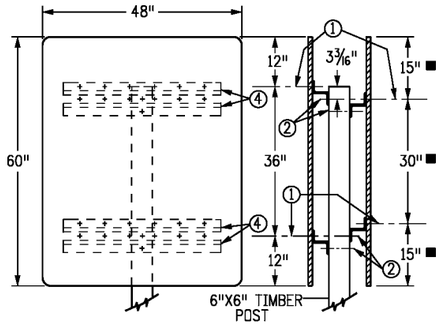
48" X 48" REGULATORY SIGN AND 48" DIAMOND WITH EDUCATIONAL PLAQUE



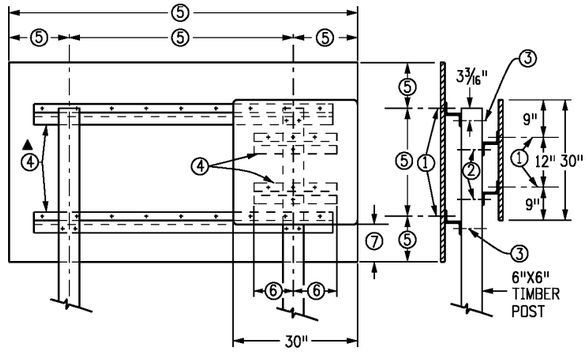
36" X 24" REGULATORY SIGN AND 36" DIAMOND WITH EDUCATIONAL PLAQUE



36" X 24" REGULATORY AND GUIDE SIGN



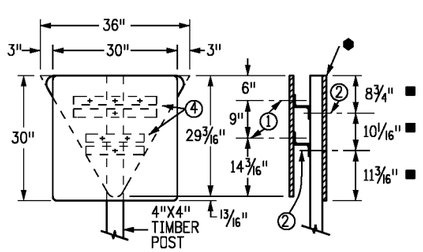
48" X 60" REGULATORY SIGNS



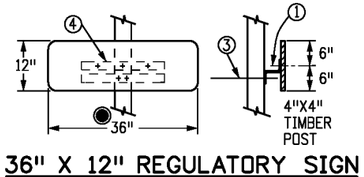
30" REGULATORY SIGN AND GUIDE SIGN

GENERAL NOTES

1. FOR SIGN PLACEMENT SEE COLORADO STANDARD PLAN S-614-1.
2. FOR TYPICAL CLASS I, II AND III GROUND SIGN INSTALLATION DETAILS SEE COLORADO STANDARD PLANS S-614-2, S-614-3 AND S-614-4.
- ● 3. IF THE BACK-SIDE OF ANY PANEL USED IN THE MULTI-SIGN INSTALLATIONS (DO NOT ENTER, WRONG WAY, ETC.) PROTRUDES BEYOND THE EDGE OF ANOTHER PANEL THAT FACES TRAFFIC APPROACHING FROM A NORMAL OR PROPER DIRECTION, THE ENTIRE BACK-SIDE OF THE PROTRUDING PANEL SHALL BE PAINTED FLAT BLACK ENAMEL.
- ▲ 4. A BACKING ZEE SIZE OF 3 IN. X 2 11/16 IN. X 1/4 IN. SHALL BE USED FOR MOST GUIDE SIGN INSTALLATIONS.
- ◉ 5. 36 IN. X12 IN. AND ALL SIGNS 30 IN. WIDE OR LESS BECOME CLASS II AND REQUIRE BACKING ZEE(S) WHEN THEY ARE MOUNTED ON THE SAME FACE AS A NORMAL CLASS II SIGN. ONE REGULAR 1 FT.-8 IN. ZEE WILL BE USED FOR THOSE 15 IN. OR LESS IN HEIGHT AND 2 REGULAR 1 FT.-8 IN. ZEES FOR THOSE GREATER THAN 15 IN. IN HEIGHT.
6. OTHER MULTI-SIGN INSTALLATIONS, NOT DETAILED ON THIS STANDARD, MAY BE REQUIRED BY THE PLANS AND ARE TO BE FABRICATED IN ACCORDANCE WITH THE GENERAL PRINCIPLES OF THIS STANDARD.
- ■ 7. SPECIAL NON-STANDARD SPACING MAY BE REQUIRED TO FACILITATE ASSEMBLY OF MULTI-SIGN INSTALLATIONS.



30" REGULATORY SIGN AND 36" TRIANGLE



36" X 12" REGULATORY SIGN

(THIS DETAIL APPLIES ONLY WHEN SIGN IS MOUNTED ON THE SAME FACE WITH A CLASS II SIGN)

FABRICATION LEGEND

① 3/8" 90° COUNTERSUNK ALUMINUM LOCKBOLT FASTENER.
② 5/8" GALVANIZED OR CADMIUM PLATED MACHINE BOLT, NUT AND WASHERS.
③ 3/8" GALVANIZED OR CADMIUM PLATED MACHINE BOLT, NUT AND WASHERS.
④ 3" X 2 11/16" X 1/4" BACKING ZEE.
⑤ GUIDE SIGN DIMENSION VARIES.
⑥ DIMENSION VARIES, PANEL SHALL NOT PROJECT BEYOND THE EDGE OF THE GUIDE SIGN.
⑦ THIS SPACE NOT TO EXCEED 1'-6", OTHERWISE CENTER PANEL VERTICALLY ON THE GUIDE SIGN.

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Creation Date: 07/04/12 Initials: KEN		Date:	Comments
Last Modification Date: 07/04/12 Initials:	(R-X)		
Full Path: www.coloradodot.info/library/traffic/traffic-s-standard-plans	(R-X)		
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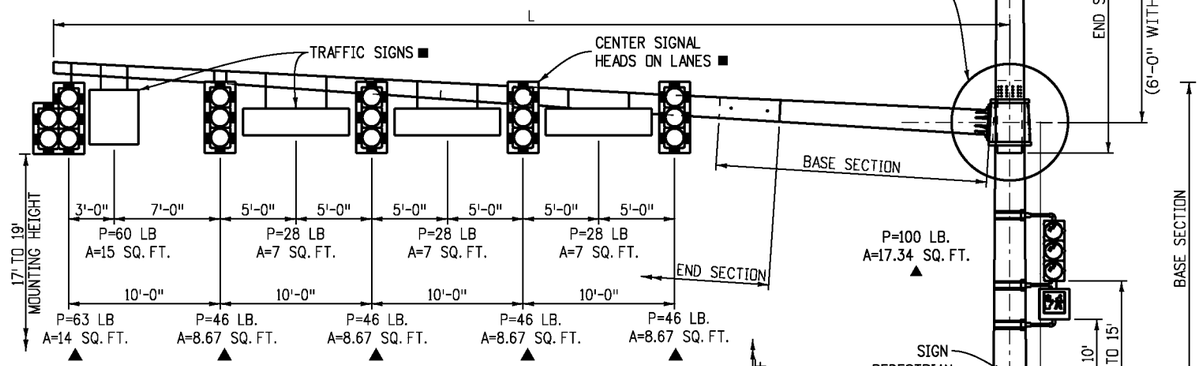
TYPICAL MULTI-SIGN INSTALLATIONS

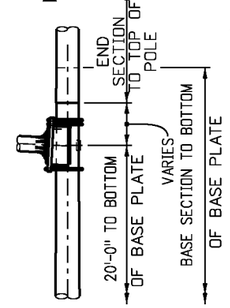
Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-614-22
Sheet No. 1 of 1

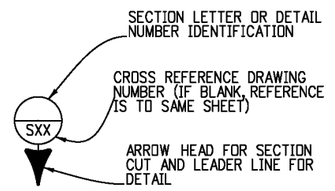
GENERAL NOTES

1. REFER TO ROADWAY PLANS FOR THE ACTUAL CONFIGURATION AND LOCATION OF TRAFFIC SIGNAL HEADS AND SIGNS MARKED WITH A ■ .
2. ALL POLES AND ARMS SHALL BE FABRICATED WITH ASTM A572 GRADE 65 STEEL. LUMINAIRE ARMS MAY BE FABRICATED WITH ASTM A595 GRADE A STEEL WITH A MINIMUM YIELD POINT OF 55 KSI.
3. ALL POLES AND ARMS SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A500, A501, OR A595.
4. ALL POLES AND ARMS SHALL BE ROUND OR DODECAGONAL TUBES WITH A 0.14 IN/FT TAPER.
5. HARDENED WASHERS SHALL CONFORM TO ASTM F436.
6. ALL POLES AND ARMS SHALL BE GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION IN ACCORDANCE WITH ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM.
7. POLE AND MAST ARM SPLICES SHALL BE MECHANICALLY FORCED TOGETHER FOR A SNUG FIT.
8. BLIND BOLTS SHALL BE A307 GRADE A STEEL AND ARE NOT REQUIRED FOR MULTISIDED POLES. MECHANICAL ALTERNATIVES TO BLIND BOLTS UTILIZING FRICTION, KEYS, INTERLOCKING TEETH OR A COMBINATION THEREOF TO PREVENT THE BUILT-UP BOX FROM TWISTING ON THE POLE MAY BE USED AS APPROVED BY CDOT STAFF BRIDGE.
9. ALL MAST ARMS MORE THAN 40 FT IN LENGTH SHALL BE TWO PIECE CONSTRUCTION TO LIMIT ARM WEIGHTS.
10. GALVANIZED ASTM A325 H.S. BOLTS SHALL BE USED FOR ATTACHING LUMINAIRE AND MAST ARMS. A LUBRICATED TIGHTENING TORQUE OF 178 FT-LBS FOR ¾" DIAMETER BOLTS, 395 FT-LBS FOR 1" DIAMETER BOLTS AND 1300 FT-LBS FOR 1½" DIAMETER BOLTS SHALL BE USED TO TIGHTEN ALL H.S. BOLTS. MAST ARMS SHALL BE TEMPORARILY SUPPORTED TO TAKE LOAD OFF OF FIELD CONNECTIONS WHILE BOLTS ARE TIGHTENED IN ORDER TO FIRMLY SEAT THE FLANGE PLATE. BOLTS SHALL BE SEQUENTIALLY TIGHTENED. ASSUMING 12 BOLTS AND A CLOCK FACE, THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7, ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED.
11. CAST POLE END CAP TO BE SECURED IN PLACE WITH 3 SET SCREWS.
12. ALL SIGNAL HEADS, SIGNS, AND HARDWARE SHALL BE FIELD POSITIONED.
13. ACCESSORIES TO BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A153.
14. ALL PLATES AND STIFFENERS SHALL BE FABRICATED WITH AASHTO M270 (ASTM A709) GRADE 36 STEEL AND SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A6. ALL HANDHOLES SHALL BE FABRICATED WITH ASTM A572 GRADE 42 STEEL.
15. LEVELING CONCRETE SHALL BE 3000 PSI AIR ENTRAINED CONCRETE VIBRATED IN PLACE BELOW THE POLE BASE PLATE.
16. THE DESIGNS HEREIN ASSUME THAT SIGNALS ARE INSTALLED WITHIN THE ROADWAY EARTHWORK PRISM WITH THE FOLLOWING SOIL PARAMETERS:
    SOIL DENSITY γ = 110 LB./CU.FT.
    SOIL COHESION = 750 LB./SQ.FT. FOR MEDIUM STIFF COHESIVE SOIL
    SOIL ø ANGLE = 30° FOR MEDIUM DENSE COHESIONLESS SOIL
    SF = 1.5 FOR TORSIONAL RESISTANCE AND 3.0 FOR FLEXURAL RESISTANCE
17. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:
    (A) SIGNALS WILL NOT BE INSTALLED WITHIN THE ROADWAY EARTHWORK PRISM.
    (B) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.
    (C) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG.
    (D) THE FOUNDATION SOILS ARE NOT HOMOGENOUS.
    (E) FIRM BEDROCK IS ENCOUNTERED.
18. CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH. WET OR CAVING HOLES SHALL BE BACKFILLED WITH FLOW-FILL AND REDRILLED AFTER A THREE DAY CURING PERIOD WITHOUT THE USE OFA CASING.
19. CAISSONS SHALL BE CONSTRUCTED WITH AIR ENTRAINED CLASS BZ CONCRETE IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS. REINFORCING STEEL SHALL BE GRADE 60.
20. CAISSON CONCRETE SHALL REACH THE SEVEN DAY PREDICTED STRENGTH PRIOR TO INSTALLING THE SIGNAL STRUCTURE.
21. U-BOLTS AND ANCHOR BOLTS SHALL BE FABRICATED WITH AASHTO M314-90 GRADE 55 STEEL.
22. ANCHOR BOLTS SHALL BE FABRICATED WITH HEAVY HEX NUTS AND FLAT WASHERS. THREAD UPPER 12 INCHES AND GALVANIZE UPPER 13 INCHES OF THE ANCHOR BOLTS. FIELD WELDING OF ANCHOR BOLTS TO REBAR DURING ERECTION WILL NOT BE ALLOWED. ANCHOR BOLTS SHALL BE SET WITH A STEEL TEMPLATE UNTIL THE CONCRETE HAS CURED AT LEAST TWO DAYS. THE ANCHOR BOLTS SHALL BE TIGHTENED USING THE TURN-OF-NUT METHOD. THE BOLTS SHALL FIRST BE TIGHTENED TO SNUG TIGHT, WHICH IS DEFINED AS THE TIGHTNESS THAT EXISTS WHEN THE UPPER AND LOWER NUTS ARE IN FIRM CONTACT WITH THE BASE PLATE. WITH MAST ARMS FREE TO DEFLECT, THE UPPER AND LOWER NUTS SHALL THEN EACH BE ROTATED AN ADDITIONAL ⅓ TURN (30° ± 5°) WITH A SLUGGING, HYDRAULIC OR AIR IMPACT WRENCH.
23. WELDING OF STEEL SHALL CONFORM TO THE REQUIREMENTS OF ANSI/AWS D1.1. ALL AREAS TO BE WELDED SHALL BE GROUND TO BRIGHT METAL. ALL WELDING AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED. ALL CIRCUMFERENTIAL AND STIFFENER WELDS SHALL BE NON-DESTRUCTIVELY TESTED USING THE ENHANCED MAGNETIC PARTICLE METHOD IN ACCORDANCE WITH SUBSECTION 509.18 (d) OF THE STANDARD SPECIFICATIONS. THE ACCEPTANCE CRITERIA IS STATED IN TABLE 6.1 OF ANSI/AWS D1.1. ALL LONGITUDINAL WELDS WITHIN 6 INCHES OF FULL PENETRATION CIRCUMFERENTIAL GROOVE WELDS AND FULL PENETRATION GROOVE WELDS SHALL BE INSPECTED AS SPECIFIED ABOVE. MAXIMUM WELD UNDERCUT SHALL BE 0.01 INCHES.
24. ALL ELECTRICAL CONNECTIONS TO THE SIGNALS SHALL BE GROUNDED IN ACORDANCE WITH APPLICABLE ELECTRICAL CODES.
25. TRAFFIC SIGNAL STRUCTURES HAVE BEEN DESIGNED IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES, AND TRAFFIC SIGNALS, FOURTH EDITION, 2001.
26. A DESIGN WIND VELOCITY OF 100 MPH AND ONE 12' LANE WITH A 65 MPH TRUCK INDUCED GUST LOADING HAVE BEEN USED FOR THE DESIGNS HEREIN.
27. CERTIFIED MILL TEST REPORTS INCLUDING CHARPY V-NOTCH TEST RESULTS, WELD INSPECTION REPORTS AND ENHANCED MAGNETIC PARTICLE TEST REPORTS SHALL BE SUBMITTED TO CDOT STAFF BRIDGE, 4201 E. ARKANSAS AVE. DENVER, COLORADO 80222 AS SOON AS THEY BECOME AVAILABLE. CVN TEST RESULTS FOR ASTM A572 GRADES 42 AND 65 STEEL SHALL HAVE A MINIMUM VALUE OF 15 FT-LBS AT 40°F AS PER THE H FREQUENCY TEST REQUIREMENTS IN AASHTO T243 (ASTM A673).
28. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
29. DEFINITIONS: U.O.N. = UNLESS OTHERWISE NOTED
    W.P. = WORK POINT
30. TRAFFIC SIGNALS MOUNTED ON MAST ARMS SHALL BE FURNISHED WITH ASTRO TYPE MOUNTING BRACKETS.
31. END SECTION DIAMETERS MUST BE INCREASED TO ACCOMMODATE OUT-OF-ROUNDNESS, GALVANIZING THICKNESS AND SEAM WELD PROFILES TO PROVIDE THE MINIMUM REQUIRED ARM SLIP SPLICE LENGTHS AND POLE MEMBER OVERLAPS.
32. USE 35' OF ⅜" HIGH STRENGTH CHAIN (SAFE WORKING LOAD OF 5,000 LB.), TWO "S" SHAPED HOOKS PROPERLY FORGED FROM 1" SQUARE BAR STOCK AND TWO 4,000 LB. CAPACITY COME-ALONGS TO SEAT THE POLE END SECTION ON ITS BASE SECTION BY ATTACHING THE COME-ALONGS TO OPPOSING ACCESS HOLES IN THE BUILT-UP BOX WITH THE "S" SHAPED HOOKS AND PULLING AGAINST THE CHAIN WHICH IS STRUNG UNDERNEATH THE POLE BASE PLATE. APPLY ENOUGH FORCE TO ALIGN THE WIRE ACCESS HOLES AND TO SEAT THE SLIP SPLICE WITHIN 4" OF THE SPECIFIED LENGTH.
33. SECURE ARM FLANGE PLATE, POLE BASE PLATE, AND CONNECTION FACEPLATE DURING WELDING TO PREVENT DISTORTION.
34. ONE DRILLED HOLE WITH A MAXIMUM DIAMETER OF ¾" IS ALLOWED AT LOCATIONS MARKED WITH A ▲ TO ACCOMMODATE ELECTRICAL WIRING.
35. SEE S-614-42 AND S-614-43 FOR "CABINET FOUNDATION DETAILS" AND "TRAFFIC LOOP AND MISC. SIGNAL DETAILS" RESPECTIVELY.





SINGLE MAST ARM CONNECTION



DESIGN DATA

1. DRAWING SHOWN HAS 5 SIGNAL HEADS, SHORTER ARM LENGTHS MAY HAVE FEWER HEADS. THIS CONFIGURATION IS INTENDED TO REPRESENT A WORST CASE LOADING CONDITION.

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

THE DESIGN LENGTH "L" FOR EACH SERIES IS SHOWN IN PARENTHESIS.

2. FOR THE TWIN MAST ARM CONNECTION, THE SECOND ARM IS ASSUMED TO BE WITHIN 60° TO 120° OF THE PRIMARY ARM AND IS ASSUMED TO BE LOADED WITH THE SAME LOADS AS SHOWN ABOVE. THE SECONDARY ARM MAY BE THE SAME LENGTH AS OR SHORTER THAN THE PRIMARY ARM.

Computer File Information		Sheet Revisions	
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Last Modification Date: 07-04-12 Initials: LAW	R-X		
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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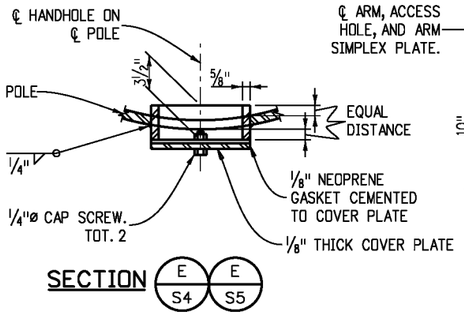
TYPICAL TRAFFIC SIGNAL INSTALLATION DETAILS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

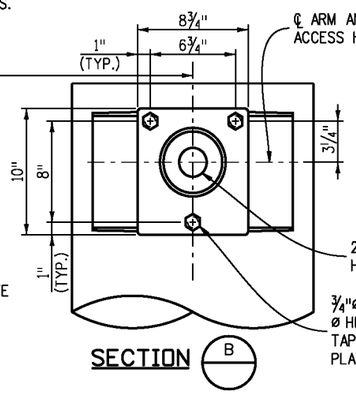
STANDARD PLAN NO.
S-614-40
Sheet No. 1 of 5

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

* BASE SECTION LENGTH INCLUDES THE SPLICE LENGTH AS PER THE "MAST ARM SLIP SPLICE DETAIL" BELOW.
◆ SEE GENERAL NOTE 31 ON SHEET 1 OF 5.
■ STOP ALL WELDS 1/2" SHORT OF PLATE EDGES AND BOLT HOLES.
● 3 3/4" FOR 30' ARM UPPER HANDHOLE.



SECTION E S4 E S5



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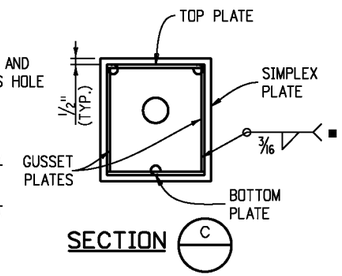

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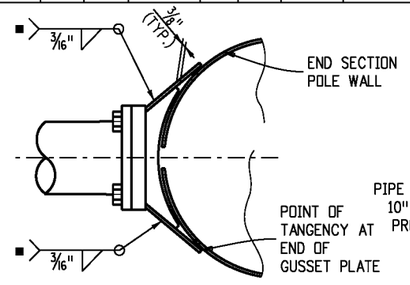
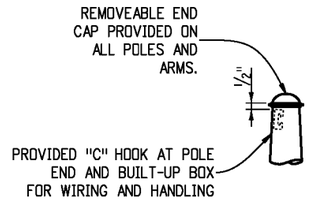
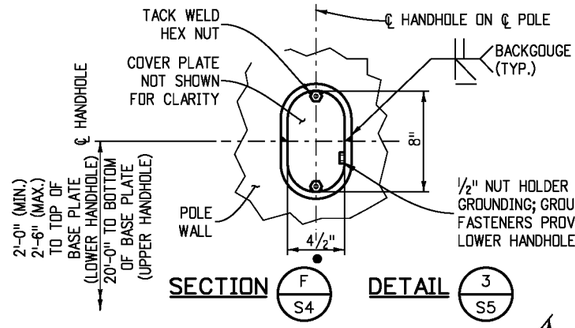


(TYPICAL TOP AND BOTTOM PLATES)

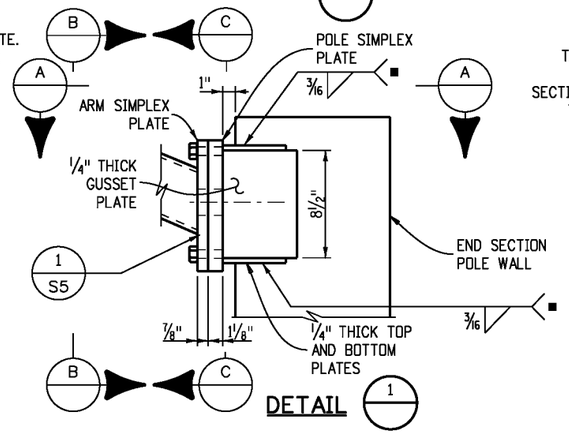
SECTION A



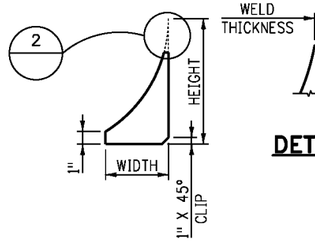
END CAP DETAIL



SECTION F S4 DETAIL 3 S5

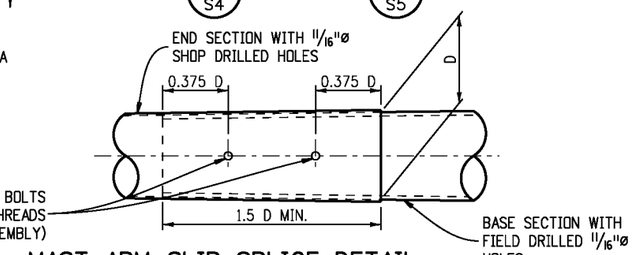


DETAIL 1

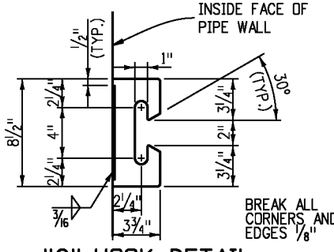


DETAIL 2

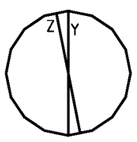
STIFFENER DETAIL



MAST ARM SLIP SPLICE DETAIL

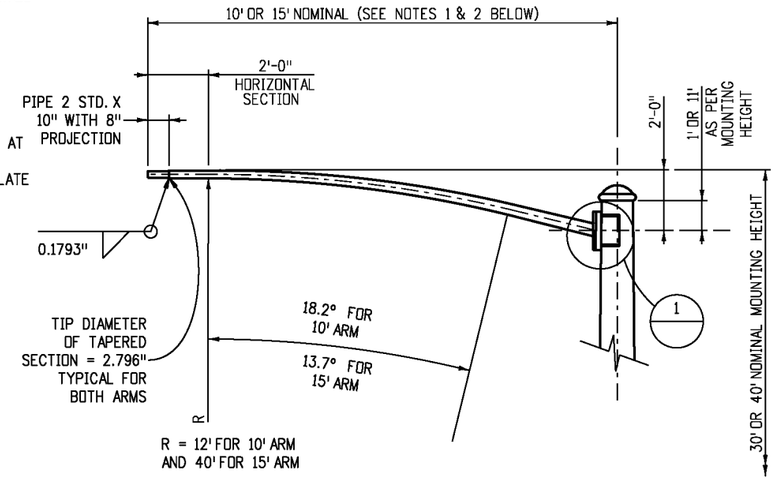


"C" HOOK DETAIL



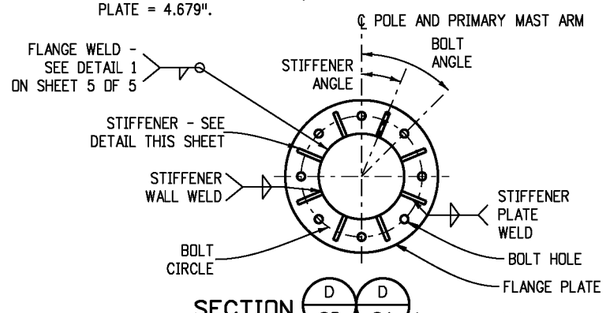
Y = DIAMETER OF A ROUND TUBE.
Z = PERPENDICULAR DISTANCE BETWEEN FLATS.
Y AND Z ARE OUTSIDE DIAMETER DIMENSIONS.
Z/Y RATIO MUST BE .98 MINIMUM.

OPTIONAL MULTI-SIDED POLE OR MAST ARM



LUMINAIRE ARM NOTES

1. 10' LUMINAIRE ARM SHAFT: WALL THICKNESS = 0.1793"; LINEAR TAPER = 0.14 IN./FT.; DIAMETER AT ARM SIMPLEX PLATE = 4.066"
2. 15' LUMINAIRE ARM SHAFT: WALL THICKNESS = 0.1793"; LINEAR TAPER = 0.14 IN./FT.; DIAMETER AT ARM SIMPLEX PLATE = 4.679".



SECTION D S3 D S4 (BOLTS NOT SHOWN FOR CLARITY)

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Last Modification Date: 07-04-12 Initials: LAW	R=X		
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TYPICAL TRAFFIC SIGNAL INSTALLATION DETAILS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

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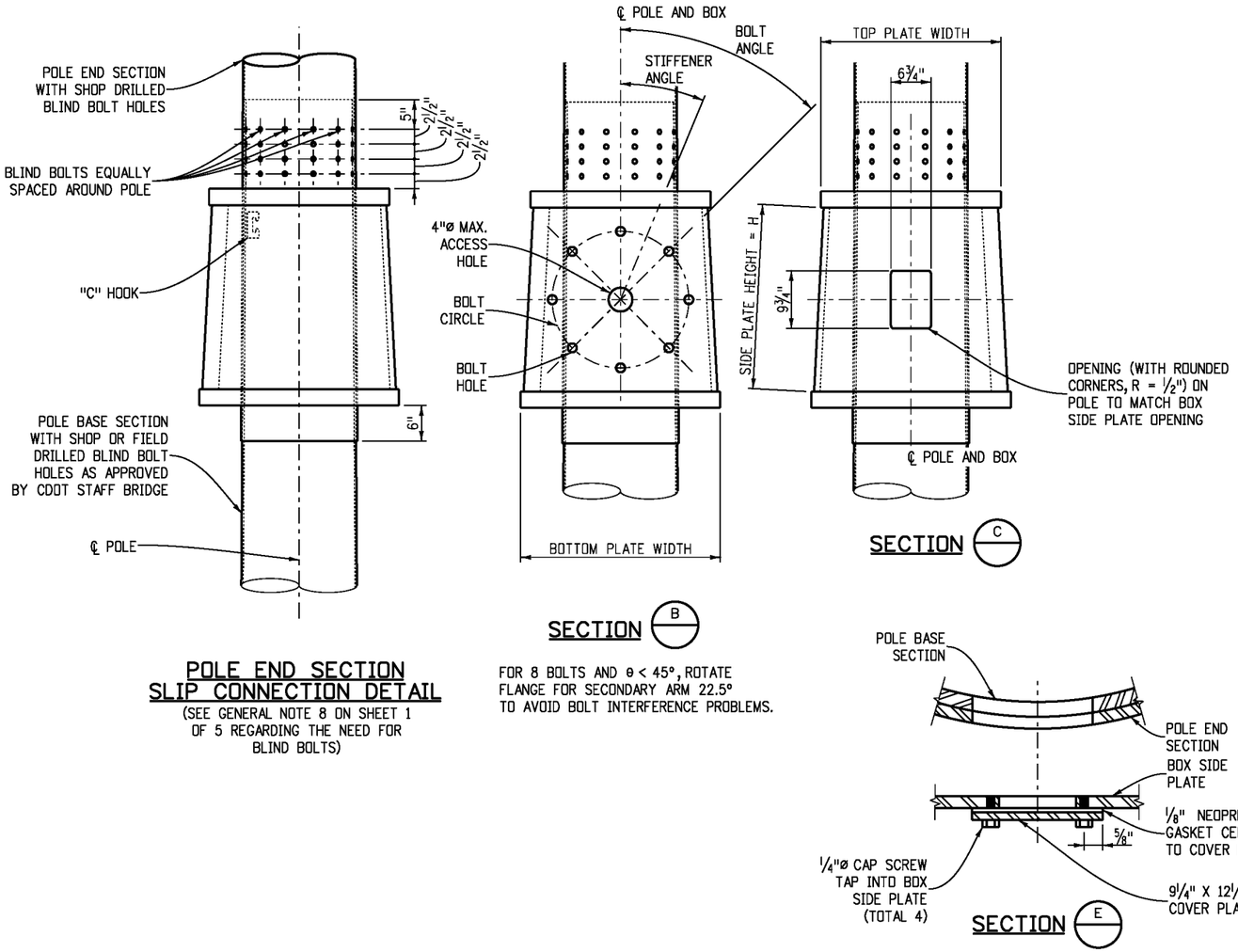
MAST ARM LENGTH (FT.)	BUND BOLD DATA				BUILT-UP BOX DATA *					POLE DATA							
							SIDE PLATE	TOP PLATE	BOTTOM PLATE	BASE SECTION				END SECTION ◆ WITH LUMINAIRE			
	NO. OF	DIA. (IN.)	BOLTS PER ROW	NO. OF ROWS	THICKNESS OF BOX PLATES U.O.N. (IN.)	POLE WELD (IN.)	H (IN.)	WIDTH FOR θ = 45° (IN.)	WIDTH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

✱ USE LARGER ARM IN A DOUBLE ARM SIGNAL TO DETERMINE PLATE THICKNESS AND DIMENSIONS.

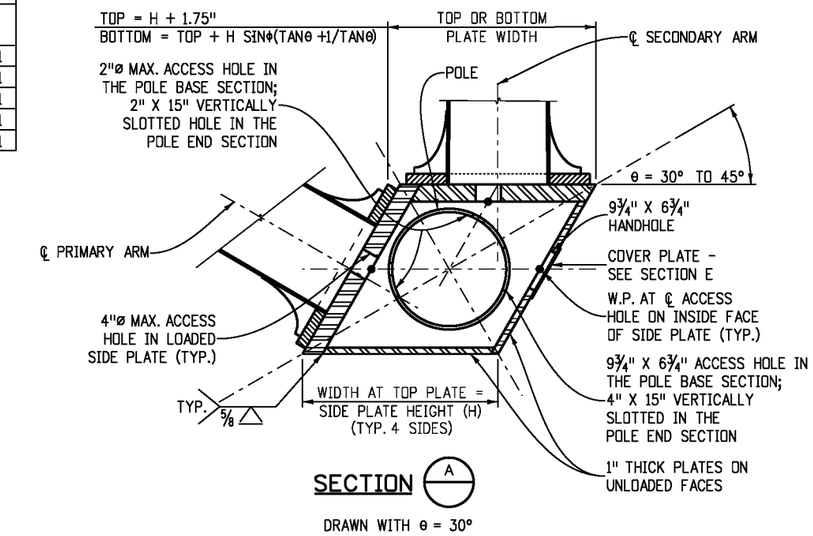
◆ SEE GENERAL NOTE 31 ON SHEET 1 OF 5



POLE END SECTION SLIP CONNECTION DETAIL

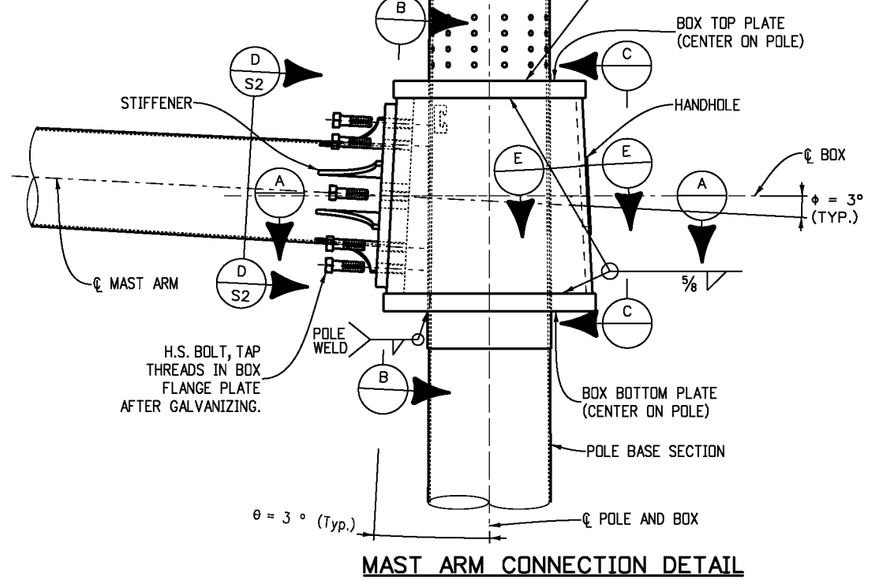
(SEE GENERAL NOTE 8 ON SHEET 1 OF 5 REGARDING THE NEED FOR BLIND BOLTS)

FOR 8 BOLTS AND θ < 45°, ROTATE FLANGE FOR SECONDARY ARM 22.5° TO AVOID BOLT INTERFERENCE PROBLEMS.



SECTION A

DRAWN WITH θ = 30°



MAST ARM CONNECTION DETAIL

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MAST ARM LENGTH (FT.)	FACEPLATE DATA								STOP BAR DATA	SIDE PLATE DATA		WASHER DATA			U-BOLT DATA •			
	FACEPLATE HEIGHTS			THICKNESS OF FACEPLATE	WIDTH OF FACEPLATE		RADIUS	EDGE DISTANCE										
	TOP (H_{TOP}) (IN.)	BOTTOM (H_{BOTTOM}) (IN.)	TOTAL (H_{FACE}) (IN.)	(T_{FACE}) (IN.)	ENDS (W_E) (IN.)	CENTER (W_C) (IN.)	(IN.)	(S_{EDGE}) (IN.)	BAR LENGTH (L_{BAR}) (IN.)	THICKNESS OF SIDE PLATE (T_{SP}) (IN.)	EAR HEIGHT (H_{EAR}) (IN.)	LENGTH OF WASHER (L_{WASHER}) (IN.)	WIDTH OF WASHER (W_{WASHER}) (IN.)	BOLT SPACING (S_{BOLT}) (IN.)	DIAMETER OF U-BOLT (D_{U-BOLT}) (IN.)	BEND RADIUS U-BOLT (A) (IN.)	BEND RADIUS U-BOLT (B) (IN.)	DIAMETER OF OVERSIZED HOLE (IN.)
30	17.72	15.09	32.81	1.500	14.73	20.00	52.40	2.125	18.000	0.875	1.000	7.000	3.00	4.000	0.875	5.09	5.23	1.188
40	18.47	15.72	34.19	1.750	17.74	23.00	56.85	2.125	19.000	1.000	1.125	7.000	3.00	4.000	1.125	6.58	6.73	1.438
50	20.78	17.78	38.56	2.125	20.89	24.00	120.22	2.125	23.000	1.000	1.375	7.000	3.00	4.000	1.250	8.13	8.31	1.563
65	24.91	20.91	45.81	2.375	25.67	29.00	158.58	2.563	28.000	1.125	1.500	8.500	3.50	5.000	1.375	10.05	10.26	1.688
75	26.59	22.59	49.19	2.500	28.07	31.00	207.07	2.563	31.000	1.125	1.625	8.500	3.50	5.000	1.500	11.23	11.46	1.813

MAST ARM LENGTH (FT.)	POLE DATA								SADDLE DATA
	BASE SECTION ✶				END SECTION WITH LUMINAIRE ◆				THICKNESS OF SADDLE PLATES (T_{SA}) (IN.)
	LENGTH (FT.)	TOP ø (IN.)	BOTTOM ø (IN.)	THK. (IN.)	LENGTH (FT.)	TOP ø (IN.)	BOTTOM ø (IN.)	THK (IN.)	
30	24.55	8.79	12.23	0.3125	15.57	7.25	9.43	0.2391	1.375
40	24.96	11.49	14.98	0.3125	15.51	10.00	12.17	0.2391	1.375
50	25.54	14.40	17.98	0.3125	15.30	13.00	15.14	0.2391	1.375
65	26.30	18.05	21.73	0.3125	14.99	16.75	18.85	0.2391	1.500
75	26.74	20.24	23.98	0.3125	14.83	19.00	21.07	0.2391	1.625

- BEND RADIUS MEASURED TO THE ℄ OF EACH U-BOLT. INCREASE RADII AS NEEDED TO ACCOMMODATE OUT-OF-ROUNDNESS, GALVANIZING THICKNESS AND SEAM WELD PROFILES. U-BOLTS SHALL BE TIGHTENED 1/12 TURN (30° ±5°) PAST SNUG TIGHT; PEEN THREADS AFTER TIGHTENING. U-BOLTS AND FACEPLATE SHALL BE MOUNTED ON BASE SECTION PRIOR TO SHIPMENT.

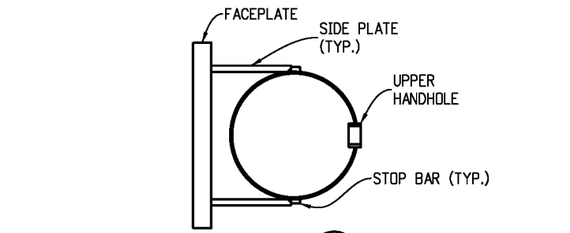
✚ MATCH FIT STOP BAR TO SIDE PLATE USING TACK WELDS TO ENSURE UNIFORM BEARING.

✶ BASE SECTION LENGTHS INCLUDE THE SPLICE LENGTH AS PER THE "MAST ARM SLIP SPLICE DETAIL" ON SHEET 2 OF 5.

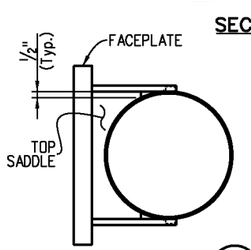
◆ SEE GENERAL NOTE 31 ON SHEET 1 OF 5.

■ END ALL WELDS 1/2 IN. SHORT OF BOLT HOLE AND PLATE EDGES.

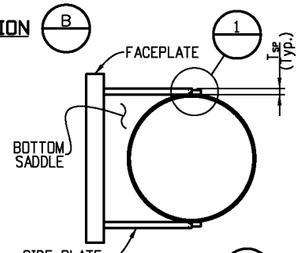
▼ BEND STOP BAR TO MATCH POLE CURVATURE.



SECTION B



SECTION A



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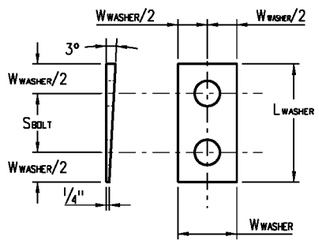
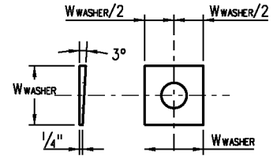
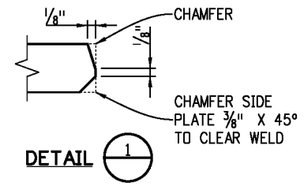
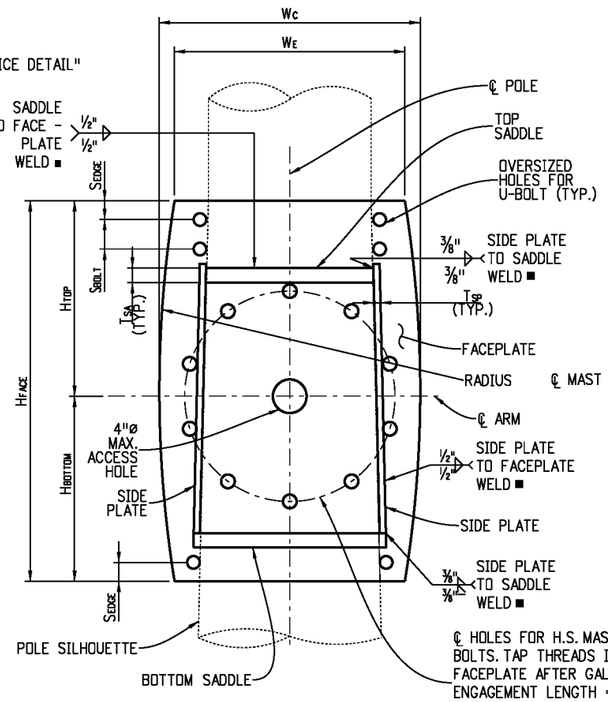


TAPERED WASHER DETAILS

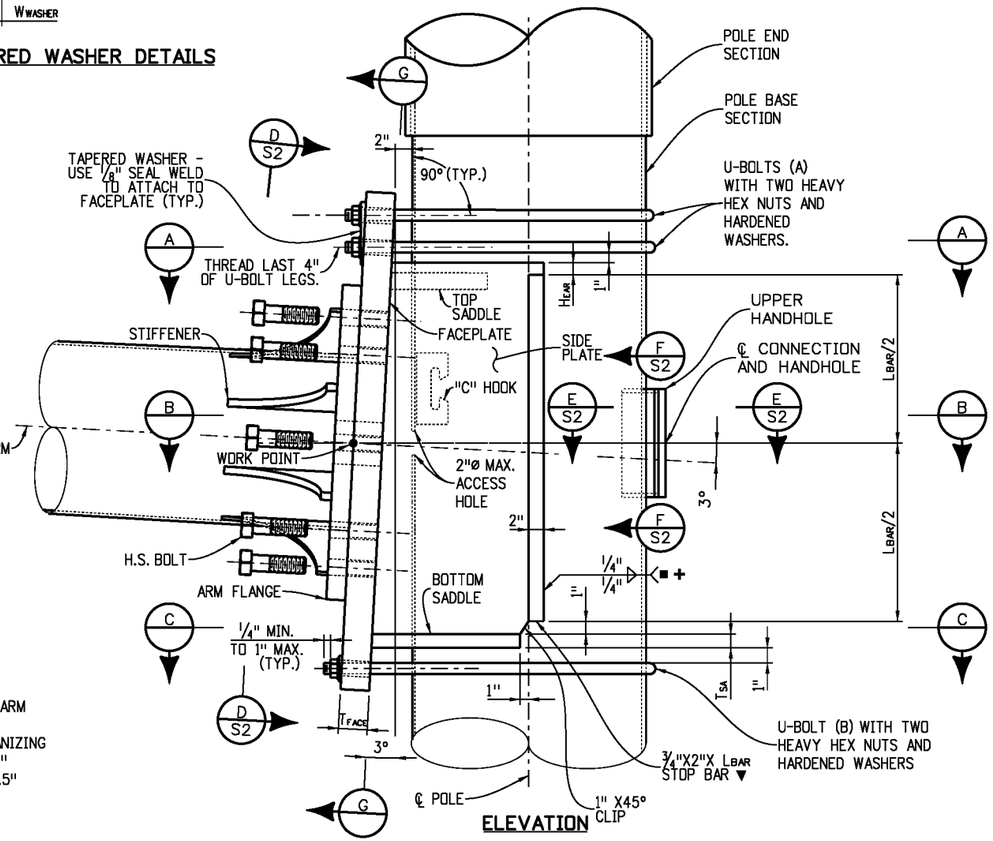




DETAIL 1



SECTION G



ELEVATION

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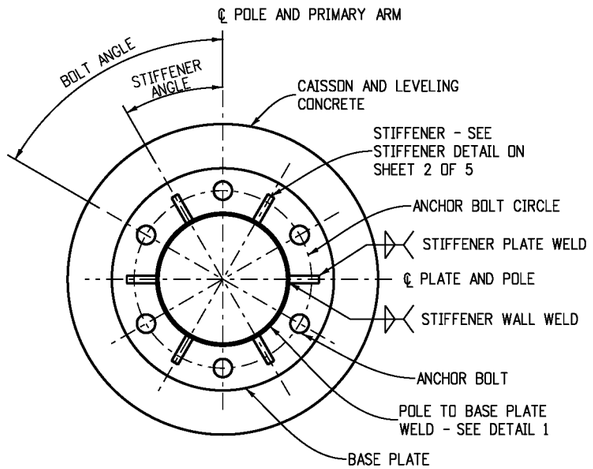
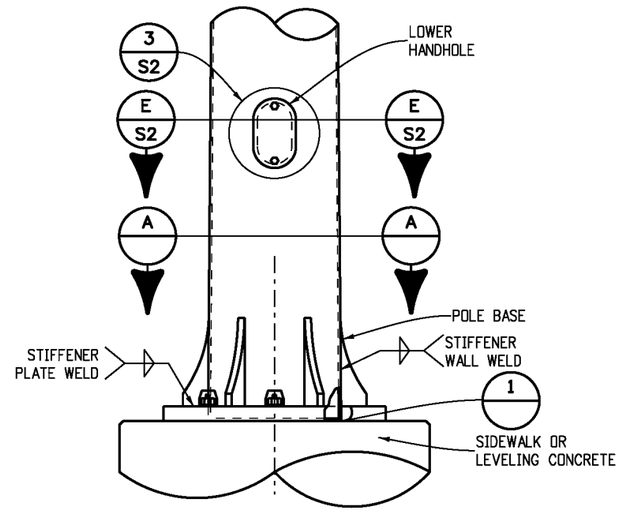
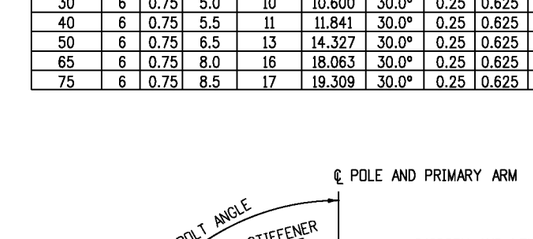
MAST ARM LENGTH (FT.)	POLE BASE CONNECTION DATA																	CAISSON DATA (FOR SINGLE AND DOUBLE ARM INSTALLATIONS)				
	STIFFENER								BASE PLATE		ANCHOR BOLT										V BARS	
	NO. OF	THK. (IN.)	WIDTH (IN.)	HEIGHT (IN.)	RADIUS (IN.)	ANGLE	WALL WELD (IN.)	PLATE WELD (IN.)	DIA. (IN.)	THK. (IN.)	NO.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



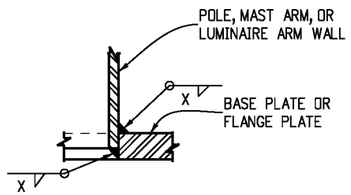
SECTION (A)



BASE PLATE DETAIL

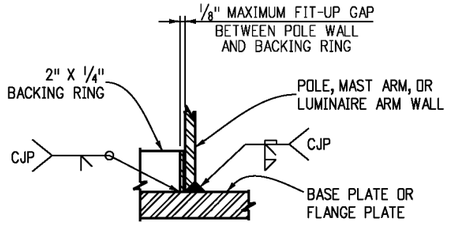


CONSTRUCTION REQUIREMENTS



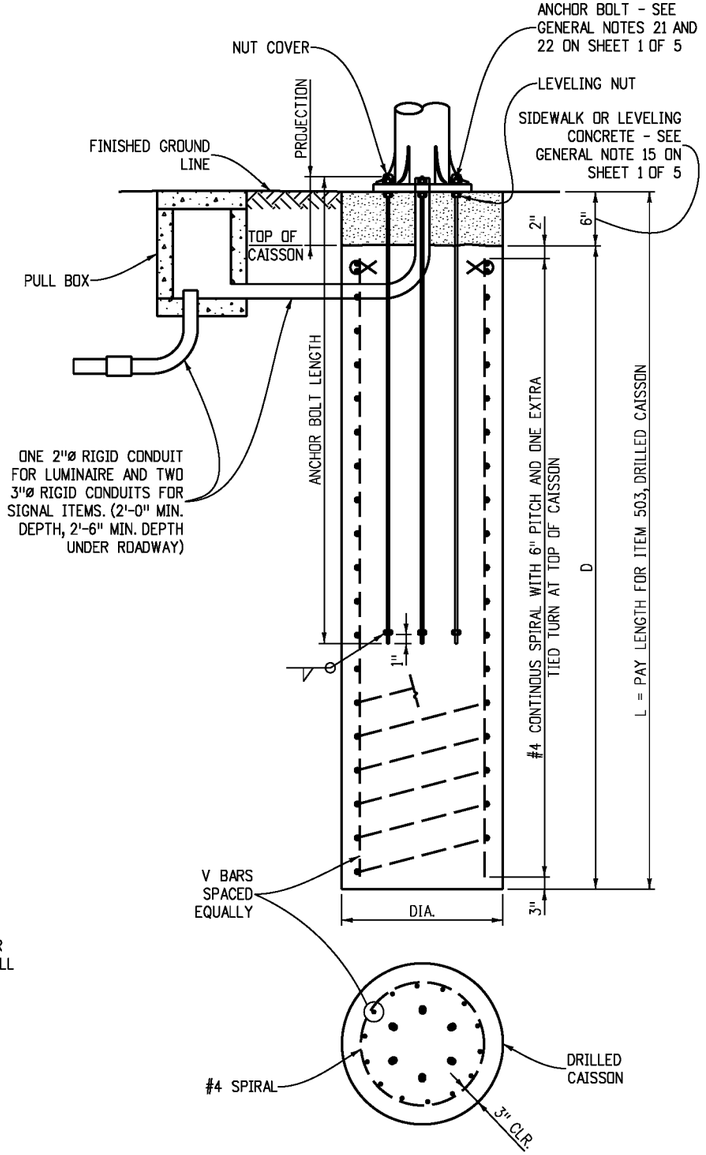
SOCKET WELD

X = 3⁄16" FOR LUMINAIRE ARMS AND 1⁄4" FOR POLES. SEE TABLE ON SHEET 2 OF 5 FOR MAST ARMS.



BACKING RING WELD

DETAIL (1) (1 S2)



TRAFFIC SIGNAL POLE CAISSON

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GENERAL NOTES

1. REFER TO THE ROADWAY PLANS FOR THE ACTUAL CONFIGURATION AND LOCATION OF TRAFFIC SIGNAL HEADS AND SIGNS MARKED WITH A ■ .
2. ALL POLES SHALL BE FABRICATED WITH ASTM A572 GRADE 65 STEEL.
3. ALL ARMS SHALL BE FABRICATED WITH ASTM A572 GRADE 65 STEEL OR ASTM A595 GRADE A STEEL WITH A MINIMUM YIELD POINT OF 55 KSI.
4. ALL POLES AND ARMS SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A500, A501, OR A595.
5. ALL POLES AND ARMS SHALL BE ROUND OR DODECAGONAL TUBES WITH A 0.14 IN/FT TAPER.
6. HARDENED WASHERS SHALL CONFORM TO ASTM F436.
7. ALL POLES AND ARMS SHALL BE GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION IN ACCORDANCE WITH ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM.
8. POLE AND MAST ARM SPLICES SHALL BE MECHANICALLY FORCED TOGETHER FOR A SNUG FIT.
9. ALL MAST ARMS MORE THAN 35 FT IN LENGTH SHALL BE TWO PIECE CONSTRUCTION TO LIMIT ARM WEIGHTS.
10. GALVANIZED ASTM A325 H.S. BOLTS SHALL BE USED FOR ATTACHING MAST ARMS. A LUBRICATED TIGHTENING TORQUE OF 178 FT-LBS FOR ¾" DIAMETER BOLTS, AND 1300 FT-LBS FOR 1½" INCH DIAMETER BOLTS SHALL BE USED TO TIGHTEN ALL H.S. BOLTS. MAST ARMS SHALL BE TEMPORARILY SUPPORTED TO TAKE LOAD OFF OF FIELD CONNECTIONS WHILE BOLTS ARE TIGHTENED IN ORDER TO FIRMLY SEAT THE FLANGE PLATE. BOLTS SHALL BE SEQUENTIALLY TIGHTENED.
11. CAST POLE END CAP TO BE SECURED IN PLACE WITH 3 SET SCREWS.
12. ALL SIGNAL HEADS, SIGNS, AND HARDWARE SHALL BE FIELD POSITIONED.
13. ACCESSORIES TO BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A153.
14. ALL PLATES SHALL BE FABRICATED WITH AASHTO M270 (ASTM A709) GRADE 36 STEEL AND SHALL COMPLY WITH THE DIMENSIONAL TOLERANCES SPECIFIED IN ASTM A6. ALL HANDHOLES SHALL BE FABRICATED WITH ASTM A572 GRADE 42 STEEL.
15. LEVELING CONCRETE SHALL BE 3000 PSI AIR ENTRAINED CONCRETE VIBRATED IN PLACE BELOW THE POLE BASE PLATE.
16. CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH. WET OR CAVING HOLES SHALL BE BACKFILLED WITH FLOW-FILL AND REDRILLED AFTER A THREE DAY CURING PERIOD WITHOUT THE USE OF A CASING.
17. CAISSONS SHALL BE CONSTRUCTED WITH AIR ENTRAINED CLASS BZ CONCRETE IN ACCORDANCE WITH SECTION 503 OF THE STANDARD SPECIFICATIONS. REINFORCING STEEL SHALL BE GRADE 60.
18. CAISSON CONCRETE SHALL REACH THE SEVEN DAY PREDICTED STRENGTH PRIOR TO INSTALLING THE SIGNAL STRUCTURE.
19. U-BOLTS AND ANCHOR BOLTS SHALL BE FABRICATED WITH AASHTO M314-90 GRADE 55 STEEL.
20. ANCHOR BOLTS SHALL BE FABRICATED WITH HEAVY HEX NUTS AND FLAT WASHERS. THREAD UPPER 12 INCHES AND GALVANIZE UPPER 13 INCHES OF THE ANCHOR BOLTS. FIELD WELDING OF ANCHOR BOLTS TO REBAR DURING ERECTION WILL NOT BE ALLOWED. ANCHOR BOLTS SHALL BE SET WITH A STEEL TEMPLATE UNTIL THE CONCRETE HAS CURED AT LEAST TWO DAYS. THEY SHALL BE TIGHTENED USING THE TURN-OF-NUT METHOD BY FIRST TIGHTENING THEM TO SNUG TIGHT, WHICH IS DEFINED AS THE TIGHTNESS THAT EXISTS WHEN THE UPPER AND LOWER NUTS ARE IN FIRM CONTACT WITH THE BASE PLATE. WITH MAST ARMS FREE TO DEFLECT, THE UPPER AND LOWER NUTS SHALL THEN EACH BE ROTATED AN ADDITIONAL 1/12 TURN (30° ± 5°) WITH A SLUGGING, HYDRAULIC OR AIR IMPACT WRENCH.
21. WELDING OF STEEL SHALL CONFORM TO THE REQUIREMENTS OF ANSI/AWS D1.1. ALL AREAS TO BE WELDED SHALL BE GROUND TO BRIGHT METAL. ALL WELDING AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED. ALL CIRCUMFERENTIAL WELDS SHALL BE NON-DESTRUCTIVELY TESTED USING THE ENHANCED MAGNETIC PARTICLE METHOD IN ACCORDANCE WITH SUBSECTION 509.18 (d) OF THE STANDARD SPECIFICATIONS. THE ACCEPTANCE CRITERIA IS STATED IN TABLE 6.1 OF ANSI/AWS D1.1. ALL LONGITUDINAL WELDS WITHIN 6 INCHES OF FULL PENETRATION CIRCUMFERENTIAL GROOVE WELDS AND FULL PENETRATION GROOVE WELDS SHALL BE INSPECTED AS SPECIFIED ABOVE. MAXIMUM WELD UNDERCUT SHALL BE 0.01 INCHES.
22. ALL ELECTRICAL CONNECTIONS TO THE SIGNALS SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES.
23. CERTIFIED MILL TEST REPORTS INCLUDING CHARPY V-NOTCH (CVN) TEST RESULTS, WELD INSPECTION REPORTS AND ENHANCED MAGNETIC PARTICLE TEST REPORTS SHALL BE SUBMITTED TO CDOT STAFF BRIDGE, 4201 E. ARKANSAS AVE., DENVER COLORADO 80222 AS SOON AS THEY BECOME AVAILABLE. CVN TEST RESULTS FOR ASTM A572 GRADES 42, 55 AND 65 STEEL SHALL HAVE A MINIMUM VALUE OF 15 FT-LBS AT 40°F AS PER THE H FREQUENCY TEST REQUIREMENTS IN AASHTO T243 (ASTM A673).
24. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
25. TRAFFIC SIGNALS MOUNTED ON MAST ARMS SHALL BE FURNISHED WITH ASTRO TYPE MOUNTING BRACKETS.
26. END SECTION DIAMETERS MUST BE INCREASED TO ACCOMMODATE OUT-OF-ROUNDNESS, GALVANIZING THICKNESS AND SEAM WELD PROFILES TO PROVIDE THE MINIMUM REQUIRED ARM SLIP SPLICE LENGTHS AND POLE MEMBER OVERLAPS.
27. SECURE ARM FLANGE PLATE, POLE BASE PLATE, AND CONNECTION FACE PLATE DURING WELDING TO PREVENT DISTORTION.
28. IF THE VERTICAL DEFLECTIONS DURING A 10 TO 20 MPH WIND EXCEED THE GALLOPING DEFLECTION LIMITS LISTED IN THE TABLE ON SHEET 2 OF 4, THE OWNER SHALL INSTALL AN ALUMINUM SIGN BLANK (16" X 66" OR LARGER) NEAR THE FREE END OF THE TRAFFIC SIGNAL MAST ARM. SAID SIGN BLANK SHALL BE ROTATED ABOUT THE LONGITUDINAL AXIS OF THE ARM WHILE THE WIND BLOWS TO MINIMIZE THE GALLOPING DEFLECTIONS. CONTACT STAFF BRIDGE FOR MORE INFORMATION.
29. ONE DRILLED HOLE WITH A MAXIMUM DIAMETER OF ¾" IS ALLOWED AT LOCATIONS MARKED WITH A ▲ TO ACCOMMODATE ELECTRICAL WIRING.
30. SEE S-614-42 AND S-614-43 FOR "CABINET FOUNDATION DETAILS" AND "TRAFFIC LOOP AND MISC. SIGNAL DETAILS" RESPECTIVELY.

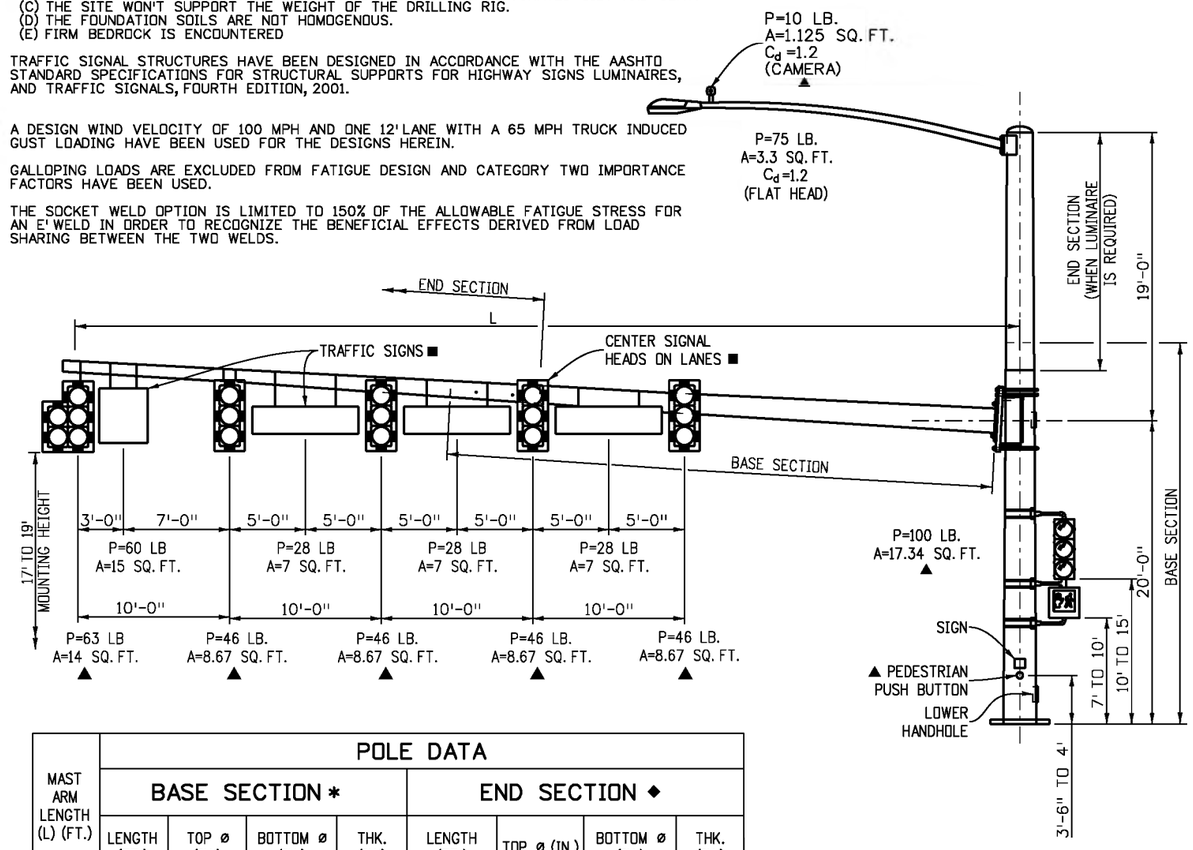
DESIGN DATA

1. DRAWING SHOWN HAS 5 SIGNAL HEADS, SHORTER ARM LENGTHS MAY HAVE FEWER HEADS. THIS CONFIGURATION IS INTENDED TO REPRESENT A WORST CASE LOADING SITUATION.

(55'), 50'	(45'), 40'	(35'), 30'	(25')
5 SIGNAL HEADS	4 SIGNAL HEADS	3 SIGNAL HEADS	2 SIGNAL HEADS

   THE DESIGN LENGTH "L" FOR EACH SERIES IS SHOWN IN PARENTHESIS.

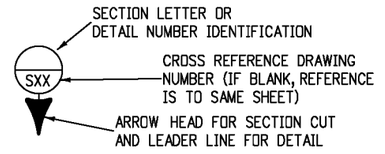
2. THE DESIGNS HEREIN ASSUME THAT SIGNALS ARE INSTALLED WITHIN THE ROADWAY EARTHWORK PRISM WITH THE FOLLOWING SOIL PARAMETERS:
   SOIL DENSITY γ = 110 LB./CU.FT.
   SOIL COHESION = 750 LB./SQ.FT. FOR MEDIUM STIFF COHESIVE SOIL
   SOIL ø ANGLE = 30° FOR MEDIUM DENSE COHESIONLESS SOIL
   SF = 1.25 FOR TORSIONAL RESISTANCE AND 3.0 FOR FLEXURAL RESISTANCE
3. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:
   (A) SIGNALS WILL NOT BE INSTALLED WITHIN THE ROADWAY EARTHWORK PRISM.
   (B) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.
   (C) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG.
   (D) THE FOUNDATION SOILS ARE NOT HOMOGENOUS.
   (E) FIRM BEDROCK IS ENCOUNTERED
4. TRAFFIC SIGNAL STRUCTURES HAVE BEEN DESIGNED IN ACCORDANCE WITH THE AASHTO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS LUMINAIRES, AND TRAFFIC SIGNALS, FOURTH EDITION, 2001.
5. A DESIGN WIND VELOCITY OF 100 MPH AND ONE 12' LANE WITH A 65 MPH TRUCK INDUCED GUST LOADING HAVE BEEN USED FOR THE DESIGNS HEREIN.
6. GALLOPING LOADS ARE EXCLUDED FROM FATIGUE DESIGN AND CATEGORY TWO IMPORTANCE FACTORS HAVE BEEN USED.
7. THE SOCKET WELD OPTION IS LIMITED TO 150% OF THE ALLOWABLE FATIGUE STRESS FOR AN E' WELD IN ORDER TO RECOGNIZE THE BENEFICIAL EFFECTS DERIVED FROM LOAD SHARING BETWEEN THE TWO WELDS.



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

* BASE SECTION LENGTHS INCLUDE THE SPLICE LENGTH AS PER THE "MAST ARM SLIP SPLICE DETAIL" ON SHEET 2 OF 4

◆ SEE GENERAL NOTE 26



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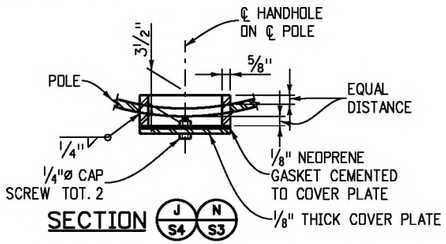
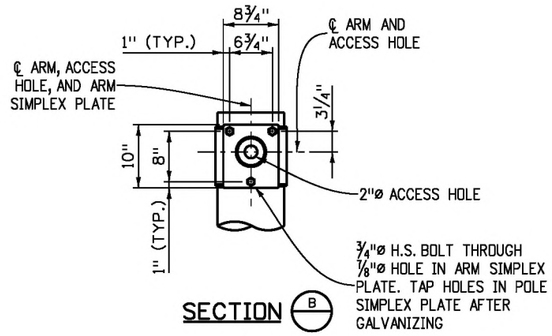
MAST ARM LENGTH (L) (FT.)	MAST ARM DATA								GALLOPING DEFLECTION LIMITS (Δ) (IN) ●
	BASE SECTION ✱				END SECTION ◆				
	LENGTH (FT.)	TIP ø (IN.)	TRUNK ø (IN.)	THK (IN.)	LENGTH (FT.)	TIP ø (IN.)	TRUNK ø (IN.)	THK. (IN.)	
25	23.92	6.65	10.00	0.2391	N.A.	N.A.	N.A.	N.A.	✦
35	33.92	7.50	12.25	0.2391	N.A.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

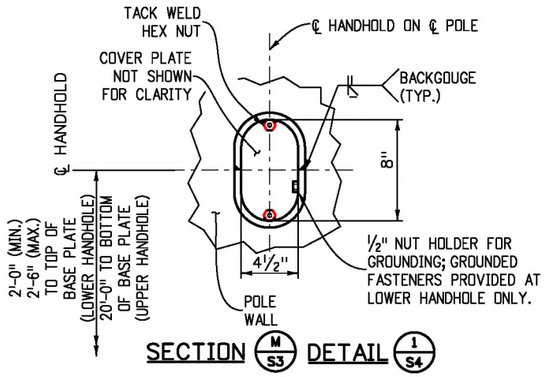
✱ BASE SECTION LENGTH INCLUDES THE SPLICE LENGTH AS PER THE "MAST ARM SLIP SPLICE DETAIL" BELOW.
◆ SEE GENERAL NOTE 26 ON SHEET 1 OF 4.
● SEE GENERAL NOTE 28 ON SHEET 1 OF 4.
✦ DEFLECTION TOO SMALL TO MEASURE.
■ STOP ALL WELDS ½" SHORT OF PLATE EDGES AND BOLT HOLES.



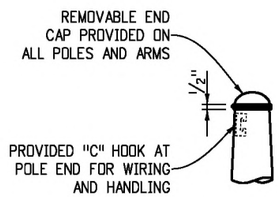
SECTION



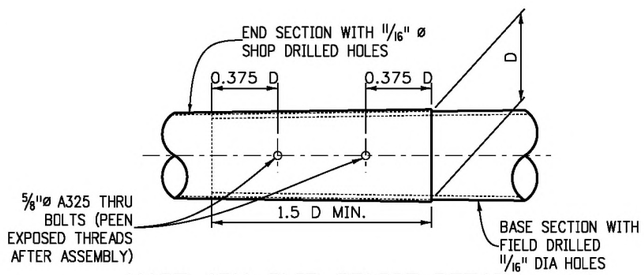
SECTION B



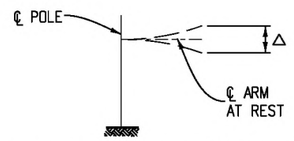
SECTION M S3 DETAIL 1 S4



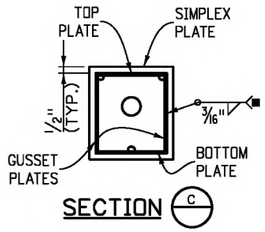
END CAP DETAIL



MAST ARM SLIP SPLICE DETAIL



GALLOPING DEFLECTION LIMITS



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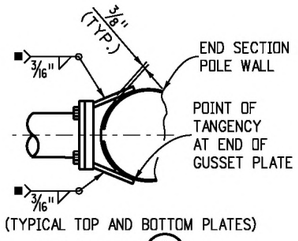
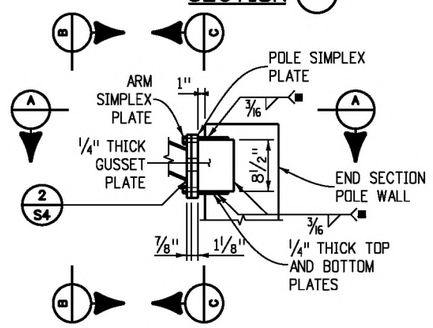
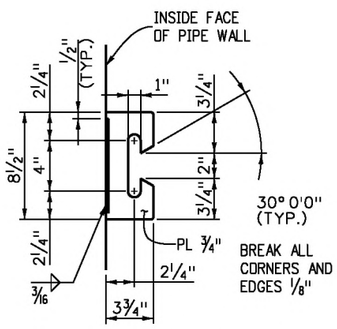


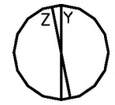
(TYPICAL TOP AND BOTTOM PLATES)
SECTION A



DETAIL 3

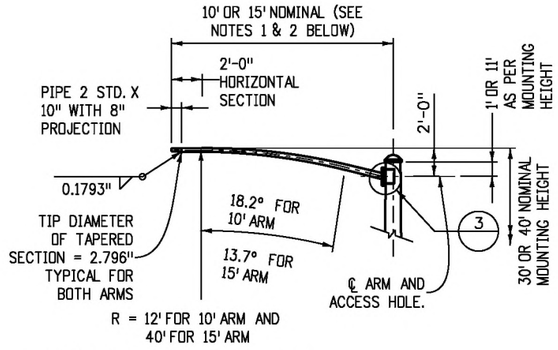


"C" HOOK DETAIL



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

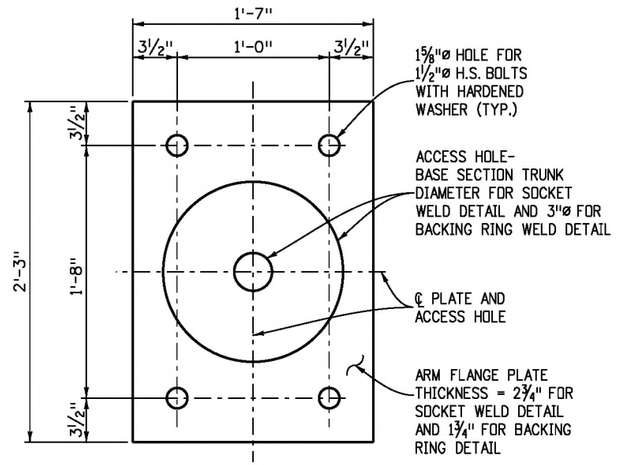
OPTIONAL MULTI-SIDED POLE OR MAST ARM



LUMINAIRE ARM NOTES

1. 10' LUMINAIRE ARM SHAFT: WALL THICKNESS = 0.1793"; LINEAR TAPER = 0.14 IN./FT.; DIAMETER AT ARM SIMPLEX PLATE = 4.066".

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



SECTION D S3

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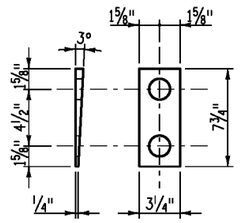
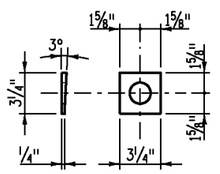
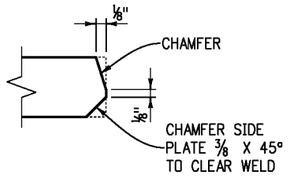
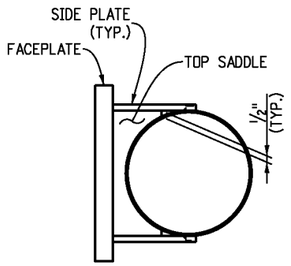
- BEND RADIUS MEASURED TO THE ℄ OF EACH U-BOLT. INCREASE RADII AS NEEDED TO ACCOMODATE OUT-OF-ROUNDNESS, GALVANIZING THICKNESS AND SEAM WELD PROFILES. U-BOLTS SHALL BE TIGHTENED 1/12 TURN (30° ± 5°) PAST SNUG TIGHT; PEEN THREADS AFTER TIGHTENING. U-BOLTS AND FACEPLATE SHALL BE MOUNTED ON BASE SECTION PRIOR TO SHIPMENT.
- ✚ MATCH FIT STOP BAR TO SIDE PLATE USING TACK WELDS TO ENSURE UNIFORM REARING.
- ■ STOP ALL WELDS 1/2" SHORT OF PLATE EDGES AND BOLT HOLES.
- * BEND STOP BAR TO MATCH POLE CURVATURE.







