

# 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 the CDOT Standard Specifications for Road and Bridge Construction book.

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. The New and Revised Standards Plans may be accessed on the CDOT website here: <https://www.codot.gov/business/designsupport/standard-plans>.

These Standard Plans are adopted for use as of July 31, 2019.

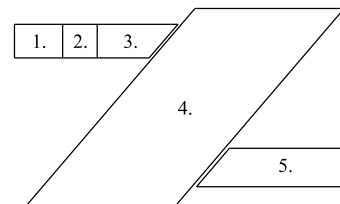
**PHOTO CREDITS:**

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1. GAME RAMP | CDOT, COLORADO PARKS & WILDLIFE, ECO RESOLUTIONS | 2016 | STATE HIGHWAY 9, KREMMLING, CO.
2. WELCOME TO COLORFUL COLORADO SIGN INSTALLATION | CDOT | 2019 | JULESBURG, CO.
3. FEDERAL BOULEVARD BRIDGE OVER COLFAX AVENUE | CDOT | 2011 | DENVER, CO.
4. GRAND AVENUE BRIDGE OPENING | CDOT | 2017 | GLENWOOD SPRINGS, CO.
5. DENVER PANORAMIC | STEPHEN MARTINEZ - CDOT | 2019 | DENVER, CO.

**BACK COVER:**

6. HANGING LAKE TUNNELS, WEST | STEPHEN MARTINEZ - CDOT | 2015 | I-70, GLENWOOD CANYON, CO.



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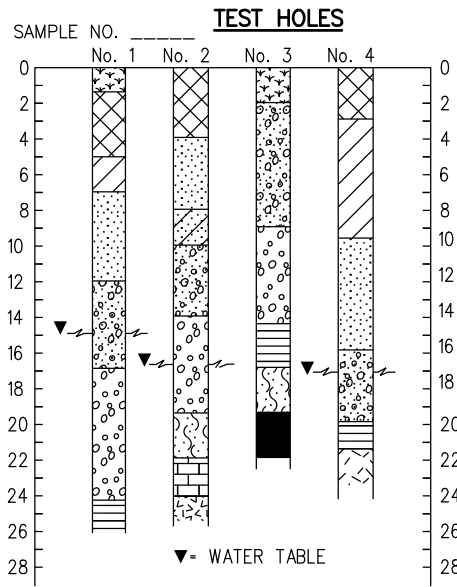
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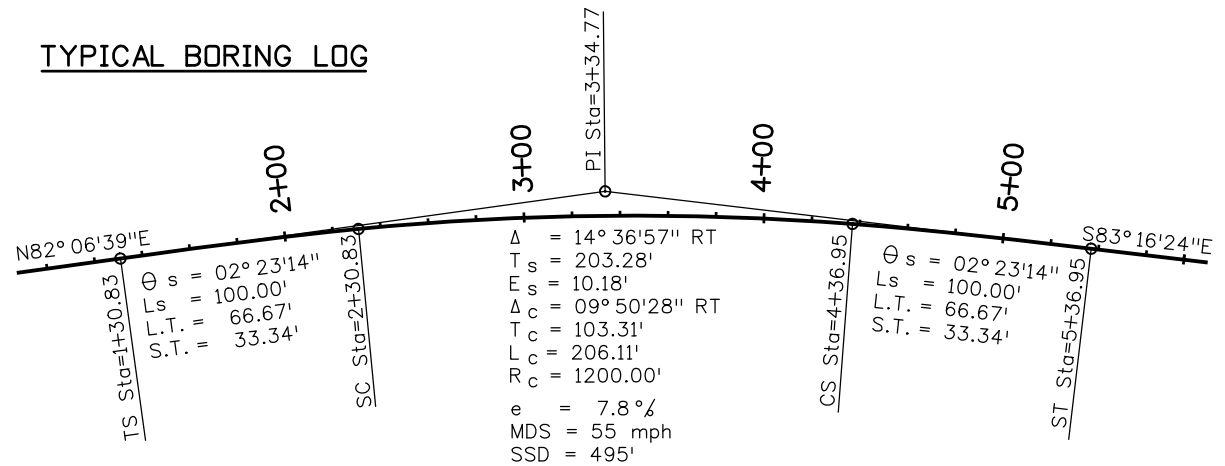
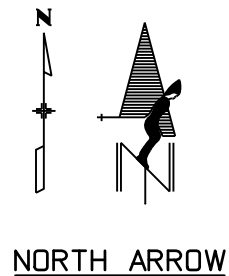
**COLORADO**  
**DEPARTMENT OF TRANSPORTATION**  
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**JULY 31, 2019**

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Designer Initials: JBK		<input type="checkbox"/>				<b>Standard Sheet No. 1 of 1</b>	
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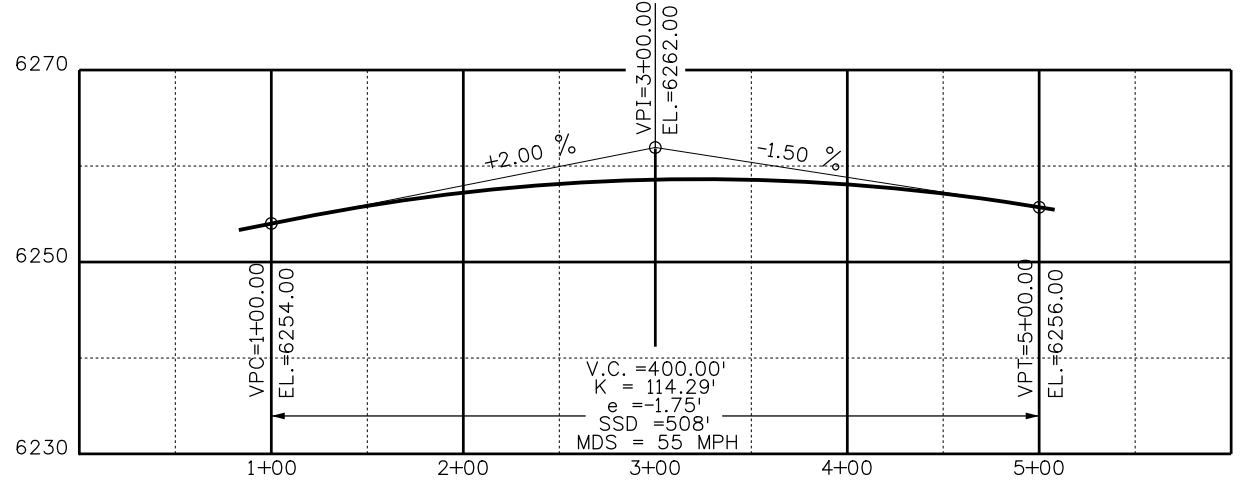
- LEGEND**
- TOPSOIL
  - OVERBURDEN
  - CLAY
  - SILT
  - SAND
  - GRAVEL
  - SHALE
  - LIMESTONE
  - SANDSTONE
  - SOLID ROCK (IGNEOUS)
  - SOLID ROCK (METAMORPHIC)
  - COAL
  - SANDY CLAY
- COMPOSITE MATERIALS ARE REPRESENTED BY COMBINATIONS OF THE ABOVE SYMBOLS, SUCH AS:



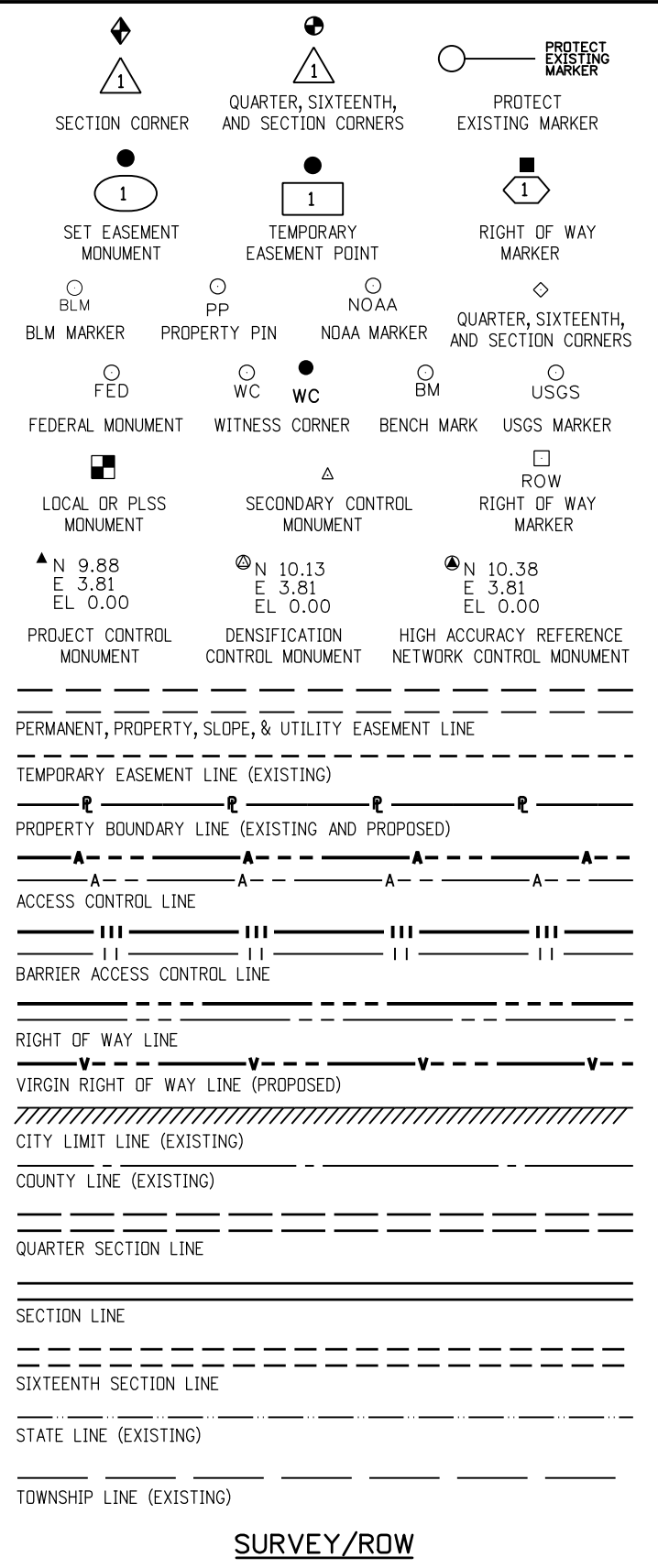
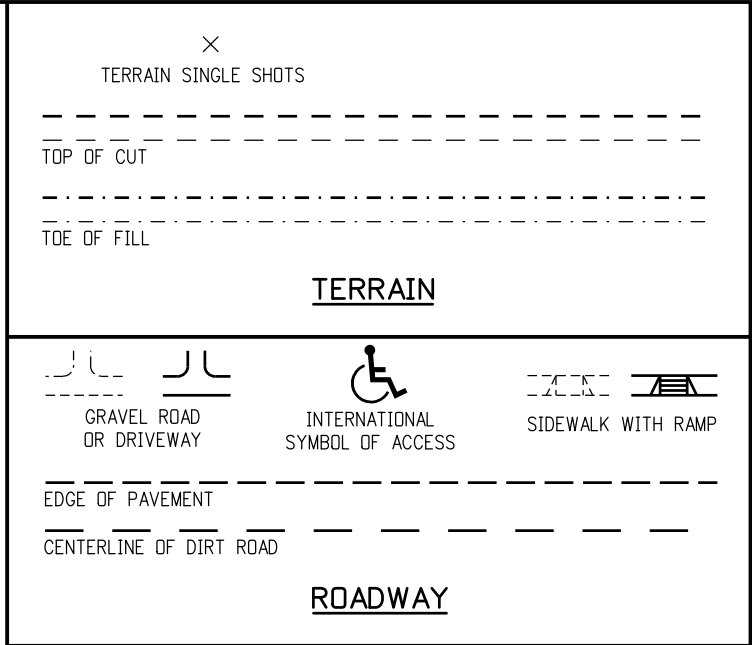
**TYPICAL BORING LOG**



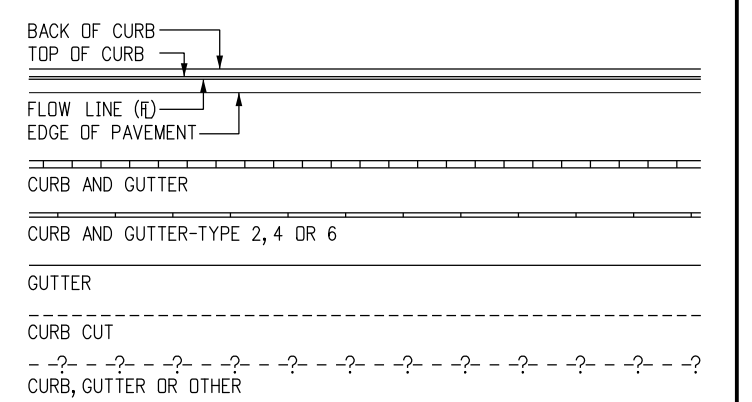
**TYPICAL HORIZONTAL CURVE**



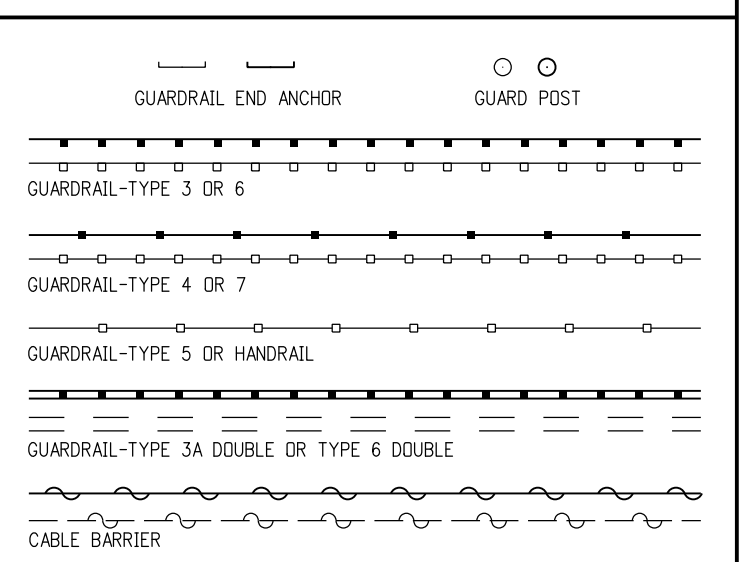
**TYPICAL VERTICAL CURVE**



- GENERAL NOTES**
- 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).
  - 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.
  - GUARDRAIL, CURB AND GUTTER, ETC., ARE REPRESENTED BY A SYMBOL WITH TYPE GIVEN BY NOTE.



**CURB AND GUTTER**



**GUARDRAIL**

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**STANDARD SYMBOLS**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.

**M-100-1**

Standard Sheet No. 1 of 3

Project Sheet Number:

ROCK, MASONRY OR MECHANICALLY STABILIZED WALL (FACE)

BRIDGE CURB

BRIDGE RAIL

BRIDGE RAIL-TYPE 3A

FLOW LINE CBC

STRUCTURES MISCELLANEOUS

### STRUCTURE

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

PLASTIC FENCE

SILT FENCE

DEBRIS FENCE

### FENCE

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 DISTURBED AREA

ENVIRONMENTAL CONCERN

HAZARDOUS WASTE SITE

NOXIOUS WEED

FLOW ARROW

### ENVIRONMENTAL

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

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

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

SA SA SA

SANITARY SEWER MANHOLE

SANITARY SEWER MISCELLANEOUS SYMBOL

SIZE, MATERIAL, OWNER

SANITARY SEWER PIPE

SANITARY SEWER PIPE MISCELLANEOUS

### SANITARY SEWER

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

BOULDER UNDER 6FT

GEOLOGY MISC SYMBOL

MINESHAFT SYMBOL

ROCK OUTCROP

BOULDER FIELD OR ROCK OVERHANG

### GEOLOGY

WATER SPIGOT

WATER VALVE

WATER MANHOLE

FIRE HYDRANT

WATER METER

WATER WELL SYMBOL

SIZE, MATERIAL, OWNER

WATER LINE

WATER MISCELLANEOUS LINE

### WATER

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# STANDARD SYMBOLS

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 M-100-1  
 Standard Sheet No. 2 of 3  
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**GAS**

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, GAS LINE LOW PRESSURE, GAS LINE HIGH PRESSURE, PROPANE GAS LINE, GAS LINES MISCELLANEOUS

**LIGHTING**

LIGHT STANDARD, HIGH MAST LIGHT STANDARD, SPOT OR FLOOD LIGHT

**ELECTRICAL**

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, ELECTRICAL UNDERGROUND LINE, ELECTRICAL OVERHEAD LINE, ELECTRICAL MISCELLANEOUS LINE

**TELEPHONE**

TELEPHONE GUY POLE, TELEPHONE MANHOLE, TELEPHONE MISCELLANEOUS, FIBER OPTIC CABLE MARKER, COMBINATION POLE-POWER, COMBINATION GUY POLE-POWER, TELEPHONE UNDERGROUND CONDUIT OR CABLE, FIBER OPTICS UNDERGROUND CABLE, TELEPHONE OVERHEAD LINE, TELEPHONE MISCELLANEOUS LINE

**TRAFFIC CONTROL**

TRAVEL DIRECTION, BARRIER LIGHT, FLAGGER, DELINEATOR-TYPE I, SEQUENCING ARROW PANEL, FLASHING BEACON, DELINEATOR-TYPE II, 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

**OIL**

OIL METER HIGH AND LOW PRESSURE, OIL VALVE HIGH AND LOW PRESSURE, OIL MISCELLANEOUS, OIL LINE LOW OR HIGH PRESSURE, OIL MISCELLANEOUS LINE

**INTELLIGENT TRANSPORTATION SYSTEM**

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

**TRAFFIC SIGNAL**

DOUBLE MAST ARM POLE, SIGNAL SPAN WIRE 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, TRAFFIC CONDUIT

**MISCELLANEOUS TOPOGRAPHY**

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

**TELEVISION**

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

**TRAFFIC STRIPING**

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, RAILROAD CROSSING, BICYCLE PED ACCESS

**CAMPING**

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

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Colorado Department of Transportation  
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 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**STANDARD SYMBOLS**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
 M-100-1  
**Standard Sheet No. 3 of 3**  
 Project Sheet Number:

A

AAC	Aluminum Arch Culvert
AADT	Annual Average Daily Traffic
ABC	Aggregate Base Course
Abut	Abutment
ACM	Asbestos 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
ASDP	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
BAFD	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
CDC	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

- ABBREVIATIONS SHOULD BE UPPER AND LOWER CASE LETTERS EXCEPT WHERE ALL UPPER CASE LETTERS ARE REQUIRED.  
Const Jt = Construction Joint
- ACRONYMS SHALL BE ALL UPPER CASE LETTERS.  
CBC = Concrete Box Culvert
- 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)
DRCDG	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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STANDARD PLAN NO.

M-100-2

Standard Sheet No. 1 of 4

Project Sheet Number:

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  
 HDV 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  
 MR Resilient Modulus  
 MR Modulus of Rupture

N

NAD North American Datum  
 NAVD North American Vertical Datum  
 NB Northbound, Total Number of Blocks  
 NDES 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

Standard Sheet No. 2 of 4

Project Sheet Number:

O

OC On Center  
 OD Outside Diameter  
 OGFC Open Grade Friction Course  
 OJT On-the-Job Trainee or On-the-Job Training  
 Opp Hand Opposite Hand  
 oz Ounces

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, PI Plate  
 PLS Professional Land Surveyor  
 PM Project Manager  
 PMBB Plant Mix Bituminous Base  
 PMBP Plant Mix Bituminous Pavement  
 PMSC Plant Mix Seal Coat  
 PDC Point on Curve  
 PDSS Point of Slope Selection  
 PDT 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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STANDARD PLAN NO.

M-100-2

Standard Sheet No. 3 of 4

Project Sheet Number:



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
USDDT	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 Tangency

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

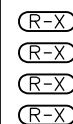
Yd	Yard
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SYMBOLS

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
ⓔ	Epoxy Coated Rebar
Ⓝ	Non-Epoxy Coated Rebar
ⓧ	Girder Label
°F	Fahrenheit
°C	Celsius
≈	Approximate
Ⓢ	Interstate Highway
Ⓡ	US Highway
Ⓡ	State Highway

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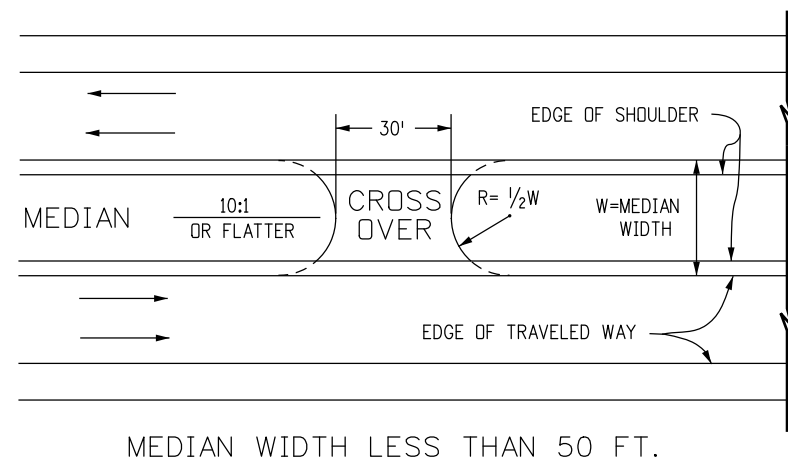
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STANDARD PLAN NO.

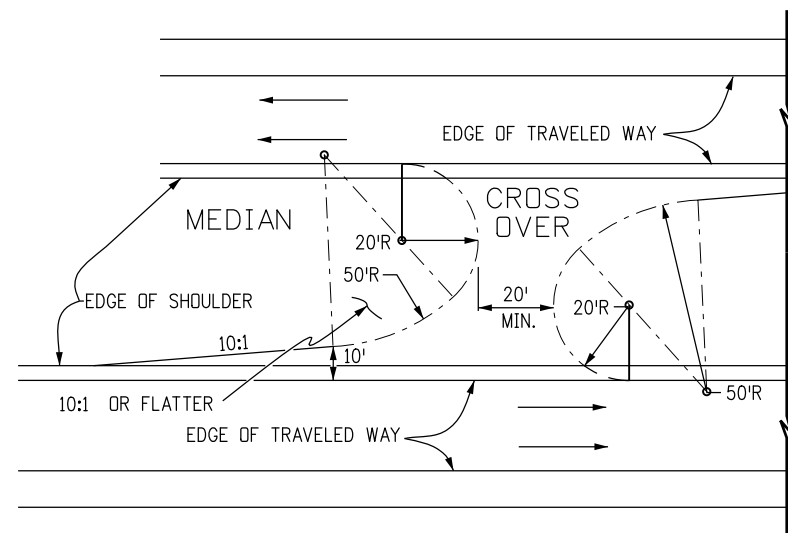
M-100-2

Standard Sheet No. 4 of 4

Project Sheet Number:



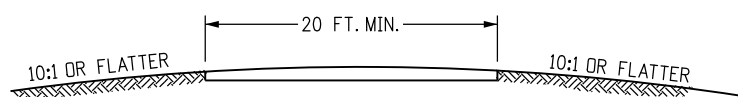
MEDIAN WIDTH LESS THAN 50 FT.



MEDIAN WIDTH GREATER THAN 50 FT.

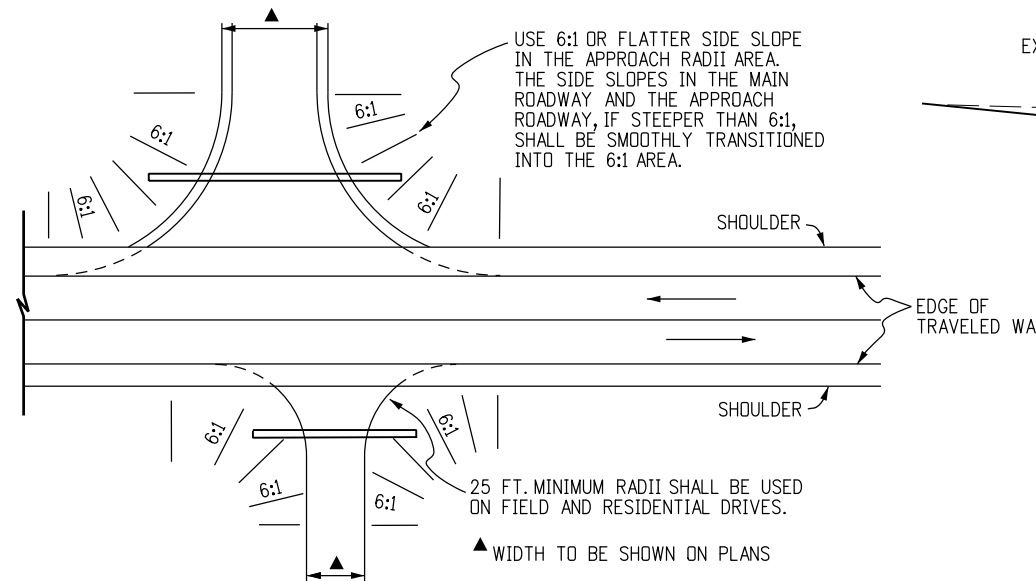
**TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER**

LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT



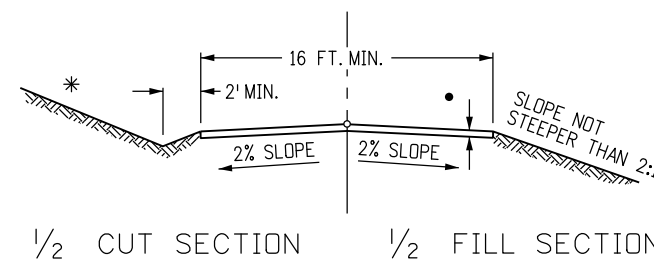
**TYPICAL SECTION FOR MEDIAN CROSS OVER**

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.

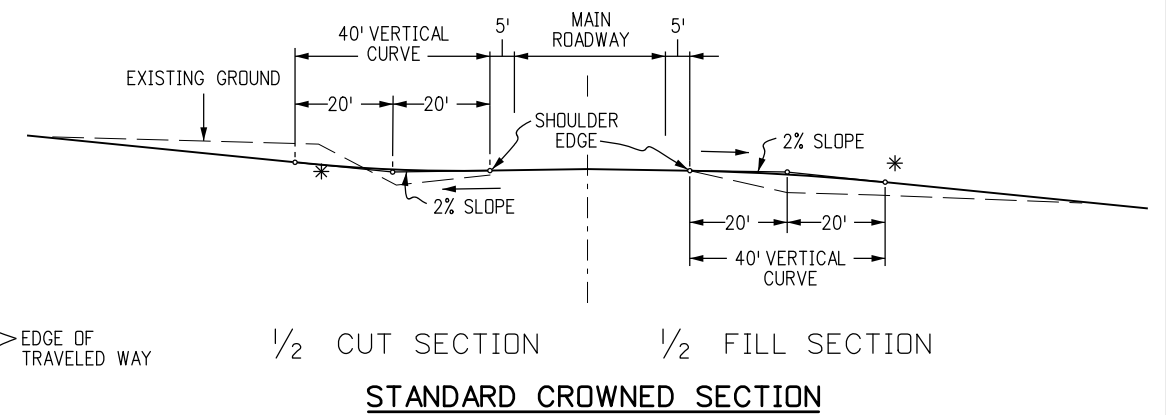
**TYPICAL PLANS FOR SIDE APPROACH ROAD**



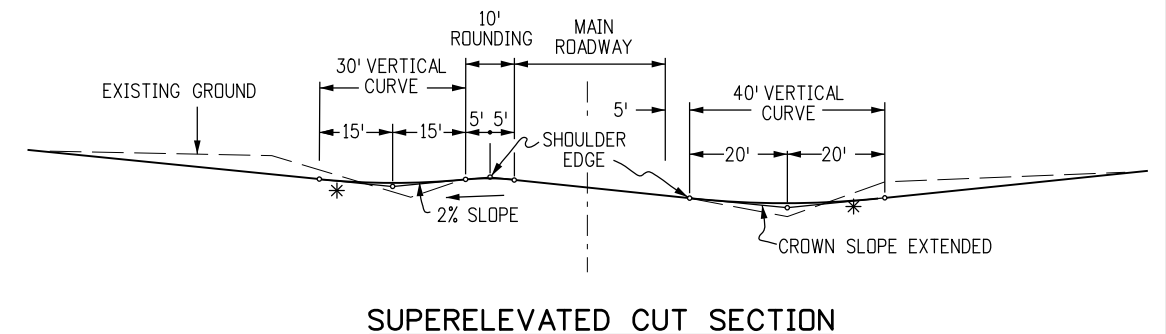
**TYPICAL SECTION FOR APPROACH (ACCESS) ROAD**

NOTE: ROAD APPROACHES WHICH REQUIRE HMA (ASPHALT) PAVEMENT SHALL BE PLACED AT THE FOLLOWING DISTANCES BACK FROM THE ROADWAY EDGE OF PAVEMENT:

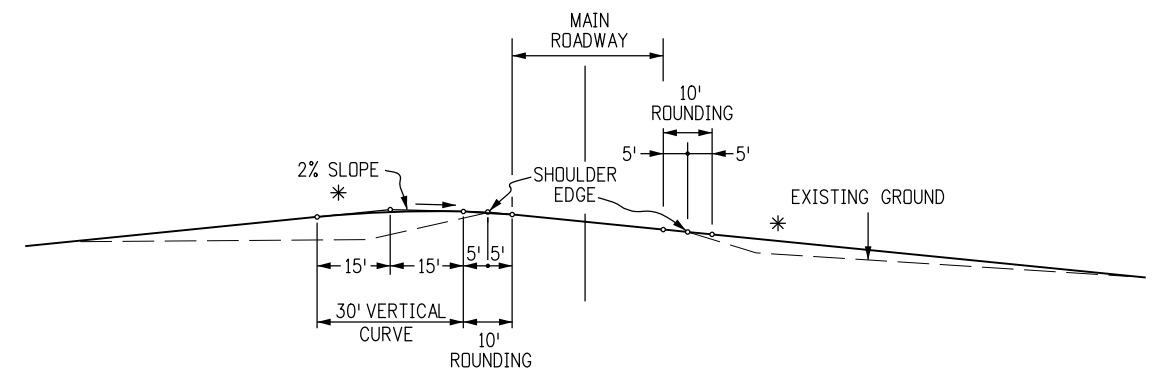
1. RESIDENTIAL OR AGRICULTURAL FIELD ENTRANCES - PAVE 4 FEET BACK.
2. THREE OR MORE RESIDENCES OR COMMERCIAL PROPERTY - PAVE 20 FEET BACK OR TO ROW LINE, WHICHEVER IS LESS.
3. PUBLIC STREET - PAVE 50 FEET BACK OR TO ROW LINE, WHICHEVER IS LESS.
4. IF EXISTING ACCESS IS PAVED, THEN FEATHER NEW ASPHALT OVERLAY A MINIMUM OF 2 FEET BACK OR AS DIRECTED BY THE ENGINEER.



**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.

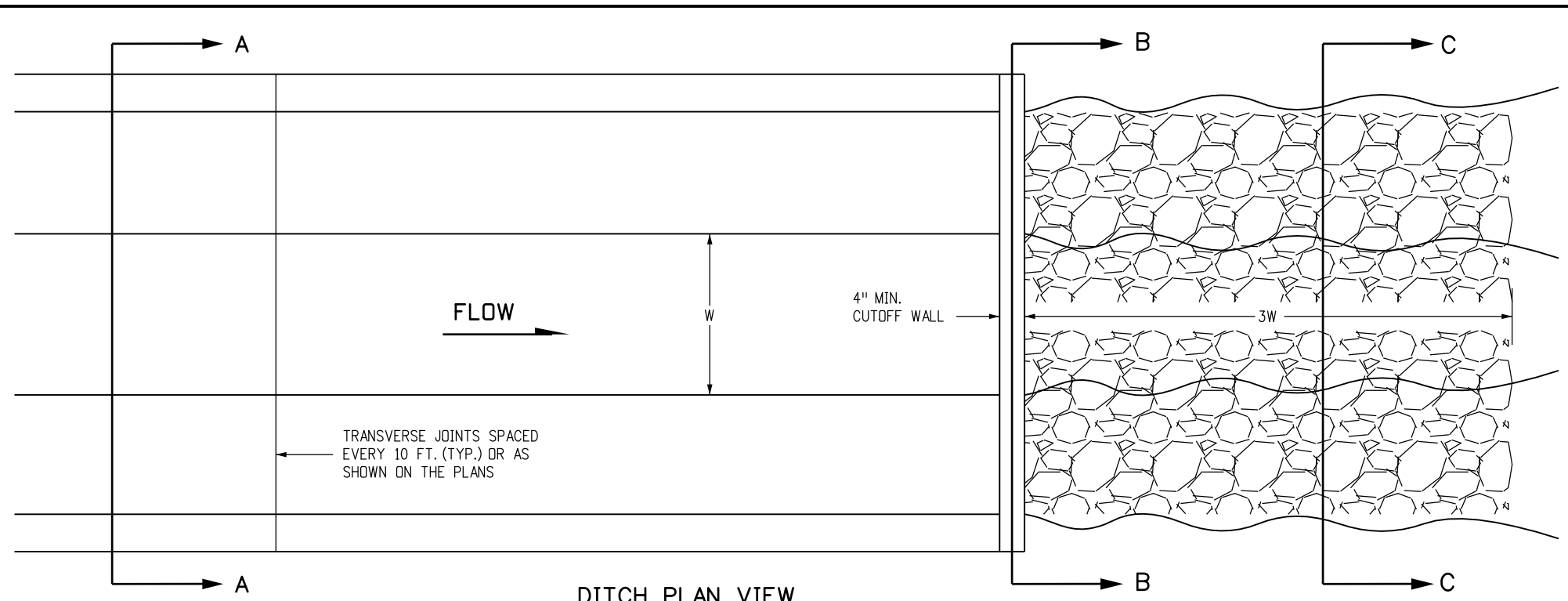
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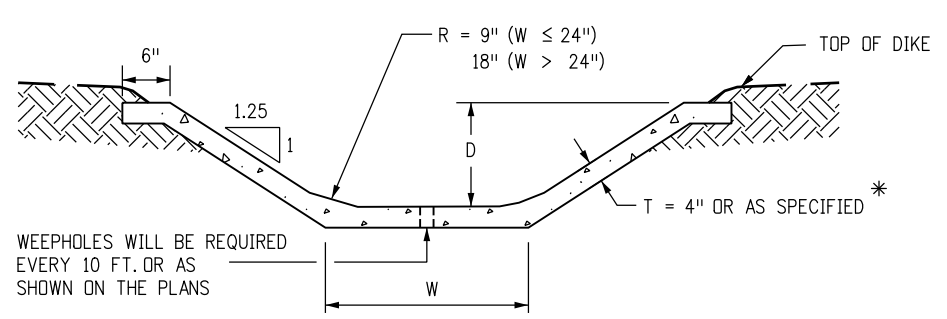
**APPROACH ROADS**  
 Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-203-1**  
 Standard Sheet No. 1 of 1  
 Project Sheet Number:



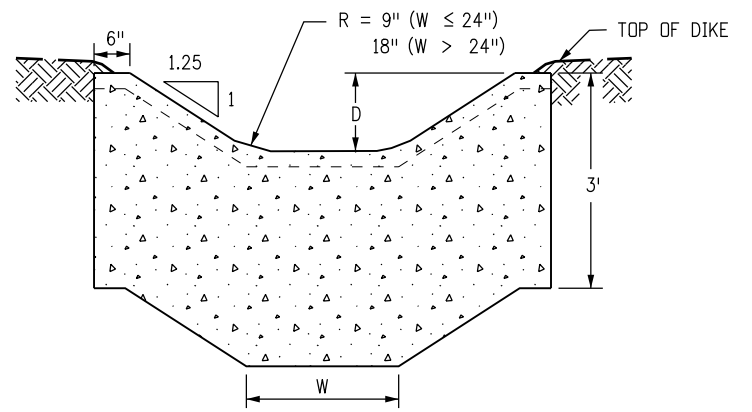
**GENERAL NOTES**

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.

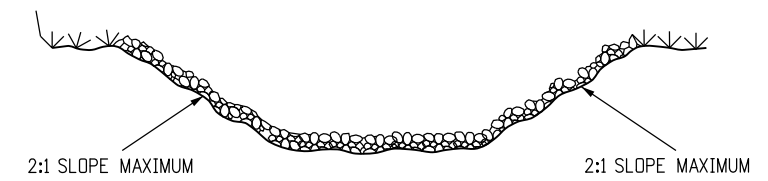


**SECTION A-A CONCRETE-LINED DITCH**

\* FOR SECTIONS WHERE  $W \leq 18"$  AND  $D \leq 18"$  USE  $T = 3"$



**SECTION B-B CUTOFF WALL**

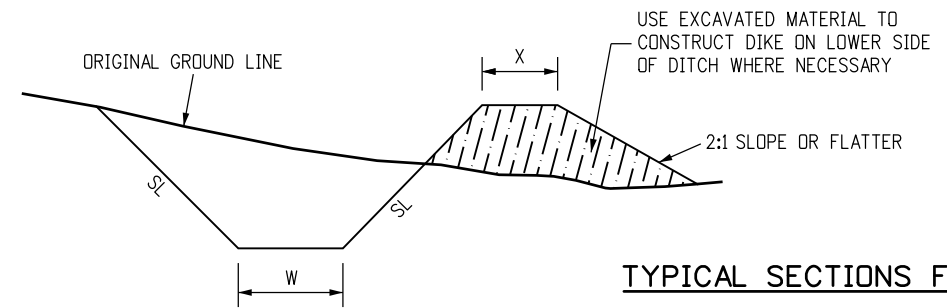


**SECTION C-C RIPRAP-LINED DITCH**

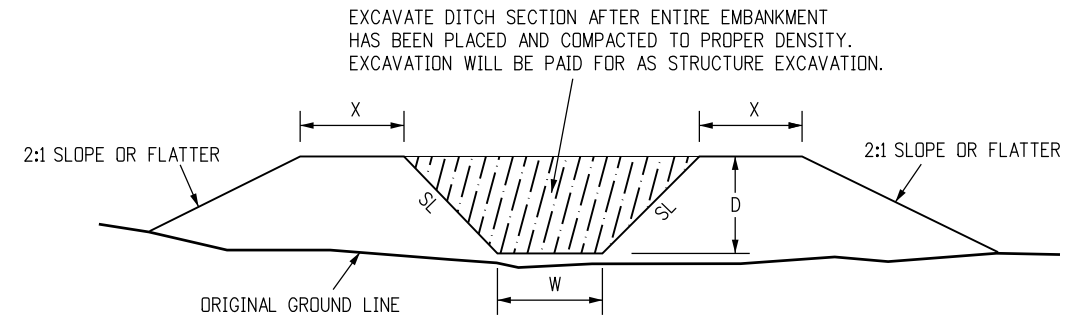
RIPRAP GRADATION SHALL BE AS SPECIFIED IN THE CONTRACT.

D (INCHES)	CU. YDS. PER 100 LIN. FT.				
	W (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**



**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.

**EMBANKMENT SECTIONS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 	<h1>DITCH TYPES</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:			M-203-2	
Last Modification Date: 07/31/19	Detailer Initials: LTA			Standard Sheet No. 1 of 1			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				Project Development Branch <b>JBK</b>		Project Sheet Number:	
				Issued by the Project Development Branch: July 31, 2019			

**SUPERELEVATION NOTES**

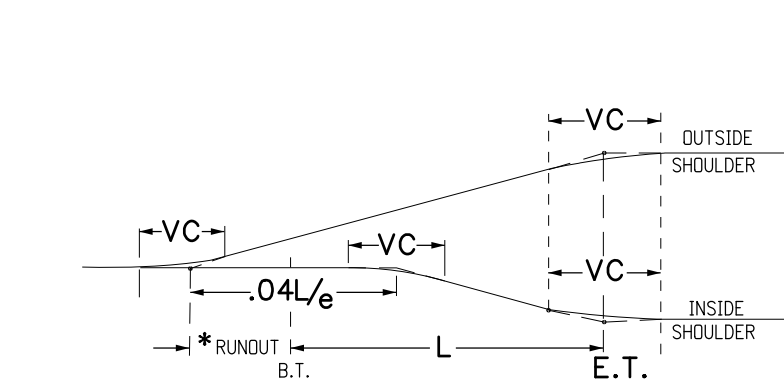
- THIS STANDARD PLAN SHOWS THE REQUIRED RATES OF SUPERELEVATION FOR THE VARIOUS RADIUS LENGTHS AT DIFFERENT DESIGN SPEEDS FOR THE MAXIMUM SUPERELEVATION RATE OF 8%. ALTERNATIVE MAXIMUM RATE OF SUPERELEVATION SHALL BE USED FOR CROWNED HIGHWAYS WHEN SPECIFIED ON THE PLANS.
- VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR 2-LANE AND 4-LANE HIGHWAYS.
- NUMBER OF LANES ROTATED:
  - ONE LANE ROTATED IS TYPICAL FOR A TWO-LANE HIGHWAY.
  - TWO LANES ROTATED ARE TYPICAL FOR A FOUR-LANE HIGHWAY.
- 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 max = 8%** TABLE CONTINUES ON SHEET 2.

e (%)	Vd=15 mph				Vd=20 mph				Vd=25 mph				Vd=30 mph				Vd=35 mph				Vd=40 mph				Vd=45 mph				Vd=50 mph				e (%)
	R (FT.)		L (FT.)		R (FT.)		L (FT.)		R (FT.)		L (FT.)		R (FT.)		L (FT.)		R (FT.)		L (FT.)		R (FT.)		L (FT.)		R (FT.)		L (FT.)						
	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS					
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								
4.6	215<-235	71	106	384<-418	75	112	585<-630	79	118	834<-893	84	125	1130<-1200	89	134	1470<-1560	95	143	1850<-1960	102	153	2280<-2410	110	166	4.6								
4.8	193<-215	74	111	349<-384	78	117	542<-585	82	123	779<-834	87	131	1060<-1130	93	139	1390<-1470	99	149	1750<-1850	107	160	2160<-2280	115	173	4.8								
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								

e = SUPERELEVATION RATE  
 R - RADIUS OF CURVE  
 Vd - ASSUMED DESIGN SPEED  
 L - LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH  
 LN - TRAVEL LANE

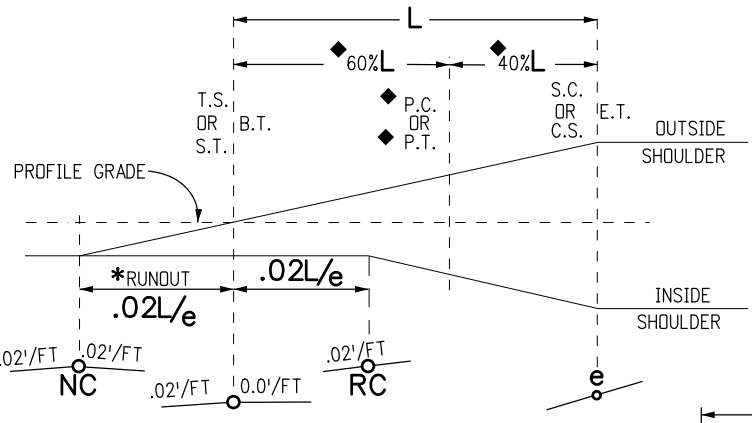
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>		<b>SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS</b>			<b>STANDARD PLAN NO. M-203-11</b> <b>Standard Sheet No. 1 of 3</b>	
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:							
Last Modification Date: 07/31/19	Detailer Initials: LTA									
CAD Ver.: MicroStation V8   Scale: Not to Scale   Units: English										



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  $.04L/e$ .

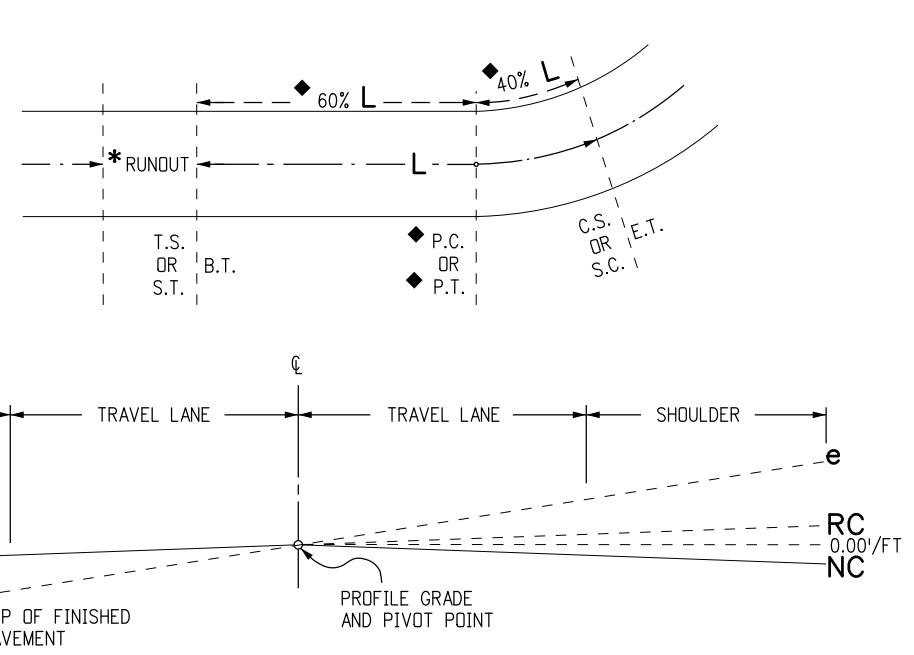
\* RUNOUT LENGTH SHOULD USUALLY BE  $.02L/e$ . WHEN CONDITIONS ARE SUCH THAT THIS LENGTH IS NOT SUITABLE, THE DESIGNER SHALL CHOOSE ANOTHER LENGTH TO SUIT CONDITIONS.

○ = 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.

e (%)	V <sub>d</sub> = 50 mph			V <sub>d</sub> = 55 mph			V <sub>d</sub> = 60 mph			V <sub>d</sub> = 65 mph			V <sub>d</sub> = 70 mph			V <sub>d</sub> = 75 mph			V <sub>d</sub> = 80 mph			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	
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  
V<sub>d</sub> - 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**

- 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.
- VALUES ARE FOR DESIGN ELEMENTS RELATED TO DESIGN SPEED AND HORIZONTAL CURVATURE FOR 2-LANE AND 4-LANE HIGHWAYS.
- 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.
- 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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Date:	Comments
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(R-X)	
(R-X)	
(R-X)	

Colorado Department of Transportation

2829 West Howard Place  
CDOT HQ, 3rd Floor  
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**Project Development Branch JBK**

**SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS**

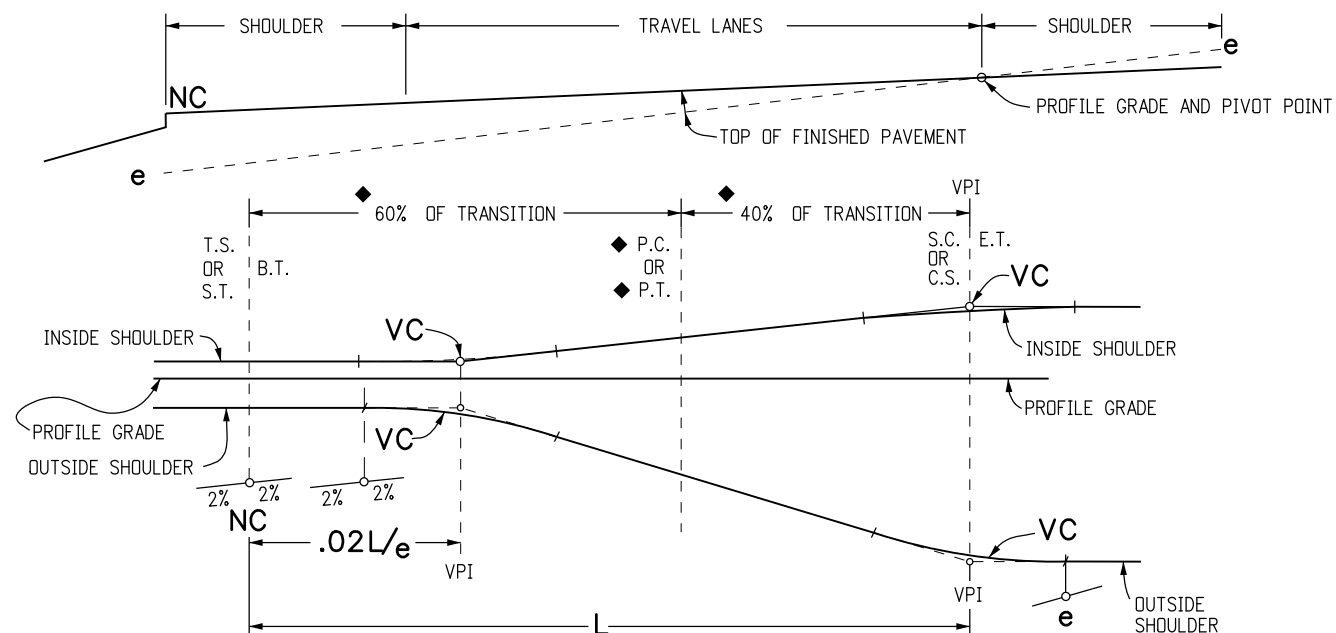
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

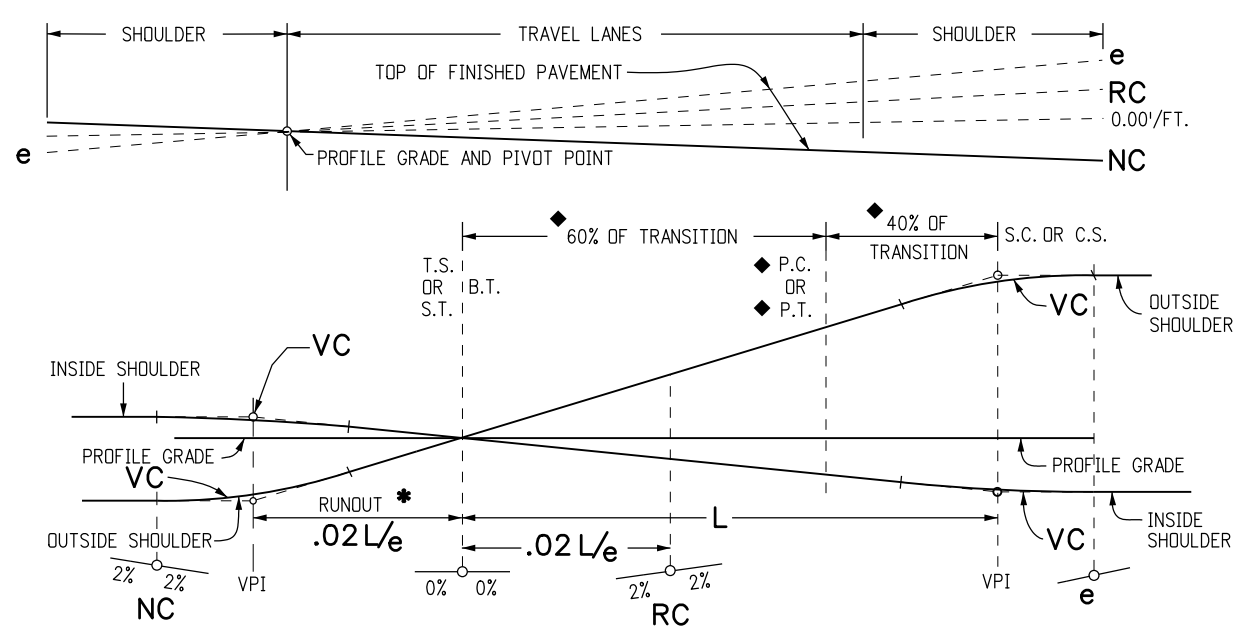
**M-203-11**

**Standard Sheet No. 2 of 3**

Project Sheet Number:



DIAGRAMMATIC PROFILE FOR SUPERELEVATION OF INSIDE LANES



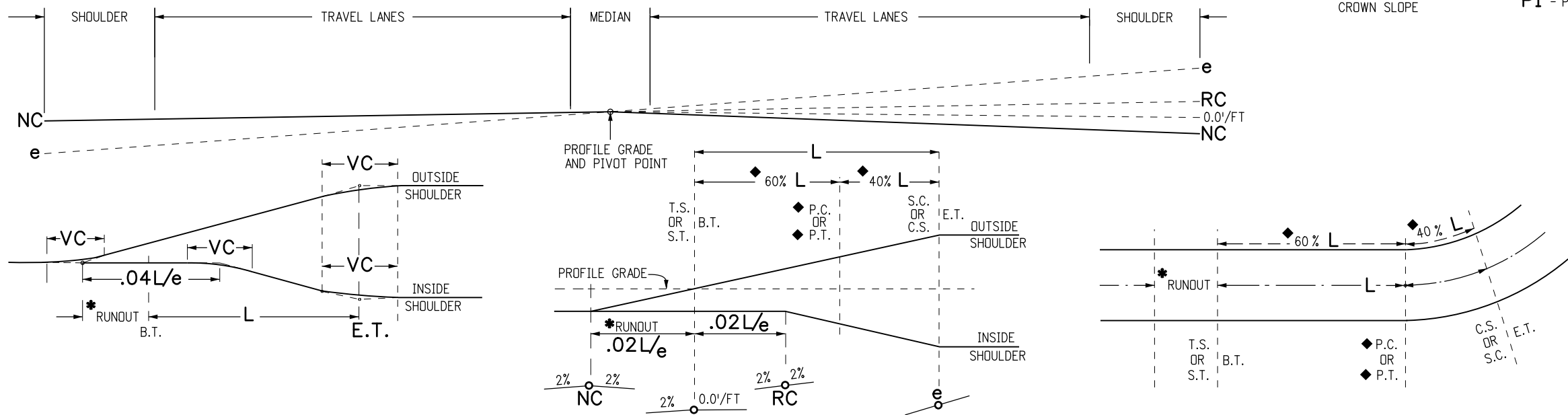
DIAGRAMMATIC PROFILE FOR SUPERELEVATION OF OUTSIDE LANES

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  $.04L/e$ .

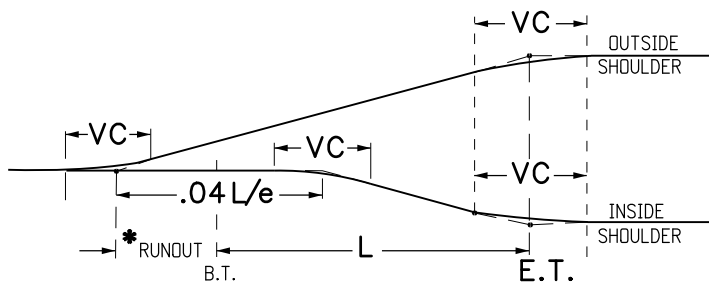
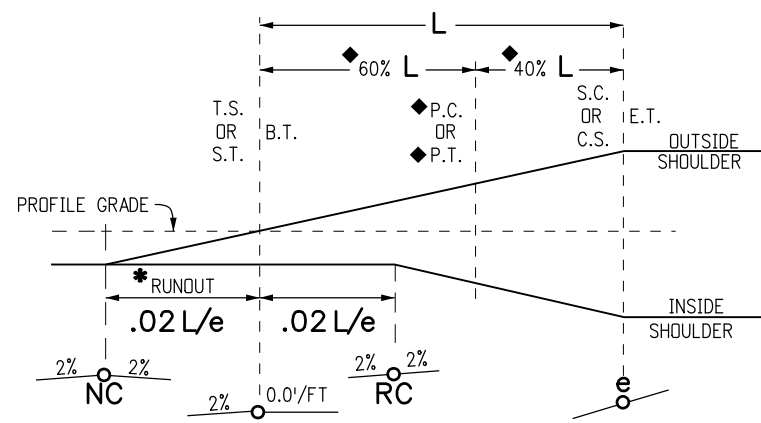
- R - RADIUS OF CURVE
- $V_d$  - ASSUMED DESIGN SPEED
- L - LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH
- NC - NORMAL CROWN SECTION
- RC - REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE
- VC - VERTICAL CURVE
- BT - BEGINNING OF TRANSITION
- ET - ENDING OF TRANSITION
- TS - TANGENT TO SPIRAL
- 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  $.02 L/e$ . WHEN CONDITIONS ARE SUCH THAT THIS LENGTH IS NOT SUITABLE, THE DESIGNER SHALL CHOOSE ANOTHER LENGTH TO SUIT CONDITIONS.

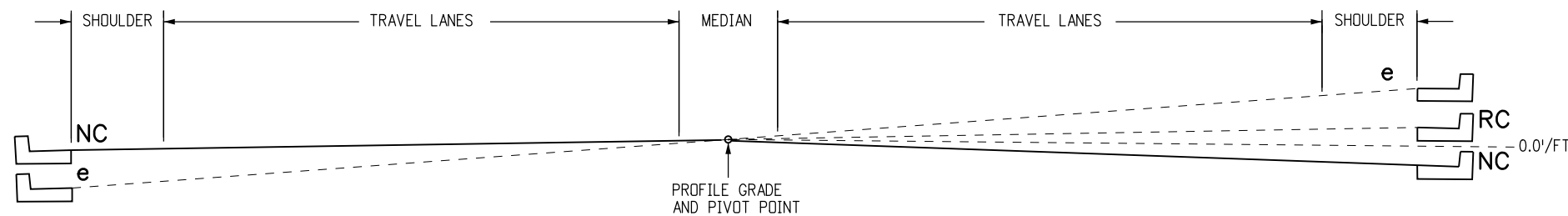
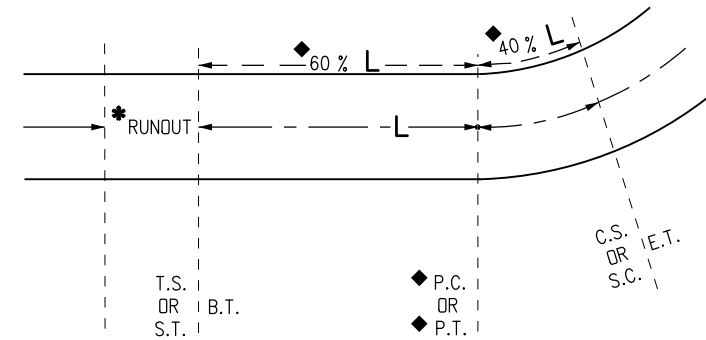


SUPERELEVATION DIAGRAMS FOR DIVIDED HIGHWAY CENTER PIVOT

<b>Computer File Information</b> Creation Date: 07/31/19 Designer Initials: JBK Last Modification Date: 07/31/19 Detailer Initials: LTA CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		<b>Sheet Revisions</b> <table border="1"> <thead> <tr> <th>Date:</th> <th>Comments</th> </tr> </thead> <tbody> <tr> <td>(R-X)</td> <td></td> </tr> <tr> <td>(R-X)</td> <td></td> </tr> <tr> <td>(R-X)</td> <td></td> </tr> <tr> <td>(R-X)</td> <td></td> </tr> </tbody> </table>		Date:	Comments	(R-X)		(R-X)		(R-X)		(R-X)		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>		<b>SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS</b> Issued by the Project Development Branch: July 31, 2019		<b>STANDARD PLAN NO.</b> M-203-11 <b>Standard Sheet No. 3 of 3</b> Project Sheet Number:	
Date:	Comments																		
(R-X)																			
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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  $.04L/e$ .



### SUPERELEVATION DIAGRAMS

$e_{max} = 4\%$

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

e (%)	V <sub>d</sub> = 15 mph			V <sub>d</sub> = 20 mph			V <sub>d</sub> = 25 mph			V <sub>d</sub> = 30 mph			V <sub>d</sub> = 35 mph			V <sub>d</sub> = 40 mph			V <sub>d</sub> = 45 mph			V <sub>d</sub> = 50 mph			V <sub>d</sub> = 55 mph			V <sub>d</sub> = 60 mph			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	
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

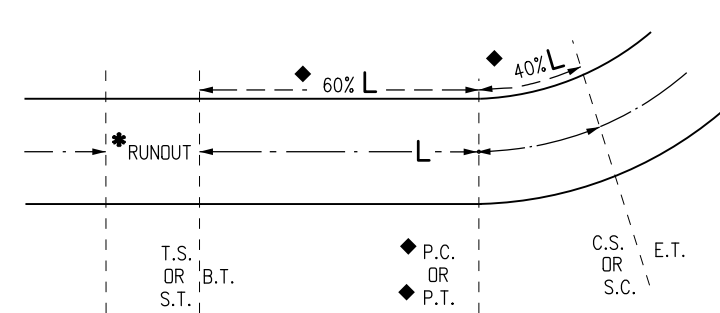
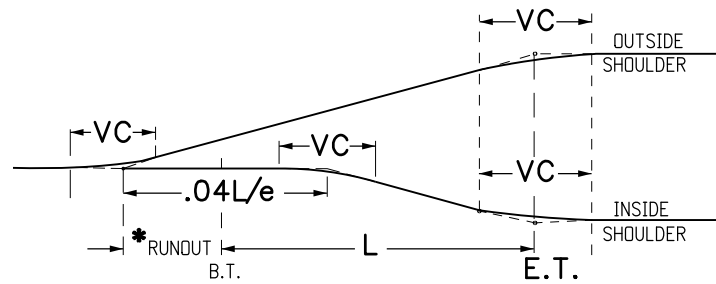
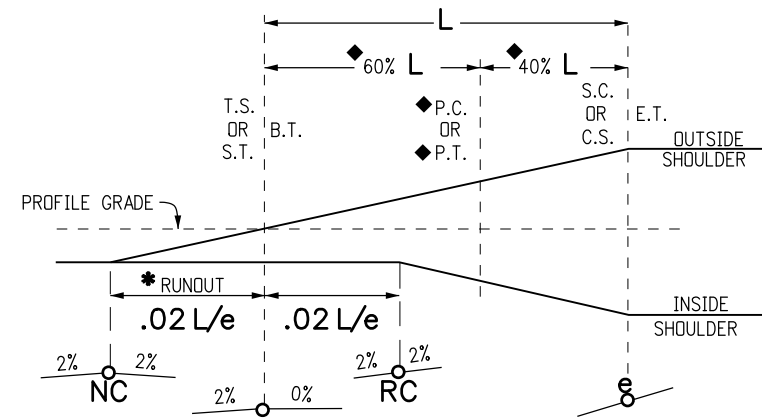
- o = PIVOT
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### SUPERELEVATION NOTES

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.
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  - 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.

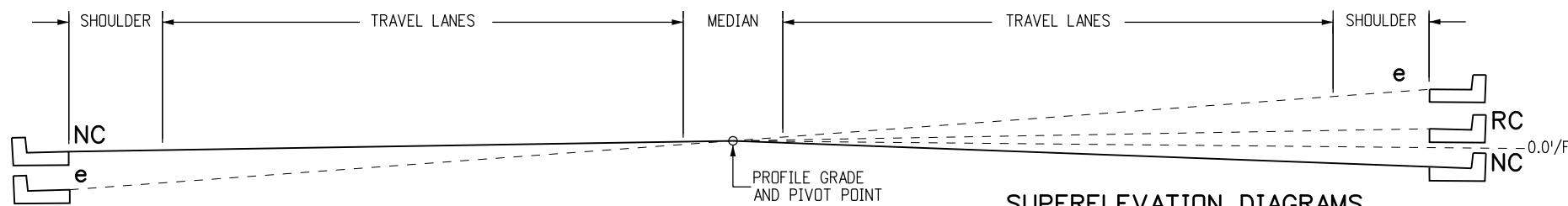
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Date:	Comments											
Issued by the Project Development Branch: July 31, 2019												



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### SUPERELEVATION DIAGRAMS

e<sub>max</sub> = 6%

e (%)	V <sub>d</sub> = 15 mph		V <sub>d</sub> = 20 mph		V <sub>d</sub> = 25 mph		V <sub>d</sub> = 30 mph		V <sub>d</sub> = 35 mph		V <sub>d</sub> = 40 mph		V <sub>d</sub> = 45 mph		V <sub>d</sub> = 50 mph		V <sub>d</sub> = 55 mph		V <sub>d</sub> = 60 mph		e (%)
	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	R (FT.)	L (FT.)	
	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	1 LN	2 LNS	
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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
2.8	384-430	43 65	709-791	45 68	1050-1170	48 72	1460-1610	51 76	1930-2130	54 81	2490-2740	58 87	3110-3420	62 93	3800-4170	67 101	4580-5020	71 107	5440-5950	75 112	2.8
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3.4	256-300	52 78	498-566	55 83	761-850	58 87	1080-1200	62 93	1460-1600	66 99	1900-2080	70 106	2390-2600	76 113	2940-3200	82 122	3560-3860	87 130	4250-4600	91 136	3.4
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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
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### 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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Last Modification Date: 07/31/19	
Detailer Initials: LTA	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	

Sheet Revisions	
Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868

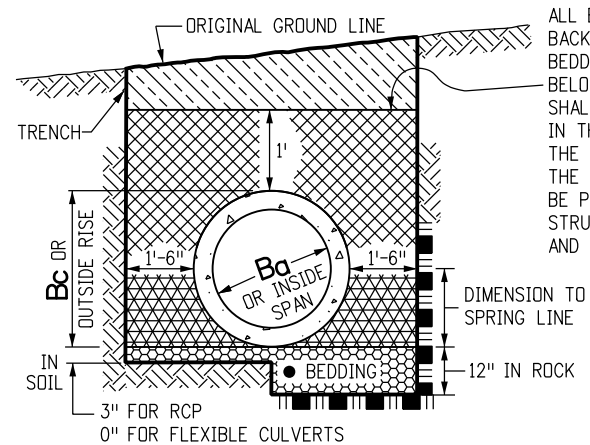
Project Development Branch JBK

# SUPERELEVATION STREETS

Issued by the Project Development Branch: July 31, 2019

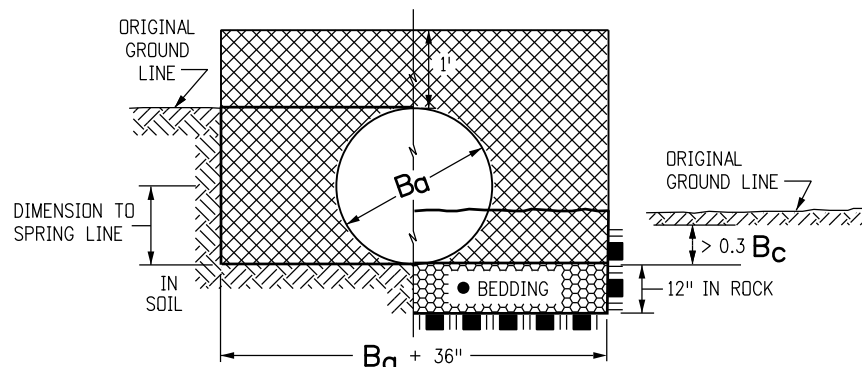
STANDARD PLAN NO.  
 M-203-12  
 Standard Sheet No. 2 of 2  
 Project Sheet Number:





**PIPE IN TRENCH**

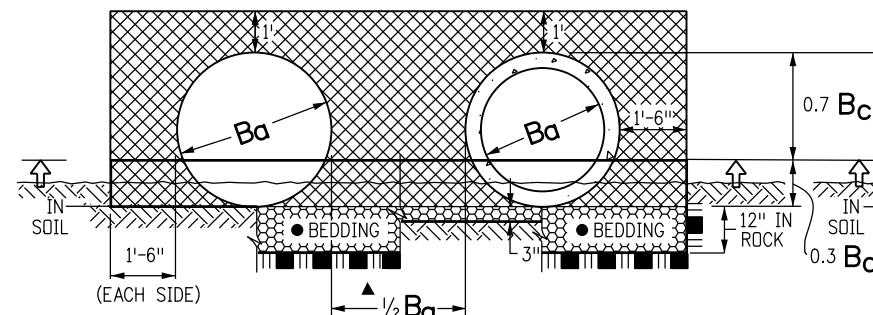
- THE BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OF LOOSE STRUCTURE BACKFILL, CLASS 1.



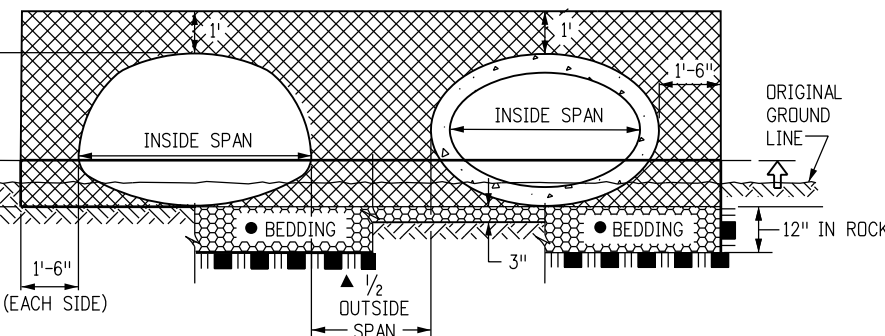
**CIRCULAR PIPE**

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

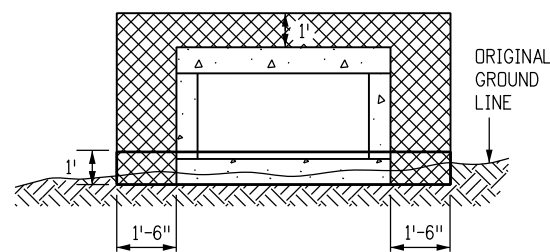
- ▲ WHEN TWO OR MORE CONDUITS ARE LAID SIDE-BY-SIDE, THEY SHALL BE PLACED SO THAT THEY ARE  $\frac{1}{2}$  OUTSIDE DIAMETER, OR  $\frac{1}{2}$  OUTSIDE SPAN, OR 3 FT. APART, WHICHEVER IS LESS. HOWEVER, IF END SECTIONS ARE USED, THE MINIMUM SPACING SHALL BE 1 FT. BETWEEN END SECTIONS.



**CIRCULAR PIPE IN FILL**

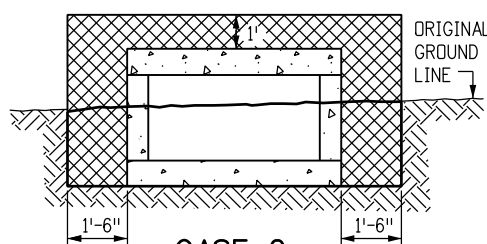


**ARCH OR ELLIPTICAL PIPE IN FILL**



**CASE 1**

APPLIES WHEN THE ORIGINAL GROUND LINE IS LESS THAN 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.

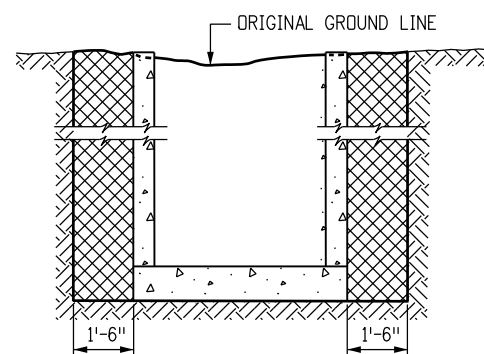


**CASE 2**

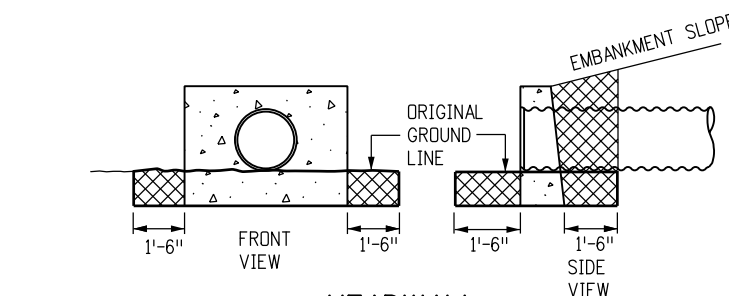
APPLIES WHEN THE ORIGINAL GROUND LINE IS MORE THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT.

**CONCRETE BOX CULVERT**

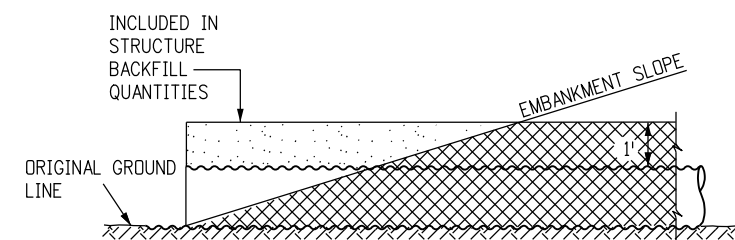
IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.



**DROP INLETS AND DIVISION BOXES**



**HEADWALL**



**END OF PIPE**

**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.  $B_o$  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  $B_o = B_c$ .
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**

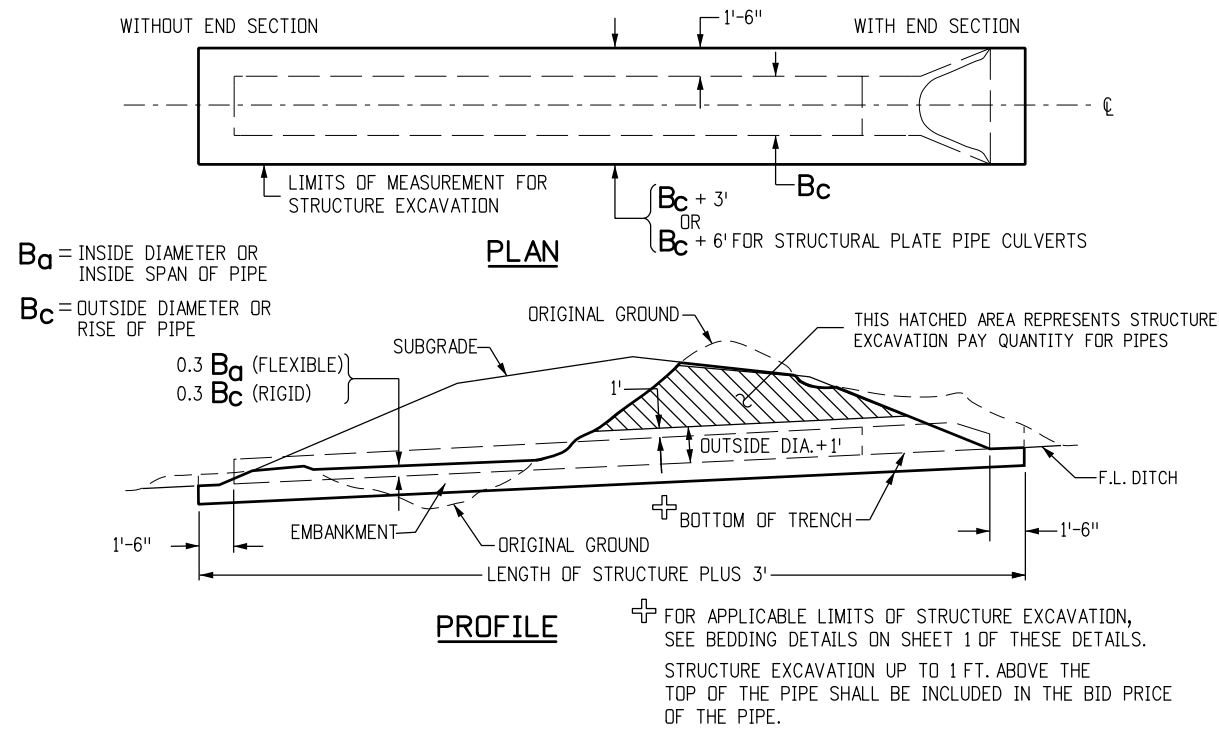
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Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

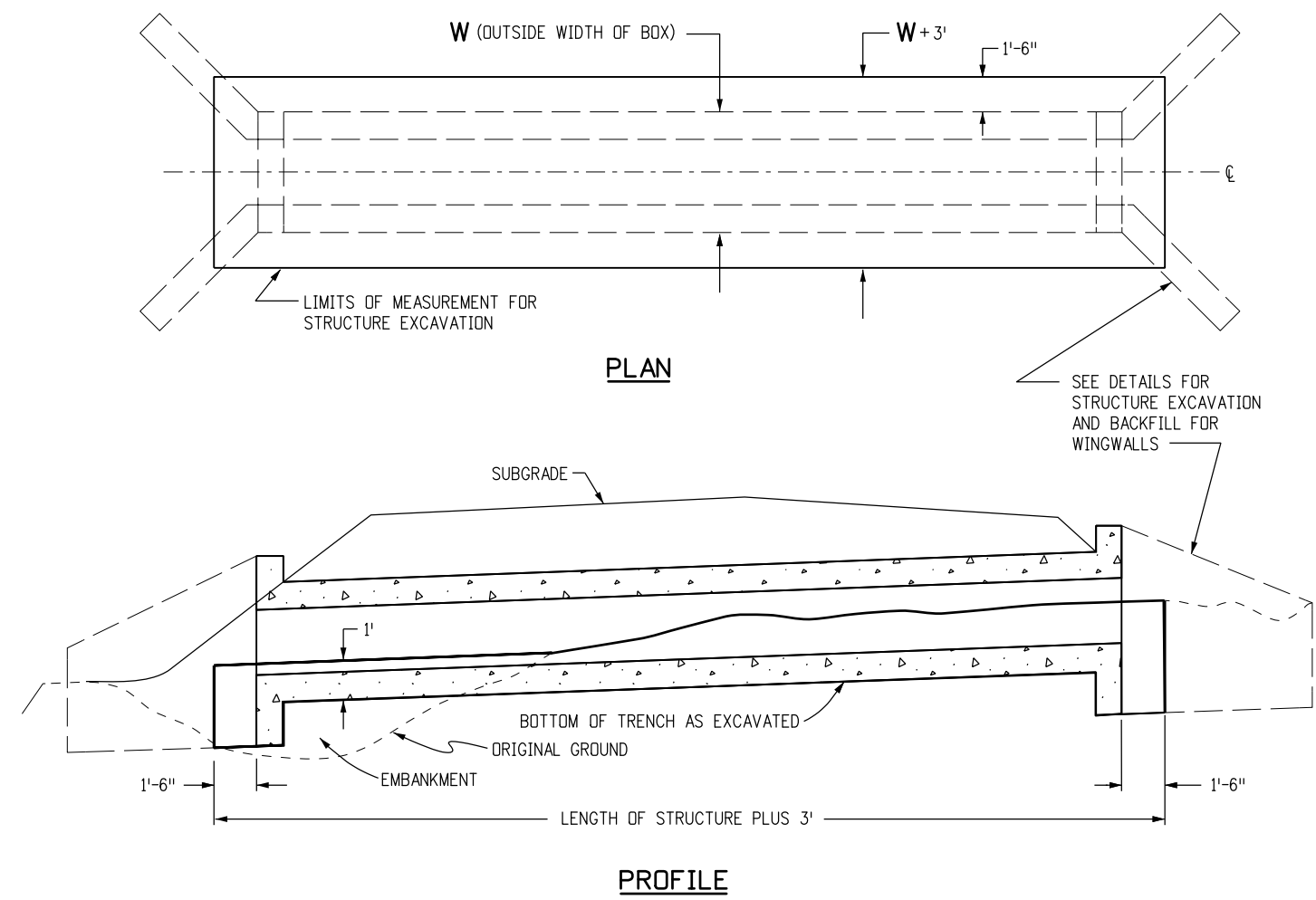
Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**EXCAVATION AND BACKFILL FOR STRUCTURES**  
 Issued by the Project Development Branch: July 31, 2019

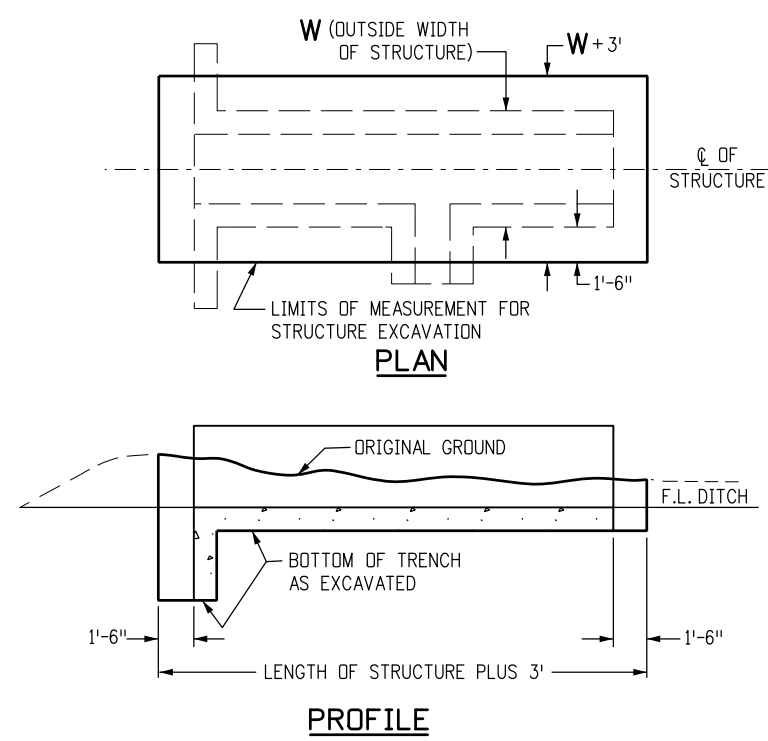
**STANDARD PLAN NO. M-206-1**  
 Standard Sheet No. 1 of 2  
 Project Sheet Number:



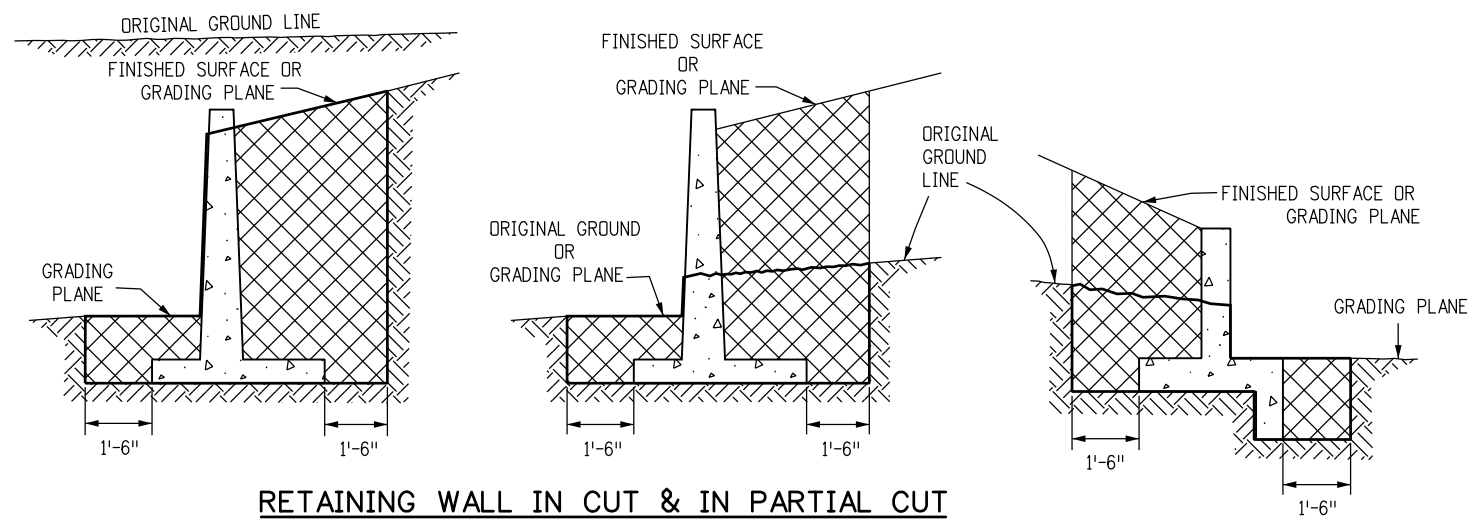
**STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS**



**STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS**



**STRUCTURE EXCAVATION MEASUREMENT FOR DIVISION BOXES**



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

**Computer File Information**

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

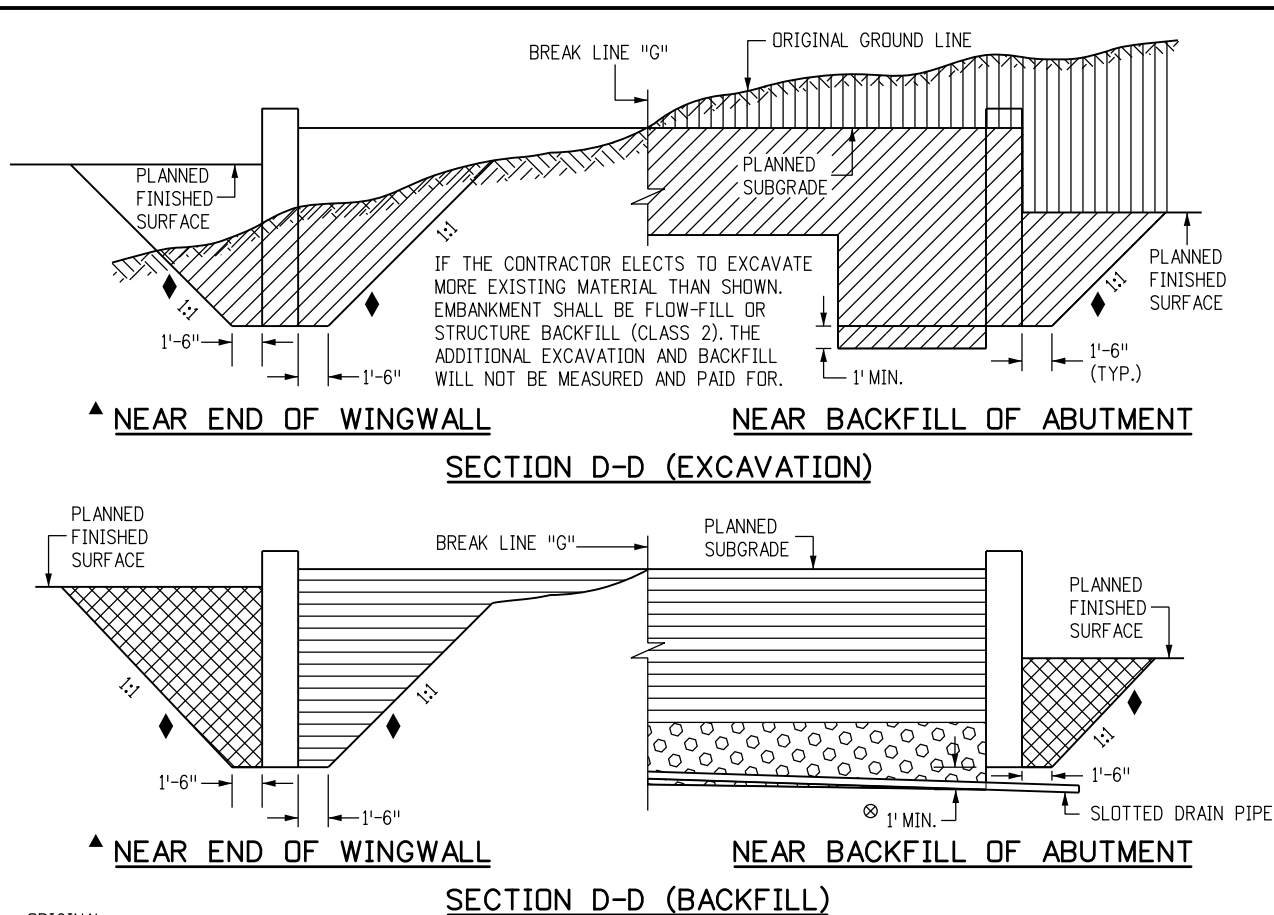
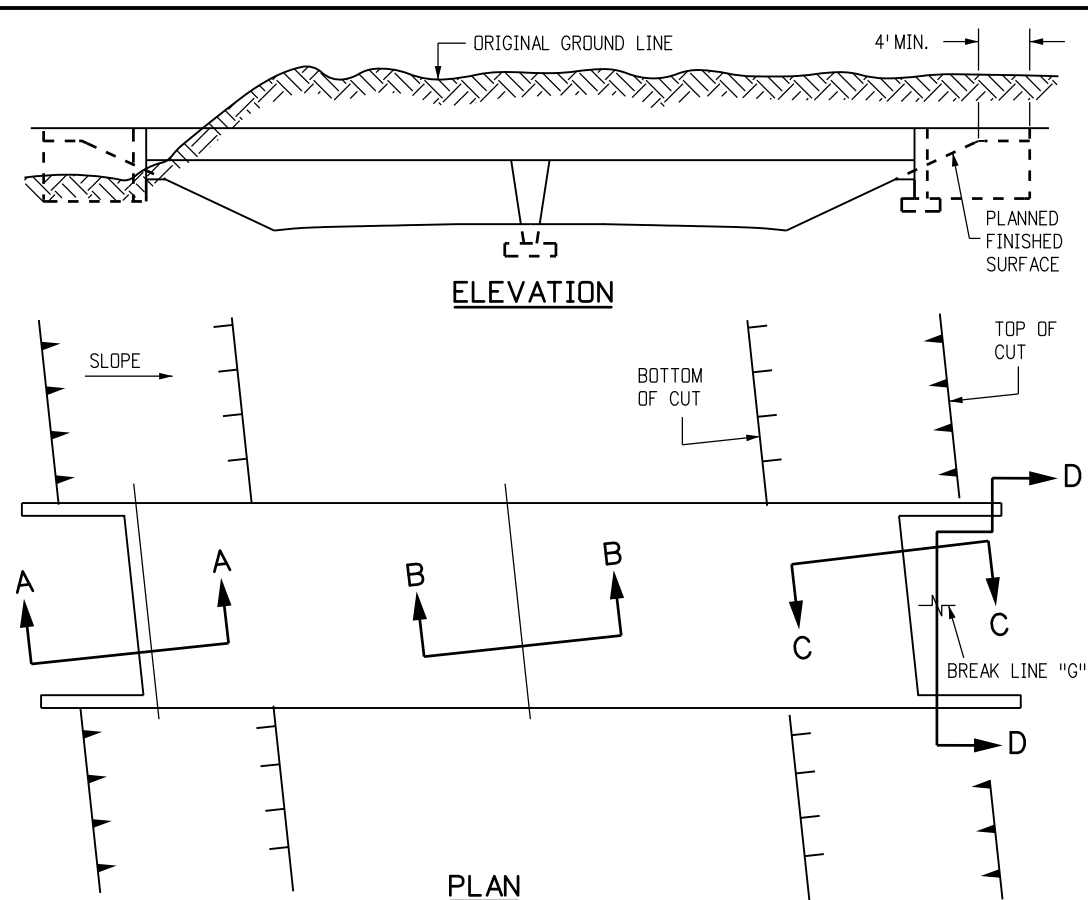
**Sheet Revisions**

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

**Colorado Department of Transportation**  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
**Project Development Branch** **JBK**

**EXCAVATION AND BACKFILL FOR STRUCTURES**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
**M-206-1**  
**Standard Sheet No. 2 of 2**  
 Project Sheet Number:



**GENERAL NOTES**

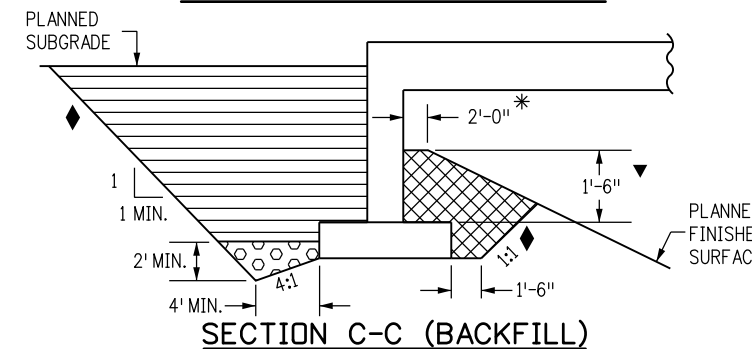
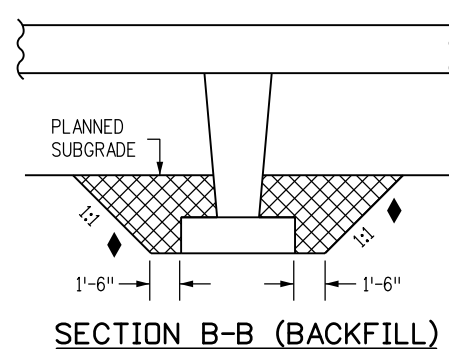
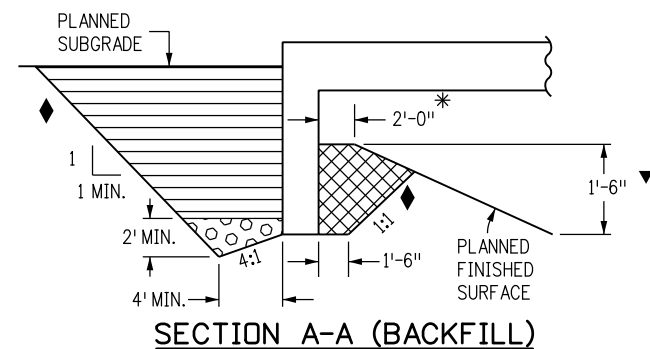
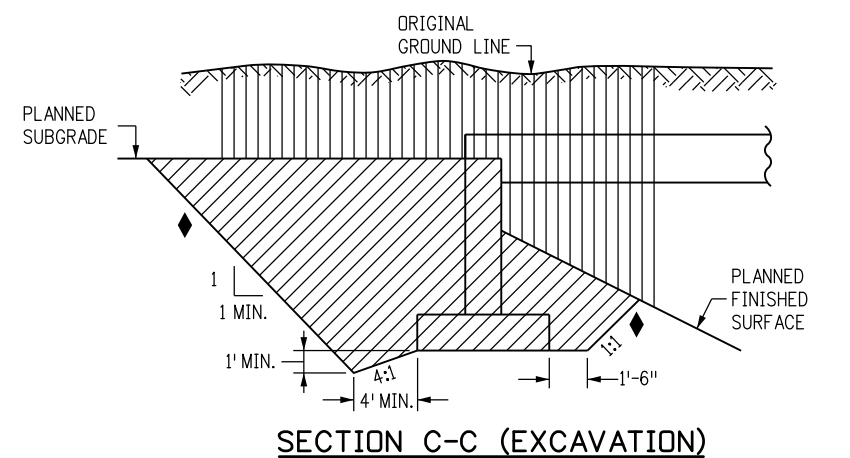
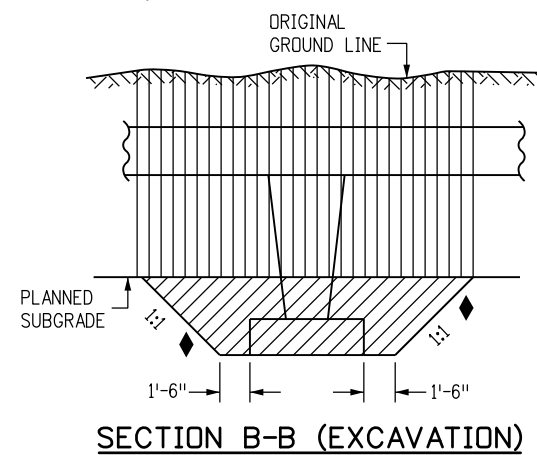
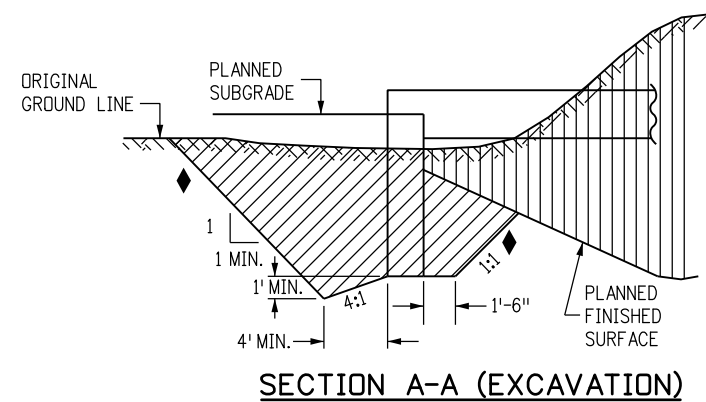
- EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THIS SHEET WILL BE SHOWN ON THE PLANS.
- STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING, IN CONFORMANCE WITH SUBSECTION 601.09(b).
- STRUCTURE EXCAVATION FOR SLOPE PAVING NOT SHOWN.

**LEGEND**

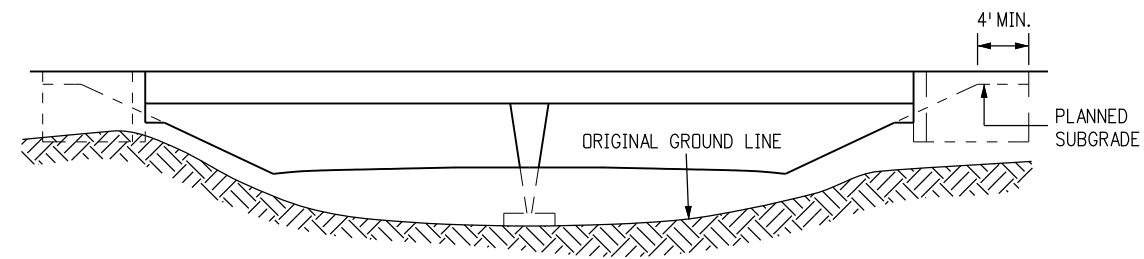
- UNCLASSIFIED EXCAVATION
- STRUCTURE EXCAVATION
- STRUCTURE BACKFILL (FLOW-FILL), OR STRUCTURE BACKFILL (CLASS 1) WITH MECHANICAL REINFORCEMENT AS SHOWN ON THE PLANS
- STRUCTURE BACKFILL CLASS 1
- FILTER MATERIAL

- ▲ FOR PURPOSES OF QUANTITY CALCULATIONS THIS TEMPLATE APPLIES TO END OF WINGWALL.
- ⊗ SLOPE TO DRAIN.
- ◆ SLOPE FOR PAY LIMITS OF EXCAVATION AND BACKFILL.

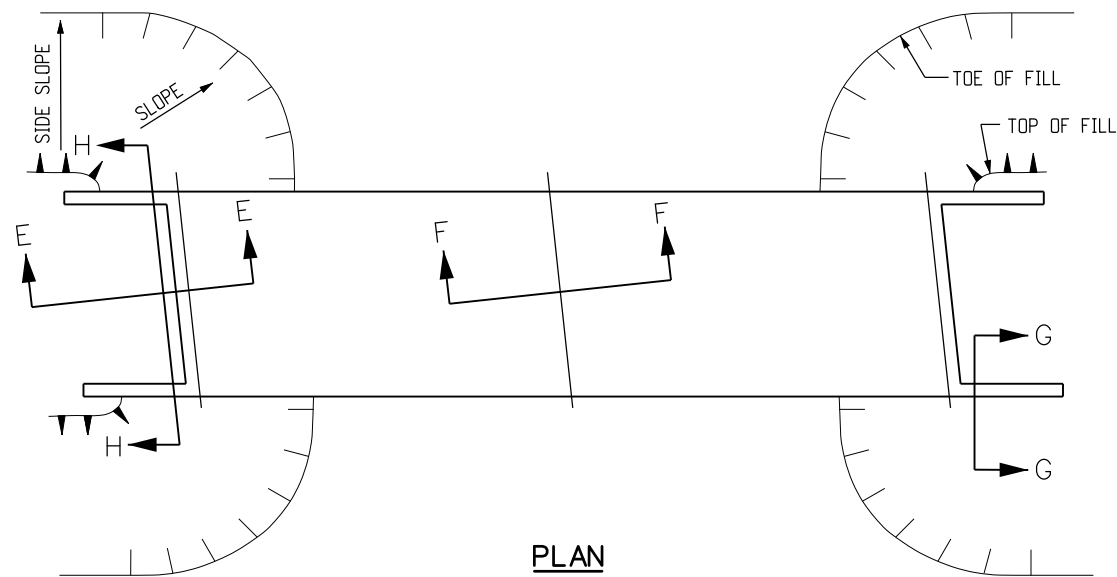
- \* MINIMUM BERM DIMENSION
- ▼ MINIMUM EMBEDMENT OF ABUTMENT, IN STRUCTURE BACKFILL



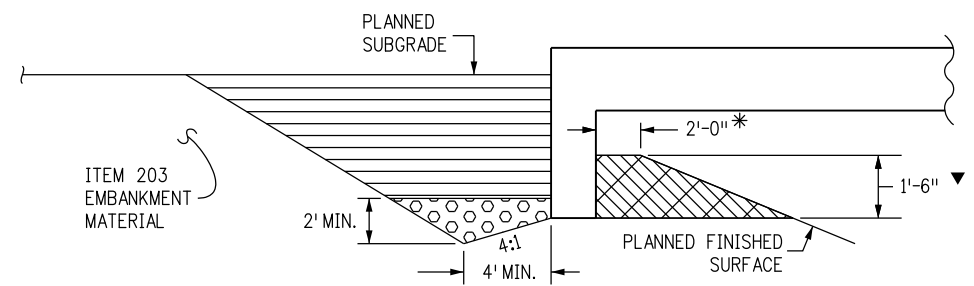
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch <b>JBK</b>	<b>EXCAVATION AND BACKFILL FOR BRIDGES</b>	<b>STANDARD PLAN NO.</b>
Creation Date: 07/31/19		Date:	Comments:			<b>M-206-2</b>
Designer Initials: JBK	(R-X)					<b>Standard Sheet No. 1 of 2</b>
Last Modification Date: 07/31/19	(R-X)					
Detailer Initials: LTA	(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	



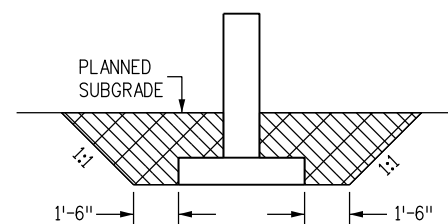
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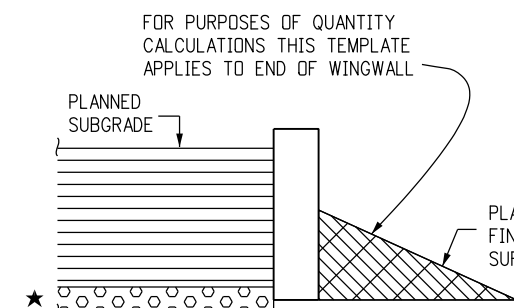
**PLAN**



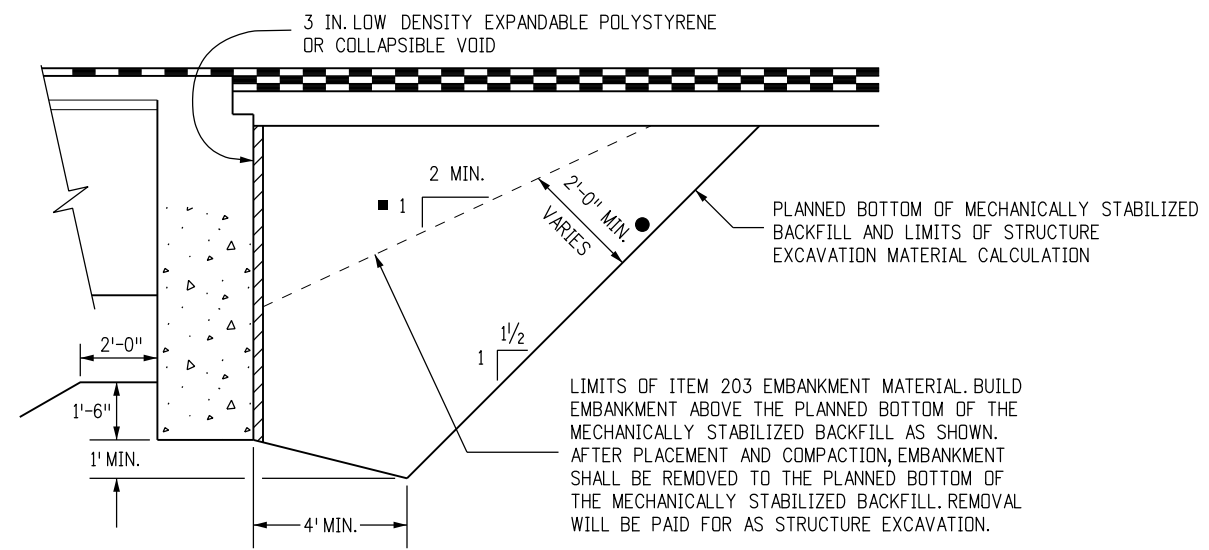
**SECTION E-E (BACKFILL)**



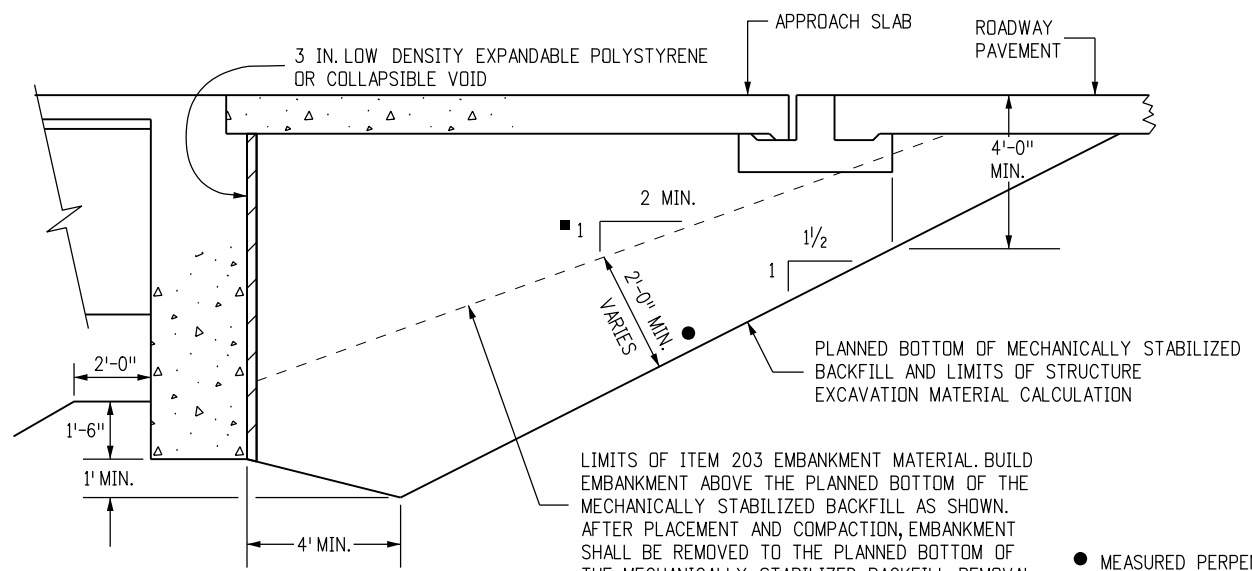
**SECTION F-F (BACKFILL)**



**SECTION G-G (BACKFILL)**



**SECTION H-H (BACKFILL)**



**DETAIL 1**

(WITH APPROACH SLAB)

LIMITS OF ITEM 203 EMBANKMENT MATERIAL. BUILD EMBANKMENT ABOVE THE PLANNED BOTTOM OF THE MECHANICALLY STABILIZED BACKFILL AS SHOWN. AFTER PLACEMENT AND COMPACTION, EMBANKMENT SHALL BE REMOVED TO THE PLANNED BOTTOM OF THE MECHANICALLY STABILIZED BACKFILL. REMOVAL WILL BE PAID FOR AS STRUCTURE EXCAVATION.

- 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)

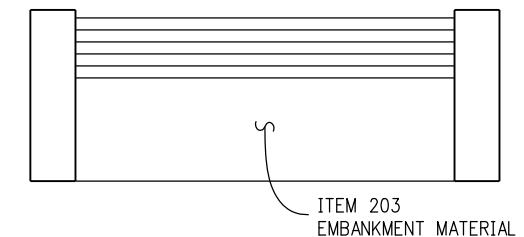
LIMITS OF ITEM 203 EMBANKMENT MATERIAL. BUILD EMBANKMENT ABOVE THE PLANNED BOTTOM OF THE MECHANICALLY STABILIZED BACKFILL AS SHOWN. AFTER PLACEMENT AND COMPACTION, EMBANKMENT SHALL BE REMOVED TO THE PLANNED BOTTOM OF THE MECHANICALLY STABILIZED BACKFILL. REMOVAL WILL BE PAID FOR AS STRUCTURE EXCAVATION.

**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)**

**Computer File Information**

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
(R-X)	
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(R-X)	
(R-X)	

**Colorado Department of Transportation**

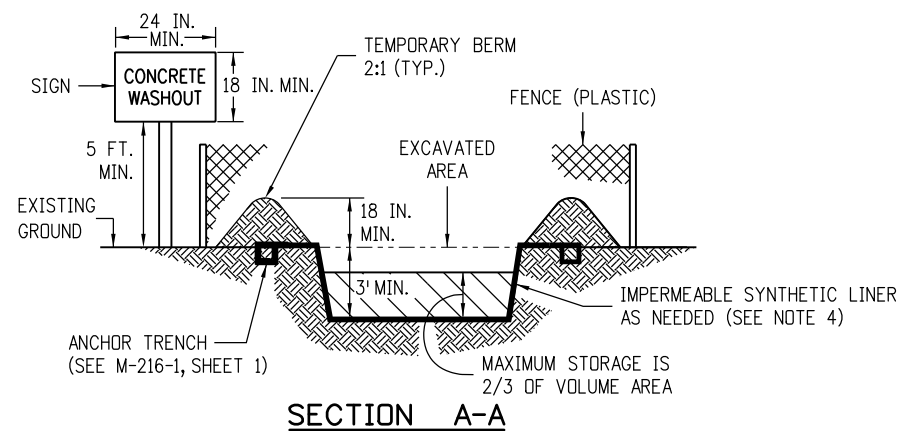
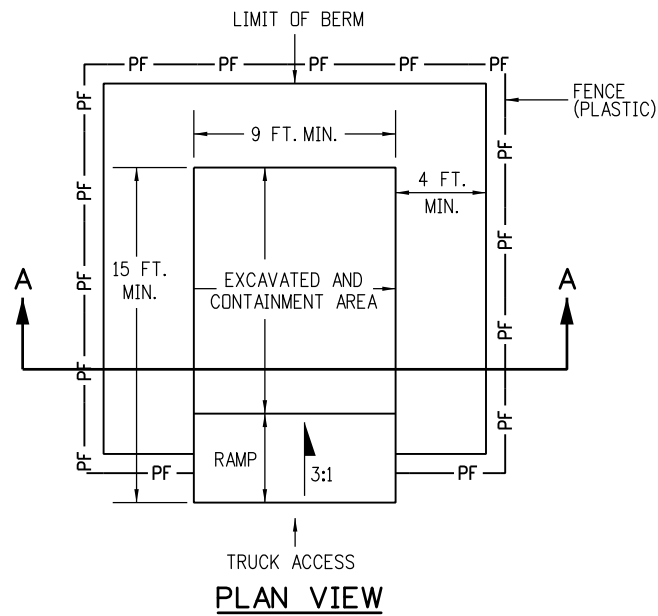
2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
**Project Development Branch** **JBK**

**EXCAVATION AND BACKFILL FOR BRIDGES**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

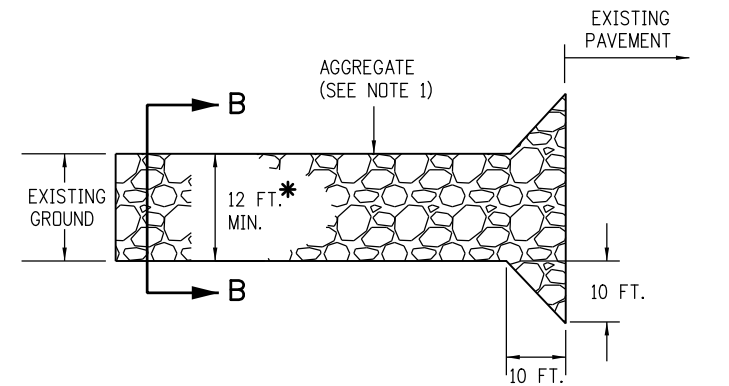
**M-206-2**  
**Standard Sheet No. 2 of 2**  
 Project Sheet Number:



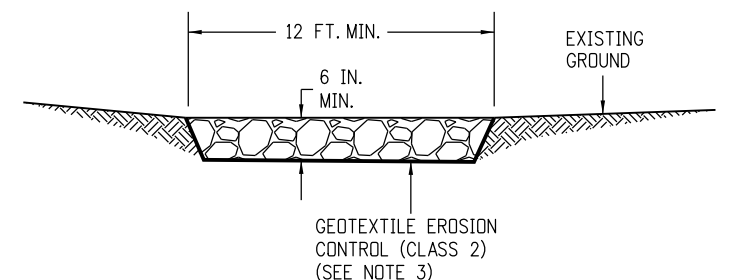
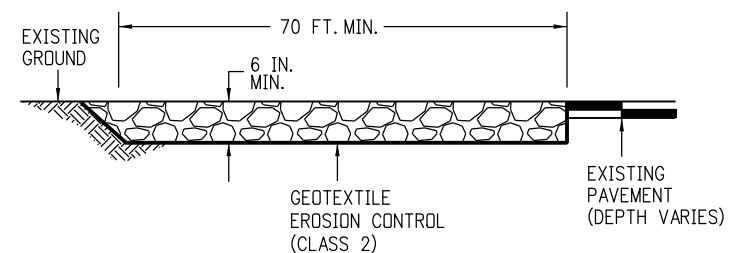
**NOTES:**

1. A FENCE (PLASTIC) CONFORMING TO SECTION 607 SHALL BE INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT AT THE OPENING.
2. THE CONCRETE WASHOUT SIGN SHALL HAVE LETTERS AT LEAST 3 INCHES HIGH AND CONFORM TO SUBSECTION 630.02.
3. ALL MATERIALS AND LABOR TO COMPLETE THE CONCRETE WASHOUT STRUCTURE SHALL BE INCLUDED IN THE COST OF WORK AND NOT PAID FOR SEPARATELY.
4. THE BOTTOM OF EXCAVATION SHALL BE A MINIMUM OF FIVE FEET ABOVE GROUND WATER. IF NOT, THE BOTTOM OF EXCAVATION SHALL BE IN ACCORDANCE WITH 208.02 (j).
5. THE PAY ITEM NUMBER FOR CONCRETE WASHOUT STRUCTURE (EACH) IS 208-00045.

**CONCRETE WASHOUT STRUCTURE**



\* SHALL EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION.

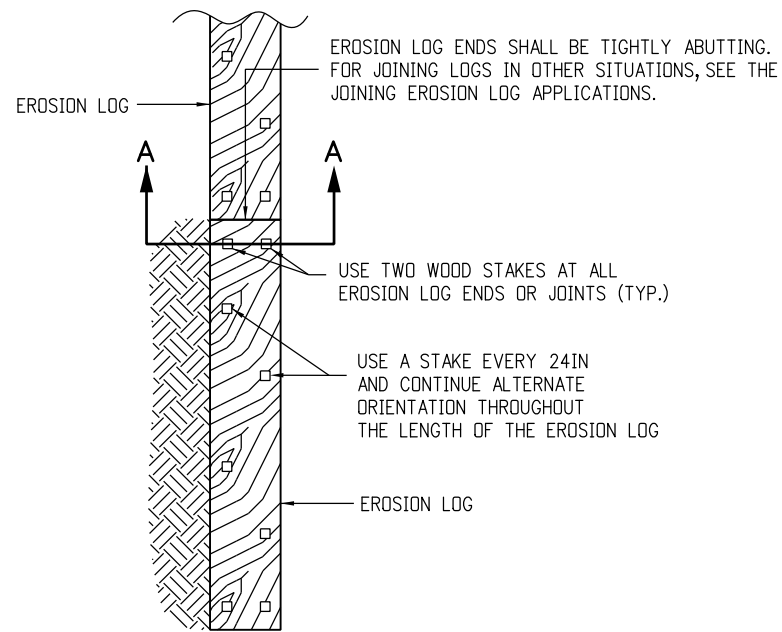


**NOTES:**

1. AGGREGATE SHALL CONFORM TO SUBSECTION 208.02 (i).
2. THE CONTRACTOR SHALL PROTECT CURB AND GUTTER THAT CROSSES THE ENTRANCE FROM DAMAGE, WHILE NOT BLOCKING FLOW OF WATER THRU STRUCTURE. PROTECTION OF THE CURB AND GUTTER SHALL BE INCLUDED IN THE COST OF WORK AND NOT PAID FOR SEPARATELY.
3. GEOTEXTILE SHALL CONFORM TO SUBSECTION 712.08.
4. ALL MATERIALS AND LABOR TO COMPLETE THE VEHICLE TRACKING PAD SHALL BE INCLUDED IN THE COST OF WORK AND NOT PAID FOR SEPARATELY.
5. THE PAY ITEM NUMBER FOR VEHICLE TRACKING PAD (EACH) IS 208-00070.

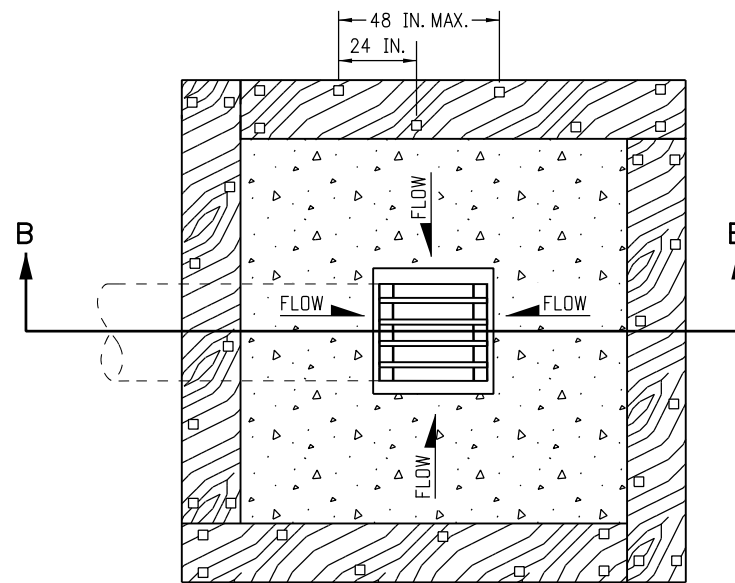
**VEHICLE TRACKING PAD**

<b>Computer File Information</b>		<b>Sheet Revisions</b>	<b>Colorado Department of Transportation</b>	<b>TEMPORARY EROSION CONTROL</b>		<b>STANDARD PLAN NO. M-208-1</b>	
Creation Date: 07/31/19		Date:                      Comments	 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868	Issued by the Project Development Branch: July 31, 2019		Standard Sheet No. 1 of 11  Project Sheet Number:	
Designer Initials: JBK	(R-X)				<b>Project Development Branch</b>		<b>JBK</b>
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8    Scale: Not to Scale    Units: English	(R-X)						

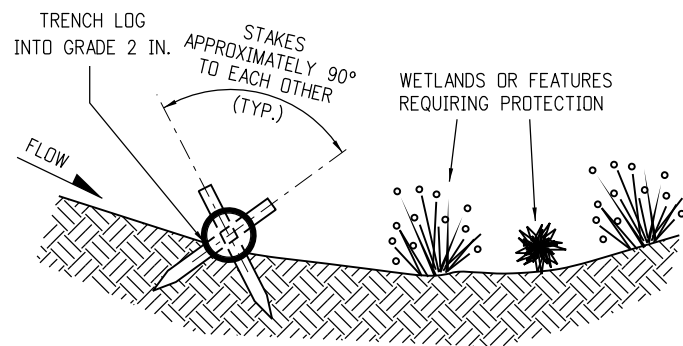


**PLAN VIEW**

EROSION LOGS PAY ITEMS	
NUMBER	DESCRIPTION
208-00012	TYPE 1 (9 IN.)
208-00002	TYPE 1 (12 IN.)
208-00013	TYPE 1 (20 IN.)
208-00007	TYPE 2 (8 IN.)
208-00008	TYPE 2 (12 IN.)
208-00009	TYPE 2 (18 IN.)
208-00022	TYPE 3 (9 IN.)
208-00023	TYPE 3 (12 IN.)
208-00024	TYPE 3 (20 IN.)



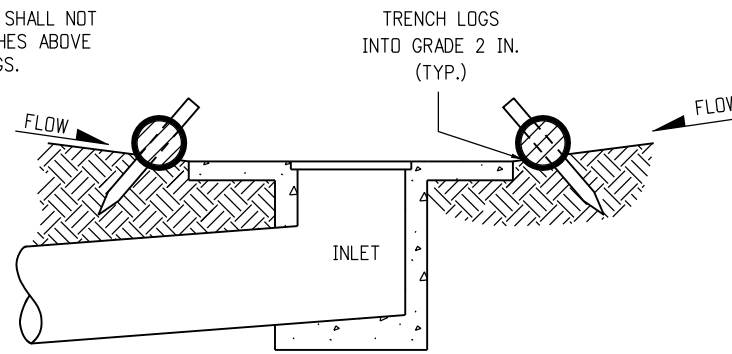
**PLAN VIEW**



**SECTION A-A**

**TYPICAL STAKE INSTALLATION**

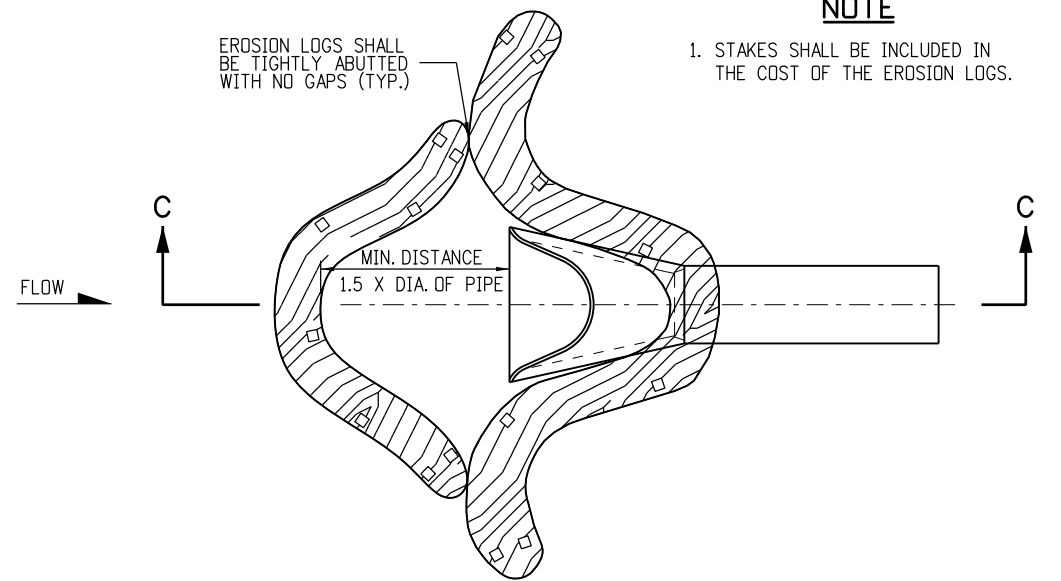
NOTE: THE TOPS OF ALL STAKES SHALL NOT EXTEND MORE THAN 2 INCHES ABOVE THE TOPS OF EROSION LOGS.



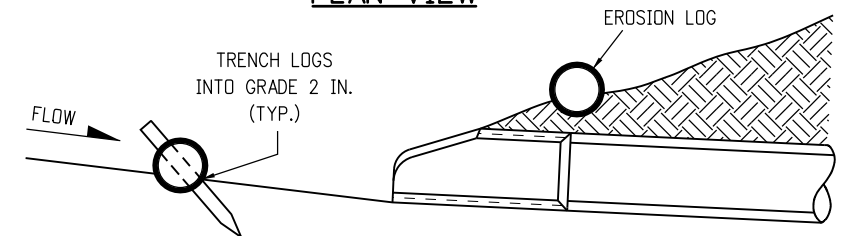
**SECTION B-B**

**EROSION LOG FILTER AT DROP INLET**

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



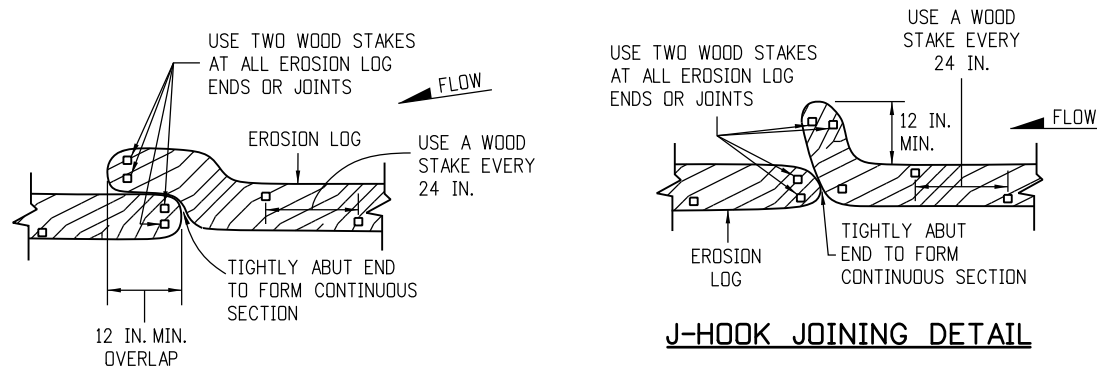
**PLAN VIEW**



**SECTION C-C**  
(NOT ALL LOGS SHOWN)

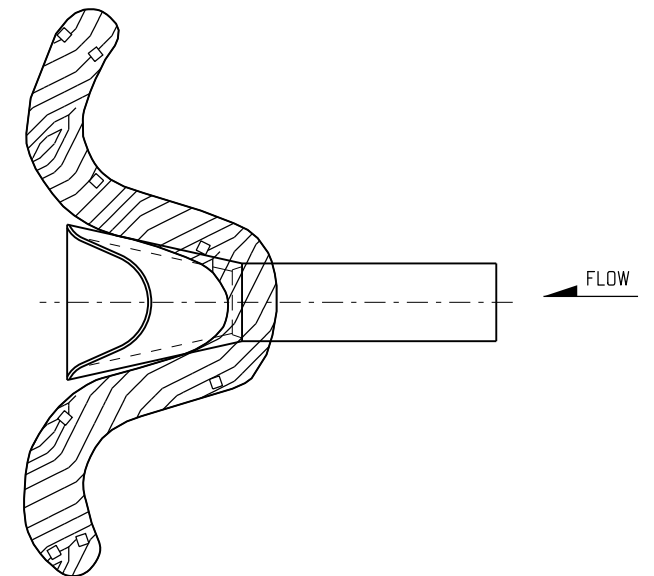
NOTE: TOP OF STAKE SHALL NOT EXTEND PAST TOP OF EROSION LOG MORE THAN 2 IN.

**EROSION LOG CULVERT INLET PROTECTION**



**OVERLAP JOINING DETAIL**

**JOINING EROSION LOG APPLICATIONS**



**EROSION LOG CULVERT OUTLET PROTECTION**

**EROSION LOG APPLICATIONS**

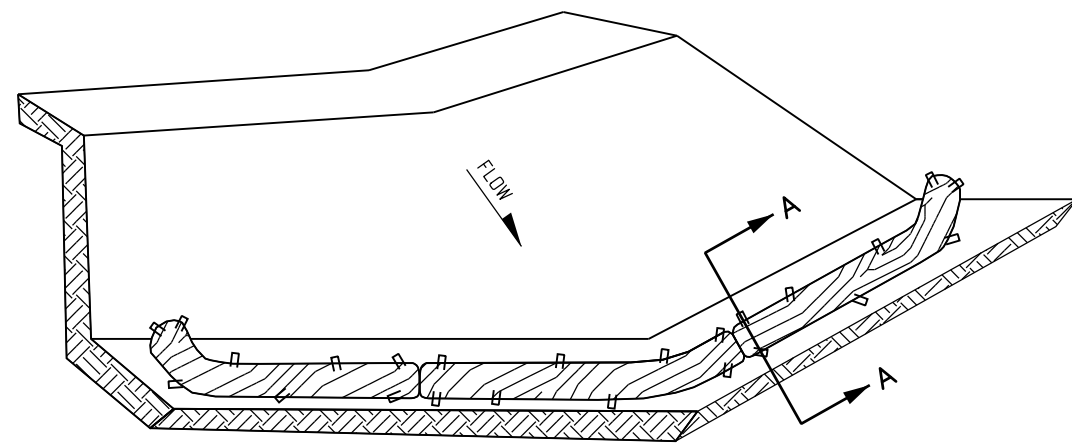
**NOTE**

1. STAKES SHALL BE INCLUDED IN THE COST OF THE EROSION LOGS.

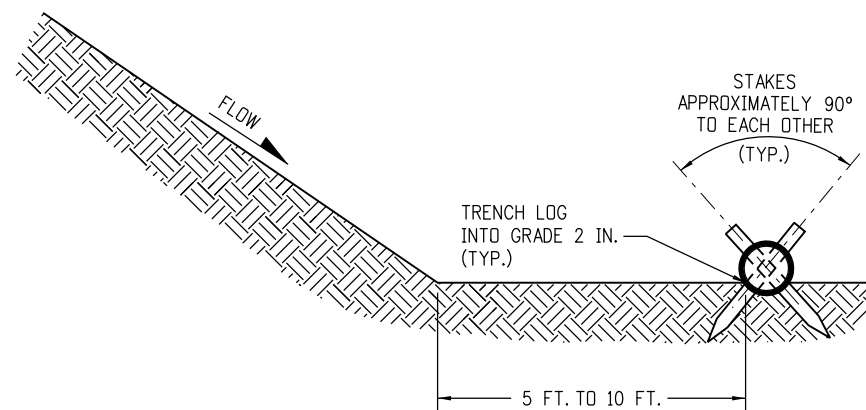
Computer File Information		Sheet Revisions		Colorado Department of Transportation 2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch	TEMPORARY EROSION CONTROL	STANDARD PLAN NO.	
Creation Date: 07/31/19	(R-X)	Date:	Comments				<p>Issued by the Project Development Branch: July 31, 2019</p>
Designer Initials: JBK	(R-X)			Standard Sheet No. 2 of 11			
Last Modification Date: 07/31/19	(R-X)			Project Sheet Number:			
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)					

**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.
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 PARALLEL TO THE CONTOUR WITH ENDS FLARED UP SLOPE.
4. THE MAXIMUM LENGTH OF EROSION LOGS OR SILT FENCES WITHOUT A FLARED END TURNING UPSLOPE IS 150 FEET.



**ISOMETRIC VIEW**



**SECTION A-A**

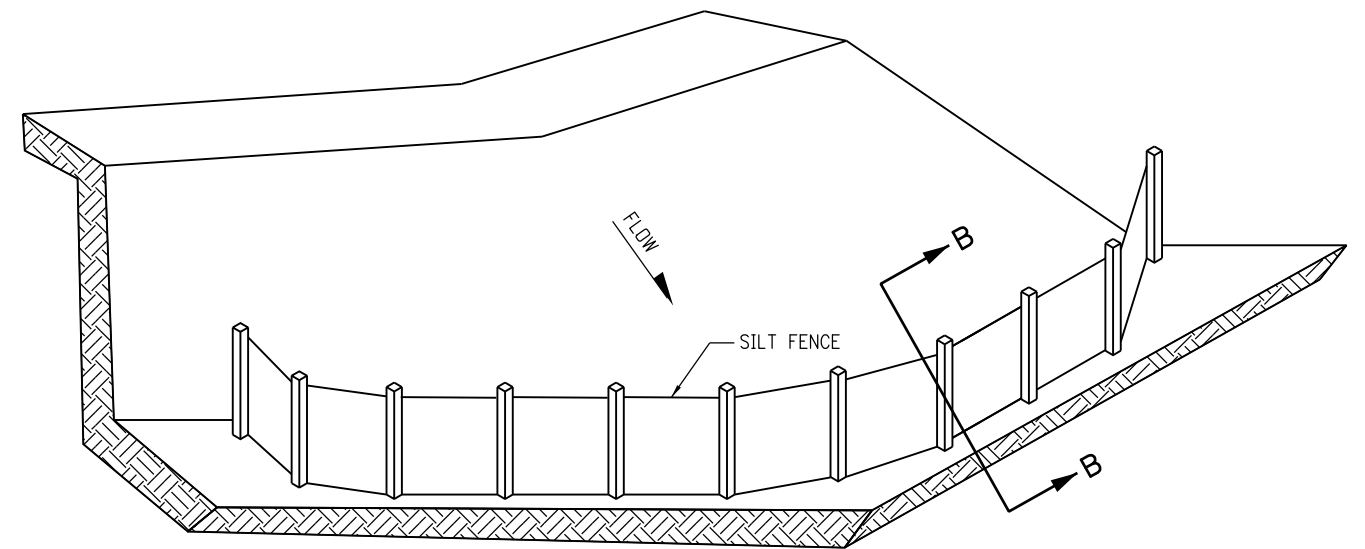
NOTE: THE TOPS OF ALL STAKES SHALL NOT EXTEND MORE THAN 2 INCHES ABOVE THE TOPS OF EROSION LOGS.

EROSION LOGS PAY ITEMS	
NUMBER	DESCRIPTION
208-00012	TYPE 1 (9 IN.)
208-00002	TYPE 1 (12 IN.)
208-00013	TYPE 1 (20 IN.)
208-00007	TYPE 2 (8 IN.)
208-00008	TYPE 2 (12 IN.)
208-00009	TYPE 2 (18 IN.)
208-00022	TYPE 3 (9 IN.)
208-00023	TYPE 3 (12 IN.)
208-00024	TYPE 3 (20 IN.)

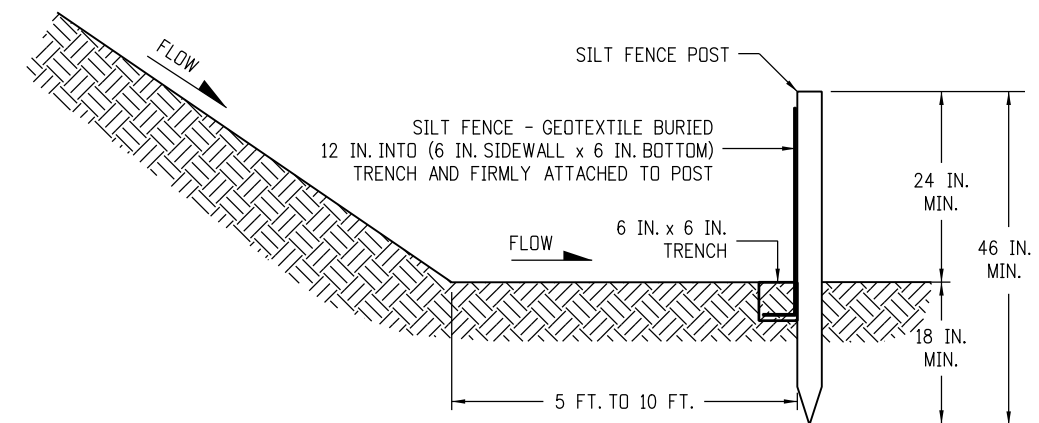
**NOTES:**

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.
3. SEE SHEET 2 OF 11 FOR JOINING LOGS DETAIL.

**EROSION LOG TOE OF SLOPE PROTECTION**



**ISOMETRIC VIEW**



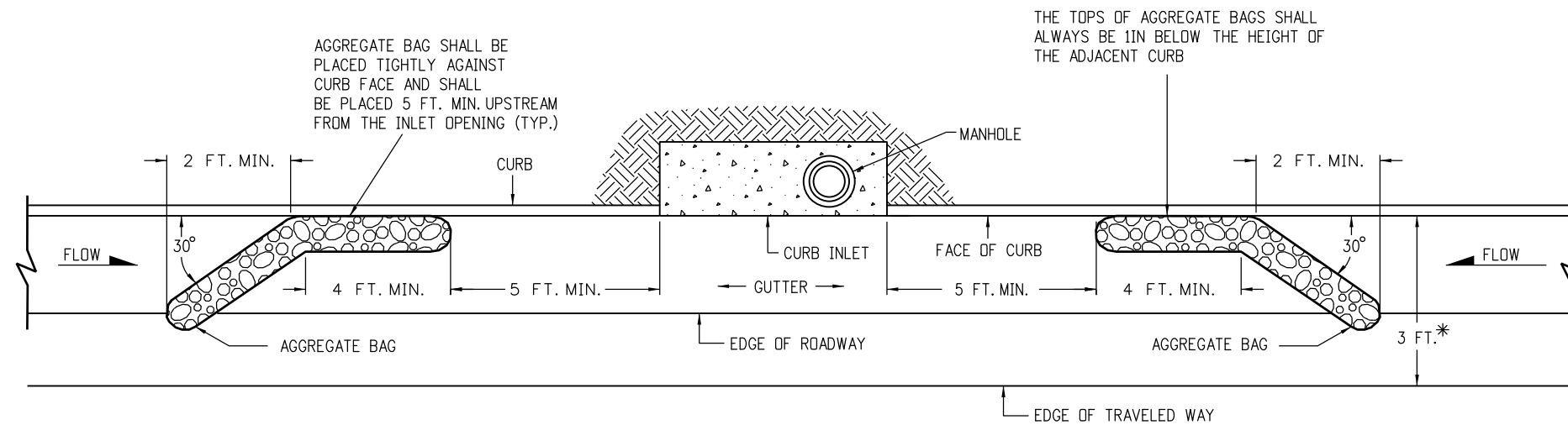
**SECTION B-B**

**SILT FENCE TOE OF SLOPE PROTECTION**

NOTE: THE PAY ITEM NUMBER FOR SILT FENCE (LF) IS 208-00020.

**TOE OF SLOPE PROTECTION APPLICATIONS**

Computer File Information		Sheet Revisions		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch	TEMPORARY EROSION CONTROL	STANDARD PLAN NO.	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			Issued by the Project Development Branch: July 31, 2019	M-208-1
Designer Initials: JBK	(R-X)			JBK			
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)					Project Sheet Number:	

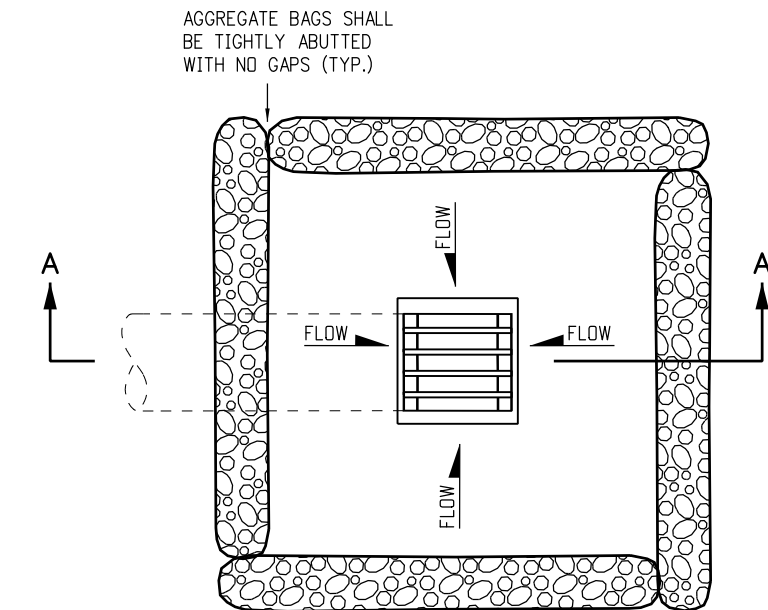


**PLAN VIEW**

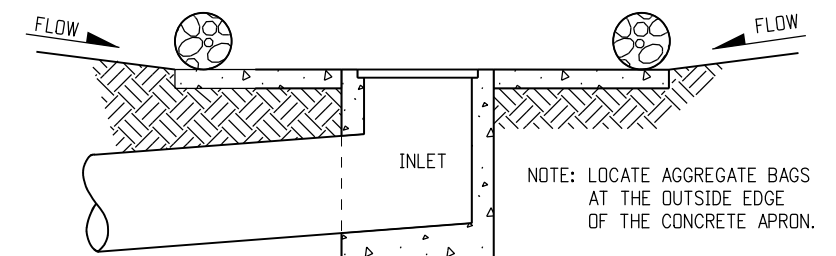
\* NOTE: USE AGGREGATE BAGS ONLY WHEN THERE IS A MINIMUM CLEARANCE OF 3 FEET FROM THE EDGE OF THE TRAVELED WAY (INCLUDING CONDITIONS DURING DETOURS) TO THE FACE OF CURB.

LENGTH (L) OF INLET FT.	NUMBER OF AGGREGATE BAGS UPSTREAM OF INLET
0 - 5	1
6 - 10	2
L > 10	3

**AGGREGATE BAGS AT STORM DRAIN INLET (TYPE I)**



**PLAN VIEW**



**SECTION A-A**

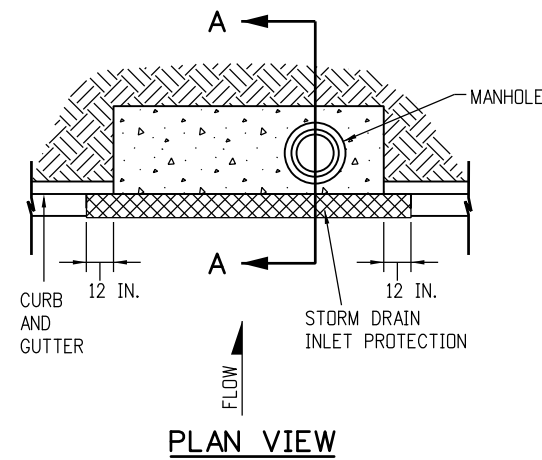
**AGGREGATE BAGS AT DROP INLET**

**AGGREGATE BAG APPLICATIONS**

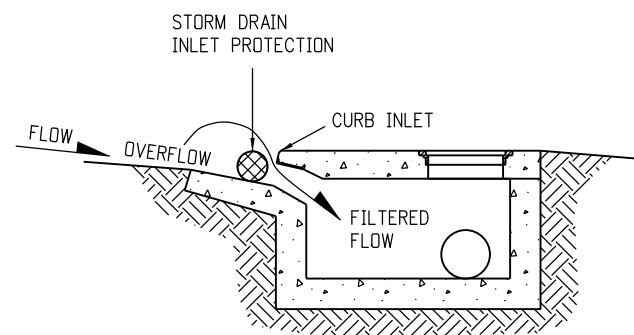
NOTE: THE PAY ITEM NUMBER FOR AGGREGATE BAG (LF) IS 208-00035

Computer File Information		Sheet Revisions		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch	TEMPORARY EROSION CONTROL	STANDARD PLAN NO.	
Creation Date: 07/31/19	(R-X)	Date:	Comments			Issued by the Project Development Branch: July 31, 2019	M-208-1
Designer Initials: JBK	(R-X)						
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)					Project Sheet Number:	





**PLAN VIEW**

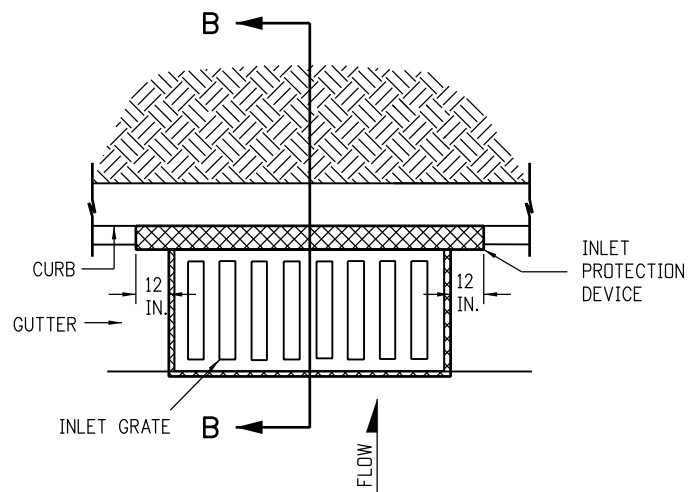


**SECTION A-A**

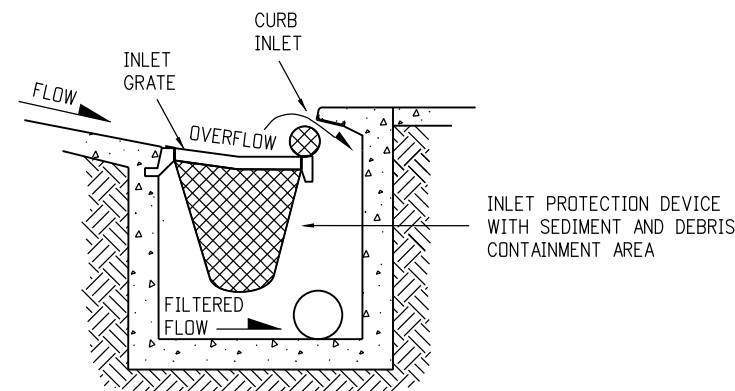
**STORM DRAIN INLET PROTECTION (TYPE I)**

**NOTES:**

1. INLET PROTECTION DEVICE SHALL EXTEND 12 INCHES PAST EACH END OF THE INLET.
2. THE PAY ITEM NUMBERS FOR STORM DRAIN INLET PROTECTION (TYPE I) ARE 208-00051 (LF), 208-00053 84 INCHES (EACH), 208-00057 144 INCHES (EACH), AND 208-00058 204 INCHES (EACH).
3. FOR STORM DRAIN INLET TYPES I AND II, IF THERE IS A MINIMUM CLEARANCE OF 3 FEET FROM THE EDGE OF THE TRAVELED WAY TO THE FACE OF CURB, USE THE AGGREGATE BAGS AT STORM DRAIN INLET (TYPE I) DETAIL ON SHEET 4 INSTEAD.



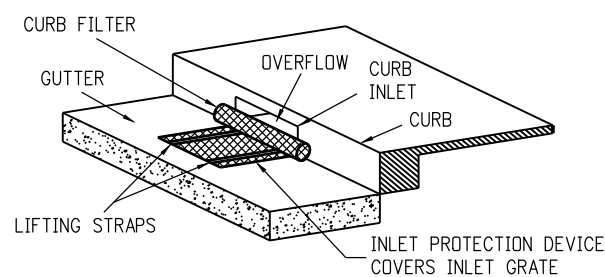
**PLAN VIEW**



**SECTION B-B**

**OPTION A**

**STORM DRAIN INLET PROTECTION (TYPE II)**

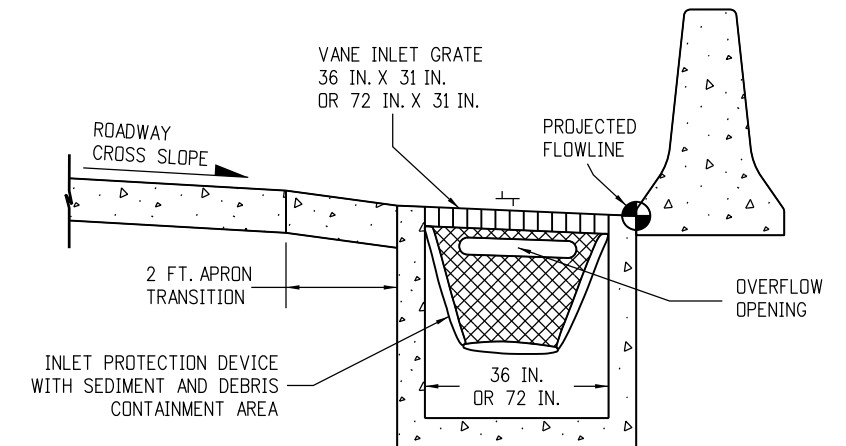


**ISOMETRIC VIEW**

**OPTION B**

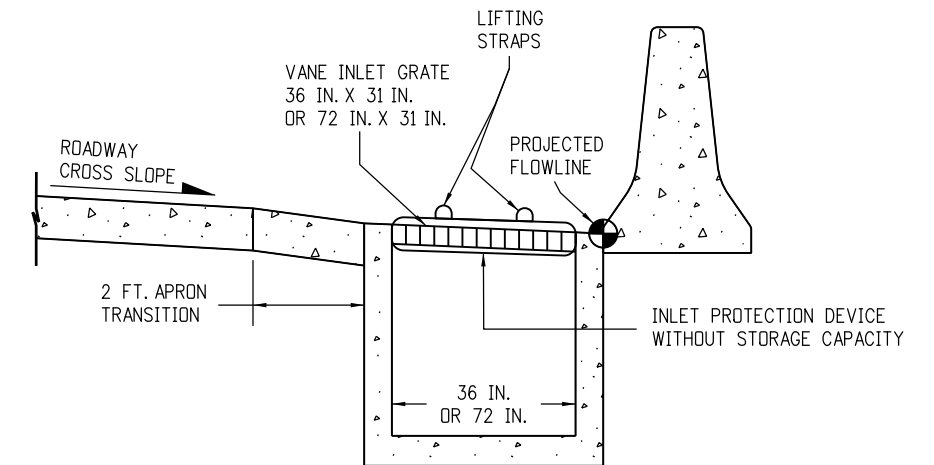
**STORM DRAIN INLET PROTECTION (TYPE II)**

NOTE: THE PAY ITEM NUMBERS FOR STORM DRAIN INLET PROTECTION (TYPE II) ARE 208-00054 (EACH).



**OPTION A**

**STORM DRAIN INLET PROTECTION (TYPE III)**



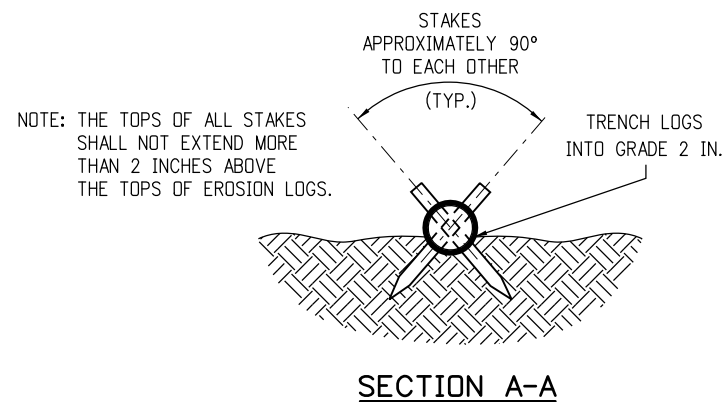
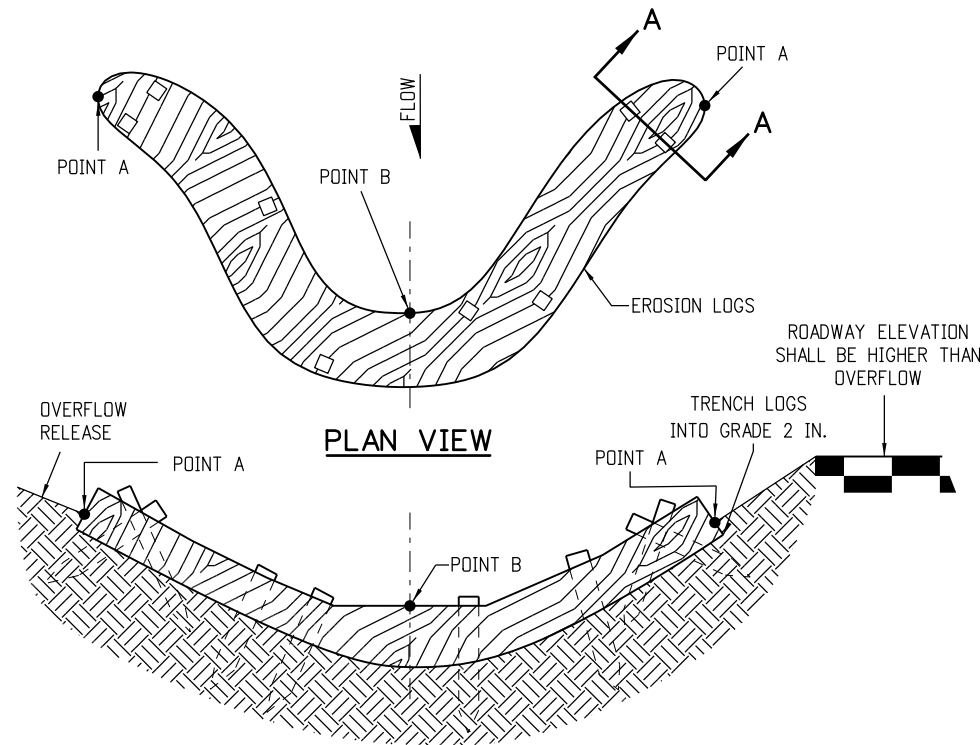
**OPTION B**

**STORM DRAIN INLET PROTECTION (TYPE III)**

NOTE: THE PAY ITEM NUMBER FOR STORM DRAIN INLET PROTECTION (TYPE III) (EACH) IS 208-00056.