DETAIL 4



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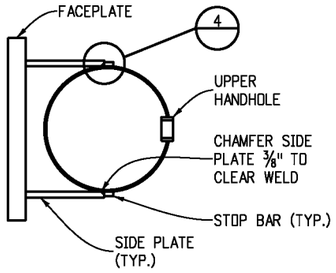

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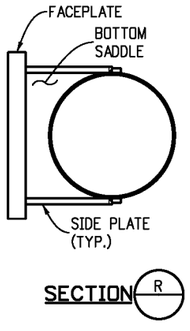

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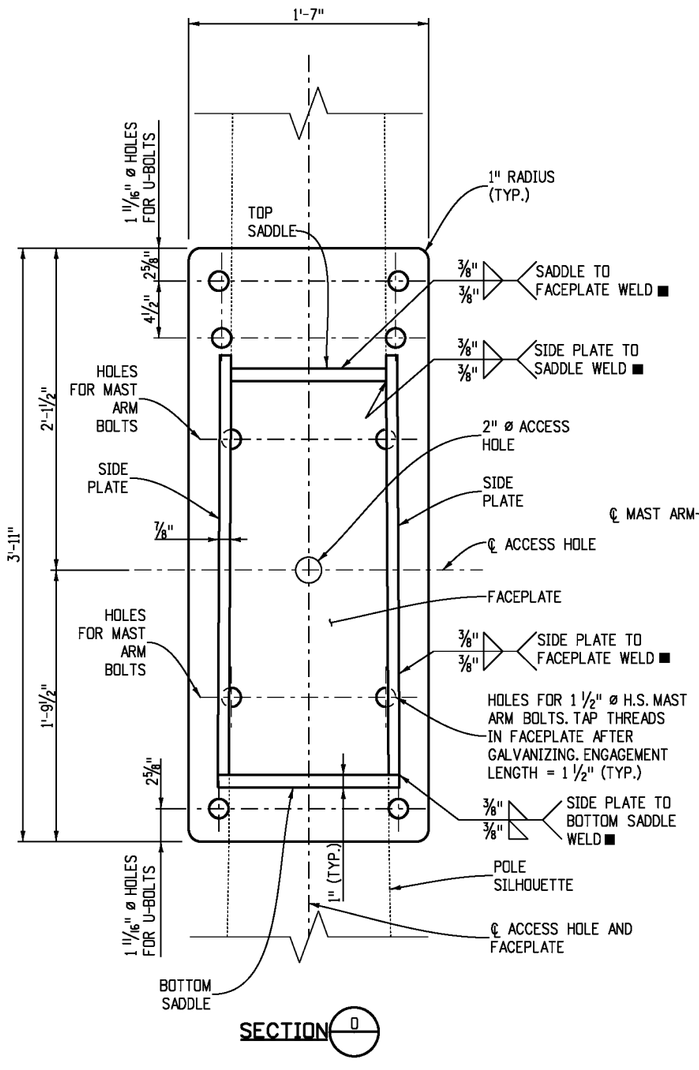
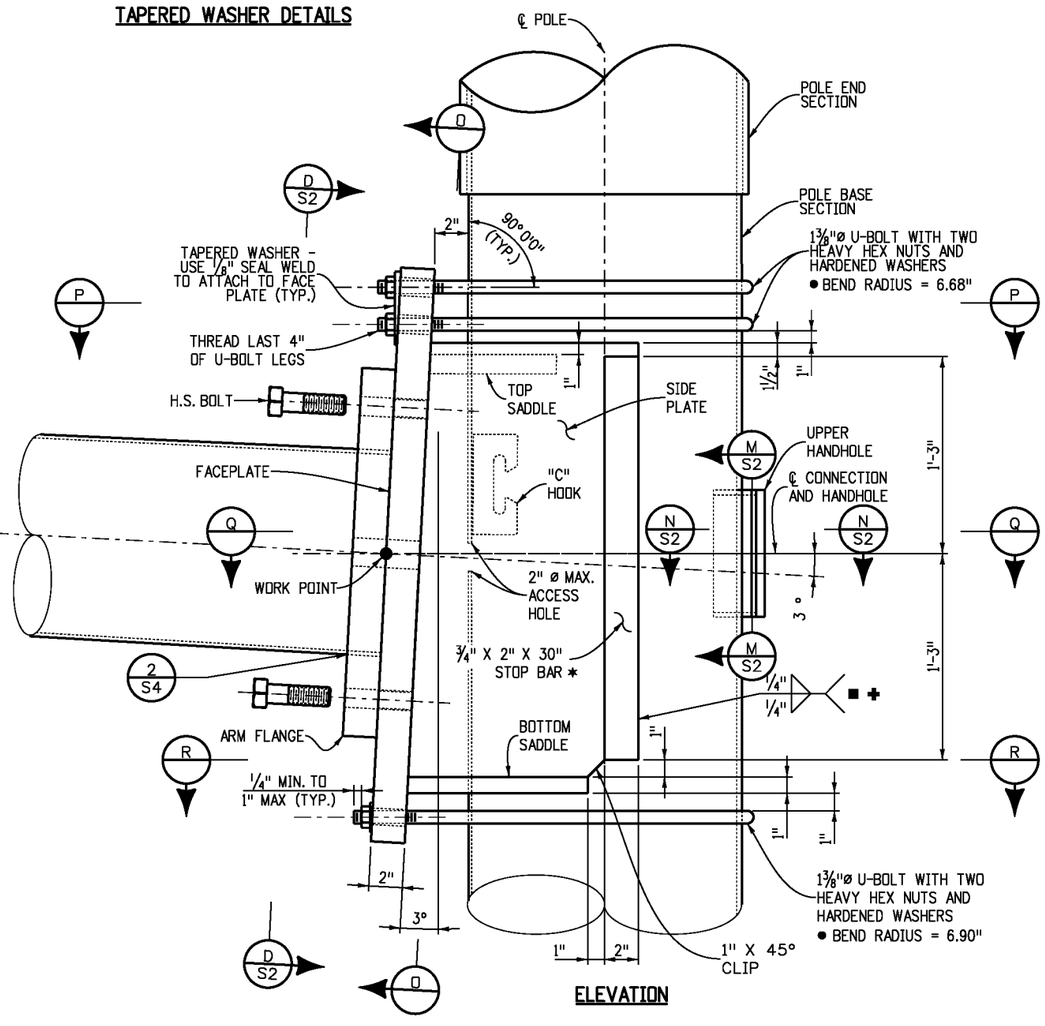


SECTION O

TAPERED WASHER DETAILS



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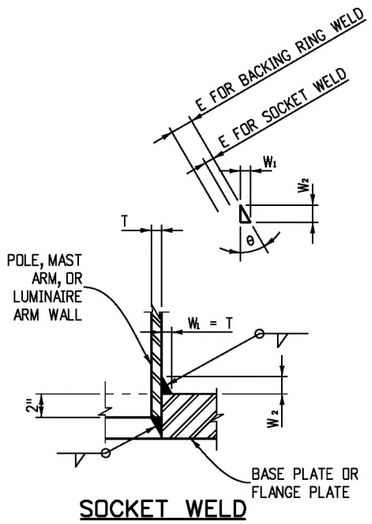
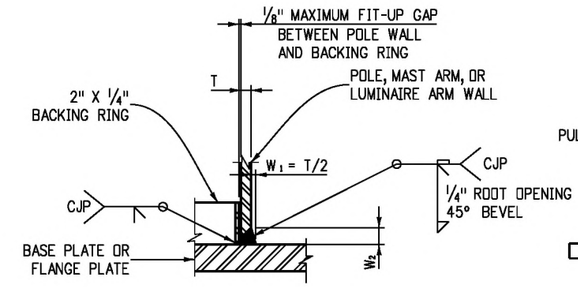
SOCKET WELD DATA					
	ARM LENGTH (FT.)	W_1 (IN.)	W_2 (IN.)	E (IN.)	θ (DEG.)
MAST ARMS	25	0.2391	0.285	0.183	40
	35	0.2391	0.285	0.183	40
	45	0.3125	0.372	0.239	40
	55	0.3125	0.372	0.239	40
POLE	ALL	0.3125	0.372	0.239	40
LUMINAIRE ARMS	ALL	0.1793	0.214	0.138	40

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

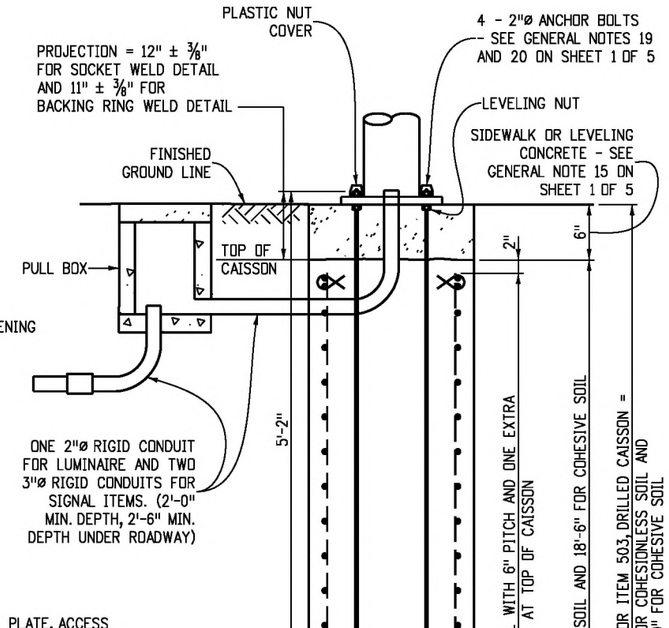


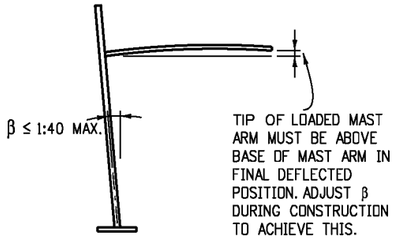
SOCKET WELD



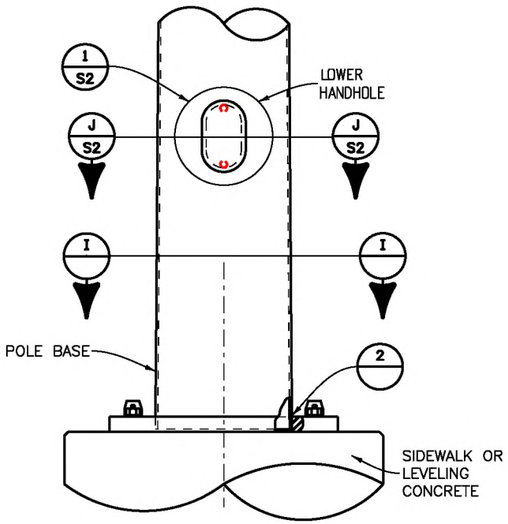
BACKING RING WELD

DETAIL 2 2 S2 2 S3

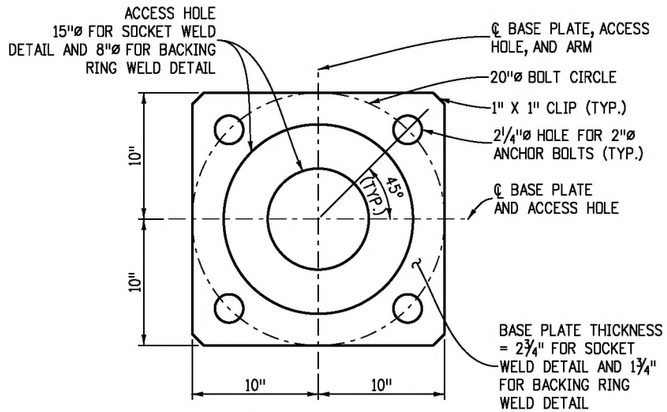




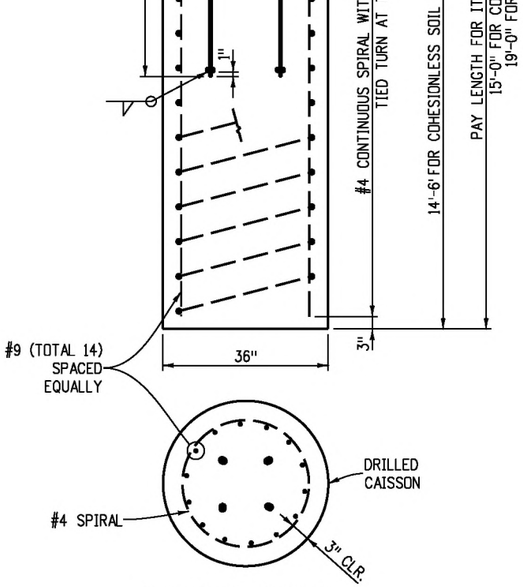
CONSTRUCTION REQUIREMENTS



BASE PLATE DETAIL



SECTION I



TRAFFIC SIGNAL POLE CAISSON

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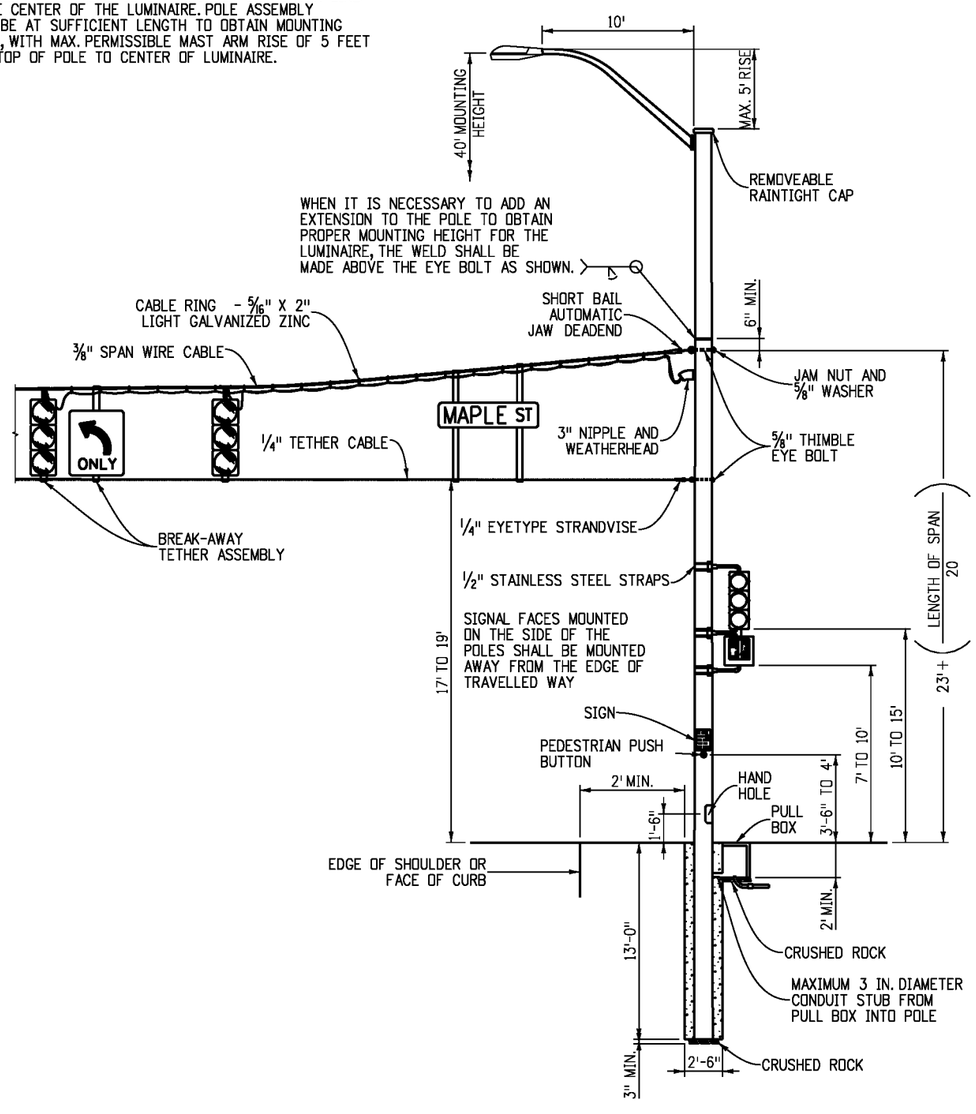
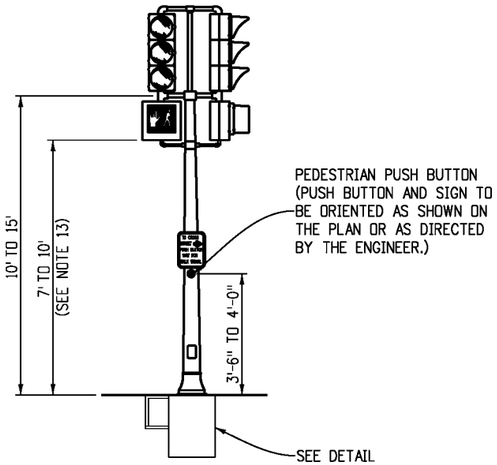
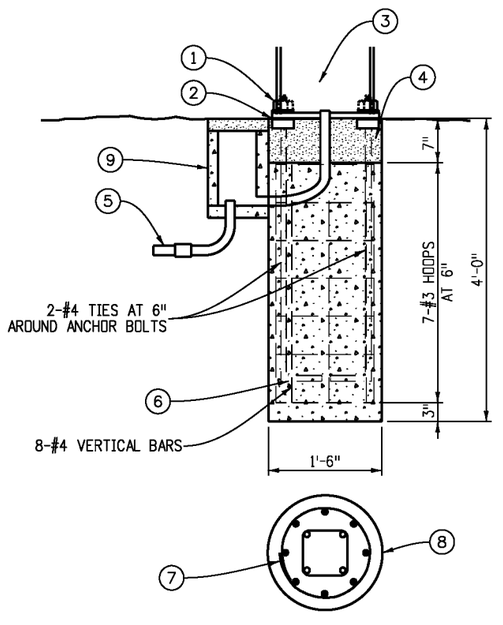
DIMENSIONS ARE AS SHOWN UNLESS OTHERWISE STATED ON THE PLANS. THE 40 FT. MOUNTING HEIGHT IS MEASURED FROM THE EDGE OF SHOULDER OR GUTTER LINE TO THE CENTER OF THE LUMINAIRE. POLE ASSEMBLY SHALL BE AT SUFFICIENT LENGTH TO OBTAIN MOUNTING HEIGHT, WITH MAX. PERMISSIBLE MAST ARM RISE OF 5 FEET FROM TOP OF POLE TO CENTER OF LUMINAIRE.



SPAN WIRE POLE DETAIL



PEDESTAL POLE INSTALLATION



PEDESTAL POLE FOOTING

GENERAL NOTES

1. TRAFFIC SIGNAL POLES AS SHOWN ON THIS SHEET SHALL BE DESIGNED TO MEET THE REQUIREMENTS OUTLINED IN THE "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", PUBLISHED BY AASHTO, FOR A WIND VELOCITY OF 100 MPH. THE CONTRACTOR SHALL SUBMIT TWO SETS OF WORKING DRAWINGS, SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF COLORADO, IN ACCORDANCE WITH SECTION 105.02 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
2. SPAN WIRE POLES SHALL BE FABRICATED OF STEEL WITH A MINIMUM DIAMETER OF 12 IN. A MINIMUM YIELD STRENGTH OF 35 KSI AND A MINIMUM WEIGHT PER LINEAR FOOT OF 49.56 LBS. POLES SHALL BE INSTALLED SO THAT THEY WILL BE PLUMB WHEN DEFLECTED BY THE INSTALLED LOAD.
3. ALL STEEL PEDESTAL POLE MEMBERS SHALL BE HOT DIPPED GALVANIZED INSIDE AND OUTSIDE ACCORDING TO ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM. STEEL SPAN WIRE POLES SHALL BE PAINTED AS DIRECTED.
4. SPAN WIRE SHALL BE STRUNG TAUT SO NO MORE THAN 5% SAG IS ENCOUNTERED WHEN SIGNAL HEADS ARE INSTALLED.
5. THE ITEM TRAFFIC SIGNAL-LIGHT SPAN WIRE POLE SHALL INCLUDE THE EXTENSION OF THE POLE AND THE ARM FOR THE MOUNTING OF THE LUMINAIRE.
6. SIGNAL FACES SUSPENDED OVER ROADWAY SHOULD BE APPROXIMATELY THE SAME LEVEL ABOVE ROADWAY GRADE.
7. MOUNTING HARDWARE FOR EACH TRAFFIC SIGNAL WILL BE FURNISHED BY THE MANUFACTURER, INCLUDING POLE PLATES FOR SIDE POLE MOUNTING.
8. SERVICE ENTRANCE FITTINGS SHALL BE 3 IN. GALVANIZED, THREADED NO. WRG.
9. LUMINAIRE ARMS SHALL BE EQUIPPED WITH A STANDARD 2 IN. SLIPFITTER.
10. PEDESTAL TYPE POLES FOR TOP MOUNTED SIGNAL OR CONTROL CABINET SHALL BE AT LEAST 4 IN. IN DIA. AND SHALL HAVE A FRANGIBLE BASE.
11. ALL POLES, PEDESTALS AND CABINETS SHALL BE PLACED A MINIMUM OF 2 FEET OFF THE ROADWAY MEASURED FROM THE EDGE OF SHOULDER OR FACE OF CURB.
12. CONCRETE SHALL BE AIR ENTRAINED CLASS BZ.
13. USE 7 FOOT POLE ON INSTALLATIONS WITHOUT SIGNAL HEADS. SEAL TOP OF POLE WITH CAST END CAP SECURED IN PLACE WITH 3 SET SCREWS.

FOOTING NOTES

1. HEX NUTS
2. SQUARE NUTS
3. HANDHOLE SHALL BE PROVIDED
4. 4 IN. MIN. NON-SHRINK GROUT OVER ROUGH FOUNDATION
5. RIGID CONDUIT (24 IN. MIN. DEPTH, 30 IN. MIN. DEPTH UNDER ROADWAY) CONDUIT STUB FROM PULL BOX TO POLE SHALL BE 3 IN. DIAMETER
6. INSTALL ANCHOR BOLTS (FURNISHED WITH POLE) PER MANUFACTURER'S TEMPLATE PRINT (FURNISHED WITH ORDER)
7. MINIMUM OVERLAP OF 12 IN.
8. 1-1/2 IN. CLEARANCE FOR HOOPS
9. PULL BOX

CAISSON DESIGNS REQUIRE THAT THE CAISSON BE FOUNDED IN COMPACT SAND, CLAY OR SANDY CLAY. IF, BY VISUAL INSPECTION OF THE HOLE, OTHER MATERIAL IS PRESENT, THE CAISSON DESIGN SHALL BE MODIFIED AS DETERMINED BY THE ENGINEER.

Computer File Information			
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CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English	R=X	

Sheet Revisions	
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PEDESTAL POLE AND TEMPORARY SPAN WIRE SIGNALS

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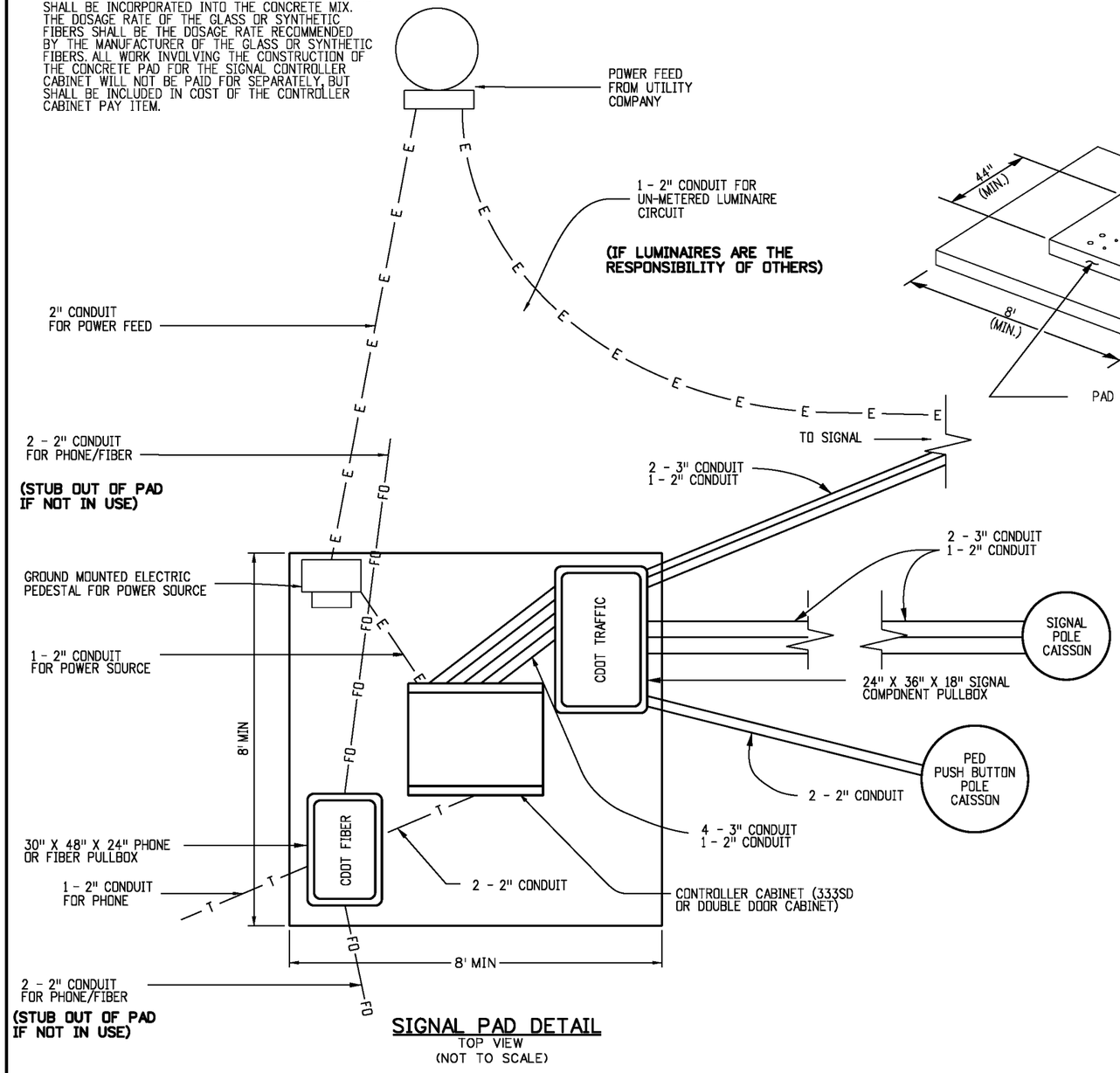
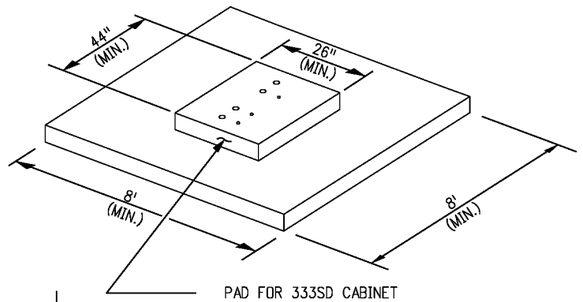
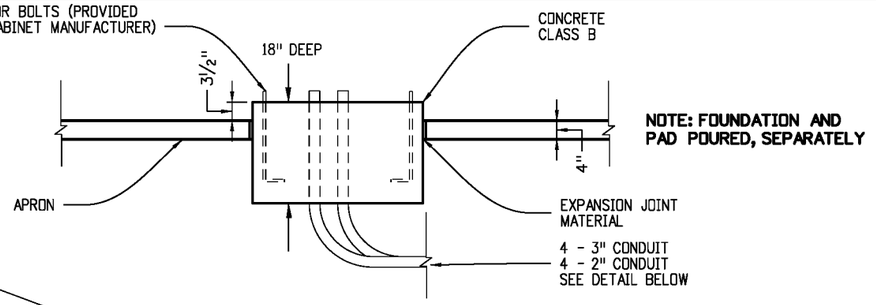
S-614-41
Sheet No. 1 of 1

THE CONCRETE PAD SURROUNDING THE CABINET BASE SHALL BE CLASS B MIX. GLASS OR SYNTHETIC FIBERS SHALL BE INCORPORATED INTO THE CONCRETE MIX. THE DOSAGE RATE OF THE GLASS OR SYNTHETIC FIBERS SHALL BE THE DOSAGE RATE RECOMMENDED BY THE MANUFACTURER OF THE GLASS OR SYNTHETIC FIBERS. ALL WORK INVOLVING THE CONSTRUCTION OF THE CONCRETE PAD FOR THE SIGNAL CONTROLLER CABINET WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN COST OF THE CONTROLLER CABINET PAY ITEM.



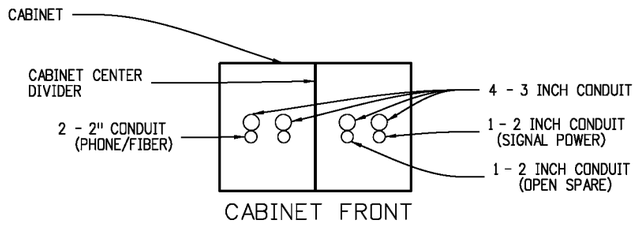
SIGNAL PAD DETAIL
TOP VIEW
(NOT TO SCALE)





NOTE: FOUNDATION AND PAD POURED, SEPARATELY

FOUNDATION CROSS SECTION
(NOT TO SCALE)



CONDUIT DETAIL
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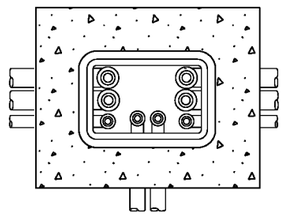
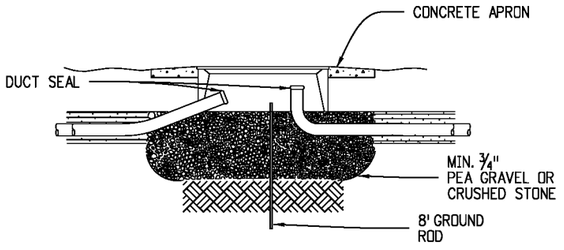


TOP VIEW



CROSS SECTION

PULL BOX DETAIL
(NOT TO SCALE)

NOTES

1. CONDUIT CENTERLINE SHALL BE ALIGNED TO TOP EDGE OF PULL BOX TO FACILITATE CABLE PULLING.
2. BED OF PEA GRAVEL OR CRUSHED STONE SHALL BE INCIDENTAL TO THE PULL BOX.
3. ALL PULL BOXES SHALL HAVE 12-INCH WIDE x 4-INCH DEEP CONC APRONS SLOPED AWAY FROM PULL BOX. THE COST OF APRON IS INCIDENTAL TO THE COST OF THE PULL BOX.
4. PULL BOXES SHALL BE GROUNDED WITH AN 8 FOOT GROUND ROD.
5. THE PULL BOX SHALL HAVE A DETACHABLE COVER WITH "CDOT TRAFFIC", "CDOT FIBER", or "CDOT COMM" PHYSICALLY IMPRESSED ON ITS TOP.

CAST-IN-PLACE FOUNDATION

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12	Initials: KEN	Date:	Comments
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CABINET FOUNDATION DETAIL

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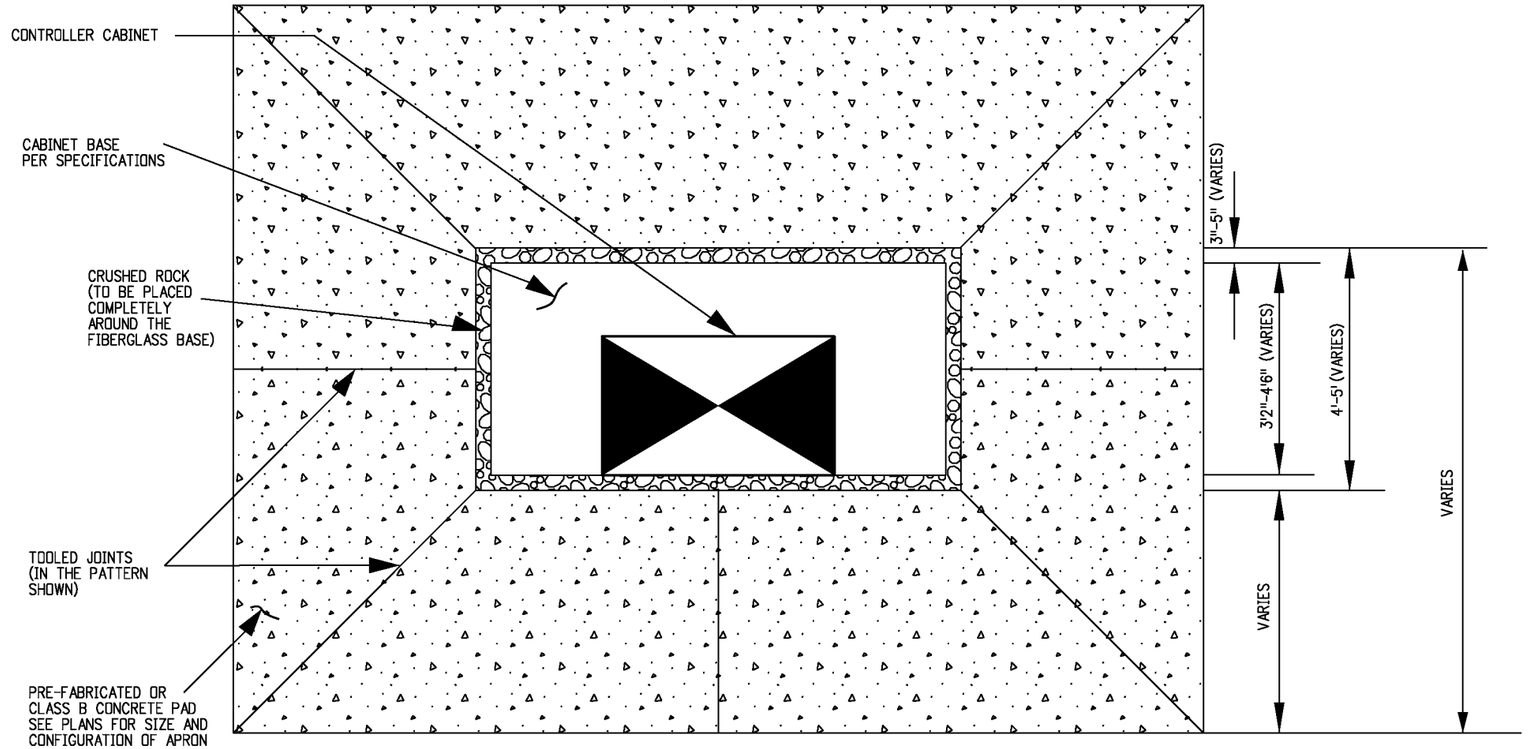
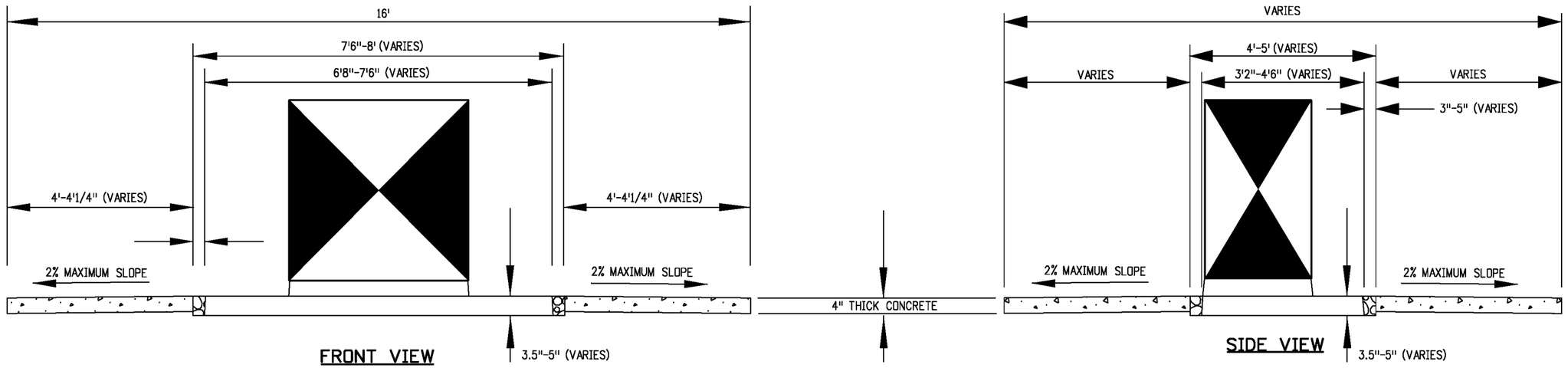
STANDARD PLAN NO.
S-614-42
Sheet No. 1 of 4



TOP VIEW



FRONT VIEW

SIDE VIEW

CONCRETE PAD NOTES

1. CONTRACTOR SHALL INSTALL PRE-FABRICATED OR CAST-IN-PLACE, FIBERGLASS CONCRETE PAD. SEE SPECIFICATION FOR MORE INFORMATION ON THE CONCRETE MATERIAL.
2. CONTRACTOR SHALL PLACE A 4-INCH THICH CONCRETE PAD (CAST-IN-PLACE OR PRE-FABRICATED), AS INDICATED IN THE PLANS, OR AS DIRECTED BY THE ENGINEER. THE CONCRETE PAD SHALL SLOPE AWAY FROM THE FIBERGLASS BASE AT A MAXIMUM 2% SLOPE.
3. THE CONCRETE PAD SURROUNDING THE CABINET BASE SHALL BE CLASS B MIX. GLASS OR SYNTHETIC FIBERS SHALL BE INCORPORATED INTO THE CONCRETE MIX. THE DOSAGE RATE OF THE GLASS OR SYNTHETIC FIBERS SHALL BE THE DOSAGE RATE RECOMMENDED BY THE MANUFACTURER OF THE GLASS OR SYNTHETIC FIBERS. ALL WORK INVOLVING THE CONSTRUCTION OF THE CONCRETE PAD FOR THE SIGNAL CONTROLLER CABINET WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE CONTROLLER CABINET PAY ITEM.
4. FIBERGLASS BASE DIMENSIONS SHOWN VARY PER MANUFACTURER'S SPECIFICATIONS.
5. PRE-FABRICATED CONCRETE BASE DIMENSIONS SHOWN VARY PER MANUFACTURER'S SPECIFICATIONS.
6. PRE-FABRICATED CONCRETE BASE MANUFACTURER SHALL PROVIDE CONNECTION POINTS IN THE BASE FOR THE SPECIFIC CONTROLLER CABINET SPECIFIED IN THE PLANS.

PRE-FABRICATED FIBERGLASS FOUNDATION

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CABINET FOUNDATION DETAIL

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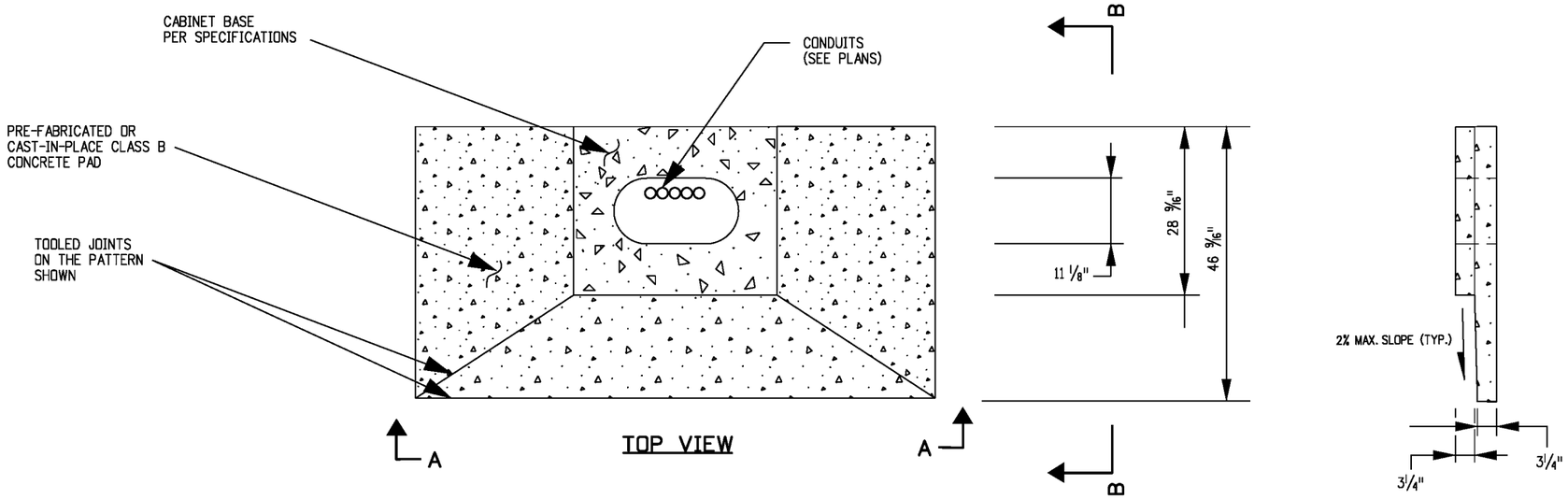
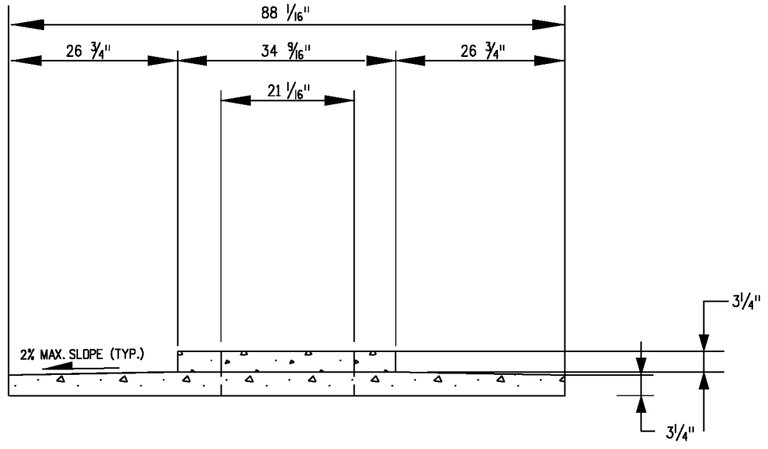
S-614-42
Sheet No. 2 of 4



TOP VIEW

SECTION B-B



SECTION A-A

CONCRETE PAD NOTES

1. CONTRACTOR SHALL INSTALL PRE-FABRICATED OR CAST-IN-PLACE CONCRETE PAD. SEE SPECIFICATION FOR MORE INFORMATION ON THE CONCRETE MATERIAL.
2. CONTRACTOR SHALL PLACE A 3¼-INCH THICK CONCRETE PAD (CAST-IN-PLACE OR PRE-FABRICATED), AS INDICATED IN THE DETAILS, OR AS DIRECTED BY THE ENGINEER. THE CONCRETE PAD SHALL SLOPE AWAY FROM THE FIBERGLASS BASE AT A MAXIMUM 2% SLOPE.
3. THE CONCRETE PAD SURROUNDING THE PRE-FABRICATED OR CAST-IN-PLACE BASE SHALL BE CLASS B MIX. GLASS OR SYNTHETIC FIBERS SHALL BE INCORPORATED INTO THE CONCRETE MIX. THE DOSAGE RATE OF THE GLASS OR SYNTHETIC FIBERS SHALL BE THE DOSAGE RATE RECOMMENDED BY THE MANUFACTURER OF THE GLASS OR SYNTHETIC FIBERS. ALL WORK INVOLVING THE CONSTRUCTION OF THE CONCRETE PAD FOR THE SIGNAL CONTROLLER CABINET WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE CONTROLLER CABINET PAY ITEM.
4. FOUNDATIONS SHALL BE LOCATED TO PROVIDE 34-INCH MINIMUM CLEARANCE BETWEEN FACE-OF-CURB AND ANY PORTION OF THE CONTROLLER CABINET.
5. IN UNPAVED AREAS, THE TOP FOUNDATION FOR MODELS 332 - 334 CONTROLLER CABINETS SHALL BE THREE (3) INCHES ABOVE SURROUNDING GRADE.
6. FIBERGLASS BASE DIMENSIONS SHOWN VARY PER MANUFACTURER'S SPECIFICATIONS.

FOUNDATION DETAILS

FOR MODEL 332 THROUGH 334 CONTROLLER CABINETS

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CABINET FOUNDATION DETAIL

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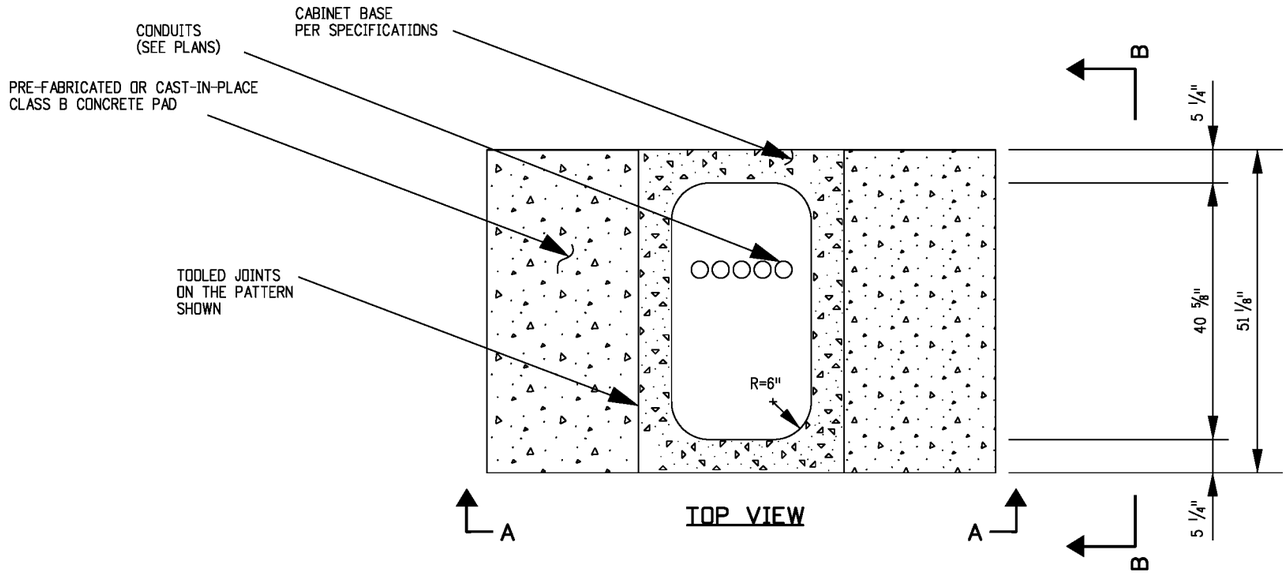
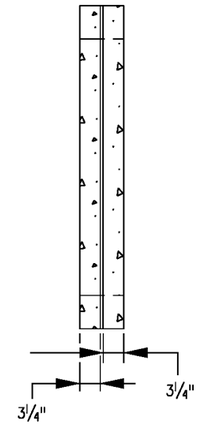
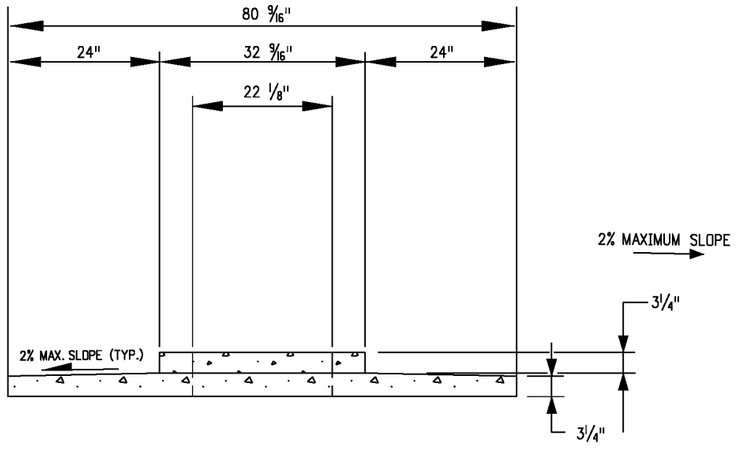


TOP VIEW



SECTION B-B



SECTION A-A

FOUNDATION DETAILS
FOR MODEL 332D - 333JP CABINETS

CONCRETE PAD NOTES

1. CONTRACTOR SHALL INSTALL PRE-FABRICATED OR CAST-IN-PLACE CONCRETE PAD. SEE SPECIFICATION FOR MORE INFORMATION ON THE CONCRETE MATERIAL.
2. CONCRETE SHALL PLACE A 3¼-INCH THICK CONCRETE PAD (CAST-IN-PLACE OR PRE-FABRICATED), AS INDICATED IN THE DETAILS, OR AS DIRECTED BY THE ENGINEER. THE CONCRETE PAD SHALL SLOPE AWAY FROM THE FIBERGLASS BASE AT A MAXIMUM 2% SLOPE.
3. THE CONCRETE PAD SURROUNDING THE PRE-FABRICATED OR CAST-IN-PLACE BASE SHALL BE CLASS B MIX. GLASS OR SYNTHETIC FIBERS SHALL BE INCORPORATED INTO THE CONCRETE MIX. THE DOSAGE RATE OF THE GLASS OR SYNTHETIC FIBERS SHALL BE THE DOSAGE RATE RECOMMENDED BY THE MANUFACTURER OF THE GLASS OR SYNTHETIC FIBERS. ALL WORK INVOLVING THE CONSTRUCTION OF THE CONCRETE PAD FOR THE SIGNAL CONTROLLER CABINET WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE CONTRLLER CABINET PAY ITEM.
4. FOUNDATIONS SHALL BE LOCATED TO PROVIDE 34-INCH MINIMUM CLEARANCE BETWEEN FACE-OF-CURB AND ANY PORTION OF THE CONTROLLER CABINET.
5. IN UNPAVED AREAS, THE TOP FOUNDATION FOR MODELS 332D AND 333JP CONTROLLER CABINETS SHALL BE THREE (3) INCHES ABOVE SURROUNDING GRADE.
6. FIBERGLASS BASE DIMENSIONS SHOWN VARY PER MANUFACTURER'S SPECIFICATIONS.

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CABINET FOUNDATION DETAIL

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STANDARD PLAN NO.
S-614-42
Sheet No. 4 of 4

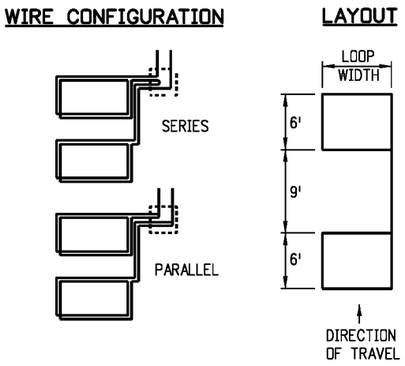
STANDARD LOOP - WIRING AND CONNECTION TABLE

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

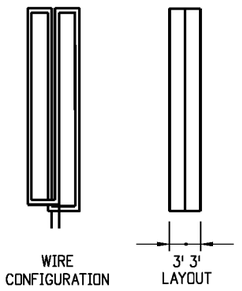
TURNS PER LOOP AND TYPE CONNECTION
(S = SERIES, P = PARALLEL)

LOOP INSTALLATION PROCEDURE

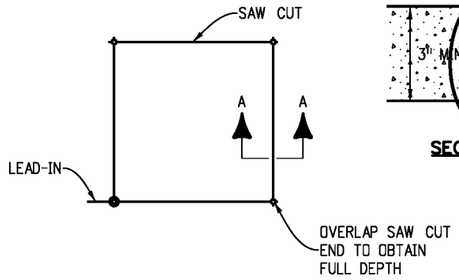
1. CUT SLOTS IN PAVEMENT TO 3 IN. MINIMUM DEPTH.
2. CLEAN AND DRY SLOTS WITH OIL-FREE COMPRESSED AIR.
3. ONE CONTINUOUS LENGTH OF 14/IC, RHW, USE, XLPE, RHWN OR THWN WIRE SHALL BE USED FOR EACH LOOP FROM SIGNAL BASE OR PULL BOX AROUND THE LOOP WITH THE NUMBER OF TURNS SPECIFIED AND BACK TO THE SIGNAL BASE OR PULL BOX. LOOP WIRE SHALL BE DUCT TYPE.
4. USE A BLUNT, NON-METALLIC INSTRUMENT TO PUSH WIRE INTO SLOT. DO NOT COIL LEADS.
5. CONNECT DETECTOR AND TEST LOOP.
6. SEAL SLOTS AS SPECIFIED.

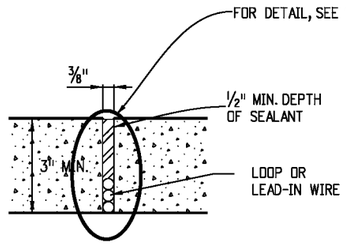


STANDARD LOOP



DUAL LOOP

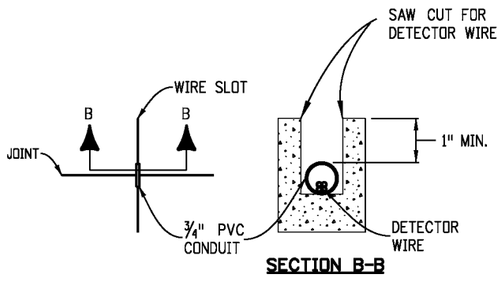




SECTION A-A

VEHICLE DETECTOR LOOP SAW CUT DETAILS

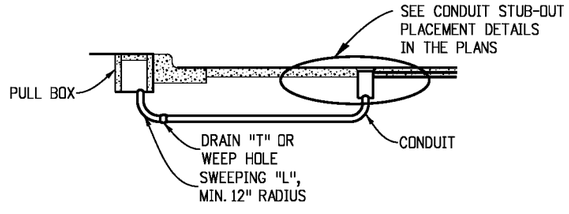
(FOR USE WITH VINYL TUBING ENCASED LOOP DETECTOR WIRE)



SECTION B-B

DETECTOR WIRE ACROSS BRIDGE JOINTS

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



LOOP DETECTOR LEAD-IN

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TRAFFIC LOOP AND MISCELLANEOUS SIGNAL DETAILS

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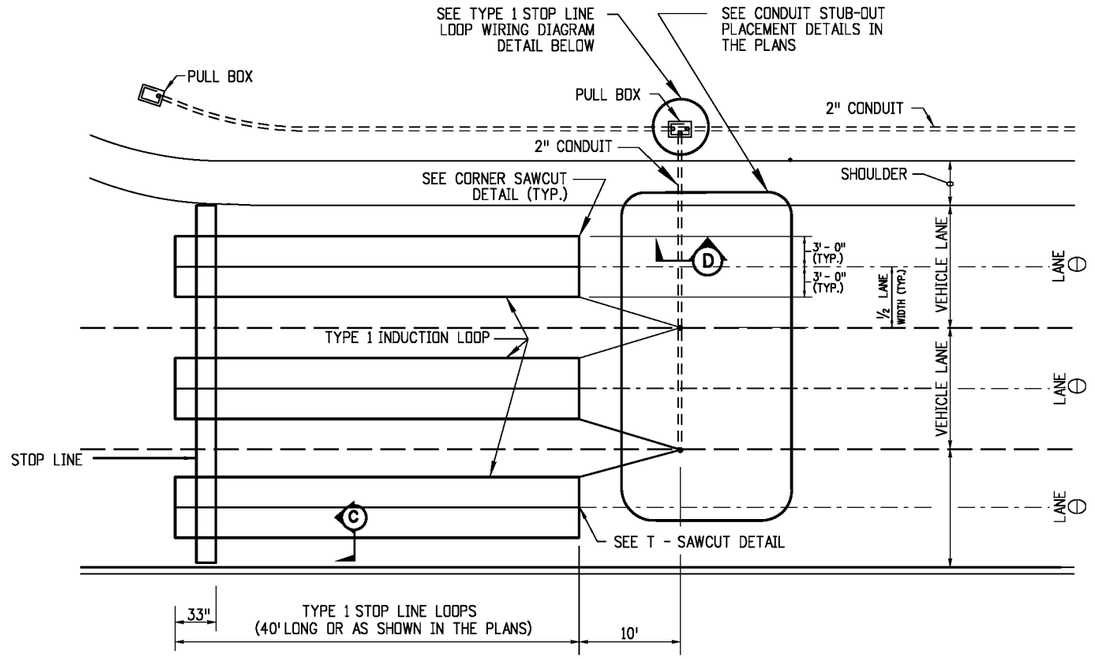
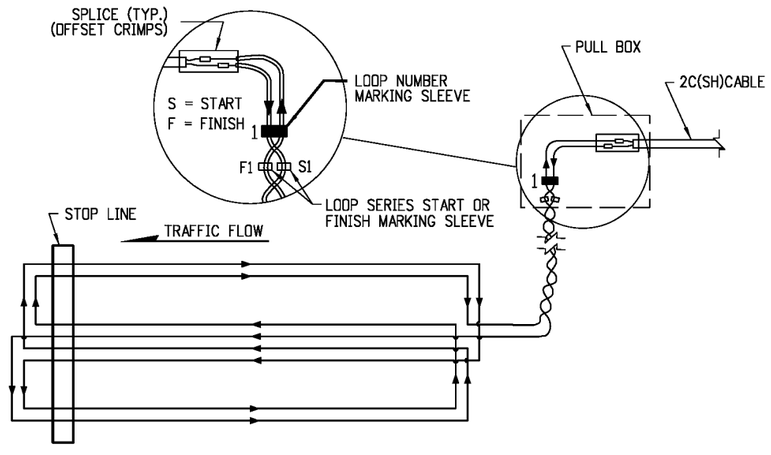
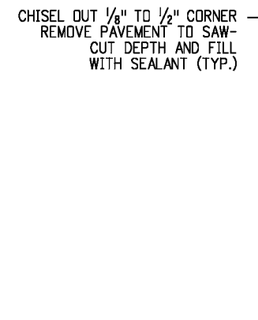
STANDARD PLAN NO.
S-614-43
Sheet No. 1 of 10



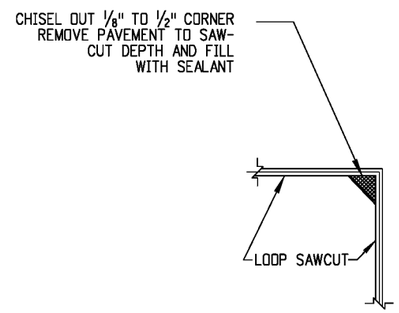
TYPE 1 STOP LINE LOOPS - PLAN VIEW



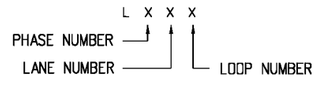
TYPE 1 STOP LINE LOOP WIRING DIAGRAM



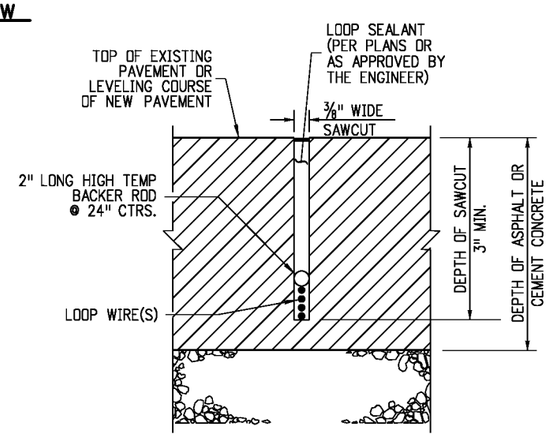
T - SAWCUT DETAIL



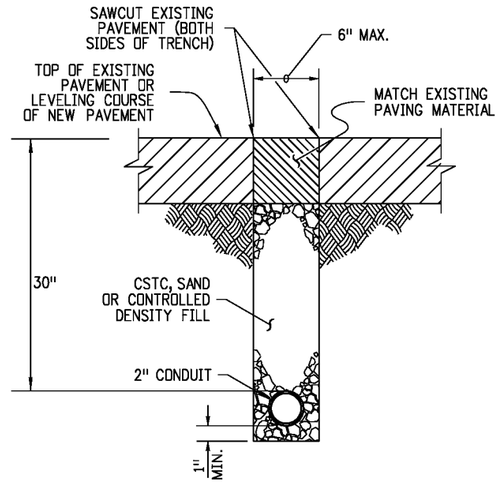
CORNER SAWCUT DETAIL



LOOP NUMBER MARKING DETAIL



SECTION C-C



SECTION D-D

TYPE 1 INDUCTION LOOP

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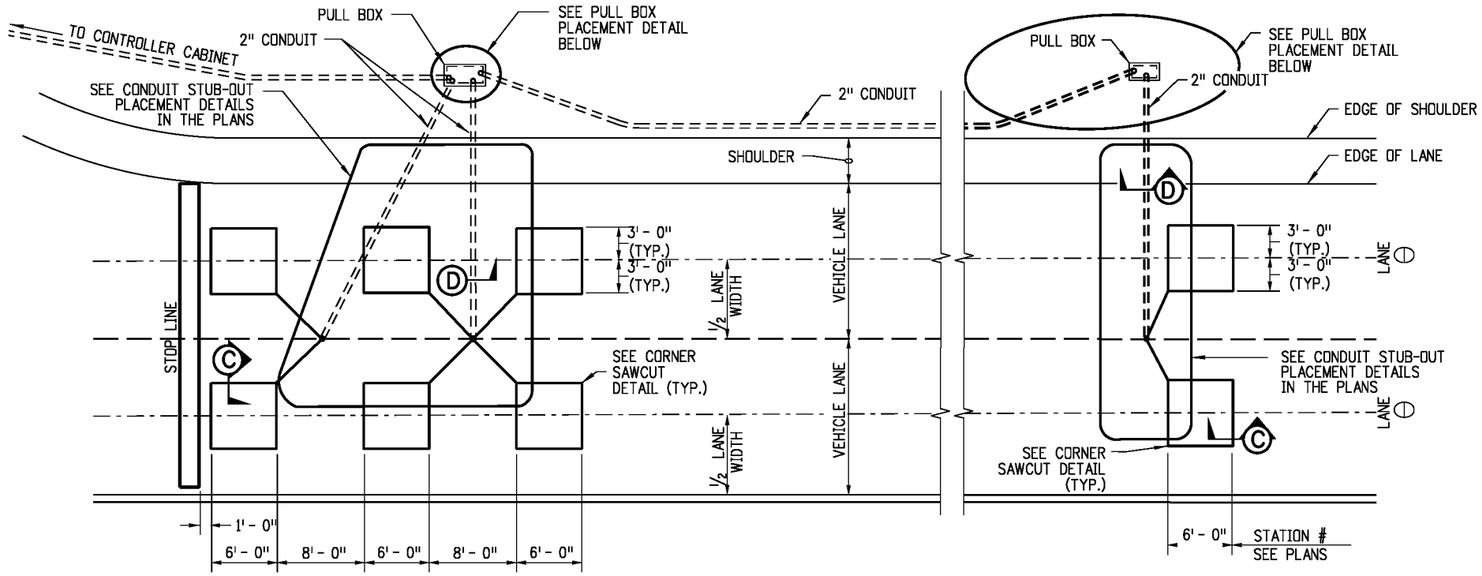
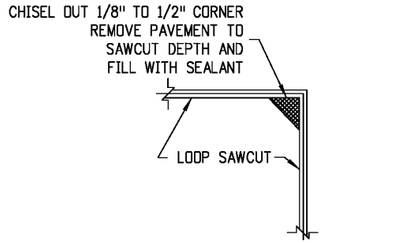


TYPE 2 STOP LINE LOOPS

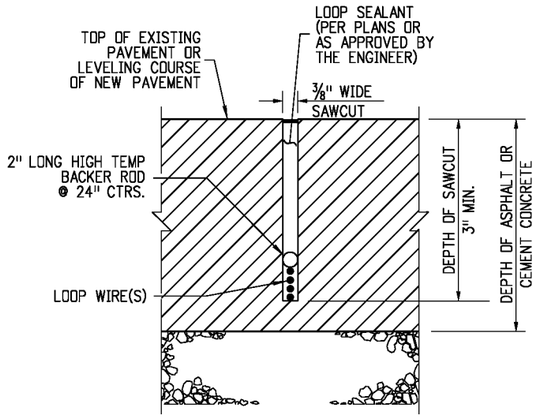
TYPE 2 ADVANCE LOOPS



CORNER SAWCUT DETAIL

NOTE

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



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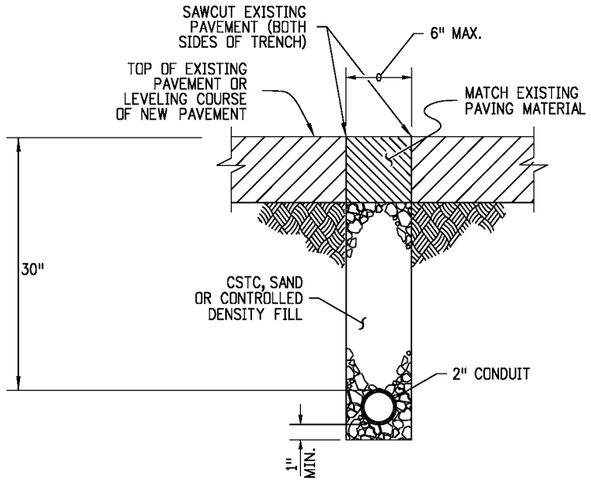
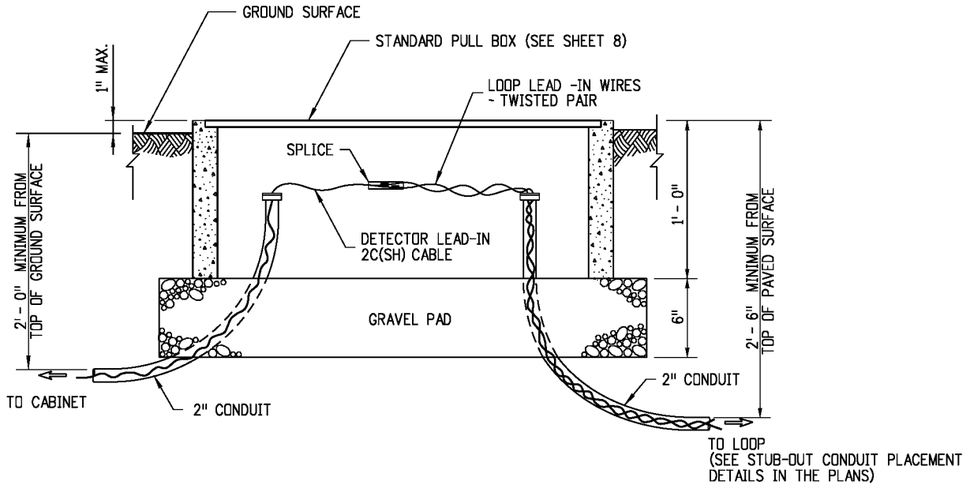


SECTION D-D



PULL BOX PLACEMENT DETAIL

TYPE 2 INDUCTION LOOPS (FOR CONVENTIONAL HIGHWAYS)

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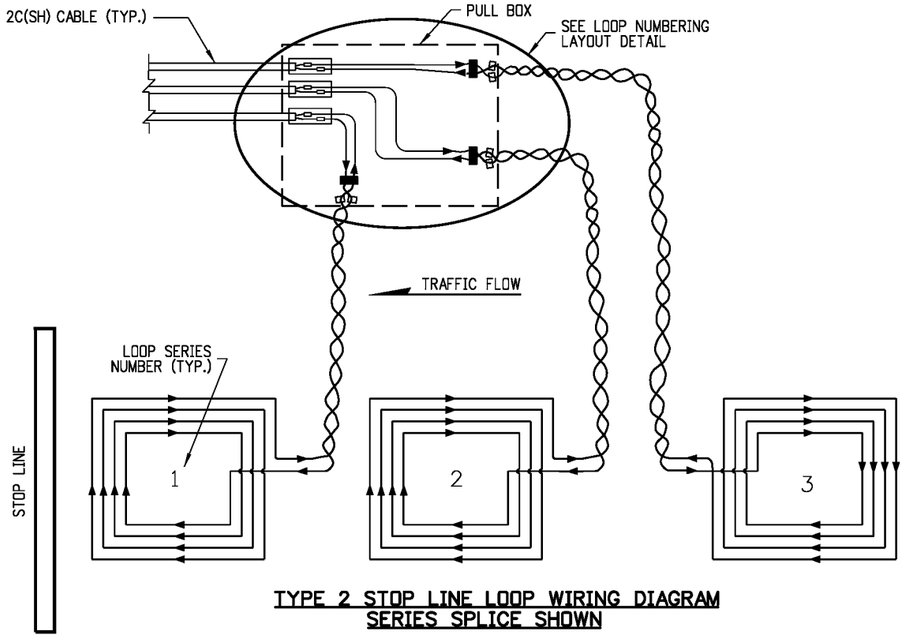
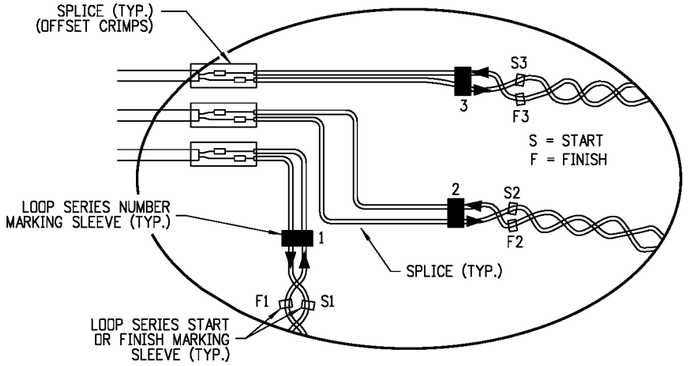
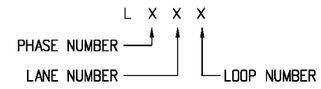


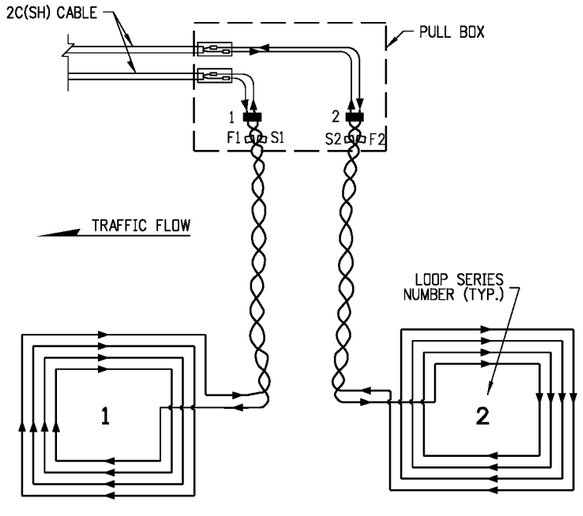
TYPE 2 STOP LINE LOOP WIRING DIAGRAM
SERIES SPLICE SHOWN



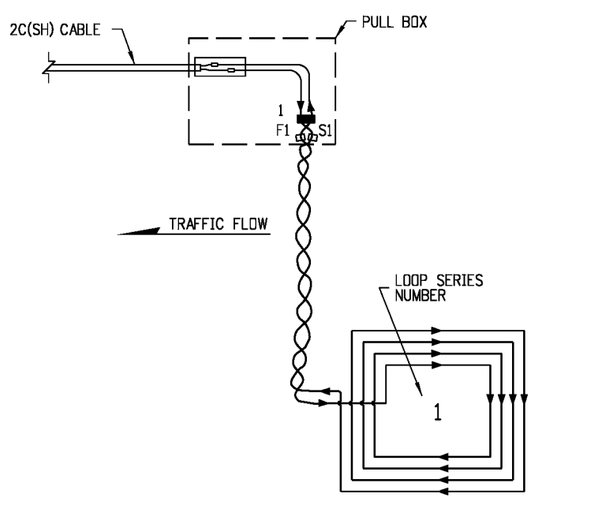
LOOP NUMBERING LAYOUT DETAIL



LOOP NUMBER MARKING DETAIL



TYPE 2 SAMPLING LOOP WIRING DIAGRAM
SERIES SPLICE SHOWN



TYPE 2 ADVANCE LOOP WIRING DIAGRAM

NOTE

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

TYPE 2 INDUCTION LOOP

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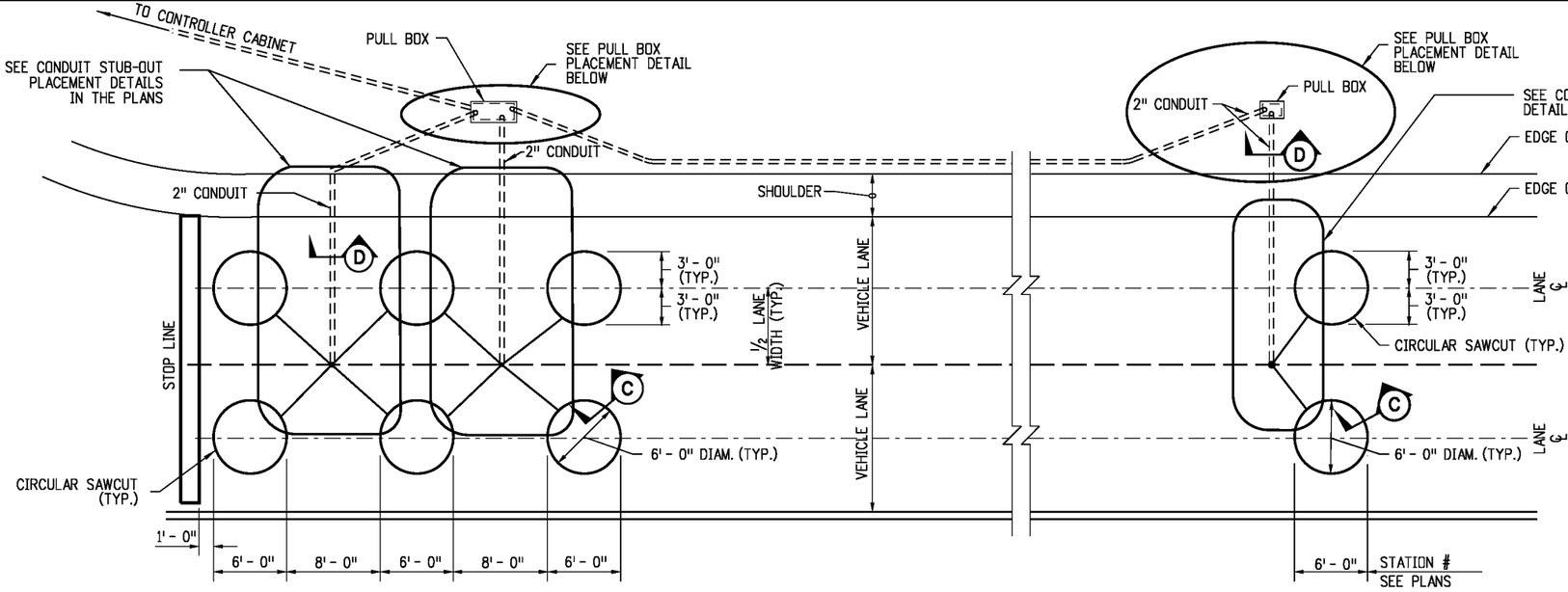
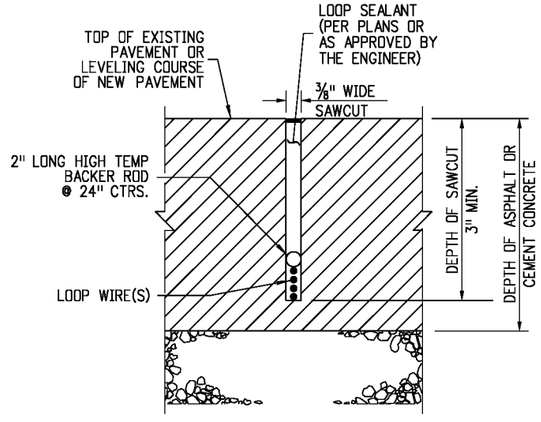
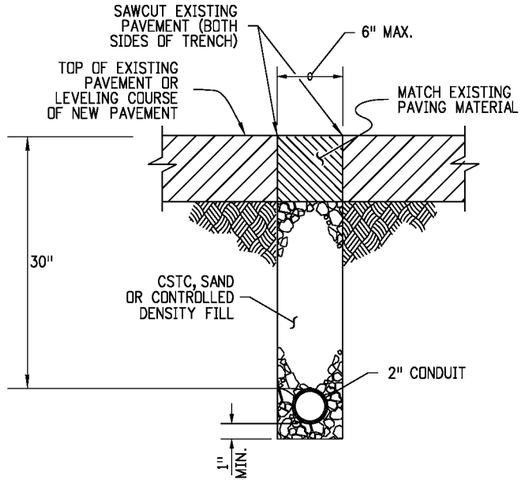


NOTES

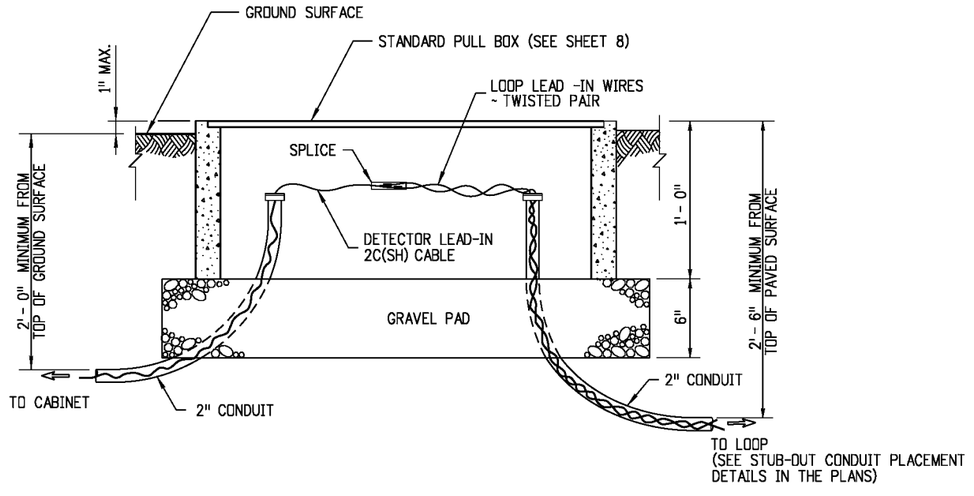
1. ALL OF THE LOOP LEAD-IN WIRES SHALL RETURN TO THE PULL BOX.
2. FOR LOOP NUMBERING LAYOUT DETAILS, SEE SHEET 7.