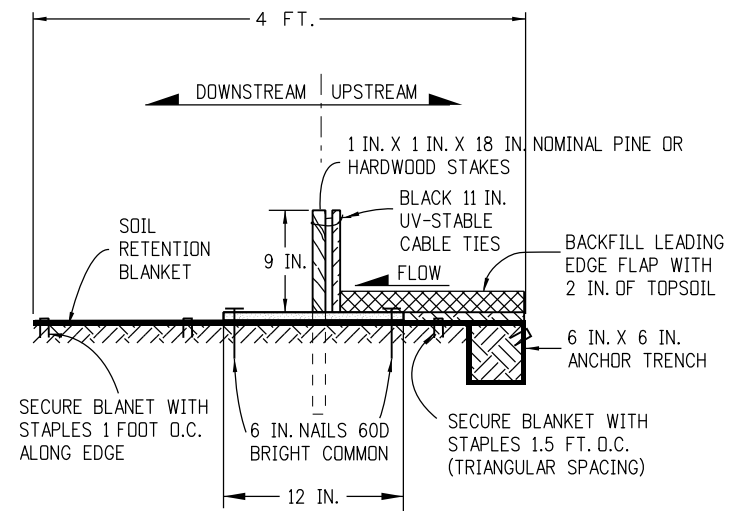
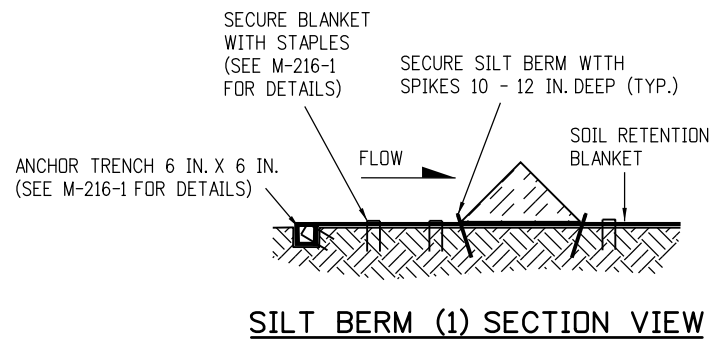
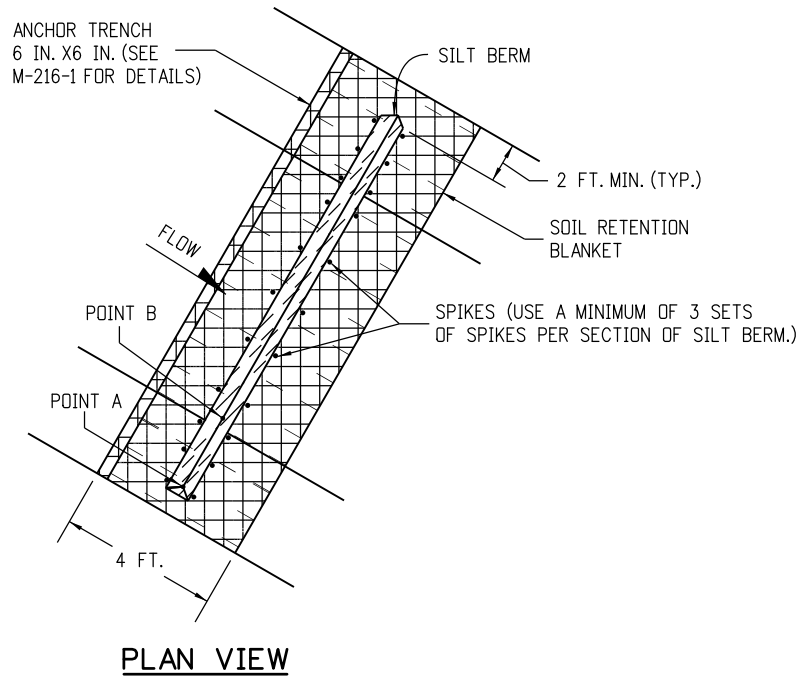
**STORM DRAIN INLET PROTECTION TYPES**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>TEMPORARY EROSION CONTROL</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-208-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 5 of 11	
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			Project Development Branch	JBK	Issued by the Project Development Branch: July 31, 2019	
						Project Sheet Number:	



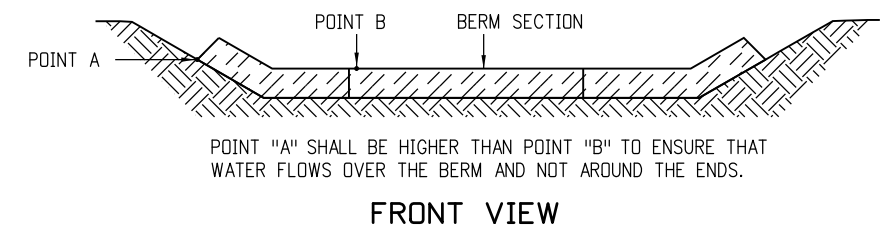
- NOTES:
1. EROSION LOGS SHALL BE EMBEDDED 2 INCHES INTO THE SOIL.
  2. EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.
  3. V-SHAPED TEMPORARY DITCHES SHALL NOT BE USED. DITCHES SHALL BE GRADED IN A PARABOLIC OR TRAPEZOIDAL SHAPE.

**EROSION LOG INSTALLATION**



- NOTES:
1. MINIMUM 4 NAILS PER SEGMENT (UPSTREAM).
  2. MINIMUM 2 NAILS PER SEGMENT (DOWNSTREAM).
  3. MINIMUM 2 WOOD STAKES PER SEGMENT.

**SILT BERM (2) SECTION VIEW**

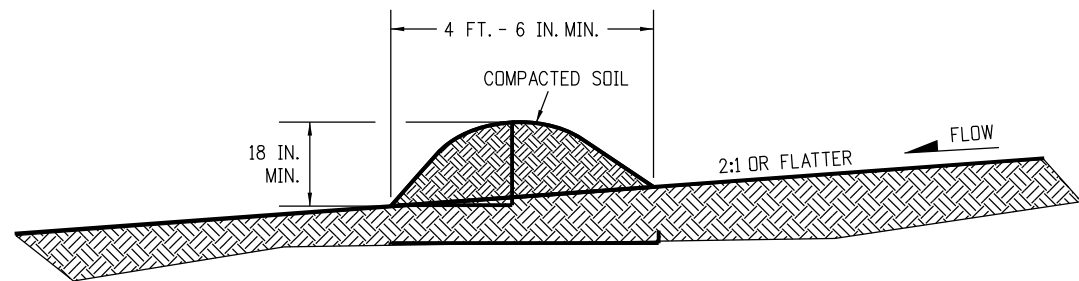


- NOTES
1. ANCHOR SOIL RETENTION BLANKET INTO TRENCH WITH 8 INCHES MIN. STAPLES PLACED AT 1 FOOT INTERVALS ALONG EDGE.
  2. FILL AND COMPACT TRENCH.
  3. SECTIONS OF THE SILT BERM SHALL BE OVERLAPPED WITH NO GAPS.
  4. FOR SLOPE AND CHANNEL SPACING SEE THE "SECTION VIEW ALONG DITCH FLOWLINE" DETAIL ON SHEET 11 OF 11.
  5. SOIL RETENTION BLANKET SHALL ALWAYS BE REQUIRED.
  6. THE PAY ITEM NUMBER FOR SILT BERM (LF) IS 208-00004.

**SILT BERM INSTALLATION**

**DRAINAGE DITCH APPLICATIONS**

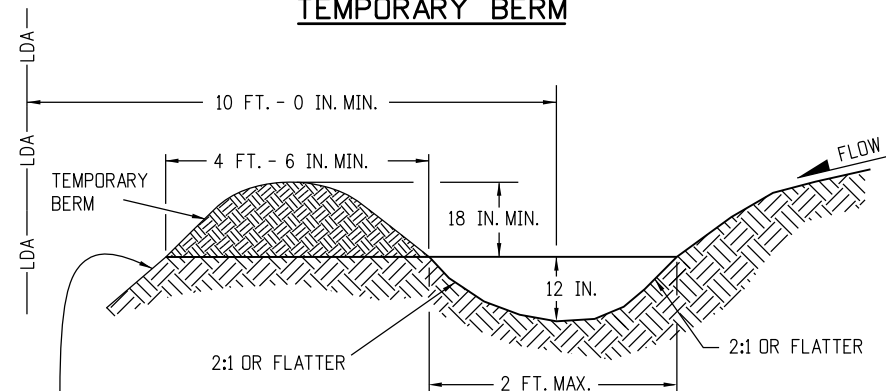
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>TEMPORARY EROSION CONTROL</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-208-1	
Designer Initials: JBK		(R-X)				Standard Sheet No. 6 of 11	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Project Sheet Number:			
				JBK	Issued by the Project Development Branch: July 31, 2019		



**NOTES:**

1. BERMS SHALL HAVE A HEIGHT OF 18 INCHES, SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM BASE WIDTH OF 4 FT. -6 IN.
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.
4. BERMS SHALL BE CONSTRUCTED OUT OF ACCEPTABLE MATERIAL THAT CAN BE COMPACTED AND RECEIVE AT A MINIMUM HEAVY EQUIPMENT WHEEL ROLLED COMPACTION.
5. TEMPORARY BERMS SHALL BE CONSTRUCTED OUT OF EMBANKMENT (SUBSOIL) AND IN NO CIRCUMSTANCE CONSTRUCTED OUT OF SALVAGED TOPSOIL.
6. THE PAY ITEM NUMBER FOR TEMPORARY BERM (LF) IS 208-00300.

**TEMPORARY BERM**

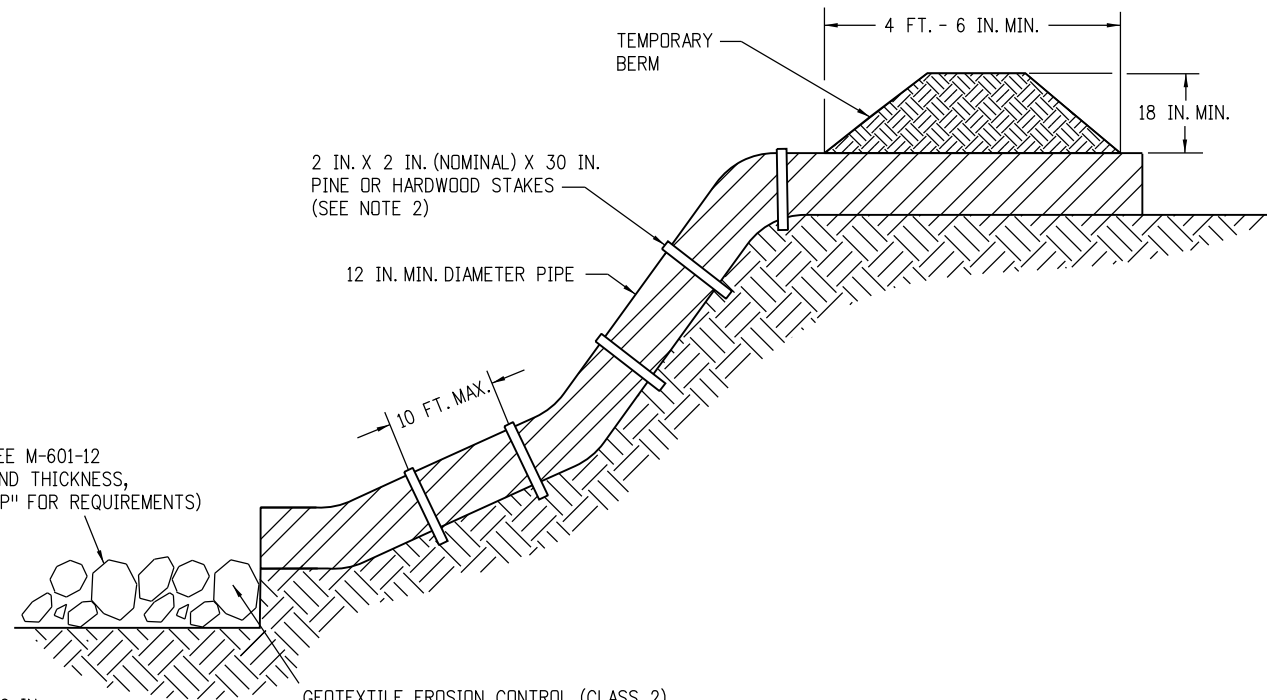


FOR BERMS TALLER THAN 2 FT.,  
INSTALL TOE OF SLOPE CONTROL MEASURES.  
SEE SHEET 3 OF 11 FOR DETAILS.

**NOTES:**

1. TEMPORARY DIVERSION DITCHES SHALL BE CONSTRUCTED ACROSS THE SLOPE TO INTERCEPT RUNOFF AND DIRECT IT TO A STABLE OUTLET OR SEDIMENT TRAP.
2. USE THE TEMPORARY DIVERSION DITCH IMMEDIATELY ABOVE A NEW CUT, FILL SLOPE, OR AROUND THE PERIMETER OF A DISTURBED AREA.
3. THE 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.
4. THE DIVERSION FLOWLINE SHALL ALWAYS BE LOCATED A MINIMUM 10 FEET FROM THE OUTSIDE LIMITS OF DISTURBED AREA BOUNDARY.
5. DIVERSION BERMS SHALL BE CONSTRUCTED OUT OF EMBANKMENT (SUBSOIL) AND IN NO CIRCUMSTANCE CONSTRUCTED OUT OF SALVAGED TOPSOIL.
6. THE PAY ITEM NUMBER FOR TEMPORARY DIVERSION (LF) IS 208-00301.

**TEMPORARY DIVERSION**



\* RIPRAP OUTLET PROTECTION (SEE M-601-12 FOR MIN. HORIZONTAL LAYOUT AND THICKNESS, AND SPECIFICATION 506 "RIPRAP" FOR REQUIREMENTS)

\* RIPRAP SIZE  $D_{50} = 6$  IN. OR AS SHOWN ON THE PLANS.

GEOTEXTILE EROSION CONTROL (CLASS 2) SHALL ALWAYS BE REQUIRED

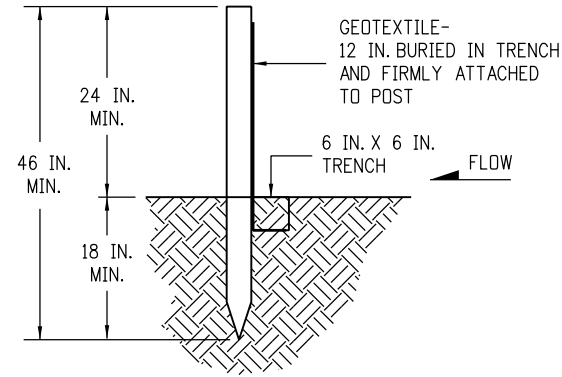
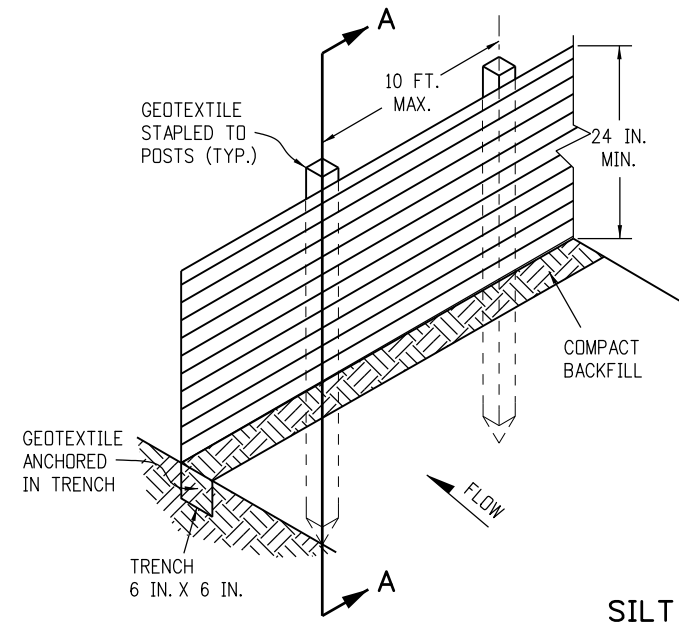
**NOTES:**

1. ANCHOR SIZE VARIES ACCORDING TO PIPE SIZE
2. TO SECURE THE PIPE, DRIVE STAKES INTO GROUND, THEN TIE A 12 GAUGE WIRE BETWEEN THEM ABOVE AND ACROSS THE PIPE'S WIDTH.
3. THE OUTLET SHALL BE ALIGNED WITH THE FLOW DIRECTION OF THE EXISTING GRADE. PERPENDICULAR DISCHARGE TO A CHANNEL SHALL NOT BE ACCEPTABLE.
4. THE GRADE AROUND THE INLET TO THE PIPE SHALL BE COMPACTED.
5. THE PAY ITEM NUMBER FOR TEMPORARY SLOPE DRAINS (LF) IS 208-00060.

**TEMPORARY SLOPE DRAINS**

**GRADING APPLICATIONS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>TEMPORARY EROSION CONTROL</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-208-1	
Designer Initials: JBK		(R-X)				Standard Sheet No. 7 of 11	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)				Project Sheet Number:	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Issued by the Project Development Branch: July 31, 2019			

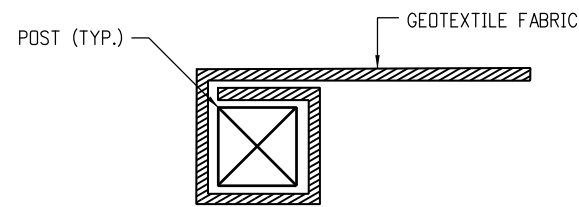


**SECTION A-A**

**SILT FENCE**

**NOTES:**

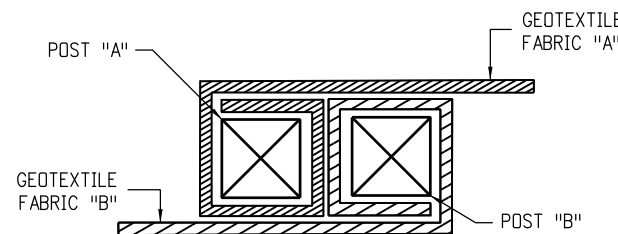
1. GEOTEXTILE SHALL BE ATTACHED TO WOOD POSTS WITH THREE OR MORE STAPLES PER POST. STAPLES SHALL BE HEAVY DUTY WIRE AND AT LEAST 1 INCH LONG.
2. WOOD POST SHALL BE 1 IN. X 1 IN. NOMINAL.
3. THE PAY ITEM NUMBER FOR SILT FENCE (LF) IS 208-00020.
4. THE SILT FENCE SHALL BE PLACED ON THE CONTOUR (AT THE SAME ELEVATION ±6 IN.). THE ENDS SHALL BE FLARED UP SLOPE (MINIMUM ELEVATION GAIN OF 18 IN.).



**END SECTION DETAIL (PLAN VIEW)**

**NOTE:**

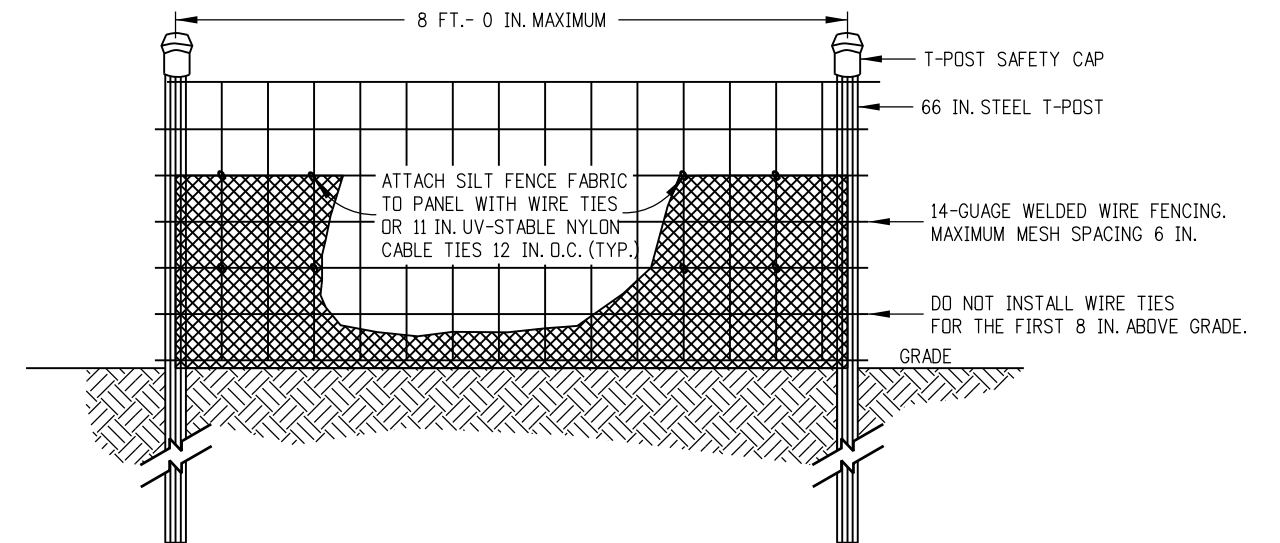
1. THE END OF THE SILT FENCE FABRIC SHALL BE WRAPPED APPROX. 6 INCHES AROUND A WOODEN POST ONE FULL TURN, THEN SECURED ALONG THE POST WITH 6 HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH LONG.



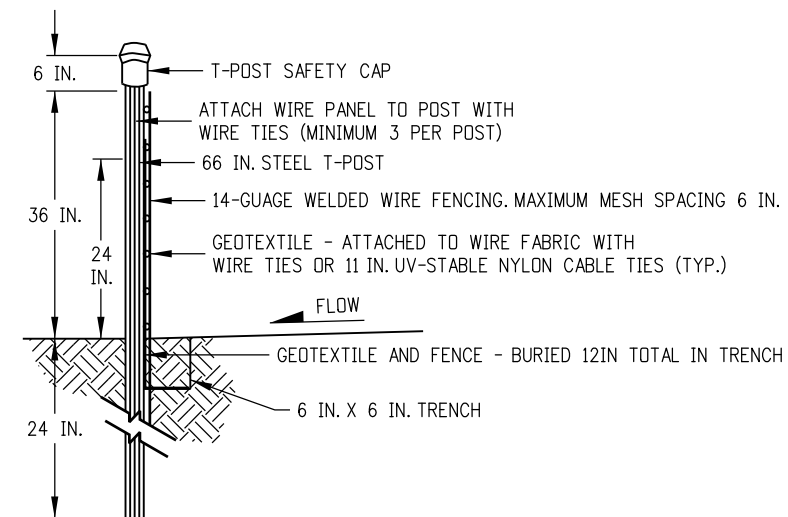
**JOINING SECTION DETAIL (PLAN VIEW)**

**NOTES:**

1. THE ENDS OF THE SILT FENCE FABRIC SHALL BE JOINED TOGETHER BY WRAPPING APPROX. 6 INCHES OF EACH END AROUND A WOODEN POST ONE FULL TURN, THEN SECURED ALONG THE POST WITH 6 HEAVY DUTY WIRE STAPLES AT LEAST 1 INCH LONG.
2. POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.



**ELEVATION VIEW**



**SIDE VIEW**

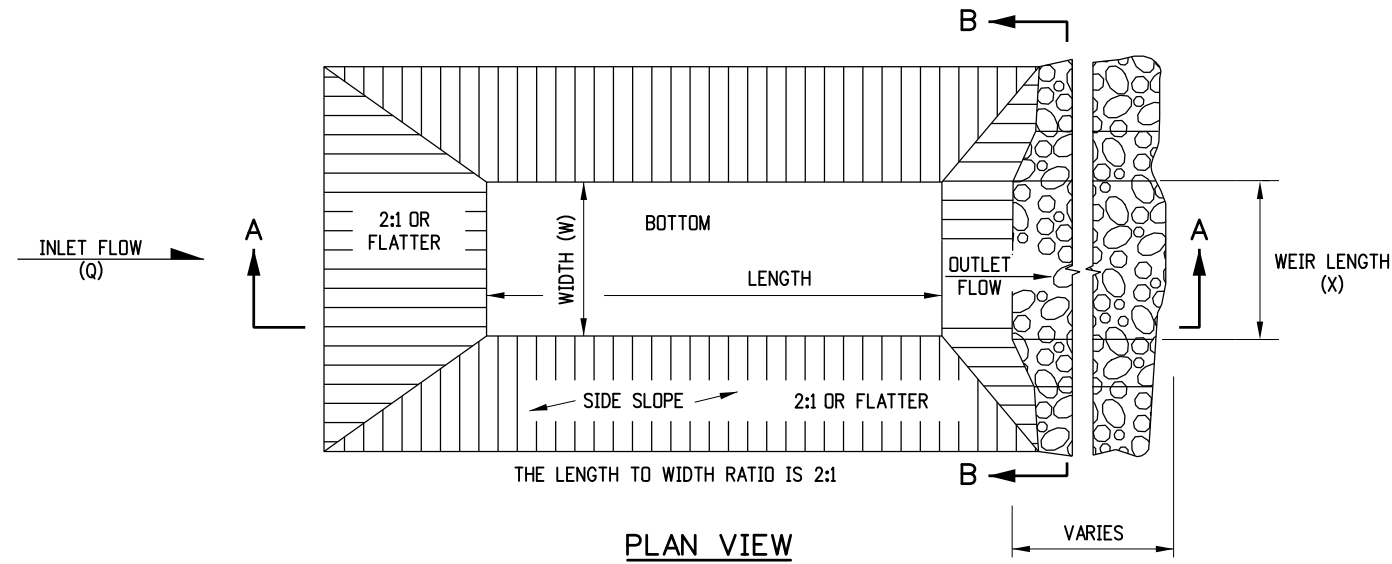
**NOTES:**

1. THE ENDS OF THE SILT FENCE FABRIC SHALL BE JOINED TOGETHER BY WRAPPING APPROX. 6 INCHES OF EACH END AROUND A STEEL T-POST, THEN SECURED ALONG THE POST WITH WIRE TIES (MINIMUM 3 PER POST).
2. POSTS SHALL BE TIGHTLY ABUTTED WITH NO GAPS TO PREVENT POTENTIAL FLOW-THROUGH OF SEDIMENT AT JOINT.
3. SILT FENCES SHALL NOT BE USED FOR CHECK DAMS.
4. THE PAY ITEM NUMBER FOR SILT FENCE (REINFORCED) (LF) IS 208-00021.

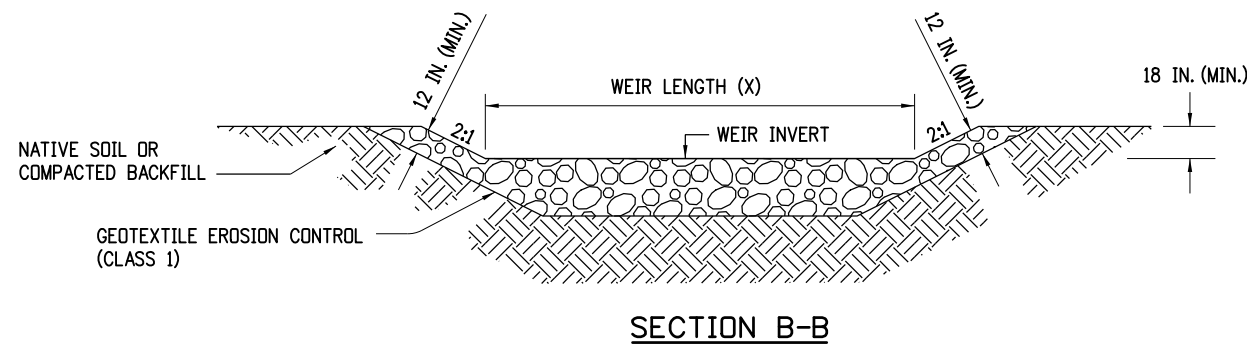
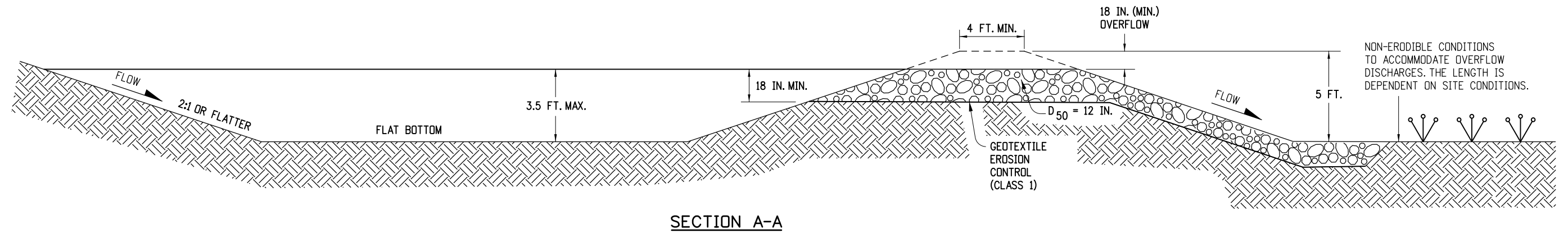
**SILT FENCE (REINFORCED)**

**SILT FENCE APPLICATIONS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>TEMPORARY EROSION CONTROL</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-208-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 8 of 11	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)					Issued by the Project Development Branch: July 31, 2019	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			<b>JBK</b>			



- 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.
  8. THE DOWN GRADE FROM WEIR SHALL BE STABLE AND NON-ERODIBLE.
  9. THE PAY ITEM NUMBER FOR SEDIMENT TRAP (LF) IS 208-00033.

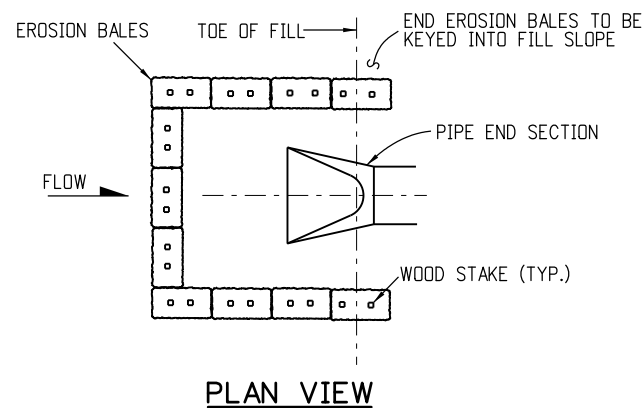
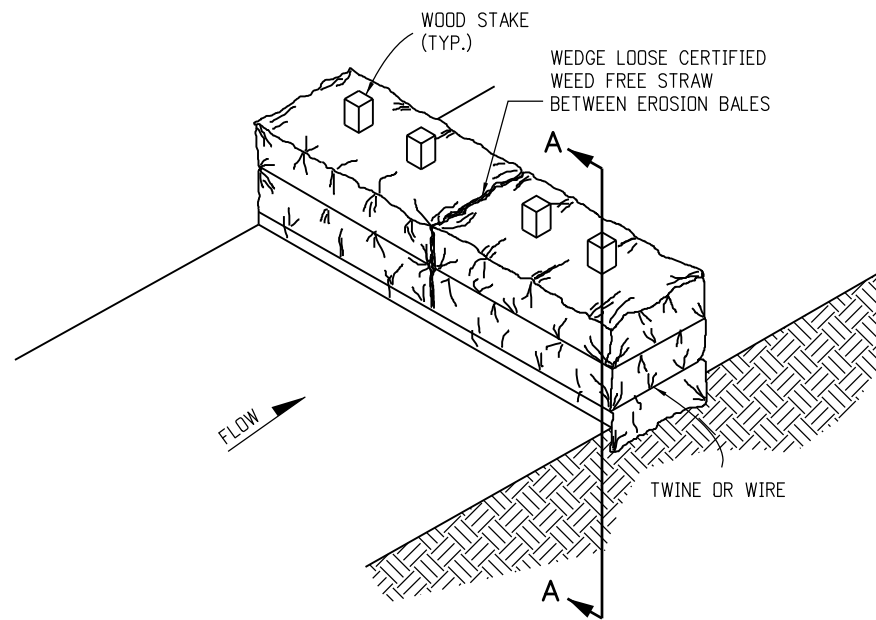
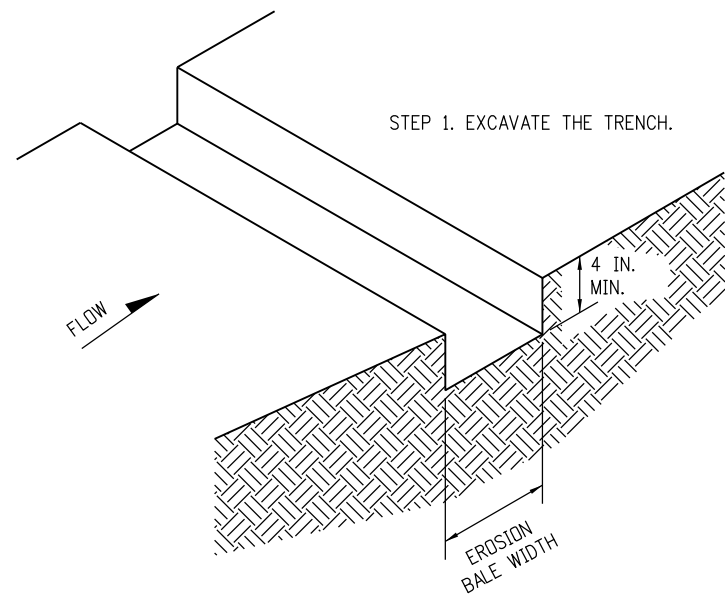


DRAINAGE AREA (ACRES)	WEIR LENGTH (FEET)
1	4
2	6
3	8
4	10
5	12

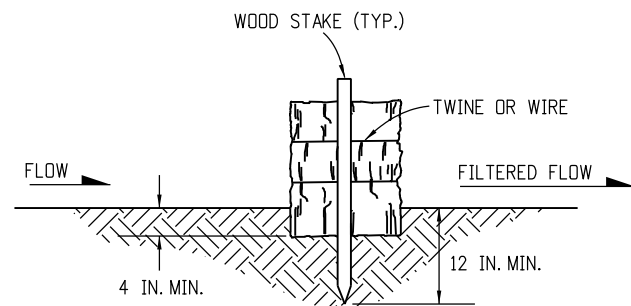
**WEIR LENGTH TABLE**

**SEDIMENT TRAP**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>TEMPORARY EROSION CONTROL</b>		<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:                      Comments		2829 West Howard Place				M-208-1	
Designer Initials: JBK		(R-X)		CDOT HQ, 3rd Floor		<b>Standard Sheet No. 9 of 11</b>		Project Sheet Number:	
Last Modification Date: 07/31/19		(R-X)		Denver, CO 80204					
Detailer Initials: LTA		(R-X)		Phone: 303-757-9021 FAX: 303-757-9868		Issued by the Project Development Branch: July 31, 2019			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>Project Development Branch</b> <b>JBK</b>					

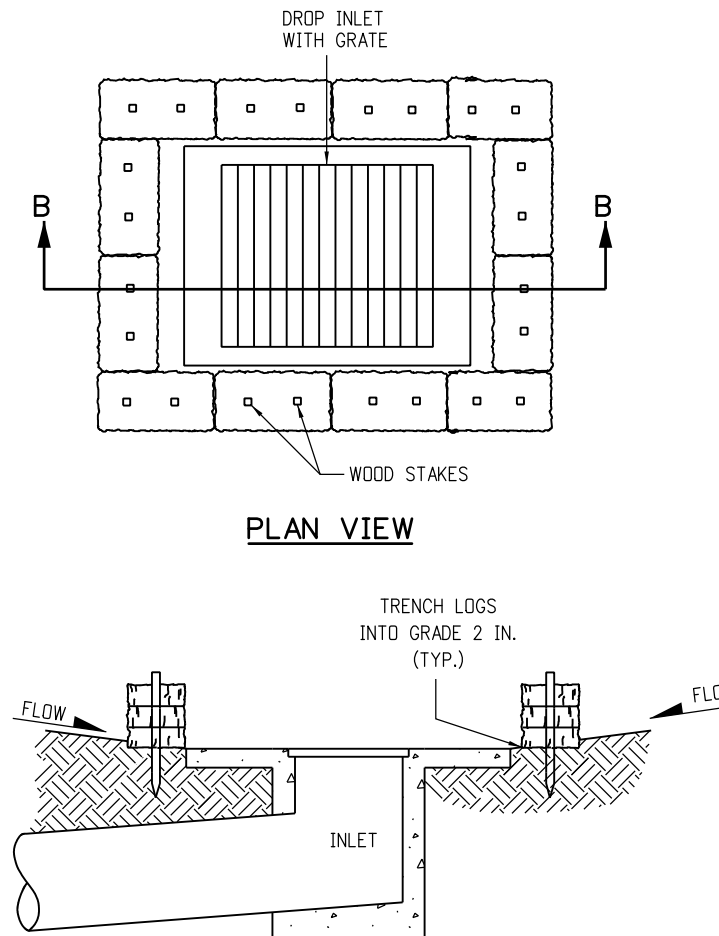


**EROSION BALES CULVERT INLET PROTECTION**



**SECTION A-A**

**EROSION BALES TRENCHING AND STAKING**



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

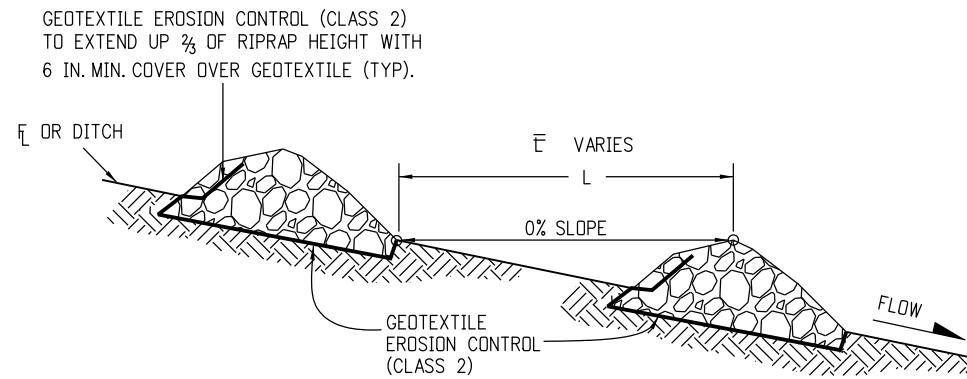
**EROSION LOG FILTER AT DROP INLET**

**NOTES**

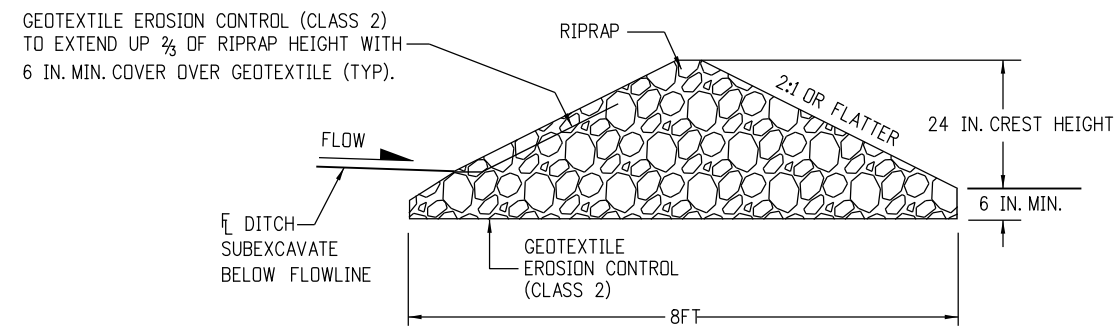
1. STAKES SHALL BE WOOD AND SHALL BE 2 IN. X 2 IN. X 30 IN. NOMINAL.
2. EROSION BALES SHALL BE 18 IN. X 18 IN. X 36 IN.
3. EROSION BALES SHALL BE ENTRENCHED 4 IN. MINIMUM INTO THE SOIL, TIGHTLY ABUTTED WITH NO GAPS, STAKED, AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER.
4. EROSION BALES CANNOT BE USED FOR CHECK DAMS.
5. EROSION BALE FILTER SHALL BE LOWER THAN BERM ELEVATION OR USED IN A SUMP CONDITION.
6. THE PAY ITEM NUMBER FOR EROSION BALES (WEED FREE) (EA) IS 208-00011.

**EROSION BALES APPLICATIONS**

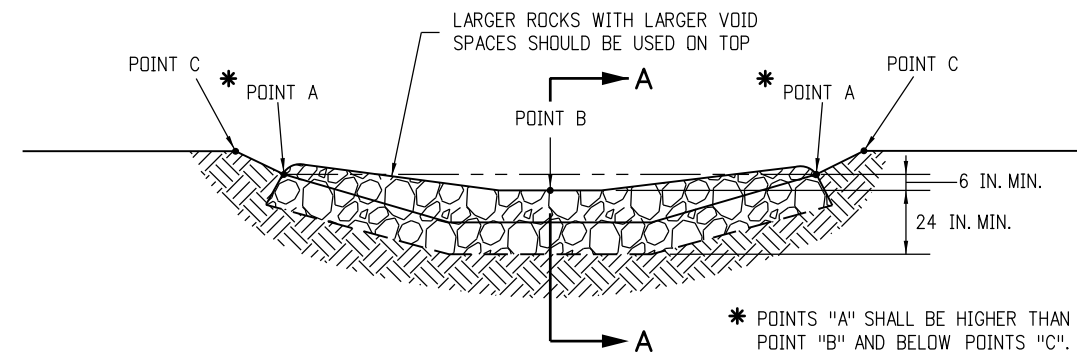
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>TEMPORARY EROSION CONTROL</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-208-1	
Designer Initials: JBK		(R-X)				Standard Sheet No. 10 of 11	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Project Sheet Number:			



**SECTION VIEW ALONG DITCH FLOWLINE**



**SECTION A-A**



**TYPICAL SECTION VIEW**

**NOTES:**

1. RIPRAP SIZE  $D_{50}$  = 6IN OR AS SHOWN ON THE PLANS.
2. THE GEOTEXTILE EROSION CONTROL SHALL BE CLASS 2 AND CONFORM TO THE REQUIREMENTS OF SUBSECTION 712.08.
3. THE ENDS OF RIPRAP CHECK DAM SHALL BE A MINIMUM OF 6 IN. HIGHER THAN CENTER OF CHECK DAM.
4. FOR USE AS TEMPORARY CHECK DAMS ONLY AND NOT FOR PERMANENT INSTALLATIONS.
5. THE PAY ITEM NUMBER FOR ROCK CHECK DAM (EA) IS 208-00041.

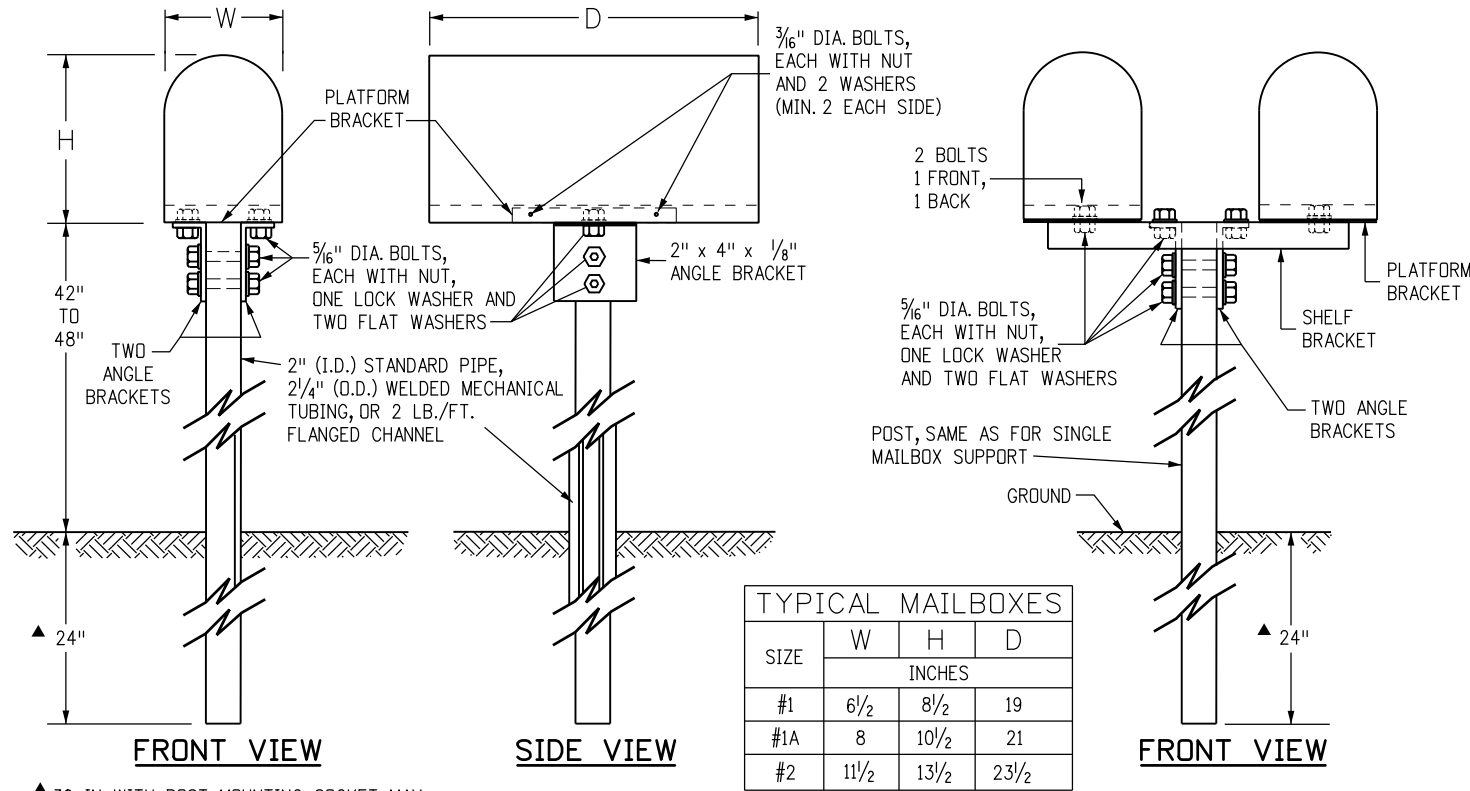
NOTE: ALL MATERIALS AND LABOR TO COMPLETE THE ROCK CHECK DAM SHALL BE INCLUDED IN THE COST OF WORK.

**ROCK CHECK DAM**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>	<b>TEMPORARY EROSION CONTROL</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-208-1	
Designer Initials: JBK		(R-X)				Standard Sheet No. 11 of 11	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Issued by the Project Development Branch: July 31, 2019		Project Sheet Number:	

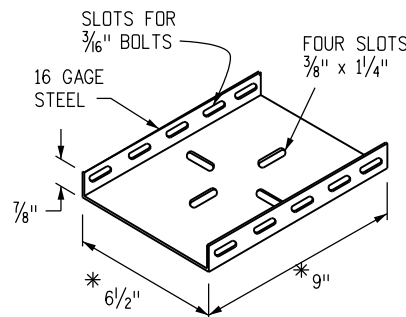
**GENERAL NOTES**

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.
5. 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 CDDT APPROVED PRODUCTS LIST WILL BE ACCEPTED AS EQUIVALENT ALTERNATIVES.

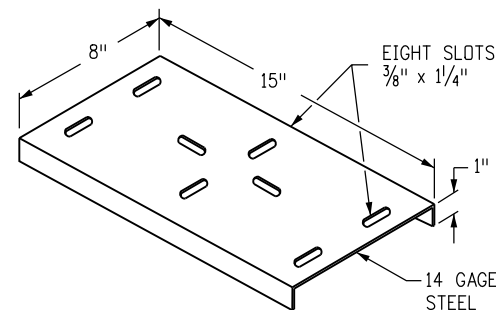


TYPICAL MAILBOXES			
SIZE	W	H	D
	INCHES		
#1	6 1/2	8 1/2	19
#1A	8	10 1/2	21
#2	11 1/2	13 1/2	23 1/2

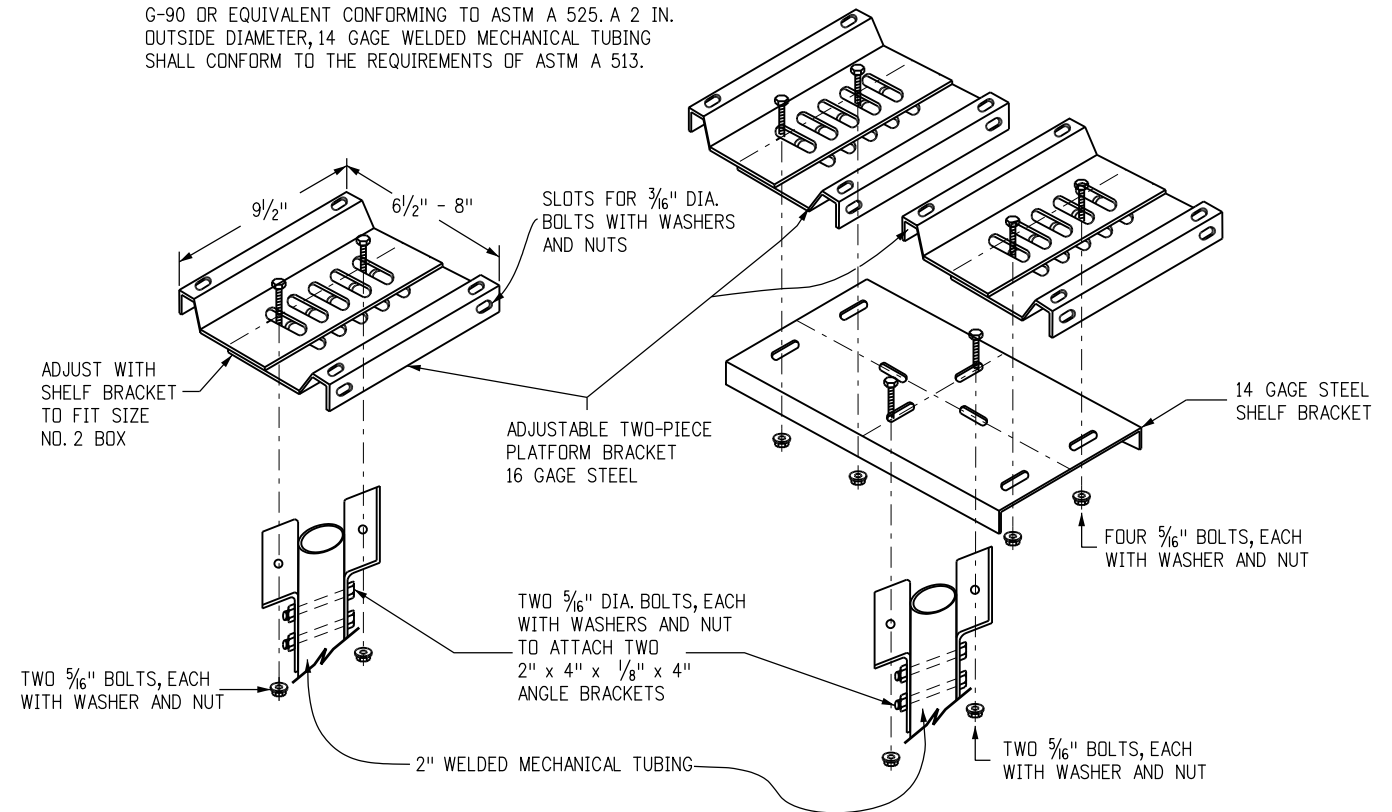
**SINGLE (TYPE 1) AND DOUBLE (TYPE 2) MAILBOX SUPPORTS**



**PLATFORM BRACKET**



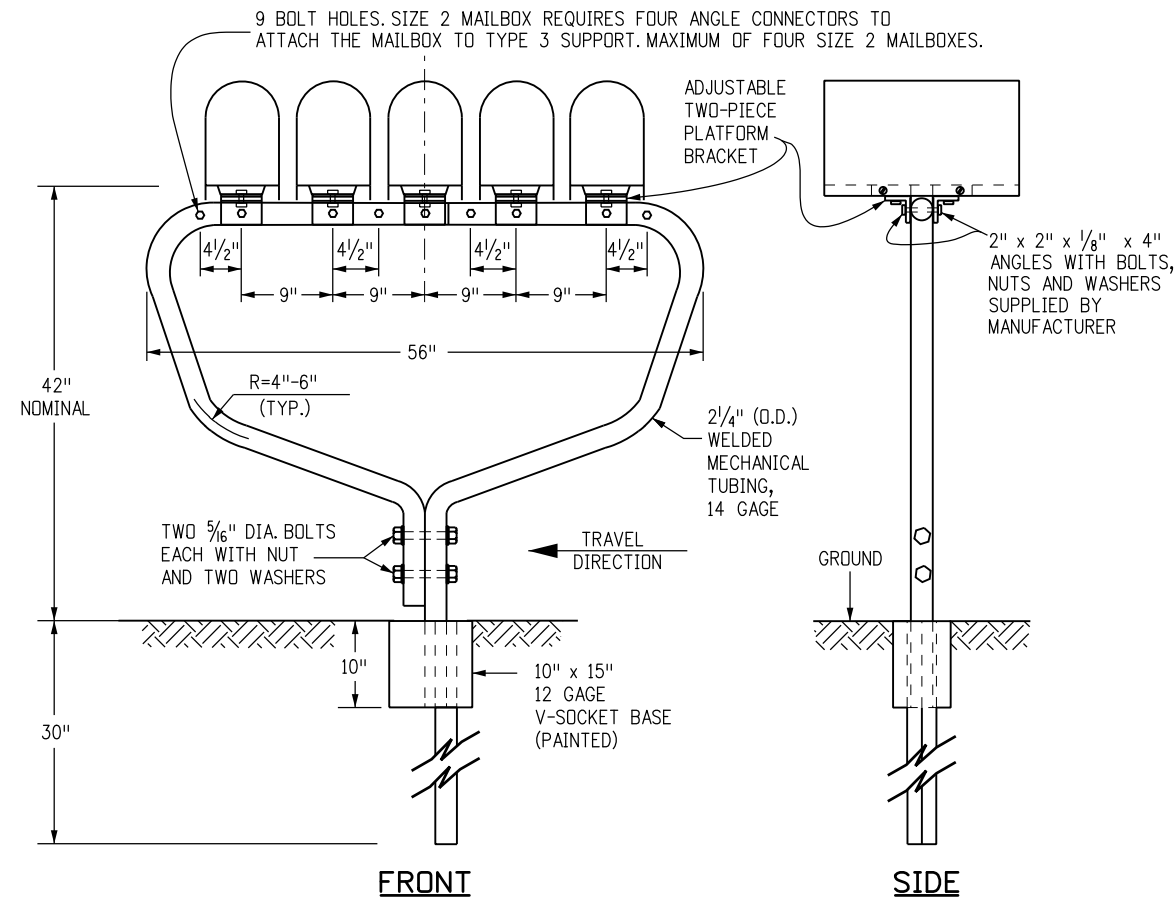
**SHELF BRACKET**



**SINGLE AND DOUBLE MAILBOX SUPPORTS ALTERNATIVE**

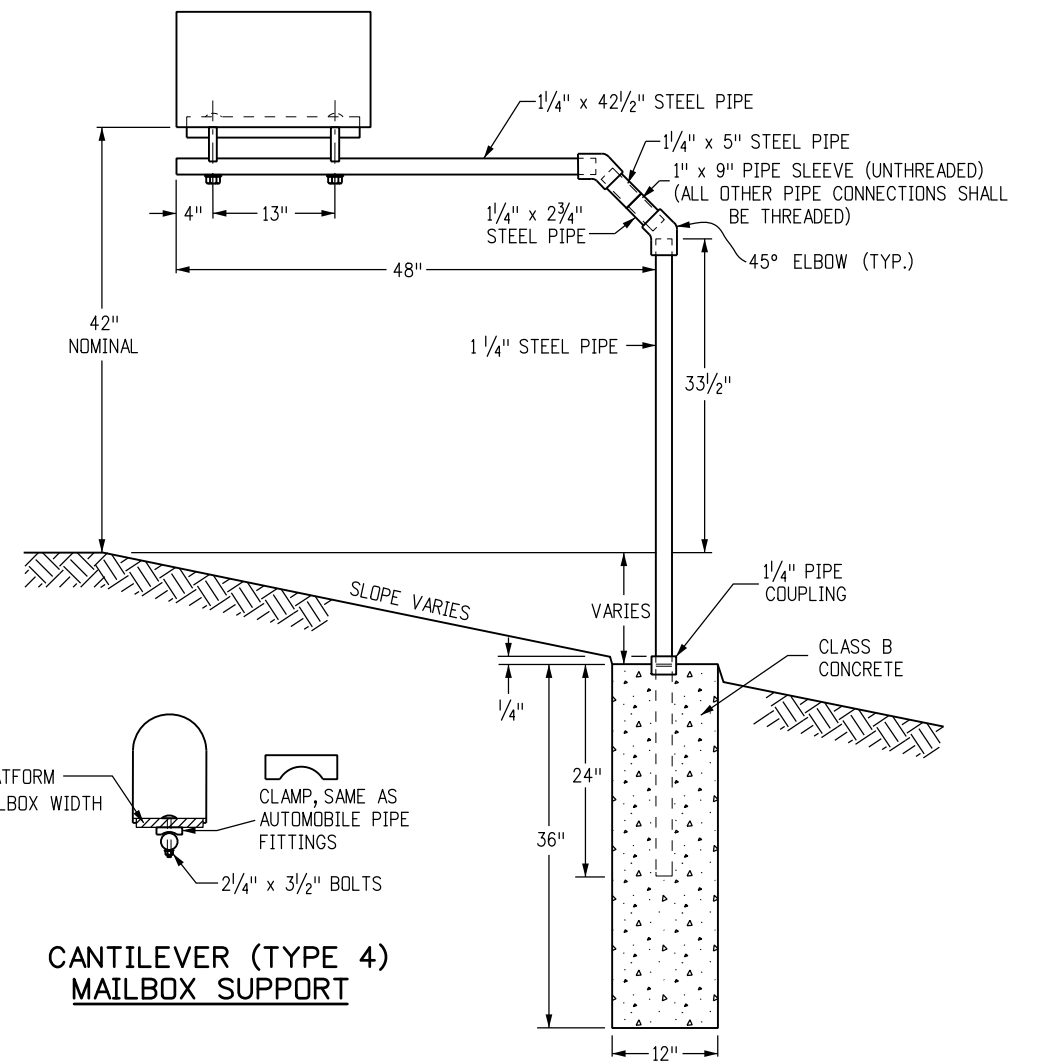
<b>Computer File Information</b> Creation Date: 07/31/19 Designer Initials: JBK Last Modification Date: 07/31/19 Detailer Initials: LTA CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		<b>Sheet Revisions</b> Date: _____ Comments: _____ (R-X) _____ (R-X) _____ (R-X) _____ (R-X) _____		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>		<h1>MAILBOX SUPPORTS</h1>		<b>STANDARD PLAN NO.</b> M-210-1 <b>Standard Sheet No. 1 of 2</b> Project Sheet Number: _____	
				Issued by the Project Development Branch: July 31, 2019		JBK			





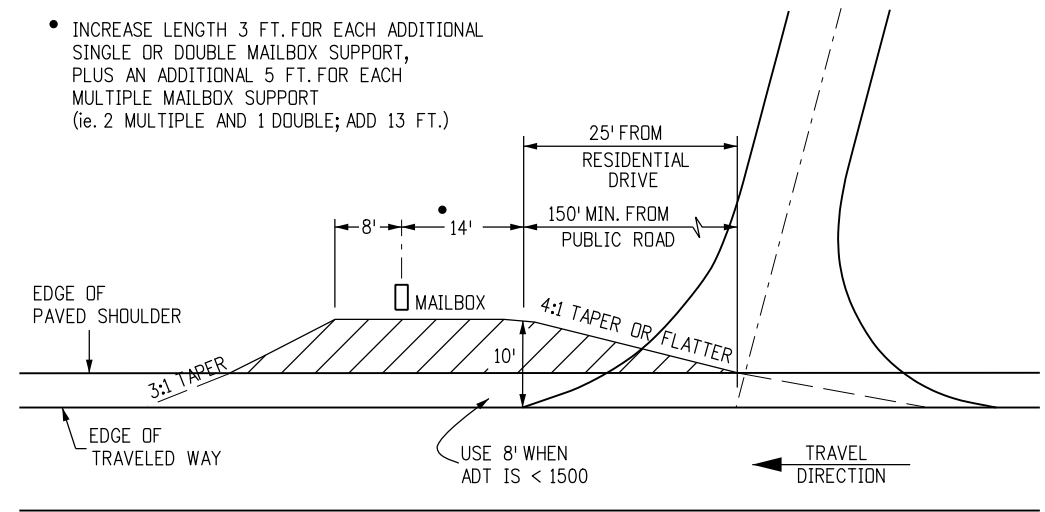
**MULTIPLE (TYPE 3) MAILBOX SUPPORT FOR 3, 4, OR 5 MAILBOXES OR APPROVED EQUAL**

FIVE SIZE 1 MAILBOXES SHOWN

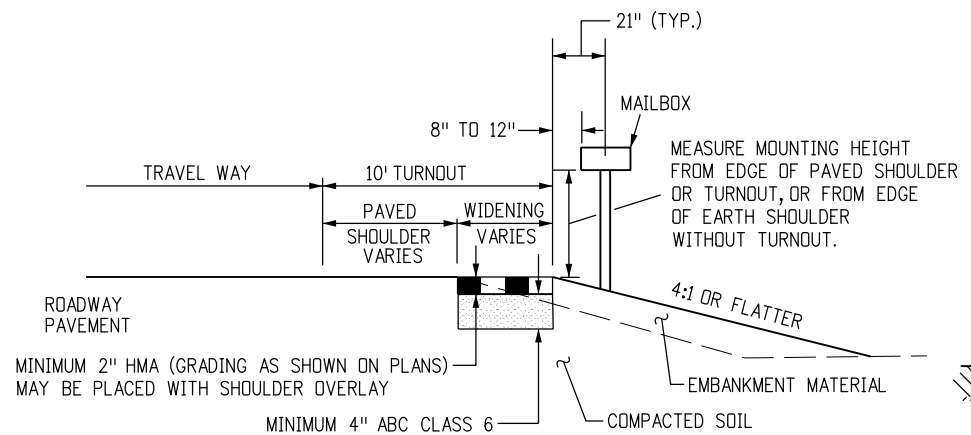


**CANTILEVER (TYPE 4) MAILBOX SUPPORT**

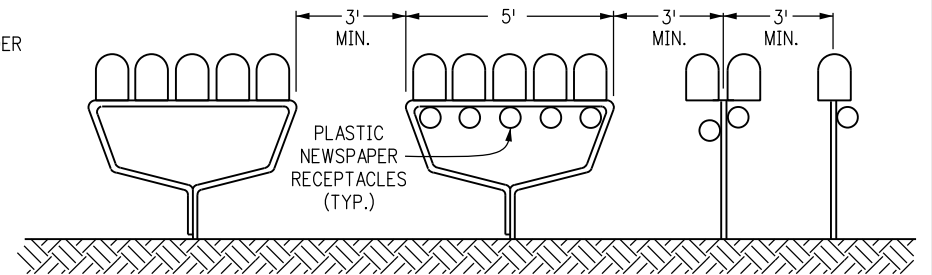
- INCREASE LENGTH 3 FT. FOR EACH ADDITIONAL SINGLE OR DOUBLE MAILBOX SUPPORT, PLUS AN ADDITIONAL 5 FT. FOR EACH MULTIPLE MAILBOX SUPPORT (ie. 2 MULTIPLE AND 1 DOUBLE; ADD 13 FT.)



**MAILBOX TURNOUT**



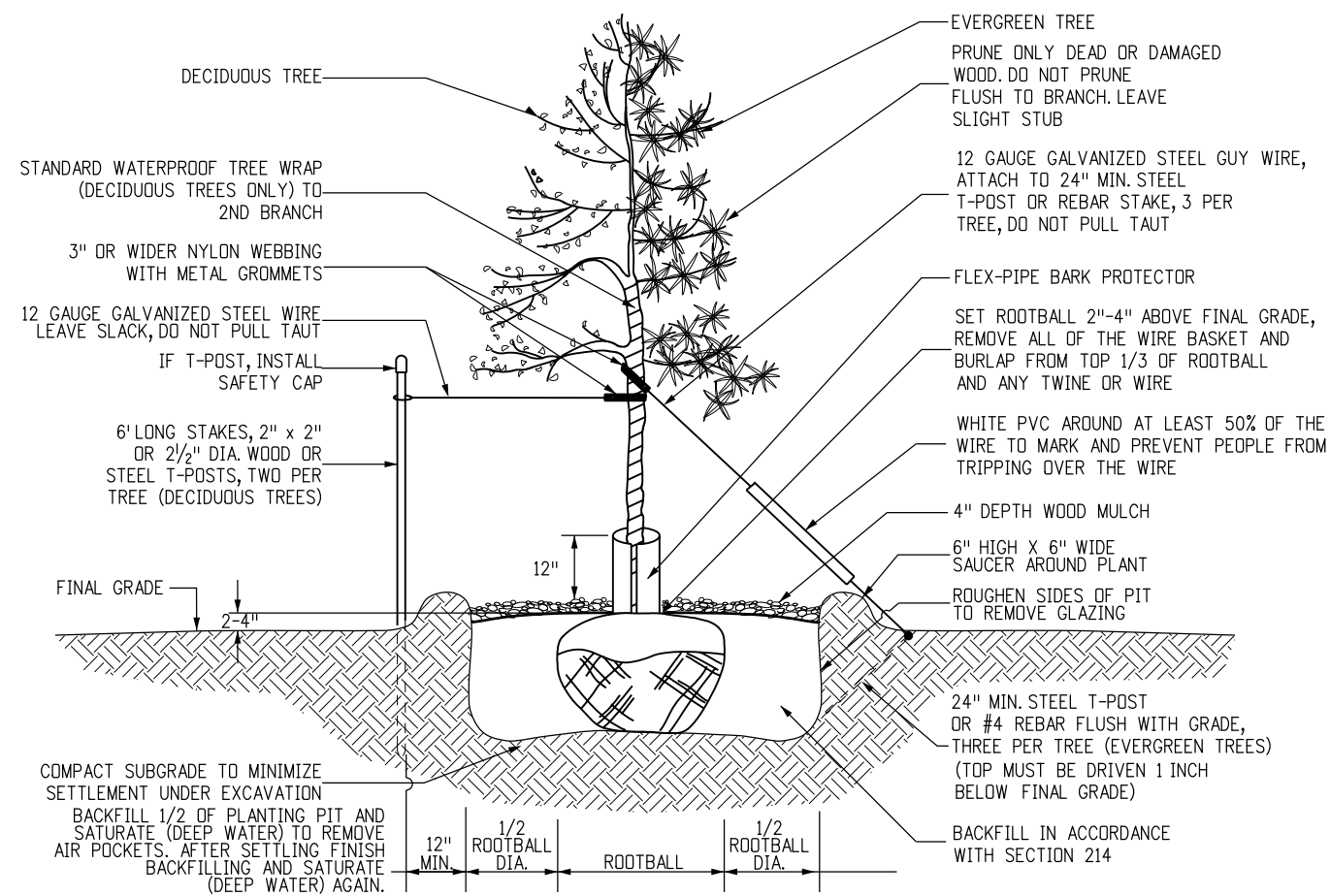
**TURNOUT TYPICAL SECTION**



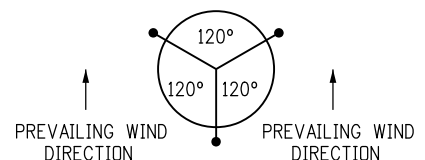
**SUPPORT SPACING**

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

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>MAILBOX SUPPORTS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-210-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 2 of 2	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Issued by the Project Development Branch: July 31, 2019			

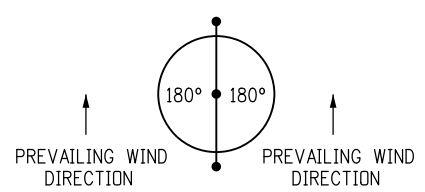


**DECIDUOUS AND EVERGREEN BALLED AND BURLAPPED TREE PLANTING AND GUYING DETAIL**  
 (GUY AND STAKE DECIDUOUS TREES 2" AND LARGER CALIPER AND EVERGREEN TREES OVER 4' HEIGHT.)  
 NOT TO SCALE

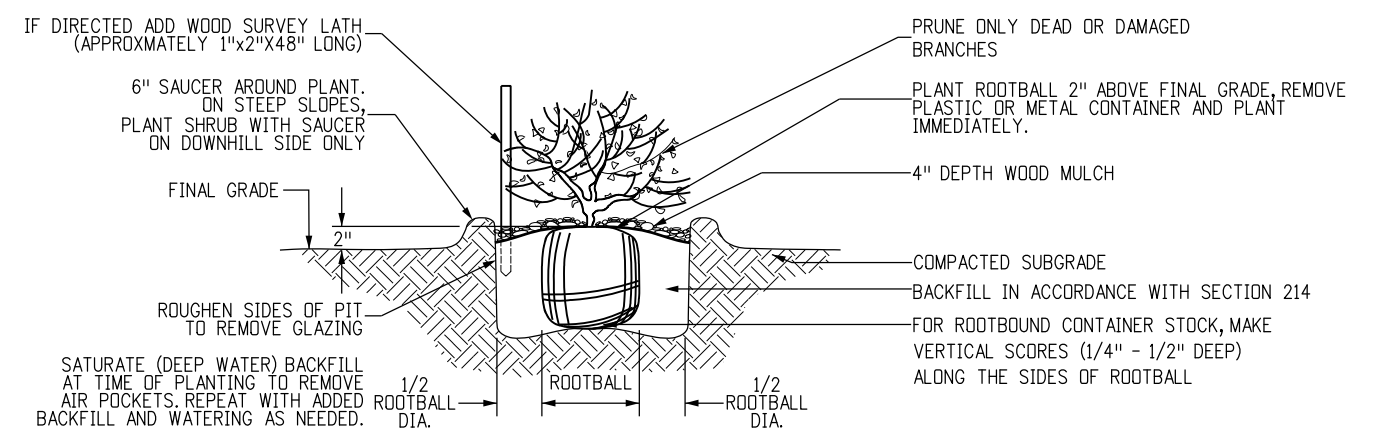


NOTE: FOR TREES ON 4:1 OR STEEPER SLOPES, PLACE TWO GUYS UPSLOPE AND ONE DOWN SLOPE. OTHERWISE, PLACE FOR PREVAILING WIND.

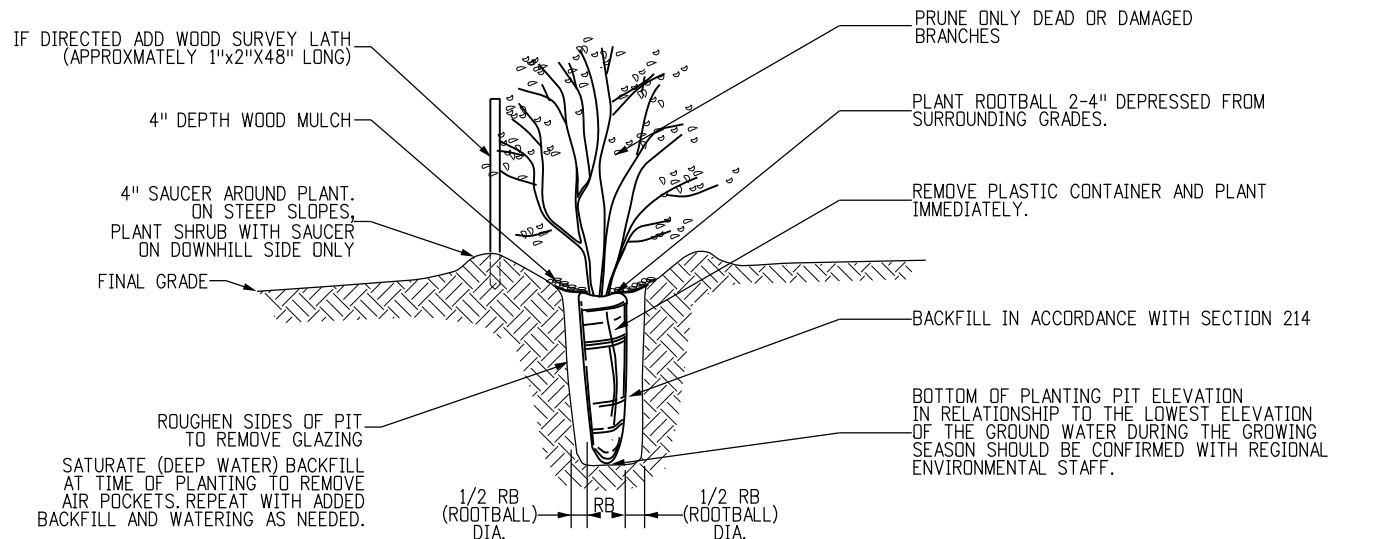
**GUYING PATTERN FOR EVERGREEN TREE BALLED AND BURLAPPED TREE PLANTINGS**



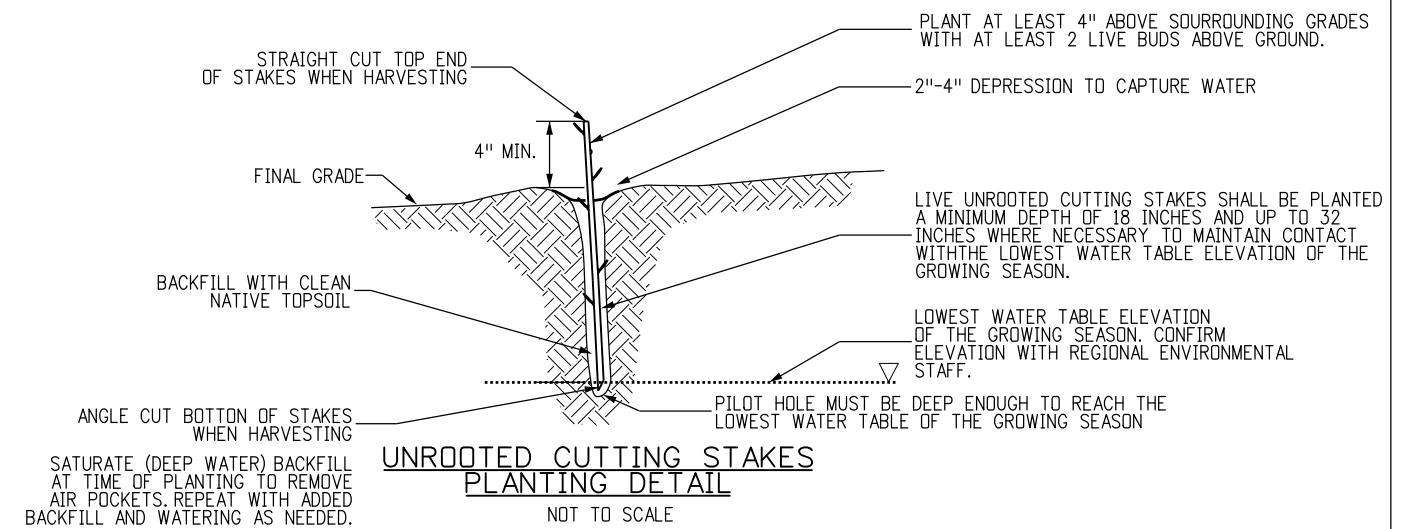
**GUYING PATTERN FOR DECIDUOUS TREE BALLED AND BURLAPPED TREE PLANTINGS**



**STANDARD NURSERY STOCK CONTAINERS (#5, #10 AND #20) PLANTING DETAIL**  
 NOT TO SCALE



**DEEP ROOTED UPLAND NURSERY CONTAINERS (DRC #10, #40, #60 AND #180) PLANTING DETAIL**  
 NOT TO SCALE



**UNROOTED CUTTING STAKES PLANTING DETAIL**  
 NOT TO SCALE

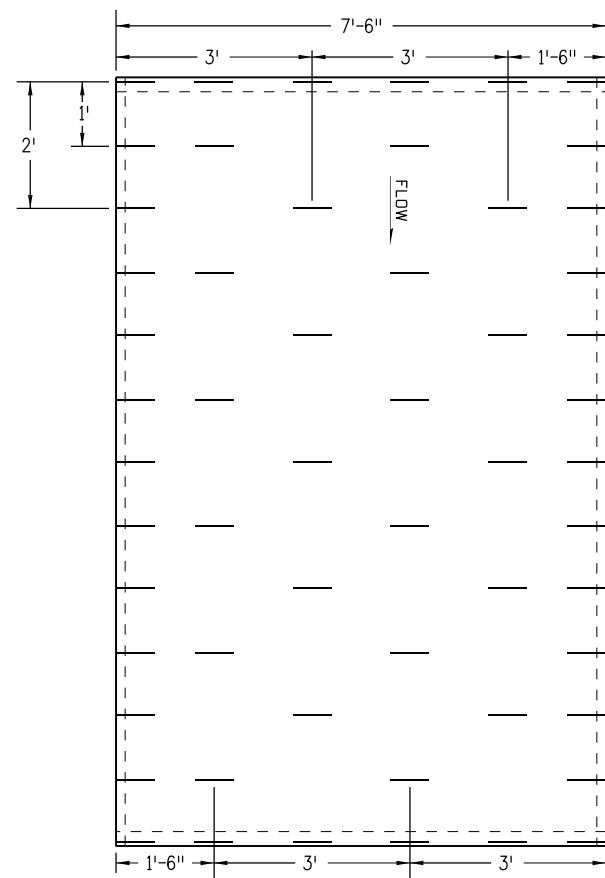
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: MP	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

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Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDOT HQ,  
 Denver, CO 80204  
 Phone: 303-757-9542  
**Project Development Branch** **JBK**

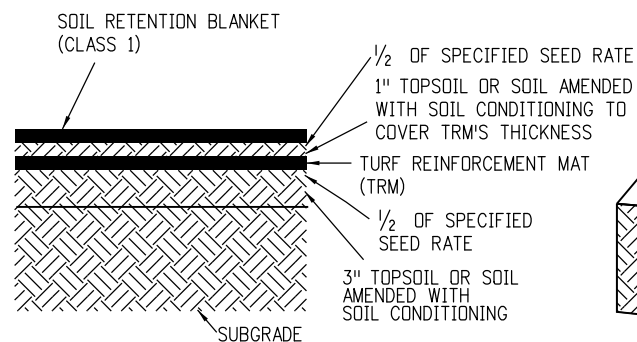
**NURSERY STOCK DETAILS**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
**M-214-1**  
**Standard Sheet No. 1 of 1**  
 Project Sheet Number:



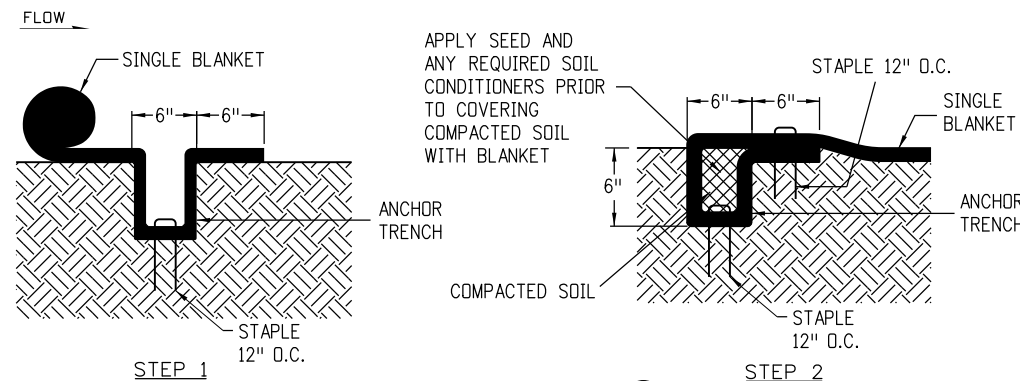
**TYPICAL STAPLE PATTERN FOR CHANNEL APPLICATION**

SEE SUBSECTION 216.05.



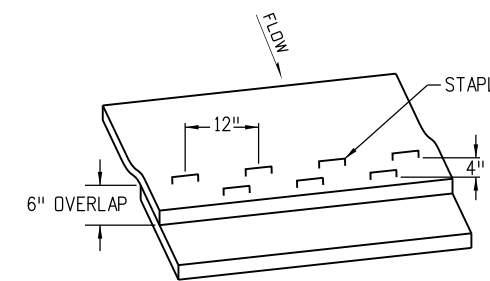
**SOIL FILLED TRM APPLICATION**

1. PLACE 3" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING.
2. APPLY HALF OF THE SPECIFIED SEED AT THE BROADCAST RATE AND RAKE IT INTO THE SOIL.
3. INSTALL TRM.
4. PLACE 1" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING INTO THE MATRIX TO COVER THE PRODUCT'S THICKNESS.
5. APPLY THE REMAINING HALF OF THE SPECIFIED SEED AT THE BROADCAST RATE AND RAKE IT INTO THE SOIL.
6. INSTALL SOIL RETENTION BLANKET (CLASS 1).



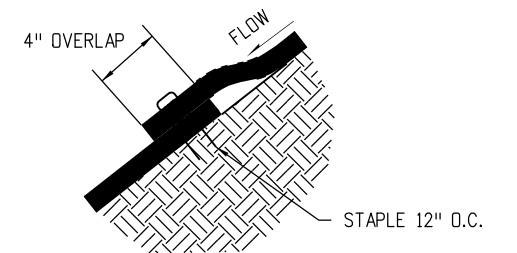
**ANCHOR TRENCH (A)**

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



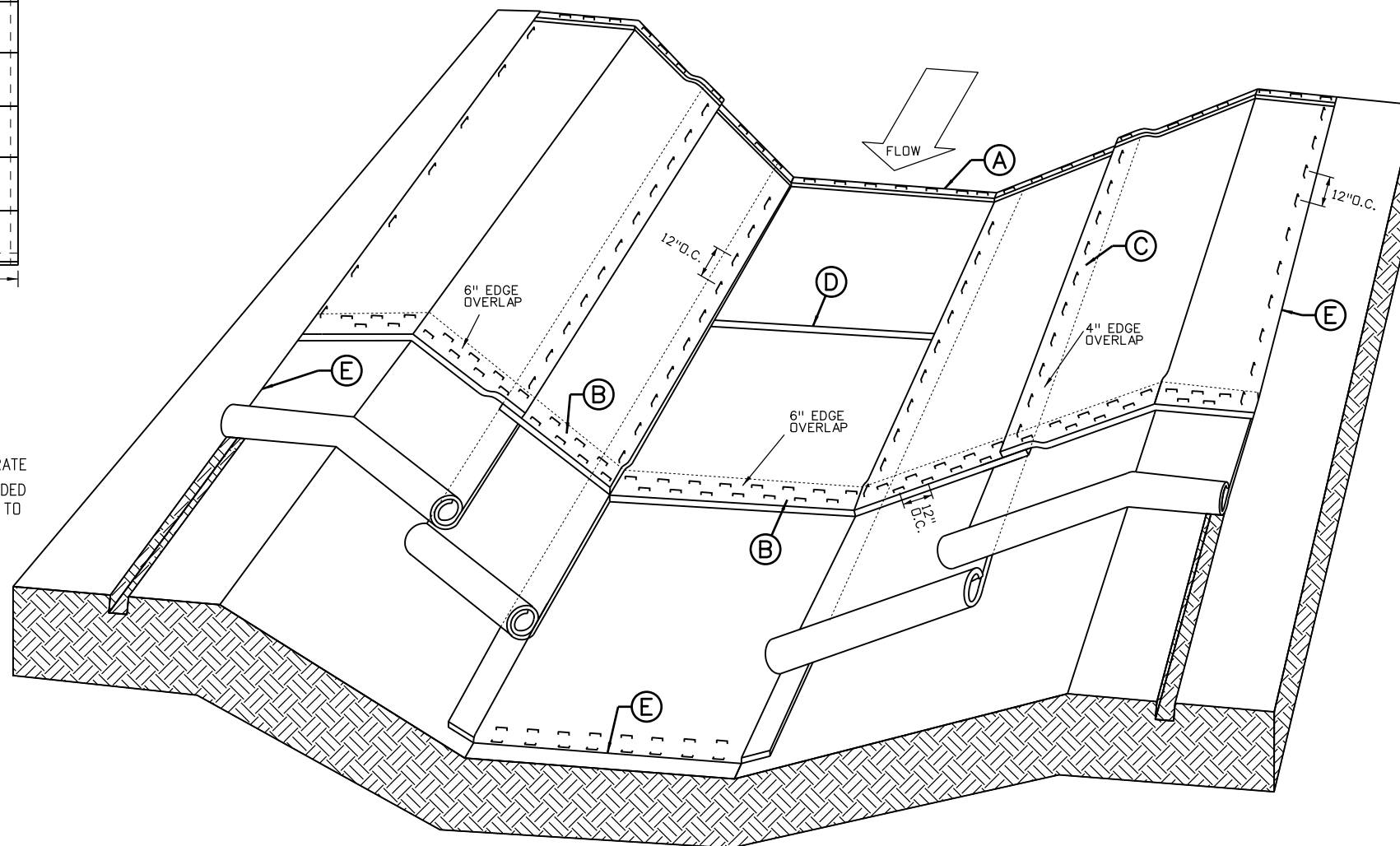
**CONSECUTIVE ROLL OVERLAP (B)**

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.



**SIDE SEAM OVERLAP (C)**

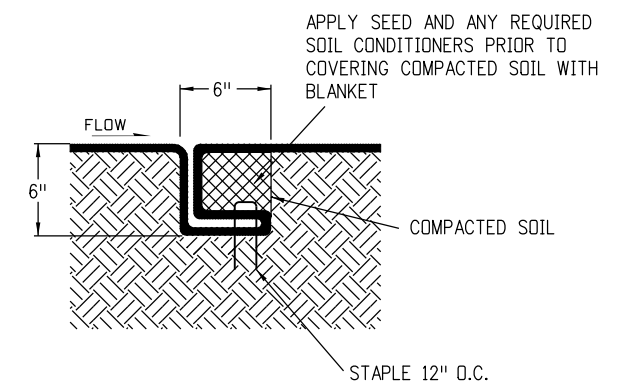
TO BE USED FOR OVERLAP WHEN 2 WIDTHS OF BLANKET ARE APPLIED SIDE BY SIDE WITH THE UPHILL BLANKET PLACED ON TOP OF THE BLANKET ON THE DOWNHILL SIDE.



**SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM)**

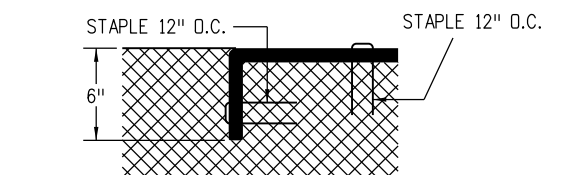
**CHANNEL APPLICATION**

IN ACCORDANCE WITH SECTION 216.



**CHANNEL CHECK SLOT (D)**

TO BE USED AT 30' INTERVALS IN CHANNEL FLOWLINE.



**TERMINATION OF CHANNEL (E)**

**GENERAL 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.

**Computer File Information**

Creation Date: 07/31/19	(R-X)
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**Sheet Revisions**

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 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**SOIL RETENTION COVERING**

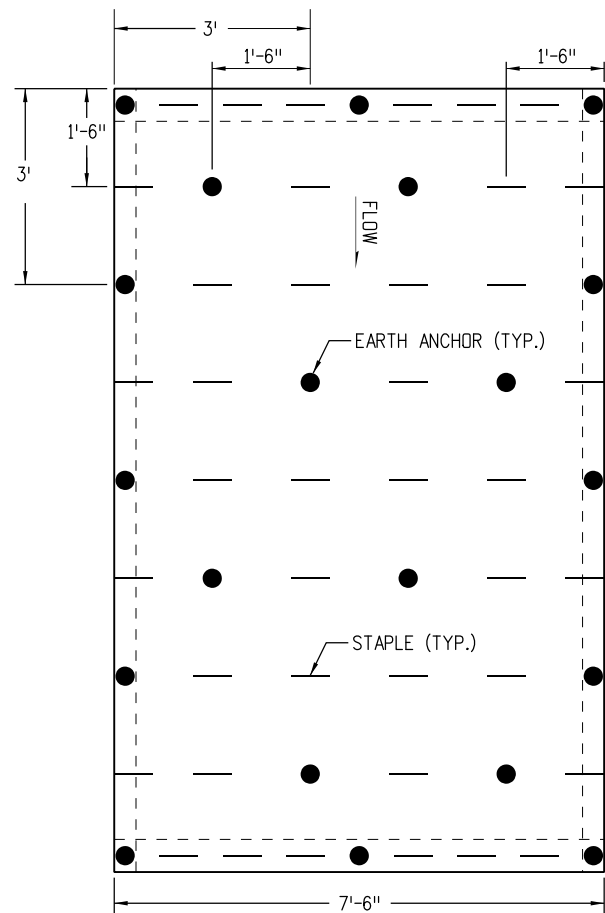
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

M-216-1

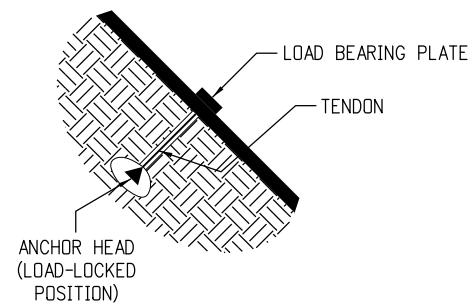
**Standard Sheet No. 1 of 2**

Project Sheet Number:



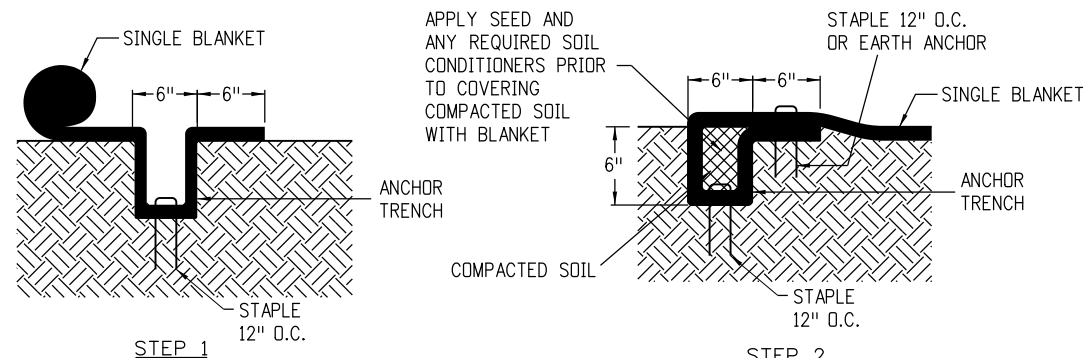
**TYPICAL STAPLE OR EARTH ANCHOR PATTERN FOR SLOPE APPLICATION**

IF EARTH ANCHORS ARE NOT SPECIFIED ON THE PLANS, ONLY STAPLES SHALL BE USED. SEE SUBSECTION 216.04



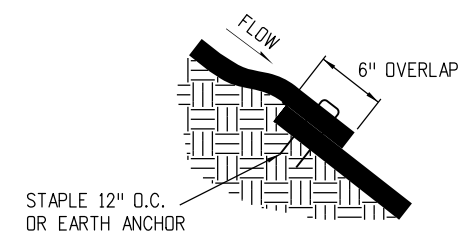
**EARTH ANCHOR**

- NOTES: 1. EARTH ANCHORS WILL BE USED INSTEAD OF STAPLES WHEN SPECIFIED IN THE PLANS.  
2. EARTH ANCHORS SHALL BE PAID FOR SEPERATLY AS SPECIFIED IN SECTION 216.



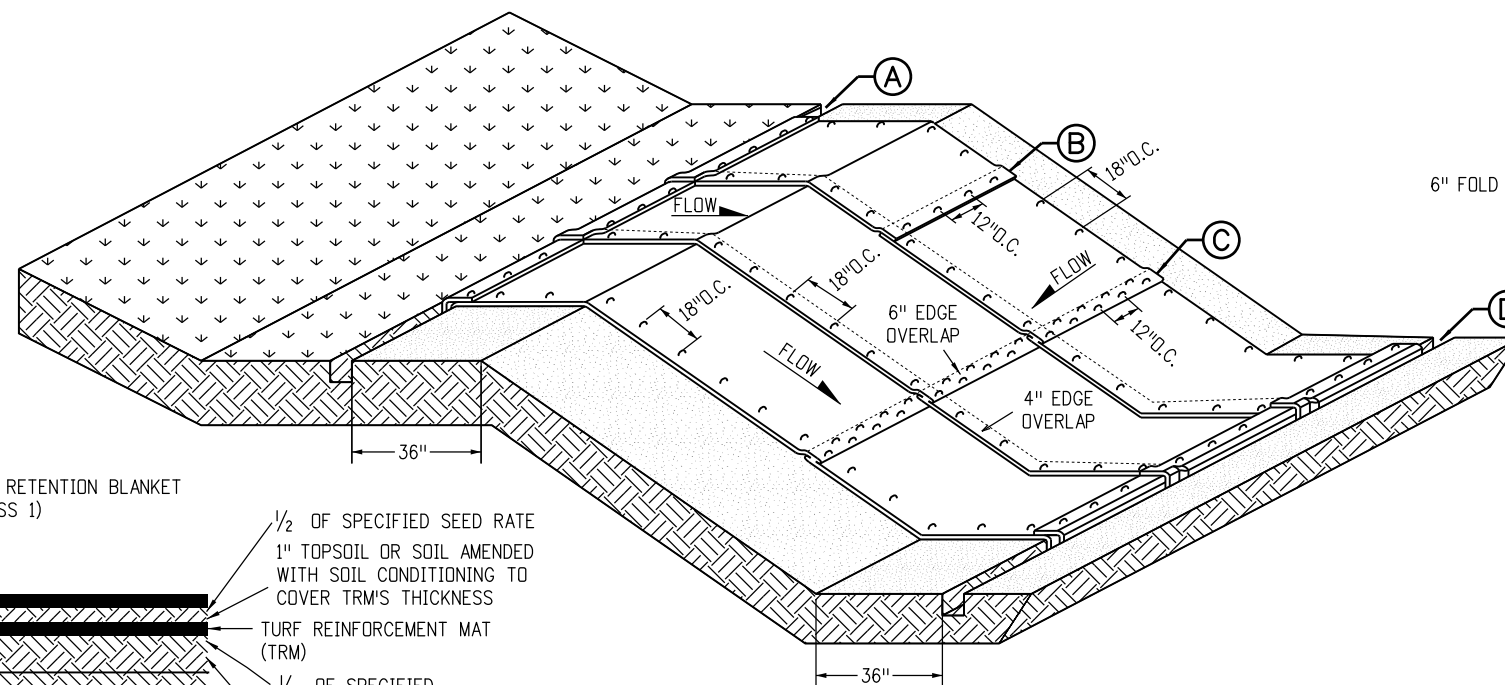
**ANCHOR TRENCH (A)**

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).



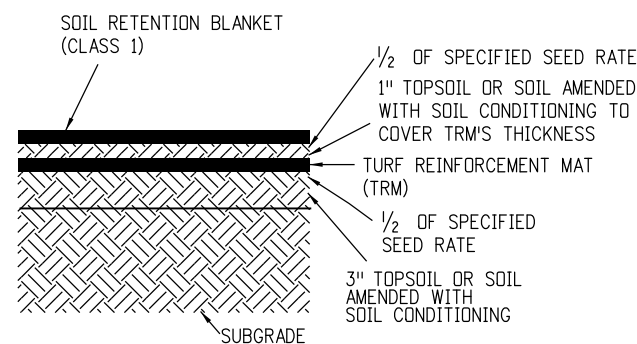
**CONSECUTIVE ROLL OVERLAP (B)**

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.



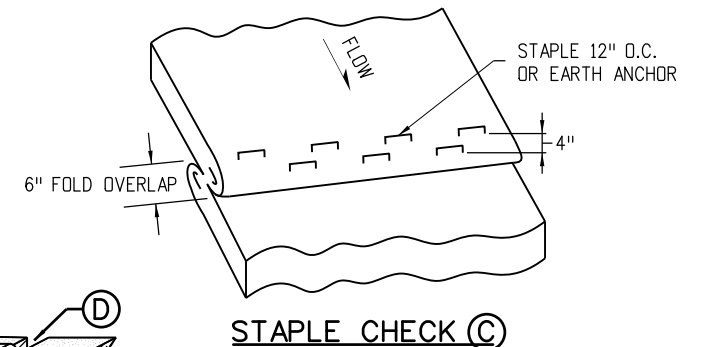
**SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) SLOPE APPLICATION**

IN ACCORDANCE WITH SECTION 216.

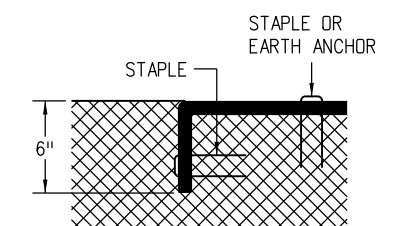


**SOIL FILLED TRM APPLICATION**

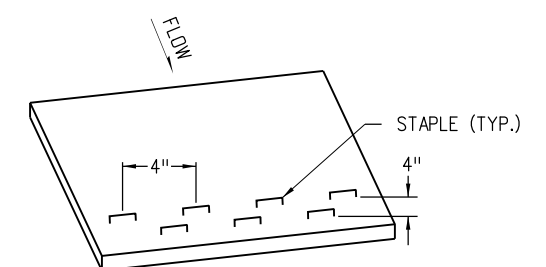
1. PLACE 3" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING.
2. APPLY HALF OF THE SPECIFIED SEED AT THE BROADCAST RATE AND RAKE IT INTO THE SOIL.
3. INSTALL TRM.
4. PLACE 1" TOPSOIL OR SOIL AMENDED WITH SOIL CONDITIONING INTO THE MATRIX TO COVER THE PRODUCT'S THICKNESS.
5. APPLY THE REMAINING HALF OF THE SPECIFIED SEED AT THE BROADCAST RATE AND RAKE IT INTO THE SOIL.
6. INSTALL SOIL RETENTION BLANKET (CLASS 1).



**STAPLE CHECK (C)**



**TERMINATION OF CHANNEL (D)**



**DOWNSLOPE END STAPLE CHECK**

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

**Computer File Information**

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**Sheet Revisions**

Date:	Comments

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 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**SOIL RETENTION COVERING**

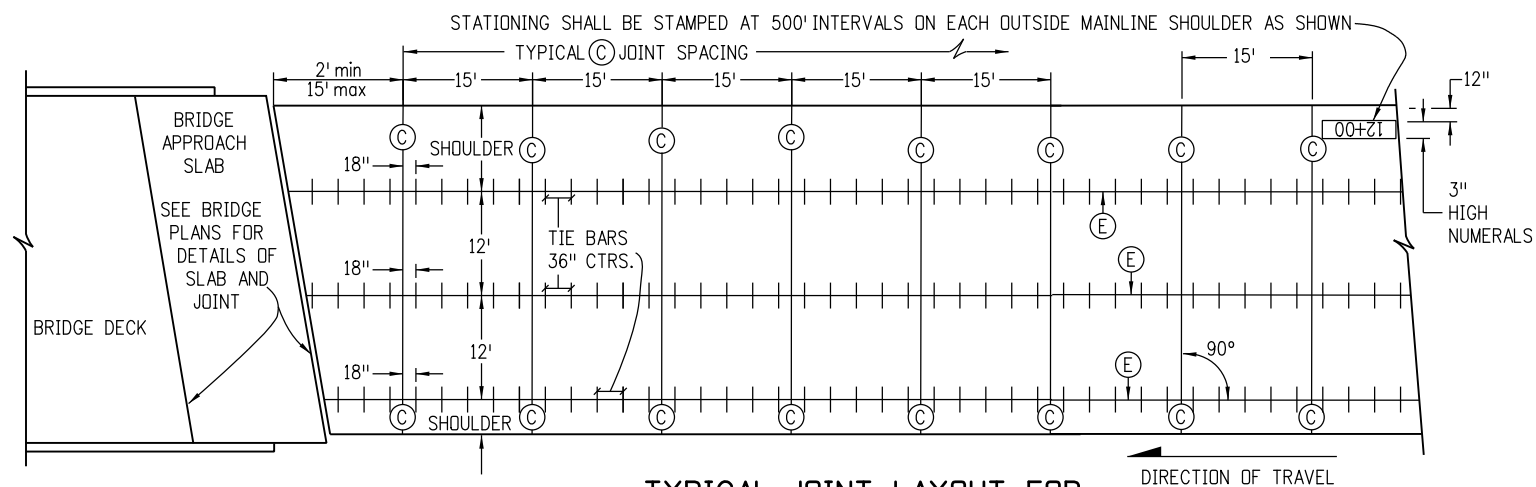
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

M-216-1

**Standard Sheet No. 2 of 2**

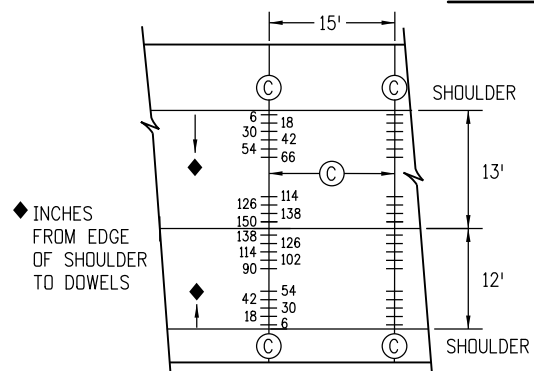
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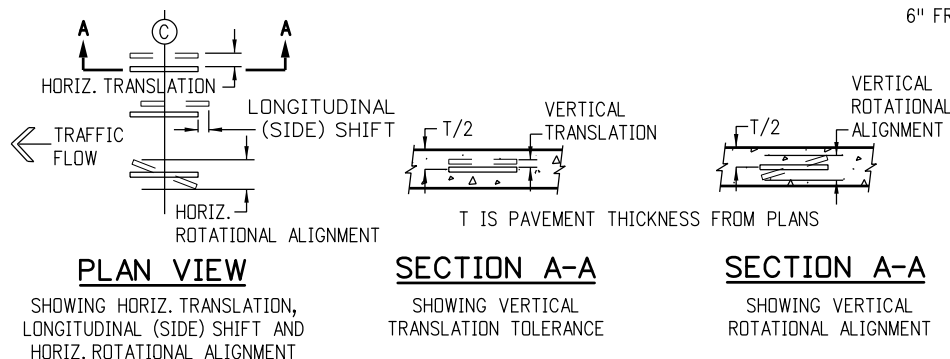
**TYPICAL JOINT LAYOUT FOR CONCRETE ROADWAY WITH CONCRETE SHOULDERS**

**GENERAL NOTES**

1. THIS STANDARD PLAN DOES NOT APPLY TO THIN CONCRETE OVERLAYS (WHITETOPPING).
2. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT 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 13 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 (C) JOINTS ARE SHOWN IN THE SHOULDER, THE DOWEL BARS WILL BE PLACED ON 12" CENTERS STARTING 6" FROM THE ROADWAY (E) JOINT.



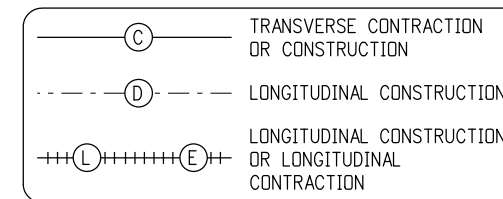
**DOWEL BAR DETAIL FOR (C) JOINT WITH 13 FT. AND 12 FT. WIDE SLABS**



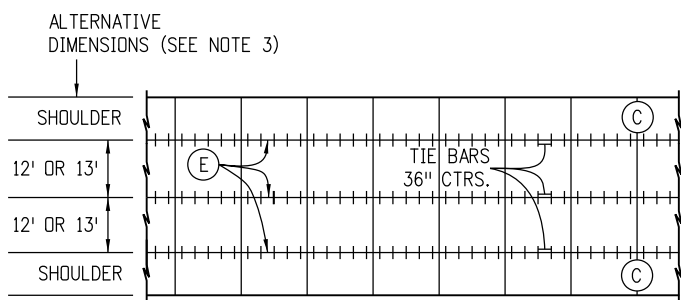
**DETAILS ILLUSTRATING DOWEL PLACEMENT TOLERANCES**  
SEE SUBSECTION 412.13(b)2 FOR ALLOWED TOLERANCE VALUES.

**JOINT LEGEND**

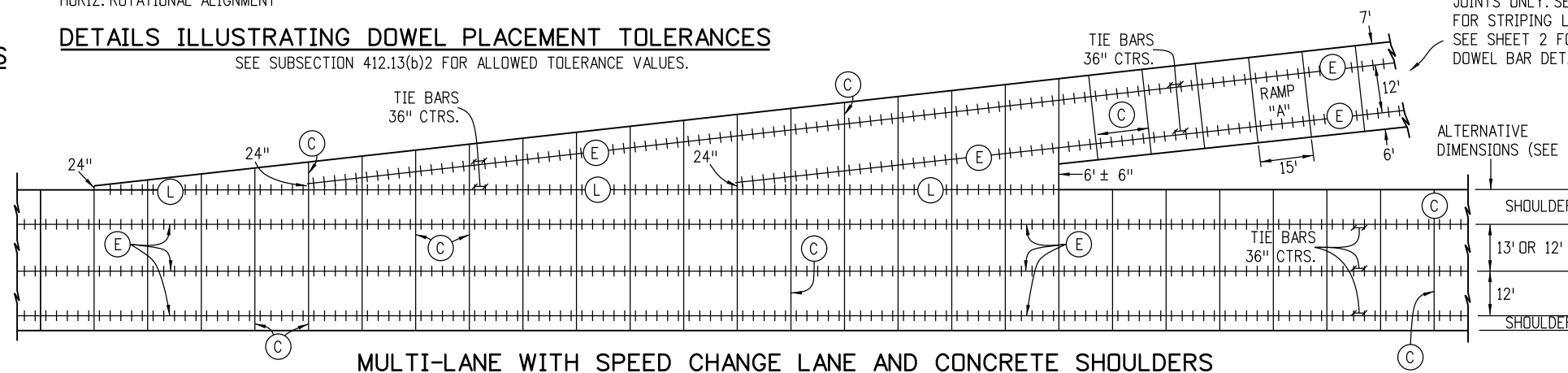
(SEE SHEET 5 FOR JOINT DETAILS)



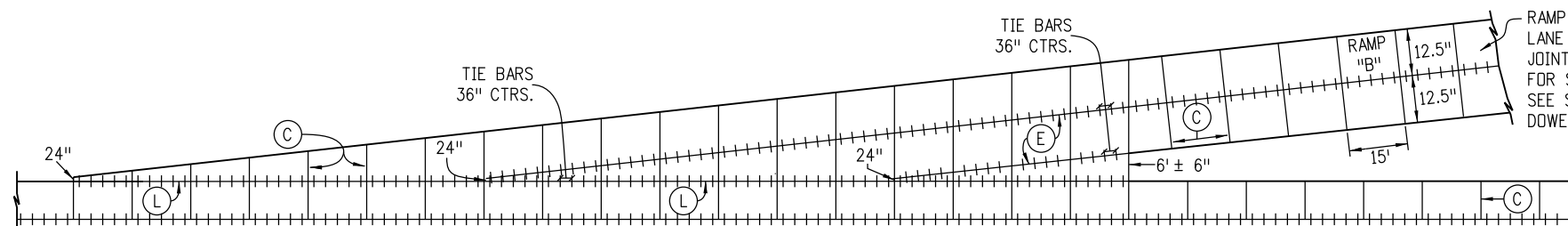
RAMP AND SPEED CHANGE LANE DIMENSIONING FOR JOINTS ONLY. SEE PLANS FOR STRIPING LOCATIONS. SEE SHEET 2 FOR RAMP DOWEL BAR DETAILS.



**RURAL TWO-LANE**



**MULTI-LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS**



**OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE SPEED CHANGE LANE**

RAMP AND SPEED CHANGE LANE DIMENSIONING FOR JOINTS ONLY. SEE PLANS FOR STRIPING LOCATIONS. SEE SHEET 2 FOR RAMP DOWEL BAR DETAILS.

Computer File Information	
Creation Date: 07/31/19	
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Sheet Revisions	
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(R-X)	
(R-X)	

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Project Development Branch JBK

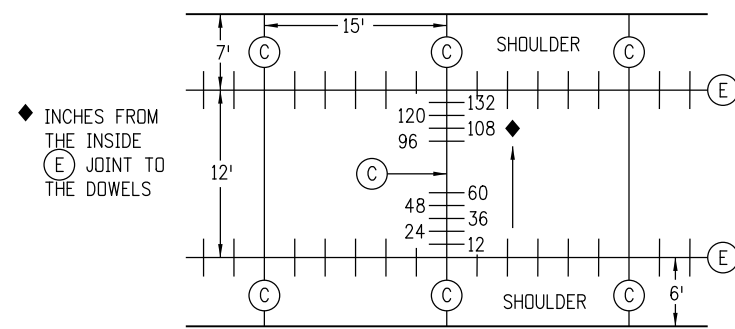
**CONCRETE PAVEMENT JOINTS**

Issued by the Project Development Branch: July 31, 2019

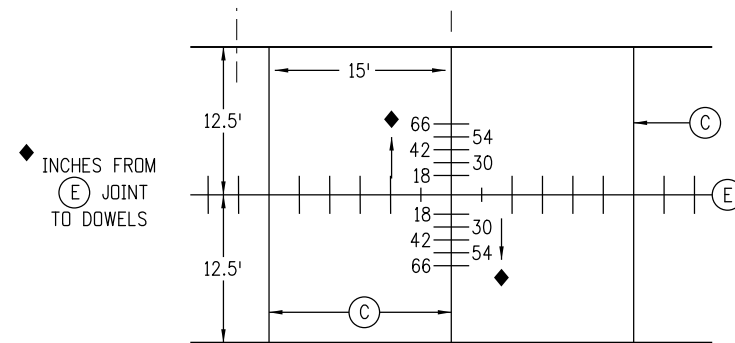
**STANDARD PLAN NO. M-412-1**

Standard Sheet No. 1 of 5

Project Sheet Number:



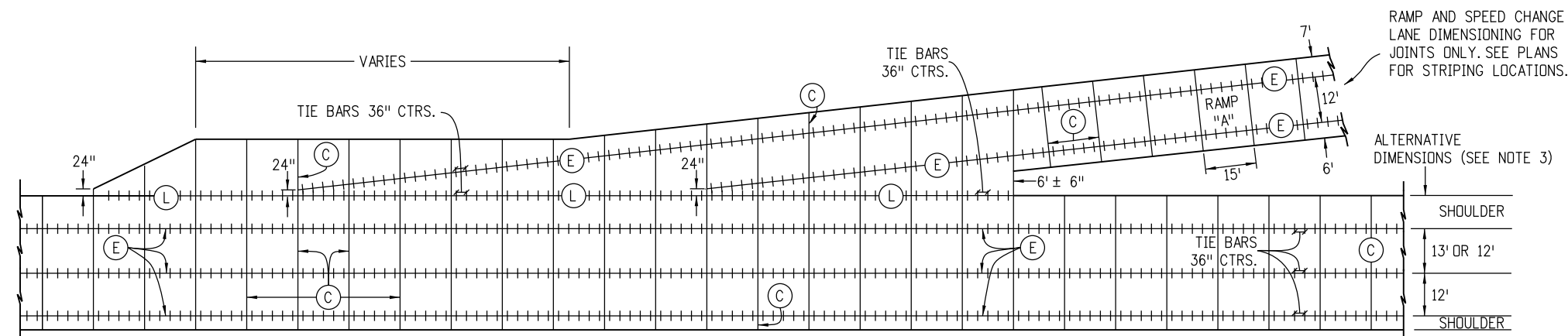
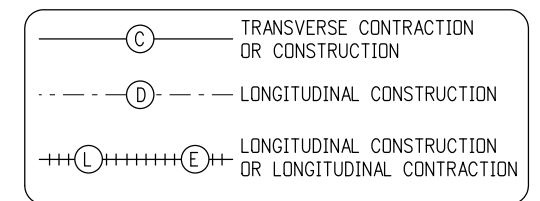
**RAMP "A" DOWEL BAR DETAIL FOR C JOINT WITH A 12 FT. LANE**



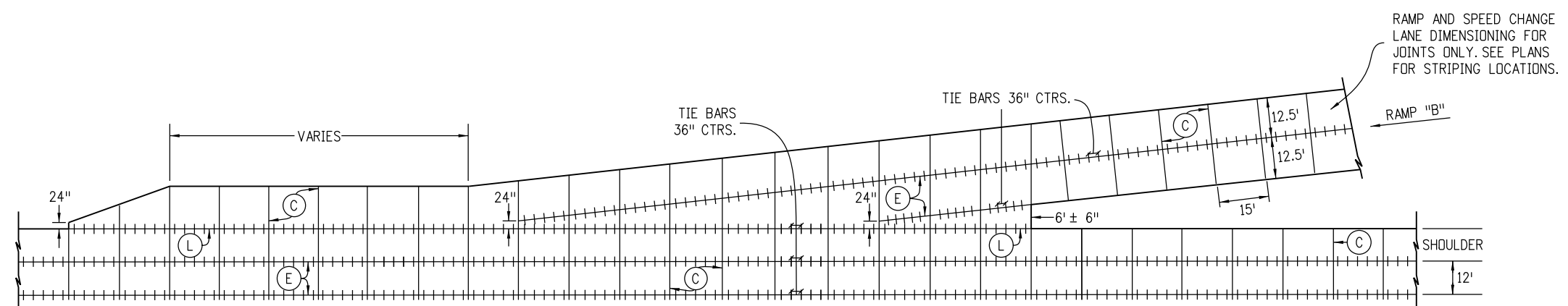
**RAMP "B" DOWEL BAR DETAIL FOR C JOINT WITH CENTER LONGITUDINAL SPLIT LANE**

**JOINT LEGEND**

(SEE SHEET 5 FOR JOINT DETAILS)



**MULTI-LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS**



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

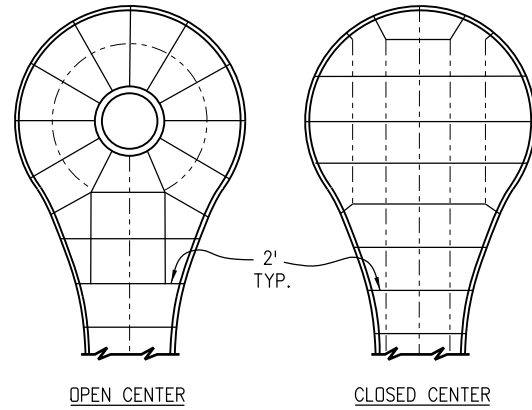
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
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**CONCRETE PAVEMENT JOINTS**  
 Issued by the Project Development Branch: July 31, 2019

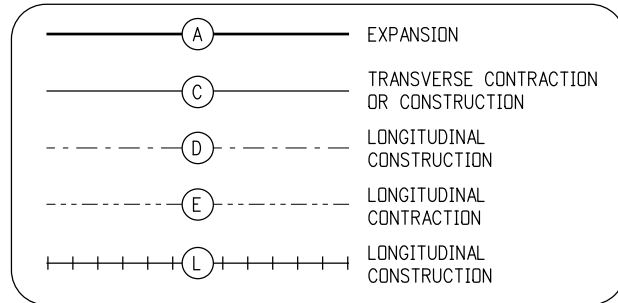
STANDARD PLAN NO.  
**M-412-1**  
 Standard Sheet No. 2 of 5  
 Project Sheet Number:



**CUL-DE-SAC**

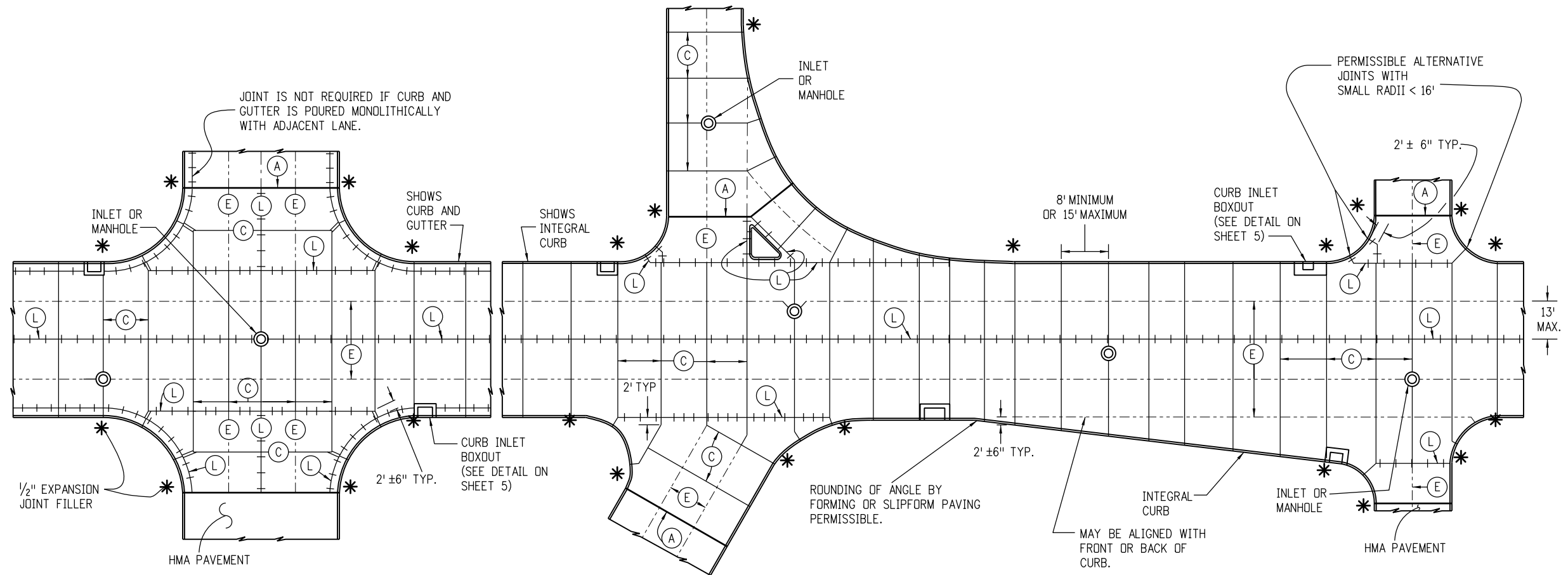
**JOINT LEGEND**

(SEE SHEET 5 FOR JOINT DETAILS)



**NOTES**

1. LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE, AND HAVE A MAXIMUM SPACING OF 13 FT. (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 1/2 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. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT A (C) JOINT.
6. THE ENGINEERS SHALL HAVE AN OPTION TO USE INDIVIDUAL DOWELS IN THE (C) JOINT ON SHORT RUN (2' ± 6") TO CURB RADIUS RETURNS.

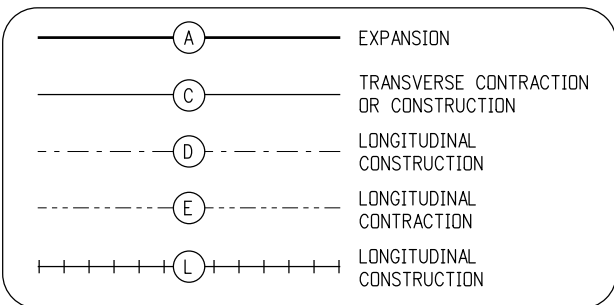


**TYPICAL CURBED PAVEMENT JOINT LAYOUT**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>CONCRETE PAVEMENT JOINTS</b>		<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date: _____		2829 West Howard Place				M-412-1	
Designer Initials: JBK		Comments: _____		CDDT HQ, 3rd Floor		<b>Standard Sheet No. 3 of 5</b>		Project Sheet Number: _____	
Last Modification Date: 07/31/19		_____		Denver, CO 80204					
Detailer Initials: LTA		_____		Phone: 303-757-9021 FAX: 303-757-9868		Issued by the Project Development Branch: July 31, 2019			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		_____		<b>Project Development Branch</b>					
		_____		<b>JBK</b>					

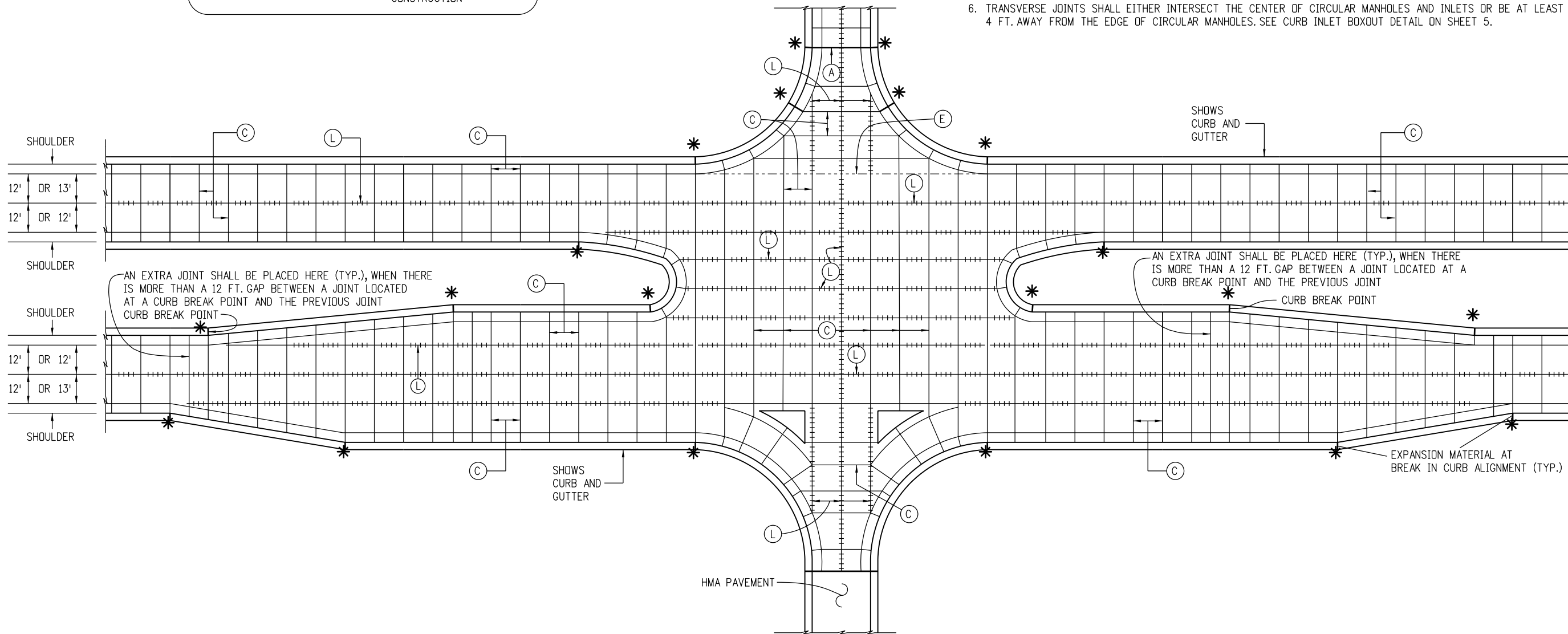
**JOINT LEGEND**

(SEE SHEET 5 FOR JOINT DETAILS)



**NOTES**

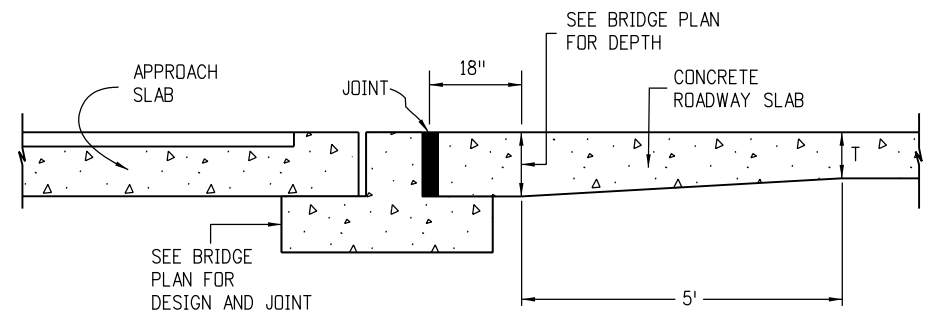
- LONGITUDINAL JOINTS SHALL BE PLACED ADJACENT TO LANE MARKINGS WHEN POSSIBLE, AND HAVE A MAXIMUM SPACING OF 13 FT. (15 FT. IS PERMITTED WITH MONOLITHIC CURB AND GUTTER).
- CONSTRUCT TRANSVERSE JOINTS PERPENDICULAR TO THE CENTERLINE OF PAVEMENT AND EXTEND THROUGH THE CURB OR CURB AND GUTTER.
- PLACE 1/2 IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
- 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.
- 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.
- 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.



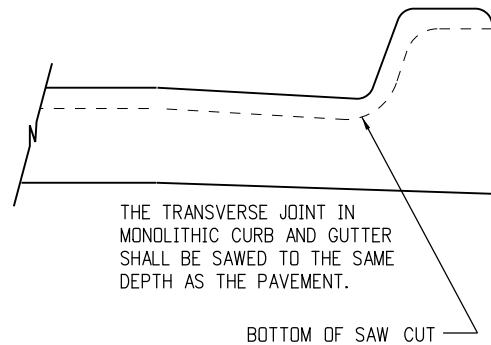
**MULTI-LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>CONCRETE PAVEMENT JOINTS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-412-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 4 of 5	
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			Project Development Branch	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	





**BRIDGE APPROACH**



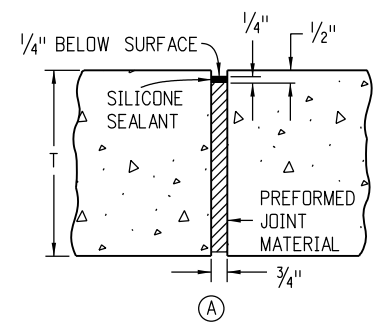
**NOTE**

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

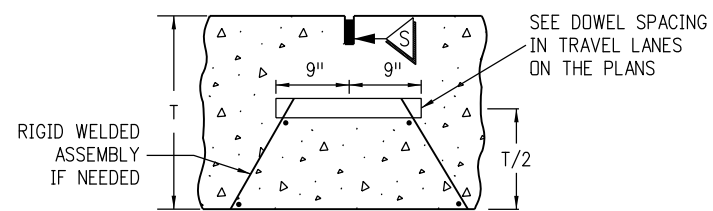
PAVEMENT THICKNESS (T)	DOWEL BAR DIAMETER
7 IN. ≤ T < 8 IN.	1 IN.
8 IN. ≤ T ≤ 10 IN.	1.25 IN.
10 IN. < T ≤ 15 IN.	1.50 IN.

**REINFORCING SIZE TABLE**

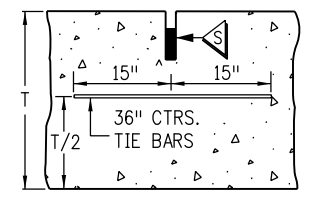
TIE BAR SIZE IS NO. 5 WHEN PAVEMENT IS PLACED ON UNBOUND BASES.  
TIE BAR IS NO. 6 WHEN PAVEMENT IS PLACED ON LIME TREATED SOIL, ASPHALT OR CEMENT TREATED, MILLED ASPHALT, OR RECYCLED ASPHALT BASES.



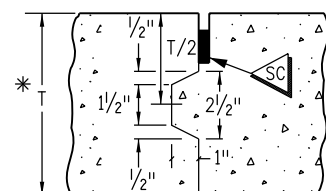
**EXPANSION JOINT**



**DOWELED TRANSVERSE CONSTRUCTION OR CONTRACTION JOINT**  
(TRANSVERSE WEAKENED PLANE JOINT)

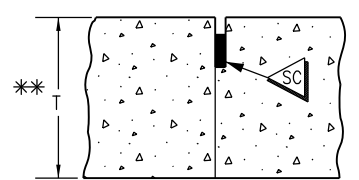


**LONGITUDINAL CONTRACTION JOINT**  
(LONGITUDINAL WEAKENED PLANE JOINT)



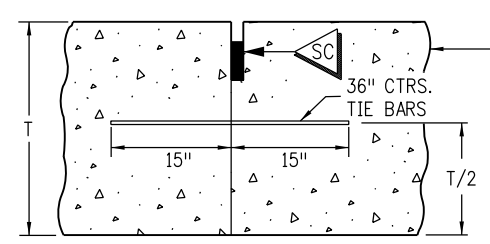
**LONGITUDINAL CONSTRUCTION JOINT**

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



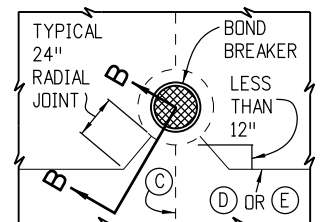
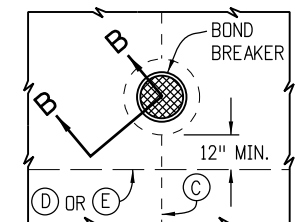
**LONGITUDINAL CONSTRUCTION JOINT**

\*\* USE ONLY IF T < 8 IN.

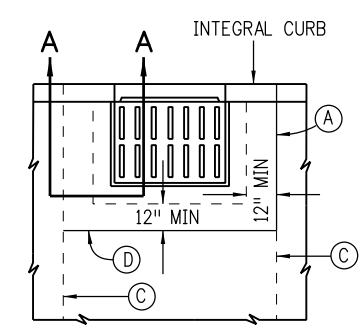


**LONGITUDINAL CONSTRUCTION JOINT**

A KEYWAY IS ALLOWED TO FACILITATE USE OF BENT TIE BARS OR APPROVED TWO PIECE CONNECTORS

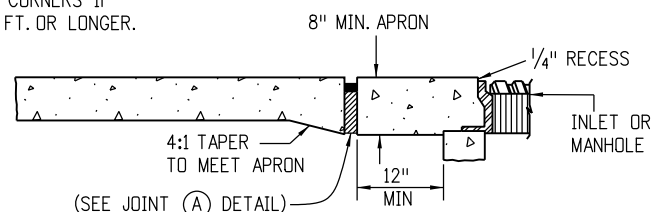


**INLET OR MANHOLE CAST IN PAVEMENT**

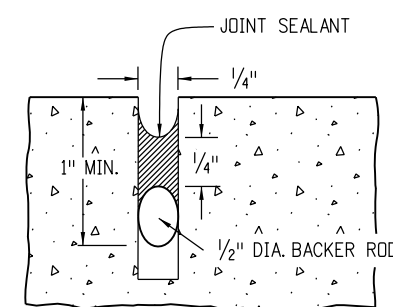


**CURB INLET BOXOUT**

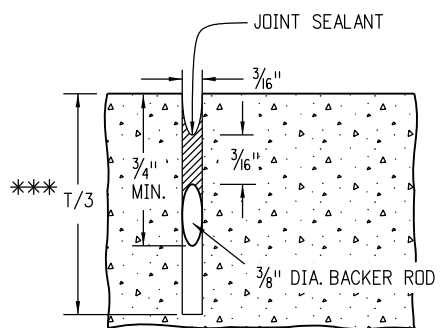
INSTALL TRANSVERSE JOINT AT BOTH BOXOUT CORNERS IF BOXOUT IS 8 FT. OR LONGER.



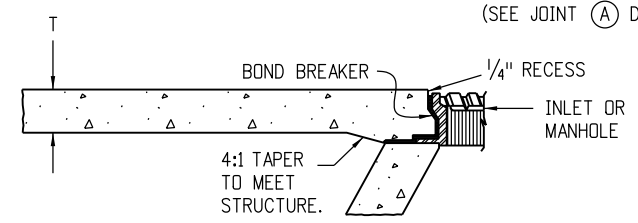
**SECTION A-A**



**SEAL AT CONSTRUCTION JOINT**



**SAWED JOINT**  
\*\*\* USE T/4 WHEN T < 8 IN.



**SECTION B-B**

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

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

**Sheet Revisions**

Date:	Comments

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Phone: 303-757-9021 FAX: 303-757-9868  
Project Development Branch **JBK**

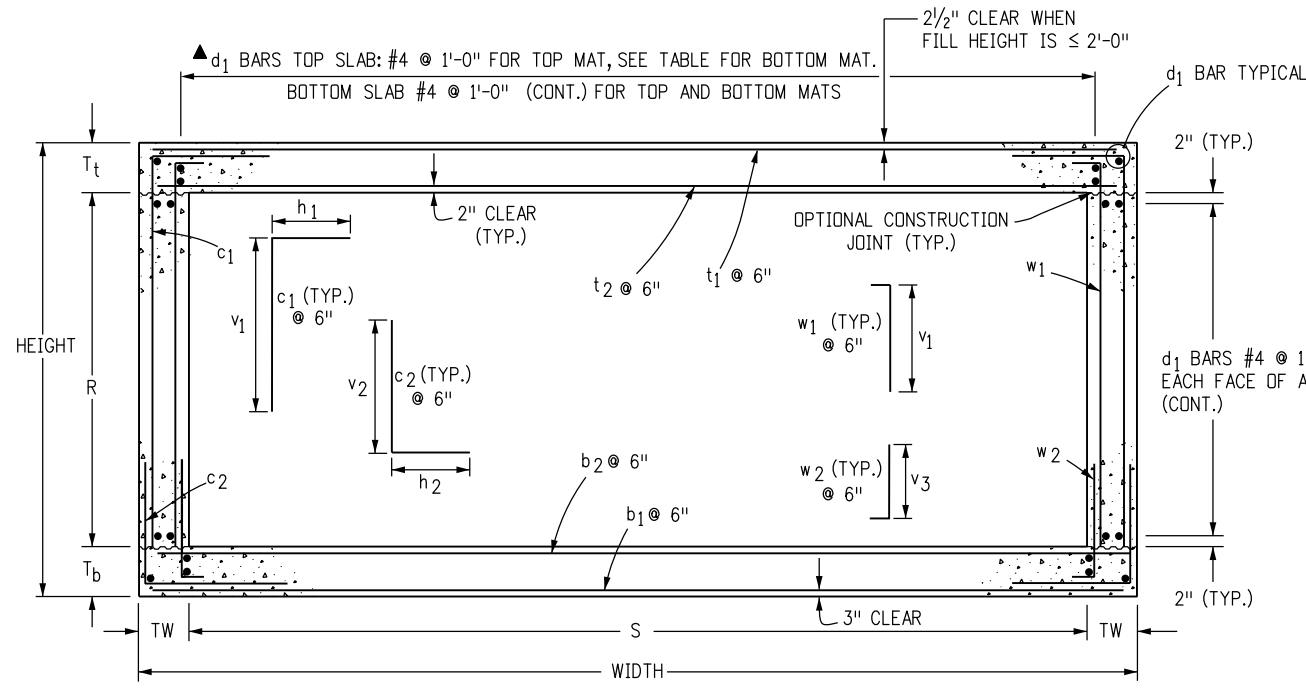
**CONCRETE PAVEMENT JOINTS**

Issued by the Project Development Branch: July 31, 2019

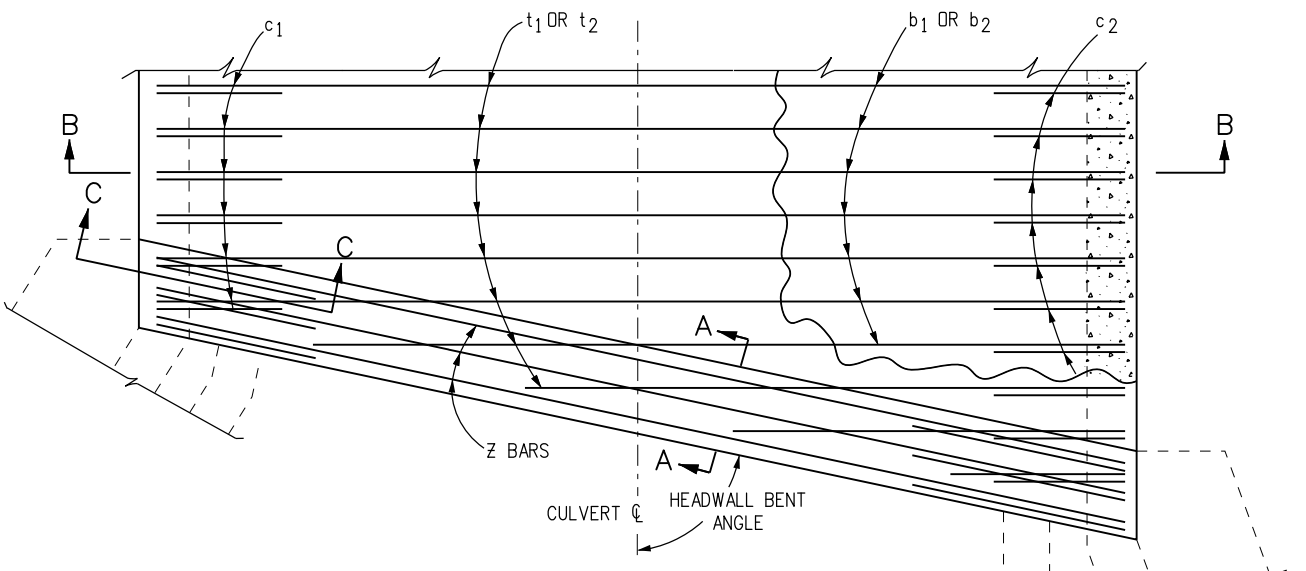
**STANDARD PLAN NO.**

**M-412-1**  
Standard Sheet No. 5 of 5  
Project Sheet Number:



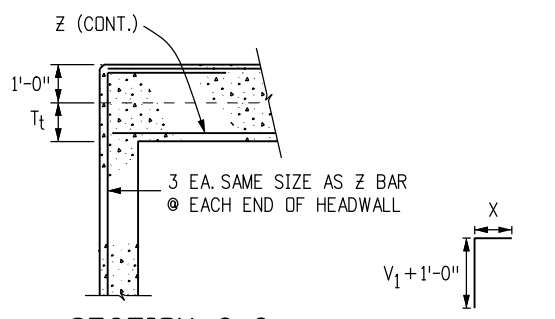


**SECTION B-B**

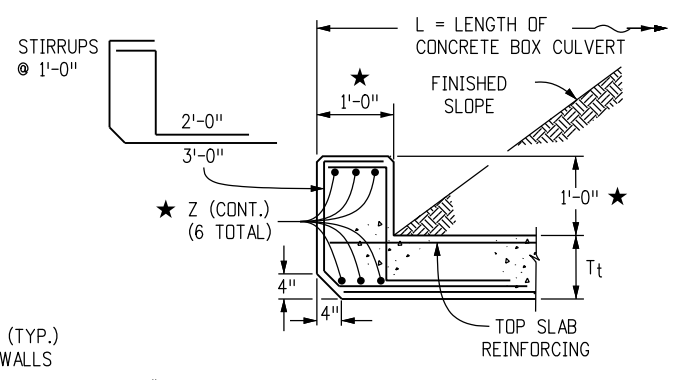


**REINFORCING PLAN**

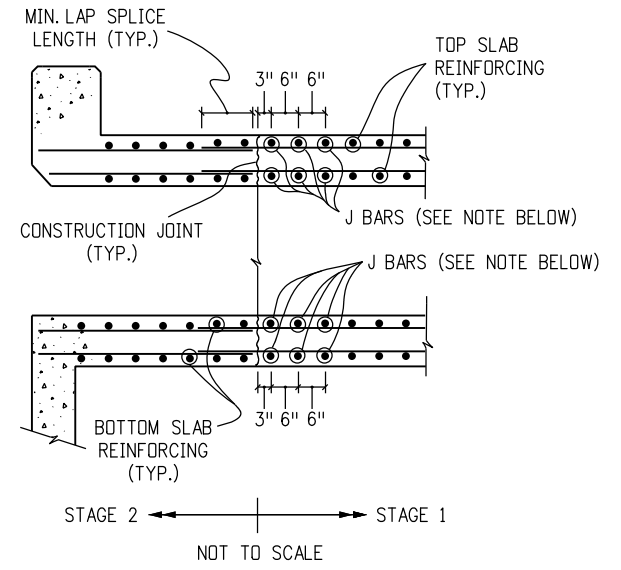
BAR SIZE (#)	EPOXY X (FT.-IN.)	BLACK X (FT.-IN.)
4	2-4	1-11
5	2-10	2-4
6	3-5	2-10
7	4-1	3-3
8	5-3	4-3
9	6-8	5-5



**SECTION C-C  
HEADWALL CORNER REINFORCING DETAIL**



**SECTION A-A**



**CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION**

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE C OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

**GENERAL NOTES**

- ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
- ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
- ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
- THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
- STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
- BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'c.
- SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
- REINFORCING STEEL SHALL BE GRADE 60.
- 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'-7"	2'-5"	2'-10"	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'-1"	1'-4"	1'-7"	1'-11"	2'-6"	3'-1"	3'-11"	4'-10"

- THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.
- ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
  - WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
  - ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
  - THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
  - ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4".
  - FOR FILL HEIGHTS LESS THAN 2 FT. A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18 INCHES DOWN FROM THE TOP OF THE EXTERIOR WALLS.
  - FOR FILL HEIGHTS LESS THAN 2 FT, THE d1 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	6	8	10	12, 14, 16, 18, 20
BAR SIZE:	#5	#6	#6	#5
SPACING	1'-0"	1'-0"	0'-6"	0'-6"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS  
 RATING DATA: 2ND EDITION, 2011, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION

f<sub>y</sub> = 60,000 psi,  
 f'c = 4,500 psi,  
 LOADING DATA:  
 LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK, AND NRL  
 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.  
 THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.  
 WEARING SURFACE - 12 INCHES THICK CONCRETE PAVEMENT.  
 DEAD LOAD - TYPE 7 BARRIER.  
 EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDDT DRAINAGE MANUAL.  
 EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE DESIGN BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.  
 LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

- ★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19, AND THE INFORMATION BELOW):
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
  - ANY SPECIAL DESIGN FOR STIRRUPS 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 19.
  - POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
  - 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.
18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

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 Project Development Branch JBK

**SINGLE CONCRETE BOX  
 CULVERT (CAST-IN-PLACE)**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
 M-601-1  
 Standard Sheet No. 1 of 2**  
 Project Sheet Number:

**SINGLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)**

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES						d1	DIMENSIONS					QUANTITIES			RATING FACTORS					
S	R	HT.	WIDTH		FT-IN	Tt	Tb	TW	t1*	b1	t2	b2	w1*		w2	c1*	c2	NO.	h1	h2	v1	v2	v3	CONCRETE	REBAR STL	WATERPROOFING	HL-93 INVENTORY	HL-93 OPERATING
6	7	8-8	7-8	< 2	10	10	10	4	6	6	4	5	5	5	5	64	3-5	4-4	7-7	3-1	1-11	0.905	215	1.185	1.23	1.59	2.03	2.09
		8-4.5	7-8	2 TO 8	8.5	8	10	4	5	5	4	5	5	5	5	64	3-10	4-4	7-6	2-11	1-9	0.823	199	1.67	1.67	2.17	2.51	2.58
		8-5	7-8	8 TO 15	8.5	8.5	10	4	5	5	4	5	5	5	5	64	3-8	2-4	7-6	3-0	1-9	0.834	190	◆	◆	◆	◆	◆
		8-5	7-8	15 TO 20	8.5	8.5	10	4	5	5	4	5	5	5	5	64	3-8	2-4	7-6	3-0	1-9	0.834	190	◆	◆	◆	◆	◆
		7-9	9-8	< 2	11	10	10	4	7	7	4	5	5	5	5	68	4-9	2-4	6-8	3-1	1-11	0.997	251	1.407	1.10	1.43	1.65	1.63

**HEADWALL AND TOEWALL QUANTITIES**

HEADWALL BENT ANGLE	90° TO 75°			74° TO 60°			59° TO 45°			
	CLEAR SPAN (S)	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF	
6	4	4	22.8	4	4	22.2	6	4	34.6	
8	4	4	23.0	5	4	28.8	7	4	44.0	
10	5	4	28.5	6	4	35.1	9	4	68.7	
12	6	4	35.3	6	4	34.4	9	5	71.7	
14	6	4	34.2	7	4	41.5	★	★	★	
16	6	4	33.1	8	5	54.0	★	★	★	
18	7	4	39.5	9	5	63.3	★	★	★	
20	7	4	39.3	★	★	★	★	★	★	

CONCRETE QUANTITY = 0.086 CY/LF

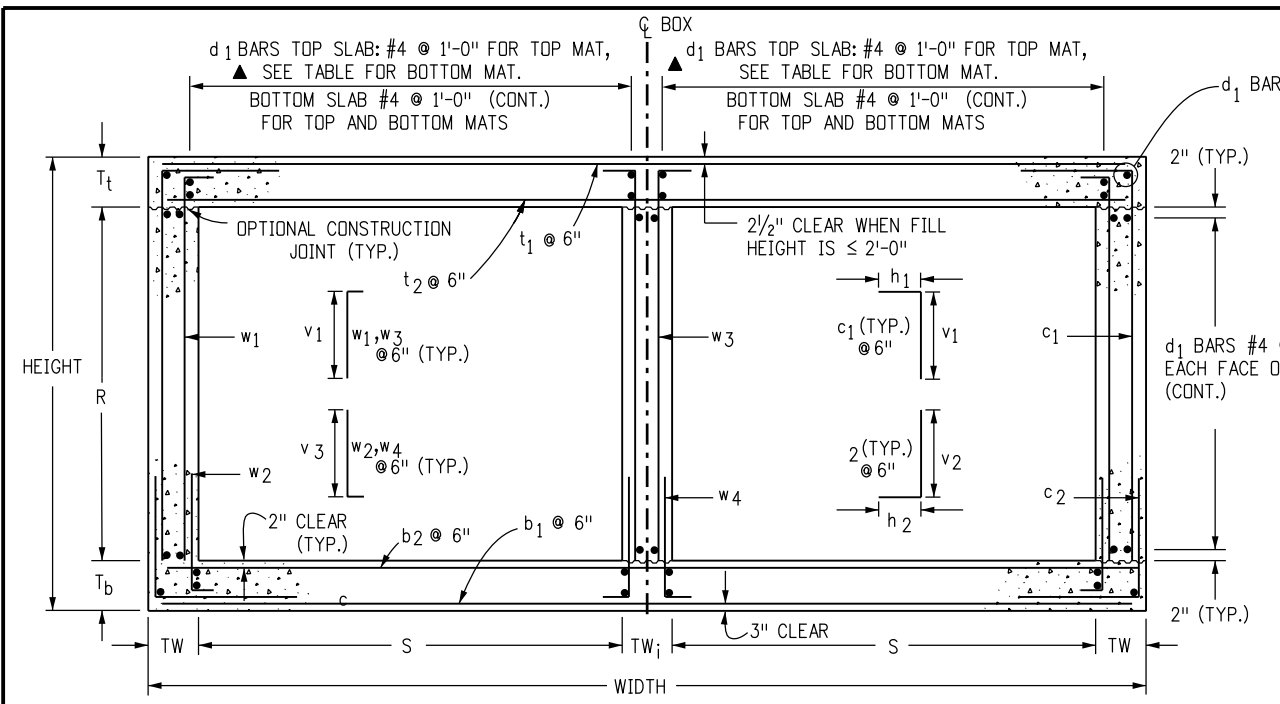
**NOTES**

- SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.
- QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL. STEEL QUANTITIES INCLUDE ALL REINFORCING. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.
- ★ SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.
- FOR HEADWALL AND TOEWALL DETAILS SEE M-601-1, SHEET 1 OF 2.
- WHEN THE FILL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT, ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (\*), AND THE d1 BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.
- REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.
- WHEN A (RISE) R 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).
- ▲ FOR SIZE AND SPACING OF THE BOTTOM MAT BARS IN THE TOP SLAB SEE TABLE ON M-601-1, SHEET 1 OF 2. ALL OTHER d1 BARS ARE #4's AT 1'-0" SPACING. THE NUMBER OF BARS REQUIRED IS LISTED ON THIS SHEET AND INCLUDES BOTH #4 BARS AND THOSE FROM THE TABLE.
- ◆ LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDDT RATING MANUAL.
- FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDDT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDDT RATING MANUAL.

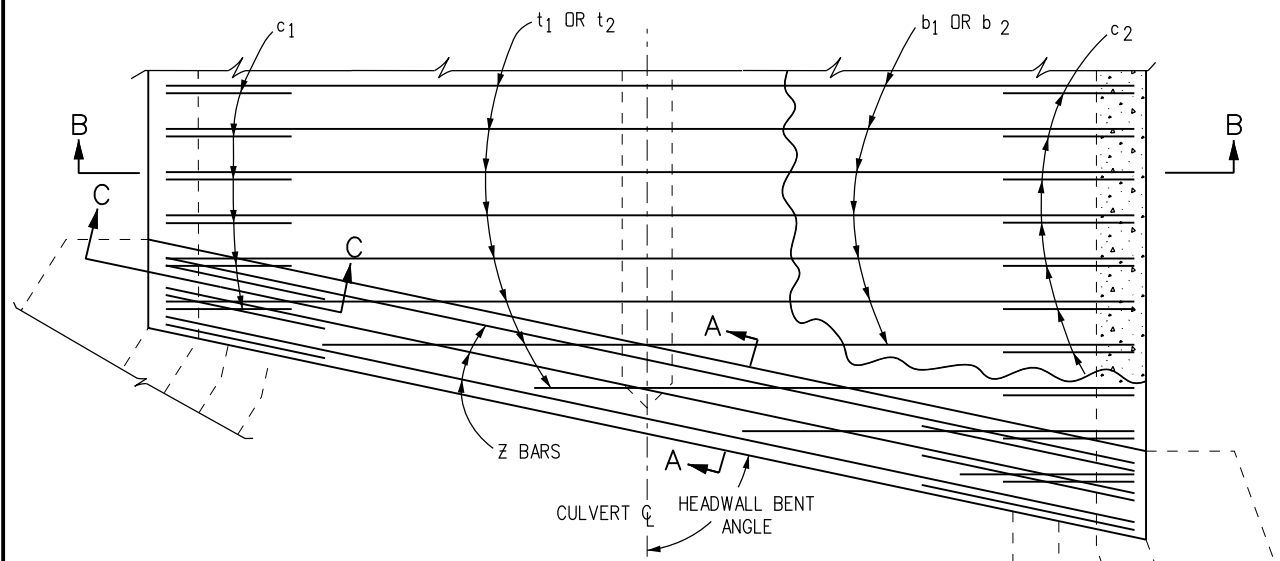
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>SINGLE CONCRETE BOX CULVERT (CAST-IN-PLACE)</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			<b>M-601-1</b> <b>Standard Sheet No. 2 of 2</b>	
Designer Initials: JBE		(R-X)					
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Project Development Branch	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	



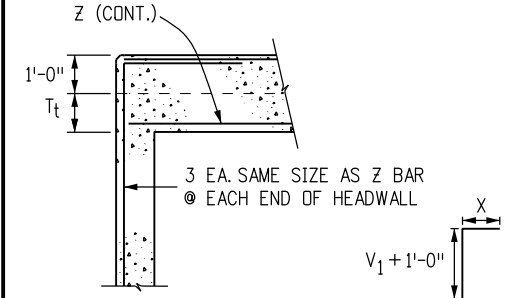
JBK



**SECTION B-B**

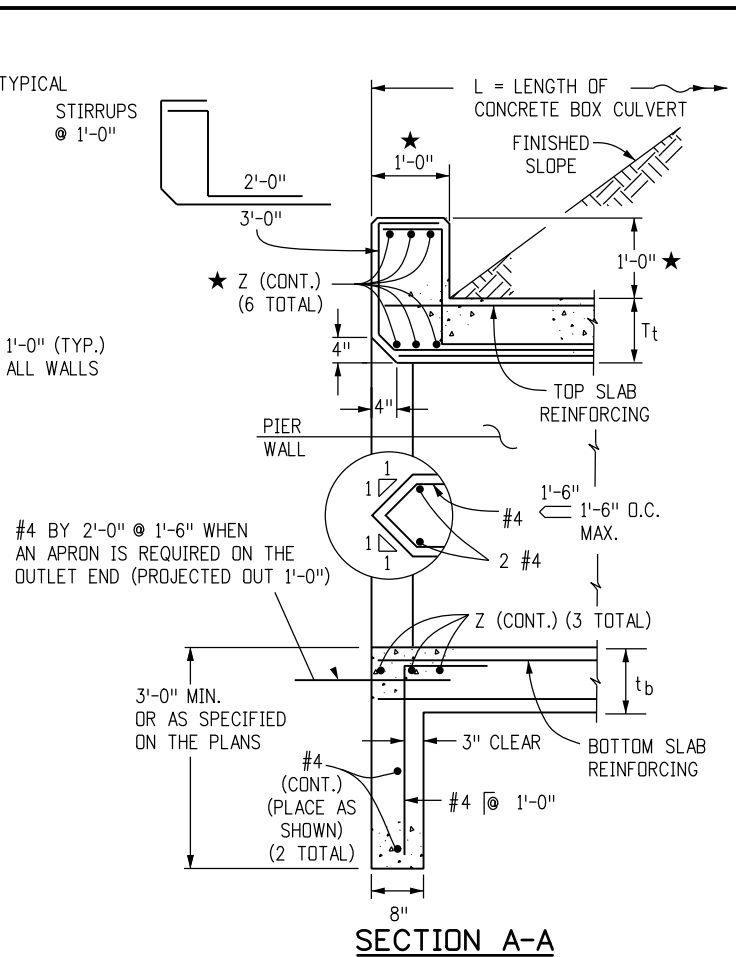


**REINFORCING PLAN**

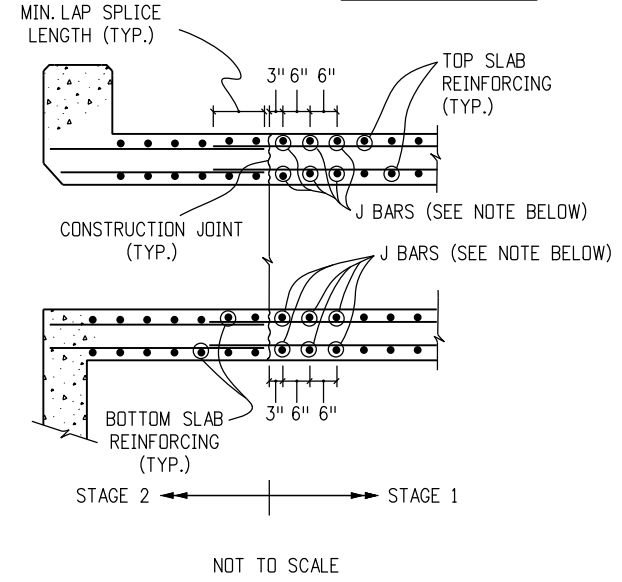


**SECTION C-C  
HEADWALL CORNER REINFORCING DETAIL**

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



**SECTION A-A**



**CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION**  
NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE C OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

**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'-7"	2'-5"	2'-10"	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'-1"	1'-4"	1'-7"	1'-11"	2'-6"	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. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED  $\frac{3}{4}$ ".
16. FOR FILL HEIGHTS LESS THAN 2 FT, A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18" DOWN ALONG THE TOPS OF THE EXTERIOR WALLS.
17. FOR FILL HEIGHTS LESS THAN 2 FT, THE  $d_1$  BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	6, 8	10, 12, 16	14, 18	20
BAR SIZE:	#4	#5	#6	#7
SPACING	0'-6"	1'-0"	1'-2"	1'-2"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS  
RATING DATA: 2ND EDITION, 2011, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION

LOADING DATA:  
 $f_y = 60,000$  psi,  
 $f_c = 4,500$  psi,  
LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK AND NRL

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.

WEARING SURFACE - 12 IN. THICK CONCRETE PAVEMENT.  
DEAD LOAD - TYPE 7 BARRIER.

THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.  
EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDDT DRAINAGE MANUAL.  
EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.

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

- ★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19) AND THE NOTES BELOW:
  - ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
  - ANY SPECIAL DESIGN FOR STIRRUPS 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 19.
  - POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
  - 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.
- 18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

**Computer File Information**

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Last Modification Date: 07/31/19	(R-X)
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**Sheet Revisions**

Date:	Comments

Colorado Department of Transportation  
2829 West Howard Place  
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Phone: 303-757-9021 FAX: 303-757-9868  
Project Development Branch **JBK**

**DOUBLE CONCRETE BOX  
CULVERT (CAST-IN-PLACE)**  
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
M-601-2**  
Standard Sheet No. 1 of 2  
Project Sheet Number:

**DOUBLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)**

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES							DIMENSIONS					QUANTITIES			RATING FACTORS							
S	R	HT.	WIDTH	FT-FT	T <sub>1</sub>	T <sub>2</sub>	TW & TW <sub>1</sub>	t <sub>1</sub> *	t <sub>2</sub>	b <sub>1</sub>	b <sub>2</sub>	w <sub>1</sub> *	w <sub>2</sub>	w <sub>3</sub> *	w <sub>4</sub>	c <sub>1</sub> *	c <sub>2</sub>	d <sub>1</sub> ▲	h <sub>1</sub>	h <sub>2</sub>	v <sub>1</sub>	v <sub>2</sub>	v <sub>3</sub>	CONCRETE	REBAR STL	MEMBRANE	HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE
FT	FT	FT-IN	FT-IN	FT-FT				#	#	#	#	#	#	#	#	#	#	NO.	FT-IN	FT-IN	FT-IN	FT-IN	FT-IN	CY/LF	LBS/LF	CY/LF				
6	6	7-9	14-6	< 2	11	10	10	5	6	5	6	4	4	5	5	114	3-5	2-4	6-8	3-1	1-11	1.495	338	1.944	1.27	1.65	2.09	2.05		
		7-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	300	1.944	1.81	2.35	2.90	2.82	
		7-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	4	4	5	102	2-6	2-4	6-8	3-1	1-11	1.428	258	1.944	4.53	5.88	6.42	7.36	
		7-8	14-6	12.8 TO 20	10	10	10	4	4	4	4	4	4	4	4	5	102	2-6	2-4	6-8	3-1	1-11	1.451	258	1.944	◆	◆	◆	◆	
		9-9	14-6	< 2	11	10	10	5	6	5	6	4	4	4	4	5	126	3-5	2-4	8-8	3-1	1-11	1.681	365	1.944	1.28	1.66	2.10	2.05	
		9-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	4	4	5	114	2-6	2-4	8-8	3-1	1-11	1.613	327	1.944	1.82	2.36	2.85	2.77	
	8	9-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	4	4	5	114	2-6	2-4	8-8	3-1	1-11	1.613	285	1.944	4.66	6.04	6.82	5.08	
		9-8	14-6	12.8 TO 20	10	10	10	4	5	5	5	4	4	4	4	5	114	2-6	2-4	8-8	3-1	1-11	1.636	317	1.944	◆	◆	◆	◆	
		11-9	14-6	< 2	11	10	10	5	6	5	6	4	4	4	4	5	138	3-5	2-4	10-8	3-1	1-11	1.866	392	1.944	1.28	1.67	1.00	2.06	
		11-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	4	4	5	126	2-6	2-4	10-8	3-1	1-11	1.799	354	1.944	1.83	2.38	1.00	2.78	
		11-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	4	4	5	126	2-6	2-4	10-8	3-1	1-11	1.799	312	1.944	2.22	2.88	2.79	1.96	
		11-8.5	14-10.5	12.8 TO 20	10	10.5	11.5	4	5	4	5	4	4	4	4	5	126	2-6	2-4	10-8	3-2	2-0	2.006	336	1.944	◆	◆	◆	◆	

**HEADWALL AND TOEWALL QUANTITIES**

HEADWALL BENT ANGLE	90° TO 75°			74° TO 60°			59° TO 45°			
	CLEAR SPAN (S)	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF	
6	4	4	20.8	4	4	20.4	6	4	31.2	
8	4	4	19.9	5	4	24.3	7	4	36.2	
10	5	4	25.0	6	4	30.6	9	4	57.8	
12	6	4	30.0	6	4	29.6	9	5	61.3	
14	6	4	29.7	7	4	35.7	★	★	★	
16	6	4	29.0	8	5	46.7	★	★	★	
18	7	4	35.0	9	5	54.9	★	★	★	
20	7	4	34.4	★	★	★	★	★	★	

CONCRETE QUANTITY = 0.086 CY/LF

**NOTES**

- SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.
- QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL. STEEL QUANTITIES INCLUDE ALL REINFORCING. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.
- ★ SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.
- FOR HEADWALL AND TOEWALL DETAILS SEE M-601-2, SHEET 1 OF 2.
- WHEN THE FILL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT, ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (\*), AND THE d<sub>1</sub> BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.
- REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.
- WHEN A (RISE) R 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).
- ▲ FOR SIZE AND SPACING OF THE BOTTOM MAT BARS IN THE TOP SLAB SEE TABLE ON M-601-2, SHEET 1 OF 2. ALL OTHER d<sub>1</sub> BARS ARE #4'S AT 1'-0" SPACING. THE NUMBER OF BARS REQUIRED IS LISTED ON THIS SHEET AND INCLUDES BOTH #4 BARS AND THOSE FROM THE TABLE.
- ◆ LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDDT RATING MANUAL.
- FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDDT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDDT RATING MANUAL.

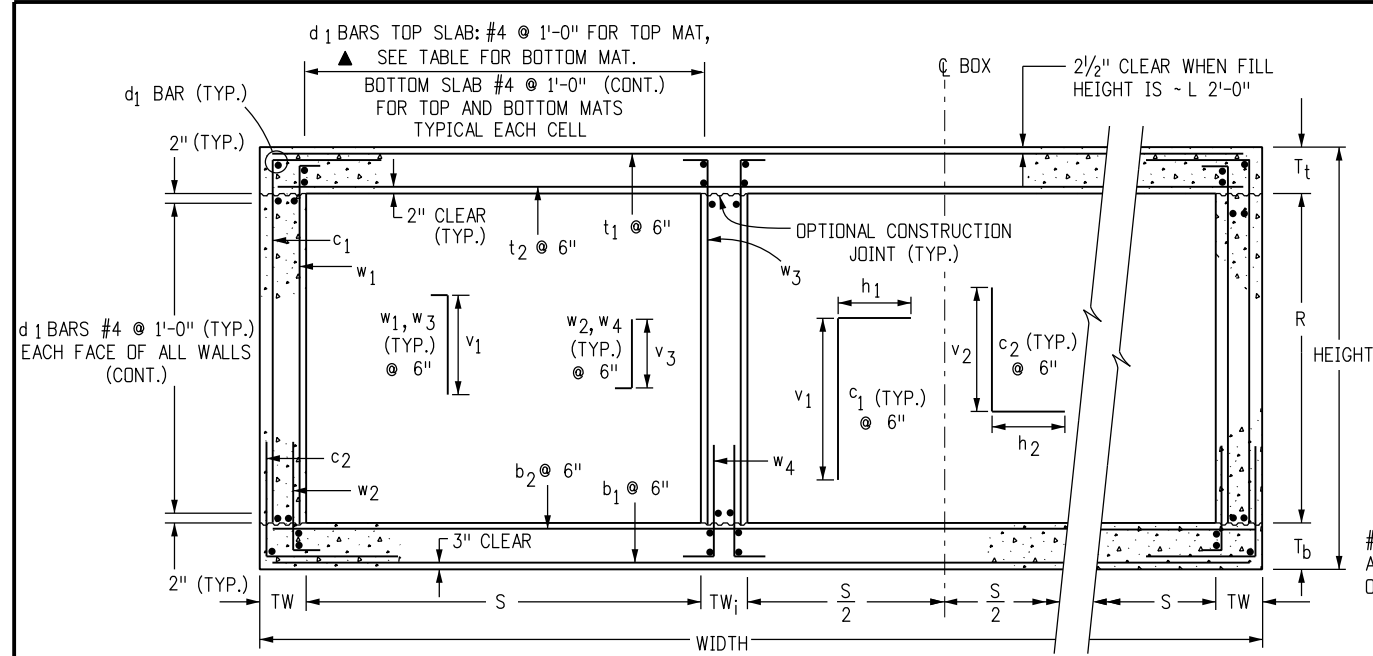
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CAD Ver.: MicroStation V8	(R-X)
Scale: Not to Scale	
Units: English	

Sheet Revisions	
Date:	Comments

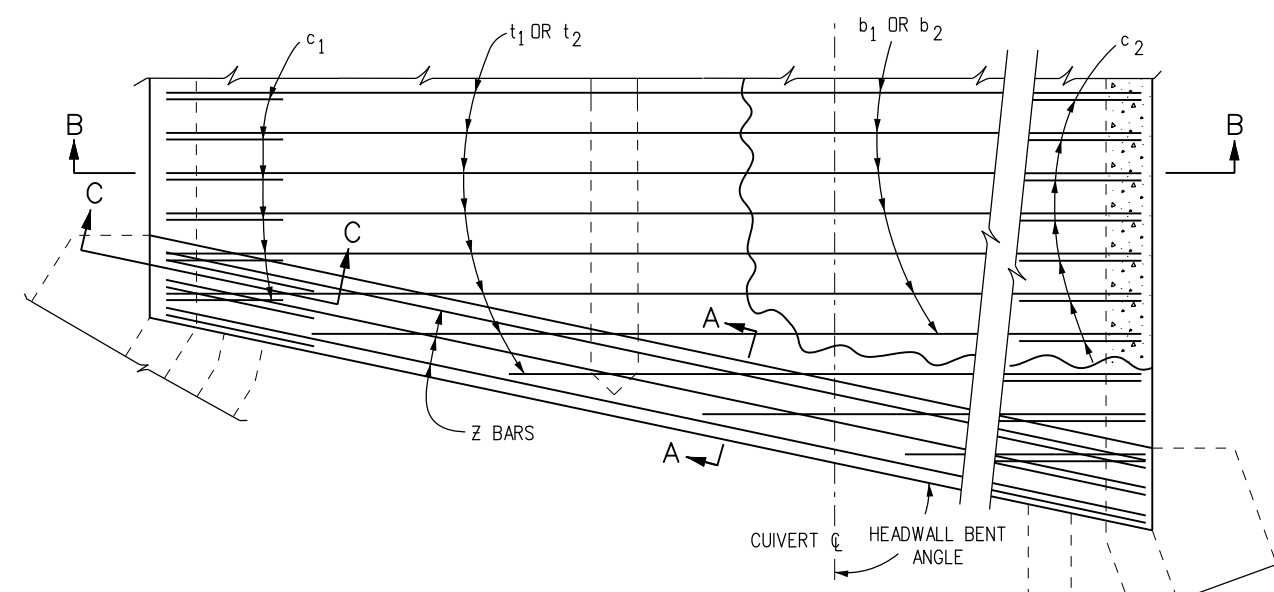
Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
  
 Project Development Branch JBK

**DOUBLE CONCRETE BOX CULVERT (CAST-IN-PLACE)**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO. M-601-2**  
**Standard Sheet No. 2 of 2**  
 Project Sheet Number:

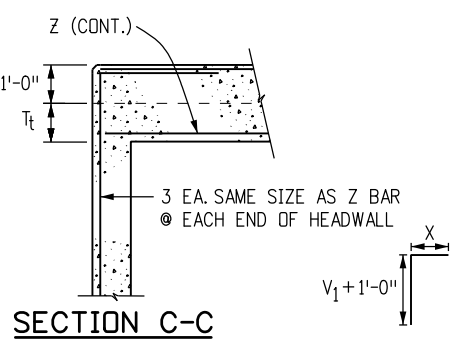


**SECTION B-B**



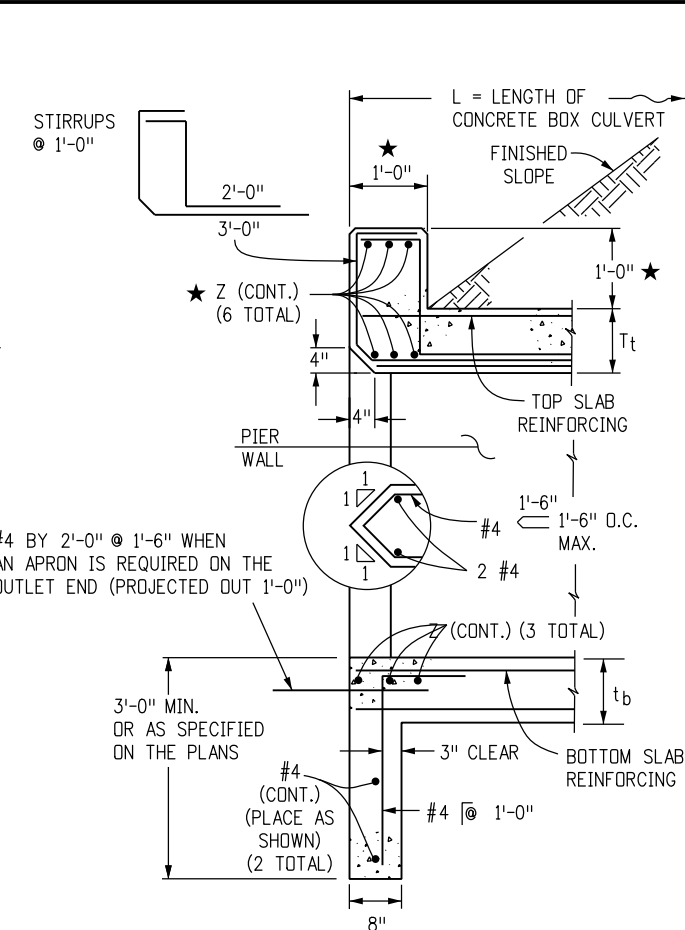
**REINFORCING PLAN**

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

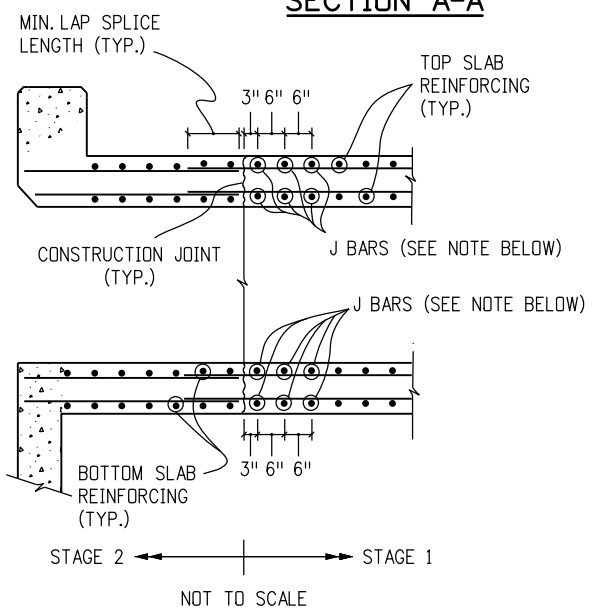


**SECTION C-C**

**HEADWALL CORNER REINFORCING DETAIL**



**SECTION A-A**



**CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION**

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE C OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

**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'-7"	2'-5"	2'-10"	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'-1"	1'-4"	1'-7"	1'-11"	2'-6"	3'-1"	3'-11"	4'-10"

THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.

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. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED  $\frac{3}{4}$  IN.
16. FOR FILL HEIGHTS LESS THAN 2 FT, A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18" DOWN ALONG THE TOPS OF THE EXTERIOR WALLS.
17. FOR FILL HEIGHTS LESS THAN 2 FT. THE  $d_1$  BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	8, 9, 10	14, 16, 18	20
BAR SIZE:	#5	#6	#7
SPACING	1'-0"	1'-0"	1'-0"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS  
 RATING DATA: 2ND EDITION, 2011, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION

LOADING DATA:  $f_y = 60,000$  psi.,  $f'_c = 4,500$  psi.,  
 LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK AND NRL  
 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.  
 WEARING SURFACE - 12 IN. THICK CONCRETE PAVEMENT.  
 DEAD LOAD - TYPE 7 BARRIER.  
 THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.  
 EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDDT DRAINAGE MANUAL.  
 EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.  
 LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

- ★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19 AND NOTES BELOW):
  - ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
  - ANY SPECIAL DESIGN FOR STIRRUPS 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 19.
  - POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
  - 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.
- 18. SEE M-603-3 FOR PRECAST CONCRETE BOX CULVERT DETAILS.

**Computer File Information**

Creation Date: 07/31/19	(R-X)
Designer Initials: JBE	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO. M-601-3**  
**Standard Sheet No. 1 of 2**  
 Project Sheet Number:

TRIPLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

BOX SIZE				FILL HEIGHT ALLOWED FT-FT	SLAB & WALL THICKNESS (INCHES)			BAR SIZES						DIMENSIONS					QUANTITIES			RATING FACTORS												
S	R	HT.	WIDTH		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>	T <sub>5</sub>	T <sub>6</sub>	T <sub>7</sub>	T <sub>8</sub>	T <sub>9</sub>	T <sub>10</sub>	h <sub>1</sub>	h <sub>2</sub>	v <sub>1</sub>	v <sub>2</sub>	v <sub>3</sub>	CONCRETE CY/LF	REBAR STL LBS/LF	WATERPROOFING SY/LF	HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE								
7-10.5	27-4	< 2	10	10	10	10	10	10	10	10	10	10	10	6	7	6	7	5	5	5	5	168	3-5	2-4	6-10	2-4	1-11	3.210	796	4.037	1.20	1.55	1.44	1.37

HEADWALL AND TOEWALL QUANTITIES

HEADWALL BENT ANGLE	90° TO 75°			74° TO 60°			59° TO 45°			
	CLEAR SPAN (S)	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF	
8	4	4	19.2	5	4	23.5	7	4	34.4	
10	5	4	23.9	6	4	28.7	9	4	54.0	
12	6	4	28.7	6	4	28.2	9	5	59.2	
14	6	4	27.9	7	4	33.5	*	*	*	
16	6	4	27.5	8	5	44.1	*	*	*	
18	7	4	33.0	9	5	51.8	*	*	*	
20	7	4	32.8	*	*	*	*	*	*	

CONCRETE QUANTITY = 0.086 CY/LF

NOTES

- SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.
- QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL. STEEL QUANTITIES INCLUDE ALL REINFORCING. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.
- ★ SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.
- FOR HEADWALL AND TOEWALL DETAILS SEE M-601-3, SHEET 1 OF 2.
- WHEN THE FILL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT, ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (\*), AND THE d<sub>1</sub> BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.
- REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.
- WHEN A (RISE) R 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).
- ▲ FOR SIZE AND SPACING OF THE BOTTOM MAT BARS IN THE TOP SLAB SEE TABLE ON M-601-3, SHEET 1 OF 2. ALL OTHER d<sub>1</sub> BARS ARE #4'S AT 1'-0" SPACING. THE NUMBER OF BARS REQUIRED IS LISTED ON THIS SHEET AND INCLUDES BOTH #4 BARS AND THOSE FROM THE TABLE.
- ◆ LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDDT RATING MANUAL.
- FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDDT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDDT RATING MANUAL.

Computer File Information	
Creation Date: 07/31/19	(R-X)
Designer Initials: JBE	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

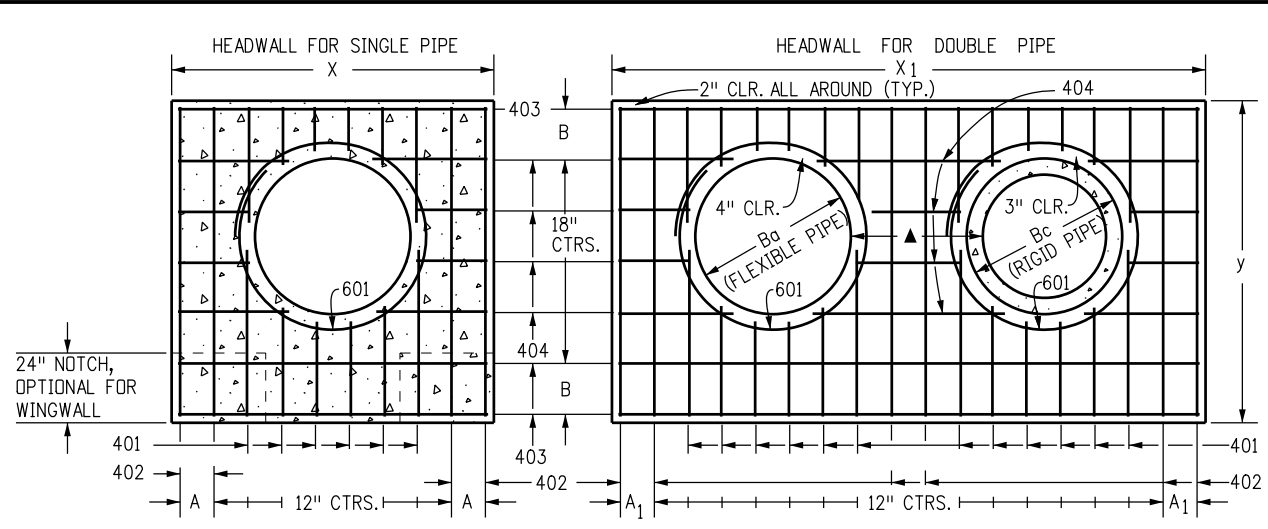
Sheet Revisions	
Date:	Comments

Colorado Department of Transportation  
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 Project Development Branch JBK

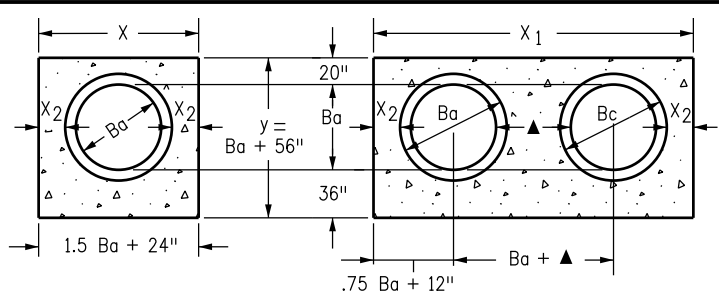
**TRIPLE CONCRETE BOX  
 CULVERT (CAST-IN-PLACE)**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
 M-601-3  
 Standard Sheet No. 2 of 2**  
 Project Sheet Number:





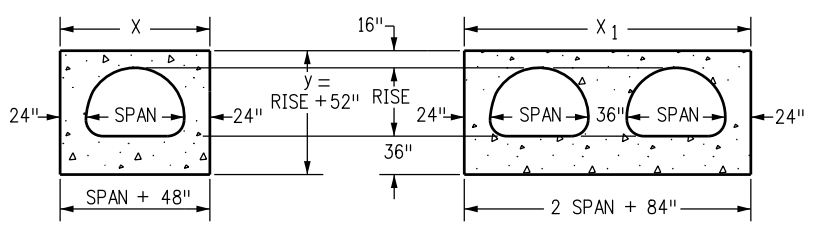
TYPICAL BAR LAYOUT FOR CONCRETE HEADWALLS



DIMENSIONS		QUANTITIES										
Ba IN.	Bc IN.	X FT.-IN.	A IN.	X1 FT.-IN.	A1 IN.	y FT.-IN.	B IN.	X2 IN.	CONCRETE SGL CU. YD.	DBL CU. YD.	STEEL SGL LBS.	DBL LBS.
54	65	8-9	8 1/2	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	11 1/2	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	8 1/2	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	11 1/2	23-9	8 1/2	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	8 1/2	26-3	11 1/2	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

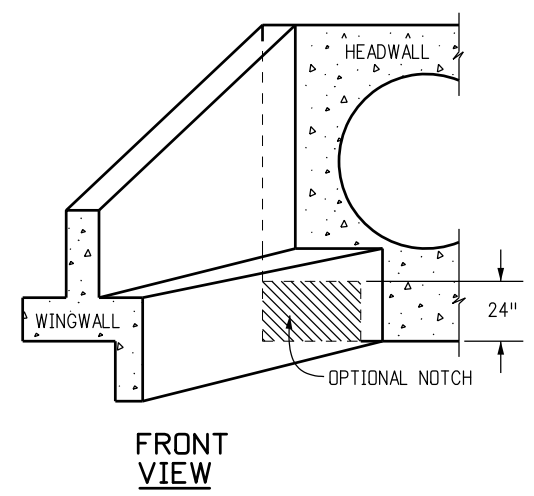
HEADWALL FOR RIGID ROUND PIPE

- ### GENERAL NOTES
1. CONCRETE SHALL BE CLASS B.
  2. HEADWALL SHALL BE PERPENDICULAR TO THE PIPE C 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 3/4 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 1/2 INSIDE DIAMETER APART, OR 1/2 INSIDE SPAN APART, OR 3 FT. APART (INCLUDING WALL THICKNESS), WHICHEVER IS LESS.
- ADD 0.89 x (X OR X1) (LB.) WHEN APRON IS REQUIRED.

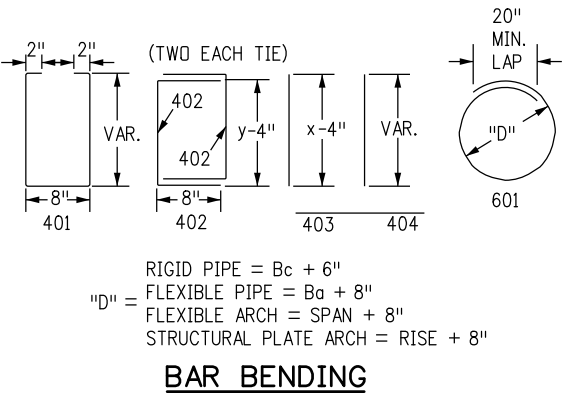


DIMENSIONS		QUANTITIES										
EQUIV. Ba IN.	SPAN IN.	RISE IN.	X FT.-IN.	A IN.	X1 FT.-IN.	A1 IN.	y FT.-IN.	B IN.	CONCRETE SGL CU. YD.	DBL CU. YD.	STEEL SGL LBS.	DBL LBS.
72	81	59	10-9	8 1/2	20-6	7	9-3	17 1/2	2.72	5.10	250	467
78	87	63	11-3	11 1/2	21-6	7	9-7	10 1/2	2.85	5.34	275	531
84	95	67	11-9	8 1/2	22-10	9	9-11	12 1/2	3.08	5.79	290	547
90	103	71	12-7	7 1/2	24-2	11	10-3	15	3.30	6.21	321	591
96	112	75	13-4	12	25-8	8	10-7	16 1/2	3.52	6.65	314	606
102	117	79	13-9	8 1/2	26-6	7	10-11	9 1/2	3.63	6.86	356	672
108	128	83	14-8	8	28-4	12	11-3	11 1/2	3.96	7.51	376	699

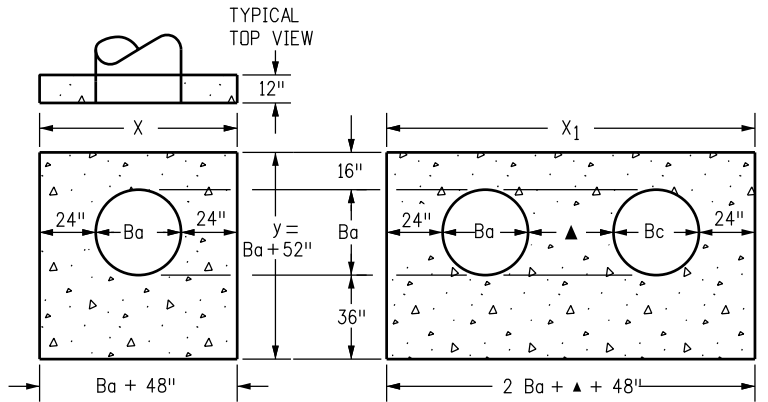
HEADWALL FOR FLEXIBLE PIPE ARCH



FRONT VIEW



BAR BENDING

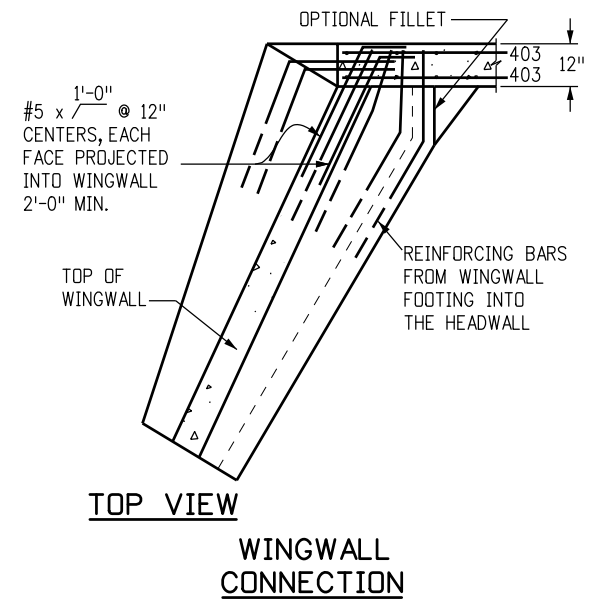


DIMENSIONS		QUANTITIES								
Ba IN.	X FT.-IN.	A IN.	X1 FT.-IN.	A1 IN.	y FT.-IN.	B IN.	CONCRETE SGL CU. YD.	DBL CU. YD.	STEEL SGL LBS.	DBL LBS.
54	8-6	7	15-3	11 1/2	8-10	15	2.19	3.81	211	358
60	9-0	10	16-6	7	9-4	18	2.38	4.25	217	396
66	9-6	7	17-9	8 1/2	9-10	12	2.58	4.70	252	454
72	10-0	10	19-0	10	10-4	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

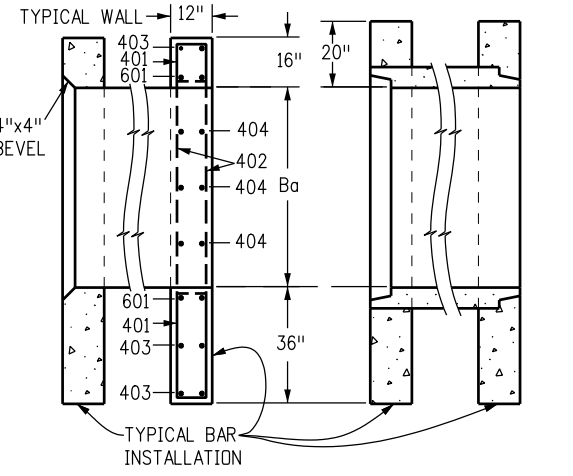
HEADWALL FOR FLEXIBLE ROUND PIPE

DIMENSIONS		QUANTITIES										
EQUIV. Ba IN.	SPAN FT.-IN.	RISE FT.-IN.	X FT.-IN.	A IN.	X1 FT.-IN.	A1 IN.	y FT.-IN.	B IN.	CONCRETE SGL CU. YD.	DBL CU. YD.	STEEL SGL LBS.	DBL LBS.
66	6-1	4-7	10-1	10 1/2	19-2	11	8-11	15 1/2	2.52	4.70	232	424
75	7-0	5-1	11-0	10	21-0	10	9-5	9 1/2	2.80	5.25	282	509
84	7-11	5-7	11-11	9 1/2	22-10	9	9-11	12 1/2	3.08	5.79	291	540
93	8-10	6-1	12-10	9	24-8	8	10-5	15 1/2	3.36	6.33	309	622
102	9-9	6-7	13-9	8 1/2	26-6	7	10-11	9 1/2	3.63	6.86	379	673
111	10-11	7-1	14-11	9 1/2	28-10	9	11-5	12 1/2	4.05	7.67	377	711
120	11-10	7-7	15-10	9	30-8	8	11-11	15 1/2	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	10 1/2	35-2	11	13-1	13 1/2	5.17	9.86	448	931
150	15-4	9-3	19-4	12	37-8	8	13-7	16 1/2	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

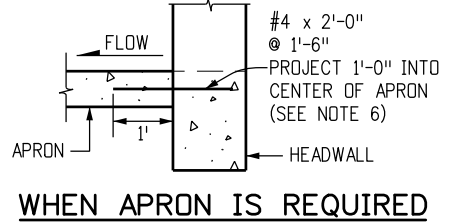
HEADWALL FOR STRUCTURAL PLATE ARCH



WINGWALL CONNECTION



INLET OUTLET ENDS OF FLEXIBLE PIPE INLET OUTLET ENDS OF RIGID PIPE

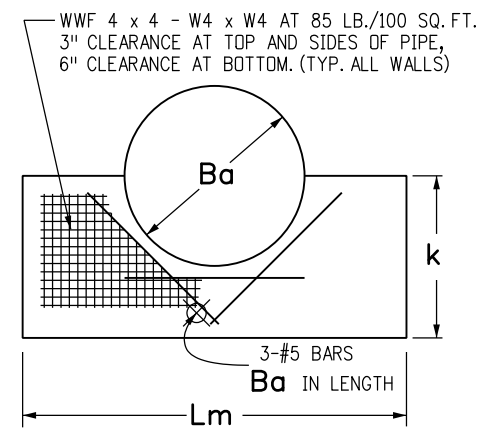


WHEN APRON IS REQUIRED

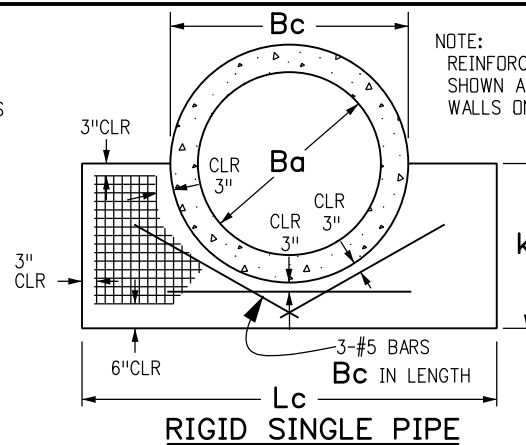
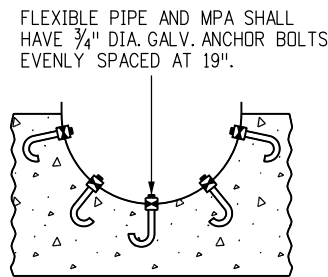
SKEW ANGLE A°	90	85	80	75	70	65	60	55	50	45	40	35	30
FACTOR (cosecA°)	1.000	1.004	1.015	1.035	1.064	1.103	1.155	1.221	1.305	1.414	1.556	1.743	2.000

SKEW FACTOR TABLE

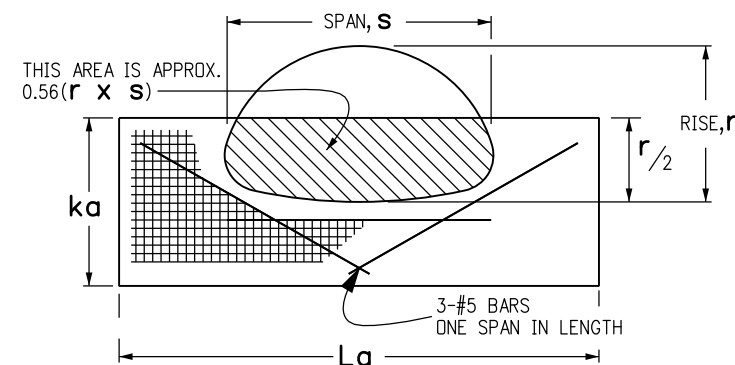
<b>Computer File Information</b> Creation Date: 07/31/19 Designer Initials: JBK Last Modification Date: 07/31/19 Detailer Initials: LTA CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		<b>Sheet Revisions</b> Date:                      Comments (R-X) (R-X) (R-X) (R-X)		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>		<h1>HEADWALL FOR PIPES</h1> Issued by the Project Development Branch: July 31, 2019		<b>STANDARD PLAN NO.</b> <b>M-601-10</b> <b>Standard Sheet No. 1 of 1</b> Project Sheet Number:	
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**FLEXIBLE SINGLE PIPE**

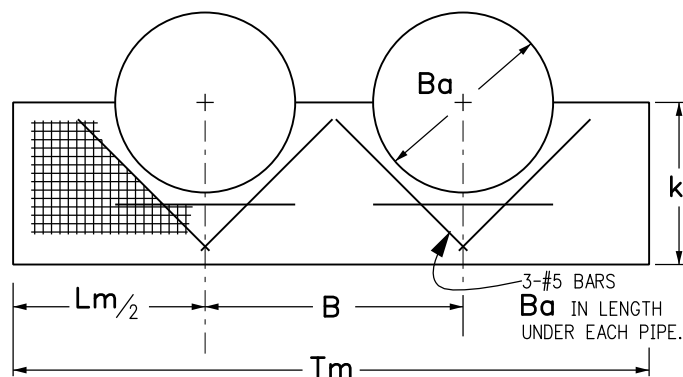


**RIGID SINGLE PIPE**

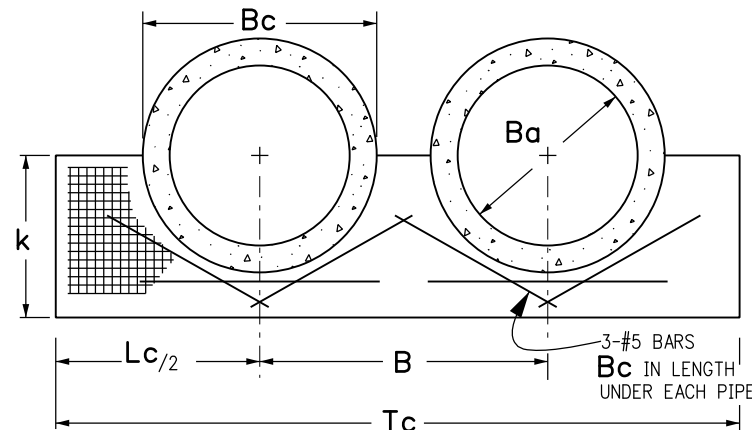


**SINGLE MPA**

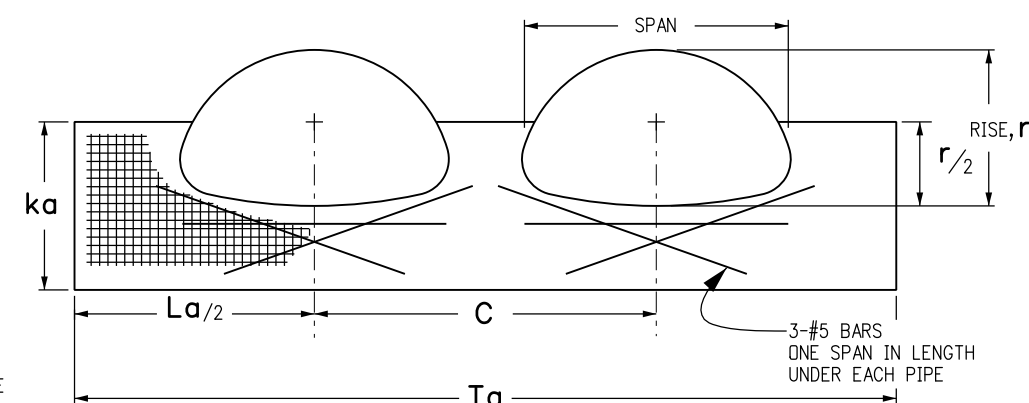
- GENERAL NOTES**
1. CONCRETE SHALL BE CLASS B.
  2. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN.
  3. IF A PRECAST HEADWALL IS USED, A PERMANENT EPOXY BOND, APPROVED BY THE ENGINEER, SHALL BE USED BETWEEN PIPE AND HEADWALL.
  4. HEADWALL SHALL BE PERPENDICULAR TO THE CULVERT CENTERLINE UNLESS 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**

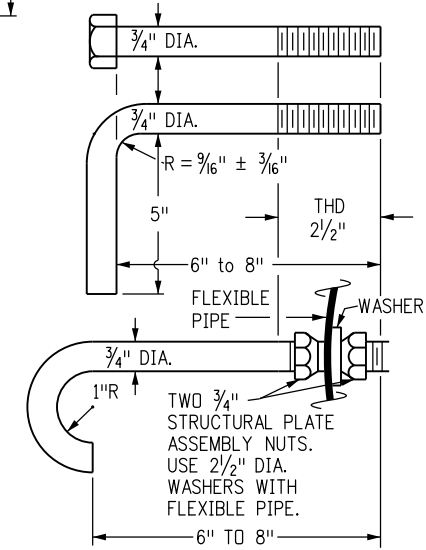
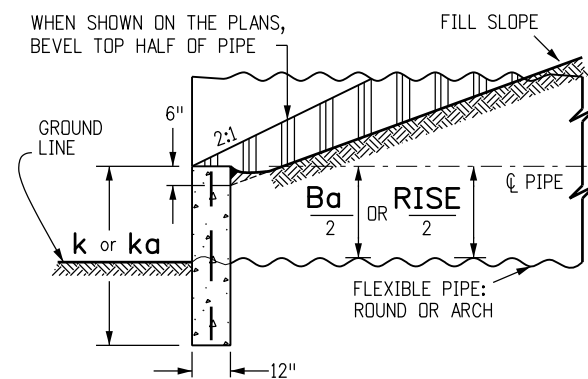


**DOUBLE MPA**

RANGE OF EQUIV. DIAMS.	RANGE OF SPANS s	RANGE OF RISES r	ka	La	C	Ta	SINGLE		DOUBLE	
							CONCRETE	STEEL	CONCRETE	STEEL
							CU. YDS.	LBS.	CU. YDS.	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

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°



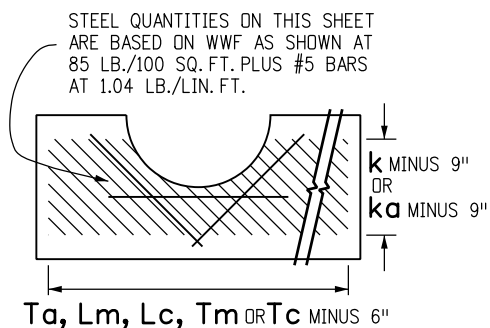
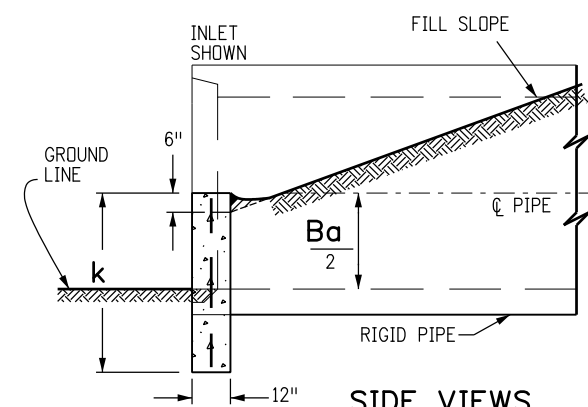
**TYPICAL GALVANIZED ANCHOR BOLTS**

**HEADWALL FOR METAL PIPE ARCH (MPA)**

NOM. DIA. Ba	RCP O.D. Bc	k	Lm	Lc	B	Tm	Tc	FLEXIBLE PIPE				RIGID PIPE			
								SINGLE		DOUBLE		SINGLE		DOUBLE	
								CONCRETE	STEEL	CONCRETE	STEEL	CONCRETE	STEEL	CONCRETE	STEEL
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

**HEADWALL FOR ROUND PIPE**

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



**SIDE VIEWS**

**Computer File Information**

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**Sheet Revisions**

Date:	Comments

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 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
**Project Development Branch JBK**

**TYPE "S" SADDLE HEADWALLS FOR PIPE**

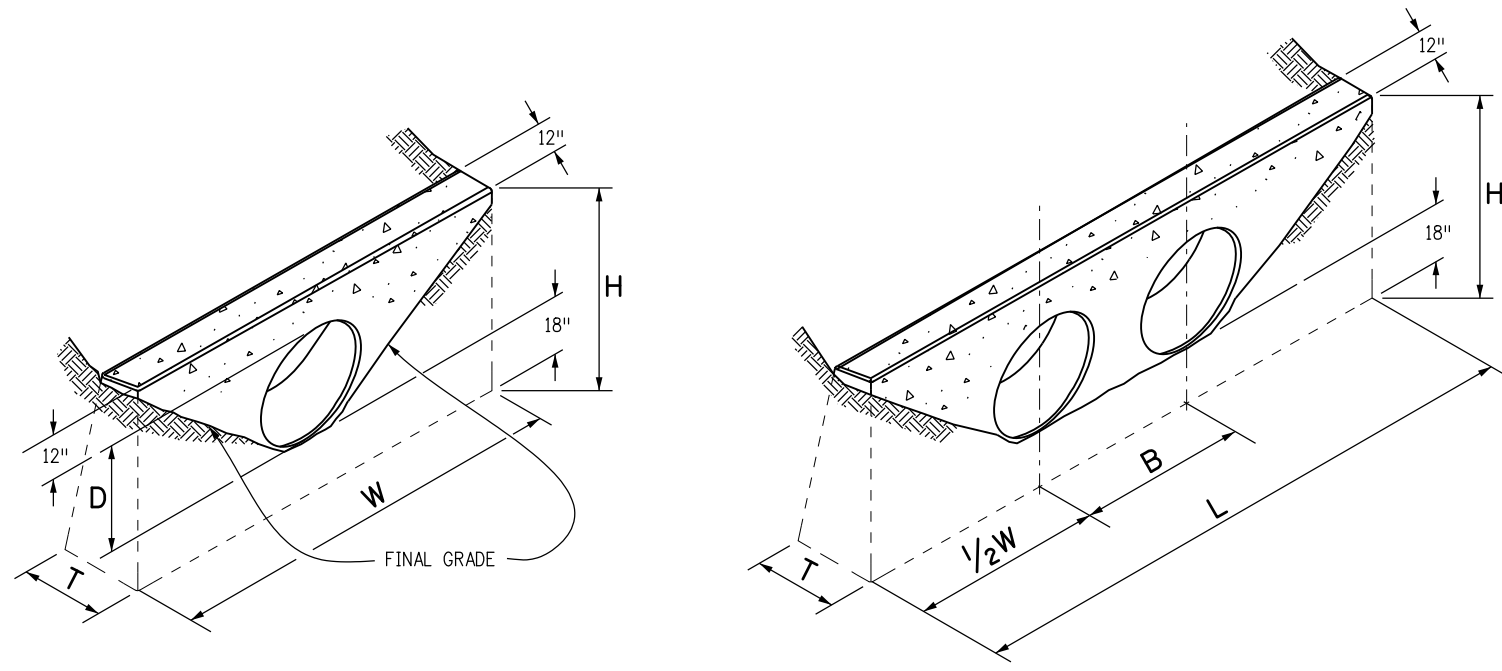
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

M-601-11

**Standard Sheet No. 1 of 1**

Project Sheet Number:



**SINGLE PIPE**

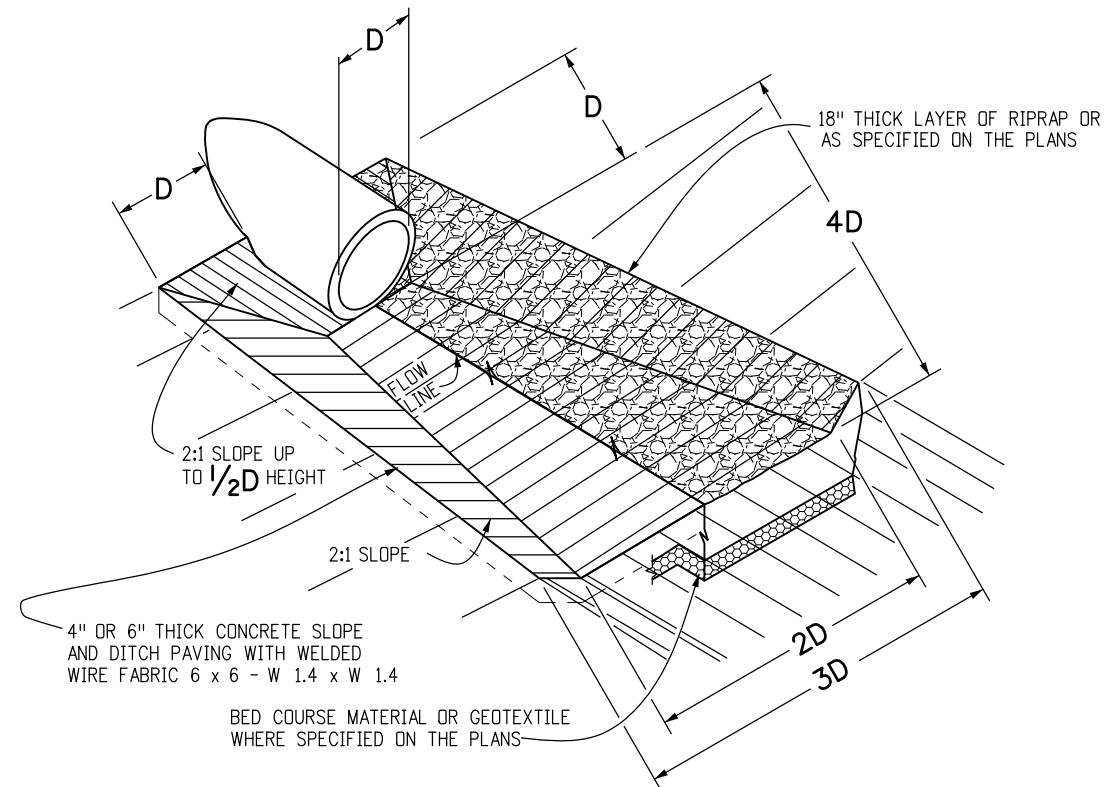
**DOUBLE PIPE**

**CONCRETE HEADWALL INSTALLATIONS**

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

**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  $\frac{3}{4}$  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.

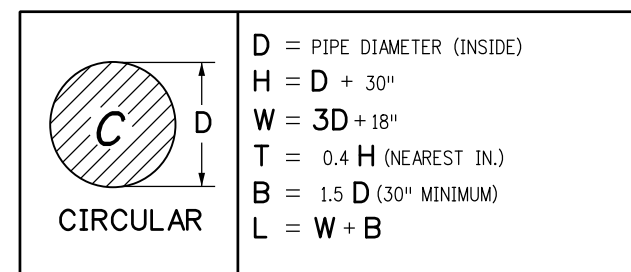
PIPE		PIPE DIAMETER (AND EQUIVALENT DIAMETER) (IN.)											
		18		24		30		36		42		48	
TYPE	MATERIAL	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE
CIRCULAR	RIGID	1.0	1.3	1.5	2.0	2.0	2.7	2.8	3.6	3.6	4.6	4.6	6.0
	FLEXIBLE	1.1	1.4	1.6	2.1	2.2	3.0	3.0	4.0	3.9	5.3	5.0	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)**

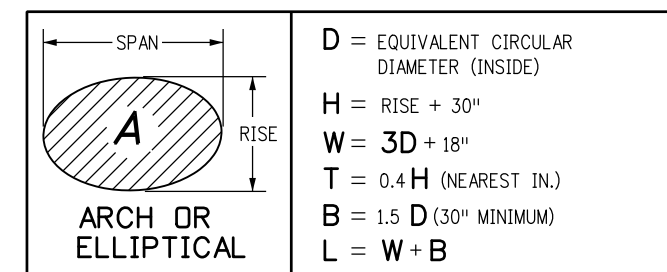
THICKNESS	MATERIAL	PIPE DIAMETER (IN.)					
		18	24	30	36	42	48
4"	CONCRETE	0.4	0.8	1.2			
6"	CONCRETE				2.6	3.6	4.7
18"	RIPRAP	2.0	3.5	5.4	7.8	10.7	13.9

**PIPE OUTLET PAVING (CUBIC YARDS)**

NOTE: VOLUME OCCUPIED BY PIPE HAS BEEN DEDUCTED.

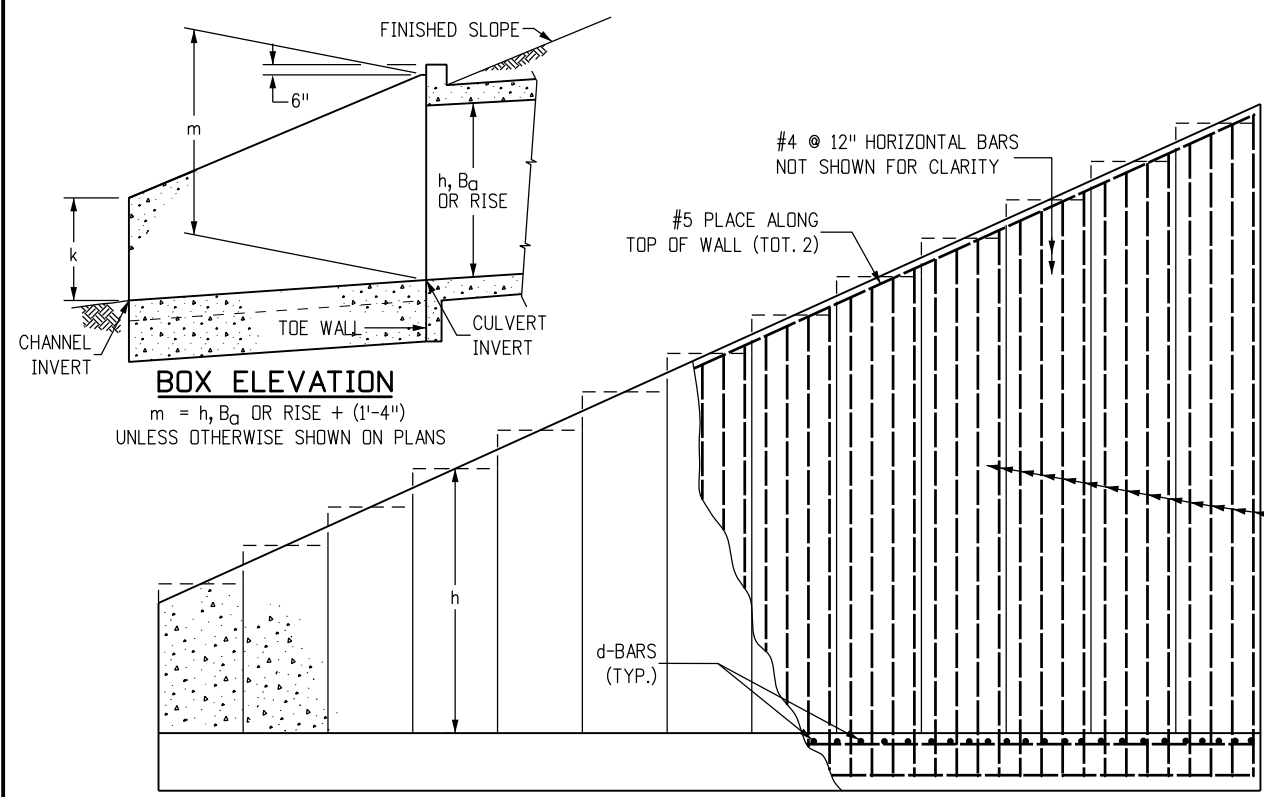


**CIRCULAR TYPE OF PIPE HEADWALL DIMENSIONS**



**ARCH OR ELLIPTICAL TYPE OF PIPE HEADWALL DIMENSIONS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>	<b>Colorado Department of Transportation</b>	<b>HEADWALLS AND PIPE OUTLET PAVING</b>	<b>STANDARD PLAN NO.</b>
Creation Date: 07/31/19		Date: _____	2829 West Howard Place		M-601-12
Designer Initials: JBK	(R-X)	Comments: _____	CDOT HQ, 3rd Floor		Standard Sheet No. 1 of 1
Last Modification Date: 07/31/19	(R-X)		Denver, CO 80204		
Detailer Initials: LTA	(R-X)		Phone: 303-757-9021 FAX: 303-757-9868		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		<b>Project Development Branch</b>	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number: _____



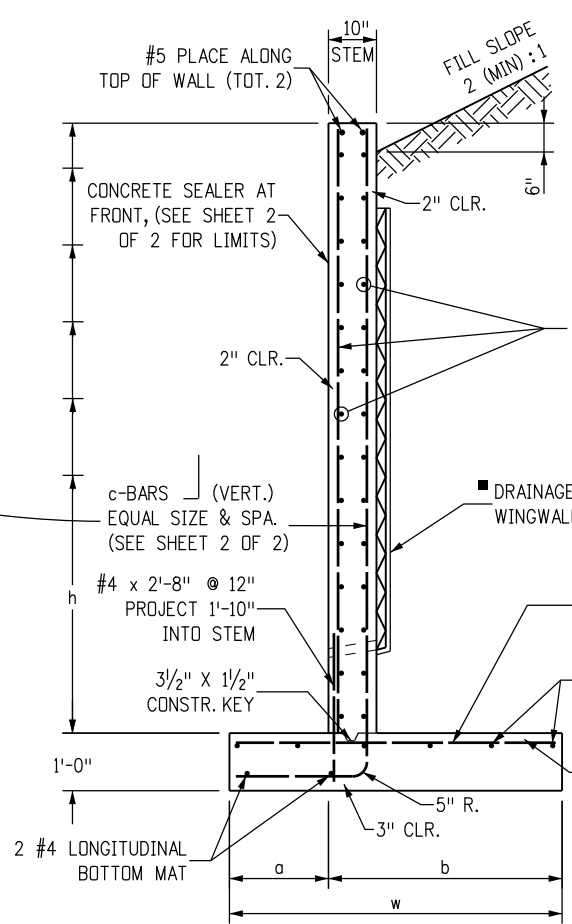
**BOX ELEVATION**

$m = h, B_a \text{ OR RISE} + (1'-4")$   
UNLESS OTHERWISE SHOWN ON PLANS

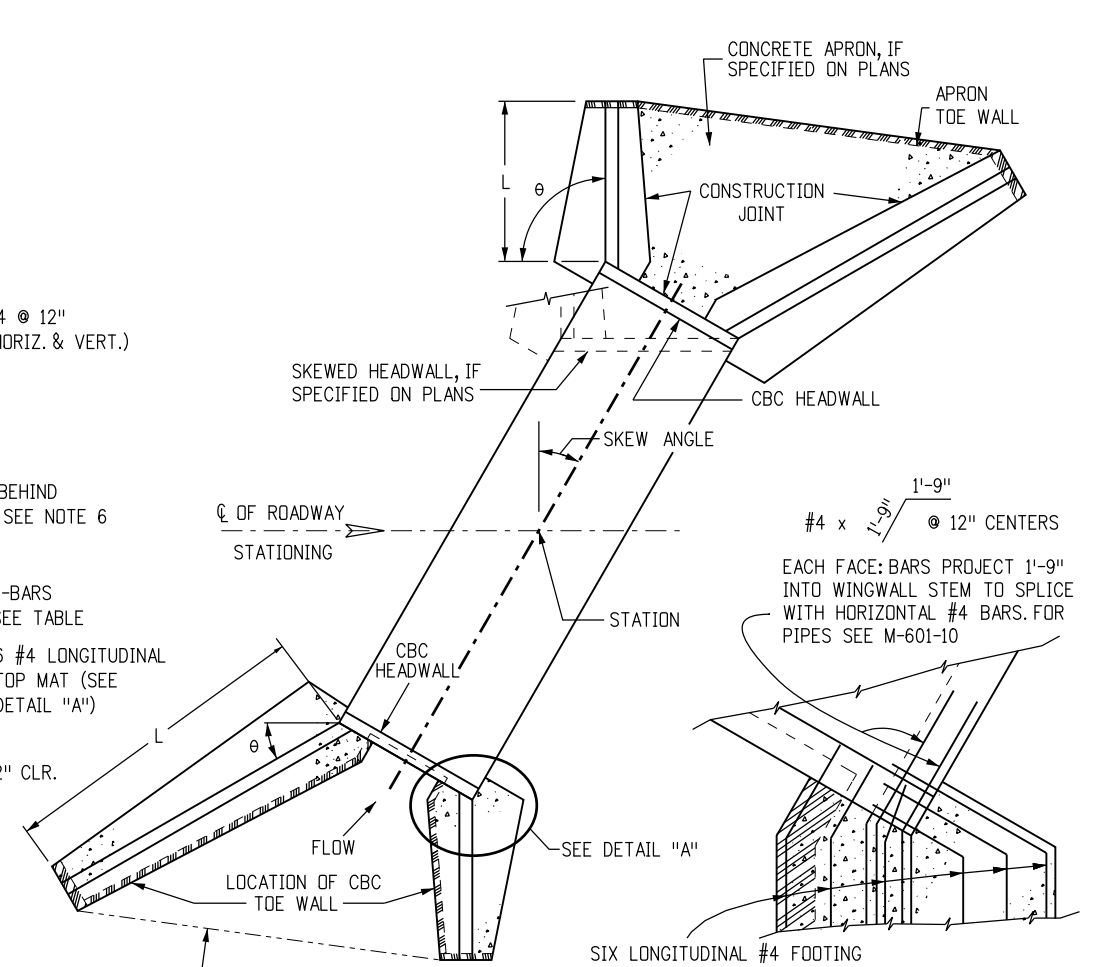
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'
a =	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	2'-8"	2'-10"	3'-0"
b =	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	5'-0"	5'-4"	5'-8"
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	7'-8"	8'-2"	8'-8"
d-BARS	#4 @ 9"	#4 @ 9"	#4 @ 9"	#4 @ 9"	#4 @ 9"	#4 @ 9"	#5 @ 11"	#5 @ 10"	#5 @ 10"	#5 @ 8"	#6 @ 8"	#7 @ 9"	#7 @ 7"
* CONC. CY/LF	0.161	0.210	0.259	0.309	0.358	0.407	0.457	0.506	0.556	0.605	0.654	0.704	0.753

\* DOES NOT INCLUDE TOE WALL QUANTITIES SEE SHEET 2 OF 2 FOR REINFORCING STEEL QUANTITY

■ REQUIRED DRAINAGE BEHIND WINGWALLS SEE NOTE 6



**TYPICAL SECTION**



**TYPICAL CULVERT LAYOUT**

**DESIGN DATA:**

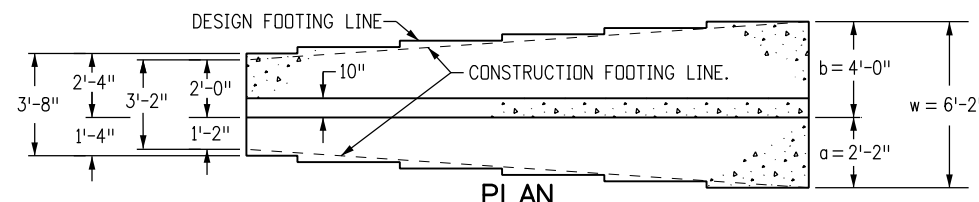
AASHTO LRFD EIGHTH EDITION, 2017  
DESIGN METHOD: LOAD AND RESISTANCE FACTOR DESIGN, YIELD LINE METHOD

REINFORCED CONCRETE:  
CONCRETE CLASS D (BOX CULVERT):  $f'_c = 4,500 \text{ PSI}$   
REINFORCING STEEL:  $f_y = 60,000 \text{ PSI}$

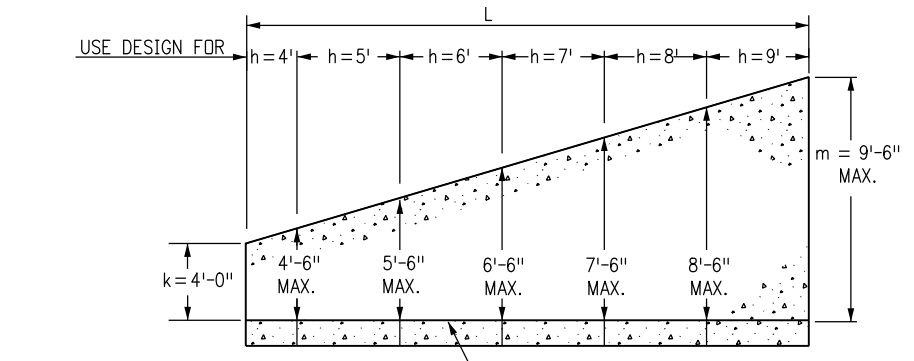
LOADING:  
AT-REST EARTH (FLUID) PRESSURE FOR CONCRETE STEM DESIGN = 55 PCF FOR 2 (MIN.):1 SLOPED BACKFILL  
ACTIVE EARTH (FLUID) PRESSURE FOR CONCRETE FOOTING DESIGN = 40 PCF FOR 2 (MIN.):1 SLOPED BACKFILL  
LIVE LOAD SURCHARGE = 2'  
MINIMUM RESISTANCE FOR SOIL BEARING = 5.5 KSF  
SOIL BEARING RESISTANCE FACTOR = 0.45

**GENERAL NOTES:**

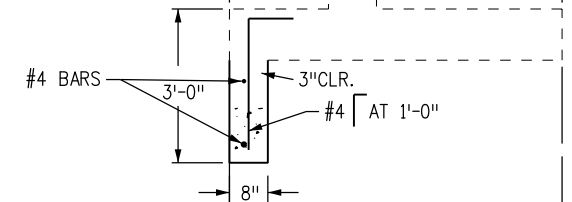
- ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED  $\frac{3}{4}$  IN.
- WINGWALL FOOTING AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
- DIMENSIONS "h", "k", "L", "m" AND ANGLE "θ" FOR WINGWALL SHALL BE AS SHOWN ON THE PLANS.
- MINIMUM CLASS B LAP SPLICE LENGTH FOR BLACK REINFORCING BARS:  
BAR SIZE: #4 #5 #6 #7  
SPLICE LENGTH: 1'-6" 1'-11" 2'-3" 2'-7"
- DESIGN DOES NOT CONSIDER ANY SCOUR EFFECTS.
- WINGWALL DRAIN SHALL BE REQUIRED IF "h" ≥ 12.0 FT., SEE SHEET 2 OF 2 FOR DETAILS.



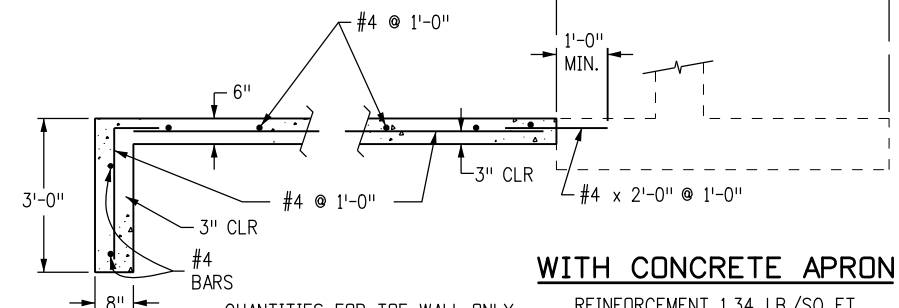
**PLAN**



**ELEVATION DESIGN EXAMPLE**



**WITH TOE WALL**



**WITH CONCRETE APRON**

QUANTITIES FOR TOE WALL ONLY  
CONCRETE 0.049 CU. YD./LIN. FT.  
REINFORCEMENT 5.1 LB./LIN. FT.

REINFORCEMENT 1.34 LB./SQ. FT.

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Date:	Comments

Colorado Department of Transportation

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CDOT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch JBK

**WINGWALLS FOR PIPE OR BOX CULVERTS**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-601-20**

**Standard Sheet No. 1 of 2**

Project Sheet Number:

c-BARS AND REINFORCING STEEL QUANTITY (EXCLUDE TOE WALL)

\* REINFORCING STEEL QUANTITY INCLUDES STEM AND FOOTING QUANTITIES, BUT DOES NOT INCLUDE TOE WALL QUANTITIES.

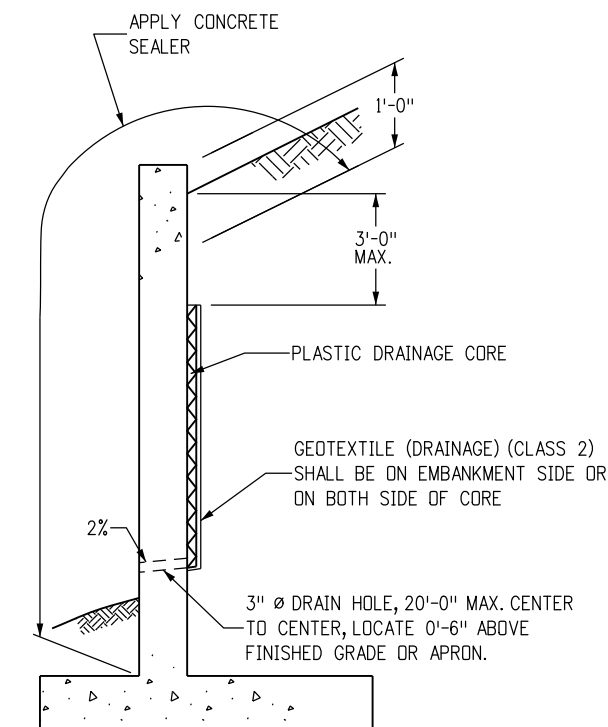
Main table with columns: L (MULTIPLE OF m), m (FT), k (FT), c-BARS, \* REINF. LB./L.F., and various length categories (e.g., ≤ (1.0 x m), ≤ (1.25 x m), etc.).

EXAMPLE:

SELECT THE c-BARS SIZE, SPACING AND STEEL QUANTITY FOR A 25.0 FEET LONG WINGWALL WITH m = 11.8 FT. AND k = 6.3 FT.

SOLUTION:

- 1. DETERMINE WINGWALL LENGTH IN MULTIPLE OF m: L / m = 25.0 / 11.8 = 2.12... 2. ROUND TO REAREST WHOLE NUMBER FOR m AND k: m = 11.8 FT., USE m = 12.0 FT... 3. DETERMINE c-BARS BY USING THE TABLE: L ≤ (2.25 x m) m = 12 k = 6... 4. DETERMINE REINFORCING STEEL QUANTITY OF WHOLE WINGWALL: REINFORCING STEEL QUANTITY = 25.0 x 60.60 = 1,515 LB.



LIMITS OF CONCRETE SEALER AND WINGWALL DRAIN DETAILS

- NOTES: 1. THE GEOCOMPOSITE SHALL BE SECURED TO THE WALL TO PREVENT MOVEMENT DURING BACKFILLING. 2. COST OF GEOCOMPOSITE DRAIN AND CONCRETE SEALER SHALL BE INCLUDED IN THE WORK.

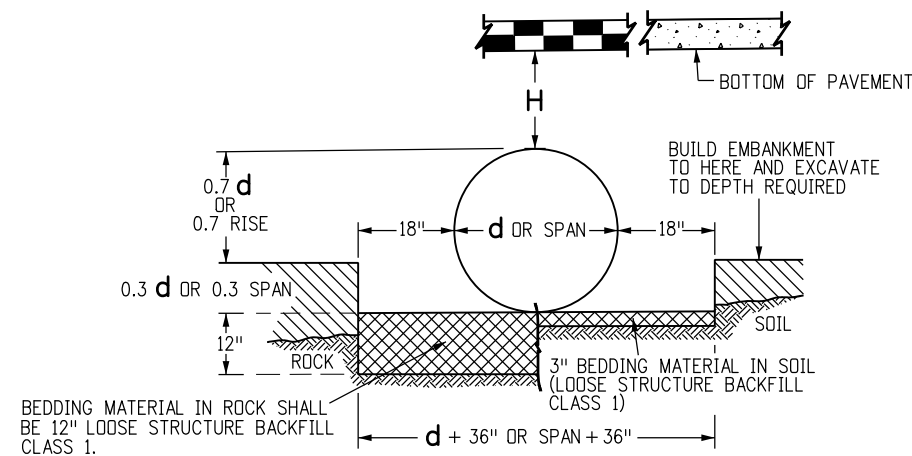
Computer File Information table with rows: Creation Date: 07/31/19, Designer Initials: JBK, Last Modification Date: 07/31/19, Detailer Initials: LTA, CAD Ver.: MicroStation V8, Scale: Not to Scale, Units: English.

Sheet Revisions table with columns: Date, Comments. Includes revision markers (R-X).

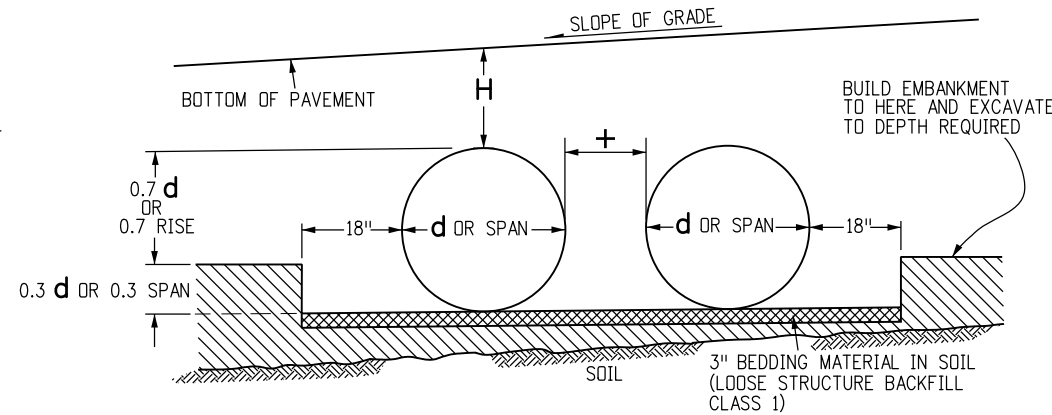
Colorado Department of Transportation logo and address: 2829 West Howard Place, CDDT HQ, 3rd Floor, Denver, CO 80204, Phone: 303-757-9021 FAX: 303-757-9868. Project Development Branch JBK.

WINGWALLS FOR PIPE OR BOX CULVERTS. Issued by the Project Development Branch: July 31, 2019.

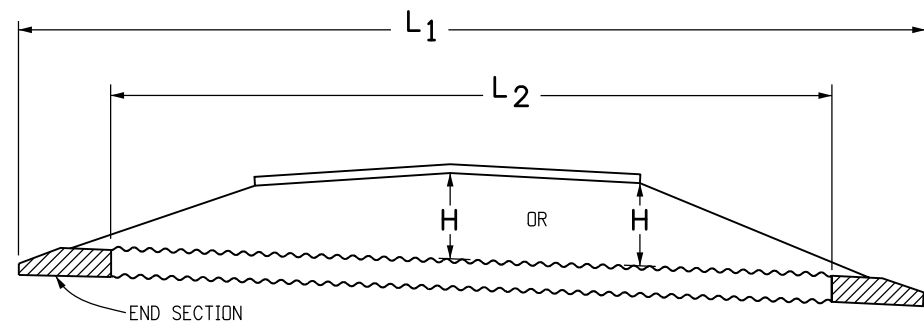
STANDARD PLAN NO. M-601-20. Standard Sheet No. 2 of 2. Project Sheet Number:



**INSTALLATION OF METAL PIPE**

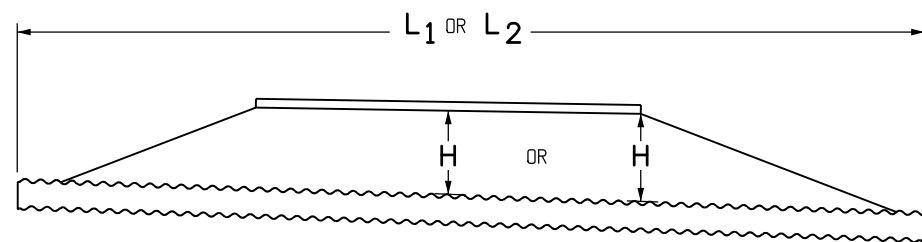


**INSTALLATION OF MULTIPLE METAL PIPES**



**METAL PIPE WITH END SECTIONS**

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

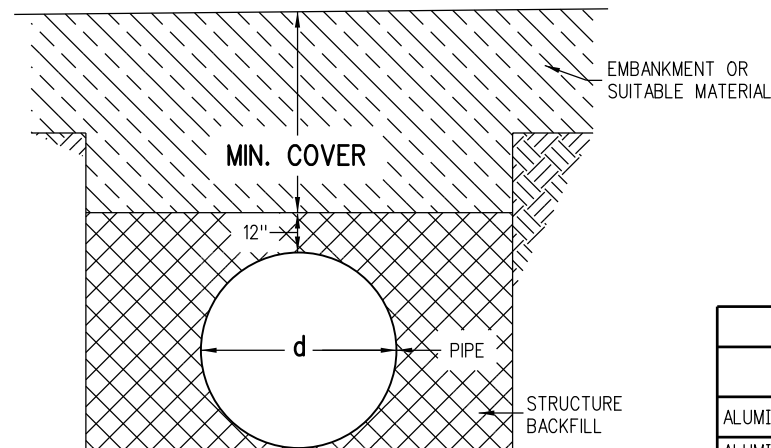


**METAL PIPE WITHOUT END SECTIONS**

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

PIPE SPAN (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
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**



**CONSTRUCTION MINIMUM COVER FOR PIPE**

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
ALUMINIZED OR GALVANIZED STEEL THICKNESS - IN.	0.064	0.079	0.109	0.138	0.168

**ALLOWED WALL THICKNESS**

**GENERAL NOTES**

- STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M36. ALUMINUM PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M196. ALUMINIZED STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M274.
- MINIMUM COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE STRUCTURE FROM DAMAGE.
- PIPE SHALL BE PLACED WITH LONGITUDINAL SEAMS AT THE SIDES OR QUARTER POINTS BUT NOT ALONG TOP OF VERTICAL AXIS.
- 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.
- WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
- EXTENSIONS FOR CMP ARCH PIPE SHALL MATCH THE CORRUGATIONS, AND THE SPAN AND RISE DIMENSIONS OF THE PIPE TO BE EXTENDED.
- 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.
- PIPE ARCH WITH EQUAL PERIPHERY AND WITH SPAN AND RISE DIMENSIONS APPROXIMATELY EQUAL TO THOSE SPECIFIED ON THE PLANS WILL BE PERMITTED.
- PIPE ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. WHEN COVER EXCEEDS 11 FT. USE ROUND PIPE.
- PIPE COVER GREATER THAN 90 FT. SHALL REQUIRE AN INVESTIGATION OF THE FOUNDATION MATERIAL.

**LEGEND**

H = THE MAXIMUM ALLOWABLE HEIGHTS OF FILL OVER THE TOP OF THE PIPE, EXCLUDING PAVEMENT THICKNESS, ARE SHOWN IN THE TABLES OF THIS STANDARD.

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<sub>1</sub> = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

L<sub>2</sub> = 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 1/2 d, WHICHEVER IS GREATER, BUT NOT TO EXCEED 36".

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**Project Development Branch**

**JBK**

**METAL PIPE**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-603-1**

**Standard Sheet No. 1 of 4**

Project Sheet Number:

THESE TABLES ARE APPLICABLE FOR THE FOLLOWING LIST OF CORRUGATED STEEL PIPE:

1. GALVANIZED CORRUGATED STEEL PIPE (CSP)
2. ALUMINIZED CORRUGATED STEEL PIPE TYPE 2 (ALT2 CSP)
3. BITUMINOUS COATED CORRUGATED STEEL PIPE (BIT. CO. CSP)
4. ARAMID FIBER BONDED CORRUGATED STEEL PIPE (A.F. BO. CSP)
5. PRECOATED CORRUGATED STEEL PIPE (PCSP- BOTH SIDES)

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE				
		H MAXIMUM 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" CORRUGATIONS CORRUGATED STEEL PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE	H 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" CORRUGATIONS \* CORRUGATED STEEL PIPE ARCH

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

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

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

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE				
		H MAXIMUM 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" CORRUGATIONS CORRUGATED STEEL PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE	H 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" CORRUGATIONS \* CORRUGATED STEEL PIPE ARCH

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 	<h1>METAL PIPE</h1>	STANDARD PLAN NO.
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:			M-603-1
Last Modification Date: 07/31/19	Detailer Initials: LTA			Project Development Branch	Issued by the Project Development Branch: July 31, 2019	Standard Sheet No. 2 of 4
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				JBK		Project Sheet Number:

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE				
		H MAXIMUM 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" CORRUGATIONS  
CORRUGATED STEEL PIPE

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE			
		H MAXIMUM 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

3/4" X 3/4 7-1/2" CORRUGATIONS  
CORRUGATED STEEL PIPE

THESE TABLES ARE APPLICABLE FOR THE FOLLOWING LIST OF CORRUGATED STEEL PIPE:

1. GALVANIZED CORRUGATED STEEL PIPE (CSP)
2. ALUMINIZED CORRUGATED STEEL PIPE TYPE 2 (ALT2 CSP)
3. BITUMINOUS COATED CORRUGATED STEEL PIPE (BIT. CO. CSP)
4. ARAMID FIBER BONDED CORRUGATED STEEL PIPE (A.F. BO. CSP)
5. PRECOATED CORRUGATED STEEL PIPE (PCSP- BOTH SIDES)

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE	H 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" CORRUGATIONS  
CORRUGATED STEEL PIPE ARCH \*

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

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE	H 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

3/4" X 3/4 7-1/2" CORRUGATIONS  
CORRUGATED STEEL PIPE ARCH \*

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(R-X)	
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**METAL PIPE**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
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Project Sheet Number:



THESE TABLES ARE APPLICABLE FOR THE FOLLOWING LIST OF CORRUGATED STEEL PIPE:  
 1. GALVANIZED CORRUGATED STEEL PIPE (CSP)  
 2. ALUMINIZED CORRUGATED STEEL PIPE TYPE 2 (ALT2 CSP)  
 3. BITUMINOUS COATED CORRUGATED STEEL PIPE (BIT. CO. CSP)  
 4. ARAMID FIBER BONDED CORRUGATED STEEL PIPE (A.F. BO. CSP)  
 5. PRECOATED CORRUGATED STEEL PIPE (PCSP- BOTH SIDES)

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

1-1/2" X 1/4" CORRUGATIONS CORRUGATED ALUMINUM PIPE

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE				
		H MAXIMUM 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" CORRUGATIONS CORRUGATED ALUMINUM PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE			
			H MAXIMUM 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" CORRUGATIONS CORRUGATED ALUMINUM PIPE ARCH \*

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE				
		H MAXIMUM 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" CORRUGATIONS CORRUGATED ALUMINUM PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE	H 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" CORRUGATIONS CORRUGATED ALUMINUM PIPE ARCH \*

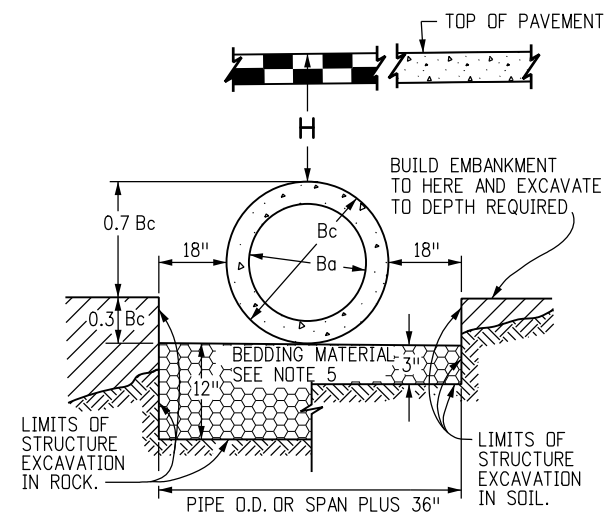
\* CORNER BEARING PRESSURE OF 2 TONS PER SQ. FT.

DIAMETER (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE				
		H MAXIMUM 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" CORRUGATIONS CORRUGATED ALUMINUM PIPE

SPAN X RISE (IN. X IN.)	ROUND EQUIVALENT (IN.)	H MINIMUM COVER (IN.)	PIPE GAGE	H 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" CORRUGATIONS CORRUGATED ALUMINUM PIPE ARCH \*



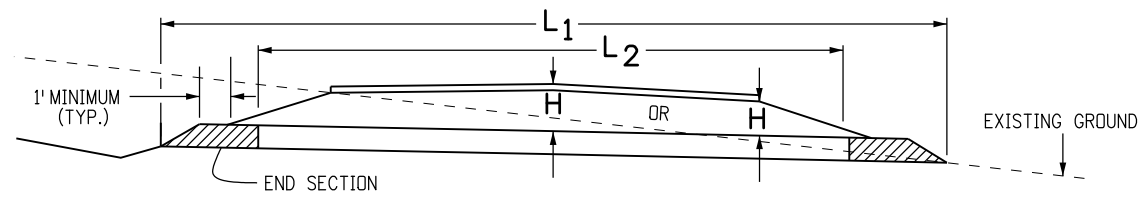
NOTE: Bc IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

**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.				IN.			
			FT.				FT.			
12	2	0.40					23	14	2-3/4	0.49
15	2-1/4	0.49								
18	2-1/2	0.58								
21	2-3/4	0.66					30	19	3-1/4	0.66
24	3	0.75					34	22	3-1/2	0.73
27	3-1/4	0.84								
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.

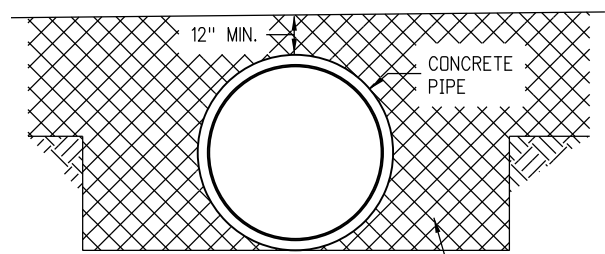
**DIMENSIONS FOR REINFORCED CONCRETE PIPE**  
(FOR INFORMATION ONLY)



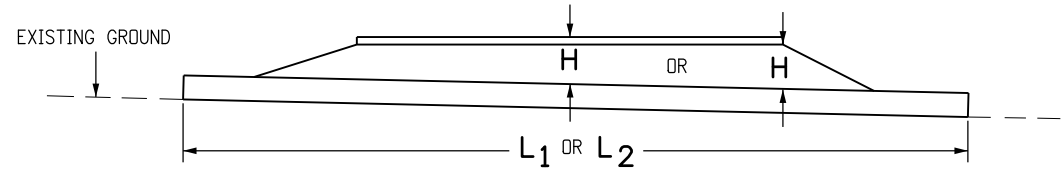
**CONCRETE PIPE WITH END SECTIONS**

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

- H = HEIGHT OF FILL OVER TOP OF PIPE, INCLUDING PAVEMENT THICKNESS.
- L1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.
- L2 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.



**CONSTRUCTION**  
**MINIMUM COVER FOR RIGID PIPE**



**CONCRETE PIPE WITHOUT END SECTIONS**

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

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 1000 D	CLASS CIR III CLASS VE III 1350 D	CLASS CIR IV CLASS VE IV 2000 D	CLASS CIR V CLASS VE V 3000 D	CLASS VE VI 4000 D
CIRCULAR (CIR)	1 TO 18	1 TO 25	± 25 TO 37	± 37 TO 45	
VERTICAL ELLIPTICAL (VE)	1 TO 18	1 TO 25	± 25 TO 37	± 37 TO 45	± 45 TO 62
HORIZONTAL ELLIPTICAL (HE)	1 TO 18	1 TO 25	± 25 TO 37		

**ALLOWABLE RANGE OF HEIGHTS FOR FILL**  
**OVER REINFORCED CONCRETE PIPE**

(ALL SIZES)

**GENERAL NOTES**  
**REINFORCED CONCRETE PIPE**

- FILL HEIGHTS GREATER THAN MAXIMUM ALLOWED IN THE HEIGHTS OF FILL TABLE ON THIS SHEET REQUIRE SPECIAL DESIGN OF STRUCTURE.
- PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.
- THE HEIGHTS OF FILL OVER TOP OF PIPE ARE BASED ON UNIT WEIGHT OF SOIL AT 135 LBS. PER CUBIC FT.
- PIPE CLASS IS DETERMINED FROM 0.01 IN. CRACK D-LOAD.
- BEDDING IS CLASS B (MODIFIED) (FROM CONCRETE PIPE DESIGN MANUAL-AMERICAN CONCRETE PIPE ASSOCIATION) WITH SETTLEMENT RATIO R = 0.0<sub>sd</sub> (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.
- CHANGES IN DESIGN FACTORS REQUIRE COMPENSATING CHANGES IN PIPE DESIGN.
- MINIMUM WALL THICKNESS DIMENSIONS ARE BASED ON AASHTO M 170 (WALL B) FOR CIRCULAR PIPE, AND AASHTO M 207 FOR ELLIPTICAL PIPE.
- SPACING FOR MULTIPLE PIPE INSTALLATIONS SHALL CONFORM TO THE DETAILS SHOWN ON STANDARD PLAN M-206-1.
- 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**

- 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 CONFORMANCE. THE WALL THICKNESS OF THE NONREINFORCED PIPE MAY BE INCREASED AS REQUIRED TO MEET D-LOAD REQUIREMENT.
- ALL REQUIREMENTS FOR REINFORCED CONCRETE PIPE, EXCEPT THOSE REFERRING TO REINFORCEMENT, SHALL APPLY TO NONREINFORCED CONCRETE PIPE.

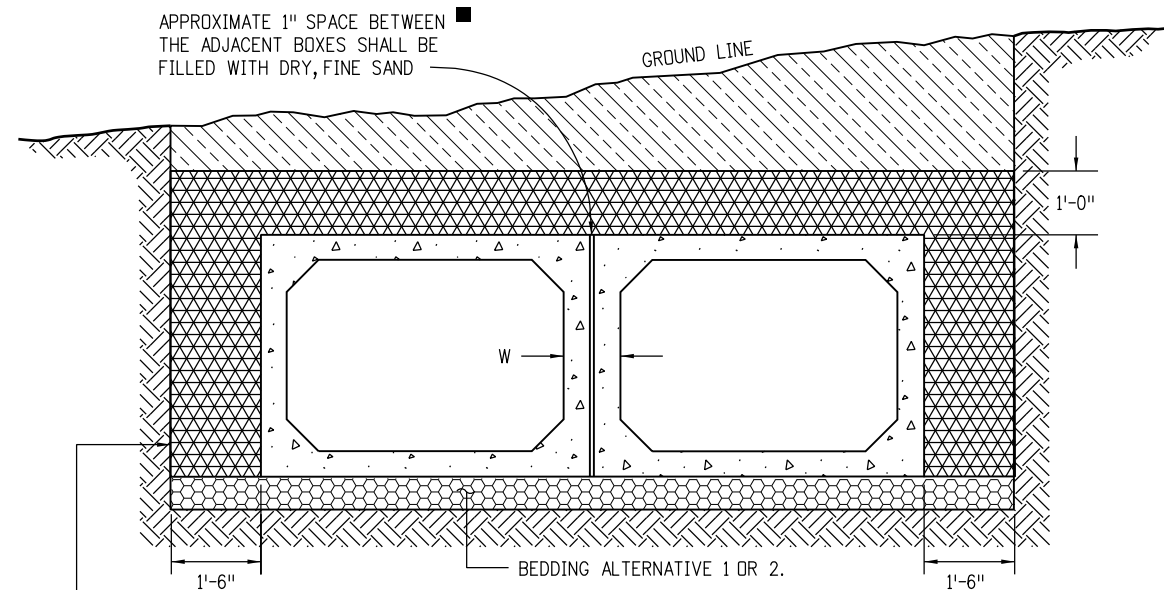
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**REINFORCED CONCRETE PIPE**  
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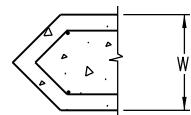
STANDARD PLAN NO.  
**M-603-2**  
Standard Sheet No. 1 of 1  
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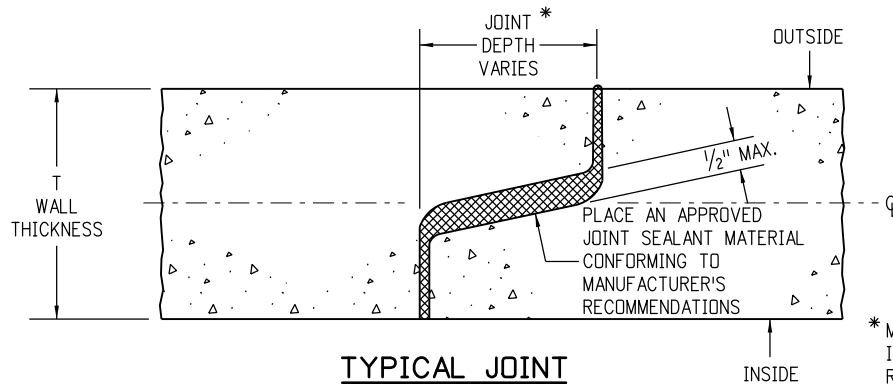
EXCAVATION & BACKFILL WILL BE MEASURED AND PAID FOR TO THIS LINE IN ACCORDANCE WITH SECTION 206.

**EXCAVATION & BACKFILL**  
(DOUBLE PARALLEL PRECAST BOX CULVERT INSTALLATION SHOWN)

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

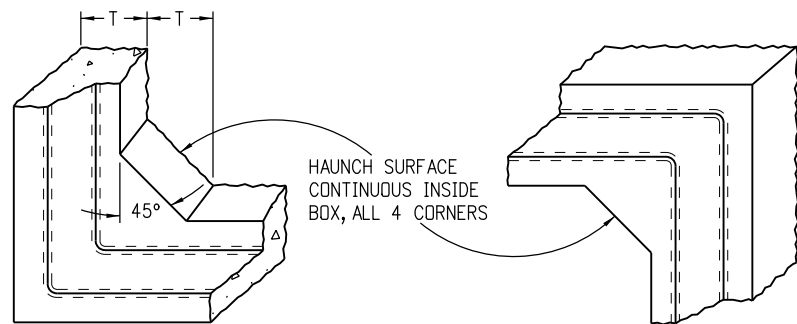


**NOSE ANGLE DETAIL**  
SEE STANDARD PLANS M-601-2, AND 3 TYPICAL AT ADJACENT BOXES DRILL AND GROUT REINFORCING BARS (TYP.)

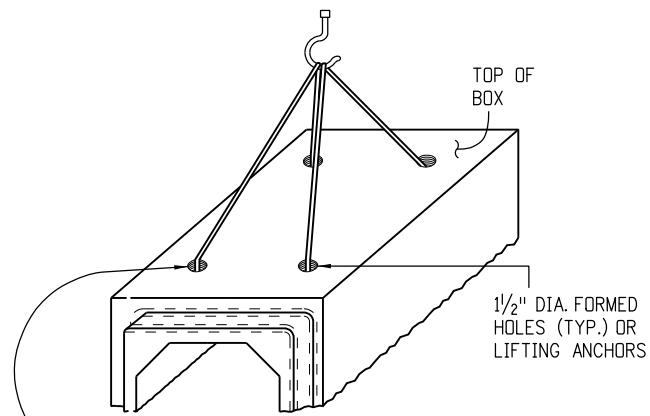


**TYPICAL JOINT**

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

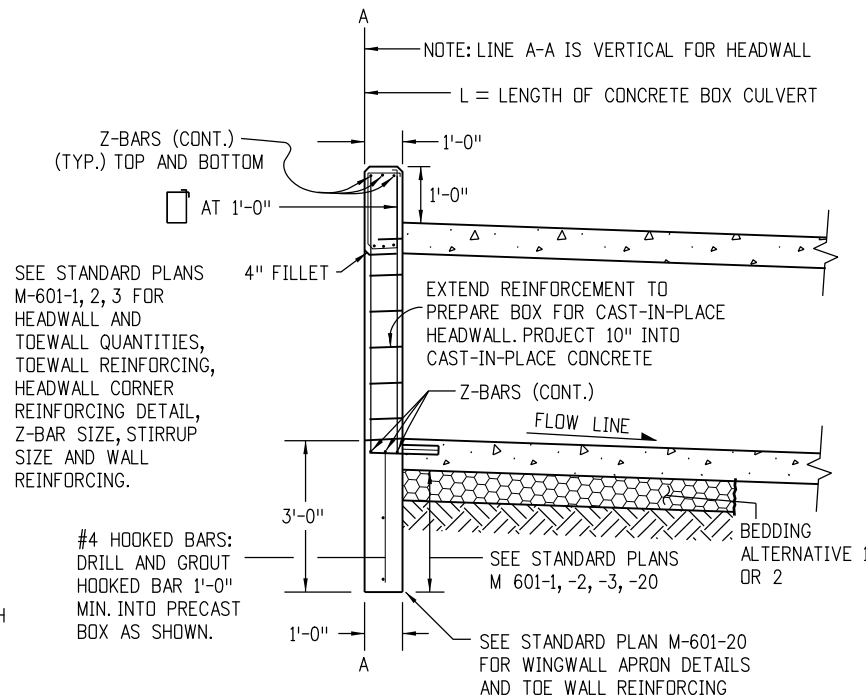


**CORNERS**

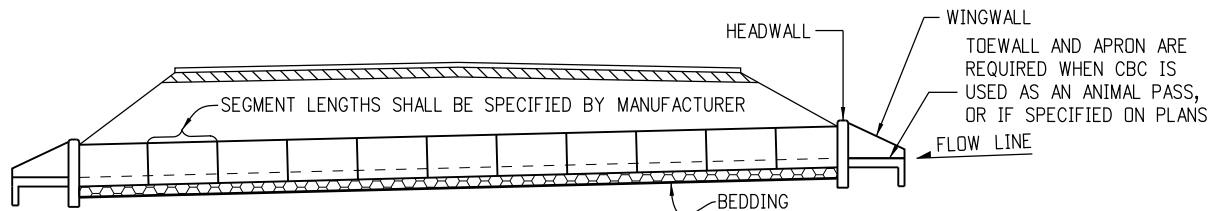


LIFTING HOLES (LOCATED BY MFR.) SHALL BE FILLED WITH GROUT BEFORE BACKFILLING IS STARTED, (2 HOLES PLACED DIAGONALLY MAY SUFFICE FOR SMALLER BOX SIZES). LIFTING ANCHOR RECESSES MAY NOT BE FILLED.

**LIFTING**



**CULVERT END (WITH HEADWALL)**



**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.

8. SEE M-601-1, 2, AND 3 FOR CAST-IN-PLACE CONCRETE BOX CULVERT DETAILS.

**LEGEND**

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

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**PRECAST CONCRETE BOX CULVERT**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

M-603-3

**Standard Sheet No. 1 of 1**

Project Sheet Number:

**LEGEND**

**H** = MAXIMUM ALLOWABLE HEIGHT OF COVER 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 M294 FOR POLYETHYLENE AND AASHTO M330 FOR POLYPROPYLENE, TYPE S PIPES WITH OUTER, CORRUGATED WALLS AND SMOOTH INNER LINEARS.

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

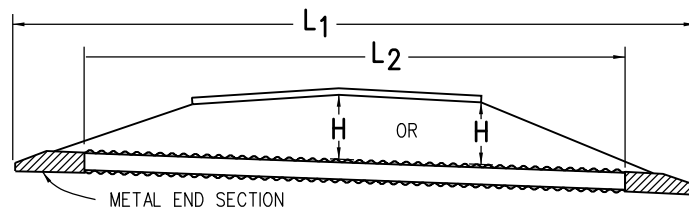
THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

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<sub>1</sub>** = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

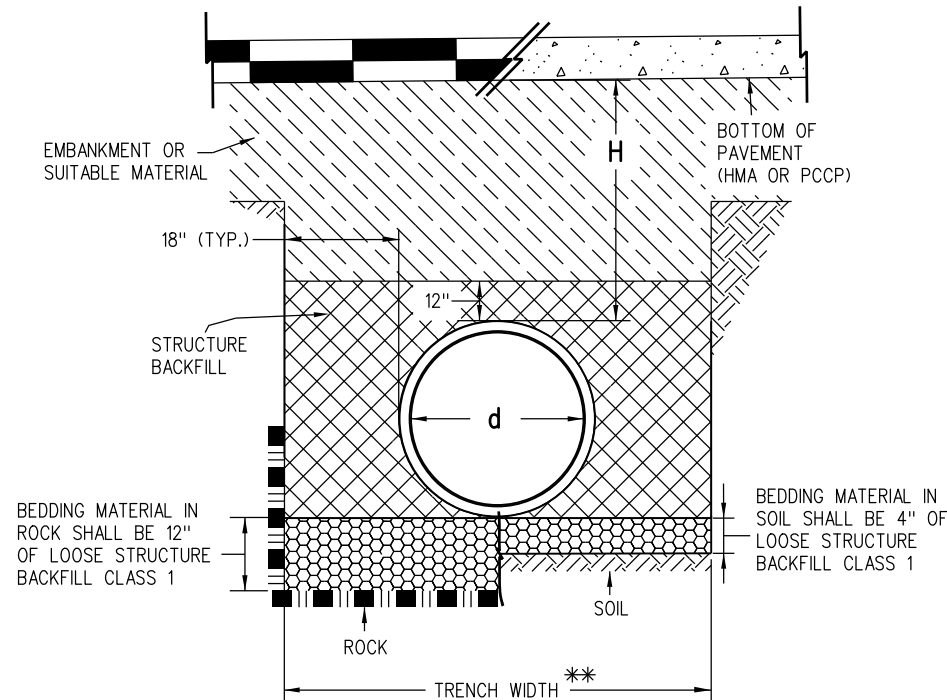
**L<sub>2</sub>** = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.

**+** = THE MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR 1/2(d), WHICHEVER IS GREATER.

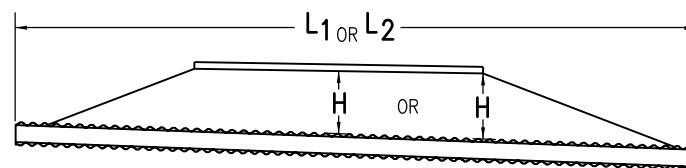


NOTE: USE THE **H** THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

**PIPE WITH END SECTIONS**

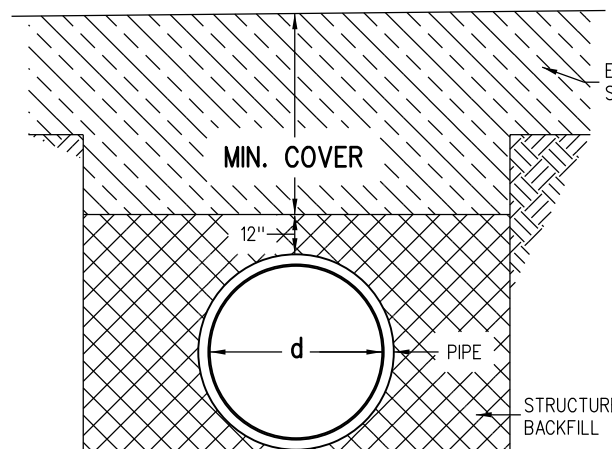


**INSTALLATION OF PIPE**



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

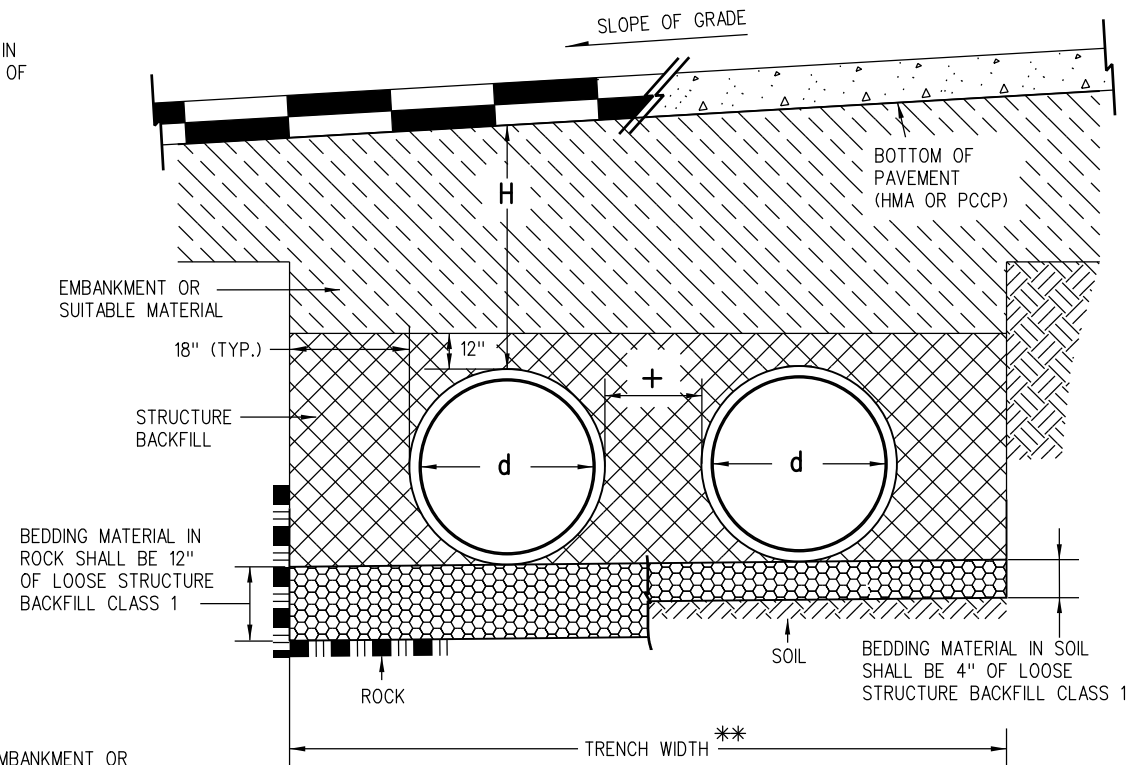
**PIPE WITHOUT END SECTIONS**



**CONSTRUCTION MINIMUM COVER FOR PIPE**

**GENERAL NOTES**

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO M294 FOR POLYETHYLENE AND AASHTO M330 FOR POLYPROPYLENE, TYPE S FOR HIGH DENSITY CORRUGATED POLYETHYLENE PIPE (HDPE) AND POLYPROPYLENE PIPE (PP) RESPECTIVELY, 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. MINIMUM 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

PIPE DIAMETER, d (IN.)	H MINIMUM HEIGHT OF COVER (FT.)		H MAXIMUM HEIGHT OF COVER (FT.)			
	95% COMPACTION	90% COMPACTION	95% COMPACTION	90% COMPACTION	95% COMPACTION	90% COMPACTION
12	2	<i>2</i>	27	<i>25</i>	19	<i>17</i>
15	2	<i>2</i>	29	<i>27</i>	20	<i>20</i>
18	2	<i>2</i>	24	<i>23</i>	17	<i>17</i>
24	2	<i>2</i>	21	<i>20</i>	15	<i>14</i>
30	2	<i>2</i>	18	<i>23</i>	12	<i>17</i>
36	2	<i>2</i>	20	<i>20</i>	13	<i>14</i>
42	2	<i>2</i>	19	<i>18</i>	13	<i>13</i>
48	3	<i>2</i>	17	<i>20</i>	12	<i>13</i>
60	3	<i>2.5</i>	20	<i>21</i>	13	<i>14</i>

NOTE: THE VALUES FOR POLYPROPYLENE PIPES (AASHTO M330) ARE SHOWN IN ITALICS.

**MINIMUM AND MAXIMUM COVER**

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**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	CORRUGATED POLYETHYLENE PIPE (AASHTO M294) AND POLYPROPYLENE PIPE (AASHTO M330)	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-603-4	
Designer Initials: JBK	(R-X)					Standard Sheet No. 1 of 1	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)					Issued by the Project Development Branch: July 31, 2019	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			<b>JBK</b>			

**LEGEND**

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

FILL HEIGHTS ARE BASED ON AASHTO M304 POLYVINYL CHLORIDE (PVC) PIPE WITH OUTER, RIBBED WALL AND SMOOTH INNER WALL, AND ON AASHTO T180 MINIMUM RELATIVE COMPACTION OF 95% OR 90%.

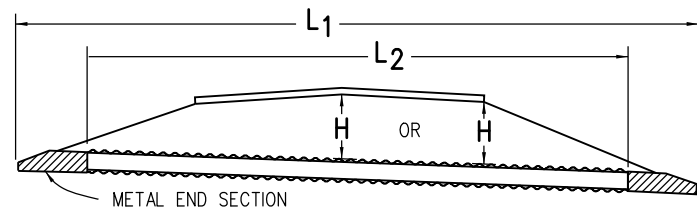
FILL HEIGHTS, FOR INSTALLATION WITH HIGH WATER TABLE, REQUIRE A SPECIAL DESIGN. THE MAXIMUM HEIGHT IN HIGHWATER LOCATIONS SHOULD BE 15 FEET OR BASED ON AASHTO LRFD DESIGN SPECIFICATIONS.

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.

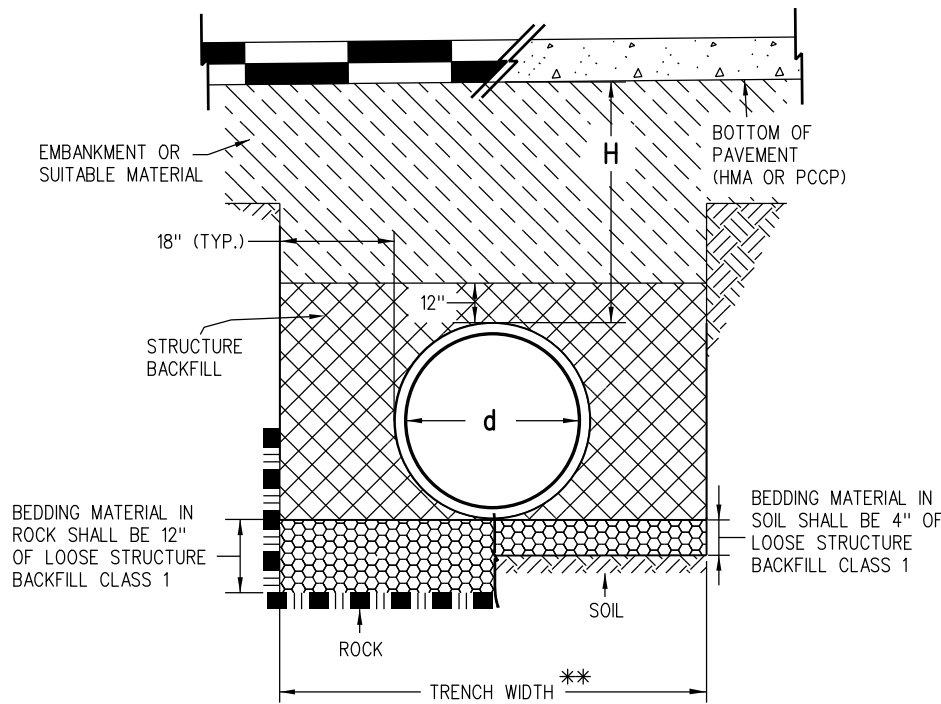
**L<sub>1</sub>** = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

**L<sub>2</sub>** = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.

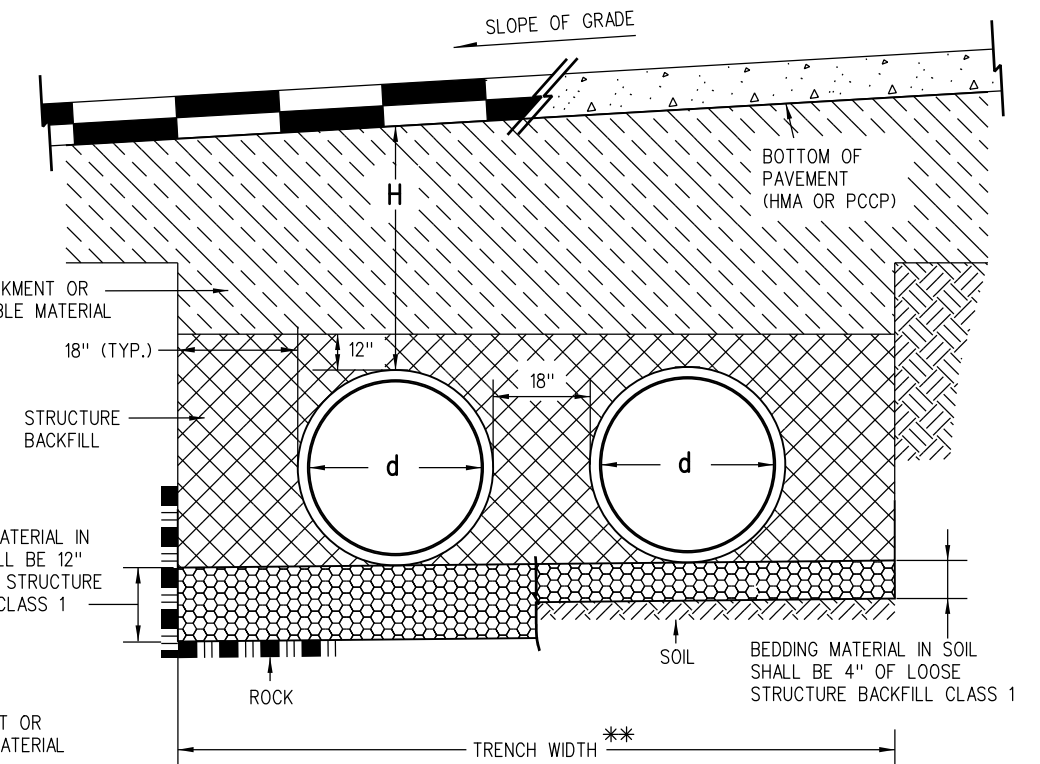


NOTE: USE THE **H** THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

**PIPE WITH END SECTIONS**



**INSTALLATION OF PIPE**

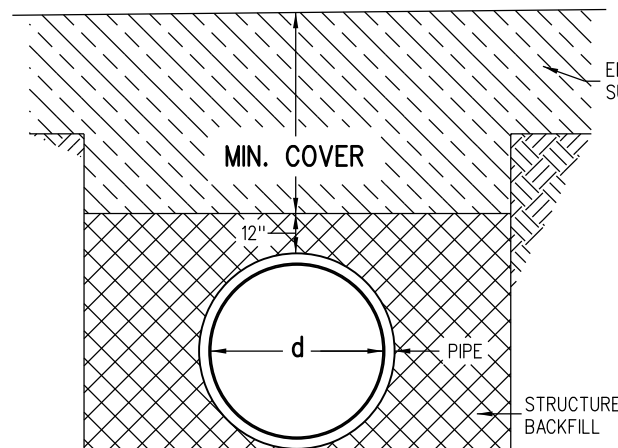


**INSTALLATION OF MULTIPLE PIPES**

\*\* TRENCH WIDTH ASSUMES STABLE IN-SITU SIDE WALL

PIPE DIAMETER, d (IN.)	H MINIMUM HEIGHT OF COVER (FT.)	H MAXIMUM HEIGHT OF COVER (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**



**CONSTRUCTION MINIMUM COVER FOR PIPE**

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**

- 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.
- FOR PIPES WITH DIAMETERS OF 15 INCHES OR LESS, SOLID WALL PVC PIPES MEETING AASHTO M278 MAY BE USED.
- WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
- MINIMUM COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE.
- 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.
- STRUCTURE BACKFILL MATERIAL SHALL BE CLASS 1.
- 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.

**GENERAL NOTES**

**Computer File Information**

Creation Date: 07/31/19  
 Designer Initials: JBK  
 Last Modification Date: 07/31/19  
 Detailer Initials: LTA  
 CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch **JBK**

**POLYVINYL CHLORIDE (PVC) PIPE (AASHTO M304)**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-603-5**

**Standard Sheet No. 1 of 1**

Project Sheet Number:

**LEGEND**

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

FILL HEIGHTS AND DESIGN ASSUMPTIONS ARE BASED ON AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 7TH EDITION, SECTION 12.7.

FILL HEIGHTS ARE BASED ON AASHTO MP 20, TYPE S PIPES WITH RIBBED REINFORCED STEEL WALLS.

FILL HEIGHTS FOR INSTALLATION WITH HIGH WATER TABLE REQUIRE A SPECIAL DESIGN.

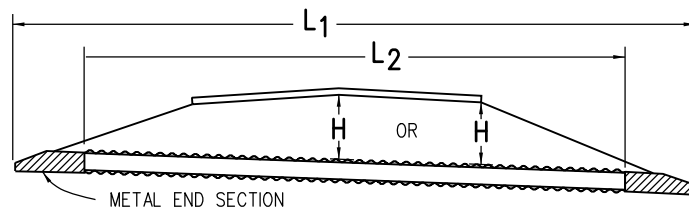
THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

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<sub>1</sub>** = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

**L<sub>2</sub>** = 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  $d/2$ , WHICHEVER IS GREATER.



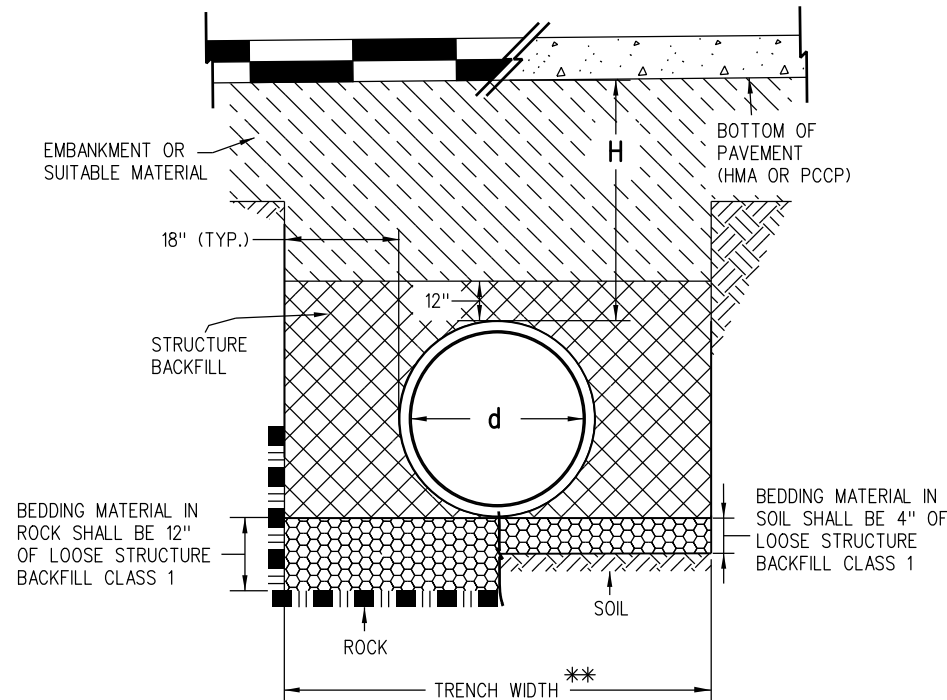
NOTE: USE THE **H** THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

**PIPE WITH END SECTIONS**

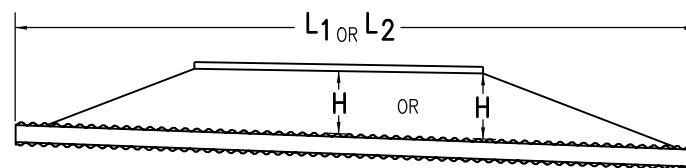
PIPE DIAMETER, <i>d</i> (IN.)	H MINIMUM HEIGHT OF COVER (FT.)	H MAXIMUM HEIGHT* OF COVER (FT.)
30	2	50
36	2	50
42	2	50
48	2	30
54	2	30
60	2.5	30

\* A MANUFACTURER'S CERTIFICATION OF MAXIMUM ALLOWABLE FILL HEIGHT IS REQUIRED PRIOR TO INSTALLATION.

**MINIMUM AND MAXIMUM COVER**

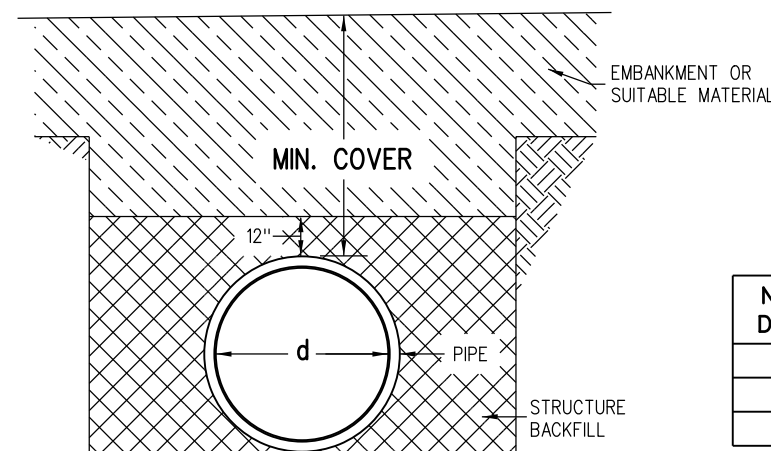


**INSTALLATION OF PIPE**



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

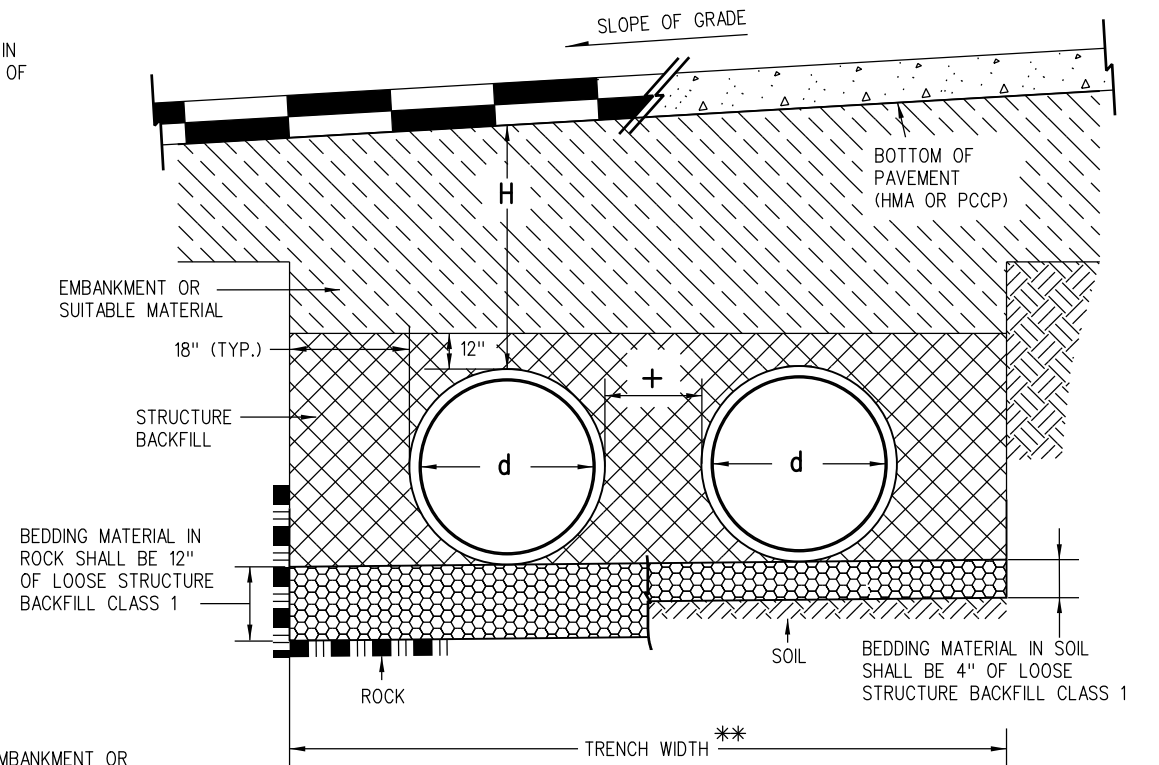
**PIPE WITHOUT END SECTIONS**



**CONSTRUCTION MINIMUM COVER FOR PIPE**

**GENERAL NOTES**

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO MP 20 FOR STEEL REINFORCED, POLYETHYLENE, TYPE S RIBBED PIPE WITH SMOOTH INNER SURFACE. INSTALLATION SHALL CONFORM TO AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS, 3RD EDITION, SECTION 26.
2. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
3. MINIMUM 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.



**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
30 - 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**

**Computer File Information**

Creation Date: 07/31/19	(R-X)
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch **JBK**

**STEEL REINFORCED  
 POLYETHYLENE RIBBED PIPE  
 (AASHTO MP 20)**

Issued by the Project Development Branch: July 31, 2019

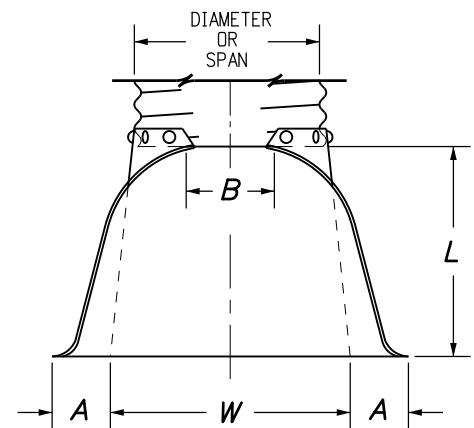
**STANDARD PLAN NO.**

**M-603-6**

**Standard Sheet No. 1 of 1**

Project Sheet Number:

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



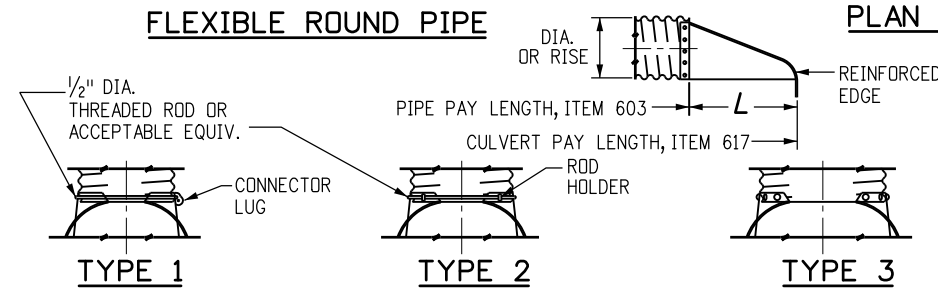
PIPE ARCH	THICKNESS	DIMENSIONS					
		A	B	H	L	W	T
IN.							
21 x 15	0.064	7	10	6	23	36	46
24 x 18	0.064	8	12	6	28	42	52
28 x 20	0.064	9	14	6	32	48	58
35 x 24	0.079	10	16	6	39	60	70
42 x 29	0.079	12	18	8	46	75	85
49 x 33	0.109	13	21	9	53	85	103
57 x 38	0.109	18	26	12	63	90	108
64 x 43	0.109	18	30	12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

**FLEXIBLE PIPE ARCH**

**GENERAL NOTES**

- DIMENSIONS OF END SECTIONS MAY VARY SLIGHTLY FROM THOSE SHOWN ON THE TABLES DUE TO DIFFERENT MANUFACTURERS' CONFIGURATIONS.
- CONCRETE END SECTIONS SHALL BE FURNISHED WITH TONGUE OR GROOVE AS REQUIRED.
- 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.
- THE INSIDE CONFIGURATION AND THE JOINT OF CONCRETE END SECTION AND PIPE SHALL MATCH.
- END SECTIONS FOR CMP ARCH PIPE SHALL MATCH THE DIMENSIONS OF THE PIPE SHOWN ON THE PLANS.
- 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 3/8" IN. GALVANIZED BOLTS, NUTS AND WASHERS.
- GALVANIZED STEEL SHALL CONFORM TO AASHTO M 111, M 218 OR M 232.
- 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.
- CONNECTIONS OF METAL END SECTIONS TO PLASTIC PIPE SHALL BE APPROVED BY THE ENGINEER. PLASTIC END SECTIONS SHALL NOT BE USED.
- THE END SECTION STYLE, EITHER REGULAR OR SAFETY, SHALL BE AS SHOWN ON THE PLANS.
- AT THE OPTION OF THE CONTRACTOR AND APPROVAL OF THE CDDT PROJECT ENGINEER, REINFORCED CONCRETE END SECTIONS MAY BE MADE WITH SYNTHETIC FIBERS INSTEAD OF STEEL FOR PIPES 36 INCHES IN DIAMETER AND SMALLER, AND CONFORM TO AASHTO M 86 AND SUBSECTION 601.03.

**FLEXIBLE ROUND PIPE**

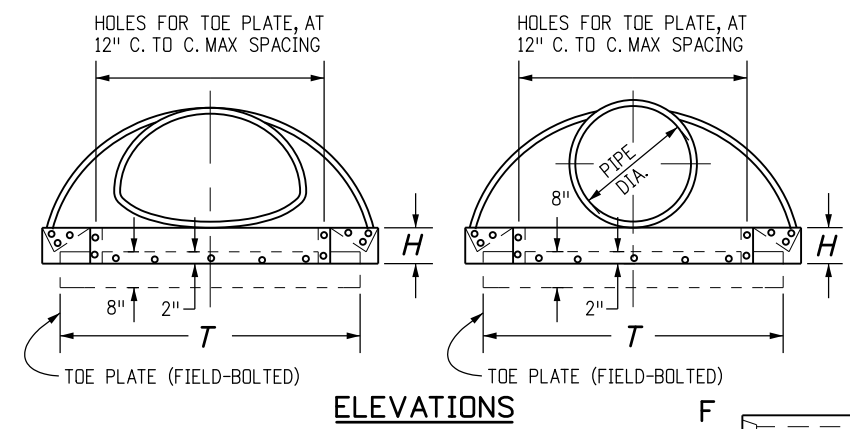


**TYPE 1**  
FOR 18 IN. THRU 24 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY-FORMED PIPE UNLESS RECORRUGATED.

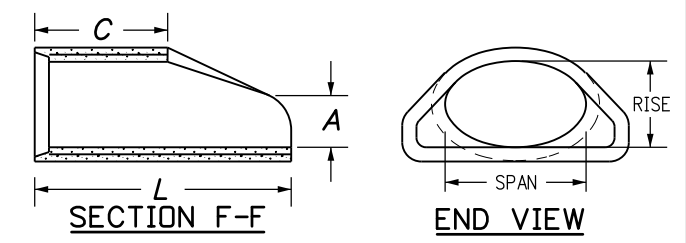
**TYPE 2**  
FOR 30 IN. THRU 36 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY-FORMED PIPE UNLESS RECORRUGATED.

**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**



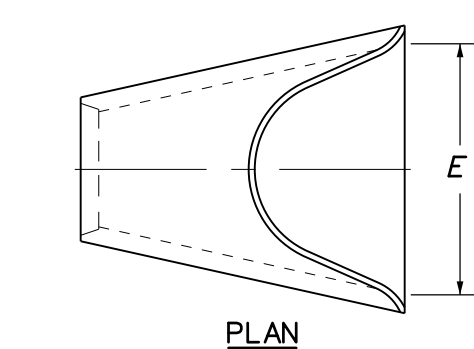
**ELEVATIONS**



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

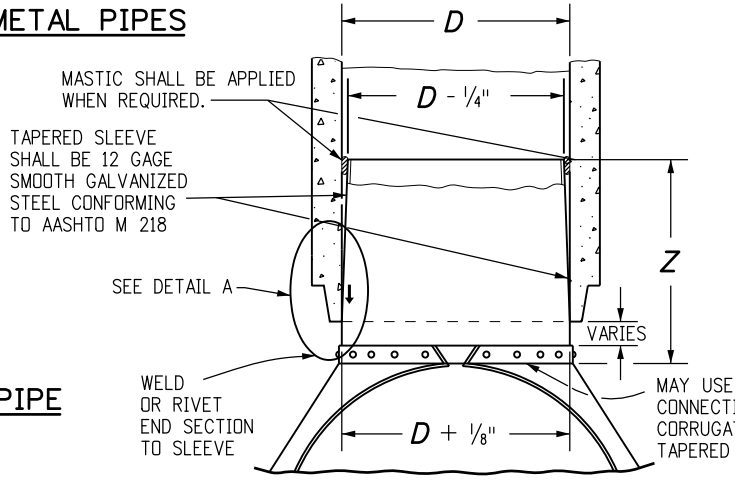
**END SECTION FOR REINFORCED CONCRETE ELLIPTICAL PIPE**

**END SECTION AND CONNECTION DETAILS FOR ROUND AND ARCH METAL PIPES**



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

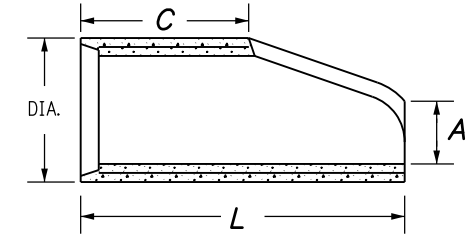
**REINFORCED CONCRETE CIRCULAR PIPE**



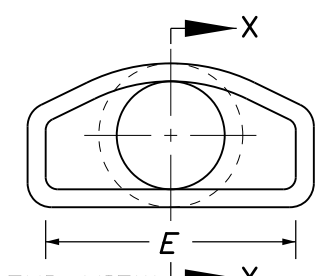
D	Z (MIN.)
IN.	
18 - 24	12
30 AND 36	16
42 AND LARGER	24

**STEEL END SECTION FOR CONCRETE CIRCULAR PIPE**

(ALTERNATIVE FOR CONCRETE END SECTION)

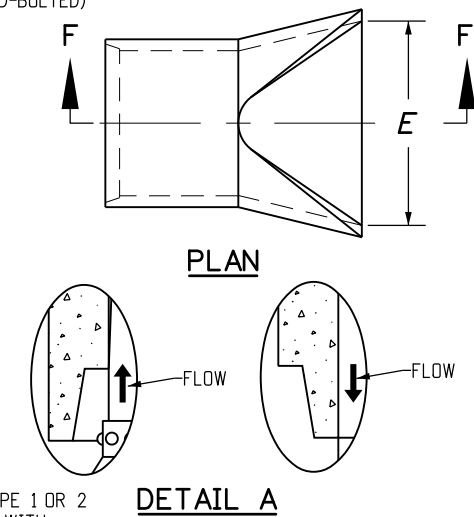


**SECTION X-X**



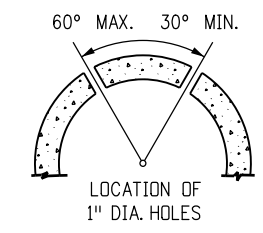
**END VIEW**

**END SECTION FOR REINFORCED CONCRETE CIRCULAR PIPE**

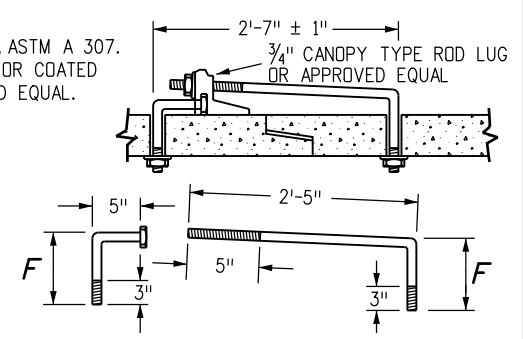


**DETAIL A**

3/4" GALVANIZED ANCHOR BOLTS, NUTS AND WASHERS, MILD STEEL, ASTM A 307. ROD LUG SHALL BE GALVANIZED OR COATED WITH EPOXY PAINT OR APPROVED EQUAL.



**LOCATION OF 1" DIA. HOLES**



**CONCRETE JOINT FASTENER (TWO PER JOINT)**

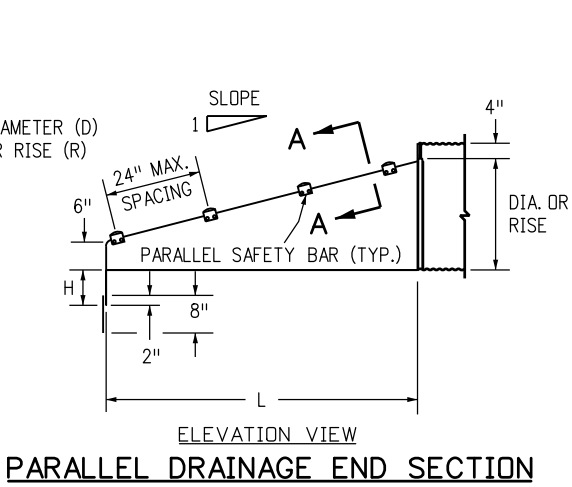
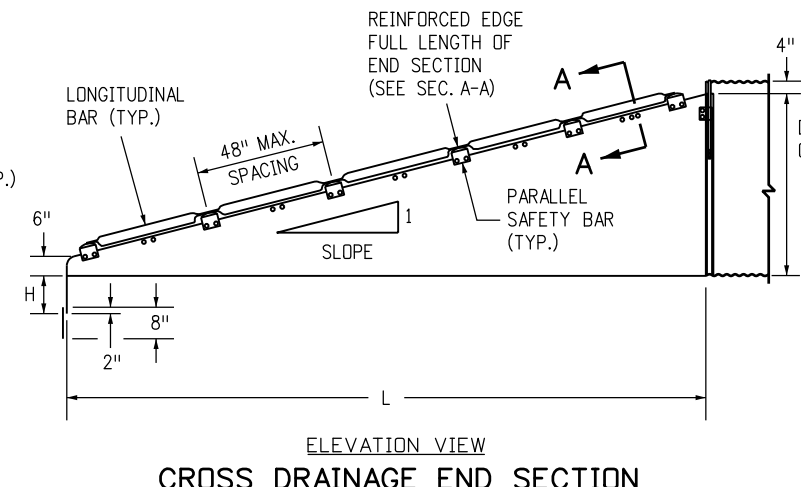
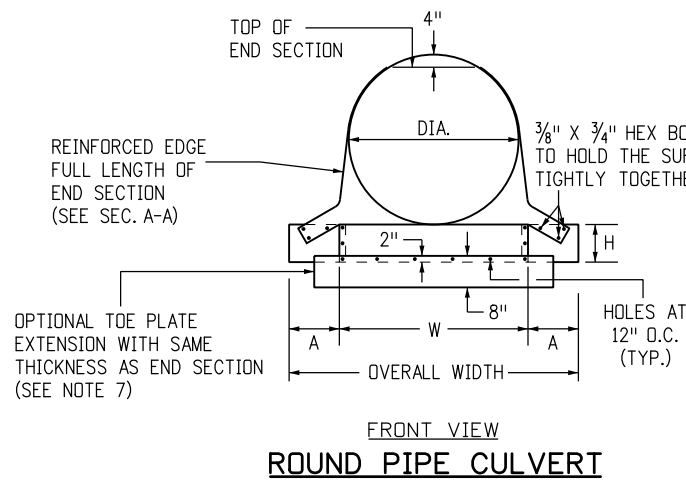
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

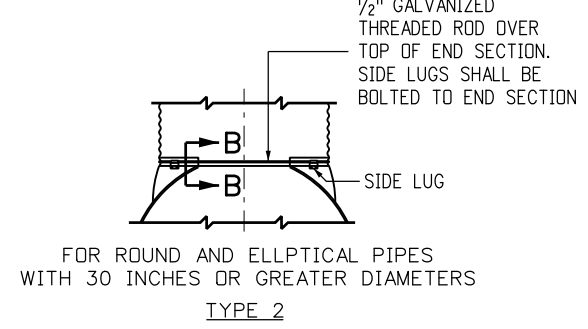
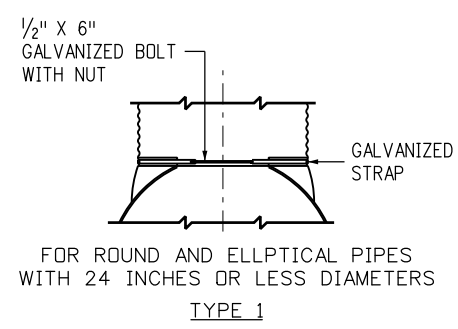
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 Project Development Branch JBK

**CONCRETE AND METAL END SECTIONS**  
 Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-603-10**  
 Standard Sheet No. 1 of 1  
 Project Sheet Number:

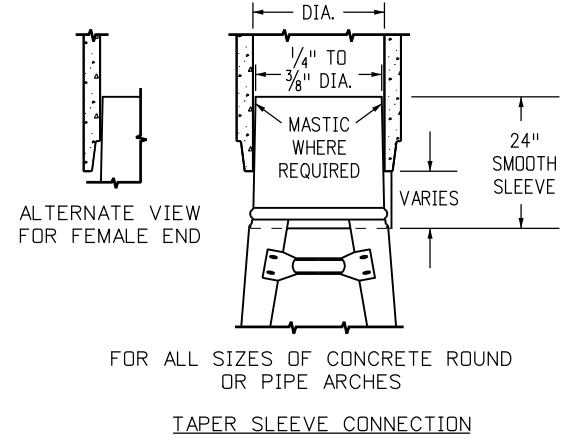


- GENERAL NOTES**
1. USE END SECTIONS ON 1V:4H TO 1V:6H SLOPES ONLY. USE TOE PLATE EXTENSION WHERE SHOWN ON THE PLANS.
  2. FABRICATE SAFETY AND LONGITUDINAL BARS FROM STEEL PIPE CONFORMING TO ASTM A53 SCHEDULE 40 SPECIFICATIONS. GALVANIZE BARS HOT DIPPED AFTER FABRICATION.
  3. A LONGITUDINAL BAR IS REQUIRED FOR CROSS DRAINAGE END SECTIONS WHEN THE SPAN IS GREATER THAN 30 INCHES. USE ADDITIONAL LONGITUDINAL BARS IF SPACING EXCEEDS 30 INCHES ON LARGER END SECTIONS.
  4. SAFETY AND LONGITUDINAL BARS ARE NOT REQUIRED ON 30 INCHES AND SMALLER CROSS DRAINAGE END SECTIONS.
  5. SAFETY BARS ARE NOT REQUIRED ON 18 INCHES AND SMALLER PARALLEL DRAINAGE END SECTIONS.
  6. WHEN REQUIRED, TOE PLATE EXTENSIONS SHALL BE THE SAME GAGE AS END SECTIONS. DIMENSIONS SHALL BE OVERALL WIDTH LESS 6 INCHES BY 8 INCHES HIGH.



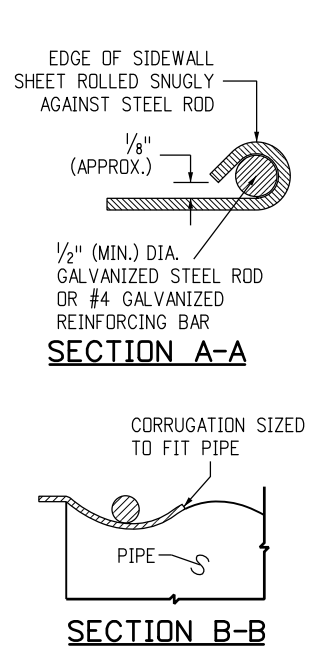
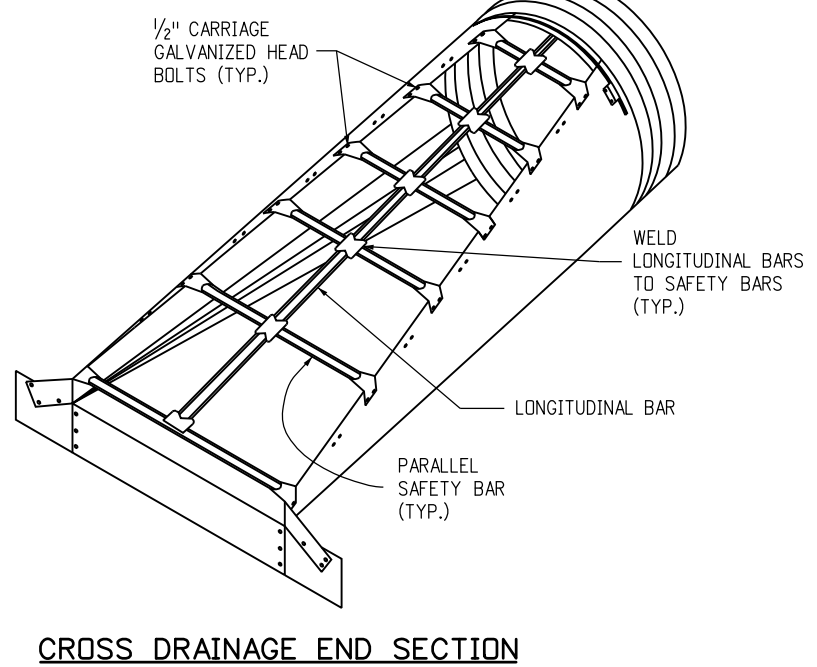
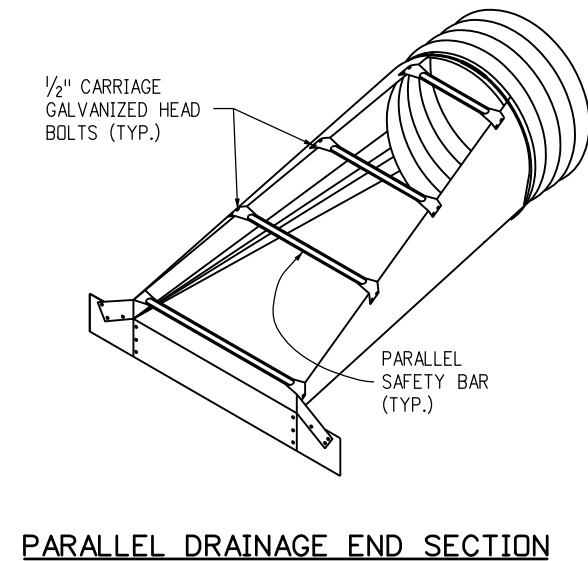
**CONNECTOR DETAILS**

NOTE: SIZES THRU 24" ATTACH TO PIPE WITH TYPE 1 STRAPS. ALL OTHER SIZES ATTACH WITH TYPE 2 RODS AND LUGS.



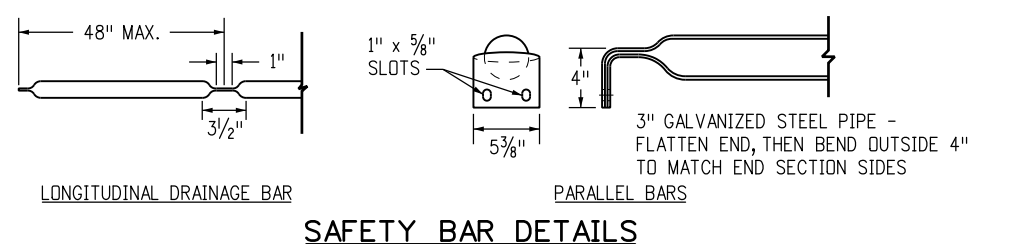
**METAL END SECTIONS FOR ROUND PIPE CULVERT**

PIPE DIA. SIZE (INCHES)	METAL THICK MIN. (INCH/GAGE)	DIMENSIONS IN INCHES					
		A	H	W	OVERALL WIDTH	L	
						Slope = 4	Slope = 6
18	0.064/16	8	6	24	40	32	47
24	0.064/16	8	6	30	46	55	83
30	0.109/12	12	9	36	60	79	118
36	0.109/12	12	9	42	66	102	154
42	0.109/12	16	12	48	80	126	189
48	0.109/12	16	12	54	86	150	224
54	0.109/12	16	12	60	92	173	260
60	0.109/12	16	12	66	98	197	295



**METAL END SECTIONS FOR PIPE ARCH CULVERT**

PIPE SIZE (INCHES)			METAL THICK MIN. (INCH/GAGE)	DIMENSIONS (INCHES)					
EQUIV. DIA.	SPAN	RISE		A	H	W	OVERALL WIDTH	L	
								Slope = 4	Slope = 6
18	21	15	0.064/16	8	6	27	43	20	30
24	28	20	0.064/16	8	6	33	49	40	60
30	35	24	0.109/12	12	9	40	64	55	83
36	41	29	0.109/12	12	9	47	71	75	112
42	48	32	0.109/12	16	12	54	86	90	136
48	56	37	0.109/12	16	12	62	94	110	165
54	63	42	0.109/12	16	12	69	101	130	195
60	70	46	0.109/12	16	12	76	107	146	218
72	82	56	0.109/12	16	12	88	120	185	278



**Computer File Information**

Creation Date: 07/31/19
Designer Initials: JJP
Last Modification Date: 07/31/19
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
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(R-X)	
(R-X)	
(R-X)	

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**Project Development Branch** **JBK**

**TRAVERSABLE END SECTIONS AND SAFETY GRATES**

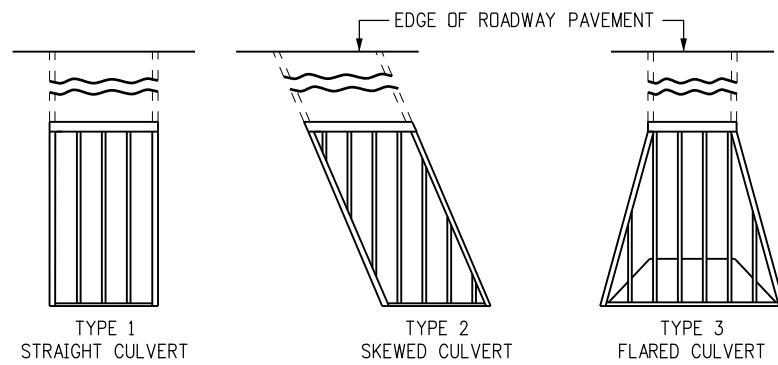
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**STANDARD PLAN NO. M-603-12**

**Standard Sheet No. 1 of 3**

Project Sheet Number:





TYPE 1  
STRAIGHT CULVERT

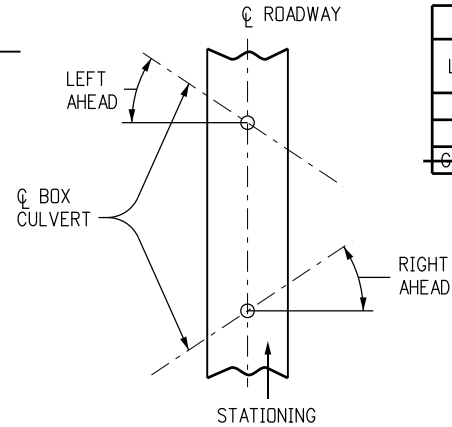
TYPE 2  
SKEWED CULVERT

TYPE 3  
FLARED CULVERT

TYPE 4  
FLARED-SKEWED CULVERT

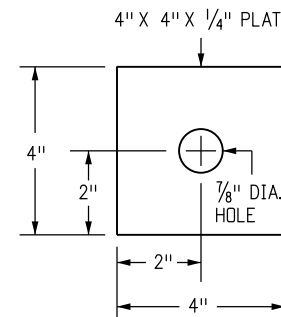
**INSTALLATION TYPES**

GRATE BARS SHALL BE PERPENDICULAR TO DIRECTION OF TRAFFIC FLOW.

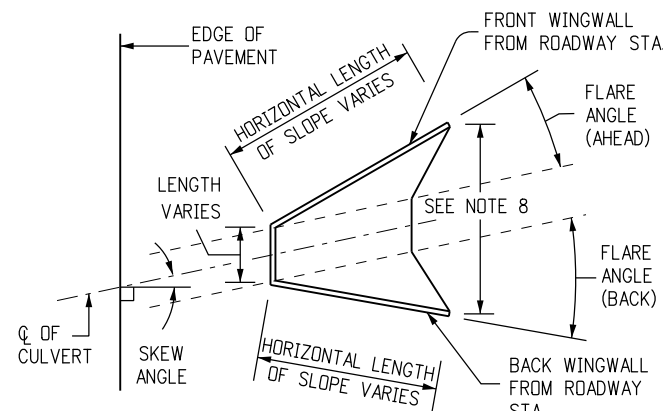


**SKEW ANGLE DETERMINATION**

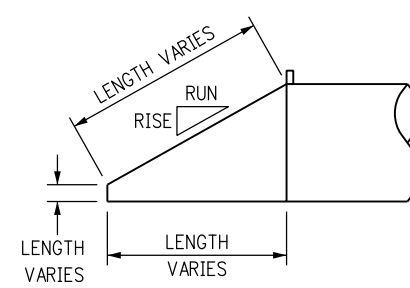
GRATE & CROSS BAR SIZE REQUIREMENTS		
LENGTH OF SPAN	NOMINAL PIPE SIZE (SEE NOTE 7)	O.D. SIZE
LESS THAN 12'	3.0"	3.0"
12' - 16'	3.5"	3.5"
GREATER THAN 16'	4.0"	4.0"



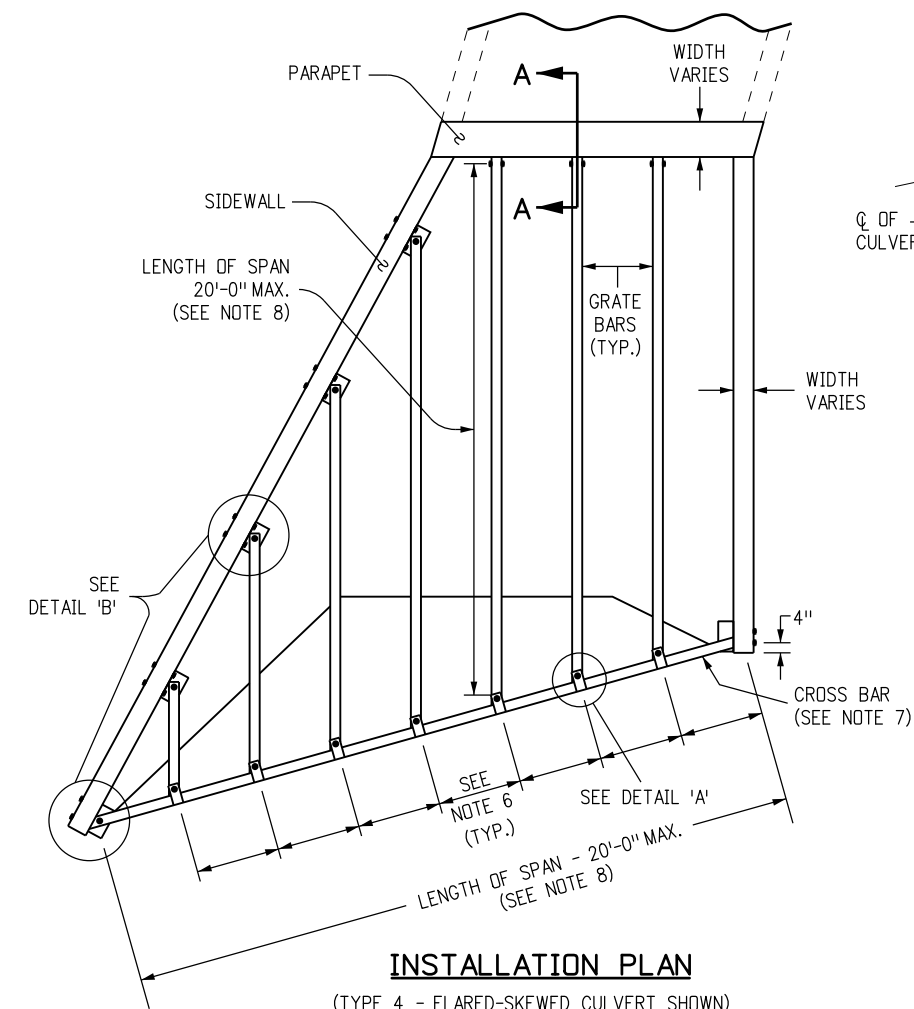
**SHIM DETAIL**



**TOP VIEW**

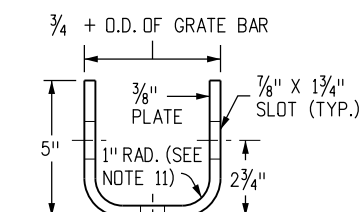


**SIDE VIEW**



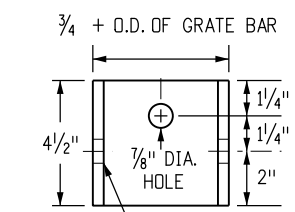
**INSTALLATION PLAN**

(TYPE 4 - FLARED-SKEWED CULVERT SHOWN)



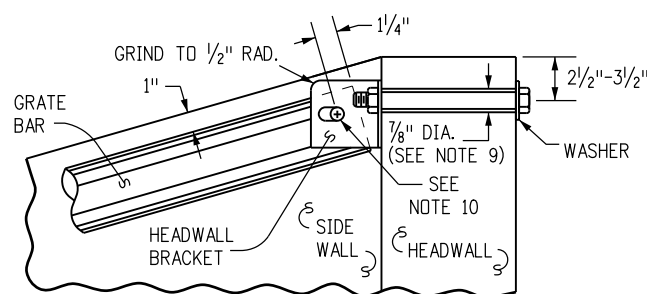
**HEADWALL BRACKET**

TOP VIEW

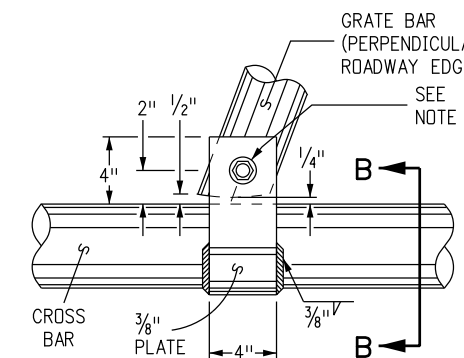


**HEADWALL BRACKET**

FRONT VIEW

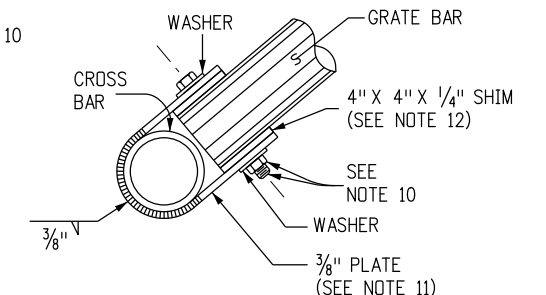


**SECTION A-A**

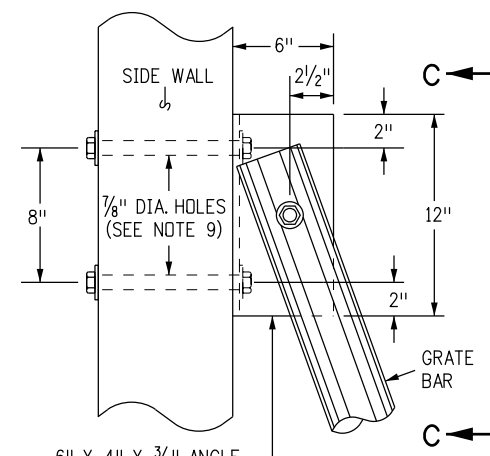


**DETAIL "A"**

TOP VIEW

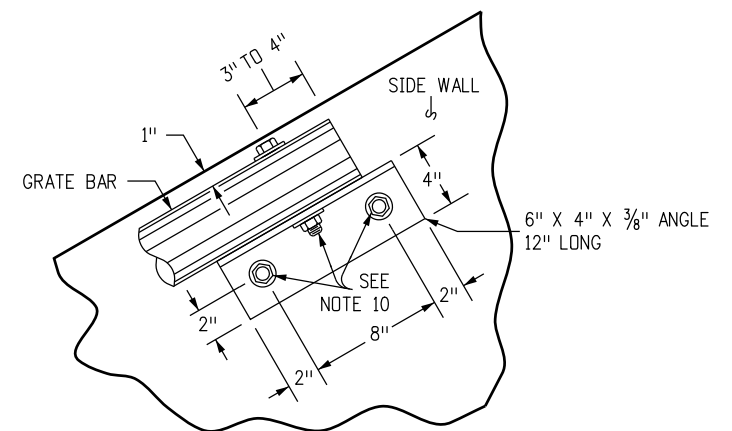


**SECTION B-B**



**DETAIL "B"**

TOP VIEW



**SECTION C-C**

- NOTES**
- SHOP DRAWINGS SHALL BE SUBMITTED PER 105.02
  - HARDWARE SUCH AS BOLTS, WASHERS, AND LOCK NUTS SHALL BE HOT-DIPPED GALVANIZED PER ASTM A123
  - INTENDED FOR USE ON TERRAIN XX SLOPES WITH A CLEAR RUNOUT FOR ERRANT VEHICLES. GUARDRAIL IS THE PREFERRED OPTION ON STEEPER TERRAIN OR WITH HIGHER TRAFFIC VOLUMES
  - MINIMUM SCHEDULE 40 PIPE SHALL BE USED. GALVANIZE ALL PIPES, FITTINGS AND HARDWARE AFTER ALL CUTTING, WELDING, DRILLING, AND FABRICATION.
  - BOTH ENDS OF CULVERT SHALL BE TREATED TO PREVENT DEBRIS FROM ENTERING
  - EQUALLY SPACED 24 INCHES MIN. TO 30 INCHES MAX. FROM EDGE OF SIDEWALL TO CENTER OF BRACKET, OR FROM CENTER TO CENTER OF BRACKET.
  - THE CROSS BAR DIAMETER SHALL BE EQUAL TO OR GREATER THAN THE GRATE BAR DIAMETER.
  - IF MORE THAN 20 FEET THAN A MIDSPAN SUPPORT SHALL BE REQUIRED. SEE SHEETS 3 AND 4.
  - DRILL HOLES USING EQUIPMENT DESIGNED TO CUT THROUGH CONCRETE AND REINFORCING STEEL.
  - A 3/4 INCH BOLT, LOCK NUT AND WASHERS. ALL HOLES ARE TO BE 7/8 INCH IN DIAMETER.
  - BEND PLATES OR STRIPS WITHOUT CRACKING MATERIAL.
  - SHIM THICKNESS EQUALS THE DIFFERENCE IN DIAMETERS OF THE GRATE BAR AND CROSS BAR.