SECTION C-C



SECTION D-D



PULL BOX PLACEMENT

TYPE 3 INDUCTION LOOP (FOR CONVENTIONAL HIGHWAYS)

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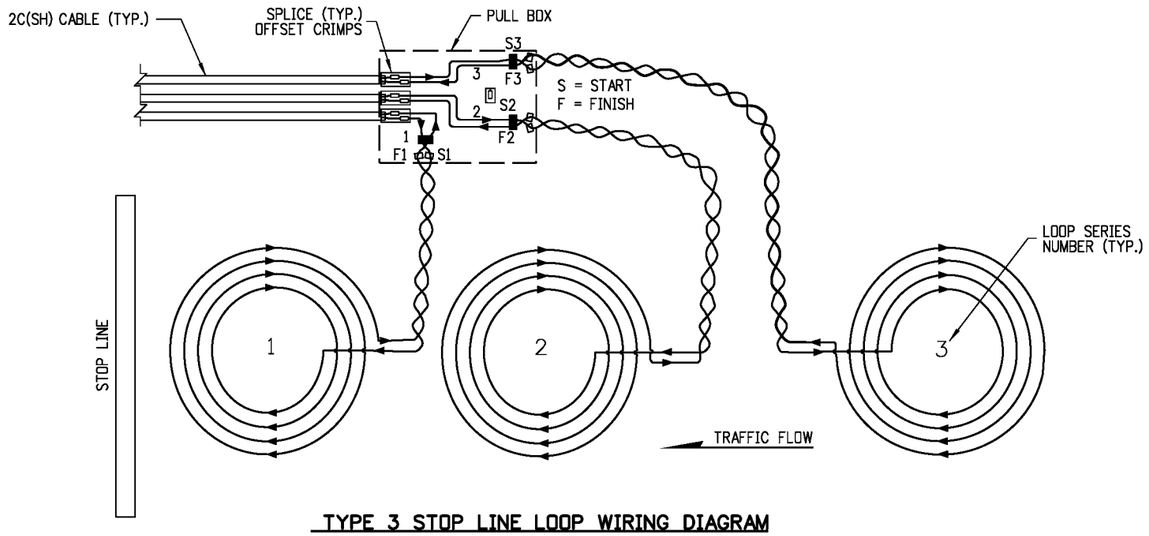
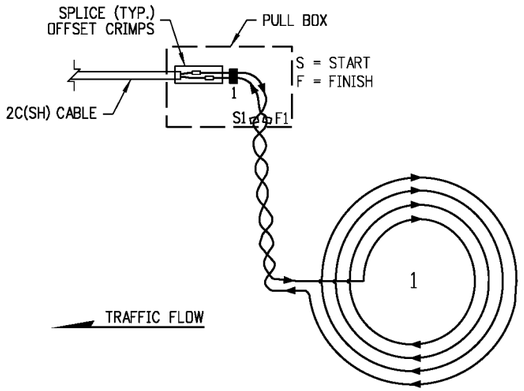
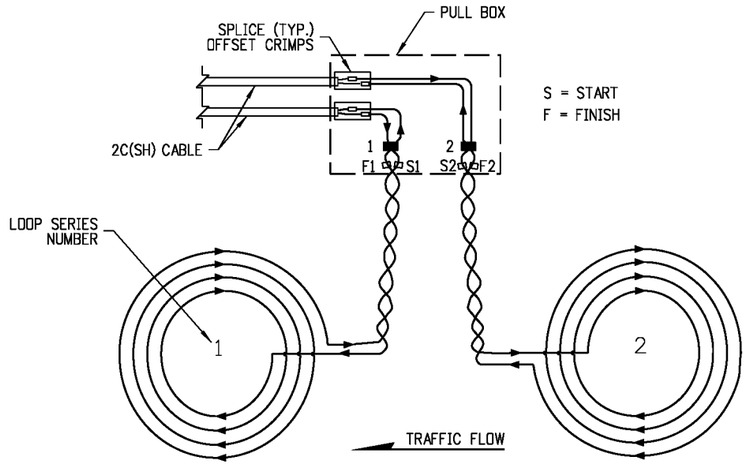


TYPE 3 STOP LINE LOOP WIRING DIAGRAM

SERIES SPLICE SHOWN

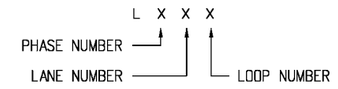


TYPE 3 ADVANCE LOOP WIRING DIAGRAM



TYPE 3 SAMPLING LOOP WIRING DIAGRAM

SERIES SPLICE SHOWN



LOOP NUMBER MARKING DETAIL

NOTES

1. LOOP NUMBERING LAYOUT WILL BE SIMILAR TO LOOP NUMBERING LAYOUT DETAIL. SEE SHEET 7
2. FOR WIRING AND CONDUIT LAYOUT, SEE CONDUIT STUB-OUT PLACEMENT DETAIL IN THE PLANS.

TYPE 3 INDUCTION LOOP

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Last Modification Date: 07/04/12	Initials:	R-X		
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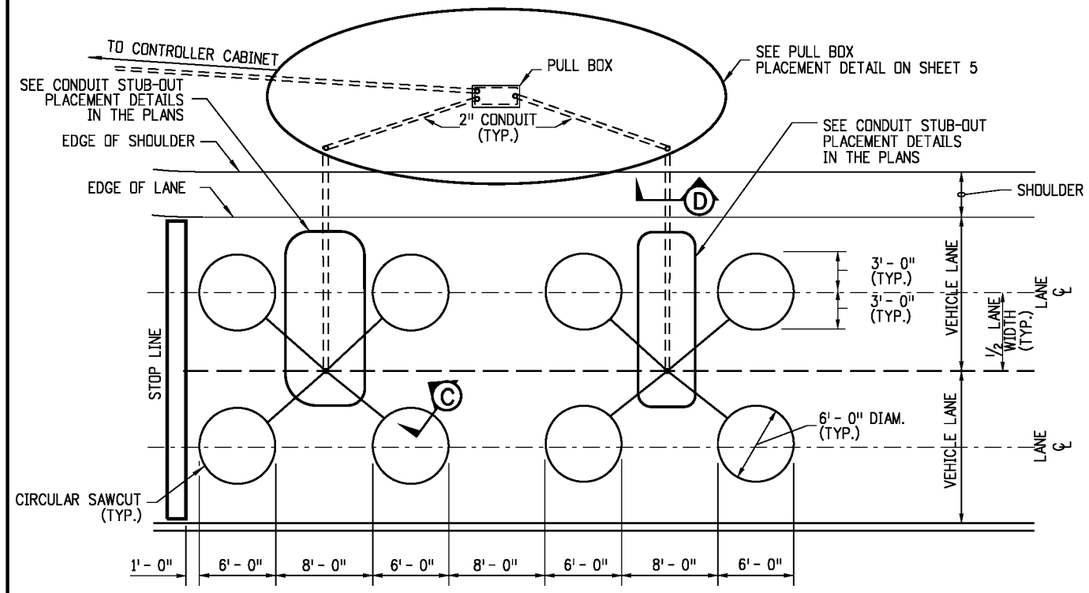
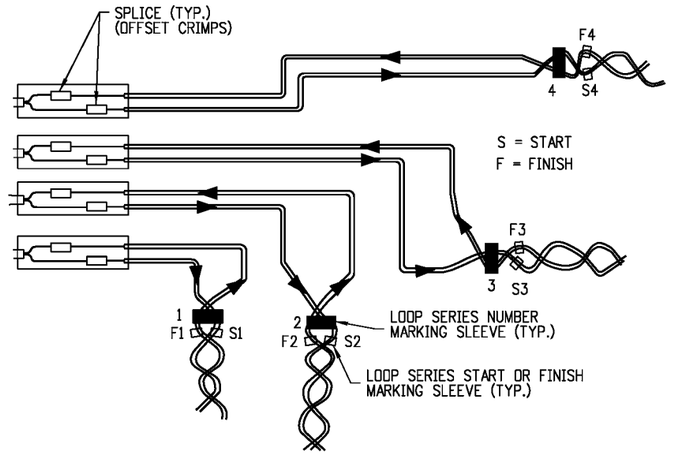
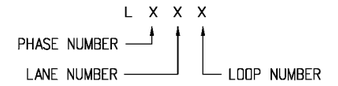


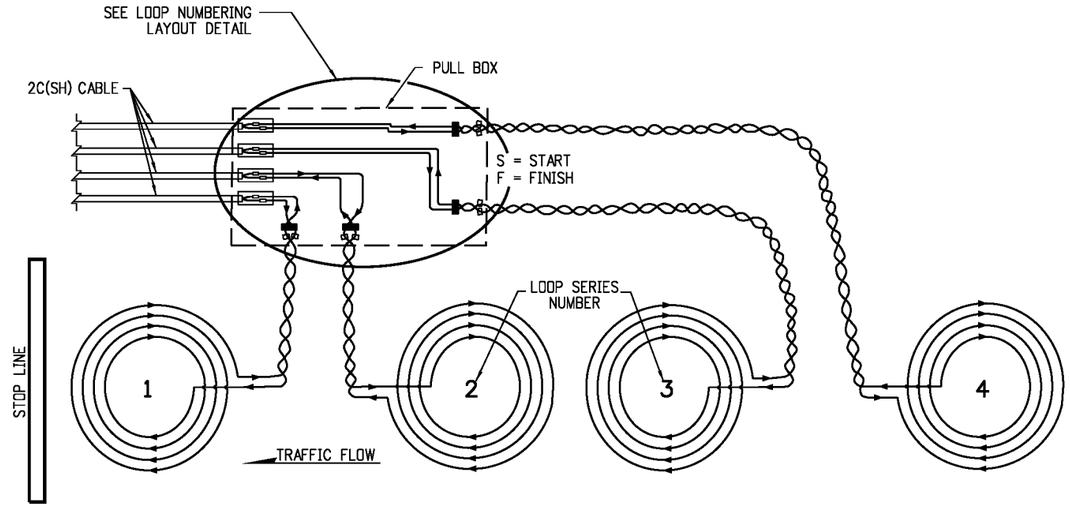
TYPE 3A STOP LINE LOOPS - PLAN VIEW



LOOP NUMBERING LAYOUT DETAIL

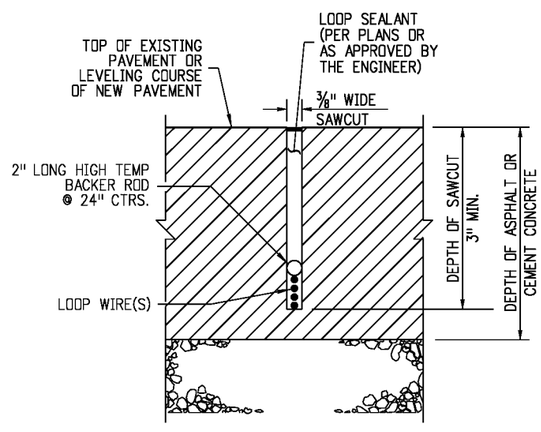


LOOP NUMBER MARKING DETAIL

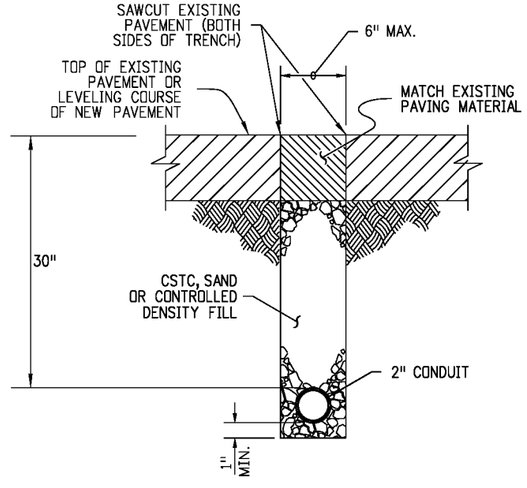


TYPE 3A STOP LINE LOOP WIRING DIAGRAM

SERIES SPLICE SHOWN



SECTION C-C



SECTION D-D

TYPE 3 INDUCTION LOOP

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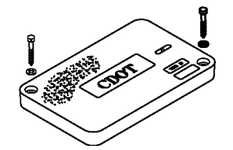

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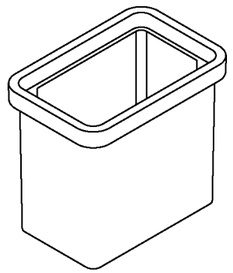

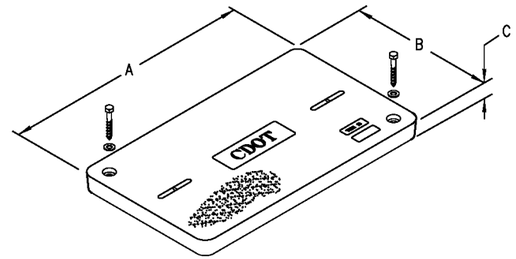

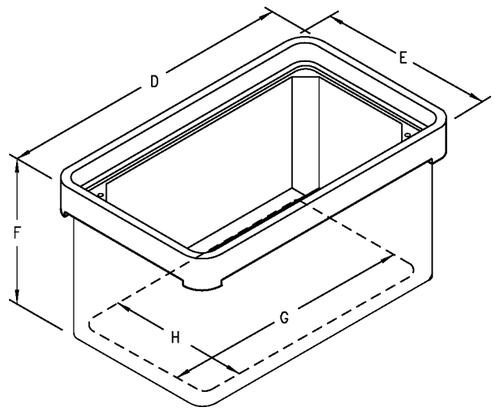

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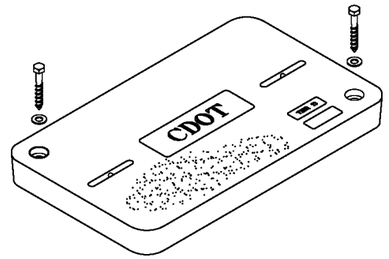
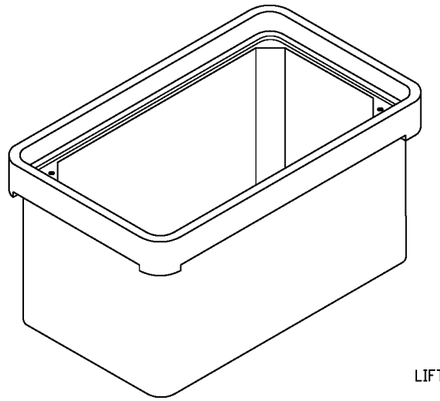
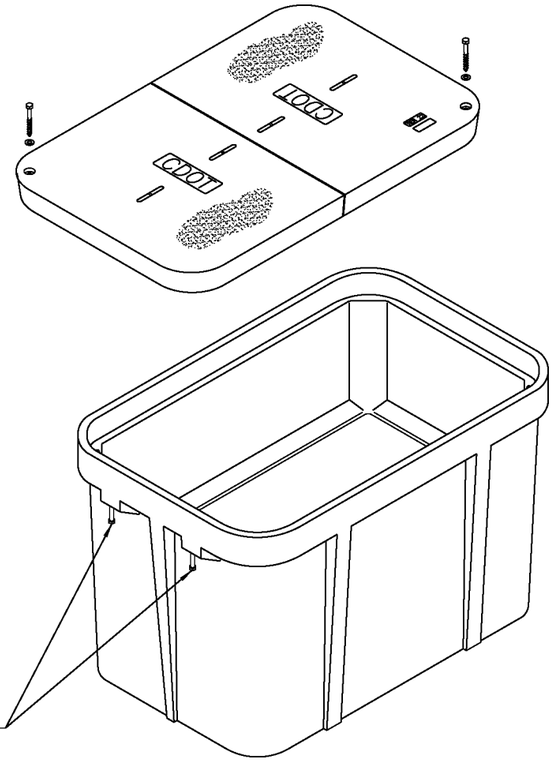




TYPE 3



TYPES 4 AND 5

NOTES

1. PULL BOXES, PULL BOX COVERS AND EXTENSIONS SHALL BE MADE OF FIBERGLASS REINFORCED POLYMER CONCRETE. PULL BOXES SHALL BE VERIFIED BY A 3RD PARTY NATIONALLY-RECOGNIZED INDEPENDENT TESTING LABORATORY AS MEETING ALL TEST PROVISIONS OF THE LATEST ANSI/SCTE 77 SPECIFICATION FOR UNDERGROUND ENCLOSURE INTEGRITY, TIER 22 RATING. CERTIFICATION DOCUMENTS SHALL BE SUBMITTED WITH MATERIAL SUBMITTALS. THE PULL BOX SHALL HAVE A DETACHABLE COVER WITH A SKID-RESISTANT SURFACE AND HAVE THE WORDS "CDOT TRAFFIC" OR "CDOT COMM" CAST INTO THE SURFACE. PAINTING THE WORDS SHALL NOT BE ACCEPTED. MARKINGS SHOWING THE TIER 22 RATING MUST BE LABELED OR STENCILED ON THE INSIDE AND OUTSIDE OF THE BOX AND ON THE UNDER SIDE OF THE COVER. THE COVER SHALL BE ATTACHED TO THE PULL BOX BODY BY MEANS OF A MINIMUM $\frac{3}{8}$ - 7 UNIFIED NATIONAL COURSE (UNC) STAINLESS STEEL PENTA HEAD BOLTS AND SHALL HAVE TWO LIFT SLOTS TO AID IN THE REMOVAL OF THE LID.
2. PULL SLOTS SHALL BE RATED FOR A MINIMUM PULL OUT OF 3,000 POUNDS.
3. TYPE 4 AND 5 PULL BOX COVERS SHALL BE A TWO-PIECE COVER.
4. MAGNESIUM CHLORIDE TESTS SHOULD BE PERFORMED IN ACCORDANCE WITH THE LATEST ANSI/SCTE 77 SPECIFICATION FOR UNDERGROUND ENCLOSURE INTEGRITY, TIER 22 RATING.

TABLE OF DIMENSIONS (MINIMUMS)

TYPE	DESCRIPTION	DIMENSIONS (IN.)							
		A	B	C	D	E	F	G	H
1	PULL BOX - (11" X 18" X 12")	18 1/8	11 1/4	1 3/4	20 1/4	13 3/8	12	15 3/4	8 7/8
2	PULL BOX - (13" X 24" X 12")	23 1/4	13 3/4	2	25	15 1/2	12	19 1/4	9 3/4
3	PULL BOX - (17" X 30" X 12")	30 1/2	17 1/2	2	32 1/4	19 1/4	12	26 1/2	13 1/2
4	PULL BOX - (24" X 36" X 24")	35 5/8	24	3	37 5/8	26	24	30 1/8	18 1/2
5	PULL BOX - (30" X 48" X 24")	47 5/8	30	3	49 5/8	32 1/8	24	45 5/8	28 1/8

STANDARD PULL BOXES

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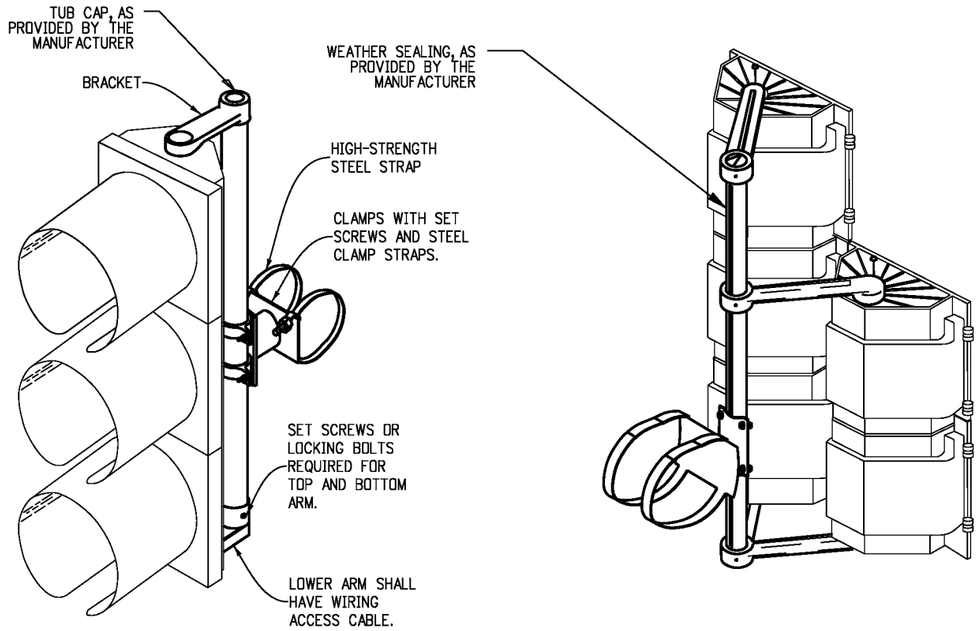
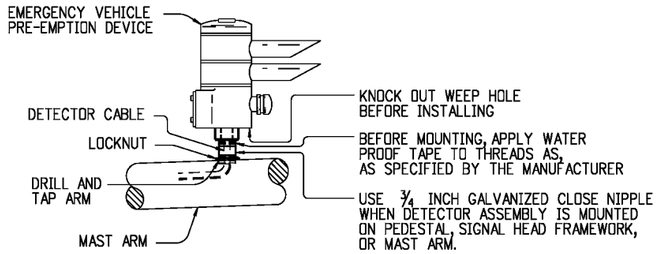
NOTES

1. SIGNAL HEAD CONFIGURATIONS SHALL BE AS SHOWN ON PLANS
2. INSTALL MOUNTING BRACKETS ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
3. FOR MOUNTING OVERHEAD SIGNS, EXCEPT FOR LIGHTED STREET SIGNS, ON MAST ARMS, SEE STANDARD PLAN S-614-20, USING ¾ INCH WIDE BANDING.
4. LIGHTED STREET NAME SIGNS SHALL UTILIZE ASTRO-TYPE MOUNTING BRACKETS DESIGNED FOR THE REQUIRED DESIGN LOADING AND BE FREE-SWINGING TO REDUCE WIND LOADING EFFECT.



ASTRO-TYPE MOUNTING BRACKET



EMERGENCY VEHICLE PRE-EMPTION DEVICE MOUNTING DETAIL

MAST-ARM MOUNTING BRACKETS

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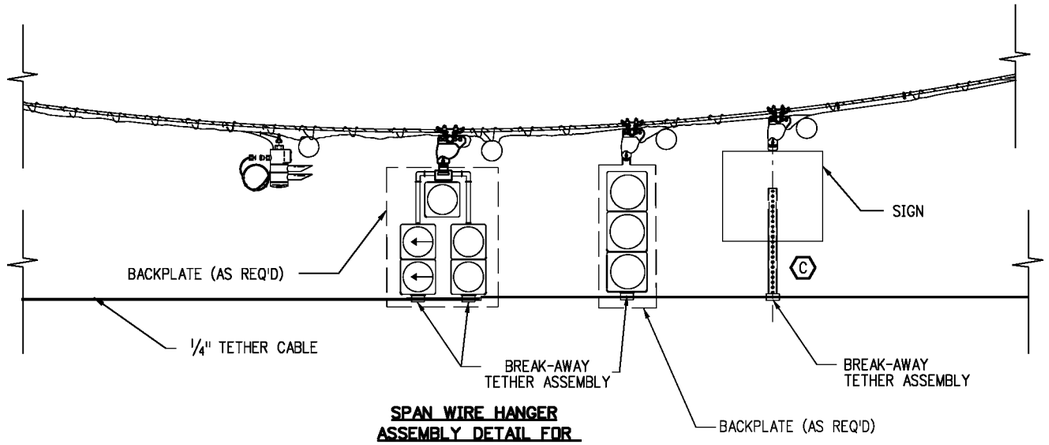
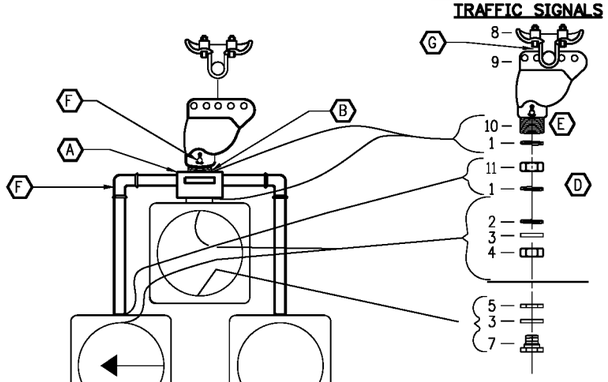
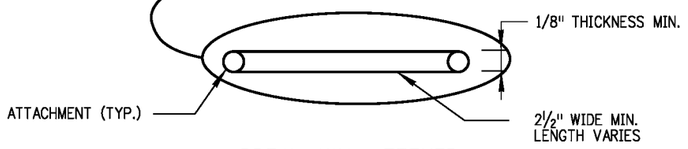
STANDARD PLAN NO. S-614-43



SPAN WIRE HANGER ASSEMBLY DETAIL FOR TRAFFIC SIGNALS



DIRECT ASSEMBLY DETAIL



BREAK-AWAY TETHER ASSEMBLY DETAIL

ITEM DESCRIPTION FOR ASSEMBLY DETAIL

1 - SERRATED TABBED LOCKRING, ALUMINUM (TAB MUST BE FULL WIDTH OF RING)
2 - GASKET, NEOPRENE
3 - WASHER, STEEL
4 - HEX NUT, STEEL
5 - CONDUIT LOCKNUT, STEEL
6 - BUSHING PLASTIC (ONLY IN JUNCTION BOX OR NIPPLED DOWN TRAFFIC SIGNAL)
7 - OCTAGONAL CAP, ALUMINIUM
8 - SPAN WIRE CLAMP
9 - WIRE OUTLET BODY, STEEL, FEMALE ONLY
10 - NIPPLE, STEEL
11 - HEX NUT, STEEL, NOTCHED WITH SETSCREWS

LEGEND

(A) TOP BRACKET CENTER HUB SHALL BE MINIMUM 3.5 INCH SQUARE AND 3 INCHES DEEP OR EQUAL VOLUME. SERRATION CAST IN HUB, TABBED OR SERRATED LOCKRING, OPENINGS SHALL BE THREADED.

(B) NIPPLE LENGTH DEPENDS ON SPAN HEIGHT.

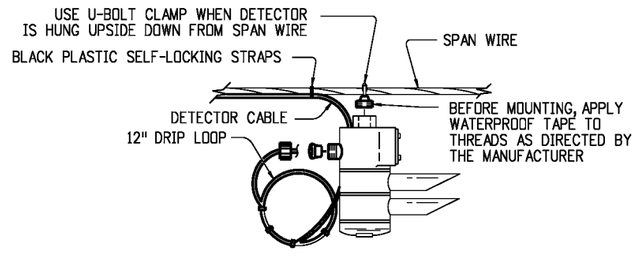
(C) SIGN SUPPORT BRACKET ASSEMBLY SHALL UTILIZE SPAN WIRE CLAMP ADJUSTMENT AND BE ADJUSTABLE TO ACCOMMODATE VARYING SPAN HEIGHT. TETHER SUPPORT BAR SHALL BE ATTACHED TO THE SIGN USING A MINIMUM OF TWO (2), 5/16 INCH BOLTS, SPACED A MINIMUM OF 6 INCHES APART.

(D) APPLY SILICONE CAULK BETWEEN OR AROUND SERRATED LOCKRING AND HOUSING.

(E) ALL THREAD

(F) SETSCREW (SQUARE OR ALLEN) ON ALL FITTINGS.

(G) INSTALL STAINLESS STEEL WASHER ON THE INSIDE OF THE COTTER PIN. COTTER PIN AND WASHER SHALL BE ON THE SIDE OF THE HANGER AWAY FROM THE SIGNAL CABLES.



SPAN WIRE MOUNTING DETAIL FOR EMERGENCY VEHICLE PRE-EMPTION DEVICE

SPAN WIRE MOUNTING BRACKET DETAILS

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TRAFFIC LOOP AND MISCELLANEOUS SIGNAL DETAILS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-614-43
Sheet No. 10 of 10

GENERAL NOTES

1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS SHOWN IN THE MATERIALS TABLE ON SHEET 2.
2. SIGN STRUCTURES SHALL BE CONSTRUCTED TRUE TO THE SPECIFIED DIMENSIONS, SHALL BE FREE FROM KINKS, TWISTS OR BENDS, AND SHALL BE UNIFORM IN APPEARANCE. THE COMPLETED SECTIONS SHALL BE ASSEMBLED IN THE SHOP AND SHALL BE CHECKED FOR STRAIGHTNESS, ALIGNMENT, AND DIMENSIONAL ACCURACY. ANY VARIATIONS SHALL BE CORRECTED TO THE SATISFACTION OF THE ENGINEER.
3. MAST ARMS SHALL BE TEMPORARILY SUPPORTED TO TAKE ALL LOAD OFF OF THE FIELD SPLICES WHILE BOLTS ARE BEING TIGHTENED IN ORDER TO FIRMLY SEAT THE FLANGE PLATES.
4. POSTS FOR TUBULAR SIGN STRUCTURES SHALL BE FORMED TO THE RADII SHOWN ON THE PLANS BY HEAT TREATMENT OR BY FABRICATION TO SUCH RADII BY METHODS WHICH WILL NOT CRIMP OR BUCKLE THE INTERIOR RADIUS OF THE PIPE BEND.
5. CLIPS, EYES, OR REMOVABLE BRACKETS SHALL BE AFFIXED TO ALL POSTS AND MAST ARMS, AS NECESSARY, TO SECURE THE SIGN DURING SHIPPING AND FOR LIFTING AND MOVING DURING ERECTION. THIS IS TO PREVENT DAMAGE TO THE FINISHED GALVANIZED OR PAINTED SURFACES. BRACKETS ON TUBULAR SIGN STRUCTURES SHALL BE REMOVED AFTER ERECTION. DETAILS OF SUCH DEVICES SHALL BE SHOWN ON THE SHOP DRAWINGS.
6. HIGH-STRENGTH BOLTED CONNECTIONS SHALL CONFORM TO THE PROVISIONS IN SECTION 509.28 OF THE STANDARD SPECIFICATIONS. ASSEMBLY OF HIGH-STRENGTH BOLTED CONNECTIONS FOR SIGN STRUCTURES MAY BE MADE WITH GALVANIZING OR PAINT ON THE CONTACT (FAYING) SURFACES.
7. ALL SIGN STRUCTURES SHALL BE FABRICATED INTO THE LARGEST PRACTICAL SECTIONS PRIOR TO GALVANIZING. SPLICE LOCATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL AND THE CONTRACTOR SHALL NOT COMMENCE FABRICATION UNTIL SUCH SPLICE LOCATIONS ARE APPROVED.
8. ALL PIPE MEMBERS SHALL BE HOT-DIP GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM. WALKWAY GRATINGS, WALKWAY BRACKETS, SAFETY RAILINGS, ACCESS LADDER AND CAGE, STEEL MOUNTINGS FOR LIGHT FIXTURES AND ALL NUTS, BOLTS AND WASHERS FOR SIGN STRUCTURES SHALL BE GALVANIZED AFTER FABRICATION PER ASTM A123 OR ASTM A153, AS APPROPRIATE AND SHALL NOT BE PAINTED. TENSION CONTROL BOLTS OR DIRECT TENSION INDICATING WASHERS USED IN HIGH-STRENGTH BOLTED CONNECTIONS SHALL BE MECHANICALLY GALVANIZED PER ASTM B695, COATING CLASS 55.
9. ALL CONCRETE SHALL BE CLASS BZ WITH AIR ENTRAINMENT; REINFORCING STEEL SHALL BE GRADE 60. CAISSON FOUNDATIONS SHALL REACH THE SEVEN DAY PREDICTED STRENGTH BEFORE SIGN STRUCTURES ARE ERECTED THEREON.
10. STRUCTURES SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES.
11. SHEETS IN THE INDEX MARKED WITH A ■ PROVIDE INSTRUCTIONS TO DESIGNERS FOR THEIR USE IN THE PREPARATION OF THE SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.
12. NPS = NOMINAL PIPE SIZE; O.D. = OUTSIDE DIAMETER.
13. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
14. INSTALL STRUCTURE IDENTIFICATION PANEL IN ACCORDANCE WITH M AND S STANDARD S-614-12 USING TWO 1#2" WIDE STAINLESS STEEL BANDS AND STAINLESS STEEL FLARED LEG BRACKETS WITH HEX HEAD BOLTS (BAND-IT D315 OR EQUIVALENT).
15. CAISSON, STEEL SUPPORTS AND SURVEY WORK SHALL BE PAID FOR IN ACCORDANCE WITH BID ITEMS 503, 614 AND 625 RESPECTIVELY.
16. CANTILEVER ARMS MARKED WITH A ▲ MUST BE LEVEL OR TILTED UPWARD NO MORE THAN 1° MAXIMUM AFTER INSTALLATION OF THE SIGN.
17. THERE SHALL BE NO PENETRATIONS OF THE TUBE MEMBERS OTHER THAN AS SHOWN IN THESE PLANS UNLESS APPROVED BY THE ENGINEER PRIOR TO FABRICATION.

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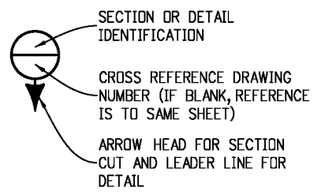
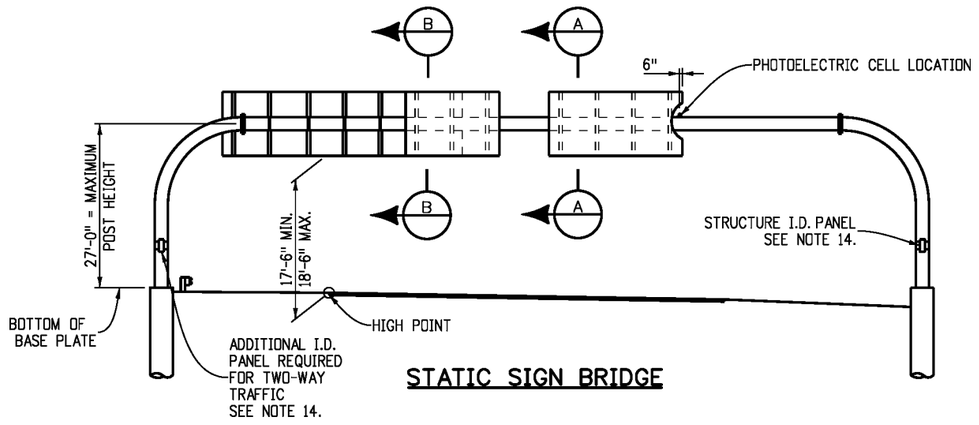
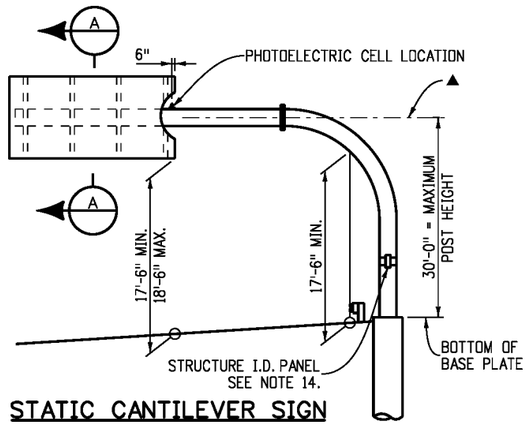
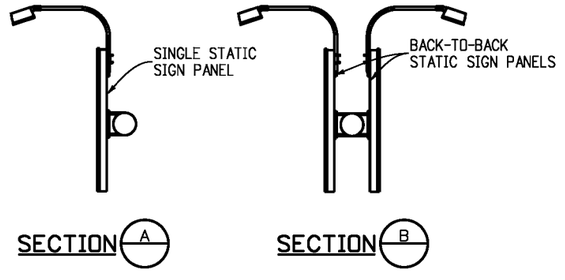




STATIC SIGN BRIDGE



STATIC CANTILEVER SIGN



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STATIC SIGN MONOTUBE STRUCTURES

Issued By: Safety and Traffic Engineering Branch on July 4, 2012

STANDARD PLAN NO.
S-614-50
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GENERAL NOTES (CONTINUED)

18. WELDING OF STEEL SHALL CONFORM TO THE REQUIREMENTS OF AWS D 1.1. ALL AREAS TO BE WELDED SHALL BE GROUND TO BRIGHT METAL. NO BUTT WELD SPLICES WILL BE PERMITTED. ALL WELDING AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED.

    ENHANCED MAGNETIC PARTICLE TESTING SHALL BE PERFORMED ON AREAS DEFINED IN AWS D1.1 AND HEREIN. ENHANCED MAGNETIC PARTICLE TESTING SHALL BE CONDUCTED IN ACCORDANCE WITH ASTM E 709 AND AWS D 1.1, EXCEPT AS AMENDED HEREIN. ALTERNATING CURRENT SHALL BE USED. THE YOKE SPACING SHALL BE BETWEEN 2 AND 4 INCHES. THE MINIMUM LIFTING POWER SHALL BE 10LBS. RED DRY PARTICLES SHALL BE USED. THE LIGHT INTENSITY SHALL MEET ASTM E 709, SECTION 7. PARTICLE APPLICATION AND SPECIMEN PREPARATION SHALL MEET THE REQUIREMENTS OF ASTM E 709 SECTIONS 9 AND 15, EXCEPT WHITE NON-AQUEOUS DEVELOPER MEETING ASTM E 165, TYPE 3, SHALL BE APPLIED TO THE TEST SURFACE PRIOR TO TESTING.

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

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

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

    (2) FILLET WELDS. EACH DESIGN WELD SIZE ON MAIN MEMBER TO MAIN MEMBER AND SECONDARY MEMBER TO MAIN MEMBER WELDMENTS. ALL STOP-STARTS AND WELD TERMINI. ALL LINEAR INDICATIONS SHALL FURTHER BE EVALUATED WITH 10X OR 30X MAGNIFICATION. VERIFICATION SHALL BE RESOLVED BY EXCAVATION.

    (3) GROOVE WELDS. ALL THROUGH THICKNESS EDGES ON TRANSVERSE BUTT JOINT WELDMENTS IN TENSION AREAS.

    (4) REPAIRS. ALL REPAIR WELDS TO CORRECT DEFECTS IN GROOVE AND FILLET WELDS, PLATE CUT EDGES, CORRECTION OF FABRICATION ERRORS IN CUTTING, PUNCHING, DRILLING, OR FITTING, AND MEMBERS WHICH ARE TACKED OR WELDED AND SUBSEQUENTLY CUT APART AND REWELDED.

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

MATERIALS

ELEMENT	SPECIFICATION ASTM	AASHTO	CLARIFICATIONS
POSTS, MAST ARMS	A53		#1
BARS, PLATES AND SHAPES	A709	M-270	#2
HOLLOW STRUCTURAL SECTIONS (HSS)	A500		#3
HIGH-STRENGTH BOLTS (H.S. BOLTS)	A325	M-164	#4
HIGH-STRENGTH NUTS	A563	M-291	
HIGH-STRENGTH WASHERS	F436	M-292	#5
U-BOLTS (RODS)	F1554	M-314	GRADE 55 STEEL
ANCHOR BOLTS	F1554	M-314	GRADE 55 STEEL

#1 PIPESS SHALL BE WELDED OR SEAMLESS STEEL PIPE CONFORMING TO THE SPECIFICATIONS OF ASTM DESIGNATION: A53, GRADE B.

#2 GRADES 36 OR 50 STEEL. ASTM A992 SHAPES MAY BE SUBSTITUTED.

#3 HOLLOW STRUCTURAL SECTION SPECIFICATIONS APPLY TO THE STRUCTURAL TUBING SECTIONS (TS) USED AT HANDHOLES AND STATIC SIGN LIGHTING LOCATIONS.

#4 TENSION CONTROL (TC) BOLTS CONFORMING TO ASTM F1852 MAY BE SUBSTITUTED FOR ASTM A325 BOLTS. ALL OTHER BOLTS AND NUTS SHALL CONFORM TO THE SPECIFICATIONS OF ASTM DESIGNATION: A307. INSTALL A307 BOLTS WITH COMMERCIAL QUALITY WASHERS.

#5 ASTM F959, COMPRESSIBLE-WASHER-TYPE DIRECT TENSION INDICATORS MAY BE SUBSTITUTED FOR ASTM F436 WASHERS AT HIGH-STRENGTH BOLTED CONNECTIONS.

DESIGN DATA

SPECIFICATIONS:

DESIGN: "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (1994 AASHTO).

"FATIGUE-RESISTANT DESIGN OF CANTILEVERED SIGNAL, SIGN AND LIGHT SUPPORTS", NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM (NCHRP) REPORT 412, 1998.

SUBSECTION 17.4, SIGNS, IN THE STAFF BRIDGE BRANCH BRIDGE DESIGN MANUAL.

CONSTRUCTION: CDOT STANDARD SPECIFICATIONS, THESE STANDARD SHEETS AND THE PROJECT PLANS.

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

OVERHEAD SIGN X-SECTION SHEET(S) SHALL SHOW:

1. SIGN STRUCTURE LOCATION (HIGHWAY, STATION AND DIRECTION)
2. LENGTH OF STRUCTURE SPAN
3. PANEL SIZE AND LOCATION ON STRUCTURE
4. OFFSET FROM SHOULDER
5. POST HEIGHT(S) FROM TOP OF CAISSON TO ℄ MAST ARM
6. CAISSON DIAMETER AND MINIMUM EMBEDMENT
7. TOP OF CAISSON ELEVATION
8. CAISSON PAY LENGTH
9. STATIONS AND OFFSETS TO CAISSON
10. GUARDRAIL PROTECTION LIMITS
11. LANE LINE LOCATION(S)
12. AS CONSTRUCTED BLOCK
13. PHOTOELECTRIC CELL LOCATION IF REQUIRED

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STATIC SIGN MONOTUBE STRUCTURES

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STANDARD PLAN NO.
S-614-50
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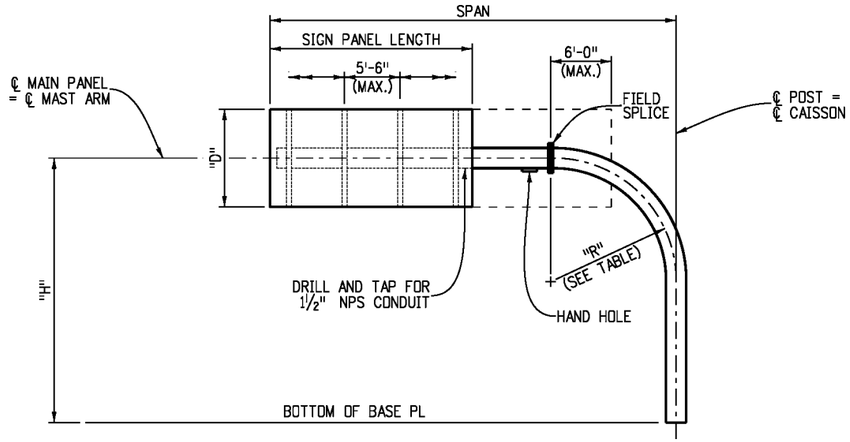

CANTILEVER

CANTILEVER NOTES

1. THE MAXIMUM SIGN PANEL OVERLAP ONTO ELBOW SHALL NOT EXCEED 6'-0" FROM THE FIELD SPLICE.
2. ALL POSTS BETWEEN BASE PLATE AND FIELD SPLICE SHALL HAVE A TUBE WALL THICKNESS OF ½". ALL MAST ARMS SHALL HAVE A TUBE WALL THICKNESS OF ⅜".
3. SEE SHEET 7 FOR FIELD SPLICE DETAILS.

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

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STATIC SIGN MONOTUBE STRUCTURES

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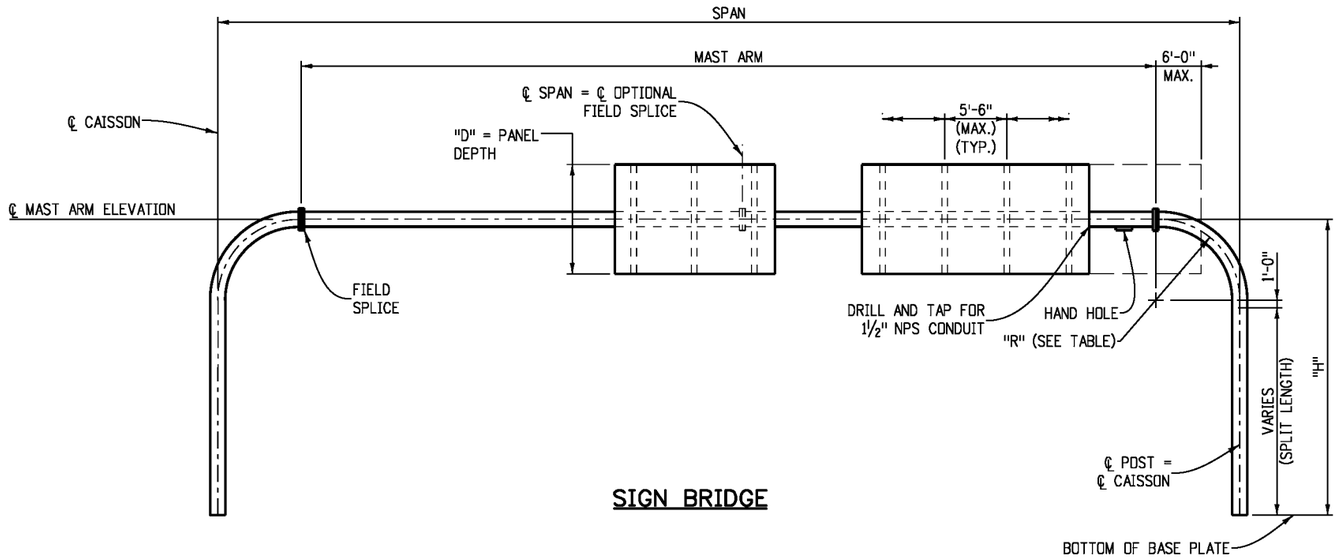
-SIGN BRIDGE INSTALLATION DETAILS-



SIGN BRIDGE

NOTES

1. THE MAXIMUM SIGN PANEL OVERLAP ONTO ELBOW SHALL NOT EXCEED 6'-0" FROM THE FIELD SPLICE.
2. ALL POSTS BETWEEN BASE PLATE AND FIELD SPLICE SHALL HAVE A TUBE WALL THICKNESS OF ½". ALL MAST ARMS SHALL HAVE A TUBE WALL THICKNESS OF ⅜".
3. BEFORE ANY PORTION OF THE SIGN FRAMES ARE ASSEMBLED IN THEIR FINAL POSITIONS THE CONTRACTOR SHALL DEMONSTRATE TO THE ENGINEER BY PREASSEMBLY OR OTHER APPROVED METHODS THAT THE SPAN LENGTHS OF THE FRAMES IN THE NO LOAD CONDITION MATCH WITHIN ½" OF THE FIELD MEASURED SPAN LENGTHS BETWEEN FOUNDATIONS.
4. IF THE SIGN FRAMES ARE ERECTED AS ONE UNIT, THEY SHALL BE ADEQUATELY SUSPENDED TO AVOID DISTORTIONS OR CHANGES IN SPAN LENGTH BETWEEN BASE PLATES.
5. FOR MAST ARMS WITH LENGTHS BETWEEN 40'-0" AND 80'-0" A BOLTED FIELD SPLICE WILL BE PERMITTED AT ℄ OF THE ARM TO FACILITATE GALVANIZING AND HAULING OPERATIONS. FOR MAST ARMS WITH LENGTHS GREATER THAN 80'-0", TWO BOLTED FIELD SPLICES WILL BE PERMITTED AT THE ⅓ POINTS TO FACILITATE GALVANIZING AND HAULING OPERATIONS.
6. SEE SHEET 7 FOR FIELD SPLICE DETAILS.

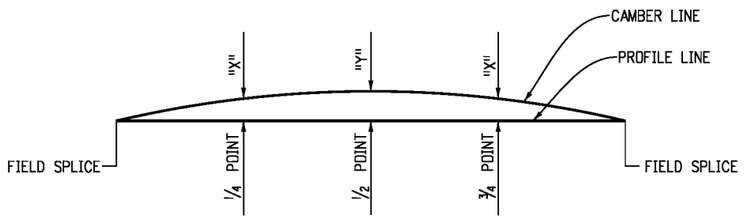
✳ PIPE POST

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

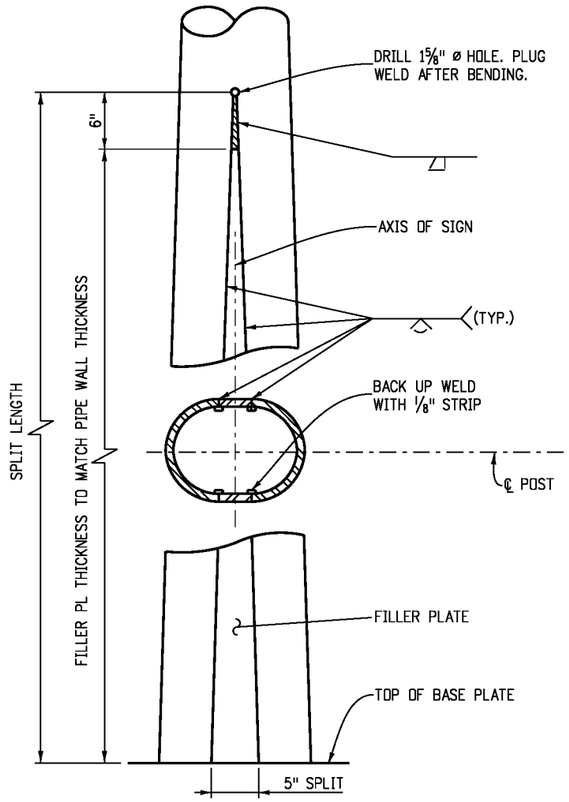
- USE CAMBER TYPE E FOR 130' - 140'.
✳ MAST ARM DIAMETER SAME AS POST.
◯ INDICATES CAMBER TYPE, SEE TABLE.

CAMBER

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



CAMBER DIAGRAM



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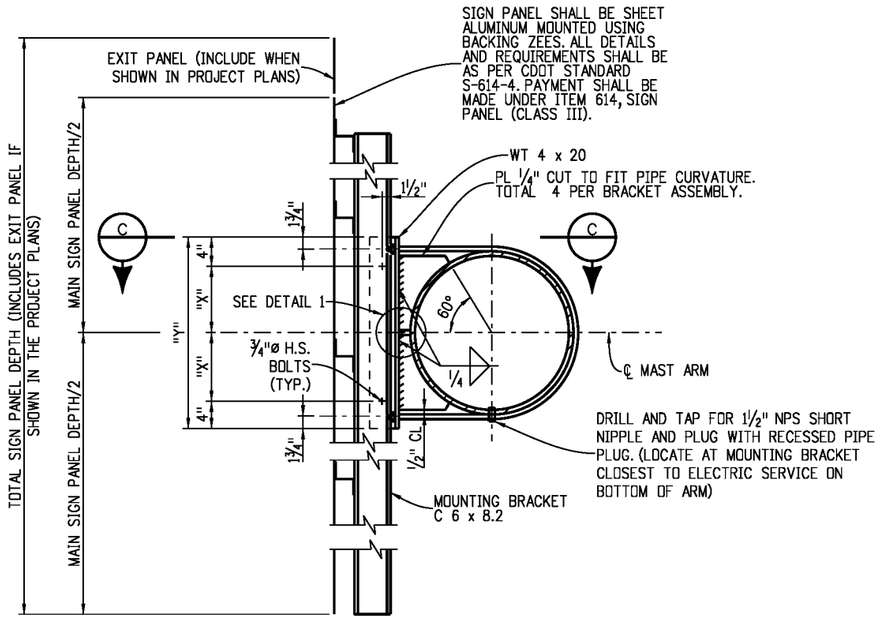
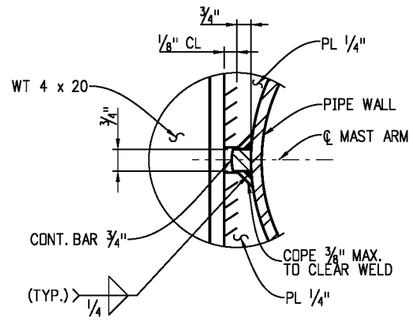
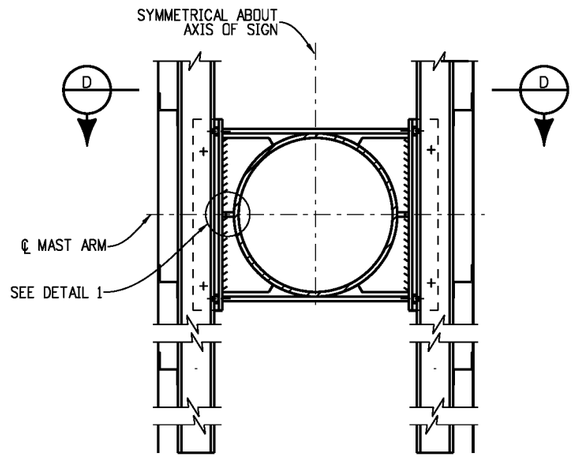
-SIGN MOUNTING BRACKET DETAILS-



SINGLE SIGN PANEL



DETAIL 1

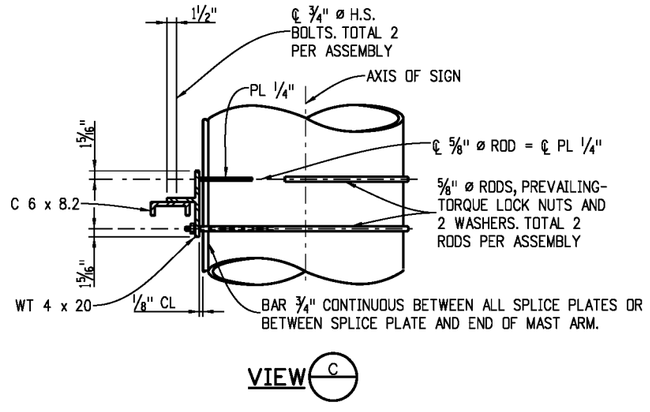


NOTES

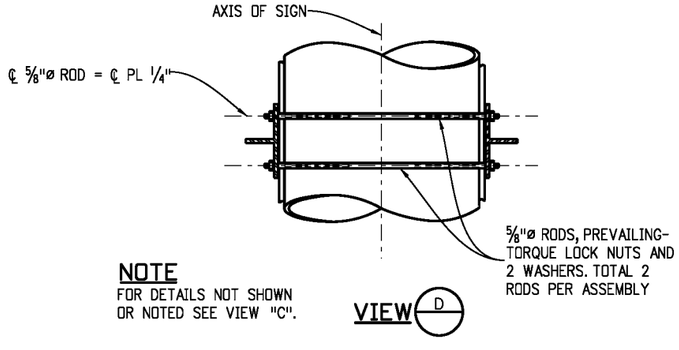
FOR DETAILS NOT SHOWN OR NOTED SEE "SINGLE SIGN PANEL". ASSEMBLY DETAILS SHOWN APPLY TO TANGENT PORTION OF PIPE ONLY. FOR MOUNTING BRACKET ON ELBOW SEE DETAIL 2.

BACK-TO-BACK SIGN PANELS

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

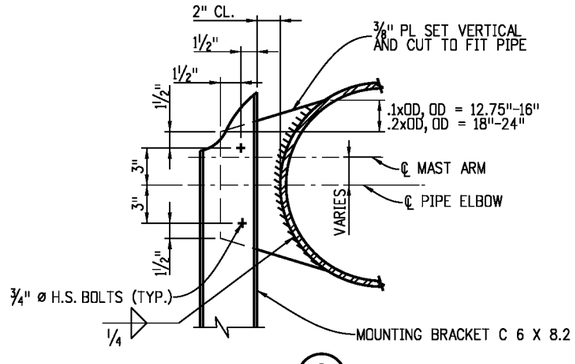


VIEW C



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

VIEW D



DETAIL 2

MOUNTING BRACKET ON ELBOW

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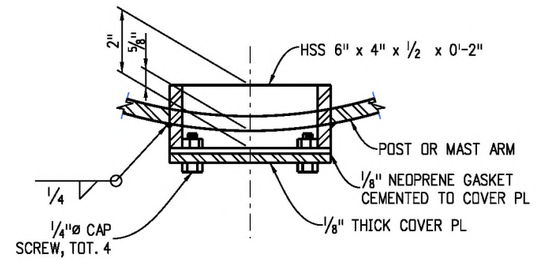
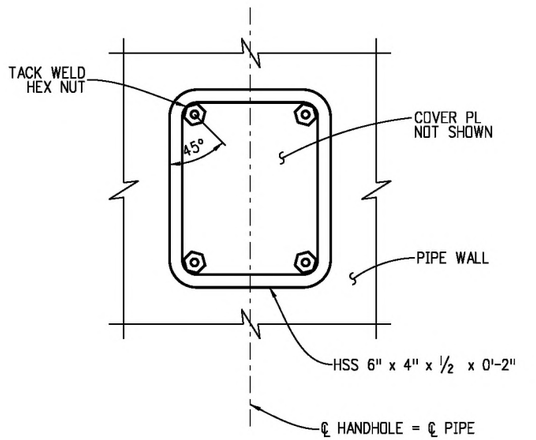
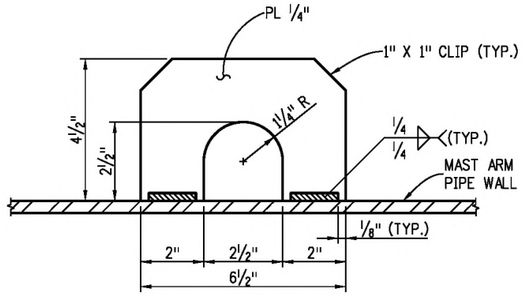
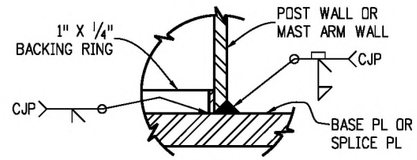




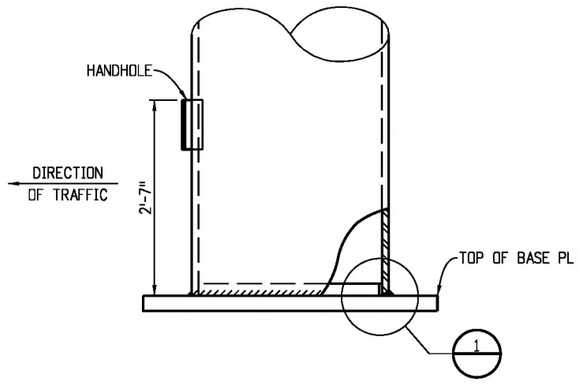
HANDHOLE AND COVER DETAILS



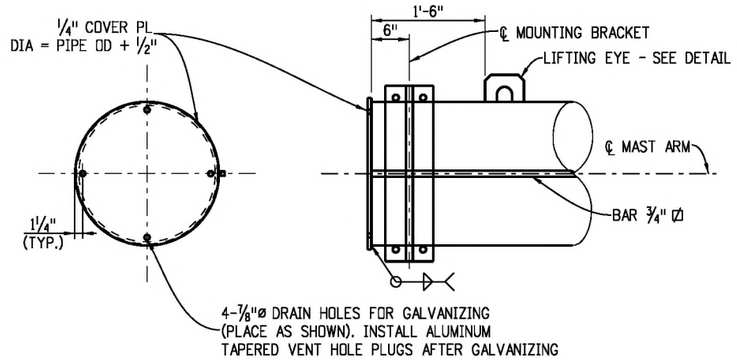
LIFTING EYE DETAIL



DETAIL 1



POST BASE ELEVATION
(FOR BASE PL DETAILS SEE SHEET 8)

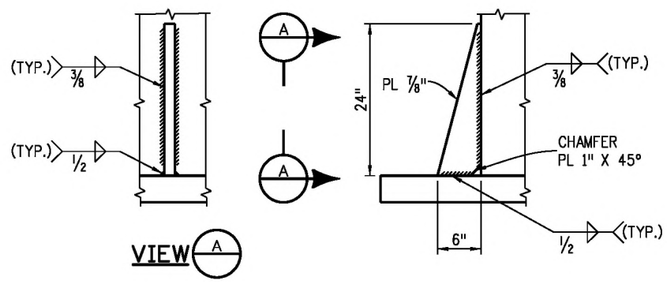


MAST ARM END DETAIL
(FOR CANTILEVER ARMS)

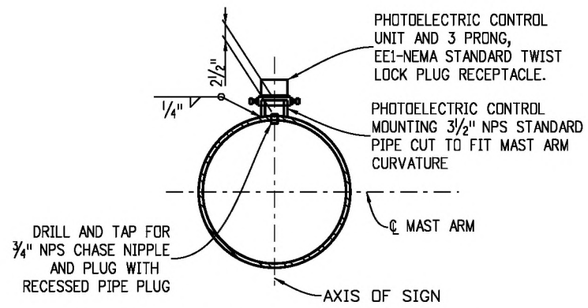
NOTES:

1. STIFFENERS ARE TO BE PLACED AT THE BASE OF ALL POSTS. SEE SHEET 8 FOR THE LOCATION OF STIFFENERS. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY.

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



STIFFENER DETAILS
(AT POLE BASE - SEE NOTES)



PHOTOELECTRIC CONTROL DETAILS
(SEE "LAYOUT" SHEET FOR LOCATION WHEN REQUIRED)

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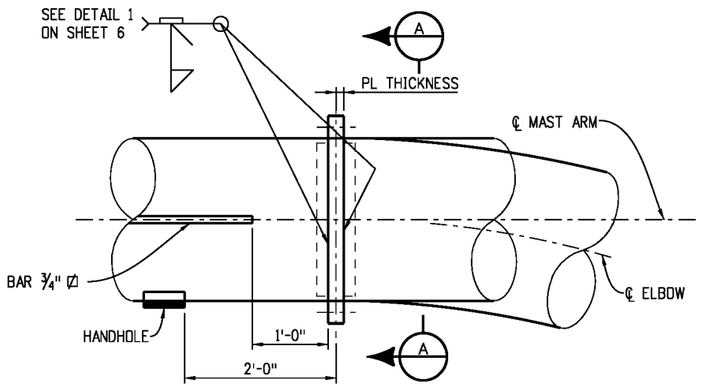
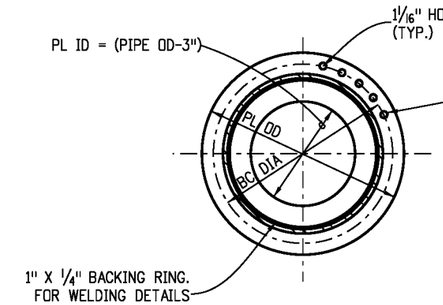


FIELD SPLICE

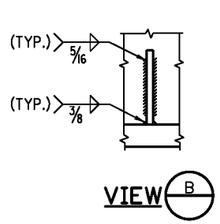


1" ø H.S. BOLTS (GALVANIZED) EQUALLY SPACED. BOLTS SHALL BE SEQUENTIALLY TIGHTENED. ASSUMING 12 BOLTS AND A CLOCK FACE, THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7 ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED. SEE THE FIELD SPLICE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

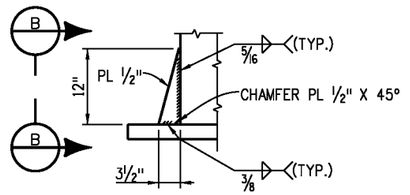
SECTION A

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

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



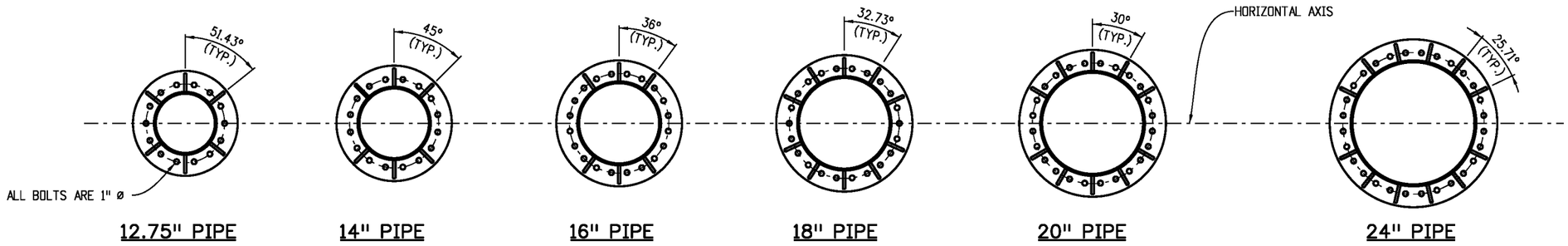
VIEW B



STIFFENER DETAILS
(AT FIELD SPLICE)

NOTES:

1. STIFFENERS ARE TO BE PLACED ON ALL FIELD SPLICES. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY.
2. TERMINATE WELD ½" SHORT OF THE TOP OF THE STIFFENER PLATE. AT THE OTHER 3 WELD TERMINATIONS ON THESE TWO TYPICAL WELDS, STOP THE WELD ¼" SHORT OF THE END OF THE PLATE.
3. SPLICE DESIGN BASED ON ARM CAPACITY.
4. THE MATING SURFACES OF THE FLANGE SPLICE PLATES SHALL BE MACHINED TO A COMMON PLANE WITHIN A TOLERANCE OF 1/64" USING A PORTABLE FLANGE FACER AFTER WELDING AND PRIOR TO GALVANIZING.



12.75" PIPE | 14" PIPE | 16" PIPE | 18" PIPE | 20" PIPE | 24" PIPE

FIELD SPLICE DETAILS

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

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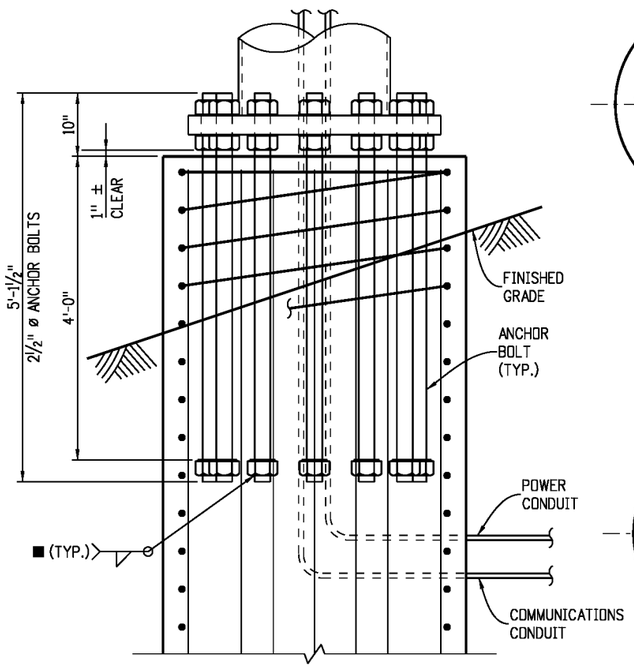
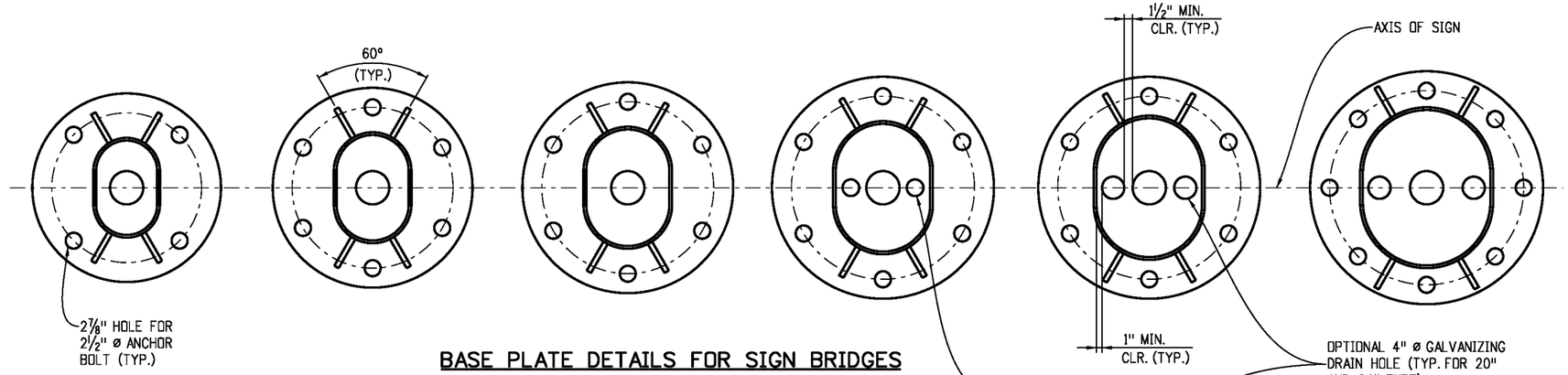
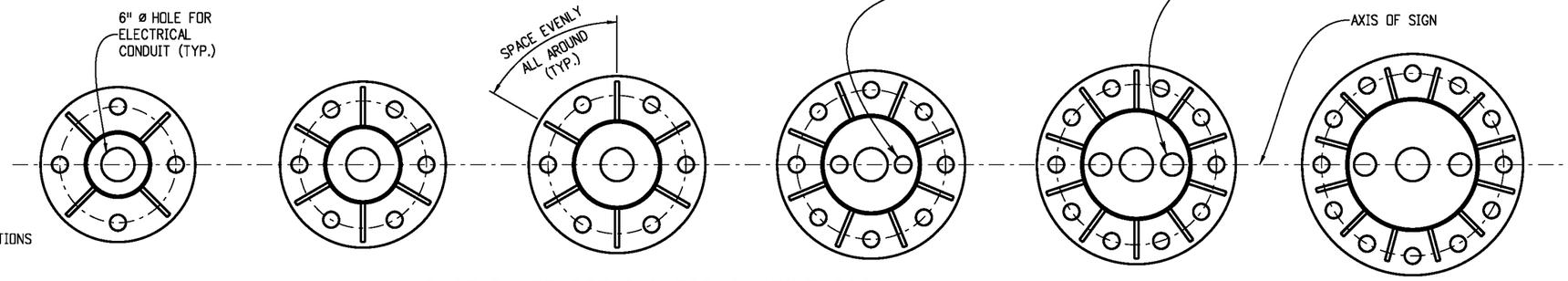


ANCHOR BOLT DETAIL

■ WELDING PROCEDURE IS NOT REQUIRED FOR THIS WELD



BASE PLATE DETAILS FOR SIGN BRIDGES



BASE PLATE DETAILS FOR CANTILEVERS

12.75" PIPE | 14" PIPE | 16" PIPE | 18" PIPE | 20" PIPE | 24" PIPE

CANTILEVERS

PIPE OD (IN.)	SPLIT (IN.)	BASE PL SIZE (DIAM. X THICK.) (IN.)	BOLT CIRCLE (IN.)	# OF ANCHOR BOLTS	# OF STIFF.
12.75	-	28" x 2.5"	21"	4	4
14	-	30" x 2.5"	23"	6	6
16	-	32" x 2.5"	25"	6	6
18	-	34" x 2.75"	27"	8	8
20	-	36" x 3.0"	29"	10	10
24	-	40" x 3.0"	33"	12	12

SIGN BRIDGES

PIPE OD (IN.)	SPLIT (IN.)	BASE PL SIZE (DIAM. X THICK.) (IN.)	BOLT CIRCLE (IN.)	# OF ANCHOR BOLTS	# OF STIFF.
12.75	5	34" x 2.5"	27"	4	4
14	5	36" x 2.5"	29"	6	4
16	5	38" x 2.5"	31"	6	4
18	5	40" x 2.75"	33"	6	4
20	5	40" x 3.0"	33"	6	4
24	5	42" x 3.0"	35"	8	4

NOTES

1. THREAD UPPER 10" AND GALVANIZE UPPER 1'-3" OF THE ANCHOR BOLTS.
2. ANCHOR BOLTS SHALL BE SET WITH A STEEL TEMPLATE UNTIL THE CONCRETE HAS CURED AT LEAST TWO DAYS.
3. THERE SHALL BE NO GROUT PAD INSTALLED ON TOP OF THE EXISTING FOUNDATIONS.
4. THE ANCHOR BOLTS SHALL BE TIGHTENED USING THE TURN-OF-NUT METHOD. THE BOLTS SHALL FIRST BE TIGHTENED TO SNUG TIGHT, WHICH IS DEFINED AS THE TIGHTNESS THAT EXISTS WHEN THE UPPER AND LOWER NUTS ARE IN FIRM CONTACT WITH THE BASE PLATE. WITH THE MAST ARM FREE TO DEFLECT, THE UPPER AND LOWER NUTS SHALL EACH THEN BE ROTATED AN ADDITIONAL $^{1}/_{12}$ TURN (30° ± 5°) USING A SLUGGING WRENCH.
5. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY. ALL POST BASES ARE TO HAVE STIFFENERS.

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STATIC SIGN MONOTUBE STRUCTURES

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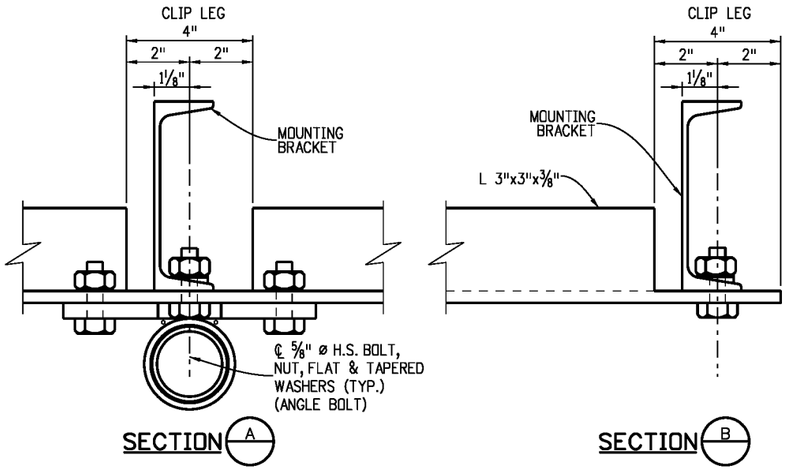
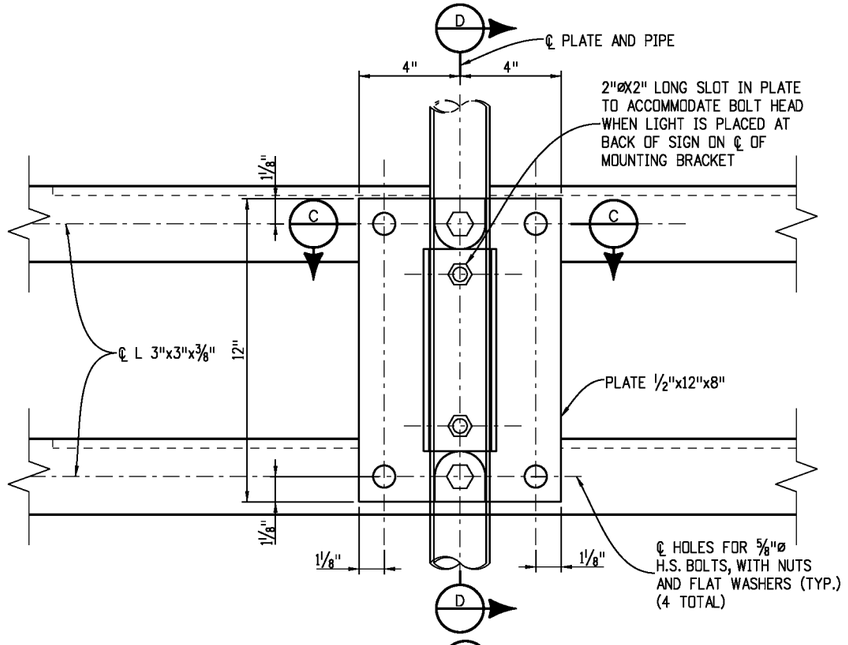
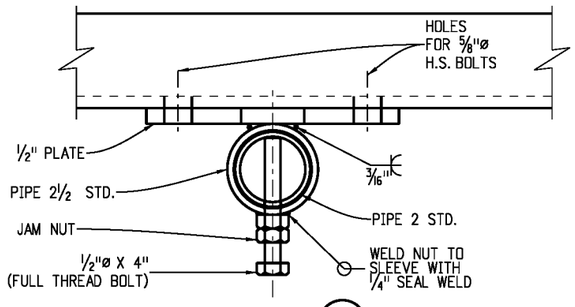
-SIGN LIGHTING DETAILS-

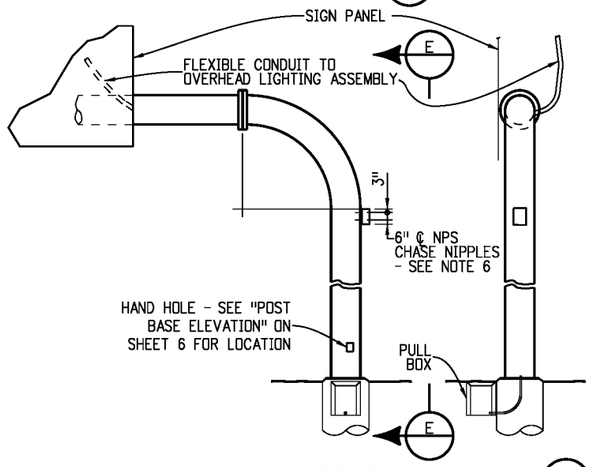
LIGHTING NOTES

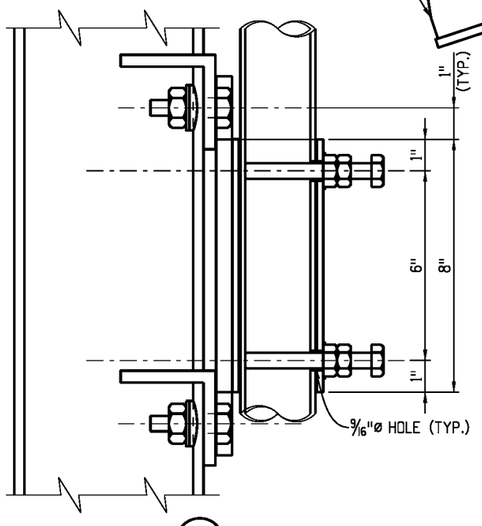
1. FIXTURES SHALL BE WATERTIGHT, DUSTPROOF AND DESIGNED FOR EASE OF LAMP AND BALLAST REPLACEMENT.
2. WHEN LIGHTS ARE REQUIRED, LAMP SHALL BE OF HIGH PRESSURE SODIUM TYPE (85 WATT OR 250 WATT AS DIRECTED BY THE ENGINEER). LAMPS AND BALLAST SHALL BE DESIGNED TO OPERATE OVER AN AMBIENT TEMPERATURE RANGE OF -20° F TO +120° F.
3. BALLASTS SHALL BE OF THE MAGNETIC REGULATOR TYPE SPECIFICALLY MANUFACTURED FOR USE WITH HIGH PRESSURE SODIUM LAMPS, AND SHALL OPERATE AT A MINIMUM OF 90% POWER FACTOR. OPERATION SHALL BE SUITABLE WITH A LINE VOLTAGE VARIATION OF ±10%.
4. THE TYPE, NUMBER AND SPACING OF FIXTURES SHALL BE PER MANUFACTURER'S SPECIFICATIONS TO MAINTAIN A MAXIMUM INITIAL ILLUMINATION OF THE SIGN FACE OF 30 FOOTCANDLES TO 60 FOOTCANDLES WITH A MAXIMUM UNIFORMITY RATIO (MAXIMUM ILLUMINATION / MINIMUM ILLUMINATION) OF 5:1.
5. FIXTURE AND MOUNTING DETAILS WILL BE SUBJECT TO APPROVAL BY THE ENGINEER.
6. DRILL AND TAP 1½" NPS CHASE NIPPLES AND PLUG WITH RECESSED PIPE PLUGS. PLACE PERPENDICULAR TO SIGN PANEL AXIS AND AWAY FROM APPROACHING TRAFFIC.

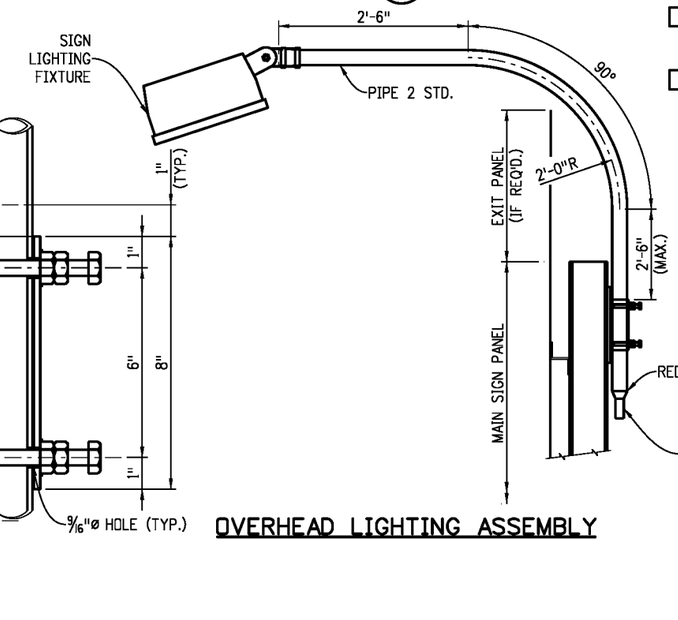


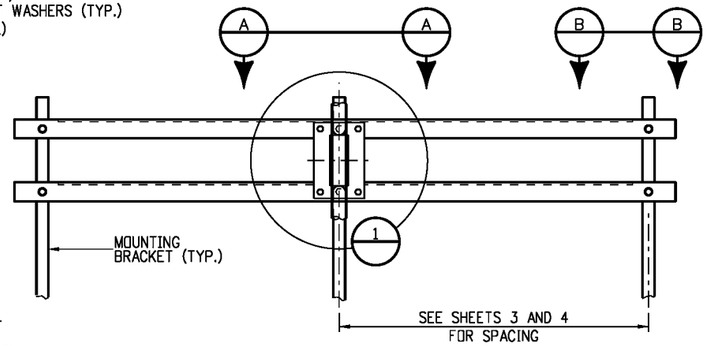






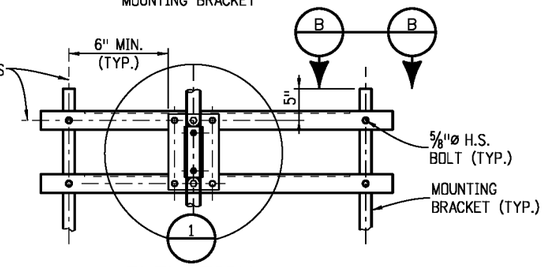






ELEVATION

LIGHT CONNECTION PLACED AT BACK OF SIGN ON ℄ OF MOUNTING BRACKET



ELEVATION

LIGHT CONNECTION PLACED AT BACK OF SIGN BETWEEN MOUNTING BRACKETS

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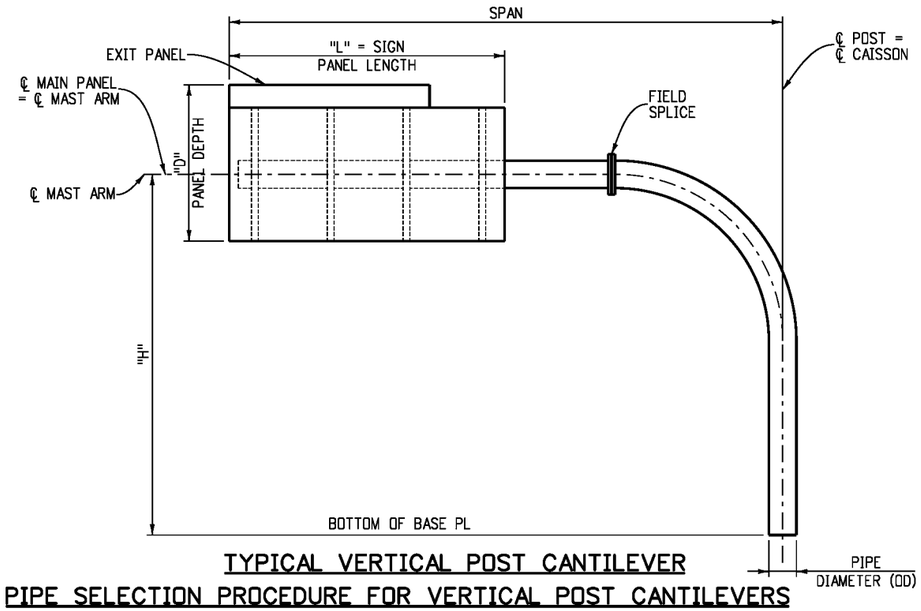

TYPICAL VERTICAL POST CANTILEVER

PIPE SELECTION PROCEDURE FOR VERTICAL POST CANTILEVERS

A. COVERAGE PERCENTAGE = $\frac{\text{SIGN PANEL LENGTH}}{\text{SPAN}}$ FOR THE SPAN LENGTH USE THE SPAN FROM ONE OF THE CHARTS (25', 35', ETC.), NOT THE ACTUAL SPAN

B. PICK THE PIPE OUTSIDE DIAMETER (OD) FROM THE 0-50% OR THE 51-80% CHART. THE COVERAGE PERCENTAGE CHOSEN SHOULD BE HIGH ENOUGH TO INCLUDE ANY SIGN PANELS WHICH MAY POTENTIALLY BE PLACED ON THIS SIGN IN THE FUTURE.

C. TO DETERMINE "D" FOR THE SELECTION CHARTS ADD THE AREA OF THE EXIT PANEL, IF PRESENT, TO THE MAIN SIGN PANEL AREA. DIVIDE BY THE MAIN PANEL LENGTH TO OBTAIN "D".

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

E. ON THE OVERHEAD SIGN X-SECTION SHEET INDICATE THE DIAMETER OF THE PIPE, THE HEIGHT "H" AND THE SPAN.

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

80 MPH WIND

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	12.75	14	14	14	14	16
	25	14	16	16	16	16	18
	30	16	18	18	18	18	20
	35	18	20	20	20	24	24
	40	20	24	24	24	24	24
	45	24	24	24	24		

UP TO 50% COVERAGE CHART

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	16	16	16	18	18	20
	25	18	18	18	20	20	24
	30	20	20	20	20	24	24
	35	24	24	24	24	24	
	40	24	24	24			
	45						

51-80% COVERAGE CHART

-CANTILEVER SIGN PIPE SELECTION TABLES-

90 MPH WIND

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	14	14	16	16	16	18
	25	16	18	18	18	18	20
	30	18	20	20	20	24	24
	35	20	24	24	24	24	24
	40	24	24	24			
	45						

UP TO 50% COVERAGE CHART

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	16	18	18	20	20	20
	25	20	20	20	24	24	24
	30	24	24	24	24	24	
	35	24					
	40						
	45						

51 - 80% COVERAGE CHART

100 MPH WIND

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	16	16	16	18	18	18
	25	18	18	20	20	20	24
	30	20	24	24	24	24	24
	35	24	24	24			
	40						

UP TO 50% COVERAGE CHART

"D" (FT.) →		10'		12'		14'	
"H" (FT.) →		H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30	H ≤ 25	25 < H ≤ 30
SPAN ≤ (FT.)	20	18	20	20	24	24	24
	25	20	24	24	24	24	
	30	24	24				
	35						

51 - 80% COVERAGE CHART

PROCEDURE TO DETERMINE THE DESIGN WIND SPEED

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

1. USE THE 90 MPH WIND SPEED FOR LOCATIONS WITHIN 4 MILES OF EITHER SIDE OF THE BASE OF THE FOOTHILLS ALONG THE FRONT RANGE OF THE EASTERN SLOPE.
2. USE THE 100 MPH WIND SPEED FOR LOCATIONS IN BOULDER COUNTY.

IF THERE ARE QUESTIONS CONCERNING THE PROPER DESIGN WIND SPEED CONTACT THE STAFF BRIDGE BRANCH.

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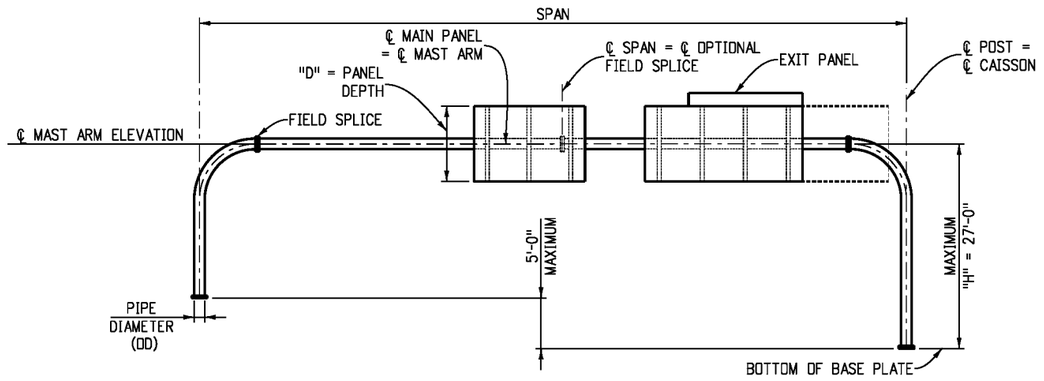
STATIC SIGN MONOTUBE STRUCTURES

Issued By: Safety and Traffic Engineering Branch on July 4, 2012

STANDARD PLAN NO.
S-614-50
Sheet No. 10 of 12



TYPICAL VERTICAL POST SIGN BRIDGE

STRUCTURE SELECTION PROCEDURE FOR SIGN BRIDGES

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

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

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

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

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

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

-SIGN BRIDGE PIPE SELECTION TABLES-

80 MPH WIND

SPAN ≤	MAXIMUM SIGN PANEL AREA (SQ. FT.)	* PIPE POST	
		PIPE OD (IN.)	SPLIT (IN.)
50'	375	12.75	5
60'	450	14	5
70'	525	16	5
80'	600	18	5
90'	675	20	5
100'	750	20	5
110'	825	24	5
120'	900	24	5
130'	780	24	5
140'	700	24	5

90 MPH WIND

SPAN ≤	MAXIMUM SIGN PANEL AREA (SQ. FT.)	* PIPE POST	
		PIPE OD (IN.)	SPLIT (IN.)
50'	375	14	5
60'	450	16	5
70'	525	18	5
80'	600	20	5
90'	675	24	5
100'	750	24	5
110'	775	24	5
120'	650	24	5
130'	585	24	5
140'	525	24	5

100 MPH WIND

SPAN ≤	MAXIMUM SIGN PANEL AREA (SQ. FT.)	* PIPE POST	
		PIPE OD (IN.)	SPLIT (IN.)
50'	375	16	5
60'	450	18	5
70'	525	20	5
80'	600	24	5
90'	675	24	5
100'	660	24	5
110'	580	24	5
120'	500	24	5
130'	450	24	5
140'	400	24	5

PROCEDURE TO DETERMINE THE DESIGN WIND SPEED

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

1. USE THE 90 MPH WIND SPEED FOR LOCATIONS WITHIN 4 MILES OF EITHER SIDE OF THE BASE OF THE FOOTHILLS ALONG THE FRONT RANGE OF THE EASTERN SLOPE.
2. USE THE 100 MPH WIND SPEED FOR LOCATIONS IN BOULDER COUNTY.

IF THERE ARE QUESTIONS CONCERNING THE PROPER DESIGN WIND SPEED CONTACT THE STAFF BRIDGE BRANCH

* MAST ARM DIAMETER SAME AS POST.

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STATIC SIGN MONOTUBE STRUCTURES

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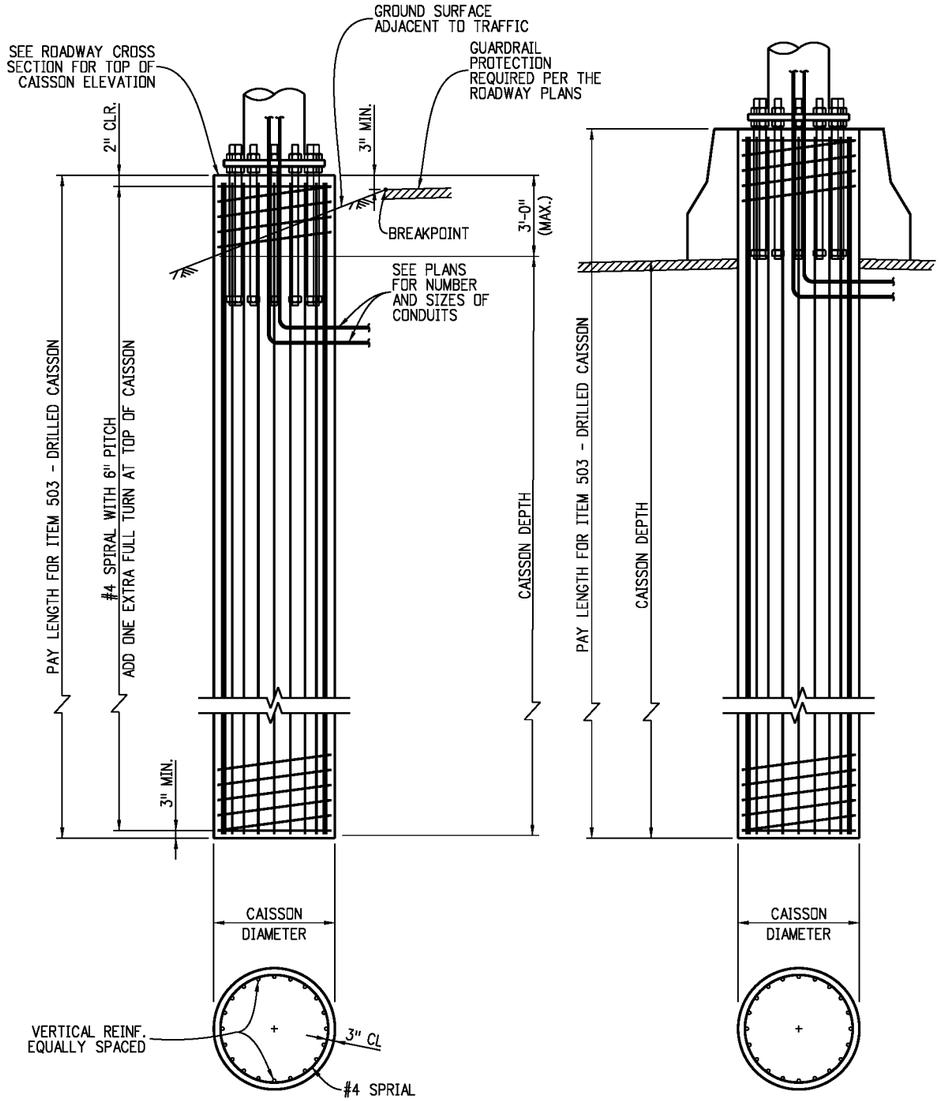

ROADSIDE SHOULDER INSTALLATION

MEDIAN RAIL INSTALLATION
(SEE ROADSIDE SHOULDER INSTALLATION FOR ADDITIONAL INFORMATION)

CAISSON FOUNDATION DETAILS

CAISSON DRILLING AND INSTALLATION NOTES

1. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:
   - A) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.
   - B) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG.
   - C) THE FOUNDATION SOILS ARE NOT HOMOGENOUS.
   - D) FIRM BEDROCK IS ENCOUNTERED.
2. CAISSONS SHALL BE PLACED AGAINST UNDISTURBED EARTH. WET OR CAVING HOLES SHALL BE BACKFILLED WITH FLOW-FILL AND REDRILLED AFTER A THREE DAY CURING PERIOD WITHOUT THE USE OF A CASING.
3. THE FOLLOWING SOIL PARAMETERS WERE USED FOR DESIGN:
   - A) LOOSE GRANULAR SOIL WITH A UNIT WEIGHT OF 100 PCF AND A 28 DEGREE ANGLE OF INTERNAL FRICTION (PHI ANGLE).
   - B) SOFT COHESIVE SOIL WITH A UNIT WEIGHT OF 100 PCF AND A UNIT COHESION OF 500 PSF.
4. THE CONTRACTOR SHALL PROVIDE A SURVEY OF EACH OVERHEAD SIGN FOUNDATION TO VERIFY PLACEMENT SOON AFTER WORK ON THE FOUNDATION HAS BEEN COMPLETED. THE SURVEY SHALL CONFORM TO THE REQUIREMENTS OF SECTION 625, CONSTRUCTION SURVEYING. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER A COPY OF THE SURVEY NOTES DETAILING THE FOUNDATION LOCATION AND ELEVATION AND THE ANCHOR BOLT LOCATIONS, PROJECTIONS, AND ORIENTATIONS, AND IN THE CASE OF SIGN-BRIDGE TYPE OF OVERHEAD SIGNS, THE DISTANCE MEASURED BETWEEN THE CENTERLINE OF THE ANCHOR BOLT GROUPS. THE ELEVATION OF THE GROUND SURROUNDING EACH FOUNDATION SHALL ALSO BE PROVIDED. THE CONTRACTOR SHALL COMPARE THE SURVEY INFORMATION TO THE REVIEWED SHOP DRAWINGS AND RECONCILE ANY DIFFERENCES BETWEEN THEM. THE CONTRACTOR SHALL SUBMIT ALL PROPOSED ADJUSTMENTS OR MODIFICATIONS TO THE ENGINEER FOR APPROVAL.

BRIDGES

PIPE OUTSIDE DIAMETER (INCHES)	SPLIT (INCHES)	CAISSON DIAMETER (INCHES)	CAISSON DEPTH (FEET)	VERTICAL REINF.
12.75	5	48	17	18 - #8
14	5	48	19	24 - #8
16	5	48	20	24 - #8
18	5	54	21	24 - #9
20	5	54	22	24 - #9
24	5	54	24	24 - #9

CANTILEVERS

PIPE OUTSIDE DIAMETER (INCHES)	SPLIT (INCHES)	CAISSON DIAMETER (INCHES)	CAISSON DEPTH (FEET)	VERTICAL REINF.
12.75	-	36	13	13 - #8
14	-	42	15	18 - #8
16	-	42	16	18 - #8
18	-	42	17	18 - #8
20	-	48	18	24 - #8
24	-	48	20	24 - #8

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STATIC SIGN MONOTUBE STRUCTURES

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STANDARD PLAN NO.
S-614-50

GENERAL NOTES

1. ALL STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS SHOWN IN THE MATERIALS TABLE ON SHEET 2.
2. HIGH-STRENGTH BOLTED CONNECTIONS SHALL CONFORM TO THE PROVISIONS IN SECTION 509.28 OF THE STANDARD SPECIFICATIONS. ASSEMBLY OF HIGH-STRENGTH BOLTED CONNECTIONS FOR SIGN STRUCTURES MAY BE MADE WITH GALVANIZING OR PAINT ON THE CONTACT (FAYING) SURFACES.
3. ALL SIGN STRUCTURES SHALL BE FABRICATED INTO THE LARGEST PRACTICAL SECTIONS PRIOR TO GALVANIZING. SPLICE LOCATIONS SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL AND THE CONTRACTOR SHALL NOT COMMENCE FABRICATION UNTIL SUCH SPLICE LOCATIONS ARE APPROVED.
4. ALL CONCRETE SHALL BE CLASS BZ WITH AIR ENTRAINMENT; REINFORCING STEEL SHALL BE GRADE 60. CAISSON FOUNDATIONS SHALL REACH THE SEVEN DAY PREDICTED STRENGTH BEFORE SIGN STRUCTURES ARE ERECTED THEREON.
5. A DISCONNECT FOR THE POWER SUPPLY TO THE DMS SHALL BE PROVIDED AS SHOWN IN THE ROADWAY PLANS.
6. STRUCTURES SHALL BE GROUNDED IN ACCORDANCE WITH APPLICABLE ELECTRICAL CODES.

GENERAL NOTES (CONTINUED)

7. SHEETS IN THE INDEX MARKED WITH A ■ PROVIDE INSTRUCTIONS TO DESIGNERS FOR THEIR USE IN THE PREPARATION OF THE SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.
8. NPS = NOMINAL PIPE SIZE; O.D. = OUTSIDE DIAMETER; DMS = DYNAMIC MESSAGE SIGN.
9. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW IN ACCORDANCE WITH SUBSECTION 105.02 OF THE STANDARD SPECIFICATIONS.
10. CAISSONS, STEEL SUPPORTS AND SURVEY WORK SHALL BE PAID FOR IN ACCORDANCE WITH BID ITEMS 503, 614 AND 625 RESPECTIVELY.
11. THERE SHALL BE NO PENETRATIONS OF MAST/CROSS ARMS OR POST OTHER THAN AS SHOWN ON THESE PLANS UNLESS APPROVED BY THE ENGINEER PRIOR TO FABRICATION.
12. ATTACH REMOTE ACCESS CABINET(S) TO POST WITH TWO ½" WIDE STAINLESS STEEL BANDS AND STAINLESS STEEL FLARED LEG BRACKETS WITH HEX HEAD BOLTS (BAND-IT D315 OR EQUIVALENT).
13. INSTALL STRUCTURE IDENTIFICATION PANEL IN ACCORDANCE WITH M AND S STANDARD S-614-12 USING TWO ½" WIDE STAINLESS STEEL BANDS AND STAINLESS STEEL FLARED LEG BRACKETS WITH HEX HEAD BOLTS (BAND-IT D315 OR EQUIVALENT).

GENERAL NOTES (CONTINUED)

14. WELDING OF STEEL SHALL CONFORM TO THE REQUIREMENTS OF AWS D 1.1. ALL AREAS TO BE WELDED SHALL BE GROUND TO BRIGHT METAL. NO BUTT WELD SPLICES WILL BE PERMITTED. ALL WELDING AND REQUIRED TESTING SHALL BE COMPLETE BEFORE ANY MATERIAL IS GALVANIZED.

    ENHANCED MAGNETIC PARTICLE TESTING SHALL BE PERFORMED ON AREAS DEFINED IN AWS D1.1 AND HEREIN. ENHANCED MAGNETIC PARTICLE TESTING SHALL BE CONDUCTED IN ACCORDANCE WITH ASTM E 709 AND AWS D 1.1, EXCEPT AS AMENDED HEREIN. ALTERNATING CURRENT SHALL BE USED. THE YOKE SPACING SHALL BE BETWEEN 2 AND 4 INCHES. THE MINIMUM LIFTING POWER SHALL BE 10 LBS. RED DRY PARTICLES SHALL BE USED. THE LIGHT INTENSITY SHALL MEET ASTM E 709, SECTION 7. PARTICLE APPLICATION AND SPECIMEN PREPARATION SHALL MEET THE REQUIREMENTS OF ASTM E 709 SECTIONS 9 AND 15, EXCEPT WHITE NON-AQUEOUS DEVELOPER MEETING ASTM E 165, TYPE 3, SHALL BE APPLIED TO THE TEST SURFACE PRIOR TO TESTING.

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

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

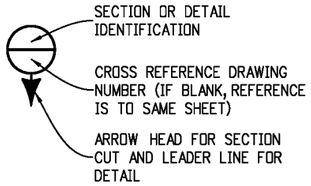
    (1) BASE METAL. ALL AREAS CONTACTED BY THE CARBON ARC GOUGE ELECTRODE, THE ELECTRODE CUP, AND THE WELDING ELECTRODE. ALL THREE CONDITIONS ARE ARC STRIKES.

    (2) FILLET WELDS. EACH DESIGN WELD SIZE ON MAIN MEMBER TO MAIN MEMBER AND SECONDARY MEMBER TO MAIN MEMBER WELDMENTS. ALL STOP-STARTS AND WELD TERMINI. ALL LINEAR INDICATIONS SHALL FURTHER BE EVALUATED WITH 10X OR 30X MAGNIFICATION. VERIFICATION SHALL BE RESOLVED BY EXCAVATION.

    (3) GROOVE WELDS. ALL THROUGH THICKNESS EDGES ON TRANSVERSE BUTT JOINT WELDMENTS IN TENSION AREAS.

    (4) REPAIRS. ALL REPAIR WELDS TO CORRECT DEFECTS IN GROOVE AND FILLET WELDS, PLATE CUT EDGES, CORRECTION OF FABRICATION ERRORS IN CUTTING, PUNCHING, DRILLING, OR FITTING, AND MEMBERS WHICH ARE TACKED OR WELDED AND SUBSEQUENTLY CUT APART AND REWELDED.

15. ALL CIRCUMFERENTIAL AND ALL LONGITUDINAL PIPE SEAM WELDS WITHIN 5" OF FULL PENETRATION CIRCUMFERENTIAL GROOVE WELDS SHALL BE FULL PENETRATION GROOVE WELDS AND SHALL BE INSPECTED AS SPECIFIED HEREIN. THE ACCEPTABLE MAXIMUM WELD UNDERCUT IS 0.01".
16. SEE TABLE ON SHEET 4 FOR CABINET ROTATION ADJUSTMENTS TO VERTICAL CLEARANCES MARKED WITH A ● .



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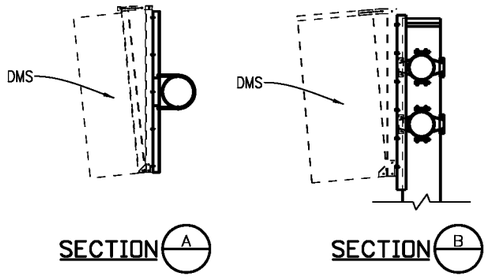
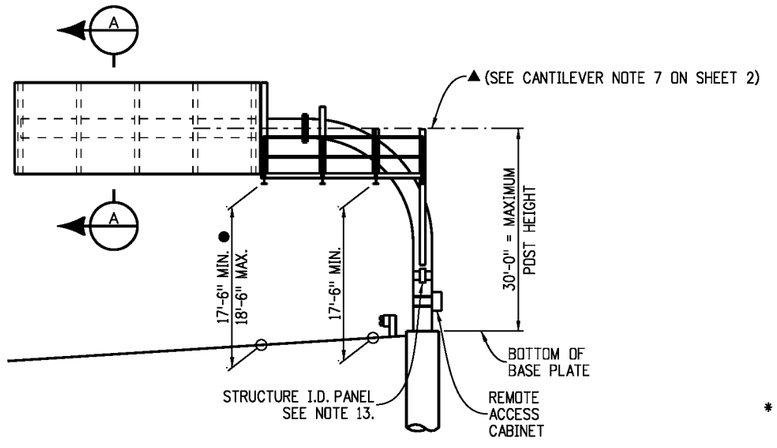
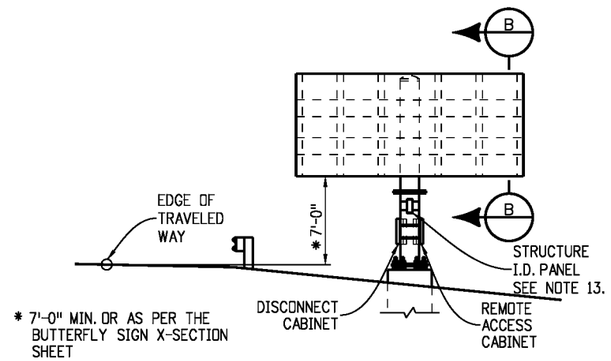
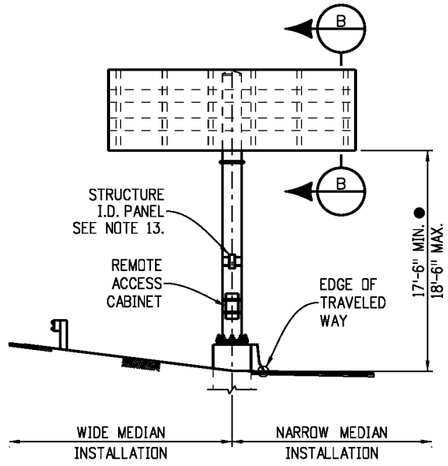




CANTILEVER SIGN



BUTTERFLY SIGN (ROADSIDE INSTALLATION)
(SEE SIGN X-SECTION SHEET IN TRAFFIC PLANS)



BUTTERFLY SIGN (MEDIAN INSTALLATION)
(SEE SIGN X-SECTION SHEET IN TRAFFIC PLANS)

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DYNAMIC SIGN MONOTUBE STRUCTURES

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STANDARD PLAN NO.
S-614-60
Sheet No. 1 of 14

CANTILEVER NOTES

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

2. MAST ARMS SHALL BE TEMPORARILY SUPPORTED TO TAKE ALL LOAD OFF OF THE FIELD SPLICES WHILE BOLTS ARE BEING TIGHTENED IN ORDER TO FIRMLY SEAT THE FLANGE PLATES.

3. POST MEMBERS SHALL BE FORMED TO THE RADII SHOWN ON THE PLANS BY HEAT TREATMENT OR BY FABRICATION TO SUCH RADII BY METHODS WHICH WILL NOT CRIMP OR BUCKLE THE INTERIOR RADIUS OF THE PIPE BEND.

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

5. WALKWAYS SHALL LEAD UP TO THE CABINET ACCESS DOOR AS SPECIFIED ON THE SIGN X-SECTION SHEETS IN THE ROADWAY PLANS.

6. ALL PIPE MEMBERS SHALL BE HOT-DIP GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM. WALKWAY GRATINGS, WALKWAY BRACKETS, SAFETY RAILINGS AND ALL NUTS, BOLTS AND WASHERS FOR SIGN STRUCTURES SHALL BE GALVANIZED AFTER FABRICATION AS PER ASTM A123 OR ASTM A153, AS APPROPRIATE, AND SHALL NOT BE PAINTED. TENSION CONTROL BOLTS OR DIRECT TENSION INDICATING WASHERS USED IN HIGH-STRENGTH BOLTED CONNECTIONS SHALL BE MECHANICALLY GALVANIZED PER ASTM B695, COATING CLASS 55.

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

BUTTERFLY NOTES

1. SIGN STRUCTURES SHALL BE CONSTRUCTED TRUE TO THE SPECIFIED DIMENSIONS, SHALL BE FREE OF KINKS, TWISTS OR BENDS, AND SHALL BE UNIFORM IN APPEARANCE. THE POST TO CROSS ARM CONNECTIONS SHALL BE PREASSEMBLED IN THE SHOP AFTER GALVANIZING. ASSEMBLIES WITH THE OPTIONAL FIELD SPLICE SHALL BE PREASSEMBLED ABOVE THE SPLICE FOR SHIPPING TO THE JOB SITE.

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

3. CLIPS, EYES, OR REMOVABLE BRACKETS SHALL BE AFFIXED TO POST AND CROSS ARMS, AS NECESSARY, TO SECURE FOR SHIPPING AND FOR LIFTING AND MOVING DURING ERECTION IN ORDER TO PREVENT DAMAGE TO THE FINISHED GALVANIZED SURFACES. TEMPORARY BRACKETS ON SIGN STRUCTURE SHALL BE REMOVED AFTER ERECTION. DETAILS OF SUCH DEVICES SHALL BE SHOWN ON THE SHOP DRAWINGS. ERECTION LUGS ARE REQUIRED ON ONE END OF THE CROSS ARMS TO FACILITATE PULLING OF THE CROSS ARMS THROUGH THE POST. THE ERECTION LUGS SHALL BE POSITIONED TO FORCE THE "PULL" TO OCCUR ON THE CENTERLINE OF THE CROSS ARM. ERECTOR SHALL SUPPORT THE POST ON EITHER SIDE OF THE CROSS-ARM PRIOR TO PULLING THE CROSS-ARM THROUGH THE HOLE IN THE POST.

4. ALL PIPE MEMBERS SHALL BE HOT-DIP GALVANIZED INSIDE AND OUTSIDE AFTER FABRICATION AS PER ASTM A123, UNLESS PAINTING IS CALLED FOR ON THE PLANS. PAINTING SHALL CONFORM TO SECTION 522, DUPLEX COATING SYSTEM. ALL NUTS, BOLTS AND WASHERS FOR SIGN STRUCTURES SHALL BE GALVANIZED AFTER FABRICATION AS PER ASTM A123 OR ASTM A153, AS APPROPRIATE, AND SHALL NOT BE PAINTED. TENSION CONTROL BOLTS OR DIRECT TENSION INDICATING WASHERS USED IN HIGH-STRENGTH BOLTED CONNECTIONS SHALL BE MECHANICALLY GALVANIZED PER ASTM B695, COATING CLASS 55.

5. SEE THE BUTTERFLY MOUNTED SIGN X-SECTION SHEET IN THE TRAFFIC PLANS FOR THE DMS PANEL WIDTH, HEIGHT, DEPTH, AND WEIGHT; TOP OF CAISSON ELEVATION, STATION AND OFFSET; DMS PANEL OFFSET FROM SHOULDER; SUPPORT POST HEIGHT, ANGLE θ, AND GUARDRAIL PROTECTION LIMITS. DO NOT USE ANY POST HEIGHT WHICH EXCEEDS THE MAXIMUM POST HEIGHT SHOWN IN THE POST AND CROSS ARM PIPE DATA TABLE ON SHEET 11. STRUCTURES OVER TRAFFIC AND STRUCTURES THAT COULD FALL INTO THE TRAVELED WAY OR ONTO THE SHOULDER SHALL BE ASSIGNED A STAFF BRIDGE GENERATED STRUCTURE NUMBER.

CANTILEVER DESIGN DATA

SPECIFICATIONS:

DESIGN: "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (2009 AASHTO).

SUBSECTION 17.4, SIGNS, IN THE STAFF BRIDGE BRANCH BRIDGE DESIGN MANUAL.

CONSTRUCTION: CDOT STANDARD SPECIFICATIONS, THESE STANDARD SHEETS AND THE PROJECT PLANS.

WIND LOADING: 100 MPH VELOCITY

BUTTERFLY DESIGN DATA

SPECIFICATIONS:

DESIGN: "STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS", AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (2009 AASHTO).

SUBSECTION 17.4, SIGNS, IN THE STAFF BRIDGE BRANCH BRIDGE DESIGN MANUAL.

CONSTRUCTION: CDOT STANDARD SPECIFICATIONS, THESE STANDARD SHEETS AND THE PROJECT PLANS.

WIND LOADING: 110 MPH VELOCITY (3-SECOND GUST).

MATERIALS

	SPECIFICATION			
ELEMENT	ASTM	AASHTO	AISI	CLARIFICATIONS
POSTS, MAST/CROSS ARMS	A53			#1
BARS, PLATES AND SHAPES	A709	M-270		#2
HOLLOW STRUCTURAL SECTIONS (HSS)	A500			#3
HIGH-STRENGTH BOLTS (H.S. BOLTS)	A325	M-164		#4
HIGH-STRENGTH NUTS	A563	M-291		
HIGH-STRENGTH WASHERS	F436	M-292		#5
U-BOLTS (RODS)	F1554	M-314		GRADE 55 STEEL
ANCHOR BOLTS	F1554	M-314		GRADE 55 STEEL
SPHERICAL WASHER SETS	A29		4140	#6
COLLAR NUTS	A29		4140	#6, #7

#1 PIPE POSTS AND MAST/CROSS ARMS SHALL BE WELDED OR SEAMLESS STEEL PIPE CONFORMING TO THE SPECIFICATIONS OF ASTM DESIGNATION: A53, GRADE B.

#2 GRADES 36 OR 50. ASTM A992 SHAPES MAY BE SUBSTITUTED.

#3 HOLLOW STRUCTURAL SECTION SPECIFICATIONS APPLY TO THE STRUCTURAL TUBING SECTIONS (TS) USED AT HANDHOLES AND SAFETY RAILINGS.

#4 TENSION CONTROL (TC) BOLTS CONFORMING TO ASTM F1852 MAY BE SUBSTITUTED FOR ASTM A325 BOLTS. ALL OTHER BOLTS AND NUTS SHALL CONFORM TO THE SPECIFICATIONS OF ASTM DESIGNATION: A307. INSTALL A307 BOLTS WITH COMMERCIAL QUALITY WASHERS.

#5 ASTM F959, COMPRESSIBLE-WASHER-TYPE DIRECT TENSION INDICATORS MAY BE SUBSTITUTED FOR ASTM F436 WASHERS AT HIGH-STRENGTH BOLTED CONNECTIONS.

#6 SPHERICAL WASHER SETS AND COLLAR NUTS SHALL BE HARDENED IN ACCORDANCE WITH ASTM F436 AND HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A153.

#7 A SPHERICAL WASHER SET AND AN A325 NUT MAY BE SUBSTITUTED FOR A COLLAR NUT.

OVERHEAD SIGN X-SECTION SHEET(S) SHALL SHOW:

1. SIGN STRUCTURE LOCATION (HIGHWAY, STATION AND DIRECTION)
2. LENGTH OF STRUCTURE SPAN
3. DMS SIZE (WIDTH, HEIGHT, DEPTH AND WEIGHT) AND LOCATION ON STRUCTURE
4. OFFSET FROM SHOULDER
5. POST HEIGHT FROM TOP OF CAISSON TO ℄ MAST ARM
6. CAISSON DIAMETER AND MINIMUM EMBEDMENT
7. TOP OF CAISSON ELEVATION
8. CAISSON PAY LENGTH
9. STATIONS AND OFFSETS TO CAISSON
10. ANGLE θ FOR BUTTERFLY INSTALLATIONS
11. GUARDRAIL PROTECTION LIMITS
12. WALKWAY LOCATION IF REQUIRED
13. LANE LINE LOCATION(S) IF STRUCTURE IS OVER TRAFFIC
14. LOCATION OF DISCONNECT FOR THE POWER SUPPLY
15. LOCATION OF REMOTE ACCESS CABINET ON POLE
16. AS CONSTRUCTED BLOCK

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DYNAMIC SIGN MONOTUBE STRUCTURES

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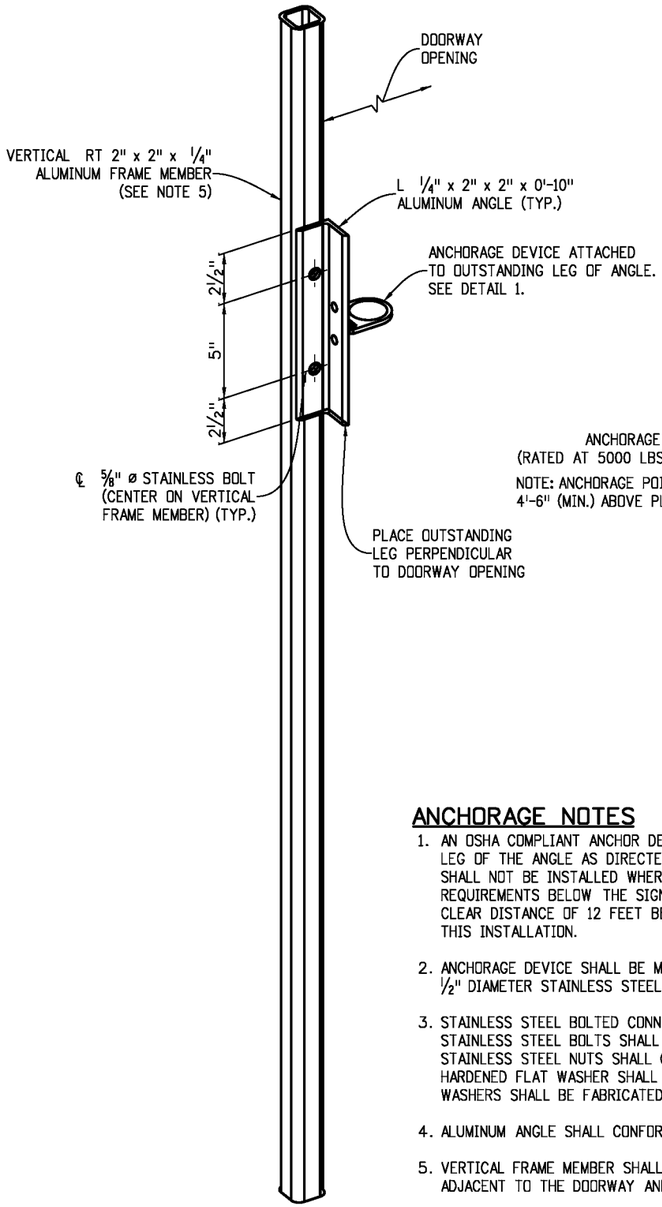
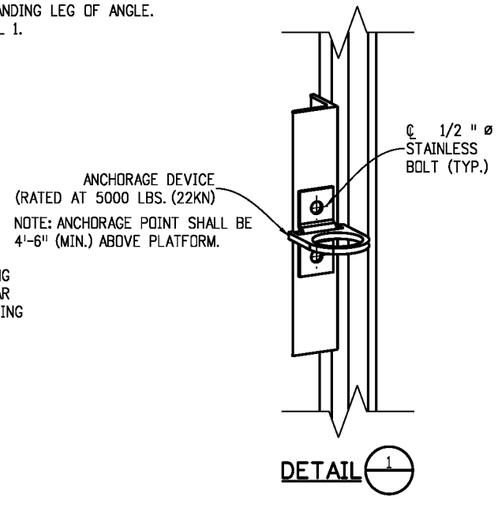
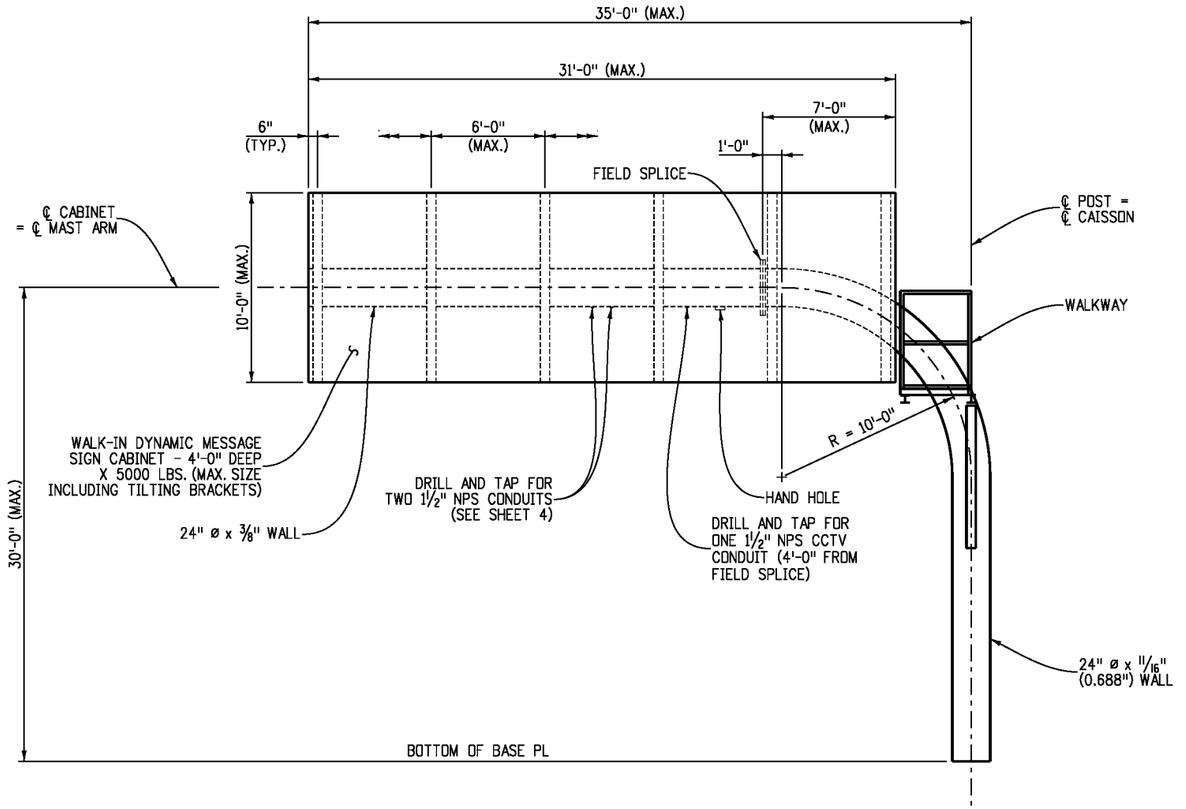
-CANTILEVER INSTALLATION DETAILS-





ANCHORAGE NOTES

1. AN OSHA COMPLIANT ANCHOR DEVICE SHALL BE MOUNTED TO THE OUTSTANDING LEG OF THE ANGLE AS DIRECTED BY THE ENGINEER. ANCHORAGE DEVICES SHALL NOT BE INSTALLED WHERE MINIMUM FALL PROTECTION CLEARANCE REQUIREMENTS BELOW THE SIGN ARE NOT MET. A MINIMUM UNOBSTRUCTED CLEAR DISTANCE OF 12 FEET BELOW THE SIGN CABINET IS REQUIRED FOR THIS INSTALLATION.
2. ANCHORAGE DEVICE SHALL BE MOUNTED WITH A MINIMUM OF TWO 1/2" DIAMETER STAINLESS STEEL BOLTS.
3. STAINLESS STEEL BOLTED CONNECTIONS SHALL CONFORM TO ASTM A962. STAINLESS STEEL BOLTS SHALL CONFORM TO ASTM F593, GROUP 1. STAINLESS STEEL NUTS SHALL CONFORM TO ASTM F594, GROUP 1. A HARDENED FLAT WASHER SHALL BE PROVIDED UNDER THE NUT. FLAT WASHERS SHALL BE FABRICATED FROM THE SAME MATERIAL AS THE NUTS.
4. ALUMINUM ANGLE SHALL CONFORM TO ASTM B308.
5. VERTICAL FRAME MEMBER SHALL BE A PRIMARY FRAMING COMPONENT, ADJACENT TO THE DOORWAY AND ON THE SUPPORT FACE OF THE CABINET.



CANTILEVER NOTES

1. THE MAXIMUM CABINET OVERLAP ONTO ELBOW SHALL NOT EXCEED 7'-0" FROM THE FIELD SPLICE.
2. ALL POSTS BETWEEN BASE PLATE AND FIELD SPLICE SHALL HAVE A TUBE WALL THICKNESS OF 11/16" (0.688"). ALL MAST ARMS SHALL HAVE A TUBE WALL THICKNESS OF 3/8".
3. SEE SHEET 6 FOR FIELD SPLICE DETAILS.

OSHA COMPLIANT ANCHORAGE DETAILS

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DYNAMIC SIGN MONOTUBE STRUCTURES

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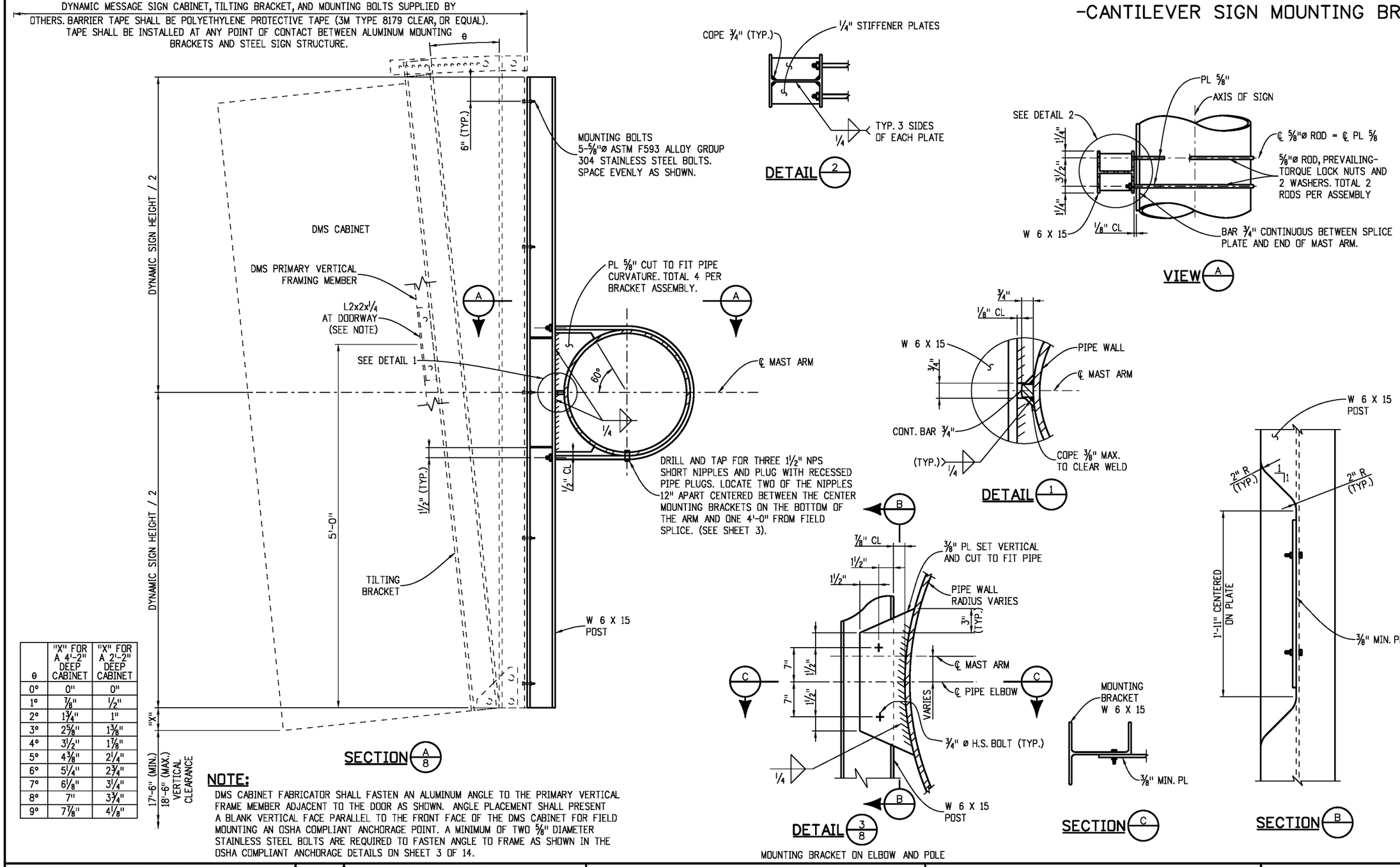
-CANTILEVER SIGN MOUNTING BRACKETS-



θ	"X" FOR A 4'-2" DEEP CABINET	"X" FOR A 2'-2" DEEP CABINET
0°	0"	0"
1°	7/8"	1/2"
2°	1¾"	1"
3°	2⅝"	1⅜"
4°	3½"	1⅞"
5°	4⅜"	2¼"
6°	5¼"	2¾"
7°	6⅛"	3¼"
8°	7"	3¾"
9°	7⅞"	4⅛"

NOTE:

DMS CABINET FABRICATOR SHALL FASTEN AN ALUMINUM ANGLE TO THE PRIMARY VERTICAL FRAME MEMBER ADJACENT TO THE DOOR AS SHOWN. ANGLE PLACEMENT SHALL PRESENT A BLANK VERTICAL FACE PARALLEL TO THE FRONT FACE OF THE DMS CABINET FOR FIELD MOUNTING AN OSHA COMPLIANT ANCHORAGE POINT. A MINIMUM OF TWO 5/8" DIAMETER STAINLESS STEEL BOLTS ARE REQUIRED TO FASTEN ANGLE TO FRAME AS SHOWN IN THE OSHA COMPLIANT ANCHORAGE DETAILS ON SHEET 3 OF 14.

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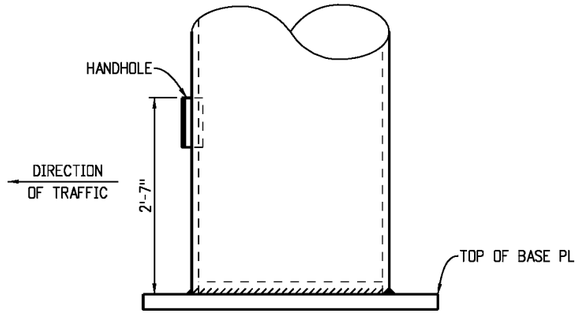
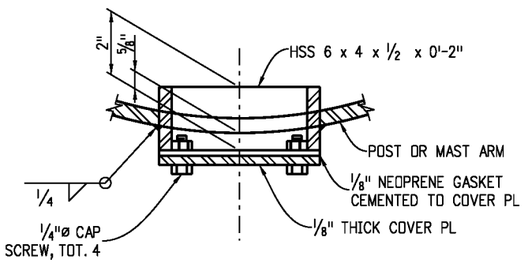
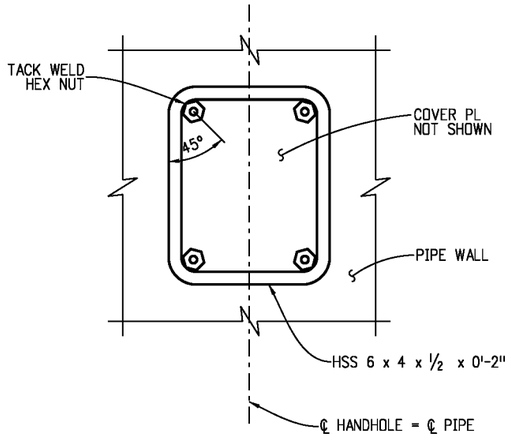
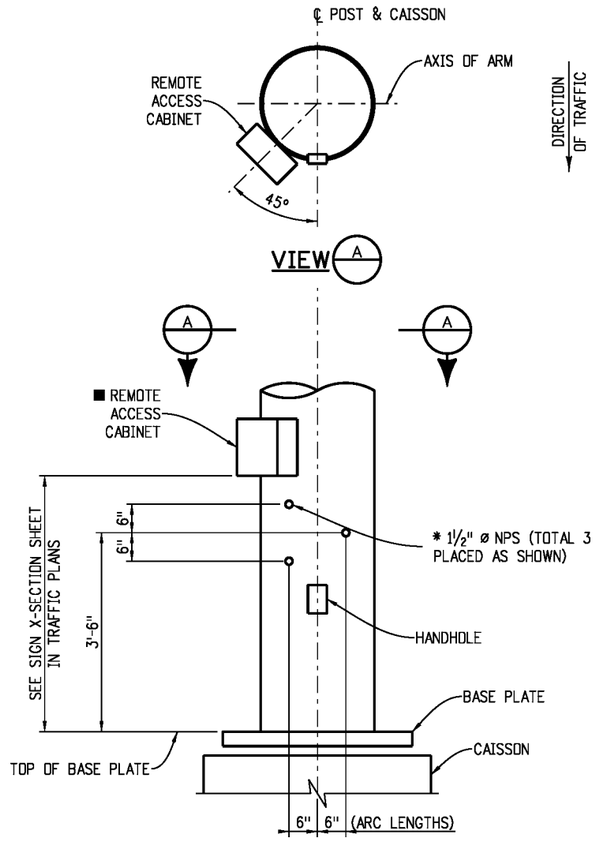


POST BASE ELEVATION
(FOR BASE PL DETAILS SEE SHEET 7)

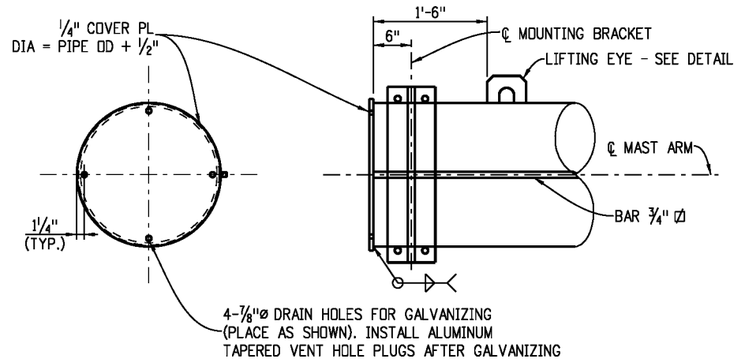




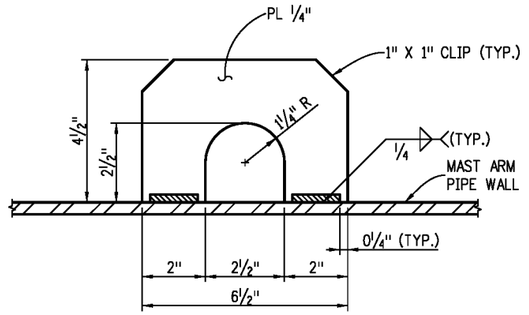
HANDHOLE AND COVER DETAILS



CONDUIT PENETRATION DETAILS
* PLUG WITH RECESSED PIPE PLUGS
■ DISCONNECT CABINET FOR THE POWER SUPPLY SHALL BE LOCATED OUTSIDE OF THE CLEAR-ZONE.



MAST ARM END DETAIL



LIFTING EYE DETAIL

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DYNAMIC SIGN MONOTUBE STRUCTURES

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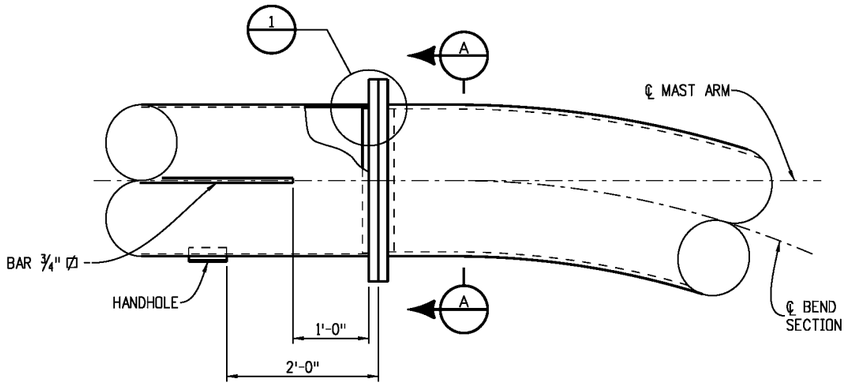
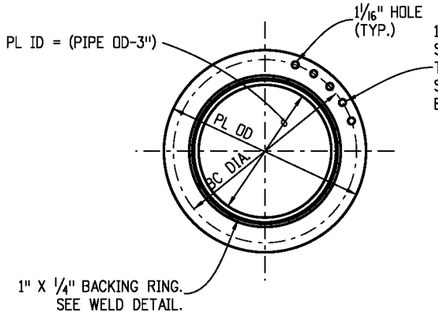
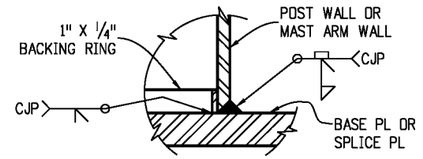


FIELD SPLICE

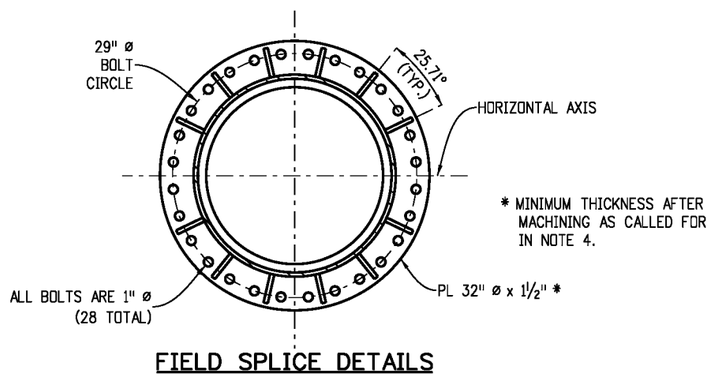


1" ⌀ H.S. BOLTS (GALVANIZED) EQUALLY SPACED. BOLTS SHALL BE SEQUENTIALLY TIGHTENED. ASSUMING 12 BOLTS AND A CLOCK FACE, THE TIGHTENING SEQUENCE WOULD BE 12, 6, 1, 7 ETC. THIS PROCESS SHALL BE CONTINUED UNTIL NO LOOSE BOLTS ARE FOUND AFTER ALL BOLTS HAVE BEEN INITIALLY TIGHTENED.

SECTION A

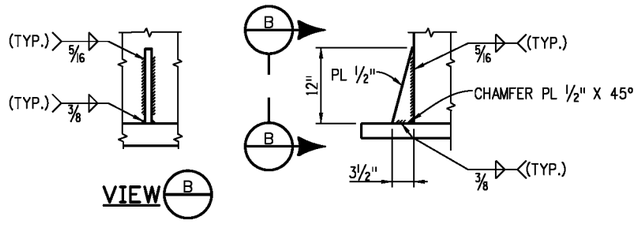


DETAIL 1



FIELD SPLICE DETAILS

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



VIEW B

STIFFENER DETAILS

NOTES:

1. STIFFENERS ARE TO BE PLACED ON ALL CANTILEVER FIELD SPLICES. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY.
2. TERMINATE WELD ½" SHORT OF THE TOP OF THE STIFFENER PLATE. AT THE OTHER 3 WELD TERMINATIONS ON THESE TWO TYPICAL WELDS, STOP THE WELD ¼" SHORT OF THE END OF THE PLATE.
3. SPLICE DESIGN BASED ON ARM CAPACITY.
4. THE MATING SURFACES OF THE FLANGE SPLICE PLATES SHALL BE MACHINED TO A COMMON PLANE WITHIN A TOLERANCE OF 1/64" USING A PORTABLE FLANGE FACER AFTER WELDING AND PRIOR TO GALVANIZING.

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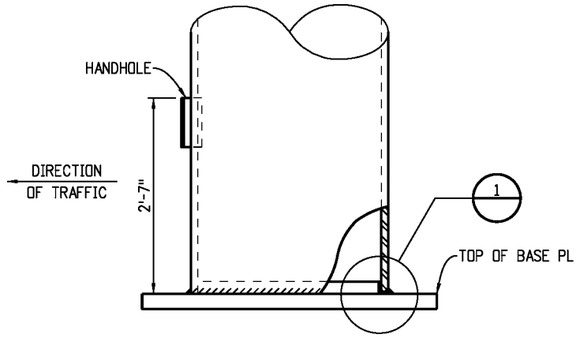
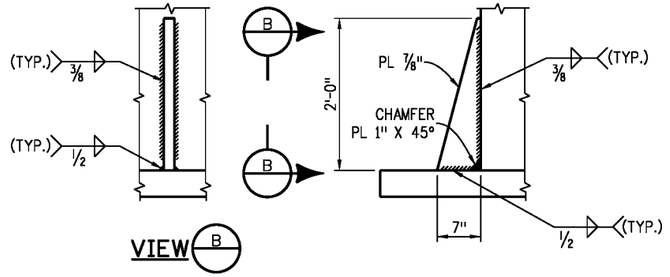
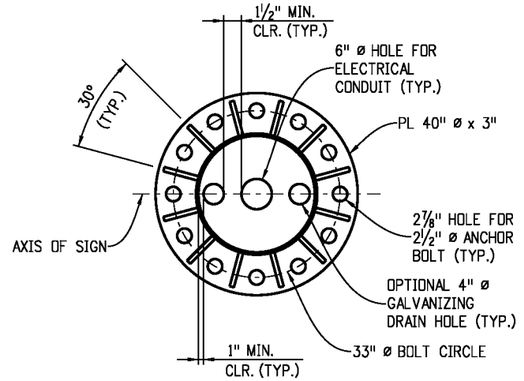


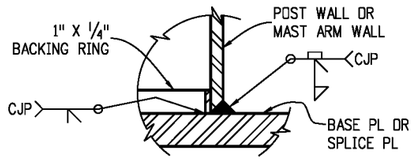
POST BASE ELEVATION



STIFFENER DETAILS
(AT POST BASE - SEE NOTES)



BASE PLATE DETAILS



DETAIL 1

NOTES:

1. STIFFENERS ARE NOT SHOWN ELSEWHERE IN THESE SHEETS FOR CLARITY.
2. TERMINATE WELD 1/2" SHORT OF THE TOP OF THE STIFFENER PLATE. AT THE OTHER 3 WELD TERMINATIONS ON THESE TWO TYPICAL WELDS STOP THE WELD 1/4" SHORT OF THE END OF THE PLATE.

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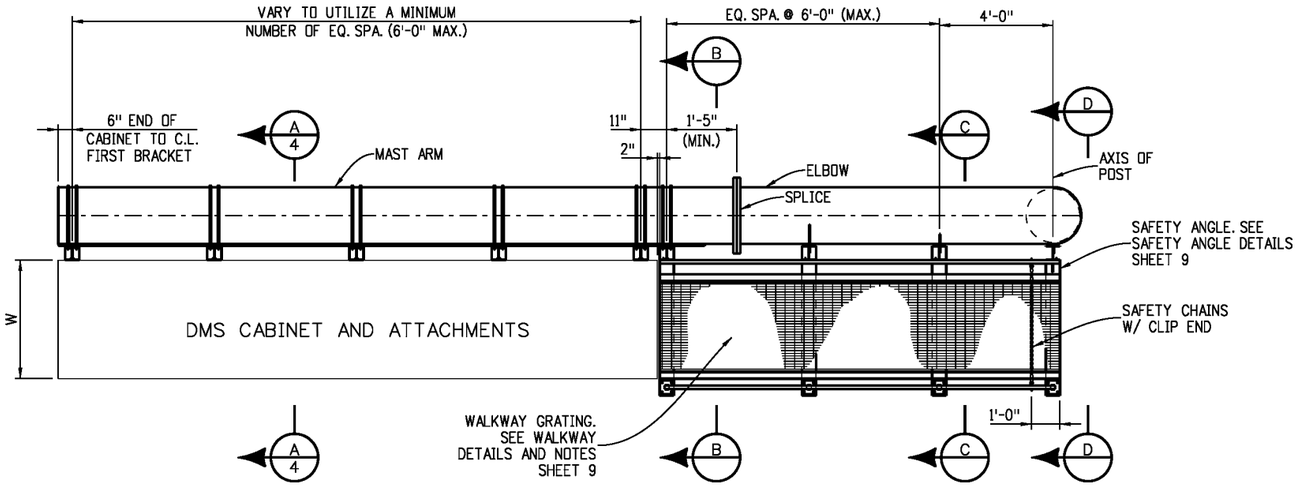
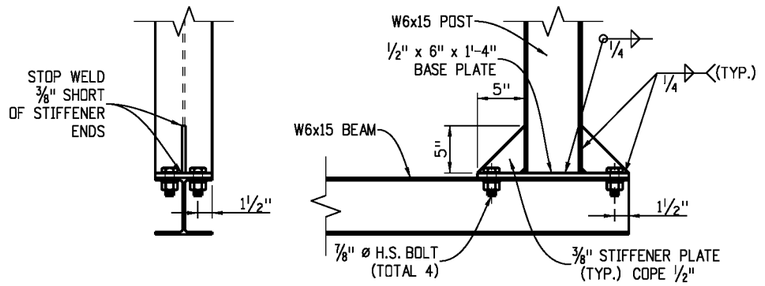


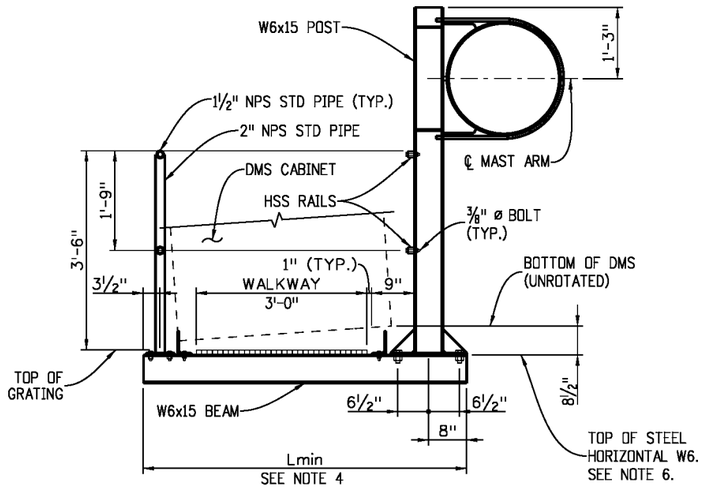
WALKWAY PLAN
WALKWAY LEADING TO CABINET



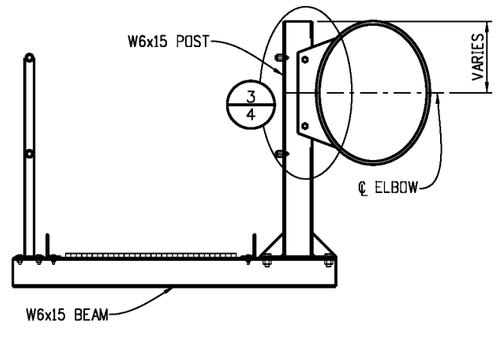
BEAM TO POST CONNECTION DETAIL

NOTES

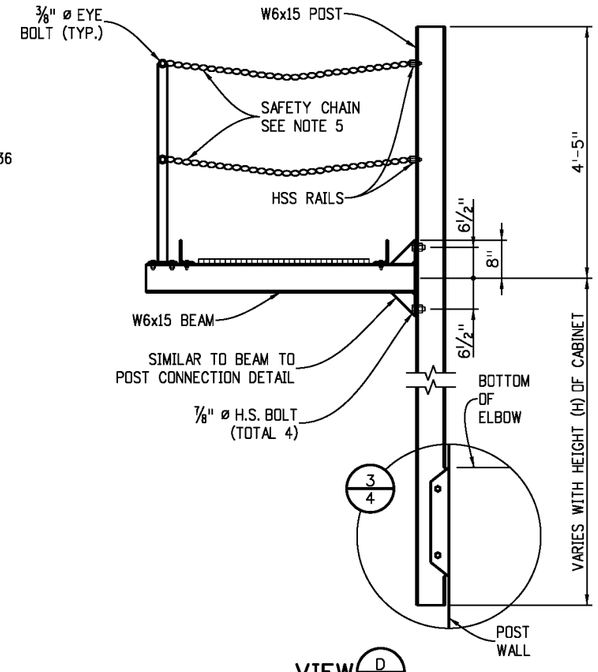
1. MAINTAIN UNIFORM POST SPACING WHERE POSSIBLE.
2. MAXIMUM POST SPACING SHALL NOT EXCEED 6'-0".
3. SEE SHEETS 4 AND 9 FOR ADDITIONAL DETAILS NOT SHOWN HEREON.
4. LENGTH OF BEAM SHALL BE BASED ON DMS WIDTH (W) TO PERMIT CLEARANCE BETWEEN RAILS FOR UNOBSTRUCTED OPENING OF DMS ACCESS DOOR. Lmin = W+27 INCHES.
5. SAFETY CHAIN SHALL BE ¼" GALVANIZED STEEL COIL CHAIN, APPROXIMATELY 36 LINKS PER YARD.
6. TOP OF HORIZONTAL W6x15 ELEVATION SHALL BE 8½" BELOW BOTTOM OF DMS CABINET WITH THE TILTING BRACKET IN THE 0° (UNROTATED) POSITION.