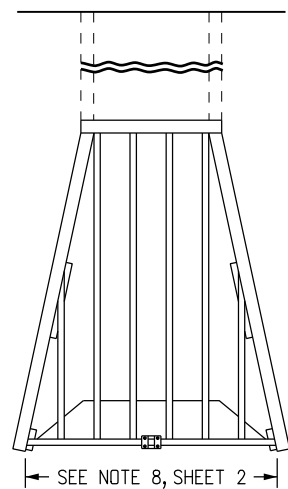
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JJP	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

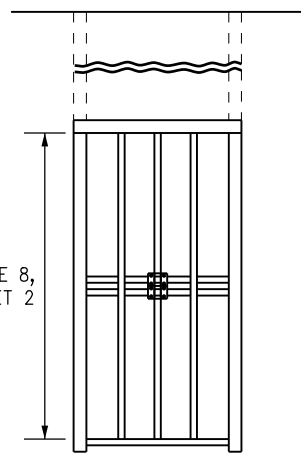
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**TRAVERSABLE END SECTIONS  
AND SAFETY GRATES**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
M-603-12**  
**Standard Sheet No. 2 of 3**  
 Project Sheet Number:



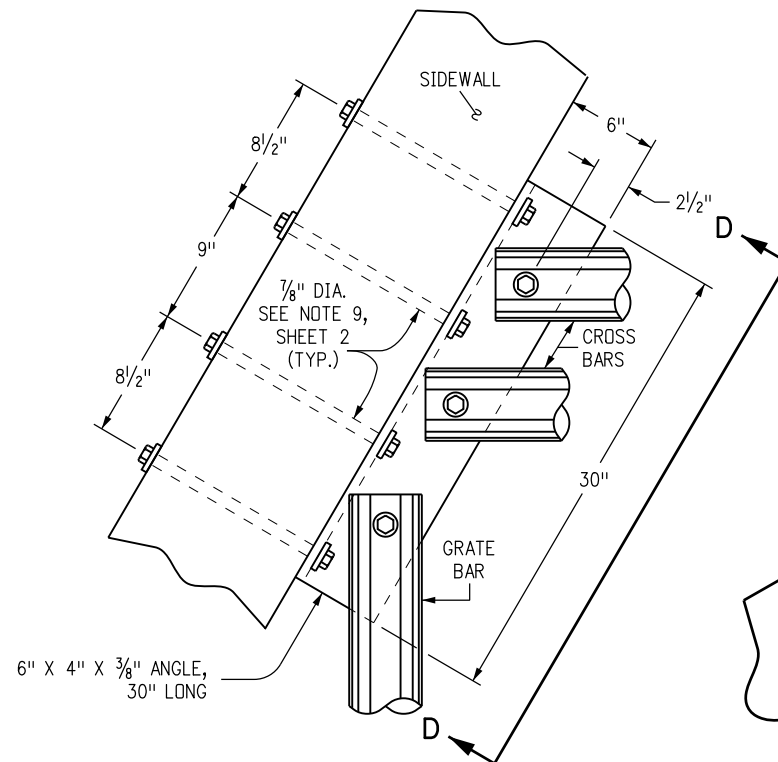
**CASE 1**



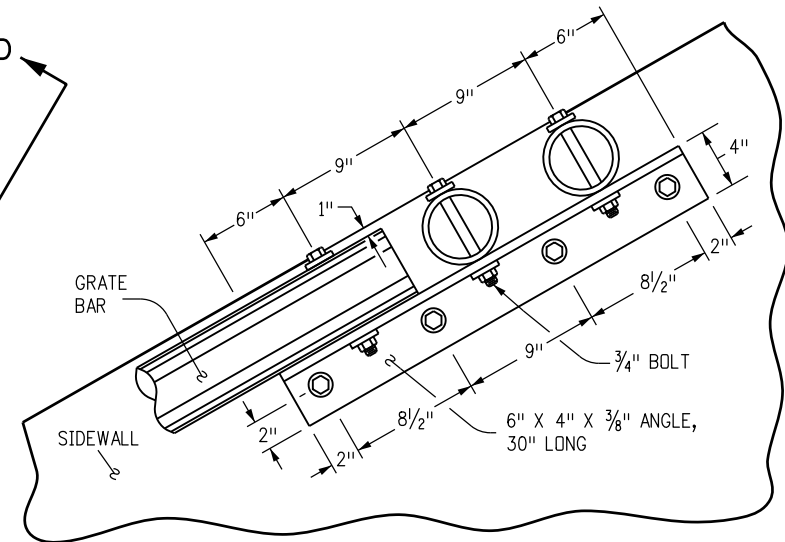
**CASE 2**

SEE NOTE 8, SHEET 2

SEE NOTE 8, SHEET 2



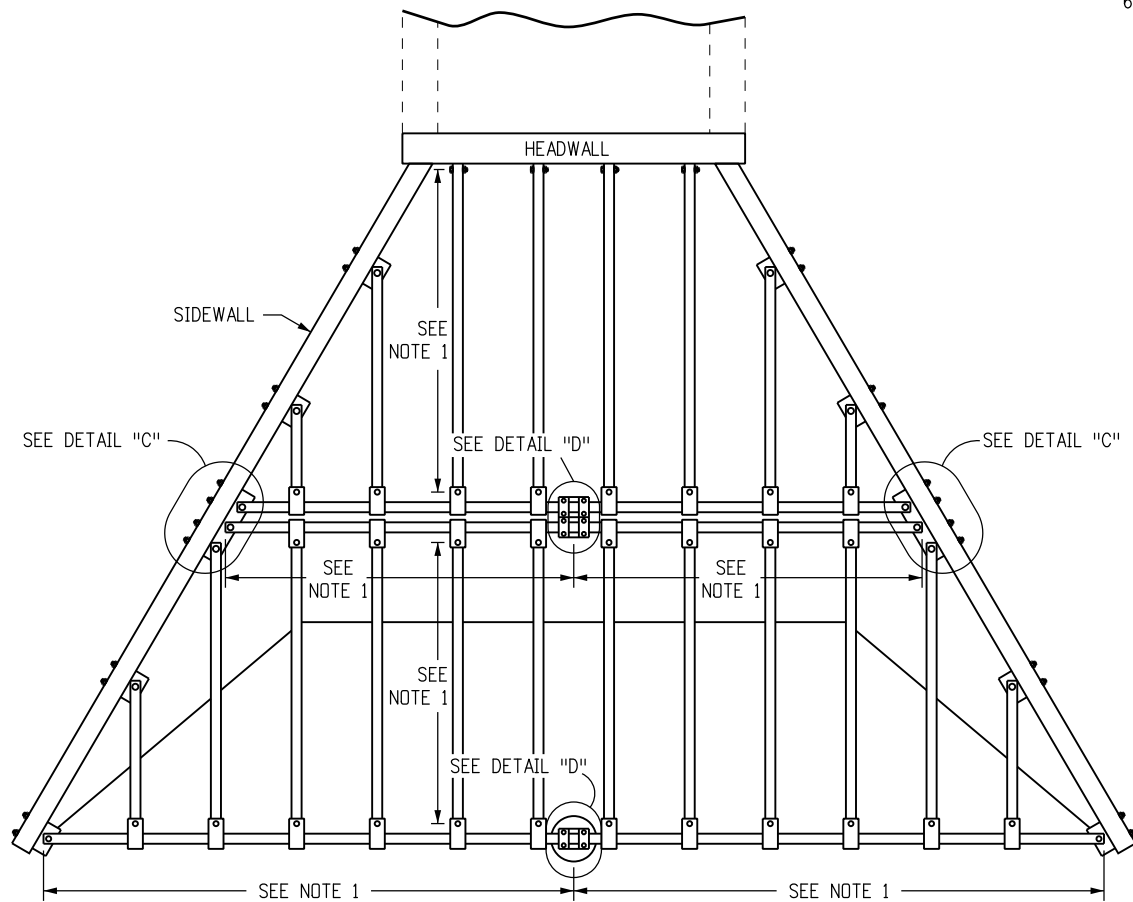
**DETAIL "C"**



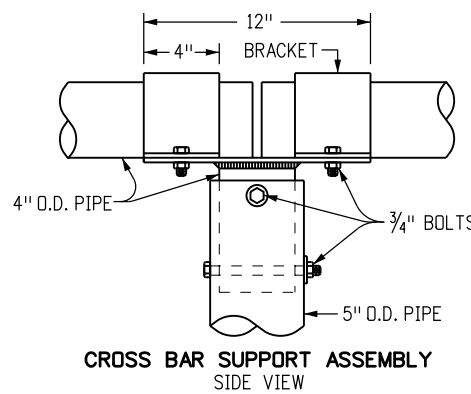
**SECTION D-D**

**NOTES**

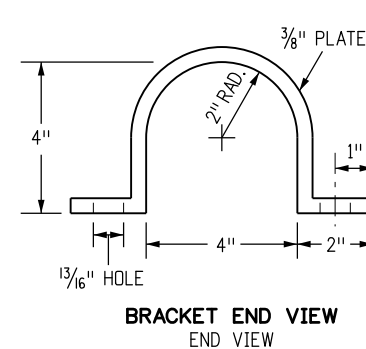
1. LENGTH OF SPAN (20 FEET MAXIMUM).
2. ALL ANCHOR BOLTS SHALL BE GROUTED IN PLACE WITH A NONSHRINK OR EPOXY GROUT WHICH SHALL COMPLETELY FILL THE HOLES.



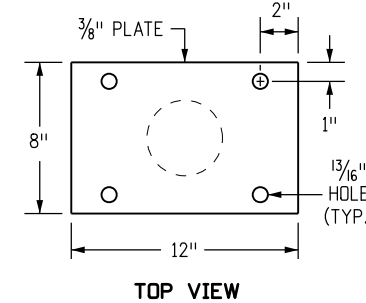
**INSTALLATION PLAN WITH MIDSPAN SUPPORT**



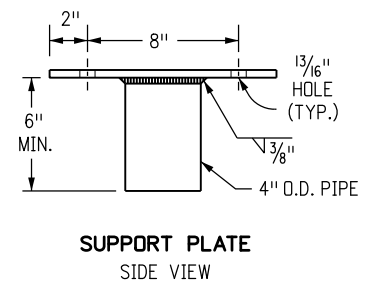
**CROSS BAR SUPPORT ASSEMBLY SIDE VIEW**



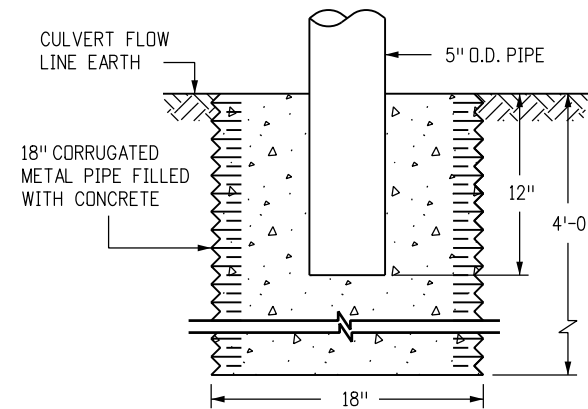
**BRACKET END VIEW END VIEW**



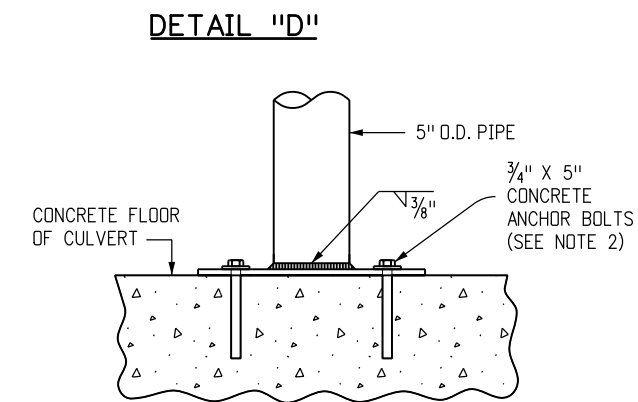
**TOP VIEW**



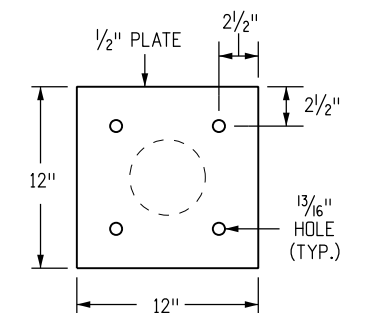
**SUPPORT PLATE SIDE VIEW**



**BOTTOM SUPPORT ON EARTH**



**BOTTOM SUPPORT ON CULVERT FLOOR**



**BOTTOM SUPPORT PLATE**

**Computer File Information**

Creation Date: 07/31/19	(R-X)
Designer Initials: JJP	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

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**TRAVERSABLE END SECTIONS AND SAFETY GRATES**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-603-12**

**Standard Sheet No. 3 of 3**

Project Sheet Number:

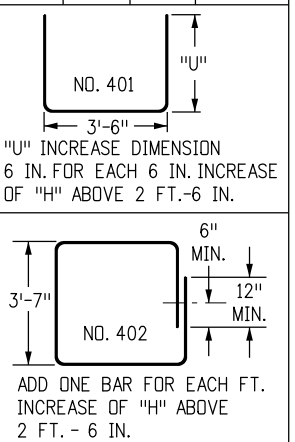
**QUANTITIES FOR ONE INLET**

H	CONCRETE (CU. YDS.)	STEEL (LBS.)	NO. STEPS REQ'D.
2'-6"	1.0	76	0
3'-0"	1.1	81	0
3'-6"	1.2	97	0
4'-0"	1.3	102	1
4'-6"	1.5	117	2
5'-0"	1.6	123	2
5'-6"	1.7	138	2
6'-0"	1.9	143	3
6'-6"	2.0	159	3
7'-0"	2.1	164	3
7'-6"	2.2	180	4
8'-0"	2.4	185	4
8'-6"	2.5	200	4
9'-0"	2.6	206	5
9'-6"	2.8	221	5
10'-0"	2.9	236	6
11'-6"	3.3	252	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'-2 1/2"	8'-0"
401	6	2'-7"	8'-8"
402	4	"U"	15'-4"

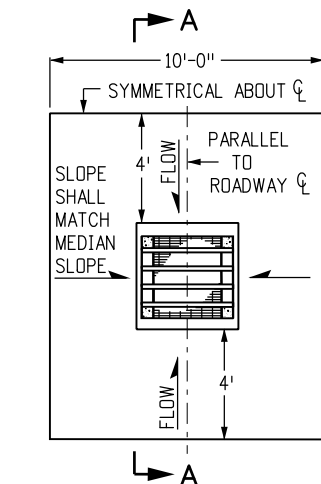


402 BARS SHALL BE EQUALLY SPACED FROM EACH OTHER.

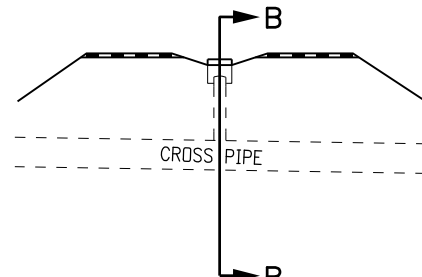
**STEEL GRATE QUANTITIES**

NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
4	S4 x 7.7 BEAM	41"	7.90	106
2	3 1/2" x 1/4" FLAT	26 5/8"	2.98	13
2	3" x 1/4" FLAT	26 5/8"	2.55	12

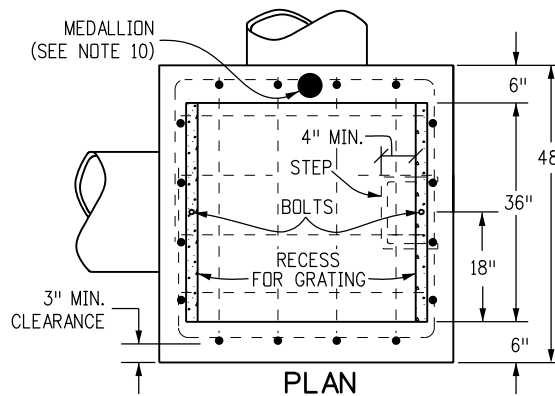
TOTAL LBS. - 131



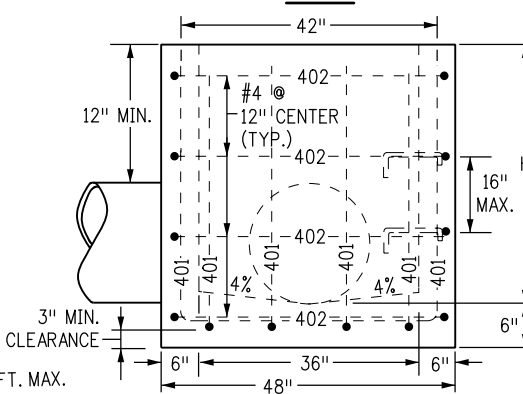
**INLET WITH DITCH PAVING**



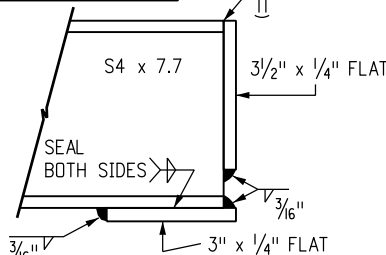
**SECTION VIEW**



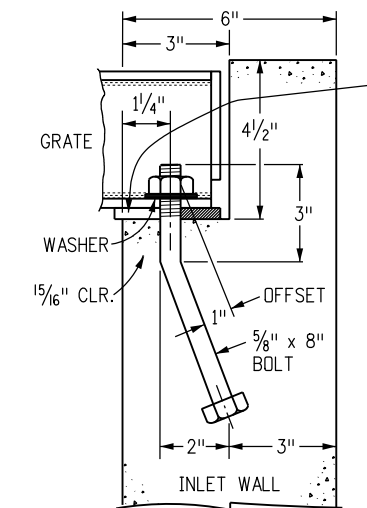
**PLAN**



**ELEVATION CONCRETE INLET**

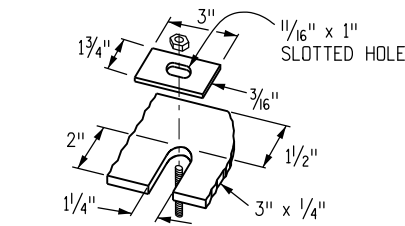


**SECTION D-D**



**GRATE INSTALLATION DETAIL**

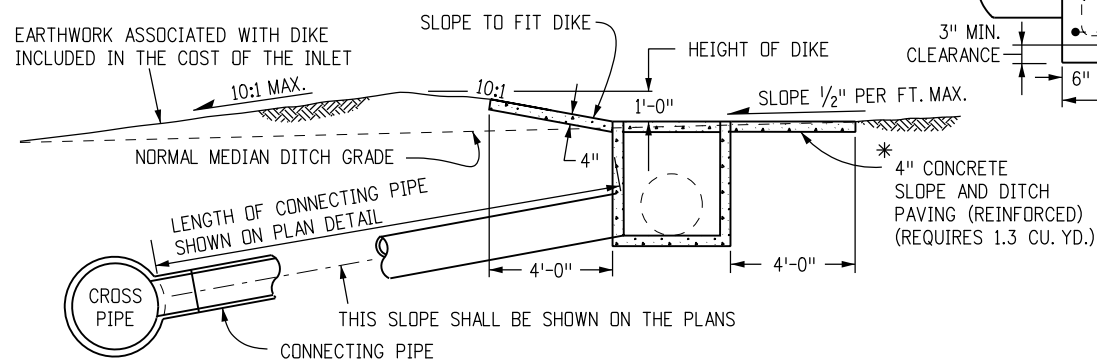
**SLOT DETAIL**



**ALTERNATE SLOT AND HOLD DOWN PLATE DETAIL**

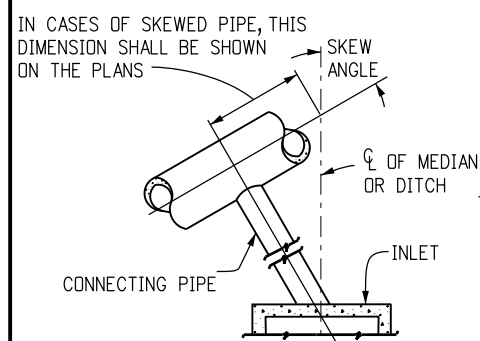
**GENERAL NOTES**

- 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.
- CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
- REINFORCING BARS SHALL BE GRADE 60, EPOXY COATED, AND DEFORMED #4, AND SHALL HAVE A MIN. 2 INCH CLEARANCE. CUT OR BEND AROUND PIPES AS REQUIRED.
- 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.
- STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED, AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
- THE STANDARD INLET GRATES SHALL BE USED ON ALL TYPE C INLETS UNLESS CLOSE MESH INLET GRATES ARE SPECIFIED ON THE PLANS.
- 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.
- STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FEET - 6 INCHES AND SHALL CONFORM TO AASHTO M 199.
- SEE STANDARD PLAN M-604-11, FOR REINFORCEMENT AROUND THE PIPE OPENING.
- ALL INLETS SHALL HAVE A 4 INCH 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.

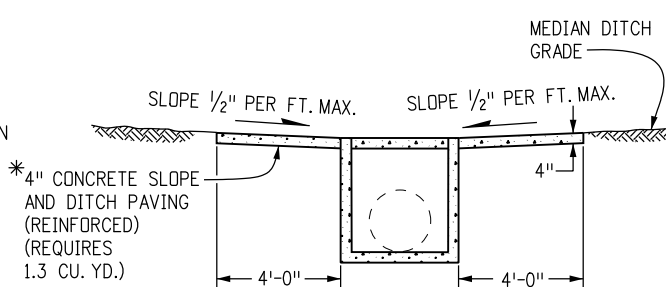


**SECTION A-A INLET ON GRADE (FLOW FROM ONE DIRECTION)**

**SECTION B-B INLET CONNECTED TO A CROSS PIPE**

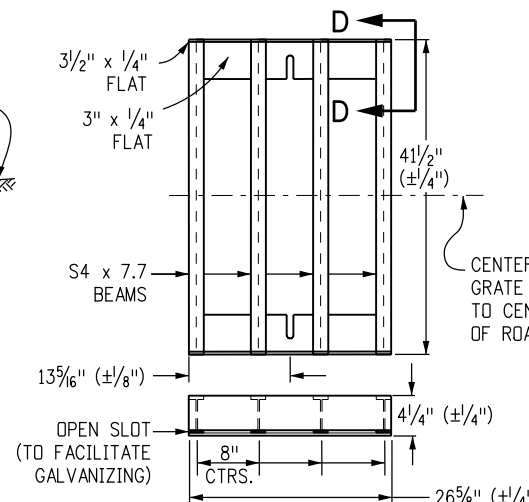


**INLET CONNECTED TO A SKEWED CROSS PIPE**

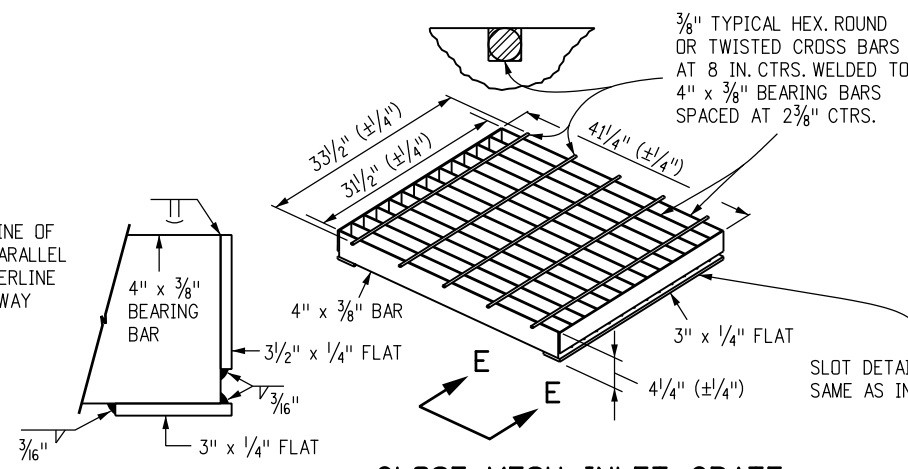


**SECTION A-A INLET AT BOTTOM OF VERTICAL CURVE (FLOW FROM TWO DIRECTIONS)**

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



**STANDARD INLET GRATE**



**SECTION E-E**

**CLOSE MESH INLET GRATE**

SLOT DETAIL IN 3 1/2" x 1/4" FLATS SAME AS IN STANDARD INLET GRATE

**Computer File Information**

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

**Colorado Department of Transportation**

2829 West Howard Place  
CDDT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

**Project Development Branch**

JBK

**INLET, TYPE C**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

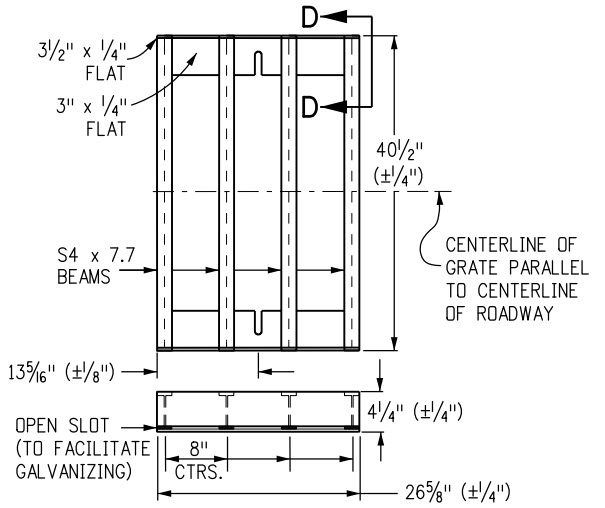
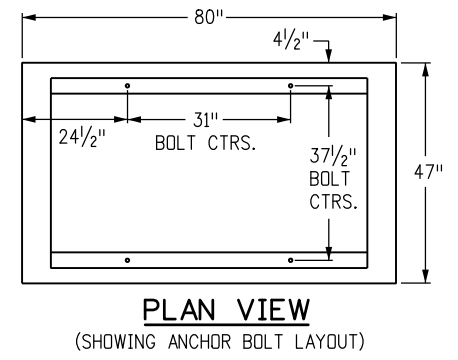
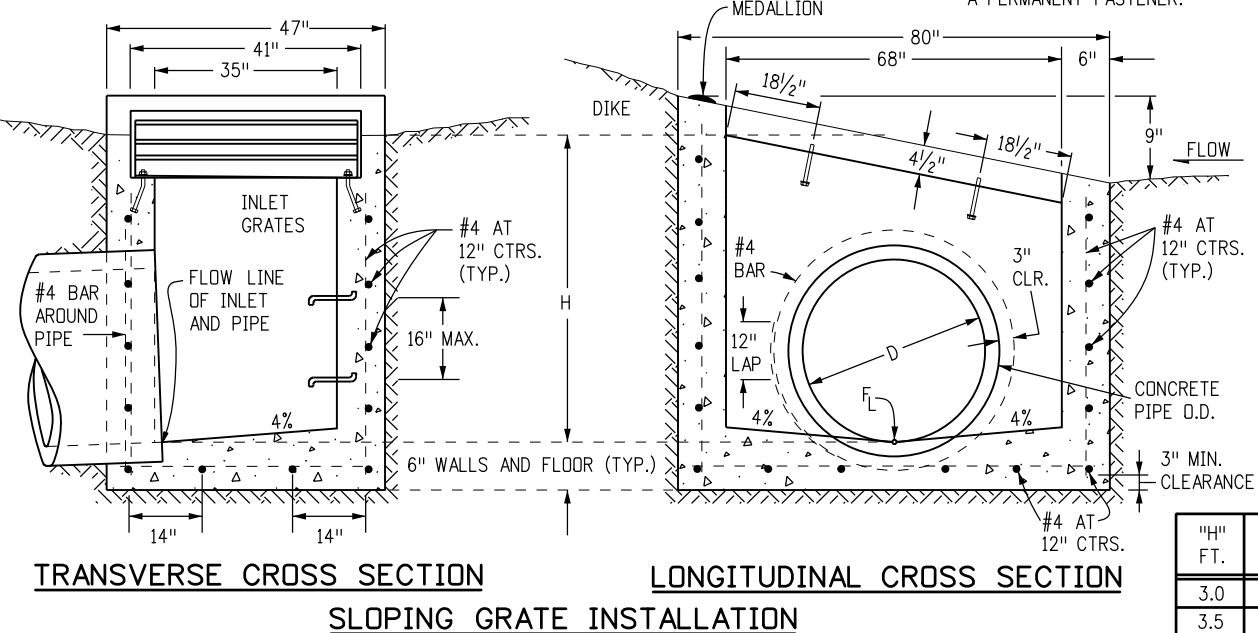
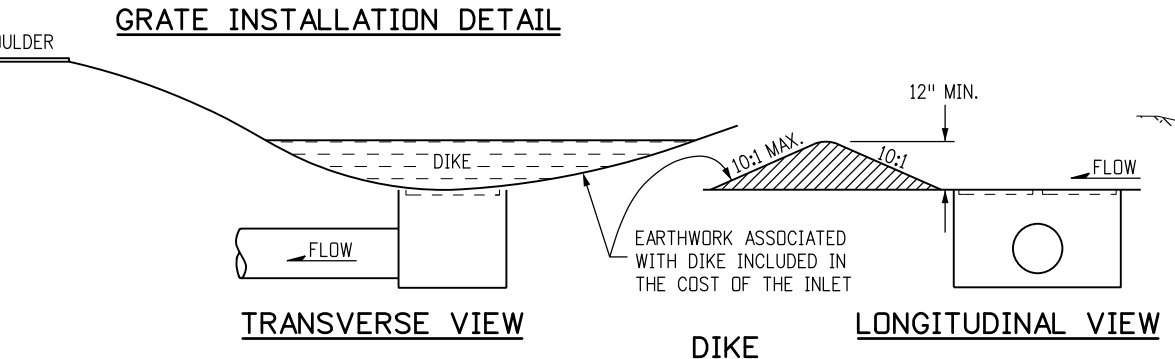
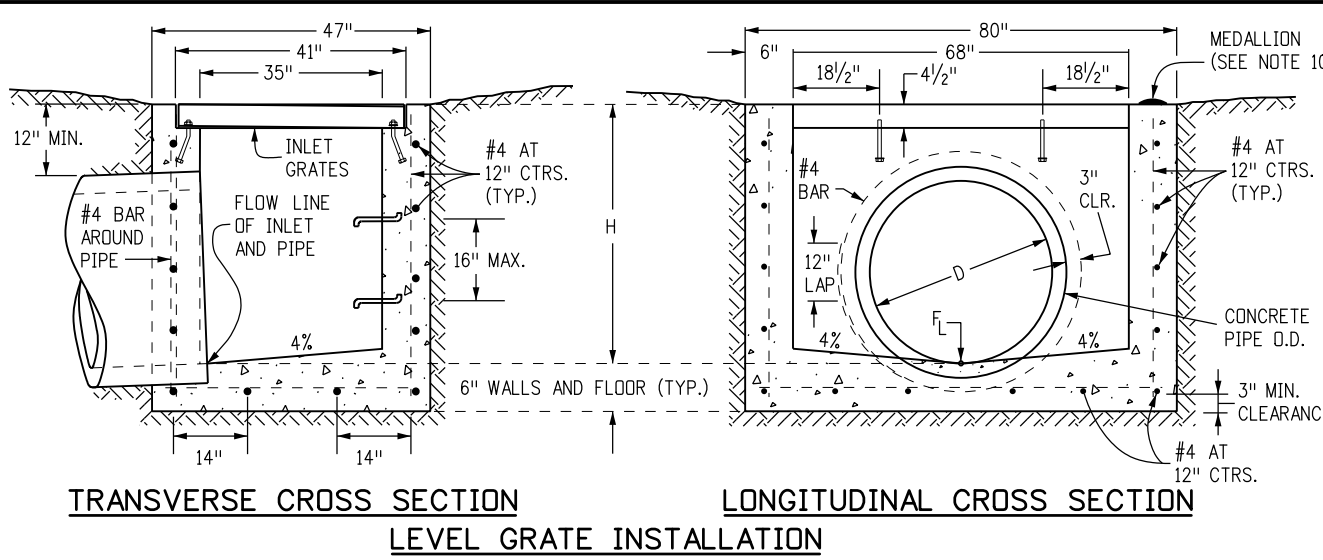
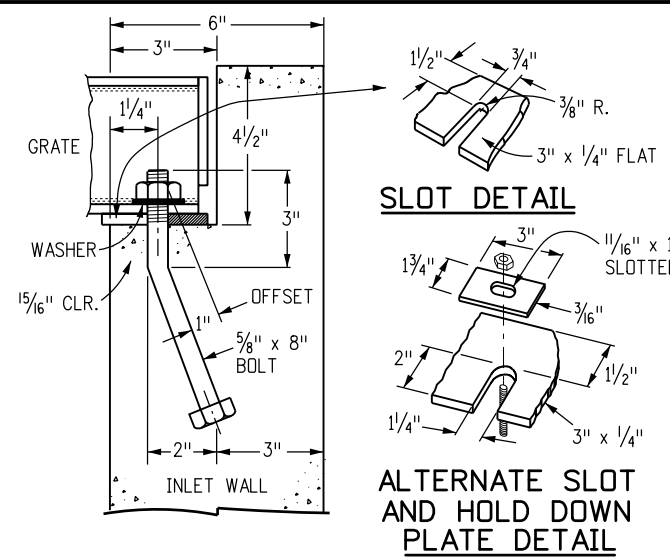
M-604-10

**Standard Sheet No. 1 of 1**

Project Sheet Number:

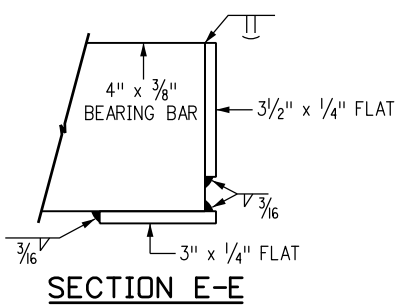
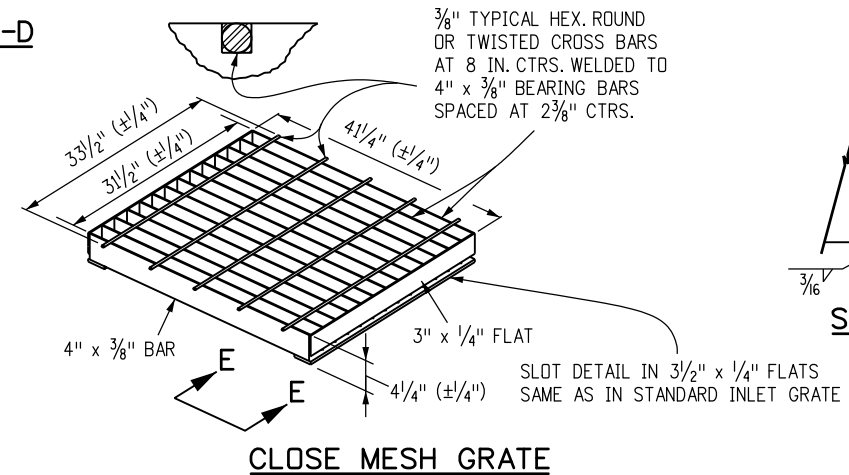
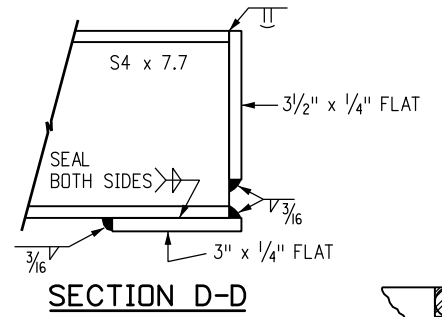
**GENERAL NOTES**

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 FEET-6 INCHES AND SHALL CONFORM WITH AASHTO M 199.
8. REINFORCING BARS SHALL BE GRADE 60, EPOXY COATED, AND DEFORMED #4, AND SHALL HAVE A 2 INCH MIN. CLEARANCE. CUT OR BEND BARS AROUND PIPE AS REQUIRED.
9. ALL INLETS SHALL HAVE A 4 INCH 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.



NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
8	S4 x 7.7 BEAM	40"	7.70	206
4	3 1/2" x 1/4" FLAT	26 5/8"	2.98	26
4	3" x 1/4" FLAT	26 5/8"	2.55	24

TOTAL LBS. - 256



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

"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**

**Computer File Information**

Creation Date: 07/31/19	(R-X)
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

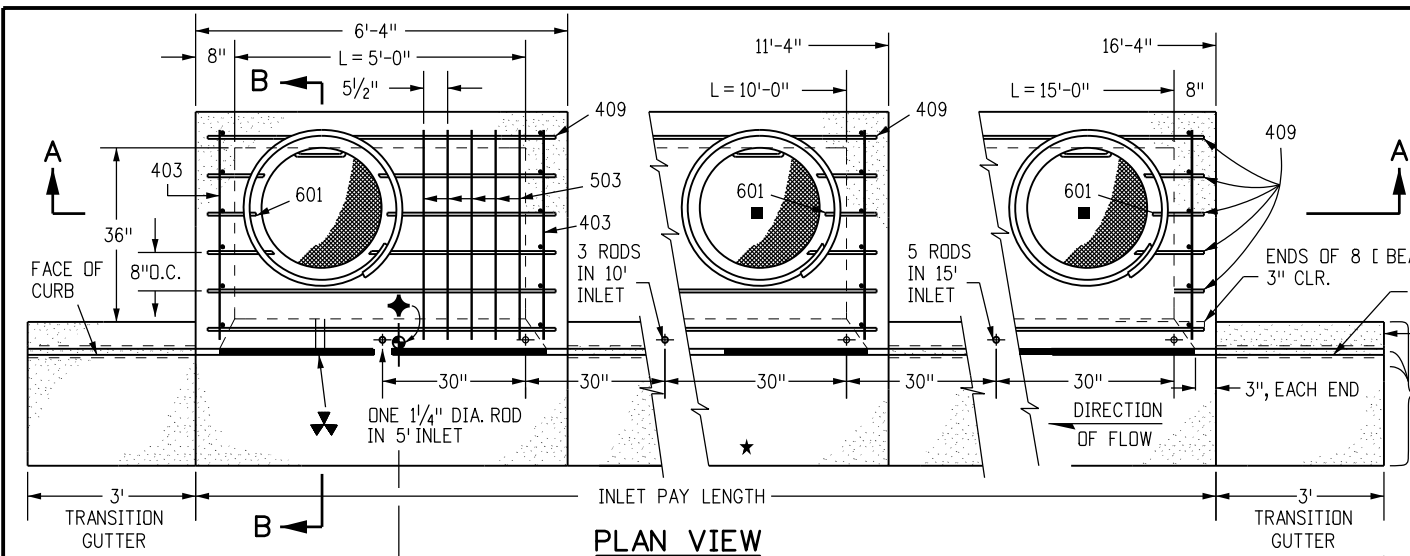
Date:	Comments

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 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**INLET, TYPE D**

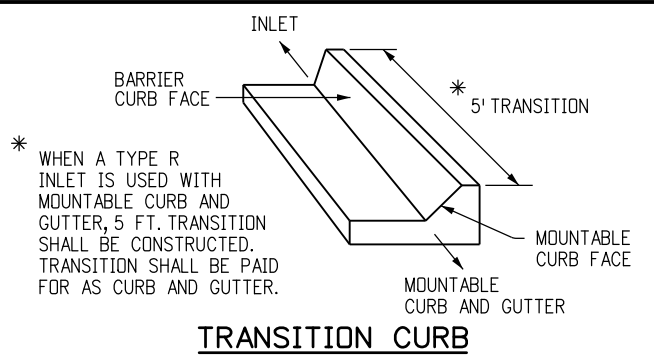
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
 M-604-11  
**Standard Sheet No. 1 of 1**  
 Project Sheet Number:

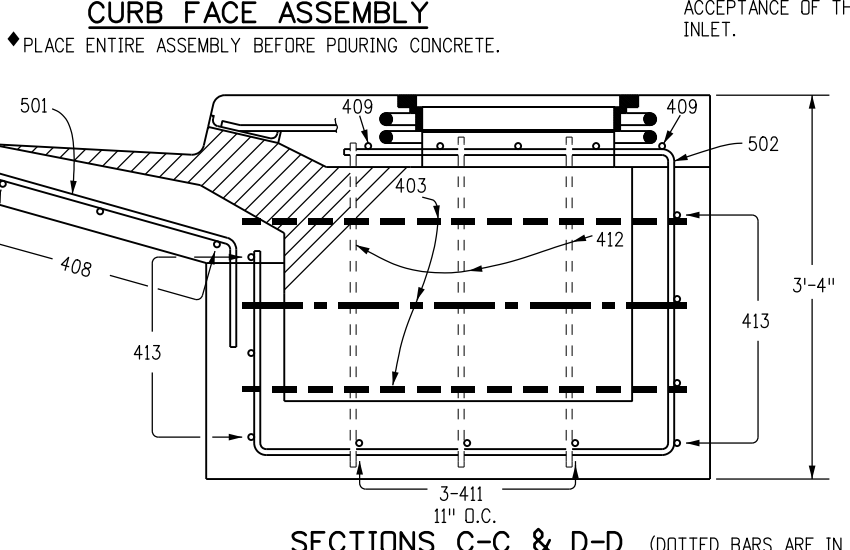
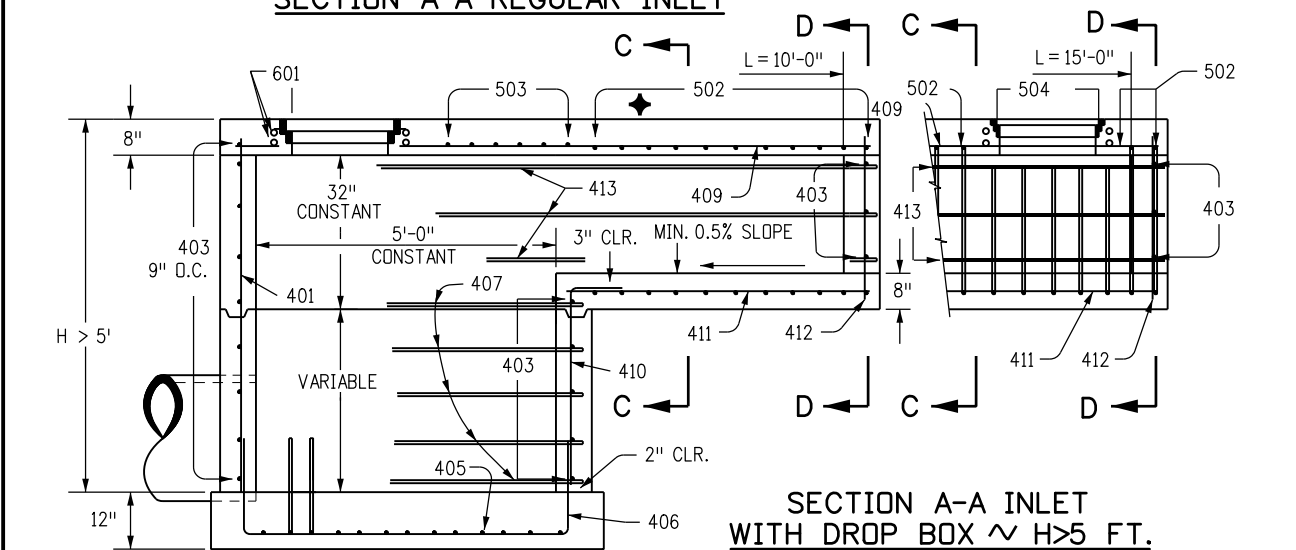
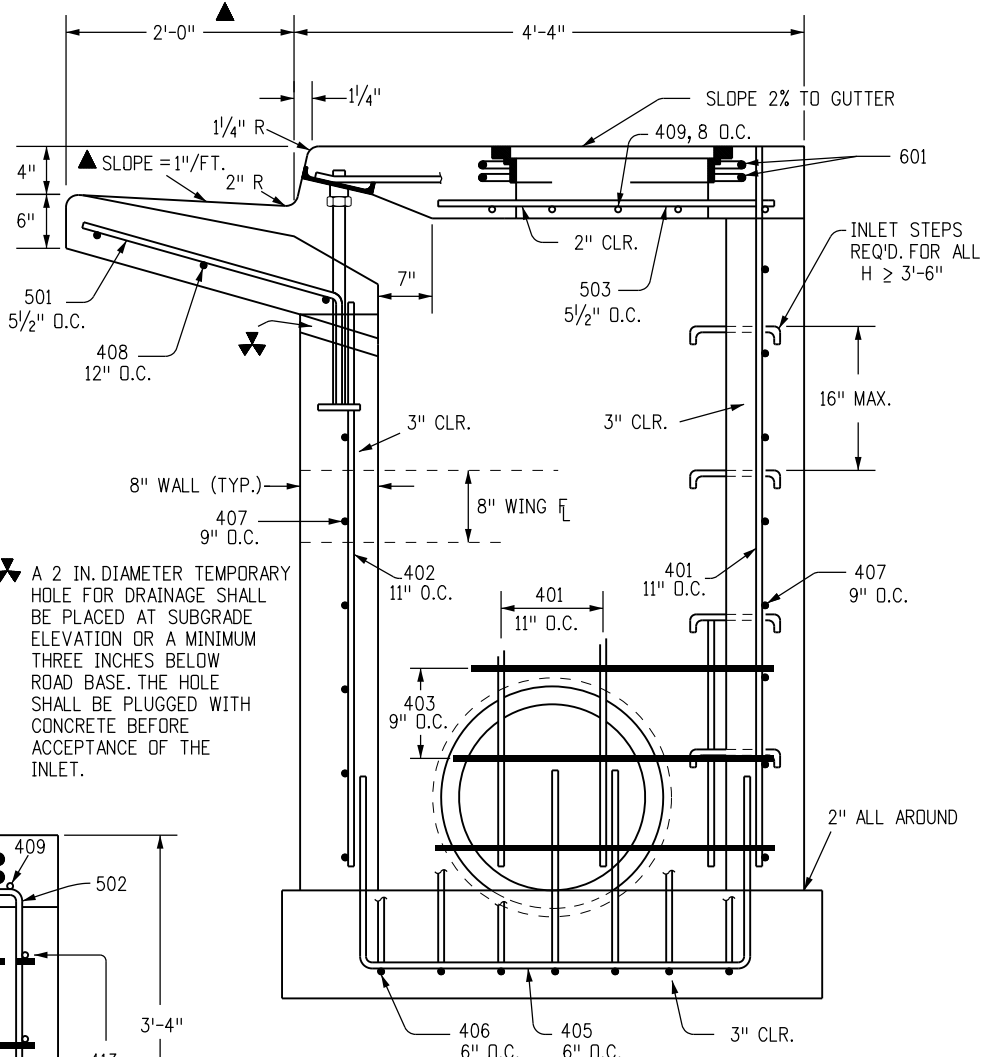
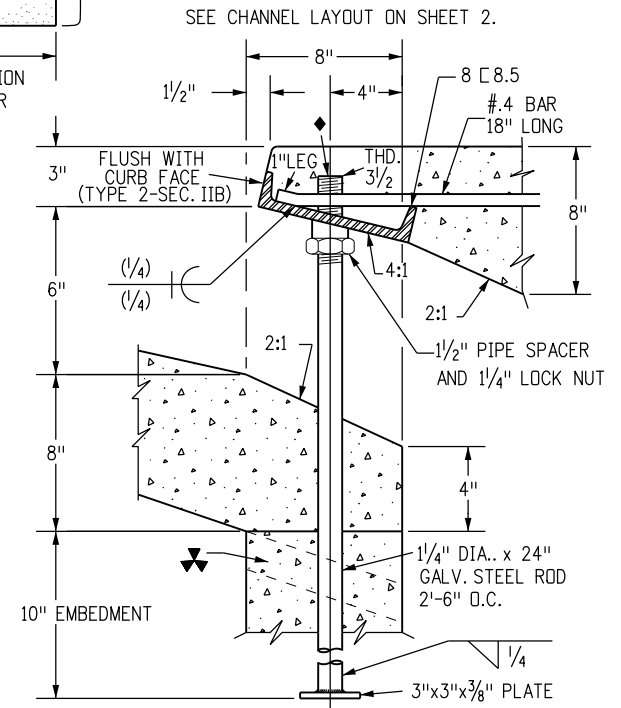
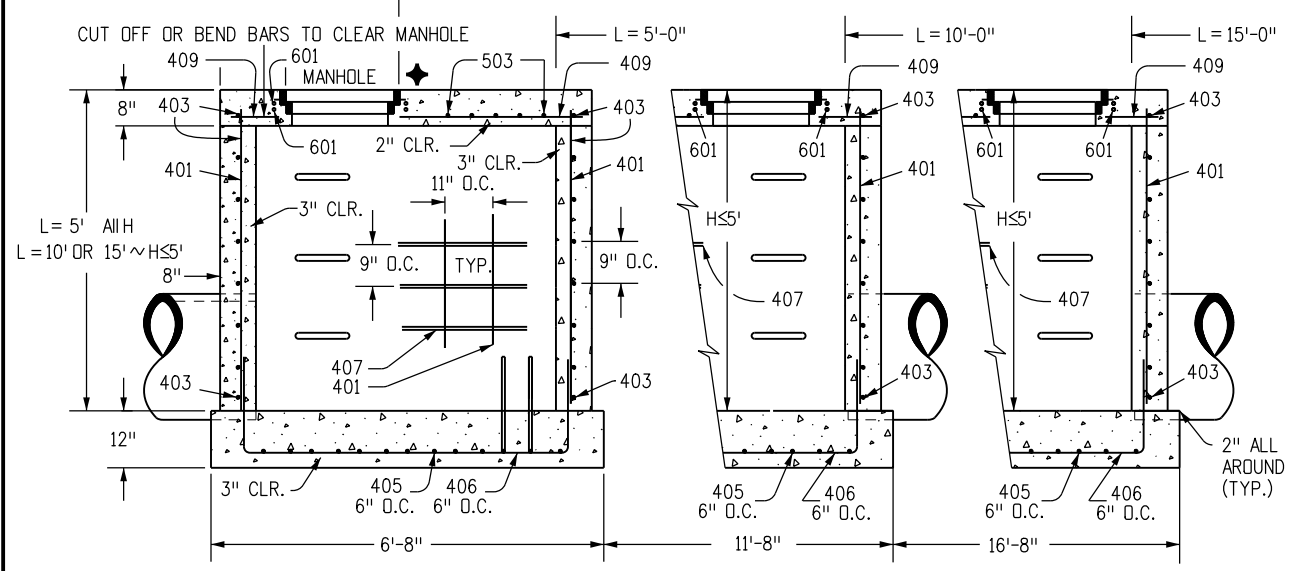


★ FOR LENGTH (L) 10 FT. OR MORE, PROVIDE MAINTENANCE ACCESS AT BOTH ENDS WITH AN ADDITIONAL MANHOLE RING AND COVER. CUT REINFORCEMENT BAR ACCORDINGLY.

◆ STATION POINT AT MIDPOINT OF INLET ALONG FLOWLINE



**GENERAL NOTES:**  
SEE SHEET 2.



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

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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Project Development Branch JBK

# CURB INLET TYPE R

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-604-12**  
Standard Sheet No. 1 of 2  
Project Sheet Number:

MARK	BAR # OR SIZE	O.C. SPACING	TYPE	ALL INLETS		INLETS: H ≤ 5 FT.				INLETS: H > 5 FT.			
				L = 5 FT.		L = 10 FT.		L = 15 FT.		L = 10 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	5 1/2"	IV	11	3'-4"	22	3'-4"	33	3'-4"	22	3'-4"	33	3'-4"
502	5	5 1/2"	III							11	11'-5"	17	11'-5"
503	5	5 1/2"	II	5	3'-6"	16	3'-6"	27	3'-6"	6	3'-6"	6	3'-6"
504	5	5 1/2"	IX									5	8'-4"
601	6	2 1/2"	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	

\* VARIABLE REFER TO TABLE TWO.  
 ■ INCLUDE #4, 18 IN. BARS (SEE CHANNEL LAYOUT).

REGULAR INLETS

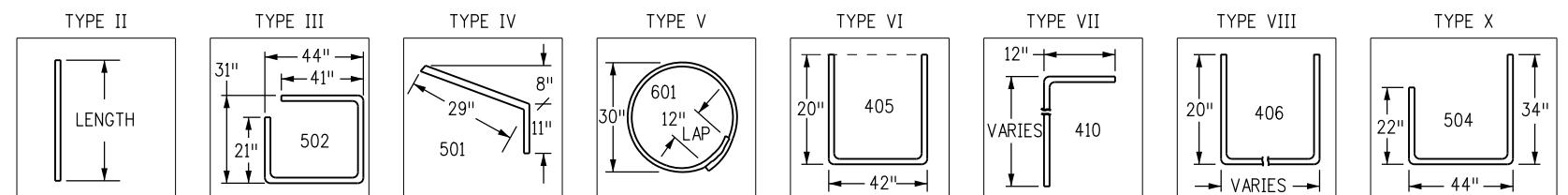
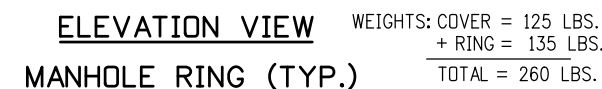
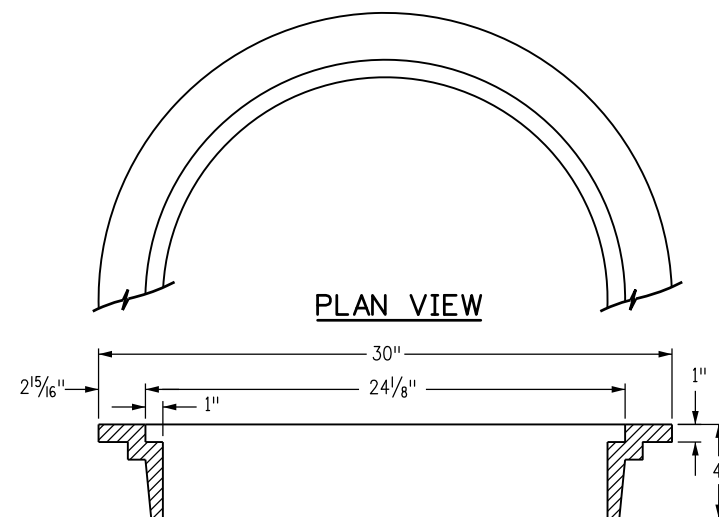
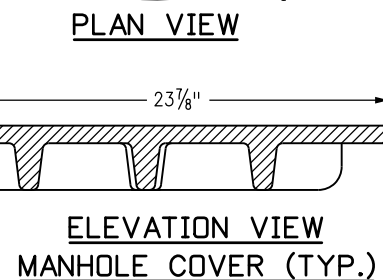
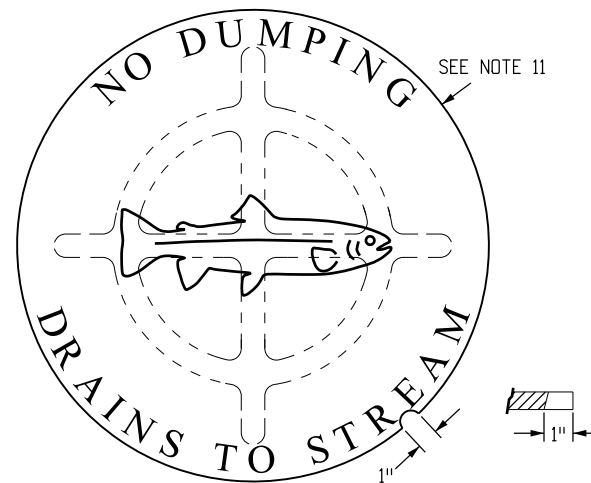
DROP BOX INLETS

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

"H"	LENGTH			NO. REQ'D.		NO. REQ'D.		L = 5 FT.		L = 10 FT.		L = 15 FT.			
	401	402	410	REGULAR		DROP BOX		CONC. CU. YDS.		STEEL LBS.		CONC. CU. YDS.		STEEL LBS.	
	403	407	403	407	403	407									
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		

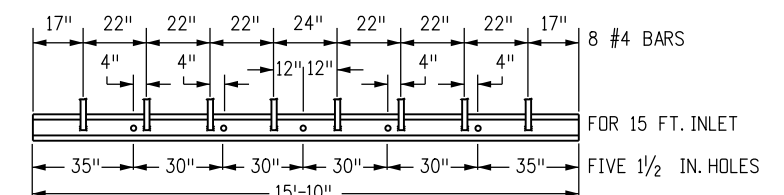
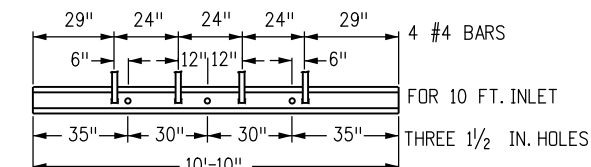
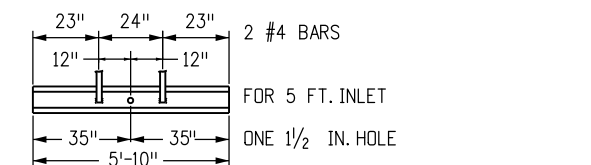
NOTES: FOR L = 5 FT., L = 10 FT., AND L = 15 FT.  
 REGULAR INLETS: TOTAL QUANTITIES NEEDED ARE OUTSIDE THE HEAVY BLACK LINE.  
 DROP BOX INLETS: TOTAL QUANTITIES NEEDED ARE INSIDE THE HEAVY BLACK LINE.  
 STEEL WEIGHTS DO NOT INCLUDE STRUCTURAL STEEL CHANNEL.

**TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"**

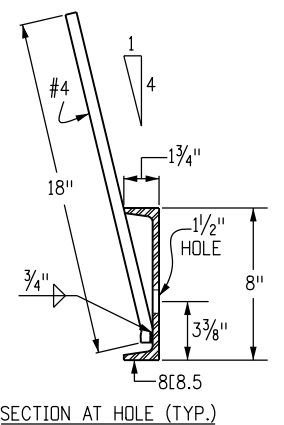


**GENERAL NOTES**

- CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
- CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 INCHES THICK.
- INLET STEPS SHALL BE IN CONFORMANCE WITH AASHTO M 199.
- CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING.
- EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 OF A INCH. CURB AND GUTTER CORNERS SHALL BE FINISHED TO MATCH THE EXISTING CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
- REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 INCH MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED.
- DIMENSIONS AND WEIGHTS OF TYPICAL MANHOLE RING AND COVER ARE NOMINAL.
- MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
- 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.
- STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
- 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.



**CHANNEL LAYOUT DETAILS**  
 SEE CURB FACE ASSEMBLY ON SHEET 1.



**Computer File Information**

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Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

(R-X)  
 (R-X)  
 (R-X)  
 (R-X)

**Sheet Revisions**

Date:	Comments

**Colorado Department of Transportation**

2829 West Howard Place  
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 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868

**Project Development Branch** **JBK**

**CURB INLET**  
**TYPE R**

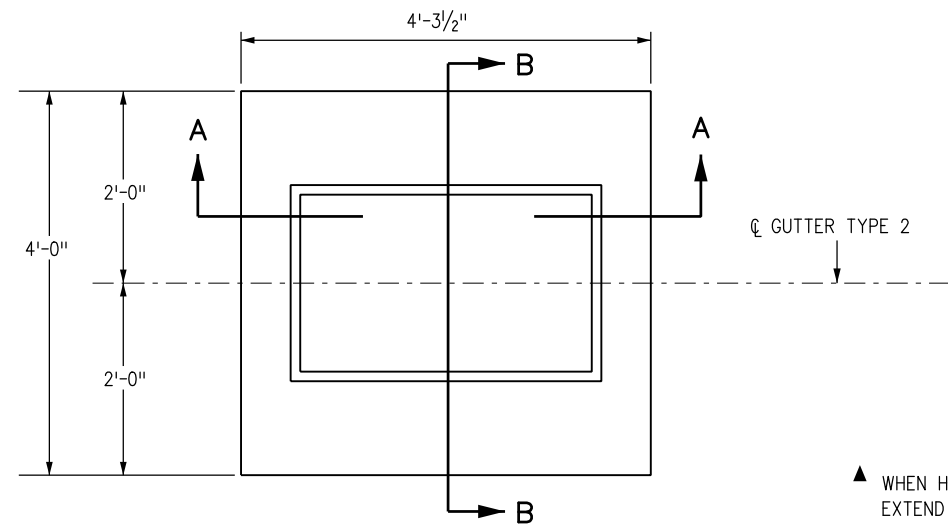
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

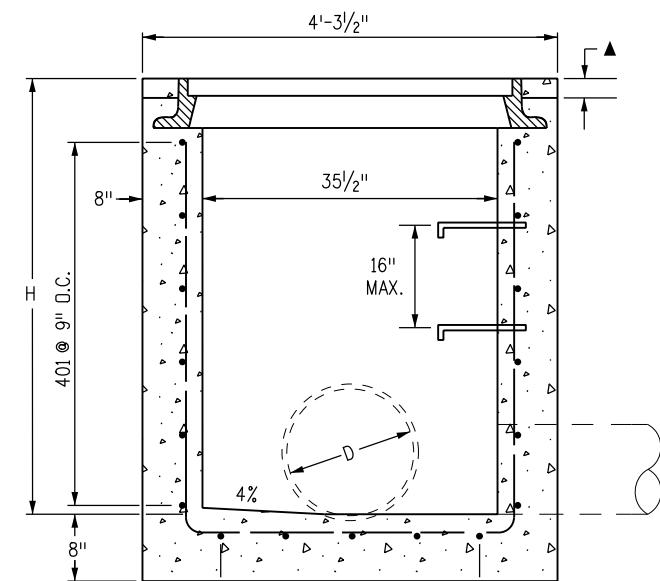
**M-604-12**

**Standard Sheet No. 2 of 2**

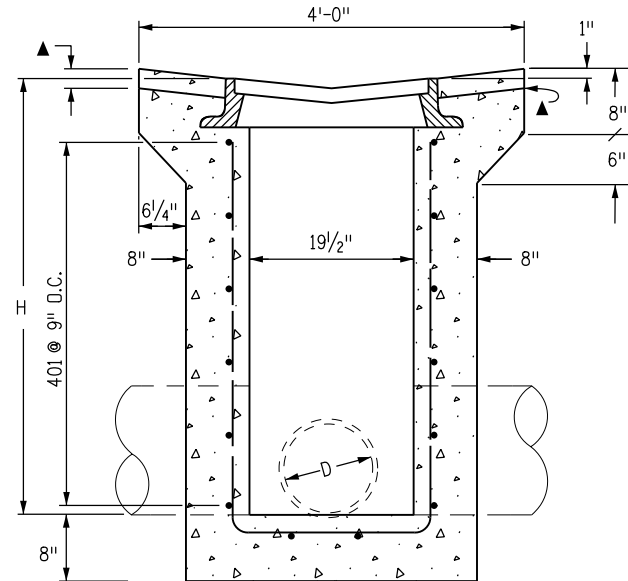
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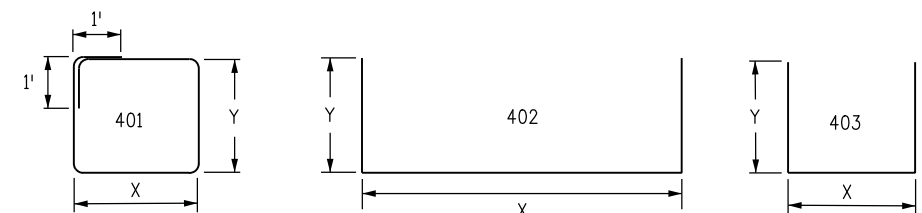
**PLAN VIEW**  
**TYPE 13 INLET FOR GUTTER TYPE 2**



**SECTION A-A**  
D MAX = 30 IN. FOR H > 4 FT.

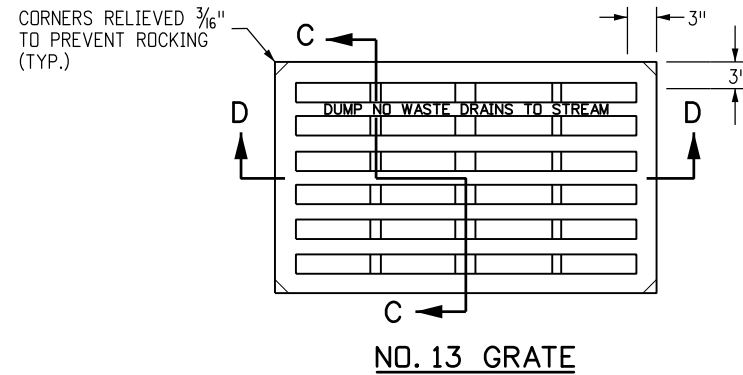


**SECTION B-B**  
D MAX = 18 IN. FOR ALL H

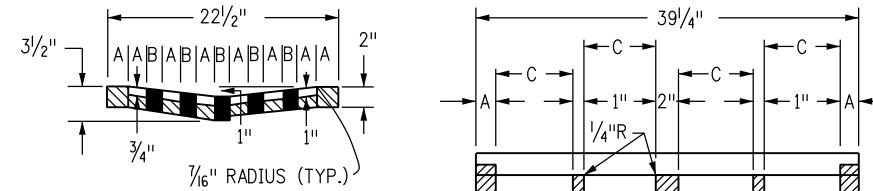


**BENDING DIAGRAMS**

ALL DIMENSIONS ARE OUT-TO-OUT OF BAR.



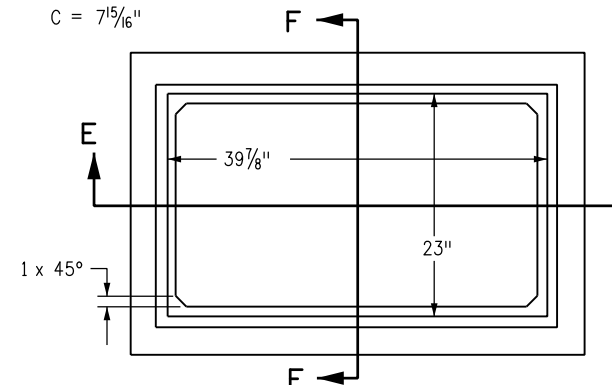
**NO. 13 GRATE**



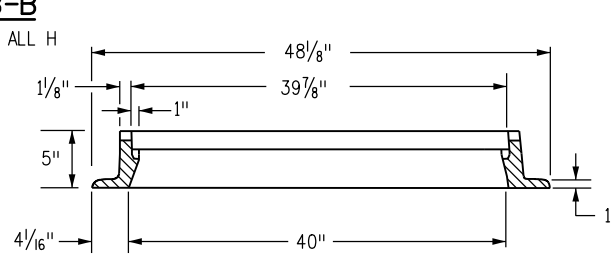
**SECTION C-C**

**SECTION D-D**

A = 1 3/4"  
B = 1 1/16"  
C = 7 15/16"

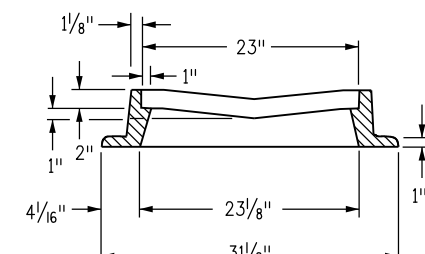


**NO. 13 GRATING & FRAMES**



**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 3/4 OF AN INCH.
4. REINFORCING BARS SHALL BE DEFORMED #4 AND SHALL HAVE A 2 INCH MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FEET-6 INCHES 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 CU. YDS.	REINFORCING STEEL Ø LB.	NO. OF 401 BARS REQ'D.	MAXIMUM PIPE I.D.	
				SEC. A-A IN.	SEC. B-B 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

Ø 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'-4 1/2"	* 2'-6 1/2"	8'-5 1/2"
403	5	2'-1/2"	* 2'-7"	7'-2 1/2"

\* 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.**

**Computer File Information**

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

**Colorado Department of Transportation**

2829 West Howard Place  
CDDT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

**Project Development Branch** **JBK**

**CONCRETE INLET**  
**TYPE 13**

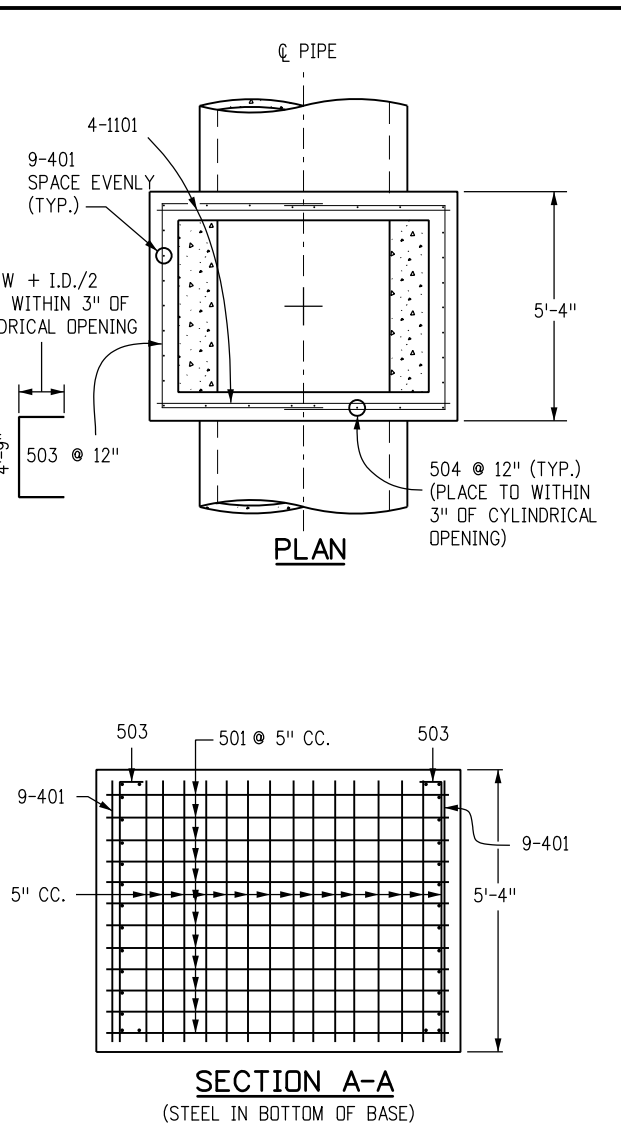
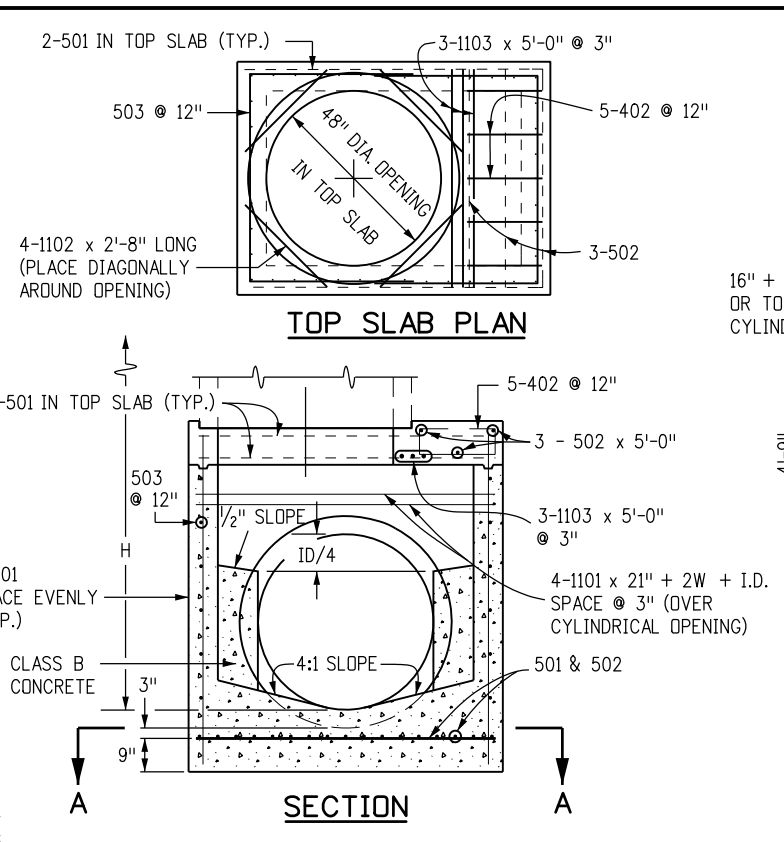
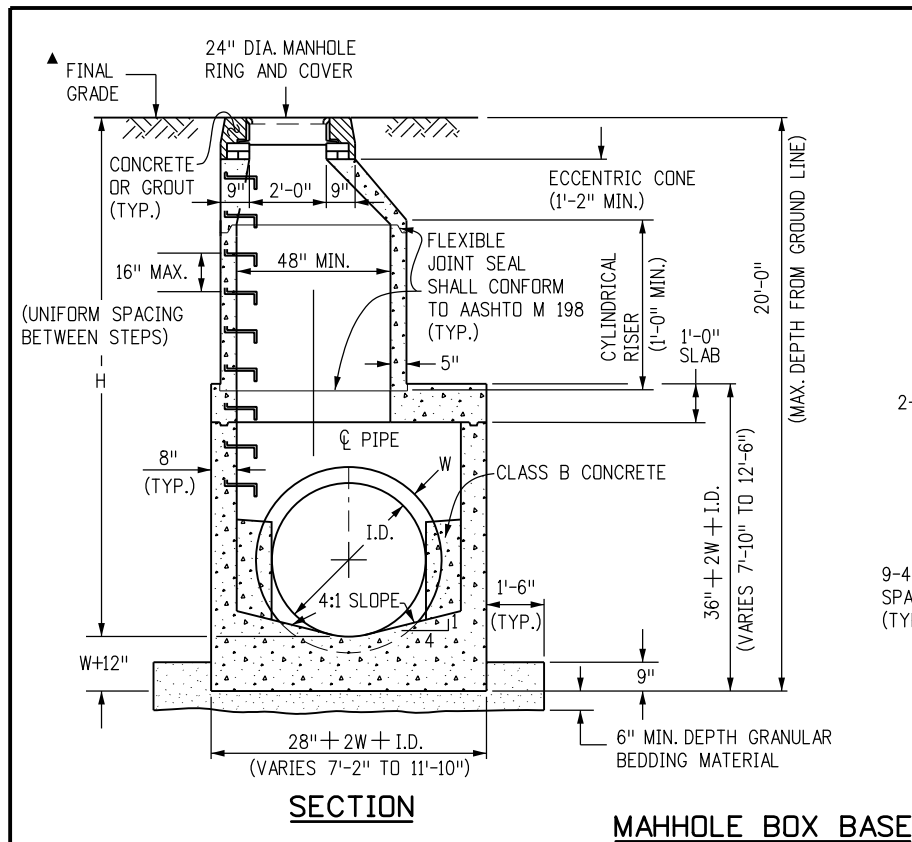
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

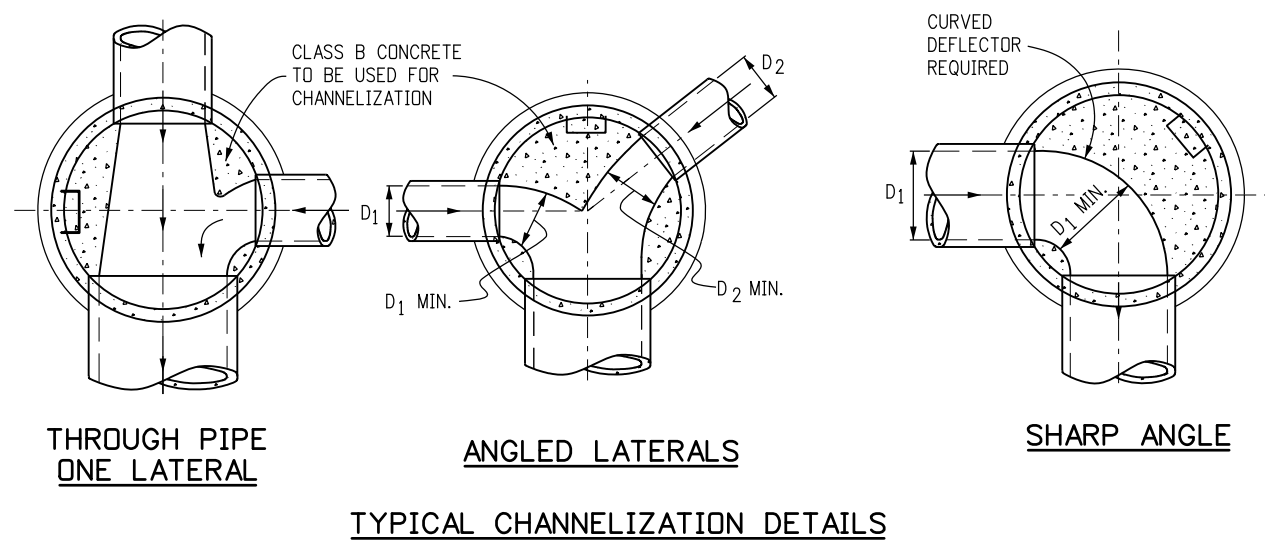
**M-604-13**

**Standard Sheet No. 1 of 1**

Project Sheet Number:



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

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(R-X)	
(R-X)	

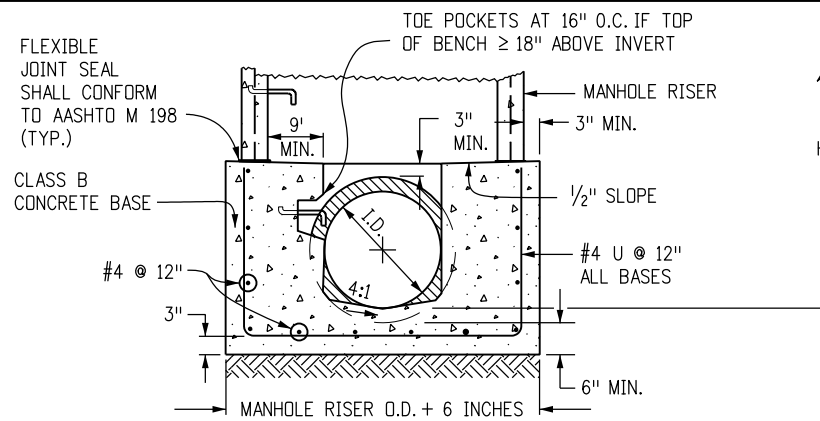
Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**MANHOLES**

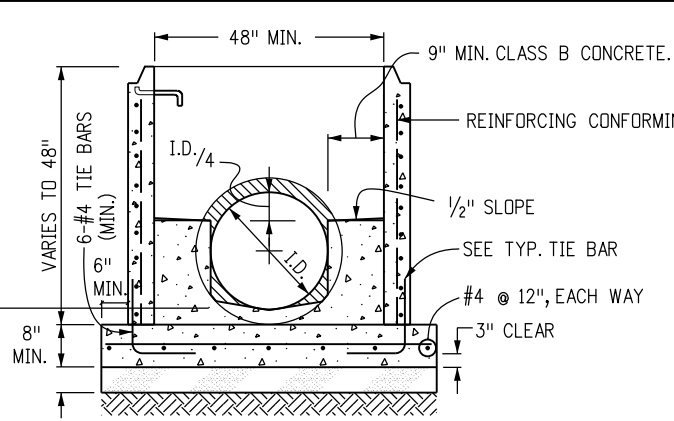
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STANDARD PLAN NO.  
**M-604-20**  
 Standard Sheet No. 1 of 3  
 Project Sheet Number:

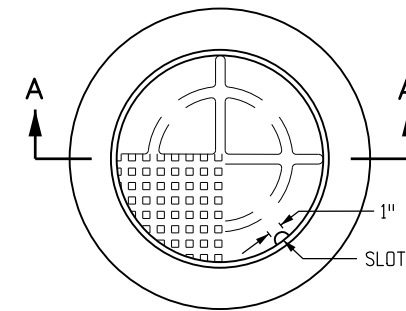
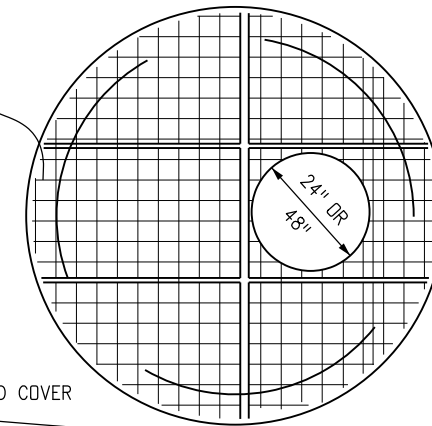




**SECTION B-B**

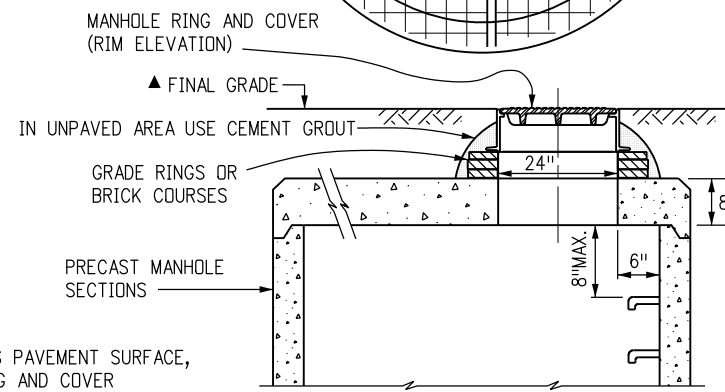


**SECTION D-D**



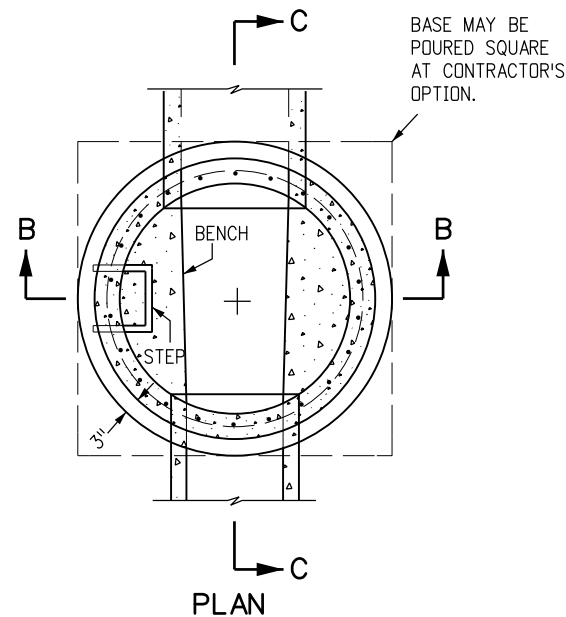
TOTAL WEIGHT: APPROXIMATELY 400 LBS.  
SHALL BE GRAY OR DUCTILE CAST  
IRON IN ACCORDANCE WITH  
SUBSECTION 712.06.

**SECTION A-A  
MANHOLE RING AND COVER**

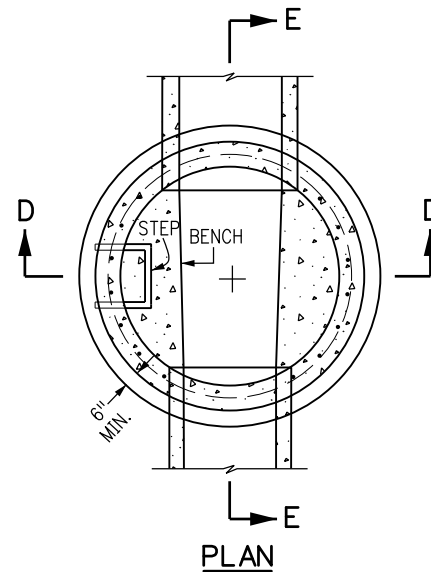


**FLAT TOP SECTION DETAIL**

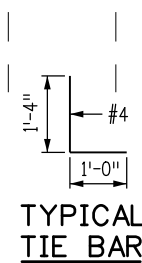
▲ WHEN FINAL GRADE IS PAVEMENT SURFACE,  
RECESS MANHOLE RING AND COVER  
1/4" MIN. TO 1/2" MAX.



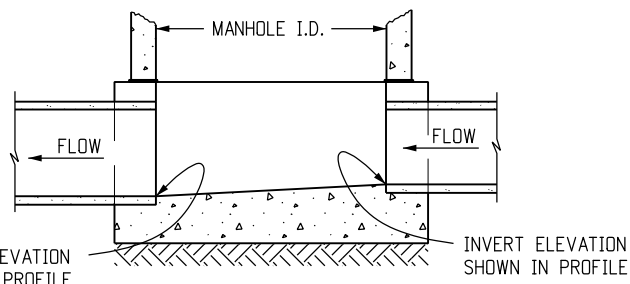
**PLAN**



**PLAN**

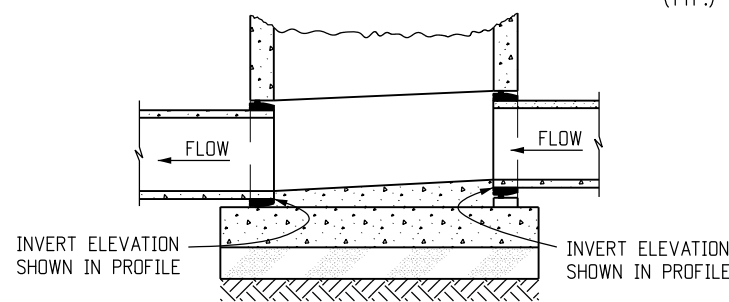


**TYPICAL TIE BAR**



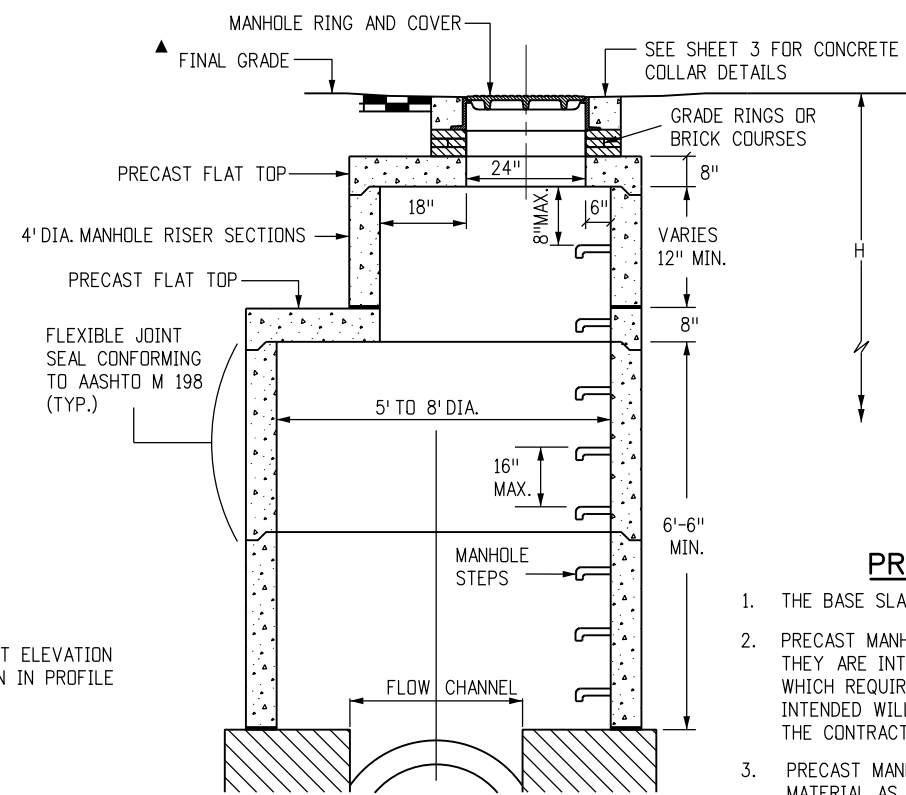
**SECTION C-C**

**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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**Sheet Revisions**

Date:	Comments

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2829 West Howard Place  
CDDT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868  
Project Development Branch **JBK**

**MANHOLES**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-604-20**

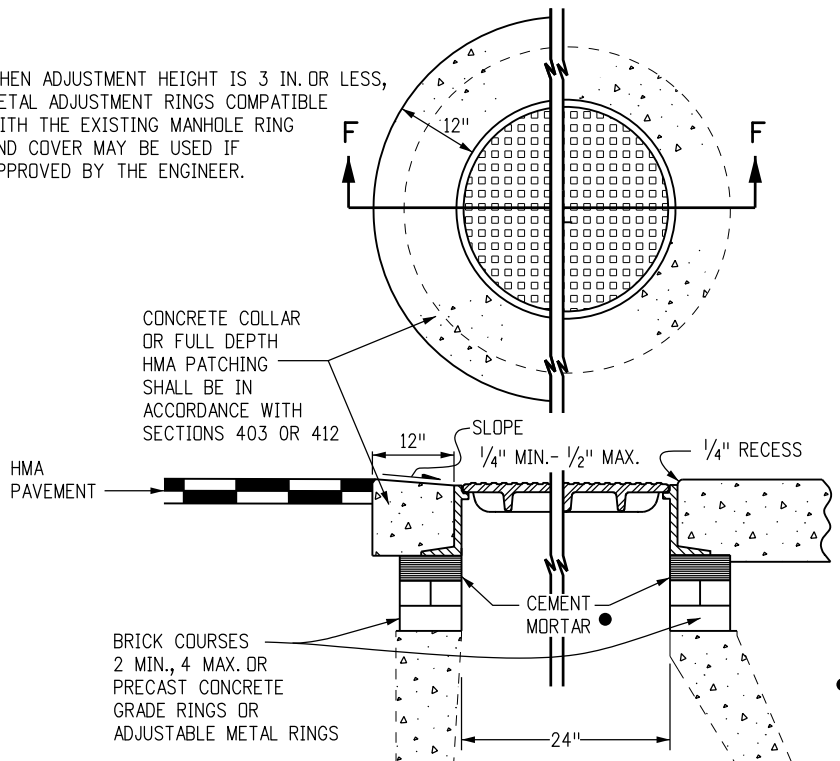
**Standard Sheet No. 2 of 3**

Project Sheet Number:

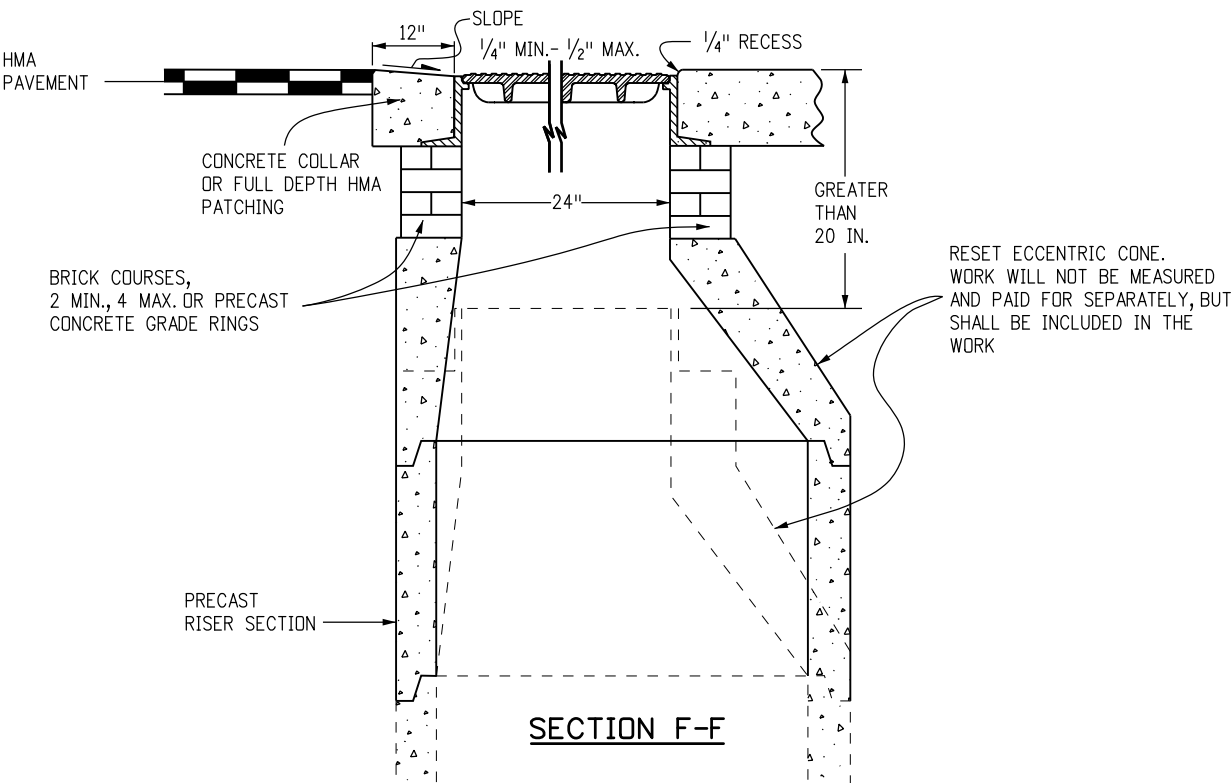
**T-BASE MANHOLES NOTES**

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 ADJUSTMENT HEIGHT IS 3 IN. OR LESS, METAL ADJUSTMENT RINGS COMPATIBLE WITH THE EXISTING MANHOLE RING AND COVER MAY BE USED IF APPROVED BY THE ENGINEER.

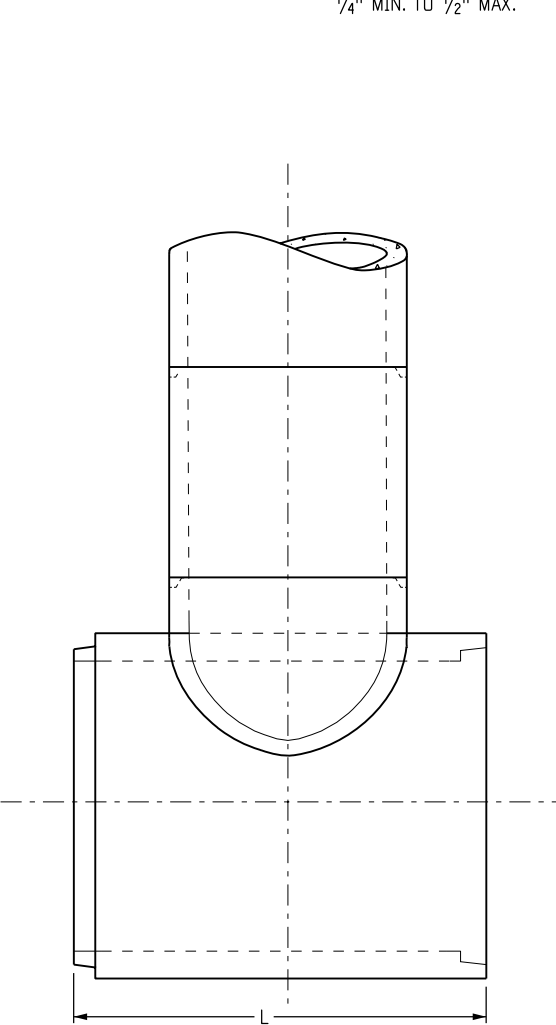


**SECTION F-F  
ADJUST MANHOLE 20 IN. OR LESS**

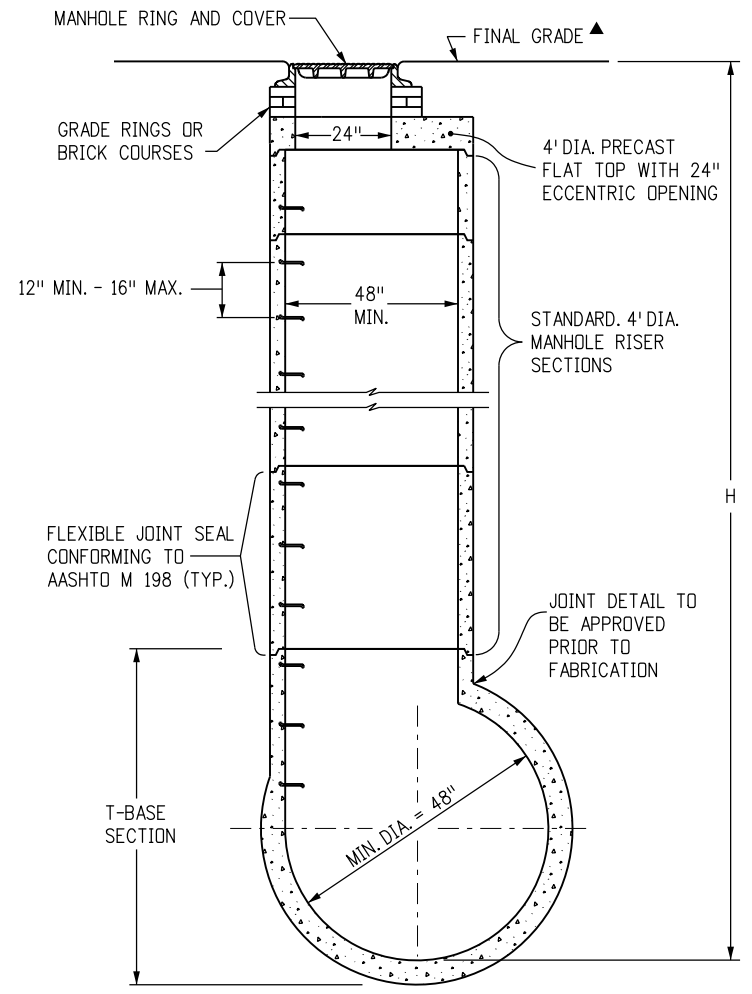


**SECTION F-F  
MODIFY MANHOLE GREATER THAN 20 IN.**

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



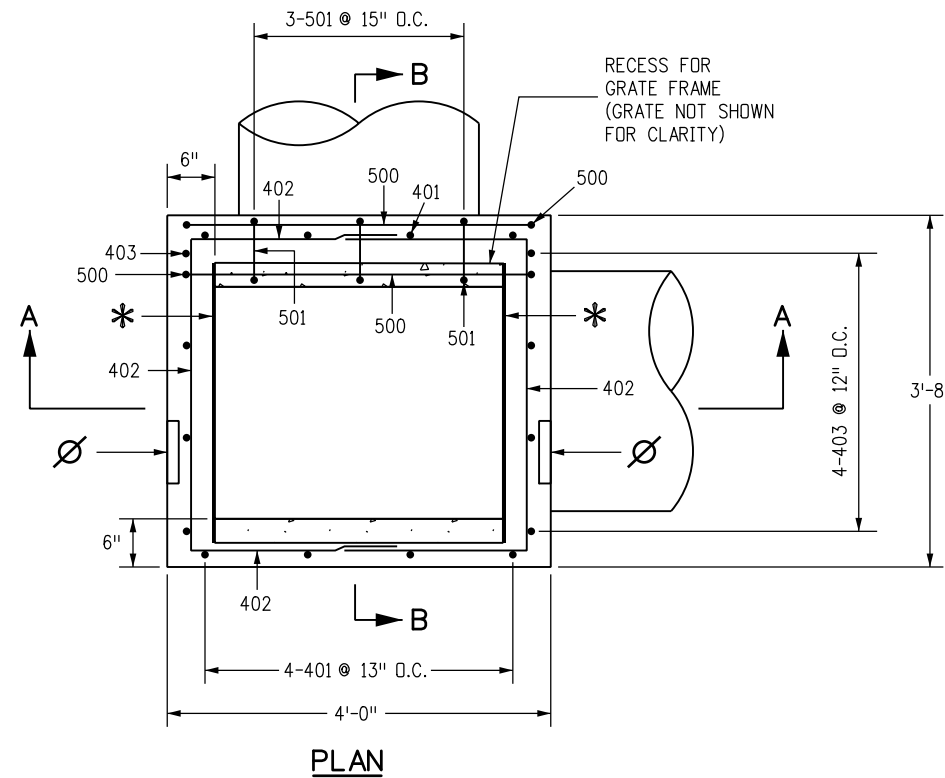
**CIRCULAR RIGID PIPE  
(LONGITUDINAL SECTION)**



**CIRCULAR RIGID PIPE  
(TRANSVERSE SECTION)**

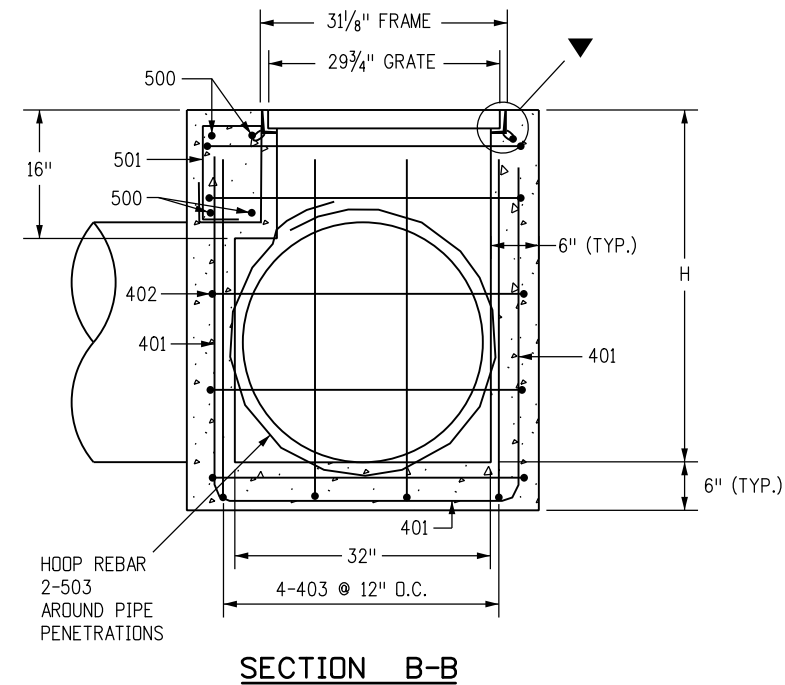
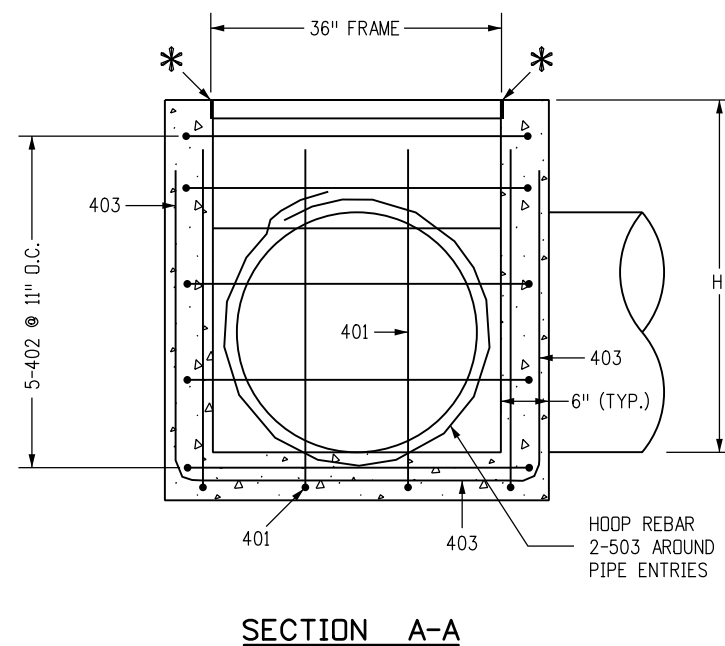
**MANHOLE T-BASE**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>MANHOLES</b>	<b>STANDARD PLAN NO.</b>
Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868			M-604-20
Designer Initials: JBK		(R-X)		Project Development Branch			Standard Sheet No. 3 of 3
Last Modification Date: 07/31/19		(R-X)		JBK			Project Sheet Number:
Detailer Initials: LTA		(R-X)		Issued by the Project Development Branch: July 31, 2019			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)					



### GENERAL NOTES

- 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.
- ALL CONCRETE SHALL BE CLASS B.
- INLET MAY BE CAST-IN-PLACE OR PRECAST.
- REINFORCING BARS SHALL BE #4 UNLESS SHOWN OTHERWISE.
- ALL REINFORCING BARS SHALL BE GRADE 60 AND EPOXY COATED. REINFORCING BARS SHALL HAVE A MINIMUM CLEARANCE OF 2 IN.
- ALL EDGE DISTANCES NOT MARKED "CLEAR" ARE TO THE CENTERLINE OF THE BAR.
- CUT OR BEND REINFORCING BARS AROUND PIPES AS REQUIRED.
- STEPS SHALL BE REQUIRED WHEN THE INLET DEPTH "H" IS EQUAL TO OR GREATER THAN 4 FT. AND SHALL CONFORM TO AASHTO M 199.
- THE INVERT OF THE BOX SHALL BE SLOPED TO DRAIN.
- 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 3/8 IN. DEEP. FOR INLETS IN SUMP CONDITIONS, THE STAMPED FLOW ARROWS SHALL INDICATE THE PREDOMINATE DIRECTION OF RUNOFF FLOW.
- 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.



### 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 1/4 IN. x 31-3/8 IN. ALONG EDGE OF THE GRATE AS SHOWN.
- ∅ FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.). FLOW →

#### Computer File Information

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(R-X)	
(R-X)	
(R-X)	

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 Project Development Branch JBK

# VANE GRATE INLET

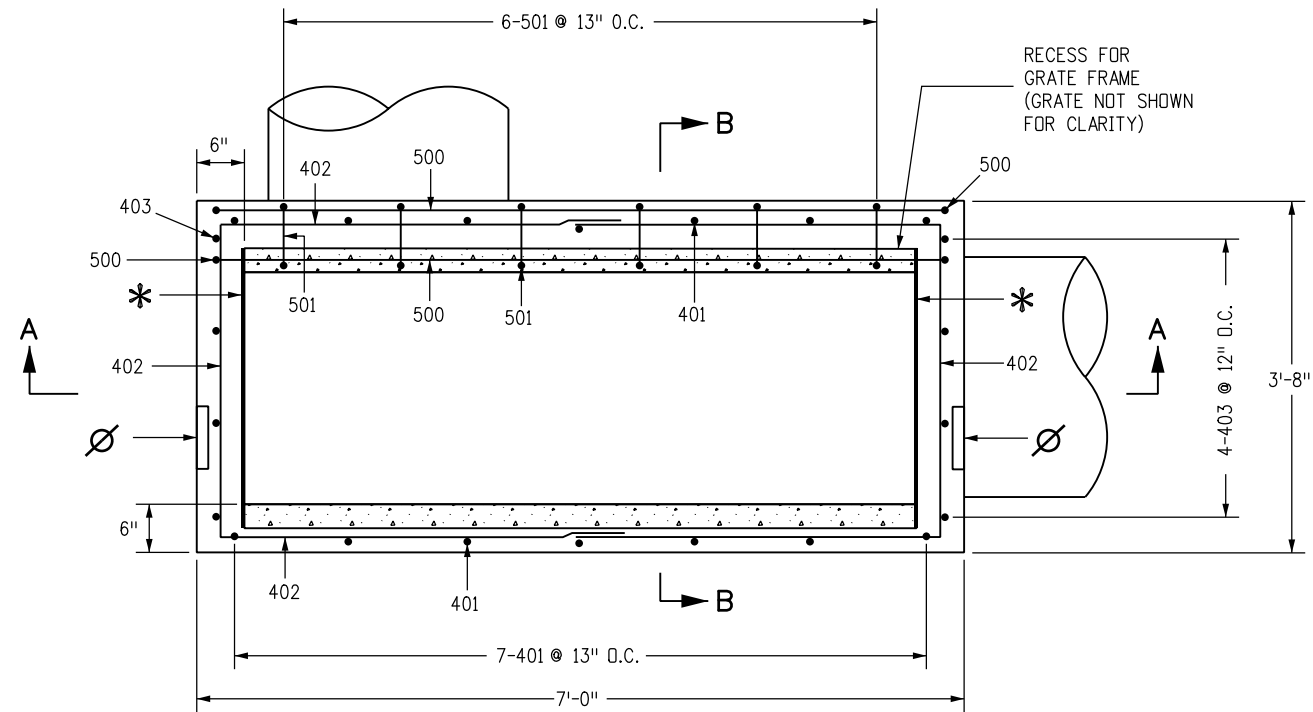
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.

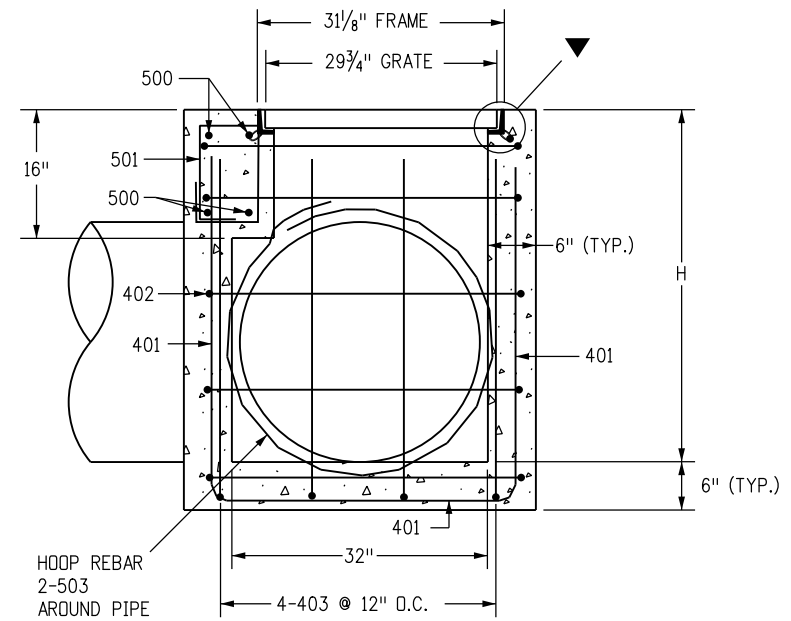
M-604-25

Standard Sheet No. 1 of 5

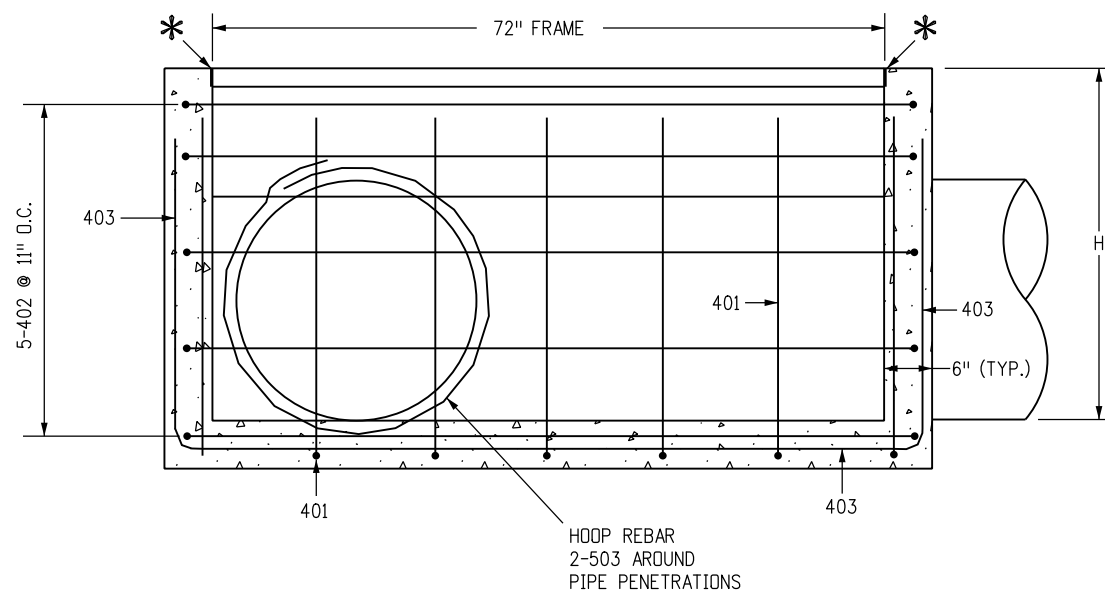
Project Sheet Number:



PLAN



SECTION B-B



SECTION A-A

**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 1/4 IN. x 31-3/8 IN. ALONG EDGE OF THE GRATE AS SHOWN.
- ∅ FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.).

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

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 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
**Project Development Branch**      **JBK**

**VANE GRATE  
INLET**

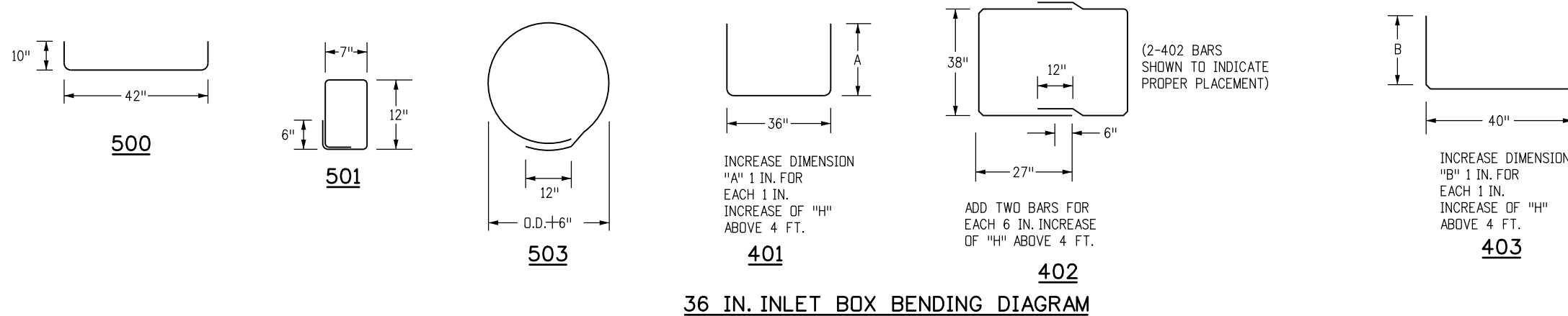
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STANDARD PLAN NO.

M-604-25

Standard Sheet No. 2 of 5

Project Sheet Number:



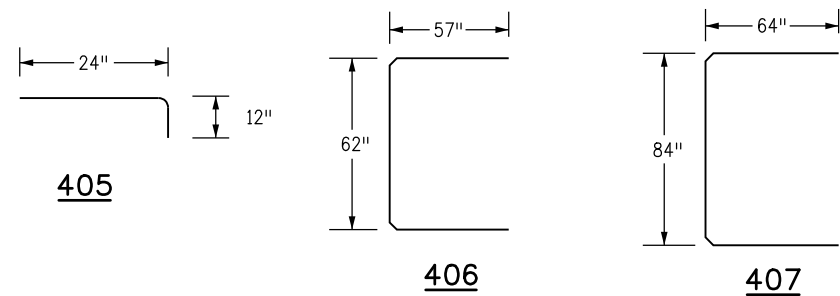
**36 IN. INLET BOX BENDING DIAGRAM**

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

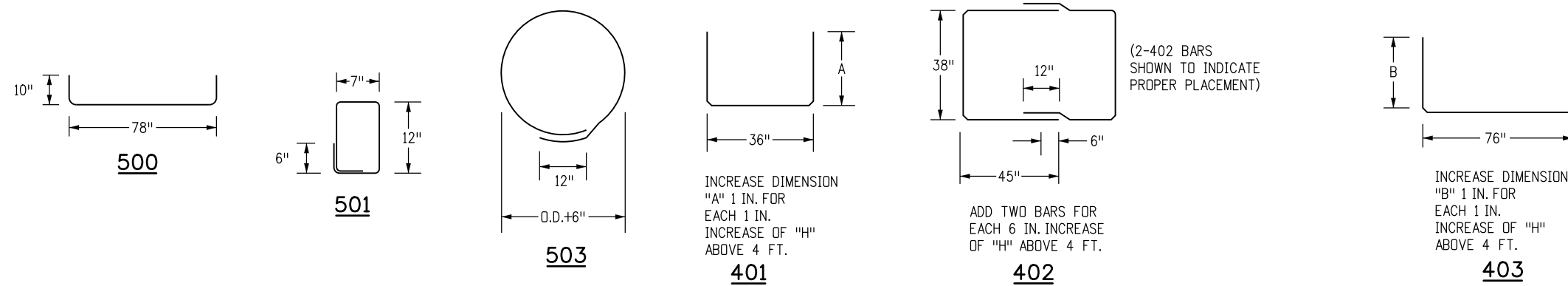
**BAR LIST FOR CONCRETE APRON**  
(FOR INFORMATION ONLY)

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**



**INLET APRON BENDING DIAGRAM FOR 36 IN. INLET**



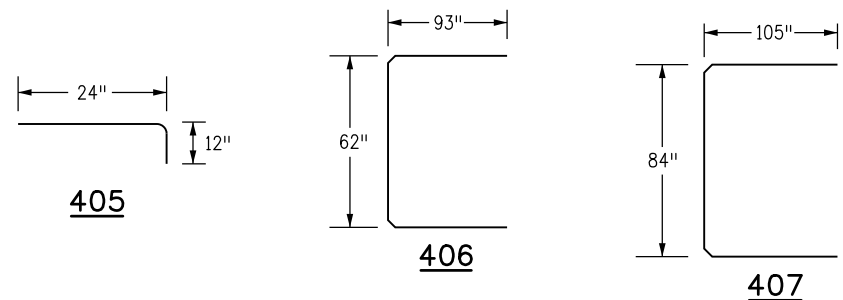
**72 IN. INLET BOX BENDING DIAGRAM**

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**



**INLET APRON BENDING DIAGRAM FOR 72 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

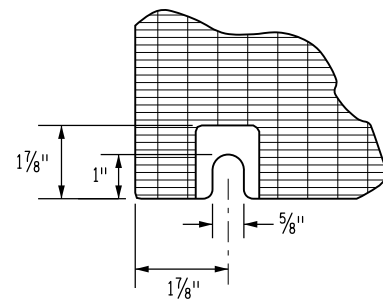
**NOTES**

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.

**QUANTITIES FOR ONE 72 IN. INLET**

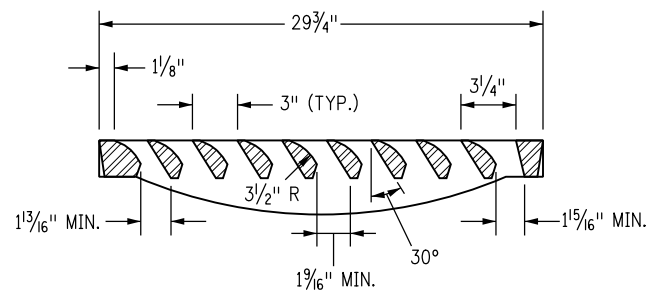
H	NUMBER OF STEPS REQUIRED	CONC. CU. YD.	STEEL LBS.
4'-0"	1	2.1	253
4'-6"	2	2.3	260
5'-0"	2	2.4	282
5'-6"	2	2.6	289
6'-0"	3	2.8	310
6'-6"	3	3.0	318
7'-0"	3	3.2	339
7'-6"	4	3.3	346
8'-0"	4	3.5	369
8'-6"	4	3.7	376
9'-0"	5	3.9	397
9'-6"	5	4.1	405
10'-0"	5	4.2	426
10'-6"	6	4.4	433
11'-0"	6	4.6	455
11'-6"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

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>VANE GRATE INLET</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-604-25	
Designer Initials: JBK		(R-X)				Standard Sheet No. 3 of 5	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Project Sheet Number:			

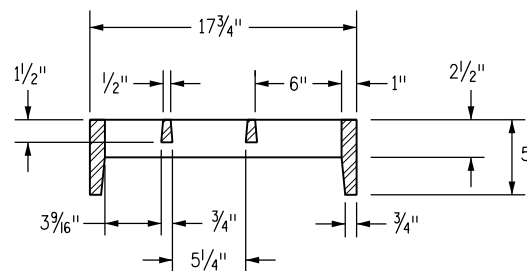


**DETAIL A**

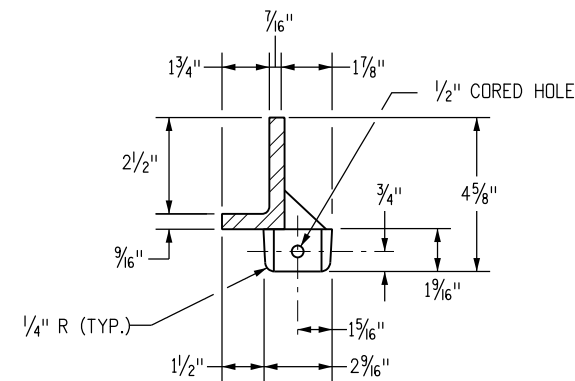
**BOLT SLOT AT CORNER (TYP.)**



**SECTION A-A**



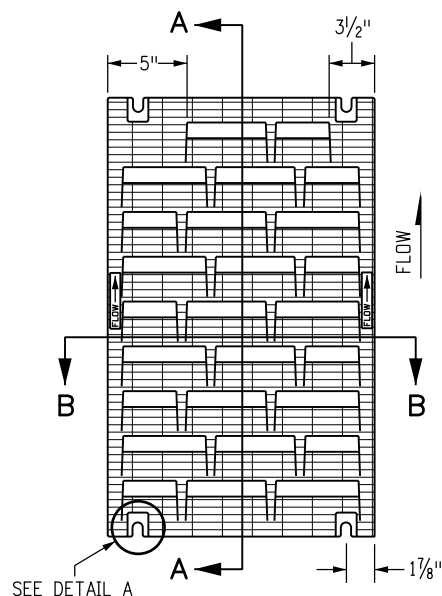
**SECTION B-B**



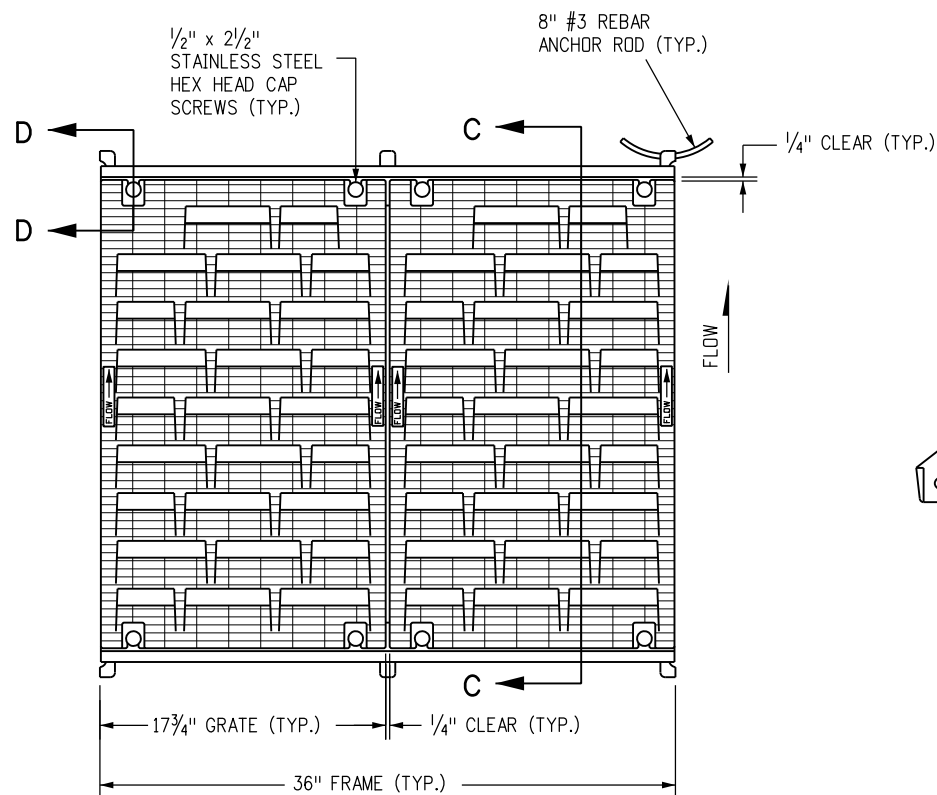
**DETAIL B**

**NOTES**

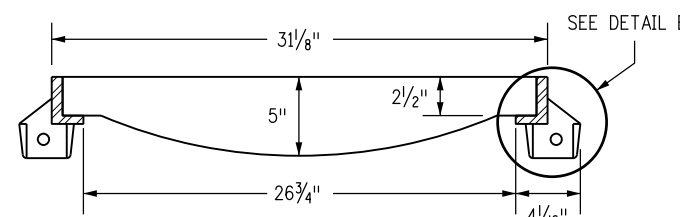
1. FREE OPEN AREA: 190 SQ. IN./GRATE.
2. MATERIAL: CAST GRAY IRON ASTM A-48 CLASS 35B.
3. FINISH: NO PAINT.
4. WEIGHT: GRATE 170 LBS. EACH; FRAME 29 LBS. EACH.
5. ALL REINFORCING BARS SHALL BE EPOXY COATED.



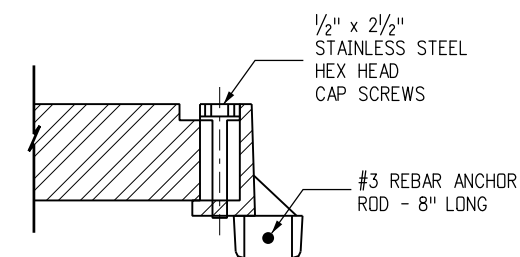
**GRATE PLAN**



**MULTIPLE GRATE WITH FRAME PLAN**



**SECTION C-C**



**SECTION D-D**

**Computer File Information**

Creation Date: 07/31/19
Designer Initials: JBK
Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

**Sheet Revisions**

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**Project Development Branch** **JBK**

**VANE GRATE  
INLET**

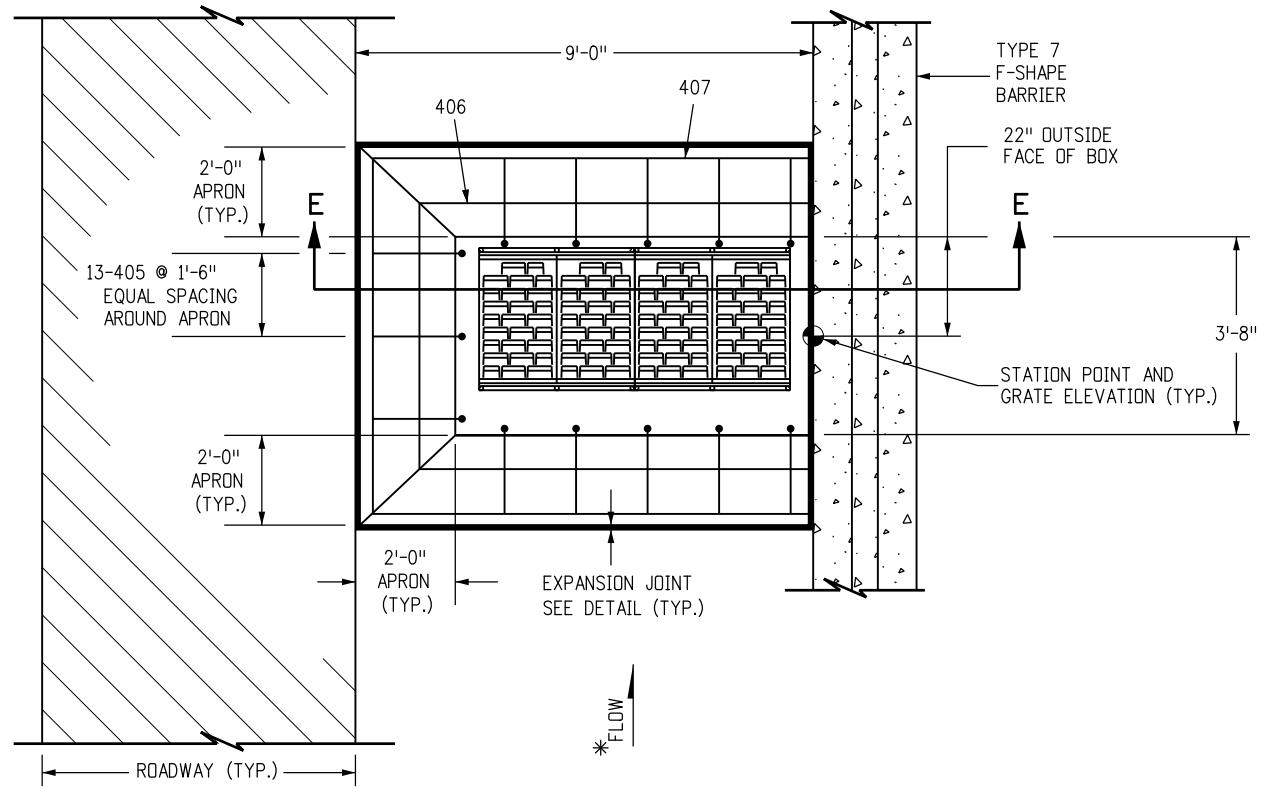
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

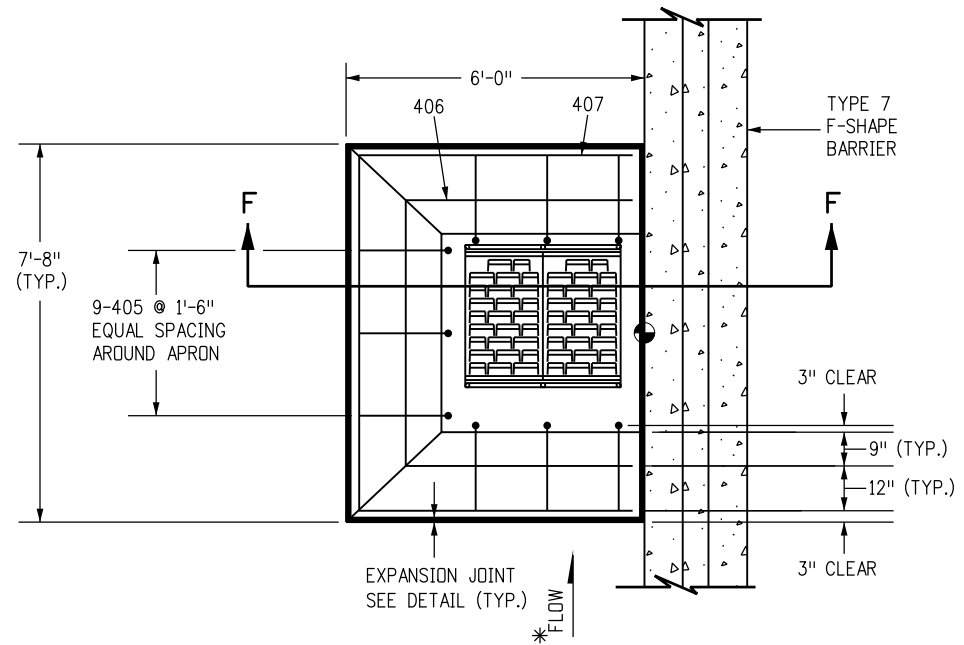
**M-604-25**

**Standard Sheet No. 4 of 5**

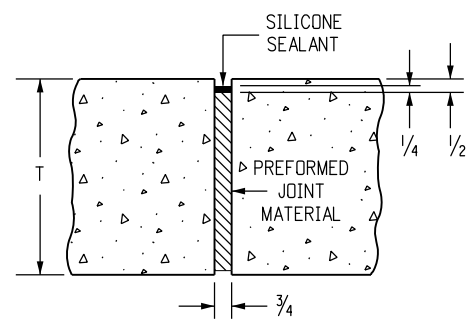
Project Sheet Number:



**CONCRETE APRON FOR 72 IN. INLET**



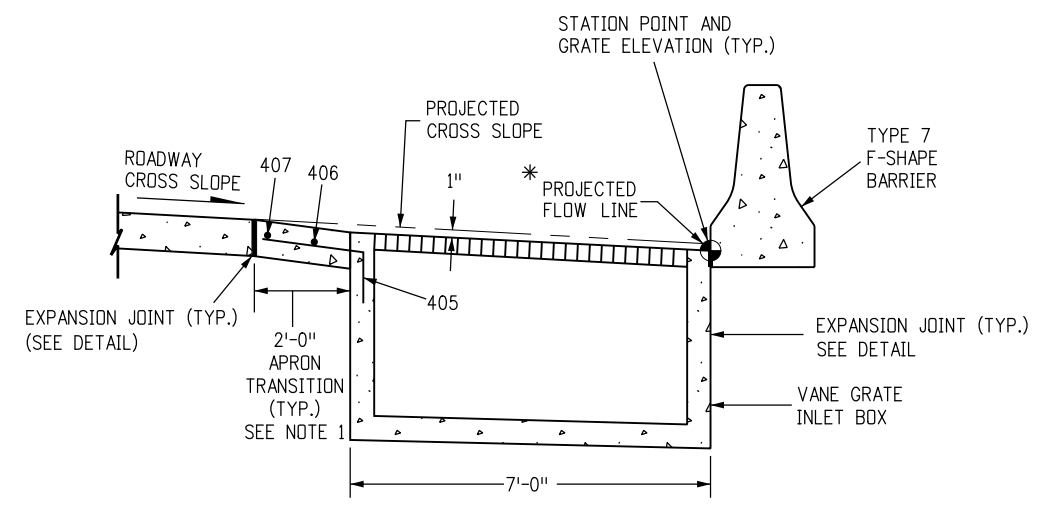
**CONCRETE APRON FOR 36 IN. INLET**



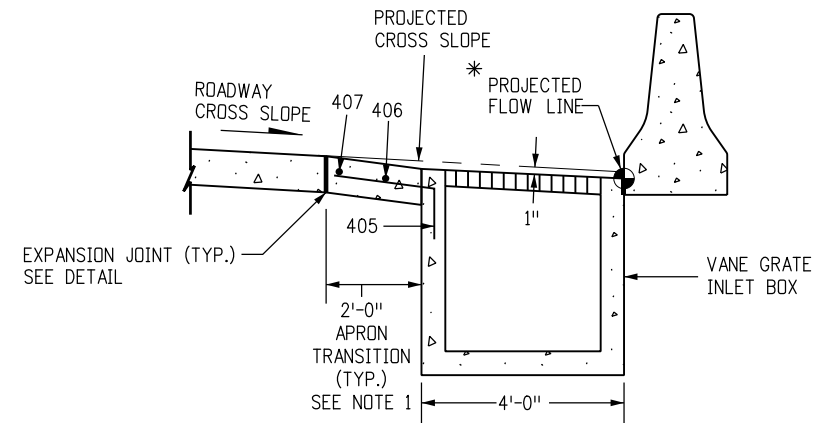
**EXPANSION JOINT (TYP.)**

**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 E-E**



**SECTION F-F**

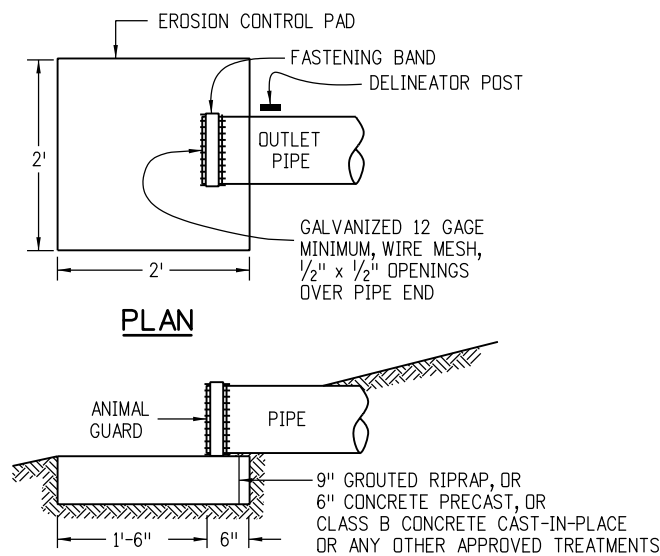
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	
Last Modification Date: 07/31/19	
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CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English

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**VANE GRATE INLET**  
 Issued by the Project Development Branch: July 31, 2019

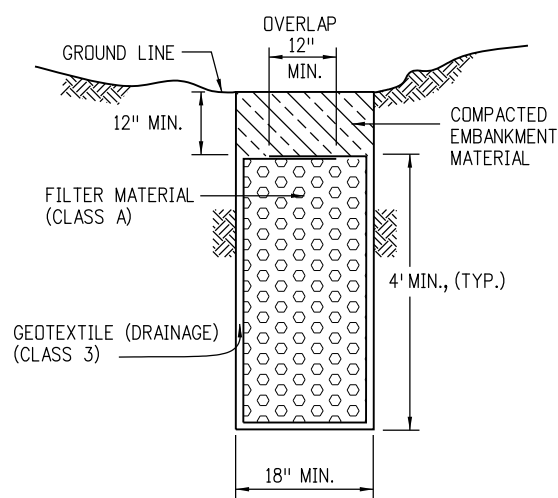
STANDARD PLAN NO.  
**M-604-25**  
 Standard Sheet No. 5 of 5  
 Project Sheet Number:



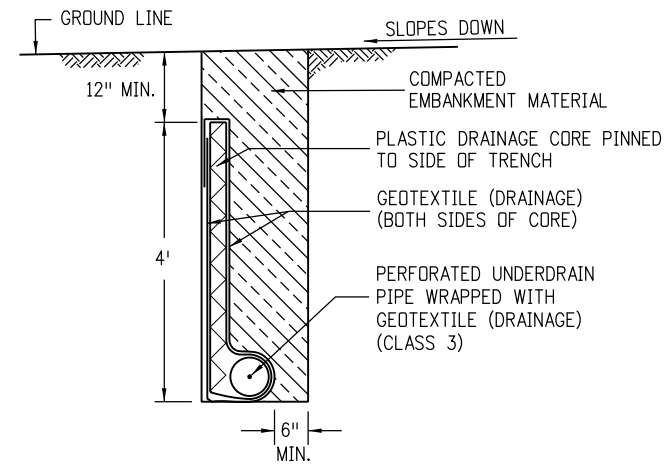
**PLAN**

**PROFILE**

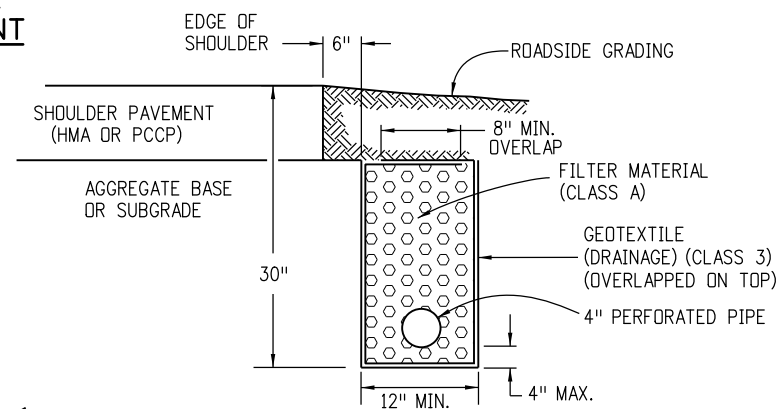
**OUTLET PIPE END TREATMENT**



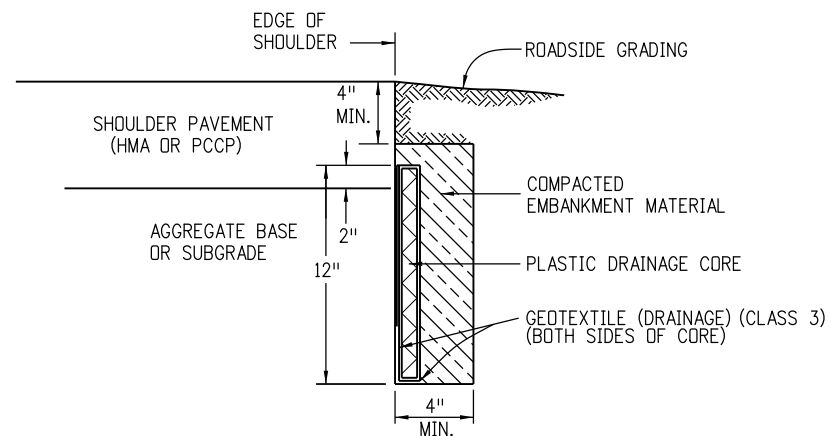
**FRENCH DRAIN**



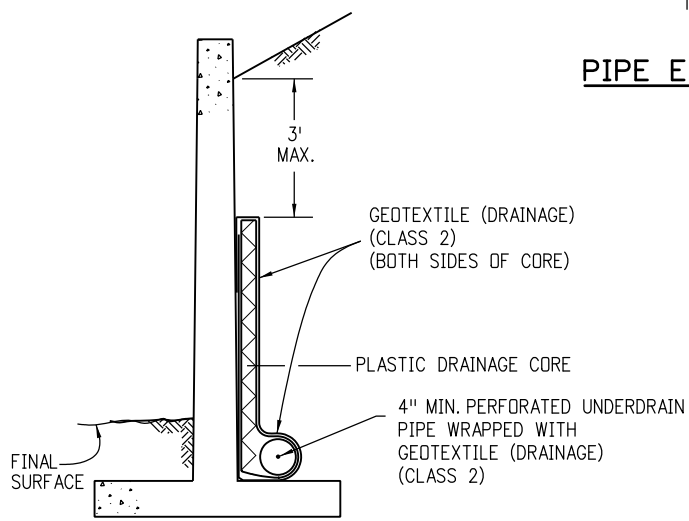
**GEOCOMPOSITE UNDERDRAIN**



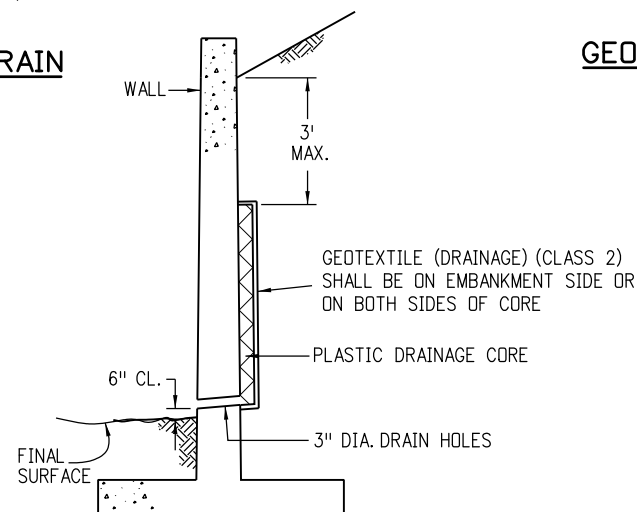
**PIPE EDGE DRAIN**



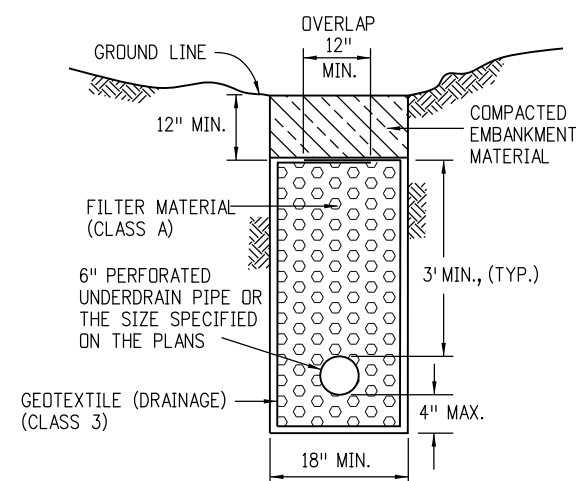
**GEOCOMPOSITE EDGE DRAIN**



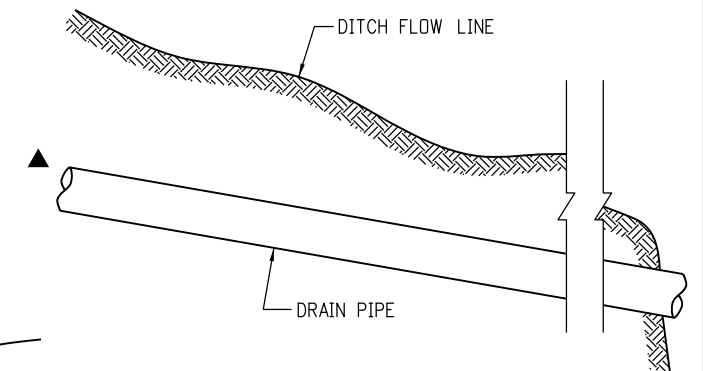
**GEOCOMPOSITE DRAIN WITH PIPE**



**GEOCOMPOSITE DRAIN WITHOUT PIPE**



**PIPE UNDERDRAIN**



**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.

**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.

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**Sheet Revisions**

Date:	Comments

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**SUBSURFACE DRAINS**

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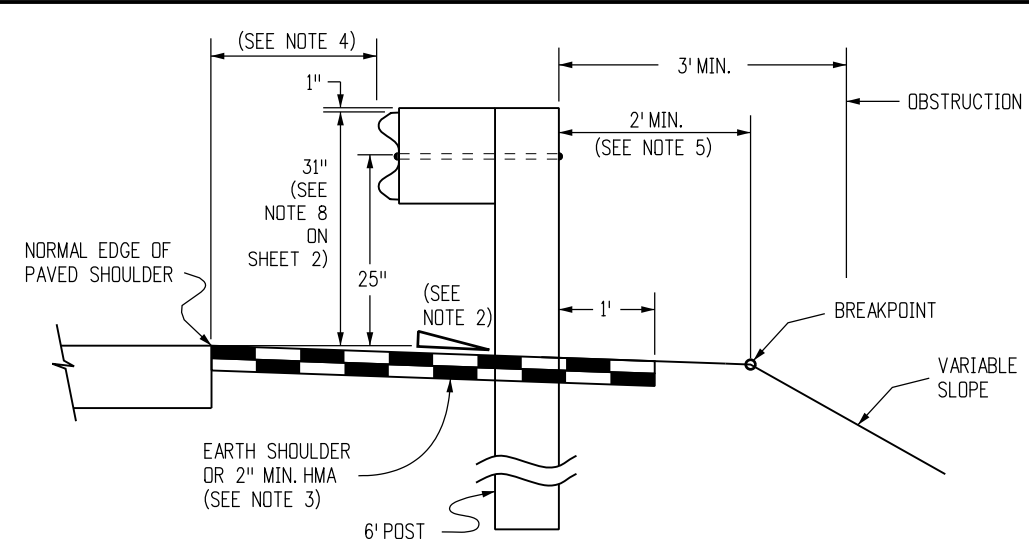
STANDARD PLAN NO.

M-605-1

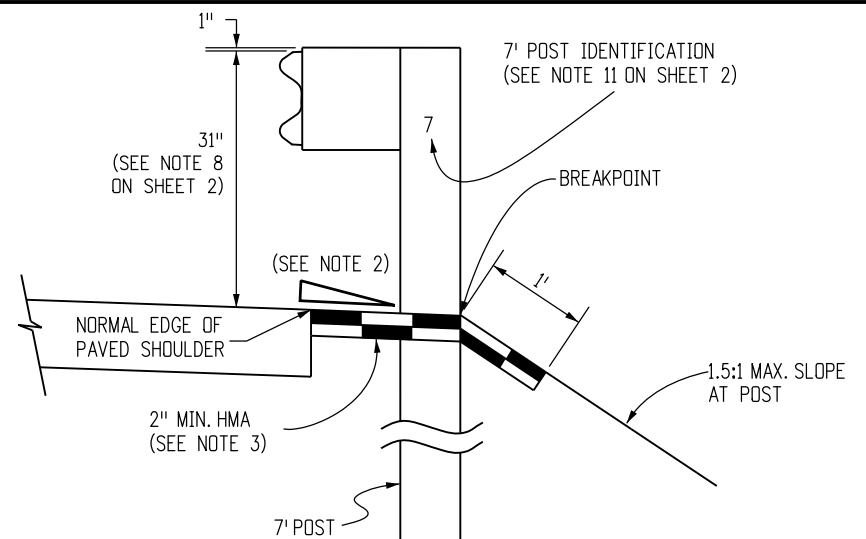
Standard Sheet No. 1 of 1

Project Sheet Number:

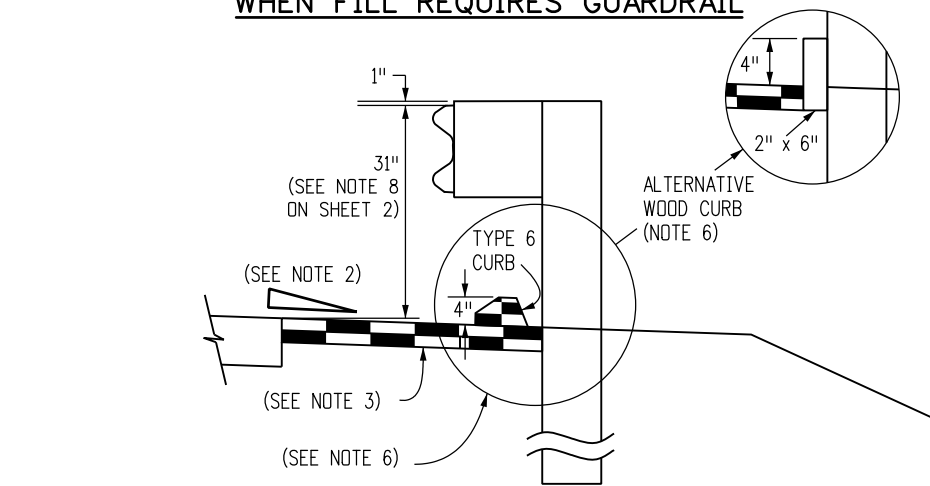




**NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL**

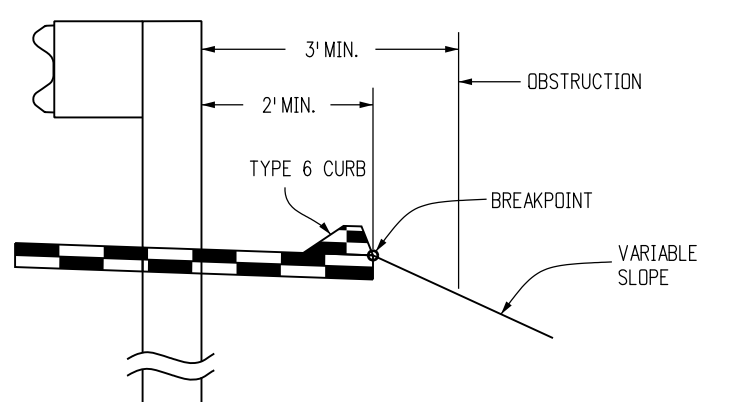


**RESTRICTIVE ROADSIDE INSTALLATION WITH 7 FOOT GUARDRAIL POSTS**  
(SEE NOTE 5)

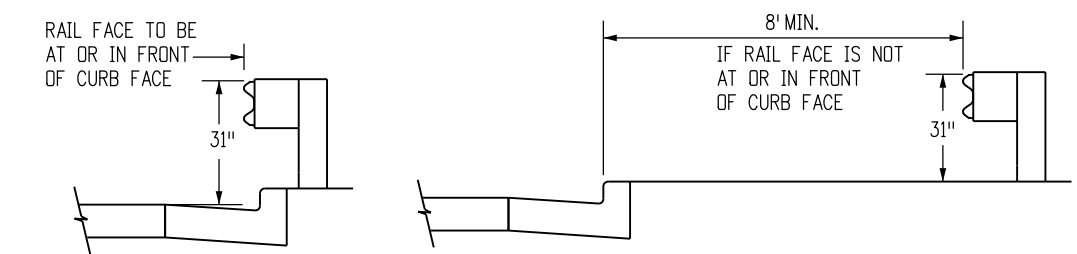


**OPTION A**

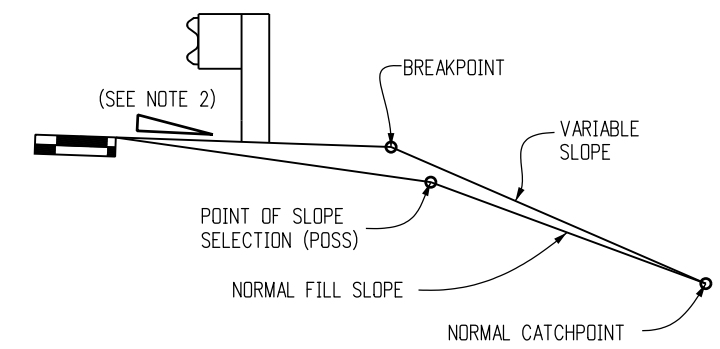
**ROADSIDE INSTALLATION WITH EROSION CONTROL CURB**



**OPTION B (PREFERRED)**



**URBAN ROADSIDE INSTALLATION WITH CURB AND GUTTER**



**EMBANKMENT WITH GUARDRAIL**

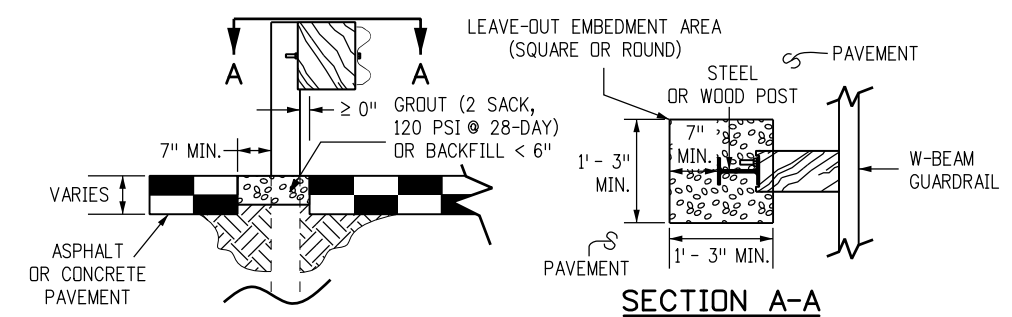
(NOTE: THE CATCHPOINT REMAINS THE SAME AS THAT FOR "NORMAL" FILL SLOPE. FOR THE WIDER "Z" DISTANCES, THE VARIABLE SLOPE MAY "CATCH" AT THE POSS.)

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

**NORMAL CENTER-TO-CENTER POST SPACING**

**GENERAL NOTES** (CONTINUE ON SHEET 2)

- TOLERANCE FOR TOP OF GUARDRAIL BEAM IS  $\pm 1$  IN.
- RATE OF SLOPE DEPENDS ON GUARDRAIL LOCATION:
  - 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.
  - FOR GUARDRAIL FACE MORE THAN 2 FT. FROM THE NORMAL EDGE OF THE PAVED SHOULDER, THE SLOPE SHALL BE 10:1 OR FLATTER.
- 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 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.
- 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:
  - FOR AN EXISTING HIGHWAY WITH A DESIGN SPEED LESS THAN 50 MPH, THE MINIMUM OFFSET IS 4 FT. FROM THE TRAVELED WAY.
  - FOR A ONE-WAY ONE-LANE RAMP, AND WHERE ONE OR MORE OF THE FOLLOWING ARE TRUE:
    - THE NON-OFFSET GUARDRAIL BEGINS AT LEAST 100 FT. BEYOND RAMP NOSE.
    - THE NON-OFFSET GUARDRAIL IS NOT LOCATED ON THE RAMP EXIT OR ENTRANCE CURVE CONNECTION TO THE MAJOR HIGHWAY.
    - 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.
- 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.
- 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 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.



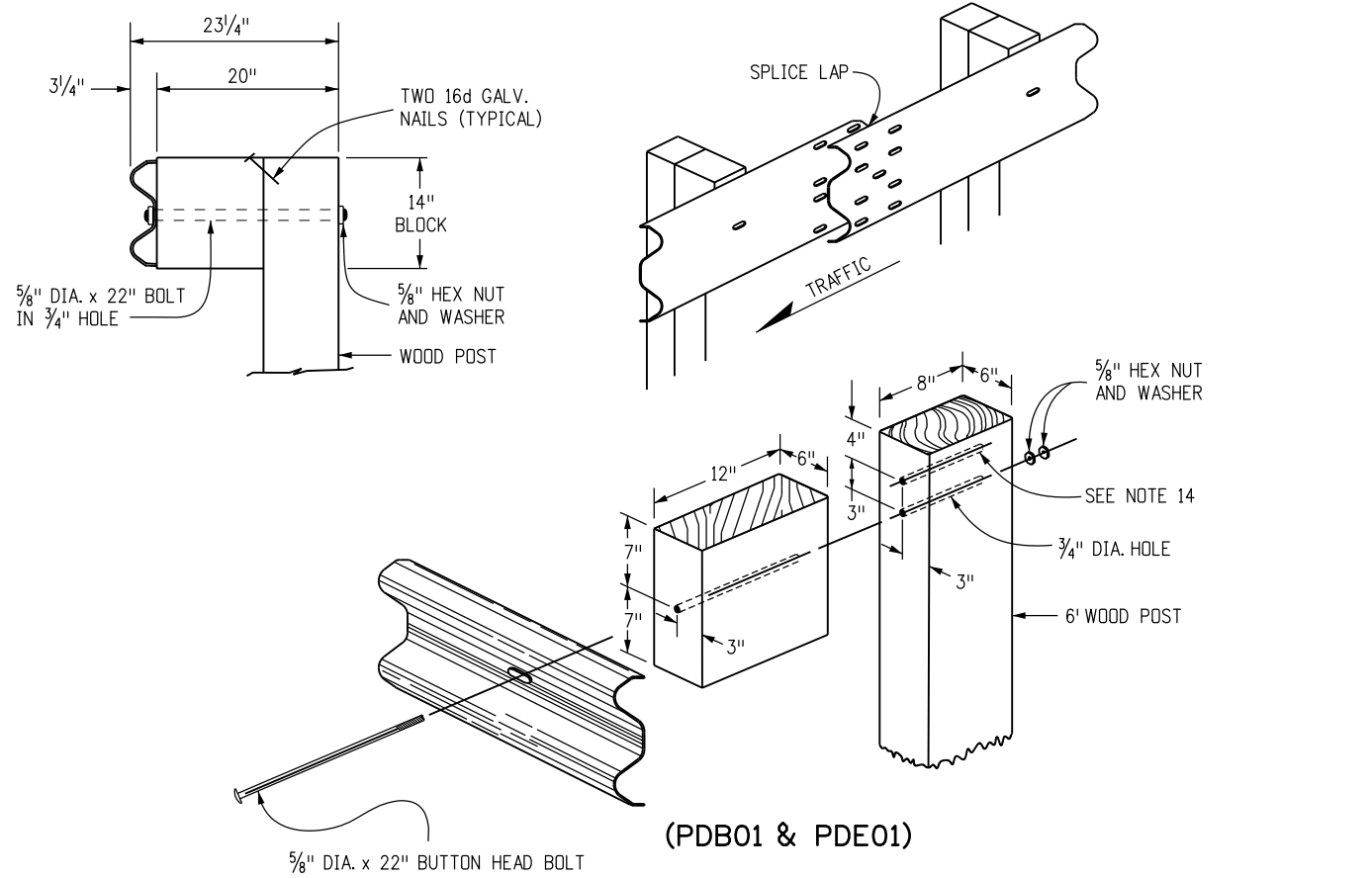
**SECTION A-A**  
**LEAVE-OUT AREA FOR GUARDRAIL POSTS LOCATED IN PAVEMENT**

NOTE: LEAVE-OUT AREAS SHALL BE PROVIDED FOR ALL GUARDRAIL POSTS LOCATED IN PAVEMENT TO ALLOW THE POSTS TO ROTATE IN THEIR EMBEDMENT SUCH THAT VEHICLE IMPACT LOADS ARE DISTRIBUTED THROUGH THE POST INTO THE EMBEDMENT MATERIAL PRIOR TO THE POSTS BREAKING PREMATURELY.

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES</b>		<b>STANDARD PLAN NO. M-606-1</b>	
Creation Date: 07/31/19		Date: _____		2829 West Howard Place		Issued by the Project Development Branch: July 31, 2019		Standard Sheet No. 1 of 19	
Designer Initials: JBK		Comments: _____		CDOT HQ, 3rd Floor					
Last Modification Date: 07/31/19		_____		Denver, CO 80204		Project Sheet Number: _____		Project Sheet Number: _____	
Detailer Initials: LTA		_____		Phone: 303-757-9021 FAX: 303-757-9868					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		_____		<b>Project Development Branch</b>		<b>JBK</b>			

**GENERAL NOTES** (CONTINUED FROM SHEET 1)

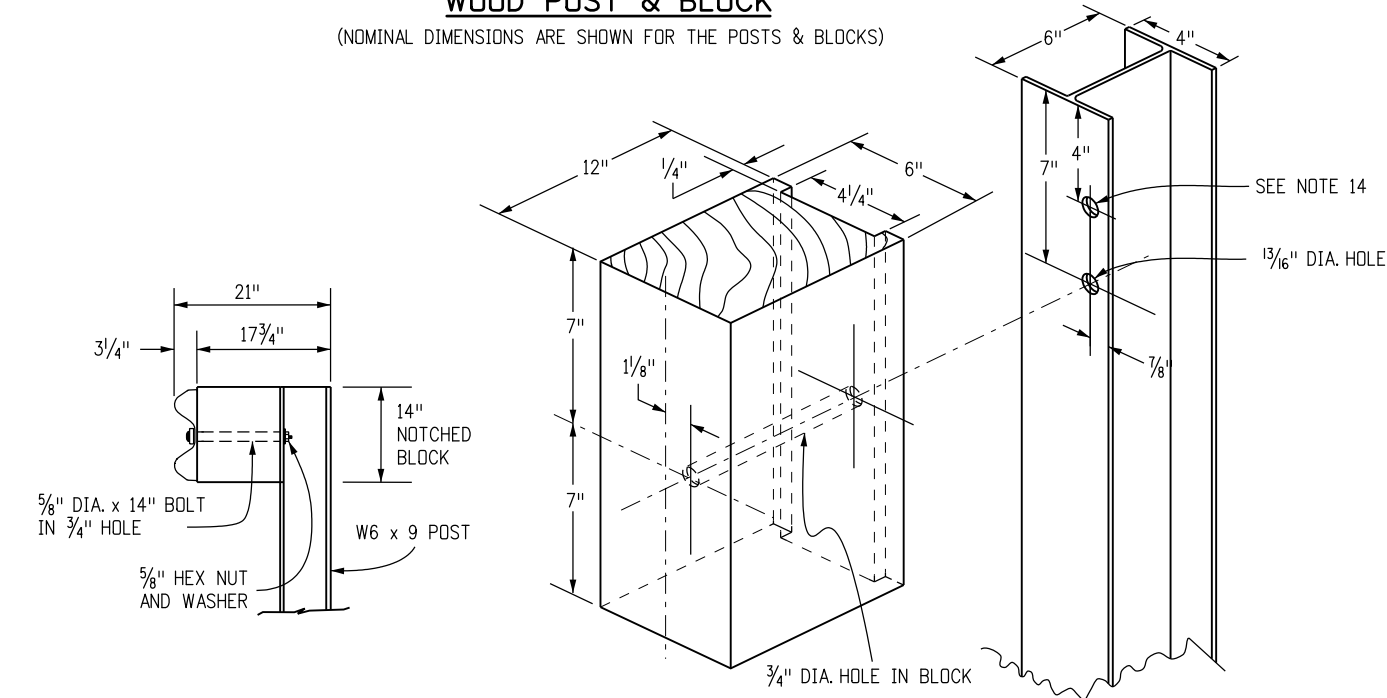
7. SEE SHEETS 7 AND 9 FOR CURB TREATMENTS AT GUARDRAIL TERMINALS.
8. IF THIS DIMENSION WILL BE LESS THAN 28 INCHES, RESET GUARDRAIL HEIGHT TO 28 INCHES OR ABOVE.
9. ALL W-BEAM SPLICES, AND SPLICES OF TERMINAL CONNECTORS TO W-BEAM SHALL BE LAPPED IN THE DIRECTION OF TRAFFIC UNLESS OTHERWISE NOTED IN THE PLANS OR BY THE MANUFACTURER.
10. 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.
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 IDENTIFICATION. 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 1 3/4 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. POSTS PROVIDED MAY ALSO HAVE ADDITIONAL HOLES (UP TO 4 PER FLANGE) FOR MEDIAN GUARDRAIL APPLICATION.
15. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT. INTERVALS (SEE SHEETS 6 AND 8 FOR EXCEPTIONS). RETROREFLECTOR TABS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. THE TABS SHALL BE INSTALLED ON SPLICE BOLTS, NOT ON POST BOLTS AND 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 1/4 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. RAIL BLOCKS MANUFACTURED FROM SYNTHETIC MATERIAL WILL BE ACCEPTED AS ALTERNATIVES TO WOOD BLOCKS FOR USE WITH STEEL POSTS PROVIDED THAT THE BLOCKS HAVE RECEIVED FHWA 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 IS ALLOWED PER MANUFACTURER'S RECOMMENDATIONS, OR WITH THE APPROVAL OF THE STANDARDS AND SPECIFICATIONS UNIT. POSTS SHALL NOT BE MODIFIED. COMPONENTS ON WHICH THE SHELTER 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.



(PDB01 & PDE01)

**WOOD POST & BLOCK**

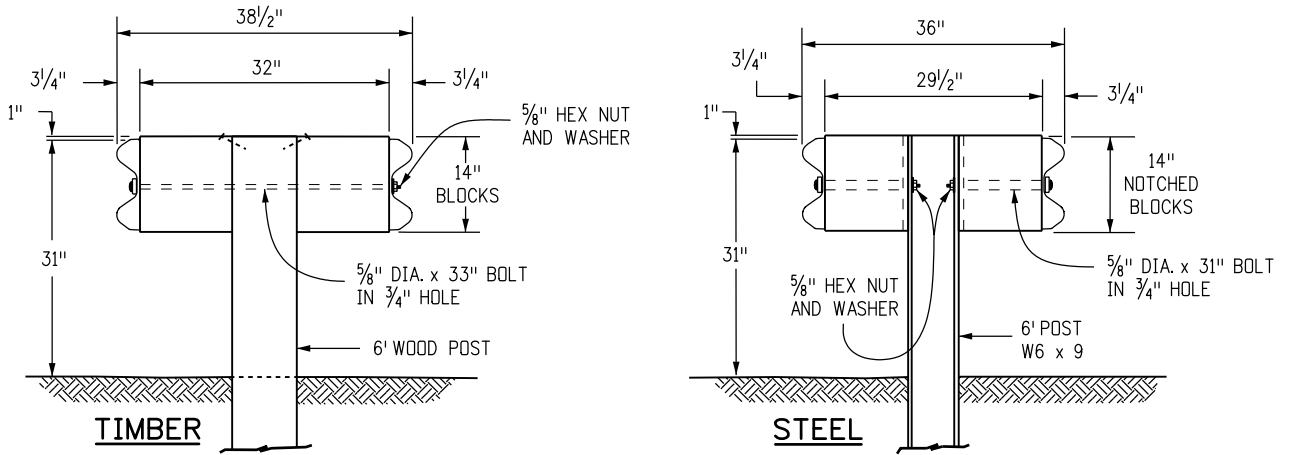
(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)



(PWE01)

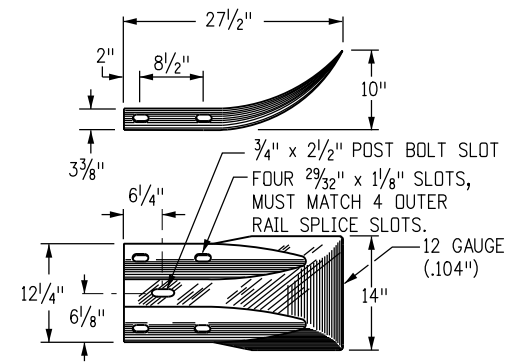
**STEEL POST & NOTCHED BLOCK**

(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)

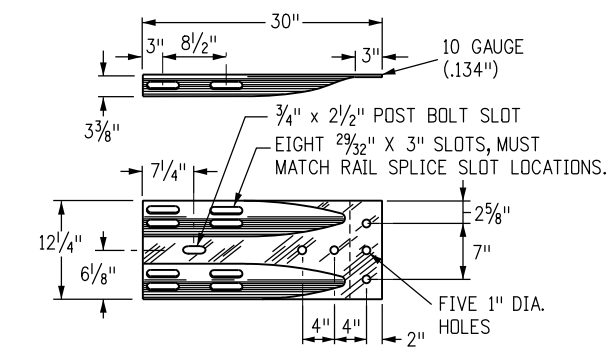


**DOUBLE BLOCK AND GUARDRAIL TYPE 3 (DOUBLE) FOR MEDIAN BARRIER**

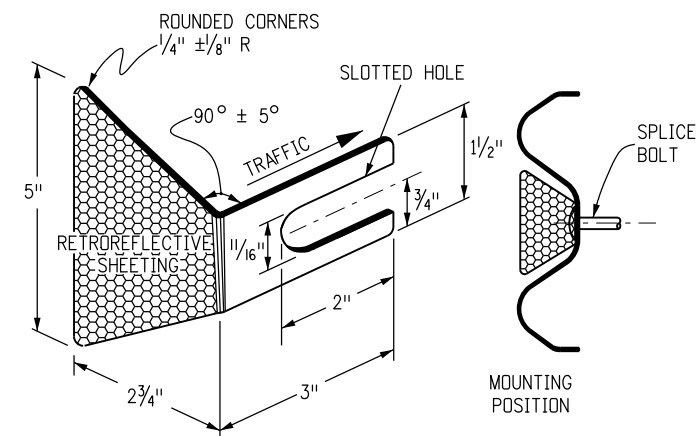
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>MIDWEST</b> <b>GUARDRAIL SYSTEM (MGS)</b> <b>TYPE 3 W-BEAM 31 INCHES</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b> <b>M-606-1</b> <b>Standard Sheet No. 2 of 19</b> Project Sheet Number:
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Designer Initials: JBK	(R-X)					
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Detailer Initials: LTA	(R-X)					
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**TERMINAL SECTION (FLARED)**

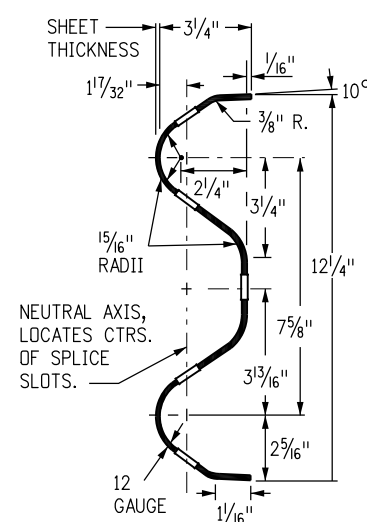


**TERMINAL SECTION (CONNECTOR)**

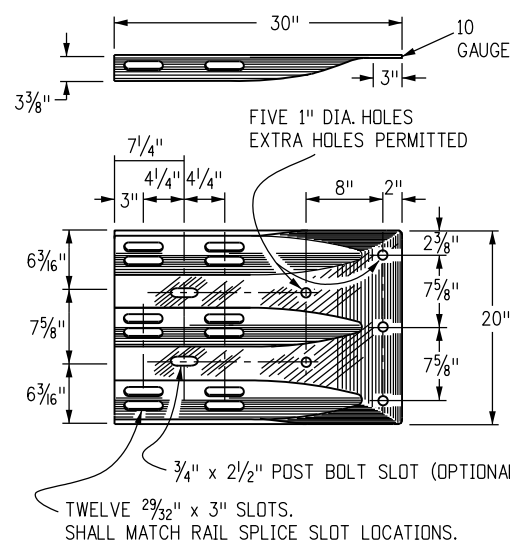


**RETROREFLECTOR TAB**

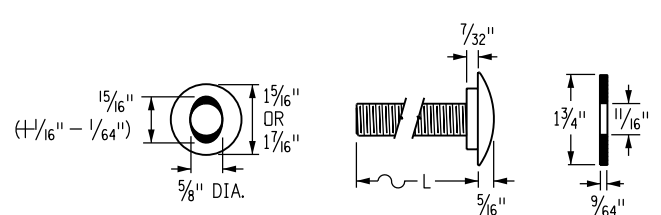
NOTE: RETROREFLECTOR TABS SHALL BE MANUFACTURED FROM 12 TO 14 GAUGE STEEL AND SHALL CONFORM TO THE REQUIREMENTS OF S STANDARD S-612-1.



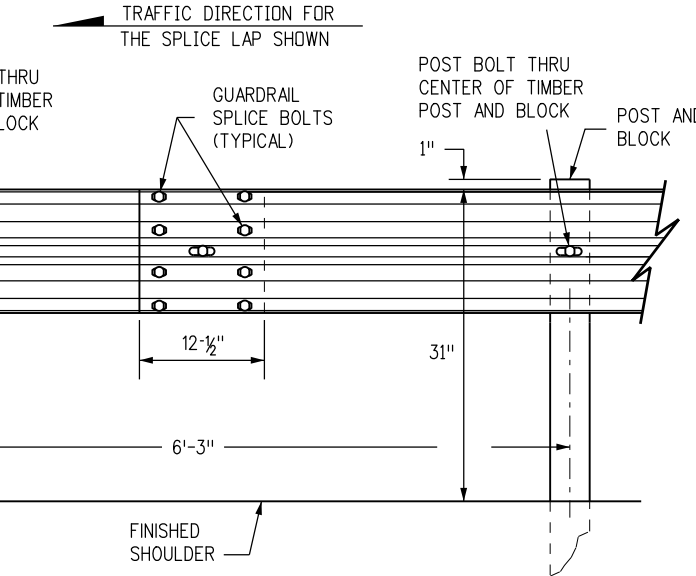
**W-BEAM RAIL SECTION**



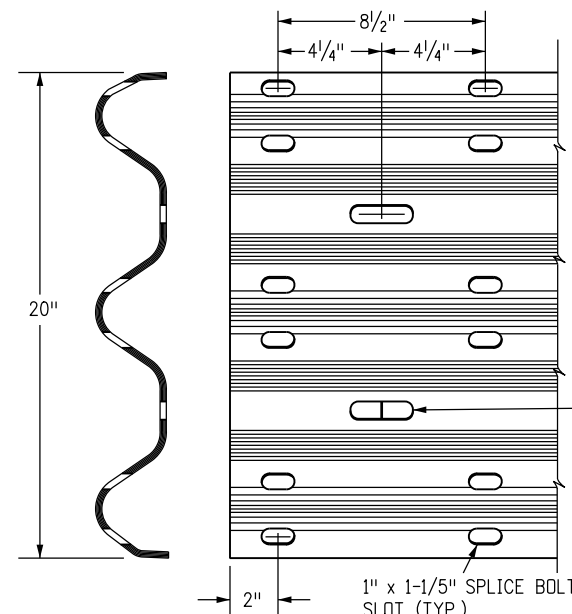
**THRIE BEAM TERMINAL SECTION (CONNECTOR)**



**BUTTON HEAD BOLT WITH OVAL SHOULDER**



**W-BEAM RAIL SPLICE**

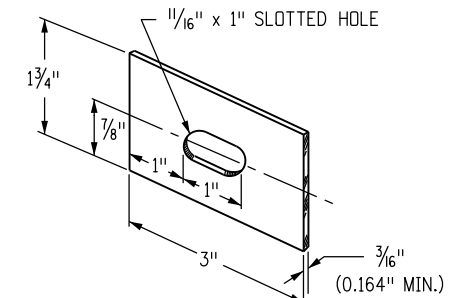


**THRIE BEAM DETAIL**

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		
HIGH STRENGTH BOLTS & NUTS	ASTM A 325		AASHTO M 232, CLASS C
HIGH STRENGTH STUDS & NUTS	ASTM A 449		OR
ROUND STEEL WASHERS	ASTM F 436		ASTM B 695 CLASS 50 TYPE 1
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.



**RECTANGULAR WASHER**  
(TO BE USED ONLY WHERE SPECIFIED.)

DIAMETER & TYPE (INCHES)	12" BLOCKS L = LENGTH (INCHES)	THREAD LENGTH (INCHES)	INTENDED USE	AASHTO-AGC-ARTBA STANDARD NUMBER	NO. BOLTS, NUTS & WASHERS
5/8	1/4	FULL (1 1/32)	ALL RAIL SPLICES	FBB01	8 PER SPLICE*
BUTTONHEAD	22	MIN. 2 1/2	SINGLE BLOCK & POST (TIMBER)	FBB04	1 PER POST
OVAL SHLDR.	33	MIN. 2	DOUBLE BLOCK & POST (TIMBER)	FBB05	1 PER POST
	14	MIN. 2	FASTEN NOTCHED BLOCK TO STEEL POST	FBB03	1 PER BLOCK

WASHERS NOT USED AT RAIL SPLICES

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**Sheet Revisions**

Date:	Comments

**Colorado Department of Transportation**

2829 West Howard Place  
CDOT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

**Project Development Branch** **JBK**

**MIDWEST  
GUARDRAIL SYSTEM (MGS)  
TYPE 3 W-BEAM 31 INCHES**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

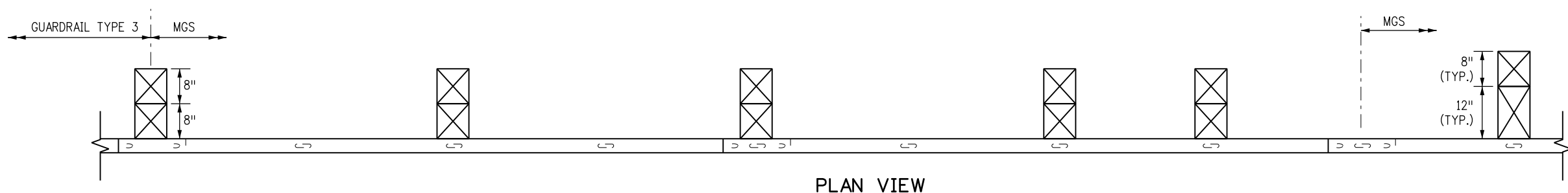
**M-606-1**

**Standard Sheet No. 3 of 19**

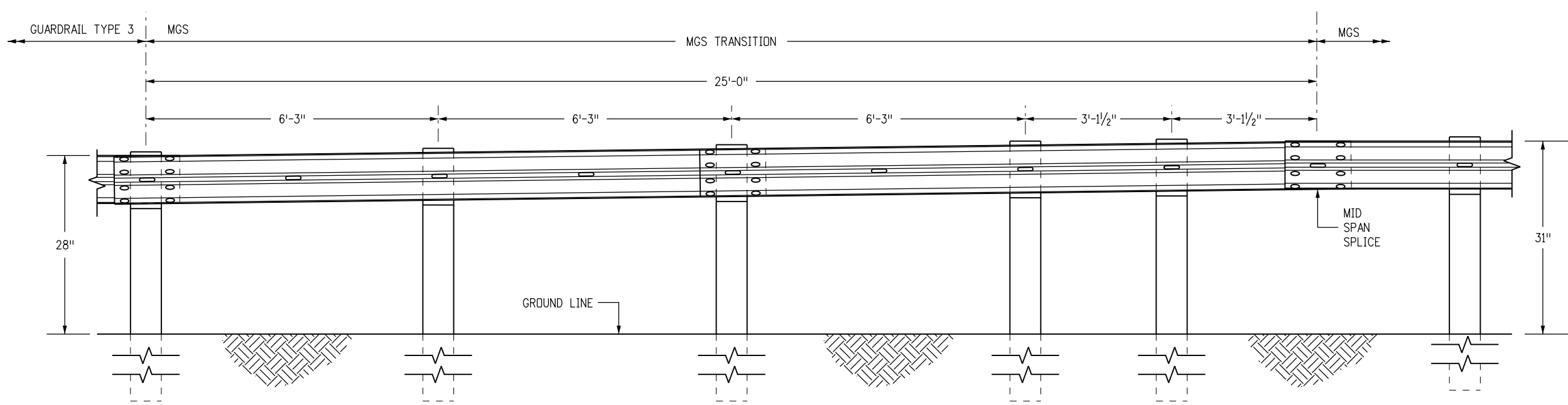
Project Sheet Number:

**NOTES**

1. THE MGS TRANSITION FROM A TYPE 3 GUARDRAIL SHALL BE COMPLETED OUTSIDE THE MGS END ANCHORAGE LIMITS.

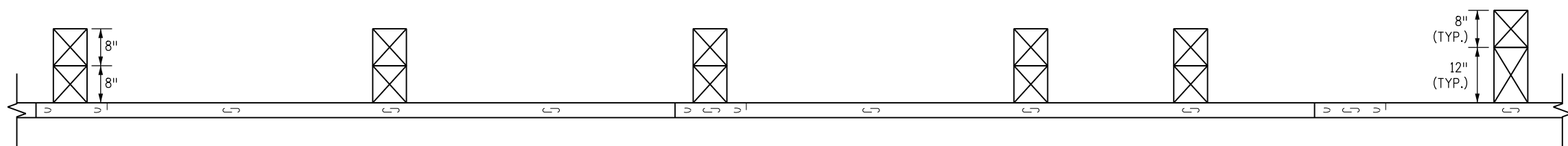


**PLAN VIEW**



**ELEVATION VIEW**

**TRANSITION FROM 28 INCH GUARDRAIL TO 31 INCH MGS**



**ALTERNATE PLAN VIEW - ALIGNMENT TAPER**

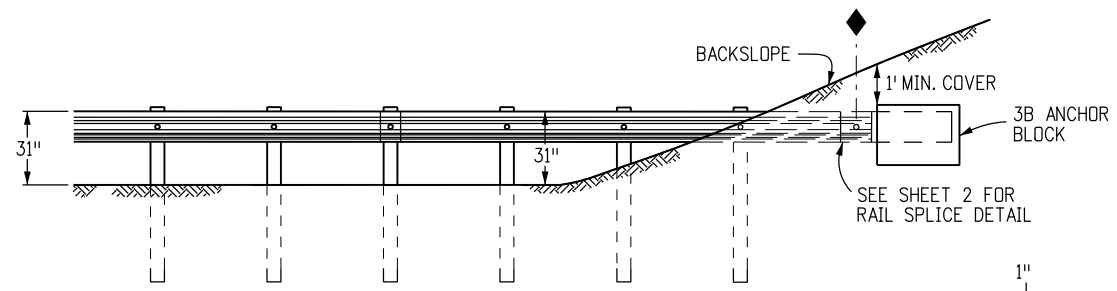
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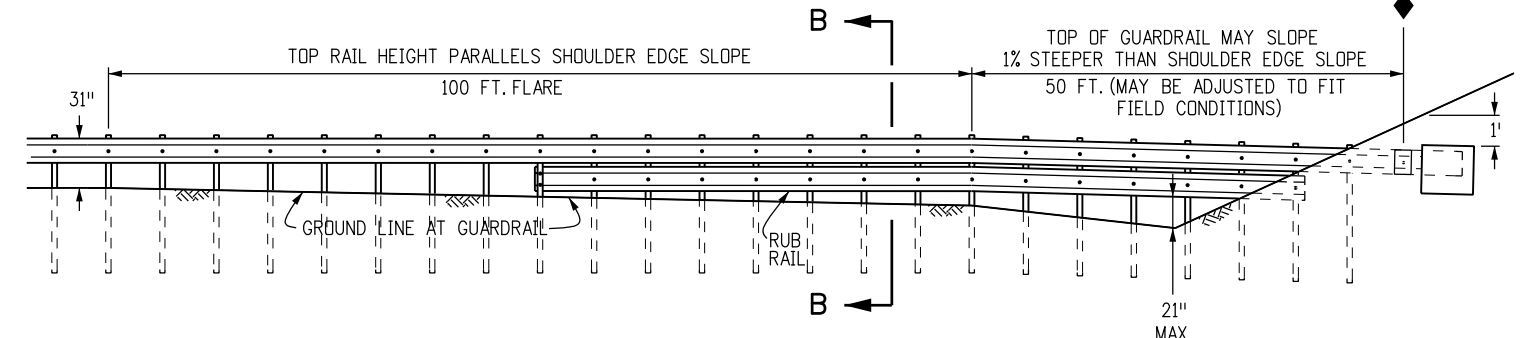
**MIDWEST  
 GUARDRAIL SYSTEM (MGS)  
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 Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-606-1
Standard Sheet No. 4 of 19
Project Sheet Number:

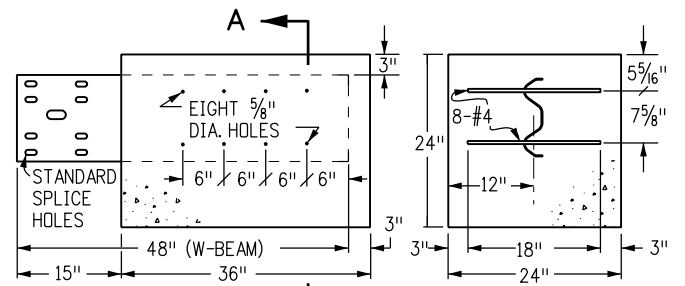


SEE TYPE 3B (RUB RAIL) PLAN VIEW FOR ALIGNMENT. THE 100 FT. FLARE LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

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

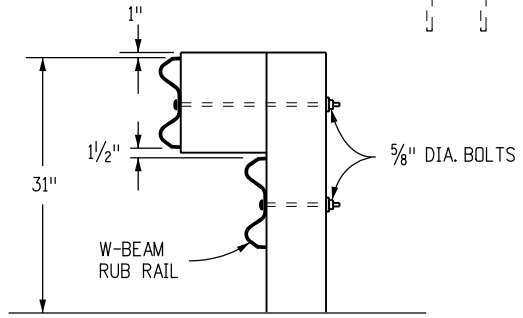


**ELEVATION VIEW**



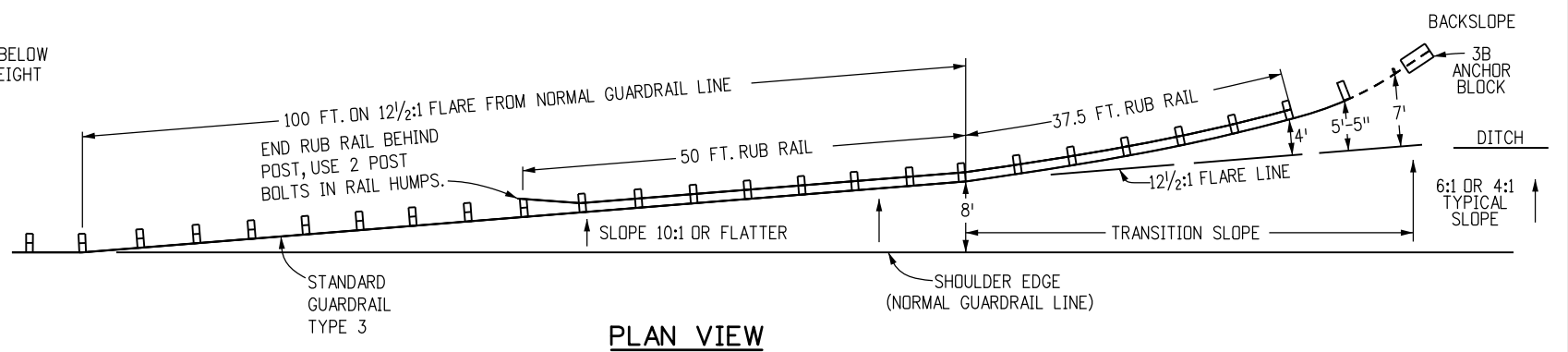
**SECTION A-A**

**TYPE 3B ANCHOR BLOCK DETAIL**



**SECTION B-B**

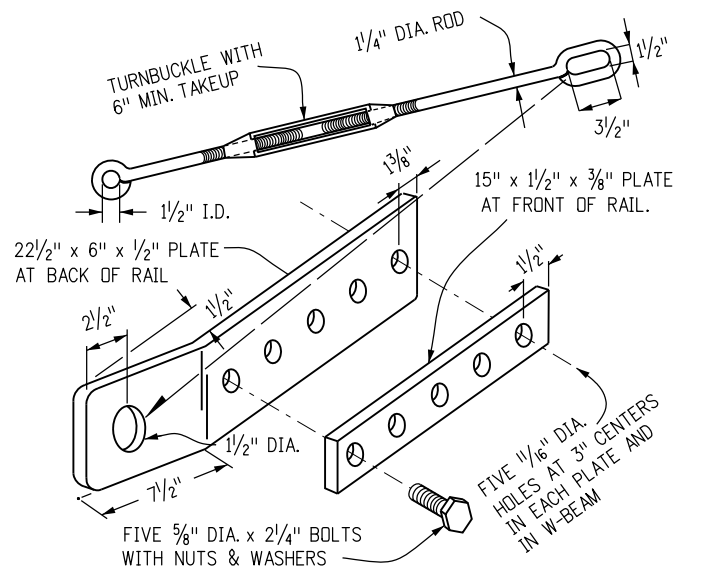
MOUNT A W-BEAM RUB RAIL 1-1/2 IN. BELOW THE TOP RAIL WHEN THE TOP RAIL HEIGHT EXCEEDS 33 IN. ABOVE THE GROUND



**PLAN VIEW**

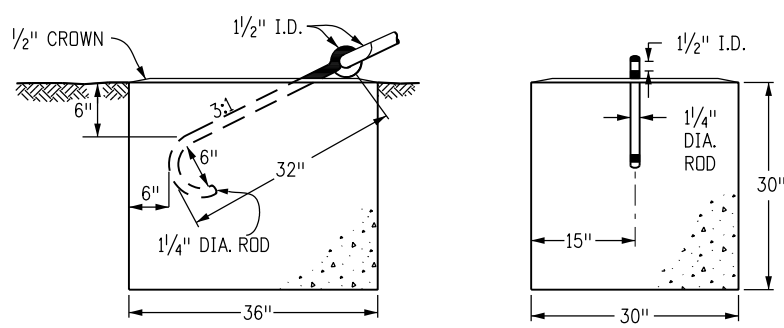
**END ANCHORAGE TYPE 3B (RUB RAIL)**

(WITH ROADSIDE DITCH AT GUARDRAIL)



**TYPE 3D HARDWARE DETAILS**

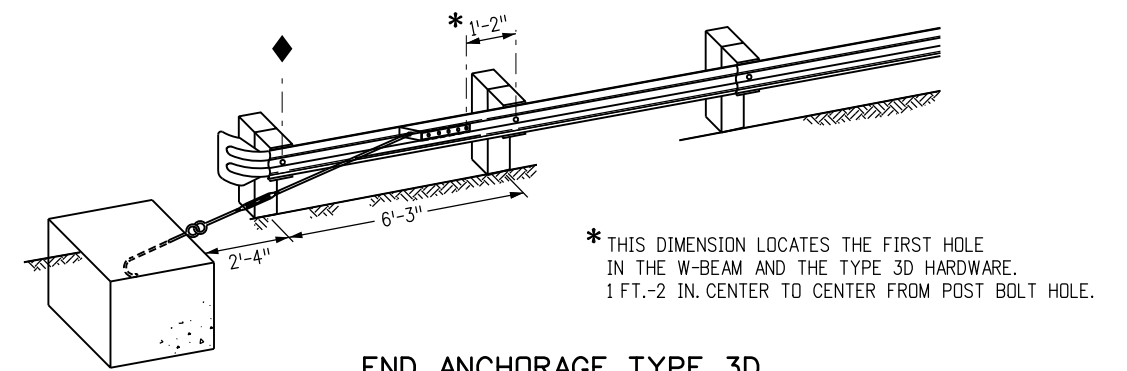
NOTE: ALL PARTS SHALL BE GALVANIZED



**FRONT**

**END**

**TYPE 3D ANCHOR BLOCK DETAIL**



**END ANCHORAGE TYPE 3D DEPARTURE TERMINAL**

\* 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.

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MIDWEST  
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 TYPE 3 W-BEAM 31 INCHES  
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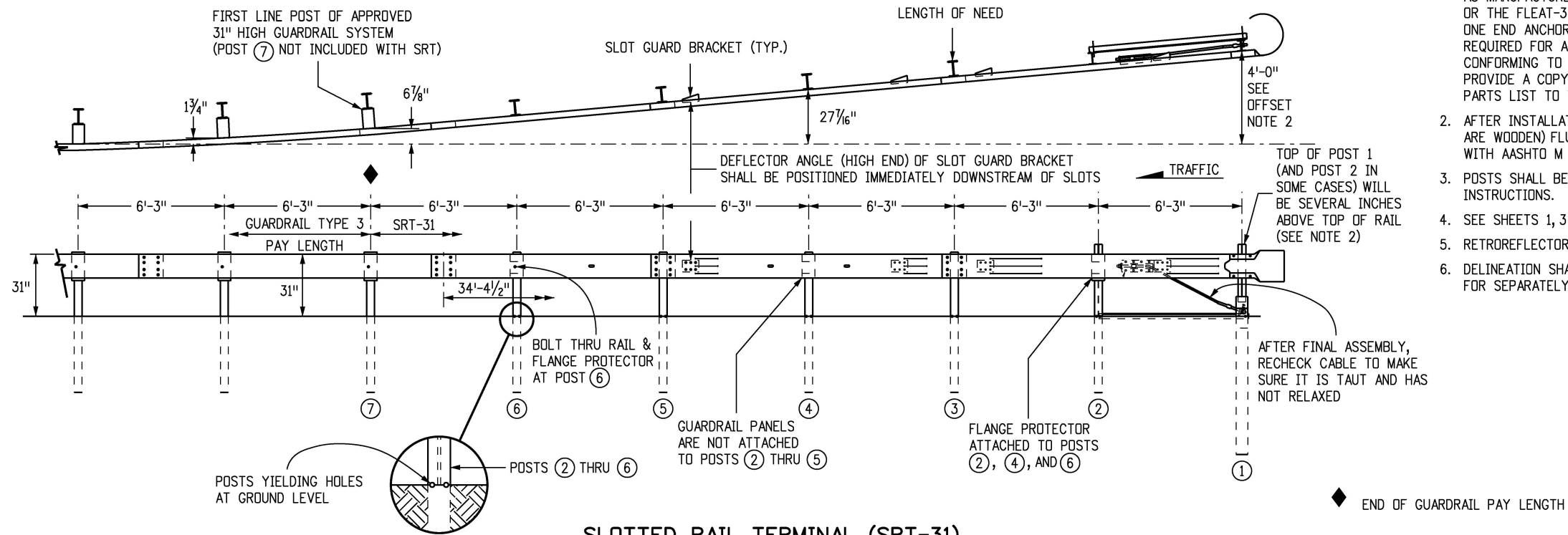
STANDARD PLAN NO.  
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**OFFSET NOTES**

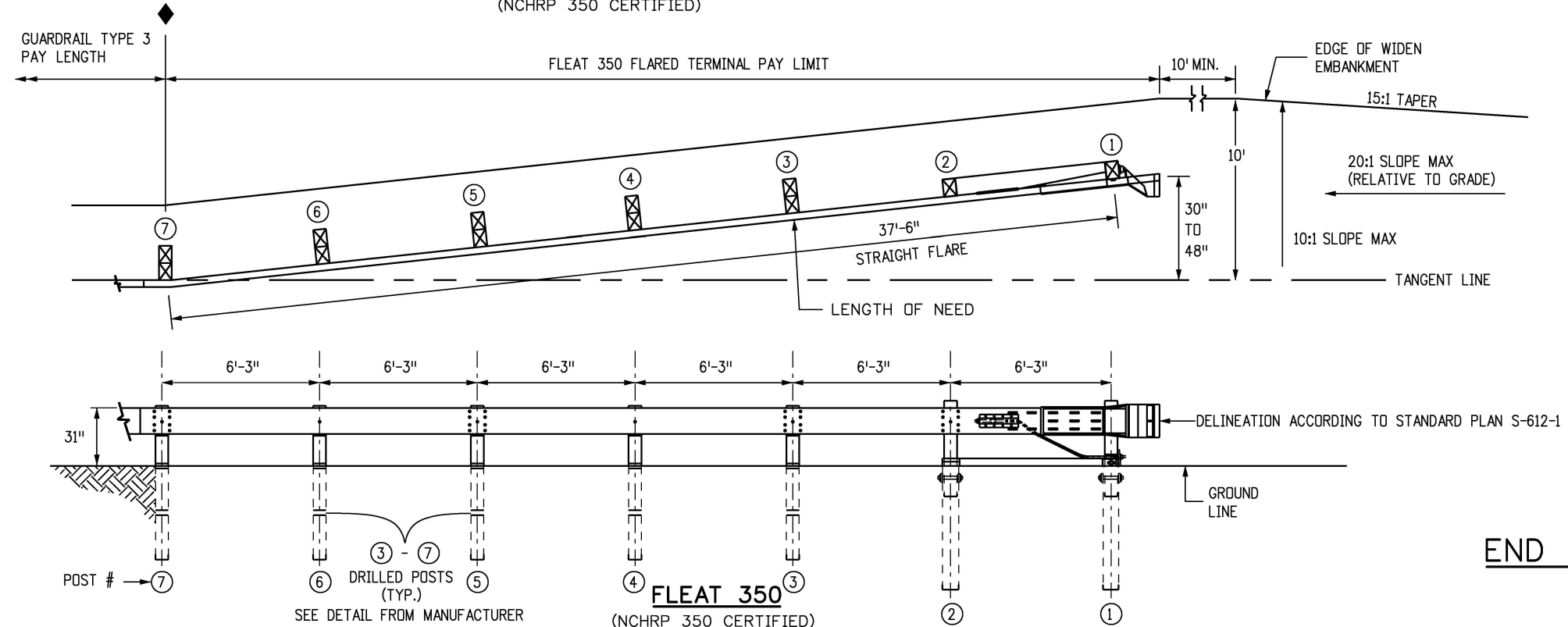
1. POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF POSTS.
2. THE GUARDRAIL BETWEEN POST ① THRU ⑦ IS ON A STRAIGHT LINE FLARE.

**NOTES**

1. THE END ANCHORAGES (FLARED) SHALL EITHER BE THE SLOTTED RAIL TERMINAL SRT-31 AS MANUFACTURED BY TRINITY HIGHWAY PRODUCTS LLC (TELEPHONE #: 1-888-356-2363), OR THE FLEAT-350, AS MANUFACTURED BY ROAD SYSTEMS INC. (TELEPHONE #: 432-263-2435). ONE END ANCHORAGE (FLARED) SHALL INCLUDE ALL POST, RAIL, AND ALL HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (FLARE) 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. AFTER INSTALLATION AND IN HEAVY SNOW LOCATIONS, TRIM POSTS ① AND ② (IF THEY ARE WOODEN) FLUSH WITH RAIL TOP AND TREAT END WITH SEALANT, IN CONFORMANCE WITH AASHTO M 133.
3. POSTS SHALL BE DRILLED FOR BREAKAWAY ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
4. SEE SHEETS 1, 3 AND 5 FOR STANDARD GUARDRAIL TYPE 3 AND INSTALLATION DETAILS.
5. RETROREFLECTOR TABS SHALL NOT BE USED ON END ANCHORAGE POSTS.
6. DELINEATION SHALL BE APPLIED TO THE END PIECE, AND SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

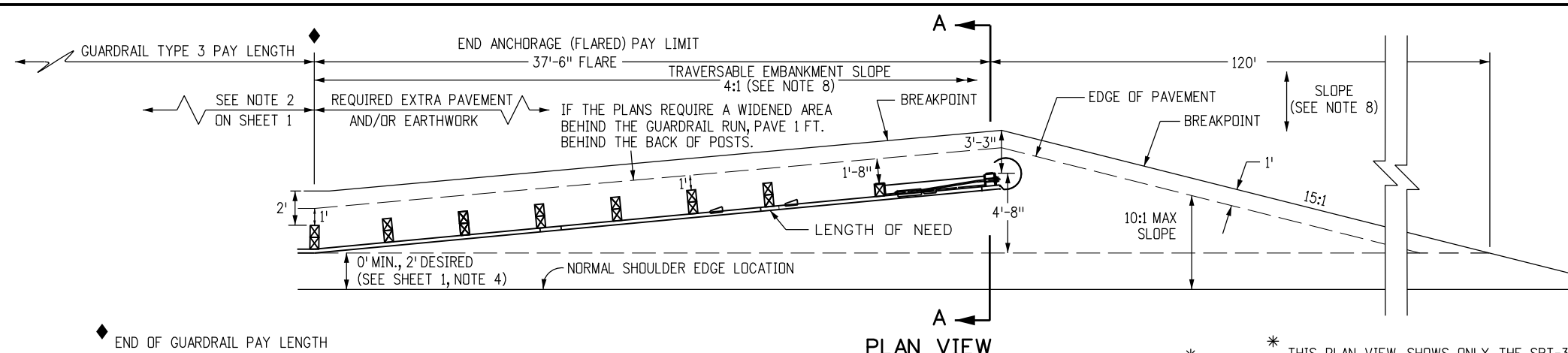


**SLOTTED RAIL TERMINAL (SRT-31)**  
(NCHRP 350 CERTIFIED)



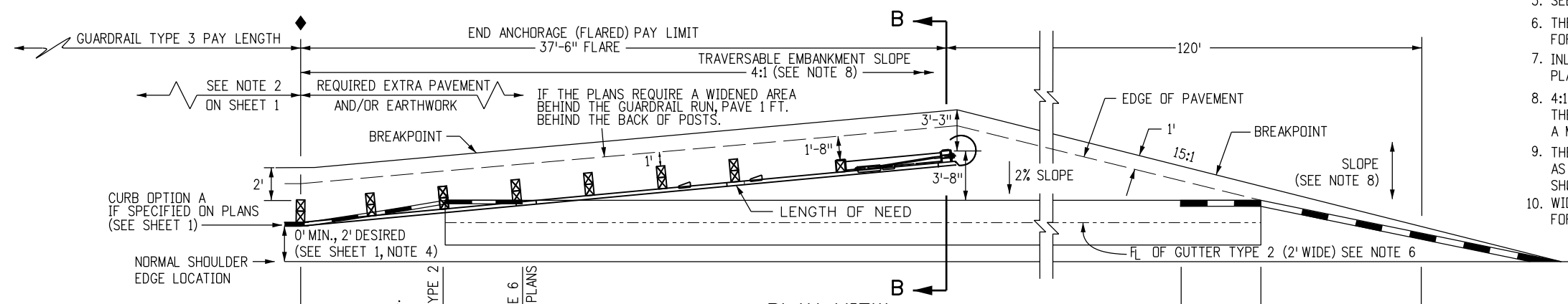
**END ANCHORAGES (FLARED)**

<b>Computer File Information</b> Creation Date: 07/31/19 Designer Initials: JBK Last Modification Date: 07/31/19 Detailer Initials: LTA CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		<b>Sheet Revisions</b> <table border="1"> <thead> <tr> <th>Date:</th> <th>Comments:</th> </tr> </thead> <tbody> <tr> <td>(R-X)</td> <td></td> </tr> <tr> <td>(R-X)</td> <td></td> </tr> <tr> <td>(R-X)</td> <td></td> </tr> <tr> <td>(R-X)</td> <td></td> </tr> </tbody> </table>		Date:	Comments:	(R-X)		(R-X)		(R-X)		(R-X)		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 Project Development Branch <b>JBK</b>		<b>MIDWEST GUARDRAIL SYSTEM (MGS)</b> <b>TYPE 3 W-BEAM 31 INCHES</b> Issued by the Project Development Branch: July 31, 2019		<b>STANDARD PLAN NO.</b> M-606-1 Standard Sheet No. 6 of 19 Project Sheet Number:	
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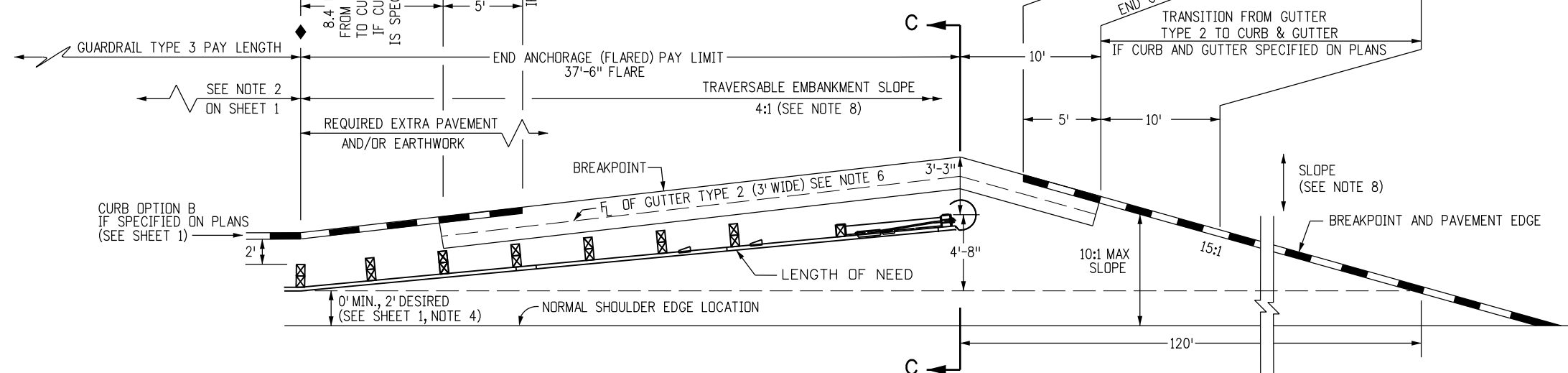


**PLAN VIEW  
WIDENING FOR END ANCHORAGE (FLARED)\***

\* THIS PLAN VIEW SHOWS ONLY THE SRT-31. THE FLEAT-350 USES THE SAME WIDENING DETAILS.

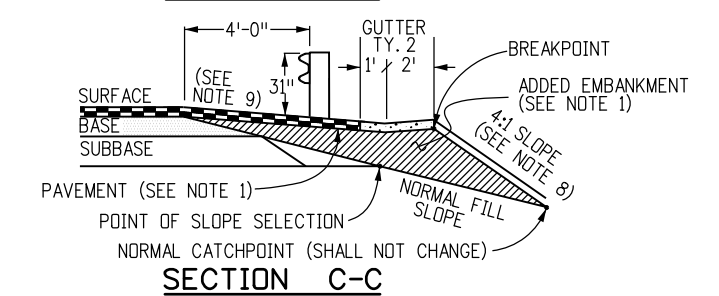
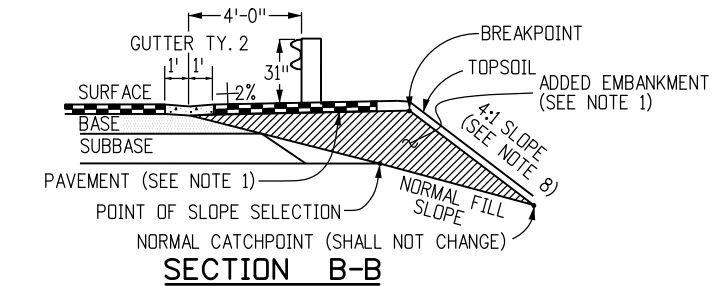
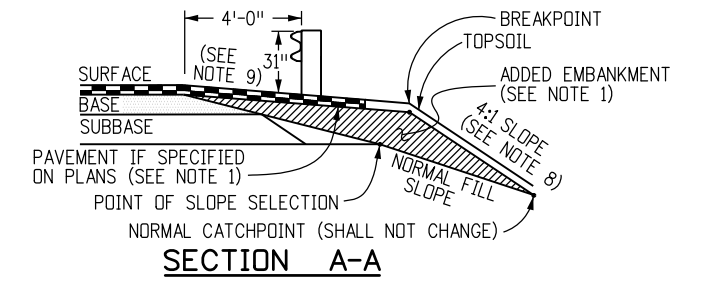


**PLAN VIEW  
WIDENING FOR END ANCHORAGE (FLARED)  
WITH CURB OPTION A\***



**PLAN VIEW  
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION B\***

- NOTES**
- 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.
  - 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)
  - CONCRETE PAVED AREAS SHALL HAVE THEIR TAPERED ENDS SQUARED OFF AS DIRECTED BY THE ENGINEER.
  - 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.
  - SEE SHEETS 1, 2, 3, AND 5 FOR STANDARD TYPE 3 GUARDRAIL INSTALLATION DETAILS.
  - 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.
  - 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.
  - 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.
  - 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.
  - 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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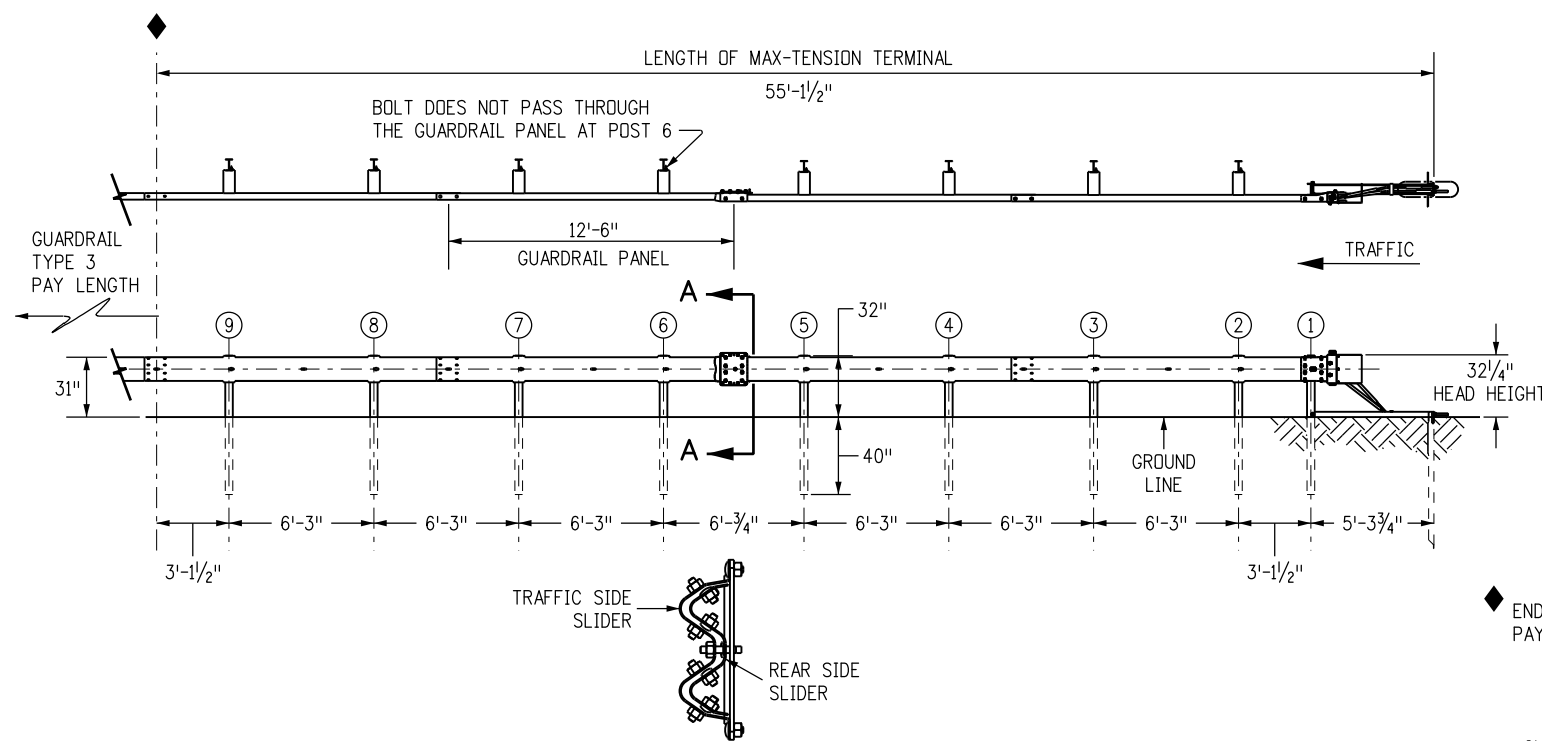
Colorado Department of Transportation  
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 Project Development Branch JBK

MIDWEST  
 GUARDRAIL SYSTEM (MGS)  
 TYPE 3 W-BEAM 31 INCHES  
 Issued by the Project Development Branch: July 31, 2019

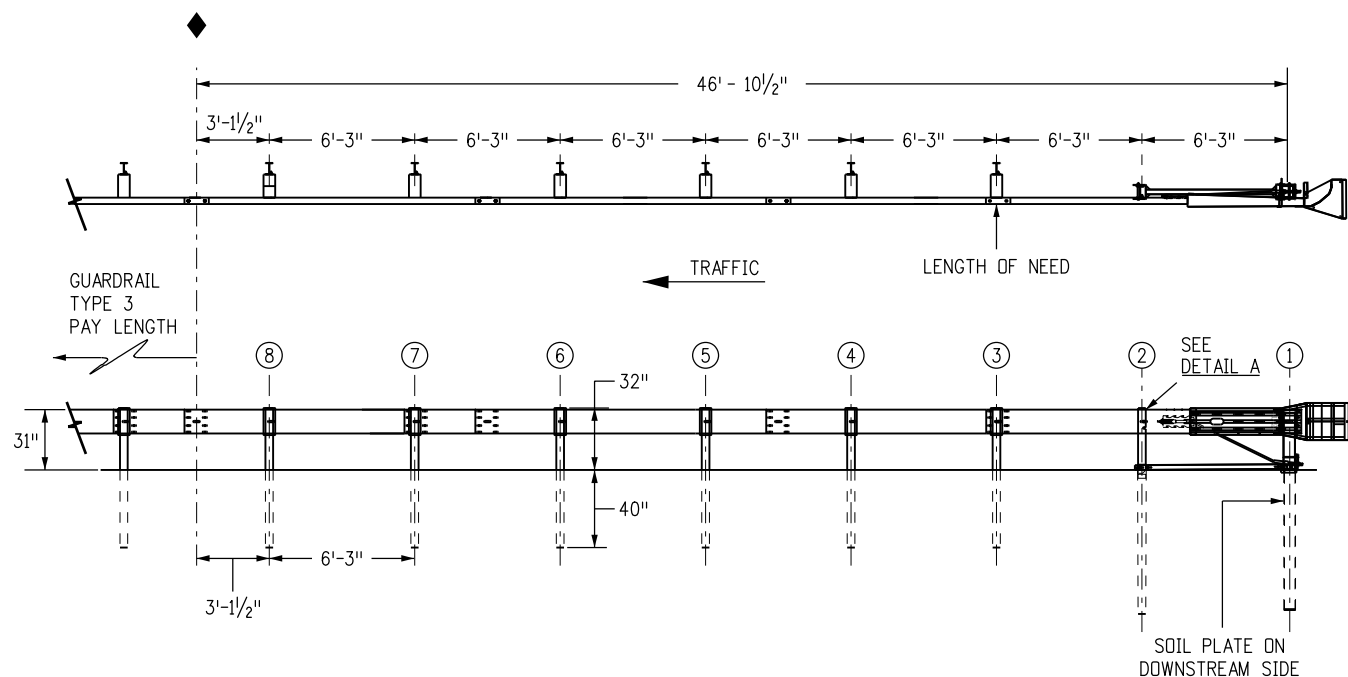
STANDARD PLAN NO.  
 M-606-1  
 Standard Sheet No. 7 of 19  
 Project Sheet Number:

**NOTES FOR NONFLARED**

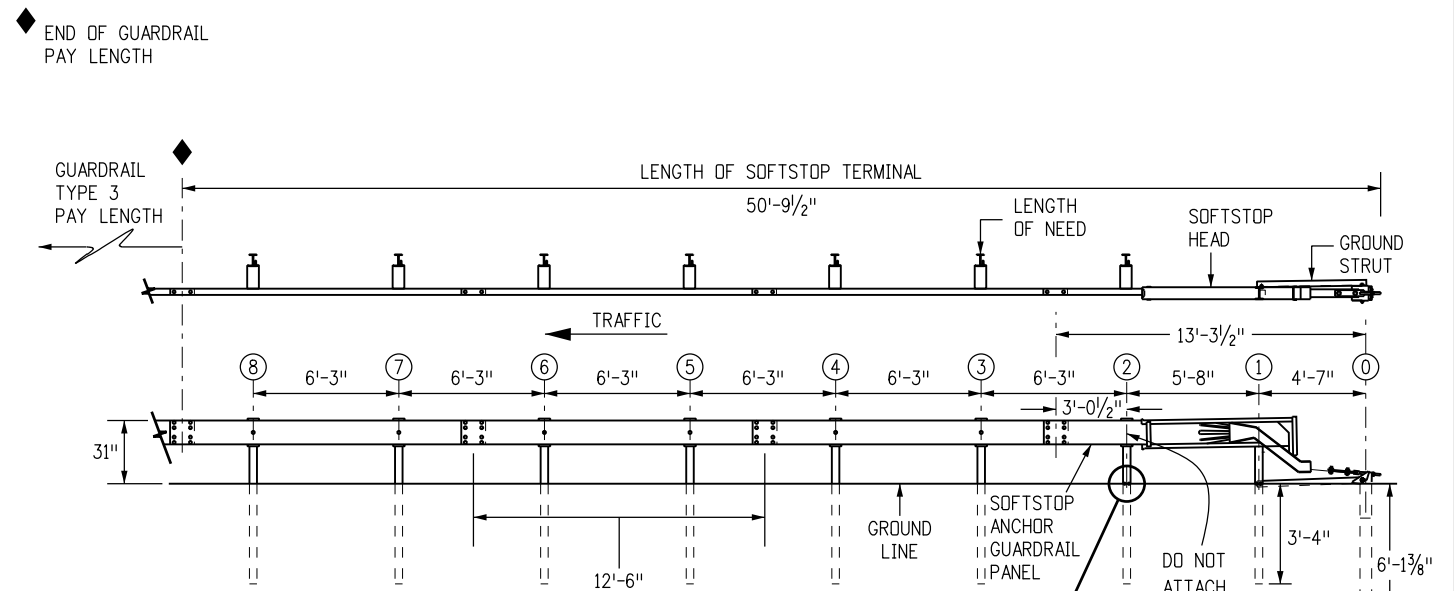
1. THE END ANCHORAGE (NONFLARED) SHALL EITHER BE THE SOFTSTOP AS MANUFACTURED BY TRINITY INDUSTRIES, INC. (TEL. #: 1-888-356-2363), OR THE MAX-TENSION AS MANUFACTURED BY LINDSAY TRANSPORTATION SOLUTIONS (TEL. #: 402-829-6800), OR THE MSKT AS MANUFACTURED BY ROAD SYSTEMS, INC. (TEL. #: 432-263-2435). 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. DO NOT ATTACH THESE END ANCHORAGES DIRECTLY TO A RIGID BARRIER (EX. CONCRETE BARRIER, STEEL BARRIER, CONCRETE STRUCTURE) WITHOUT A PROPER TRANSITION.
3. CONNECTIONS TO W-BEAMS WHERE THE SPLICE IS NOT AT MID-SPAN BUT AT A POST CAN BE MADE USING A 3'-1/2", 9'-4 1/2", OR 15'-7 1/2" W-BEAM PANEL DOWNSTREAM OF TRAFFIC.
4. FOR MSKT END ANCHORAGES (NONFLARED), USE THE MANUFACTURER'S SPECIFIED STEEL FOUNDATION TUBES FOR POSTS ① AND ②.
5. RETROREFLECTOR TABS SHALL NOT BE USED ON END ANCHORAGE POSTS.
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.



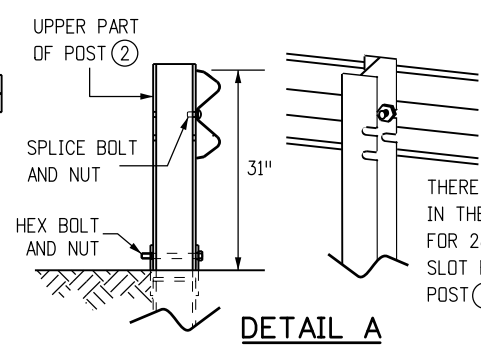
**SECTION A-A**  
**MAX-TENSION TERMINAL END ANCHORAGE (NONFLARED)**  
 (MASH CERTIFIED)



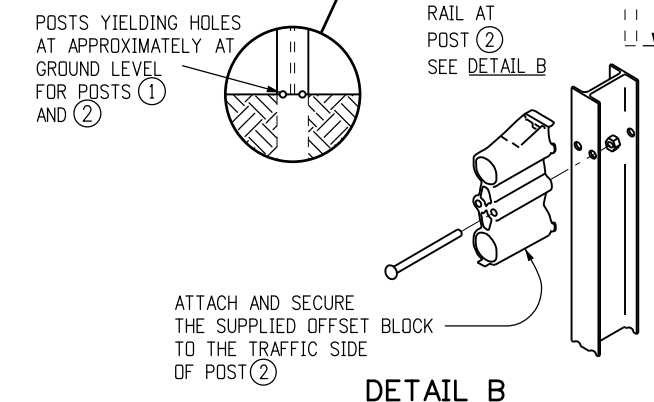
**MSKT TERMINAL END ANCHORAGE (NONFLARED)**  
 (MASH CERTIFIED)



**SOFTSTOP TERMINAL END ANCHORAGE (NONFLARED)**  
 (MASH CERTIFIED)



THERE ARE TWO SETS OF OPEN-ENDED SLOTS IN THE UPPER PART OF POST ②. THESE ARE FOR 28\"/>



**END ANCHORAGES (NONFLARED)**

Computer File Information	
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Designer Initials: JBK	(R-X)
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

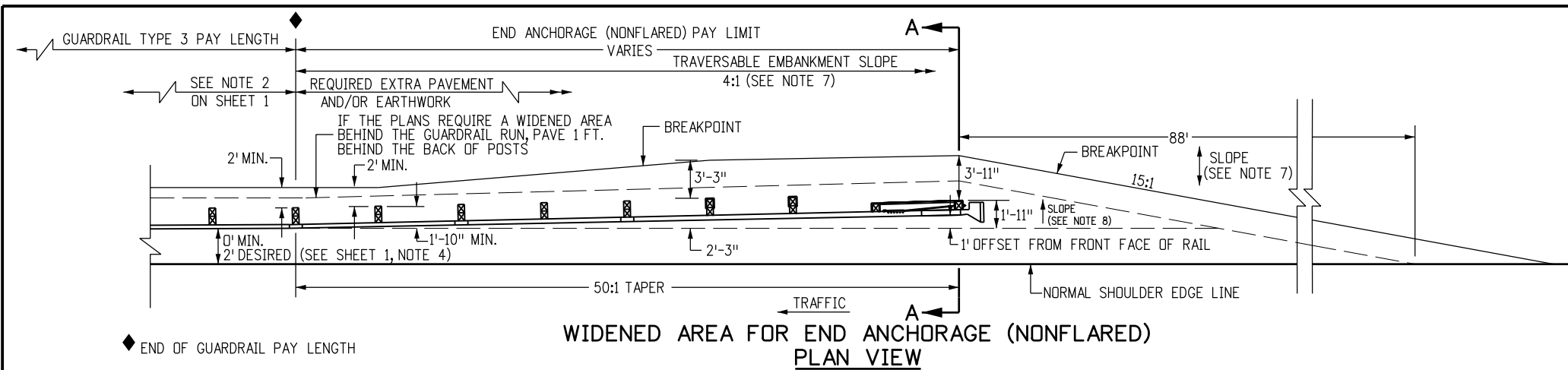
Sheet Revisions	
Date:	Comments

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**Project Development Branch** **JBK**

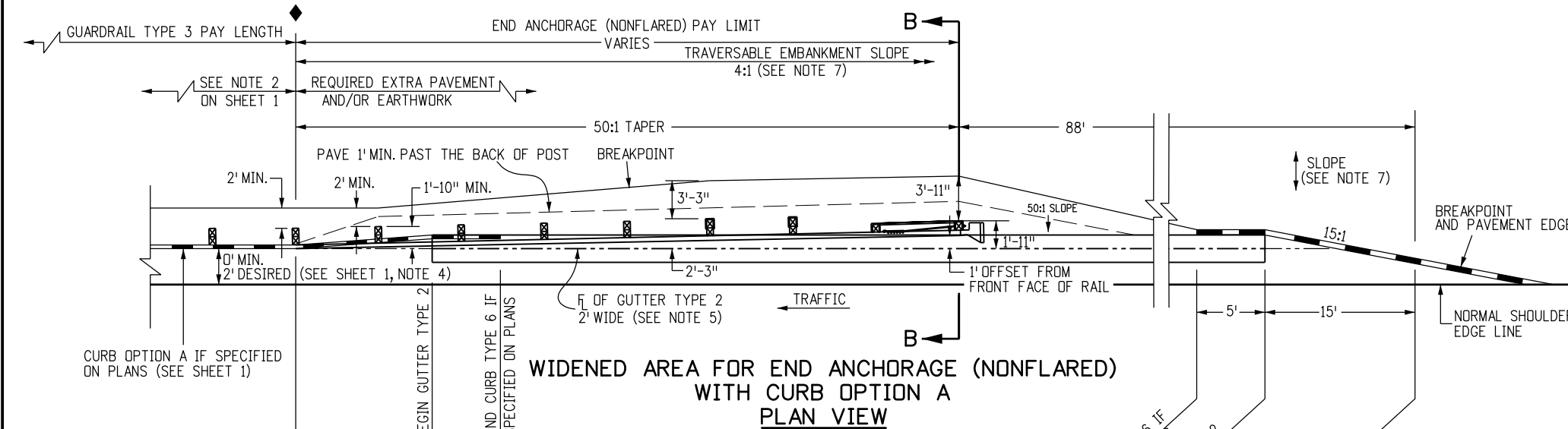
**MIDWEST**  
**GUARDRAIL SYSTEM (MGS)**  
**TYPE 3 W-BEAM 31 INCHES**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
**M-606-1**  
**Standard Sheet No. 8 of 19**  
 Project Sheet Number:

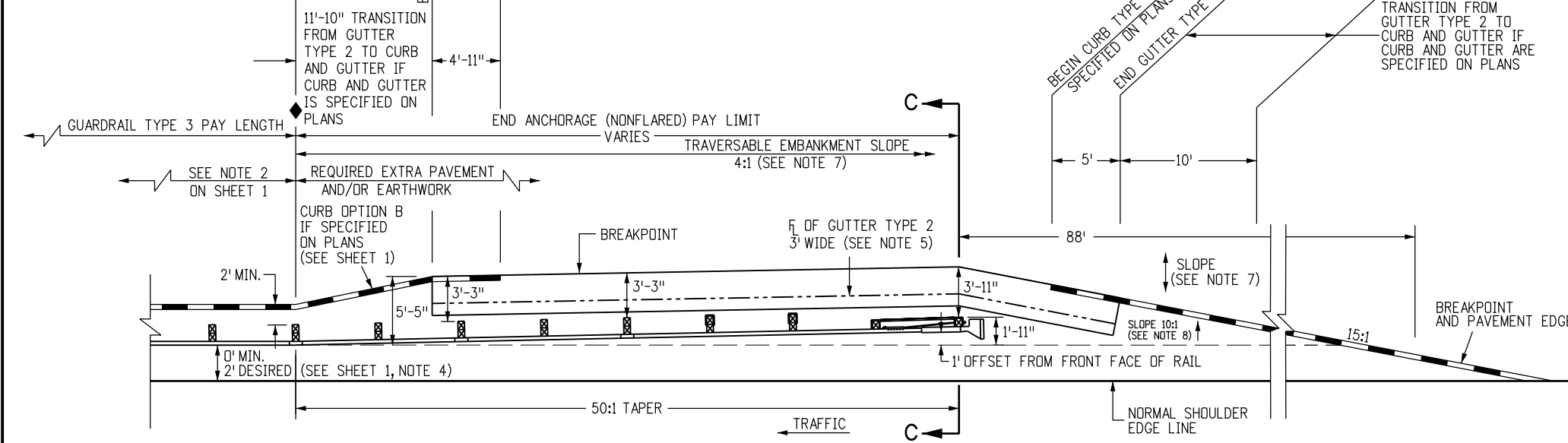




**WIDENED AREA FOR END ANCHORAGE (NONFLARED)  
PLAN VIEW**

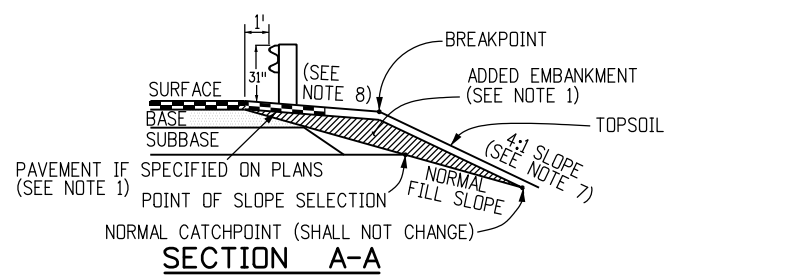


**WIDENED AREA FOR END ANCHORAGE (NONFLARED)  
WITH CURB OPTION A  
PLAN VIEW**

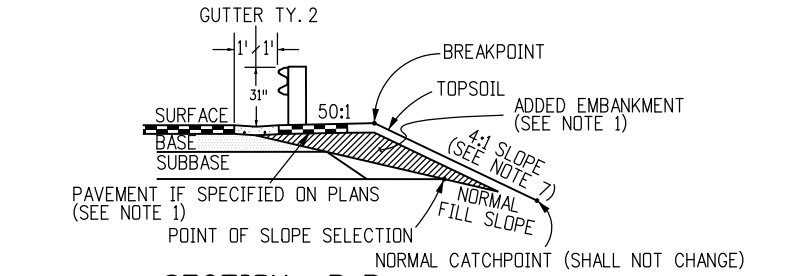


**WIDENED AREA FOR END ANCHORAGE (NONFLARED) WITH CURB OPTION B  
PLAN VIEW**

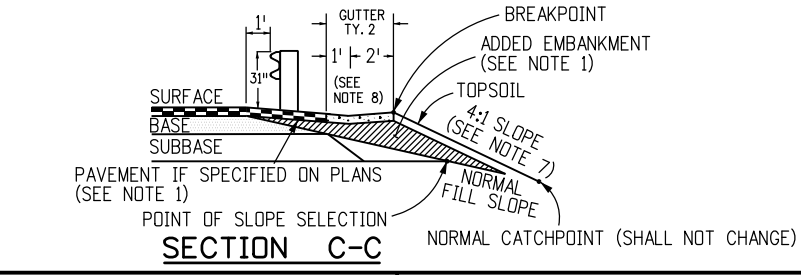
- NOTES**
- PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 25 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:  
A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203.  
B. INCLUDED IN THE COST OF THE END ANCHORAGE (NONFLARED) WHEN THE CONTRACT PLAN DOES NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL BE CONSTRUCTED IN ACCORDANCE WITH SUBSECTION 203.07, AASHTO T 99.
  - 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).
  - 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.
  - SEE SHEETS 1, 2, 3, AND 5 FOR STANDARD TYPE 3 GUARDRAIL INSTALLATION DETAILS.
  - 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.
  - 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.
  - 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.
  - 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.
  - WIDENING FOR END ANCHORAGES SHALL BE PAVED ON INTERSTATES AND FREEWAYS. FOR OTHER HIGHWAYS, PAVING SHALL BE AS SHOWN ON THE PLANS.



**SECTION A-A**



**SECTION B-B**



**SECTION C-C**

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

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 Project Development Branch JBK

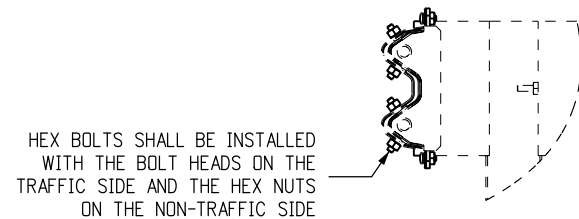
**MIDWEST  
 GUARDRAIL SYSTEM (MGS)  
 TYPE 3 W-BEAM 31 INCHES**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
 M-606-1  
 Standard Sheet No. 9 of 19**  
 Project Sheet Number:

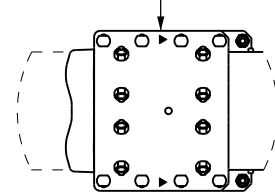
**MEDIAN TERMINAL NOTES**

1. THE MEDIAN TERMINAL SHALL BE THE MAX-TENSION MEDIAN AS MANUFACTURED BY BY BARRIER SYSTEM BY LINDSAY (LINDSAY TRANSPORTATION SOLUTIONS) (TEL #: 888 800-3691).
2. THE MAX-TENSION SHALL BE APPLIED DIRECTLY TO W-BEAM GUARDRAIL SYSTEMS AT, OR TRANSITIONED TO, 31 INCH WITH PANELS AND POST SPACING CONFIGURED AT MID-SPAN SPLICE. TRANSITIONS TO STRONG POST W-BEAM GUARDRAIL SYSTEMS OR OTHER BARRIERS WHERE THE SPLICE IS NOT MID-SPAN SHALL BE ACCOMPLISHED USING A 3 FT. 1-1/2 INCH, 9 FT. 4-1/2 INCH OR 15 FT. 7-1/2 INCH PANELS AFTER THE MAX-TENSION SYSTEM (MIN. OF 50 FT. DOWNSTREAM OF THE FIRST POST). TRANSITIONS TO OTHER BARRIER SYSTEMS SHALL ALSO BE AT A MIN. OF 50 FT. DOWNSTREAM FROM THE FIRST POST. SEE SHEET 4.
3. THE MAX-TENSION SHALL NOT BE ATTACHED DIRECTLY TO RIGID BARRIERS SUCH AS CONCRETE BARRIERS, STEEL BARRIERS OR CONCRETE STRUCTURES WITHOUT PROPER TRANSITION. IF ROCK OR STIFF SOIL IS ENCOUNTERED, THE POSTS AND SOIL ANCHOR MAY BE INSTALLED BY AUGURING AND BACKFILLING THE HOLE.
4. EITHER 8 INCH OR 12 INCH COMPOSITE OR TIMBER BLOCKOUTS SHALL BE USED PER MANUFACTURE'S RECOMMENDATIONS.
5. EITHER 12 FT.-6 INCH OR 25 FOOT PANELS SHALL BE USED DEPENDING ON SITE CONDITIONS OR CONNECTED BARRIER SYSTEMS.
6. RAIL PANELS SHALL BE LAPPED PER MANUFACTURER'S INSTALLATION MANUAL, REGARDLESS OF AN UPSTREAM OR DOWNSTREAM END SYSTEM POSITION.
7. ALL STEEL COMPONENTS SHALL BE GALVANIZED PER ASTM A123 OR EQUIVALENT UNLESS OTHERWISE STATED.
8. 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.
9. UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL BE INSTALLED FOR BIDIRECTIONAL TRAFFIC APPLICATION.
10. 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.
11. 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.

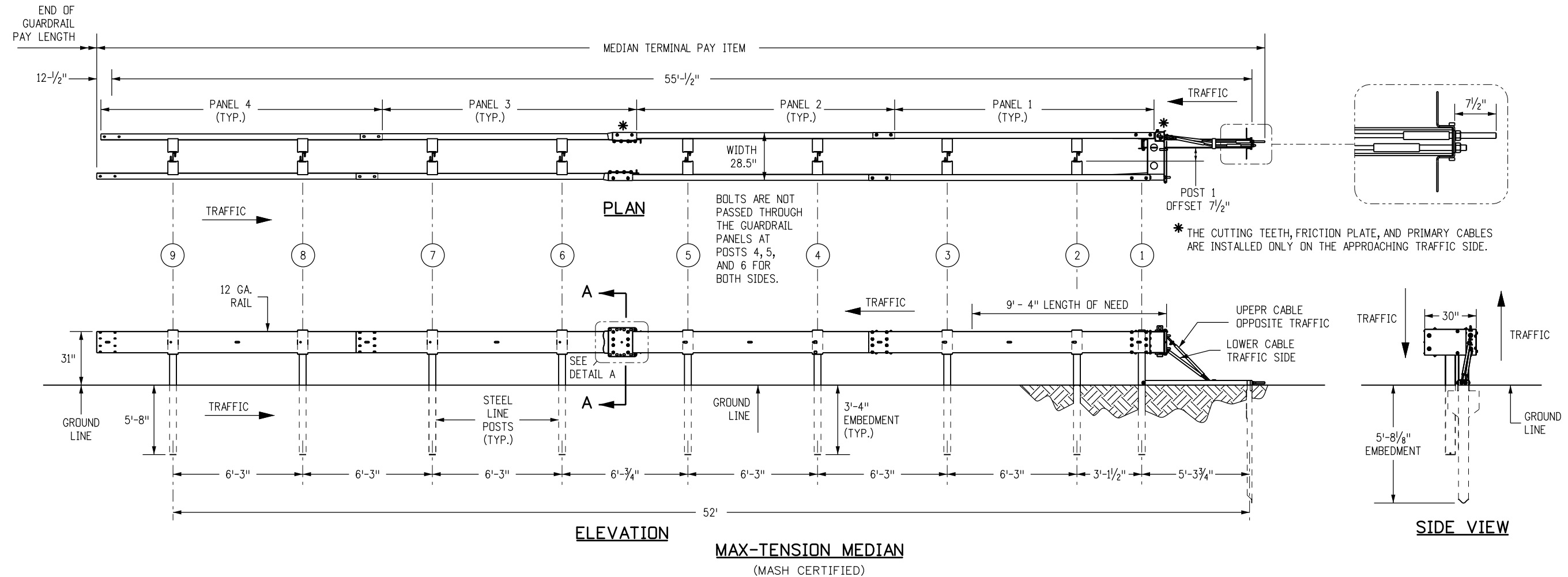
THE TRAFFIC SIDE SLIDER AND THE REAR SIDE SLIDER INSTALLED WITH ARROWS POINTING TOWARDS THE HEAD OF THE SYSTEM ON BOTH SIDES OF TRAFFIC



**SECTION A-A**



**DETAIL A**



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

**Sheet Revisions**

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**MIDWEST  
 GUARDRAIL SYSTEM (MGS)  
 TYPE 3 W-BEAM 31 INCHES**

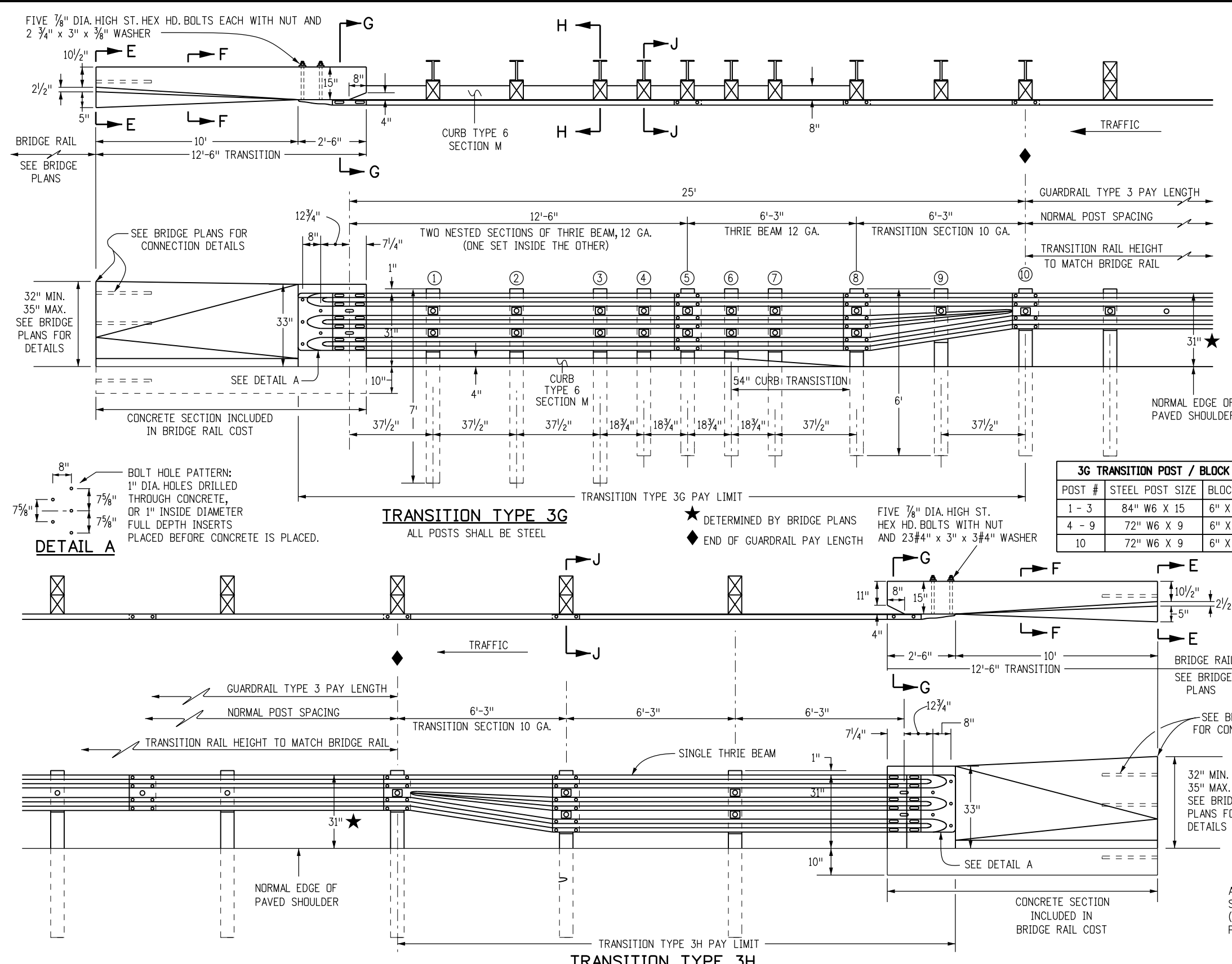
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-606-1**

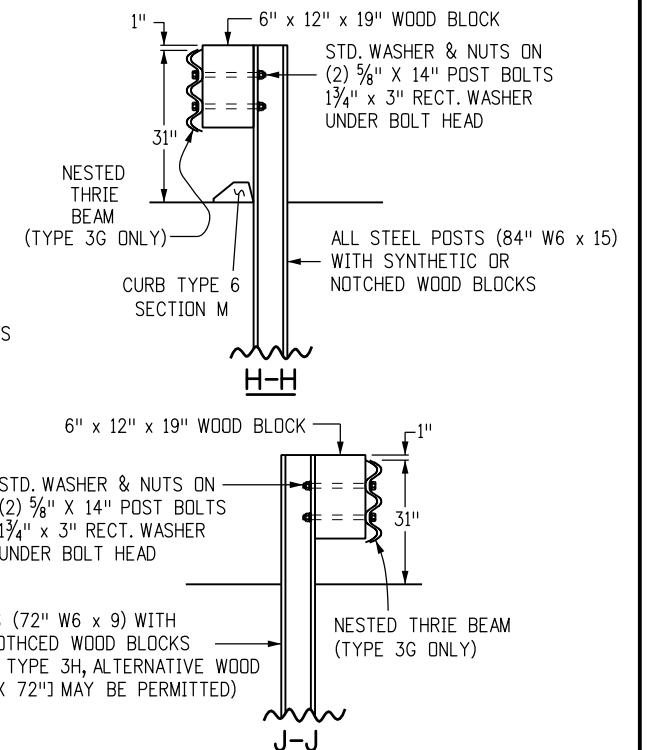
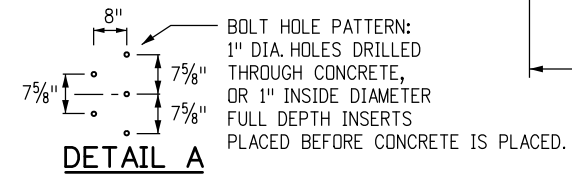
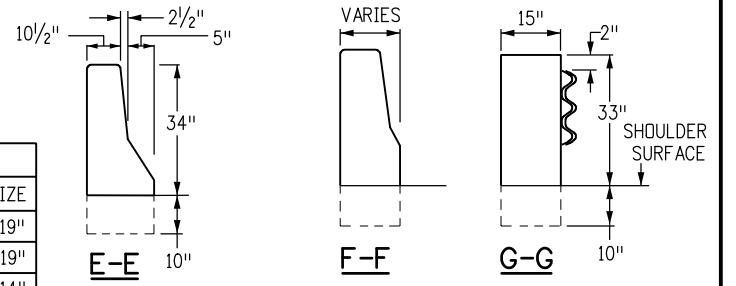
**Standard Sheet No. 10 of 19**

Project Sheet Number:



- ### 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-606-15 FOR THE TRANSITION BETWEEN TYPE 3 GUARDRAIL AND TYPE 9 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. [Symbol] 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. FOR TYPE 3G, POSTS ① THRU ③ ARE 7 FT. LONG. ALL OTHER POSTS SHALL BE A STANDARD 6 FT. LONG 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.

POST #	STEEL POST SIZE	BLOCKOUT SIZE
1 - 3	84" W6 X 15	6" X 12" X 19"
4 - 9	72" W6 X 9	6" X 12" X 19"
10	72" W6 X 9	6" X 12" X 14"



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MIDWEST  
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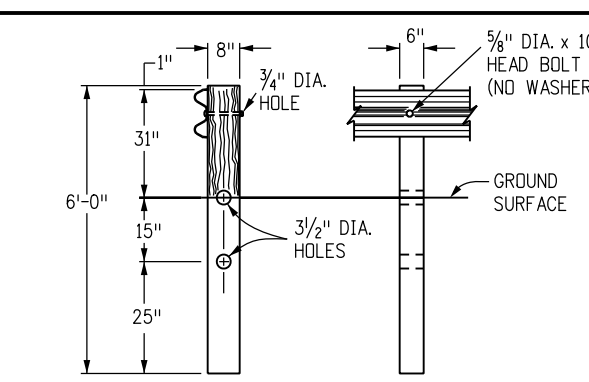
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STANDARD PLAN NO.  
 M-606-1  
 Standard Sheet No. 11 of 19  
 Project Sheet Number:

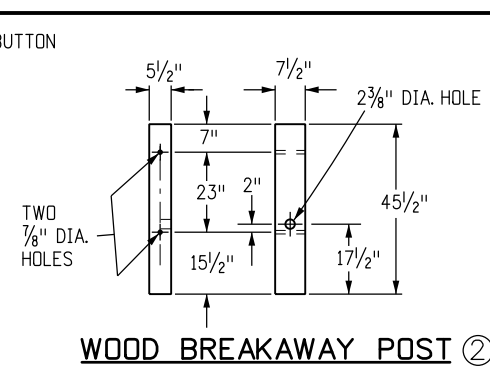
**NOTES**

- 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:
  - CANAL SERVICE ROADS AT BRIDGE ENDS.
  - 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.
- 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.
- 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.
- THE 3/4 IN. GALVANIZED WIRE ROPE (CABLE) SHALL CONFORM TO AASHTO M 30 TYPE II.
- PLATES SHALL CONFORM TO ASTM A 36, AND STRUCTURAL TUBING TO ASTM A 500. WELDING SHALL MEET ALL REQUIREMENTS OF THE AMERICAN WELDING SOCIETY.
- ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN CONFORMANCE WITH ASTM A 123. POSTS SHALL NOT BE PUNCHED, DRILLED, CUT, OR WELDED AFTER GALVANIZING.
- WHEN THE SOIL PLATE WELDED OPTION IS SELECTED, SOIL PLATE CONNECTION BOLT HOLES ARE NOT REQUIRED.
- OUTSIDE NUT SHALL BE TORQUED AGAINST INSIDE NUT WITH THE CABLE INSTALLED TAUT BETWEEN THE ANCHOR PLATE AND FIRST POST.
- ALL CURVED GUARDRAIL SHALL BE SHOP BENT.
- SEE SHEET 5 FOR ANCHOR PLATE AND OTHER DETAILS.
- THE STEEL TUBE MAY BE DRIVEN WITH WOOD POST INSERTED IF NO DAMAGE OCCURS TO THE POST OR BOLTS.



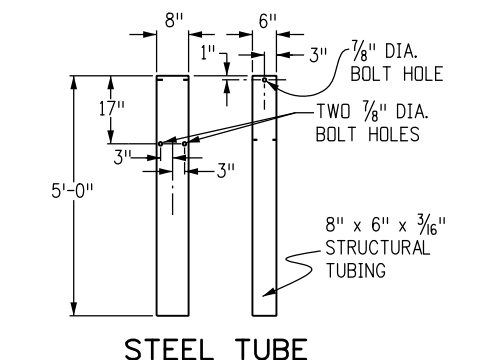
**CONTROLLED RELEASING TERMINAL (CRT) POST ①**



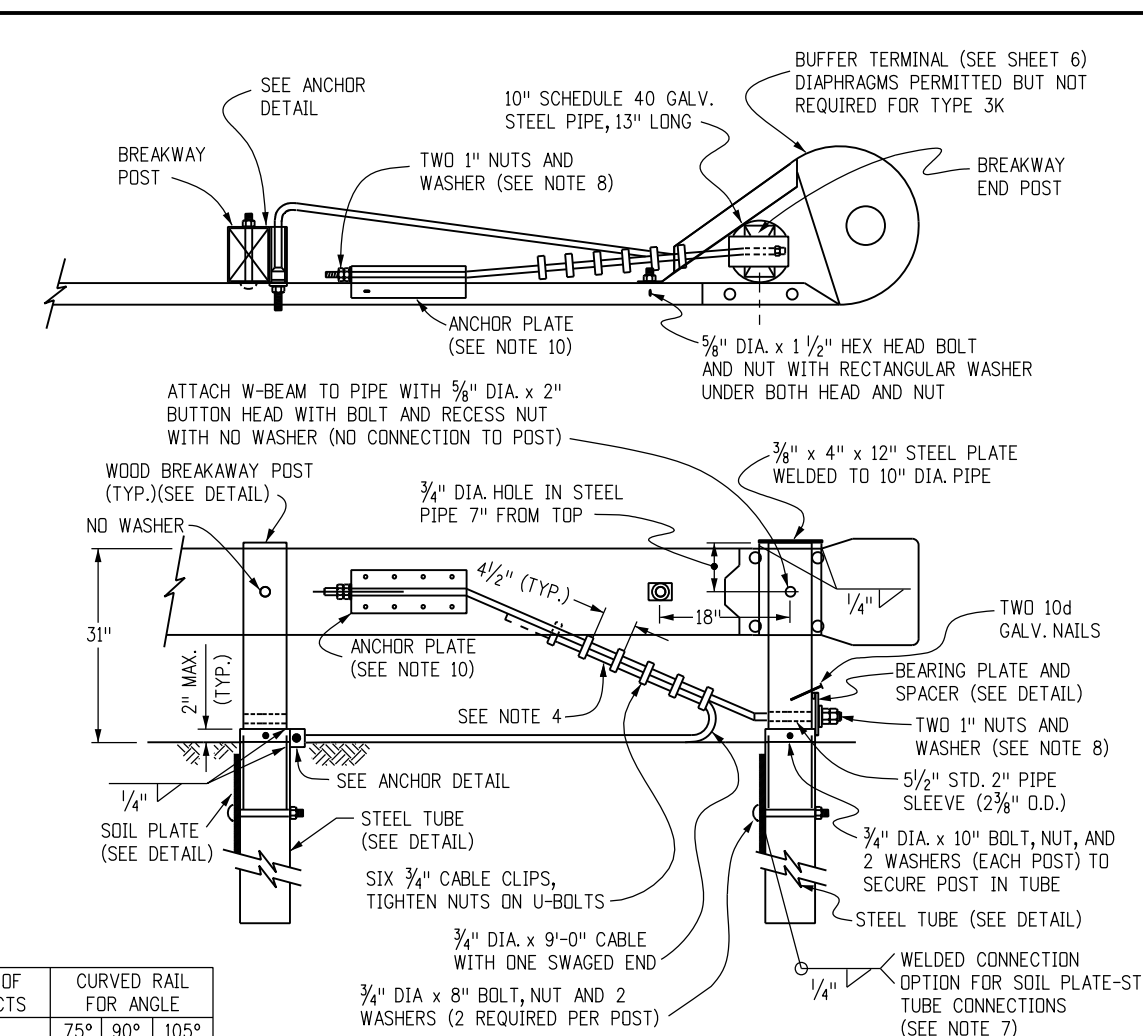
**WOOD BREAKAWAY POST ②**

POST	DIMENSIONS	TYPE
①	6" x 8" x 6'	CRT
②	5 1/2" x 7 1/2" x 45 1/2"	BREAKAWAY

**POSTS**



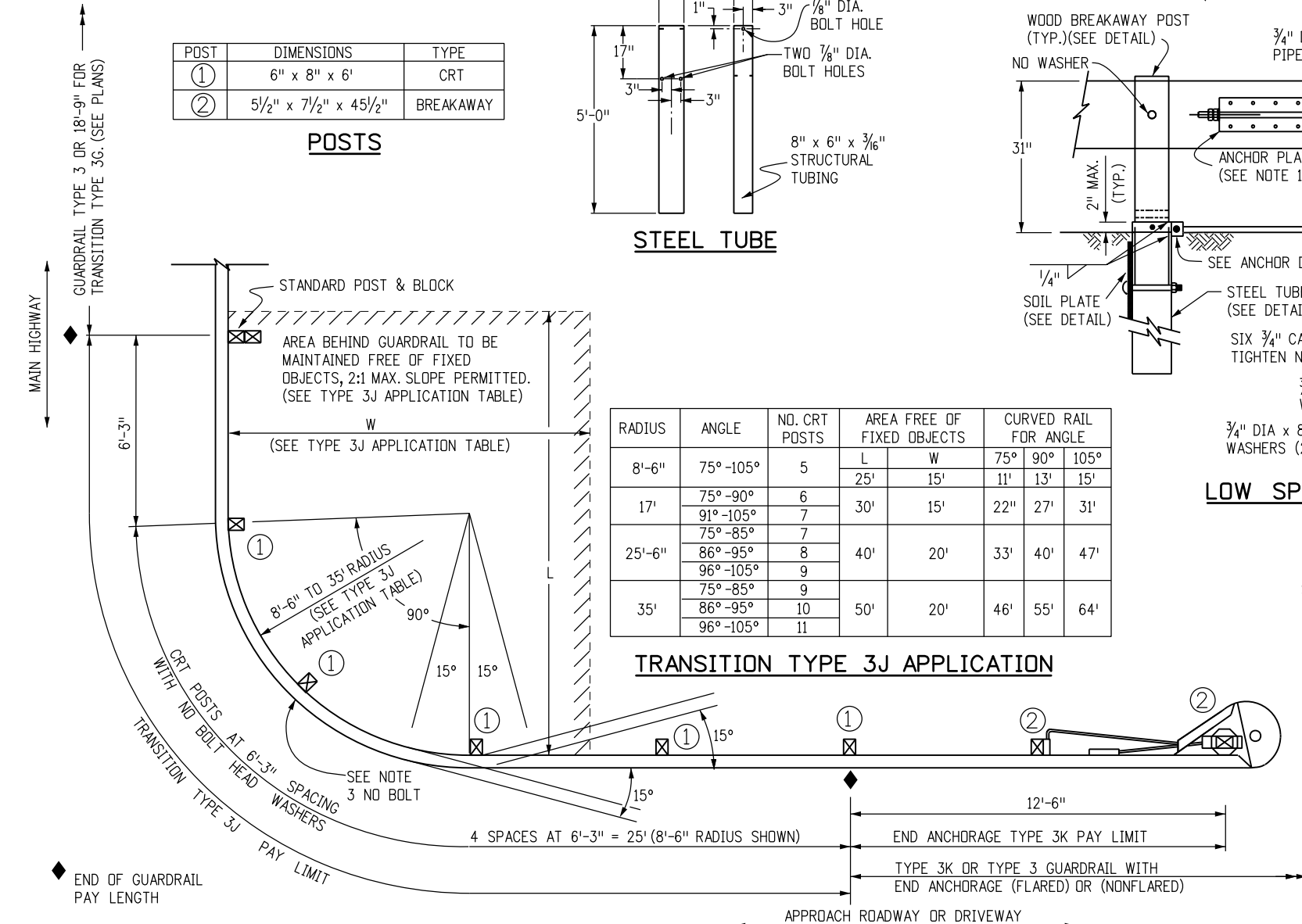
**STEEL TUBE**



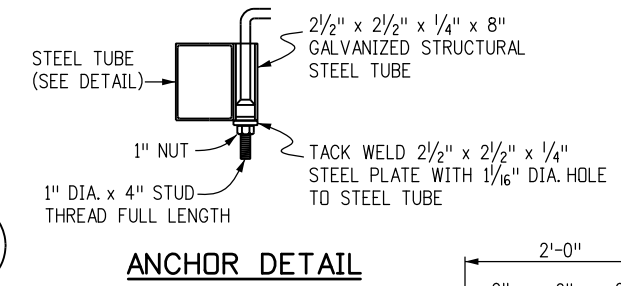
**LOW SPEED END ANCHORAGE - TYPE 3K**

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'
	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					
	75°-85°	9					
35'	86°-95°	10	50'	20'	46'	55'	64'
	96°-105°	11					

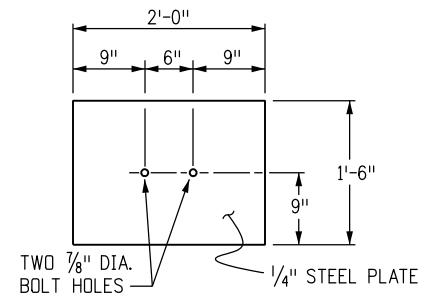
**TRANSITION TYPE 3J APPLICATION**



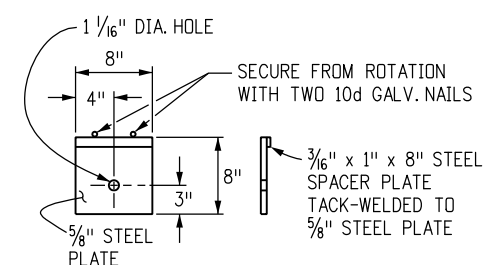
**INTERSECTING ROADWAYS TRANSITION - TYPE 3J TRANSITION**



**ANCHOR DETAIL**



**SOIL PLATE**



**BEARING PLATE FOR STEEL TUBE**

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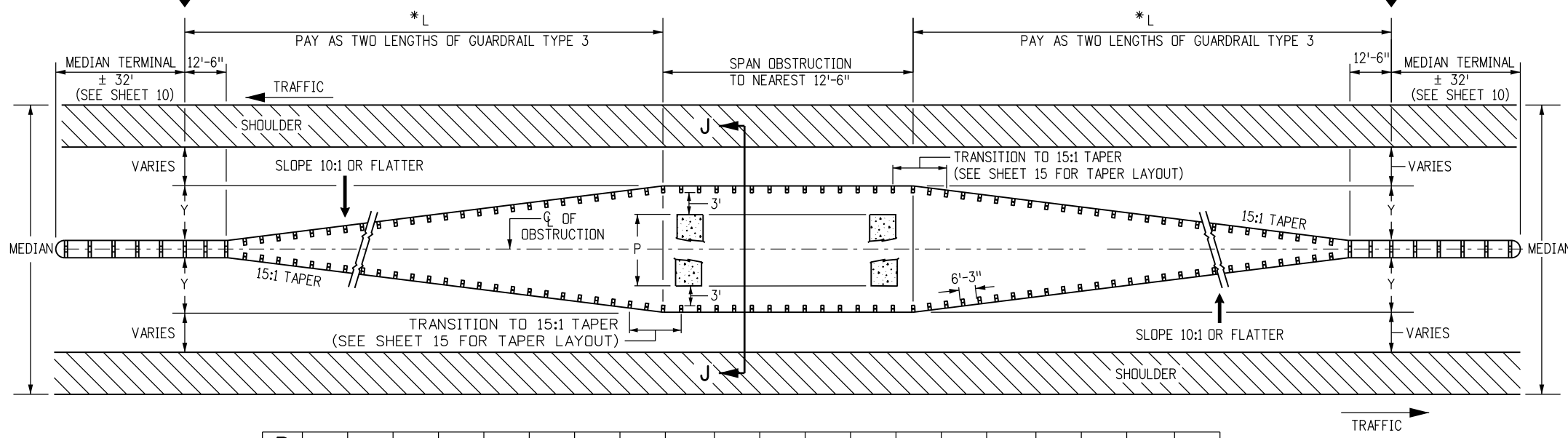
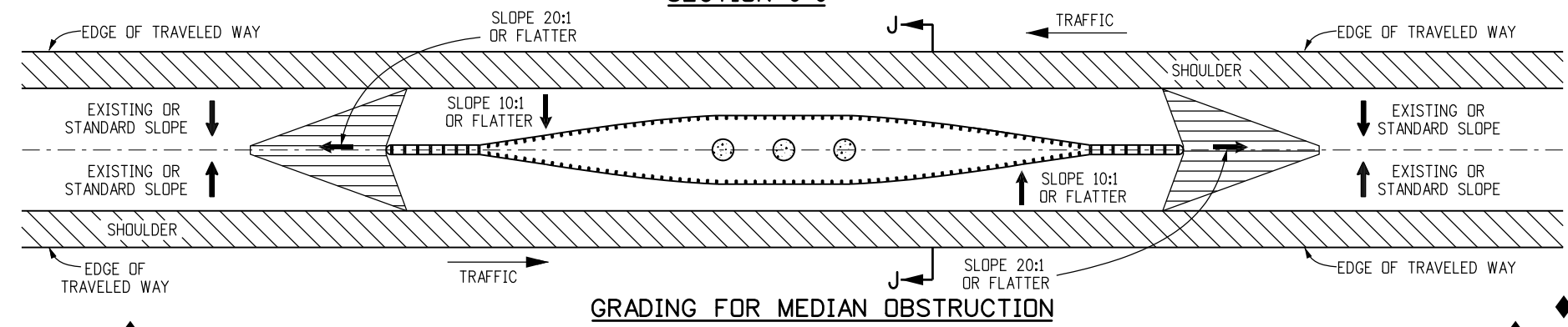
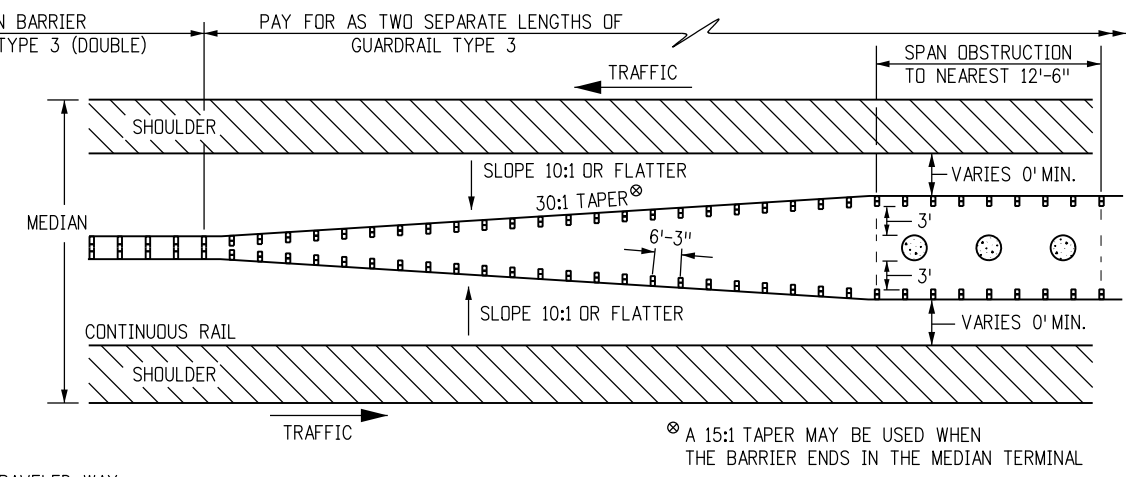
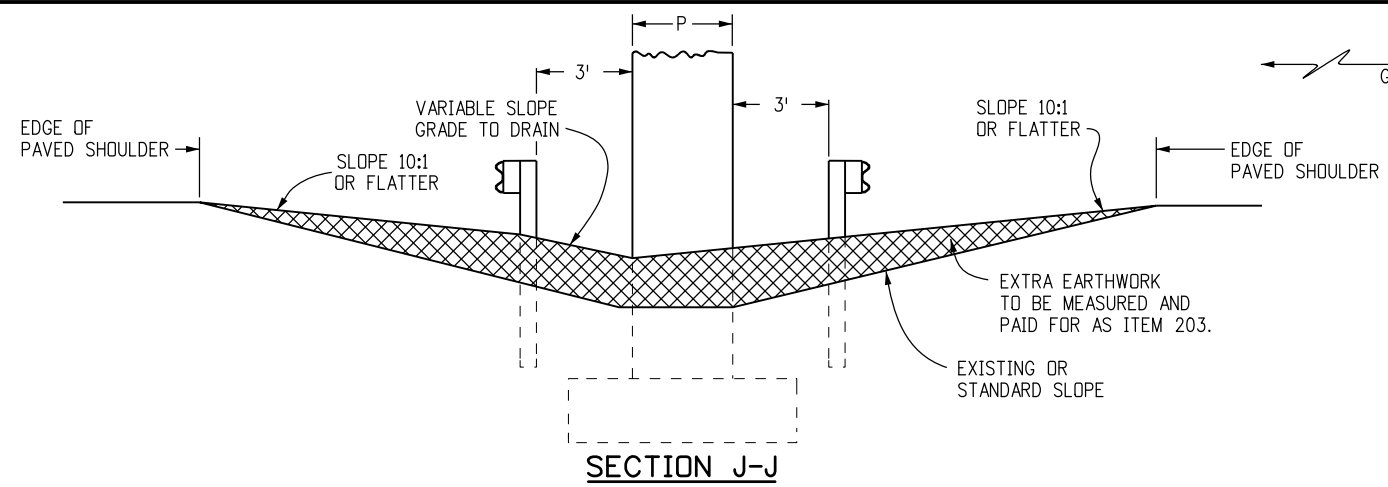
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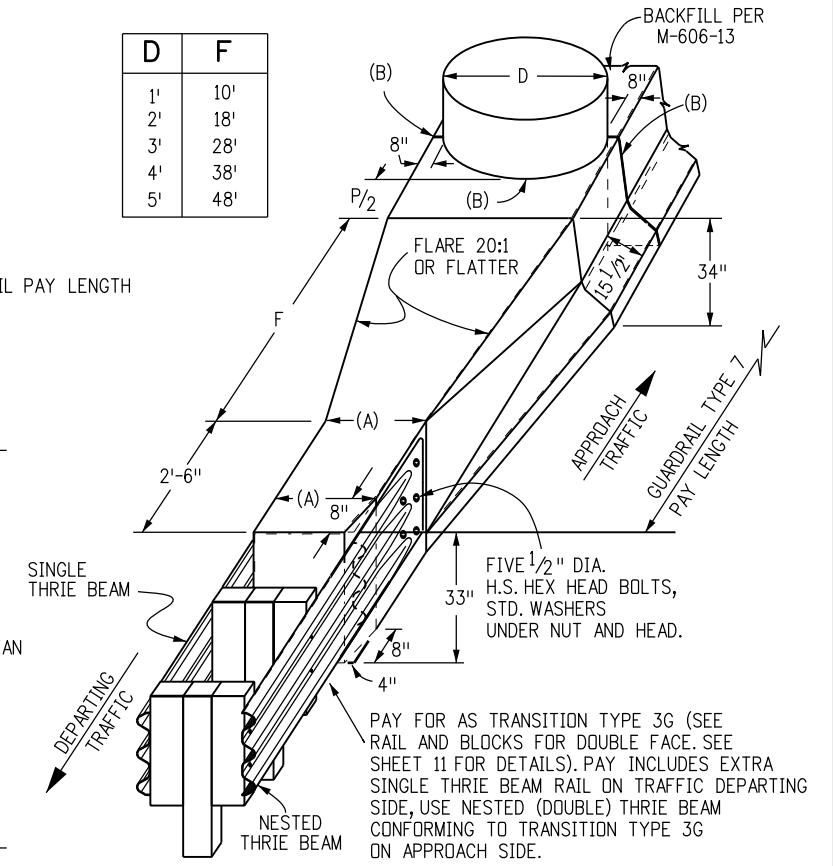
**MIDWEST**  
**GUARDRAIL SYSTEM (MGS)**  
**TYPE 3 W-BEAM 31 INCHES**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
**M-606-1**  
**Standard Sheet No. 12 of 19**  
 Project Sheet Number:



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'							

**GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.**  
NOTE: FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 20 FT. IN MEDIANS USE SHEET 16.



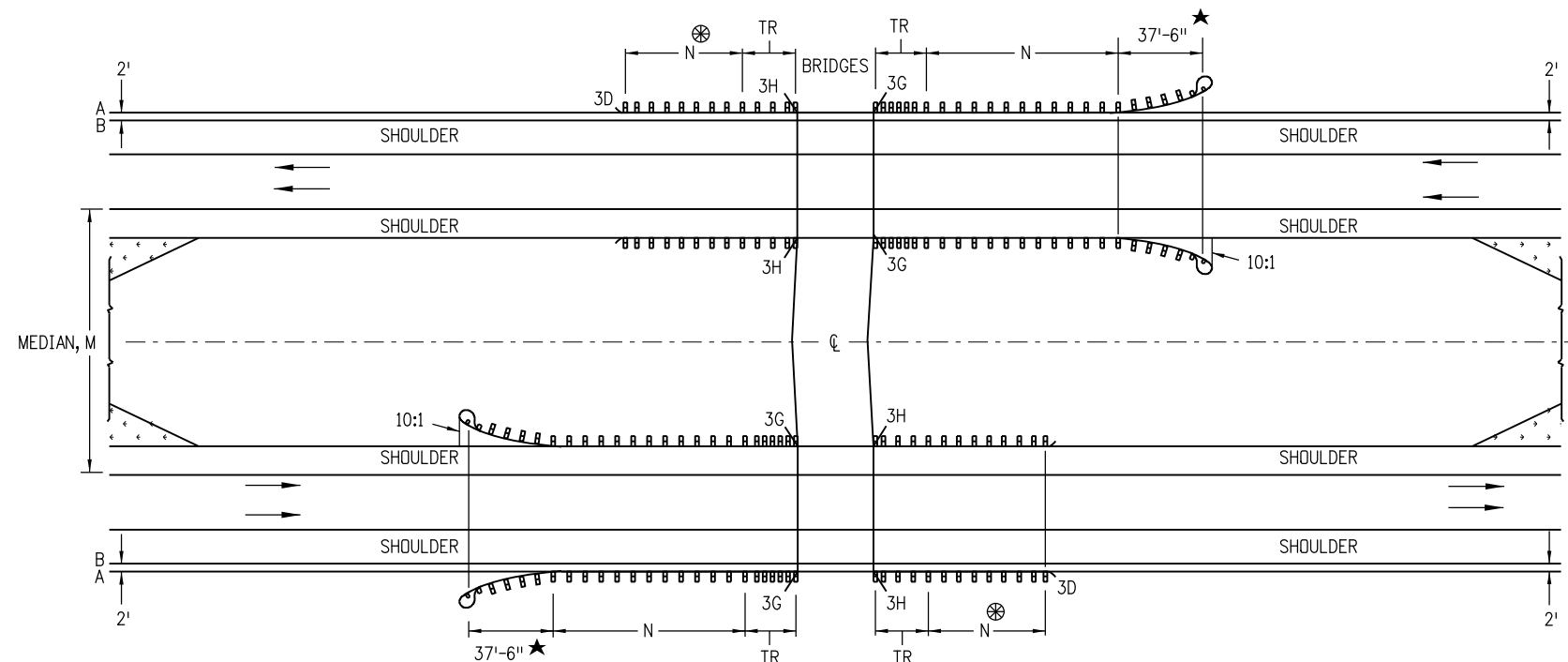
D	F
1'	10'
2'	18'
3'	28'
4'	38'
5'	48'

- (A). TIMBER POSTS 2 FT., STEEL POSTS 1 FT.-9/2 IN.
- (B). 1/2 IN. PREFORMED JOINT MATERIAL

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

**OBSTRUCTIONS IN MEDIANS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES</b>		<b>STANDARD PLAN NO. M-606-1</b>	
Creation Date: 07/31/19		Date: _____		2829 West Howard Place		Issued by the Project Development Branch: July 31, 2019		Standard Sheet No. 13 of 19	
Designer Initials: JBK		Comments: _____		CDOT					
Last Modification Date: 07/31/19				Denver, CO 80204					
Detailer Initials: LTA				Phone: 303-757-9021 FAX: 303-757-9868					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				<b>Project Development Branch</b>		<b>JBK</b>		<b>Project Sheet Number:</b>	



**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.

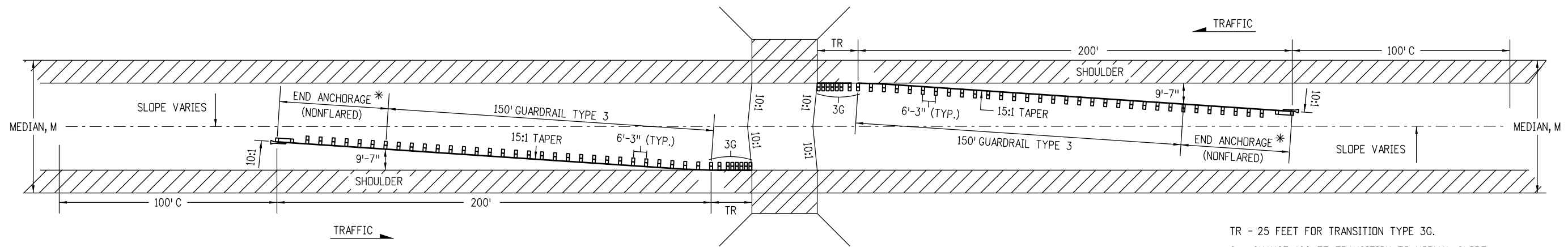
TR - 25 FEET FOR TRANSITION TYPES 3G AND 3H.

A - EDGE OF 8 FT. OR 10 FT. SHOULDER.

B - EDGE OF 6 FT. OR LESS SHOULDER.

★ - END ANCHORAGE CAN BE FLARED OR NONFLARED.

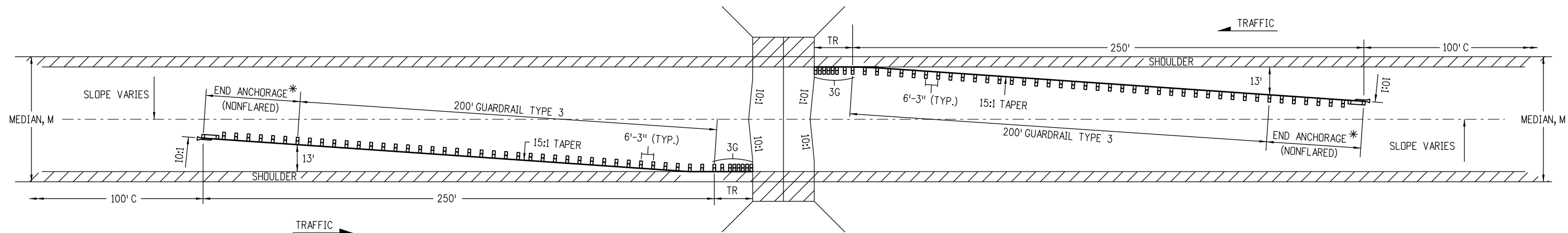
<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>MIDWEST</b>		<b>STANDARD PLAN NO.</b>			
Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868		<b>GUARDRAIL SYSTEM (MGS)</b>		M-606-1			
Designer Initials: JBK		(R-X)						<b>TYPE 3 W-BEAM 31 INCHES</b>		Standard Sheet No. 14 of 19	
Last Modification Date: 07/31/19		(R-X)								Issued by the Project Development Branch: July 31, 2019	
Detailer Initials: LTA		(R-X)				Project Development Branch		JBK			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)									



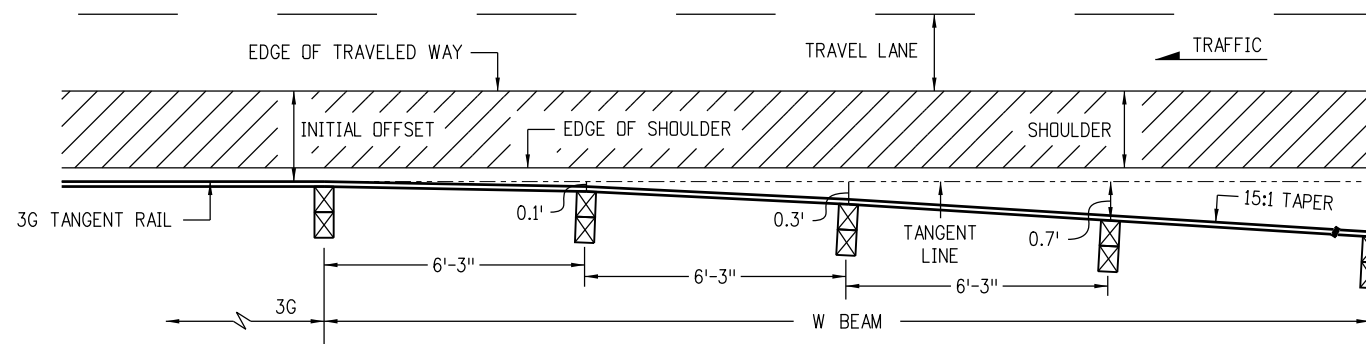
**MEDIANS 60 FT. AND OVER WITH 10 FT. OR WIDER SHOULDERS.**

\* END ANCHORAGE LENGTH AND FLARE RATES VARY BY DEVICE. SEE MANUFACTURER/SUPPLIER FOR INSTALLATION REQUIREMENTS.

TR - 25 FEET 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**

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

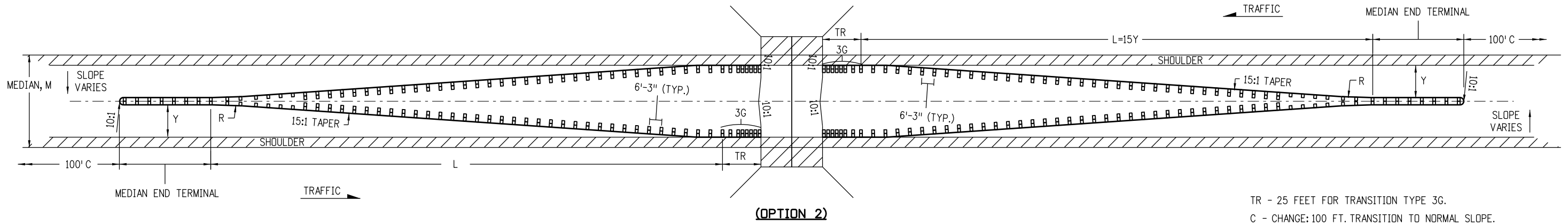
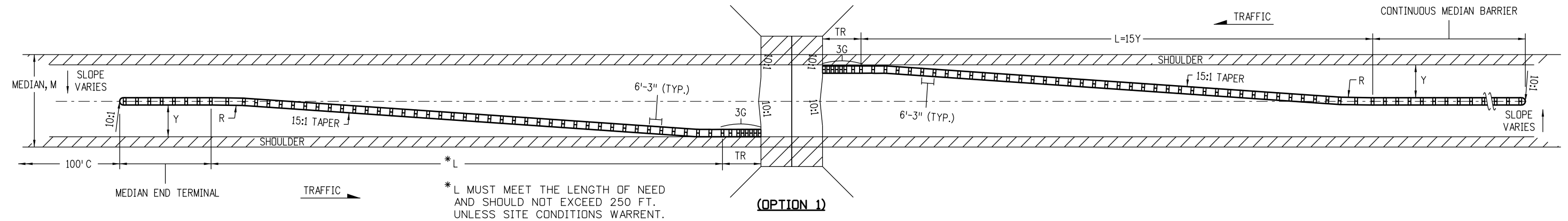
**NOTES**

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 25 FEET BASED ON POST OFFSET DIMENSIONS SHOWN.
2. SEE SHEET 14 FOR THE RIGHT SHOULDER GUARDRAIL LAYOUT.

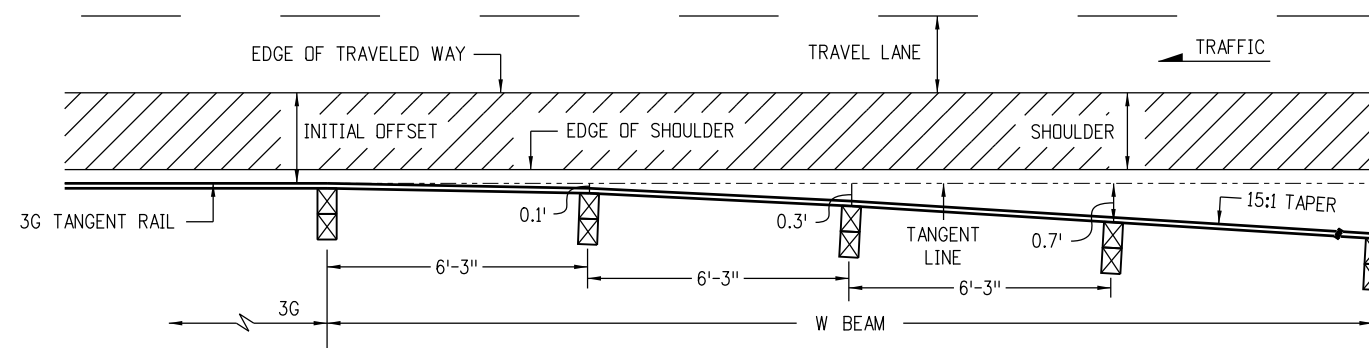
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>MIDWEST</b> <b>GUARDRAIL SYSTEM (MGS)</b> <b>TYPE 3 W-BEAM 31 INCHES</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-606-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 15 of 19	
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			Project Development Branch	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	

**NOTES**

1. GUARDRAIL TRANSITIONS FROM PARALLEL TO ROADWAY SHOULDER AT 3G SEGMENT TO 15:1 TAPER WITHIN 25 FEET 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.



TR - 25 FEET 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)**

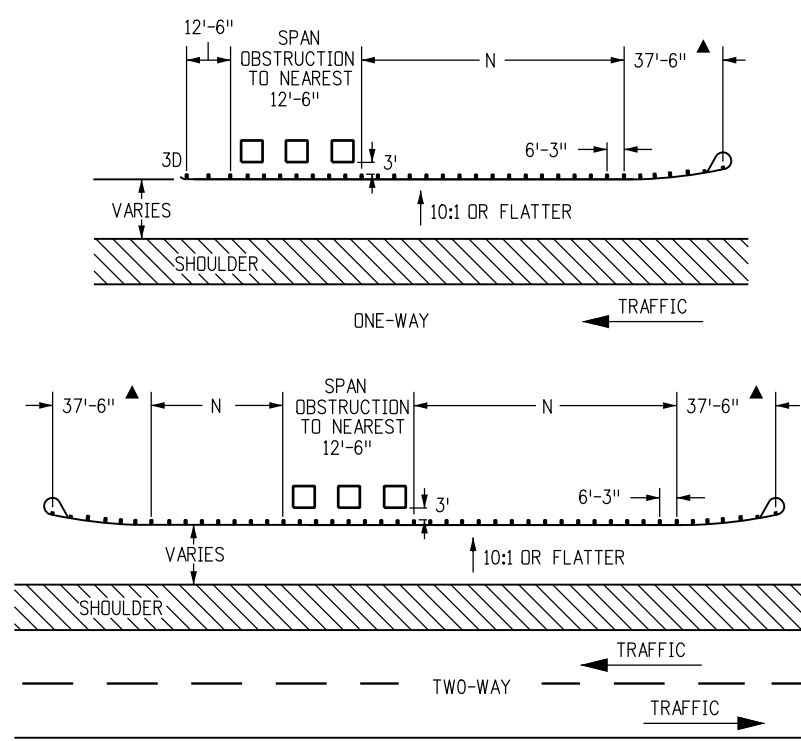
<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES</b>		<b>STANDARD PLAN NO. M-606-1</b>	
Creation Date: 07/31/19		Date:	Comments:	2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868		Issued by the Project Development Branch: July 31, 2019		Standard Sheet No. 16 of 19 Project Sheet Number:	
Designer Initials: JBK		(R-X)							
Last Modification Date: 07/31/19		(R-X)							
Detailer Initials: LTA		(R-X)							
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>Project Development Branch</b>		<b>JBK</b>			



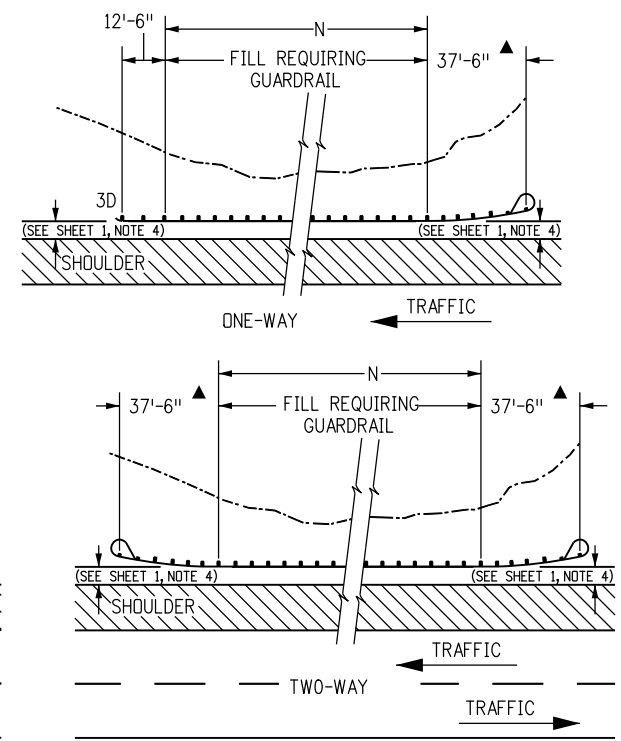
**NOTES**

1. A TYPE 3G OR 3H TRANSITION (SEE SHEET 11) SHALL BE USED TO CONNECT THE TYPE 3 W-BEAM TO A TYPE 9 CONCRETE BARRIER (SEE M-606-15) OR TO A TYPE 8 OR 10 BRIDGE RAIL.
2. "TR" SHALL BE 25 FEET FOR THE TRANSITION TYPES 3G AND 3H.
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.

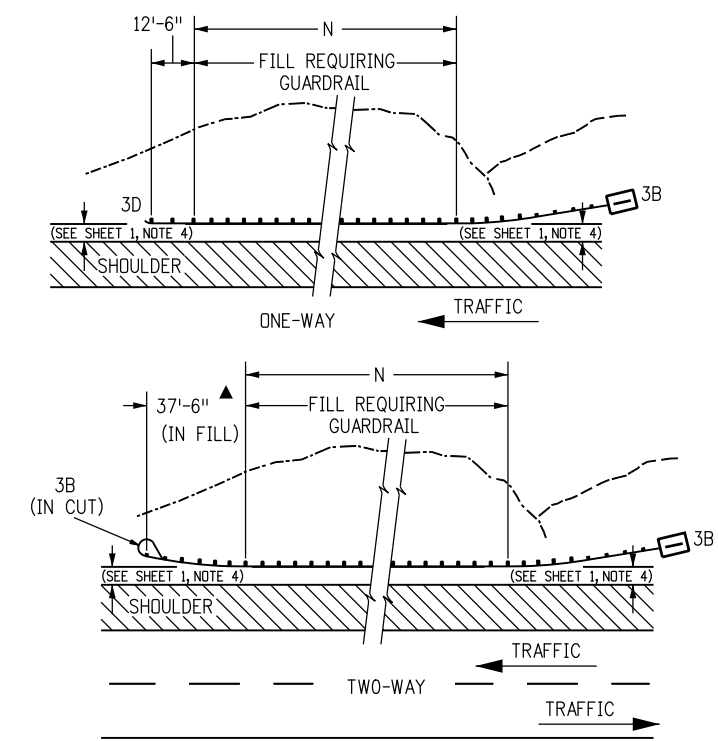
▲ END ANCHORAGE CAN BE FLARED OR NONFLARED



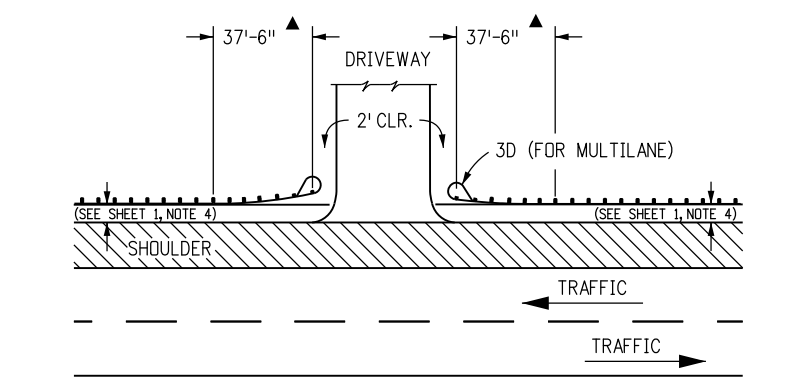
**GUARDRAIL FOR ROADSIDE OBSTRUCTIONS**



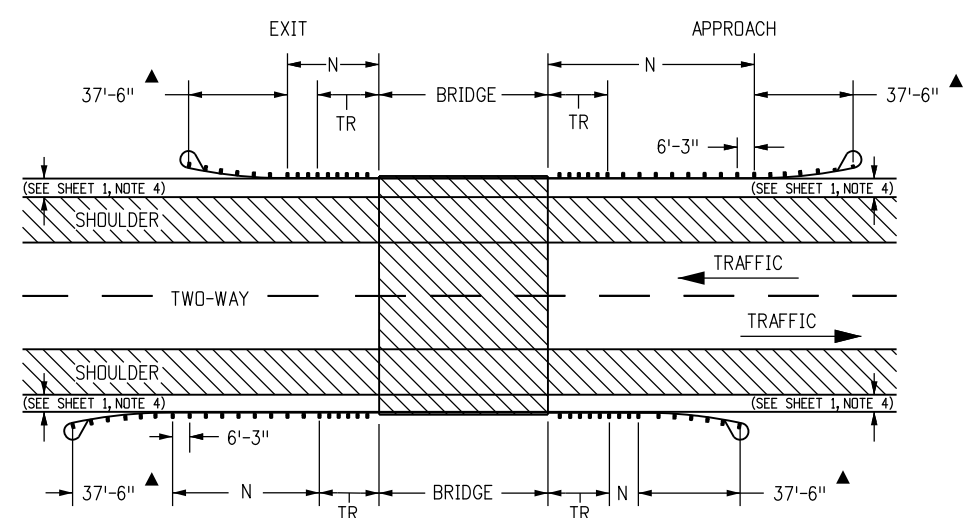
**GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION**



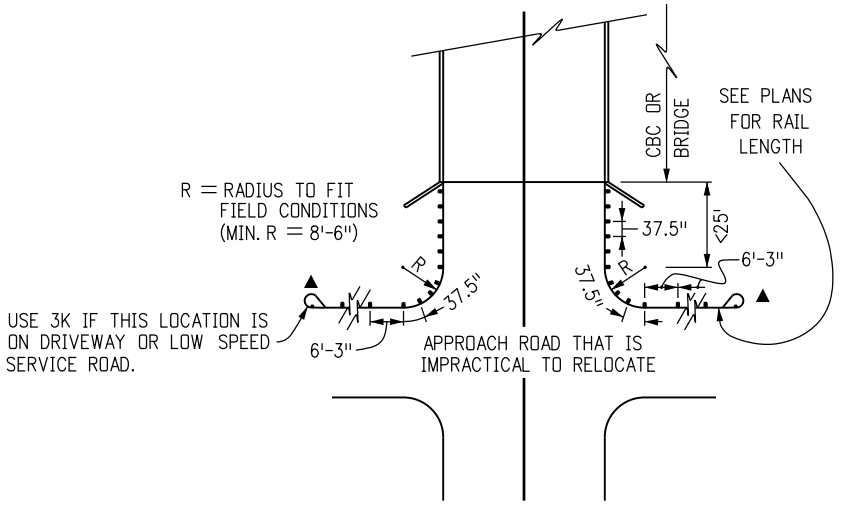
**GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION**



**LAYOUT FOR DRIVEWAY APPROACH**



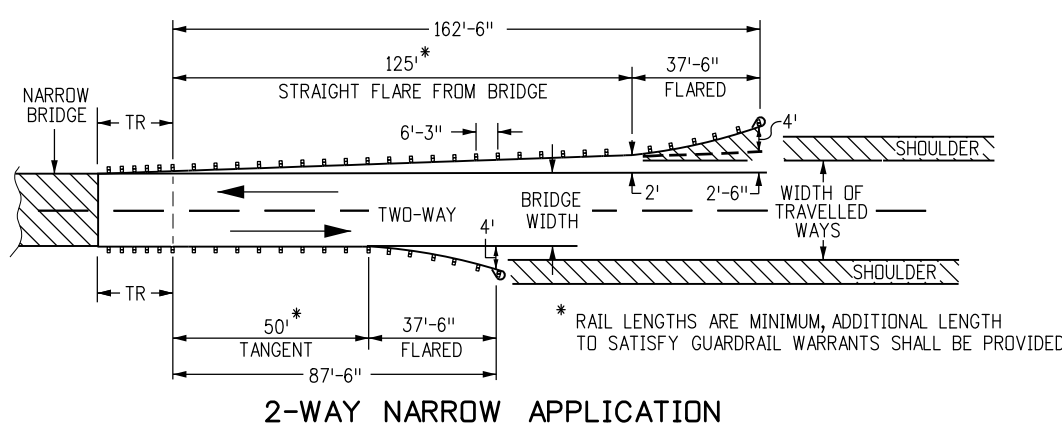
**2-WAY NORMAL BRIDGE APPLICATION**



GUARDRAIL TYPE 3 WITH BLOCKED OUT POSTS SPACED AT 3'-1/2" FROM STRUCTURE AROUND CURVE.

**INTERRUPTED STRUCTURE APPROACH**

(USE TYPE 3J ON SHEET 12 WHEN PRACTICAL)



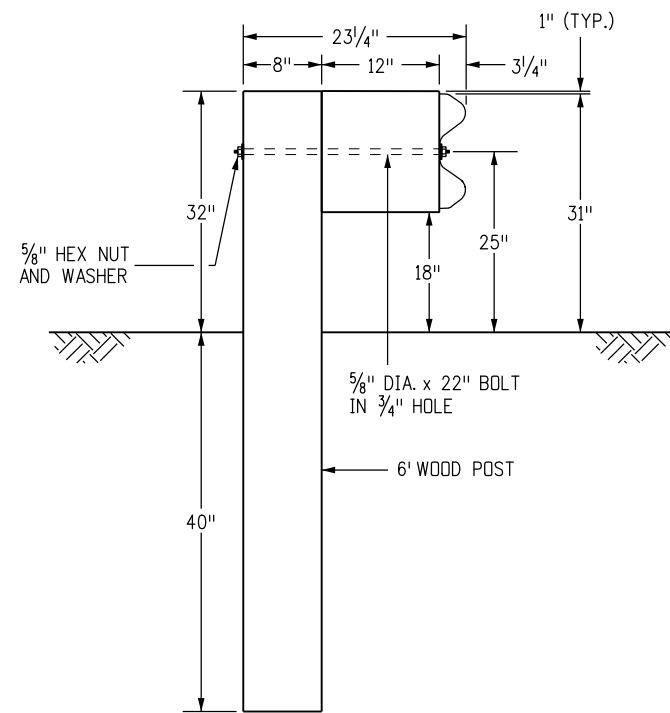
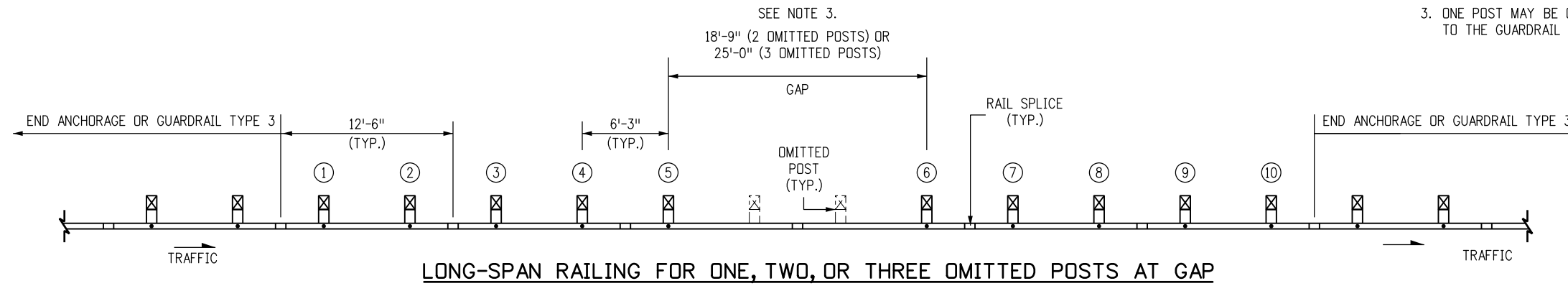
**2-WAY NARROW APPLICATION**

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

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES</b>		<b>STANDARD PLAN NO. M-606-1</b>		
Creation Date: 07/31/19		Date:	Comments:	2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868	<b>Project Development Branch</b> <b>JBK</b>		Issued by the Project Development Branch: July 31, 2019		<b>Standard Sheet No. 17 of 19</b> Project Sheet Number:	
Designer Initials: JBK	(R-X)									
Last Modification Date: 07/31/19	(R-X)									
Detailer Initials: LTA	(R-X)									
CAD Ver.: MicroStation V8    Scale: Not to Scale    Units: English	(R-X)									

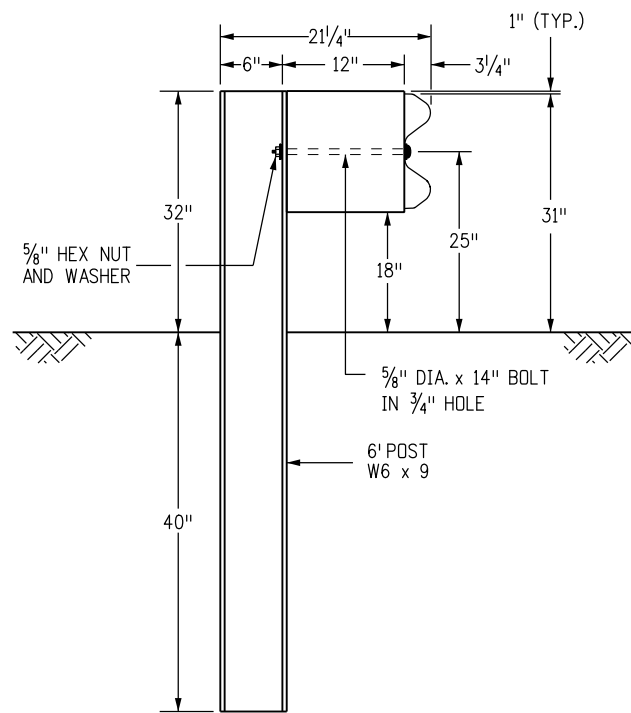
**NOTES**

1. POSTS ①, ②, ⑨, and ⑩ MAY BE TIMBER OR STEEL.
2. THE NUMBER OF OMITTED POSTS IS DEPENDENT ON THE LENGTH OF THE GAP.
3. ONE POST MAY BE OMITTED WITHOUT ANY MODIFICATION TO THE GUARDRAIL RUN.



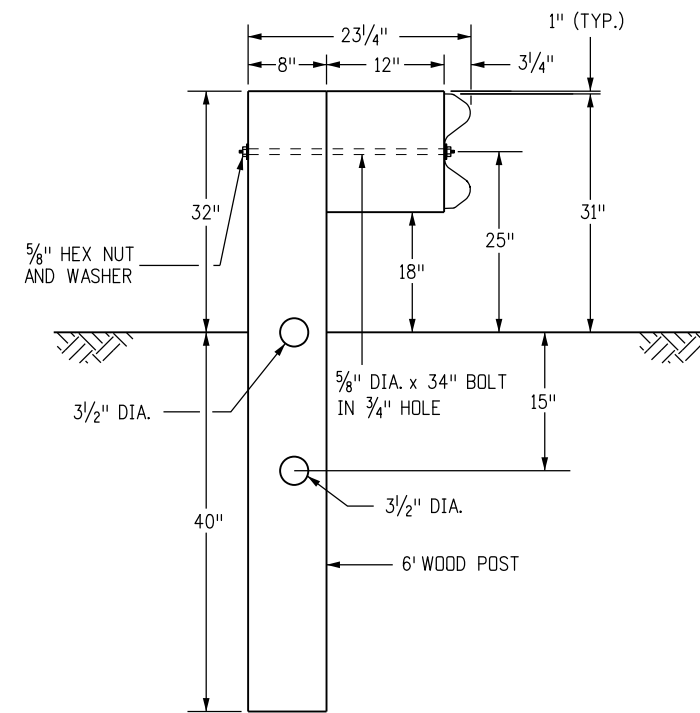
**TIMBER POST**

POSTS ①-② AND ⑨-⑩  
(SEE NOTE 1)



**STEEL POST**

POSTS ①-② AND ⑨-⑩  
(SEE NOTE 1)



**BREAKWAY TIMBER POST**

POSTS ③ - ⑧

**Computer File Information**

Creation Date: 07/31/19	(R-X)
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch **JBK**

**MIDWEST  
 GUARDRAIL SYSTEM (MGS)  
 TYPE 3 W-BEAM 31 INCHES**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

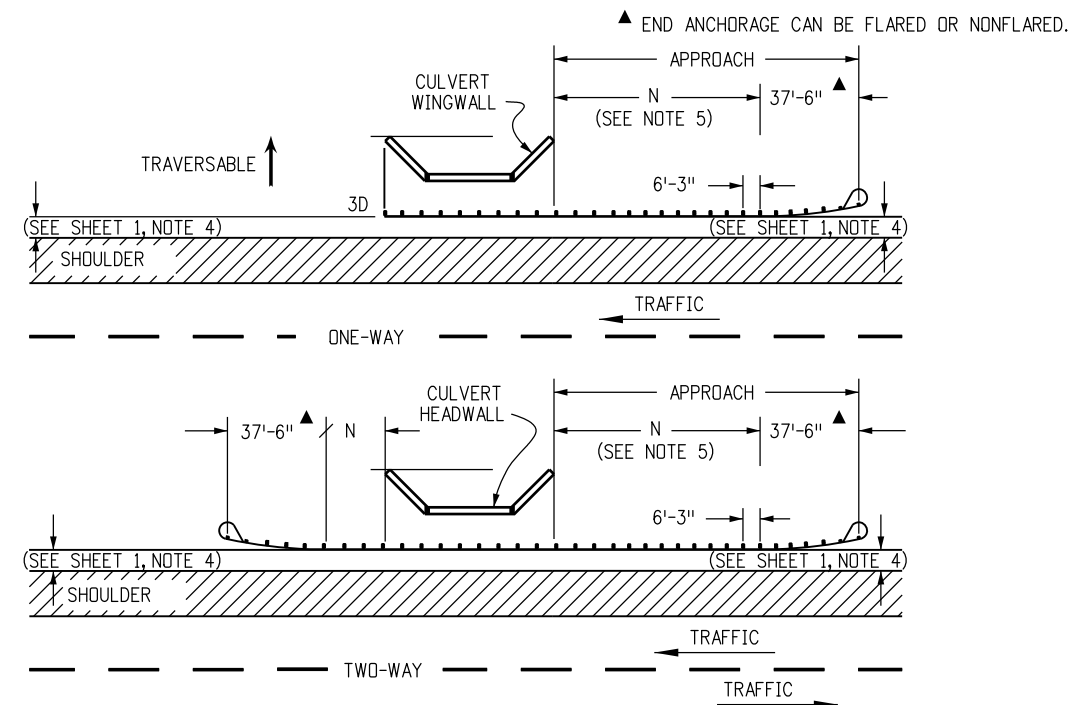
**M-606-1**

**Standard Sheet No. 18 of 19**

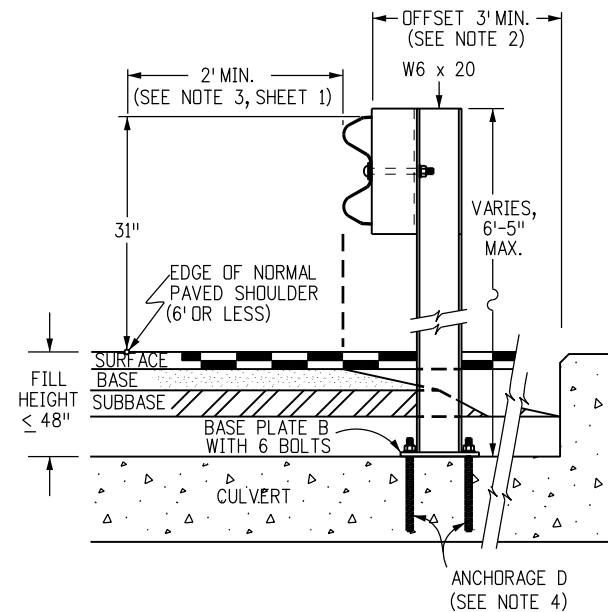
Project Sheet Number:

**NOTES**

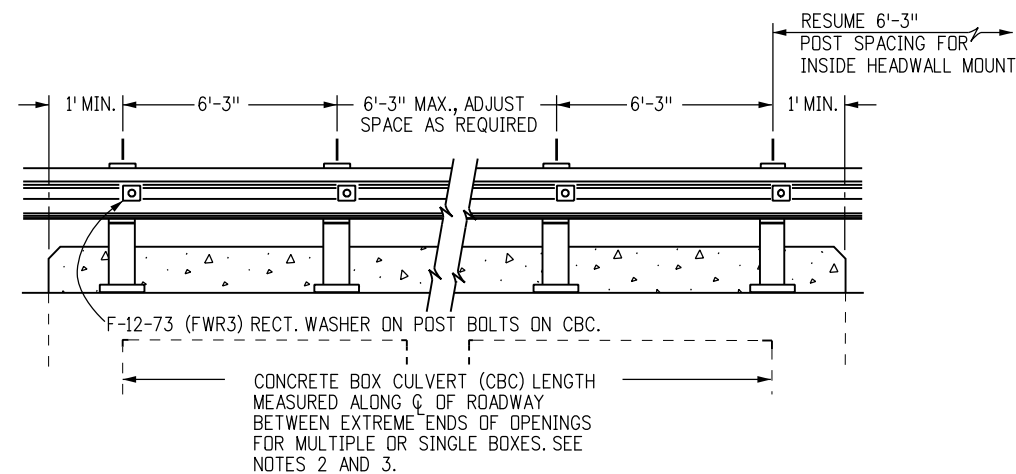
1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND WINGWALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 15. THE GUARDRAIL TYPE 3 SHALL CONTINUE ACROSS THE CULVERT AS SHOWN ON THIS SHEET.
2. RIGHT SHOULDER BOX CULVERT TREATMENT IS SHOWN ON THIS SHEET FOR CULVERTS 20 FT. OR LESS IN LENGTH.
3. CONSTRUCTION AND PAYMENT FOR FILL HEIGHTS SHALL BE INCLUDED IN THE COST OF THE GUARDRAIL TYPE 3.
4. 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 NEW STRUCTURES. FOR EXISTING STRUCTURES, THE RODS SHALL BE INSTALLED IN 1-1/4 IN. DIA HOLES WITH NON-SHRINK GROUT OR EPOXY CONFORMING TO ASTM C 881. IF THE THICKNESS OF A CULVERT'S TOP PANEL REQUIRES BOLTS TO BE LESS THAN 10 IN. HIGH, THE BOLTS SHALL BE APPROVED BY THE ENGINEER.
5. 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.
6. 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.
7. POST ANCHORS, ENCASED IN CONCRETE, SHALL BE ASTM A 36 STEEL, AND NEED NOT BE GALVANIZED.
8. PRIOR TO INSTALLATION OF GUARDRAIL ON CULVERTS, THREE SETS OF WORKING DRAWINGS WHICH COMPLY WITH THE REQUIREMENTS OF SECTION 105 SHALL BE SUBMITTED TO THE ENGINEER FOR INFORMATION ONLY.