SECTION B



SECTION C



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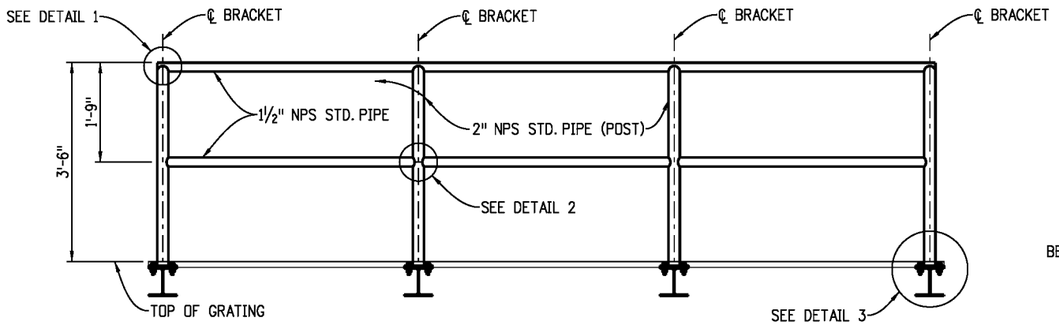
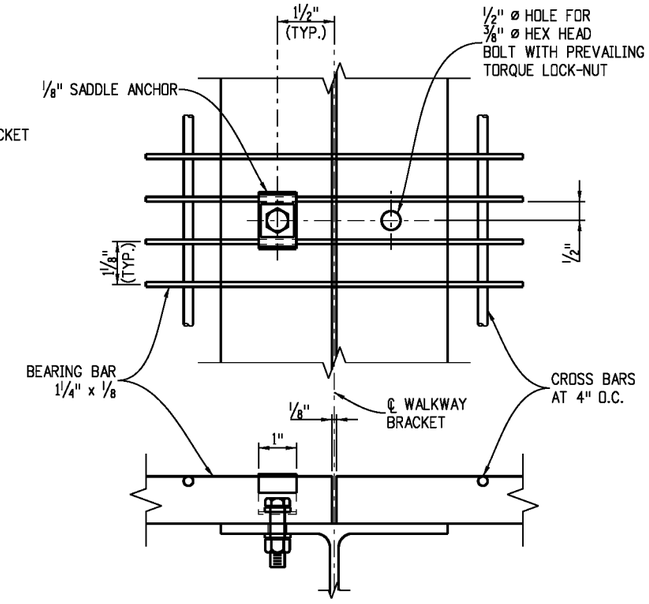
-CANTILEVER SIGN WALKWAY DETAILS (2 OF 2)-

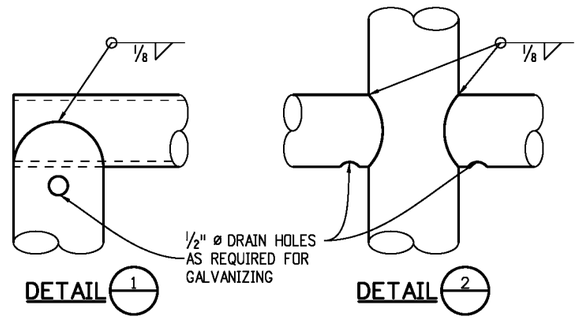


SAFETY RAILING ELEVATION

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

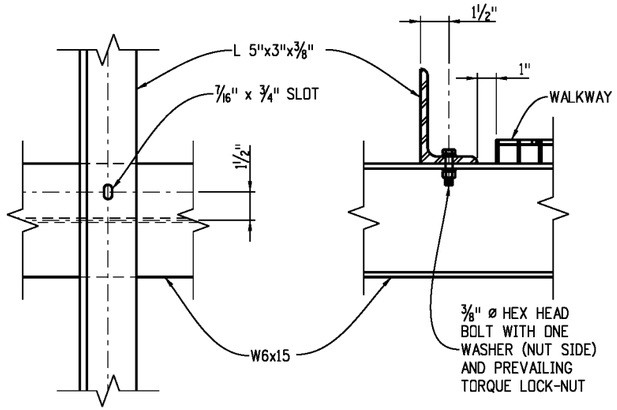


WALKWAY DETAILS

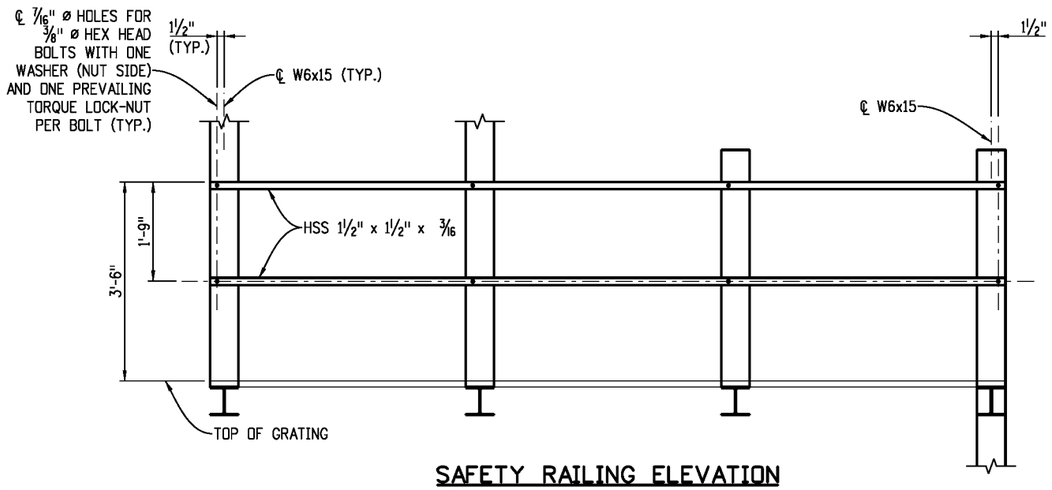


NOTES

ALTERNATIVE VENTING METHODS MAY BE USED IF APPROVED BY THE ENGINEER

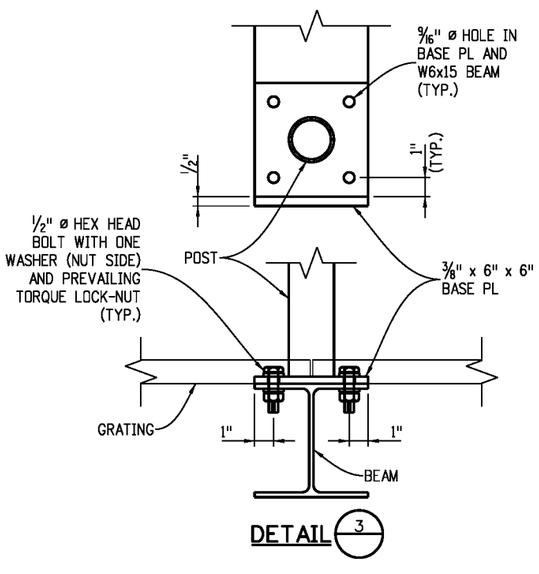


SAFETY ANGLE DETAILS



SAFETY RAILING ELEVATION

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



DETAIL 3

NOTES

1. WELDED TYPE GRATING SHALL HAVE 1 ¼" x ⅛" BEARING BARS AT 1 ⅛" CENTERS WITH ¼" DIAMETER (OR EQUAL) CROSS BARS AT 4" CENTERS. IF MECHANICAL LOCK GRATING IS USED, IT SHALL BE EQUAL IN STRENGTH TO THE WELDED TYPE. ALTERNATE HOLD-DOWN CLIPS MAY BE SUBMITTED FOR APPROVAL.
2. WALKWAY GRATING TO BE CONTINUOUS (NO SPLICES) OVER AS MANY WALKWAY BRACKETS AS PRACTICAL CONSISTENT WITH FABRICATION, EASE OF HANDLING AND ASSEMBLY.
3. ALL BOLTS SHOWN ON THIS SHEET SHALL BE ASTM A-307. THE TIGHTENING TORQUE IS 16 FT-LBS. FOR ⅜" ø BOLTS AND 40 FT-LBS. FOR 1/2 " ø BOLTS. DO NOT OVER TIGHTEN BOLTS AT WALKWAY SADDLE ANCHOR LOCATIONS.

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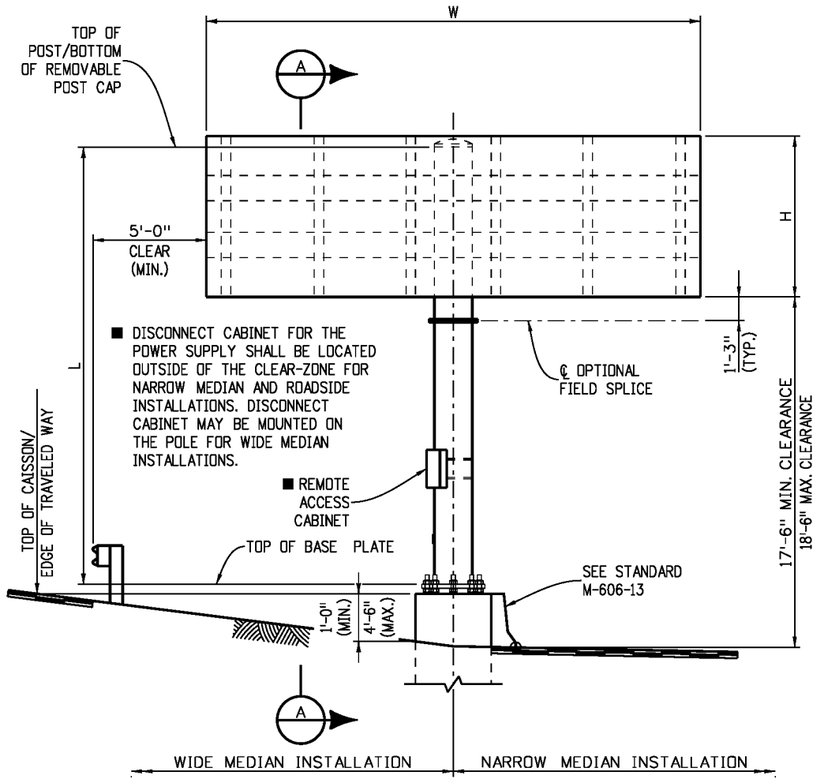
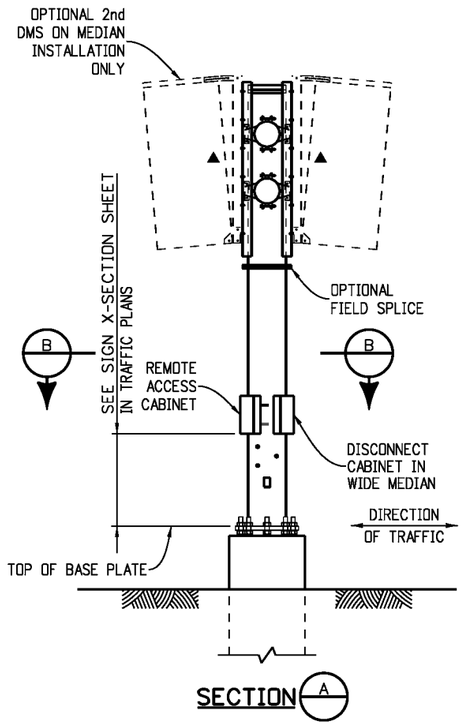
-BUTTERFLY INSTALLATION DETAILS-

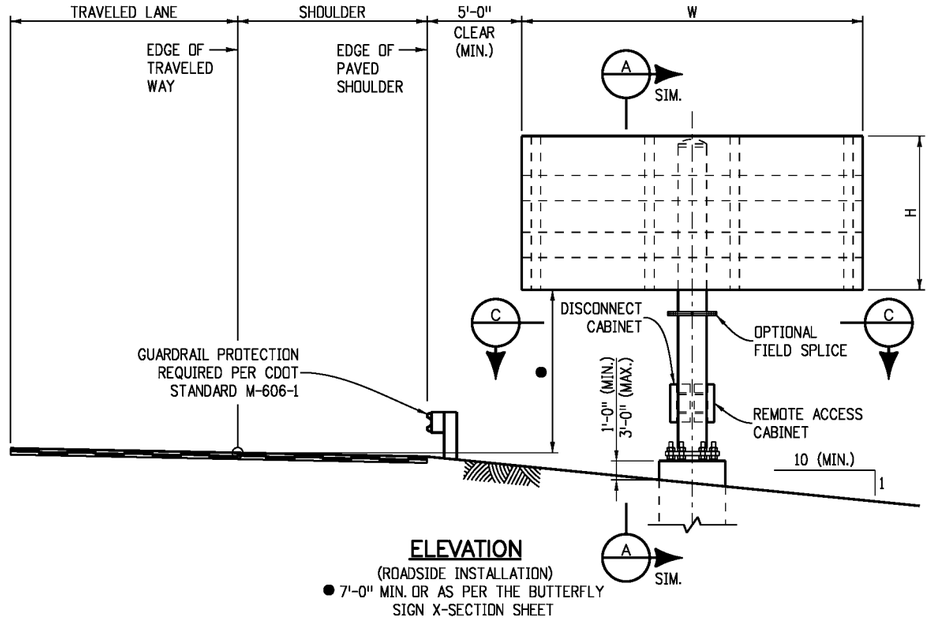


ELEVATION
(MEDIAN INSTALLATION)



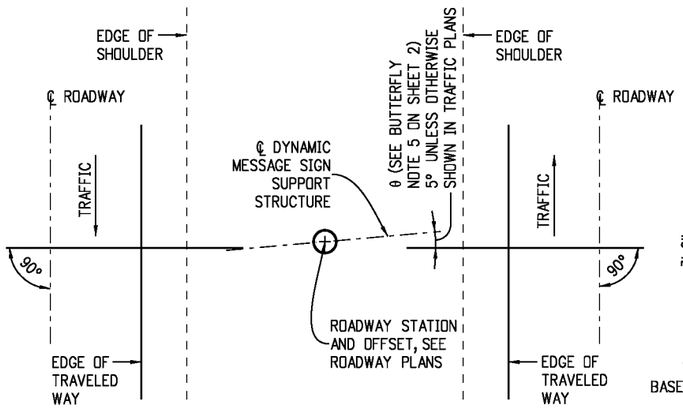
SECTION A

▲ PROVIDE OSHA COMPLIANT ANCHORAGE POINT AS DIRECTED BY THE ENGINEER. SEE SHEETS 3 & 4 FOR MOUNTING INFORMATION.

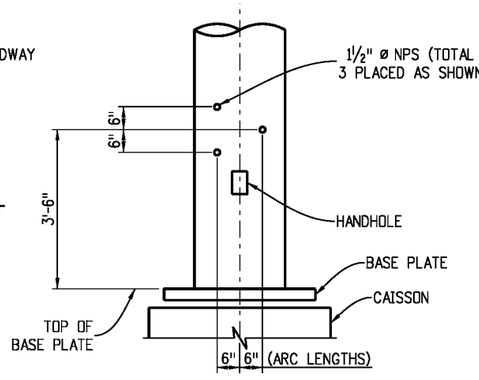


ELEVATION
(ROADSIDE INSTALLATION)

● 7'-0" MIN. OR AS PER THE BUTTERFLY SIGN X-SECTION SHEET

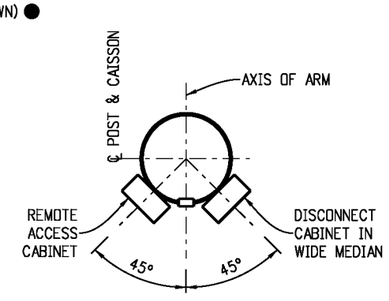


MEDIAN INSTALLATION PLAN

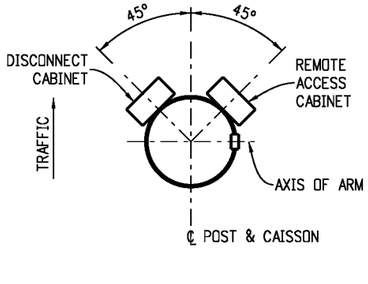


CONDUIT PENETRATION DETAILS

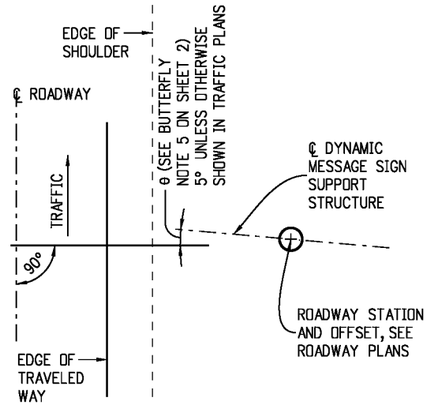
● PLUG WITH RECESSED PIPE PLUGS



SECTION B



SECTION C



ROADSIDE INSTALLATION PLAN

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Last Modification Date: 07-04-12 Initials: JRM	R=X		
Full Path: www.coloradodot.info/business/designsupport	R=X		
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R=X		

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DYNAMIC SIGN MONOTUBE STRUCTURES

Issued By: Safety and Traffic Engineering Branch on July 4, 2012

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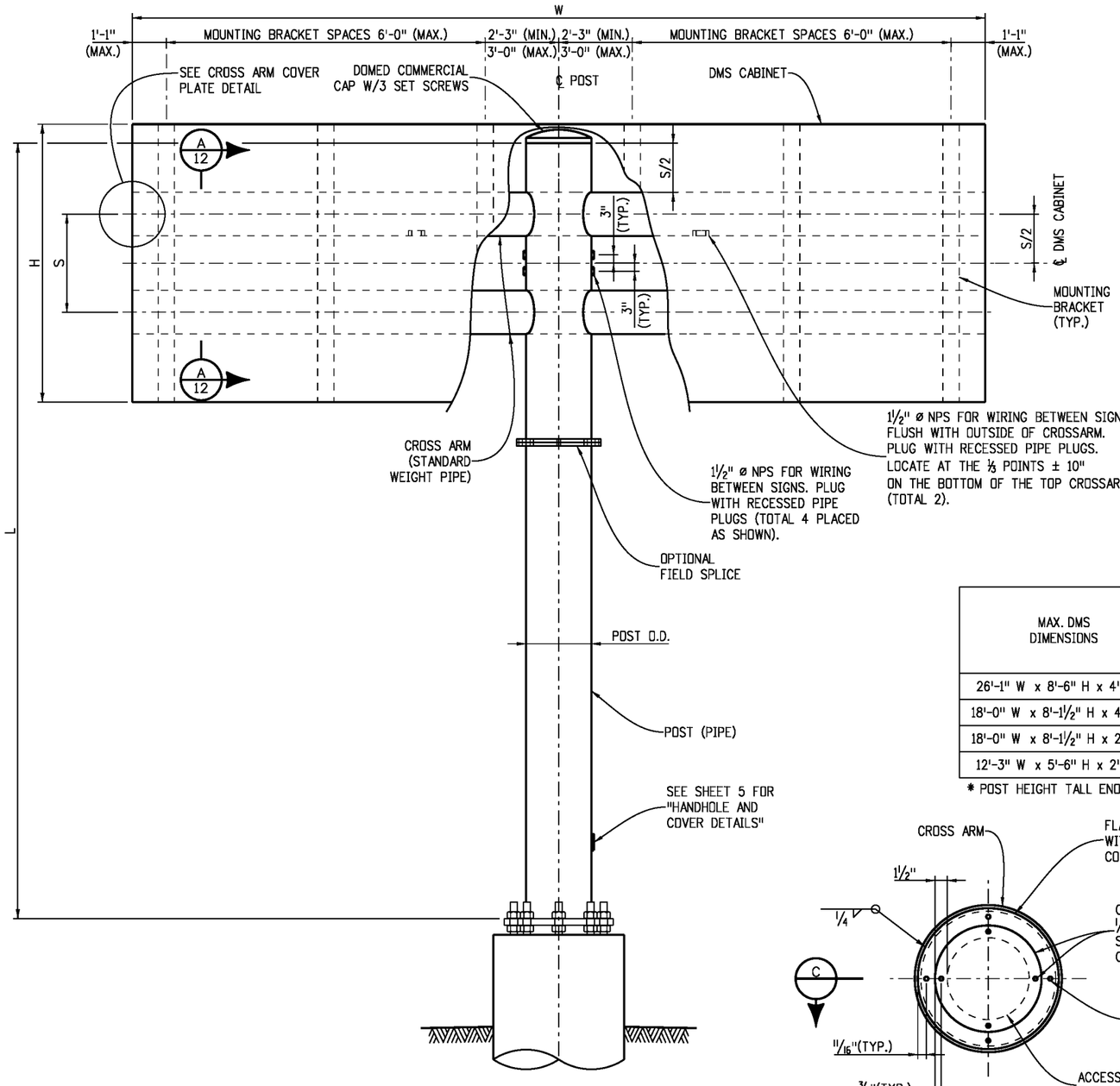
-BUTTERFLY ASSEMBLY DETAILS-



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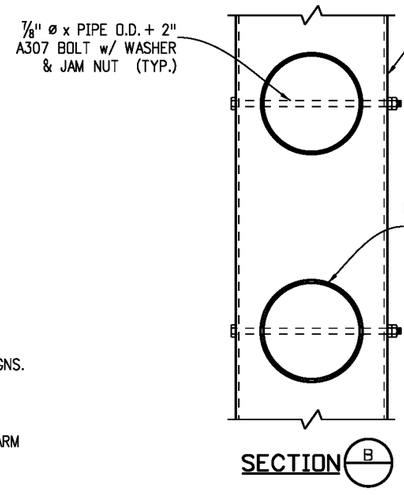
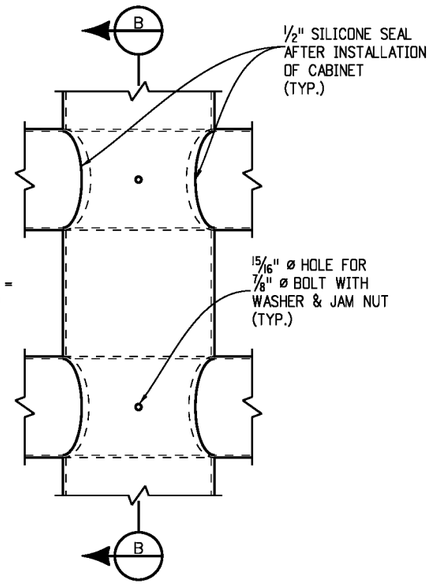


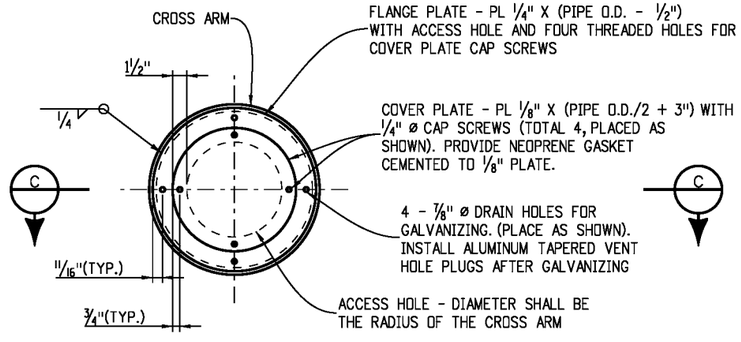
SECTION B



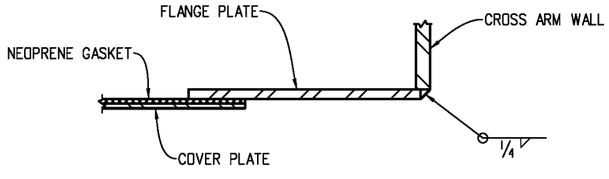
ARMS TO POST CONNECTION

MAX. DMS DIMENSIONS	MAX. DMS WEIGHT	POST PIPE DATA			CROSS ARM PIPE DATA			
		PIPE O.D. (IN)	MIN. WALL THICKNESS (IN)	MAX. POST HEIGHT (FT) "L"	PIPE O.D. (IN)	MIN. WALL THICKNESS (IN)	CROSS ARM LENGTH (FT) "W"	CROSS ARM SPACING (FT) "S"
26'-1" W x 8'-6" H x 4'-2" D	4100 LBS.	24.0	0.50	24.0 *	16.0	0.375	26.0	3.0
18'-0" W x 8'-1½" H x 4'-2" D	3000 LBS.	18.0	0.50	17.0	12.75	0.375	18.0	3.0
18'-0" W x 8'-1½" H x 2'-2" D	2280 LBS.	18.0	0.375	17.0	12.75	0.375	18.0	3.0
12'-3" W x 5'-6" H x 2'-2" D	1520 LBS.	18.0	0.375	14.0	12.75	0.375	12.25	2.5

* POST HEIGHT TALL ENOUGH TO ACCOMMODATE TRAFFIC UNDERNEATH SIGN.



CROSS ARM COVER PLATE DETAIL



SECTION C

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DYNAMIC SIGN MONOTUBE STRUCTURES

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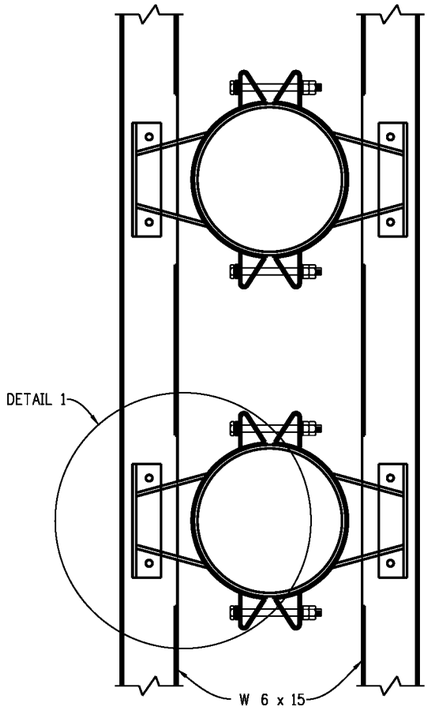
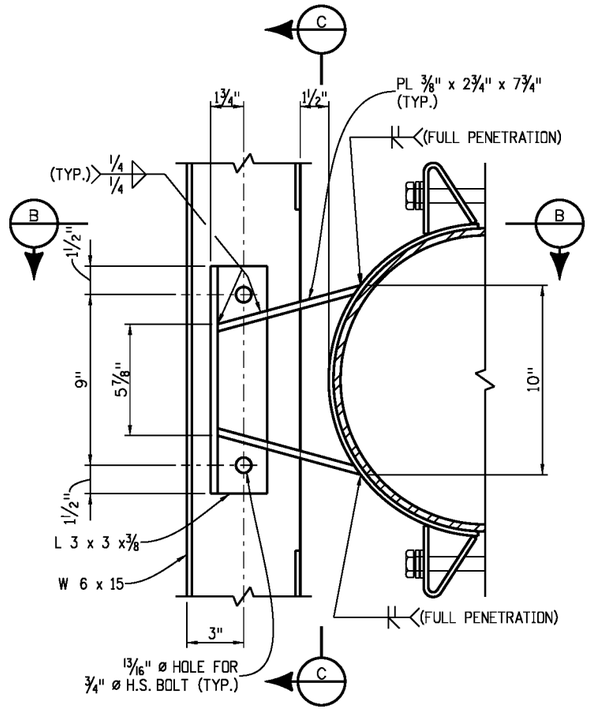
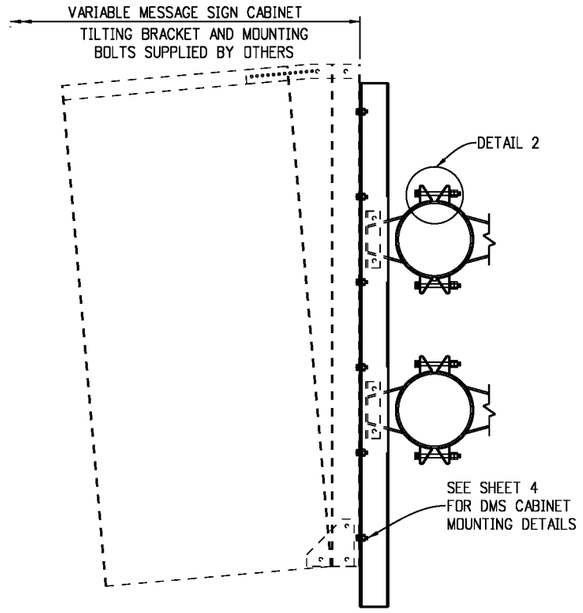
-BUTTERFLY SIGN MOUNTING DETAILS-



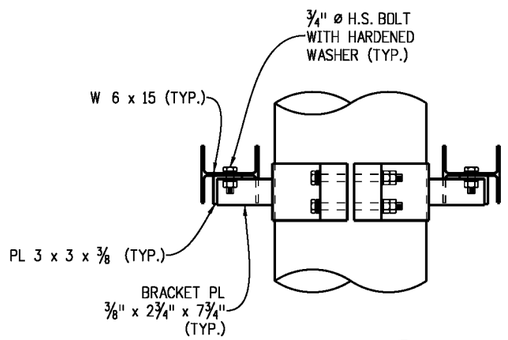
SECTION A/11



DETAIL 1

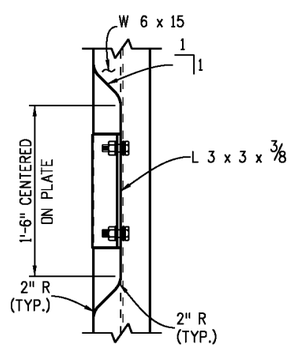


TYPICAL BRACKET CONNECTION

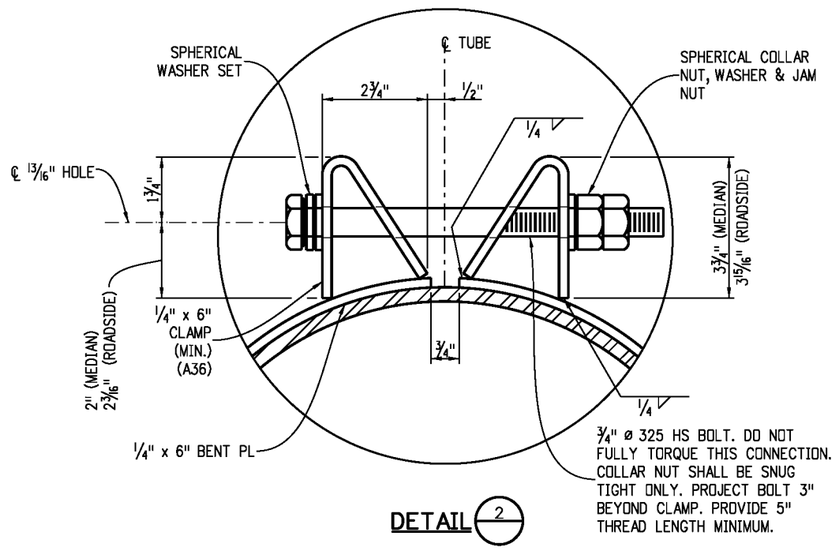


SECTION B

SEE DETAIL 2 FOR CLAMP DETAILS.



SECTION C



DETAIL 2

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DYNAMIC SIGN MONOTUBE STRUCTURES

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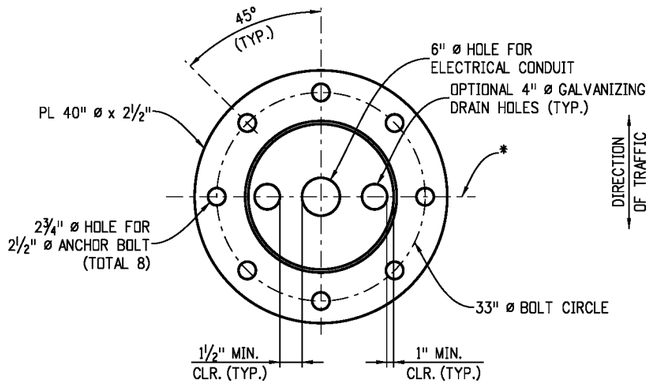
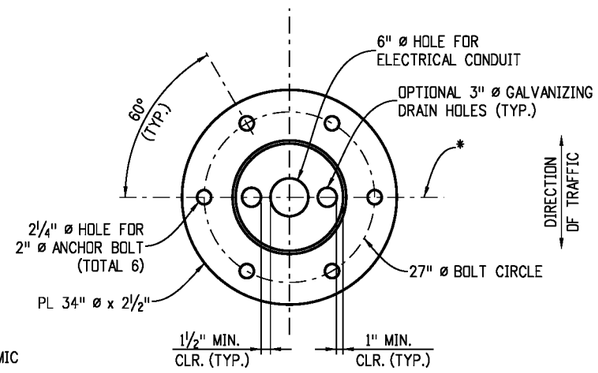
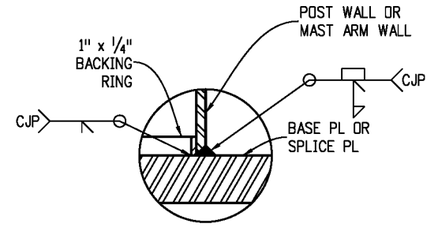


BASE PLATE DETAIL
24" PIPE POST

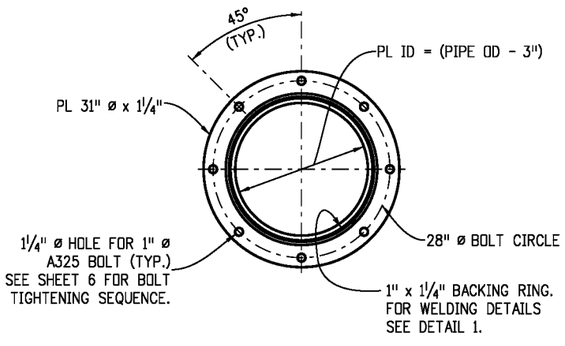
* CENTERLINE OF DYNAMIC MESSAGE SIGN SUPPORT STRUCTURE, SEE SHEET 10.



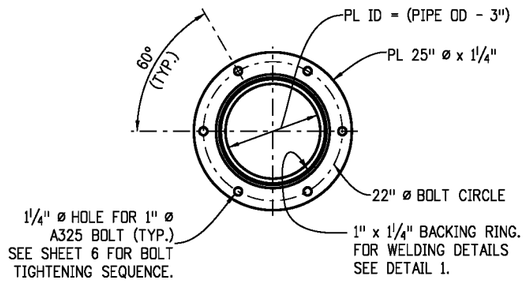
BASE PLATE DETAIL
18" PIPE POST



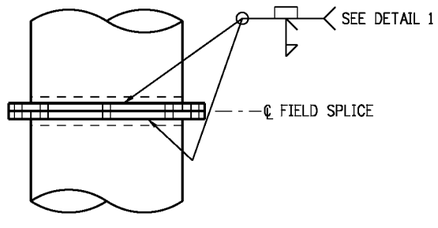
DETAIL 1



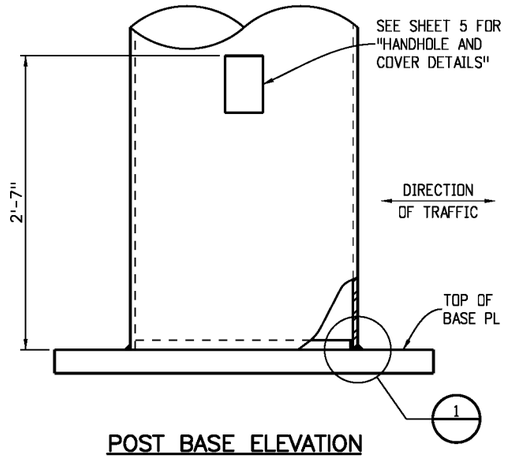
OPTIONAL FIELD SPLICE
24" PIPE POST



OPTIONAL FIELD SPLICE
18" PIPE POST



OPTIONAL FIELD SPLICE



POST BASE ELEVATION

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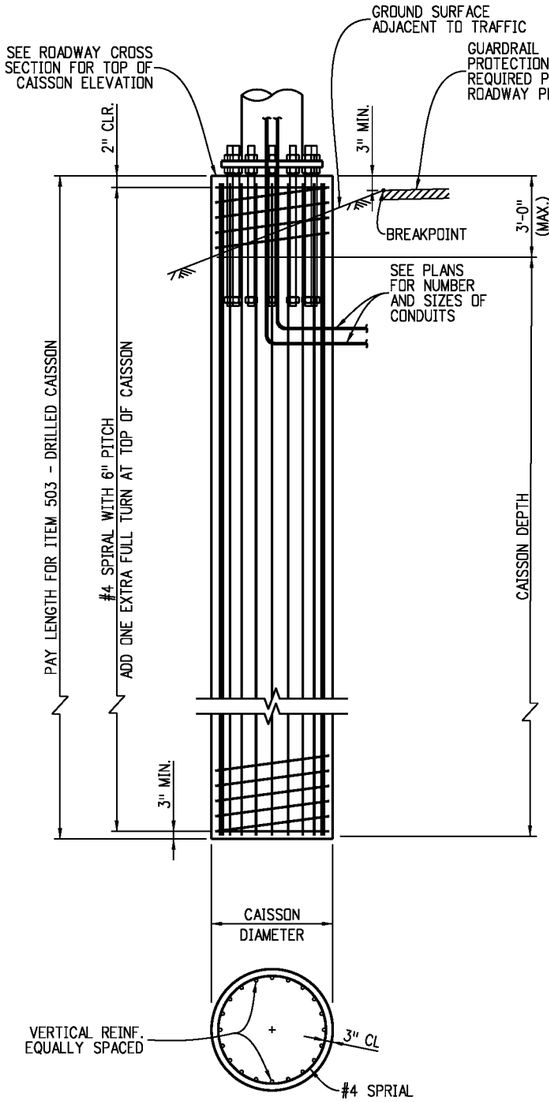
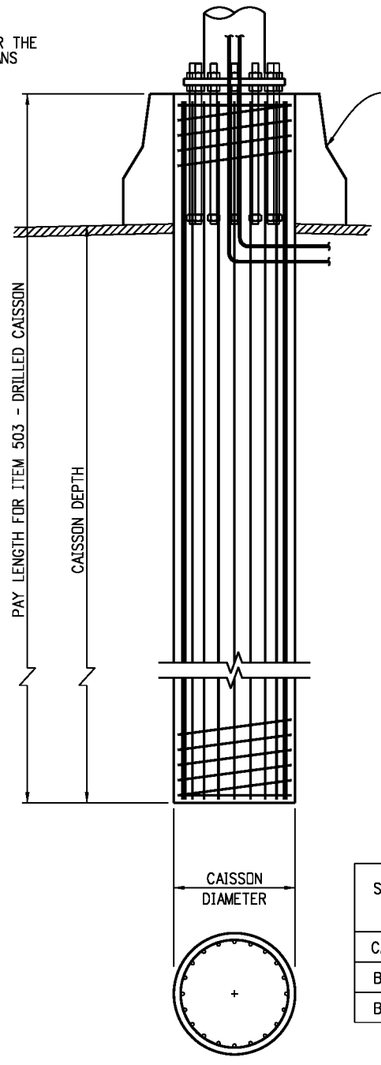
-FOUNDATION & ANCHOR BOLT DETAILS-



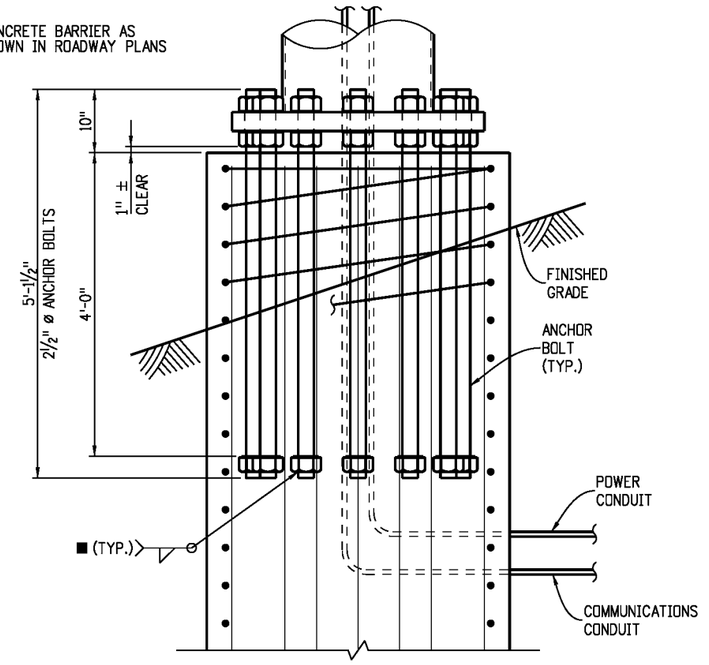
ROADSIDE SHOULDER INSTALLATION



MEDIAN RAIL INSTALLATION

(SEE ROADSIDE SHOULDER INSTALLATION FOR ADDITIONAL INFORMATION)

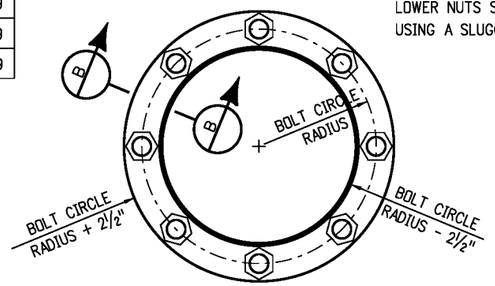
CAISSON FOUNDATION DETAILS



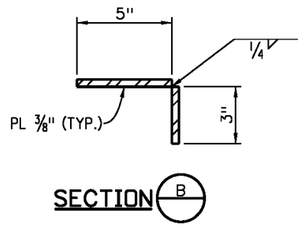
ANCHOR BOLT DETAIL

■ WELDING PROCEDURE IS NOT REQUIRED FOR THIS WELD

STRUCTURE TYPE	PIPE O.D. (IN)	CAISSON DIAMETER (IN)	CAISSON DEPTH (FT)	VERTICAL REINF.
CANTILEVER	24	48	29	18 - #9
BUTTERFLY	24	48	21	18 - #9
BUTTERFLY	18	42	16	14 - #9



BOLT TEMPLATE



SECTION B

CAISSON DRILLING AND INSTALLATION NOTES

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

2. THE DESIGN HEREIN ASSUMES THAT DMS SUPPORTS ARE INSTALLED WITHIN THE ROADWAY PRISM WITH THE FOLLOWING SOIL PARAMETERS:

   SOIL DENSITY = 110 LB./CU. FT.
   SOIL COHESION = 750 LB./SQ. FT. FOR MEDIUM STIFF COHESIVE SOIL
   SOIL ϕ ANGLE = 30° FOR MEDIUM DENSE COHESIONLESS SOIL
   SF = 3.0 FOR FLEXURAL RESISTANCE.

3. CONTACT THE ENGINEER IF ANY OF THE FOLLOWING SOIL CONDITIONS ARE ENCOUNTERED DURING DRILLING:
   (A) DMS SUPPORT WILL NOT BE INSTALLED WITHIN THE ROADWAY PRISM.
   (B) THE SOIL HAS A HIGH ORGANIC CONTENT OR CONSISTS OF SATURATED SILT AND CLAY.
   (C) THE SITE WON'T SUPPORT THE WEIGHT OF THE DRILLING RIG.
   (D) THE FOUNDATION SOILS ARE NOT HOMOGENOUS.
   (E) FIRM BEDROCK IS ENCOUNTERED.
   (F) HIGH GROUNDWATER IS ENCOUNTERED.
   (G) LARGE BOULDERS ARE ENCOUNTERED.

4. THE CONTRACTOR SHALL PROVIDE A SURVEY OF THE DMS FOUNDATION TO VERIFY PLACEMENT SOON AFTER WORK ON THE FOUNDATION HAS BEEN COMPLETED. THE SURVEY SHALL CONFORM TO THE REQUIREMENTS OF SECTION 625, CONSTRUCTION SURVEYING. THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER A COPY OF THE SURVEY NOTES DETAILING THE FOUNDATION LOCATION AND ELEVATION AND THE ANCHOR BOLT LOCATIONS, PROJECTIONS, AND ORIENTATIONS. THE ELEVATION OF THE GROUND SURROUNDING THE FOUNDATION SHALL ALSO BE PROVIDED. THE CONTRACTOR SHALL COMPARE THE SURVEY INFORMATION TO THE REVIEWED SHOP DRAWINGS AND RECONCILE ANY DIFFERENCES BETWEEN THEM. THE CONTRACTOR SHALL SUBMIT ALL PROPOSED ADJUSTMENTS OR MODIFICATIONS TO THE ENGINEER FOR APPROVAL.

NOTES

1. THREAD UPPER 10" AND GALVANIZE UPPER 1'-3" OF THE ANCHOR BOLTS.
2. ANCHOR BOLTS SHALL BE SET WITH A STEEL TEMPLATE UNTIL THE CONCRETE HAS CURED AT LEAST TWO DAYS.
3. THERE SHALL BE NO GROUT PAD INSTALLED ON TOP OF THE EXISTING FOUNDATIONS.
4. THE ANCHOR BOLTS SHALL BE TIGHTENED USING THE TURN-OF-NUT METHOD. THE BOLTS SHALL FIRST BE TIGHTENED TO SNUG TIGHT, WHICH IS DEFINED AS THE TIGHTNESS THAT EXISTS WHEN THE UPPER AND LOWER NUTS ARE IN FIRM CONTACT WITH THE BASE PLATE. WITH THE MAST ARM FREE TO DEFLECT, THE UPPER AND LOWER NUTS SHALL EACH THEN BE ROTATED AN ADDITIONAL ⅓ TURN (30° ± 5°) USING A SLUGGING WRENCH.

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Sheet Revisions	
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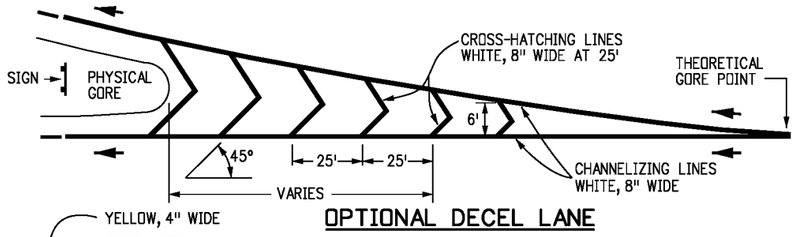
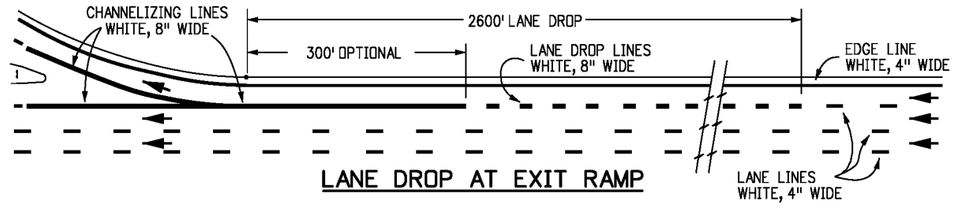
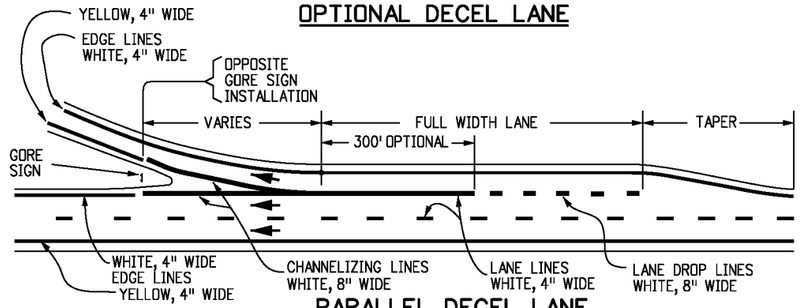


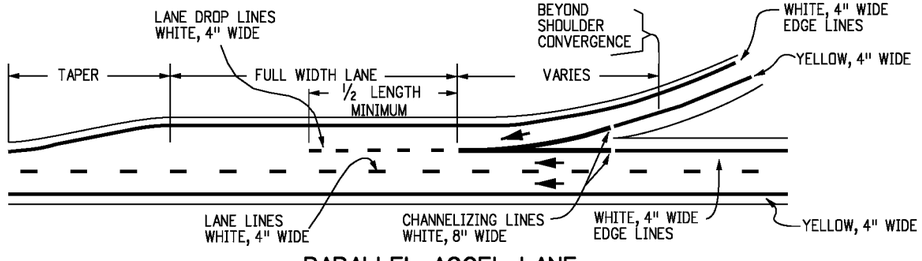
OPTIONAL DECEL LANE



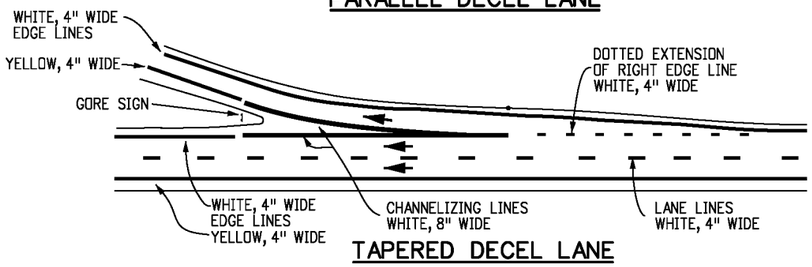
LANE DROP AT EXIT RAMP



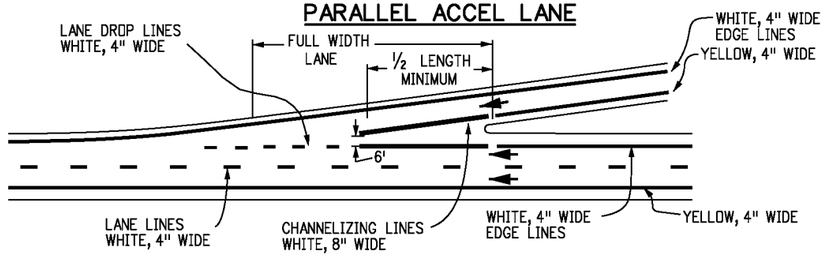
PARALLEL DECEL LANE



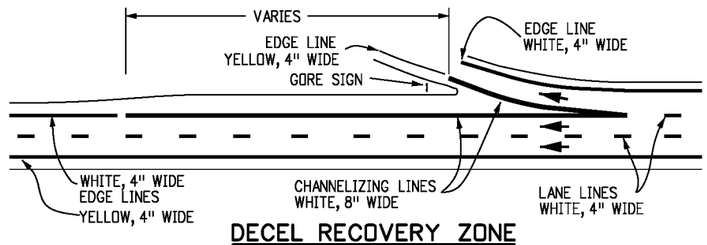
PARALLEL ACCEL LANE



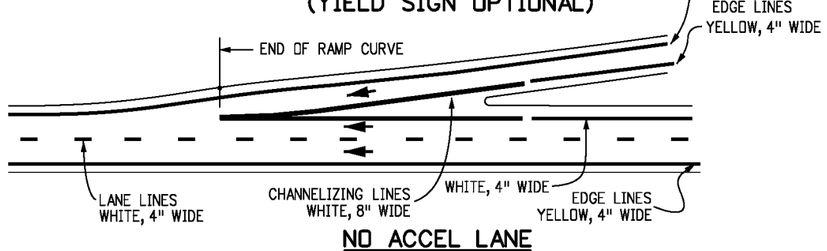
TAPERED DECEL LANE



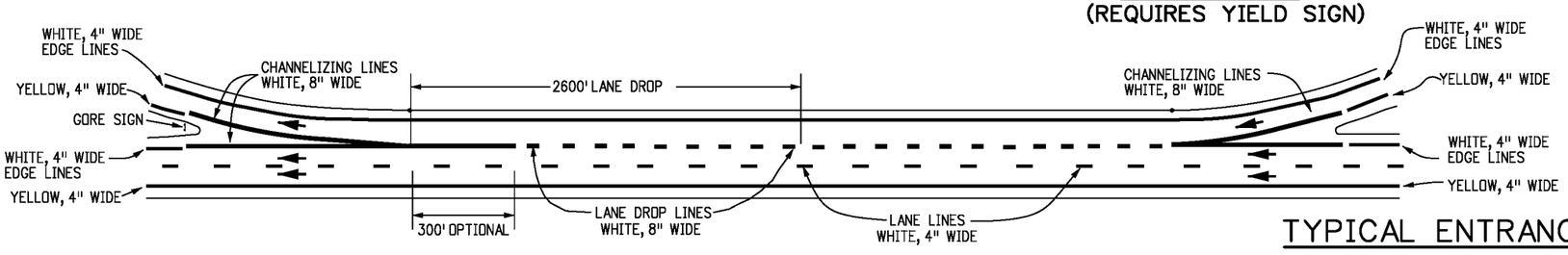
TAPERED ACCEL LANE (YIELD SIGN OPTIONAL)



DECEL RECOVERY ZONE



NO ACCEL LANE (REQUIRES YIELD SIGN)



COMBINATION ACCEL-DECEL LANE

TYPICAL ENTRANCE AND EXIT RAMP MARKINGS

GENERAL NOTES

1. CENTER LINES

   BROKEN YELLOW, 4 IN. WIDE - 10 FT. SEGMENTS WITH 30 FT. GAPS.

   SOLID YELLOW, 4 IN. WIDE.
   THESE LINES SEPARATE ADJACENT-OPPOSITE DIRECTION TRAFFIC LANES. DOUBLE LINES SHALL BE SPACED 4 IN. APART.

2. LANE LINES

   BROKEN WHITE, 4 IN. WIDE - 10 FT. SEGMENTS WITH 30' GAPS.

   SOLID WHITE, 4 IN. WIDE.
   THESE LINES SEPARATE ADJACENT-SAME DIRECTION TRAFFIC LANES. A SOLID LINE MAY BE USED TO DISCOURAGE LANE CHANGING, WHILE TWO PARALLEL SOLID WHITE LINES ARE REQUIRED TO PROHIBIT LANE CHANGING.

3. EDGE LINES

   SOLID WHITE OR YELLOW EDGE LINES SHALL BE 4 IN. WIDE. YELLOW EDGE LINES SHALL BE USED ONLY FOR LEFT EDGE, IN THE DIRECTION OF TRAVEL OF DIVIDED STREETS AND HIGHWAYS (SEPARATED BY OTHER THAN A PAINTED MEDIAN) AND ONE-WAY ROADWAYS (INCLUDING RAMPS).

   EDGE LINES ARE NOT CONTINUED THROUGH INTERSECTIONS AND ARE NOT BROKEN FOR DRIVEWAYS. CARE MUST BE TAKEN TO AVOID EDGE LINE APPEARING AS LANE LINE ALONG ROADWAYS WITH WIDE SHOULDERS AND/OR CLOSELY SPACED DRIVEWAYS.

4. DOTTED LINES

   BROKEN WHITE, WIDTH MATCHING THE LINE BEING EXTENDED-2 FT. SEGMENTS WITH 4 FT. GAPS. THESE LINES ARE USED TO DELINEATE THE EXTENSION OF A LINE THROUGH AN INTERSECTION OR INTERCHANGE AREA.

5. CHANNELIZING LINES

   SOLID WHITE, 8 IN. WIDE. THESE LINES ARE USED WITH ACCELERATION-DECELERATION LANES, PAVEMENT WIDTH TRANSITIONS, AND LEFT-RIGHT TURN SLOTS OR ISLANDS.

6. CROSS-HATCHING LINES

   SOLID WHITE OR YELLOW, 8 IN. WIDE-45 DEGREE DIAGONAL, SPACED AT 25 FT. INTERVALS. THESE LINES ARE OPTIONAL AND MAY BE PLACED AT LOCATIONS INDICATED ON THE PLANS OR DETERMINED BY THE ENGINEER. YELLOW SHALL BE USED FOR PAINTED MEDIANS OR PAVEMENT WIDTH TRANSITIONS ONLY.

   OPTIONAL DIAGONAL SHOULDER MARKINGS SHALL BE SOLID WHITE, 8 IN. WIDE, SPACED AT INTERVALS OF 20 FT. MINIMUM TO 100 FT. MAXIMUM.

7. PARKING LINES

   SOLID WHITE, 3 IN. WIDE-DIAGONAL OR PARALLEL AS SHOWN ON THE PLANS OR DIRECTED BY THE ENGINEER.

8. STOP LINES

   SOLID WHITE, 24 IN. WIDE-EXTEND PARALLEL TO INTERSECTED ROADWAY ACROSS ALL APPROACH LANES OR AS INDICATED AT LOCATIONS ON THE PLANS. LOCATE AT THE DESIRED STOPPING POINT, NOT MORE THAN 30 FT, NOR LESS THAN 4 FT. FROM THE NEAREST EDGE OF THE INTERSECTED TRAFFIC LANE.

9. LANE DROP MARKINGS

   BROKEN WHITE, 8 IN. OR 4 IN. WIDE - 3 FT. SEGMENTS WITH 12 FT. GAPS. THESE LINES SHOULD BEGIN 2600 FT. IN ADVANCE OF THE THEORETICAL GORE POINT TO DISTINGUISH THE LANE DROP FROM A CONTINUOUS LANE. THE CHANNELIZING LINE MAY BE EXTENDED APPROXIMATELY 300 FT. UPSTREAM.

(CONTINUED ON SHEET NO. 2)

Computer File Information		Sheet Revisions	
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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PAVEMENT MARKINGS

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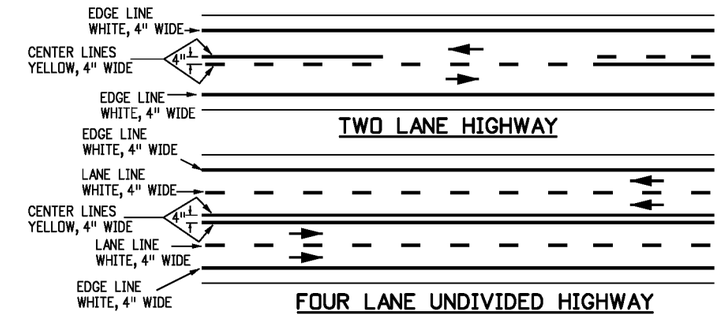
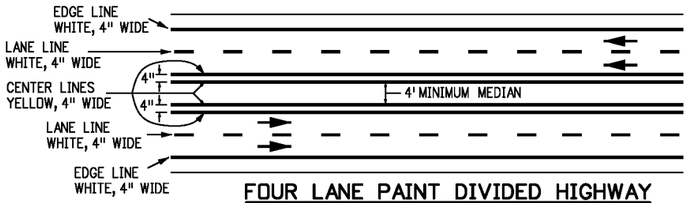
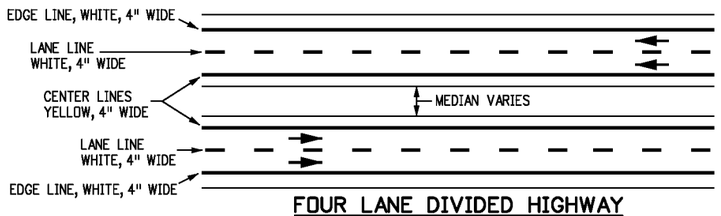


TWO LANE HIGHWAY

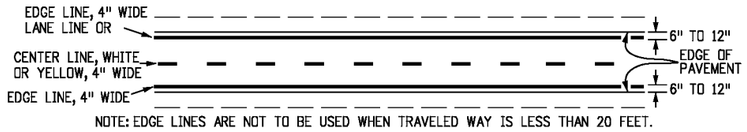
FOUR LANE UNDIVIDED HIGHWAY



FOUR LANE PAINT DIVIDED HIGHWAY

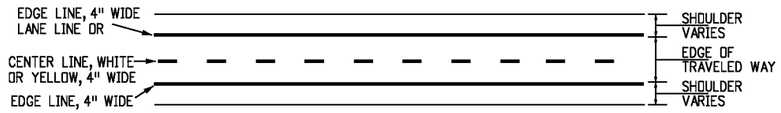


FOUR LANE DIVIDED HIGHWAY

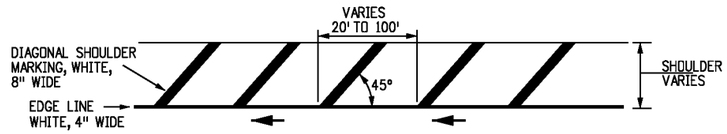


NOTE: EDGE LINES ARE NOT TO BE USED WHEN TRAVELED WAY IS LESS THAN 20 FEET.

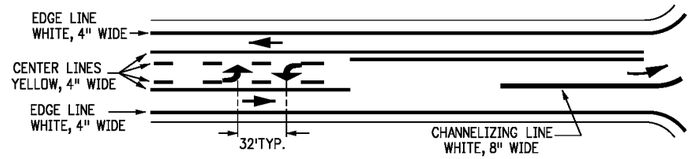
NO SHOULDER OR UNSURFACED SHOULDER



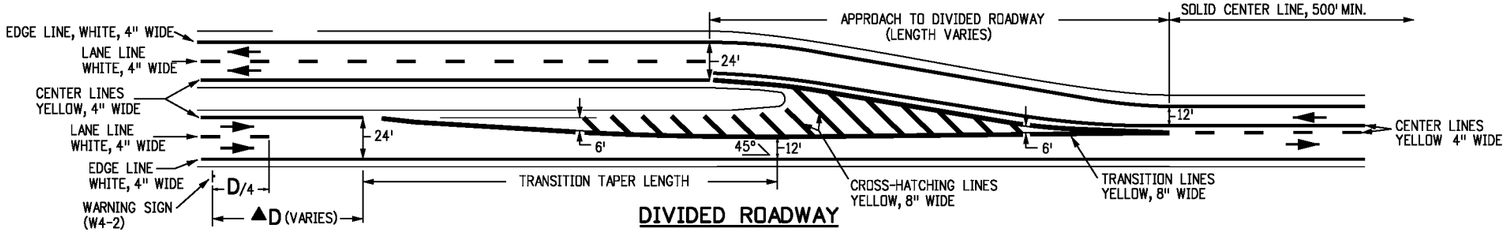
SHOULDER SURFACED



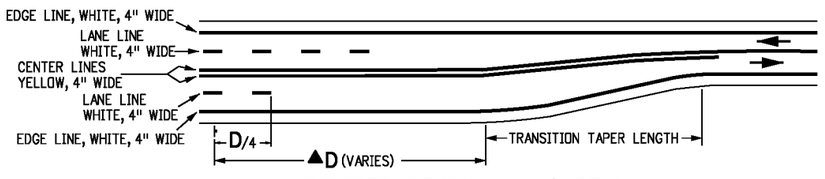
EDGE LINE WITH OPTIONAL DIAGONAL SHOULDER MARKING



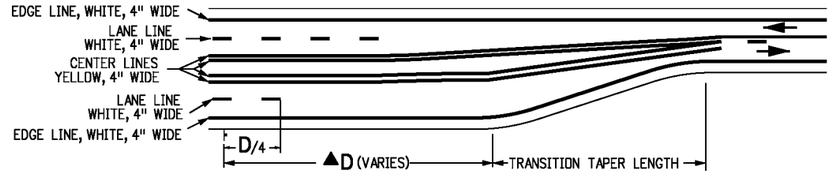
TYPICAL TWO WAY LEFT TURN LANE



DIVIDED ROADWAY



UNDIVIDED ROADWAY - CASE 1



UNDIVIDED ROADWAY - CASE 2

GENERAL NOTES

(CONTINUED FROM SHEET NO. 1)

10. CROSSWALK LINES

SOLID WHITE, 12 IN. WIDE FOR TRANSVERSE LINE TYPE - EXTEND ACROSS ENTIRE WIDTH OF PAVEMENT. IF NO ADVANCE STOP LINE IS PROVIDED, INCREASE THE WIDTH OF THE CROSSWALK LINES TO 24 IN. THE DISTANCE BETWEEN THE LINES IS USUALLY DETERMINED BY THE WIDTH OF THE SIDEWALKS SO CONNECTED, HOWEVER, IN NO CASE SHALL THIS BE LESS THAN 6 FT.

COMPLICATED AND/OR CHANNELIZED INTERSECTIONS AND MID-BLOCK CROSSWALKS SHALL BE SOLID WHITE, 12 IN. TO 24 IN. WIDE AND 8 FT. TO 10 FT. LONG FOR LONGITUDINAL LINE TYPE AS DETAILED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

11. WORD, ARROW AND SYMBOL MARKINGS

ALL LETTERS, ARROWS AND SYMBOLS SHALL BE IN CONFORMANCE WITH "THE STANDARD ALPHABETS FOR HIGHWAY SIGNS AND PAVEMENT MARKINGS" ADOPTED BY THE FEDERAL HIGHWAY ADMINISTRATION.

12. TRANSITION TAPER LENGTH

L = MINIMUM LENGTH OF TAPER.

S = DESIGN SPEED FOR NEW CONSTRUCTION OR NUMERICAL VALUE OF THE POSTED SPEED LIMIT OF THE 85TH PERCENTILE SPEED OF EXISTING TRAFFIC.

W = WIDTH TRANSITIONED

FORMULA: FOR SPEED 45 MPH OR MORE, $L = S \times W$

FOR SPEED 40 MPH OR LESS, $L = \frac{WS^2}{60}$

▲ NOTE:

D = THE DISTANCE FROM THE PAVEMENT WIDTH TRANSITION SIGN (W4-2) TO THE BEGINNING OF THE TRANSITION TAPER.

13. TRANSITION LINES

SOLID YELLOW, 8 IN. WIDE. THESE LINES ARE USED WHERE ADDITIONAL EMPHASIS OR VISIBILITY IS DESIRABLE AT PAVEMENT WIDTH TRANSITIONS. PLACE AT LOCATIONS INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

14. SPEED MEASURING MARKING

SOLID WHITE, 24 IN. - EXTEND 4 FT. FROM OUTSIDE OF EDGE LINES ON SHOULDERS.

TYPICAL PAVEMENT WIDTH TRANSITION MARKINGS

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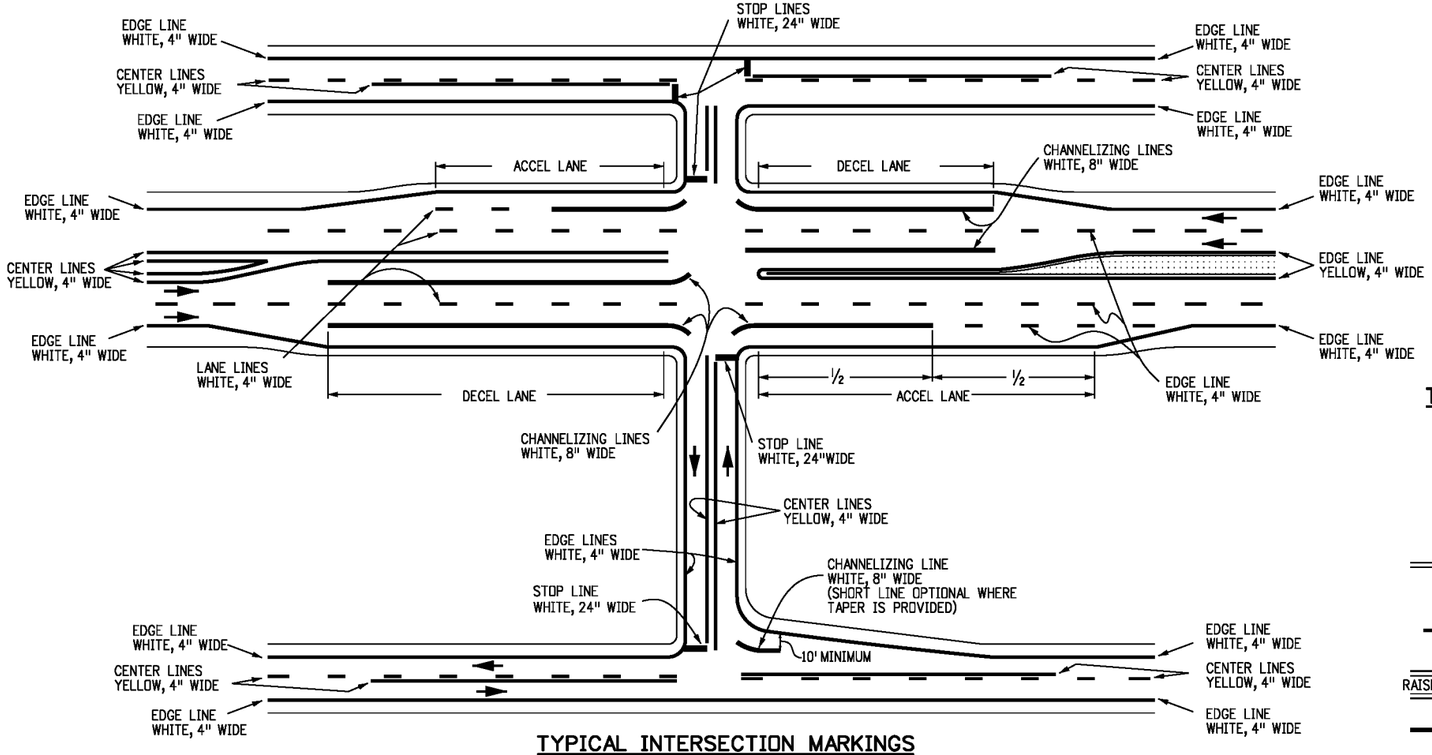
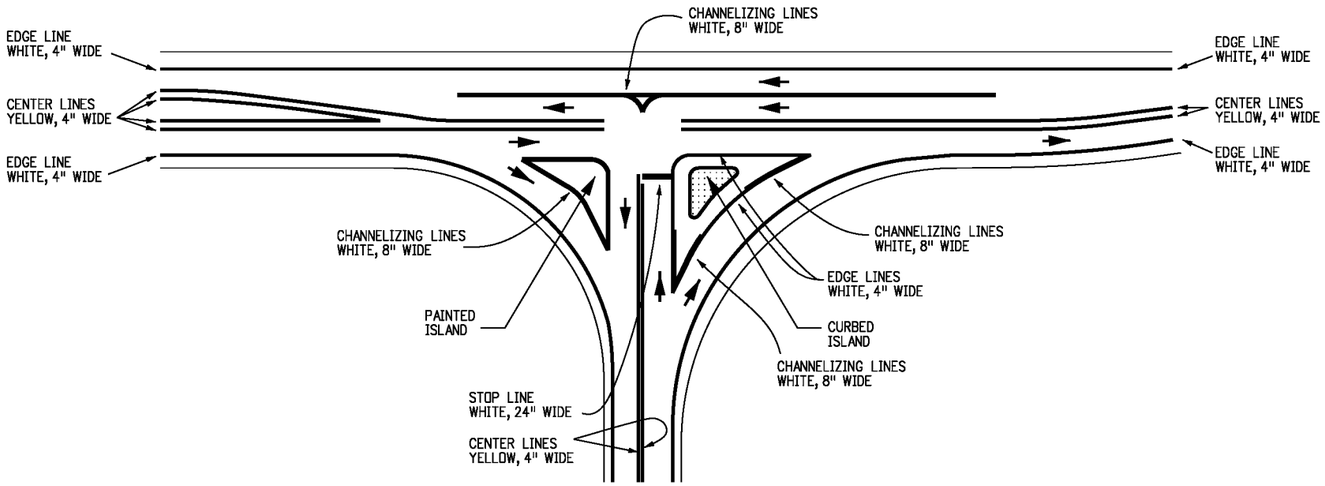
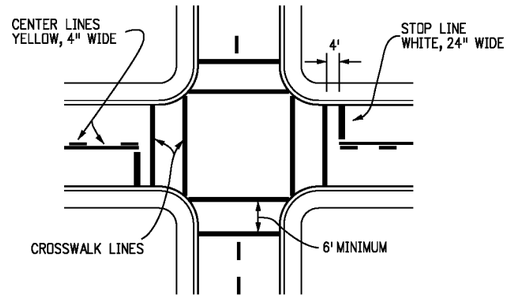


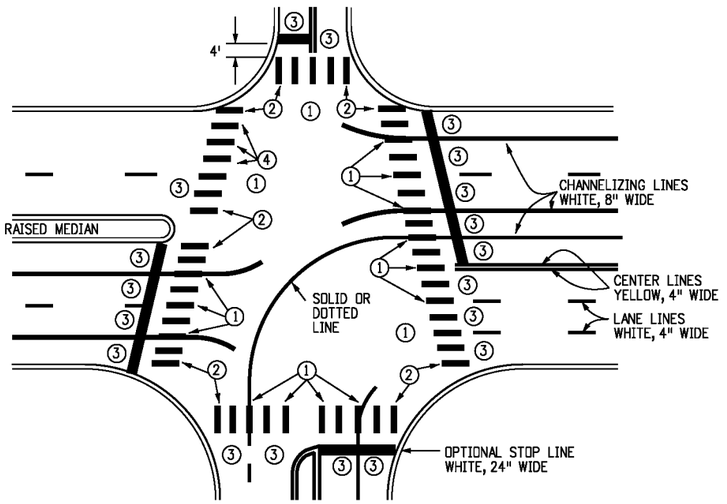
TYPICAL INTERSECTION MARKINGS



TYPICAL ISLAND MARKINGS

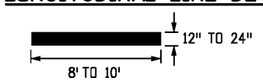


TYPICAL TRANSVERSE LINE CROSSWALK MARKINGS



TYPICAL CONTINENTAL CROSSWALK MARKINGS

LONGITUDINAL LINE DETAIL



CROSSWALK NOTES

CENTER CROSSWALKS ON CURB RAMPS. IF SUCH RAMPS ARE NOT PROVIDED CENTER ON SIGNAL POLES WHEREVER PRACTICAL.

1. CENTER ON LANE, CENTER OR CHANNELIZING LINE.
2. CENTER OR EXTENDED FLOW LINE.
3. CENTER BETWEEN ADJACENT LINES.
4. LINES AND SPACES TO APPROXIMATE ADJACENT PATTERN.