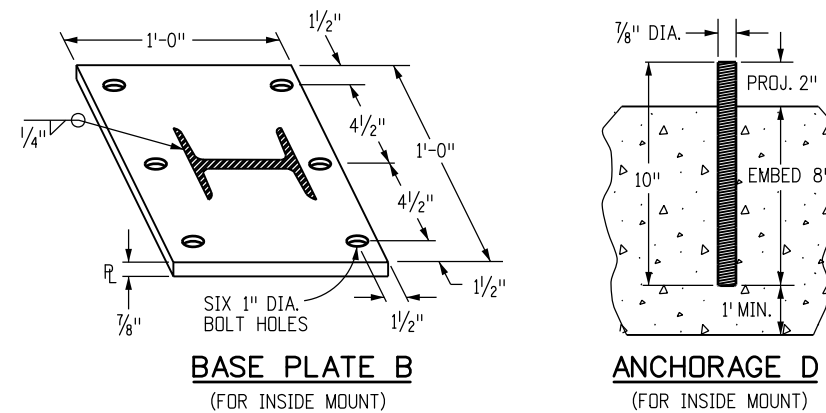
**GUARDRAIL FOR CULVERTS**



**INSIDE MOUNT ON CBC**



**RAIL PLACEMENT FOR INSIDE MOUNT**



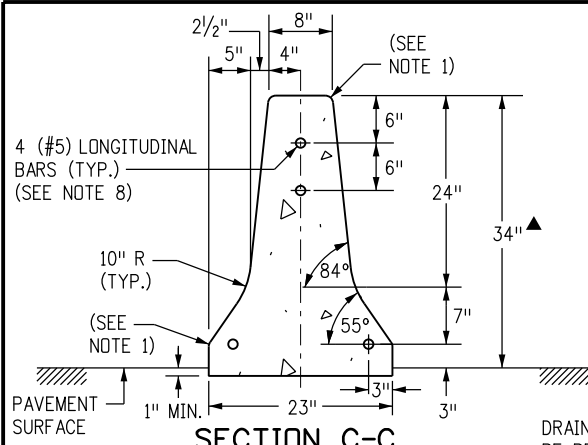
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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 Project Development Branch **JBK**

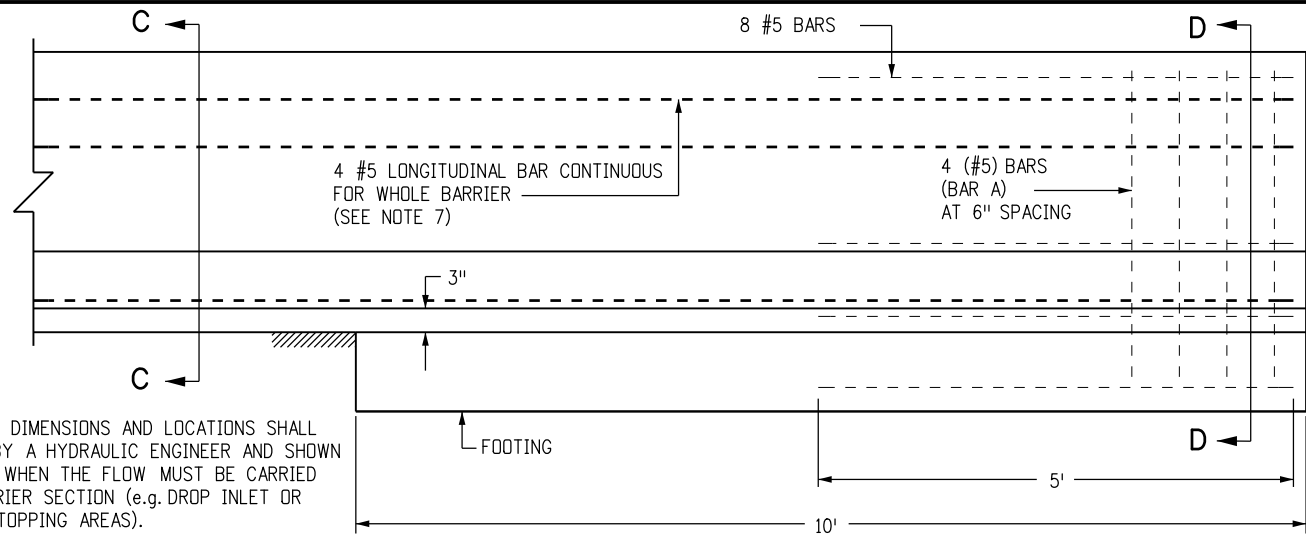
**MIDWEST**  
**GUARDRAIL SYSTEM (MGS)**  
**TYPE 3 W-BEAM 31 INCHES**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**  
**M-606-1**  
**Standard Sheet No. 19 of 19**  
 Project Sheet Number:



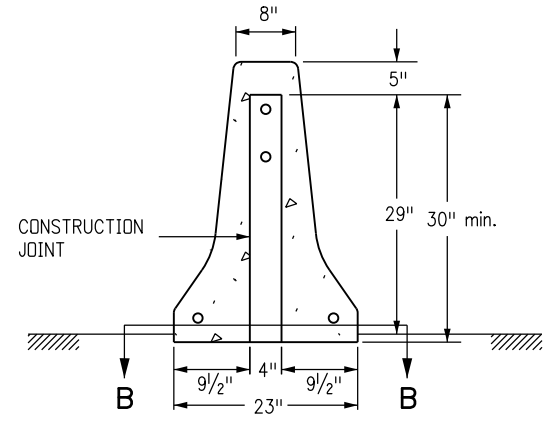
**SECTION C-C  
STYLE CA  
CONCRETE BARRIER (TYP.)**

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).



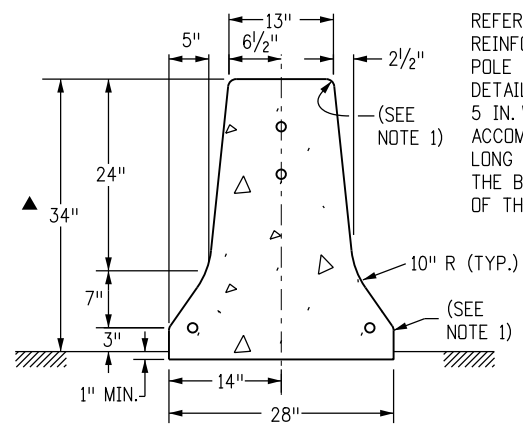
**ANCHORAGE**

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



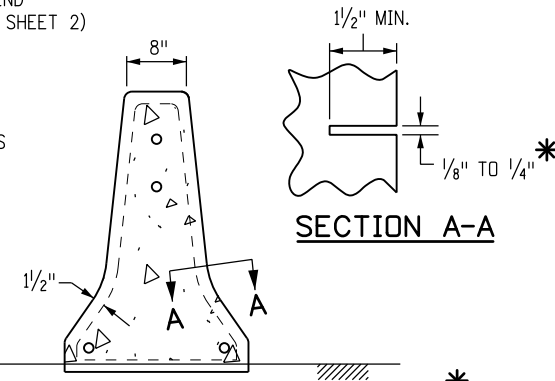
**SECTION B-B  
CONSTRUCTION JOINT**

\* SEE STYLE CA DETAIL FOR TYPICAL DIMENSIONS.



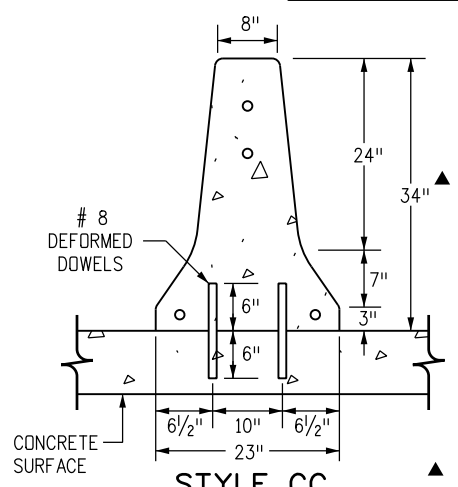
**STYLE CL  
BARRIER FOR MOUNTED LIGHT POLES**

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.



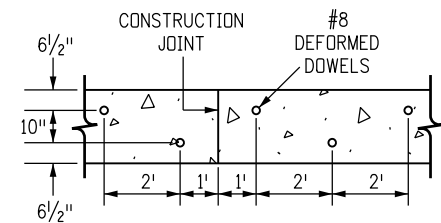
**TRANSVERSE CONTRACTION JOINTS**

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.

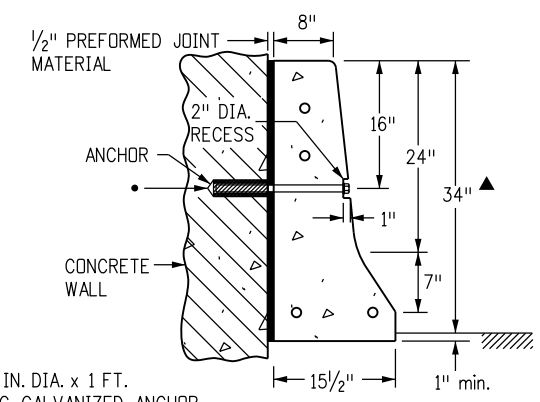


**STYLE CC  
BARRIER DOWELLED TO CONCRETE SURFACE**

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

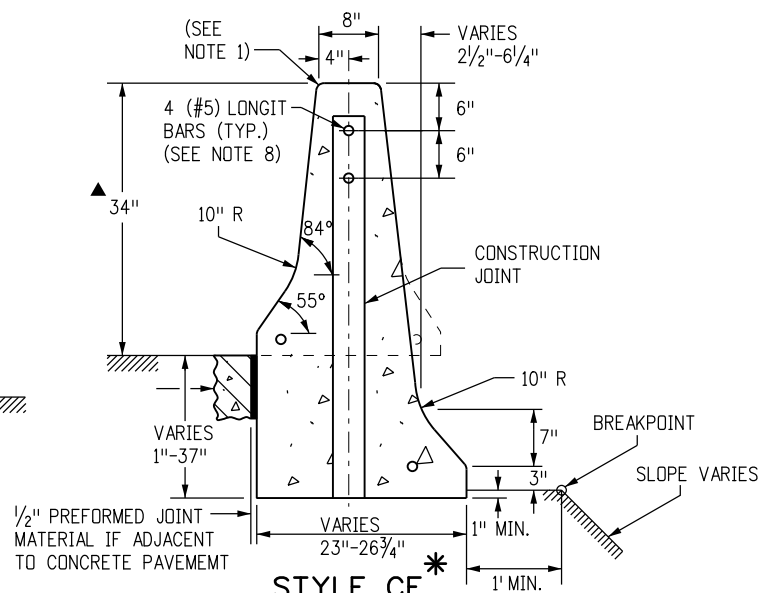


**DOWEL PLACEMENT LAYOUT  
FOR STYLE CC BARRIER  
(PLAN VIEW)**

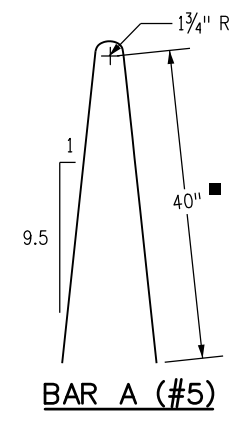


**STYLE CD  
BARRIER AGAINST WALL**

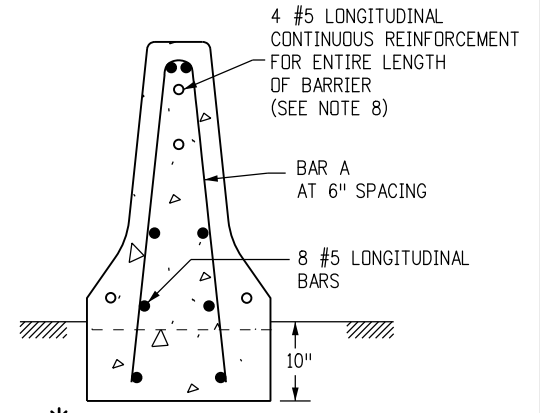
\* 1/2 IN. DIA. x 1 FT. LONG GALVANIZED ANCHOR BOLT AND WASHER, MECHANICALLY FASTENED AT 2 FT. - 6 IN. CENTERS. USE ONLY WHEN CALLED FOR ON PLANS.



**STYLE CE  
BARRIER FOR OFFSET ROADWAYS**



**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)

**GENERAL NOTES**

- ALL EDGES SHALL BE ROUNDED WITH A 1 IN. RADIUS EXCEPT AS SHOWN.
- 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.
- BARRIER MAY BE CAST-IN-PLACE, SLIP FORMED, OR PRECAST (SEE STANDARD PLAN M-606-14).
- BARRIER FOUNDATION SHALL BE PAVEMENT, OR COMPACTED AGGREGATE BASE, OR EMBANKMENT MATERIAL.
- NO FOOTING IS REQUIRED (TYP.) EXCEPT FOR 10 FT. ANCHORAGE.
- 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.
- REINFORCING STEEL IN ANCHORAGE SHALL BE GRADE 60 EPOXY COATED DEFORMED BARS.
- 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.
- TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 10 FT. LONG SEGMENT OF BARRIER.
- CONCRETE SHALL BE CLASS D.
- ADDITIONAL MATERIAL FOR BARRIER EMBEDMENT GREATER THAN 1 IN. WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- 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.
- 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.
- RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.

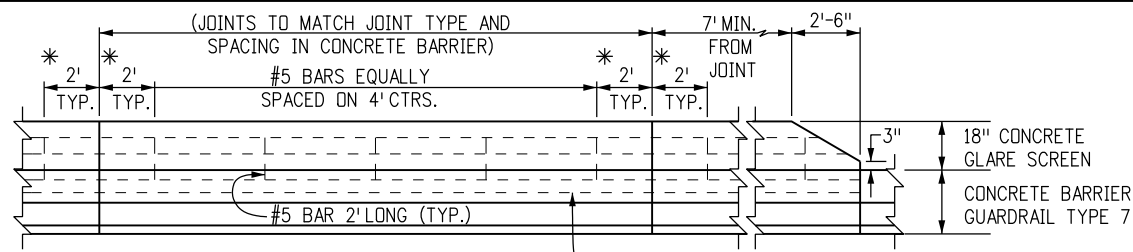
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Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

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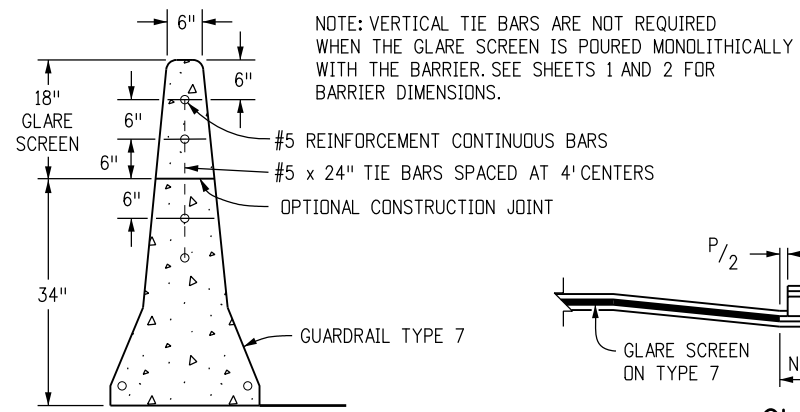
**GUARDRAIL TYPE 7  
F-SHAPE BARRIER**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
M-606-13  
Standard Sheet No. 1 of 4**  
 Project Sheet Number:

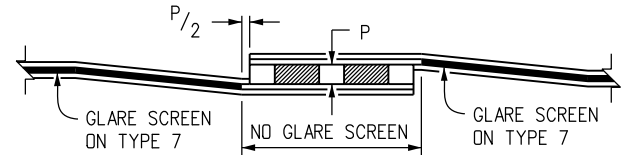


**ELEVATION** #5 REINFORCEMENT CONTINUOUS BARS

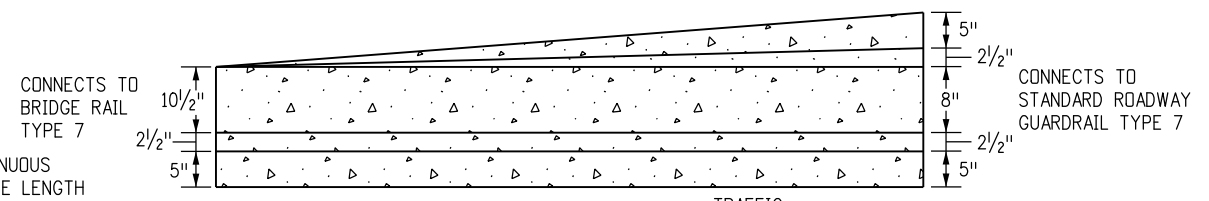
\* 2 FT. IS TYPICAL FOR CAST-IN-PLACE BARRIERS.  
1 FT. IS TYPICAL FOR PRECAST BARRIERS.  
THE MINIMUM ACCEPTABLE DIMENSION IS 6 IN.



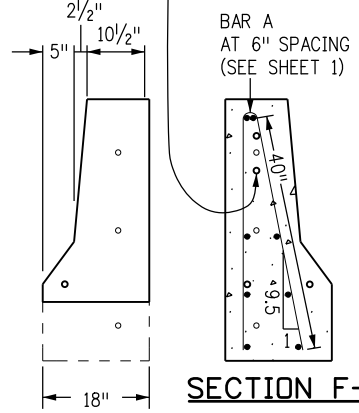
**CONCRETE GLARE SCREEN**



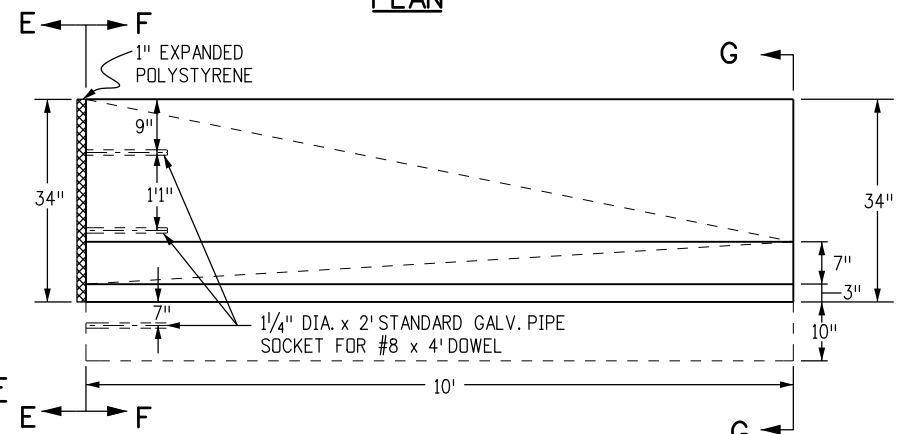
**GLARE SCREEN AT MEDIAN OBSTRUCTIONS**



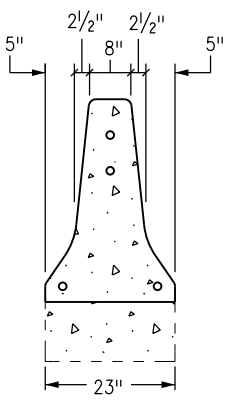
**PLAN**



**SECTION E-E**



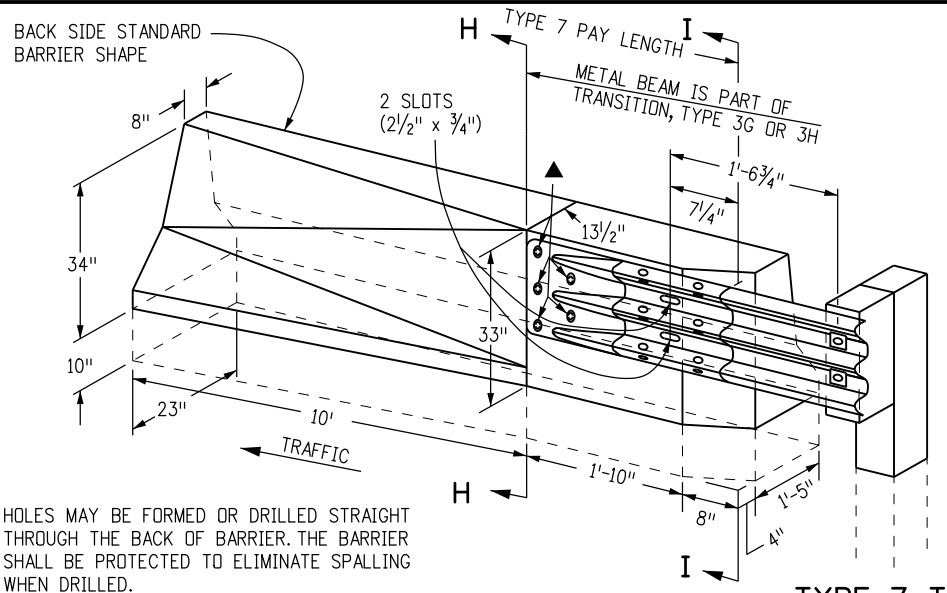
**ELEVATION**



**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)

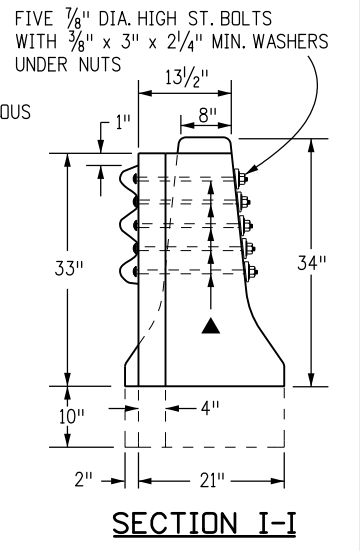
**BRIDGE RAIL TYPE 7 TO ROADWAY SHOULDER TYPE 7 TRANSITION AND ANCHORAGE**



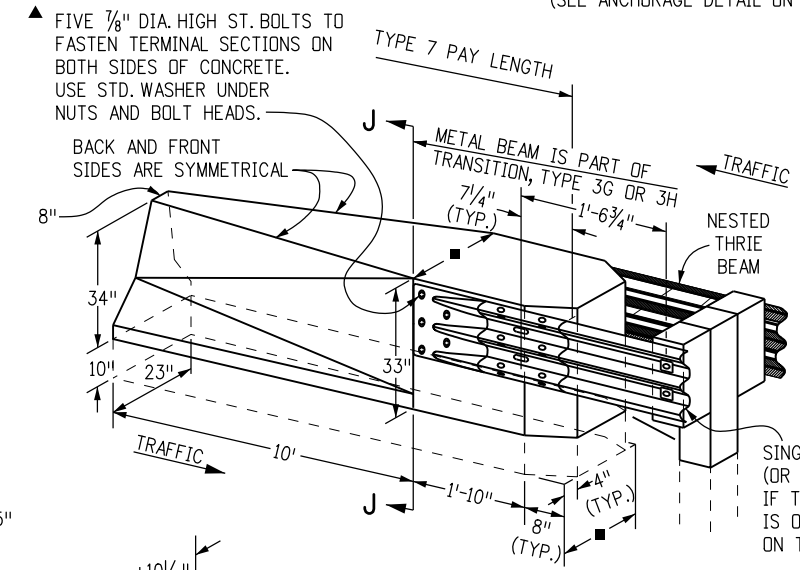
▲ HOLES MAY BE FORMED OR DRILLED STRAIGHT THROUGH THE BACK OF BARRIER. THE BARRIER SHALL BE PROTECTED TO ELIMINATE SPALLING WHEN DRILLED.

**SECTION H-H**

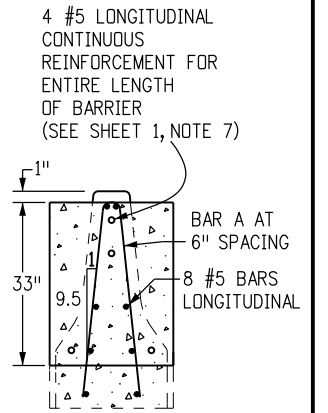
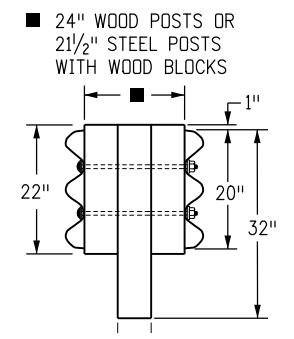
**TYPE 7 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE**  
(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)



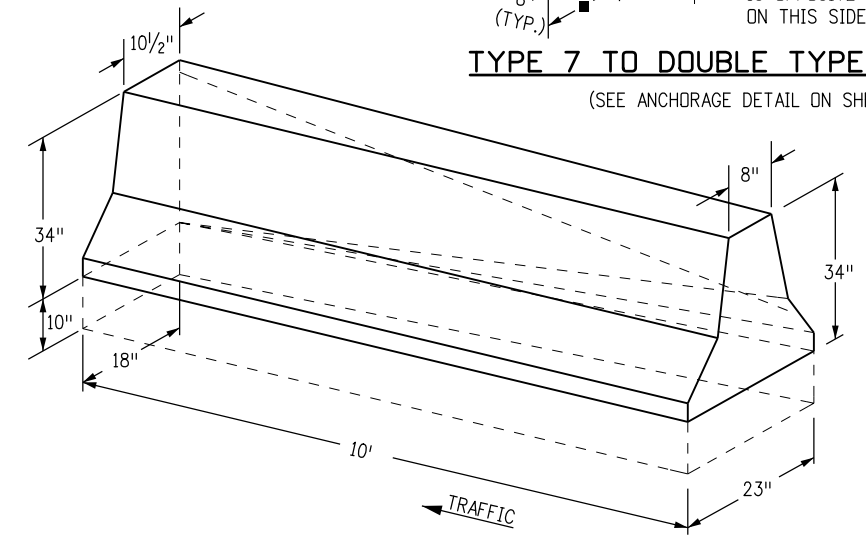
**SECTION I-I**



**TYPE 7 TO DOUBLE TYPE 3G TRANSITION AND ANCHORAGE**  
(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)



**SECTION J-J**



Computer File Information	
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Units:	English

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Date:	Comments
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(R-X)	
(R-X)	

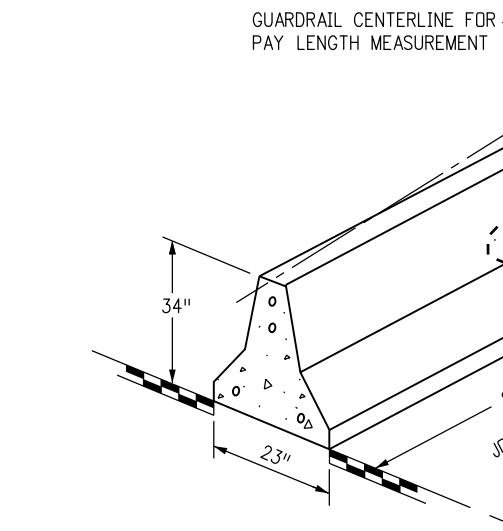
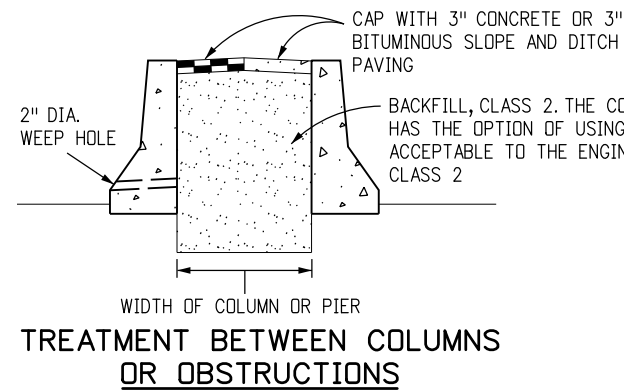
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Project Development Branch **JBK**

# GUARDRAIL TYPE 7 F-SHAPE BARRIER

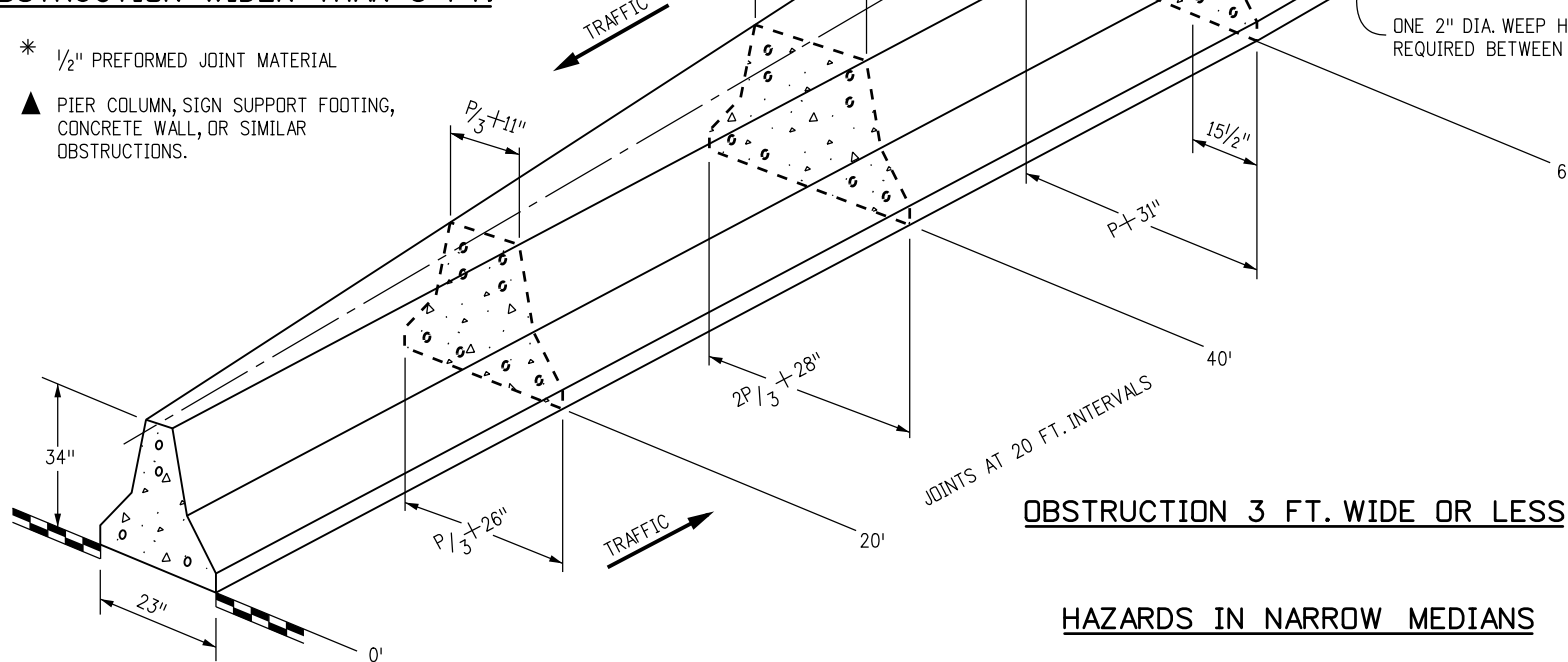
Issued by the Project Development Branch: July 31, 2019

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Standard Sheet No. 2 of 4
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**OBSTRUCTION WIDER THAN 3 FT.**

- \* 1/2" PREFORMED JOINT MATERIAL
- ▲ PIER COLUMN, SIGN SUPPORT FOOTING, CONCRETE WALL, OR SIMILAR OBSTRUCTIONS.



**OBSTRUCTION 3 FT. WIDE OR LESS**

**HAZARDS IN NARROW MEDIANS**

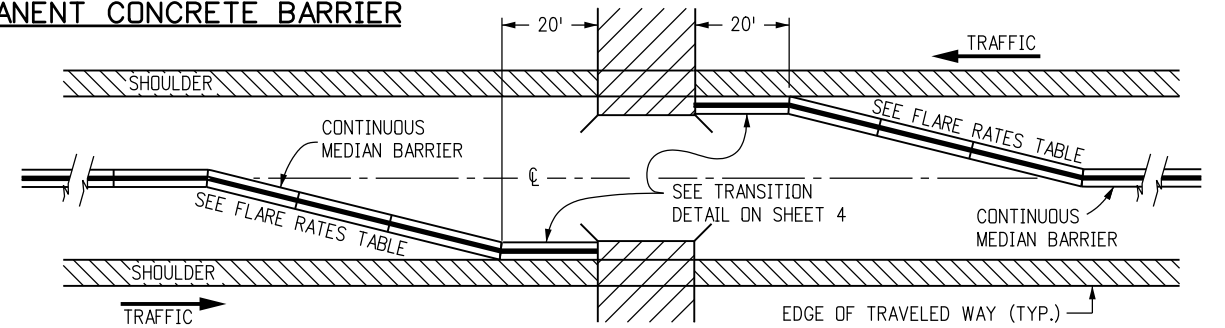
DESIGN SPEED (MPH)	SHY LINE OFFSET (FT.)*	FLARE RATE FOR BARRIER INSIDE SHY LINE	FLARE RATE FOR BARRIER OUTSIDE SHY LINE
80	12	30:1	20:1
75	10	30:1	20:1
70	9	30:1	20:1
60	8	26:1	18:1
55	7	24:1	16:1
50	6.5	21:1	14:1
45	6	18:1	12:1
40	5	16:1	10:1
30	4	13:1	8:1

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

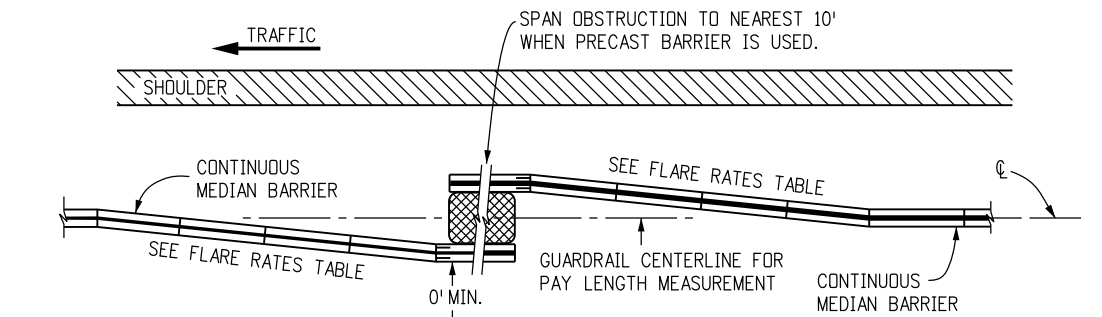
**TABLE OF FLARE RATES FOR PERMANENT CONCRETE BARRIER**

**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.

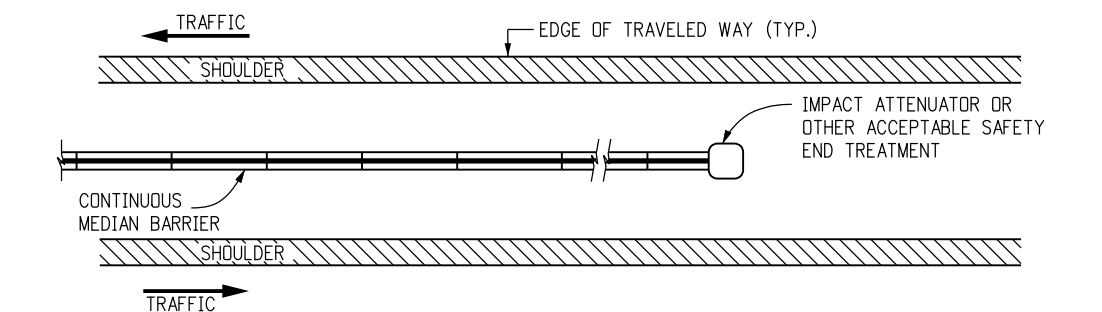


**BRIDGE APPROACH**



**STYLE CA AT OBSTRUCTION**

(OBSTRUCTION NOT SUITABLE FOR TYPE CD)



**MEDIAN BARRIER END TREATMENT**

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**GUARDRAIL TYPE 7  
F-SHAPE BARRIER**

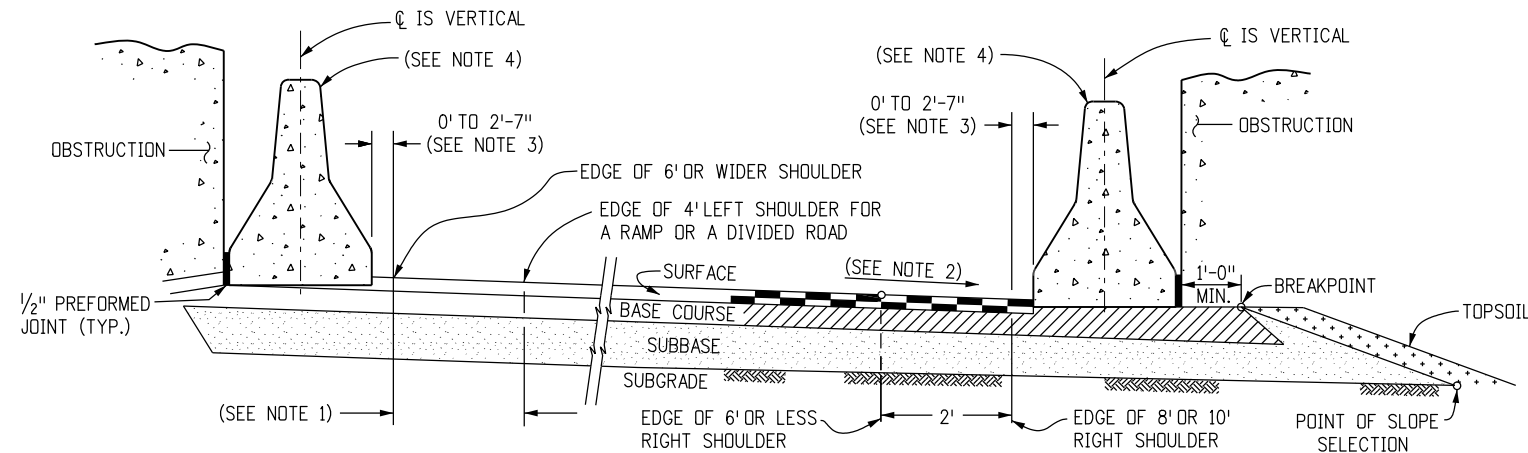
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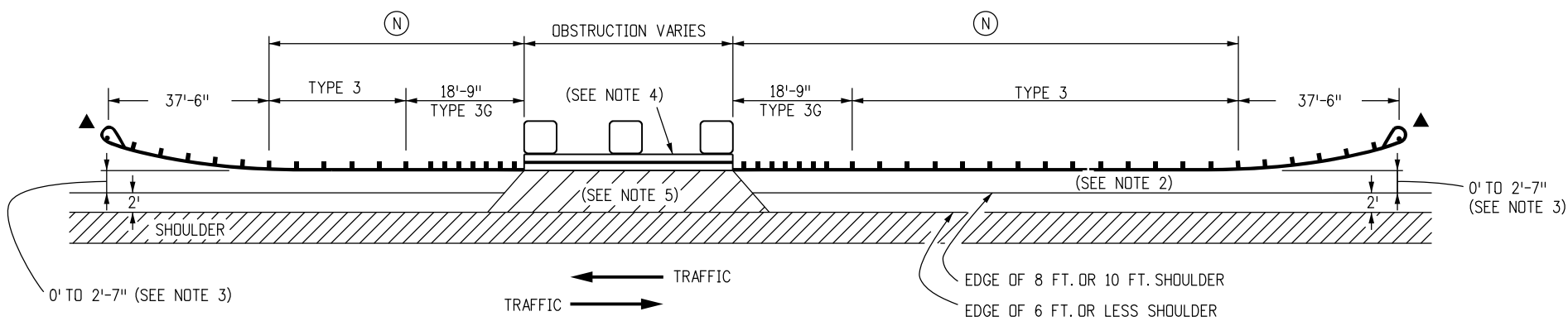
M-606-13

Standard Sheet No. 3 of 4

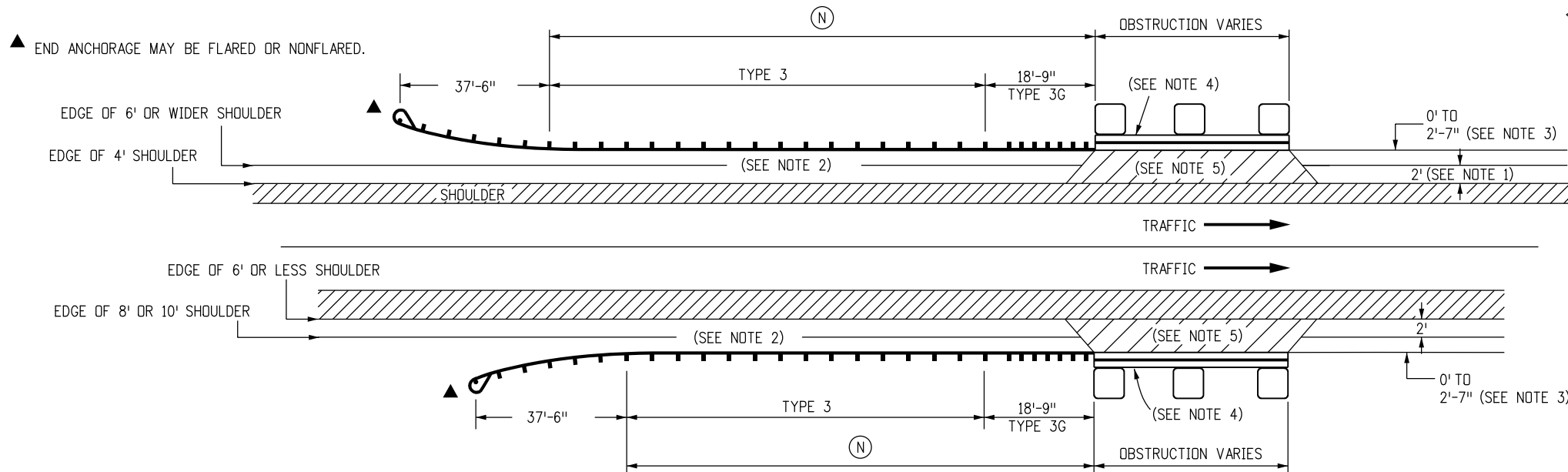
Project Sheet Number:



**TYPE 7 ON LEFT AND RIGHT SHOULDERS AT OBSTRUCTIONS**



**2-LANE 2-WAY ROADS**

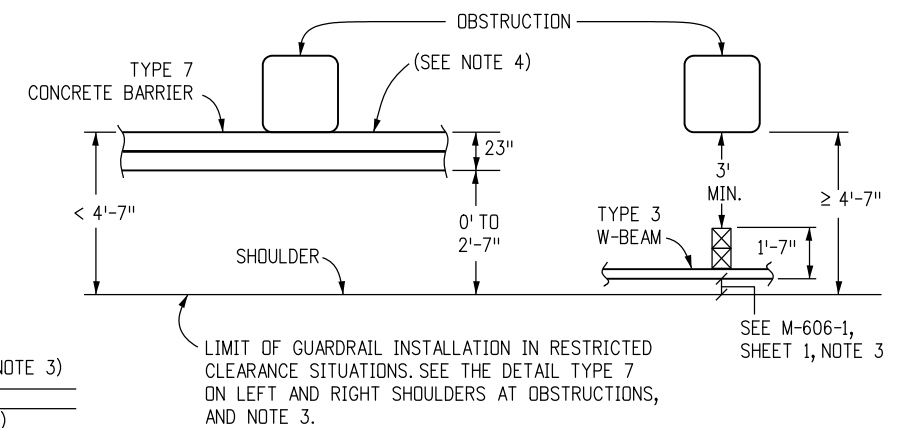


**DIRECTIONAL ROADWAYS AND RAMPS**

**HAZARDS ON ROADSIDES**

**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.



LIMIT OF GUARDRAIL INSTALLATION IN RESTRICTED CLEARANCE SITUATIONS. SEE THE DETAIL TYPE 7 ON LEFT AND RIGHT SHOULDERS AT OBSTRUCTIONS, AND NOTE 3.

**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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**GUARDRAIL TYPE 7  
F-SHAPE BARRIER**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

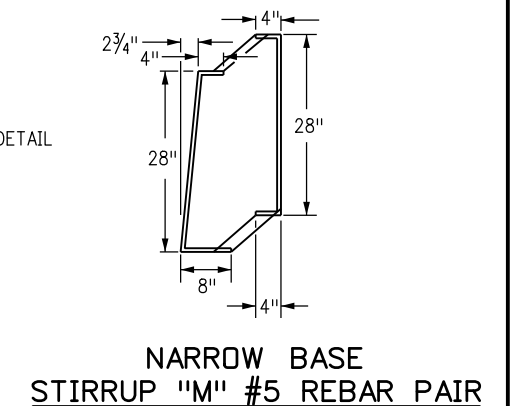
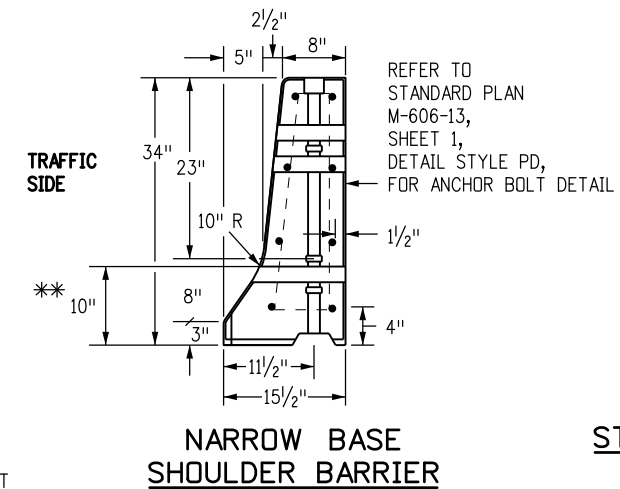
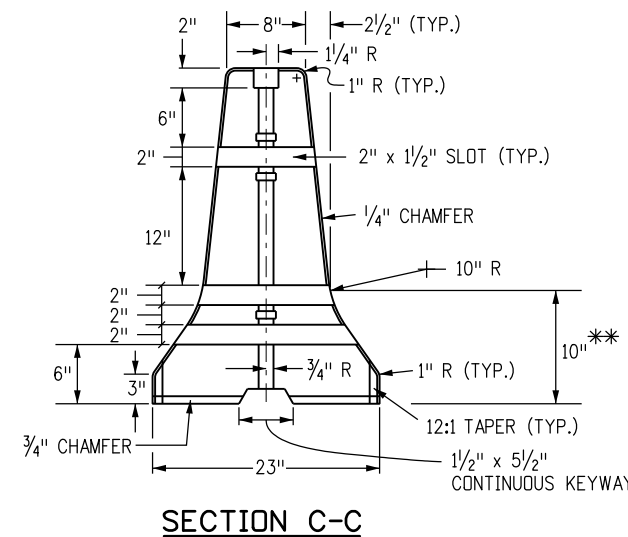
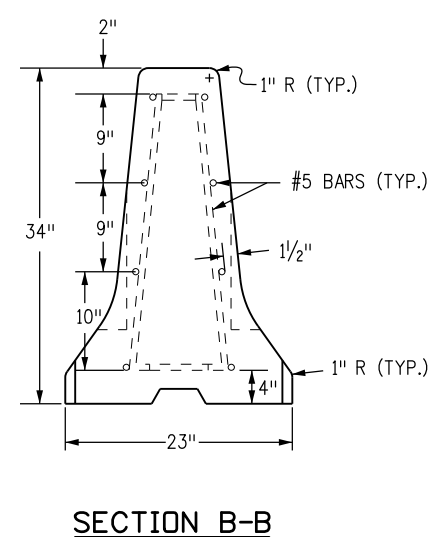
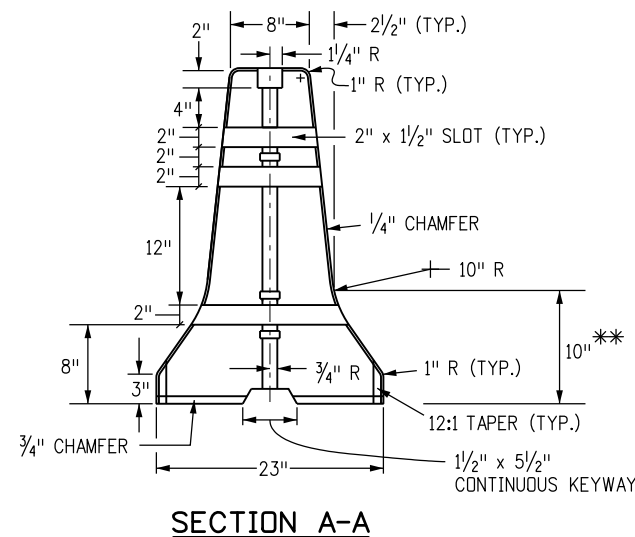
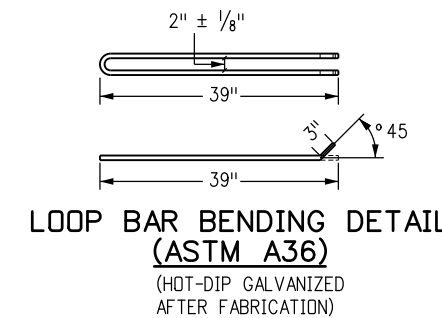
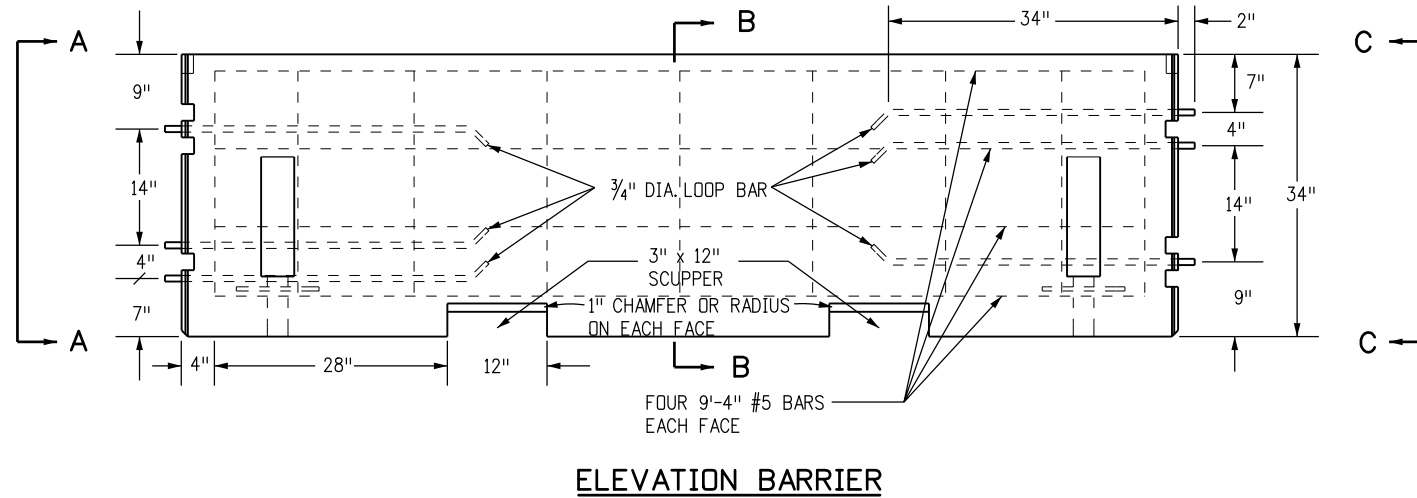
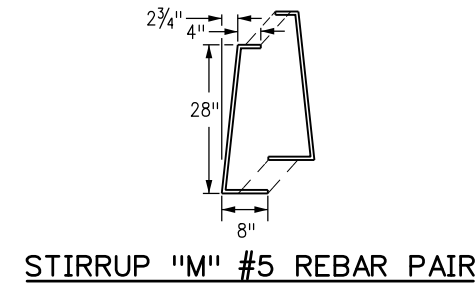
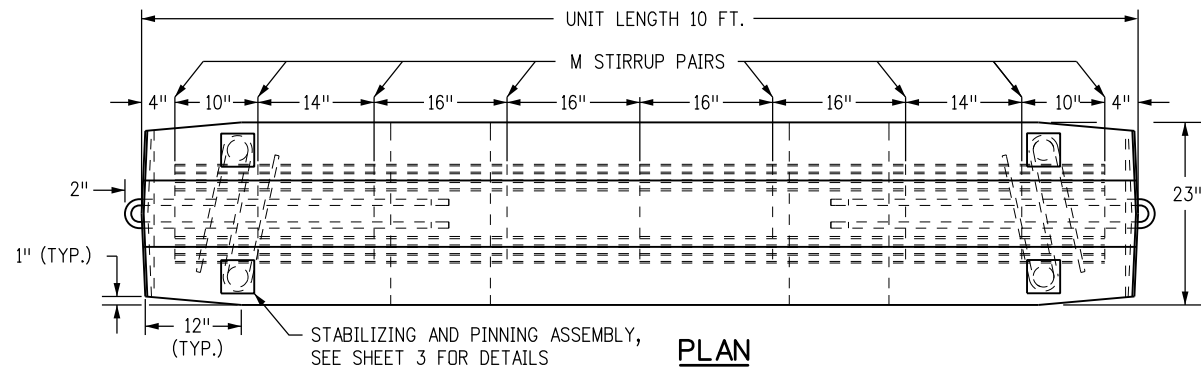
**M-606-13**

**Standard Sheet No. 4 of 4**

Project Sheet Number:

**GENERAL NOTES**

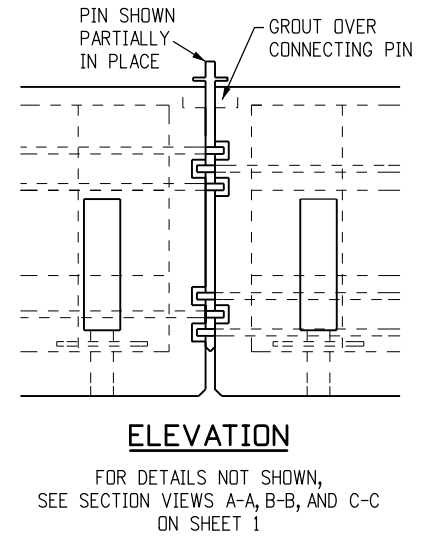
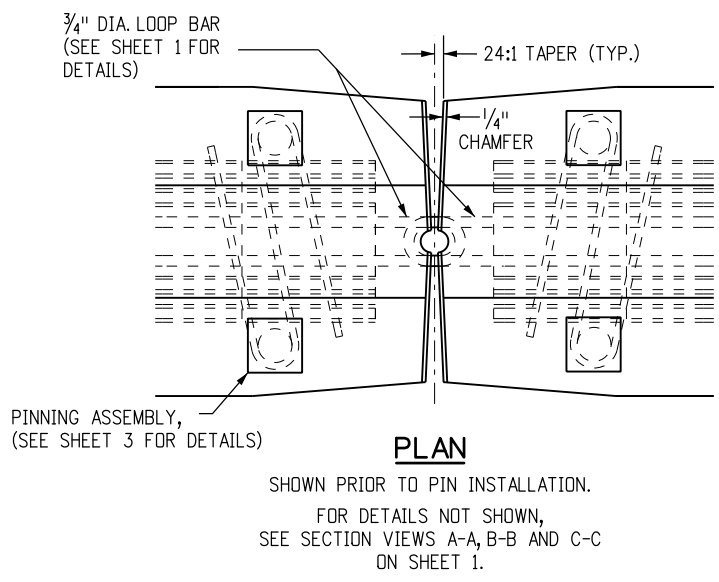
1. ALL STEEL REINFORCING SHALL BE 2 IN. CLEAR OF THE NEAREST SURFACE OF CONCRETE UNLESS OTHERWISE SHOWN. REINFORCING STEEL SHALL BE GRADE 40 MINIMUM.
2. CONCRETE SHALL BE CLASS D.
3. ALL PERMANENT PRECAST BARRIERS USED TO REPLACE OTHER CONCRETE BARRIERS, SHALL BE IN NEW CONDITION, UNDAMAGED, AND WITH 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.



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

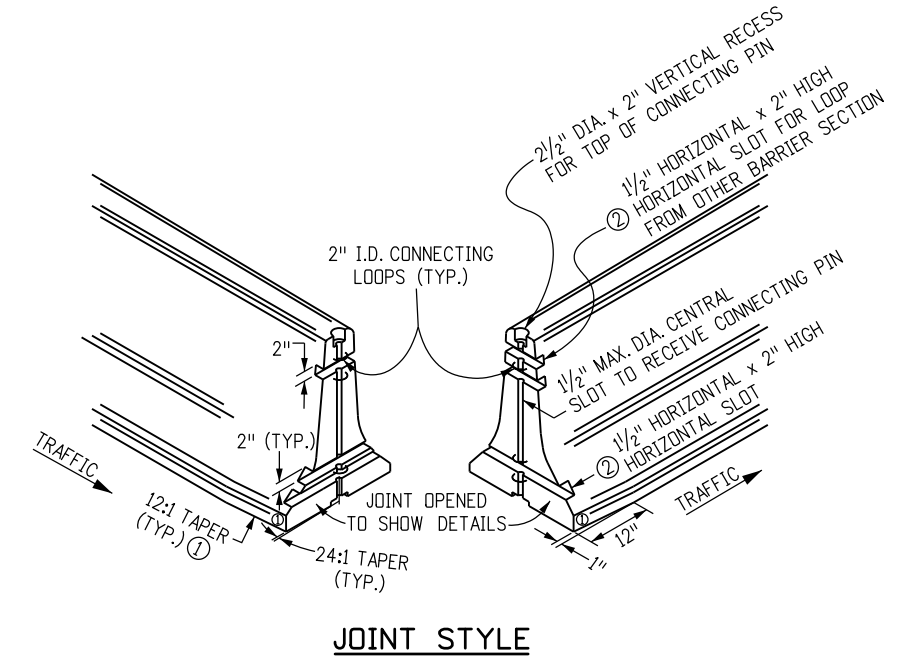
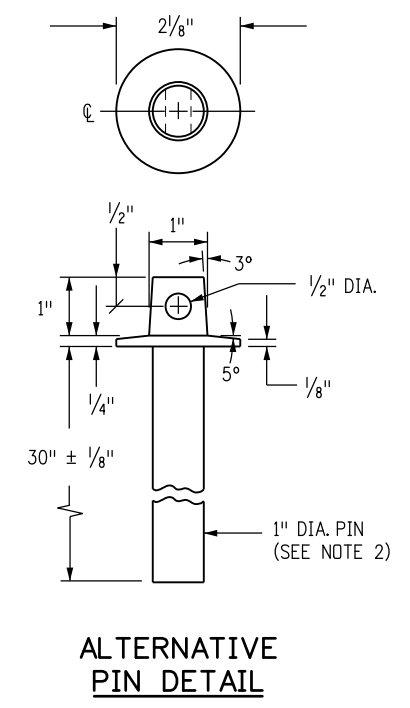
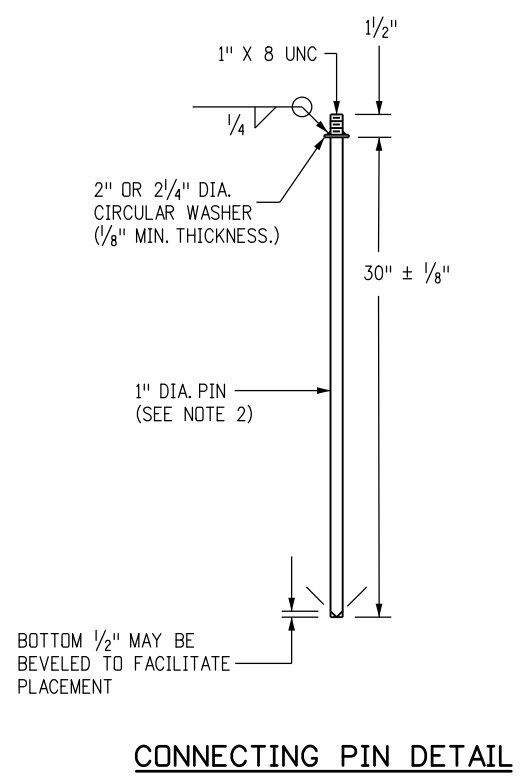
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>PRECAST TYPE 7 CONCRETE BARRIER</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
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Designer Initials: JBK		(R-X)				Standard Sheet No. 1 of 3	
Last Modification Date: 07/31/19		(R-X)				Project Sheet Number:	
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)					





**NOTES**

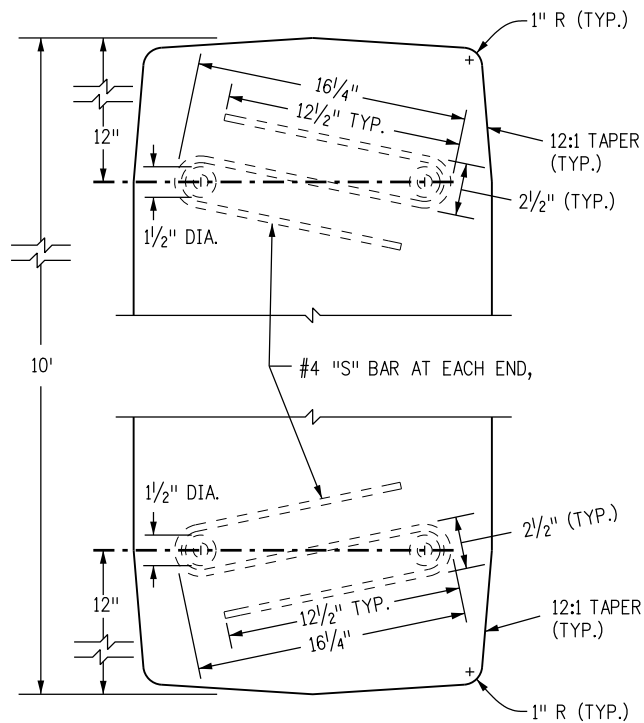
1. WASHERS SHALL BE FORGED AS AN INTEGRAL PART OF THE PIN, OR SHALL BE WELDED AS SHOWN.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
3. IF AN ALTERNATIVE TOP CONFIGURATION IS USED FOR LIFTING, THE LIFTING PIN SHALL BE PROVIDED. PINS SHALL CONFORM TO CRITICAL DIMENSIONS (PIN LENGTH DIAMETER).
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.



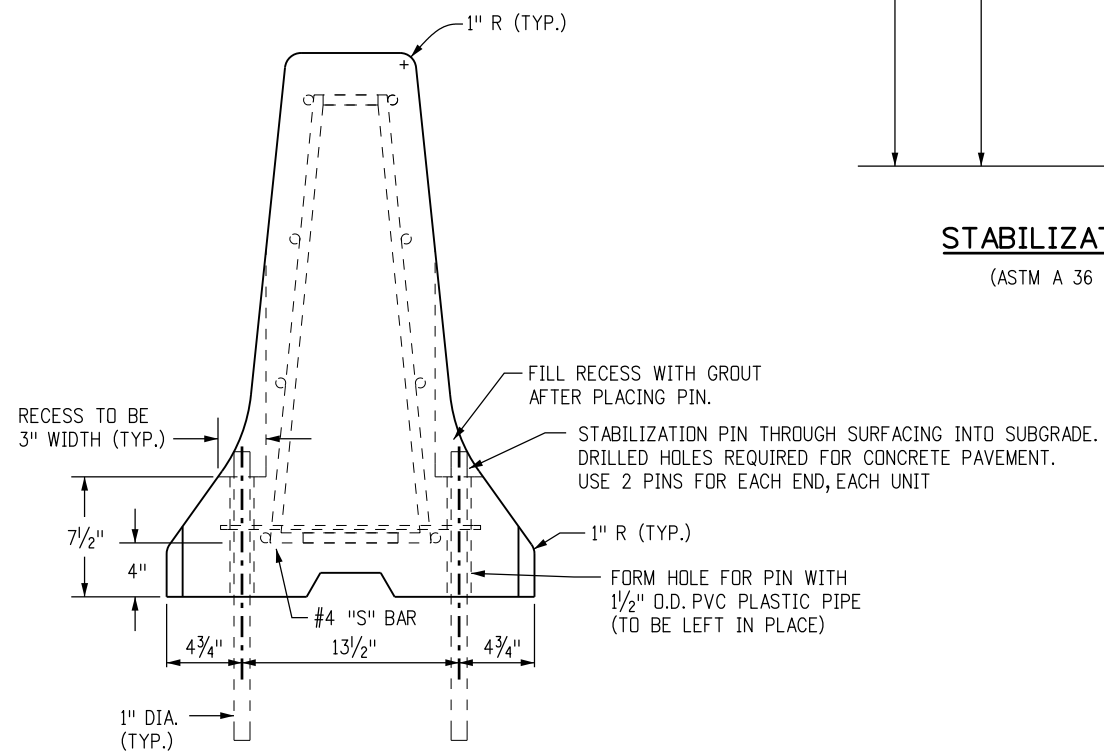
- ① A 1 IN. BY 12 IN. TAPER IS REQUIRED AT THE BOTTOM OF ALL FOUR CORNERS OF THE BARRIER SECTIONS TO ELIMINATE SNAGGING OF SNOW PLOW BLADES. THE TAPER IS OPTIONAL ON PERMANENT INSTALLATIONS.
- ② THE HORIZONTAL SLOTS SHALL BE 1/2 IN. IN DEPTH AT THE CENTER OF THE BARRIER AND MAY DECREASE IN DEPTH AT THE EDGE OF THE BARRIER DUE TO THE (24:1) TAPER.

**DETAILS FOR PIN AND LOOP CONNECTION**

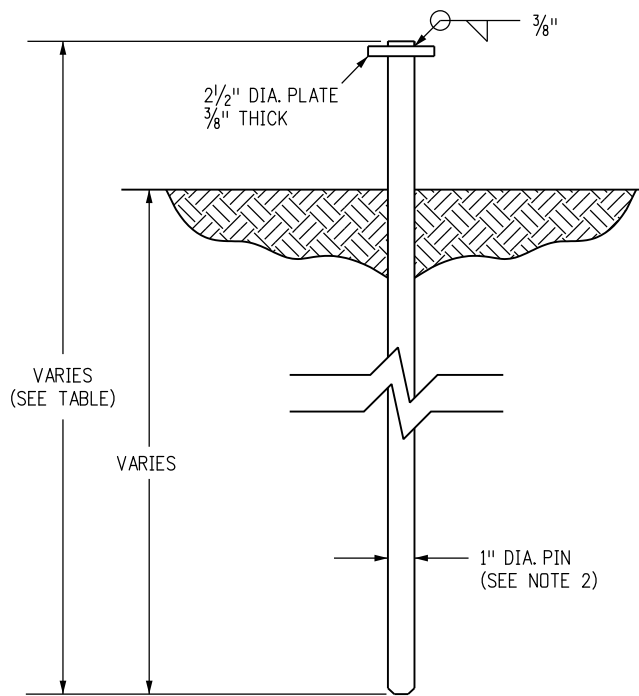
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>PRECAST TYPE 7 CONCRETE BARRIER</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-606-14	
Designer Initials: JBK		(R-X)				Standard Sheet No. 2 of 3	
Last Modification Date: 07/31/19		(R-X)				Project Sheet Number:	
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Project Development Branch <b>JBK</b>			



**PLAN VIEW OF S BAR ENDS**

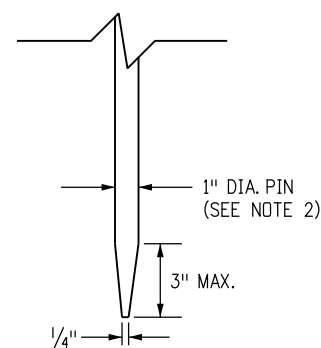


**ELEVATION VIEW WITH PINS**



**STABILIZATION PIN**

(ASTM A 36 STEEL)



**OPTIONAL TAPERED END PIN**

(SEE NOTE 4)

**NOTES**

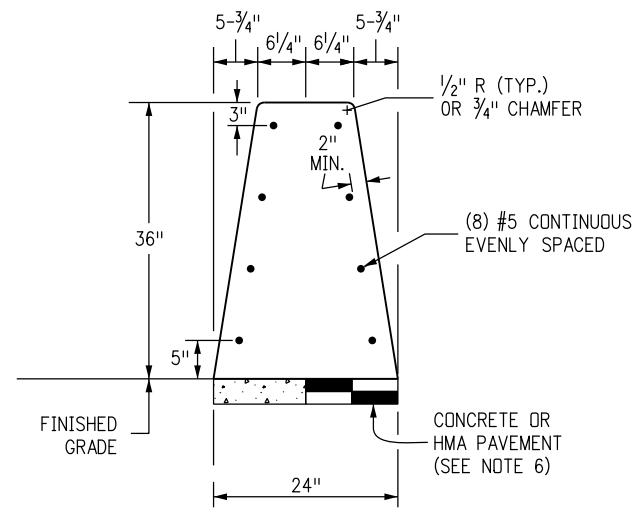
1. SEE SHEET 1 FOR REINFORCEMENT AND OTHER DETAILS NOT SHOWN HERE.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION
3. FOR TERMINAL ANCHORING OF THE PERMANENT INSTALLATION OF PRECAST TYPE 7 CONCRETE BARRIER, SEE THE END ANCHORAGE DETAIL ON STANDARD PLAN M-606-13, SHEET 1.
4. AN OPTIONAL 3 IN.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

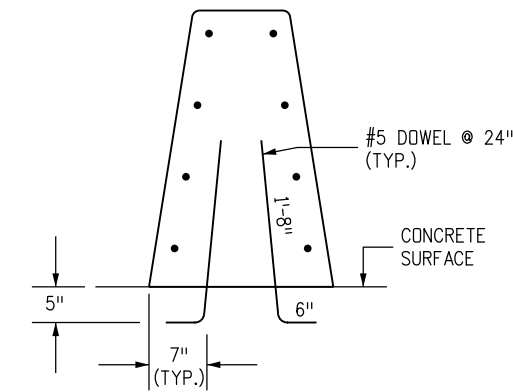
**TABLE OF STABILIZATION PIN LENGTHS**

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

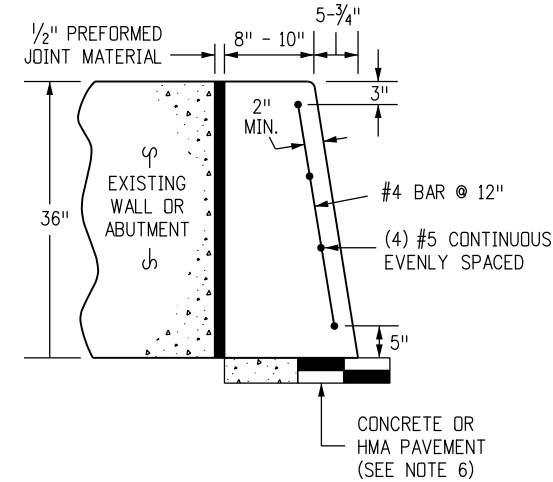
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>PRECAST TYPE 7 CONCRETE BARRIER</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-606-14	
Designer Initials: JBK		(R-X)				Standard Sheet No. 3 of 3	
Last Modification Date: 07/31/19		(R-X)				Project Sheet Number:	
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Project Development Branch <b>JBK</b>			



**CONCRETE BARRIER STYLE CA**



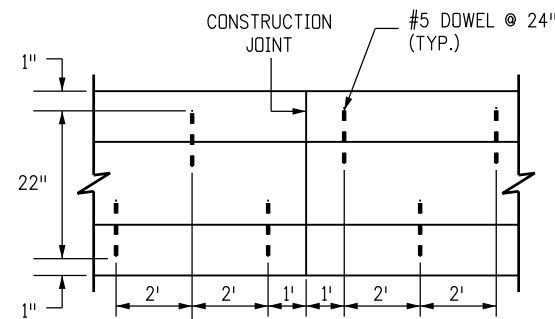
**CONCRETE BARRIER STYLE CC**  
 DETAILS SIMILAR TO STYLE CA EXCEPT AS NOTED.  
 BARRIER DOWELLED TO CONCRETE SURFACES.



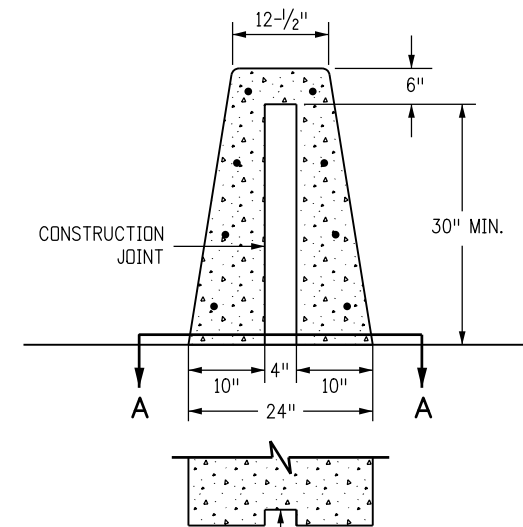
**CONCRETE BARRIER STYLE CD**  
 BARRIER AGAINST WALLS.

**GENERAL NOTES**

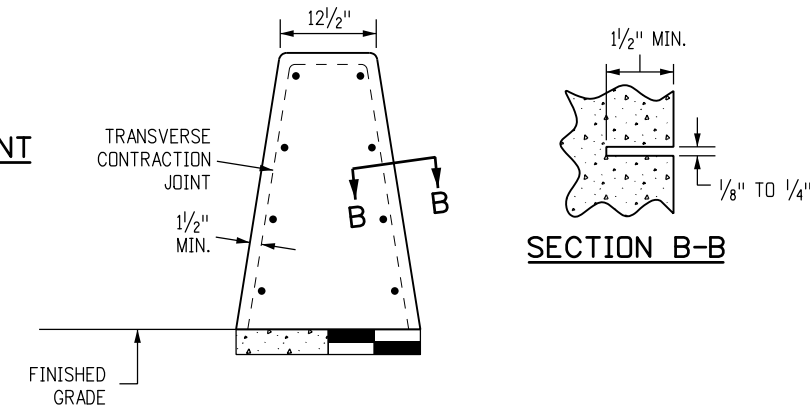
- SEE SHEET 2 FOR DETAILS OF CONCRETE BARRIER STYLE CA END ANCHOR CONNECTIONS TO STRUCTURES OR TRANSITION TO GUARDRAIL TYPE 7.
- SEE SHEET 6 FOR CONCRETE BARRIER STYLE CA TRANSITIONS AT BRIDGE COLUMNS AND SIGN PEDESTALS IN MEDIANS.
- WHERE GLARE SCREENS ARE REQUIRED, USE CONCRETE BARRIER STYLE CG ON SHEET 4.
- WHERE ROADBED OFFSET IS GREATER THAN 1 1/2 INCH, SEE CONCRETE BARRIER STYLE CE
- BARRIER MAY BE CAST-IN-PLACE OR SLIP FORMED.
- BARRIER FOUNDATION SHALL BE PAVEMENT, OR COMPACTED AGGREGATE BASE, OR COMPACTED EMBANKMENT MATERIAL.
- NO ANCHORAGE IS REQUIRED (TYP.) EXCEPT FOR THE 10 FOOT ANCHORAGE. SEE SHEETS 2 AND 3 FOR DETAILS.
- 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.
- ALL REINFORCING STEEL SHALL BE GRADE 60 EPOXY COATED DEFORMED BARS AND SHALL BE A MINIMUM OF 2 INCHES IN FROM THE NEAREST CONCRETE SURFACE, UNLESS OTHERWISE NOTED.
- 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.
- TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER. CONCRETE SHALL BE CLASS D.
- ADDITIONAL MATERIAL FOR BARRIER EMBEDMENT GREATER THAN 1 INCH WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- EPOXY COATED LONGITUDINAL REBAR SHALL HAVE A MINIMUM LAP SPLICE OF 38 INCHES. WIRE STRAND LONGITUDINAL REINFORCEMENT SHALL BE BUTT WELDED OR MECHANICALLY SPLICED TO MAINTAIN 100 PERCENT OF THE MINIMUM REQUIRED TENSILE STRENGTH.
- 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.
- RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.



**DOWEL PLACEMENT LAYOUT**  
 FOR STYLE CC BARRIER.  
 PLAN VIEW



**SECTION A-A**  
**CONSTRUCTION JOINT**  
 SEE NOTE 15.



**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 THAT ARE ON TOP OF THE CONCRETE ROADWAY PAVEMENT. SEE CONCRETE BARRIER STYLE CA FOR TYPICAL DIMENSIONS.

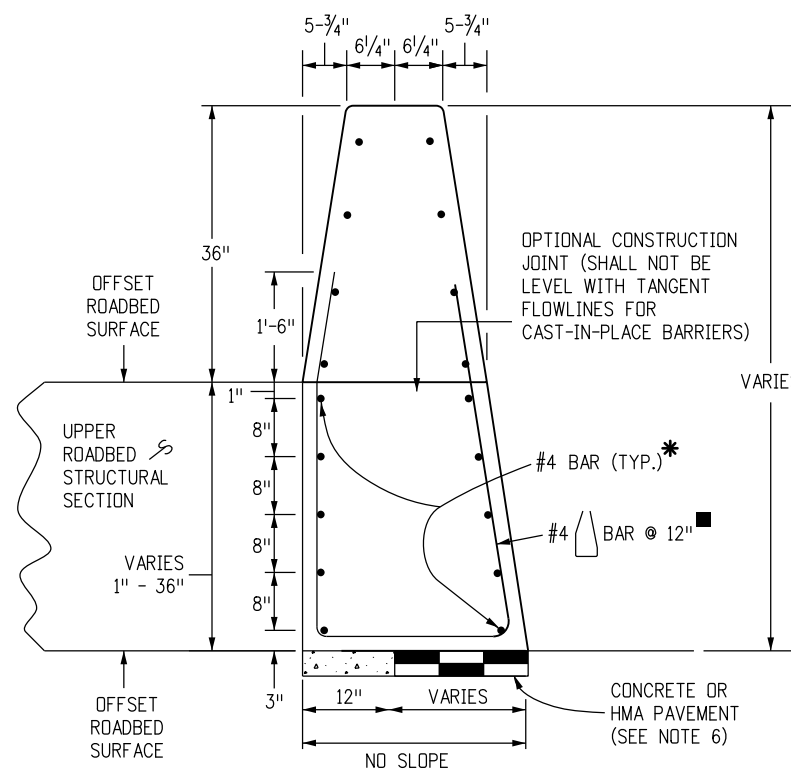
\* FOR SURFACES OFFSETS LESS THAN OR EQUAL TO 3 INCHES, NO ADDITIONAL REINFORCEMENT IS REQUIRED.

SURFACE OFFSETS GREATER THAN 3 INCHES WILL REQUIRE ADDITIONAL REINFORCEMENT AS SHOWN.

THE LOWEST LAYER OF TWO #4 SHALL BE 3 INCHES ABOVE THE BOTTOM OF THE BARRIER. EACH VERTICAL INCREMENT OF 8 INCHES MEASURED FROM THE LOWEST LAYER OF REINFORCEMENT SHALL INCLUDE AN ADDITIONAL TWO #4.

FOR BARRIER TRANSITIONING IN HEIGHT MAINTAIN THE BOTTOM REINFORCEMENT LAYER COVER AND DISCONTINUE/ADD INCREMENTAL REINFORCING PARALLEL TO THE BARRIER AS HEIGHT REQUIRES.

■ REINFORCING STIRRUP NOT REQUIRED FOR ROADBED OFFSETS LESS THAN 1 FOOT.



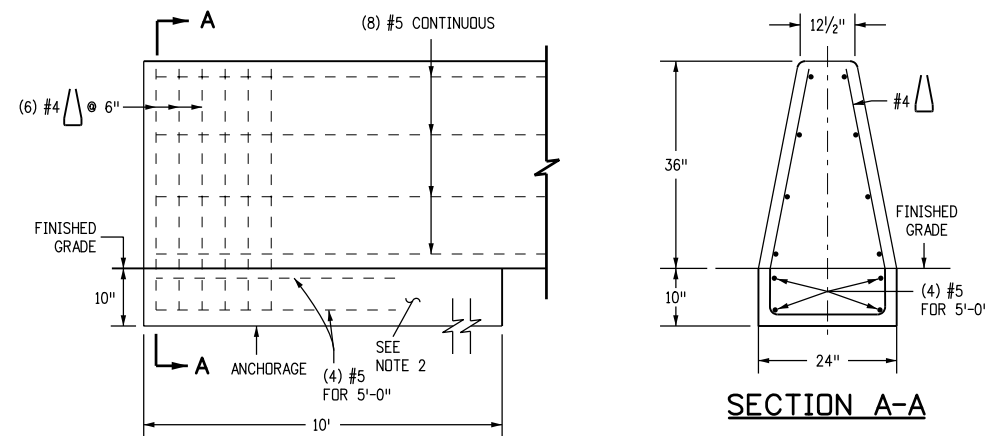
**CONCRETE BARRIER STYLE CE**

DETAILS SIMILAR TO STYLE CA EXCEPT AS NOTED.  
 USE CONCRETE BARRIER END ANCHOR WHEN NECESSARY.  
 SHOWN 36 INCH ROADBED SURFACES OFFSET.

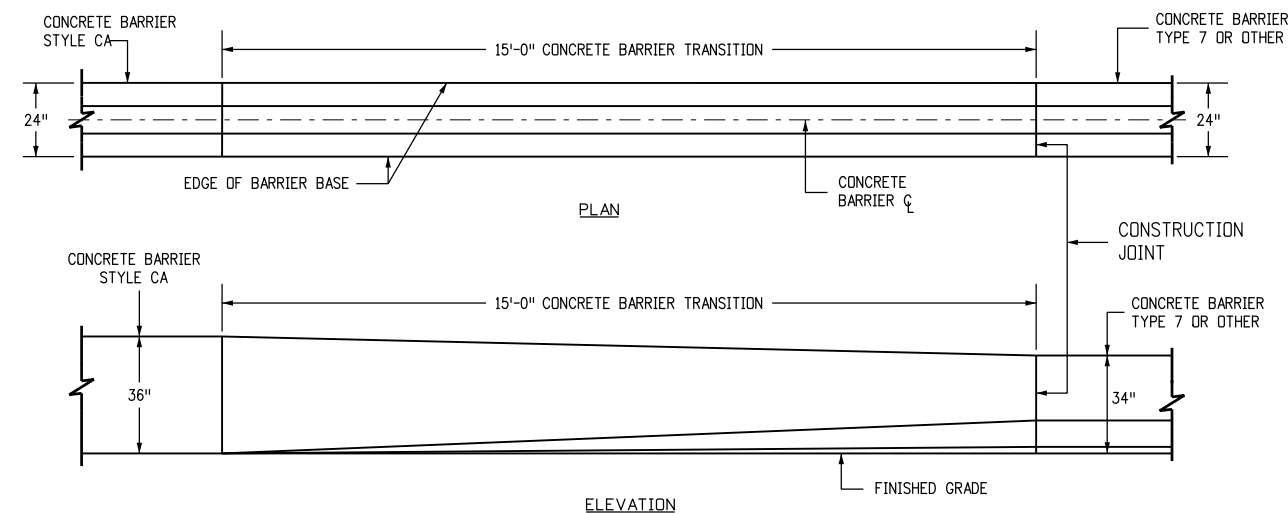
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>GUARDRAIL TYPE 9</b> <b>SINGLE SLOPE BARRIER</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-606-15	
Designer Initials: JBK	(R-X)					Standard Sheet No. 1 of 11	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)					Issued by the Project Development Branch: July 31, 2019	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			<b>JBK</b>			

**NOTES**

1. SEE SHEET 3 FOR END ANCHORAGE REQUIREMENTS. AT A MINIMUM, THE BARRIER SHALL BE ANCHORED AT THE ENDS AND AT INTERRUPTIONS WITH THE A 10 FOOT ANCHORAGE. THE ANCHORAGE SHALL BE MONOLITHIC OR DOWELED WITH 2-#8 X 8" @ 2'-0 BARS.
2. SEE SHEET 1 FOR CONCRETE BARRIER STYLE CA AND STYLE CC.
3. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER.
4. SEE SHEET 6 FOR CONCRETE BARRIER STYLE CA TRANSITIONS AT BRIDGE COLUMNS AND SIGN PEDESTALS IN MEDIANS.
5. FOR STYLE CA CONNECTIONS TO STRUCTURES, SEE THE BRIDGE PLANS.



**END ANCHORAGE**

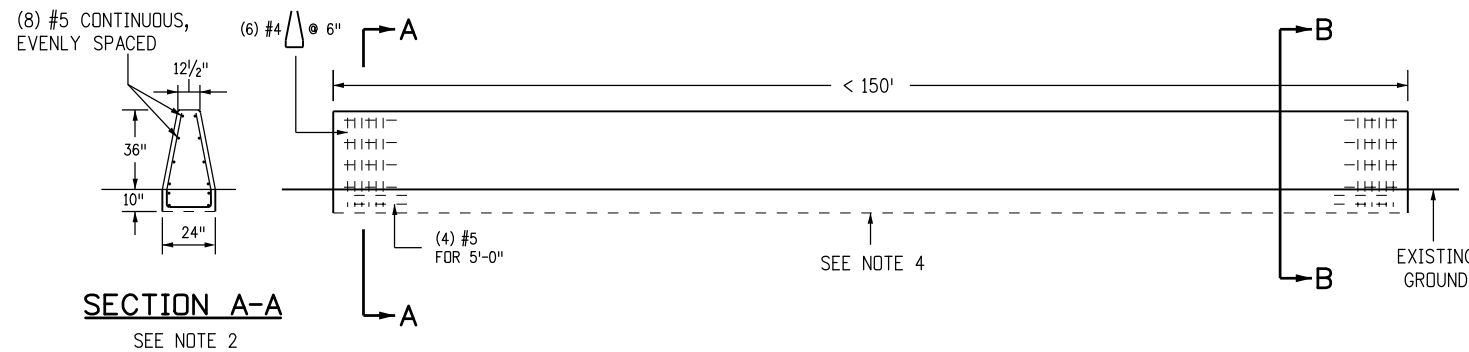


**TRANSITION CONCRETE BARRIER TYPE 9 TO CONCRETE BARRIER TYPE 7 OR EXISTING**

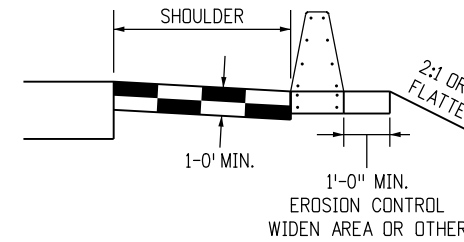
<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>GUARDRAIL TYPE 9</b> <b>SINGLE SLOPE BARRIER</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-606-15	
Designer Initials: JBK		(R-X)				Standard Sheet No. 2 of 11	
Last Modification Date: 07/31/19		(R-X)				Project Sheet Number:	
Detailer Initials: LTA		(R-X)				Issued by the Project Development Branch: July 31, 2019	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>JBK</b> Issued by the Project Development Branch: July 31, 2019			

**NOTES**

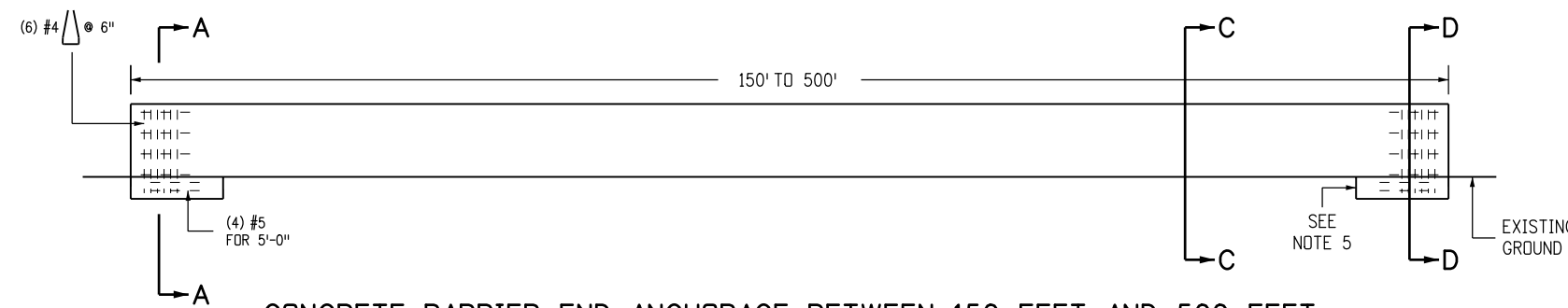
1. SEE PLANS FOR CONCRETE BARRIER LENGTHS LESS THAN 150 FEET AND/OR HINGE WIDTHS EQUAL TO OR LESS THAN 1 FOOT BEHIND THE CONCRETE BARRIER.
2. SEE SHEET 2 FOR REINFORCING BAR DETAILS.
3. NEW CONCRETE BARRIERS UNDER 150 FEET SHALL BE DOWELED INTO EXISTING CONCRETE BRIDGE BARRIERS OR WINGWALLS TO MINIMIZE ROTATIONS TO ANY OF THEM. SEE SHEET 1 FOR DOWEL PLACEMENT LAYOUT.
4. FOR END ANCHORAGES UNDER 150 FEET, CONSTRUCT THE ANCHORAGE FOR THE ENTIRE LENGTH OF THE CONCRETE BARRIER.
5. FOR CONCRETE BARRIER RUNS GREATER THAN 150 FEET BUT LESS THAN 500 FEET, THE RUN SHALL BE ANCHORED AT THE ENDS AND AT GAPS, SUCH AS AN EMERGENCY ACCESS.
6. FOR END ANCHORAGES OVER 500 FEET, CONSTRUCT ANCHORAGES EVERY 250 FEET.
7. REINFORCING STEEL IN ANCHORAGE SHALL BE GRADE 60 EPOXY COATED DEFORMED BARS.
8. CONCRETE SHALL BE CLASS D.
9. ALL INCIDENTAL WORK AND ADDITIONAL MATERIALS SHALL BE INCLUDED IN THE COST OF THE CONCRETE BARRIER.



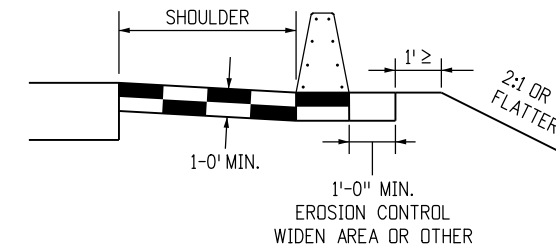
**CONCRETE BARRIER END ANCHORAGE UNDER 150 FEET**



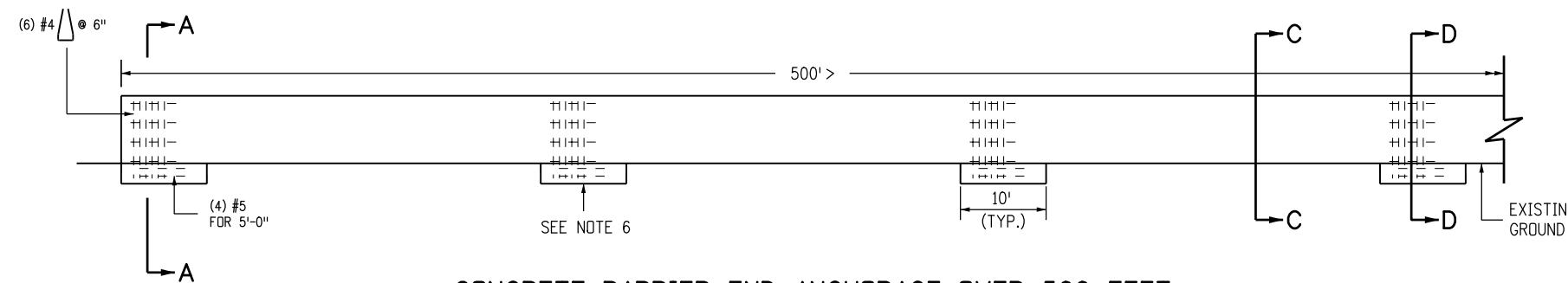
**SECTION B-B**



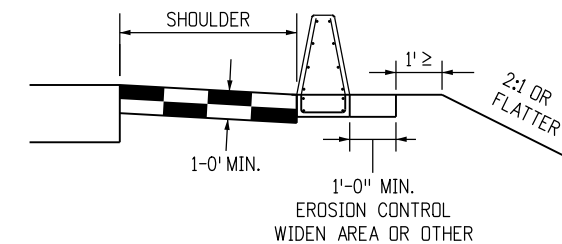
**CONCRETE BARRIER END ANCHORAGE BETWEEN 150 FEET AND 500 FEET**



**SECTION C-C**



**CONCRETE BARRIER END ANCHORAGE OVER 500 FEET**

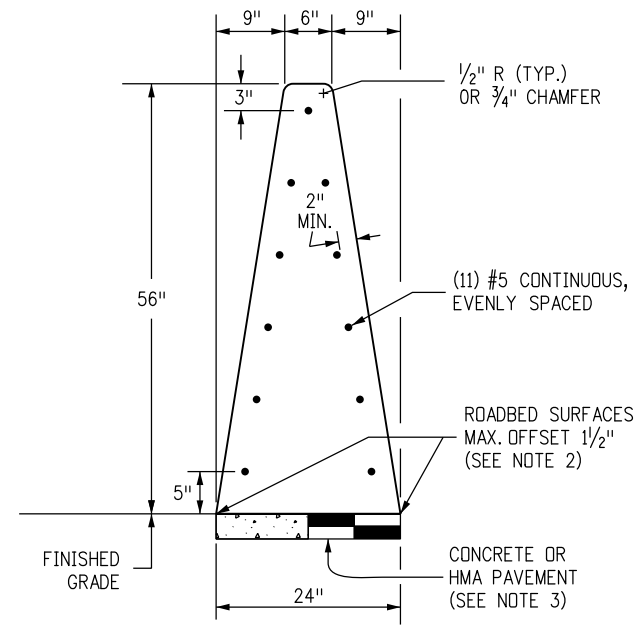


**SECTION D-D**

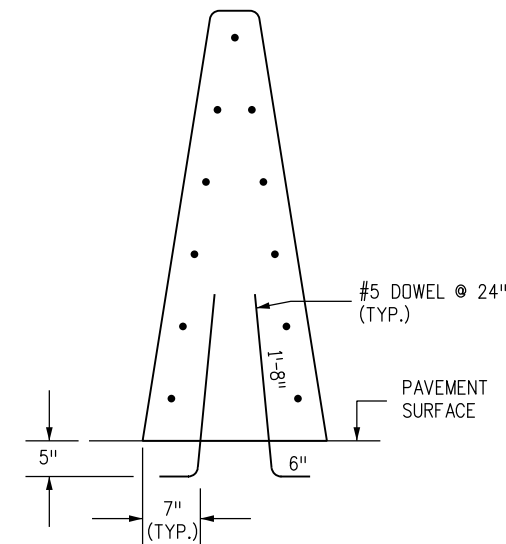
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Creation Date: 07/31/19		Date: _____		2829 West Howard Place		M-606-15		M-606-15	
Designer Initials: JBK		Comments: _____		CDOT HQ, 3rd Floor		SINGLE SLOPE BARRIER		Standard Sheet No. 3 of 11	
Last Modification Date: 07/31/19		_____		Denver, CO 80204		Issued by the Project Development Branch: July 31, 2019		Project Sheet Number: _____	
Detailer Initials: LTA		_____		Phone: 303-757-9021 FAX: 303-757-9868					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		_____		<b>Project Development Branch</b>		<b>JBK</b>			

**NOTES**

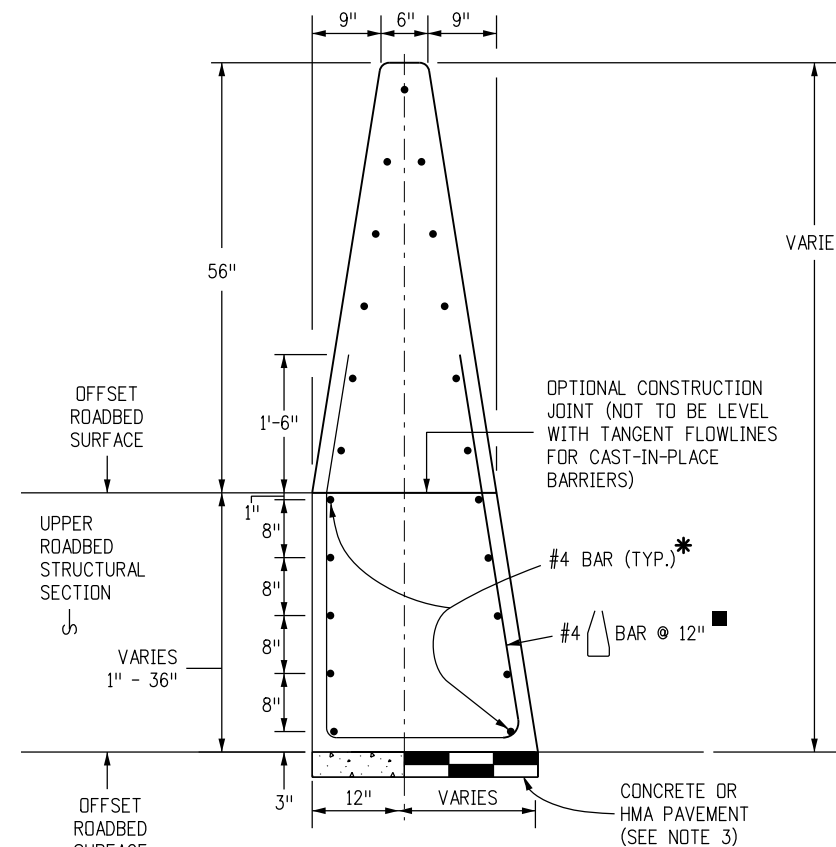
1. SEE SHEET 5 FOR DETAILS OF CONCRETE BARRIER STYLE CGE/CG END ANCHORS CONNECTIONS TO STRUCTURES AND TRANSITIONS TO GUARDRAIL TYPE 7.
2. WHERE ROADBED OFFSET IS GREATER THAN 1/2 INCH, SEE CONCRETE BARRIER TYPE CGE.
3. BARRIER FOUNDATION SHALL BE PAVEMENT, OR COMPACTED AGGREGATE BASE, OR COMPACTED EMBANKMENT MATERIAL.
4. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE THE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.



**CONCRETE BARRIER STYLE CG (56")**  
MONOLITHIC CONCRETE GLARE SCREEN/BARRIER

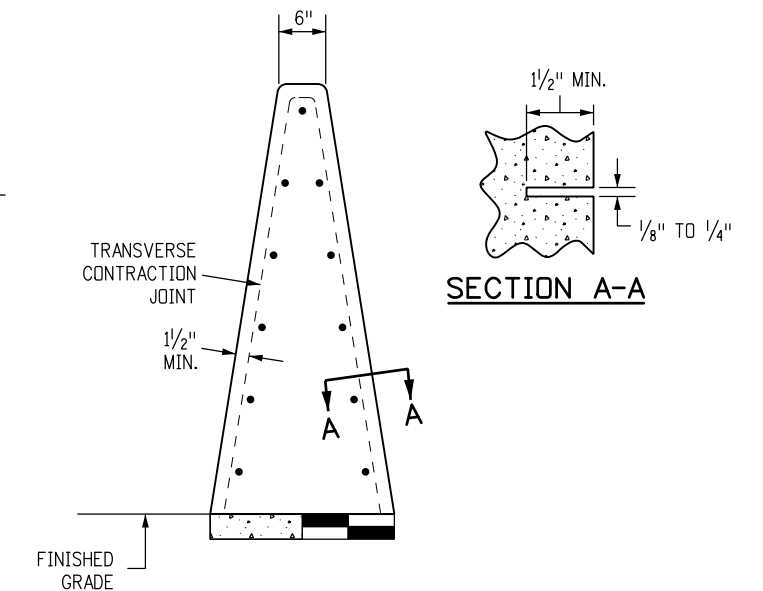


**CONCRETE BARRIER STYLE CGC**  
DETAILS SIMILAR TO STYLE CG EXCEPT AS NOTED. BARRIER DOWELLED TO CONCRETE SURFACES.



**CONCRETE BARRIER STYLE CGE**  
DETAILS SIMILAR TO STYLE CG EXCEPT AS NOTED. USE CONCRETE BARRIER END ANCHOR WHEN NECESSARY. SHOWN WITH A 36 INCH ROADBED SURFACES OFFSET. BARRIER FOR OFFSET ROADWAYS.

- \* FOR SURFACES OFFSETS LESS THAN OR EQUAL TO 3 INCHES, NO ADDITIONAL REINFORCEMENT IS REQUIRED. SURFACE OFFSETS GREATER THAN 3 INCHES WILL REQUIRE ADDITIONAL REINFORCEMENT AS SHOWN.
- THE LOWEST LAYER OF TWO #4 SHALL BE 3 INCHES ABOVE THE BOTTOM OF THE BARRIER. EACH VERTICAL INCREMENT OF 8 INCHES MEASURED FROM THE LOWEST LAYER OF REINFORCEMENT SHALL INCLUDE AN ADDITIONAL TWO #4.
- REINFORCING STIRRUP NOT REQUIRED FOR ROADBED OFFSETS LESS THAN 1 FOOT.

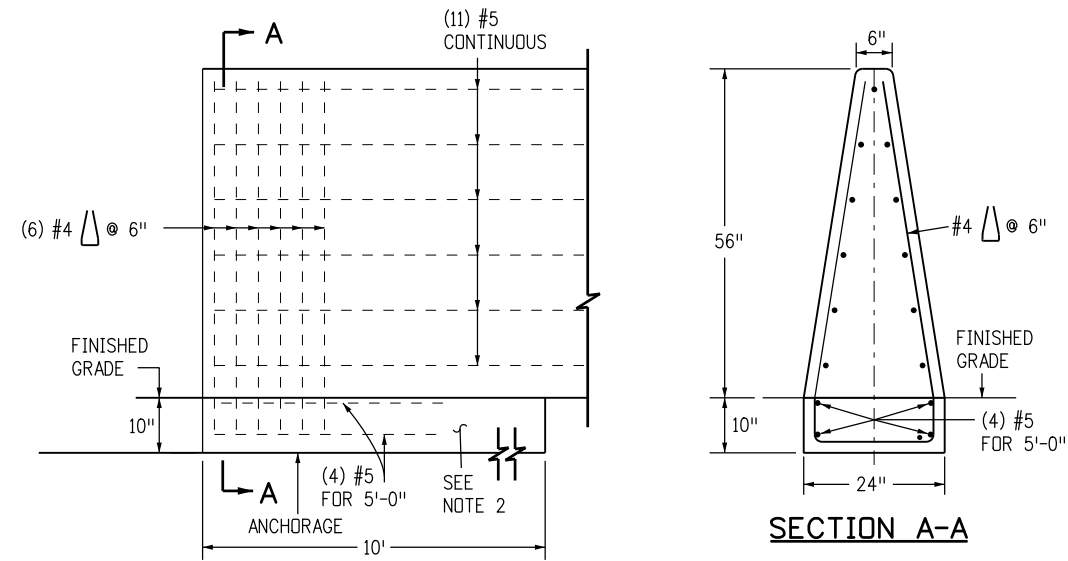


**TRANSVERSE CONTRACTION JOINTS**  
FORMED OR SAWED TRANSVERSE CONTRACTION JOINTS ARE REQUIRED AT 20 FT. INTERVALS OR THE INTERVALS SHALL MATCH THE CONCRETE PAVEMENT JOINTS FOR INSTALLATIONS THAT ARE ON TOP OF THE CONCRETE ROADWAY PAVEMENT. SEE CONCRETE BARRIER STYLE CG FOR TYPICAL DIMENSIONS.

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>GUARDRAIL TYPE 9</b> <b>SINGLE SLOPE BARRIER</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-606-15	
Designer Initials: JBK						Standard Sheet No. 4 of 11	
Last Modification Date: 07/31/19						Project Sheet Number:	
Detailer Initials: LTA							
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				Issued by the Project Development Branch: July 31, 2019			

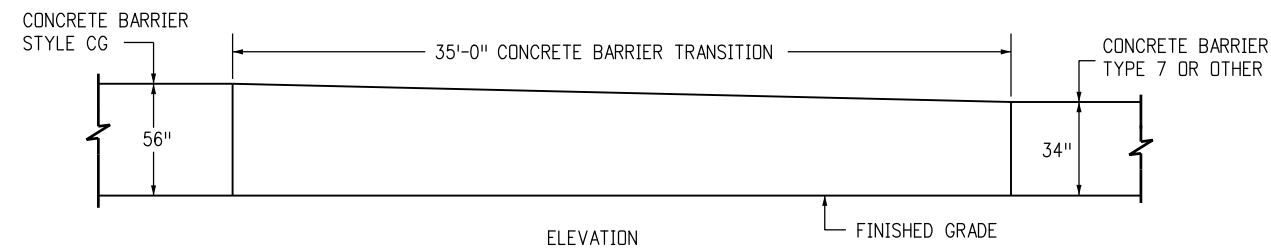
**NOTES**

1. SEE SHEET 3 FOR END ANCHORAGE REQUIREMENTS. AT A MINIMUM, THE BARRIER SHALL BE ANCHORED AT THE ENDS AND AT INTERRUPTIONS WITH THE 10 FOOT ANCHORAGE. ANCHORAGE SHALL BE MONOLITHIC OR DOWELED WITH 2-#8 X 8" @ 2'-0 BARS.
2. SEE SHEET 4 FOR CONCRETE BARRIER STYLE CG AND STYLE CGC.
3. SEE SHEET 9 FOR TRANSITION TO THRIE BEAMS.
4. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER.
5. SEE SHEET 6 FOR CONCRETE BARRIER STYLE CA TRANSITIONS AT BRIDGE COLUMNS AND SIGN PEDESTALS IN MEDIANS.
6. FOR STYLE CG CONNECTIONS TO STRUCTURES, SEE THE BRIDGE PLANS.




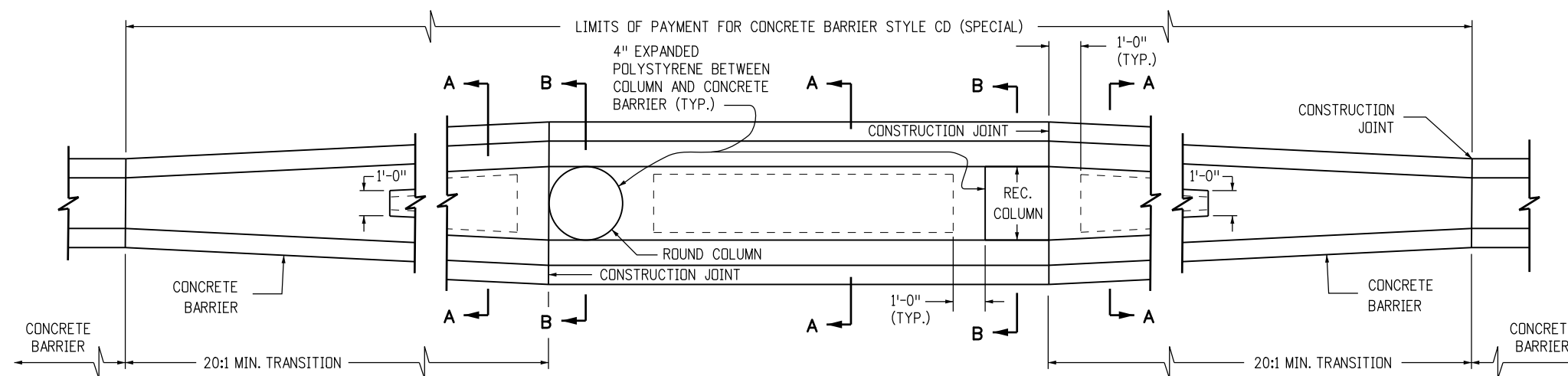
**ANCHORAGE**

BARRIER ELEVATION VIEW INCLUDING REINFORCED ANCHORAGE AT END.

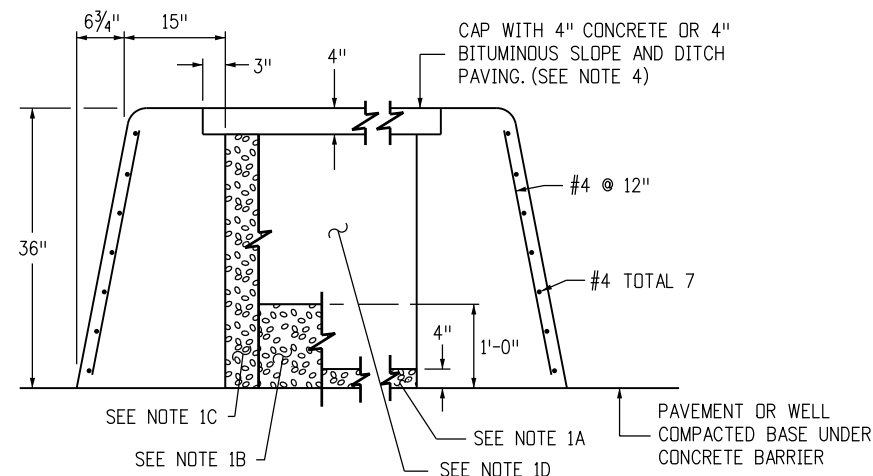


**TRANSITION CONCRETE BARRIER STYLE CGE/CG TO CONCRETE BARRIER TYPE 7 OR EXISTING**

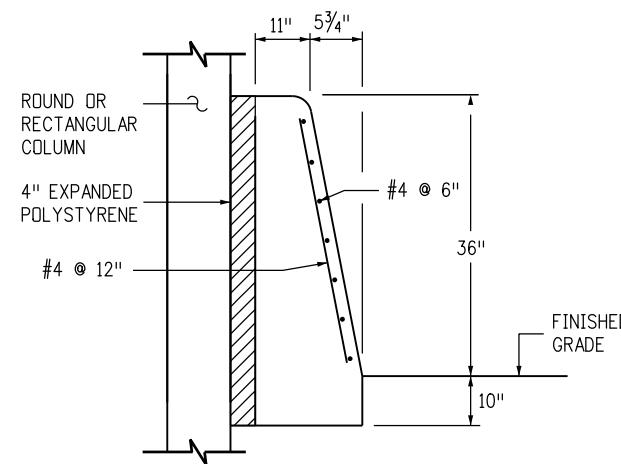
<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER</b>		<b>STANDARD PLAN NO. M-606-15</b>	
Creation Date: 07/31/19		Date:                      Comments		 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868		Issued by the Project Development Branch: July 31, 2019		Standard Sheet No. 5 of 11	
Designer Initials: JBK									
Last Modification Date: 07/31/19									
Detailer Initials: LTA									
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				<b>Project Development Branch</b> <b>JBK</b>		Project Sheet Number:			



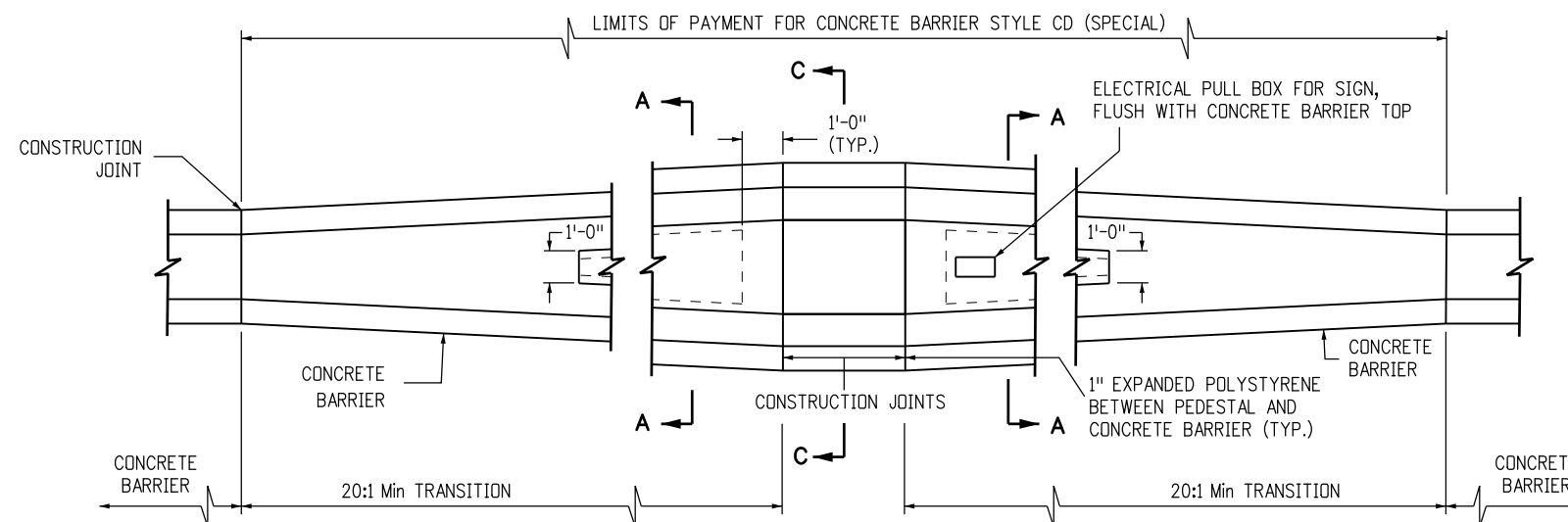
**CONCRETE BARRIER TRANSITION AT BRIDGE COLUMNS**



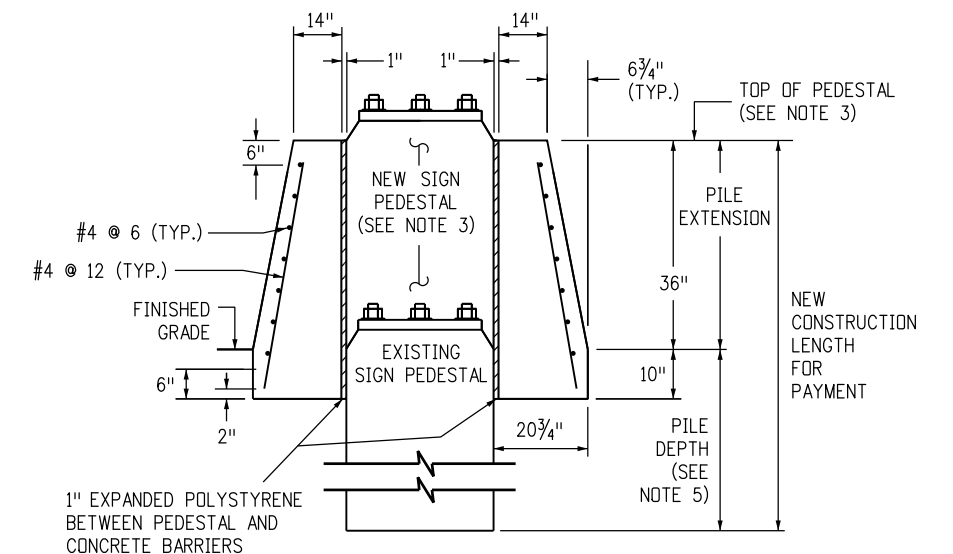
**SECTION A-A**



**SECTION B-B**



**CONCRETE BARRIER TRANSITION AT SIGN PEDESTAL**



**SECTION C-C**

**NOTES**

1. THE CONTRACTOR'S OPTIONS FOR FILL BETWEEN CONCRETE BARRIER WALLS:
  - A. PLACE 4 INCHES OF POLYSTYRENE AT BASE BETWEEN CONCRETE BARRIER WALLS.
  - B. PLACE 1 FOOT OF GRANULAR MATERIAL AT BASE BETWEEN WALLS.
  - C. PLACE GRANULAR MATERIAL FROM BASE TO BOTTOM OF 4 INCH CAP.
  - D. MONOLITHIC CONCRETE WITH FOAM BLOCKOUTS IS NOT PERMITTED.
2. REINFORCING STEEL SHALL EXTEND CONTINUOUS THROUGH CONSTRUCTION JOINTS.
3. SEE OVERHEAD SIGN PLANS FOR SIGN PEDESTAL ELEVATIONS FOR NEW CONSTRUCTION.
4. ADJUST HEIGHT OF CONCRETE BARRIER WALL ON LOW SIDE OF OFFSET OR SUPERELEVATED ROADWAYS TO PROVIDE LEVEL GRADE ACROSS TOP OF CONCRETE BARRIER CAP.
5. FOR OVERHEAD SIGNS, SEE STANDARD PLAN S-614-60.

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

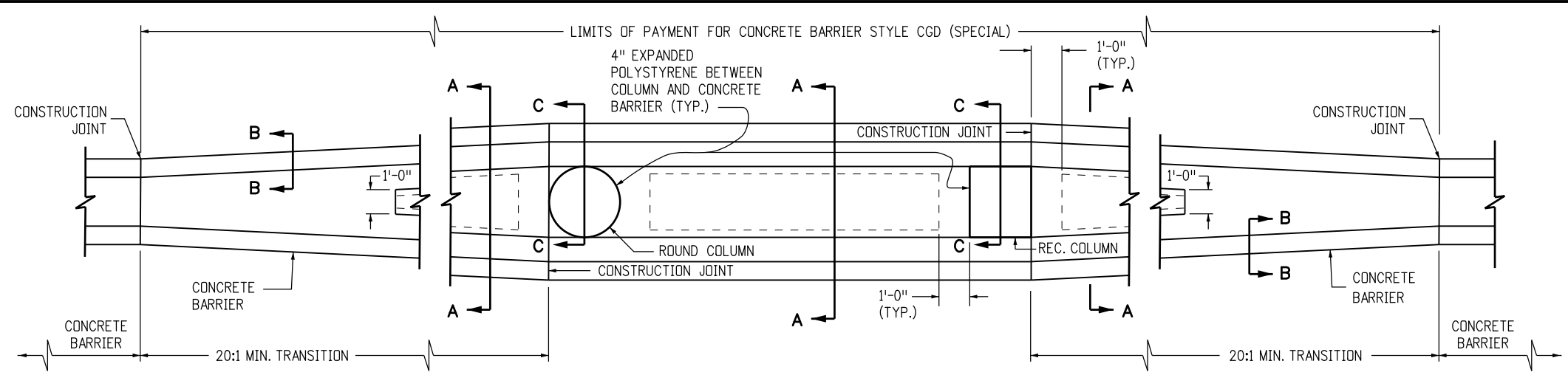
Sheet Revisions	
Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**GUARDRAIL TYPE 9  
 SINGLE SLOPE BARRIER**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
 M-606-15**  
**Standard Sheet No. 6 of 11**  
 Project Sheet Number:

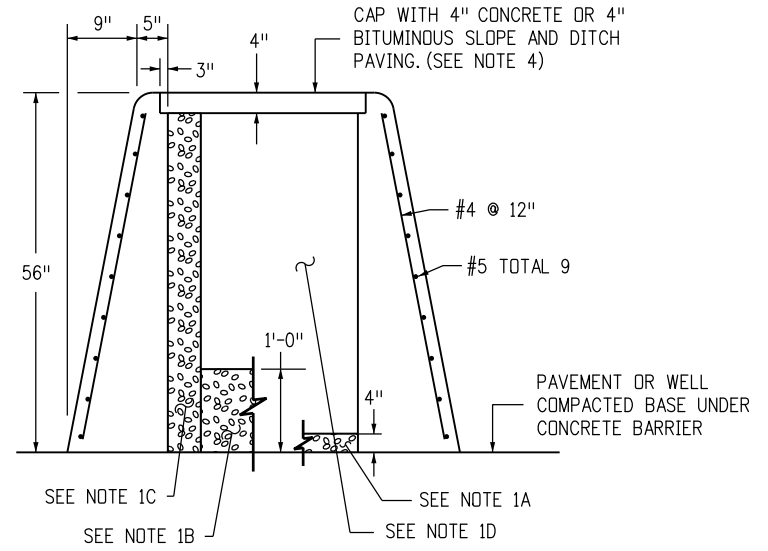




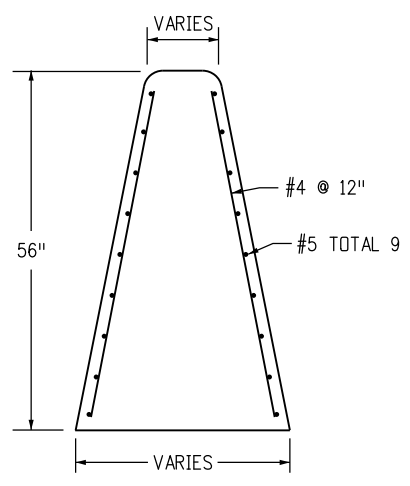
**CONCRETE BARRIER TRANSITION AT BRIDGE COLUMNS**

**NOTES**

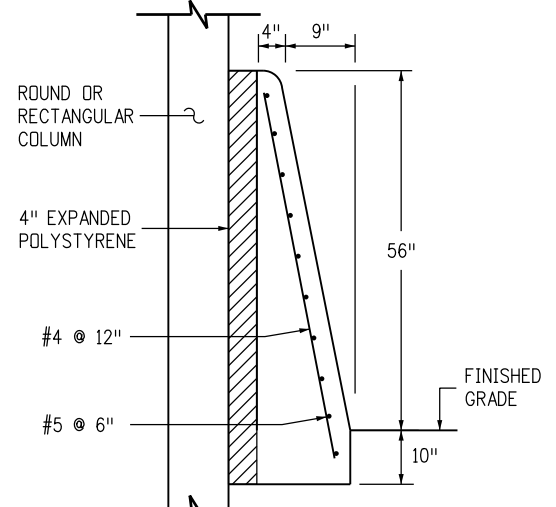
1. THE CONTRACTOR'S OPTIONS FOR FILL BETWEEN CONCRETE BARRIER WALLS:
  - A. PLACE 4 INCHES OF POLYSTYRENE AT BASE BETWEEN CONCRETE BARRIER WALLS.
  - B. PLACE 1 FOOT OF GRANULAR MATERIAL AT BASE BETWEEN WALLS.
  - C. PLACE GRANULAR MATERIAL FROM BASE TO BOTTOM OF 4 INCH CAP.
  - D. MONOLITHIC CONCRETE WITH FOAM BLOCKOUTS IS NOT PERMITTED.
2. REINFORCING STEEL SHALL EXTEND CONTINUOUS THROUGH CONSTRUCTION JOINTS.
3. SEE OVERHEAD SIGN PLANS FOR SIGN PEDESTAL ELEVATIONS FOR NEW CONSTRUCTION.
4. ADJUST HEIGHT OF CONCRETE BARRIER WALL ON LOW SIDE OF OFFSET OR SUPERELEVATED ROADWAYS TO PROVIDE LEVEL GRADE ACROSS TOP OF CONCRETE BARRIER CAP.
5. FOR OVERHEAD SIGNS, SEE STANDARD PLAN S-614-60.



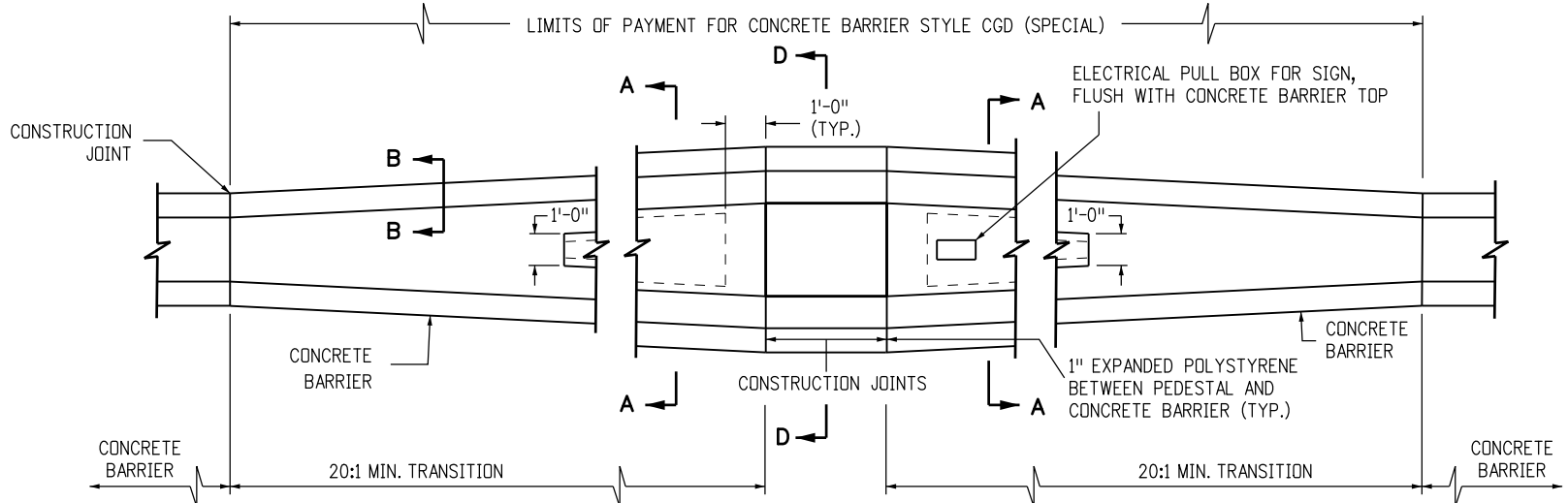
**SECTION A-A**



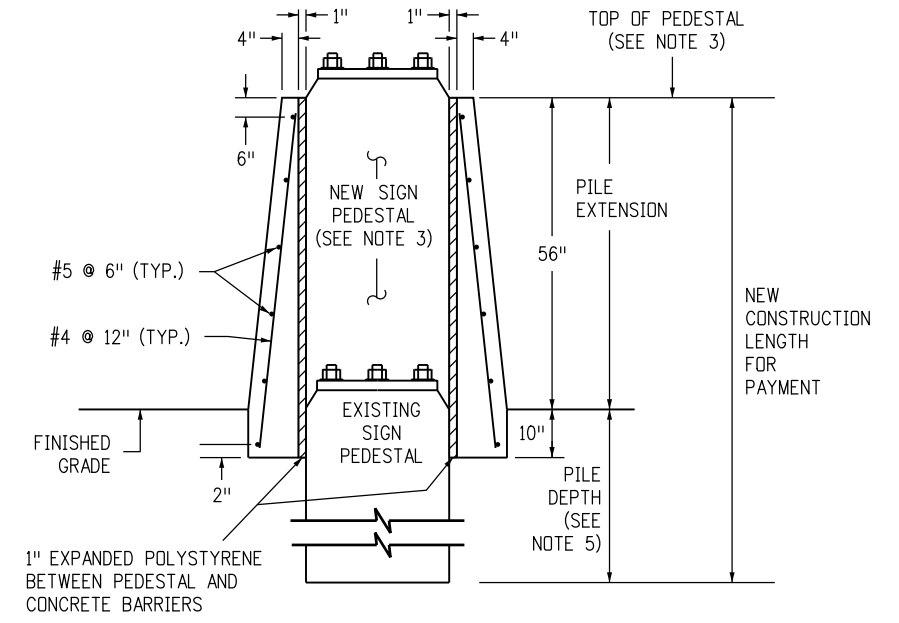
**SECTION B-B**



**SECTION C-C**



**CONCRETE BARRIER TRANSITION AT SIGN PEDESTAL**



**SECTION D-D**

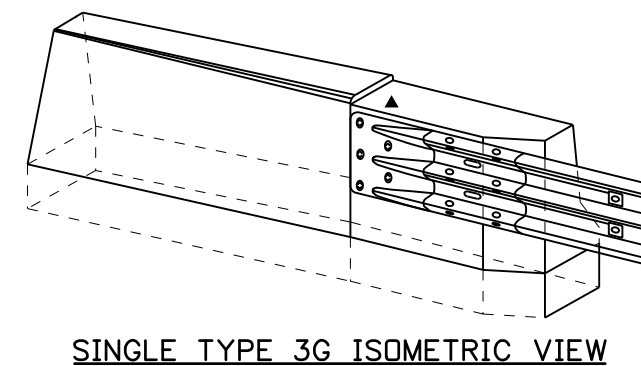
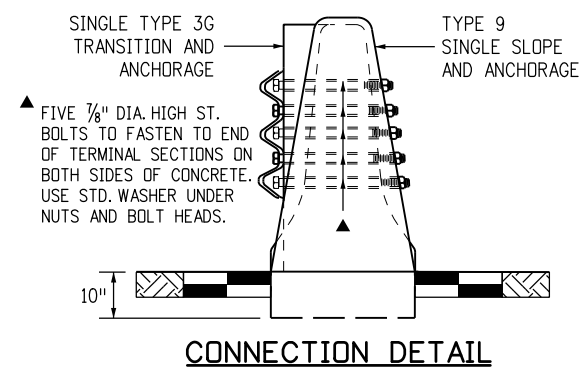
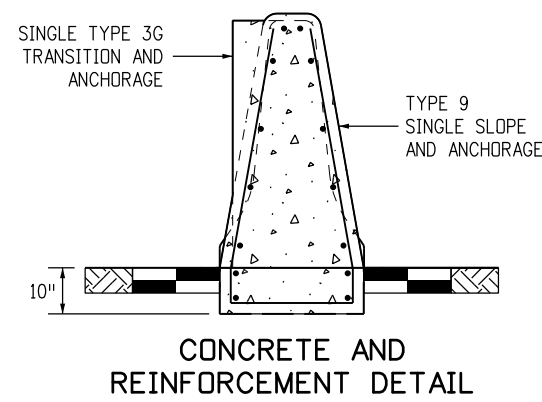
Computer File Information	
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 Project Development Branch **JBK**

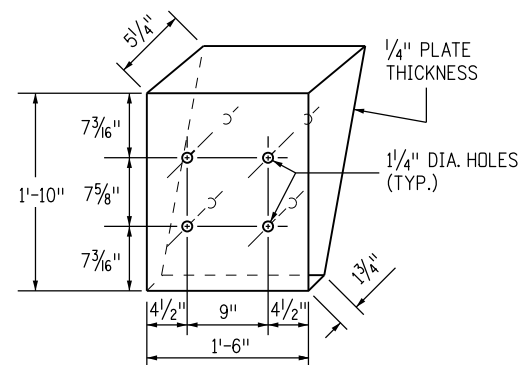
**GUARDRAIL TYPE 9  
 SINGLE SLOPE BARRIER**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
 M-606-15**  
**Standard Sheet No. 7 of 11**  
 Project Sheet Number:

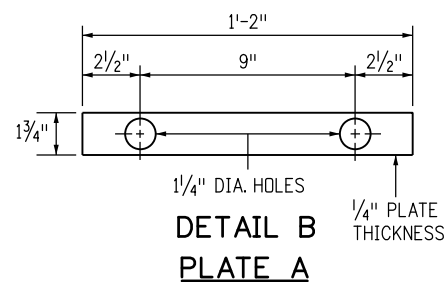


**TYPE 9 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE OPTION**  
 SEE SHEET 1 FOR REINFORCEMENT INFORMATION AND SHEET 3 FOR ANCHORAGE DETAILS

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-606-15	
Designer Initials: JBK	(R-X)					Standard Sheet No. 8 of 11	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>JBK</b>			



**DETAIL A**  
**BEVELED METAL BOX SPACE**  
(SEE NOTE 1)



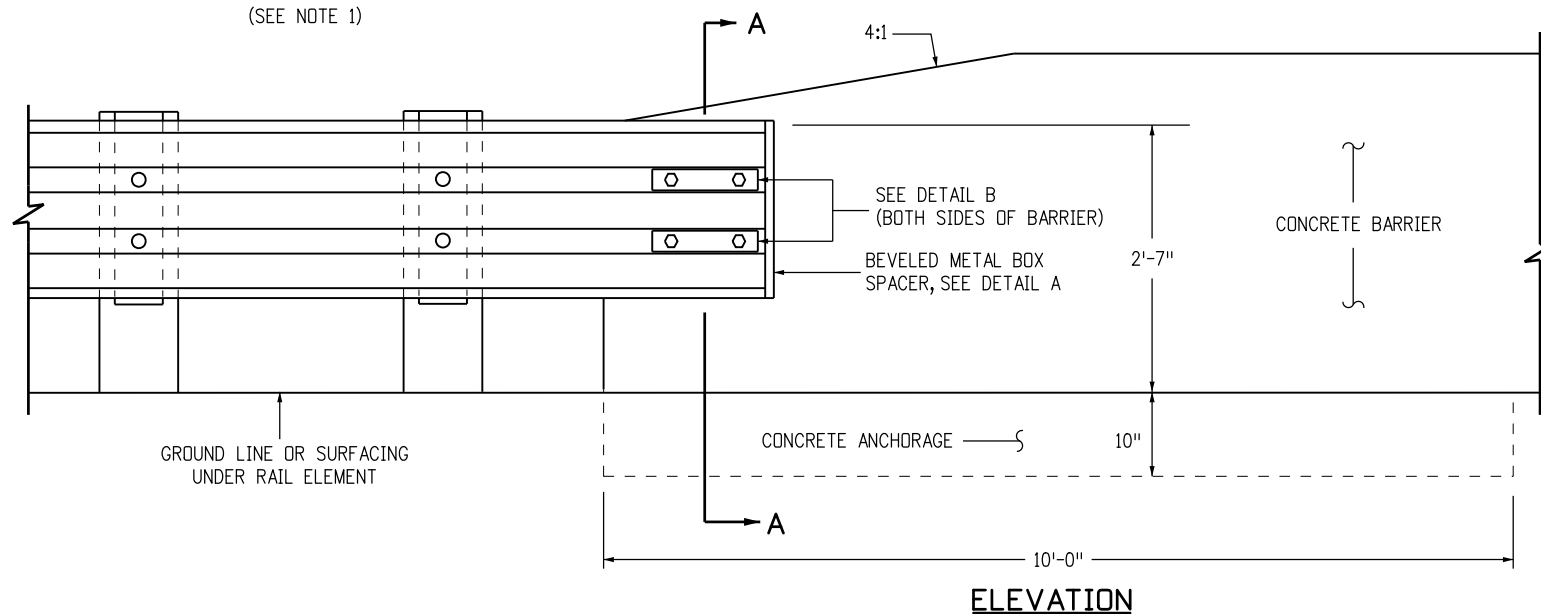
**DETAIL B**  
**PLATE A**

**LEGEND**

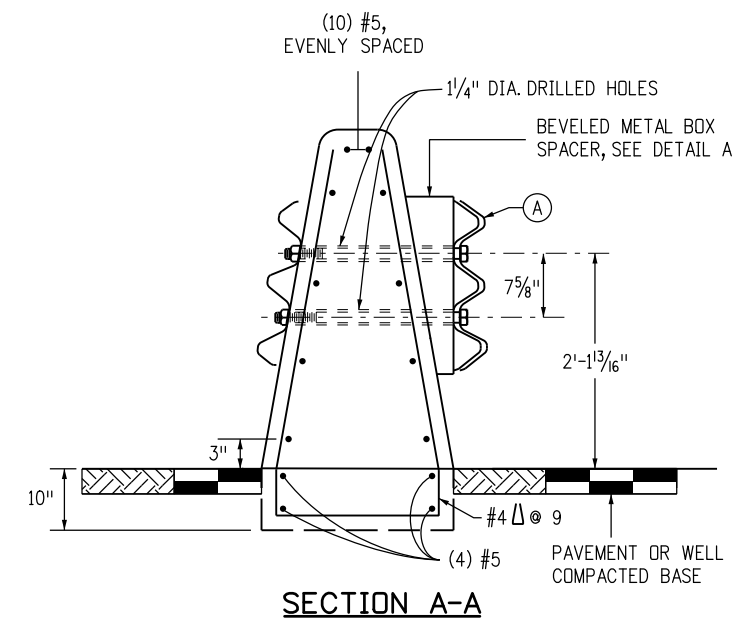
- (A) NESTED THRIE BEAM ELEMENTS (ONE 12 GAUGE ELEMENT NESTED OVER ONE 10 GAUGE ELEMENT).
- (B) ONE 10 GAUGE THRIE BEAM ELEMENT.
- (C) ONE 12 GAUGE THRIE BEAM ELEMENT.
- 10 GAUGE = 0.135" THICK
- 12 GAUGE = 0.108" THICK

**NOTES**

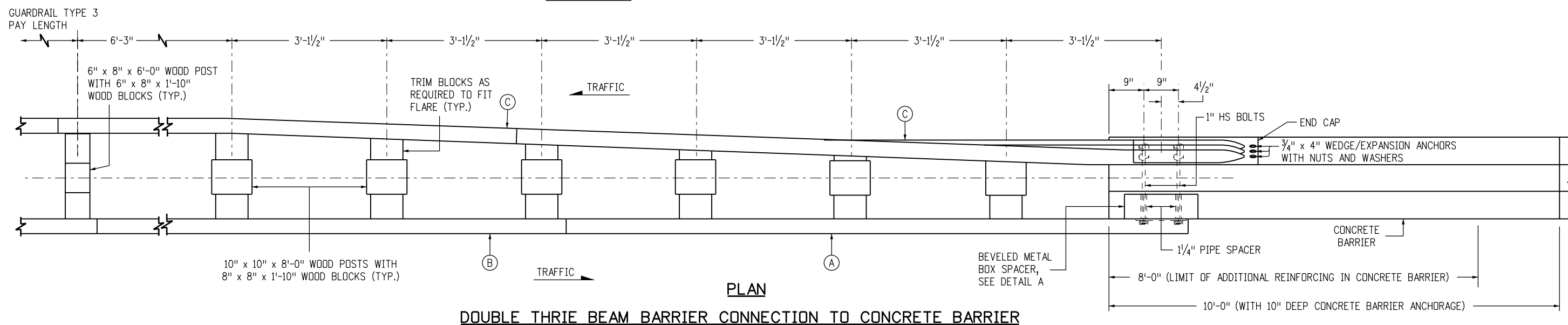
1. WHERE BEVELED METAL BOX SPACERS ARE INSTALLED, PLACE A 1 1/4 INCH X 3/4 INCH AND A 1/4 INCH X 2 INCH PIPE SPACERS ON 1 INCH HS BOLTS PASSING THROUGH THE INTERIOR OF BOX.
2. ALL METAL BOXES SHALL BE GALVANIZED.



**ELEVATION**

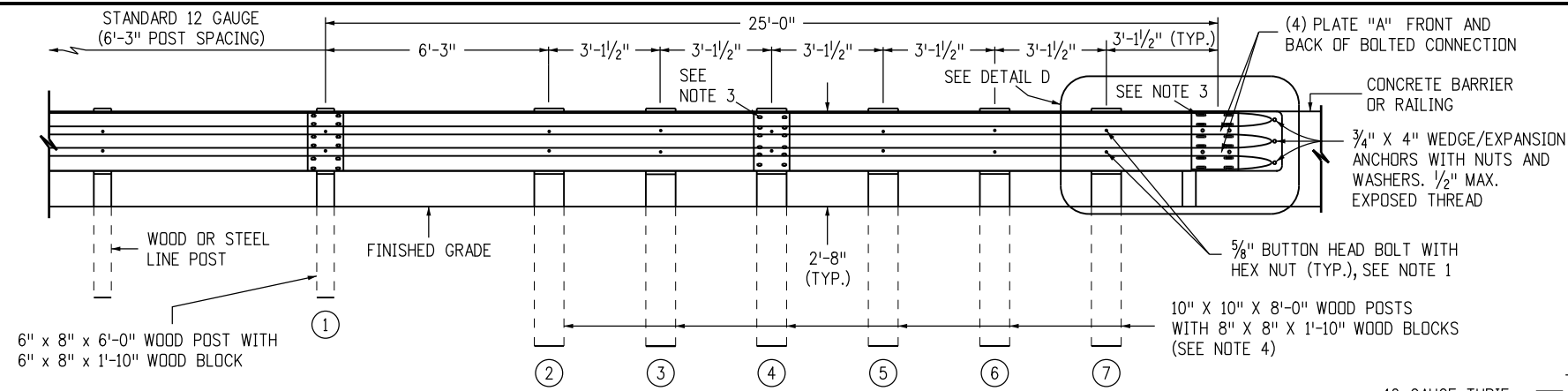


**SECTION A-A**

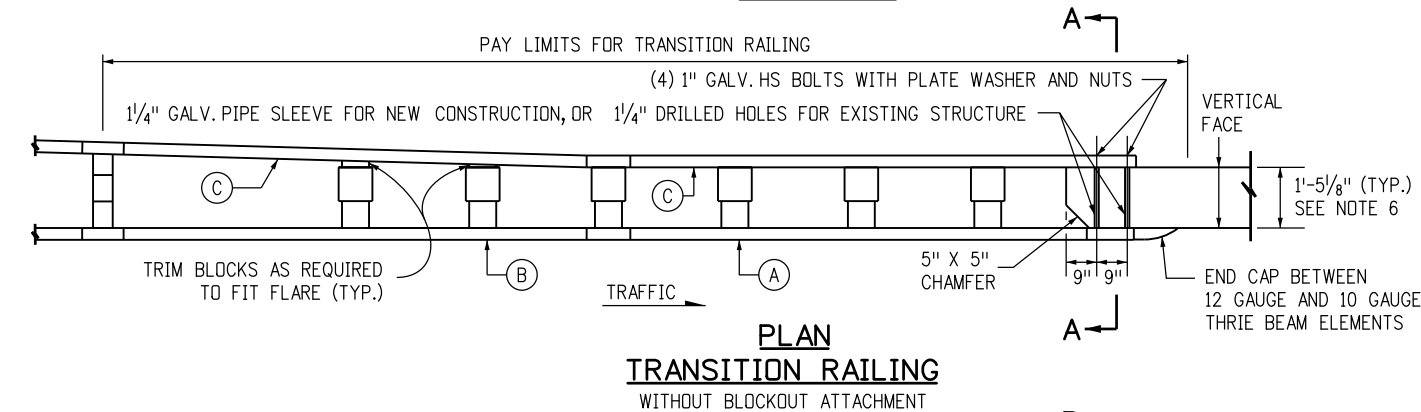


**DOUBLE THRIE BEAM BARRIER CONNECTION TO CONCRETE BARRIER**

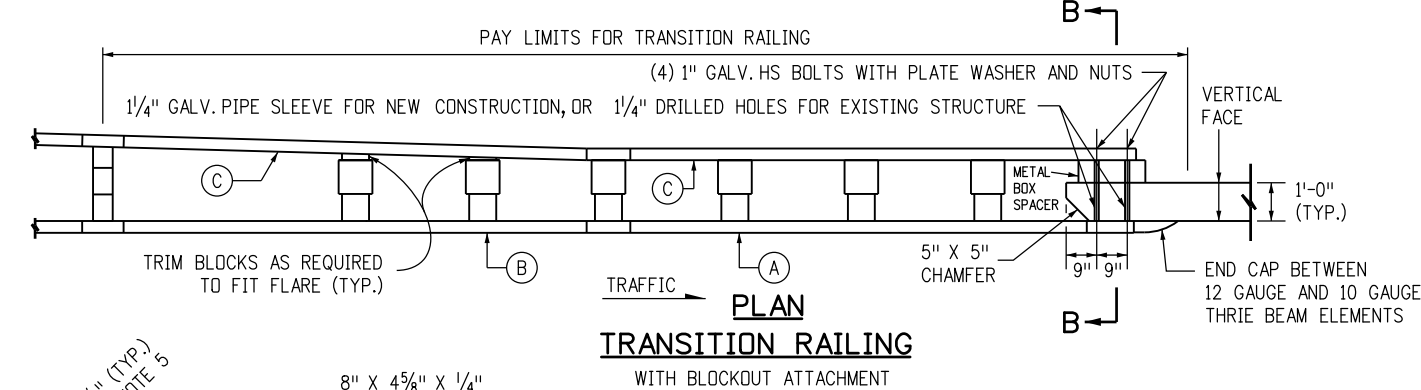
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>GUARDRAIL TYPE 9</b> <b>SINGLE SLOPE BARRIER</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-606-15	
Designer Initials: JBK		(R-X)				Standard Sheet No. 9 of 11	
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Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		JBK			



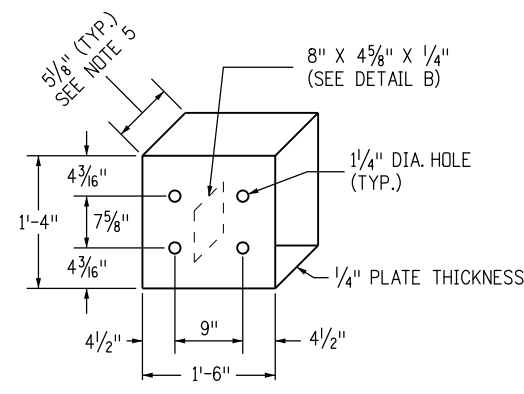
**ELEVATION**



**PLAN  
TRANSITION RAILING  
WITHOUT BLOCKOUT ATTACHMENT**

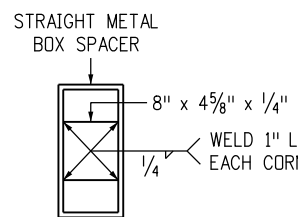


**PLAN  
TRANSITION RAILING  
WITH BLOCKOUT ATTACHMENT**



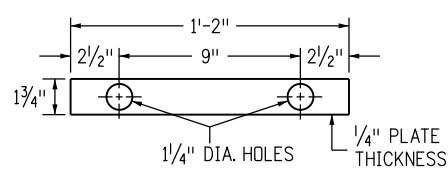
**DETAIL A**

PLACEMENT OF HOLES FOR FRONT AND BACK PANELS

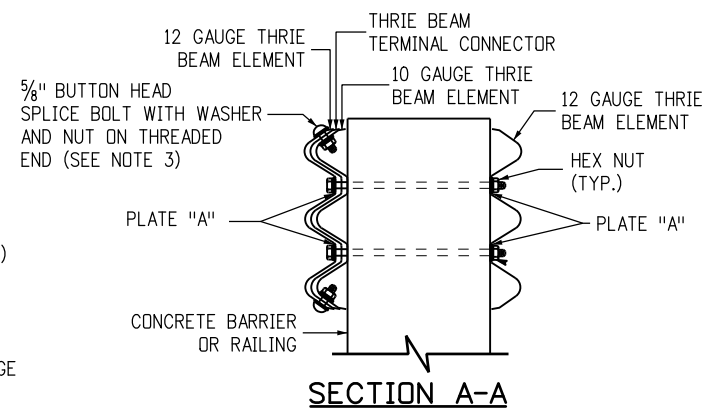


**DETAIL B**

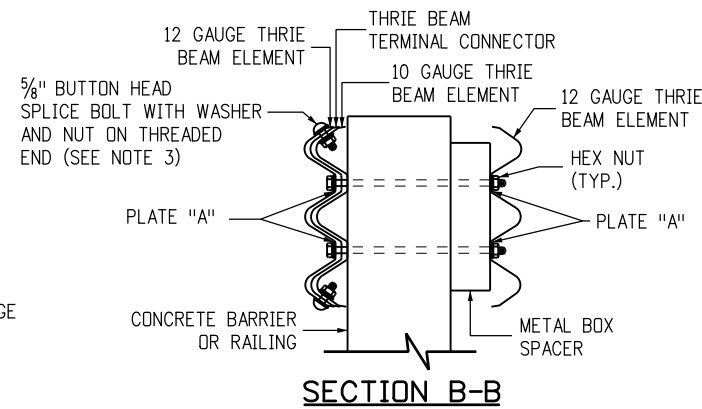
**STRAIGHT METAL BOX SPACER**



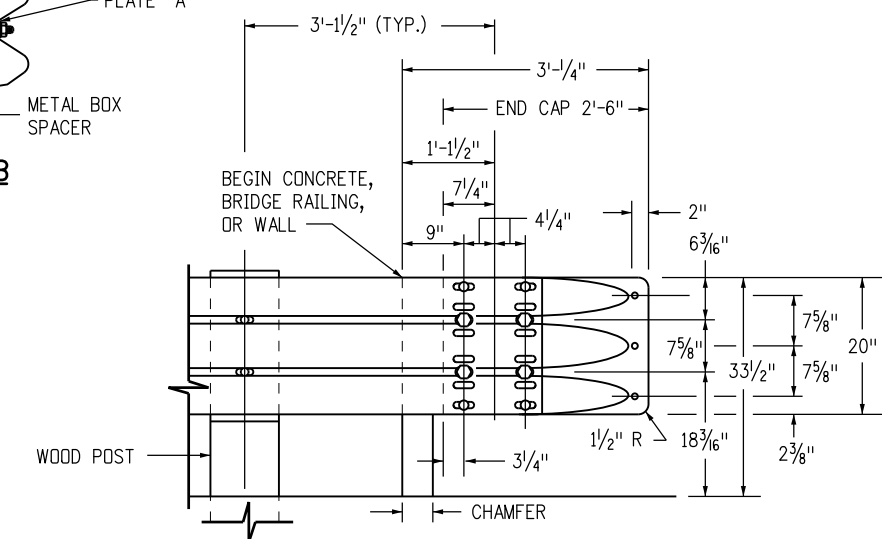
**PLATE "A"  
DETAIL C**



**SECTION A-A**



**SECTION B-B**



**DETAIL D**

SEE MANUFACTURER'S DETAILS FOR EXACT DIMENSIONS

**LEGEND**

- (A) NESTED THRIE BEAM ELEMENTS (ONE 12 GAUGE ELEMENT NESTED OVER ONE 10 GAUGE ELEMENT)
  - (B) ONE 10 GAUGE THRIE BEAM ELEMENT
  - (C) ONE 12 GAUGE THRIE BEAM ELEMENT
- 10 GAUGE = 0.135" THICK  
12 GAUGE = 0.108" THICK

**NOTES**

1. USE 5/8" BUTTON HEAD BOLTS AND HEX NUTS FOR CONNECTIONS TO POSTS. NO WASHER ON RAIL FACE FOR BOLTED CONNECTIONS TO POST.
2. THE NESTED RAIL ELEMENTS, END CAP AND SINGLE 10 GAUGE THRIE BEAM ELEMENT, MAY BE SPLICED TOGETHER PRIOR TO BOLTING THE ELEMENTS TO THE WOOD POST AND CONCRETE BARRIER OR RAILING.
3. EXTERIOR SPLICE BOLT HOLES FOR RAIL ELEMENT SPLICES AT POST (4) AND THE CONNECTION TO THE CONCRETE BARRIER OR RAILING SHALL BE THE STANDARD 2 9/32" X 1 1/8" SLOT SIZE. INTERIOR SPLICE BOLT HOLES AT THESE LOCATIONS MAY BE INCREASED UP TO 1 1/4". ONLY THE TOP TWO AND THE BOTTOM TWO SPLICE BOLTS WITH WASHERS AND NUTS ARE REQUIRED FOR RAIL SPLICES AT POST (4) AND THE CONNECTION TO THE CONCRETE BARRIER OR RAILING.
4. THE TOP ELEVATION OF POSTS (1) THROUGH (7) SHALL NOT PROJECT MORE THAN 1 INCH ABOVE THE TOP ELEVATION OF THE RAIL ELEMENT.
5. THE DEPTH OF THE METAL BOX SPACER VARIES FROM THE 5/8" TO 1 1/2" AND IS DEPENDENT ON THE WIDTH OF THE CONCRETE RAILING OR WALL. THE COMBINED DIMENSION FOR THE DEPTH OF THE METAL BOX SPACER PLUS THE WIDTH OF RAILING OR WALL IS TYPICALLY 17 7/8". WHERE THE SPACE BETWEEN THE BACKSIDE OF THE CONCRETE RAILING OR WALL AND THE REAR THRIE BEAM ELEMENT IS LESS THAN 1 1/2", METAL PLATES SIMILAR TO PLATE "A" ARE BE USED AS SPACERS.
6. WHERE THE WIDTH OF THE CONCRETE RAILING OR WALL IS GREATER THAN 17 7/8", WOOD BLOCKS ARE TO BE USED TO FILL THE SPACE CREATED BETWEEN THE BACKSIDE OF POST (4) THROUGH NO. (7) AND THE REAR THRIE BEAM ELEMENT. THESE WOOD BLOCKS SHALL BE 8 INCHES IN WIDTH AND ONE FOOT-TWO INCHES IN LENGTH. THE DIMENSION BETWEEN THE FRONT THRIE BEAM ELEMENT AND THE REAR THRIE BEAM ELEMENT IS TO MATCH THE WIDTH OF THE CONCRETE RAILING OR WALL.

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Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch JBK

**GUARDRAIL TYPE 9  
SINGLE SLOPE BARRIER**

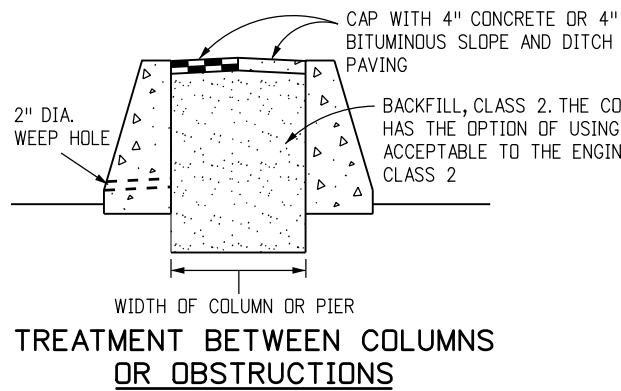
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**STANDARD PLAN NO.**

**M-606-15**

**Standard Sheet No. 10 of 11**

Project Sheet Number:



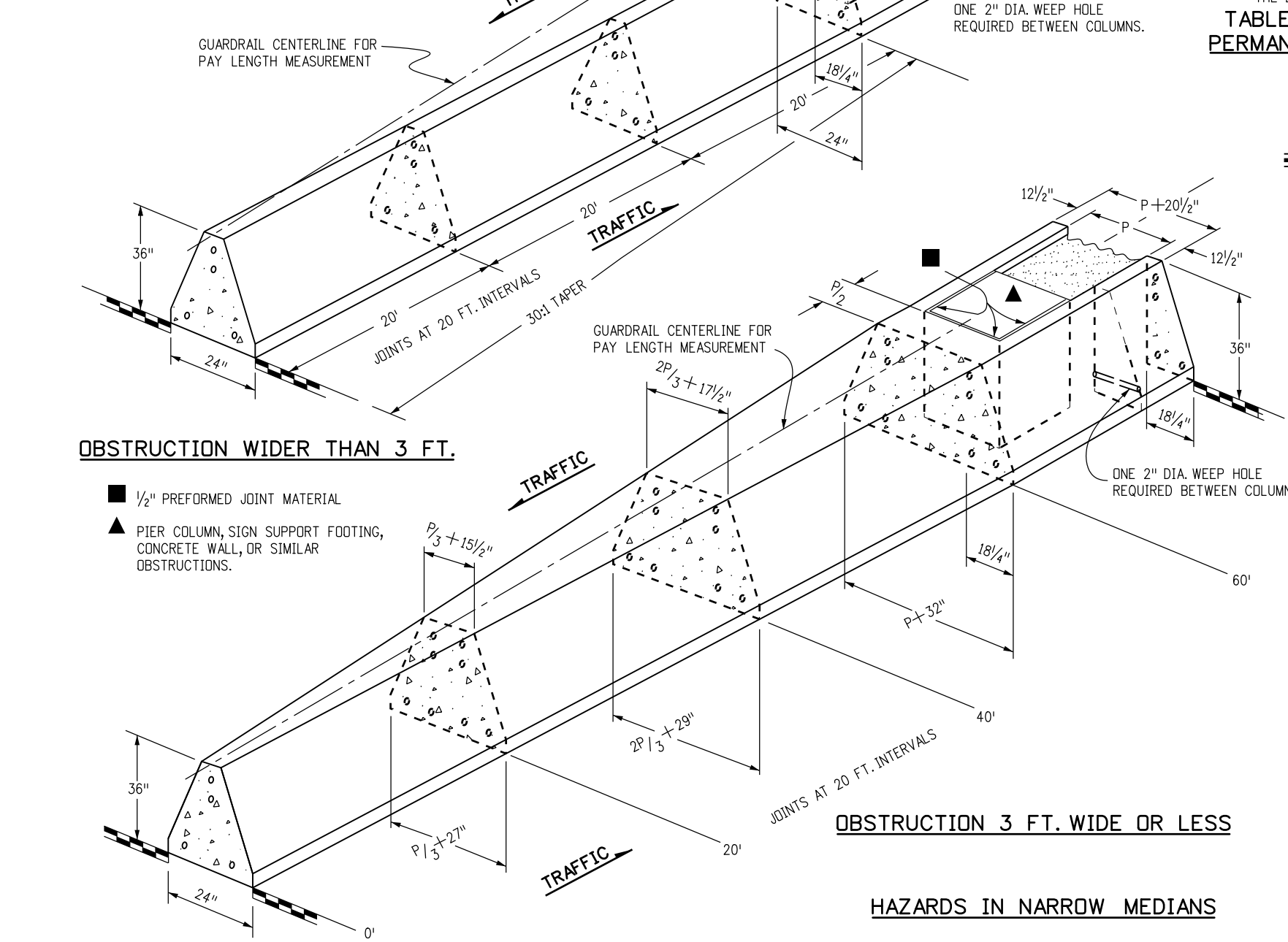
TREATMENT BETWEEN COLUMNS OR OBSTRUCTIONS

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 CA OR CD AS SHOWN ON THE PLANS.

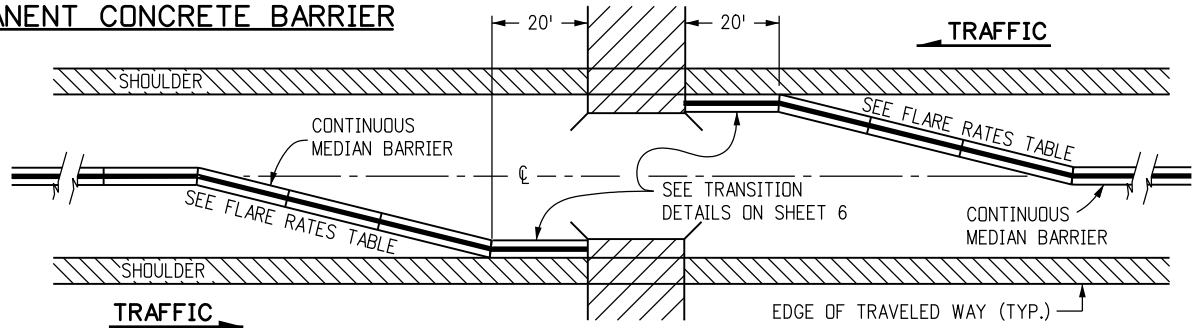


OBSTRUCTION WIDER THAN 3 FT.

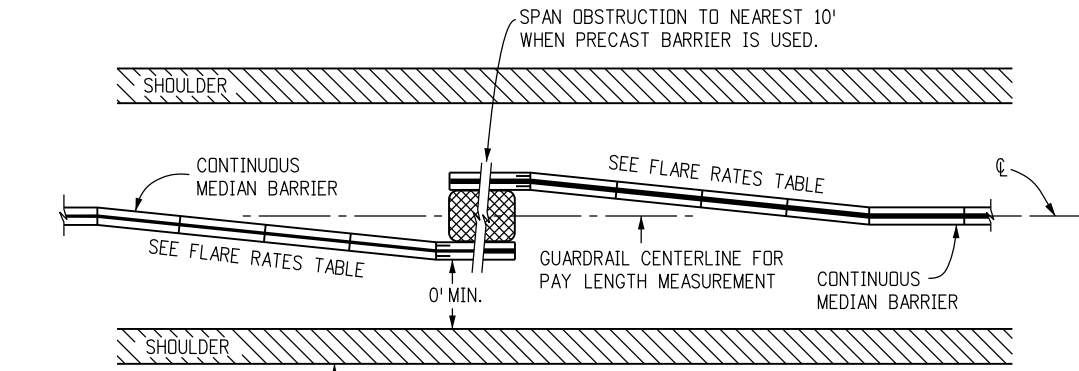
- 1/2" PREFORMED JOINT MATERIAL
- ▲ PIER COLUMN, SIGN SUPPORT FOOTING, CONCRETE WALL, OR SIMILAR OBSTRUCTIONS.

OBSTRUCTION 3 FT. WIDE OR LESS

HAZARDS IN NARROW MEDIANS

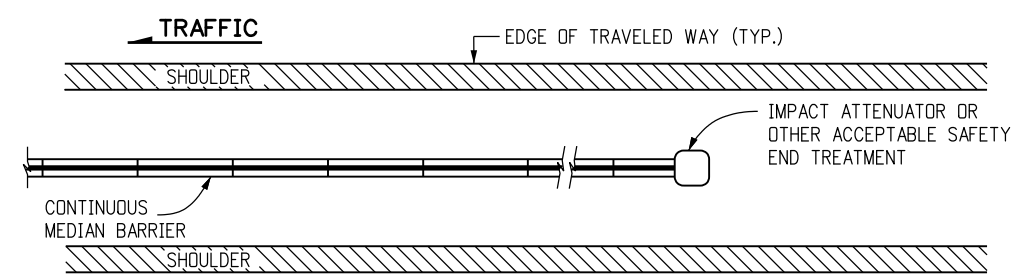


BRIDGE APPROACH



STYLE CA AT OBSTRUCTION

(OBSTRUCTION NOT SUITABLE FOR STYLE CD)



MEDIAN BARRIER END TREATMENT

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**GUARDRAIL TYPE 9  
 SINGLE SLOPE BARRIER**  
 Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.  
 M-606-15**  
 Standard Sheet No. 11 of 11  
 Project Sheet Number:

## GENERAL NOTES

- ALL MATERIAL DIMENSIONS AND WEIGHTS ON THIS STANDARD ARE NOMINAL UNLESS OTHERWISE INDICATED.
- 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 7/2 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.
- DIMENSIONS SHOWN FOR "STANDARD" AND "ALTERNATIVE" APPLY FOR BOTH WOOD AND METAL POST FENCE.
- 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.
- 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.
- WHERE STEEL POSTS ARE SPECIFIED, EVERY FIFTH POST SHALL BE WOOD, WHEN SPECIFIED ON THE PLANS.
- 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.
- 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
832-6-1*	32 IN. WIDTH 0.65 LBS./LIN.FT.	34 IN. WIDTH - 0.75 LBS./LIN.FT.
726-6-1*	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.

### Computer File Information

Creation Date: 07/31/19	(R-X)
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
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### Sheet Revisions

Date:	Comments

### Colorado Department of Transportation



2829 West Howard Place  
CDDT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

### Project Development Branch

JBK

# WIRE FENCES AND GATES

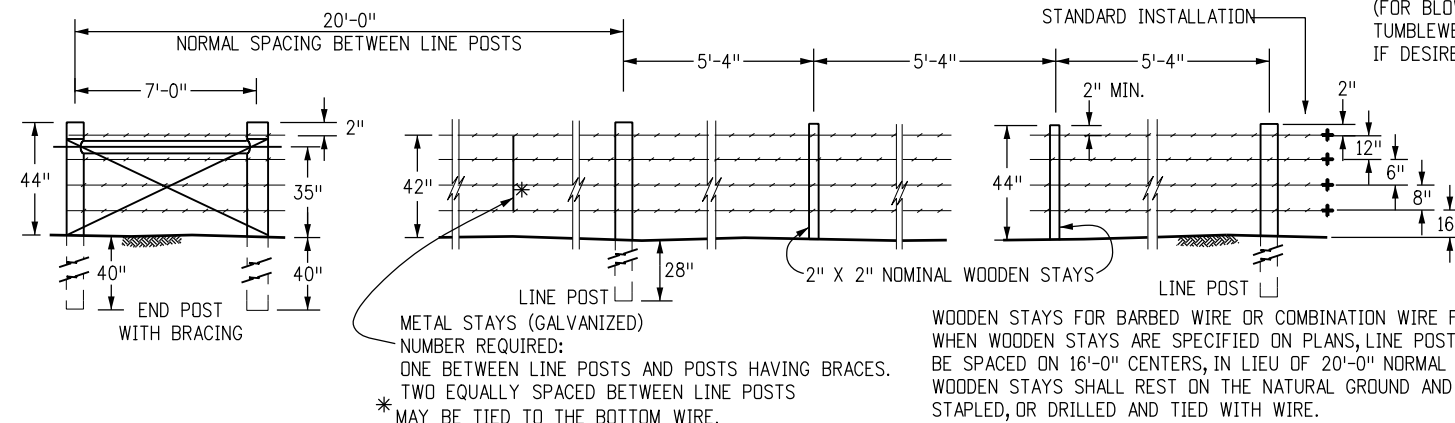
Issued by the Project Development Branch: July 31, 2019

### STANDARD PLAN NO.

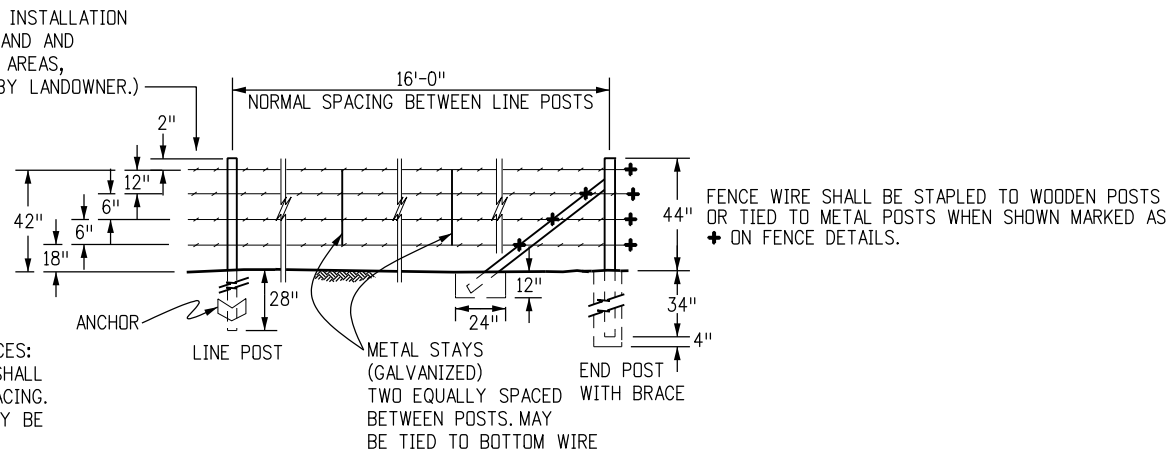
M-607-1

### Standard Sheet No. 1 of 3

Project Sheet Number:



**BARBED WIRE FENCE WITH WOODEN POSTS**

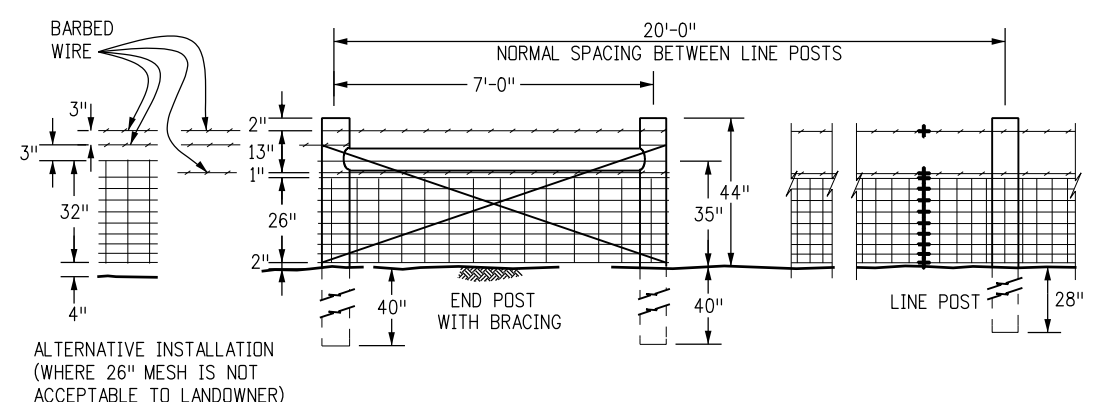


**BARBED WIRE FENCE WITH METAL POSTS**

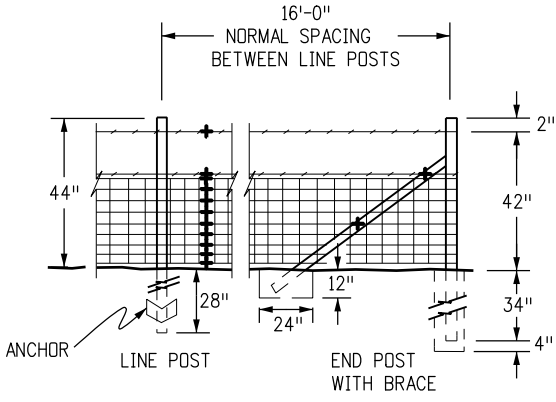
FENCE WIRE SHALL BE STAPLED TO WOODEN POSTS OR TIED TO METAL POSTS WHEN SHOWN MARKED AS \* ON FENCE DETAILS.

METAL STAYS (GALVANIZED) NUMBER REQUIRED: ONE BETWEEN LINE POSTS AND POSTS HAVING BRACES. TWO EQUALLY SPACED BETWEEN LINE POSTS \* MAY BE TIED TO THE BOTTOM WIRE.

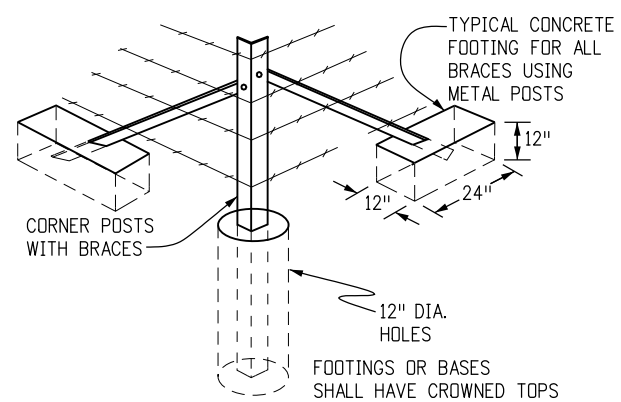
WOODEN STAYS FOR BARBED WIRE OR COMBINATION WIRE FENCES: WHEN WOODEN STAYS ARE SPECIFIED ON PLANS, LINE POSTS SHALL BE SPACED ON 16'-0" CENTERS, IN LIEU OF 20'-0" NORMAL SPACING. WOODEN STAYS SHALL REST ON THE NATURAL GROUND AND MAY BE STAPLED, OR DRILLED AND TIED WITH WIRE.



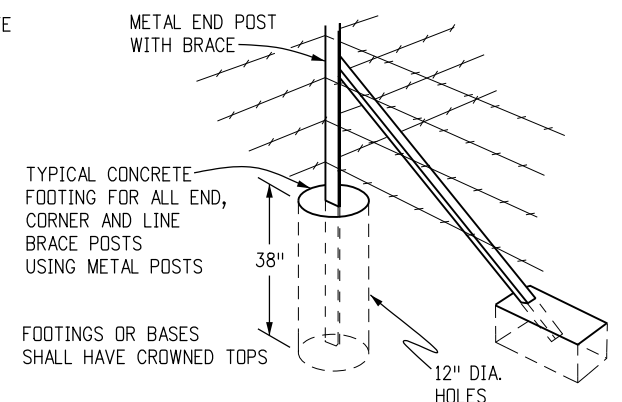
**COMBINATION WIRE FENCE WITH WOODEN POSTS**



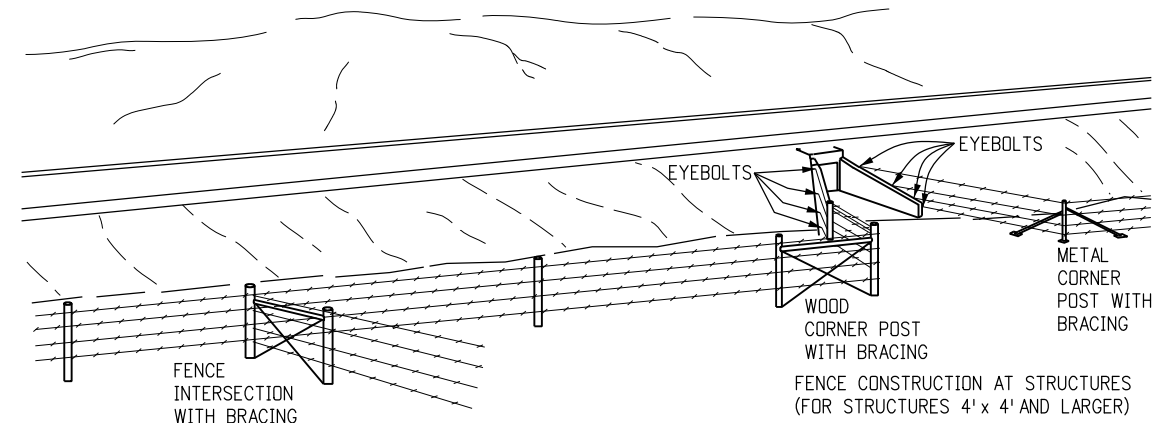
**COMBINATION WIRE FENCE WITH METAL POSTS**



**TYPICAL CORNER POST INSTALLATION**

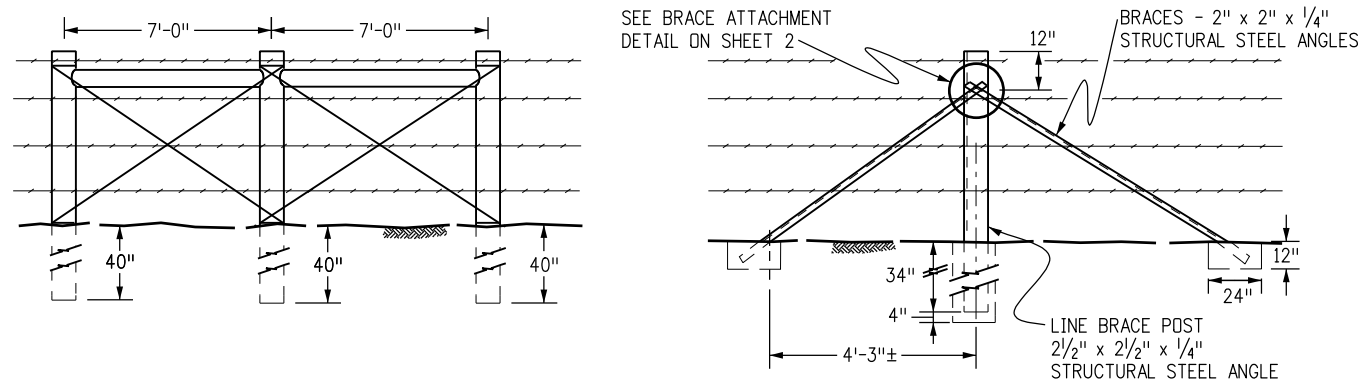


**TYPICAL INSTALLATION AT FENCE INTERSECTIONS**



**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 1/2 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 1/2 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

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

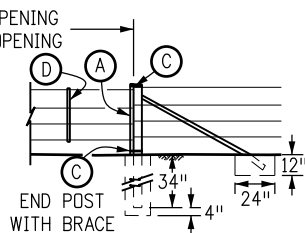
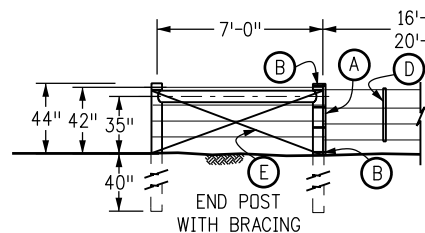
Colorado Department of Transportation  
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Project Development Branch JBK

**WIRE FENCES AND GATES**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-607-1**  
Standard Sheet No. 2 of 3  
Project Sheet Number:



▼ FOR COMBINATION WIRE GATE, USE 3/4" MESH AND ONE STRAND OF BARBED WIRE. EXTEND WOODEN STAYS TO GROUND.

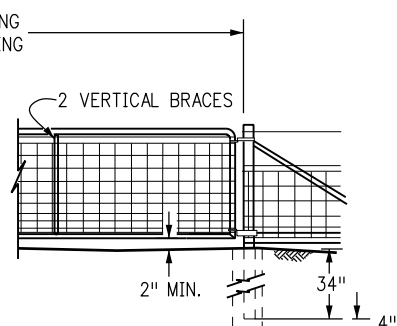
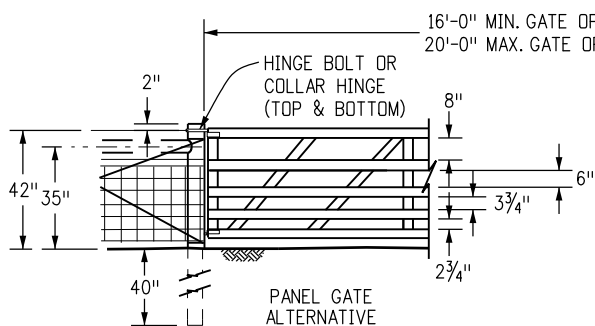
- (A) 2 IN. x 4 IN. x 4 FT. WOODEN STAYS
- (B) FOUR NO. 12-1/2 GA. WIRE LOOPS TO ACT AS HINGES
- (C) NO. 12-1/2 GA. WIRE LOOPS

- (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**

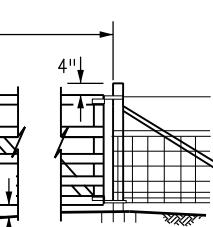
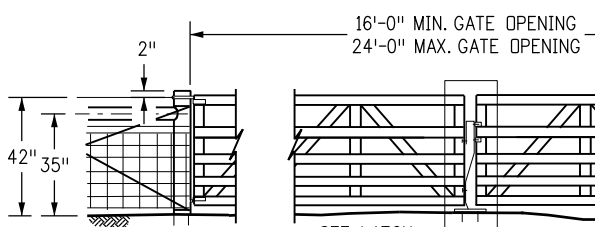


**WOODEN POSTS**  
(16'-0" MAX.)

**DRIVEWAY GATES**

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

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

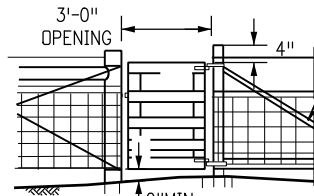


**WOODEN POSTS**

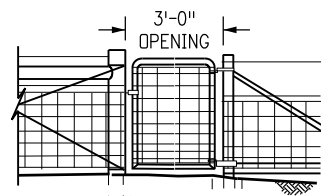
FOR SPACING OF GATE PANELS AND LENGTH OF POSTS, SEE DETAIL ABOVE.

**PANEL GATE POSTS**

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



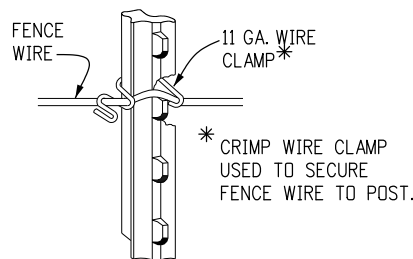
FOR LENGTH OF POSTS AND SPACING OF WIRE AND GATE PANELS, SEE DRIVEWAY GATE DETAIL ABOVE.



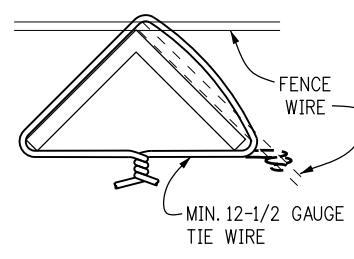
**WOODEN POSTS PANEL GATE POSTS**  
**WALK GATE**

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

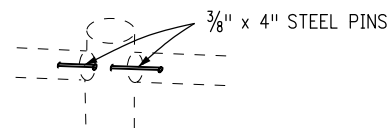
**WOODEN POSTS METAL END POSTS**  
**ALTERNATIVE WALK GATE**



**TIES FOR "STUDED TEE" OR "U" POSTS**

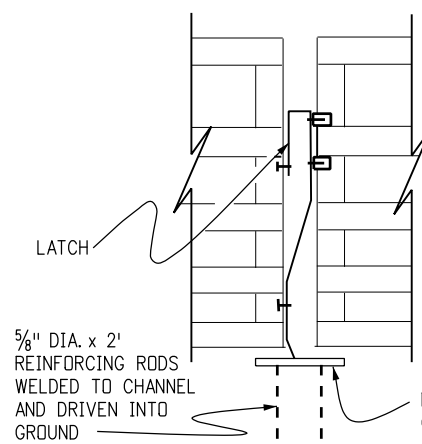


**TIES FOR ANGLE POSTS FENCE WIRE TIES**

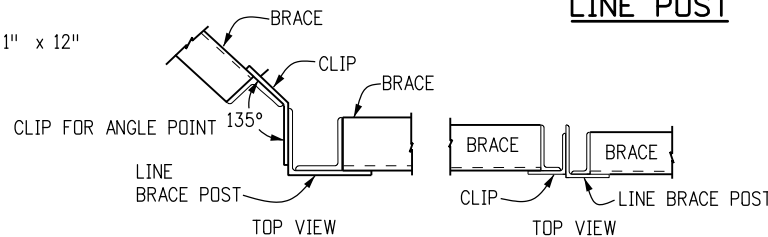


BORE A 3/8" x 2" HOLE IN EACH POST AND BRACE TO RECEIVE THE PINS. WRAP THE ENDS OF THE BRACES TIGHTLY WITH SEVERAL TURNS OF 12-1/2 GA. SMOOTH GALV. WIRE TO PREVENT SPLITTING OR NOTCH POST AND NAIL WITH 40d COMMON NAILS.

**CROSS BRACE DOWELING DETAIL**



**LATCH DETAIL**

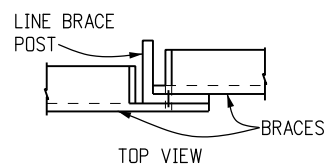


**STUDED "TEE" LINE POST**

**"U" LINE POST TYPICAL METAL POSTS**

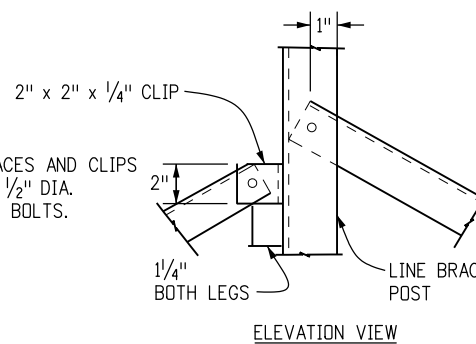
SPlicing SLEEVE SHALL BE APPROVED BY THE ENGINEER

**WIRE SPLICE**



**BRACE ATTACHMENT DETAIL**

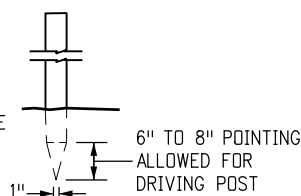
HOLE IN POSTS, BRACES AND CLIPS SHALL ACCOMMODATE 1/2" DIA. GALVANIZED MACHINE BOLTS.



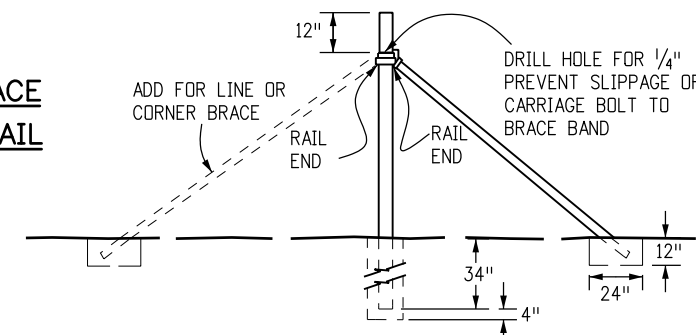
**ALTERNATIVE BRACE ATTACHMENT DETAIL**

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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Creation Date: 07/31/19	(R-X)
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**Sheet Revisions**

Date:	Comments

Colorado Department of Transportation  
2829 West Howard Place  
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Project Development Branch JBK

**WIRE FENCES AND GATES**

Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

M-607-1

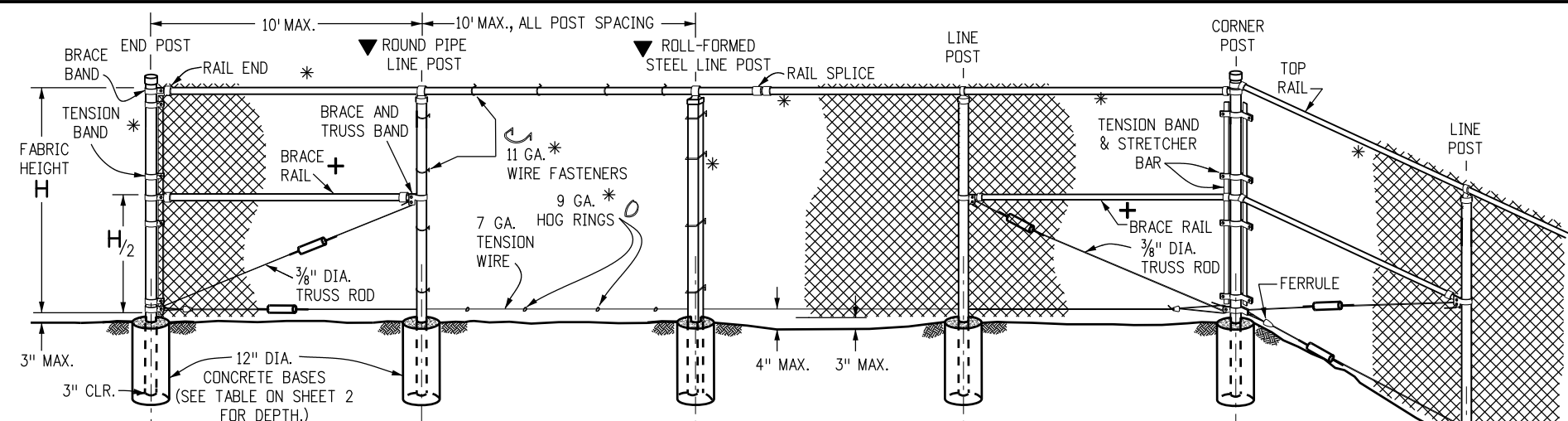
**Standard Sheet No. 3 of 3**

Project Sheet Number:



**GENERAL NOTES**

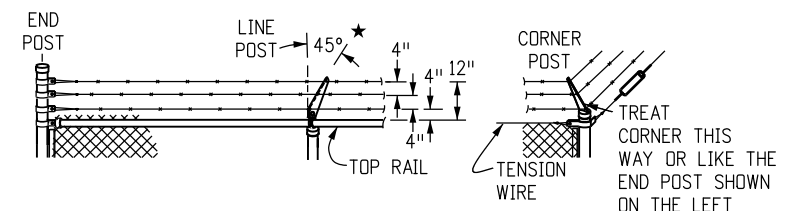
- AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION, OR SECONDARY LINE CROSSES A FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRIC CODE. A GROUND SHALL ALSO BE INSTALLED A MAXIMUM OF EVERY 500 FT. ALONG THE FENCE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF 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 COST OF THE FENCE.
- H (HEIGHT OF FABRIC) SHALL BE AS SHOWN ON THE PLANS. FABRIC IS AVAILABLE 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.
- CHAIN LINK FENCE SHALL CONFORM TO AASHTO M 181.
- 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.
- STEEL POSTS, RAILS AND GATE FRAMES SHALL CONFORM TO AASHTO M 181 TYPE 1, GRADE 2.
- 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.
- 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.
- TENSION WIRE SHALL CONFORM TO AASHTO M 181.
- 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.
- TERMINATION OF FENCE AT BRIDGES OR OTHER STRUCTURES SHALL BE AS SHOWN ON THE PLANS.
- 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.
- 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.
- 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.



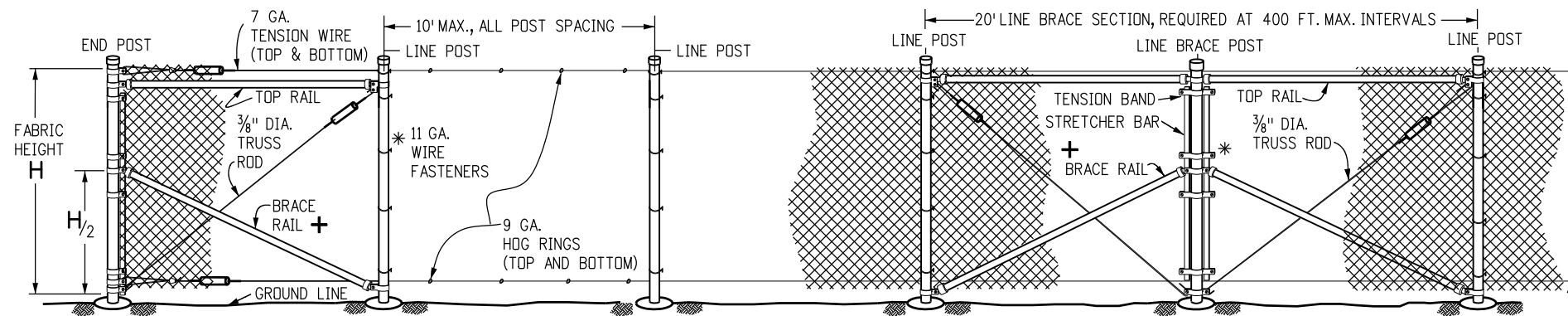
**FENCE WITH TOP RAIL** (USE ONLY AT SPECIAL LOCATIONS BEYOND CLEAR ZONE WHEN THE TOP RAIL IS SPECIFIED ON PLANS)

**LEGEND**

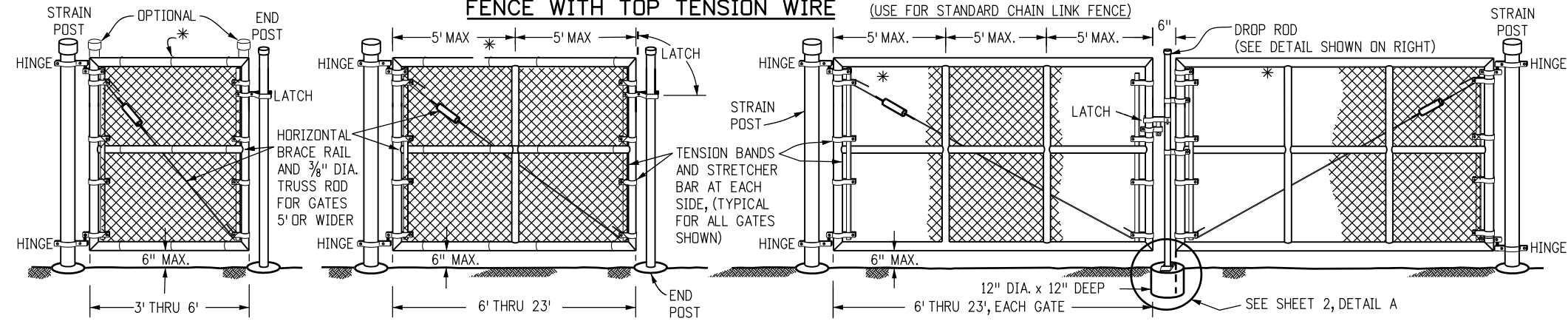
- \* ATTACH FABRIC TO ALL FENCE & GATE STRUCTURES AT 12 IN. INTERVALS VERTICALLY AND AT 20 IN. HORIZONTALLY.
- ⚡ TIGHTENER OR TURNBUCKLE SYMBOL, (SEE DETAILS ON SHEETS 2 AND 3).
- ▼ TYPE OF LINE POST (ROUND PIPE OR ROLL-FORMED STEEL) SHALL BE AT THE OPTION OF THE CONTRACTOR UNLESS OTHERWISE SHOWN ON 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).
- ★ 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



**BARBED WIRE TOP** (USE ONLY WHEN SPECIFIED ON PLANS)



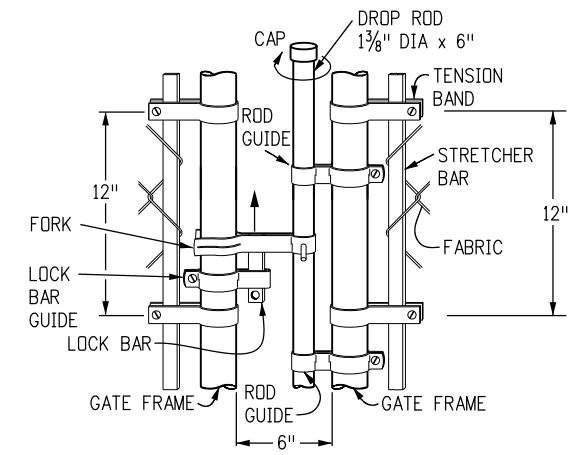
**FENCE WITH TOP TENSION WIRE** (USE FOR STANDARD CHAIN LINK FENCE)



**WALK GATE**

**SINGLE GATE**

**DOUBLE GATE**



**TYPICAL DROP ROD ASSEMBLY**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>CHAIN LINK FENCE</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-607-2	
Designer Initials: JBK		(R-X)				Standard Sheet No. 1 of 3	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		JBK	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	

**FENCE MATERIAL**

FABRIC HEIGHT	END, CORNER AND LINE BRACE POSTS		LINE POSTS		TOP & BRACE RAILS	
	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.	
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

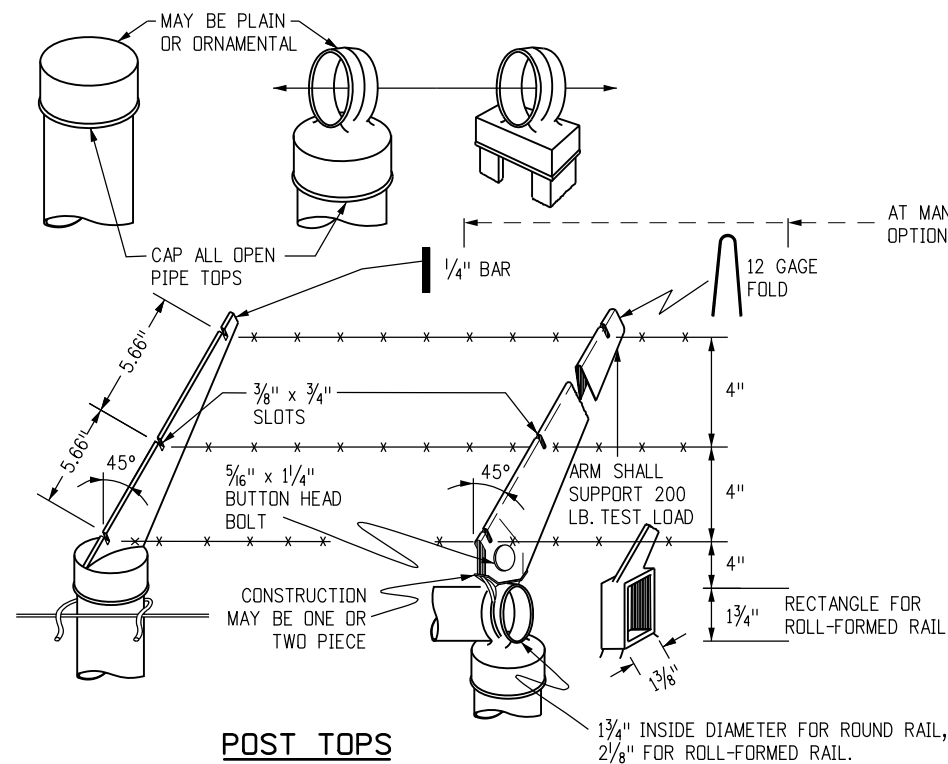
**GATE MATERIAL**

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

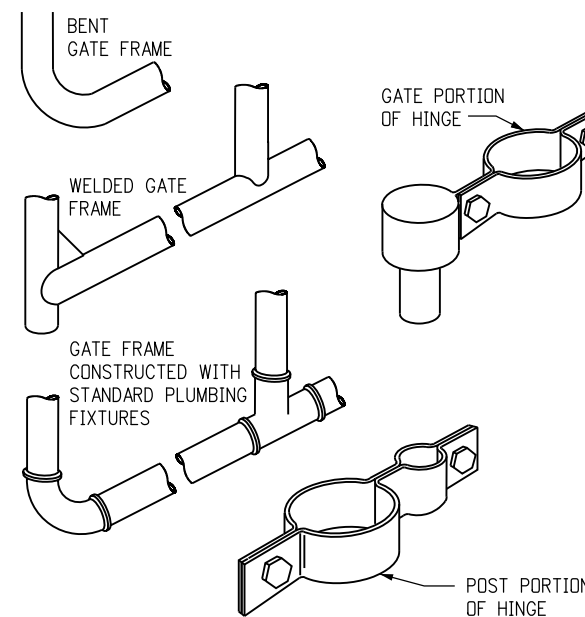
**ROLL-FORMED STEEL**

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

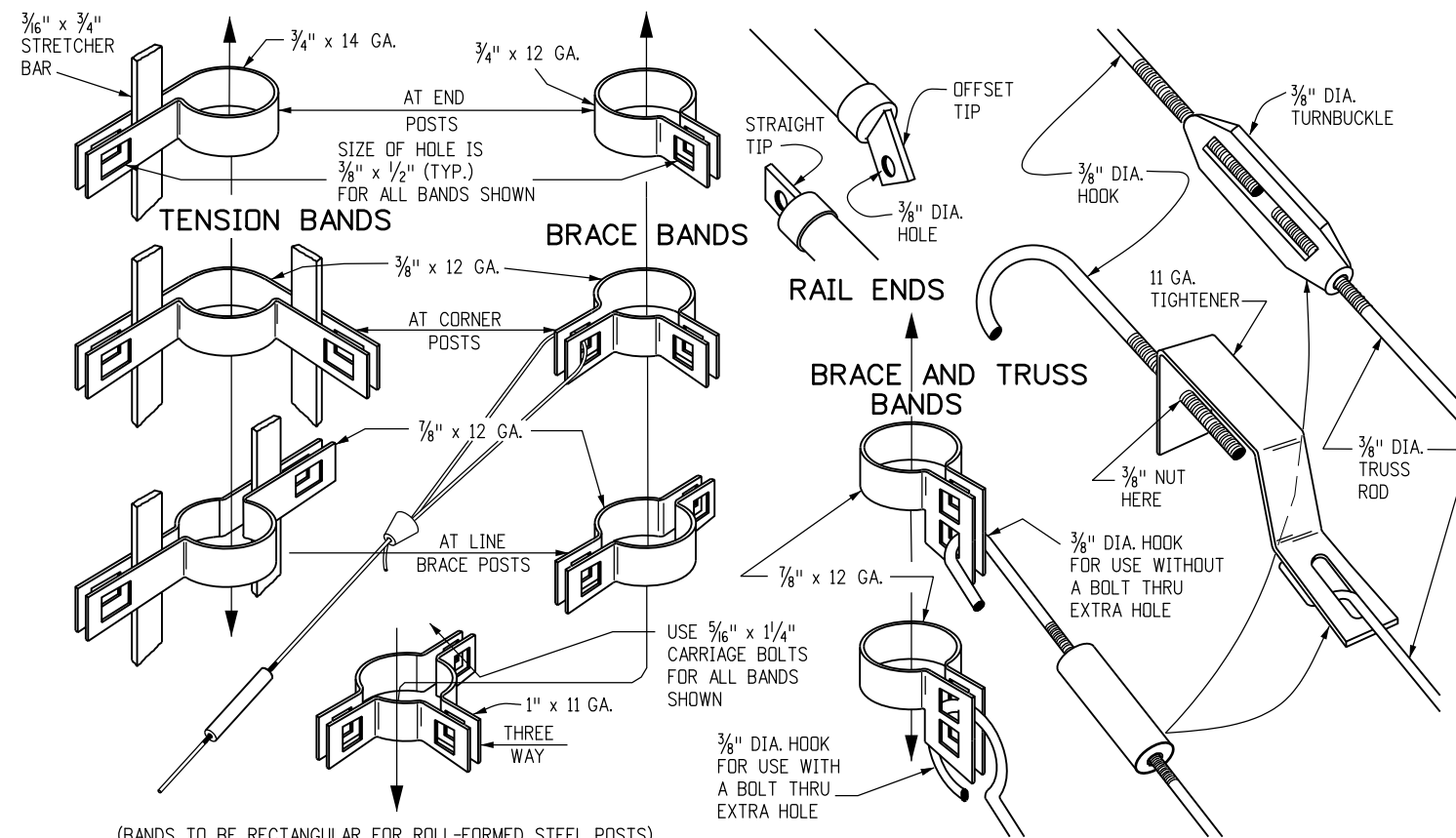


**POST TOPS**

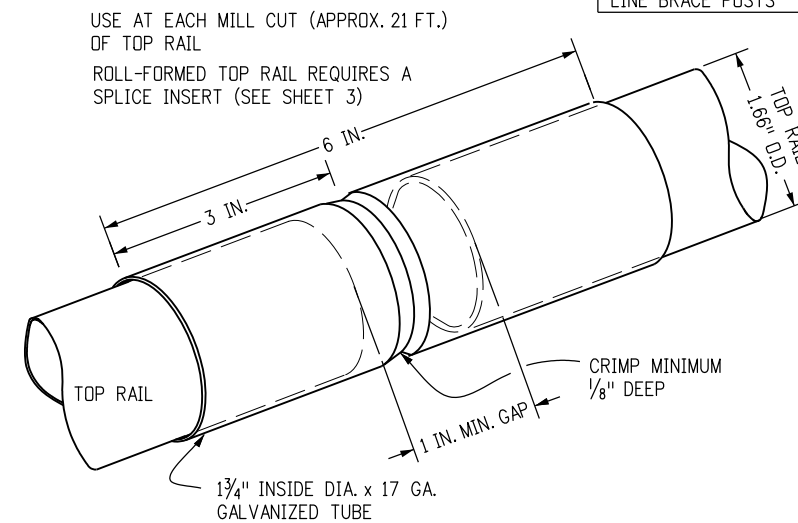
1 3/4" INSIDE DIAMETER FOR ROUND RAIL, 2 1/8" FOR ROLL-FORMED RAIL.



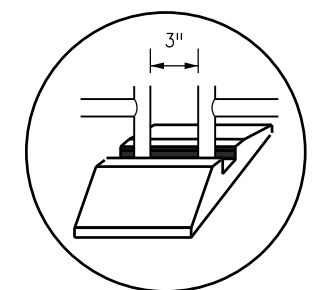
**GATE FRAMES & HINGE**



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



**RAIL SPLICE**



**DETAIL A TYPICAL CENTER REST**

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

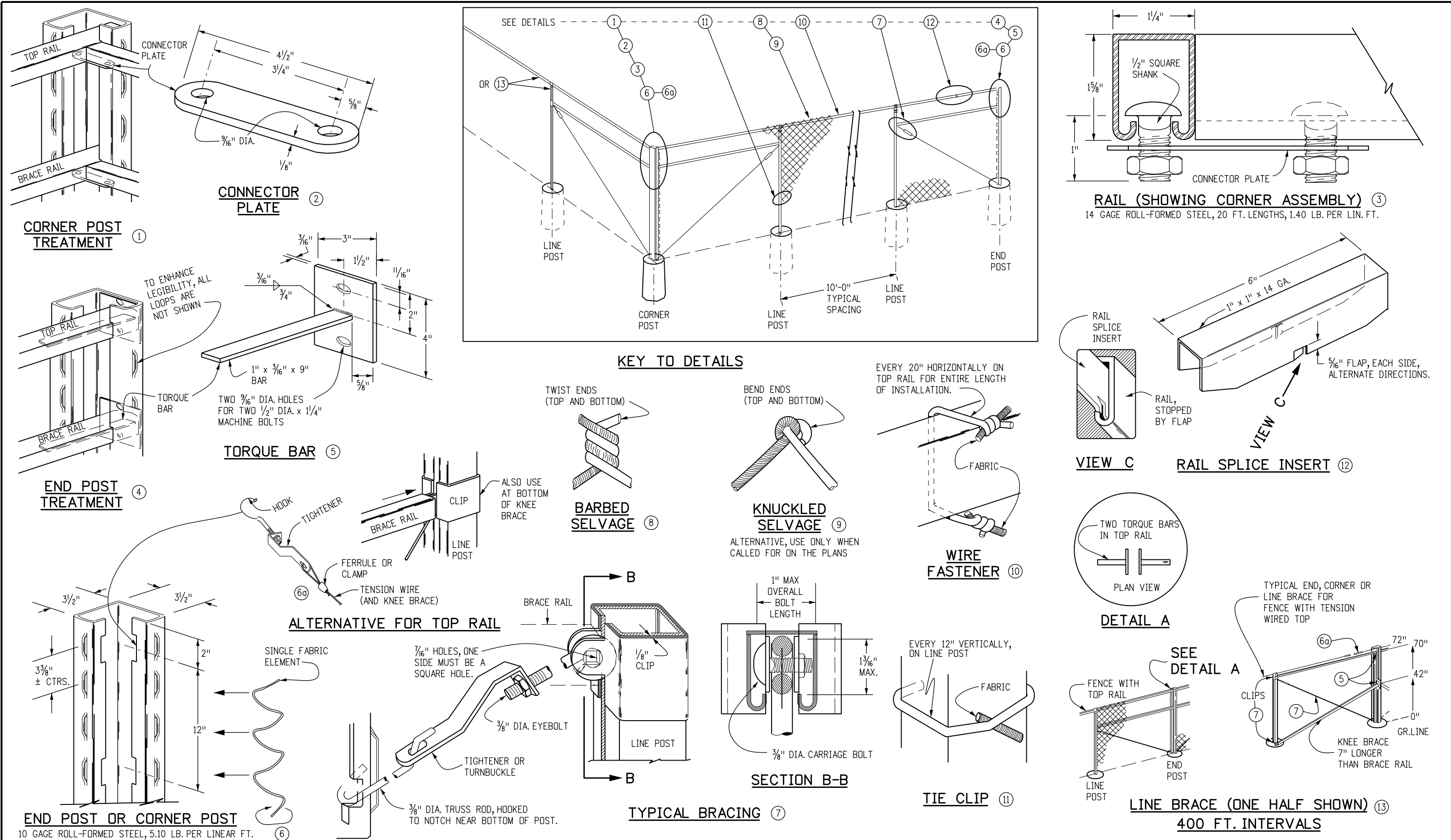
Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
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Sheet Revisions	
Date:	Comments

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 Project Development Branch JBK

**CHAIN LINK FENCE**  
 Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-607-2**  
 Standard Sheet No. 2 of 3  
 Project Sheet Number:



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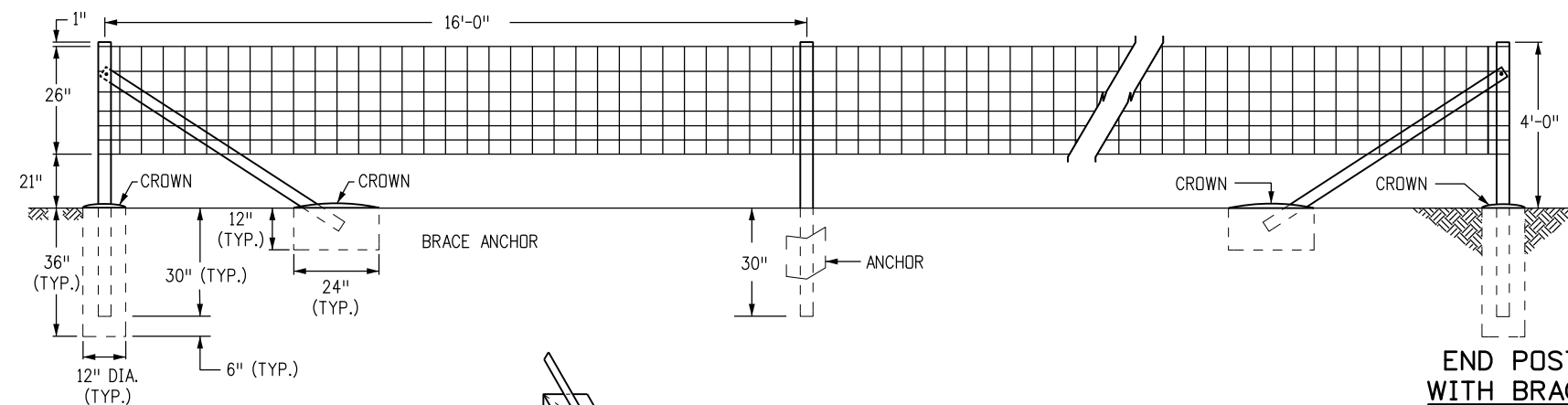
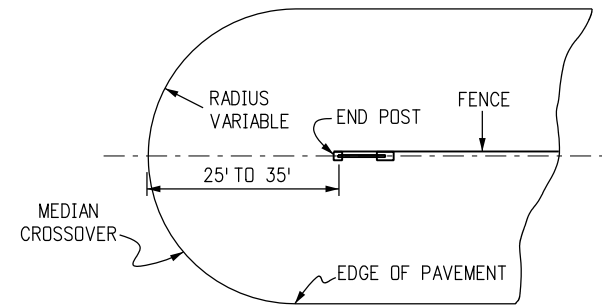
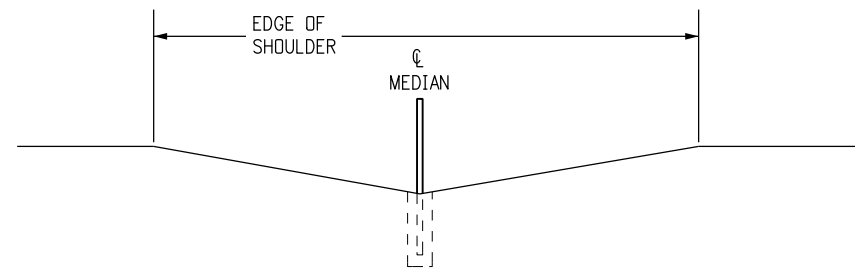
**CHAIN LINK FENCE**

Issued by the Project Development Branch: July 31, 2019

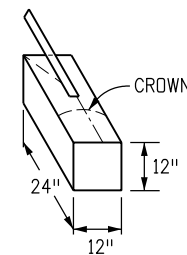
STANDARD PLAN NO.  
**M-607-2**  
 Standard Sheet No. 3 of 3  
 Project Sheet Number:

**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 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.



**END POST WITH BRACE**



**SKETCH OF BRACE ANCHOR**

**END POST WITH BRACE**

**SPECIFICATIONS**

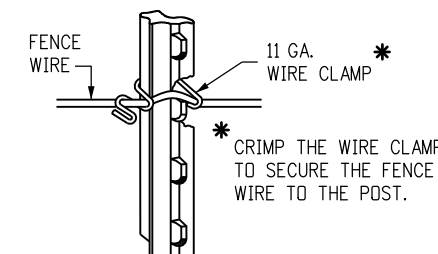
**END POSTS:**  
 TYPE: 2 1/2" x 2 1/2" x 1/4" STRUCTURAL STEEL ANGLES  
 WEIGHT: 4.10 LBS. PER LIN. FT. NOMINAL (RAW)  
 LENGTH: 6'-6" MINIMUM  
 NO. OF BRACES: ONE

**LINE POSTS:**  
 TYPE: "STUDED 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

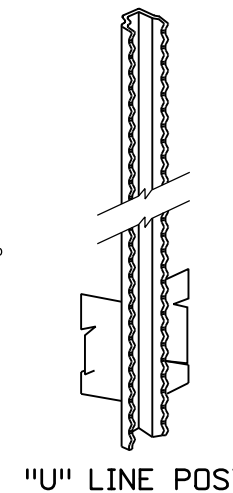
**BRACES:**  
 TYPE: 2" x 2" x 1/4" STRUCTURAL STEEL ANGLES  
 WEIGHT: 3.19 LBS. PER LIN. FT. NOMINAL (RAW)  
 LENGTH: 6'-6" MINIMUM

**WOVEN WIRE FENCE FABRIC:**  
 STYLE OR DESIGN NUMBER: 726 - 6 - 12 1/2

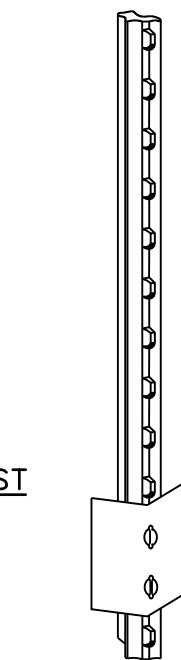
**TIES:**  
 END POSTS: EACH HORIZONTAL WIRE OF WOVEN WIRE FABRIC TO BE WRAPPED AROUND POST AND FASTENED IN ADDITION TO TWO TIE WIRES.  
 LINE POSTS: MINIMUM THREE TIES PER POST FOR WOVEN WIRE FABRIC



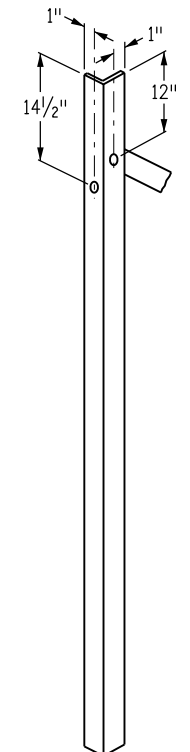
**TIES FOR "STUDED TEE" OR "U" POSTS**



**"U" LINE POST**

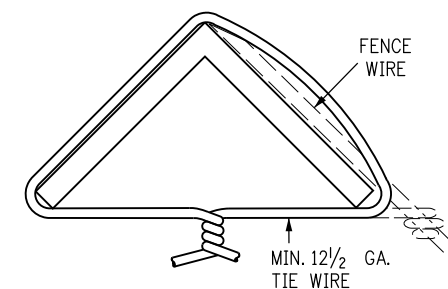


**"STUDED TEE" LINE POST**

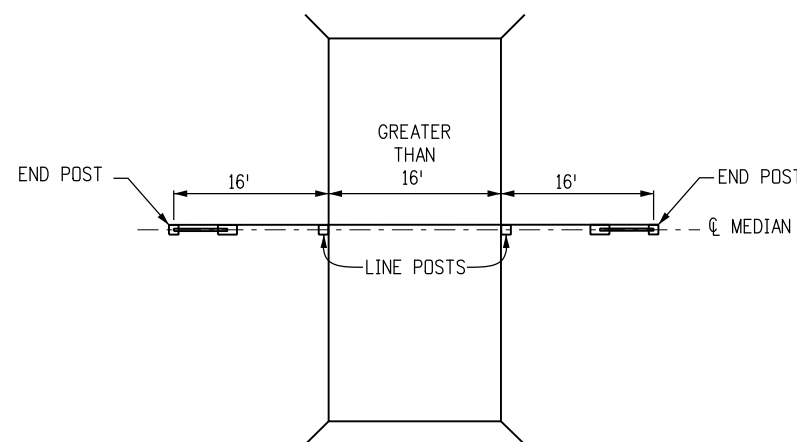


**END POST WITH BRACING**

NOTE: HOLES IN END POSTS AND BRACES SHALL ACCOMMODATE 1/2" DIA. GALVANIZED MACHINE BOLTS.



**END POST TIE**



**LOCATION OF BARRIER FENCE AT BOX CULVERTS WITH NO FILL**

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

**Sheet Revisions**

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**Project Development Branch** **JBK**

**BARRIER FENCE**

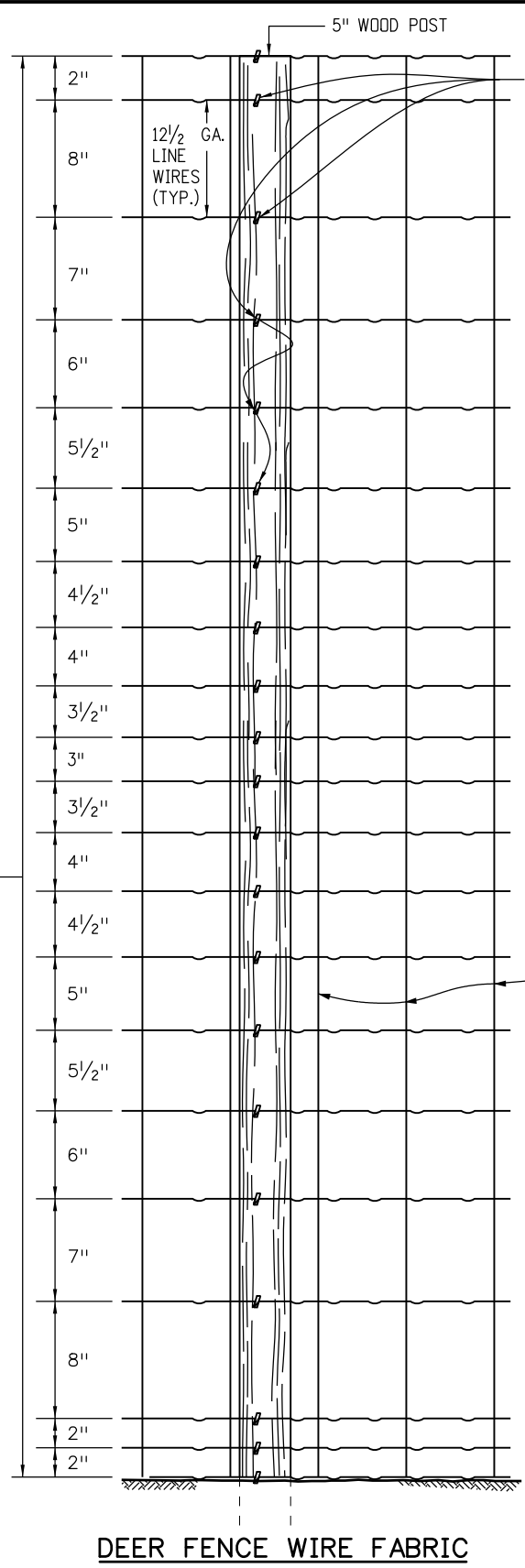
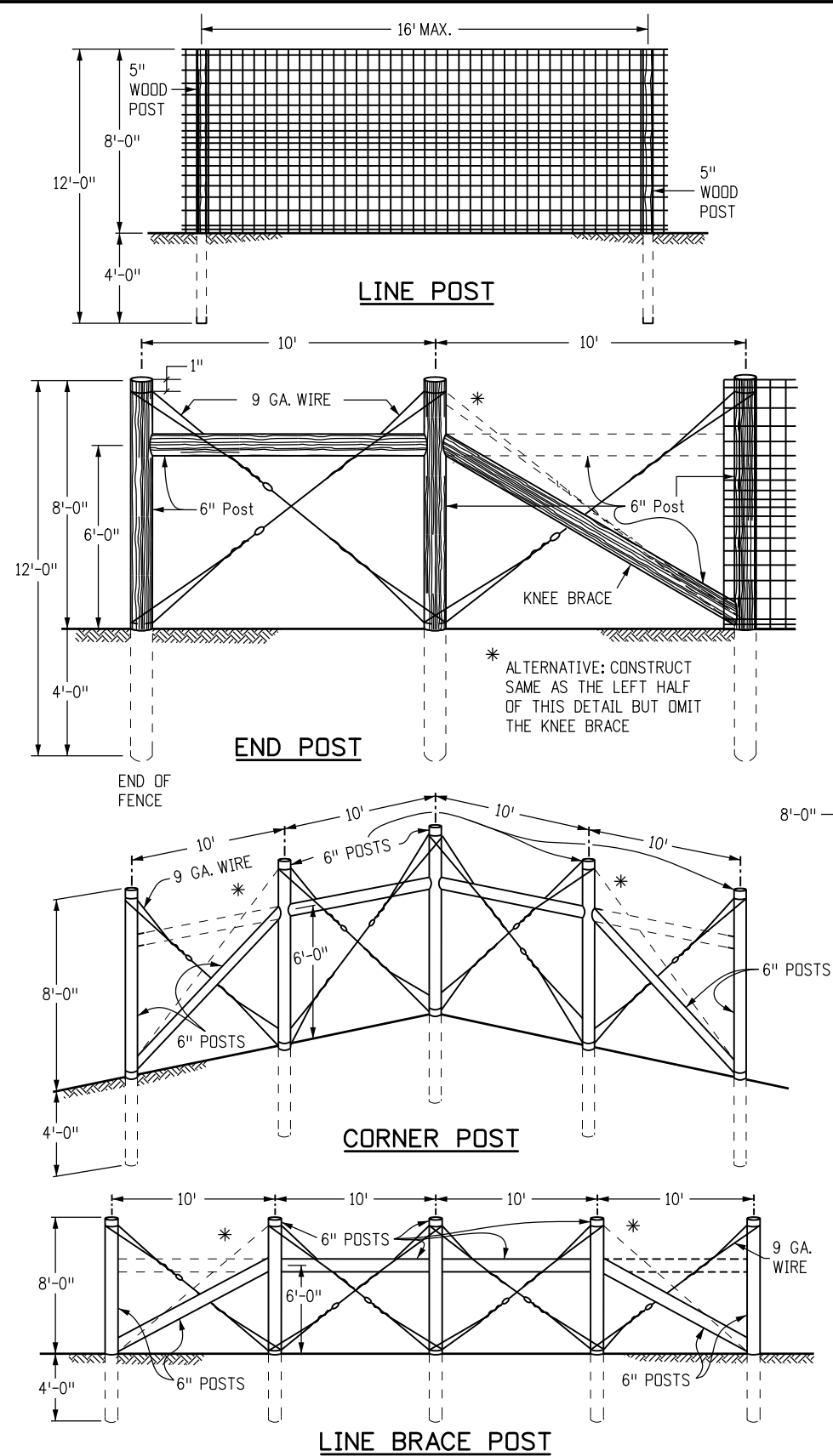
Issued by the Project Development Branch: July 31, 2019

**STANDARD PLAN NO.**

**M-607-3**

**Standard Sheet No. 1 of 1**

Project Sheet Number:



### GENERAL NOTES

- 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.
- END POST, CORNER POST, AND LINE BRACE POST SHALL BE ASSEMBLED BY THE UNIT AND PAID FOR AS SUCH. ALL WORK AND MATERIAL ASSOCIATED WITH EACH ASSEMBLY, SHALL BE INCLUDED IN THE UNIT PRICE FOR THAT ASSEMBLY.
- LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER & LINE BRACE POSTS ARE NOT SPECIFIED.
- ALL LINE POSTS SHALL BE 5 IN. MIN. DIAMETER AND 12 FT. LONG. ALL END, CORNER AND LINE BRACE POSTS SHALL BE 6 IN. MIN. DIAMETER AND 12 FT. LONG. ALL POSTS AND BRACES SHALL BE TREATED IN ACCORDANCE WITH SUBSECTION 710.07.
- 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.
- WHERE CONCRETE STRUCTURES ARE USED AS A DEER PASS, THE FENCE SHALL END AT EYEBOLTS IN WINGS OF THE STRUCTURE. EYEBOLTS IN FRESH CONCRETE SHALL BE MADE OF 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.
- WOVEN WIRE FENCE FABRIC SHALL CONFORM TO AASHTO M 279 (ASTM A 116). DESIGN NO. 2096-6-12 1/2, GRADE 60, COATING TYPE ZA, COATING CLASS 80.
- ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232.
- THE CONTRACTOR SHALL RE-ESTABLISH DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY IN ACCORDANCE WITH SUBSECTION 625.08 OF THE STANDARD SPECIFICATIONS.
- CONTINUOUS LINE WIRE SHALL BE HIGH TENSILE (175 K MIN.). CONTINUOUS STAY WIRE SHALL BE MID-TENSILE (125 K MIN.). FIXED KNOT 13 GAUGE WIRE (60K MIN.) SHALL CONNECT LINE WIRE WITH THE VERTICAL STAY WIRE.
- DEER GATE AND TOP BRACES SHALL BE PAINTED WITH GREEN PAINT ACCORDING TO SUBSECTION 708.03 AND COLOR NO. 14109 OF FEDERAL STANDARD 595B.

**TYPICAL STAPLING**

MIN. 1 1/2" "U" TYPE BARBED STAPLE  
ANGLED DOWN, WITH WIRE LOOSE

**WIRE SPLICE**

METAL SLEEVE  
METAL SLEEVE COMPRESSED  
USE A SPLICING SLEEVE APPROVED BY THE ENGINEER

**CROSS BRACE DOWELING**

POST  
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 (TYP.)

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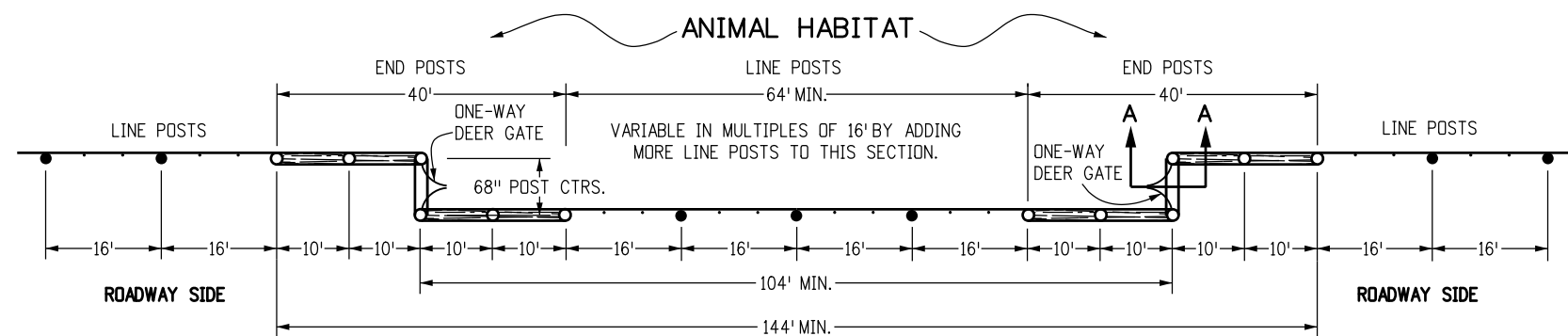
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 Project Development Branch JBK

## DEER FENCE, GATES, AND GAME RAMPS

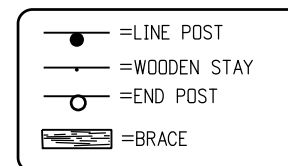
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STANDARD PLAN NO.  
**M-607-4**  
 Standard Sheet No. 1 of 5  
 Project Sheet Number:



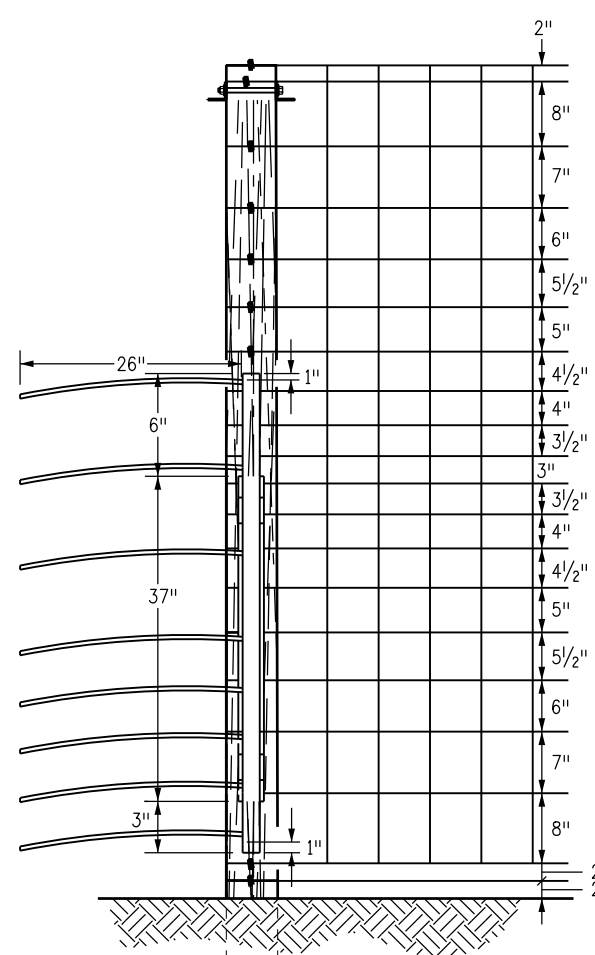
PLAN VIEW - TYPICAL DEER GATE INSTALLATION

LEGEND

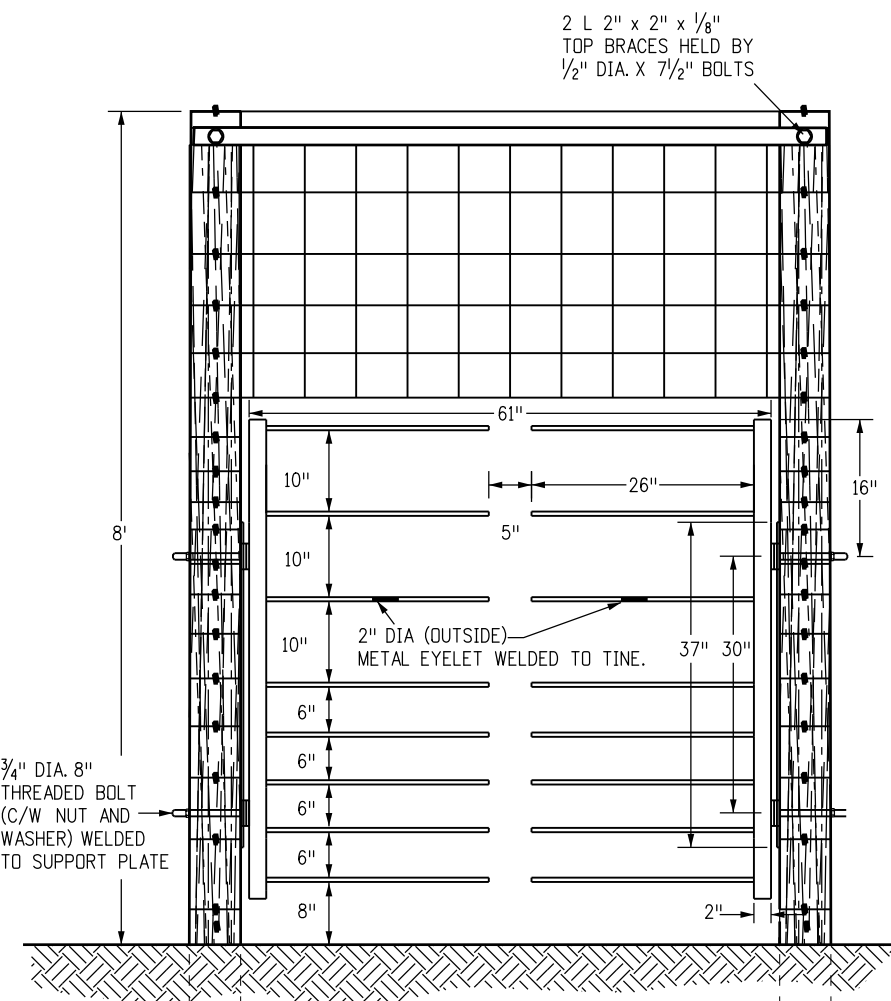


NOTES

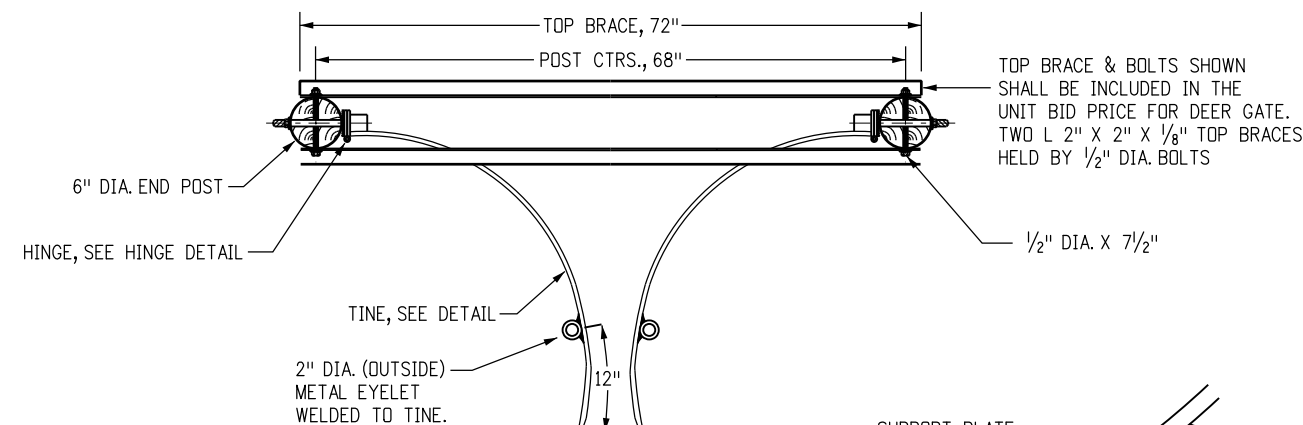
- SIX IN. DOUBLE ACTING SPRING DOOR HINGE WITH FLAT BUTTON TIPS CUT IN TWO SHALL BE USED AS A SINGLE SWING HINGE AND BE PROVIDED WITH A GREASING NIPPLE AND WELDED TO SUPPORT PLATE.
- TINES SHALL BE MOLDED IN ONE PIECE OF STEEL (AASHTO M 169, GRADE 1050), WITH NO WELDS ALLOWED.



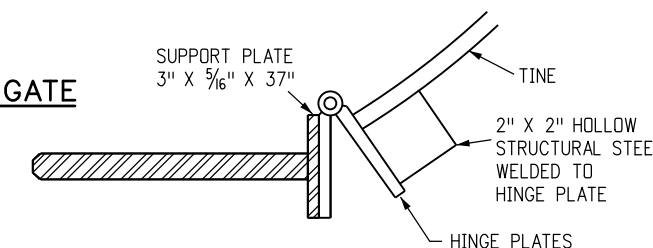
SECTION A-A



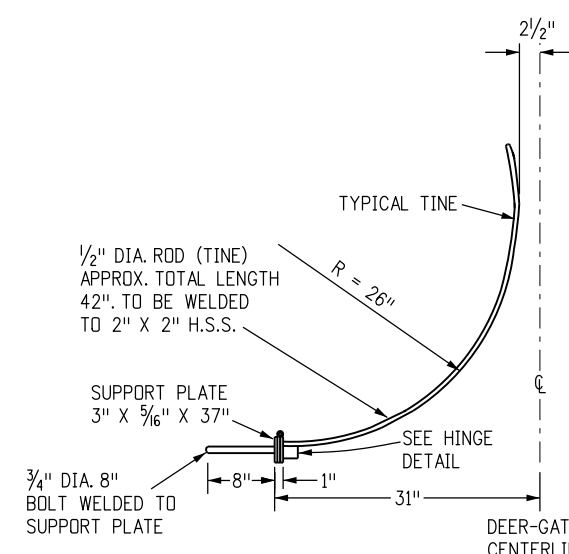
FRONT VIEW - DEER GATE



TOP VIEW - DEER GATE



TYPICAL HINGE DETAIL



TYPICAL TINE DETAIL

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Project Development Branch JBK

DEER FENCE, GATES,  
AND GAME RAMPS

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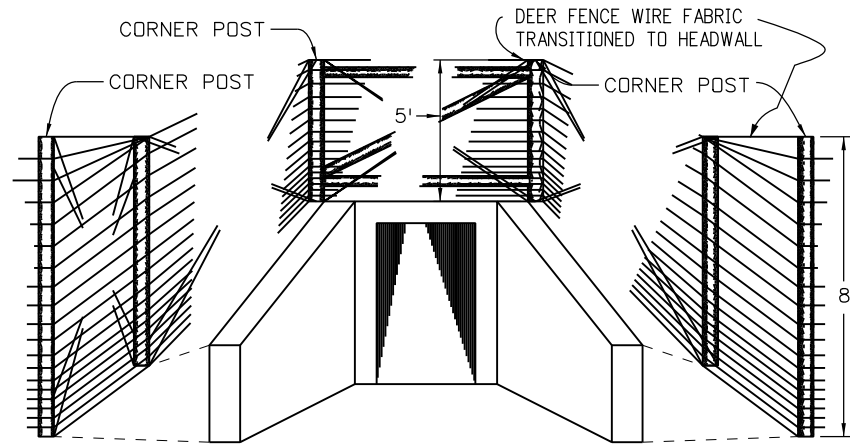
M-607-4

Standard Sheet No. 2 of 5

Project Sheet Number:

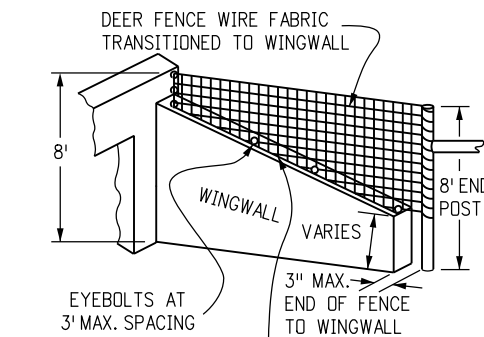
**NOTES**

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.

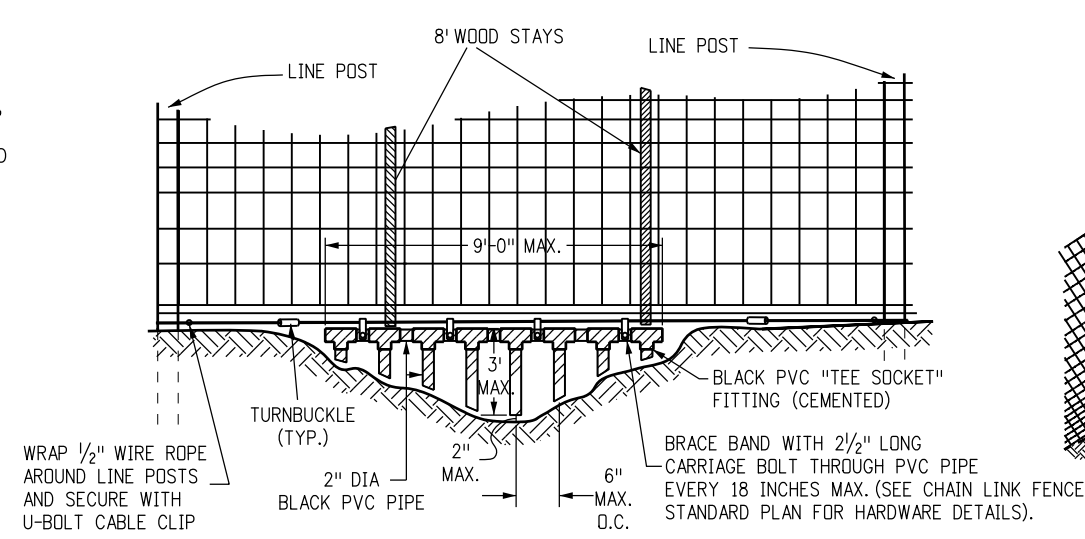


**FENCE DEER OVER CONCRETE BOX CULVERT**

FIVE FOOT POSTS AND WIRE FABRIC SHALL BE INSTALLED WHERE THE FENCE PASSES OVER A CBC AT LOCATIONS SHOWN IN THE PLANS. THIS WORK WILL BE PAID FOR AS FENCE DEER (SPECIAL).

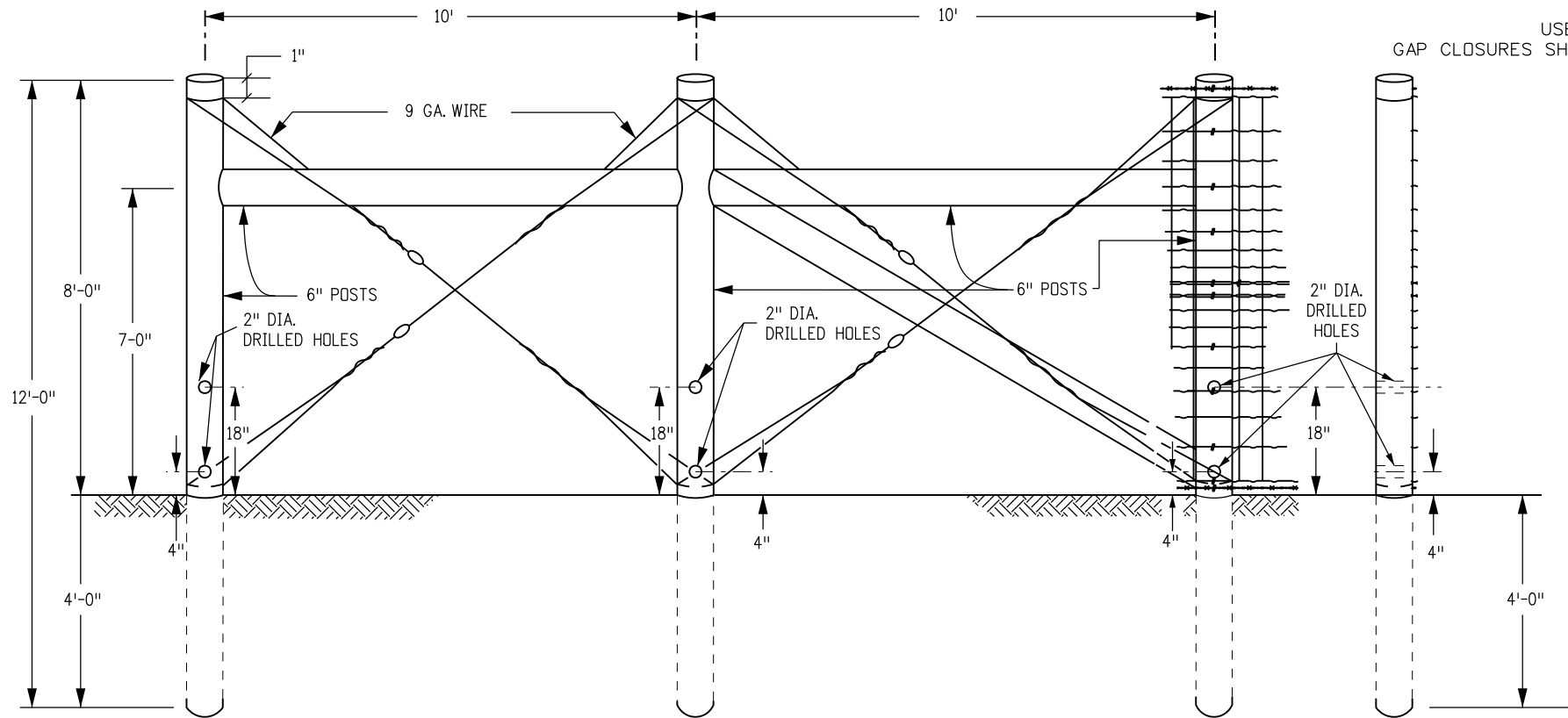


INSTALL 9 GA. WIRE THROUGH EYEBOLTS AND ATTACH FENCE FABRIC TO WIRE AT 1 FT. INTERVALS



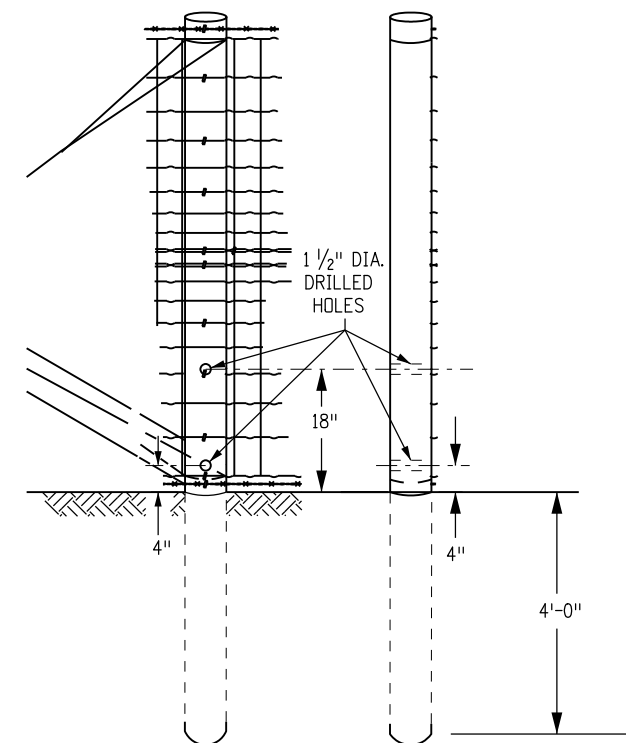
**GAP CLOSURE**

USE THIS DETAIL TO CLOSE ALL GAPS BETWEEN 6 INCHES AND 3 FEET. GAP CLOSURES SHALL BE INCLUDED IN THE PRICE OF THE FENCE AND NOT BE PAID FOR SEPARATELY.



**END POST AND CORNER POST**

**SIDE VIEW**

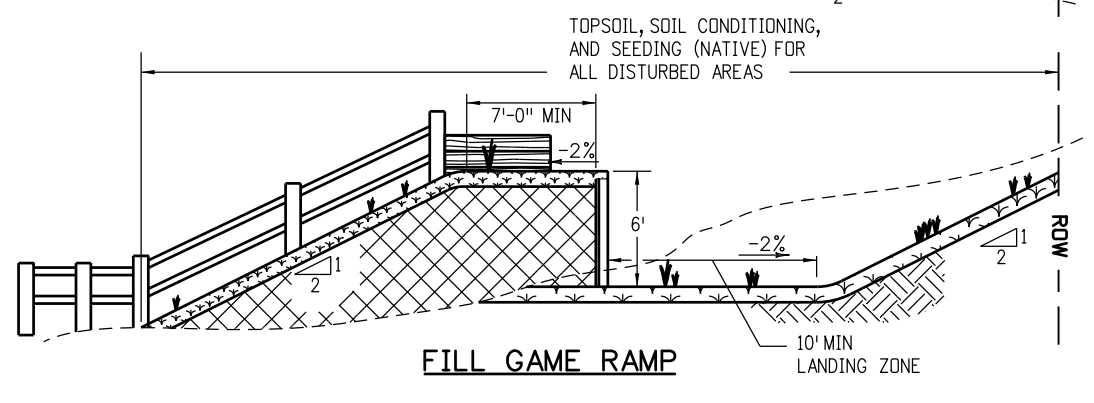
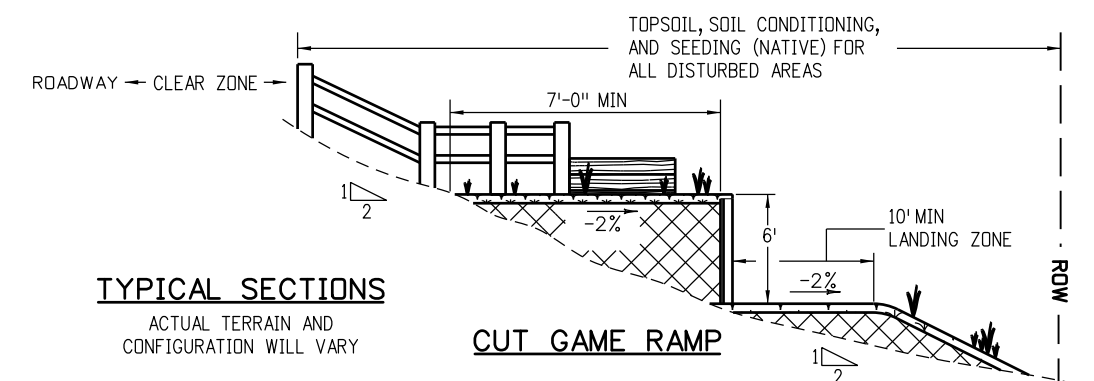
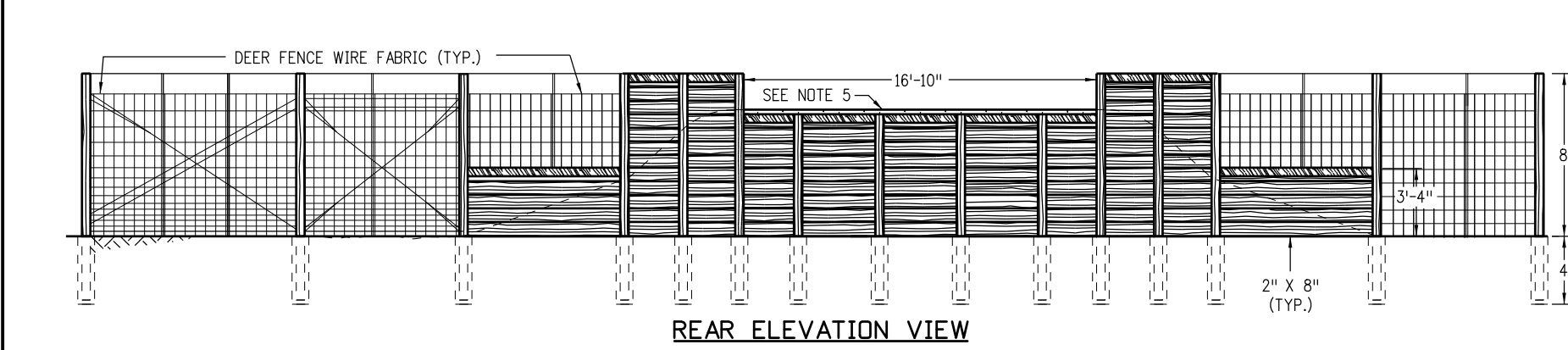
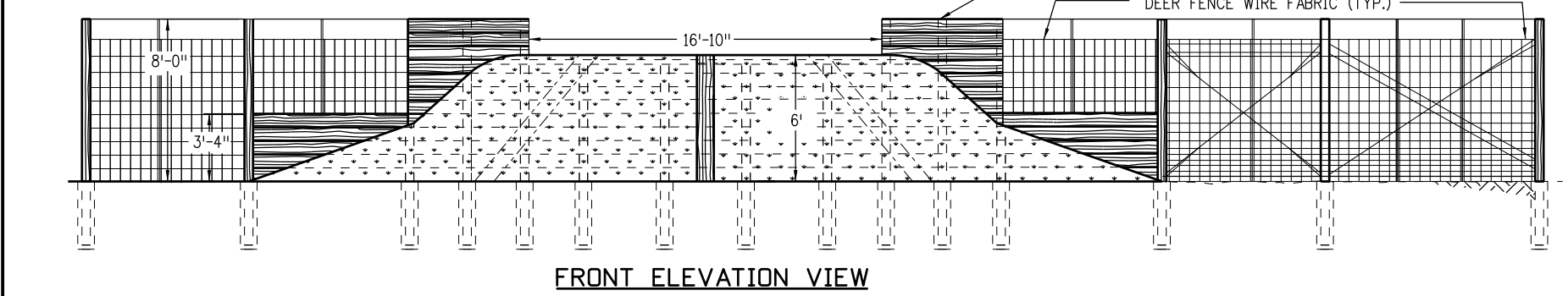
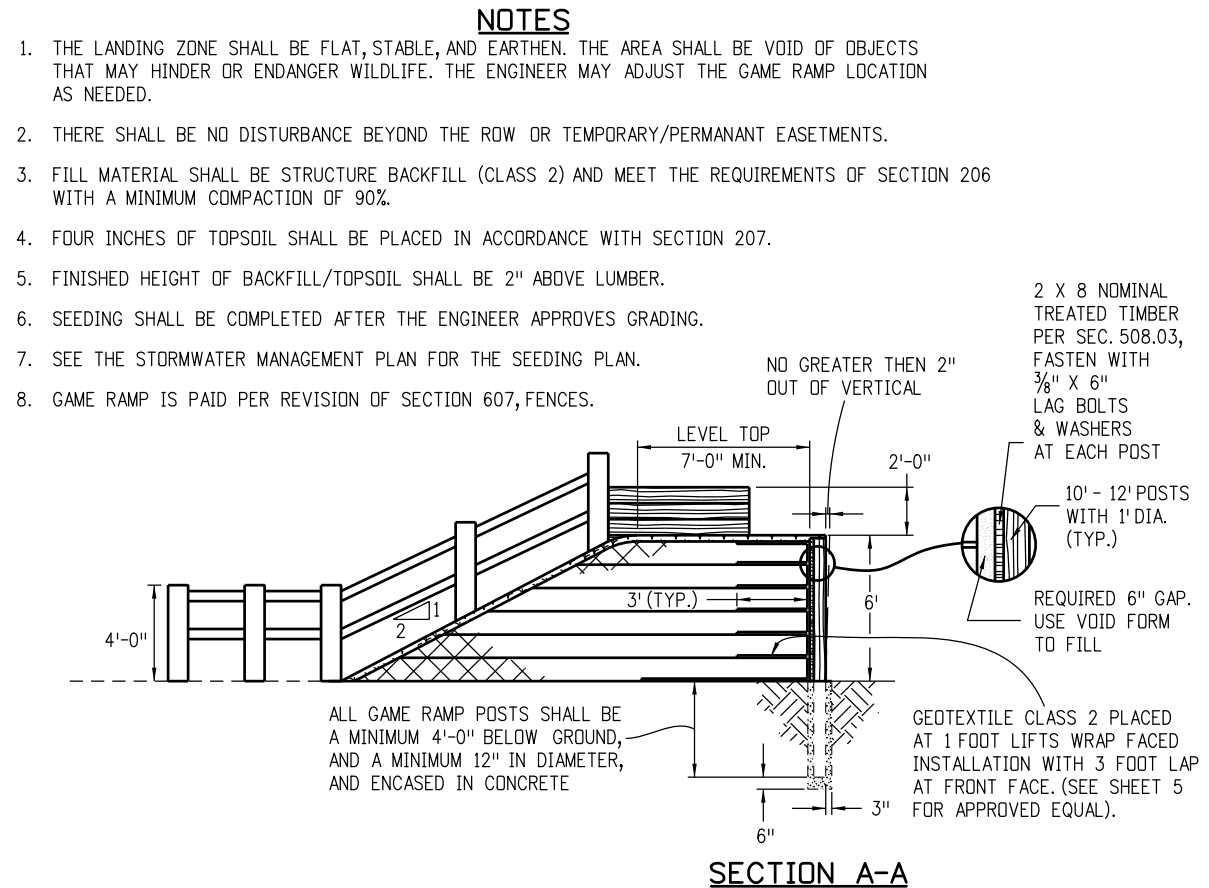
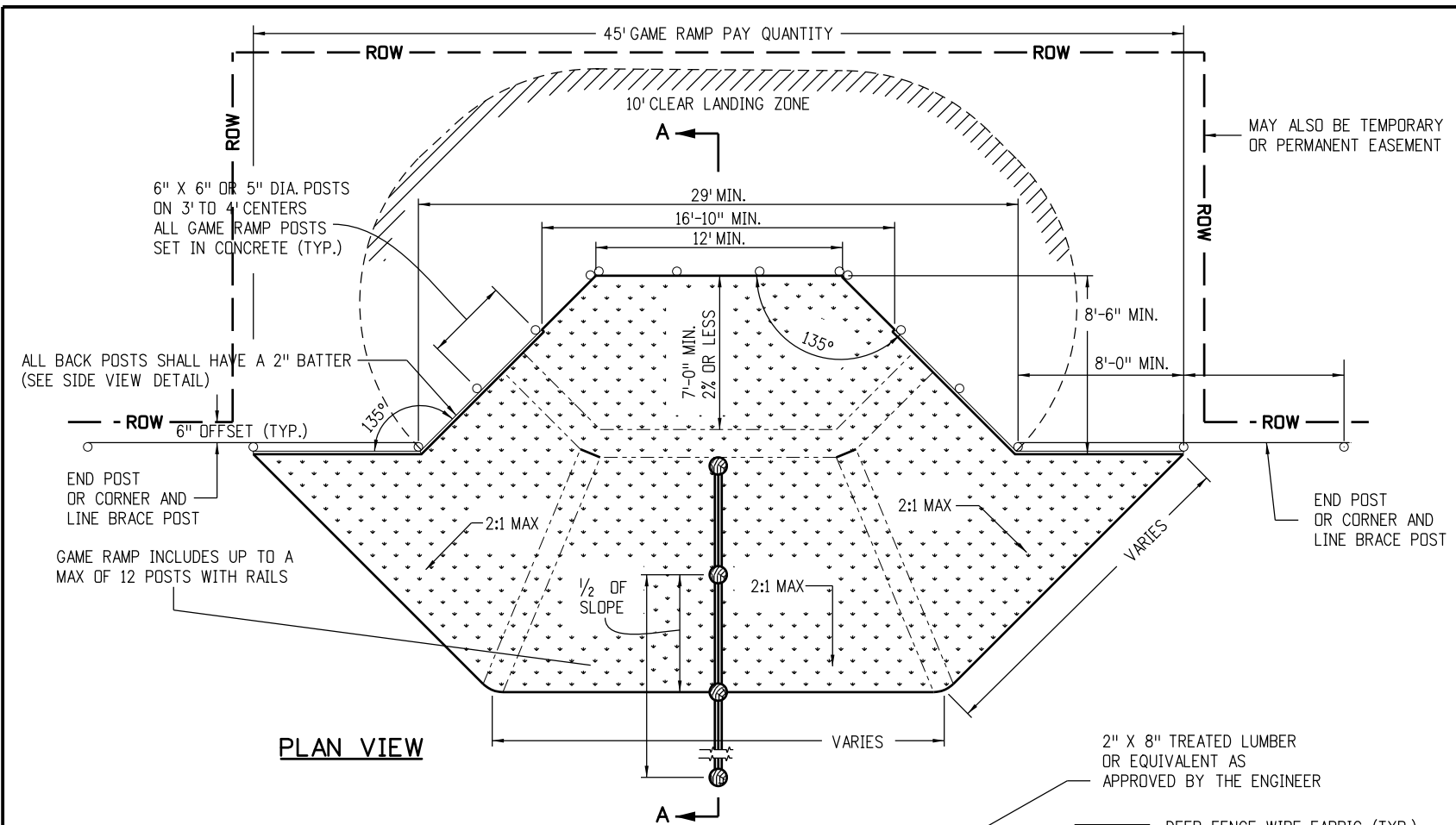


**FRONT VIEW SIDE VIEW**

**5 IN. LINE POST**

**MODIFIED FOR PLACEMENT WITHIN ROADWAY CLEAR ZONE**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>DEER FENCE, GATES, AND GAME RAMPS</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
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Designer Initials: JBK		(R-X)				Standard Sheet No. 3 of 5	
Last Modification Date: 07/31/19		(R-X)				Project Sheet Number:	
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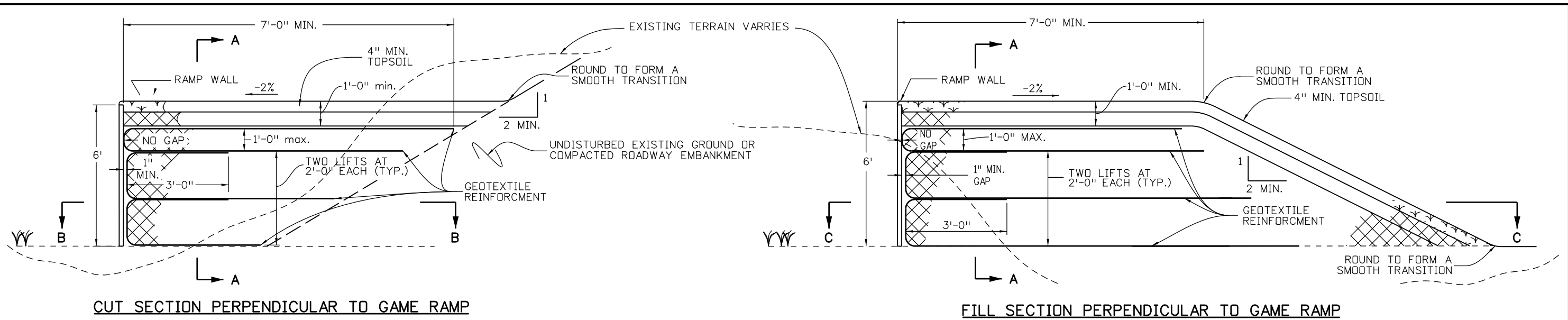
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(R-X)	
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(R-X)	
(R-X)	

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**DEER FENCE, GATES, AND GAME RAMPS**  
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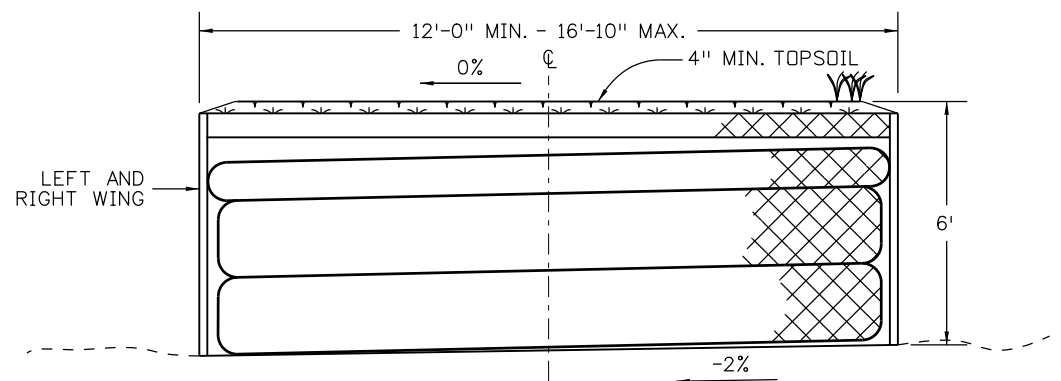
**STANDARD PLAN NO.**  
**M-607-4**  
**Standard Sheet No. 4 of 5**  
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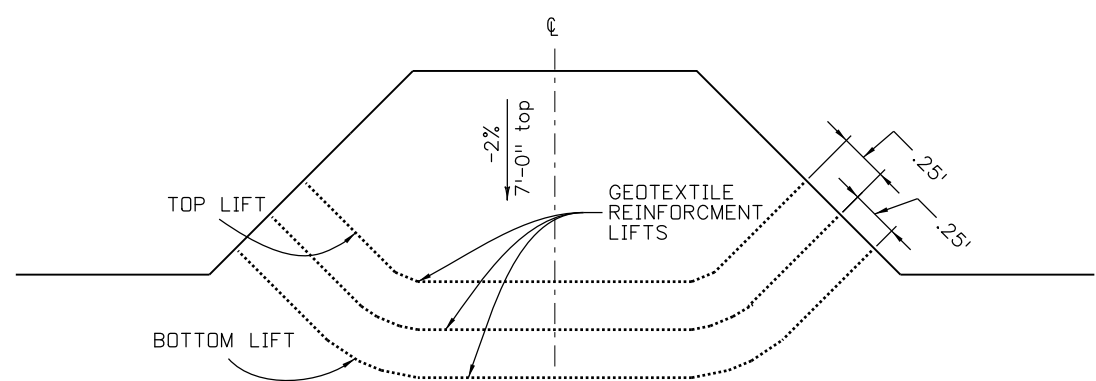


CUT SECTION PERPENDICULAR TO GAME RAMP

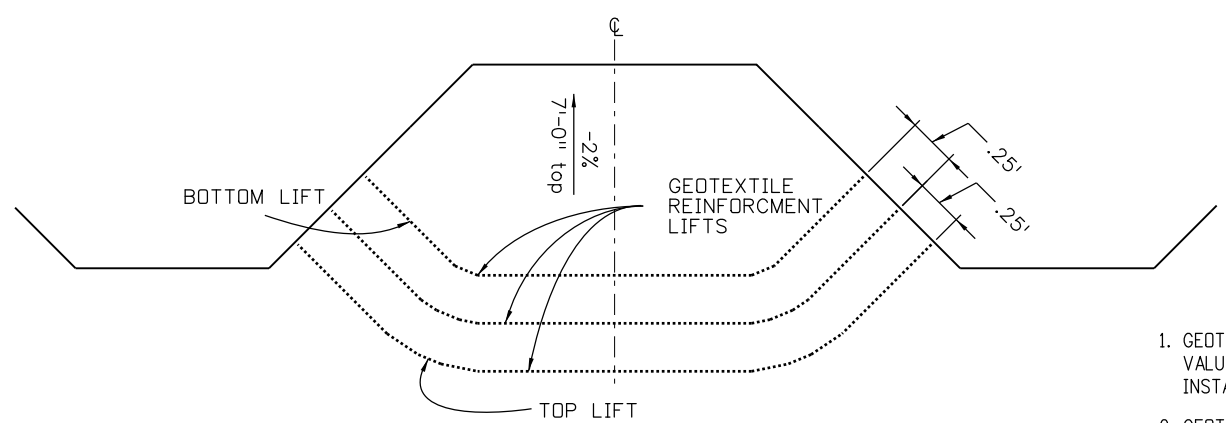
FILL SECTION PERPENDICULAR TO GAME RAMP



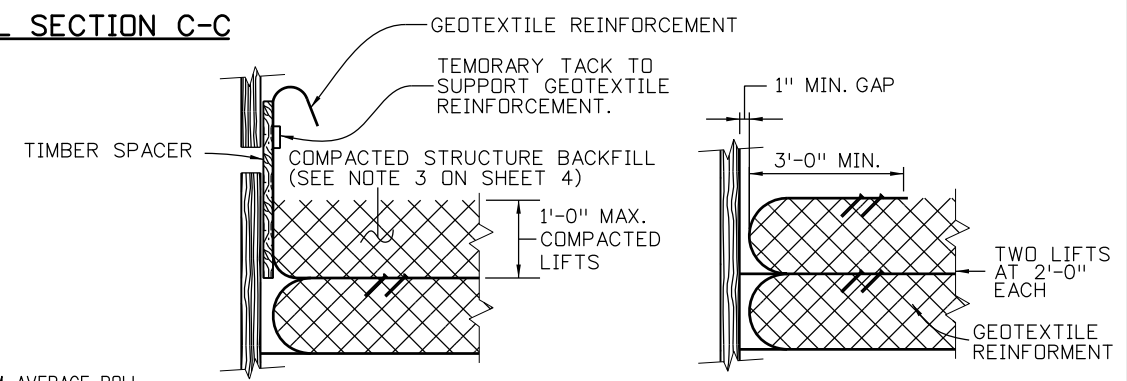
SECTION A-A



FILL SECTION C-C



CUT SECTION B-B



GAP DETAIL STEP 1

GAP DETAIL STEP 2

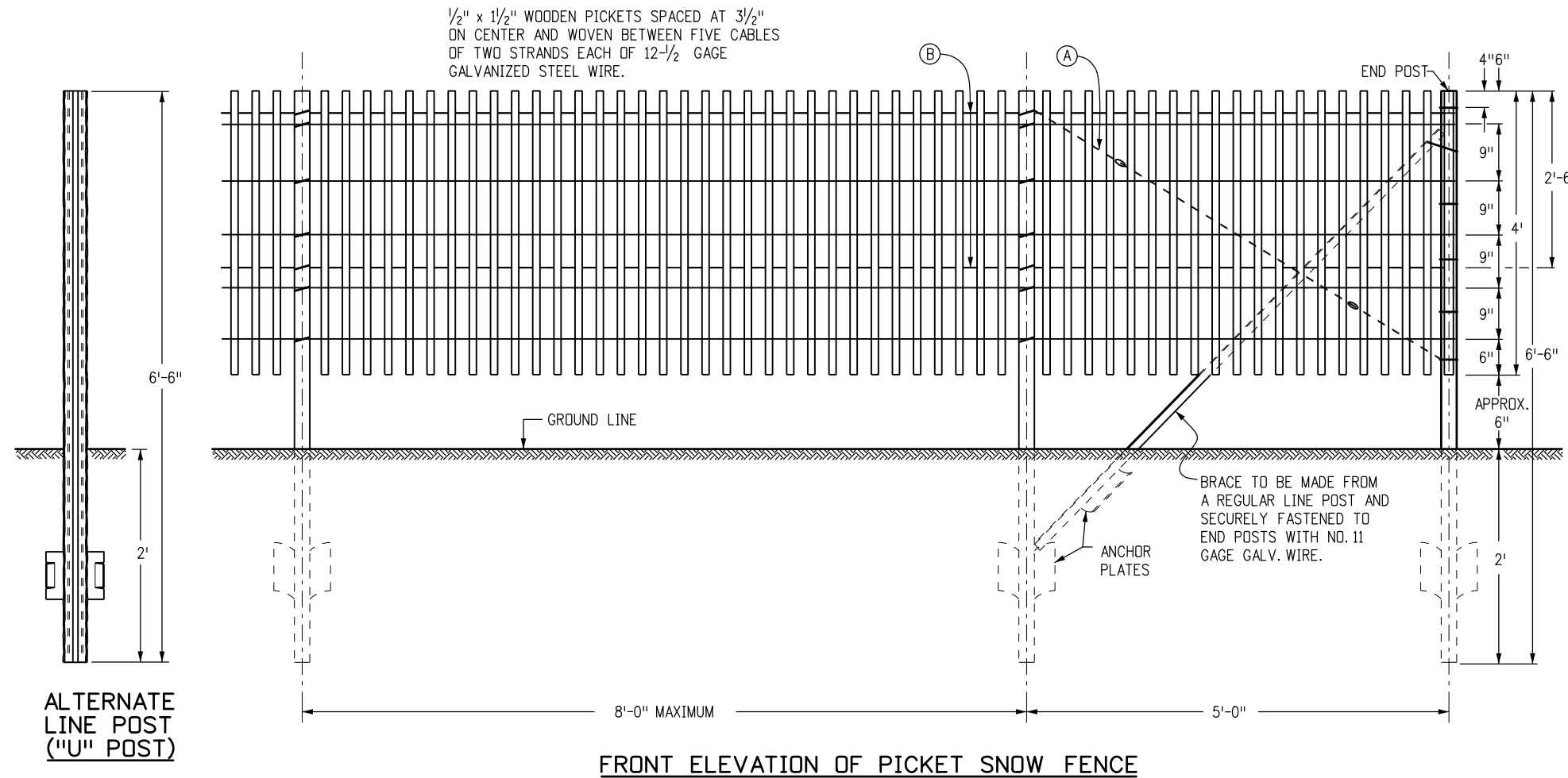
NOTES

1. GEOTEXTILE REINFORCEMENT SHALL BE WOVEN FABRIC WITH A MINIMUM AVERAGE ROLL VALUE OF 4800 LB/FT FOR INSTALLATIONS WITH A GAP AND 2400 LB/FT FOR INSTALLATIONS WITHOUT A GAP BASED ON ASTM D4595.
2. GEOTEXTILE REINFORCEMENT SHALL BE PLACED BY ALTERNATING MACHINE DIRECTION (MD) WITH CROSS MACHINE DIRECTION (XD) FROM LAYER TO LAYER.
3. THE GEOTEXTILE REINFORCEMENT WRAP AT BACK FACE OF GAME RAMP SHALL BE PULLED BACK SLACK FREE WITH ITS END ANCHORED TO SOIL UNDERNEATH WITH STAPLES OR PINS.
4. MINIMUM SPLICE OF ALL GEOTEXTILE SHALL CONSIST OF 1 FOOT OF OVERLAP.
5. GEOTEXTILE REINFORCEMENT WRAP AT BACK FACE OF GAME RAMP WALL SHALL BE TEMPORARILY HUNG WITH A SPACER BOARD AND TACK STRIP. AFTER REACHING A TOTAL OF 2'-0" COMPACTED LIFT, THE TACK STRIP SHALL BE REMOVED AND GEOTEXTILE REINFORCEMENT SHALL BE PULLED BACK SLACK FREE WITH ITS END ANCHORED TO SOIL UNDERNEATH WITH STAPLE OR PINS BEFORE THE SPACER BOARD IS PULLED.
6. DO NOT USE SPACER FOR THE TOP LIFT (FINAL LIFT). TOP LIFT SHALL ABUT THE GAME RAMP WALL.

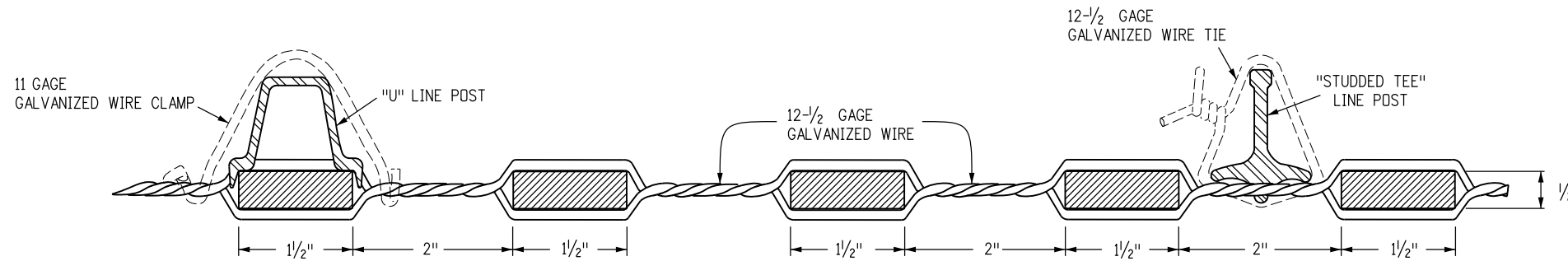
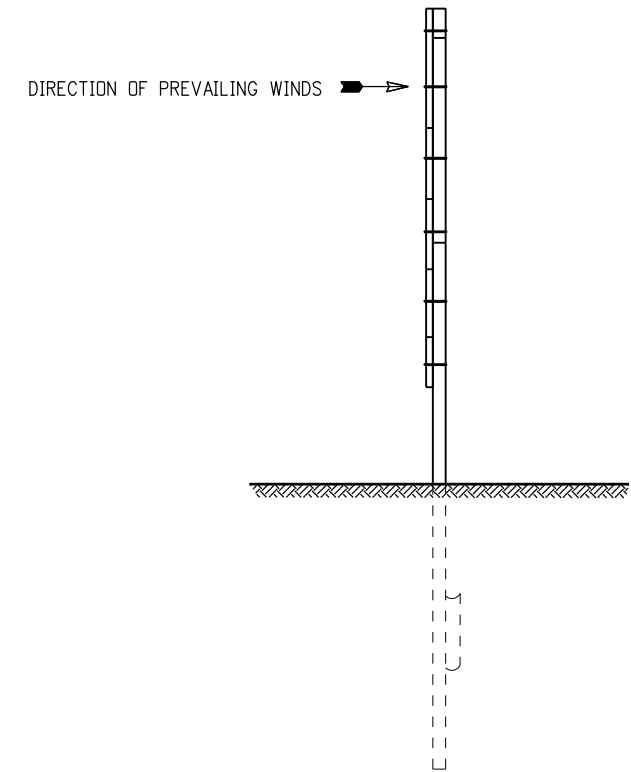
<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>DEER FENCE, GATES, AND GAME RAMPS</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-607-4	
Designer Initials: JBK	(R-X)					Standard Sheet No. 5 of 5	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>JBK</b>			

**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 12-1/2 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 12-1/2 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 12-1/2 GAGE WIRE TIES.



ALTERNATE LINE POST ("U" POST)



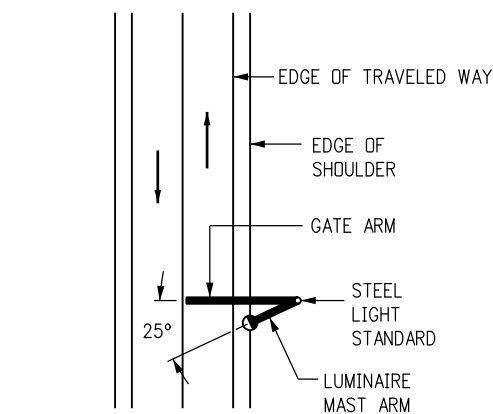
NOTE: OTHER SECTIONS OF STEEL POSTS HAVING EQUAL WEIGHT AND EQUIVALENT STRENGTH MAY BE USED IN LIEU OF EITHER OF THESE SECTIONS SHOWN.

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>PICKET SNOW FENCE</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:			M-607-10	
Last Modification Date: 07/31/19	Detailer Initials: LTA			Standard Sheet No. 1 of 1		Project Sheet Number:	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				Issued by the Project Development Branch: July 31, 2019			

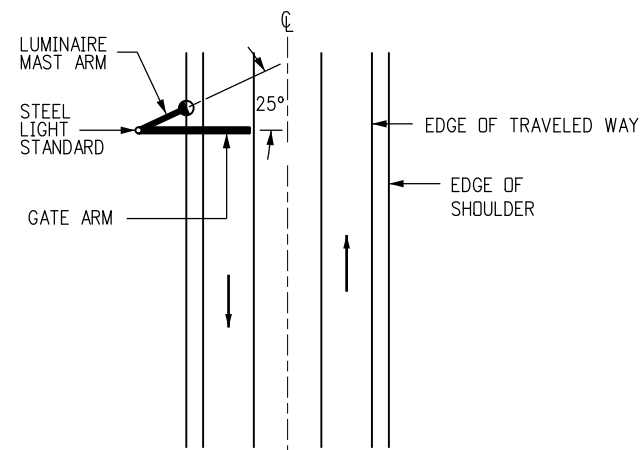
**GENERAL NOTES**

1. STEEL LIGHT STANDARDS SHALL HAVE AN 8 IN. OUTSIDE DIAMETER AT THE BASE WITH A  $\frac{3}{16}$  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 PROVIDED 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.

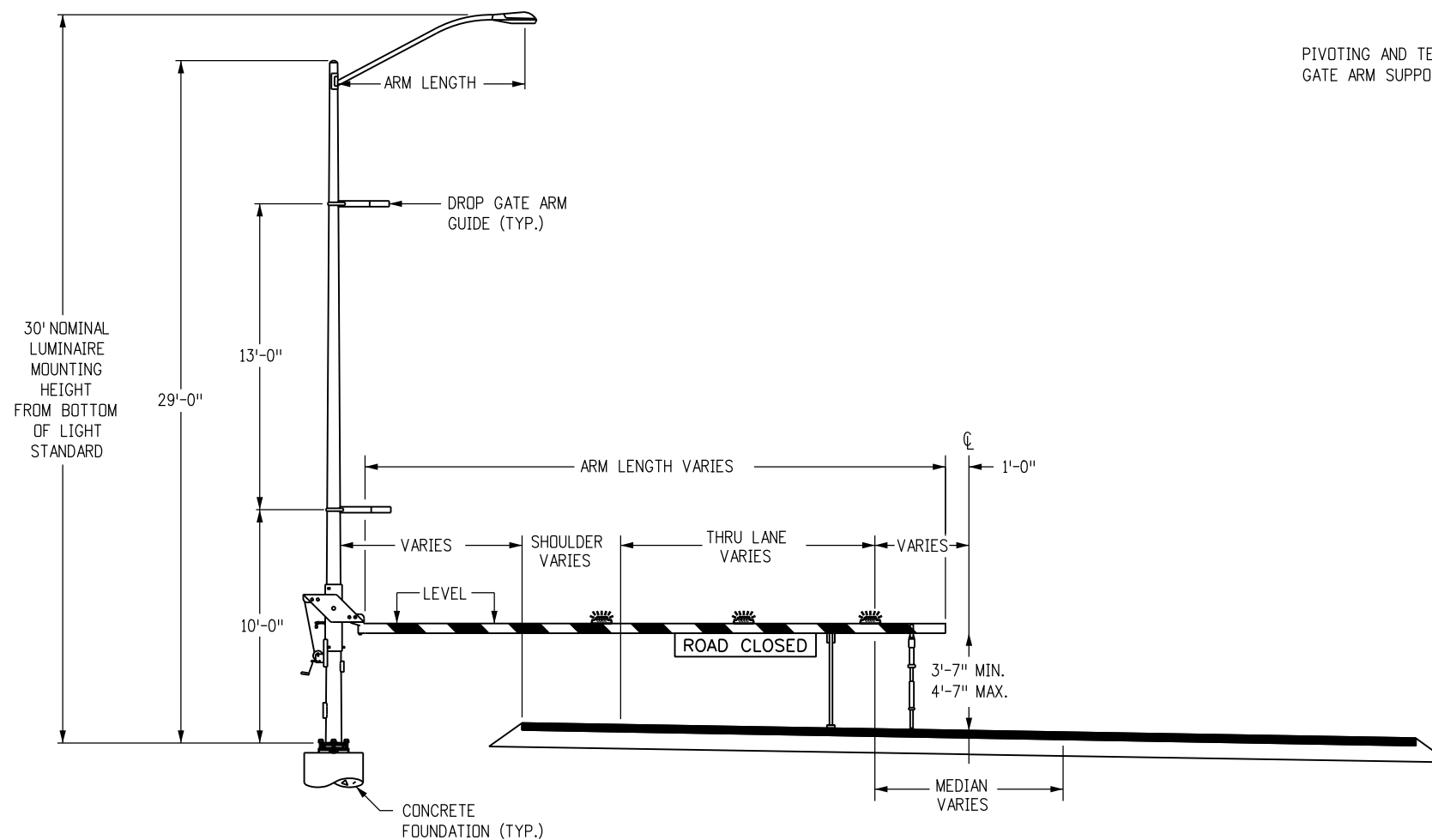
<b>Computer File Information</b>		<b>Sheet Revisions</b>		 <b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>ROAD CLOSURE GATE</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			<b>M-607-15</b>	
Designer Initials: JBK	(R-X)					<b>Standard Sheet No. 1 of 9</b>	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)					Issued by the Project Development Branch: July 31, 2019	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			<b>JBK</b>			



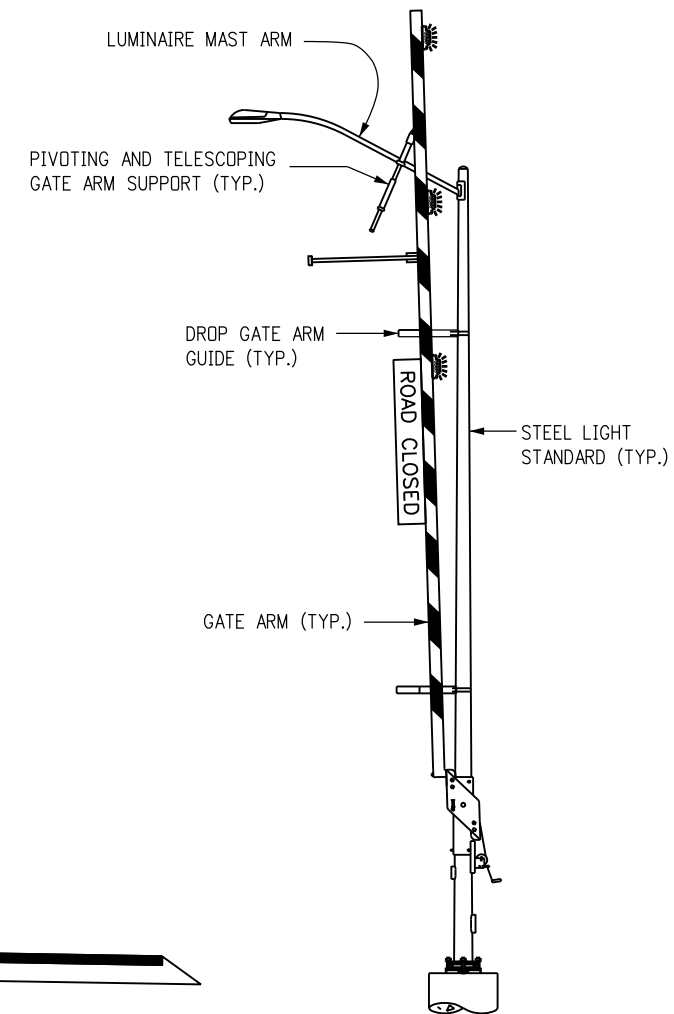
**TWO-WAY HIGHWAY  
(ONE GATE REQUIRED)**



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

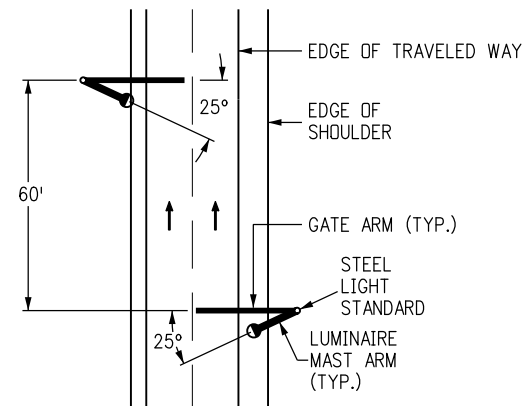


**TYPICAL LOWERED POSITION**

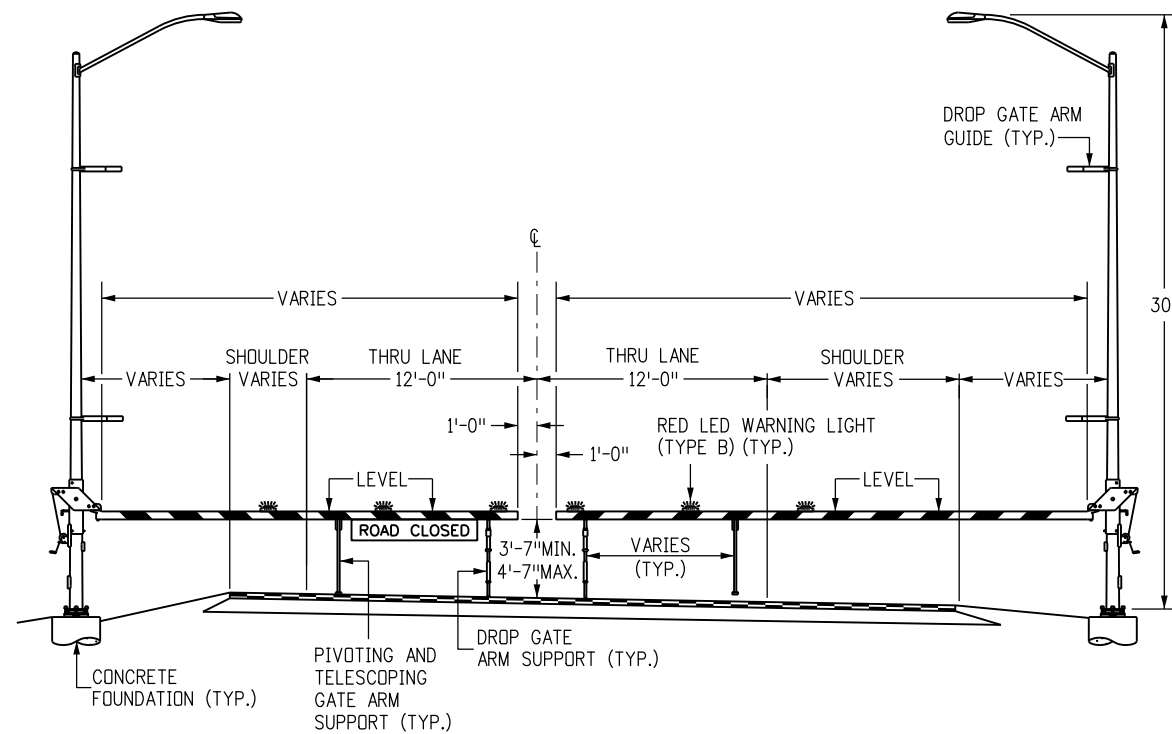


**TYPICAL RAISED POSITION**

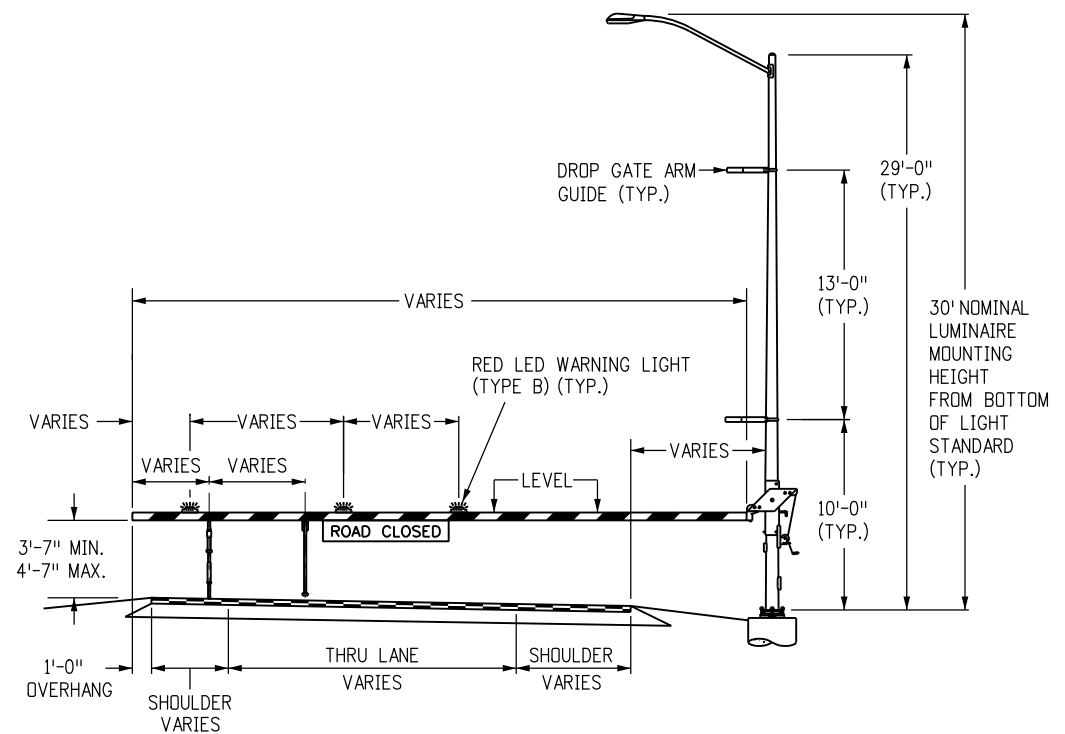
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Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place				M-607-15	
Designer Initials: JBK		(R-X)		CDOT HQ, 3rd Floor		Standard Sheet No. 2 of 9		Project Sheet Number:	
Last Modification Date: 07/31/19		(R-X)		Denver, CO 80204		Issued by the Project Development Branch: July 31, 2019			
Detailer Initials: LTA		(R-X)		Phone: 303-757-9021 FAX: 303-757-9868					
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**DIVIDED HIGHWAY INSTALLATION**  
(TWO GATES REQUIRED)



**INTERSTATE MAINLINE**



**LUMINAIRE AND GATE**  
(RAMP LOCATIONS)

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
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Date:	Comments

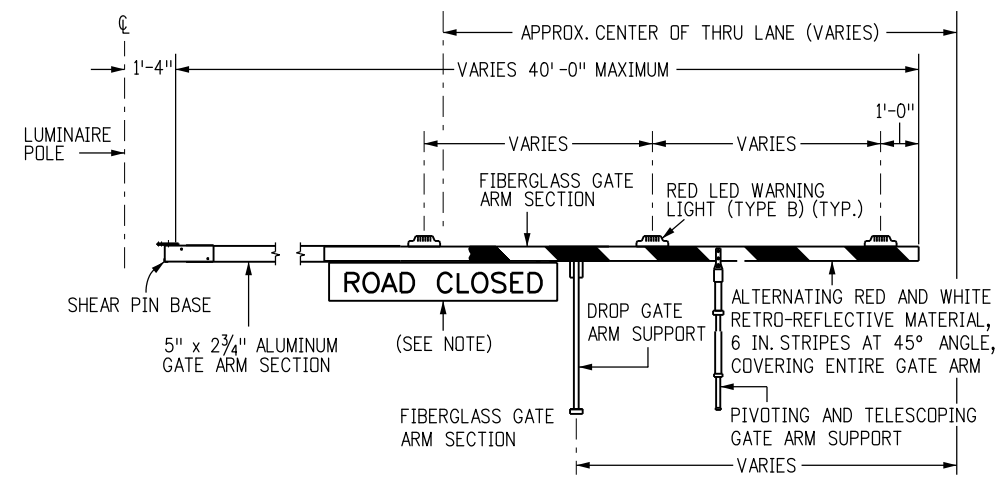
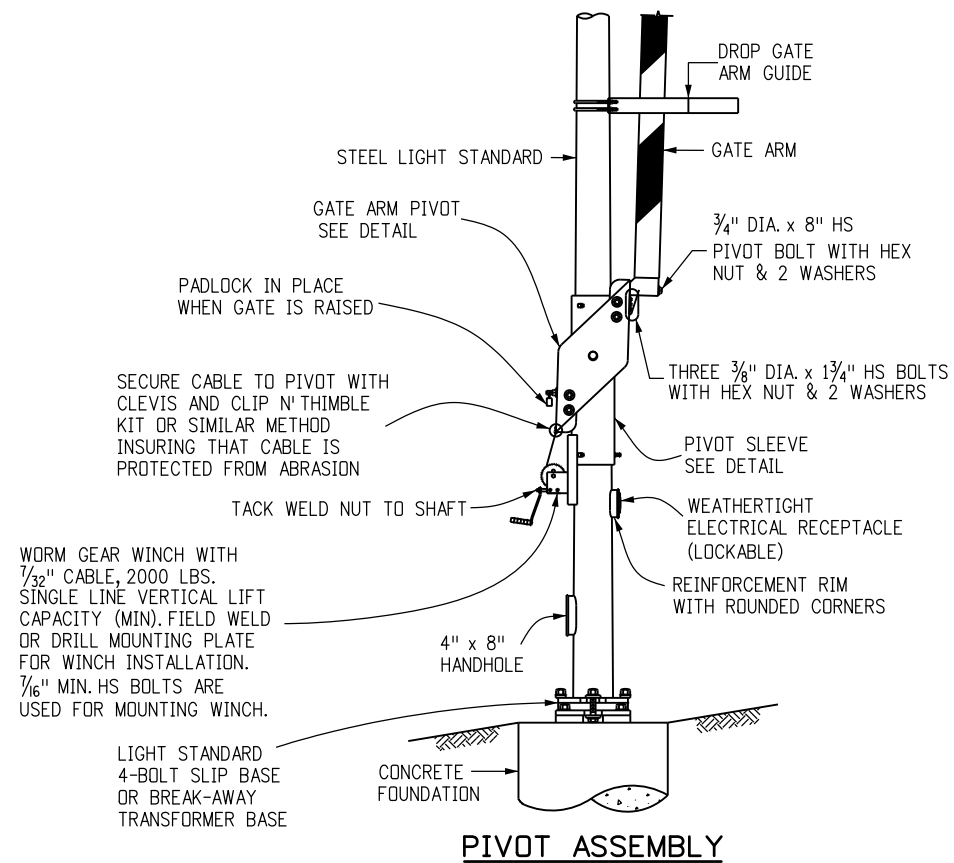
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Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch JBK

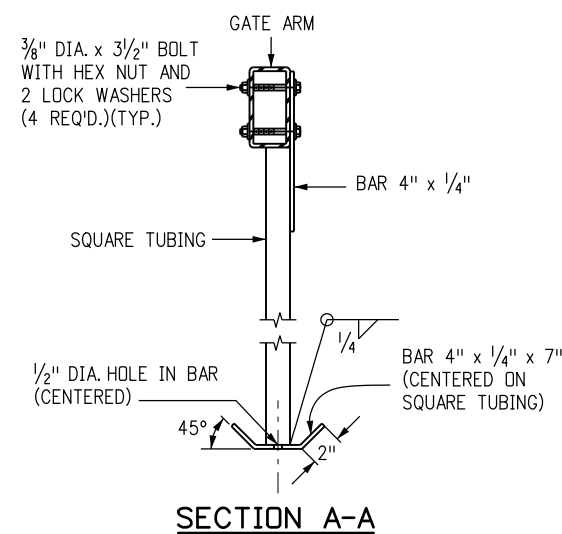
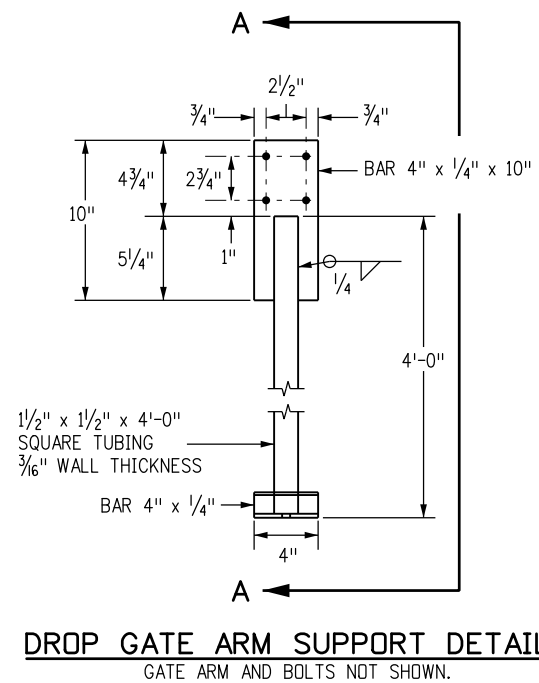
**ROAD CLOSURE GATE**

Issued by the Project Development Branch: July 31, 2019

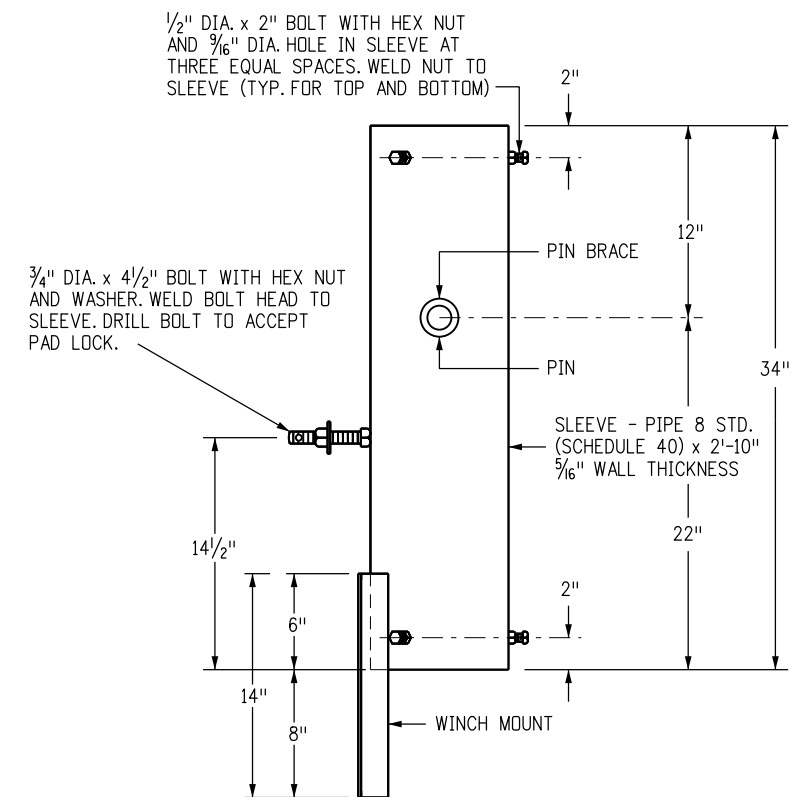
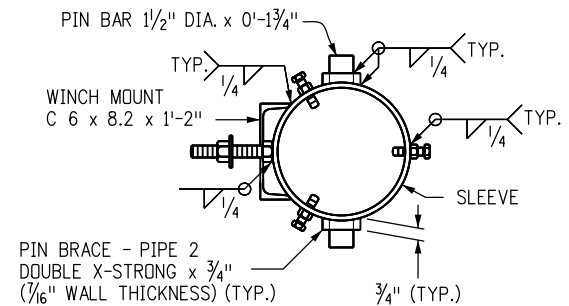
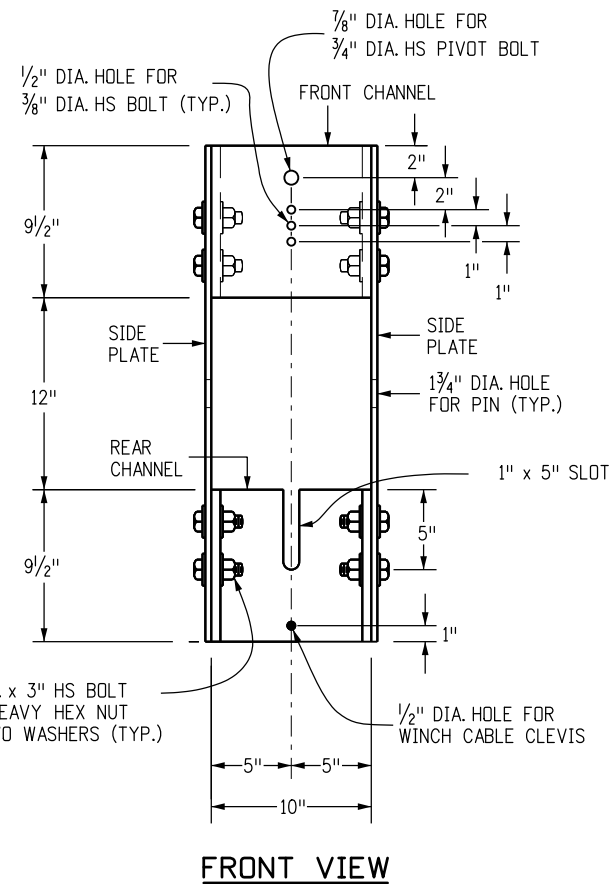
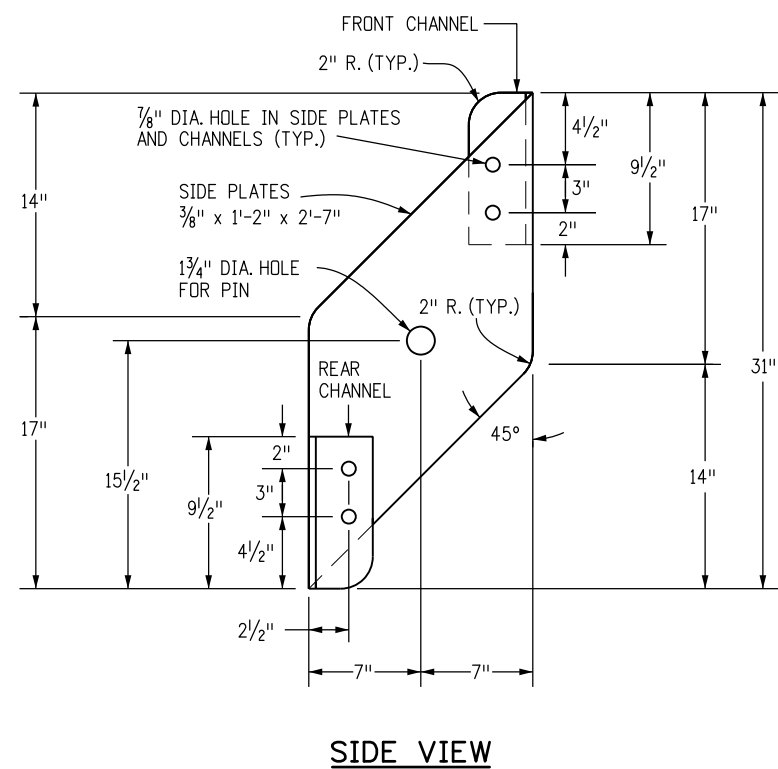
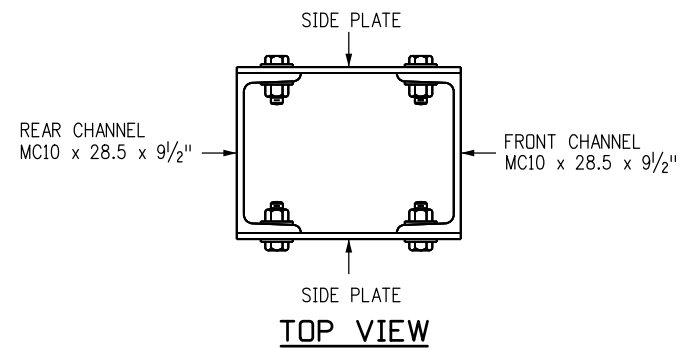
STANDARD PLAN NO.
M-607-15
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NOTE: PLACE THE BLACK AND WHITE "ROAD CLOSED" SIGN IN THE CENTER OF THE THROUGH LANE. THE SIGN LETTERS WILL BE 6" IN HEIGHT.