INTERSECTIONS, ISLANDS AND CROSSWALKS

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Full Path: www.coloradodot.info/library/traffic/traffic-s-standard-plans	R-X		
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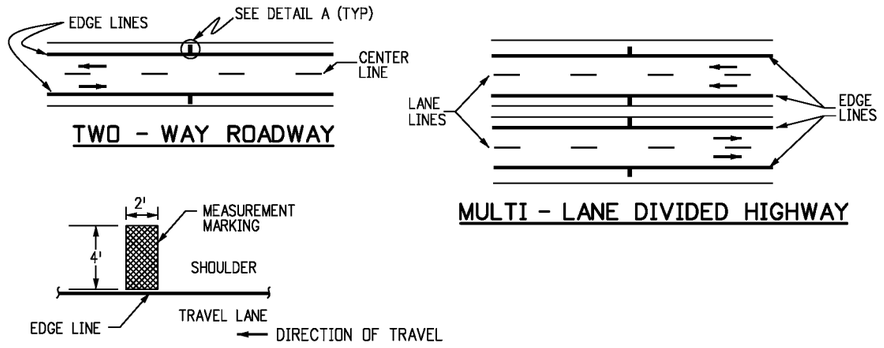
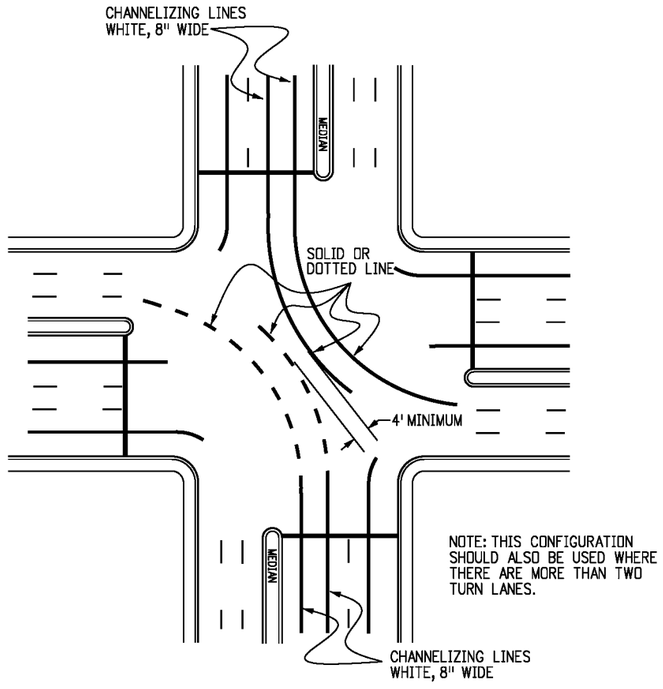
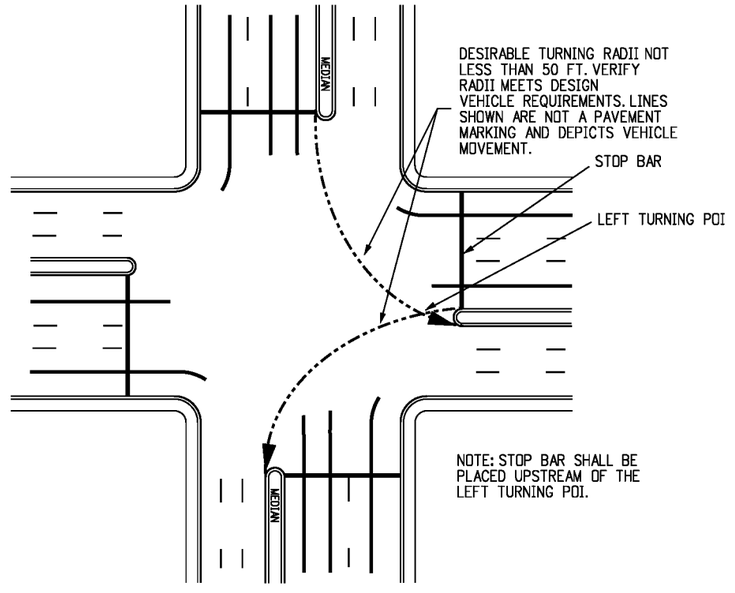


DETAIL A

TYPICAL SPEED MEASUREMENT MARKING



TYPICAL DOUBLE LEFT TURN MARKINGS



TYPICAL STOP BAR PLACEMENT

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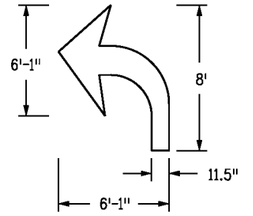
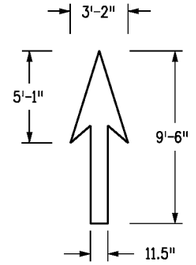


AREA = 15.5 SQ.FT.



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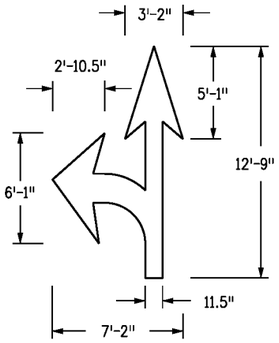
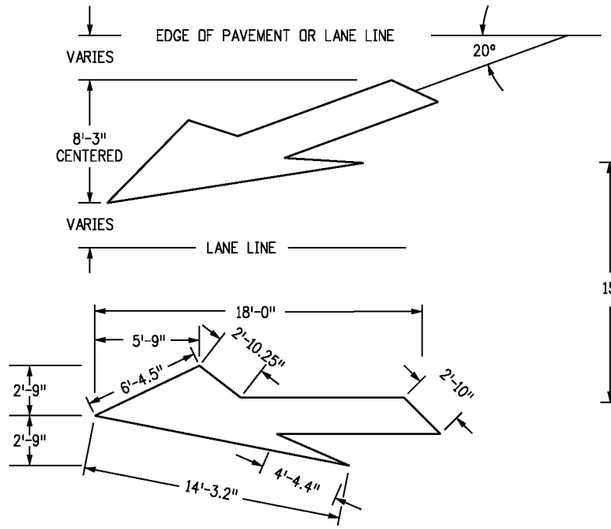


AREA = 27.5 SQ.FT.



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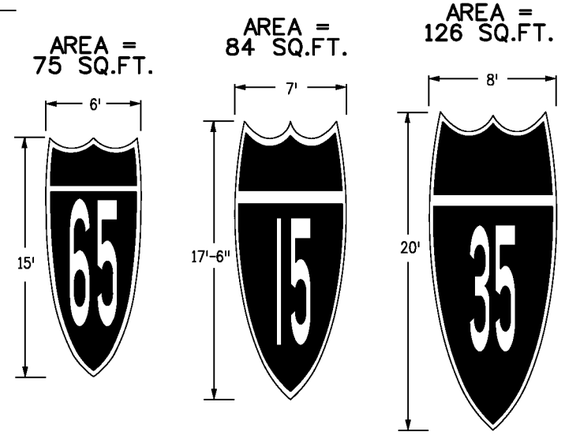


ELONGATED ROUTE SHIELDS

ELONGATED ROUTE SHIELD NOTES

ELONGATED ROUTE SHIELDS SHALL BE AT LEAST 8'x20' WHEN USED ON HIGH SPEED ROADWAYS (45 MPH OR MORE).

PER FIGURE 3B-25 OF THE 2009 MUTCD ELONGATED ROUTE SHIELD COLORS SHALL CONFORM WITH THE STANDARD HIGHWAY SIGNS AND MARKINGS BOOK.

DESIGNATED PAYMENT AREAS

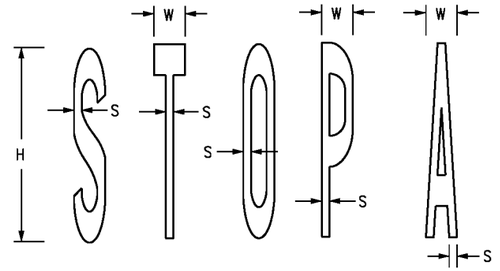
FOR THE FOLLOWING H, W, AND S DIMENSIONS PAY:

H = 4' WORDS

BIKE - 5.5 SQ.FT.	LANE - 6.0 SQ.FT.
ONLY - 6.0 SQ.FT.	XING - 5.0 SQ.FT.

H = 8' WORDS

STOP - 23.0 SQ.FT.	XING - 20.0 SQ.FT.
ONLY - 22.5 SQ.FT.	LANE - 22.5 SQ.FT.
AHEAD - 29.0 SQ.FT.	BIKE - 21.0 SQ.FT.
BUS - 18.5 SQ.FT.	HWY - 16.5 SQ.FT.
THRU - 22.0 SQ.FT.	SCHOOL(1L) - 33.0 SQ.FT.
PED - 17.5 SQ.FT.	SCHOOL(2L) - 85.0 SQ.FT.



H = HEIGHT	H = 8'	H = 4'
W = WIDTH	W = 1'-3.4" TO 1'-4"	W = 7.7" TO 8"
S = STROKE	S = 3.8" TO 4"	S = 1.9" TO 2"

TYPICAL LETTER MEASUREMENTS

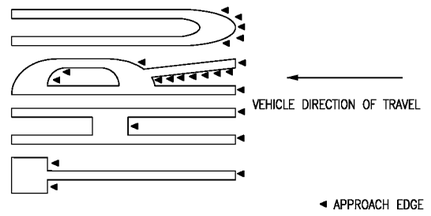
WORD AND SYMBOL NOTES

IF HEIGHT IS INCREASED OR DECREASED THEN ALL MEASUREMENTS CHANGE PROPORTIONATELY. EXAMPLE: "H" MEASUREMENT FOR STOP IS REDUCED TO 4' FROM 8' THEN SQUARE FEET = 5.75 (1/4 OF 23.0 SQ. FT.).

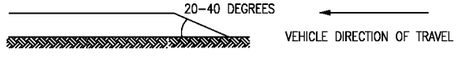
PAVEMENT WORD AND SYMBOL MARKINGS, TRANSVERSE AND LONGITUDINAL (CONTINENTAL) CROSSWALK LINES, AND STOP LINES WILL BE PAID FOR IN SQUARE FEET USING THEIR SPECIFIC BID ITEMS.

TAPERING NOTES

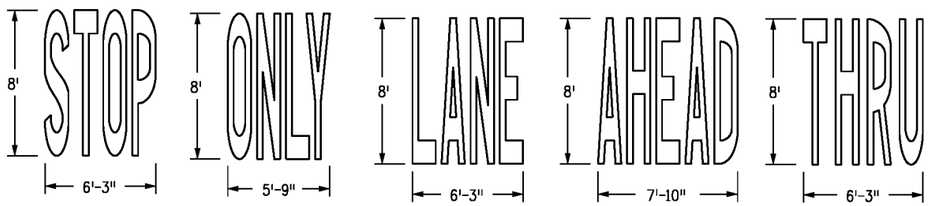
ALL PAVEMENT MARKING APPROACH EDGES FROM THE VEHICLE DIRECTION OF TRAVEL SHALL BE TAPERED USING A PUTTY KNIFE OR SIMILAR TOOL.

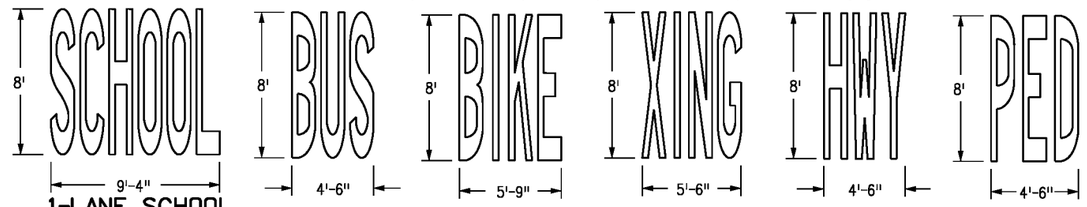


TYPICAL APPROACH EDGE TAPERING VIEW

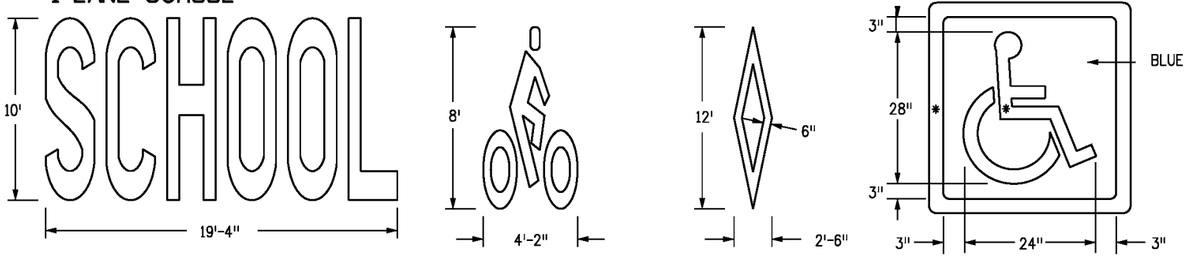


TYPICAL APPRAOCH EDGE TAPERING PROFILE VIEW





1-LANE SCHOOL



STROKE = 8"
2-LANE SCHOOL

AREA = 10.5 SQ.FT. AREA = 10 SQ.FT.

* WHITE 3" STROKE WIDTH (BORDER MAY BE 4" STROKE WIDTH)

PAVEMENT MARKING WORDS AND SYMBOLS

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GENERAL NOTES

1. ALL CONSTRUCTION ZONE TRAFFIC CONTROL DEVICES, INCLUDING BUT NOT LIMITED TO BARRICADES, SIGNS, ARROW PANELS, FLASHING BEACON (PORTABLE), AND CHANNELIZING DEVICES, SHALL BE FURNISHED, INSTALLED, MAINTAINED (INCLUDING WASHING), REPLACED IF DAMAGED, REMOVED WHEN TEMPORARILY NOT IN USE AND RETURNED WHEN REQUIRED, RESET AS NECESSARY DURING THE PROGRESS OF CONSTRUCTION, AND REMOVED ENTIRELY WHEN THE PROJECT IS COMPLETED. ALL DEVICES SHALL MEET THE REQUIREMENTS OF THE LATEST EDITION OF THE ATSSA "QUALITY STANDARDS FOR WORK ZONE TRAFFIC CONTROL.

2. WORK ON THE PROJECT SHALL NOT BE STARTED UNTIL ALL REQUIRED TRAFFIC CONTROL DEVICES ARE IN PLACE, AND APPROVED BY THE ENGINEER.

3. WHEN SPEED LIMIT REDUCTION IS REQUIRED, SUCH REDUCTION SHALL BE IN ACCORDANCE WITH CDOT FORM 568, "AUTHORIZATION AND DECLARATION OF TEMPORARY SPEED LIMITS."

   WHEN A CHANGE IN AN EXISTING SPEED LIMIT IS REQUIRED, THE R2-1 SIGNS, SHOWN ON THE SCHEDULE OF CONSTRUCTION TRAFFIC CONTROL DEVICES, SHOULD BE INSTALLED AT THE LOCATIONS SHOWN ON THE TYPICAL CASES BY R2-1 (OPTIONAL) SIGNS.

   AN ADVISORY SPEED PLATE (W13-1P) MAY BE USED WITH A WARNING SIGN WHEN THE MAXIMUM RECOMMENDED SPEED FOR CONDITION NAMED IS LOWER THAN THE POSTED SPEED LIMIT.

   THE REGULATORY OR ADVISORY SPEED REDUCTION DISPLAYED SHALL NOT EXCEED 15 MPH PER SIGN INSTALLATION.

4. ANY TRAFFIC CONTROL DEVICE THAT IS DAMAGED, WEATHERED, WORN, OR OTHERWISE DEEMED UNACCEPTABLE BY THE ENGINEER, SHALL BE REPLACED.

5. CONTRACTOR AND PERSONAL VEHICLE PARKING IS PROHIBITED WITHIN THE RIGHT-OF-WAY UNLESS DESIGNATED ON THE PLANS, OR APPROVED BY THE ENGINEER.

6. CONSTRUCTION TRAFFIC SIGNS SHALL BE MEASURED BY THE FOLLOWING SIZES AND DESCRIPTIONS:

PANEL SIZE A	0.01 TO 9.00 SQ. FT. (INCLUDING TYPE 1 AND TYPE 2 BARRICADES).
PANEL SIZE B	9.01 TO 16.00 SQ. FT.
PANEL SIZE C	GREATER THAN 16 SQ. FT.

   CONSTRUCTION TRAFFIC SIGN (SPECIAL), SQ. FT., MAY BE USED FOR SOME PROJECT SPECIFIC INFORMATION SIGNS.

   FOR DETAILED DIMENSIONS OF SIGNS WITH SIGN CODE NUMBERS, SEE "STANDARD HIGHWAY SIGNS" AND THE "COLORADO SUPPLEMENT" THERETO. SIGN LAYOUTS FOR OTHER SIGNS WILL BE FURNISHED IN THE PLANS, TRANSMITTED TO THE ENGINEER AFTER AWARD, OR MAY BE AVAILABLE UPON REQUEST.

   W20-5 WARNING SIGNS SHALL BE FURNISHED WITH EXCHANGEABLE PLAQUES READING "RIGHT", "LEFT", "CENTER", "RIGHT 2", ETC. AT NO ADDITIONAL COST.

7. ALL WARNING AND REGULATORY SIGNS SHALL BE POSTED ON BOTH SIDES OF THE ROADWAY ON DIVIDED HIGHWAYS, MULTI-LANE RAMPS, ONE-WAY STREETS, AND AS DIRECTED BY THE ENGINEER, EXCEPT WHERE ONLY ONE SHOULDER IS CLOSED (EX: CASE 11 ON SHEET 7).

8. ADDITIONAL TRAFFIC CONTROL DEVICES ADDRESSING FLAGGING, SPEED REDUCTION, ETC. WILL BE NECESSARY FOR SET-UP AND TAKE-DOWN OF MOST CASE APPLICATIONS; DAILY WORK SITE ACCESS; AND PAVEMENT MARKING REMOVAL AND INSTALLATION OPERATIONS.

9. BASED ON SIGHT DISTANCE AND OTHER CONSIDERATIONS, THE FINAL LOCATIONS OF SIGNS ARE SUBJECT TO APPROVAL OF THE ENGINEER.

10. IF CONSTRUCTION RELATED TRAFFIC CONGESTION BACKS UP BEYOND THE INSTALLED ADVANCE SIGN SEQUENCE, ADDITIONAL ADVANCE SIGNING SHALL BE PLACED BEYOND THE CONGESTION.

11. ALL SIGN MATERIAL SHALL BE SOUND AND DURABLE TO THE DEGREE NECESSARY FOR MAINTAINING EFFECTIVE AND NEAT APPEARING TRAFFIC CONTROLS, AND:

    a. SIGN PANELS MAY BE FABRICATED FROM PLYWOOD, STEEL, ALUMINUM, OR OTHER SUITABLE MATERIAL.
    b. REFLECTIVE SHEETING SHALL CONFORM TO ASTM D4956. THE TYPE SHALL BE AS DESCRIBED IN THE STANDARD SPECIFICATIONS AND/OR AS SHOWN ON THE PLANS.
    c. SYMBOLS AND LEGEND SHALL BE OF GOOD WORKMANSHIP (UNEVEN OR HAND LETTERING WILL NOT BE ACCEPTED).
    d. PORTABLE OR TEMPORARY MOUNTING SHALL NOT BE CONSTRUCTED OR WEIGHTED BY ANY METHOD OR MATERIAL THAT MAKES THEM HAZARDOUS TO TRAFFIC.
    e. CERTAIN POST SIZES AND SHAPES REQUIRE A "BREAK-AWAY" DEVICE. SEE THE APPLICABLE STANDARD PLAN. OTHER POST DESIGNS OR SYSTEMS REQUIRE THE SUBMITTAL OF AN FHWA LETTER OF ACCEPTANCE TO THE ENGINEER, AND MUST BE APPROVED BY THE ENGINEER PRIOR TO THEIR USE.

12. ALL CONSTRUCTION SIGN PLACEMENT SHALL BE IN ACCORDANCE WITH STANDARD PLAN "TYPICAL GROUND SIGN PLACEMENT" UNLESS OTHERWISE APPROVED.

    SIGNS APPROVED TO BE MOUNTED ON PORTABLE SUPPORTS, OR APPROPRIATE SIGNS MOUNTED ON BARRICADES, MAY BE AT LOWER HEIGHTS, BUT THE BOTTOM OF THE SIGNS SHALL NOT BE LESS THAN ONE FOOT ABOVE THE PAVEMENT ELEVATION.

13. SIGNS MOUNTED ON THE MEDIAN OF DIVIDED HIGHWAYS WHERE MEDIAN BARRIER IS IN PLACE MAY BE MOUNTED ON THE BARRIER WITH A SADDLE TYPE BRACKET. IF THE BRACKET ALLOWS THE SIGN PANEL TO BE TURNED PARALLEL TO THE ROADWAY, THE SIGN MAY REMAIN IN PLACE WHEN NOT APPLICABLE, BUT LAYING THE SIGN PANEL DOWN IN A HORIZONTAL POSITION IS NOT PERMITTED.

14. TRAFFIC CONES SHALL BE AT LEAST 28 INCHES IN HEIGHT. HOWEVER, THE MINIMUM SIZE SHALL BE 36 INCHES WHEN THEY ARE USED ON FREEWAYS AND EXPRESSWAYS, OR DURING NIGHT TIME WORKING HOURS. THEY SHOULD ALSO BE 36 INCHES WHEN USED ON OTHER HIGH SPEED ROADWAYS (45 MPH OR MORE) WITH AN ADT OF 6,000 OR MORE.

15. TYPE 1 BARRICADES SHALL NOT BE USED ON FREEWAYS, EXPRESSWAYS, OR OTHER HIGH SPEED ROADWAYS (55 MPH OR MORE).

16. WHEN TWO-WAY TRAFFIC IS PLACED ON ONE ROADWAY OF A NORMALLY DIVIDED HIGHWAY, OPPOSING TRAFFIC SHALL BE SEPARATED EITHER WITH CONCRETE BARRIER (TEMPORARY), OR WITH CHANNELIZING DEVICES APPROVED FOR THIS APPLICATION, THROUGHOUT THE LENGTH OF TWO-WAY OPERATION. THE TRANSITION ZONES SHALL HAVE CONCRETE BARRIER (TEMPORARY). THE BARRIER SHALL BE TIED TO AN EXISTING STRUCTURE OR GUARD RAIL, FLARED OR EXTENDED, TO MEET CLEAR ZONE REQUIREMENTS, OR FITTED WITH AN IMPACT ATTENUATION DEVICE.

17. CHANNELIZING DEVICE SPACING, IN FEET, SHALL BE AS FOLLOWS:
    a. FOR TAPERS AND TRANSITIONS, SPACING EQUALS THE NUMERICAL VALUE OF THE SPEED LIMIT. (e.g. 45 MPH = 45 FEET)
    b. FOR TANGENTS ALONG THE BUFFER SPACE OR WORK AREA, SPACING MAY NOT BE GREATER THAN TWO TIMES THE SPEED LIMIT. (e.g. 50 MPH = 50 FEET TO 100 FEET MAXIMUM)

18. FOR DETAILS ON BARRICADES, CONCRETE BARRIER (TEMPORARY), VERTICAL PANELS, AND FLASHING BEACON (PORTABLE), SEE THE APPLICABLE STANDARD PLANS.

19. FLOOD LIGHTS SHALL BE USED TO ILLUMINATE FLAGGER STATIONS DURING THE HOURS OF DARKNESS UNLESS OTHERWISE APPROVED. A TYPICAL LIGHT SHOULD PROVIDE THE FOLLOWING: A FULLY DIRECTIONAL SWIVEL MOUNT QUARTZ LIGHT SOURCE (500 WATT MINIMUM), SELF-SUPPORTING STAND WITH VARIABLE LIGHT HEIGHT FROM A MINIMUM OF EIGHT FEET ABOVE THE ROADWAY, AND A POWER SOURCE. IT SHALL ILLUMINATE THE STATION AREA AND A FLAGGER ESCAPE PATH, BUT SHALL NOT PRESENT ANY GLARE TO TRAFFIC.

20. IF WORK ON THE ROADWAY IS FOR A LONG-TERM STATIONARY PERIOD, AS DEFINED IN SECTION 6G.02 OF THE MUTCD, INAPPLICABLE PAVEMENT MARKINGS ARE TO BE REMOVED, AND FULL COMPLIANCE PAVEMENT MARKINGS ARE TO BE INSTALLED IN ACCORDANCE WITH THE APPLICABLE SPECIFICATIONS, (PAVEMENT MARKING - GENERAL), AND/OR AS DETAILED ON THE PLANS.

    FOR ADDITIONAL PAVEMENT MARKING DETAILS, SEE STANDARD PLAN "TYPICAL PAVEMENT MARKINGS".

21. BUFFER SPACE IS OPTIONAL. NEED MUST BE DETERMINED ON A PROJECT OR SITE SPECIFIC BASIS AS DIRECTED BY THE ENGINEER. WHEN A BUFFER SPACE IS USED, DIMENSIONS AND/OR DEVICES USED ARE TO BE INCORPORATED IN THE TRAFFIC CONTROL PLAN (TCP) OR THE CONTRACTOR'S METHOD OF HANDLING TRAFFIC (MHT).

22. ADDITIONAL VMS SIGNAGE SHOULD BE CONSIDERED AT LEAST A MILE IN ADVANCE OF THE SIGNING SHOWN IN THE DETAIL FOR ANY LANE CLOSURES ON INTERSTATE AND OTHER HIGH SPEED FACILITIES ESPECIALLY WHEN THE LEVEL OF SERVICE IS SIGNIFICANTLY REDUCED AS A RESULT OF CONSTRUCTION. THE LEGENDS SHOULD BE CHANGED TO ADVISE MOTORISTS OF UPCOMING TRAFFIC CONDITIONS AND TO ALERT THEM OF UPCOMING LANE USAGE.

    ADDITIONAL ADVANCE WARNING SIGNAGE IS ENCOURAGED IN ALL CASES WHERE TRAFFIC VOLUMES AND SPEEDS ARE HIGH AND/OR WHERE THERE ARE INFREQUENT EXITS. ADDITIONAL SIGNAGE IS ALSO ENCOURAGED IN LOCATIONS WHERE DRIVERS' LINE OF SIGHT TO ADVANCE WARNING SIGNS IS OBSTRUCTED.

23. WHEN ARROW BOARDS ARE USED TO CLOSE MULTIPLE LANES, A SEPARATE ARROW BOARD SHALL BE USED FOR EACH CLOSED LANE.

    IF ARROW BOARDS ARE USED FOR SHOULDER WORK, BLOCKING THE SHOULDER, FOR ROADSIDE WORK NEAR THE SHOULDER, OR FOR TEMPORARILY CLOSING ONE LANE ON A TWO-LANE, TWO-WAY ROADWAY, USE THE ARROW BOARDS ONLY IN THE CAUTION MODE.

24. RAISED PAVEMENT MARKERS MAY BE USED TO SUPPLEMENT TEMPORARY STRIPING DURING NON-SNOW PERIODS. THEIR USE IS ENCOURAGED ON HIGHER SPEED FACILITIES WHEN TRAFFIC IS BEING DIVERTED FROM ITS USUAL COURSE.

25. THE TYPICAL CASES DEPICTED IN THIS STANDARD REFLECT THE MINIMUM REQUIREMENTS, UNLESS AS OTHERWISE DIRECTED BY THE PROJECT PLANS AND SPECIFICATIONS, AND/OR THE PROJECT ENGINEER.

26. A SIGNIFICANT PROJECT IS DEFINED AS ONE THAT, ALONE OR IN COMBINATION WITH OTHER CONCURRENT PROJECTS NEARBY, IS ANTICIPATED TO CAUSE SUSTAINED WORK ZONE IMPACTS AT A LOCATION FOR THREE OR MORE CONSECUTIVE DAYS WITH EITHER INTERMITTENT OR CONTINUOUS LANE CLOSURES.

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TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION

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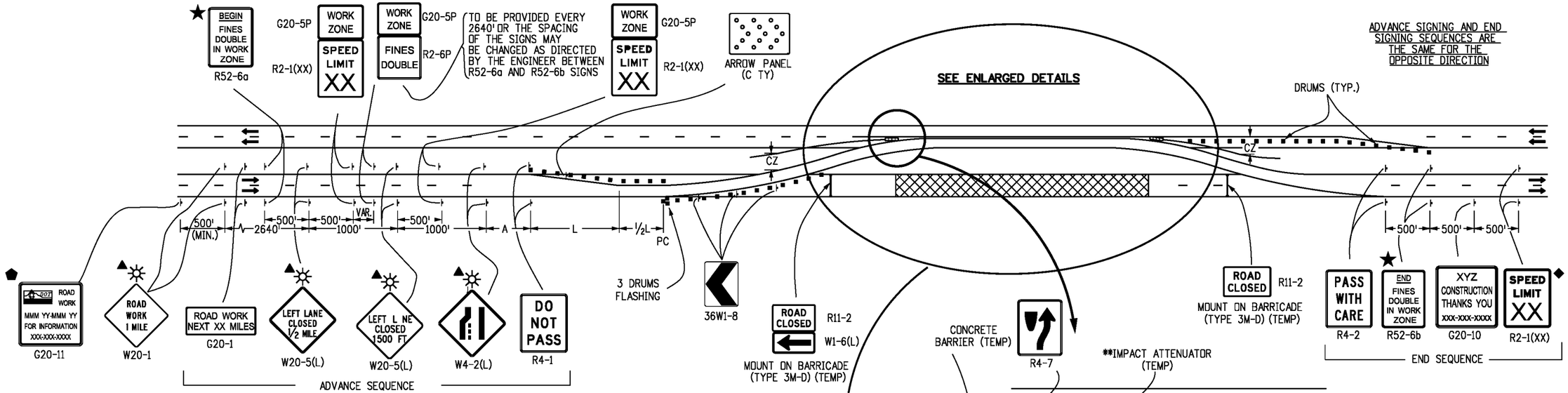

LEGEND

- ▪ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA
- L TRANSITION TAPER LENGTH:
  - L = MINIMUM LENGTH OF TAPER
  - SPEED 45 MPH OR MORE: $L = S \times W$
  - SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$
  - S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED
  - W = WIDTH OF OFFSET
- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL
- A = 100' (URBAN LOW SPEED)
  350' (URBAN HIGH SPEED)
  500' (RURAL)
  1,000' (EXPRESSWAY / FREEWAY)
- CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- VAR. BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1).
- IMPACT ATTENUATOR AS DETAILED ON THE PLANS
- FLASHING BEACON

- ◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- * THESE ITEMS ARE NOT REQUIRED WHEN CONTINUOUS CONCRETE BARRIER IS USED FOR CHANNELIZATION.
- ** SEE GENERAL NOTE 16 ON SHEET 1.
- ⬟ G20-11 SIGN IS REQUIRED IF SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

CASE NO. 1
TYPICAL APPLICATION
CLOSURE OF ONE ROADWAY 4-LANE DIVIDED HIGHWAY

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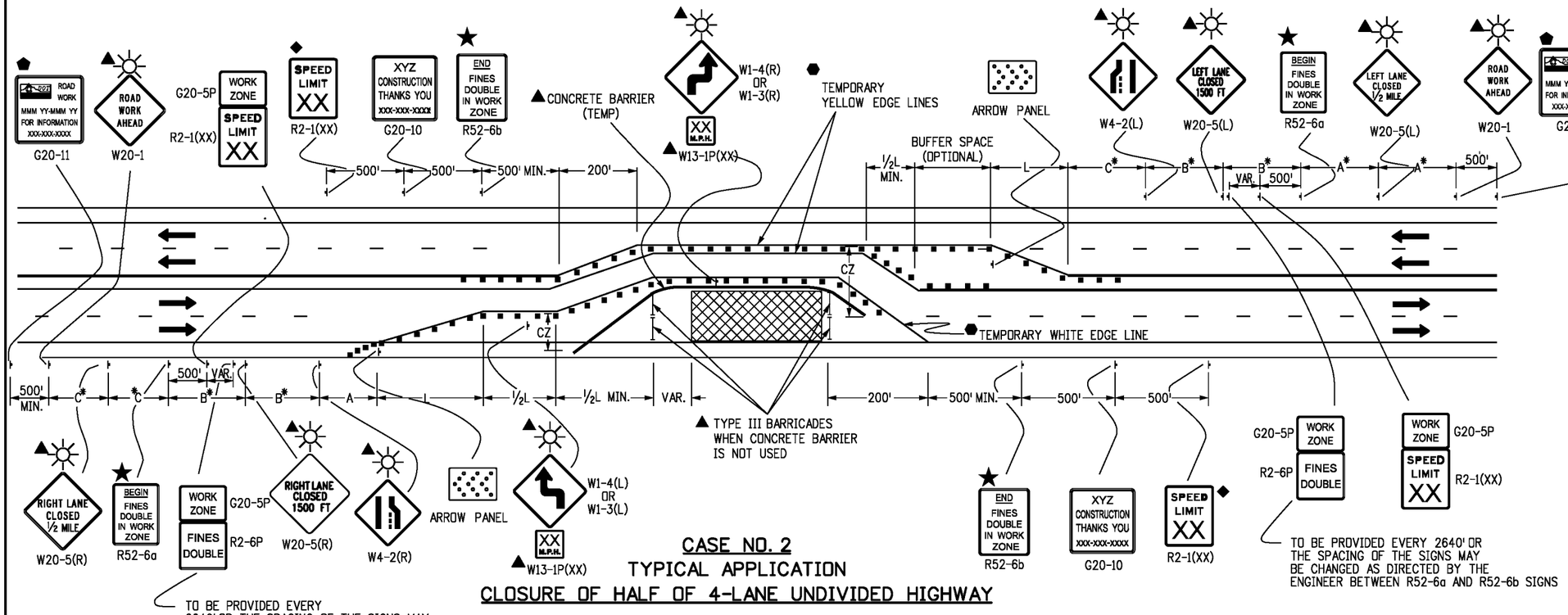
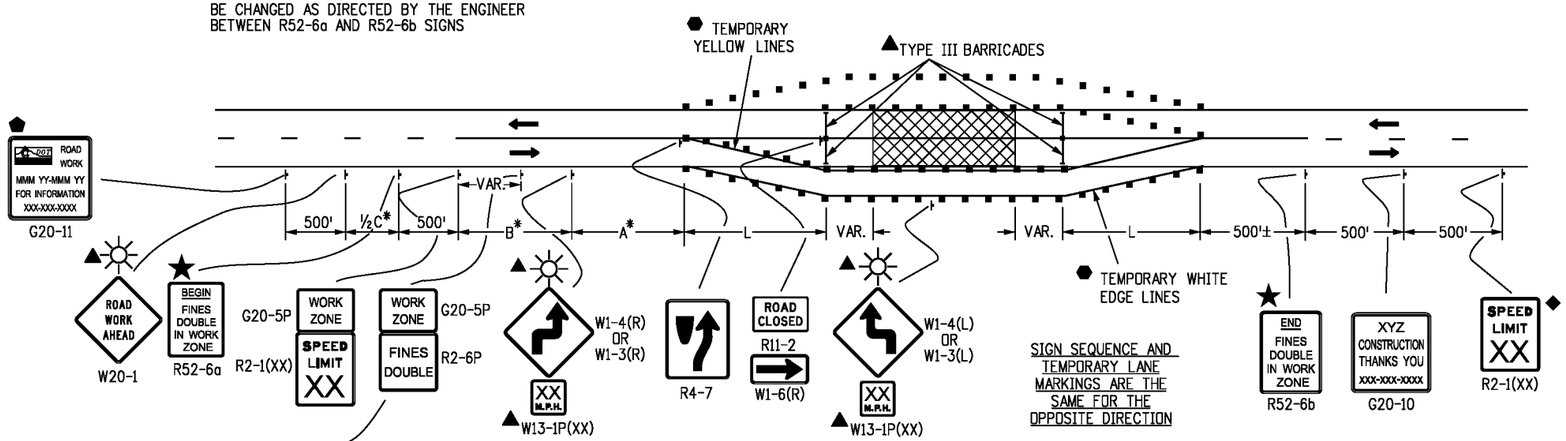


CASE NO. 2
TYPICAL APPLICATION
CLOSURE OF HALF OF 4-LANE UNDIVIDED HIGHWAY



SIGN SEQUENCE AND TEMPORARY LANE MARKINGS ARE THE SAME FOR THE OPPOSITE DIRECTION

CASE NO. 3
TYPICAL APPLICATION
ROAD CLOSURE, USE OF ADJACENT SHOULDERS

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA

L TRANSITION TAPER LENGTH:

L = MINIMUM LENGTH OF TAPER

SPEED 45 MPH OR MORE: $L = S \times W$

SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$

S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED

W = WIDTH OF OFFSET

SHOULDER TAPER = 1/3 L

ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.

A = 100' (URBAN LOW SPEED)
350' (URBAN HIGH SPEED)
500' (RURAL)
1,000' (EXPRESSWAY / FREEWAY)

CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1)

▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.

◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.

VAR. BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1).

⬢ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.

⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

FLASHING BEACON

★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

* KEY TO ADVANCE SIGNING DISTANCES

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (<=40 MPH)	100	100	100
URBAN (>=45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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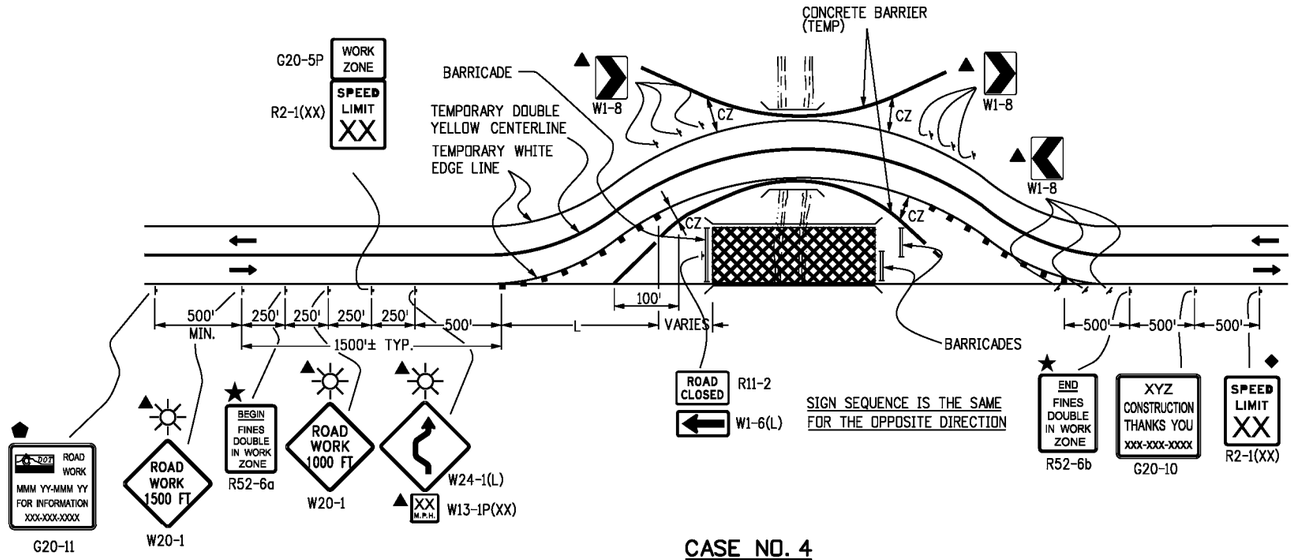
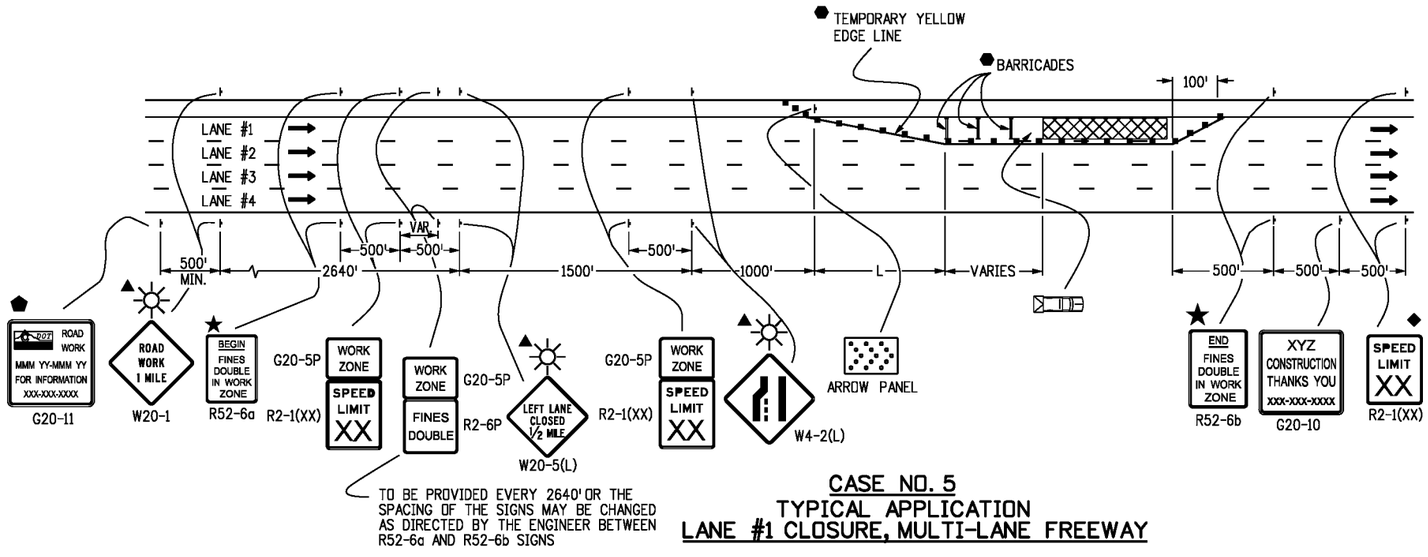


CASE NO. 4
TYPICAL APPLICATION
ROAD CLOSURE, BYPASS DETOUR PROVIDED



TO BE PROVIDED EVERY 2640' OR THE SPACING OF THE SIGNS MAY BE CHANGED AS DIRECTED BY THE ENGINEER BETWEEN R52-6a AND R52-6b SIGNS

CASE NO. 5
TYPICAL APPLICATION
LANE #1 CLOSURE, MULTI-LANE FREEWAY

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA
- L — TRANSITION TAPER LENGTH:
  - L = MINIMUM LENGTH OF TAPER
  - SPEED 45 MPH OR MORE: $L = S \times W$
  - SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$
  - S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED
  - W = WIDTH OF OFFSET
  - SHOULDER TAPER = 1/3 L
- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL
- CZ — CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).
- ▲ — THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- ◆ — THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- VARIES — BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1).
- ⬟ — REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.
- ⬟ — G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- TRUCK MOUNTED ATTENUATOR (TMA)
- FLASHING BEACON
- ★ — SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

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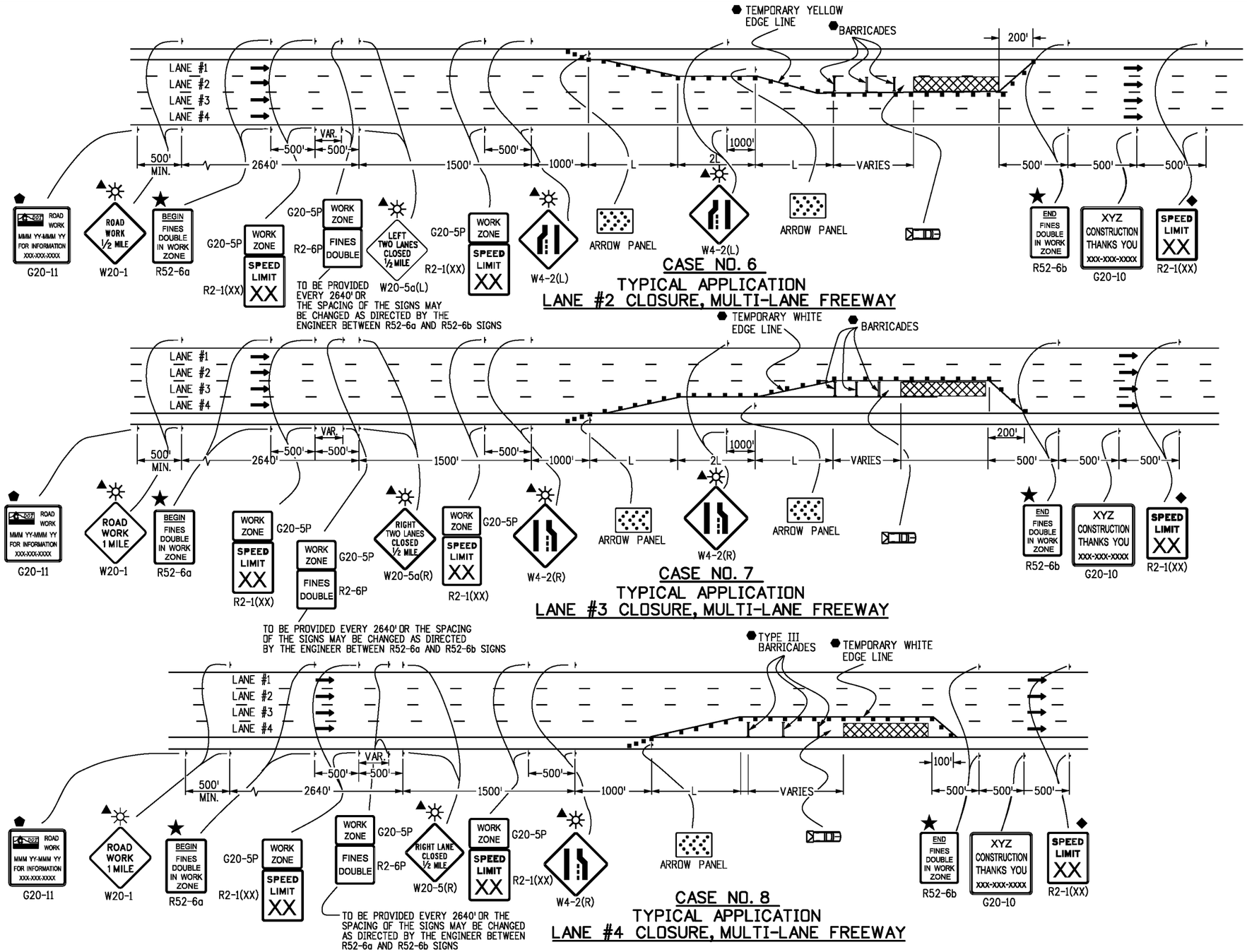

CASE NO. 6
TYPICAL APPLICATION
LANE #2 CLOSURE, MULTI-LANE FREEWAY

CASE NO. 7
TYPICAL APPLICATION
LANE #3 CLOSURE, MULTI-LANE FREEWAY

CASE NO. 8
TYPICAL APPLICATION
LANE #4 CLOSURE, MULTI-LANE FREEWAY

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA

L TRANSITION TAPER LENGTH:

L = MINIMUM LENGTH OF TAPER

SPEED 45 MPH OR MORE: $L = S \times W$

SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$

S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED

W = WIDTH OF OFFSET

SHOULDER TAPER = 1/3 L

- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL

CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).

▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.

◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.

VARIES BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1).

⬢ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.

⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

- TRUCK MOUNTED ATTENUATOR (TMA)
- FLASHING BEACON
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: RRR		Date:	Comments
Last Modification Date: 07/04/12 Initials:	R-X		
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TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION

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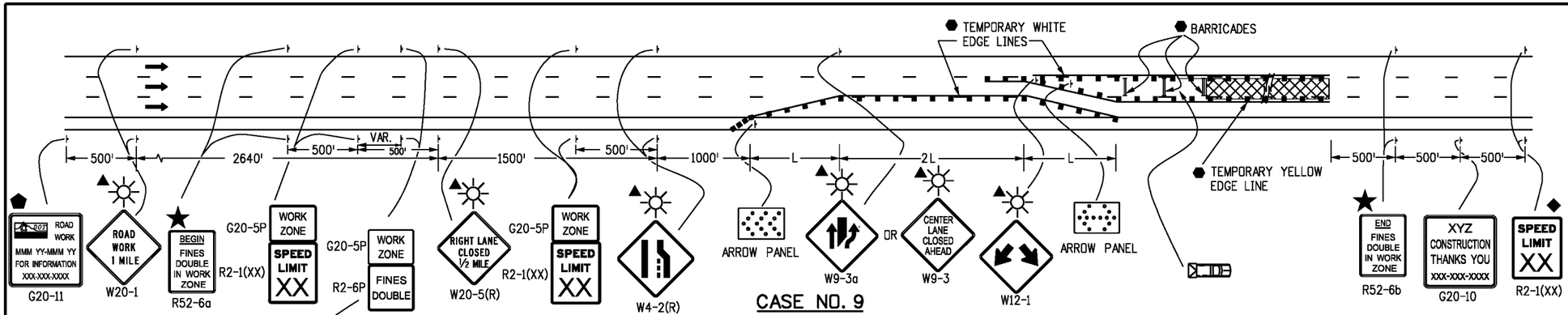
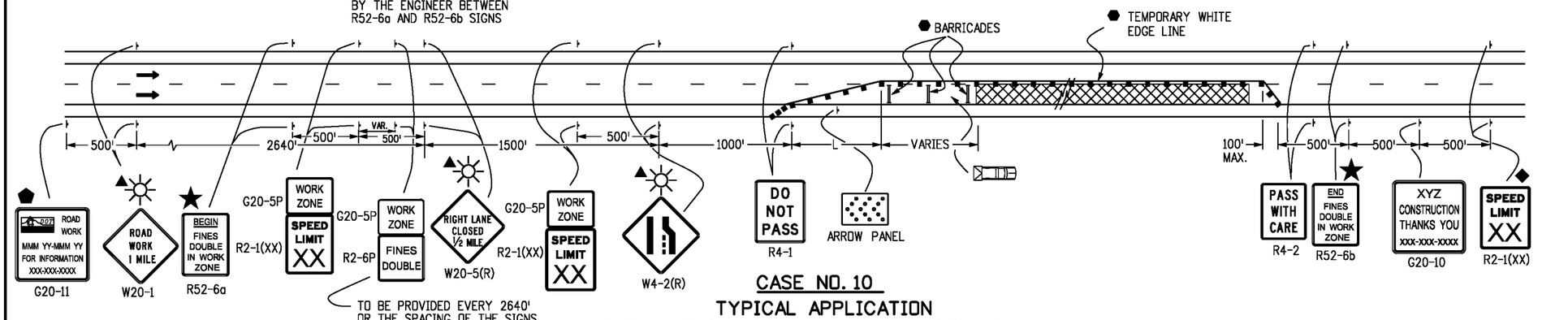
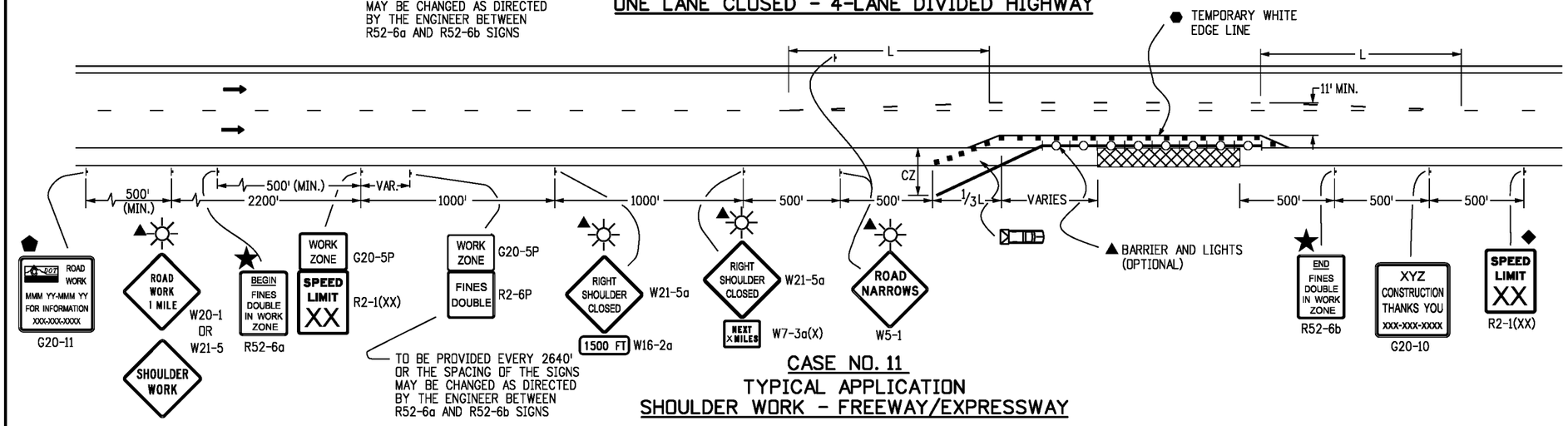


CASE NO. 9
TYPICAL APPLICATION
CENTER LANE CLOSURE - MULTI-LANE FREEWAY



CASE NO. 10
TYPICAL APPLICATION
ONE LANE CLOSED - 4-LANE DIVIDED HIGHWAY



CASE NO. 11
TYPICAL APPLICATION
SHOULDER WORK - FREEWAY/EXPRESSWAY

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA

L TRANSITION TAPER LENGTH:

L = MINIMUM LENGTH OF TAPER

SPEED 45 MPH OR MORE: $L = S \times W$

SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$

S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED

W = WIDTH OF OFFSET

SHOULDER TAPER = 1/3 L

- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL
- CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- ◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- FLASHING BEACON
- VARIES BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1).
- ⬢ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- TRUCK MOUNTED ATTENUATOR (TMA)
- CONCRETE BARRIER (TEMPORARY) WITH LIGHTS
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

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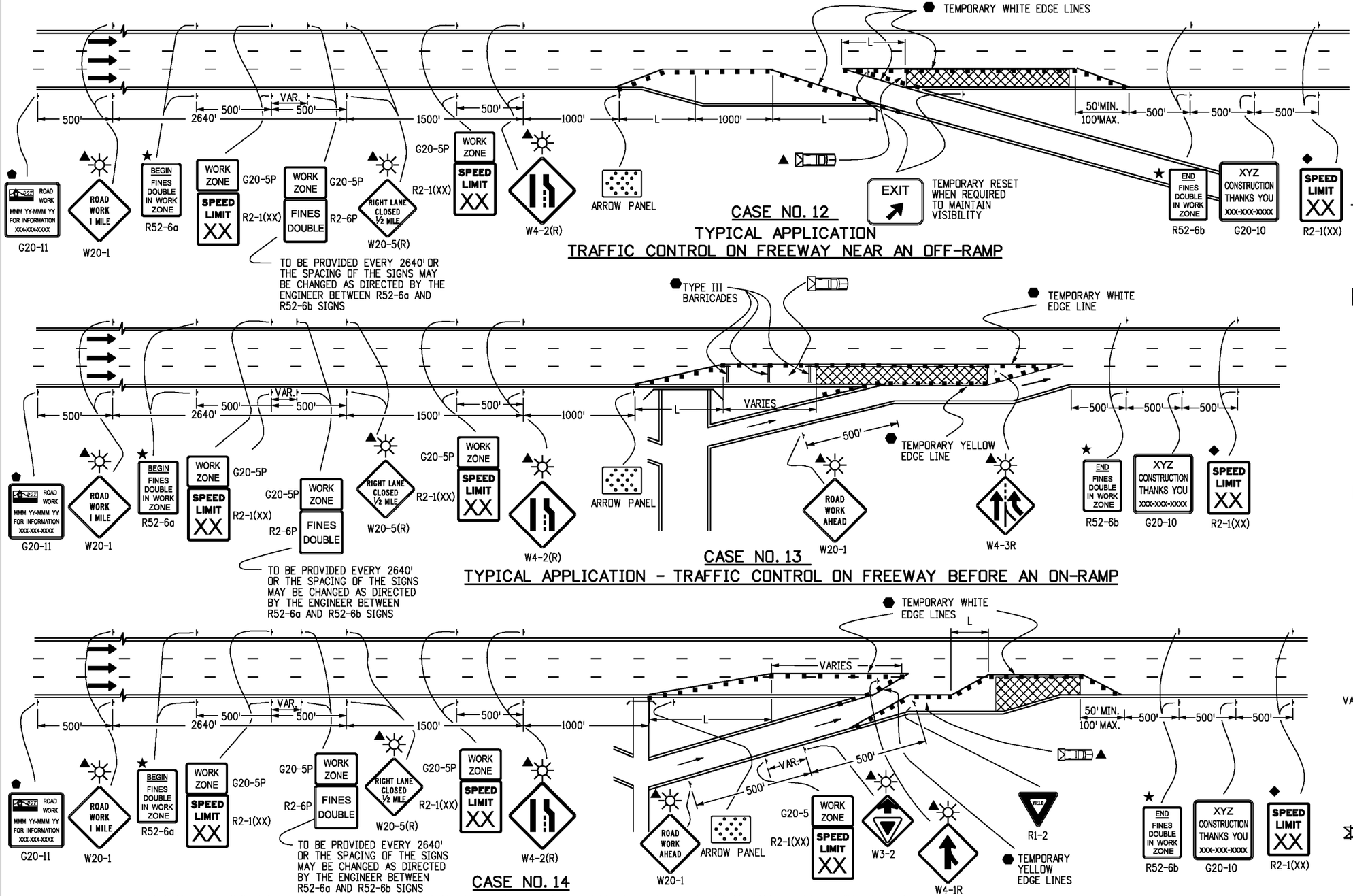

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
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- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA

L TRANSITION TAPER LENGTH:

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SPEED 45 MPH OR MORE: $L = S \times W$

SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$

S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED

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SHOULDER TAPER = 1/3 L

- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL
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- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- TRUCK MOUNTED ATTENUATOR (TMA)
- FLASHING BEACON
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

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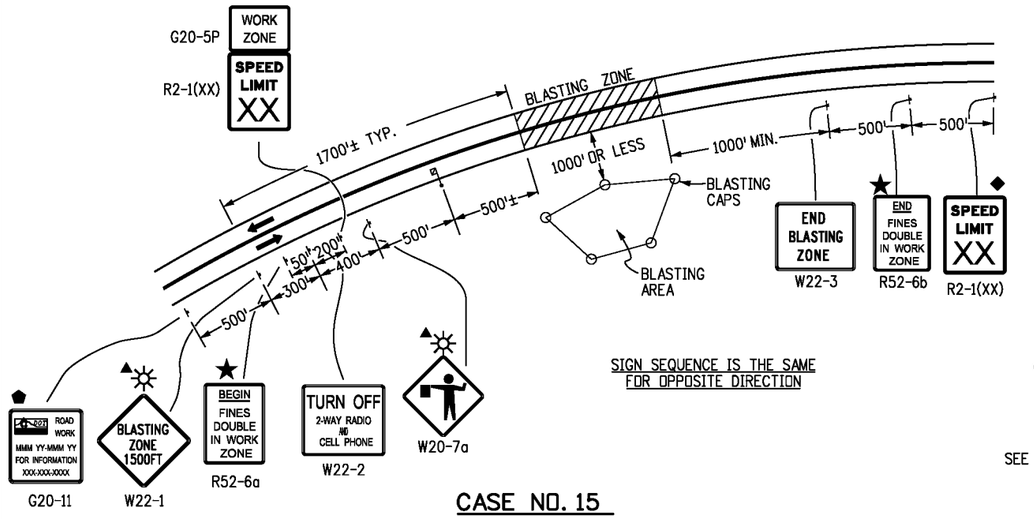
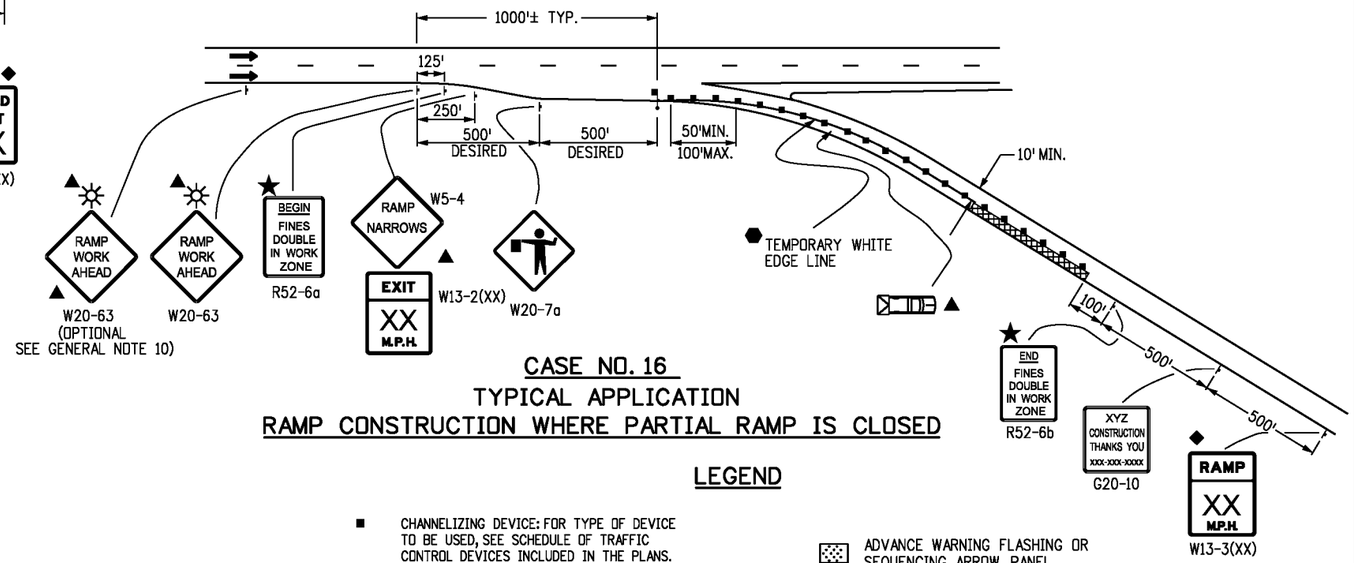
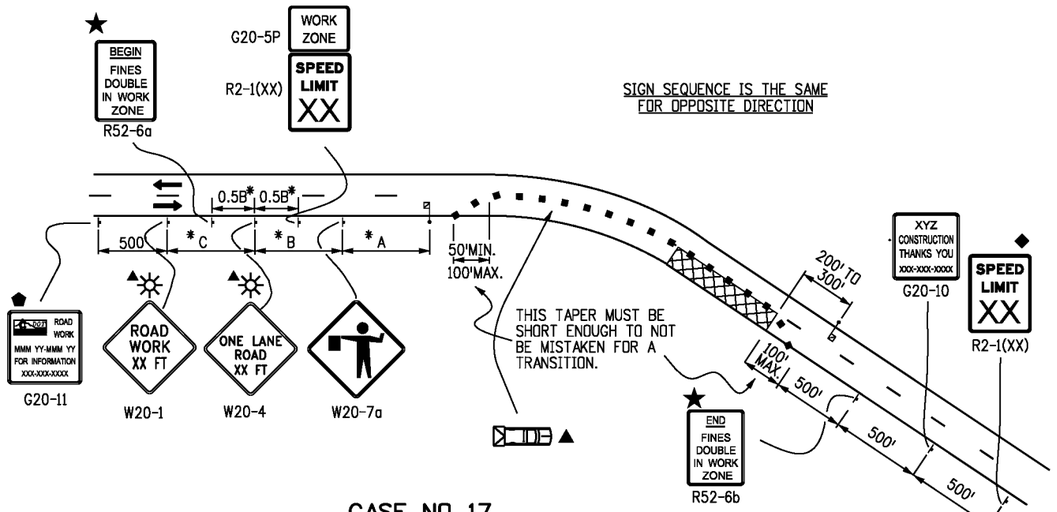


SIGN SEQUENCE IS THE SAME FOR OPPOSITE DIRECTION

CASE NO. 15
TYPICAL APPLICATION
BLASTING ZONE



CASE NO. 16
TYPICAL APPLICATION
RAMP CONSTRUCTION WHERE PARTIAL RAMP IS CLOSED



SIGN SEQUENCE IS THE SAME FOR OPPOSITE DIRECTION

CASE NO. 17
TYPICAL APPLICATION
LANE CLOSURE, 2-LANE HIGHWAY, AT CURVE

LEGEND

- ■ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA
- L TRANSITION TAPER LENGTH:
  - L = MINIMUM LENGTH OF TAPER
  - SPEED 45 MPH OR MORE: $L = S \times W$
  - SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$
  - S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED
  - W = WIDTH OF OFFSET
  - SHOULDER TAPER = 1/3 L
- TRUCK MOUNTED ATTENUATOR (TMA)
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12
- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL
- CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- ◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- FLASHING BEACON
- ● REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

*KEY TO ADVANCE SIGNING DISTANCES

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (<=40 MPH)	100	100	100
URBAN (>=45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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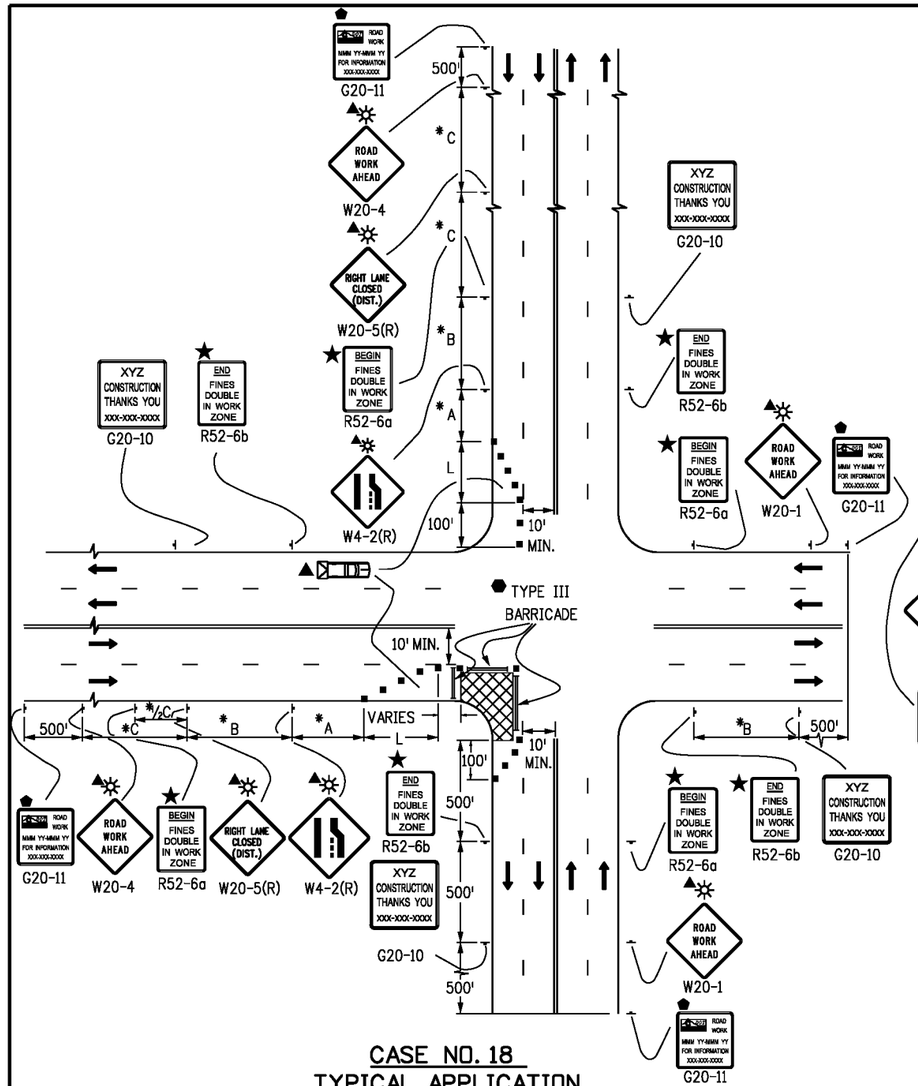
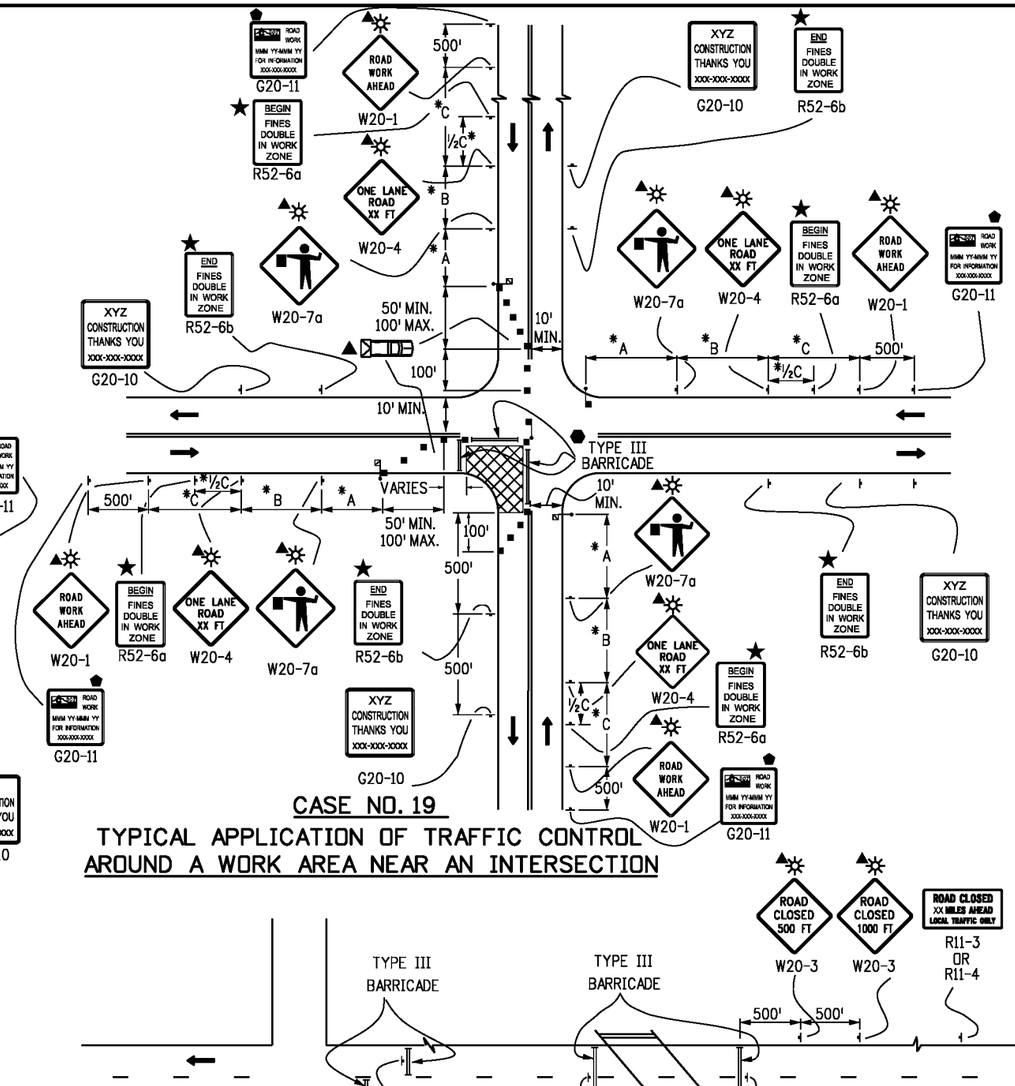
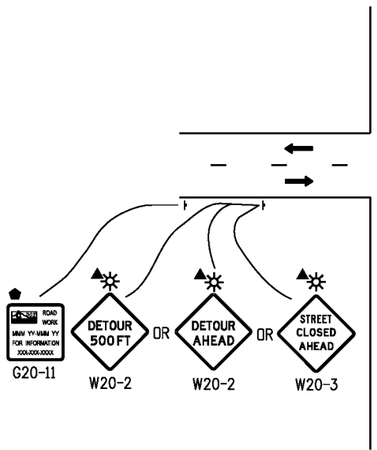
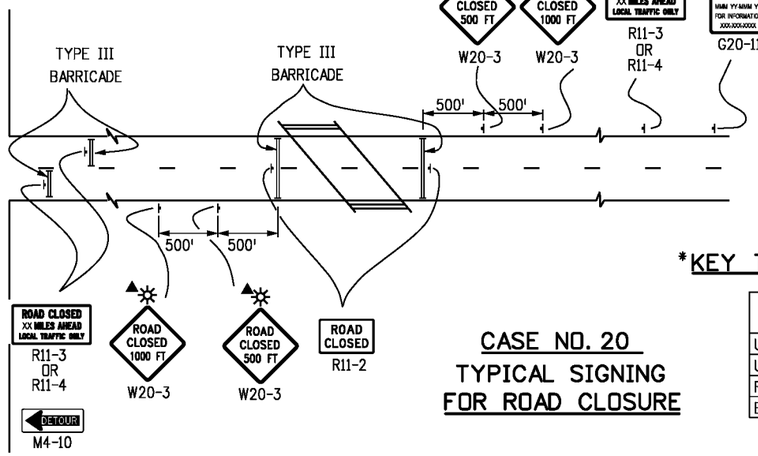


CASE NO. 18
TYPICAL APPLICATION TRAFFIC CONTROL AROUND A WORK AREA NEAR AN INTERSECTION, ONE LANE CLOSED



CASE NO. 19
TYPICAL APPLICATION OF TRAFFIC CONTROL AROUND A WORK AREA NEAR AN INTERSECTION





CASE NO. 20
TYPICAL SIGNING FOR ROAD CLOSURE

NOTES:

1. SIGN PLACEMENT SHOWN ON CASES 18 AND 19 TYPIFIES RURAL APPLICATIONS. URBAN APPLICATIONS REQUIRE THE SIGNS TO BE PLACED WITHIN ONE, OR PERHAPS TWO, BLOCKS.
2. TRUCK-MOUNTED ATTENUATORS (TMA) OPTIONAL FOR ALL CASES AS DETERMINED BY THE ENGINEER.

LEGEND

- ■ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA
- L TRANSITION TAPER LENGTH:
  - L = MINIMUM LENGTH OF TAPER
  - SPEED 45 MPH OR MORE: L = S x W
  - SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$
  - S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED
  - W = WIDTH OF OFFSET
  - SHOULDER TAPER = 1/3 L
- TRUCK MOUNTED ATTENUATOR (TMA)
- CZ CLEAR ZONE (SEE GENERAL NOTE 16).
- FLASHING BEACON
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- VARIES BUFFER SPACE (SEE GENERAL NOTE 21 ON SHEET 1).
- ⬟ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

*KEY TO ADVANCE SIGNING DISTANCES

ROAD TYPE	DISTANCE BETWEEN SIGNS		
	A	B	C
URBAN (<= 40 MPH)	100	100	100
URBAN (>= 45 MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1000	1500	2640

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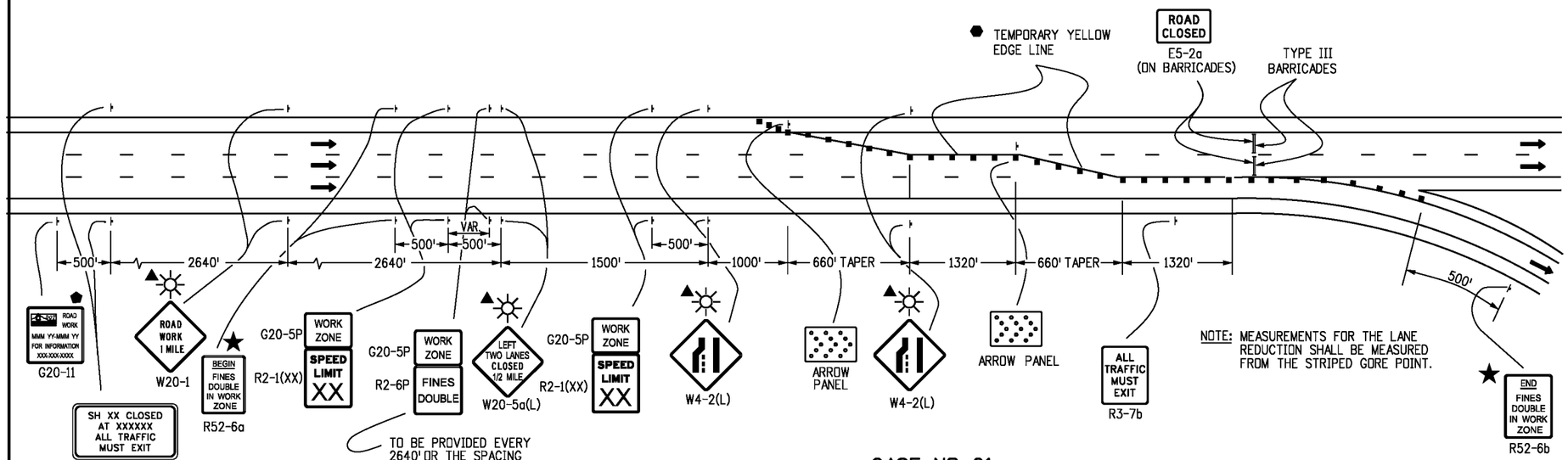
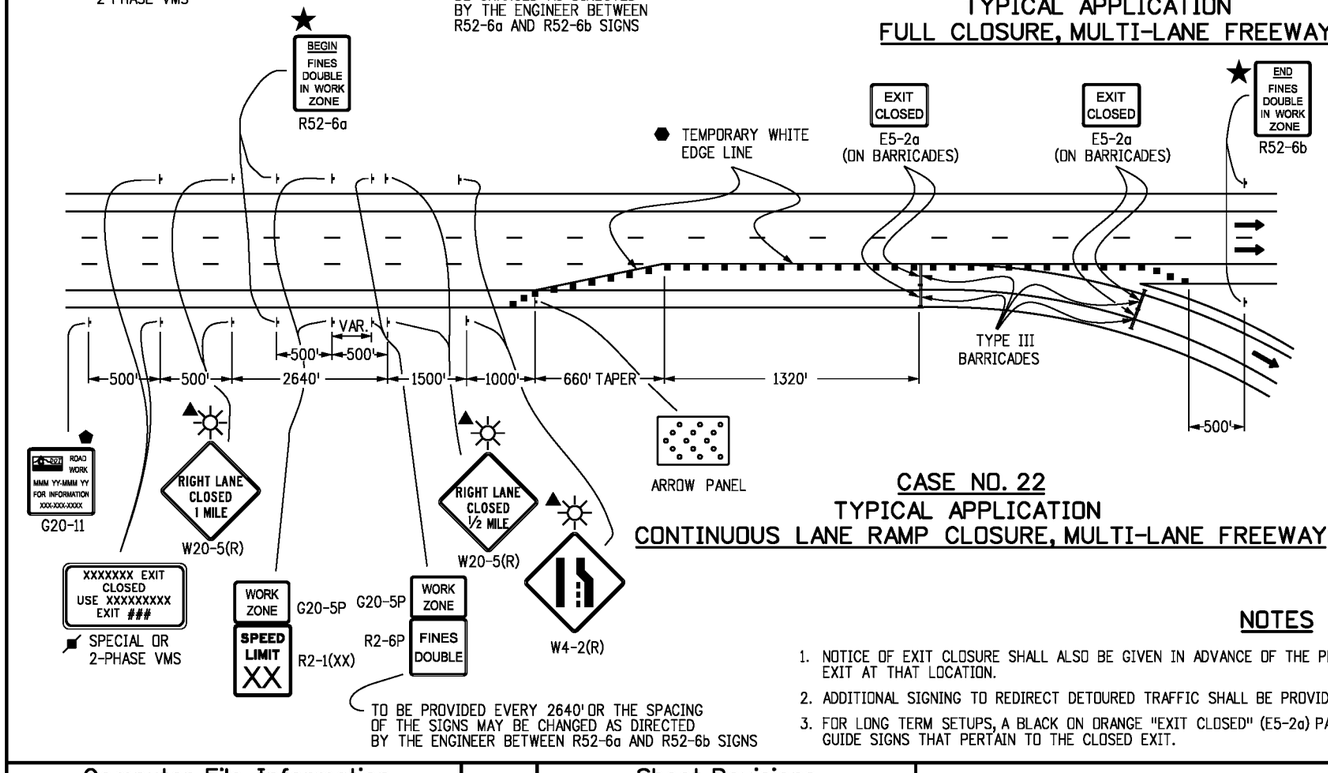
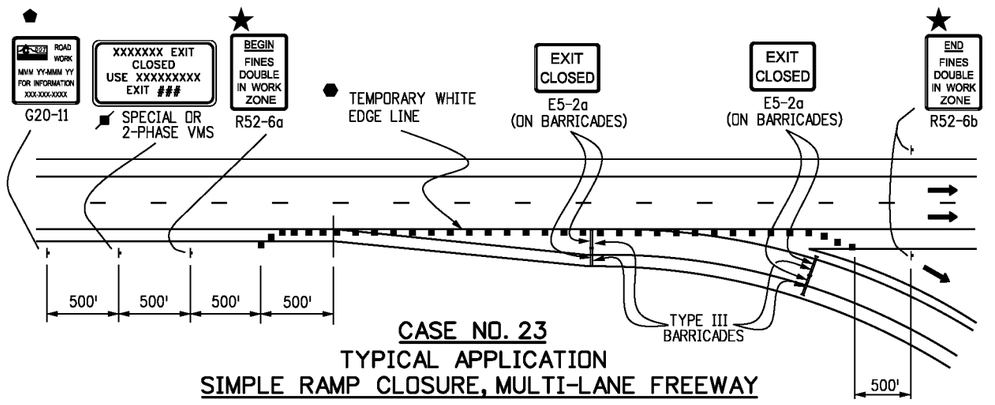


CASE NO. 21
TYPICAL APPLICATION
FULL CLOSURE, MULTI-LANE FREEWAY



CASE NO. 22
TYPICAL APPLICATION
CONTINUOUS LANE RAMP CLOSURE, MULTI-LANE FREEWAY



CASE NO. 23
TYPICAL APPLICATION
SIMPLE RAMP CLOSURE, MULTI-LANE FREEWAY

LEGEND

- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED WILL BE DETERMINED BY THE DESIGNER BASED ON DETOUR DESIGN AND/OR SCOPE OF THE CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE PLANS.
- ⬢ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- ■ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- DIRECTION OF TRAVEL
- L TRANSITION TAPER LENGTH:
  - L = MINIMUM LENGTH OF TAPER
  - SPEED 45 MPH OR MORE: $L = S \times W$
  - SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$
  - S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED
  - W = WIDTH OF OFFSET
  - SHOULDER TAPER = 1/3 L
- CLOSURE AND EXIT MESSAGES ON SIGN LEGEND(S) SHOULD BE MODIFIED TO FIT THE SITUATION.
- FLASHING BEACON
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

NOTE: MEASUREMENTS FOR THE LANE REDUCTION SHALL BE MEASURED FROM THE STRIPED GORE POINT.

NOTES

1. NOTICE OF EXIT CLOSURE SHALL ALSO BE GIVEN IN ADVANCE OF THE PREVIOUS EXIT TO PROVIDE MOTORISTS WITH THE OPTION TO EXIT AT THAT LOCATION.
2. ADDITIONAL SIGNING TO REDIRECT DETOURED TRAFFIC SHALL BE PROVIDED FOR IN THE PROJECT'S METHOD OF HANDLING TRAFFIC.
3. FOR LONG TERM SETUPS, A BLACK ON ORANGE "EXIT CLOSED" (E5-2a) PANEL SHALL BE MOUNTED DIAGONALLY ACROSS ALL EXISTING GUIDE SIGNS THAT PERTAIN TO THE CLOSED EXIT.

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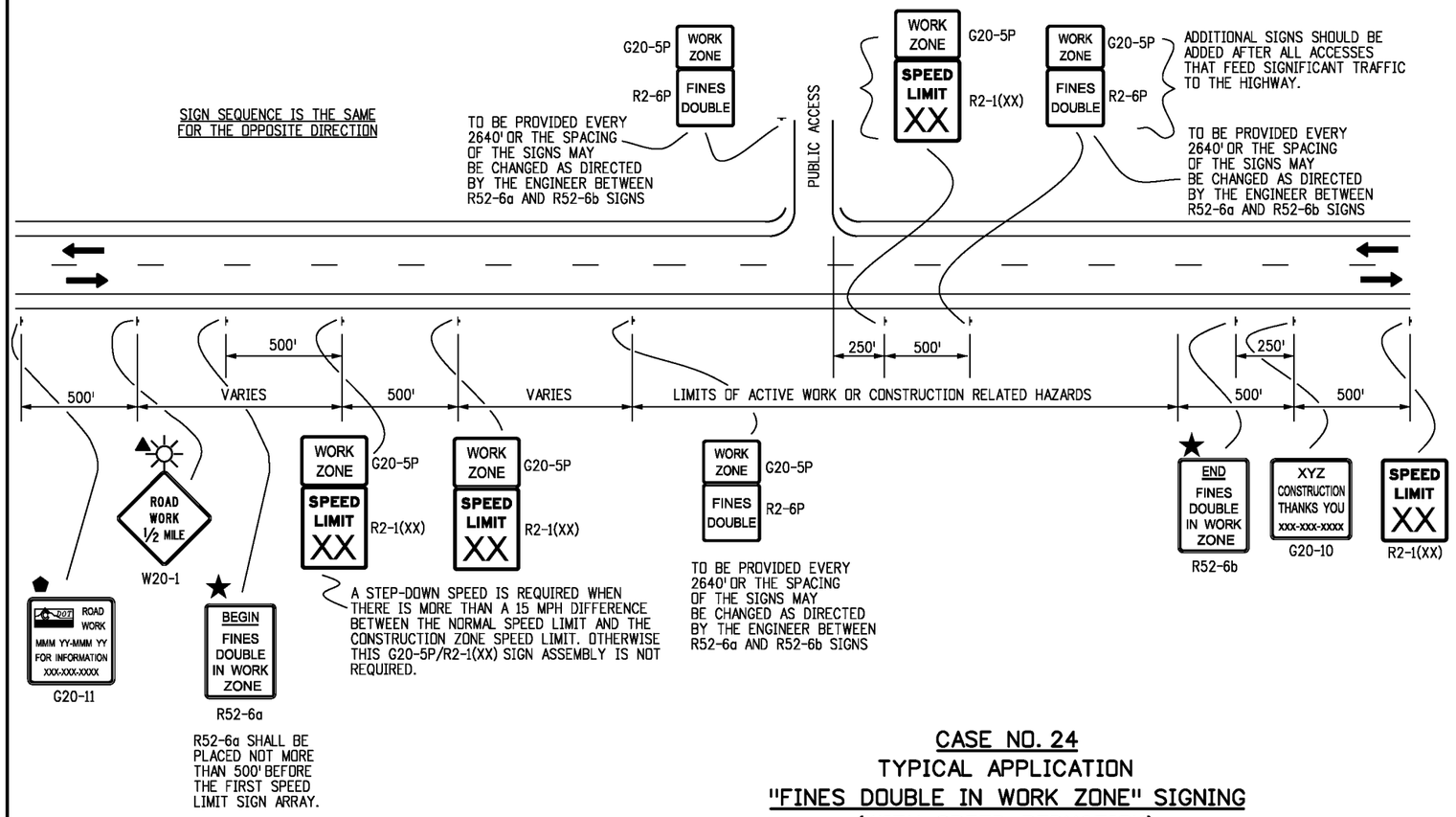

LEGEND

- DIRECTION OF TRAVEL
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED WILL BE DETERMINED BY THE DESIGNER BASED ON DETOUR DESIGN AND/OR SCOPE OF THE CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE PLANS.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- ☼ FLASHING BEACON
- ★ FINES DOUBLE SIGNING NOTES, SEE BELOW

FINES DOUBLE SIGNING NOTES:

1. SIGNS SHALL NOT BE PLACED SOONER THAN FOUR HOURS BEFORE WORK IS TO BEGIN AND SHALL BE REMOVED AS SOON AS WORK ACTIVITIES ARE CONCLUDED, UNLESS POTENTIAL HAZARDS INTRODUCED AS A RESULT OF THE WORK ARE STILL PRESENT AT THE END OF THE WORK DAY. IF SIGNS ARE LEFT IN PLACE AFTER WORK ACTIVITIES, THE TRAFFIC CONTROL SUPERVISOR SHALL MAKE AN ENTRY IN THEIR DAILY DIARY THAT JUSTIFIES THEIR USE.

   "HAZARDS" INCLUDE BUT ARE NOT LIMITED TO:
   - EDGE DROP OFFS
   - EQUIPMENT, WORKERS OR NON-SHIELDED OBJECTS IN THE CLEAR ZONE
   - ROUGH PAVEMENT
   - MAJOR CHANGE IN ALIGNMENT
   - REDUCED SHOULDER WIDTH
   - TEMPORARY GUARD RAIL OR BARRIER
   - LANE CLOSURE

2. SIGNS SHALL ONLY BE PLACED WHERE WORKERS ARE PRESENT IN THE ROADWAY OR CLEAR ZONE OR ARE AT RISK, OR WHERE THERE ARE HAZARDS IN THE TRAVELWAY, SHOULDERS OR CLEAR ZONE.

3. SIGNS SHOULD BE PLACED SO THAT MOTORISTS IMMEDIATELY ASSOCIATE THE SIGNS WITH PRESENT WORK ACTIVITIES. IF THE ZONE OF WORK ACTIVITY MOVES, THE SIGNS SHOULD BE MOVED ACCORDINGLY.

4. SIGNING SHOWN IS REQUIRED TO ENFORCE DOUBLE FINES IN A WORK ZONE. ADDITIONAL SIGNING SHALL BE IN ACCORDANCE WITH THAT NORMALLY REQUIRED FOR THE PARTICULAR WORK ZONE. PLACEMENT OF "FINES DOUBLE" SIGNING MAY BE ADJUSTED AS NEEDED TO PROVIDE A MINIMUM 250' SPACING BETWEEN OTHER SIGNING REQUIRED FOR THE SPECIFIC WORK ZONE SETUP.

CASE NO. 24
TYPICAL APPLICATION
"FINES DOUBLE IN WORK ZONE" SIGNING
(WITH SPEED REDUCTION)

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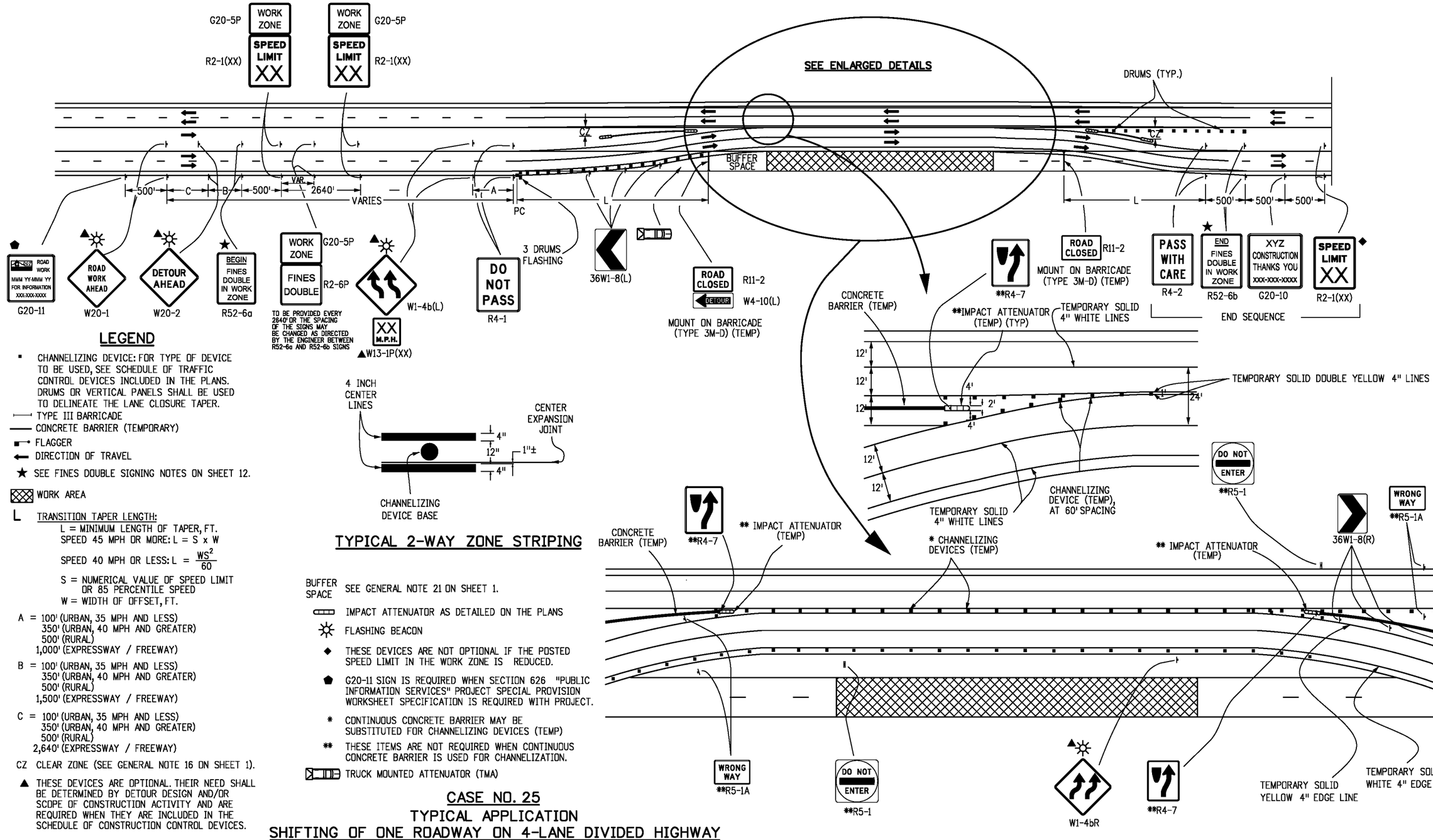

LEGEND

- ▪ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- ⊢ TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.
- WORK AREA
- L TRANSITION TAPER LENGTH:
  - L = MINIMUM LENGTH OF TAPER, FT.
  - SPEED 45 MPH OR MORE: $L = S \times W$
  - SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$
  - S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED
  - W = WIDTH OF OFFSET, FT.
- A = 100' (URBAN, 35 MPH AND LESS)
  350' (URBAN, 40 MPH AND GREATER)
  500' (RURAL)
  1,000' (EXPRESSWAY / FREEWAY)
- B = 100' (URBAN, 35 MPH AND LESS)
  350' (URBAN, 40 MPH AND GREATER)
  500' (RURAL)
  1,500' (EXPRESSWAY / FREEWAY)
- C = 100' (URBAN, 35 MPH AND LESS)
  350' (URBAN, 40 MPH AND GREATER)
  500' (RURAL)
  2,640' (EXPRESSWAY / FREEWAY)
- CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.

TYPICAL 2-WAY ZONE STRIPING

BUFFER SPACE SEE GENERAL NOTE 21 ON SHEET 1.

- IMPACT ATTENUATOR AS DETAILED ON THE PLANS
- FLASHING BEACON
- ◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- * CONTINUOUS CONCRETE BARRIER MAY BE SUBSTITUTED FOR CHANNELIZING DEVICES (TEMP)
- ** THESE ITEMS ARE NOT REQUIRED WHEN CONTINUOUS CONCRETE BARRIER IS USED FOR CHANNELIZATION.
- TRUCK MOUNTED ATTENUATOR (TMA)

CASE NO. 25
TYPICAL APPLICATION
SHIFTING OF ONE ROADWAY ON 4-LANE DIVIDED HIGHWAY

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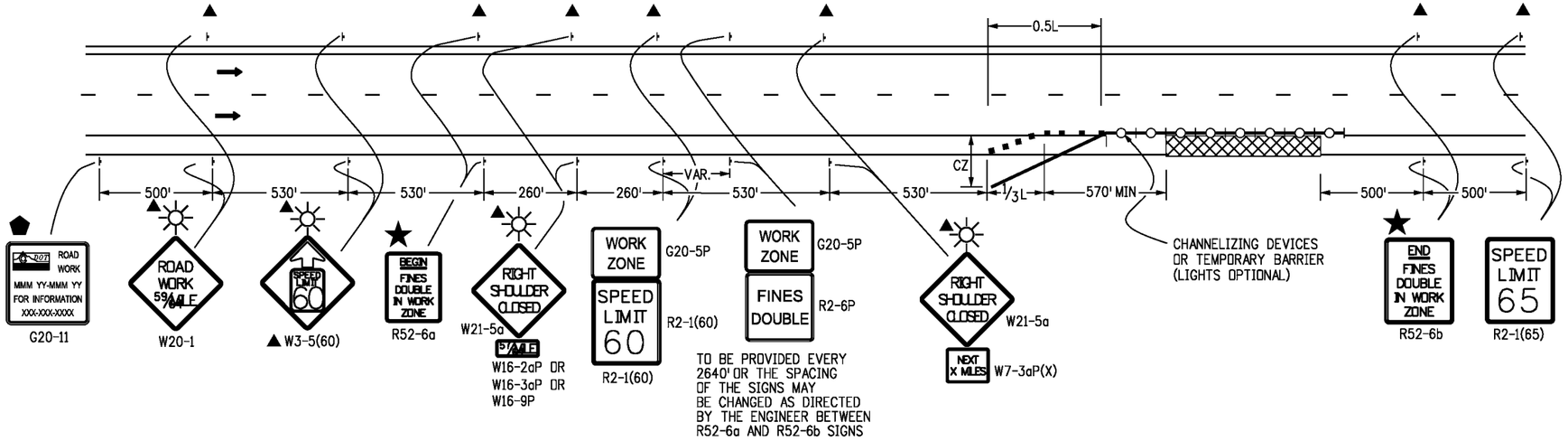
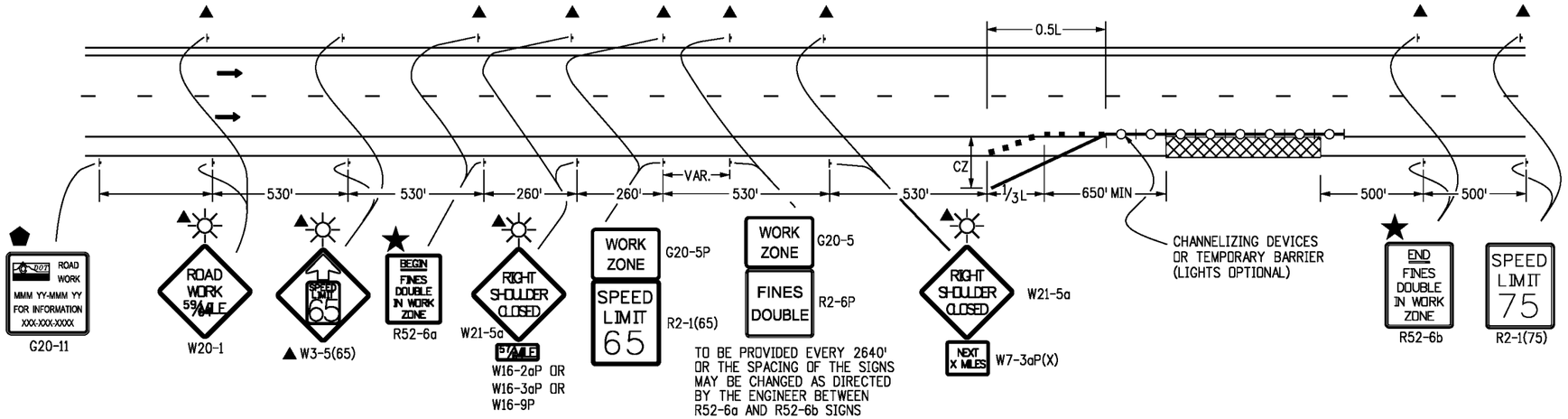


CASE NO. 26
TYPICAL APPLICATION
SHOULDER WORK - FREEWAY/EXPRESSWAY w/ 65 MPH SPEED LIMIT

WHEN HAZARDS (WORKERS, EQUIPMENT, OR TEMPORARY BARRIER) ARE WITHIN 8 FT OF TRAVEL WAY



CASE NO. 27
TYPICAL APPLICATION
SHOULDER WORK - FREEWAY/EXPRESSWAY w/ 75 MPH SPEED LIMIT

WHEN HAZARDS (WORKERS, EQUIPMENT, OR TEMPORARY BARRIER) ARE WITHIN 10 FT OF TRAVEL WAY

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. DRUMS OR VERTICAL PANELS SHALL BE USED TO DELINEATE THE LANE CLOSURE TAPER.
- TYPE III BARRICADE
- CONCRETE BARRIER (TEMPORARY)
- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA

L TRANSITION TAPER LENGTH:

L = MINIMUM LENGTH OF TAPER

SPEED 45 MPH OR MORE: L = S x W

S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED

W = WIDTH OF OFFSET

SHOULDER TAPER = 1/3 L

- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL

CZ CLEAR ZONE (SEE GENERAL NOTE 16 ON SHEET 1).

▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY TRAFFIC VOLUMES AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.

⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.

⬟ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.

- TRUCK MOUNTED ATTENUATOR
- FLASHING BEACON

★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

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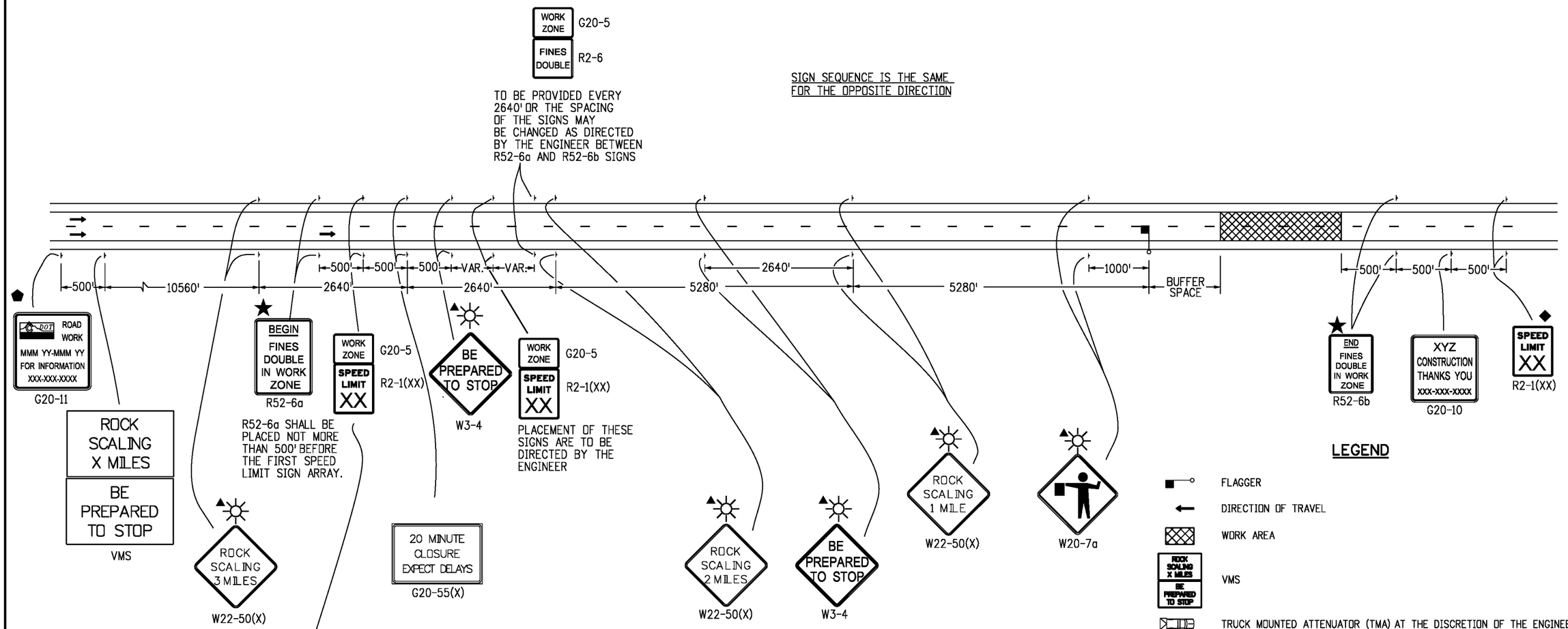

CASE NO. 28
TYPICAL APPLICATION
ROCK SCALING - ROAD CLOSURE, 4-LANE DIVIDED HIGHWAY

LEGEND

- FLAGGER
- DIRECTION OF TRAVEL
- WORK AREA
- VMS
- TRUCK MOUNTED ATTENUATOR (TMA) AT THE DISCRETION OF THE ENGINEER
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- ◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- BUFFER SPACE — SEE GENERAL NOTE 21 ON SHEET 1.
- FLASHING BEACON
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.

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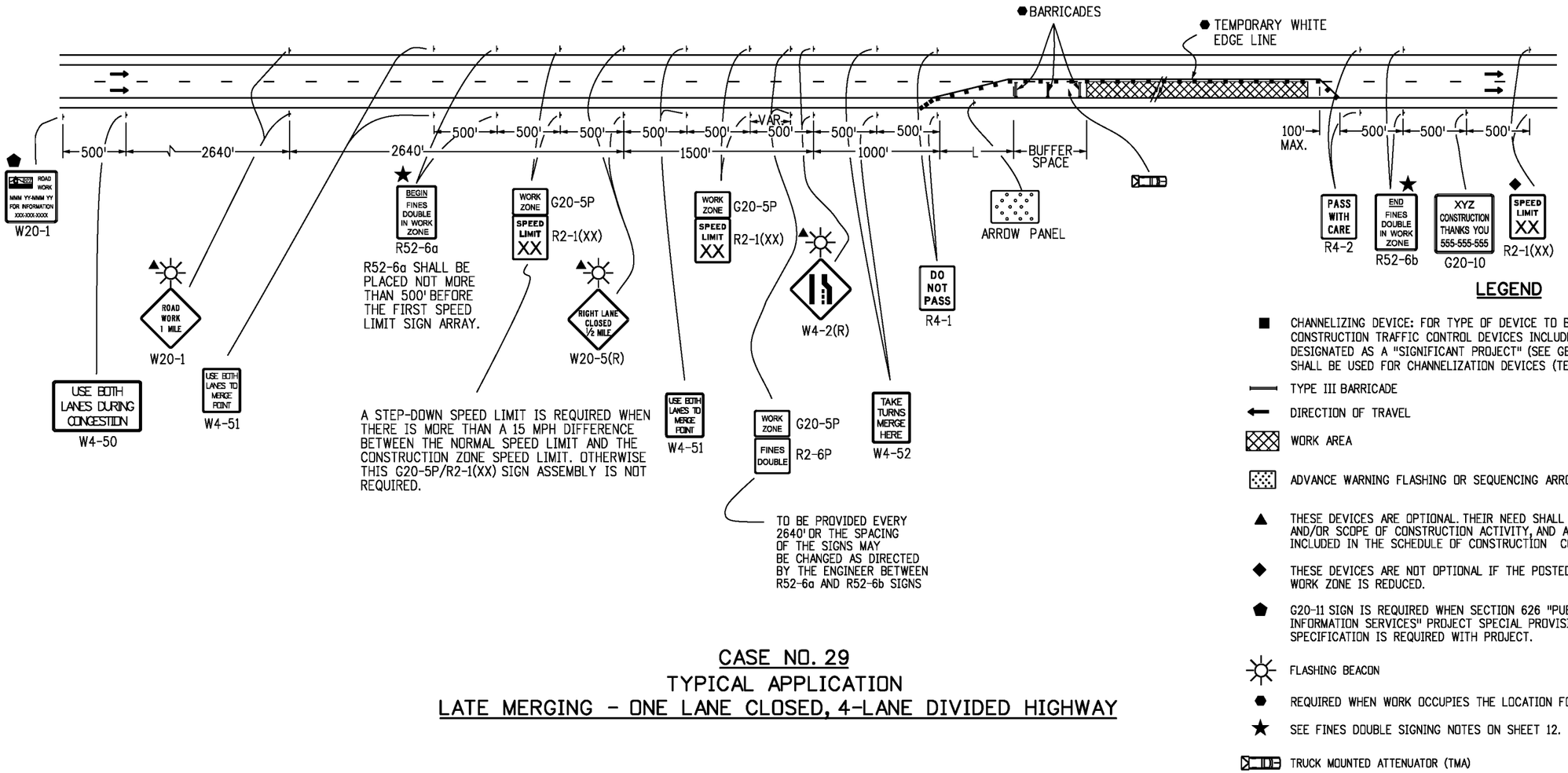

LEGEND

- ■ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE THE SCHEDULE OF CONSTRUCTION TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS. IF PROJECT IS DESIGNATED AS A "SIGNIFICANT PROJECT" (SEE GENERAL NOTE 25), CONCRETE BARRIER SHALL BE USED FOR CHANNELIZATION DEVICES (TEMP) AS DETERMINED BY THE ENGINEER.
- TYPE III BARRICADE
- DIRECTION OF TRAVEL
- WORK AREA
- ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.
- ▲ THESE DEVICES ARE OPTIONAL. THEIR NEED SHALL BE DETERMINED BY DETOUR DESIGN AND/OR SCOPE OF CONSTRUCTION ACTIVITY, AND ARE REQUIRED WHEN THEY ARE INCLUDED IN THE SCHEDULE OF CONSTRUCTION CONTROL DEVICES.
- ◆ THESE DEVICES ARE NOT OPTIONAL IF THE POSTED SPEED LIMIT IN THE WORK ZONE IS REDUCED.
- ⬟ G20-11 SIGN IS REQUIRED WHEN SECTION 626 "PUBLIC INFORMATION INFORMATION SERVICES" PROJECT SPECIAL PROVISION WORKSHEET SPECIFICATION IS REQUIRED WITH PROJECT.
- FLASHING BEACON
- ⬢ REQUIRED WHEN WORK OCCUPIES THE LOCATION FOR MORE THAN 3 DAYS.
- ★ SEE FINES DOUBLE SIGNING NOTES ON SHEET 12.
- TRUCK MOUNTED ATTENUATOR (TMA)
- L TRANSITION TAPER LENGTH:

  L = MINIMUM LENGTH OF TAPER

  SPEED 45 MPH OR MORE: $L = S \times W$

  SPEED 40 MPH OR LESS: $L = \frac{WS^2}{60}$

  S = NUMERICAL VALUE OF SPEED LIMIT OR 85 PERCENTILE SPEED

  W = WIDTH OF OFFSET

  SHOULDER TAPER = 1/3 L
- BUFFER SPACE SEE GENERAL NOTE 21 ON SHEET 1.

CASE NO. 29
TYPICAL APPLICATION
LATE MERGING - ONE LANE CLOSED, 4-LANE DIVIDED HIGHWAY

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LEGEND

VEHICLE WITH TRUCK-MOUNTED ATTENUATORS (TMA), TWO 360-DEGREE YELLOW FLASHING BEACONS, AND YELLOW FLASHING VEHICLE LIGHTS OR STROBES.

ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.

VMS — VARIABLE MESSAGE SIGN (VMS).

▲ WHEN VMS IS USED, THE "SHOULDER CLOSED" SIGN BECOMES OPTIONAL.

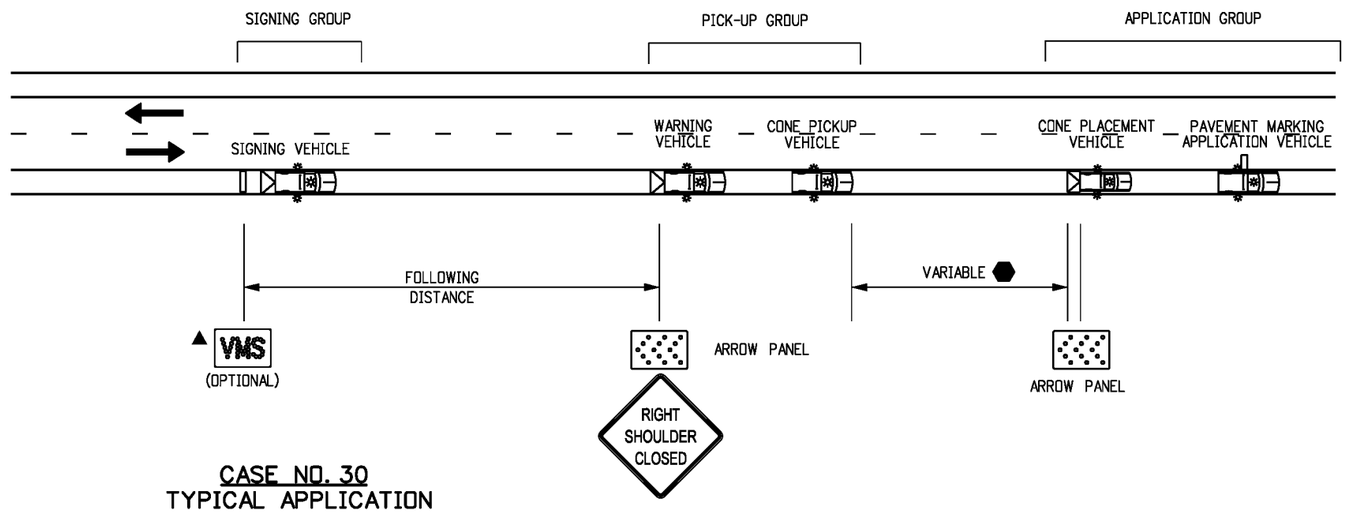
■ THE "PICK-UP VEHICLES" OR "WARNING VEHICLE" MAY ENCROACH INTO THE TRAFFIC LANE WHEN THE SHOULDER IS TOO NARROW TO DRIVE ON.

● IF TRACKING OF THE WET PAINT IS ANTICIPATED, THE USE OF CONES OR STATIONARY "WET PAINT" SIGNS SHALL BE POSTED.

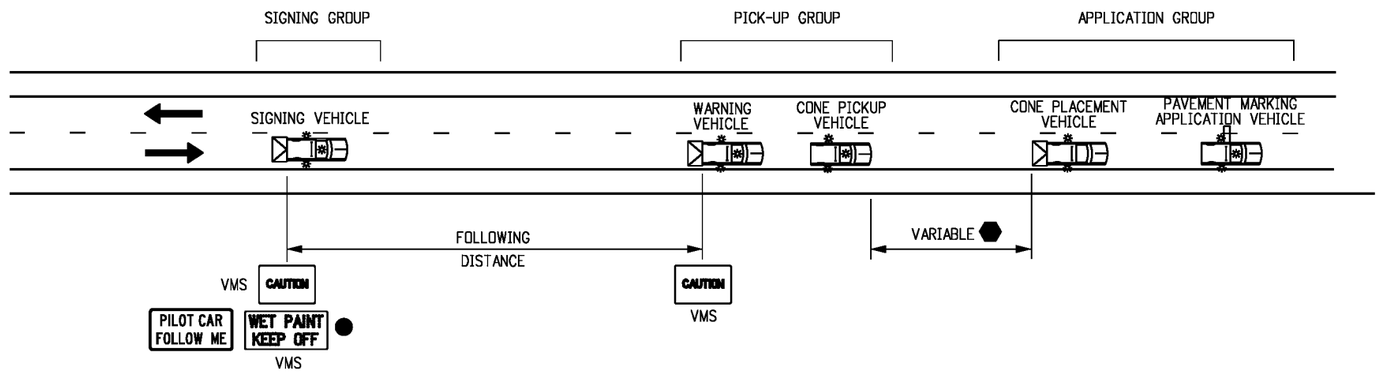
⬢ THE VARIABLE SEPARATION DISTANCE BETWEEN THE "CONE PLACEMENT VEHICLE" AND "CONE PICKUP VEHICLE" SHALL BE DETERMINED BY THE TRACK DRYING TIME OF THE PAVEMENT MARKING MATERIAL.

FOLLOWING DISTANCE CHART FOR WARNING AND SIGNING VEHICLES

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)
0 - 30	250 - 550
35 - 40	325 - 700
45 - 50	600 - 900
55	750 - 1200
60 - 65	1000 - 1400
70 - 75	1200 - 1600



CASE NO. 30
TYPICAL APPLICATION
MOBILE PAVEMENT MARKING ZONE
MOBILE SHOULDER CLOSURE ON 2-LANE UNDIVIDED HIGHWAY



CASE NO. 31
TYPICAL APPLICATION*
MOBILE PAVEMENT MARKING ZONE
CENTERLINE STRIPING ON 2-LANE UNDIVIDED HIGHWAY

* USE CASE 31 IF SHOULDER IN CASE 30 IS TOO NARROW FOR GROUP VEHICLE USE.

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LEGEND

VEHICLE WITH TRUCK-MOUNTED ATTENUATORS (TMA), TWO 360-DEGREE YELLOW FLASHING BEACONS, AND YELLOW FLASHING VEHICLE LIGHTS OR STROBES.

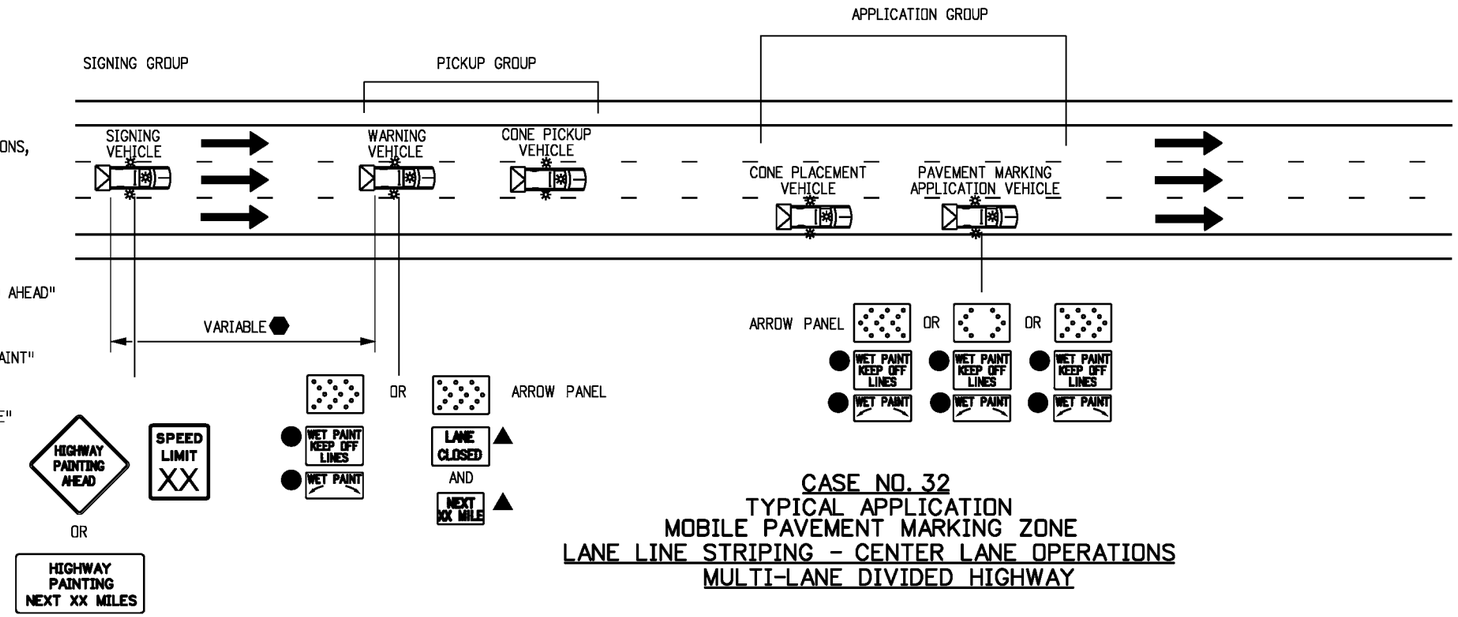
ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.

PORTABLE VARIABLE MESSAGE SIGN (VMS).

WHEN THE VMS IS USED, THE "SHOULDER CLOSED" (W21-5aX) OR W21-5bX), AND "RAMP CLOSED AHEAD" SIGNS BECOME OPTIONAL.

IF TRACKING OF THE WET PAINT IS ANTICIPATED, THE USE OF CONES OR STATIONARY "WET PAINT" SIGNS SHALL BE POSTED.

THE VARIABLE SEPARATION DISTANCE BETWEEN THE "WARNING VEHICLE" AND "SIGNING VEHICLE" SHALL BE DETERMINED BY THE TRACK DRYING TIME OF THE PAVEMENT MARKING MATERIAL.



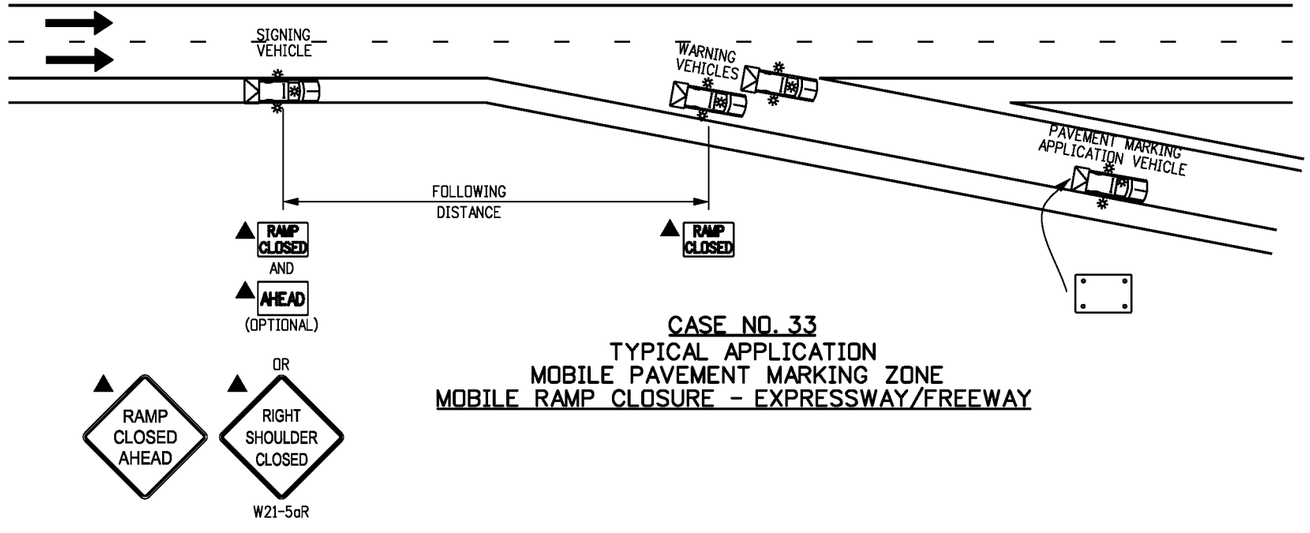
CASE NO. 32
TYPICAL APPLICATION
MOBILE PAVEMENT MARKING ZONE
LANE LINE STRIPING - CENTER LANE OPERATIONS
MULTI-LANE DIVIDED HIGHWAY

FOLLOWING DISTANCE CHART FOR WARNING VEHICLE AND SIGNING VEHICLES

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)
0 - 30	250 - 550
35 - 40	325 - 700
45 - 50	600 - 900
55	750 - 1200
60 - 65	1000 - 1400
70 - 75	1200 - 1600

NOTES

1. THE SIGNING VEHICLES MAY ENCROACH INTO THE TRAFFIC LANE WHEN THE SHOULDER IS TOO NARROW TO DRIVE ON.
2. IF THE RAMP CANNOT BE REOPENED WITHIN 15 MINUTES, USE CASE NO. 22 OF THE S-630-1 STANDARD PLAN.



CASE NO. 33
TYPICAL APPLICATION
MOBILE PAVEMENT MARKING ZONE
MOBILE RAMP CLOSURE - EXPRESSWAY/FREEWAY

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LEGEND

VEHICLE WITH TRUCK-MOUNTED ATTENUATORS (TMA), TWO 360-DEGREE YELLOW FLASHING BEACONS, AND YELLOW FLASHING VEHICLE LIGHTS OR STROBES.

ADVANCE WARNING FLASHING OR SEQUENCING ARROW PANEL.

PORTABLE VARIABLE MESSAGE SIGN (VMS).

▲ WHEN THE VMS IS USED, THE "RIGHT LANE CLSED AHEAD" (W9-3X) SIGN BECOMES OPTIONAL.

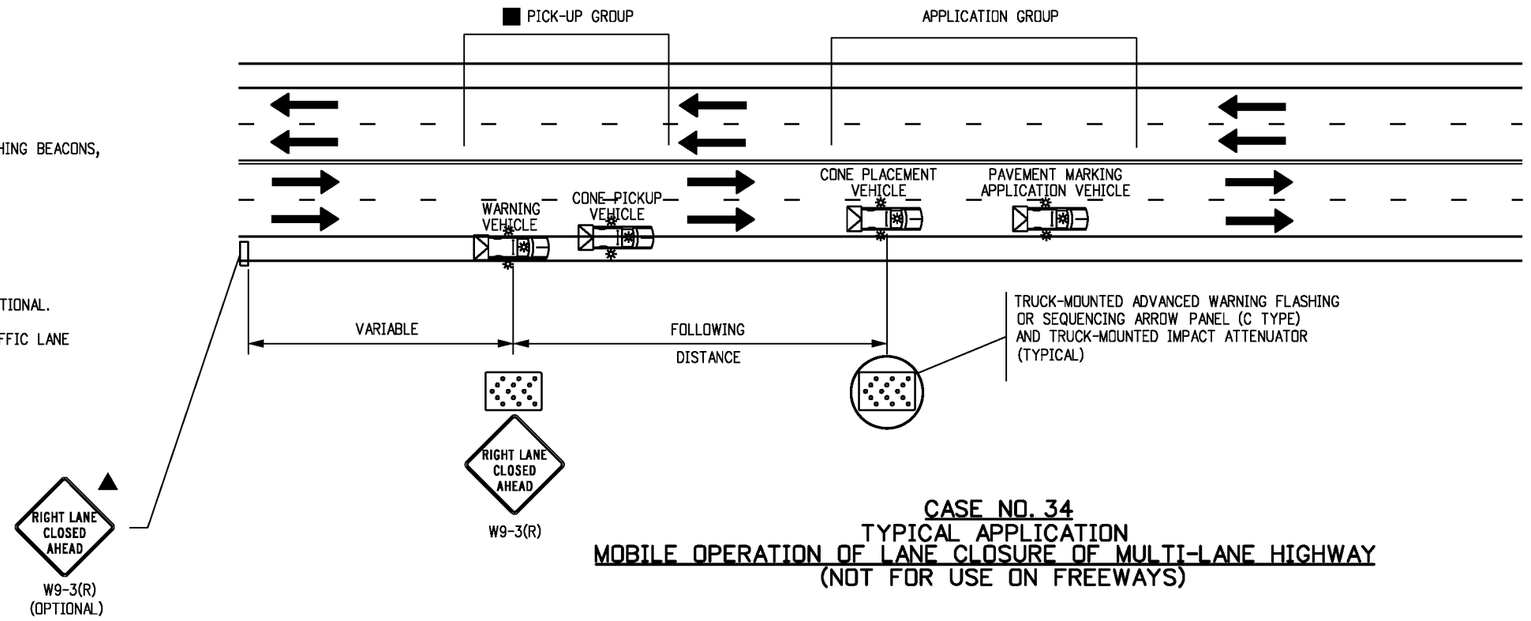
■ THE "CONE PICK-UP VEHICLE" OR "WARNING VEHICLE" MAY ENCROACH INTO THE TRAFFIC LANE WHEN THE SHOULDER IS TOO NARROW TO DRIVE ON.

NOTES

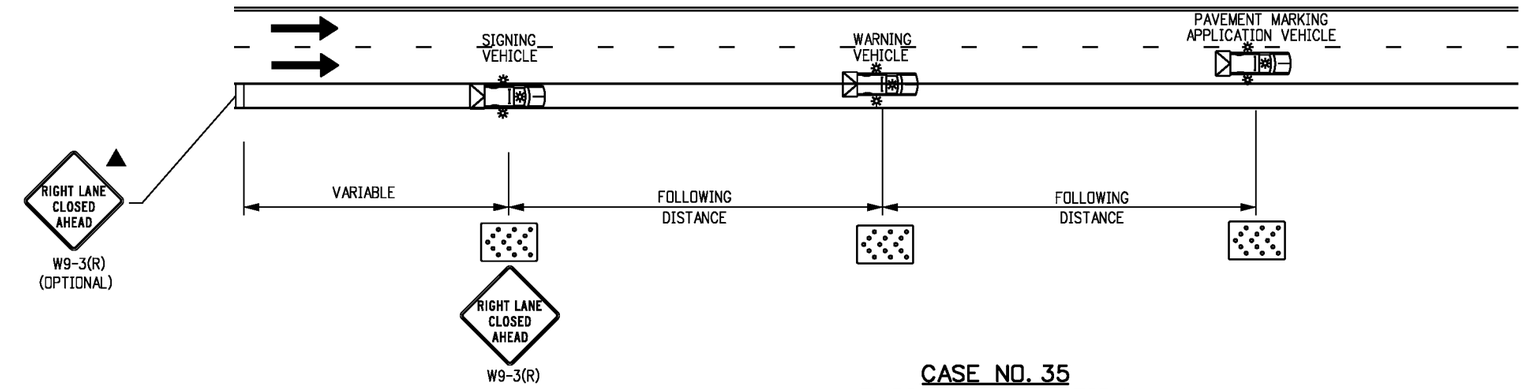
1. IN ROADWAY WHERE THE AADT IS 2,000 OR LESS, A SINGLE WORK VEHICLE WITH APPROPRIATE WARNING DEVICES ON THE VEHICLE MAY BE USED.
2. RADIO COMMUNICATIONS BETWEEN THE WORKCREW AND THE MOVING BLOCKADE ARE REQUIRED TO ADJUST THE BLOCKADE TO INCREASE OR DECREASE THE CLOSURE TIME. RELEASE TRAFFIC ONLY AFTER CONFIRMATION THAT ALL WORKERS AND THEIR VEHICLES ARE CLEAR OF THE ROADWAY.
3. IF APPLICABLE, ALL RAMPS AND ACCESS BETWEEN THE MOVING BLOCKADE AND WORK OPERATION AREA SHALL BE TEMPORARILY CLOSED USING TRAFFIC CONTROL EQUIPMENT AND PERSONNEL. EACH RAMP MUST REMAIN CLOSED UNTIL THE CREW DOING THE WORK GIVES THE "ALL CLEAR" SIGNAL OR UNTIL THE FRONT OF THE MOVING BLOCKADE PASSES THE CLOSED RAMP(S).

FOLLOWING DISTANCE CHART FOR WARNING VEHICLE AND SIGNING VEHICLES

POSTED WZ SPEED LIMIT (MPH)	FOLLOWING DISTANCE (FEET)
0 - 30	250 - 550
35 - 40	325 - 700
45 - 50	600 - 900
55	750 - 1200
60 - 65	1000 - 1400
70 - 75	1200 - 1600



CASE NO. 34
TYPICAL APPLICATION
MOBILE OPERATION OF LANE CLOSURE OF MULTI-LANE HIGHWAY
(NOT FOR USE ON FREEWAYS)



CASE NO. 35
TYPICAL APPLICATION
MOBILE OPERATION OF LANE CLOSURE OF MULTI-LANE HIGHWAY

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TYPICAL CONSTRUCTION ZONE SIGNS

THESE SIGNING NOTES ARE INTENDED AS A QUICK REFERENCE
FOR TYPICAL SIGN USE AND PLACEMENT IN CONSTRUCTION ZONES.

G20-1	"ROAD/WORK/NEXT XX MILES" - THIS SIGN SHALL BE ERECTED AT THE LIMITS OF ANY ROAD CONSTRUCTION OR MAINTENANCE PROJECT OF MORE THAN TWO (2) MILES IN LENGTH WHERE TRAFFIC IS MAINTAINED THROUGH THE PROJECT.
G20-4	"PILOT CAR/FOLLOW ME" - THIS SIGN SHALL BE MOUNTED IN A CONSPICUOUS POSITION ON THE REAR OF A VEHICLE USED FOR GUIDING ONE-WAY TRAFFIC THROUGH OR AROUND THE PROJECT.
G20-5P	"WORK ZONE" - THIS PLAQUE SHALL BE MOUNTED JUST ABOVE THE WORK ZONE SPEED LIMIT SIGNS PRIOR TO THE WORK ZONE AREA.
G20-10	THANK YOU SIGN - THIS SIGN SHOULD BE ERECTED APPROXIMATELY 500 FEET BEYOND THE END OF THE PROJECT.
G20-11	CONSTRUCTION PROJECT INFORMATION SIGN - THIS SIGN SHOULD BE ERECTED AS DESCRIBED IN THE SECTION 626 STANDARD SPECIFICATION.
G20-55(X)	"X MINUTE CLOSURE. EXPECT DELAYS" - THIS SIGN IS INTENDED FOR USE 500 FEET PAST THE "WORK ZONE"/SPEED LIMIT SIGN.
M4-9( )	"DETOUR/<<<<" - THIS SIGN IS USED FOR UNNUMBERED ROUTES; FOR USE IN EMERGENCY SITUATIONS; FOR PERIODS OF SHORT DURATION; OR WHERE, OVER RELATIVELY SHORT DISTANCES. IT IS NOT NECESSARY TO SHOW ROUTE MARKERS TO GUIDE TRAFFIC ALONG THE DETOUR AND BACK TO ITS AUTHORIZED ROUTE.
M4-10( )	"DETOUR ARROW" - THIS SIGN SHOULD BE MOUNTED JUST BELOW THE ROAD CLOSED SIGN AT THE POINT WHERE THE DETOUR ROADWAY OR ROUTE HAS BEEN ESTABLISHED DUE TO THE CLOSURE OF THE STREET OR HIGHWAY TO THROUGH TRAFFIC.
R2-1( )	"SPEED/LIMIT/XX" - THESE SIGNS ARE INTENDED TO REDUCE TRAFFIC SPEED IN ADVANCE OF THE DAILY WORK AREA WITHIN THE OVERALL PROJECT LIMITS.
R2-1(XX)	"SPEED/LIMIT/XX" - THIS SIGN IS INTENDED FOR USE 500 FEET PAST THE "THANK YOU" SIGN TO BRING TRAFFIC BACK TO ORIGINAL POSTED SPEED.
R2-6P	"FINES DOUBLE" - THIS SIGN IS INTENDED FOR USE WITHIN WORK ZONES TO PROVIDE NOTICE OF INCREASED FINES FOR TRAFFIC VIOLATIONS WITHIN WORK ZONES.
R4-1	"DO NOT PASS" - THIS SIGN SHOULD BE PLACED AT TRANSITION TAPER POINT.
R4-2	"PASS WITH CARE" - THIS SIGN SHOULD BE PLACED AT TRANSITION TAPER POINT.
R11-2	"ROAD/CLOSED" - THIS SIGN IS TO BE MOUNTED ON THE BARRICADE THAT IS PLACED BEFORE THE WORK ZONE ENTRANCE TO PROHIBIT TRAFFIC FROM ENTERING THE WORK ZONE.
R11-3	"ROAD CLOSED/X MILES AHEAD/L.T.D. - THIS SIGN SHOULD BE PLACED WHERE THROUGH TRAFFIC MUST DETOUR TO AVOID THE CLOSURE OF THE ROAD SOME DISTANCE BEYOND, BUT WHERE THE ROAD IS OPEN TO LOCAL TRAFFIC UP TO THE POINT OF CLOSURE.
R11-4	"ROAD CLOSED/TO/THRU TRAFFIC" FOR URBAN USE - THIS SIGN SHOULD BE PLACED WHERE THROUGH TRAFFIC MUST DETOUR TO AVOID THE CLOSURE OF THE ROAD SOME DISTANCE BEYOND, BUT WHERE THE ROAD IS OPEN TO LOCAL TRAFFIC UP TO THE POINT OF CLOSURE.
R52-6a	"BEGIN FINES DOUBLE IN WORK ZONE" SIGN IS PLACED AT THE BEGINNING OF THE ADVANCED WARNING AREA OF THE TRAFFIC CONTROL ZONE.
R52-6b	"END FINES DOUBLE IN WORK ZONE" SIGN IS PLACED AFTER WORK ZONE AREA, PAST DOWNSTREAM TAPER SECTION.
W1-1( )	"TURN ARROW" - THIS SIGN IS INTENDED FOR USE WHERE ENGINEERING INVESTIGATIONS OF ROADWAY CONDITIONS SHOW THE RECOMMENDED SPEED ON THE TURN TO BE 30 MPH OR LESS.*
W1-2( )	"CURVE ARROW" - THIS SIGN IS INTENDED FOR USE WHERE ENGINEERING INVESTIGATIONS OF ROADWAY CONDITIONS SHOW THE RECOMMENDED SPEED ON THE CURVE TO BE IN THE RANGE BETWEEN 30 AND 60 MILES PER HOUR.*
W1-3( )	"REVERSE TURN ARROW" - THIS SIGN IS INTENDED FOR USE WHERE TWO TURNS OR THE CURVE AND A TURN IN OPPOSITE DIRECTIONS ARE SEPARATED BY A TANGENT OF LESS THAN 600 FEET.*
W1-4( )	"REVERSE CURVE ARROW" - THIS SIGN IS INTENDED FOR USE WHERE TWO CURVES IN OPPOSITE DIRECTIONS ARE SEPARATED BY A TANGENT OF LESS THAN 600 FEET.*
W1-6( )	"ARROW" - THIS SIGN SHOULD BE MOUNTED JUST BELOW THE ROAD CLOSED SIGN AT THE POINT WHERE THE DIVERSION HAS BEEN ESTABLISHED DUE TO THE LANE CLOSURE.
W3-2	"YIELD AHEAD" - THIS SIGN IS INTENDED FOR USE AT THE APPROACH TO THE YIELD SIGN THAT IS NOT VISIBLE FOR A SUFFICIENT DISTANCE TO PERMIT THE DRIVER TO BRING HIS VEHICLE TO A STOP AT THE YIELD SIGN.*
W3-4	"BE PREPARED TO STOP" - THIS SIGN TO BE PLACED 1.5 MILES IN ADVANCED OF A FLAGGER.
W4-2(X)	"LEFT (RIGHT) LANE TRANSITION SYMBOL" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE REDUCTION IN THE NUMBER OF TRAFFIC LANES IN THE DIRECTION OF TRAVEL ON THE MULTILANE HIGHWAY.*
W4-50	"USE BOTH LANES DURING CONGESTION" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE "ROAD WORK X MILE" ADVANCED WARNING SIGN.
W4-51	"USE BOTH LANES TO MERGE POINT" - THIS SIGN IS INTENDED TO DIRECT MOTORISTS TO USE BOTH TRAVEL LANES UNTIL THE LANES ARE REDUCED TO ONE LANE.
W4-52	"TAKE TURNS MERGE HERE" - THIS SIGN IS INTENDED TO WARN MOTORISTS IN ADVANCED TO MOVE FROM THE CLOSED TRAVEL LANE TO THE OPEN TRAVEL LANE, USUALLY 500 FEET IN ADVANCED OF THE START OF THE TRANSITION TAPER .
W5-1	"ROAD NARROWS" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE TRANSITION ON THE ROAD WHERE THE PAVEMENT WIDTH IS REDUCED ABRUPTLY TO A WIDTH SUCH THAT TWO CARS CANNOT PASS WITHOUT REDUCING SPEED.*
W5-2a	"NARROW BRIDGE SYMBOL" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A BRIDGE OR CULVERT HAVING A CLEAR TWO-WAY ROADWAY WIDTH OF 16 TO 18 FEET OR ANY BRIDGE OR CULVERT HAVING A ROADWAY CLEARANCE LESS THAN THE WIDTH OF THE APPROACH PAVEMENT.*
W5-3	"ONE LANE/BRIDGE" - THIS SIGN SHOULD BE PLACED ON TWO-WAY ROADWAYS IN ADVANCE OF THE BRIDGES OR CULVERTS WHERE THE ROADWAY WIDTH IS LESS THAN 16 FEET (18 FEET FOR COMMERCIAL VEHICLES) OR WHEN THE ALIGNMENT IS POOR ON THE APPROACH TO THE STRUCTURE HAVING A CLEAR ROADWAY WIDTH OF 18 FEET OR LESS.*
W6-1	"DIVIDED HIGHWAY SYMBOL" - THIS SIGN SHOULD BE PLACED ON THE APPROACHES TO THE SECTION OF HIGHWAY WHERE OPPOSING FLOWS OF TRAFFIC ARE SEPARATED BY A PHYSICAL MEDIAN.
W6-2	"DIVIDED HIGHWAY ENDS SYMBOL" - THIS SIGN SHOULD BE PLACED AT THE END OF THE SECTION OF PHYSICALLY DIVIDED HIGHWAY AS A WARNING OF TWO-WAY TRAFFIC AHEAD.
W6-3	"TWO-WAY TRAFFIC SYMBOL" - THIS SIGN IS INTENDED FOR USE TO GIVE WARNING OF TRANSITION FROM A SEPARATED ONE-WAY ROADWAY TO A TWO-WAY ROADWAY.*
W7-1	"HILL SYMBOL" - THIS SIGN SHOULD BE PLACED AT A POINT IN ADVANCE OF THE DOWNGRADE WHERE THE LENGTH, PERCENT OF GRADE, HORIZONTAL CURVATURE, OR OTHER PHYSICAL FEATURES REQUIRE SPECIAL CONSIDERATION ON THE PART OF DRIVERS.*
W8-1,W8-2	"BUMP"/"DIP" - THESE SIGNS ARE INTENDED FOR USE TO GIVE WARNING OF A SHARP RISE OR DEPRESSION IN THE PROFILE OF THE ROAD THAT IS SUFFICIENTLY ABRUPT TO AFFECT VEHICLE OPERATION OR CAUSE CONSIDERABLE DISCOMFORT TO PASSENGERS.*
W8-3a	"PAVEMENT ENDS SYMBOL" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A POINT WHERE THE PAVEMENT SURFACE CHANGES FROM A HARD-SURFACED PAVEMENT TO THE LOW-TYPE SURFACE OR EARTH ROAD.*
W8-4	"SOFT SHOULDER" - THIS SIGN IS INTENDED FOR USE TO WARN OF A SOFT SHOULDER CONDITION THAT COULD PRESENT A PROBLEM TO VEHICLES THAT MAY GET OFF THE PAVEMENT.*
W8-5	"SLIPPERY WHEN WET SYMBOL" - THIS SIGN SHOULD BE PLACED IN ADVANCE OF THE CONDITION WHERE THE HIGHWAY SURFACE IS SLIPPERY BEYOND WHAT IS ORDINARY WHEN WET.*
W8-9a	"SHOULDER DROP-OFF" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A SHOULDER DROP-OFF THAT EXCEEDS THREE INCHES IN HEIGHT.*
W8-11	"UNEVEN LANES" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF AN UNEVEN ADJACENT LANE SITUATION THAT EXCEEDS ONE INCH IN HEIGHT.*
W9-1( )	"LEFT (RIGHT) LANE ENDS" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE PAVEMENT WIDTH TRANSITION SIGN (W4-2).
W9-2( )	"LANE ENDS/MERGE LEFT (RIGHT)" - THIS SIGN IS INTENDED FOR USE AS A SUPPLEMENT TO THE PAVEMENT WIDTH TRANSITION SIGN (W4-2).
W9-3 OR W9-3a( )	"CENTER LANE CLOSED AHEAD" - THIS SIGN SHOULD BE USED IN ADVANCE OF THE POINT WHERE WORK OCCUPIES THE CENTER LANE AND TRAFFIC IS DIRECTED TO THE RIGHT OR LEFT OF THE WORK ZONE.*
W12-1	"DOUBLE ARROW SYMBOL" - THIS SIGN SHOULD BE PLACED AT THE POINT OF THE OBSTRUCTION IN THE ROADWAY, WHERE TRAFFIC IS PERMITTED TO PASS ON EITHER SIDE OF THE OBSTRUCTION.
W12-2	"LOW CLEARANCE SYMBOL" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF AN OBSTRUCTION TO WARN VEHICLE OPERATORS OF CLEARANCES LESS THAN THE MAXIMUM VEHICLE HEIGHT PERMITTED PLUS 12 INCHES.*
W13-1P( )	"ADVISORY SPEED PLAQUE" - THIS PLAQUE IS INTENDED TO SUPPLEMENT WARNING SIGNS ONLY AND SHALL NOT BE MOUNTED ALONE. IT IS USED TO INDICATE THE MAXIMUM RECOMMENDED SPEED FOR THE INDICATED CONDITION.
W13-3	"ADVISORY RAMP SPEED" - THIS SIGN IS TO BE POSTED TO INFORM MOTORISTS WHAT THE SUGGESTED SPEED LIMIT IS ON A RAMP.
W20-1	"ROAD/WORK/AHEAD" - THIS SIGN IS TO BE LOCATED IN ADVANCE OF THE INITIAL ACTIVITY OR DETOUR A DRIVER MAY ENCOUNTER, AND IS INTENDED TO BE USED AS A WARNING OF OBSTRUCTIONS OR RESTRICTIONS.
W20-2	"DETOUR/(DIST.)" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE POINT AT WHICH TRAFFIC IS DIVERTED OVER A TEMPORARY ROADWAY OR ROUTE.
W20-3	"ROAD/CLOSED/(DIST.)" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A POINT AT WHICH A ROADWAY IS CLOSED TO ALL TRAFFIC OR TO ALL BUT LOCAL TRAFFIC.
W20-4	"ONE LANE/ROAD/(DIST.)" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A POINT WHERE TRAFFIC IN BOTH DIRECTIONS MUST USE A SINGLE LANE.
W20-5( )	"XXX LANE/CLOSED/(DIST.)" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A POINT WHERE ONE LANE OF A MULTIPLE-LANE ROADWAY IS CLOSED. IT SHOULD BE PROVIDED WITH INTERCHANGEABLE PLAQUES READING "RIGHT", "LEFT", AND "CENTER" AT NO ADDITIONAL COST TO THE PROJECT.
W20-7a	"FLAGGER SYMBOL" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF ANY POINT AT WHICH A FLAGGER HAS BEEN STATIONED TO CONTROL TRAFFIC THROUGH OR AROUND THE PROJECT.*
W20-52	"GROOVED/PAVEMENT/AHEAD" - THIS SIGN IS INTENDED TO BE USED IN ADVANCE OF A ROADWAY THAT HAS BEEN GROOVED AND/OR ROTO MILLED.
W21-1a	"WORKER SYMBOL" - THIS SIGN IS INTENDED FOR USE IN CONJUNCTION WITH MINOR MAINTENANCE AND PUBLIC UTILITY OPERATIONS FOR THE PROTECTION OF MEN WORKING IN OR NEAR THE ROADWAY.
W21-2	"FRESH/OIL" - THIS SIGN IS INTENDED FOR USE WHERE RE-SURFACING OPERATIONS HAVE RENDERED THE SURFACE OF THE PAVEMENT TEMPORARILY WET, AND OBJECTIONABLE SPLASHING ON VEHICLES MAY OCCUR.*
W21-3	"ROAD/MACHINERY/AHEAD" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE AREAS WHERE HEAVY EQUIPMENT IS OPERATING IN OR ADJACENT TO THE ROADWAY.*
W21-4	"ROAD/WORK/(DIST.)" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF MAINTENANCE FOR MINOR RECONSTRUCTION OPERATIONS IN THE ROADWAY.
W21-5	"SHOULDER/WORK" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF THE PROJECT INVOLVING THE SHOULDER, WHERE THE TRAVELED WAY REMAINS UNOBSTRUCTED.
W21-6	"SURVEY/CREW" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF A POINT WHERE A SURVEYING CREW IS WORKING IN OR ADJACENT TO THE ROADWAY.*
W22-1	"BLASTING/ZONE/(DIST.)" - THIS SIGN IS INTENDED FOR USE IN ADVANCE OF ANY POINT OR WORK SITE WHERE THERE ARE EXPLOSIVES BEING USED. THE W22-2 AND W22-3 SIGNS MUST BE USED IN SEQUENCE WITH THIS SIGN.
W22-2	"TURN OFF/2-WAY RADIOS/AND/CELLULAR/PHONES" - THIS SIGN IS TO BE USED IN SEQUENCE WITH THE W22-1 AND W22-3 SIGNS AND PLACED AT LEAST 1000 FEET FROM THE BEGINNING OF THE BLASTING ZONE.
W22-3	"END/BLASTING/ZONE" - THIS SIGN IS TO BE USED TO DENOTE THE END OF THE RADIO INFLUENCE AREA AND SHALL BE PLACED A MINIMUM OF 1000 FEET FROM THE BLASTING ZONE, EITHER WITH OR PRECEDING THE END CONSTRUCTION SIGN.
W22-50(X)	"ROCK SCALING X MILE(S)" - THIS SIGN IS INTENDED TO BE USED IN ADVANCE OF A FLAGGER IN ADVANCED OF THE WORK ZONE AREA.

ADVANCE PLACEMENT OF WARNING SIGNS

POSTED OR 85TH PERCENTILE SPEED	+ CONDITION A	++ CONDITION B: DECLARATION TO THE LISTED ADVISORY SPEED (MPH) FOR THE CONDITION							
		MPH							
		0	10	20	30	40	50	60	70
20	225	●	●	–	–	–	–	–	–
25	325	●	●	●	–	–	–	–	–
30	450	●	●	●	–	–	–	–	–
35	550	●	●	●	●	–	–	–	–
40	650	125	●	●	●	–	–	–	–
45	750	175	125	●	●	●	–	–	–
50	850	250	200	150	100	●	–	–	–
55	950	325	275	225	175	100	●	–	–
60	1100	400	350	300	250	175	●	–	–
65	1200	475	425	400	350	275	175	●	–
70	1250	550	525	500	425	350	250	150	–
75	1350	650	625	600	525	450	350	250	100

+ CONDITION A: SPEED REDUCTION AND LANE CHANGING IN HEAVY TRAFFIC. TYPICAL SIGNS ARE "MERGE" AND "RIGHT LANE ENDS".

++ CONDITION B: TYPICAL CONDITIONS ARE THE WARNING OF A POTENTIAL STOP SITUATION AND LOCATIONS WHERE THE ROAD USER MUST DECREASE SPEED TO MANEUVER THROUGH THE WARNED CONDITION. TYPICAL SIGNS ARE "STOP AHEAD", "SIGNAL AHEAD", "YIELD AHEAD", "CURVE", "REVERSE CURVE", "TURN".

● NO SUGGESTED DISTANCES ARE PROVIDED AT THESE SPEEDS, AS THE PLACEMENT IS DEPENDENT ON SITE CONDITIONS AND OTHER SIGNING.

A SUPPLEMENTAL PLAQUE MAY BE USED WITH WARNING SIGNS SPECIFYING THE DISTANCE TO THE CONDITION IF THERE IS AN IN-BETWEEN INTERSECTION THAT MIGHT CONFUSE THE MOTORIST.

* PLACEMENT SHOULD BE IN ACCORDANCE WITH WARNING SIGN PLACEMENT TABLE.

Computer File Information		Sheet Revisions	
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Last Modification Date: 07/04/12	Initials: (R-X)		
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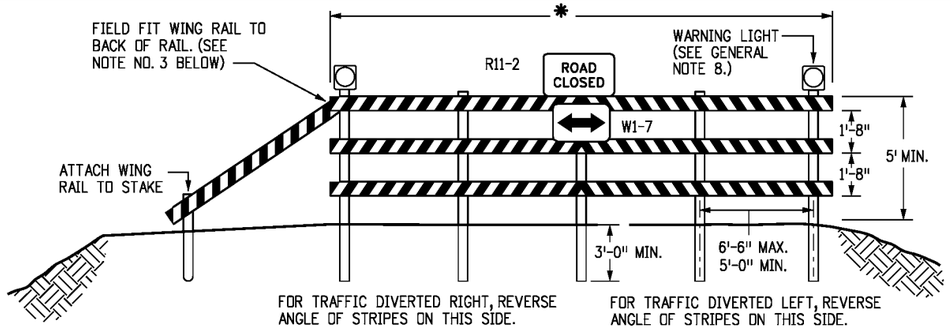
TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION

Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-630-1
Sheet No. 20 of 20



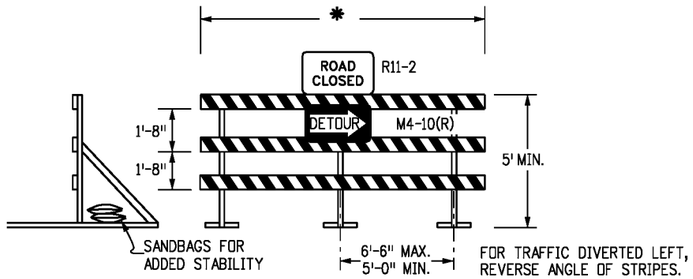
FIXED

* RAIL LENGTH TABLE

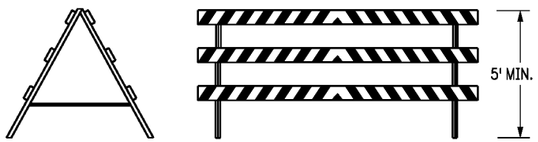
TYPE 3 BARRICADE		LENGTH
FIXED	MOVABLE	
F - A	M - A	8'- 14'
F - B	M - B	15'- 24'
F - C	M - C	25'- 35'
F - D	M - D	> 35'

NOTES

1. TYPE 3 BARRICADES HAVE 3 REFLECTORIZED RAIL FACES IF FACING TRAFFIC IN ONE DIRECTION AND 6 IF FACING TRAFFIC IN TWO DIRECTIONS.
2. THE PORTION OF THE POST ABOVE THE GROUND LINE SHALL BE PAINTED IN ACCORDANCE WITH THE APPROPRIATE GENERAL NOTE.
3. DETACHABLE EXTENSION WING RAILS FOR BYPASSING OF CONSTRUCTION EQUIPMENT ARE PERMITTED, WHEN NECESSARY, ON FIXED OR MOVABLE TYPE 3 BARRICADES. THE LENGTH SHALL BE ADEQUATE TO CLOSE THE BORROW PIT AND/OR SHOULDER AS REQUIRED.



MOVABLE-SKIDS

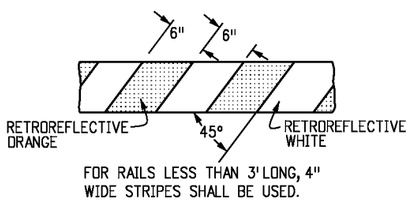


MOVABLE-HINGED

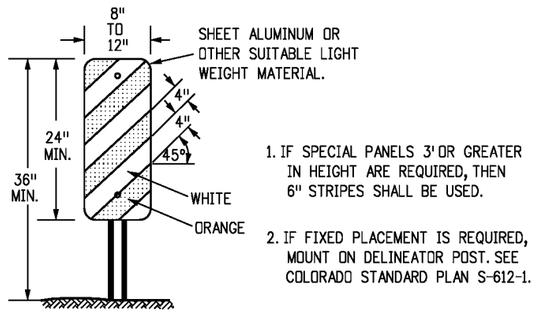
TYPICAL TYPE 3 BARRICADES

TYPICAL BARRICADE CHARACTERISTICS

	BARRICADE DESIGNATIONS
	TYPE 3
RAIL WIDTH	8" MIN.-12" MAX.
RAIL LENGTH	AS REQUIRED, SEE RAIL LENGTH TABLE
HEIGHT	5' MIN.
USE	TEMPORARY OR PERMANENT
STRIPES	SEE DETAIL OF BARRICADE STRIPING AND APPROPRIATE GENERAL NOTES.

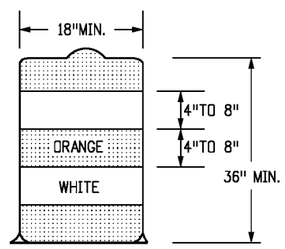


RAIL STRIPING DETAIL



1. IF SPECIAL PANELS 3' OR GREATER IN HEIGHT ARE REQUIRED, THEN 6" STRIPES SHALL BE USED.
2. IF FIXED PLACEMENT IS REQUIRED, MOUNT ON DELINEATOR POST. SEE COLORADO STANDARD PLAN S-612-1.

TYPICAL VERTICAL PANEL



1. THE 18" MINIMUM DIMENSION SHALL APPLY TO THE SMALLEST MEASUREMENT OF OBLONG, RECTANGULAR, OR FLATTENED SIDE DRUMS.
2. THERE SHALL BE AT LEAST TWO ORANGE AND TWO WHITE HORIZONTAL, CIRCUMFERENTIAL, RETROREFLECTIVE STRIPES ON EACH DRUM.

TYPICAL DRUM

GENERAL NOTES

1. THE VARIOUS TYPES, COMBINATIONS AND APPLICATIONS OF SIGNS AND WARNING LIGHTS FOR BARRICADES REQUIRED FOR EACH PROJECT SHALL BE:
   A. AS SPECIFIED OR DETAILED IN THE PLANS.
   B. AS SHOWN IN APPLICABLE TYPICAL ILLUSTRATIONS.
   C. AS CALLED FOR AND SUBJECT TO APPROVAL BY THE ENGINEER.
2. TEMPORARY AND PERMANENT BARRICADES TYPE 3 SHALL BE FABRICATED FROM APPROVED CRASH TESTED MATERIALS. SEE SECTION 614 AND 630 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION FOR ADDITIONAL REQUIREMENTS.
3. ALL PAINTING SHALL CONFORM WITH THE FOLLOWING:
   A. THE APPLICABLE SECTION OF 508 OF THE STANDARD SPECIFICATIONS.
   B. ALL SKIDS, BRACES AND POSTS SHALL BE PAINTED WITH 2 COATS OF EXTERIOR WHITE PAINT
   C. THE BACKSIDES OF RAILS AND VERTICAL PANEL CHANNELIZING DEVICES FACING ONE DIRECTION OF TRAFFIC ONLY SHALL BE PAINTED WITH "EXTERIOR WHITE PAINT.
   D. ALUMINUM OR GALVANIZED STEEL SKIDS, BRACES AND POSTS SHALL NOT BE PAINTED.
4. ALL STRIPED SURFACES SHALL CONFORM WITH THE FOLLOWING:
   A. THE ENTIRE AREA OF ORANGE AND WHITE STRIPES SHALL BE FABRICATED AS ONE PIECE.
   B. HORIZONTAL RAILS, WING RAILS AND VERTICAL PANEL CHANNELIZING DEVICES SHALL HAVE ORANGE AND WHITE STRIPES ON THE FACE SIDE(S) SLANTING DOWNWARD AT A 45° ANGLE TOWARD THE SIDE(S) TO WHICH TRAFFIC IS TO PASS OR TURN.
   C. PERMANENT BARRICADES SHALL HAVE RETROREFLECTIVE RED AND WHITE STRIPES. THEY MAY BE USED AT LOCATIONS TO MARK THE END OF A ROAD, STREET OR HIGHWAY WHERE THERE IS NO CROSSROAD OR OUTLET. THEY SHALL NOT BE USED AT A "T" INTERSECTION.
   D. ALL RETROREFLECTIVE SHEETING SHALL CONFORM TO ASTM D4956:
      1. ORANGE AND WHITE SHALL BE TYPE II, III OR IV.
      2. RED AND WHITE SHALL BE TYPE II, III OR IV.
5. FOR ALL WOODEN BARRICADE COMPONENTS NOMINAL LUMBER DIMENSIONS ARE SATISFACTORY.
6. ALL SCREWS, BOLTS, NUTS AND WASHERS SHALL BE GALVANIZED OR CADMIUM PLATED.
7. STABILITY OF BARRICADES AND CHANNELIZING DEVICES SHALL CONFORM WITH THE FOLLOWING:
   A. SKIDS (BASES) OF MOVABLE BARRICADES SHALL BE WEIGHTED WITH SANDBAGS ONLY WHERE NECESSARY TO PROVIDE STABILITY
   B. NO MOVABLE OR PORTABLE DEVICE SHALL BE WEIGHTED BY ANY METHOD OR WITH ANY MATERIAL THAT WOULD MAKE THEM HAZARDOUS TO MOTORISTS.
8. WARNING LIGHTS USED WITH BARRICADES, DRUMS AND VERTICAL PANELS SHALL CONFORM WITH THE FOLLOWING:
   A. USE FLASHING WARNING LIGHTS WHEN DEVICES ARE USED SINGLY, AND STEADY BURN LIGHTS WHEN THEY ARE USED IN A SERIES FOR CHANNELIZATION.
   B. THEY SHALL BE POSITIONED ABOVE THE TOP RAIL OF BARRICADES OR ON TOP OF DRUMS AND VERTICAL PANELS.
9. CONCRETE BARRIER (TEMPORARY) SHALL CONFORM WITH:
   A. PRECAST CONCRETE BARRIER AS SHOWN ON COLORADO STANDARD PLAN M-606-14.
   B. BARRIER REFLECTORS SHALL BE INSTALLED THAT MEET THE REQUIREMENTS OF STANDARD TYPICAL DELINEATOR INSTALLATIONS, EXCEPT THE MAXIMUM SPACING SHALL BE 50', AND THEY WILL NOT BE PAID FOR BUT ARE INCLUDED IN THE COST OF THE BARRIER.
   C. CONCRETE BARRIER END TREATMENT SHALL BE IN ACCORDANCE WITH CLEAR ZONE CRITERIA, AND PLACED AS SHOWN ON THE PLANS.
10. SIGN PANELS MOUNTED ON BARRICADES WILL BE PAID FOR SEPARATELY.

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Creation Date: 07/04/12 Initials: JSW		Date:	Comments
Last Modification Date: 07/04/12 Initials:	R-X		
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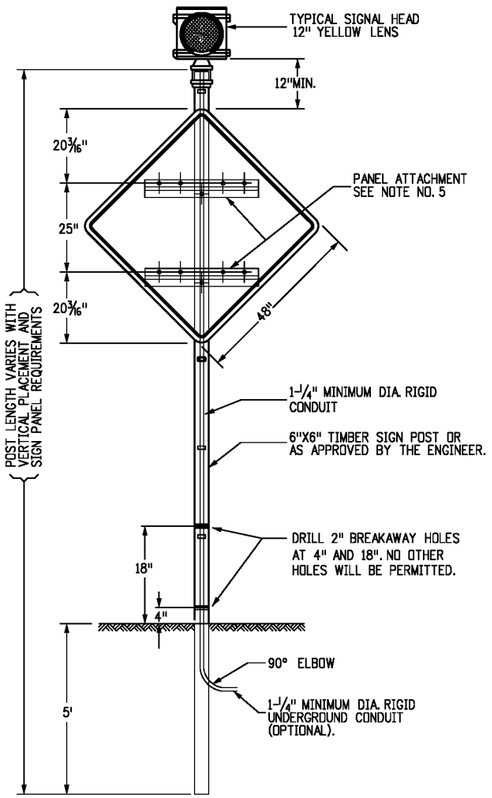
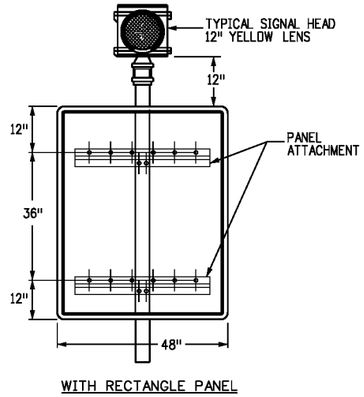
BARRICADES, DRUMS, CONCRETE BARRIERS (TEMP) & VERTICAL PANELS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

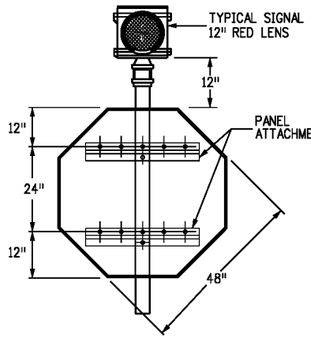
STANDARD PLAN NO.
S-630-2
Sheet No. 1 of 1



COMPLETE INSTALLATION WITH DIAMOND PANEL

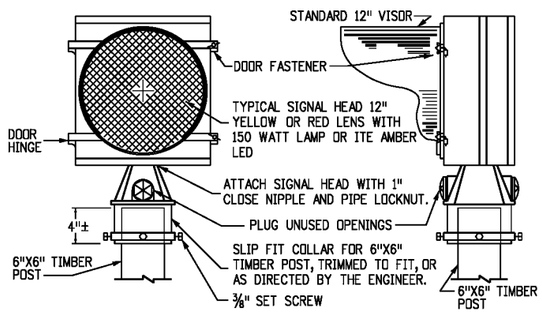


WITH RECTANGLE PANEL

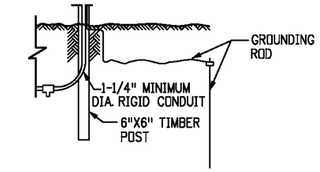


WITH OCTAGON PANEL

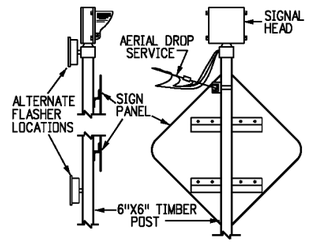
TYPICAL ELEVATION FACING TRAFFIC



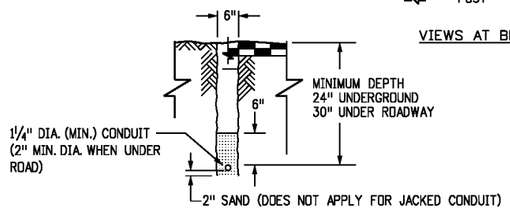
TYPICAL SIGNAL HEAD - 12" LENS



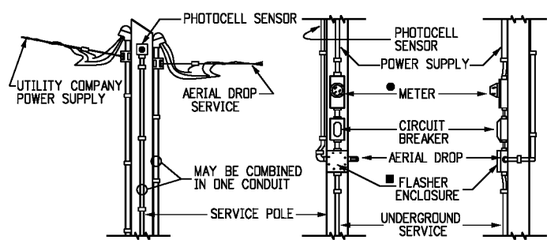
UNDERGROUND VIEW AT BEACON



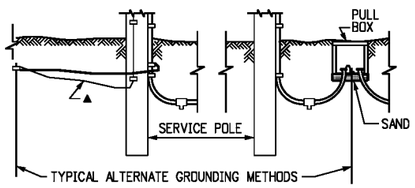
VIEWS AT BEACON



TRENCHING DETAIL



VIEW AT POWER SOURCE VIEWS AT ENCLOSURES



UNDERGROUND VIEWS AT POWER SOURCE

NOTES

LOCATION AND CONFIGURATION OF ELECTRICAL EQUIPMENT IS DIAGRAMMATIC ONLY (USE ANY METHOD COMPLYING WITH THE GENERAL NOTES).

▲ EXISTING GROUND AT SERVICE POLE; OTHERWISE PULL THRU CONDUIT OR ATTACH TO CONDUIT AND TAP OFF UNDERGROUND.

● PROVIDE WEEP HOLE WITH AERIAL DROP SERVICE.

■ OPTIONAL (PER UTILITY COMPANY REQUIREMENTS)

TYPICAL ELECTRICAL SERVICE DETAILS

GENERAL NOTES

1. ALL ELECTRICAL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST REQUIREMENTS OF THE NEX, NEMA, UL OR EIA WHEREVER APPLICABLE, ANY STATE AND LOCAL CODES OR ORDINANCES WHICH MAY APPLY, AND THE FOLLOWING:

   (A) IT IS THE CONTRACTOR'S RESPONSIBILITY TO OBTAIN A POWER SOURCE.

   (B) THE CONTRACTOR IS TO PROVIDE ALL NECESSARY WIRING WITHIN THE BEACON AND FROM THERE TO THE POWER SOURCE. THE UTILITY COMPANY WILL MAKE THE CONNECTION WITH THE CONTRACTOR'S WIRING.

   (C) THE ELECTRICAL SERVICE BETWEEN A REMOTE POWER SOURCE AND THE FLASHING BEACON SHALL BE UNDERGROUND OR AERIAL DROPPED AS AUTHORIZED BY THE ENGINEER.

   (D) IF POWER IS SUPPLIED BY SOLAR PANELS, THE SOLAR PANELS AND POWER BOX SHOULD BE MOUNTED ON A SEPARATE POST BEYOND THE CLEAR ZONE OR BEHIND GUARD RAIL OR BARRIER. WHERE THIS IS NOT POSSIBLE THE PANELS MUST BE A MINIMUM HEIGHT OF 7 FT. FROM THE BASE OF THE POST AND SHALL FACE AWAY FROM TRAFFIC. POWER BOXES SHALL BE BURIED SO THAT NO MORE THAN 4 IN. OF THE BOX IS ABOVE GROUND.

   (E) THE "FLASHER" SHALL BE HOUSED IN A SUITABLE ENCLOSURE ON THE UTILITY POLE AT THE POWER SOURCE UNLESS THE ENGINEER DIRECTS THAT THE ENCLOSURE BE MOUNTED ON THE BEACON POST OR THAT THE DEVICE MAY BE CONTAINED WITHIN THE SIGNAL HEAD ITSELF.

   (F) A SUITABLE ENCLOSURE FOR THE FLASHER SHALL BE PROVIDED. A RAIN TIGHT JUNCTION BOX OR CAN, WITH A SURFACE MOUNT MEASURING APPROXIMATELY 8 IN.X 8 IN. X 4 IN., WITH A FLANGED SCREW ATTACHED COVER, AND FABRICATED FROM NOT LESS THAN 16 GAGE GALVANIZED STEEL, SHALL BE PROVIDED.

   (G) A BUILT-IN RADIO INTERFERENCE SUPPRESSION DEVICE AND A PHOTOCELL SENSOR TYPE SIGNAL LAMP DIMMER SHALL BE PROVIDED FOR EACH FLASHING BEACON.

   (H) AN AUTOMATIC AND MANUAL MECHANISM FOR TURNING OFF THE FLASHER, APPROVED BY THE ENGINEER, SHALL BE PROVIDED. IF THE FIELD CONDITION DOES NOT WARRANT THE USE OF THE SIGN, THE FLASHING BEACON SHALL BE TURNED OFF AND THE SIGN SHALL BE COVERED WITH THE APPROPRIATE MATERIAL AS APPROVED BY THE ENGINEER OR THE SIGN SHALL BE TURNED SO IT IS NOT FACING TRAFFIC.

2. TIMBER POSTS SHALL BE IN ACCORDANCE WITH SECTION 614 OF THE STANDARD SPECIFICATIONS AS TO SIZE, ALTERNATE SIZE, GRADE, SPECIES, TREATMENT, AND BREAKAWAY HOLES.

3. FOR LATERAL AND VERTICAL PLACEMENT OF FLASHING BEACON (PORTABLE), SEE COLORADO STANDARD PLAN S-614-1.

4. SIGNS MOUNTED ON THE MEDIAN OF DIVIDED HIGHWAYS WHERE MEDIAN BARRIER IS IN PLACE SHALL NOT USE A MOUNTING THAT "STRADDLES" MULTIPLE BARRIERS. THEY MAY BE MOUNTED ON A SINGLE BARRIER WITH A "SADDLE" TYPE BRACKET. IF THE BRACKET ALLOWS THE SIGN PANEL TO BE TURNED PARALLEL TO THE ROADWAY, THE SIGN MAY REMAIN IN PLACE WHEN NOT APPLICABLE, BUT LAYING THE SIGN PANEL DOWN IN A HORIZONTAL POSITION IS NOT PERMITTED. ALL OTHER SIGNS THAT ARE NOT IN USE SHALL BE REMOVED FROM THE SHOULDER AND CLEAR ZONE, SOLAR PANELS SHALL NOT BE PLACED ON TOP OF BARRIER OR WITHIN A MEDIAN.

5. BACKING ZEE PANEL ATTACHMENT IS NOT REQUIRED. IF USED, SEE COLORADO STANDARD PLAN S-614-3.

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FLASHING BEACON (PORTABLE) DETAILS

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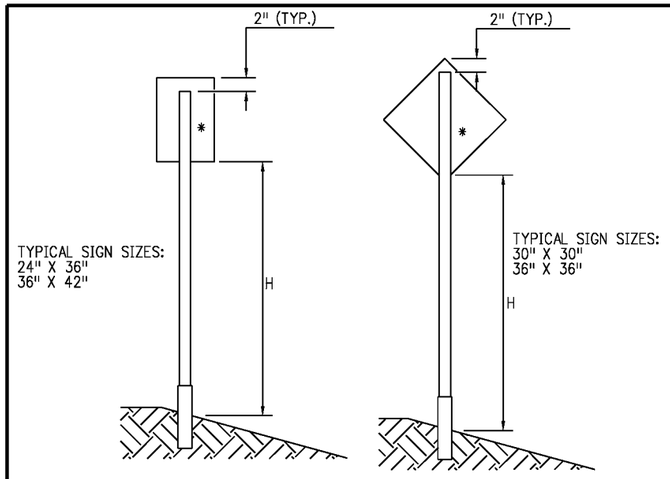


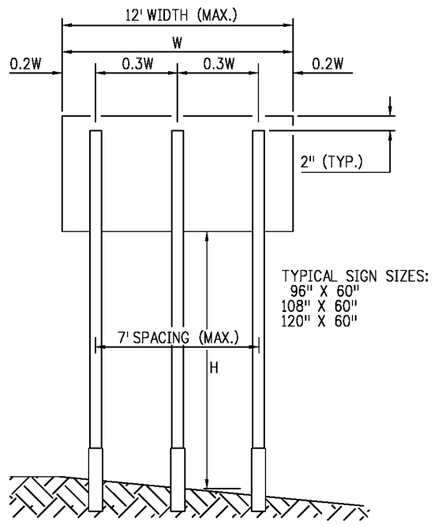
● **SIGN POST REQUIREMENTS**

POST TYPE	POST SIZE	MAX. CLEAR HEIGHT, H (FT.)	MAX. SIGN AREA (SF)
SQUARE TUBING	2.25" X 2.25" (12 GA.)	10	10.5
SQUARE TUBING	1.75" X 1.75" (12 GA.)	9	5
SQUARE TUBING	2.00" X 2.00" (12 GA.)	9	8
SQUARE TUBING	2.25" X 2.25" (12 GA.)	9	10.5
SQUARE TUBING	1.75" X 1.75" (12 GA.)	8	6
SQUARE TUBING	2.00" X 2.00" (12 GA.)	8	9
SQUARE TUBING	1.75" X 1.75" (12 GA.)	7	7
SQUARE TUBING	2.00" X 2.00" (12 GA.)	7	10

* SINGLE POST SHALL BE PLACE IN THE CENTER OF THE SIGN

SINGLE POST INSTALLATION

(TOTAL SIGN AREA NOT TO EXCEED 10.5 SF)



● **SIGN POST REQUIREMENTS**

POST TYPE	POST SIZE	MAX. CLEAR HEIGHT, H (FT.)	MAX. SIGN AREA (SF)
△U-CHANNEL	3 LB./FT.	11	36
△SQUARE TUBING	2.50" X 2.50" (10 GA.)	9	45
△SQUARE TUBING	2.50" X 2.50" (10 GA.)	7	50
⬡SQUARE TUBING	2.50" X 2.50" (10 GA.)	11	36
⬡SQUARE TUBING	2.50" X 2.50" (10 GA.)	9	45

TRIPLE POST INSTALLATION

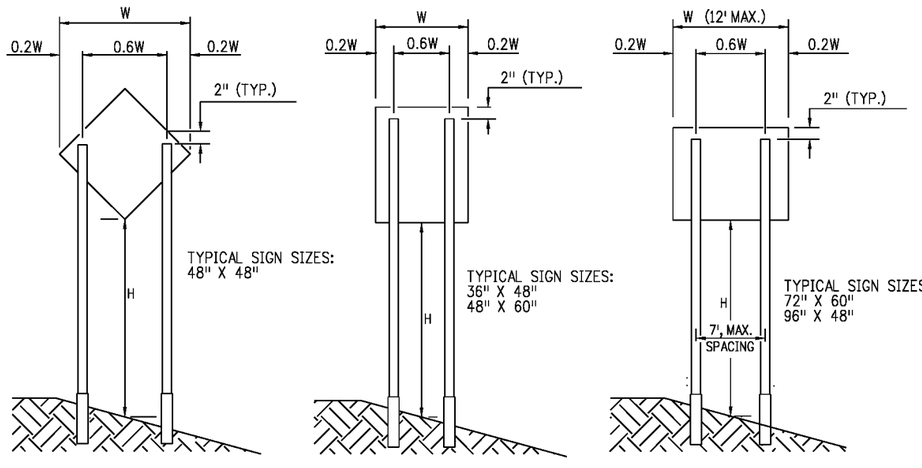
(TOTAL SIGN AREA NOT TO EXCEED 50 SF)

GENERAL NOTES

1. ALL SQUARE TUBING SIGN POST REQUIREMENTS ARE BASED ON A 10 OR 12-GAUGE THICKNESS, ASTM A570 GRADE 50 STEEL, A MINIMUM YIELD STRENGTH OF 60,000 PSI AND A 70 MPH WIND LOAD. ALL U-CHANNEL SIGN POSTS REQUIREMENTS ARE BASED ON A MINIMUM YIELD STRENGTH OF 80,000 PSI AND 85 MPH WIND LOAD.
2. STEEL POSTS, BASE POSTS, AND SLIP BASES FOR ALUMINUM PANEL SIGNS SHALL BE SELECTED FROM THE CDOT APPROVED PRODUCT LIST.
3. BASE POSTS SHALL NOT EXTEND MORE THAN 4" ABOVE GROUND LEVEL AND SHALL BE OF THE SAME WEIGHT/GAUGE AND TYPE AS THE SIGN POST.
4. INTERMIXING OF U-CHANNEL AND SQUARE TUBING POSTS, POSTS OF DIFFERENT WEIGHTS/GAUGES OR PRODUCT BRANDS IS PROHIBITED.
5. SUPPLEMENTAL SIGNS SHALL NOT BE ATTACHED DIRECTLY TO PRIMARY PANELS.
6. SPACING BETWEEN SUPPLEMENTAL PANELS AND PRIMARY PANELS SHALL NOT EXCEED 6".
7. SIGN PANELS PLACED PARALLEL TO TRAFFIC SHALL BE MOUNTED ON A MULTI-DIRECTIONAL BREAKAWAY SYSTEM. (SEE STANDARD PLAN S-630-4, SHEET 2)
8. AN APPROVED SLIP BASE IS REQUIRED WITH THE DOUBLE POST AND TRIPLE POST INSTALLATION. (SEE STANDARD PLAN S-630-4, SHEET 2).
9. SEE MANUFACTURER'S DRAWINGS FOR SPECIFIC ASSEMBLY INFORMATION (POST-TO-BASE POST OVERLAP), INCLUDING TYPES OF NUTS, BOLTS, WASHERS, AND OTHER PARTS REQUIRED FOR PRODUCT USE.
10. LAP-SPLICE OR MULTI-DIRECTIONAL SLIP BASE MAY BE USED. SEE STANDARD PLAN S-630-4, SHEET 2.

LEGEND

- ● SEE GENERAL NOTE 1.
- ▲ SEE GENERAL NOTE 4.
- △ SEE GENERAL NOTE 8.
- ● SEE GENERAL NOTE 9.
- ⬡ SEE GENERAL NOTE 10.

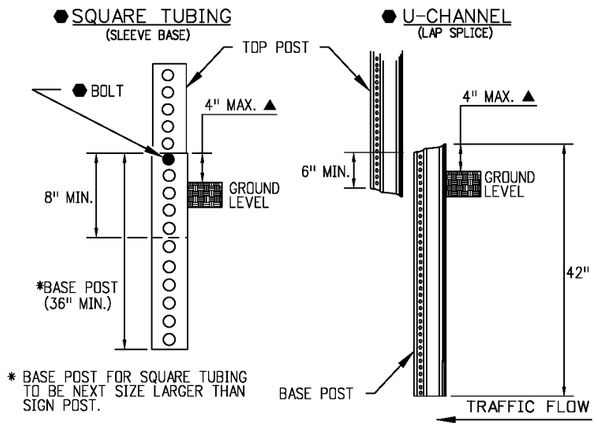


DOUBLE POST INSTALLATION

(TOTAL SIGN AREA NOT TO EXCEED 30 SF)

● **SIGN POST REQUIREMENTS**

POST TYPE	POST SIZE	MAX. CLEAR HEIGHT, H (FT.)	MAX. SIGN AREA (SF)
SQUARE TUBING	2.25" X 2.25" (12 GA.)	11	13
SQUARE TUBING	2.25" X 2.25" (12 GA.)	9	15
SQUARE TUBING	2.25" X 2.25" (12 GA.)	8	16
SQUARE TUBING	2.25" X 2.25" (12 GA.)	7	20
△U-CHANNEL	3 LB./FT.	11	25
△U-CHANNEL	3 LB./FT.	9	30
△SQUARE TUBING	2.50" X 2.50" (10 GA.)	7	36



BASE POST INSTALLATION DETAILS

FOR SQUARE TUBING AND U-CHANNEL SYSTEMS

(SEE STANDARD PLAN S-630-4, SHEET 2 FOR MULTI-DIRECTIONAL SLIP BASE SYSTEMS)

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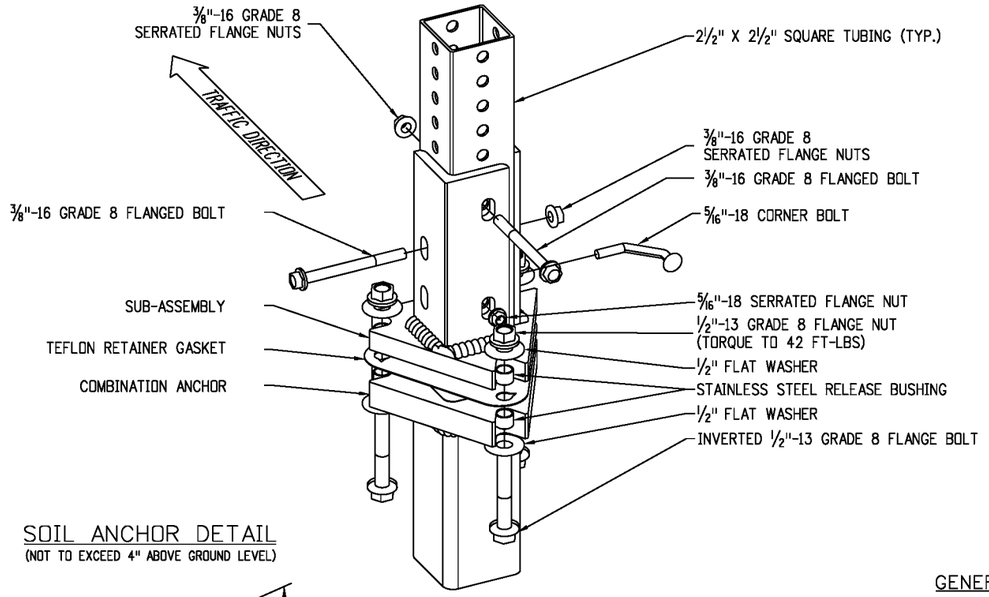
STEEL SIGN SUPPORT (TEMPORARY) INSTALLATION DETAILS

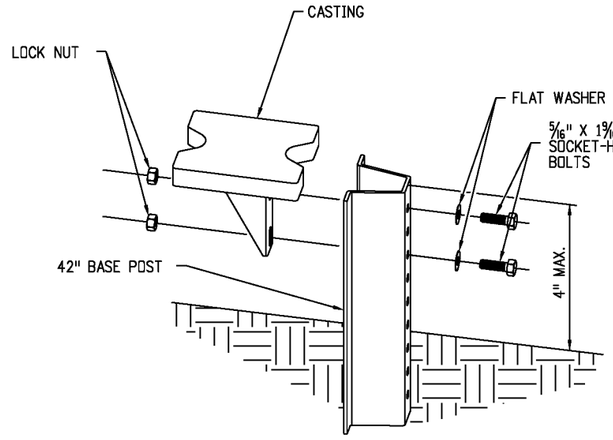
Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-630-4
Sheet No. 1 of 2

SQUARE TUBING SLIP BASE

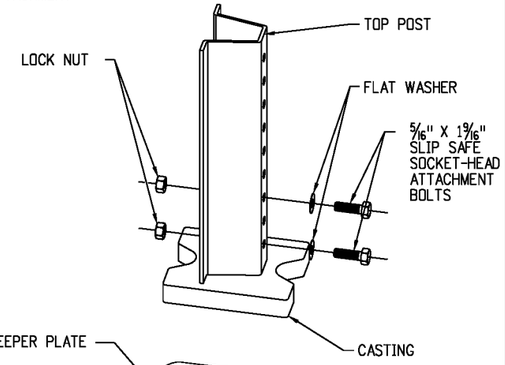


U-CHANNEL SLIP BASE



NOTE: BOLTS SHOULD BE TIGHTEN ½ TO ¾ TURN AFTER SNUG.

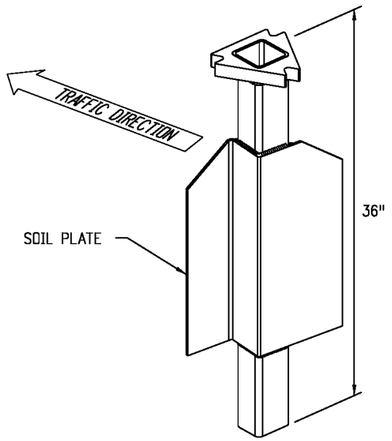
STEP 1

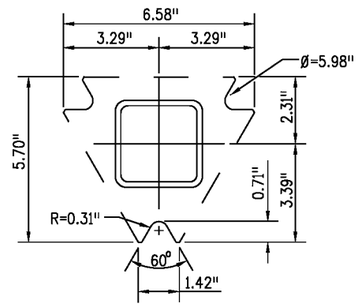


STEP 2

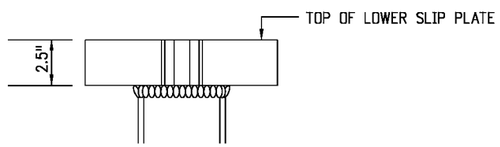
SOIL ANCHOR DETAIL

(NOT TO EXCEED 4" ABOVE GROUND LEVEL)





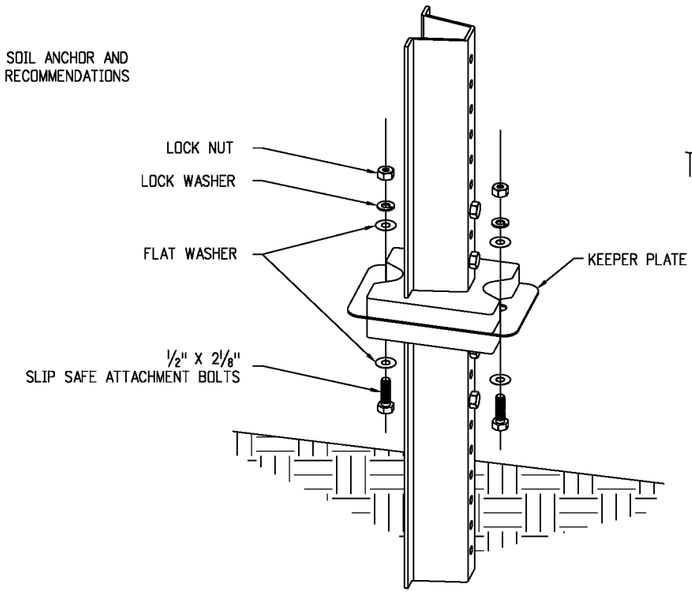
ANCHOR TOP VIEW



ANCHOR FRONT VIEW

GENERAL NOTE:

THE CONTRACTOR SHALL INSTALL THE SOIL ANCHOR AND SLIP BASE PER THE MANUFACTURER'S RECOMMENDATIONS WITHOUT ADDITIONAL COMPENSATION.



NOTE: TIGHTEN NUT ¼ TO ½TURN AFTER SNUG.

STEP 3

MULTI-DIRECTIONAL SLIP BASE POST DETAILS

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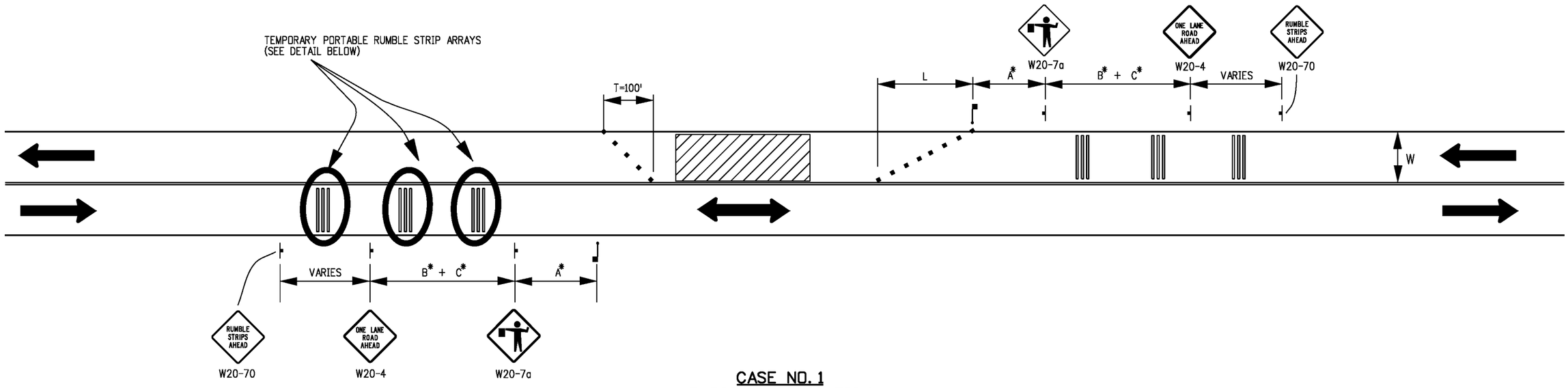
STEEL SIGN SUPPORT (TEMPORARY) INSTALLATION DETAILS

Issued By: Safety & Traffic Engineering Branch July 4, 2012

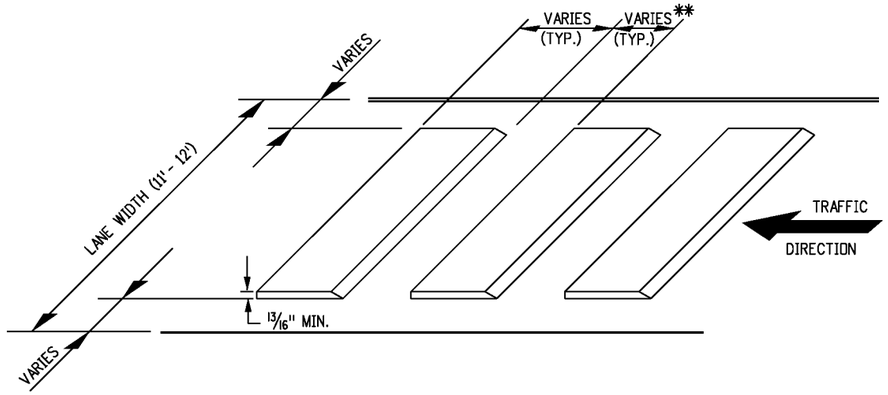
STANDARD PLAN NO.

S-630-4

Sheet No. 2 of 2



CASE NO. 1
TYPICAL APPLICATION
TWO-LANE UNDIVIDED HIGHWAY



DETAIL - TEMPORARY PORTABLE RUMBLE STRIP ARRAY

GENERAL NOTES

1. TEMPORARY PORTABLE RUMBLE STRIP ARRAYS SHALL BE PLACED IN ADVANCE OF EACH FLAGGING STATION WHEN CALLED FOR IN THE PLANS.
2. TEMPORARY PORTABLE RUMBLE STRIP ARRAYS ARE USED TO SUPPLEMENT A SERIES OF ADVANCED WARNING SIGNS AND SHALL BE INSTALLED AND REMOVED WHEN THE SIGNS ARE INSTALLED AND REMOVED.
3. REMOVE THE TEMPORARY PORTABLE RUMBLE STRIPS PRIOR TO REMOVING THE ADVANCED WARNING SIGNS.
4. LANE WIDTHS SHOULD BE MAINTAINED THROUGH WORK ZONE TRAVEL LANES WHEREVER PRACTICAL.
5. DO NOT USE TEMPORARY PORTABLE RUMBLE STRIPS ON SLIPPERY SURFACES, SUCH AS WET OR SANDY PAVEMENT.
6. DO NOT USE TEMPORARY PORTABLE RUMBLE STRIPS ON HORIZONTAL CURVES.
7. USE TEMPORARY PORTABLE RUMBLE STRIPS ON ROADWAYS WITH POSTED WORK ZONE SPEED LIMITS OF 60 MPH OR LESS.
8. FOR THE LOWEST AIR TEMPERATURE TO APPLY THE TEMPORARY PORTABLE RUMBLE STRIPS ON ROAD PAVEMENTS, CONTACT THE TEMPORARY PORTABLE RUMBLE STRIP MANUFACTURER
9. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.

LEGEND

- CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE THE SCHEDULE OF CONSTRUCTION TRAFFIC CONTROL DEVICES INCLUDED IN PLANS.
- DIRECTION OF TRAVEL
- FLAGGER
- WORK AREA

T = TERMINATION TAPER = 100'
S = WORK ZONE SPEED LIMIT
W = LANE WIDTH
L = MERGING TAPER (S > 45 MPH) = WxS
L = MERGING TAPER (S ≤ 45 MPH) = (WxS²)/60
N = NUMBER OF DEVICES (L/S) + 1
N = NUMBER OF DEVICES AT TERMINATION TAPER = 5 (MIN.)

*KEY TO ADVANCE SIGNING DISTANCES

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT.)		
	A	B	C
URBAN (S < 45 MPH)	100	100	100
URBAN (S ≥ 45 MPH)	350	350	350
RURAL	500	500	500

** FOR RUMBLE STRIP SPACING DISTANCE, USE MANUFACTURER'S RECOMMENDATIONS.

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PORTABLE RUMBLE STRIPS (TEMPORARY)

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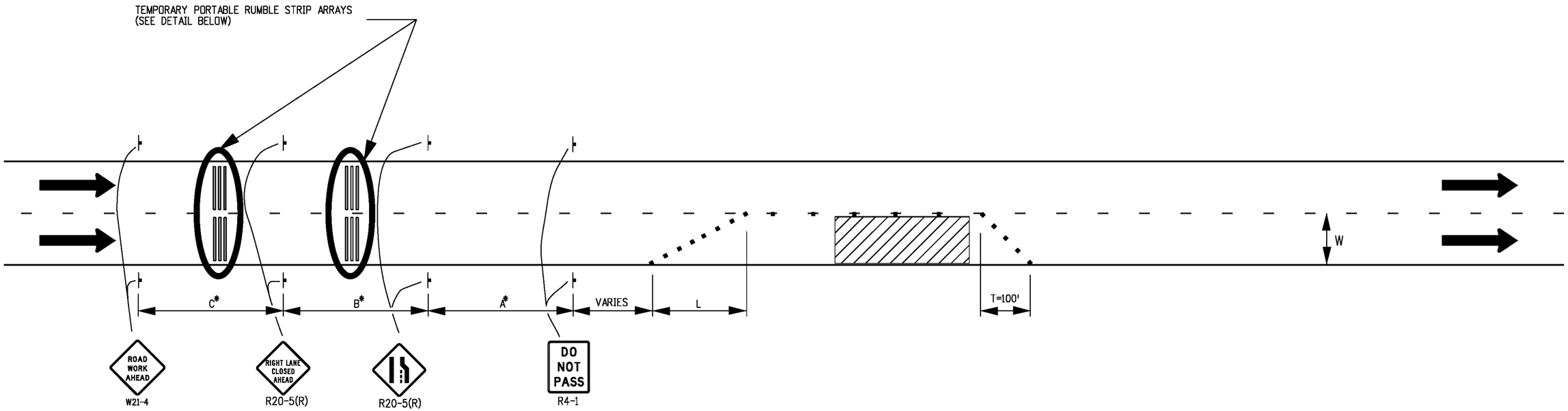
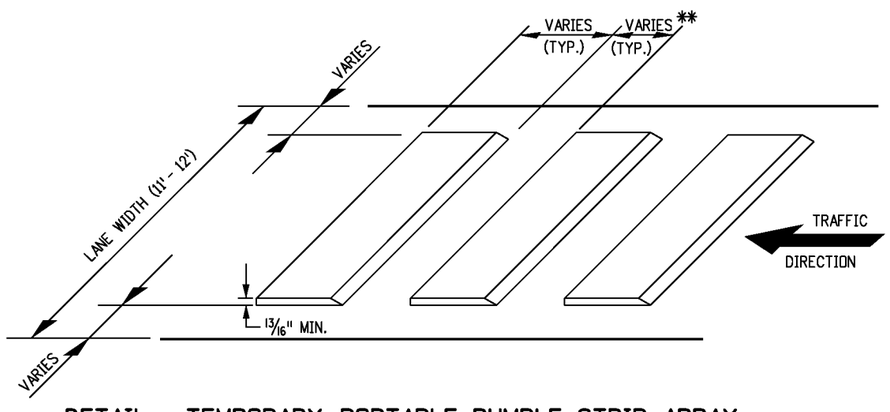
STANDARD PLAN NO.
S-630-5
Sheet No. 1 of 2



CASE NO. 2
TYPICAL APPLICATION
MULTI-LANE DIVIDED HIGHWAY WITH RIGHT LANE CLOSED



DETAIL - TEMPORARY PORTABLE RUMBLE STRIP ARRAY

GENERAL NOTES

1. TEMPORARY PORTABLE RUMBLE STRIP ARRAYS ARE USED TO SUPPLEMENT A SERIES OF ADVANCED WARNING SIGNS AND SHALL BE INSTALLED AND REMOVED WHEN THE SIGNS ARE INSTALLED AND REMOVED.
2. REMOVE THE TEMPORARY PORTABLE RUMBLE STRIPS PRIOR TO REMOVING THE ADVANCED WARNING SIGNS.
3. LANE WIDTHS SHOULD BE MAINTAINED THROUGH WORK ZONE TRAVEL LANES WHEREVER PRACTICAL.
4. DO NOT USE TEMPORARY PORTABLE RUMBLE STRIPS ON SLIPPERY SURFACES, SUCH AS WET OR SANDY PAVEMENT.
5. DO NOT USE TEMPORARY PORTABLE RUMBLE STRIPS ON HORIZONTAL CURVES.
6. USE TEMPORARY PORTABLE RUMBLE STRIPS ON ROADWAYS WITH POSTED WORK ZONE SPEED LIMITS OF 60 MPH OR LESS.
7. FOR THE LOWEST AIR TEMPERATURE TO APPLY THE TEMPORARY PORTABLE RUMBLE STRIPS ON ROAD PAVEMENTS, CONTACT THE TEMPORARY PORTABLE RUMBLE STRIP MANUFACTURER
8. INSTALL PER MANUFACTURER'S RECOMMENDATIONS.

LEGEND

- ■ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE THE SCHEDULE OF CONSTRUCTION TRAFFIC CONTROL DEVICES INCLUDED IN PLANS.
- → DIRECTION OF TRAVEL
- ▨ WORK AREA

T = TERMINATION TAPER = 100'
S = WORK ZONE SPEED LIMIT
W = LANE WIDTH
L = MERGING TAPER ($S \geq 45$ MPH) = WxS
L = MERGING TAPER ($S < 45$ MPH) = $(WxS^2)/60$
N = NUMBER OF DEVICES $(L/S) + 1$
N = NUMBER OF DEVICES AT TERMINATION TAPER = 5 (MIN.)

*KEY TO ADVANCE SIGNING DISTANCES

ROAD TYPE	DISTANCE BETWEEN SIGNS (FT.)		
	A	B	C
URBAN ($S < 45$ MPH)	100	100	100
URBAN ($S \geq 45$ MPH)	350	350	350
RURAL	500	500	500
EXPRESSWAY/FREEWAY	1,000	1,500	2,640

** FOR RUMBLE STRIP SPACING DISTANCE, USE MANUFACTURER'S RECOMMENDATIONS.

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PORTABLE RUMBLE STRIPS (TEMPORARY)

Issued By: Safety & Traffic Engineering Branch July 4, 2012

STANDARD PLAN NO.
S-630-5
Sheet No. 2 of 2

LEGEND

- IMPACT ATTENUATOR (TEMP)
- CONCRETE BARRIER (TEMP)
- CONCRETE BARRIER (TEMP) (OPTIONAL)
- ■ CHANNELIZING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS.
- TEMPORARY EMERGENCY PULL-OFF AREA
- WORK AREA
- THE ADDED EMBANKMENT SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 203 (IF APPLICABLE).

L_{PO} = TEMPORARY EMERGENCY PULL-OFF LENGTH
= 725' MINIMUM, 0.25 MILE DESIRABLE. AN ADDITIONAL 100 FEET SHOULD BE ADDED TO THE LENGTH OF THE TEMPORARY EMERGENCY PULL-OFF TO SERVE AS AN ACCIDENT INVESTIGATION AREA.

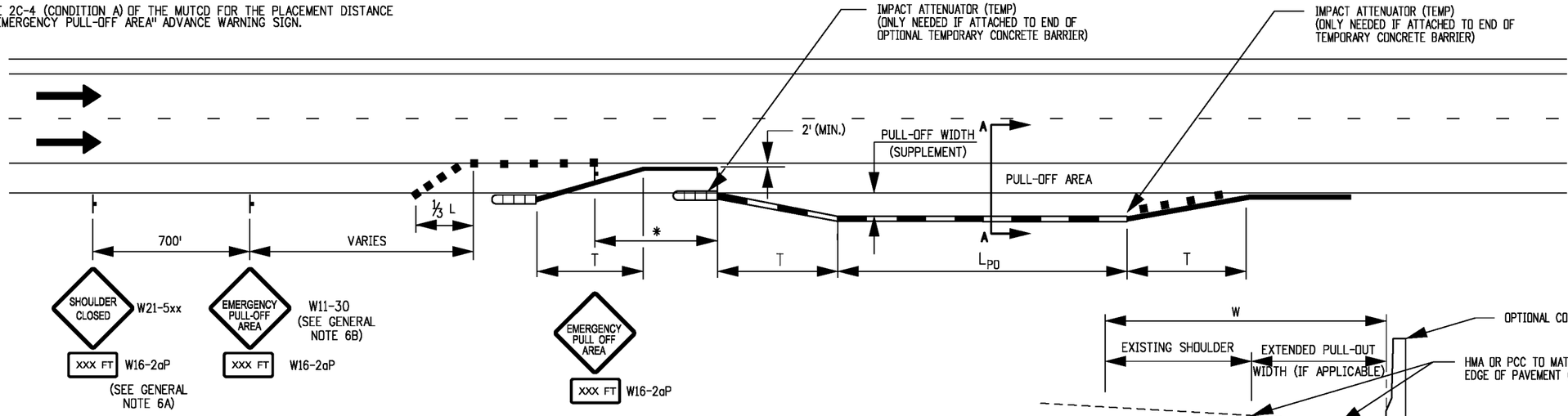
W = TEMPORARY EMERGENCY PULL-OFF WIDTH
= 12' MINIMUM
= 15' MAXIMUM

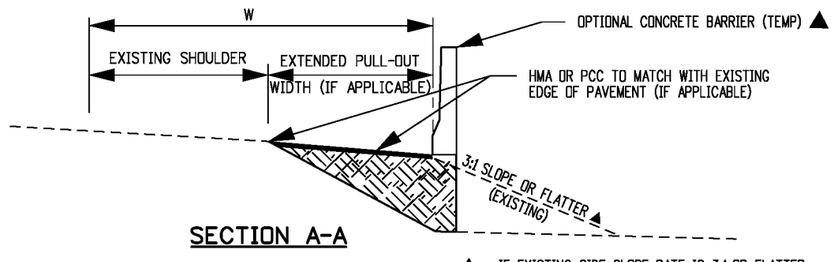
T = TAPER
= 11:1 MINIMUM
= 17:1 DESIRABLE

* SEE TABLE 2C-4 (CONDITION A) OF THE MUTCD FOR THE PLACEMENT DISTANCE OF THE "EMERGENCY PULL-OFF AREA" ADVANCE WARNING SIGN.

GENERAL NOTES

1. CONSIDER ADDING TEMPORARY EMERGENCY PULL-OFF AREA(S) WHEN ANY OF THE FOLLOWING CONDITIONS EXIST:
   - A. BOTH LEFT AND RIGHT SHOULDERS WILL BE CLOSED SIMULTANEOUSLY FOR A DISTANCE GREATER THAN 0.50 MILES.
   - B. PROJECTS HAVE BEEN IDENTIFIED AS "SIGNIFICANT PROJECTS" (SEE PAGE 1 OF THE CDOT WORK ZONE SAFETY AND MOBILITY RULE PROCEDURES DOCUMENT - JANUARY 2009).
   - C. ON DIVIDED HIGHWAYS WITH THREE OR MORE LANES IN EACH DIRECTION, THE LEFT OR RIGHT SHOULDER IS TO BE OPEN WHILE THE OPPOSITE SHOULDER IS TO BE CLOSED.
   - D. HIGH CRASH LOCATIONS HAVE BEEN IDENTIFIED WITHIN OR NEAR THE WORK ZONE LIMITS.
   - E. ALTERNATE PLACES OF REFUGE DO NOT EXIST NEARBY.
2. "SHOULDER CLOSED, AND EMERGENCY PULL-OFF AREA" SIGNS AND PLAQUES SHALL BE MOUNTED ON THE SIDE OF THE ROADWAY WHERE THE SHOULDER IS AFFECTED. USAGE OF THESE SIGNS ON THE OPPOSITE SIDE OF DIVIDED HIGHWAYS IS OPTIONAL. MOUNT ALL OTHER SIGNS ON BOTH SIDES OF THE WORK-AFECTED ROADWAY ON DIVIDED HIGHWAYS.
3. FOR WORK AREAS GREATER THAN 1 MILE IN LENGTH, MULTIPLE EMERGENCY PULL-OFF AREAS MAY BE USED AT A SPACING OF 0.50 MILE MINIMUM, AND 1 MILE MAXIMUM, OR WHERE APPROPRIATE, AS DESIGNATED BY THE ENGINEER.
4. EMERGENCY PULL-OFF AREAS SHOULD NOT BE LOCATED WHERE ADEQUATE SIGHT DISTANCES FOR ACCELERATION AND DECELERATION MANEUVERS WOULD NOT EXIST. THE LOCATION OF TEMPORARY TRAFFIC BARRIER AND CONSTRUCTION ACTIVITIES OCCURRING ON THE INSIDE OF HORIZONTAL CURVES JUST BEHIND THAT BARRIER SHOULD BE CONSIDERED WHEN DETERMINING WHETHER MOTORISTS WILL HAVE ADEQUATE SIGHT DISTANCE THROUGH A HORIZONTAL CURVE.
5. WHEN TEMPORARY EMERGENCY PULL-OFF AREAS ARE INTENDED TO SERVE AS AN ACCIDENT INVESTIGATION AREA, LAW ENFORCEMENT PERSONNEL SHOULD BE INVOLVED EARLY IN CREATING THE TRAFFIC CONTROL PLAN.
6. FOR SHOULDER CLOSURES GREATER THAN 0.50 MILES IN LENGTH, ADVANCED WARNING SIGNS SHOULD BE PLACED, AS FOLLOWS:
   - A. W7-3aP PLAQUE SHOULD BE ATTACHED TO THE FIRST "SHOULDER CLOSED" ADVANCED WARNING SIGN IN SEQUENCE.
   - B. THE SECOND "SHOULDER CLOSED" ADVANCED WARNING SIGN SHOULD BE REPLACED WITH EITHER:
     - A "NO EMERGENCY PULL-OFF AREA" IF NO PULL-OFF AREAS ARE PROVIDED THROUGHOUT THE WORK AREA, OR
     - A "EMERGENCY PULL-OFF AREA" ADVANCED WARNING SIGN WITH A W16-2aP PLAQUE IF EMERGENCY PULL-OFF AREAS ARE PROVIDED THROUGHOUT THE WORK AREA.
7. THE TEMPORARY CONCRETE BARRIER SHALL BE TIED TO AN EXISTING STRUCTURE OR GUARD RAIL, FLARED OR EXTENDED, TO MEET CLEAR ZONE REQUIREMENTS, OR FITTED WITH AN IMPACT ATTENUATOR DEVICE.





SECTION A-A

▲ IF EXISTING SIDE SLOPE RATE IS 3:1 OR FLATTER, TEMPORARY CONCRETE BARRIER NOT NEEDED

EMERGENCY PULL-OFF LAYOUT
INTERSTATE, FREEWAY, EXPRESSWAY OR OTHER DIVIDED HIGHWAYS WITH MINIMUM 11' TRAVEL LANES

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EMERGENCY PULL-OFF AREA (TEMPORARY)

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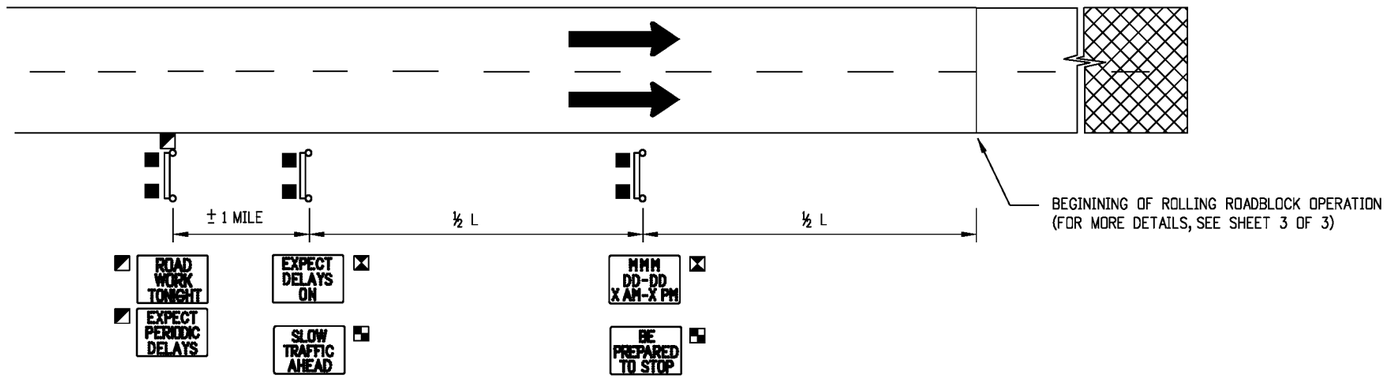

TYPICAL PLACEMENT OF VMS

SYMBOLS

- PORTABLE VARIABLE MESSAGE SIGN (VMS)
- LAW ENFORCEMENT VEHICLE WITH FLASHING RED AND BLUE LIGHTS
- DIRECTION OF TRAVEL
- CHANNELING DEVICE: FOR TYPE OF DEVICE TO BE USED, SEE SCHEDULE OF TRAFFIC CONTROL DEVICES INCLUDED IN THE PLANS.
- WORK AREA
- L — LENGTH OF ROLLING ROADBLOCK OPERATION
- TO BE PLACED ON DAY 1 OF THE ROLLING ROADBLOCK OPERATION
- TO BE PLACED ONE WEEK PRIOR TO ROLLING ROADBLOCK OPERATION
- TO BE PLACED DURING ROLLING ROADBLOCK OPERATION

GENERAL NOTES

1. ROLLING ROADBLOCK IS A TRAFFIC CONTROL TECHNIQUE TO SLOW (STOP, IF NEEDED) TRAFFIC TO FACILITATE SHORT DURATION WORK OPERATIONS WITHOUT AN ELABORATE AND DIFFICULT DETOUR. TRAFFIC CONTROL LAW ENFORCEMENT OFFICERS PACE, OR SLOW, THE TRAFFIC TO A SPEED THAT PROVIDES APPROXIMATELY 20-30 MINUTES TO PERFORM THE SPECIFIED CONSTRUCTION.
2. ON THE DAY OF THE ROLLING ROADBLOCK OPERATION, THE VARIABLE MESSAGE SIGN(S) SHALL BE REVISED TO INDICATE THE ACTIVITY WILL OCCUR THAT NIGHT OR DAY. THE ROLLING ROADBLOCK OPERATION BEGINS WITH A TRAFFIC CONTROL SUPERVISOR AT THE WORK SITE INITIATING THE PACING OPERATION IN ACCORDANCE WITH PACING DETAILS SHOWN ON SHEET 2. THE INTENT IS TO KEEP TRAFFIC MOVING, UNLESS THERE IS AN EMERGENCY.
3. TRUCK-MOUNTED ATTENUATOR(S) WITH VARIABLE MESSAGE SIGN(S) SHALL BE USED TO PROTECT CONSTRUCTION WORKERS AND/OR EQUIPMENT POSITIONED IN A TRAVEL LANE(S) AT THE WORK AREA DURING THE ROLLING ROADBLOCK OPERATION FROM AN ERRANT VEHICLE. IF NO WORKERS AND/OR EQUIPMENT ARE POSITIONED IN A TRAVEL LANE(S) AT THE WORK AREA, TRUCK-MOUNTED ATTENUATOR(S) SHALL NOT BE USED.
4. WHEN MORE THAN ONE ROLLING ROADBLOCK OPERATION IS REQUIRED IN ONE WORK PERIOD, THE CONTRACTOR SHALL ALLOW SUFFICIENT TIME BETWEEN ROLLING ROADBLOCK OPERATIONS TO PERMIT TRAFFIC TO RETURN TO NORMAL SPEEDS AND FLOW. ADDITIONAL TIME MAY BE REQUIRED BETWEEN ROLLING ROADBLOCK OPERATIONS TO ALLOW TRAFFIC TO RESUME NORMAL SPEEDS AND FLOW UPSTREAM OF THE WORK AREA, AS DETERMINED BY THE ENGINEER OR THE REGION TRAFFIC ENGINEER.

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ROLLING ROADBLOCKS FOR TRAFFIC CONTROL

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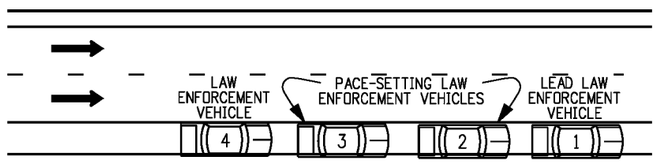
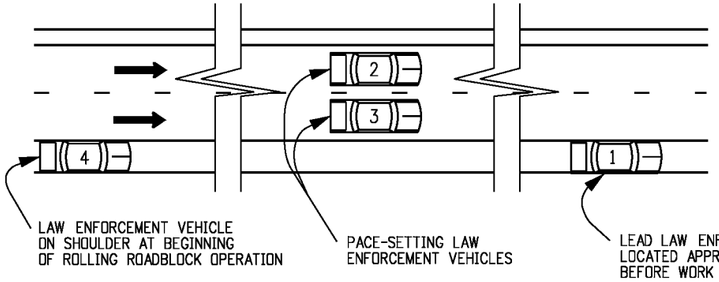


STAGE 1

STAGE 1 NOTE:

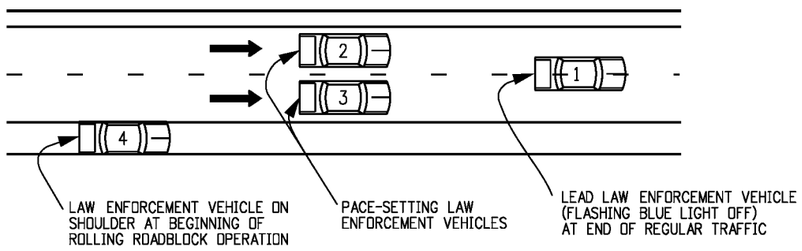
MINIMUM OF FOUR (4) LAW ENFORCEMENT VEHICLES LOCATED UPSTREAM OF THE WORK AREA AT THE BEGINNING LOCATION OF THE ROLLING ROADBLOCK OPERATION WITH FLASHING BLUE LIGHTS OFF.



STAGE 3

STAGE 3 NOTES:

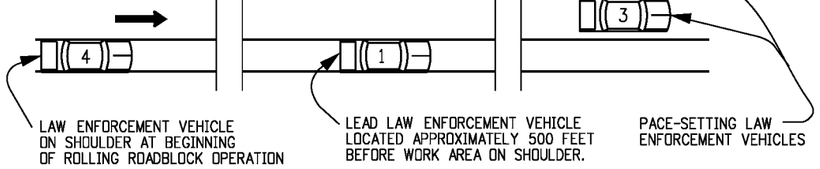
1. THE TWO (2) PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL BEGIN TO SLOW TO THE PACING SPEED (10 MPH MINIMUM), FOR THE DURATION OF THE ROLLING ROADBLOCK OPERATION.
2. THE LEAD LAW ENFORCEMENT VEHICLE (FLASHING BLUE LIGHTS OFF) SHALL MATCH THE SPEED OF THE LAST VEHICLES AHEAD OF THE PACE-SETTING LAW ENFORCEMENT VEHICLES, AND CONTINUE FOLLOWING TRAFFIC UNTIL A POINT APPROXIMATELY 500 FEET IN ADVANCE OF THE WORK AREA. THE LEAD LAW ENFORCEMENT VEHICLE SHALL THEN COME TO A COMPLETE STOP ON THE RIGHT SHOULDER, AND TURN ON ITS' FLASHING BLUE LIGHTS. IF REQUIRED, CRASH TRUCKS WITH REAR-MOUNTED ATTENUATOR(S) AND CHANGEABLE MESSAGE SIGN(S) SHALL MOVE INTO THE TRAVEL LANES APPROXIMATELY 200 FEET UPSTREAM OF THE WORK AREA WITH THE IMPACT ATTENUATORS DOWN AND OPERATING ONCE TRAFFIC HAS CLEARED THE WORK AREA.



STAGE 2

STAGE 2 NOTE:

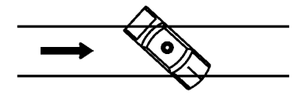
ONCE THE LAW ENFORCEMENT VEHICLES ARE IN PLACE AND THE LAW ENFORCEMENT SUPERVISOR AT THE WORK AREA NOTIFIES ALL LAW ENFORCEMENT OFFICERS INVOLVED TO BEGIN THE ROLLING ROADBLOCK OPERATION, THE LAST THREE (3) LAW ENFORCEMENT VEHICLES SHALL TURN ON THEIR FLASHING BLUE LIGHTS. THE FIRST THREE (3) LAW ENFORCEMENT VEHICLES SHALL ENTER THE TRAVEL LANES, WITH THE SECOND AND THIRD LAW ENFORCEMENT VEHICLES IMMEDIATELY FORMING A SIDE-BY-SIDE "PACING OPERATION" OF ALL LANES BEHIND THE LEAD LAW ENFORCEMENT VEHICLE (FLASHING BLUE LIGHTS OFF).



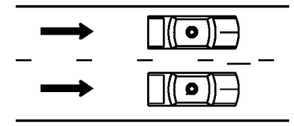
STAGE 4

STAGE 4 NOTES:

1. WHEN THE PACE-SETTING LAW ENFORCEMENT VEHICLES ARE WITHIN APPROXIMATELY TWO (2) MILES OF THE WORK AREA, THEY SHALL NOTIFY THE ONSITE TRAFFIC CONTROL SUPERVISOR OF THEIR LOCATION. ONCE THE CONTRACTOR'S ON-SITE SUPERINTENDENT HAS BEEN NOTIFIED OF THE PACE-SETTING LAW ENFORCEMENT VEHICLES' LOCATION, THE CONTRACTOR SHALL BEGIN TO CLEAR THE TRAVEL LANES OF ALL EQUIPMENT AND DEBRIS IN ORDER TO REOPEN ALL TRAVEL LANES.
2. IN CASE OF EMERGENCY, THE PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL COME TO A COMPLETE STOP ONCE THEY REACH THE LEAD POLICE VEHICLE. IF NO EMERGENCY IS ENCOUNTERED, THE CRASH TRUCK(S) SHALL BE MOVED FROM THE TRAVEL LANES, AND THE TWO (2) PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL CLEAR THE WORK AREA AND IMMEDIATELY MOVE TO THE RIGHT SHOULDER OR AN AREA DESIGNATED BY THE TRAFFIC CONTROL SUPERVISOR, AND TURN OFF THE FLASHING BLUE LIGHTS. ONCE THE TWO (2) PACE-SETTING LAW ENFORCEMENT VEHICLES PASS THE WORK AREA, THE TRAFFIC CONTROL SUPERVISOR SHALL INSTRUCT THE LEAD AND LAST LAW ENFORCEMENT VEHICLES TO TURN OFF THEIR FLASHING BLUE LIGHTS.



ONE LANE RAMP



TWO LANE RAMP

TYPICAL APPLICATIONS
ROLLING ROADBLOCK - RAMP CLOSURE DETAILS

RAMP CLOSURE NOTES:

1. ONCE NOTIFIED BY THE TRAFFIC CONTROL SUPERVISOR TO BEGIN THE ROLLING ROADBLOCK OPERATION, EACH LAW ENFORCEMENT VEHICLE AT THE INDICATED RAMP SHALL TURN THEIR FLASHING BLUE LIGHTS ON, AND POSITION THE VEHICLE ACROSS THE RAMP LANE(S) TO CLOSE RAMP ACCESS.
2. ONCE THE ROLLING ROADBLOCK OPERATION PASSES THE CLOSED ON-RAMP, THE LAW ENFORCEMENT VEHICLE ON THE RAMP SHALL TURN OFF THEIR FLASHING BLUE LIGHTS, AND MOVE FROM THE RAMP LANE(S) TO ALLOW TRAFFIC TO ENTER THE MAINLINE ROLLING ROADBLOCK OPERATION.

GENERAL NOTES:

EACH LAW ENFORCEMENT OFFICER SHALL HAVE A MARKED VEHICLE WITH FLASHING BLUE LIGHTS FOR THE ROLLING ROADBLOCK OPERATION. THE LOCATION AND NUMBER OF LAW ENFORCEMENT OFFICERS AT EACH LOCATION SHALL BE AS FOLLOWS:

NO. OF LAW ENFORCEMENT VEHICLES*	FUNCTION	LOCATION
1, MINIMUM	SUPERVISOR	WORK AREA
1 LEAD VEHICLE	VARIES	MOBILE OPERATION
1 PER TRAVEL LANE	PACING OPERATION	MOBILE OPERATION BEGINNING X MILES UPSTREAM AND TERMINATING AT THE WORK AREA.
1 STATIONED AT BEGINNING OF ROLLING ROADBLOCK OPERATION	ADVANCED WARNING TO MOTORISTS	STATIONED AT THE BEGINNING OF ROLLING ROADBLOCK OPERATION
1 PER ENTRANCE RAMP	ENTRANCE RAMP ROADBLOCKS	ONE AT EACH OF THE ENTRANCE RAMPS UPSTREAM OF THE WORK AREA

* THERE SHALL BE AT LEAST ONE LAW ENFORCEMENT VEHICLE PER LANE. FINAL NUMBER OF LAW ENFORCEMENT VEHICLES SHALL BE DETERMINED BY THE LAW ENFORCEMENT AGENCY.

TYPICAL APPLICATIONS
ROLLING ROADBLOCK - MULTI-LANE MAINLINE PACING DETAILS

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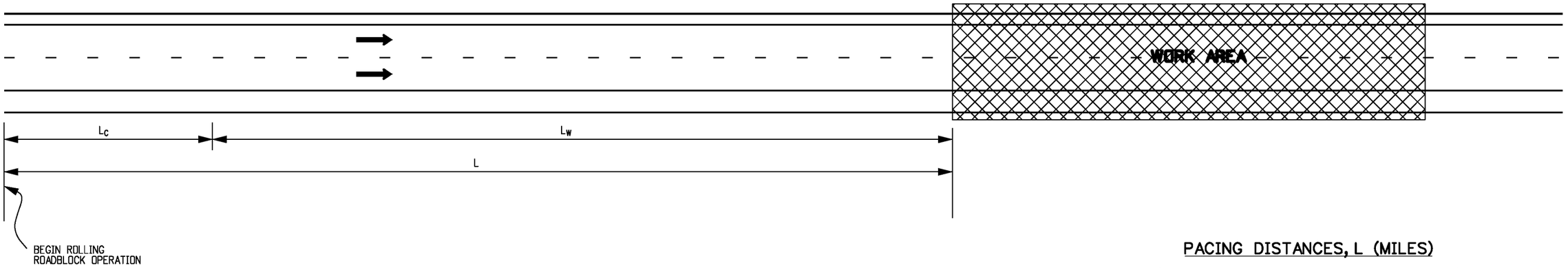

DESIGN NOTES:

1. THE DESIGN SHALL EVALUATE THE ACTUAL DISTANCE REQUIRED FOR THE ROLLING ROADBLOCK OPERATION BASED ON SITE-SPECIFIC FEATURES SUCH AS: ROADWAY GEOMETRICS, PACING SPEEDS, REGULATORY SPEEDS, INTERCHANGE SPACING, WORK DURATION, AVAILABILITY OF LAW ENFORCEMENT OFFICERS, TRAFFIC VOLUMES, AND MAXIMUM QUEUE LENGTH.
2. THE STARTING POINT OF A ROLLING ROADBLOCK OPERATION SHALL CONSIDER THE FOLLOWING FACTORS: THE SPEED OF THE PACING LAW ENFOCEMENT VEHICLES, THE LOCATION OF ENTRANCE RAMPS, HORIZONTAL AND VERTICAL ALIGNMENT OF THE FACILITY.
3. IN SOME INSTANCES, IT MAY BE NECESSARY TO CLOSE A LANE AT THE WORK SITE TO POSITION A CRANE(S) AND THE MATERIALS TO BE LIFTED.
4. ALL MATERIAL TO BE INSTALLED SHALL BE ON-SITE BEFORE THE ROLLING ROADBLOCK OPERATION BEGINS.
5. IT MAY BE NECESSARY TO INSTALL TEMPORARY BARRIER WALLS TO PROTECT PRE-POSITIONED AND ASSEMBLED MATERIALS IN THE RIGHT-OF-WAY.
6. THE MINIMUM SPEED ALLOWED FOR A PACING OPERATION IS 10 MPH.

S_R = REGULATORY SPEED, MPH

S_P = PACING SPEED, MPH

T_W = WORK DURATION, MINUTES

L = TOTAL PACING DISTANCE, MILES

$= \frac{T_W}{60} S_P \left(\frac{S_P}{S_R - S_P} + 1 \right)$

$= L_C + L_W$

L_C = DISTANCE PACE-SETTING LAW ENFORCEMENT VEHICLES SHALL TRAVEL BEFORE THE VEHICLES AT REGULATORY SPEED HAVE CLEARED THE WORK AREA.

$= \frac{\left(\frac{T_W}{60} \times S_P^2 \right)}{S_R - S_P}$

L_W = DISTANCE PACE-SETTING LAW ENFORCEMENT VEHICLES TRAVEL WHILE CONSTRUCTION WORK IS PERFORMED.

$= \left(\frac{T_W}{60} \times S_P \right)$

F_{HV} = HEAVY VEHICLE FACTOR

$= 1 + \left(\frac{P_T}{100} \times 0.50 \right)$

P_T = % TRUCKS

PACING DISTANCES, L (MILES)

S_R	S_P = 20 MPH PCPHPL <= 1,750					
	T_W (MIN.)					
	5	10	15	20	25	30
70	2.3	4.7	7.0	9.3	*	*
65	2.4	4.8	7.2	9.6	*	*
60	2.5	5.0	7.5	10.0	*	*
55	2.6	5.2	7.9	*	*	*
50	2.8	5.6	8.3	*	*	*

* SITE-SPECIFIC DESIGN REQUIRED

PACING DISTANCES NOTES:

Tw IS THE TOTAL TIME ALLOWED FOR WORK ACTIVITY, IN MINUTES. THIS TIME STARTS JUST AFTER THE LAST VEHICLE TRAVELING AT THE PRE-PACING REGULATORY SPEED CLEARS THE WORK AREA AND ENDS JUST AS THE ROLLING ROADBLOCK OPERATION REACHES THE WORK AREA. Tw MUST INCLUDE THE TIME REQUIRED TO CLEAR THE ROADWAY OF EQUIPMENT, MATERIALS, AND PERSONNEL.

DEMAND VOLUME MAY NOT EXCEED 1,750 PCPHPL WITHOUT A SITE-SPECIFIC DESIGN. TRAFFIC COUNTS CAN BE OBTAINED FROM THE REGION TRAFFIC ENGINEER, OR YOU MAY NEED TO COLLECT TRAFFIC COUNTS. HOURLY DIRECTIONAL TRAFFIC VOLUMES MUST BE CONVERTED TO PCPHPL USING THE FOLLOWING EQUATION:

PCPHPL = PASSENGER CARS PER HOUR PER LANE

$= \frac{\text{HOURLY DIRECTIONAL VOLUME}}{\text{NO. OF LANES (EACH DIRECTION)}} \times \text{HEAVY VEHICLE FACTOR}$

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