<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>		<b>ROAD CLOSURE GATE</b>		<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place				M-607-15	
Designer Initials: JBK		(R-X)		CDOT HQ, 3rd Floor		<b>Standard Sheet No. 4 of 9</b>		Project Sheet Number:	
Last Modification Date: 07/31/19		(R-X)		Denver, CO 80204					
Detailer Initials: LTA		(R-X)		Phone: 303-757-9021 FAX: 303-757-9868		Issued by the Project Development Branch: July 31, 2019			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>Project Development Branch</b> <b>JBK</b>					



GATE ARM PIVOT SIDE PLATE DETAIL

PIVOT SLEEVE DETAIL

Computer File Information	
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Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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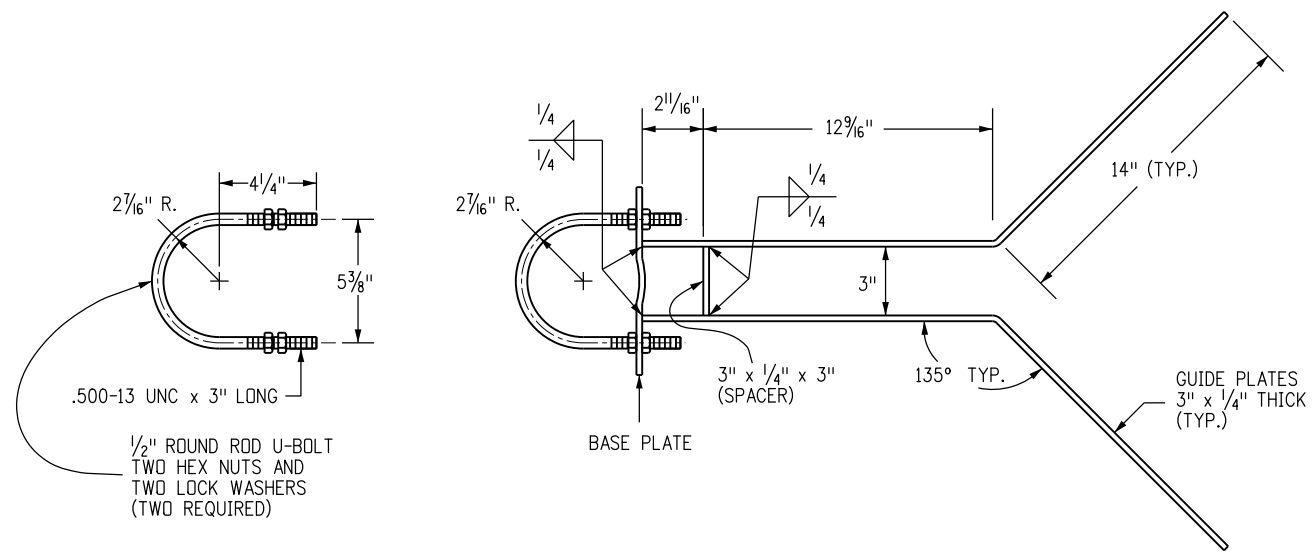


Project Development Branch JBK

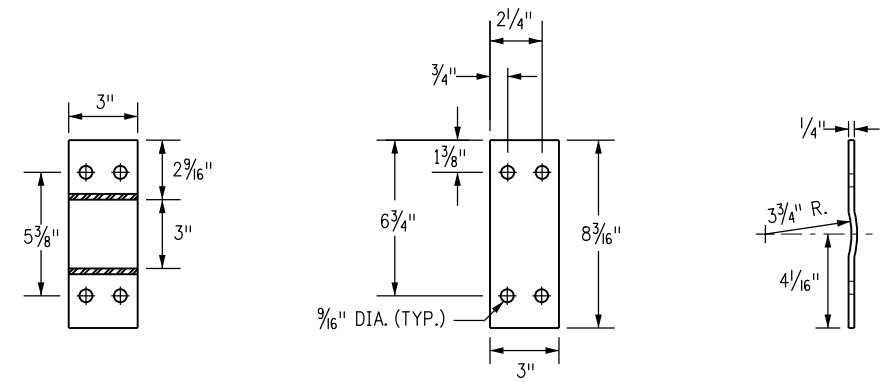
# ROAD CLOSURE GATE

Issued by the Project Development Branch: July 31, 2019

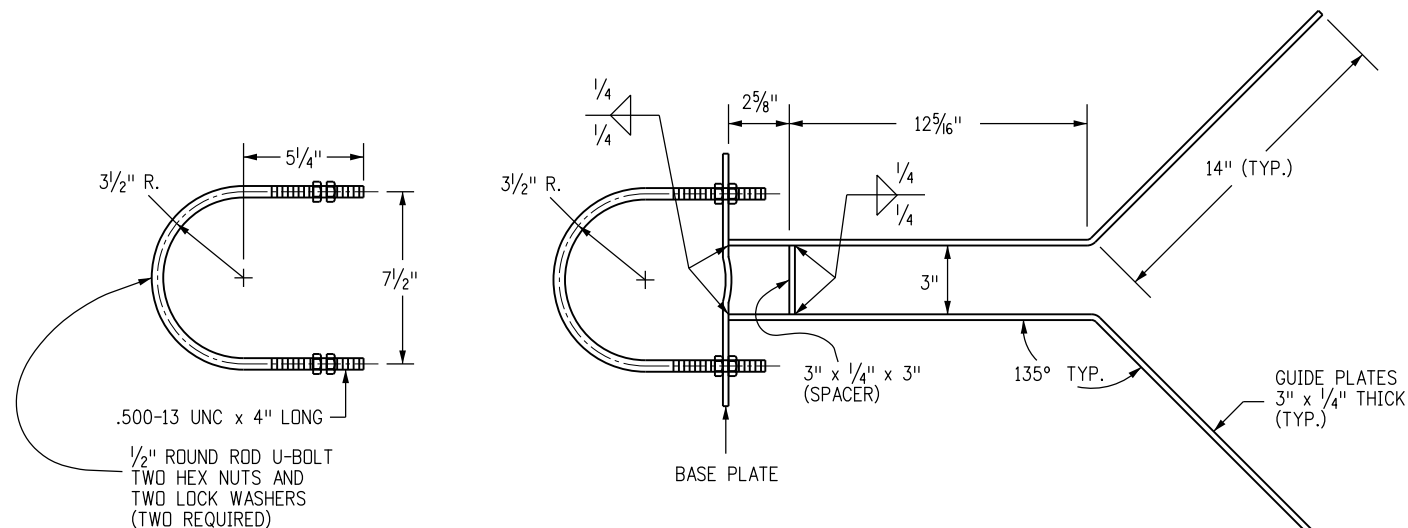
STANDARD PLAN NO.
M-607-15
Standard Sheet No. 5 of 9
Project Sheet Number:



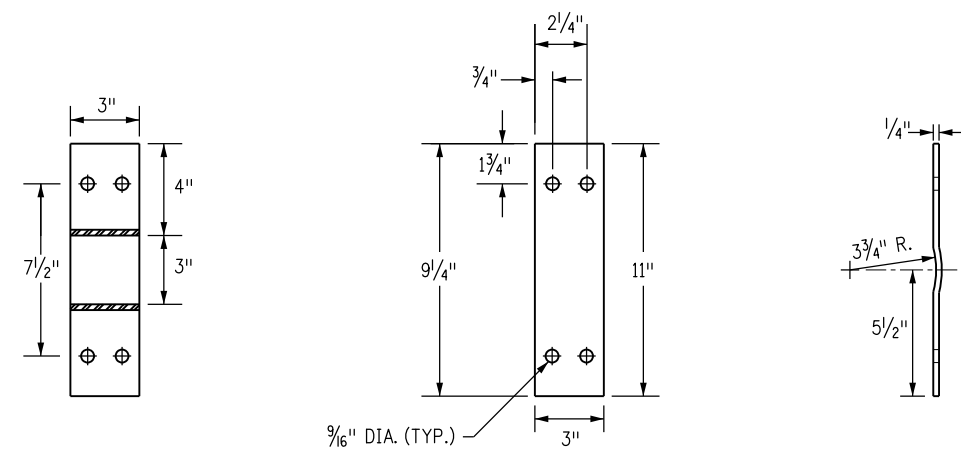
**TOP GATE ARM GUIDE**



**TOP BASE PLATE DETAILS**



**BOTTOM GATE ARM GUIDE**



**BOTTOM BASE PLATE DETAILS**

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

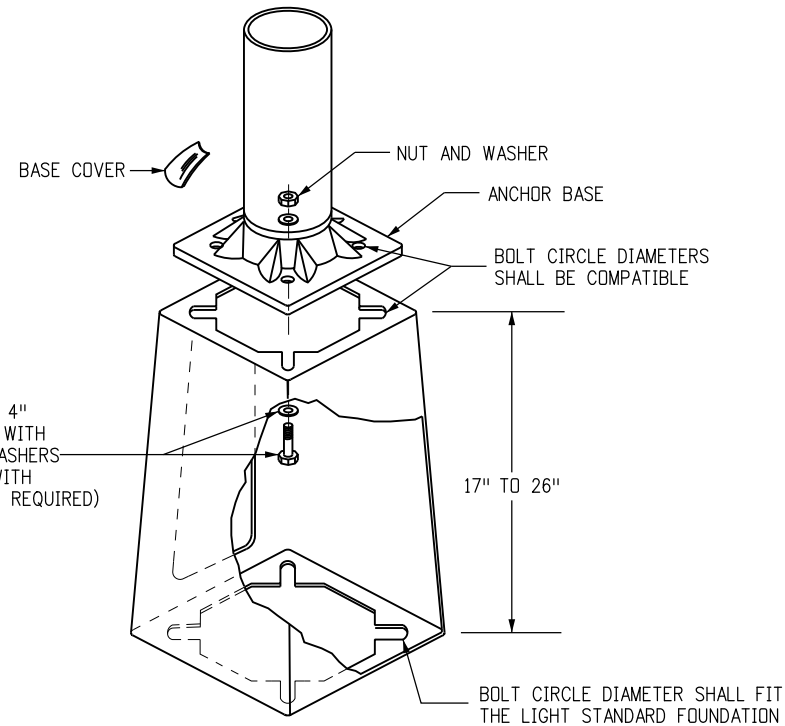
Sheet Revisions	
Date:	Comments

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**ROAD CLOSURE GATE**  
 Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-607-15**  
 Standard Sheet No. 6 of 9  
 Project Sheet Number:

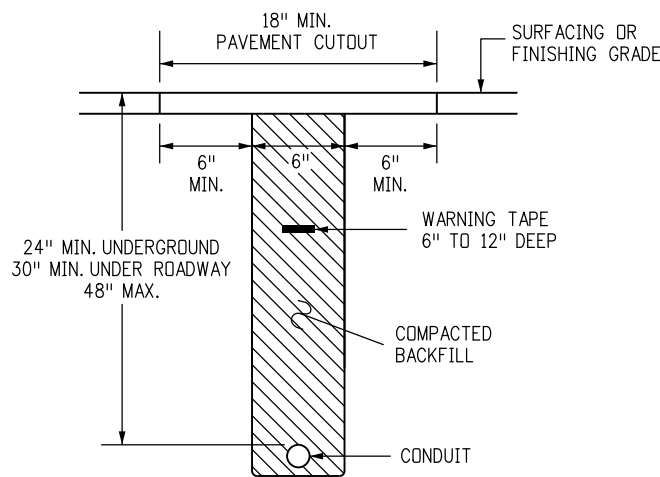




**TYPICAL BREAK-AWAY TYPE TRANSFORMER BASE DETAIL**

**NOTES:**

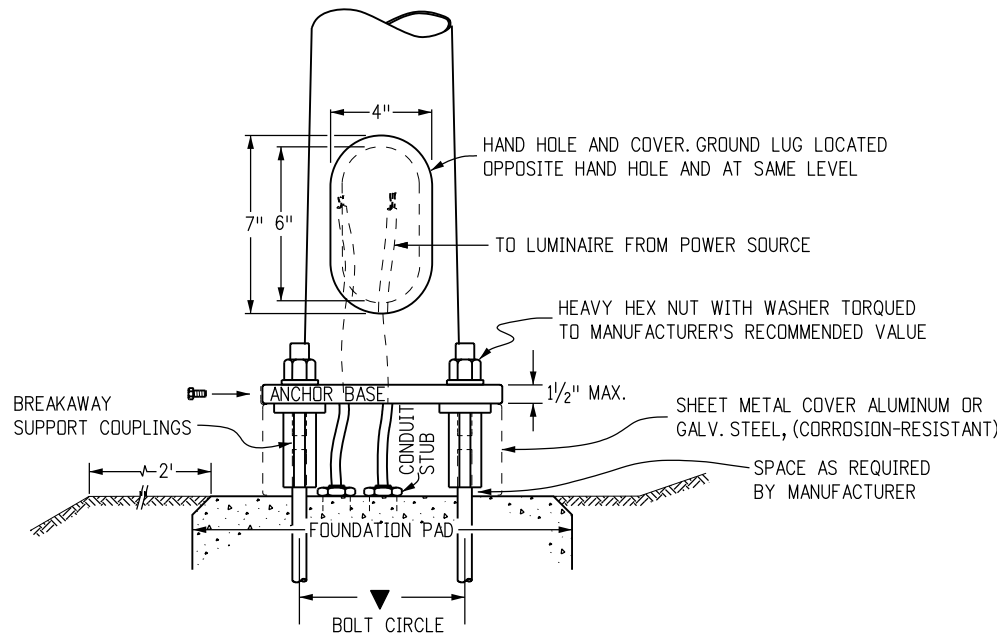
1. HARDWARE SHALL CONFORM TO MANUFACTURER'S REQUIREMENTS.
2. A HAND HOLE IS NOT REQUIRED IN POLE IF A BREAK-AWAY TRANSFORMER BASE IS USED.



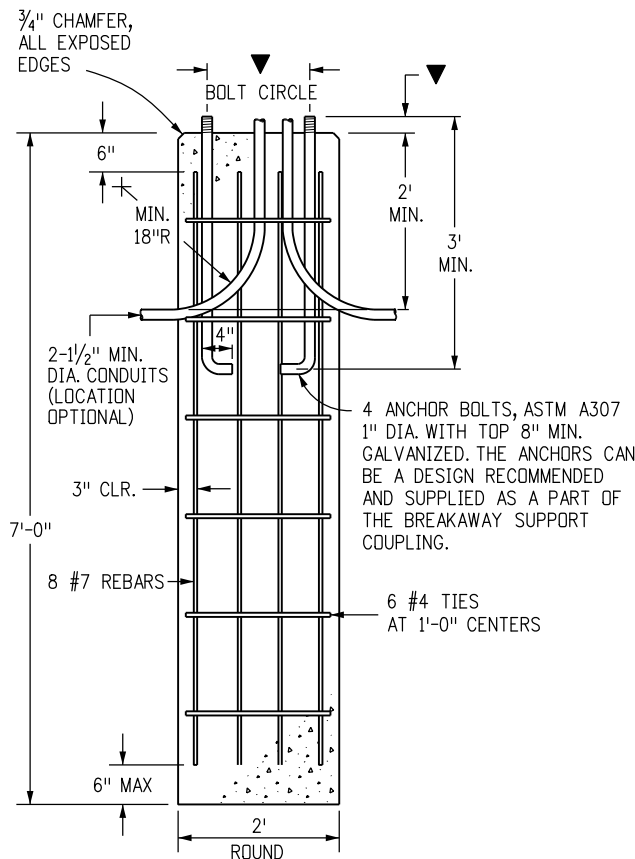
**TYPICAL CONDUIT BURIAL SECTION**

**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.



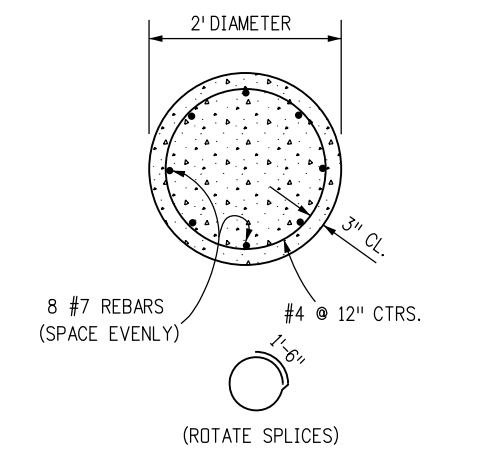
**BREAK-AWAY SUPPORT COUPLING**



**TYPICAL CONCRETE FOUNDATION**

**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).



**TYPICAL FOUNDATION SECTION**

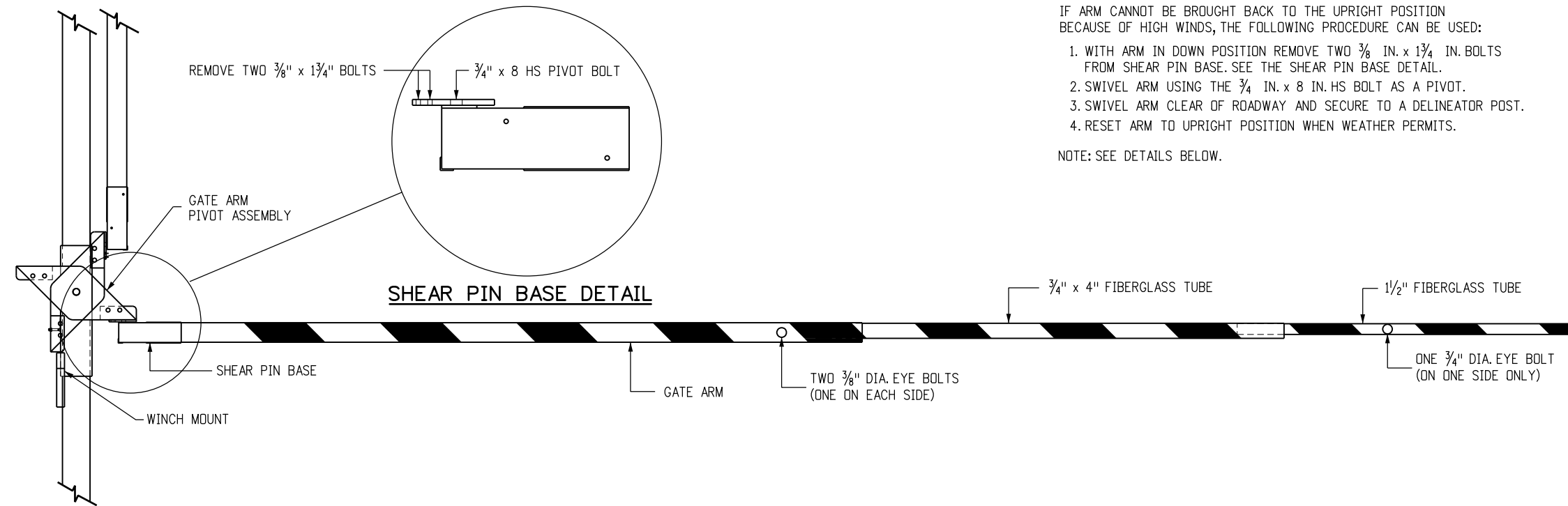
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>ROAD CLOSURE GATE</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments:			M-607-15	
Designer Initials: JBK	(R-X)					Standard Sheet No. 7 of 9	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		Issued by the Project Development Branch: July 31, 2019			

### HIGH WIND STOWING PROCEDURE

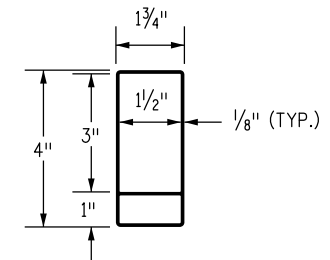
IF ARM CANNOT BE BROUGHT BACK TO THE UPRIGHT POSITION BECAUSE OF HIGH WINDS, THE FOLLOWING PROCEDURE CAN BE USED:

1. WITH ARM IN DOWN POSITION REMOVE TWO  $\frac{3}{8}$  IN. x  $1\frac{3}{4}$  IN. BOLTS FROM SHEAR PIN BASE. SEE THE SHEAR PIN BASE DETAIL.
2. SWIVEL ARM USING THE  $\frac{3}{4}$  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.

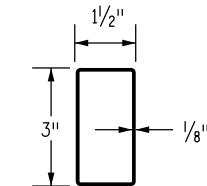
NOTE: SEE DETAILS BELOW.



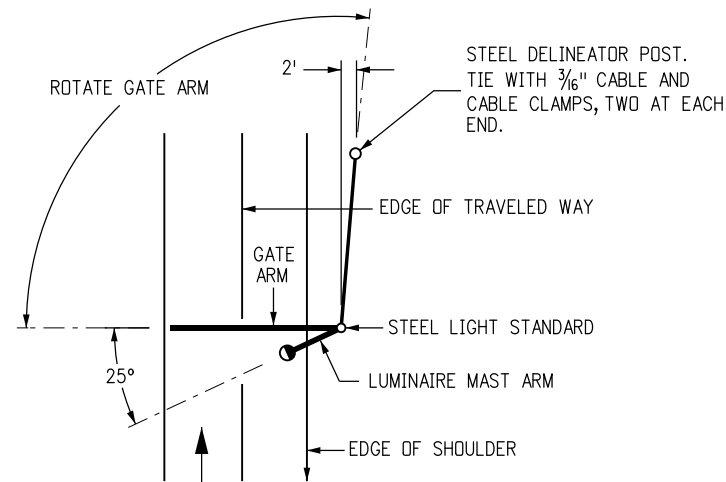
### GATE ARM PROFILE



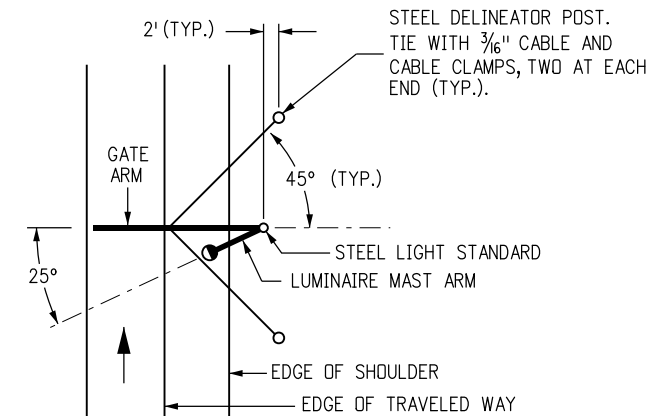
SECTION  $1\frac{3}{4}$  IN. x 4 IN. FIBERGLASS TUBE



SECTION  $1\frac{1}{2}$  IN. x 3 IN. FIBERGLASS TUBE



DETAIL FOR HIGH WIND STOW POSITION



DETAIL TO SECURE GATE IN HIGH WIND

Computer File Information	
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Designer Initials: JBK	(R-X)
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Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
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 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868

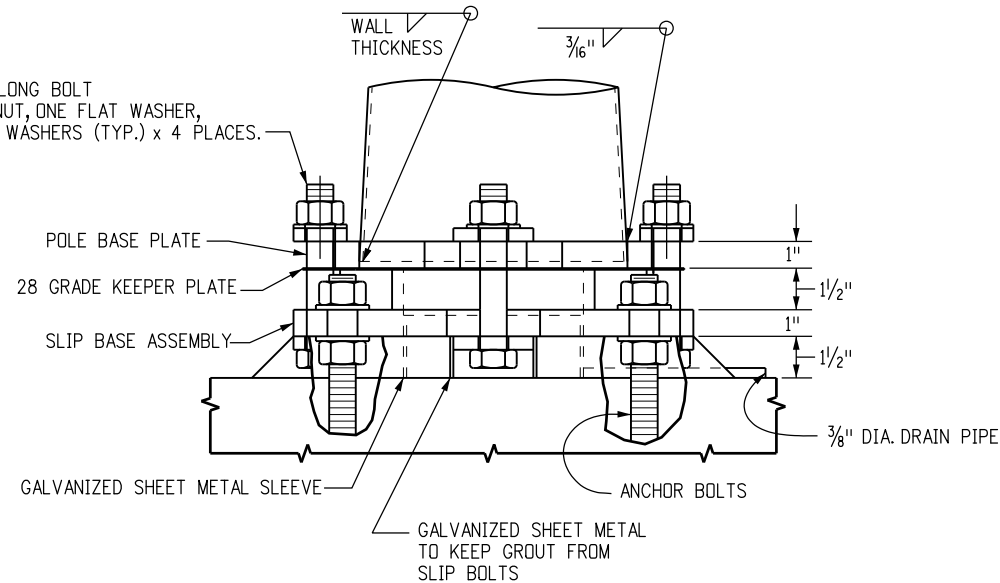
Project Development Branch JBK

# ROAD CLOSURE GATE

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-607-15
Standard Sheet No. 8 of 9
Project Sheet Number:

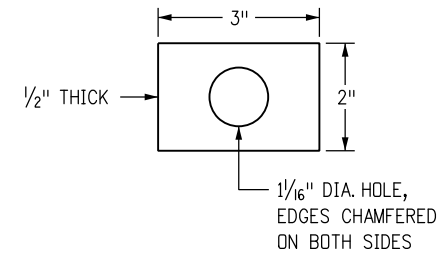
1"-8UNC x 6 1/2" LONG BOLT  
WITH ONE HEX NUT, ONE FLAT WASHER,  
AND TWO PLATE WASHERS (TYP.) x 4 PLACES.



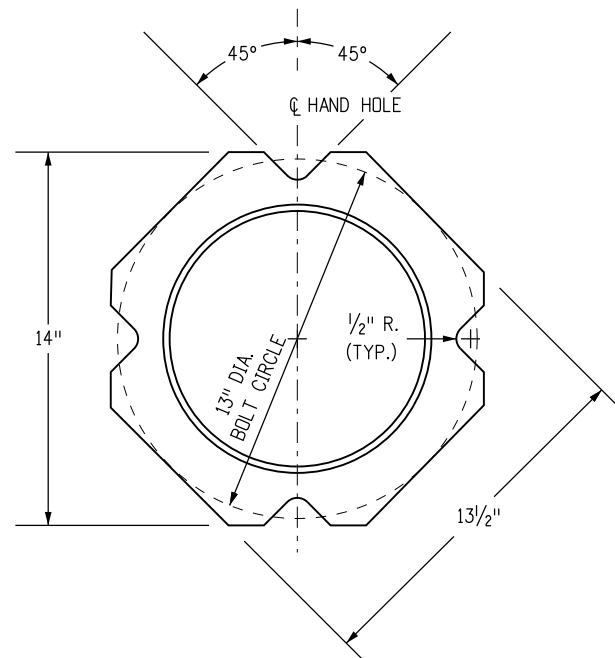
**BREAK-AWAY BASE  
(FOR INFORMATION ONLY)**

**NOTES**

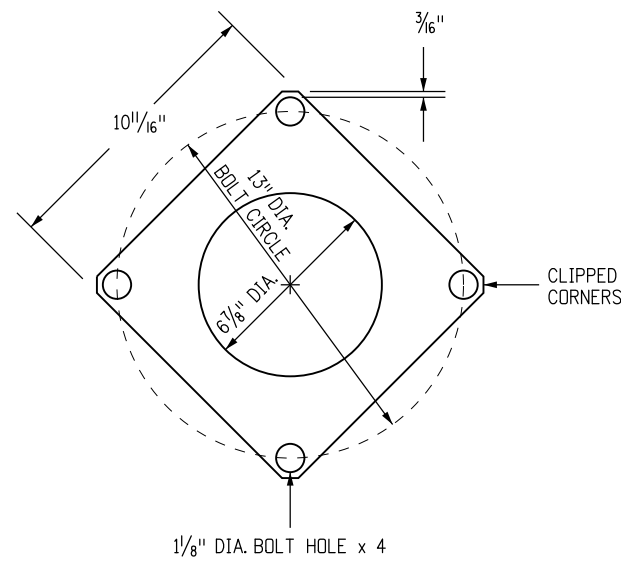
1. POLE BASE PLATE SHALL CONFORM TO ASTM A 572, GRADE 42.
2. BOTTOM PLATE OF SLIP BASE ASSEMBLY SHALL CONFORM TO ASTM A 572, GRADE 50.
3. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION IN CONFORMANCE WITH ASTM A 123. ALL CONTACT AREAS OF THE STRUCTURAL STEEL SHALL BE FREE OF GALVANIZING BEADS 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.



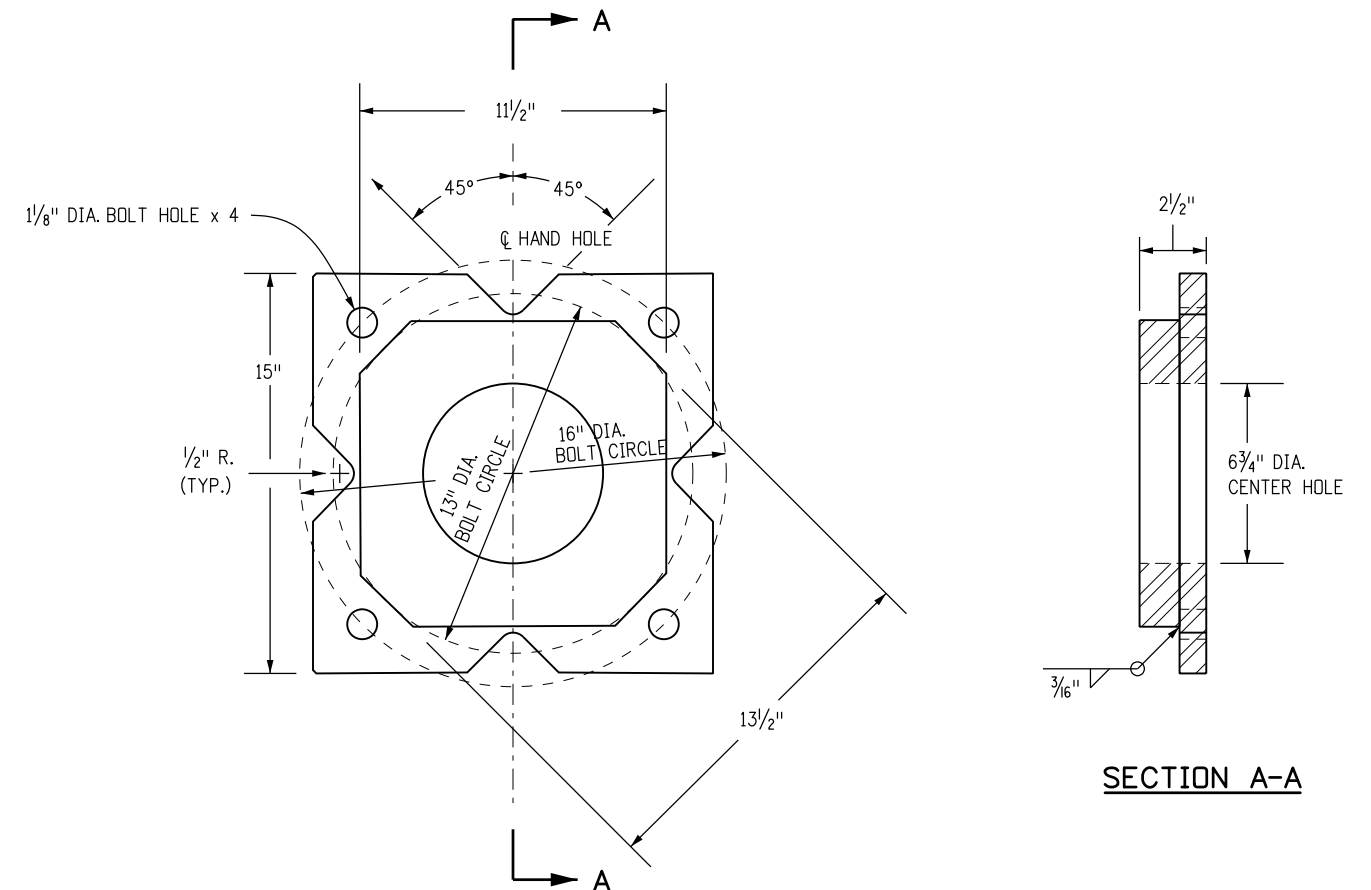
**PLATE WASHER**



**LIGHT STANDARD BASE PLATE**



**28 GRADE KEEPER PLATE**



**SLIP BASE ASSEMBLY**

**SECTION A-A**

**OPTIONAL BREAK-AWAY TYPE BASE**

Computer File Information	
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Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
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Sheet Revisions	
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Project Development Branch **JBK**

**ROAD  
CLOSURE GATE**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. <b>M-607-15</b>
Standard Sheet No. 9 of 9
Project Sheet Number:

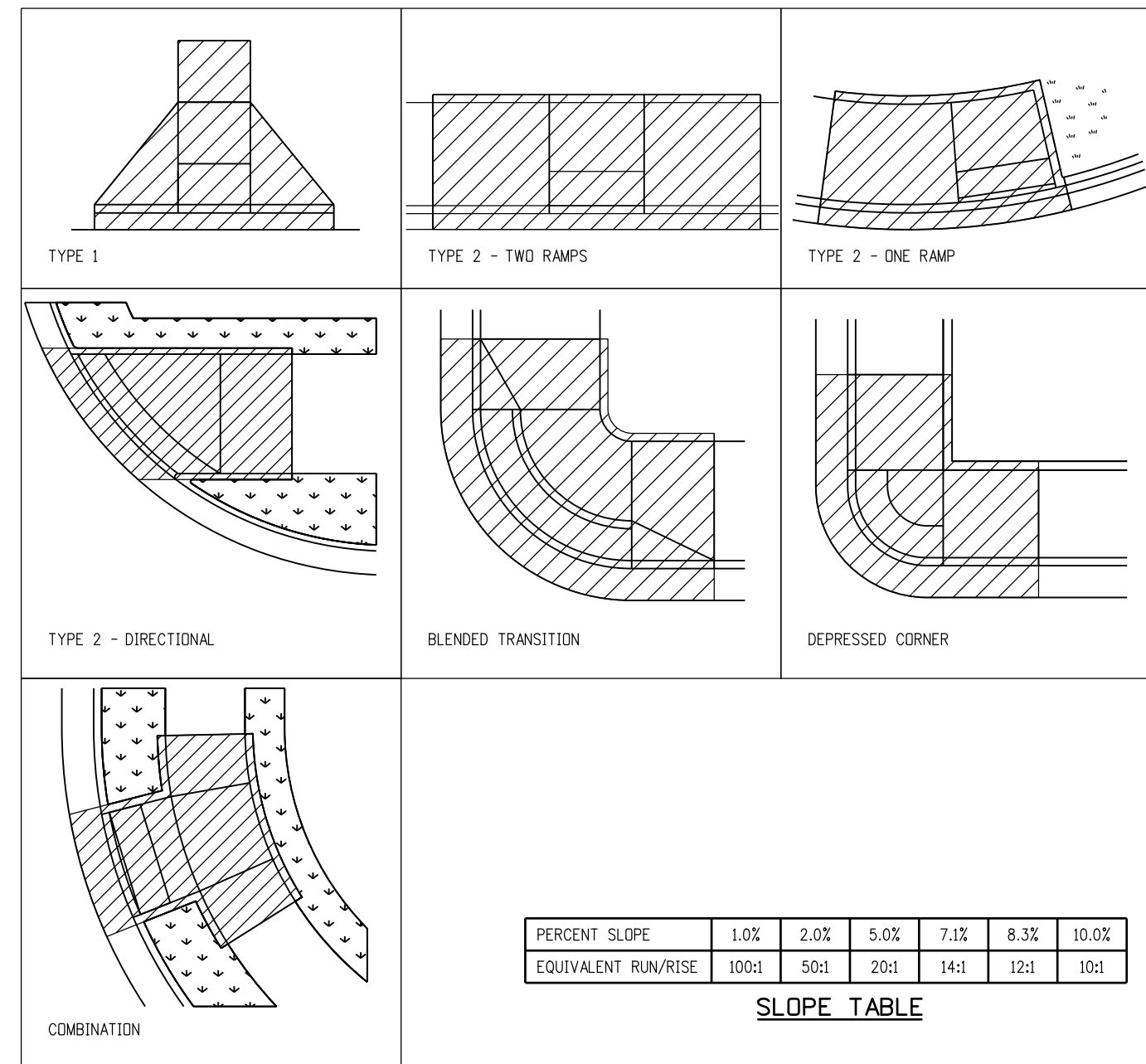
**CURB RAMP GENERAL NOTES:**

- ① IN NEW CONSTRUCTION OR FULL-DEPTH RECONSTRUCTION, PROVIDE A SEPARATE CURB RAMP FOR EACH MARKED OR UNMARKED PEDESTRIAN STREET CROSSING. CURB RAMPS SHALL BE CONTAINED WHOLLY WITHIN THE WIDTH OF THE PEDESTRIAN STREET CROSSING OR CROSSWALK THEY SERVE, OR AS SHOWN ON THE CONTRACT PLANS.
- ② ALTERATIONS ARE DEFINED AS CHANGES TO AN EXISTING HIGHWAY THAT AFFECT PEDESTRIAN ACCESS, CIRCULATION, OR USE. ALTERATIONS INCLUDE, BUT ARE NOT LIMITED TO, RESURFACING, REHABILITATION, RECONSTRUCTION, CURB RAMP RETROFITS, HISTORIC RESTORATION, OR CHANGES OR REARRANGEMENT TO STRUCTURAL PARTS OR ELEMENTS OF A PEDESTRIAN FACILITY.
- ③ A WALKABLE SURFACE IS DEFINED AS A PAVED SURFACE ADJACENT TO A CURB RAMP OR TURNING SPACE, WITHOUT RAISED OBSTACLES, THAT COULD BE MISTAKENLY TRAVERSED BY A USER WHO IS VISUALLY IMPAIRED.
- ④ IN ALTERATIONS, WHERE AN EXISTING PHYSICAL CONSTRAINT PREVENTS PROVIDING A SEPARATE CURB RAMP FOR EACH PEDESTRIAN STREET CROSSING, A SINGLE DIAGONAL RAMP (ON THE APEX) SHALL BE PERMITTED TO SERVE BOTH PEDESTRIAN STREET CROSSINGS. THE USE OF A SINGLE DIAGONAL RAMP SHALL BE APPROVED BY THE ENGINEER PRIOR TO CONSTRUCTION. DIAGONAL RAMPS ARE NOT ACCEPTABLE IN NEW CONSTRUCTION OR FULL-DEPTH RECONSTRUCTION.
- ⑤ DETECTABLE WARNING SURFACES (DWS) ARE INTENDED TO INDICATE THE BOUNDARY BETWEEN A PEDESTRIAN ROUTE AND VEHICULAR ROUTE WHERE THERE IS A FLUSH RATHER THAN CURBED CONNECTION. DWS ARE NOT INTENDED TO PROVIDE WAYFINDING. DWS SHALL BE PROVIDED AT THE FOLLOWING LOCATIONS;
  - 1. CURB RAMPS, BLENDED TRANSITIONS, AND DEPRESSED CORNERS AT PEDESTRIAN STREET CROSSINGS;
  - 2. PEDESTRIAN REFUGE ISLANDS (6 FEET IN WIDTH OR GREATER);
  - 3. BOARDING PLATFORMS AT TRANSIT STOPS WHERE THE EDGE OF THE PLATFORM IS NOT PROTECTED TO PEDESTRIAN CROSS TRAFFIC; AND
  - 4. BOARDING AREAS AT SIDEWALK OR STREET LEVEL TRANSIT STOPS WHERE THE AREA IS NOT PROTECTED TO PEDESTRIAN CROSS TRAFFIC.
- ⑥ DETECTABLE WARNING SURFACES SHALL CONTRAST VISUALLY WITH THE ADJACENT GUTTER, HIGHWAY, OR PEDESTRIAN ACCESS ROUTE SURFACE, EITHER LIGHT-ON-DARK OR DARK-ON-LIGHT. FEDERAL YELLOW COLOR IS PREFERRED, HOWEVER, OTHER COLORS MAY BE USED IF APPROVED BY THE ENGINEER.
- ⑦ IN ALTERATIONS, TO AVOID CHASING GRADE INDEFINITELY ON STEEP ROADWAYS, A CURB RAMPS LENGTH IS NOT REQUIRED TO EXCEED 15 FEET REGARDLESS OF THE RESULTING RAMP RUNNING SLOPE.
- ⑧ ALL SLOPES ARE MEASURED WITH RESPECT TO A LEVEL PLANE.
- ⑨ DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, OR OTHER OBSTRUCTIONS SHALL NOT BE INSTALLED ON THE CURB RAMP, OR TURNING SPACE AREAS.
- ⑩ IN NEW CONSTRUCTION, PULL BOXES, METER BOXES, MAINTENANCE HOLE COVERS, VAULT LIDS, OR SIMILAR, SHALL NOT BE CONSTRUCTED WITHIN ANY PART OF CURB RAMP OR TURNING SPACE. IN ALTERATIONS, WHERE THESE ITEMS CANNOT BE RELOCATED OUTSIDE OF THE CURB RAMP OR TURNING SPACE, THEY MUST NOT CREATE A VERTICAL DISCONTINUITY GRATER THAN 1/2 INCH. ANY VERTICAL DISCONTINUITY BETWEEN 1/4 INCH AND 1/2 INCH SHALL BE BEVELED WITH A SLOPE NOT STEEPER THAN 1V:2H. THE BEVEL SHALL BE APPLIED ACROSS THE ENTIRE SURFACE DISCONTINUITY.
- ⑪ CONSTRUCTION OF ANY REQUIRED PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE CURB RAMP AND WILL NOT BE PAID FOR SEPARATELY.
- ⑫ ALL CURB RAMP JOINTS AND GRADE BREAKS SHALL BE FLUSH (0'-1/8"). THE JOINT BETWEEN THE ROADWAY SURFACE AND THE GUTTER PAN SHALL BE FLUSH.
- ⑬ THE CONTRACTOR SHALL VERIFY REMOVAL LIMITS ARE SUFFICIENT TO PROVIDE POSITIVE DRAINAGE, MAINTAIN EXISTING DRAINAGE PATTERNS, AND AVOID PONDING IN THE FINAL CONFIGURATION.
- ⑭ FLARED SIDE SLOPES MAY EXCEED 10.0% ONLY WHERE THEY ABUT A NON-WALKABLE SURFACE, OR WHERE THE ADJACENT RAMP SURFACE IS BLOCKED TO PEDESTRIAN TRAFFIC.
- ⑮ THE CHANGE IN GRADE AT THE BOTTOM OF THE CURB RAMP SHALL NOT EXCEED AN ALGEBRAIC DIFFERENCE OF 13.33%. THE COUNTER SLOPE OF THE GUTTER AT THE FOOT OF A RAMP, TURNING SPACE, OR BLENDED TRANSITION SHALL NOT EXCEED 5.0%.
- ⑯ GRADE BREAKS AT THE TOP AND BOTTOM OF RAMP RUNS SHALL BE PERPENDICULAR TO THE DIRECTION OF THE RAMP RUN. GRADE BREAKS SHALL NOT BE PERMITTED ON THE SURFACE OF THE RAMP RUN OR TURNING SPACE. SURFACE SLOPES THAT MEET AT GRADE BREAKS SHALL BE FLUSH.
- ⑰ A BROOM FINISH, WITH SWEEPS PERPENDICULAR TO THE DIRECTION OF PEDESTRIAN TRAFFIC, SHALL BE APPLIED TO ALL RAMP AND TURNING SPACE SURFACES.
- ⑱ IN ALTERATIONS, WHERE A RAMP OR TURNING SPACE MUST TIE INTO AN EXISTING GRADE THAT CANNOT BE ALTERED, THE RAMP OR TURNING SPACE MAY BE WARPED TO TRANSITION TO THE REQUIRED CROSS SLOPE. THE TRANSITION TO THE REQUIRED CROSS SLOPE SHALL BE SPREAD EVENLY OVER THE LENGTH OF THE RAMP OR TURNING SPACE TO MINIMIZE THE DEGREE OF WARPING. THE RATE OF CHANGE ON A RAMP OR TURNING SPACE SHALL NOT EXCEED 3% PER LINEAR FOOT.
- ⑲ DESIGN AND CONSTRUCT CURB RAMPS, TURNING SPACES, AND FLARE SLOPES WITH THE FLATTEST SLOPES POSSIBLE. THE SLOPES INDICATED IN THESE DETAILS SHOW THE MAXIMUM SLOPES ALLOWABLE. **PREFERRED VALUES** TO BE USED DURING DESIGN, LAYOUT, AND CONSTRUCTION ARE:

- RAMP RUNNING SLOPE 7.5%
- RAMP CROSS SLOPE 1
- TURNING SPACE RUNNING SLOPE 1.5%
- TURNING SPACE CROSS SLOPE 1.5%
- FLARE SLOPE 8.0-9.0%

- ⑳ WHERE SNOW REMOVAL EQUIPMENT WILL BE USED TO CLEAR THE PEDESTRIAN ACCESS ROUTE, CONSULT THE ENGINEER PRIOR TO CONSTRUCTION TO ENSURE THE WIDTH AND THICKNESS OF CURB RAMPS IS SUFFICIENT TO ACCOMMODATE SUCH EQUIPMENT.
- ㉑ PROVIDE EXPANSION JOINT MATERIAL 1/2" THICK WHERE CURB RAMPS ADJOIN ANY RIGID PAVEMENT, OR STRUCTURE. THE TOP OF THE JOINT FILLER MATERIAL SHALL BE FLUSH WITH ADJOINING CONCRETE SURFACES. THE EXPANSION JOINT MATERIAL SHALL EXTEND FOR THE FULL DEPTH OF THE CONCRETE SURFACE.
- ㉒ PROVIDE TIE BAR REINFORCING BETWEEN INDEPEDENTLY POURED CONCRETE CURB RAMPS OR TURNING SPACES AND CURB AND GUTTER. DRILL AND GROUT NO. 4 12 INCH LONG REINFORCEMENT BARS (EPOXY COATED) AT 18 INCHES CENTER TO CENTER MINIMUM.

**CURB RAMP PAY AREAS**

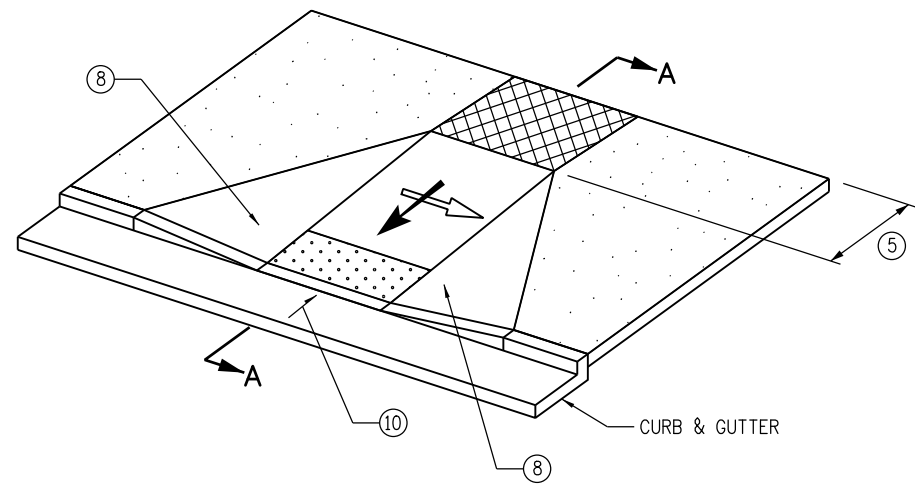


PERCENT SLOPE	1.0%	2.0%	5.0%	7.1%	8.3%	10.0%
EQUIVALENT RUN/RISE	100:1	50:1	20:1	14:1	12:1	10:1

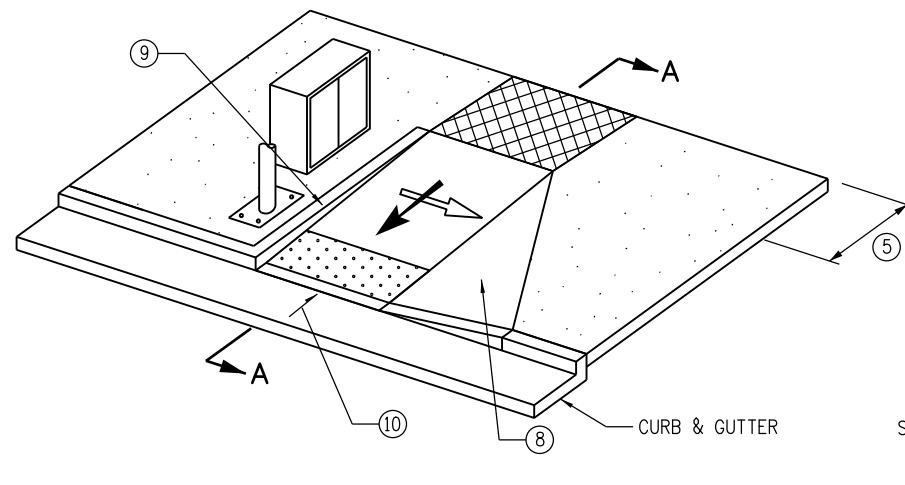
**SLOPE TABLE**

**GENERAL NOTES & PAY AREAS**

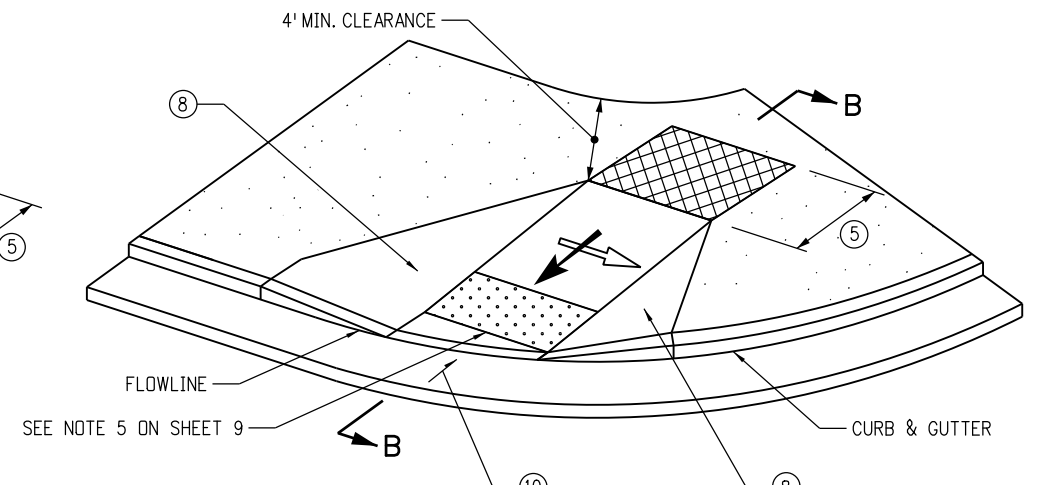
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1 style="text-align: center;">CURB RAMPS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:			M-608-1	
Last Modification Date: 07/31/19	Detailer Initials: LTA			Issued by the Project Development Branch: July 31, 2019	<b>Standard Sheet No. 1 of 10</b>		
CAD Ver.: MicroStation V8	Scale: Not to Scale				Project Sheet Number:		



**PERPENDICULAR RAMP**  
(TYPICAL)



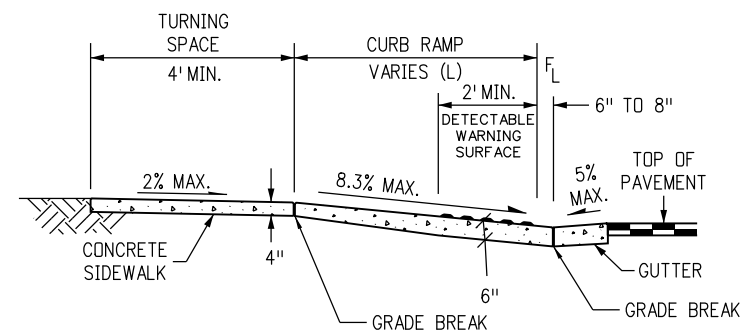
**PERPENDICULAR RAMP**  
(WITH VERTICAL RETURN CURB)



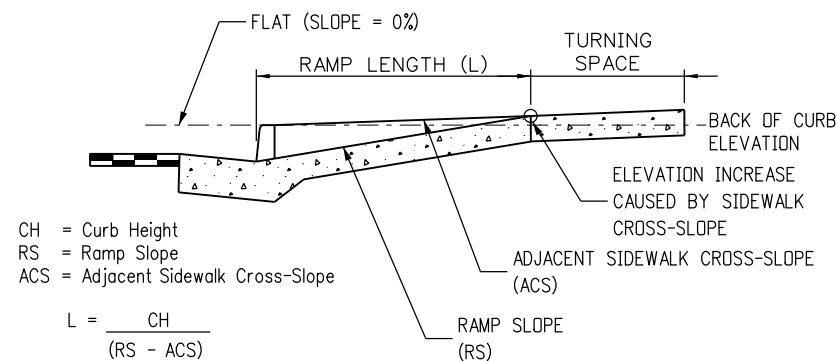
**PERPENDICULAR RAMP**  
(DIRECTIONAL)

**PERPENDICULAR RAMP NOTES**

- ① RAMP WIDTH - PROVIDE 5 FT. OR GREATER WHERE POSSIBLE. IF SITE CONSTRAINTS DO NOT PERMIT, PROVIDE 4 FT. MINIMUM. RAMPS SERVICING SHARED USE PATHS SHALL MATCH THE WIDTH OF THE PATH.
- ② RAMP RUNNING SLOPE - 8.3% MAX.
- ③ TURNING SPACE RUNNING SLOPE - 2.0% MAX. TURNING SPACE RUNNING SLOPE IS MEASURED IN THE SAME DIRECTION AS THE RAMP RUNNING SLOPE.
- ④ RAMP AND TURNING SPACE CROSS SLOPE - 2.0% TYPICAL. AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE VEHICLES CAN PROCEED THROUGH THE INTERSECTION WITHOUT SLOWING OR STOPPING, THE CROSS SLOPE OF RAMPS AND TURNING SPACES MAY EQUAL THE HIGHWAY GRADE. AT MIDBLOCK PEDESTRIAN STREET CROSSINGS THE RAMP AND TURNING SPACE CROSS SLOPE MAY EQUAL THE HIGHWAY GRADE.
- ⑤ TURNING SPACE DIMENSIONS - PROVIDE A TURNING SPACE AT THE TOP OF PERPENDICULAR RAMPS WITH A WIDTH EQUAL TO THE WIDTH OF THE CURB RAMP. TURNING SPACE LENGTH MUST BE 4 FT. MINIMUM, MEASURED IN THE DIRECTION OF THE RAMP RUN. WHEN A TURNING SPACE IS CONSTRAINED AT THE BACK OF SIDEWALK, INCREASE LENGTH TO 5 FT. MINIMUM IN THE DIRECTION OF THE RAMP RUN.
- ⑥ RAMP ALIGNMENT - RAMPS SHALL BE ALIGNED TO BE FULLY CONTAINED WITHIN THE CROSSWALK OR STREET CROSSING THEY SERVE. PROVIDE ONE RAMP FOR EACH STREET CROSSING DIRECTION. IN ALTERATIONS, WHERE EXISTING PHYSICAL CONSTRAINTS PREVENT PROVIDING ONE CURB RAMP FOR EACH CROSSING DIRECTION, A SINGLE DIAGONAL CURB RAMP (ON THE APEX OF A CORNER) SHALL BE PERMITTED TO SERVE BOTH PEDESTRIAN STREET CROSSINGS. IF A DIAGONAL RAMP IS USED, A CLEAR SPACE 4 FT. X 4FT. MUST BE PROVIDED AT THE BASE OF THE RAMP. THE CLEAR SPACE MUST BE WITHIN BOTH CROSSWALKS AND WHOLLY OUTSIDE OF ANY ADJACENT VEHICULAR TRAVEL LANES. DIAGONAL RAMPS ARE NOT ACCEPTABLE IN NEW CONSTRUCTION, OR FULL-DEPTH RECONSTRUCTION.
- ⑦ RAMP LENGTH - PERPENDICULAR RAMP LENGTH IS DEPENDENT UPON THE RAMP SLOPE, HEIGHT OF CURB, AND ADJACENT SIDEWALK CROSS-SLOPE WHICH MUST BE INTERCEPTED. SEE DETAIL A FOR CALCULATING RAMP LENGTH WHEN CHASING SIDEWALK CROSS-SLOPE. WHERE TERRAIN IS SLOPING A RAMP IS NOT REQUIRED TO CHASE GRADE MORE THAN 15 FT. REGARDLESS OF THE RESULTING RAMP SLOPE.
- ⑧ RAMP FLARES - WHERE A RAMP EDGE ABUTS A WALKABLE SURFACE, A FLARED SIDE SHALL BE PROVIDED. RAMP FLARE SLOPES SHALL NOT EXCEED 10.0%.
- ⑨ VERTICAL CURB RETURNS - VERTICAL CURB RETURNS MAY BE USED ONLY WHERE A RAMP ABUTS A NON-WALKABLE SURFACE, OR WHERE A RAMP IS PROTECTED FROM PEDESTRIAN CROSS TRAFFIC (FOR EXAMPLE BY A SIGNAL CABINET OR UTILITY POLE WHICH BLOCKS PASSAGE).
- ⑩ GUTTER COUNTER SLOPE - 5.0% MAX.



**SECTION A-A**

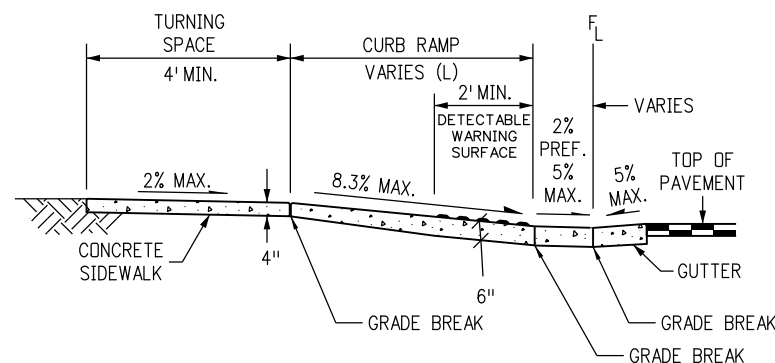


CH = Curb Height  
RS = Ramp Slope  
ACS = Adjacent Sidewalk Cross-Slope

$$L = \frac{CH}{RS - ACS}$$

EXAMPLE: CH = 6" (0.5 ft.), RS = 7.5% (0.075), ACS = 1.5% (0.015)  
L = 0.5 / (0.075 - 0.015) = 8.3 ft.

**DETAIL A - RAMP LENGTH**

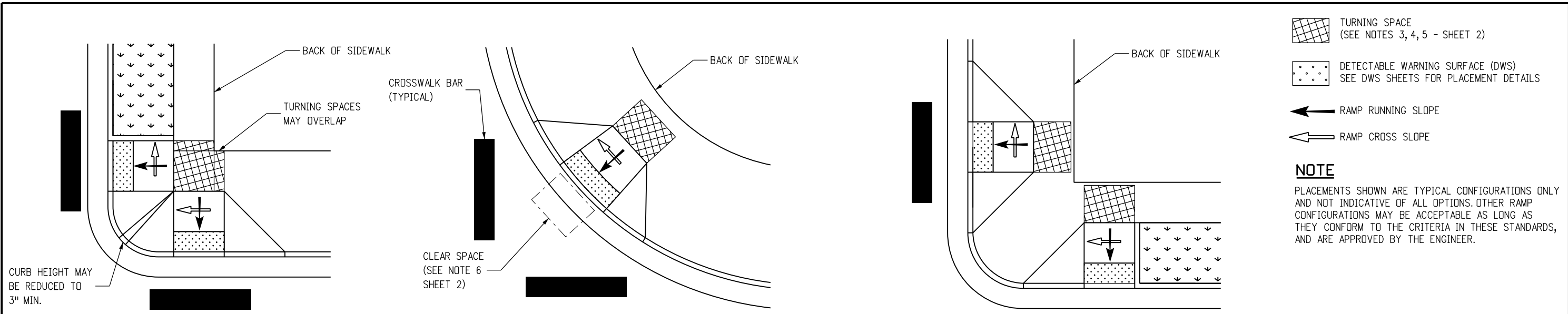


**SECTION B-B**



**TYPE 1 PERPENDICULAR CURB RAMPS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>STANDARD PLAN NO.</b> <b>M-608-1</b> <b>Standard Sheet No. 2 of 10</b>
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:		
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Units: English					
				<b>JBK</b>	Project Sheet Number:

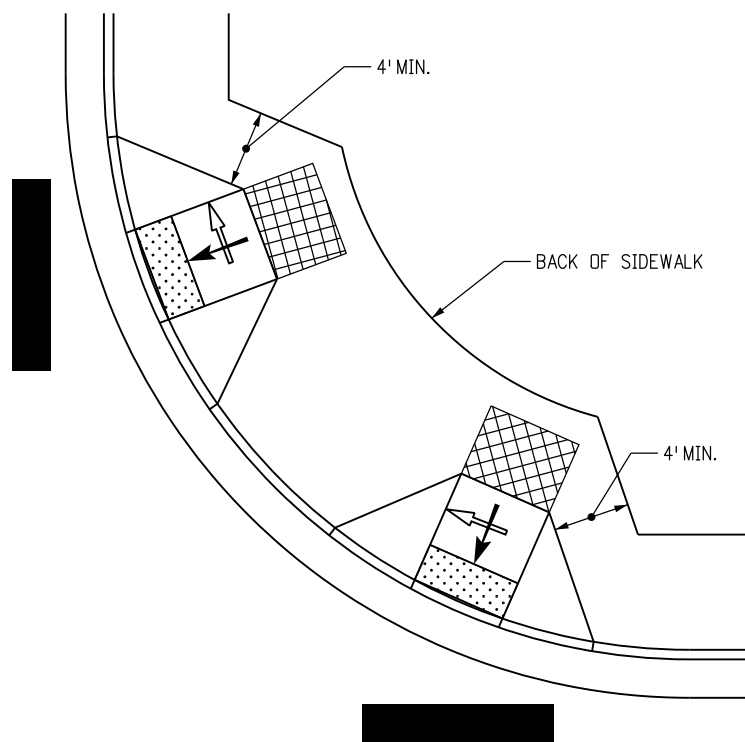


**TYPE 1 RAMPS FOR WIDE SIDEWALK**  
(3" REDUCED CURB)

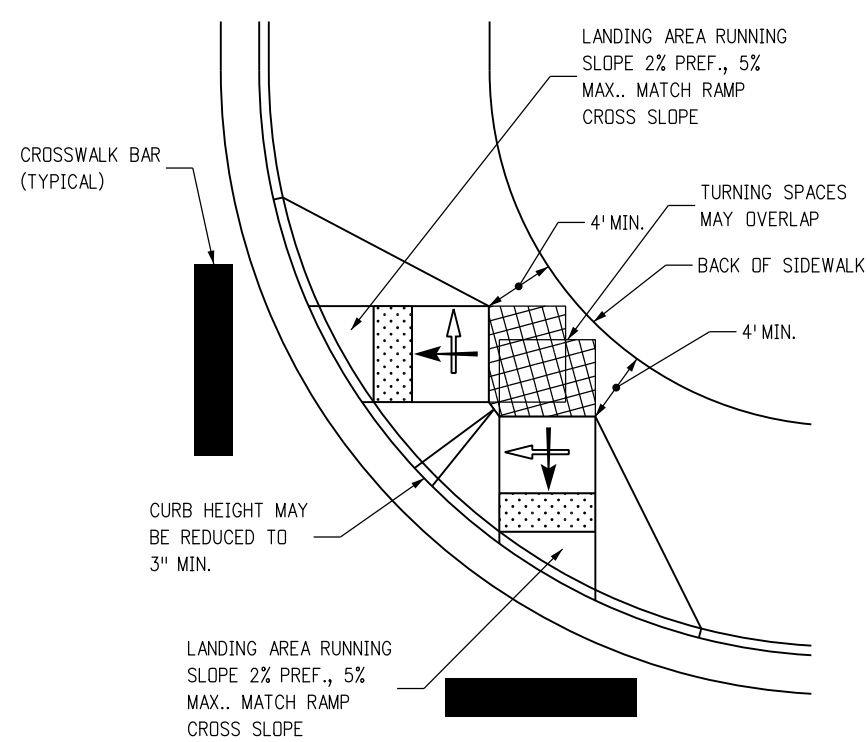
**TYPE 1 RAMP**  
(DIAGONAL)

**TYPE 1 RAMPS FOR WIDE SIDEWALK**

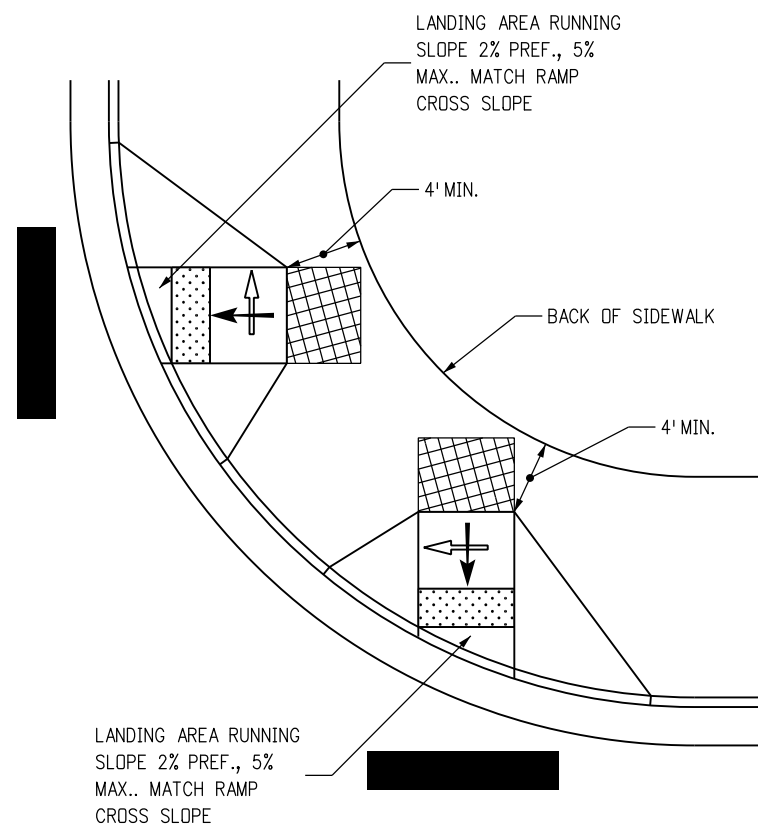
NOT ALLOWABLE IN NEW CONSTRUCTION/FULL DEPTH RECONSTRUCTION  
SEE GENERAL NOTE 4



**TYPE 1 PERPENDICULAR RAMPS**



**TYPE 1 CURB RAMPS TYPICAL CONFIGURATIONS**



**TYPE 1 DIRECTIONAL RAMPS**  
(LARGE RADIUS)

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Sheet Revisions	
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Colorado Department of Transportation

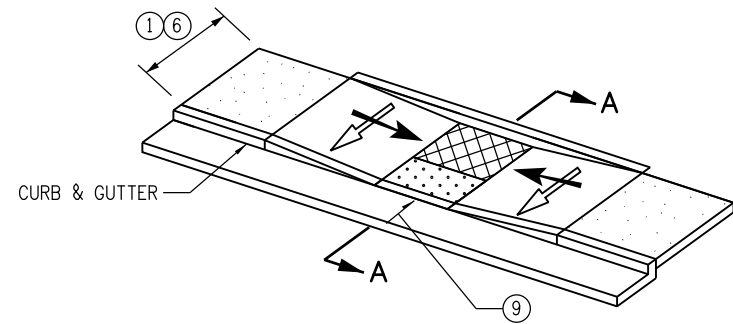
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Phone: 303-757-9021 FAX: 303-757-9868

**Project Development Branch** **JBK**

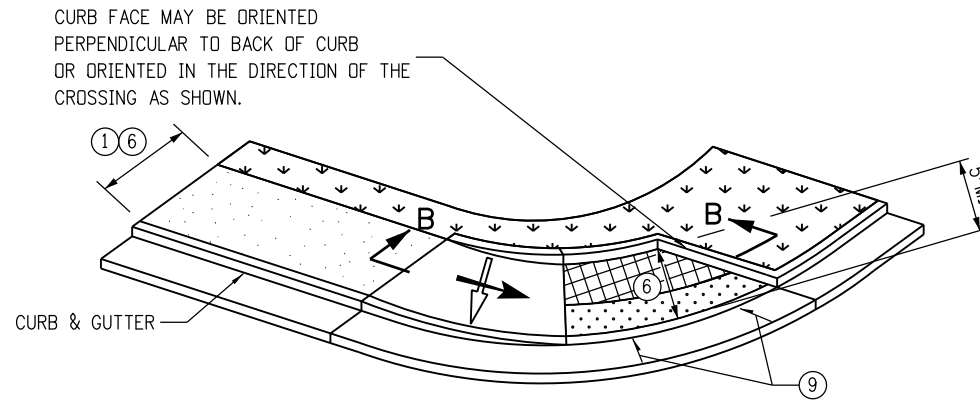
**CURB RAMPS**

Issued by the Project Development Branch: July 31, 2019

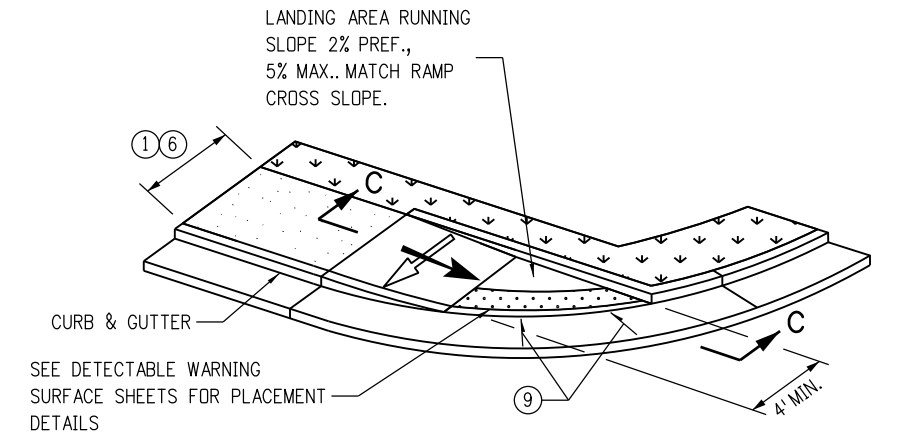
STANDARD PLAN NO.  
**M-608-1**  
Standard Sheet No. 3 of 10  
Project Sheet Number:



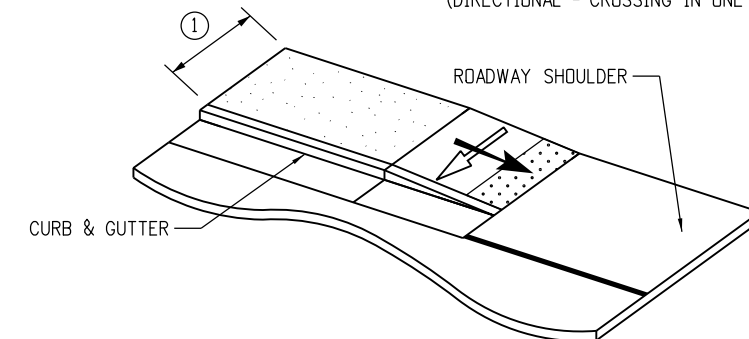
**PARALLEL RAMP**  
(TYPICAL)



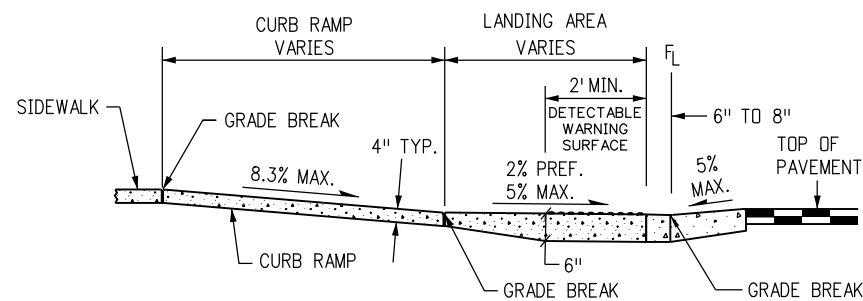
**PARALLEL RAMP**  
(SIDEWALK ENDS)



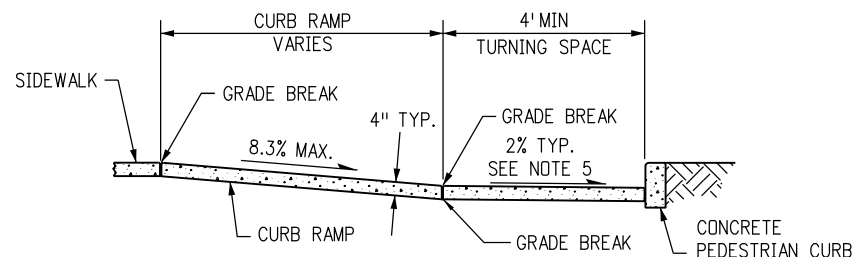
**PARALLEL RAMP**  
(DIRECTIONAL - CROSSING IN ONE DIRECTION ONLY)



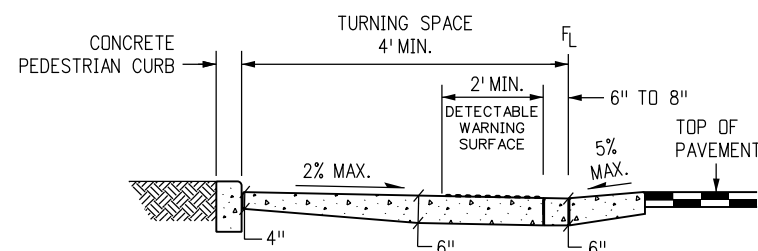
**SIDEWALK TO SHOULDER TRANSITION**



**SECTION C-C**



**SECTION B-B**



**SECTION A-A**

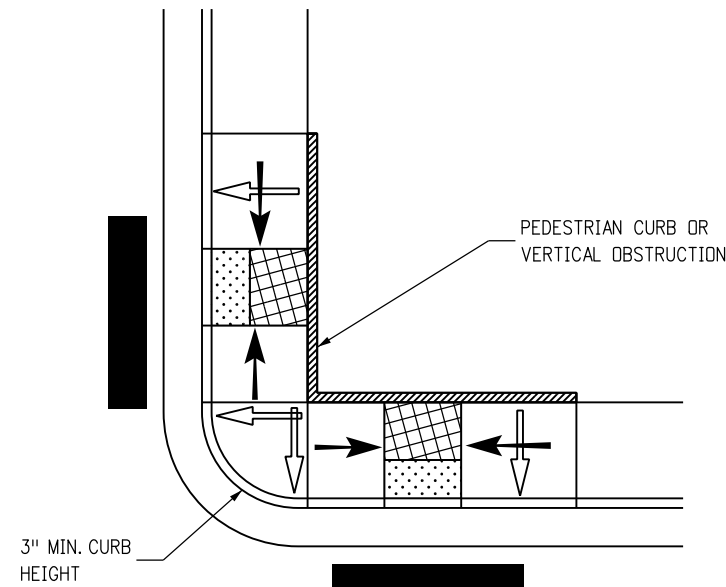
**TYPE 2 PARALLEL CURB RAMPS**

- SIDEWALK
- TURNING SPACE ④ ⑤ ⑥
- DETECTABLE WARNING SURFACE (DWS)

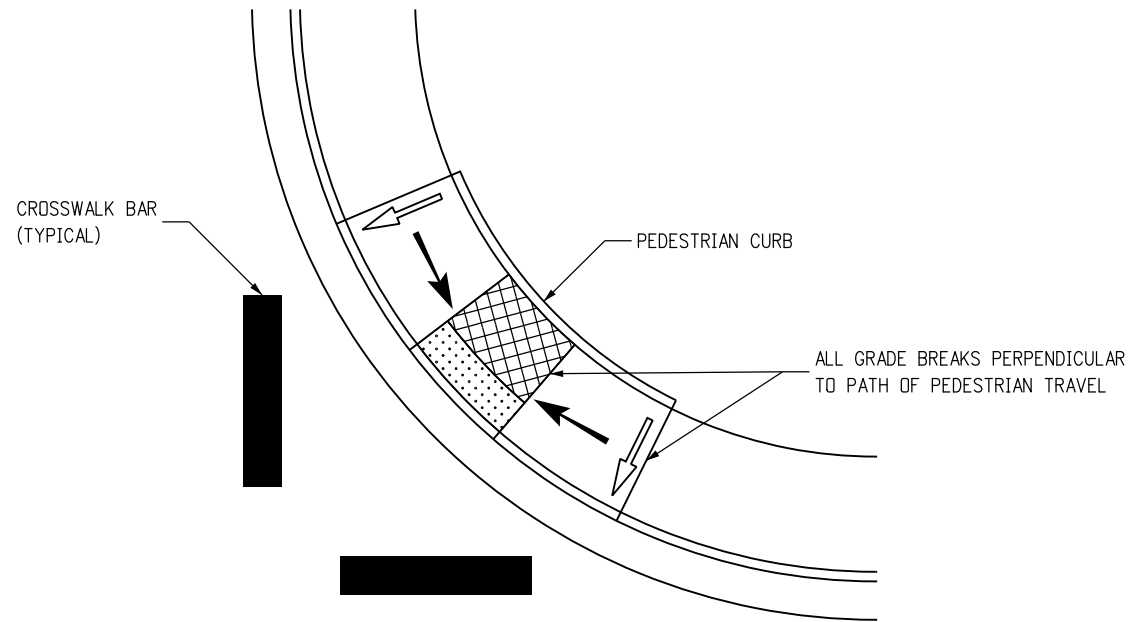
**PARALLEL RAMP NOTES**

- ① RAMP WIDTH - PROVIDE A RAMP WIDTH EQUAL TO THE ADJOINING SIDEWALK, PROVIDE 4 FT. WIDTH MINIMUM. RAMPS SERVICING SHARED USE PATHS SHALL MATCH THE WIDTH OF THE PATH.
- ② RAMP RUNNING SLOPE - 8.3% MAX.
- ③ RAMP CROSS SLOPE - 2.0% MAX.
- ④ TURNING SPACE RUNNING SLOPE - 2.0% MAX. TURNING SPACE RUNNING SLOPE IS MEASURED PERPENDICULAR TO THE BACK OF CURB.
- ⑤ TURNING SPACE CROSS SLOPE - 2.0% TYPICAL, AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE VEHICLES CAN PROCEED THROUGH THE INTERSECTION WITHOUT SLOWING OR STOPPING, THE CROSS SLOPE OF THE TURNING SPACE MAY EQUAL THE HIGHWAY GRADE. AT MIDBLOCK PEDESTRIAN STREET CROSSINGS THE TURNING SPACE CROSS SLOPE MAY EQUAL THE HIGHWAY GRADE. TURNING SPACE CROSS SLOPE IS MEASURED IN THE DIRECTION OF THE RAMP RUN.
- ⑥ TURNING SPACE DIMENSIONS - PROVIDE A TURNING SPACE AT THE BOTTOM OF PARALLEL RAMPS WITH A WIDTH EQUAL TO THE WIDTH OF THE CURB RAMP. PROVIDE 4 FT. MINIMUM, MEASURED IN THE DIRECTION OF THE RAMP RUN. IF THE TURNING SPACE IS CONSTRAINED ON TWO SIDES, PROVIDE 5 FT. MEASURED IN THE DIRECTION OF PEDESTRIAN STREET CROSSING. THE TURNING SPACE MAY CONTAIN THE DETECTABLE WARNING SURFACE.
- ⑦ RAMP ALIGNMENT - RAMPS SHALL BE ALIGNED SO THE TURNING SPACE IS FULLY CONTAINED WITHIN THE CROSSWALK OR STREET CROSSING THEY SERVE. PROVIDE ONE RAMP FOR EACH STREET CROSSING DIRECTION. IN ALTERATIONS, WHERE EXISTING PHYSICAL CONSTRAINTS PREVENT PROVIDING ONE CURB RAMP FOR EACH CROSSING DIRECTION, A SINGLE DIAGONAL CURB RAMP (ON THE APEX OF A CORNER) SHALL BE PERMITTED TO SERVE BOTH PEDESTRIAN STREET CROSSINGS. DIAGONAL RAMPS ARE NOT ACCEPTABLE IN NEW CONSTRUCTION, OR FULL-DEPTH RECONSTRUCTION.
- ⑧ RAMP LENGTH - PARALLEL RAMP LENGTH IS DEPENDENT UPON THE RAMP SLOPE AND THE CHANGE OF ELEVATION FROM THE TURNING SPACE TO THE SIDEWALK. WHERE TERRAIN IS SLOPING A RAMP IS NOT REQUIRED TO CHASE GRADE MORE THAN 15 FT. REGARDLESS OF THE RESULTING RAMP SLOPE.
- ⑨ GUTTER COUNTER SLOPE - 5.0% MAX.

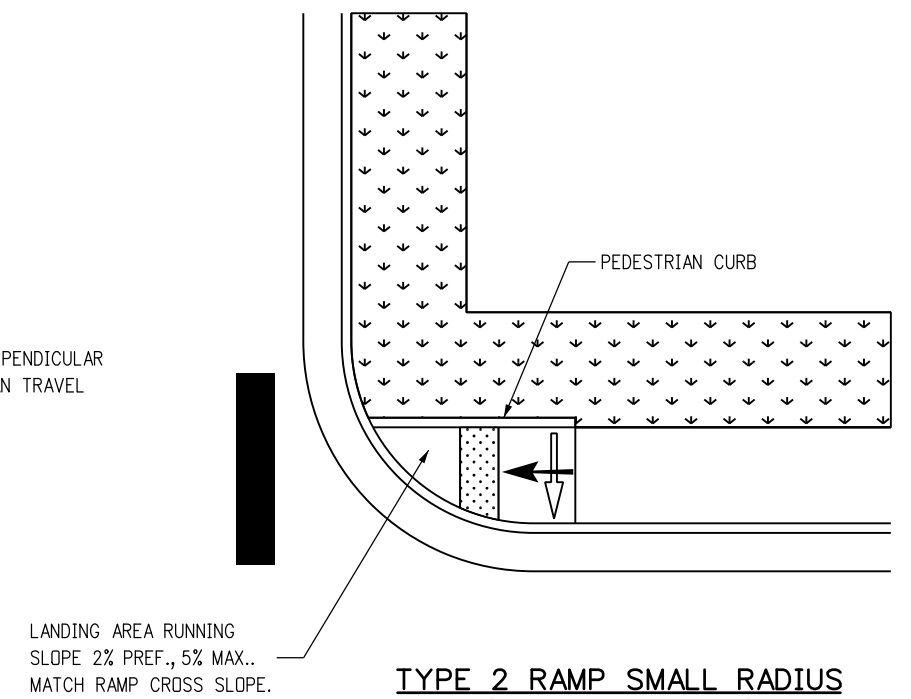
<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 	<h1>CURB RAMPS</h1>	<b>STANDARD PLAN NO.</b>
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:			M-608-1
Last Modification Date: 07/31/19	Detailer Initials: LTA			<b>Project Development Branch</b>	Issued by the Project Development Branch: July 31, 2019	<b>Standard Sheet No. 4 of 10</b>
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				<b>JBK</b>		Project Sheet Number:



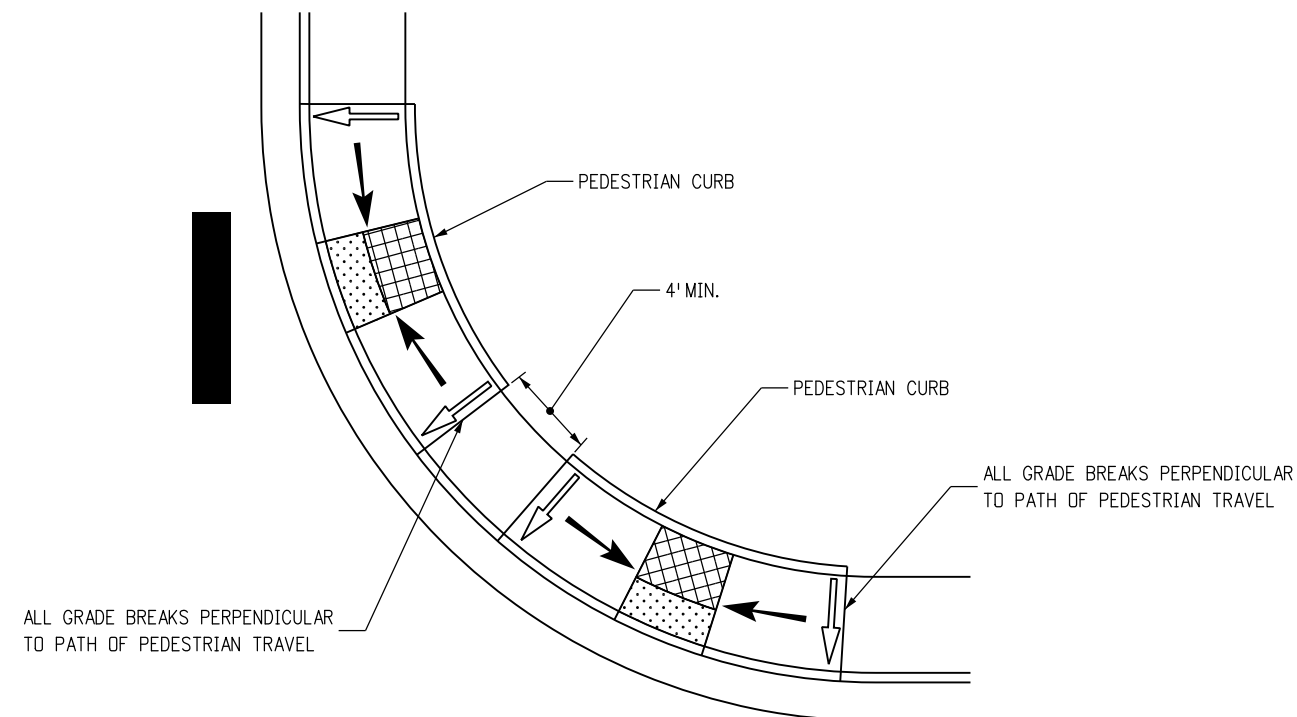
**TYPE 2 RAMPS SMALL RADIUS**  
(3" REDUCED CURB)



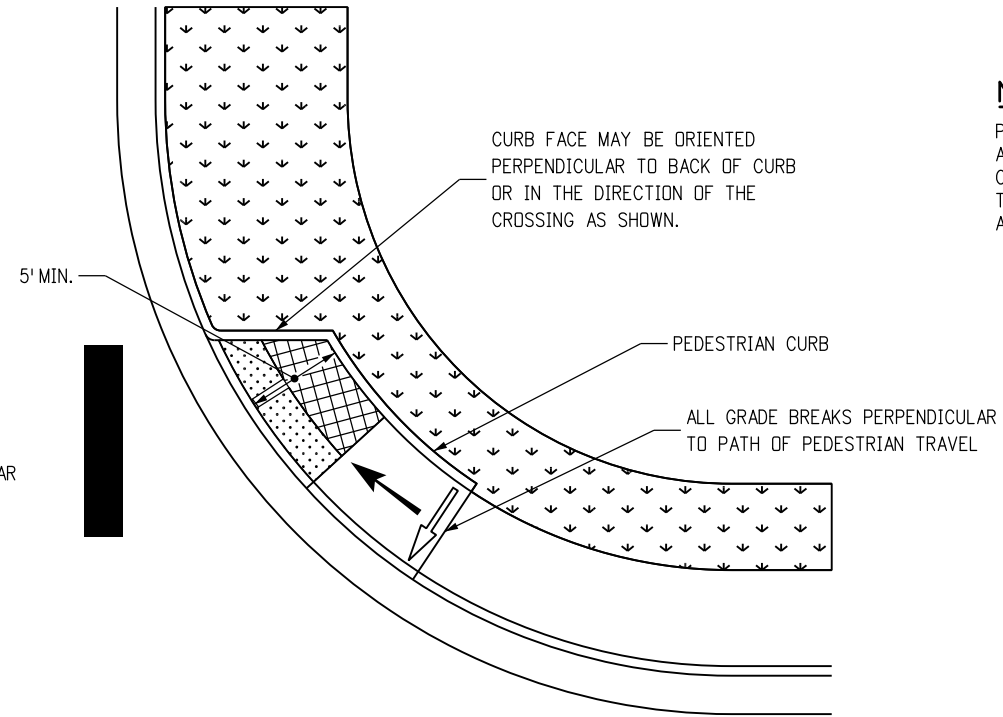
**TYPE 2 RAMP (DIAGONAL)**  
NOT ALLOWABLE IN NEW CONSTRUCTION/FULL-DEPTH RECONSTRUCTION  
SEE NOTE GENERAL NOTE 4



**TYPE 2 RAMP SMALL RADIUS**  
(CROSSING IN ONE DIRECTION)



**TYPE 2 RAMPS LARGE RADIUS**



**TYPE 2 RAMP LARGE RADIUS**  
(CROSSING IN ONE DIRECTION)

**NOTE**

PLACEMENTS SHOWN ARE TYPICAL CONFIGURATIONS ONLY AND NOT INDICATIVE OF ALL OPTIONS. OTHER RAMP CONFIGURATIONS MAY BE ACCEPTABLE AS LONG AS THEY CONFORM TO THE CRITERIA IN THESE STANDARDS, AND ARE APPROVED BY THE ENGINEER.

TURNING SPACE  
(SEE NOTE 4, 5, 6 - SHEET 4)

DETECTABLE WARNING SURFACE (DWS)  
SEE DWS SHEETS FOR PLACEMENT DETAILS

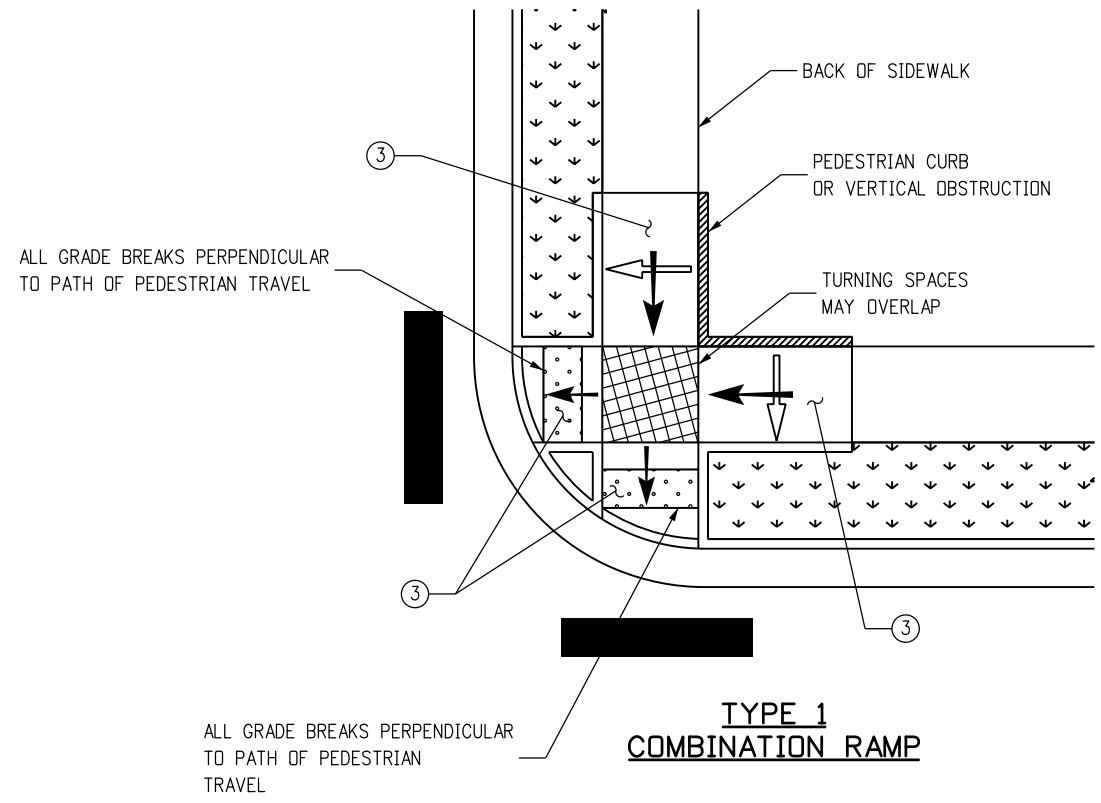
RAMP RUNNING SLOPE

RAMP CROSS SLOPE

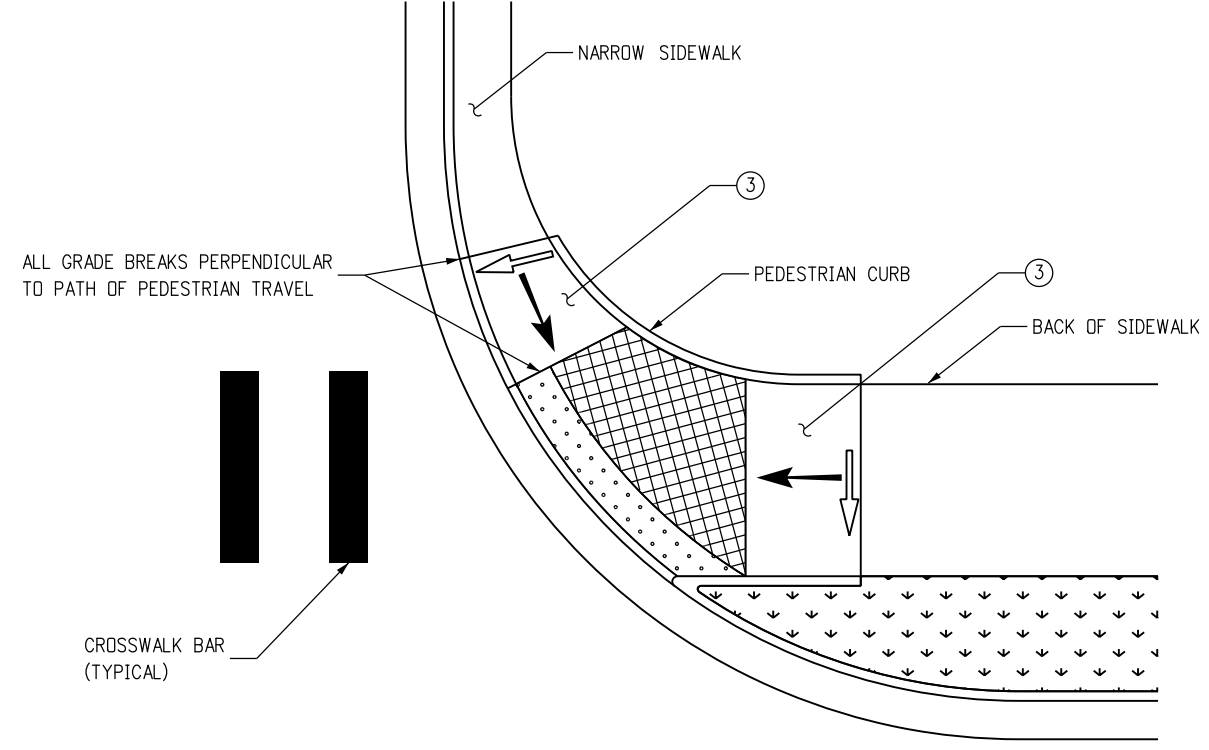
**TYPE 2 CURB RAMPS TYPICAL CONFIGURATIONS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation  2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>	<h1>CURB RAMPS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-608-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 5 of 10	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)			Issued by the Project Development Branch: July 31, 2019		

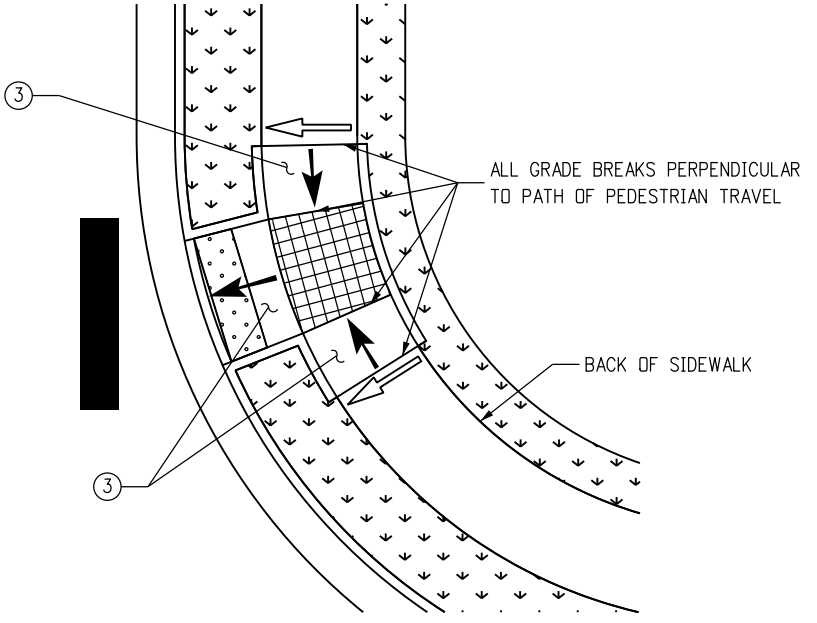




**TYPE 1  
COMBINATION RAMP**







**TYPE 1/TYPE 2  
COMBINATION RAMP**




**TYPE 1/TYPE 2  
COMBINATION RAMP**

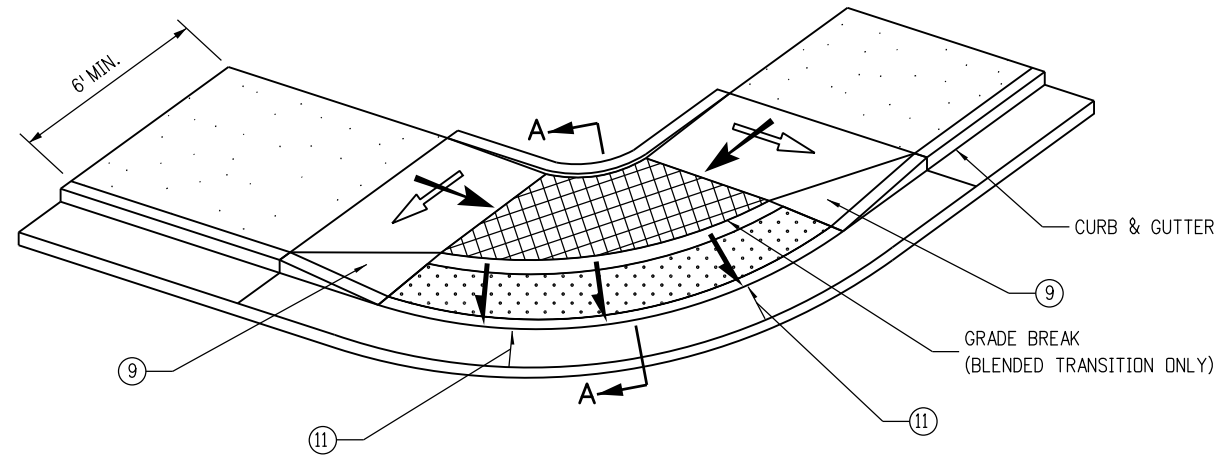
**COMBINATION CURB RAMP NOTES:**

- ① THE CURB RAMP PLACEMENTS SHOWN ARE TYPICAL CONFIGURATIONS ONLY AND NOT INDICATIVE OF ALL OPTIONS. OTHER CURB RAMP CONFIGURATIONS MAY BE ACCEPTABLE AS LONG AS THEY CONFORM TO THE CRITERIA IN THESE STANDARDS, AND ARE APPROVED BY THE ENGINEER.
- ② RAMP AND TURNING SPACE CROSS SLOPE - 2.0% TYPICAL. AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE VEHICLES CAN PROCEED THROUGH THE INTERSECTION WITHOUT SLOWING OR STOPPING, THE CROSS SLOPE OF THE RAMP AND TURNING SPACE MAY EQUAL THE HIGHWAY GRADE. AT MIDBLOCK PEDESTRIAN STREET CROSSINGS THE RAMP AND TURNING SPACE CROSS SLOPE MAY EQUAL THE HIGHWAY GRADE.
- ③ WHERE IT IS ACCEPTABLE FOR A RAMP OR TURNING SPACE CROSS SLOPE TO EXCEED 2.0% AND MATCH THE HIGHWAY GRADE, THE RAMP ABOVE THE TURNING SPACE MAY BE WARPED TO TIE INTO THE ADJOINING SIDEWALK CROSS SLOPE. THE TRANSITION TO THE SIDEWALK CROSS SLOPE SHALL BE SPREAD EVENLY OVER THE LENGTH OF THE RAMP TO MINIMIZE WARPING. THE RATE OF CHANGE IN CROSS SLOPE MAY NOT EXCEED 3.0% PER LINEAR FOOT.

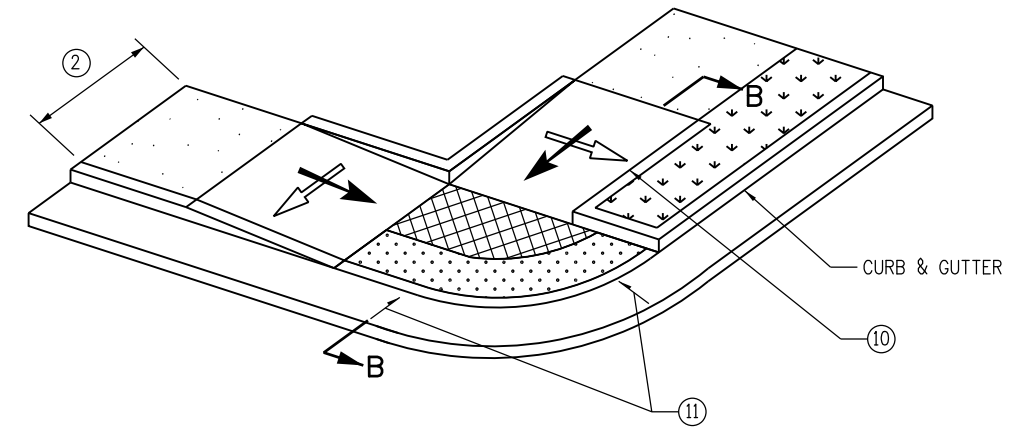
 TURNING SPACE ② ③  
 DETECTABLE WARNING SURFACE (DWS)  
SEE DWS SHEETS FOR PLACEMENT DETAILS  
 RAMP RUNNING SLOPE  
 RAMP CROSS SLOPE ② ③

**COMBINATION CURB RAMPS TYPICAL CONFIGURATIONS**

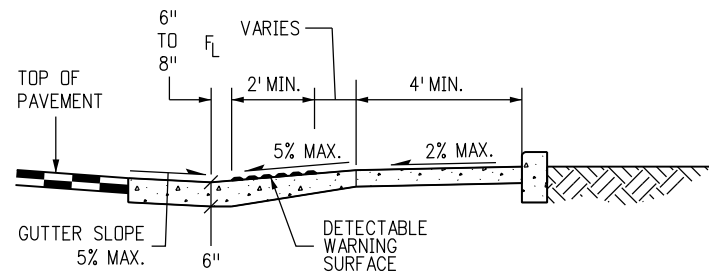
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation  2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>	<h1>CURB RAMPS</h1>	<b>STANDARD PLAN NO.</b>		
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-608-1		
Designer Initials: JBK	(R-X)					Standard Sheet No. 6 of 10		
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:		
Detailer Initials: LTA	(R-X)							
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)					Issued by the Project Development Branch: July 31, 2019	



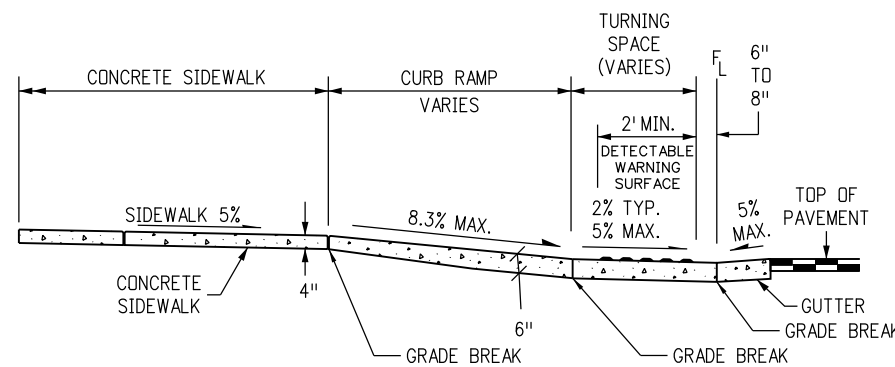
**BLENDING TRANSITION**



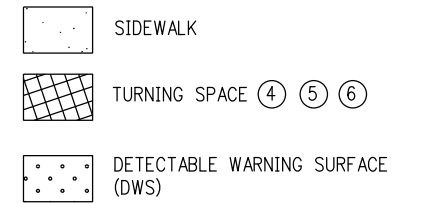
**DEPRESSED CORNER**



**SECTION A-A**

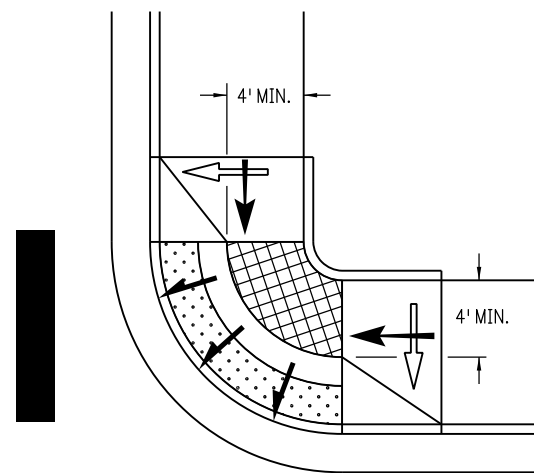


**SECTION B-B**

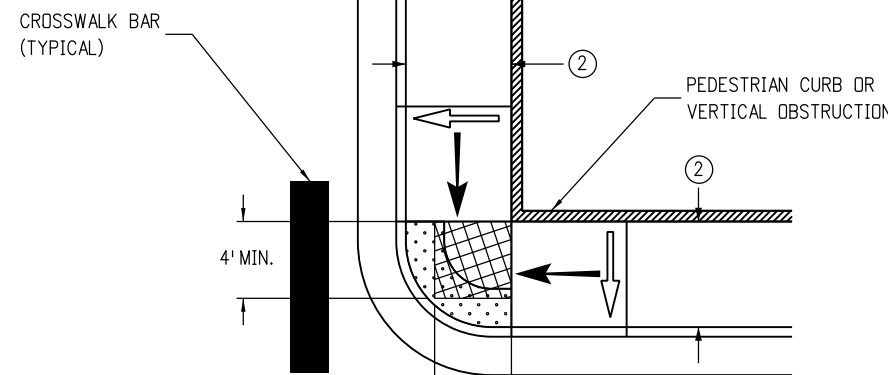


**BLENDING TRANSITION & DEPRESSED CORNER NOTES**

- ① PERPENDICULAR AND PARALLEL RAMP CONFIGURATIONS ARE PREFERRED. BLENDING TRANSITIONS AND DEPRESSED CORNERS SHOULD ONLY BE USED WHERE SITE CONDITIONS MAKE THEM A MORE APPROPRIATE OPTION, OR WHERE PERPENDICULAR OR PARALLEL RAMP CANNOT BE INSTALLED DUE TO A PHYSICAL SITE CONSTRAINT.
- ② RAMP WIDTH - PROVIDE 5 FT. OR GREATER WHERE POSSIBLE. IF SITE CONSTRAINTS DO NOT PERMIT, PROVIDE 4 FT. WIDTH MINIMUM. RAMP SERVING SHARED USE PATHS SHALL MATCH THE WIDTH OF THE PATH.
- ③ RAMP RUNNING SLOPE - 8.3% MAX.
- ④ BLENDING TRANSITION RUNNING SLOPE - 5.0% MAX.
- ⑤ RAMP AND TURNING SPACE CROSS SLOPE - 2.0% TYPICAL. AT CROSSINGS WITHOUT YIELD OR STOP CONTROL, OR WITH A SIGNAL WHERE VEHICLES CAN PROCEED THROUGH THE INTERSECTION WITHOUT SLOWING OR STOPPING, THE CROSS SLOPE OF RAMP AND TURNING SPACES MAY EQUAL THE HIGHWAY GRADE.
- ⑥ TURNING SPACE DIMENSIONS - PROVIDE A 4 FT. X 4 FT. MIN. TURNING SPACE AT THE BOTTOM OF RAMP RUNS. THE TURNING SPACE MAY CONTAIN THE DETECTABLE WARNING SURFACES.
- ⑦ RAMP ALIGNMENT - TURNING SPACE SHALL BE ALIGNED TO BE FULLY CONTAINED WITHIN THE CROSSWALK OR STREET CROSSING(S) THEY SERVE.
- ⑧ RAMP LENGTH - RAMP LENGTH IS DEPENDENT UPON THE RAMP SLOPE AND THE CHANGE OF ELEVATION FROM THE TURNING SPACE TO THE SIDEWALK. WHERE TERRAIN IS SLOPING A RAMP IS NOT REQUIRED TO CHASE GRADE MORE THAN 15 FT. REGARDLESS OF THE RESULTING RAMP SLOPE.
- ⑨ RAMP FLARES - WHERE A RAMP EDGE ABUTS A WALKABLE SURFACE, A FLARED SIDE MUST BE PROVIDED. RAMP FLARE SLOPES SHALL NOT EXCEED 10.0%.
- ⑩ VERTICAL CURB RETURNS - VERTICAL CURB RETURNS MAY BE USED ONLY WHERE A RAMP ABUTS A NON-WALKABLE SURFACE, OR WHERE A RAMP IS PROTECTED FROM PEDESTRIAN CROSS TRAFFIC (FOR EXAMPLE BY A SIGNAL CABINET OR UTILITY POLE WHICH BLOCKS PASSAGE).
- ⑪ GUTTER COUNTER SLOPE - 5.0% MAX.
- ⑫ DWS PLACEMENT - DWS SHALL BE PLACED AROUND THE RADIUS AND LOCATED AT THE BACK OF CURB ON BLENDING TRANSITION AND DEPRESSED CORNER RAMP.



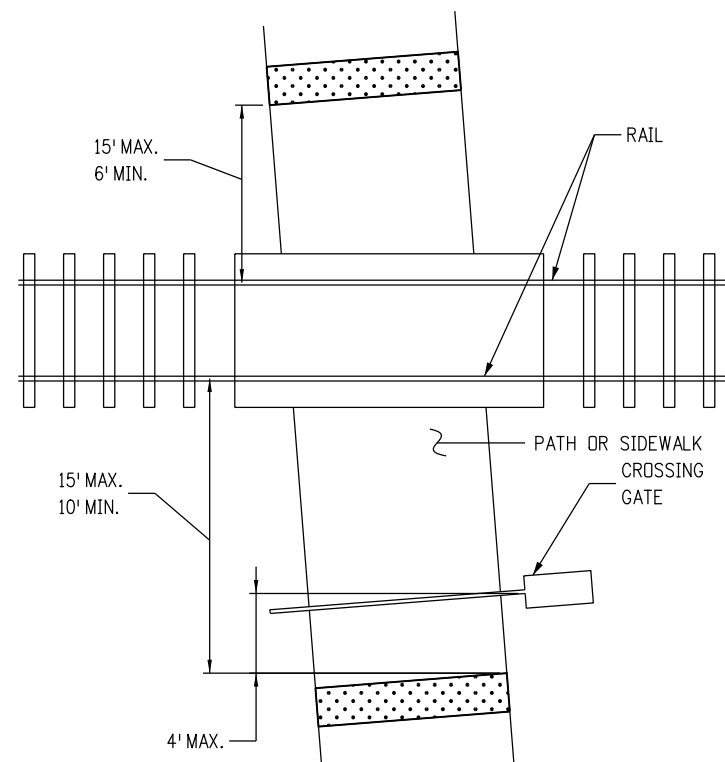
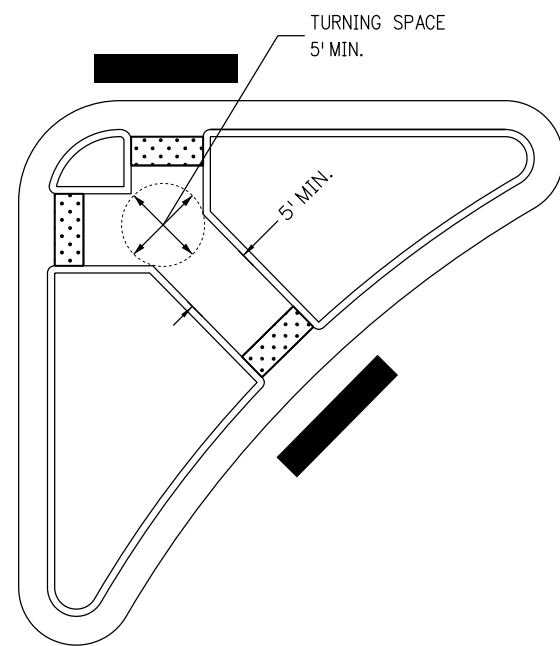
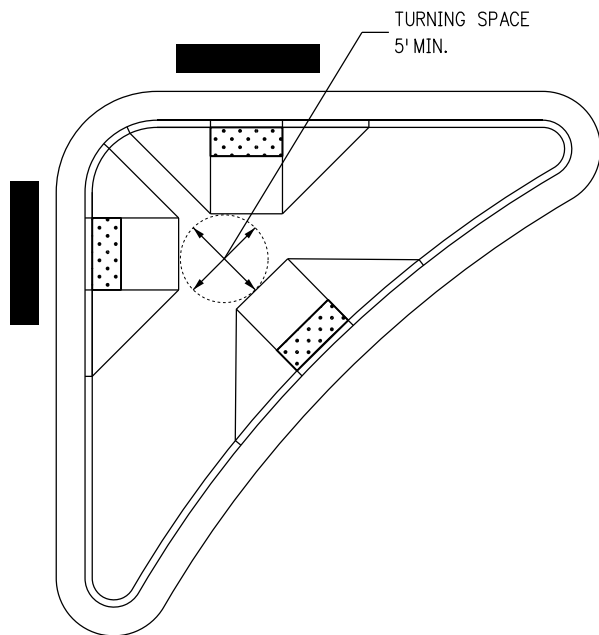
**BLENDING TRANSITION**



**DEPRESSED CORNER**

**TYPE 5 - DEPRESSED CORNER/BLENDING TRANSITION**

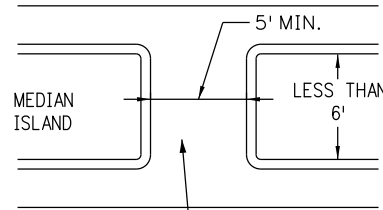
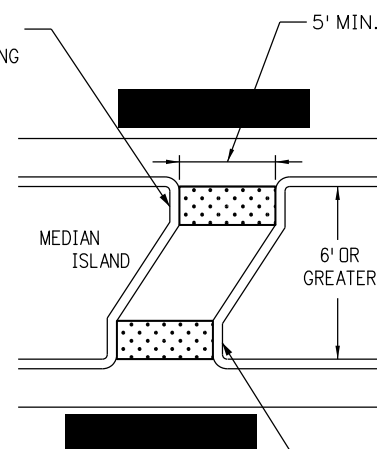
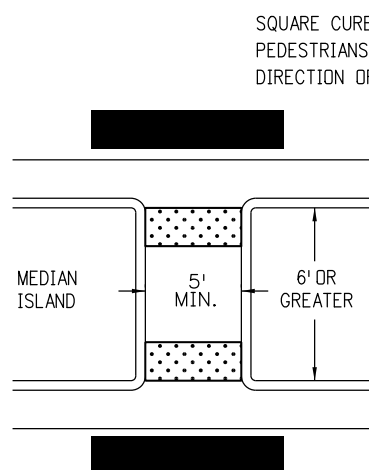
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1 style="text-align: center;">CURB RAMPS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	Designer Initials: JBK	Date:	Comments:			<b>M-608-1</b>	
Last Modification Date: 07/31/19	Detailer Initials: LTA			<b>Project Development Branch</b>	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	
CAD Ver.: MicroStation V8	Scale: Not to Scale					<b>JBK</b>	



**NOTES:**

- ① DETECTABLE WARNING SURFACES SHALL BE PLACED IN ALIGNMENT WITH THE BACK OF CURB.
- ② FLARED SIDES ARE PREFERENTIAL ON RAISED INTERSECTION ISLANDS AND SHOULD BE PROVIDED ON ISLANDS WHICH SERVE SHARED USE PATHS, OR AT LOCATIONS WHERE BICYCLE USE IS EXPECTED.
- ③ FOR CUT-THROUGH MEDIAN ISLANDS, DETECTABLE WARNING SURFACES SHALL BE PLACED IN ALIGNMENT WITH THE BACK OF CURB AND BE SEPARATED BY A MINIMUM 2 FOOT SPACE WITHOUT DWS. IF A 2 FOOT SEPARATION BETWEEN DETECTABLE WARNING SURFACES CANNOT BE PROVIDED NO DETECTABLE WARNING SURFACE SHALL BE INSTALLED.
- ④ CURB RAMP AND CUT-THROUGH WIDTHS SHOULD BE THE SAME WIDTH AS ANY SIDEWALK OR SHARED USE PATH WHICH THEY SERVE.

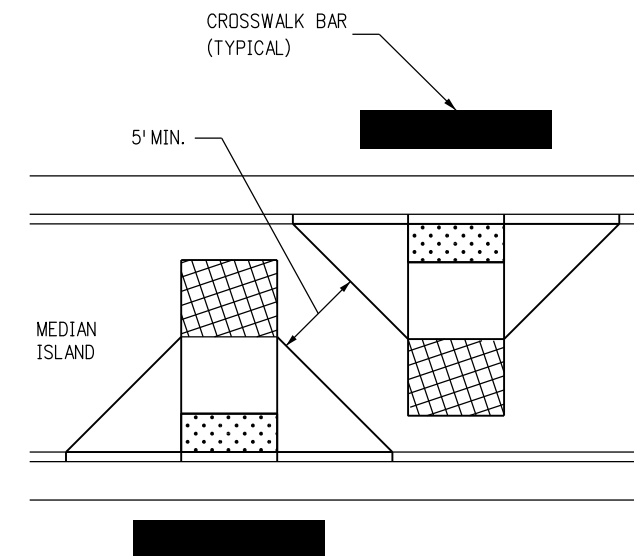
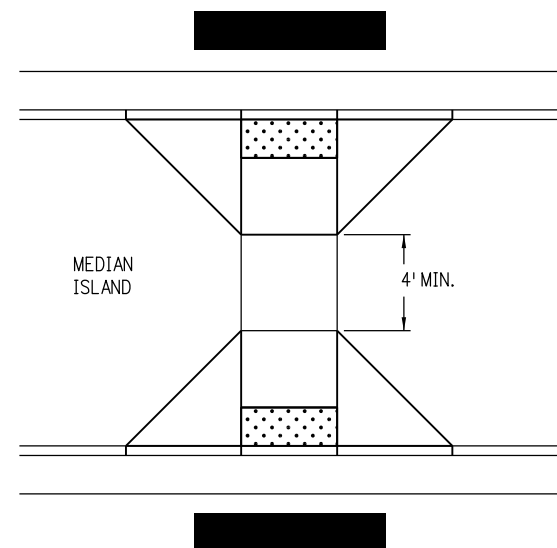
**INTERSECTION ISLANDS**



SQUARE CURB TO ORIENT PEDESTRIANS IN THE DIRECTION OF THE CROSSING

ELIMINATE DWS IF MEDIAN REFUGE IS LESS THAN 6' IN LENGTH IN THE DIRECTION OF PEDESTRIAN TRAVEL

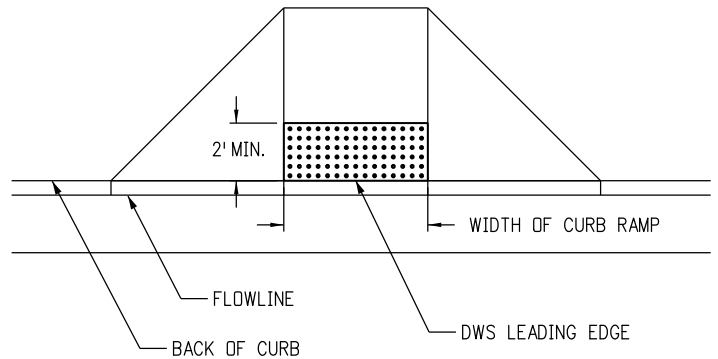
**MEDIAN ISLANDS**



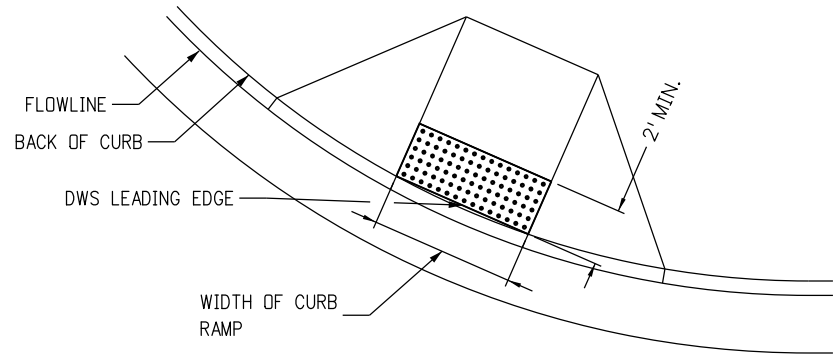
TURNING SPACE

**MEDIANS / RAILROADS / ISLANDS**

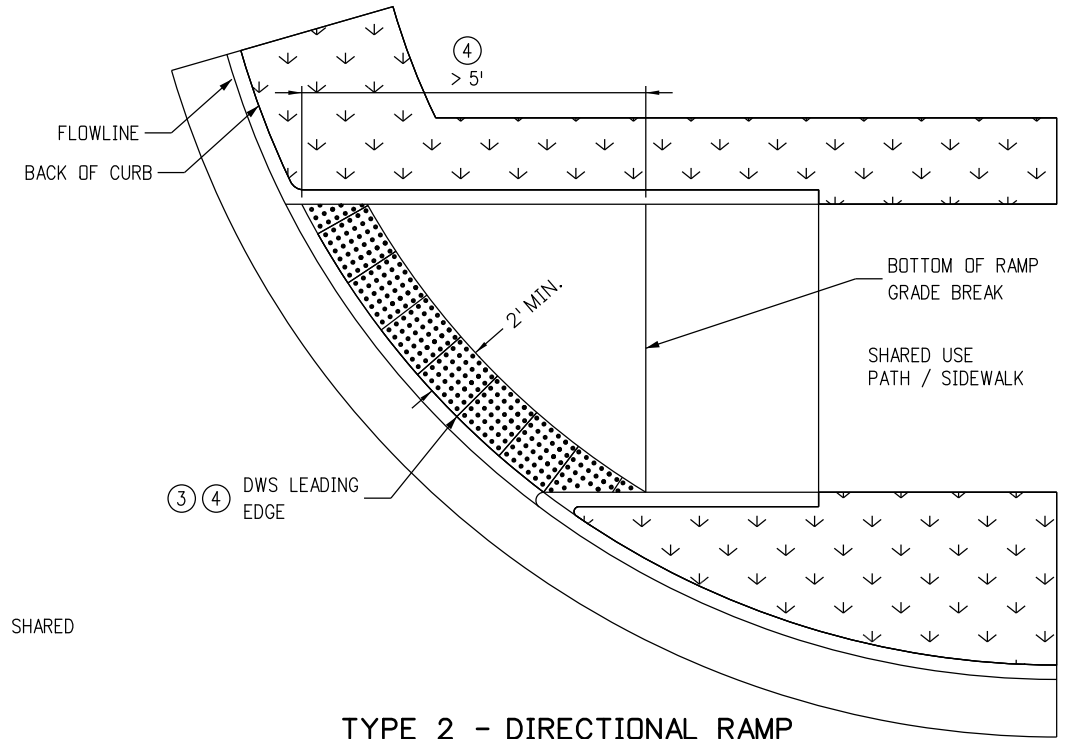
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Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868			M-608-1	
Designer Initials: JBK	(R-X)			Project Development Branch		Issued by the Project Development Branch: July 31, 2019	Standard Sheet No. 8 of 10	
Last Modification Date: 07/31/19	(R-X)			JBK			Project Sheet Number:	
Detailer Initials: LTA	(R-X)							
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)							



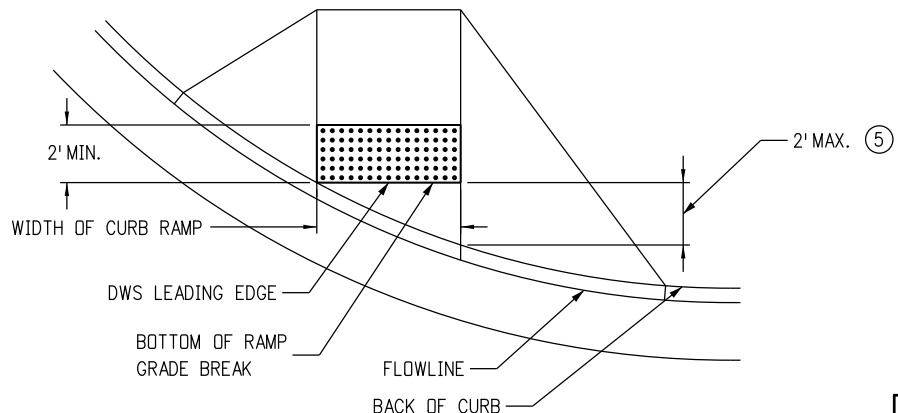
**TYPE 1 CURB RAMP**  
(PERPENDICULAR ON TANGENT)



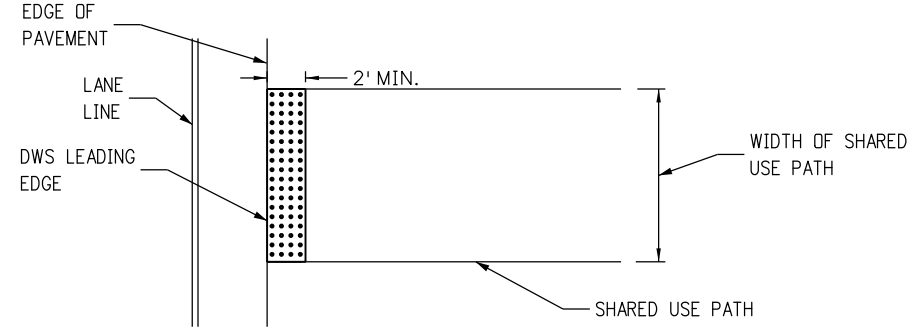
**TYPE 1 CURB RAMP**  
(PERPENDICULAR ON RADIUS)



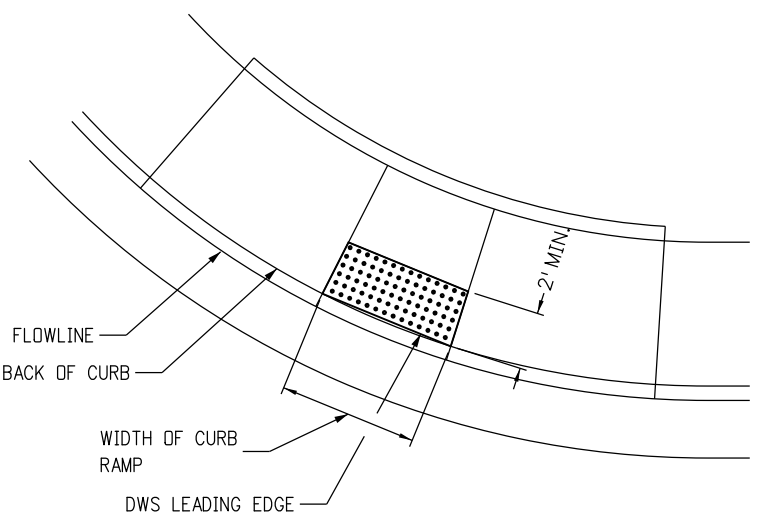
**TYPE 2 - DIRECTIONAL RAMP**



**TYPE 1 CURB RAMP**  
(DIRECTIONAL ON RADIUS)



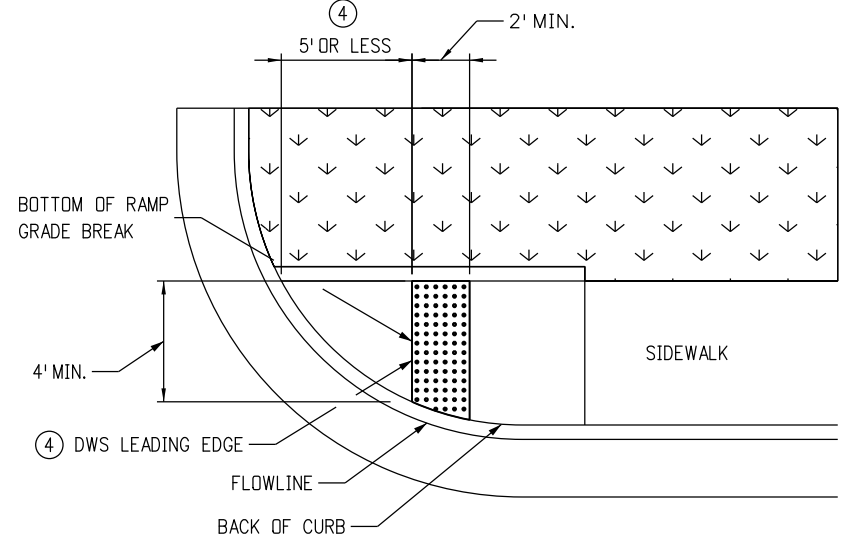
**SHARED USE PATH CROSSING**



**TYPE 2 CURB RAMP**

**DETECTABLE WARNING SURFACE NOTES:**

- ① DETECTABLE WARNING SURFACES (DWS) SHALL BE INSTALLED AT SIDEWALK, OR SHARED USE PATH, TO STREET TRANSITIONS, AND SHALL CONSIST OF TRUNCATED DOME SURFACES. ANY TRUNCATED DOME PANELS OR PAVERS WHICH ARE USED MUST BE ON THE CDOT APPROVED PRODUCTS LIST (APL).
- ② THE DETECTABLE WARNING SURFACE SHALL SPAN THE FULL WIDTH OF THE CURB RAMP, SHARED USE PATH, OR OTHER ROADWAY ENTRANCE AS APPLICABLE. A GAP OF 2 INCHES FROM THE EDGE OF THE DETECTABLE WARNING SURFACE TO THE EDGE OF THE CURB RAMP OR SHARED USE PATH IS PERMITTED.
- ③ WHEN DETECTABLE WARNING SURFACES ARE PLACED ON A SLOPE GREATER THAN 5.0%, TRUNCATED DOMES SHOULD BE ALIGNED IN THE DIRECTION OF THE RAMP RUN; OTHERWISE DOMES ARE NOT REQUIRED TO BE ALIGNED. TRUNCATED DOMES SHALL BE IN A SQUARE GRID OR RADIAL PATTERN. WHEN PLACED RADIALLY, PLACE ADJACENT DWS PLATES EDGE TO EDGE. EDGES OF CUT PLATES SHALL BE STRAIGHT.
- ④ LOCATE ONE CORNER OF THE DWS LEADING EDGE AT THE BACK OF CURB. NO POINT ON THE LEADING EDGE OF THE DWS MAY BE MORE THAN 5 FT. FROM THE BACK OF CURB. WHEN ANY POINT OF THE LEADING EDGE OF THE DWS WILL BE GREATER THAN 5 FT. FROM THE BACK OF CURB, PLACE THE DWS RADIALLY AT THE BACK OF CURB.
- ⑤ WHERE PERPENDICULAR DIRECTIONAL RAMPS ABUT A WALKABLE SURFACE, THE LEADING EDGE OF THE DWS SHALL NOT BE PLACED FURTHER THAN 2 FEET FROM THE BACK OF CURB. IF THE RADIUS OF A CORNER MAKES THIS IMPOSSIBLE, ORIENT THE CURB RAMP PERPENDICULAR TO THE CURB AND GUTTER.
- ⑥ IF THE DETECTABLE WARNING SURFACE IS CUT, GRIND OFF THE REMAINING PORTION OF ANY CUT TRUNCATED DOMES. SEAL ALL CUT PANEL EDGES WITH AN APL SEALANT TO PREVENT WATER DAMAGE.
- ⑦ TRUNCATED DOME PLATES SHALL BE EMBEDDED IN THE CONCRETE CURB RAMP WHILE THE CONCRETE IS PLASTIC.
- ⑧ DWS SHALL NOT BE PLACED OVER GRADE BREAKS.

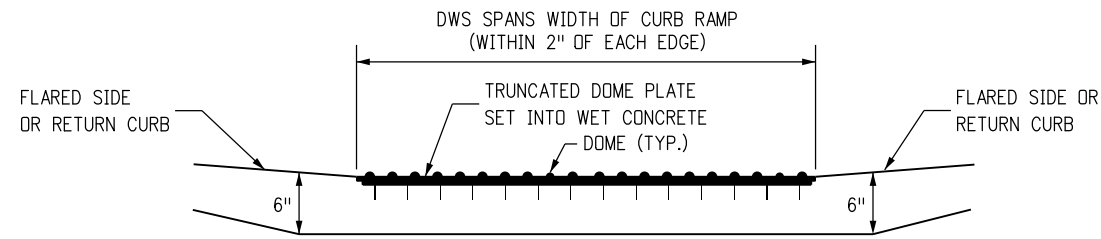


**TYPE 2 - DIRECTIONAL RAMP**

DETECTABLE WARNING SURFACE (DWS)

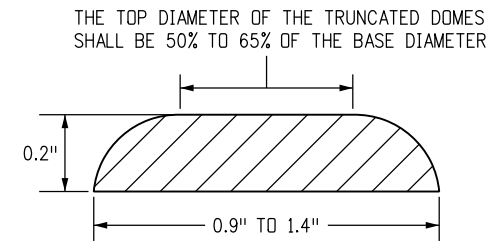
**DETECTABLE WARNING SURFACE PLACEMENT**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>	<h1>CURB RAMPS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-608-1	
Designer Initials: JBK	(R-X)					Standard Sheet No. 9 of 10	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)					Issued by the Project Development Branch: July 31, 2019

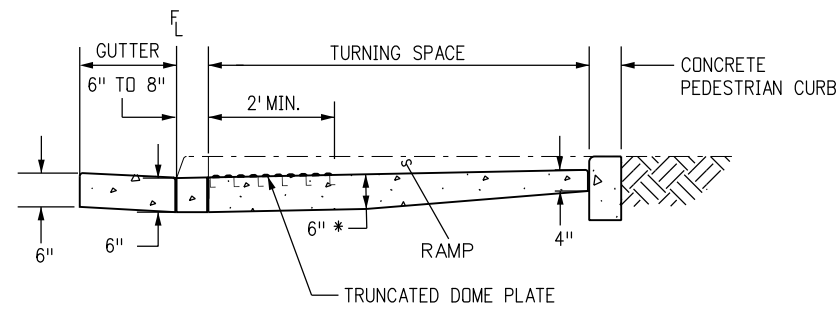


**SECTION VIEW OF DETECTABLE WARNING SURFACE PLATE**

(LOOKING AT PERPENDICULAR RAMP RUN FROM STREET)

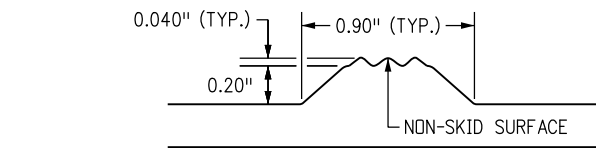


**ELEVATION VIEW OF SINGLE TRUNCATED DOME**

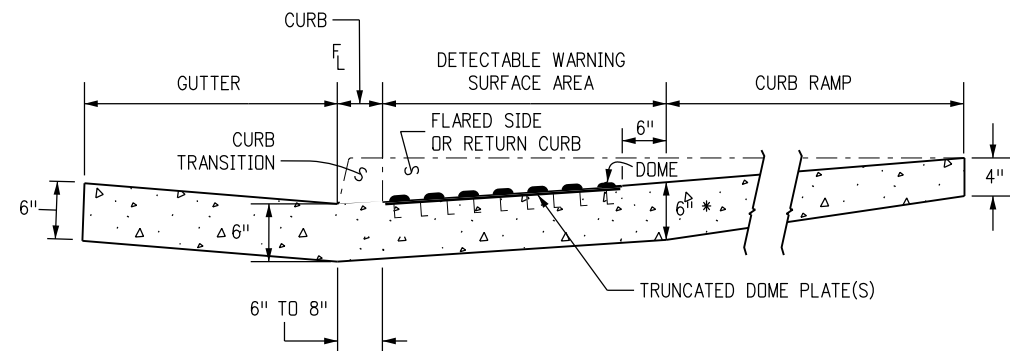


**SECTION VIEW FOR PARALLEL CURB RAMP TYPES**

(LOOKING PERPENDICULAR TO TURNING SPACE)

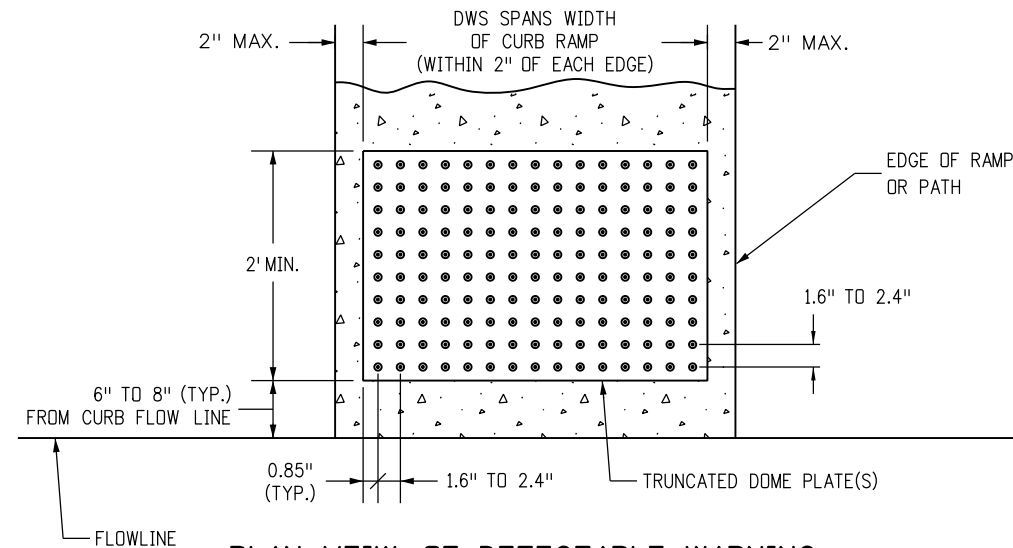


**ELEVATION VIEW OF TRUNCATED DOME FOR DETECTABLE WARNING PLATE**



**SECTION VIEW FOR PERPENDICULAR CURB RAMP TYPES**

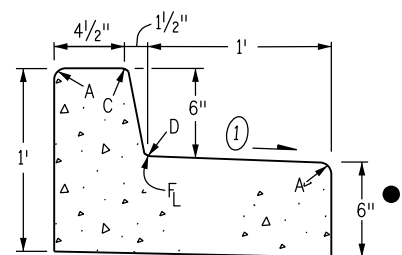
(LOOKING PERPENDICULAR TO RAMP RUN)



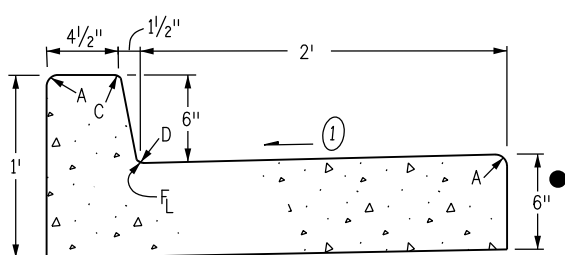
**PLAN VIEW OF DETECTABLE WARNING SURFACE PLATE**

**DETECTABLE WARNING SURFACE DETAILS**

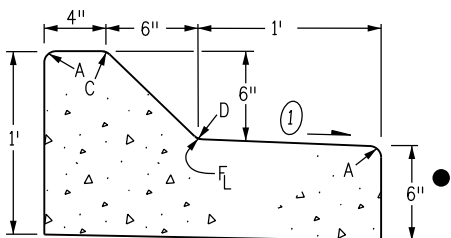
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Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place CDOT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868			M-608-1
Designer Initials: JBK	(R-X)			Project Development Branch		Issued by the Project Development Branch: July 31, 2019	<b>Standard Sheet No. 10 of 10</b>
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Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)					



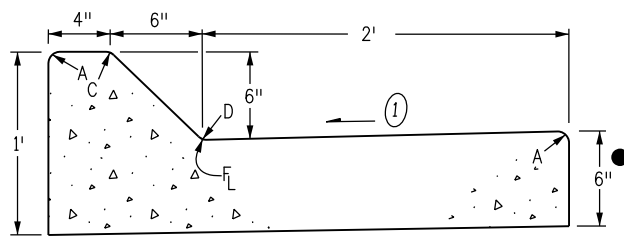
**CURB AND GUTTER TYPE 2  
(SECTION IB)  
(6 IN. BARRIER - 1 FT. GUTTER)**



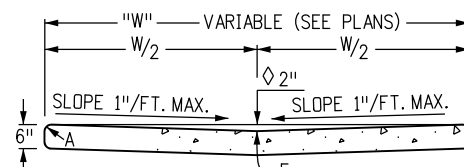
**CURB AND GUTTER TYPE 2  
(SECTION IIB)  
(6 IN. BARRIER - 2 FT. GUTTER)**



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

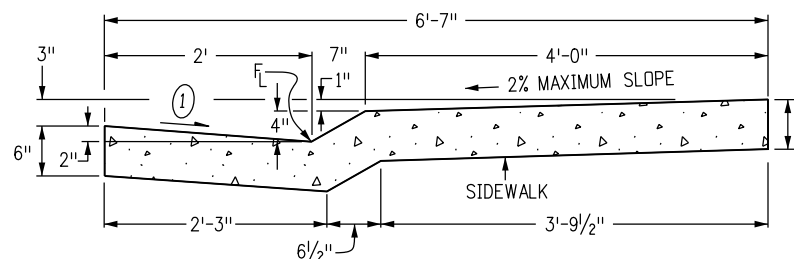


**CURB AND GUTTER TYPE 2  
(SECTION IIM)  
(6 IN. MOUNTABLE - 2 FT. GUTTER)**



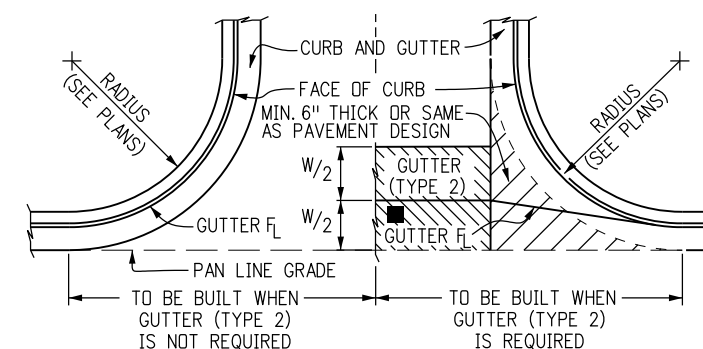
2 IN. DEPTH WHEN USED AS A CROSSSPAN IN AN INTERSECTION

**GUTTER TYPE 2**



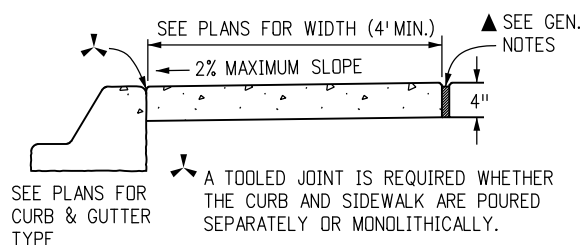
**CURB AND GUTTER TYPE 2  
(SECTION MS)  
(4 IN. MOUNTABLE WITH SIDEWALK)**

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

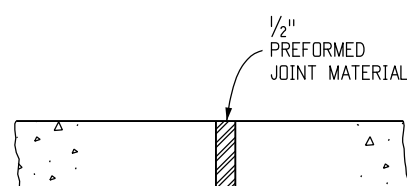


THIS AREA SHALL BE POURED MONOLITHICALLY WITH CURB AND GUTTER AND PAID FOR AS "CONCRETE PAVEMENT".  
 ■ FLOW LINE LOCATION WILL BE ESTABLISHED BY W/2 SHOWN ON PLANS.

**CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTION**



**CONCRETE SIDEWALK**



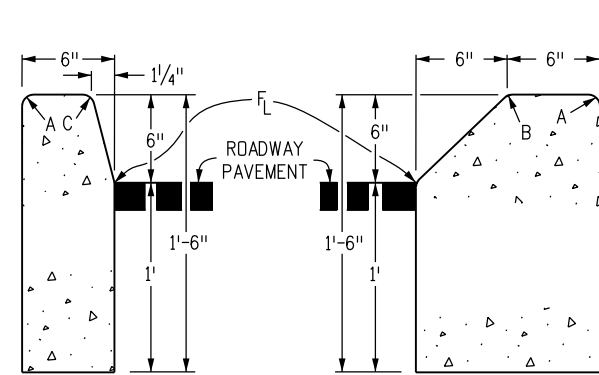
NOTES: 1. EXPANSION JOINTS SHALL BE PLACED IN THE SIDEWALK AT INTERVALS OF NOT MORE THAN 500 FT.  
 2. EXPANSION JOINTS MAY BE SEALED WHEN SPECIFIED ON THE PLANS.

**SIDEWALK EXPANSION JOINT**

- GENERAL NOTES**
- 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.
  - CONCRETE SHALL BE CLASS B.
  - PROFILE GRADE OF CURBS AND GUTTERS SHALL BE LOCATED AT THE FLOW LINE.
  - 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.
  - GUTTER CROSS SLOPES MAY BE ADJUSTED TO FACILITATE DRAINAGE FOR PROFILE GRADES AS SHOWN ON THE PLANS.
  - 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.
  - INCREASE SIDEWALK THICKNESS TO 6 IN. AT LOCATIONS SHOWN ON THE PLANS.
  - MINIMUM SIDEWALK WIDTH IS 4 FT.

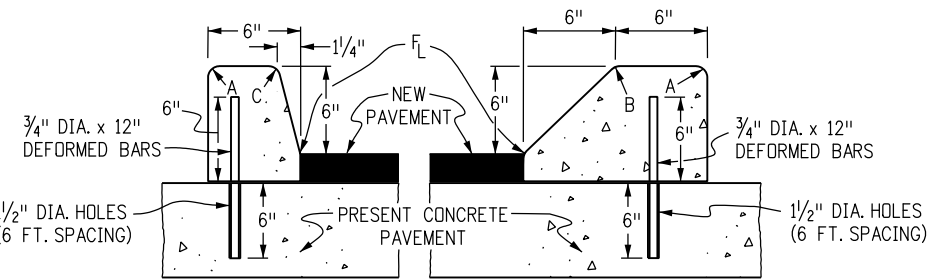
- ▲ EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE 1/2 IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE.
- ① GUTTER CROSS SLOPES SHALL BE 1/2 IN./FT. WHEN DRAINING AWAY FROM CURB AND 1 IN./FT. WHEN DRAINING TOWARD CURB (WITH EXCEPTION TO IMMEDIATELY ADJACENT TO CURB RAMPS - SEE STANDARD PLAN M-608-1 FOR SLOPE REQUIREMENTS).
- 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.

Computer File Information		Sheet Revisions		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868	<b>CURB, GUTTERS, AND SIDEWALKS</b>	STANDARD PLAN NO.	
Creation Date: 07/31/19	(R-X)	Date:	Comments			M-609-1	Standard Sheet No. 1 of 4
Designer Initials: JBK	(R-X)			Project Development Branch	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	
Last Modification Date: 07/31/19	(R-X)						
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)						



**CURB TYPE 2**  
(SECTION B)  
6 IN. BARRIER

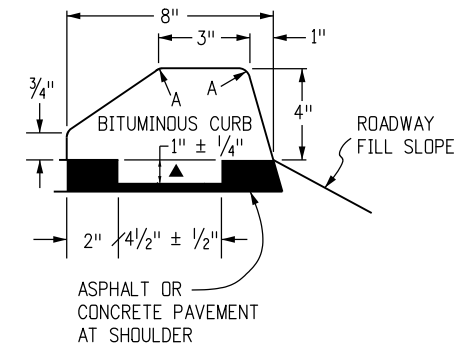
**CURB TYPE 2**  
(SECTION M)  
6 IN. MOUNTABLE



**CURB TYPE 4**  
(SECTION B)  
6 IN. BARRIER

**CURB TYPE 4**  
(SECTION M)  
6 IN. MOUNTABLE

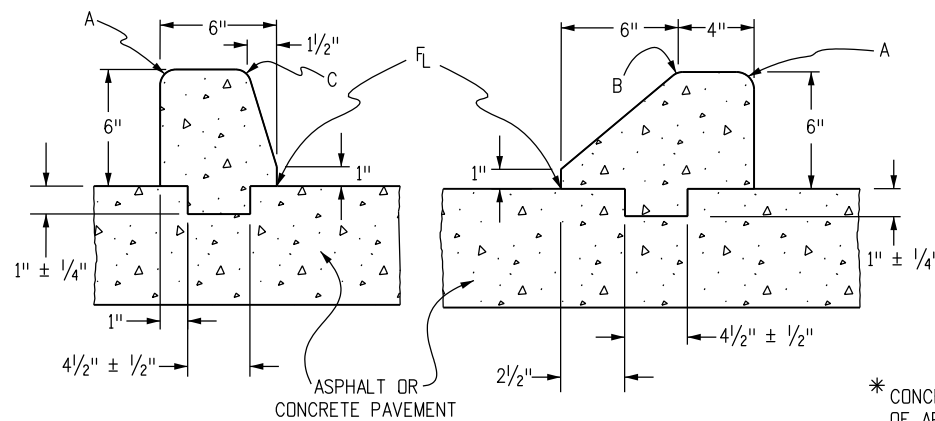
3/4" DIA. x 12" DEFORMED REINFORCING BARS AT 6 FT. SPACING SHALL BE GROUTED IN 1/4" DIA. HOLES IN EXISTING CONCRETE. GROUT SHALL CONSIST OF 2 PARTS CLEAN SAND AND 1 PART CEMENT. COST OF INSTALLATION SHALL BE INCLUDED IN THE PRICE BID FOR CURB.



**CURB TYPE 6**  
(SECTION M)  
4 IN. MOUNTABLE

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

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



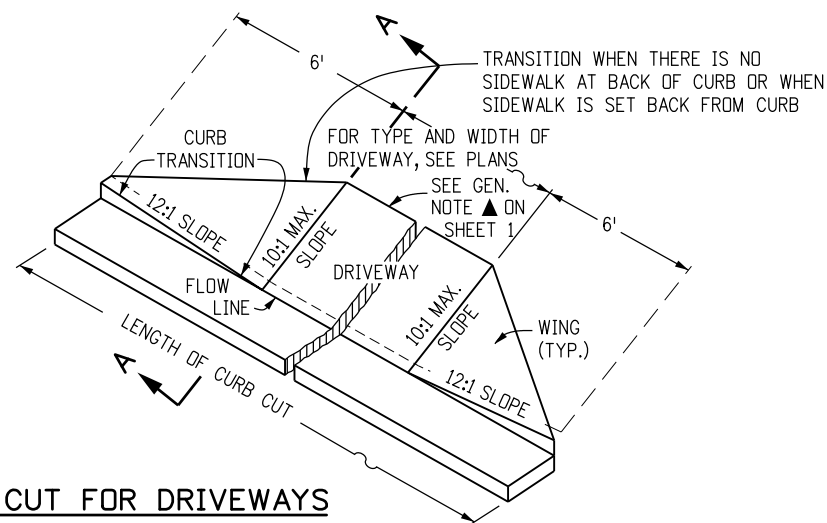
(SECTION B)

(SECTION M)

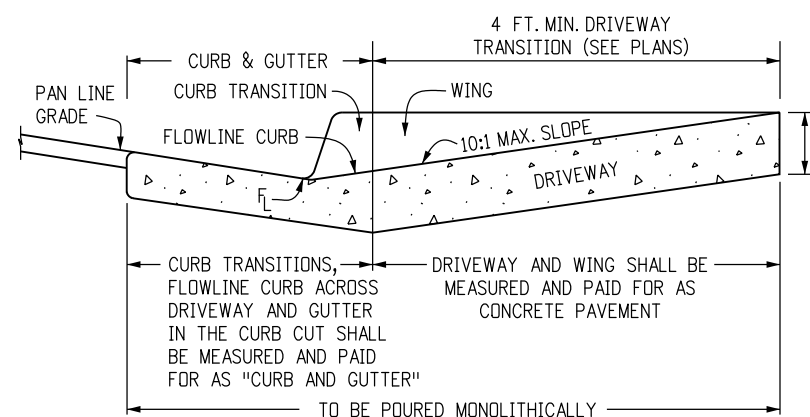
**CURB TYPE 4 (KEY-WAY)\***

\* CONCRETE CLASS B SHALL CONTAIN 1.5 POUNDS PER CUBIC YARD OF APPROVED POLYPROPYLENE FIBERS AND MAY HAVE A NOMINAL AGGREGATE SIZE OF 3/8 IN.

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

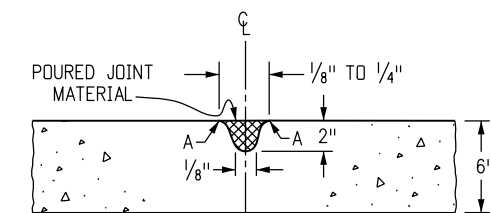


**CURB CUT FOR DRIVEWAYS**  
(WITHOUT ATTACHED SIDEWALK)



SECTION A-A

**CONCRETE PAVEMENT (DRIVEWAYS)**



NOTE: RECOMMENDED 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)**

**Computer File Information**

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Designer Initials: JBK	(R-X)
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Detailer Initials: LTA	(R-X)
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**Sheet Revisions**

Date:	Comments

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2829 West Howard Place  
CDDT HQ, 3rd Floor  
Denver, CO 80204  
Phone: 303-757-9021 FAX: 303-757-9868  
Project Development Branch JBK

**CURB, GUTTERS, AND SIDEWALKS**

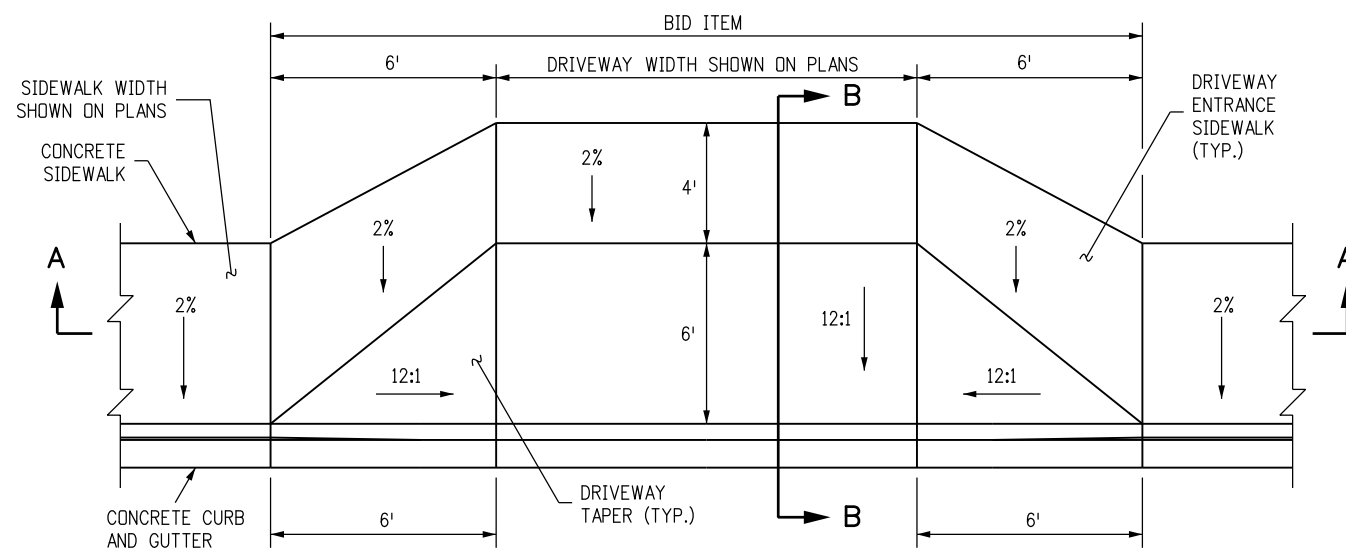
Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.

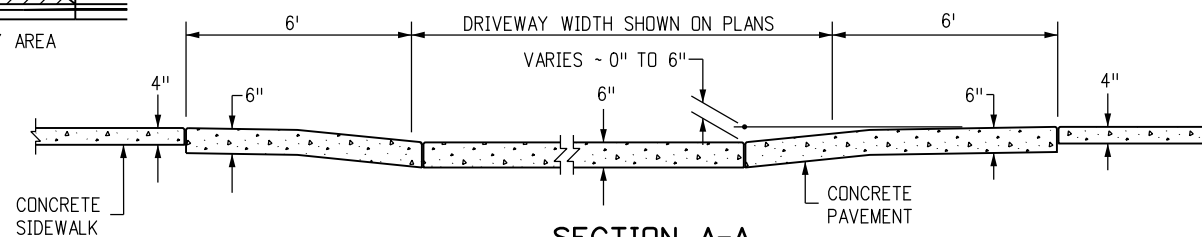
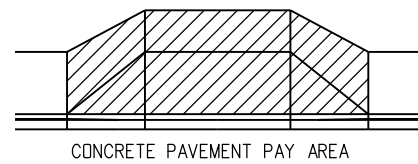
M-609-1

Standard Sheet No. 2 of 4

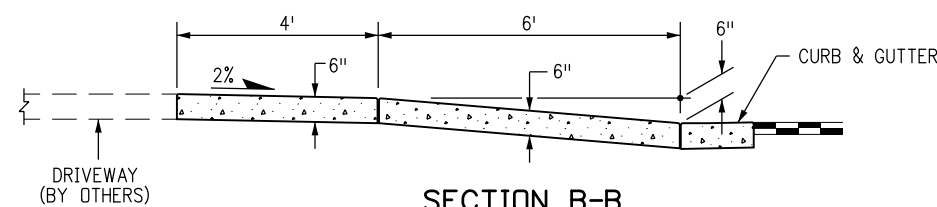
Project Sheet Number:



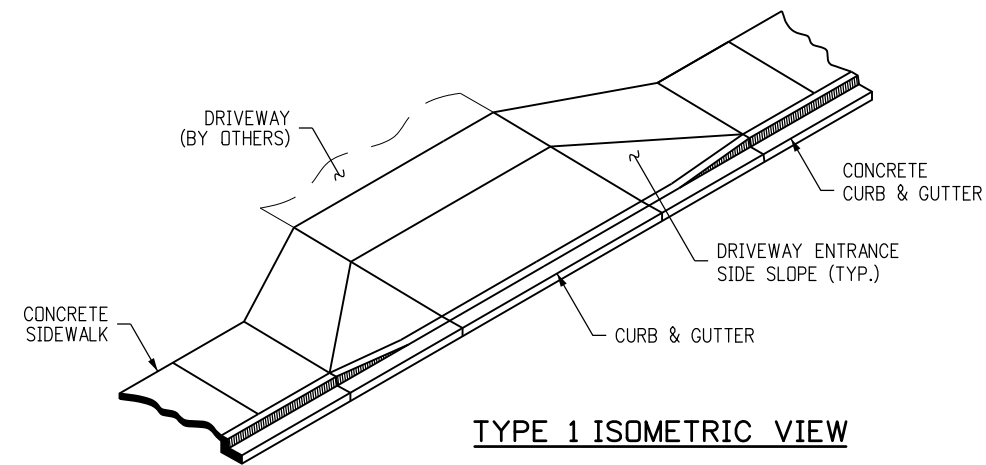
**CONCRETE DRIVEWAY ENTRANCE TYPE 1**



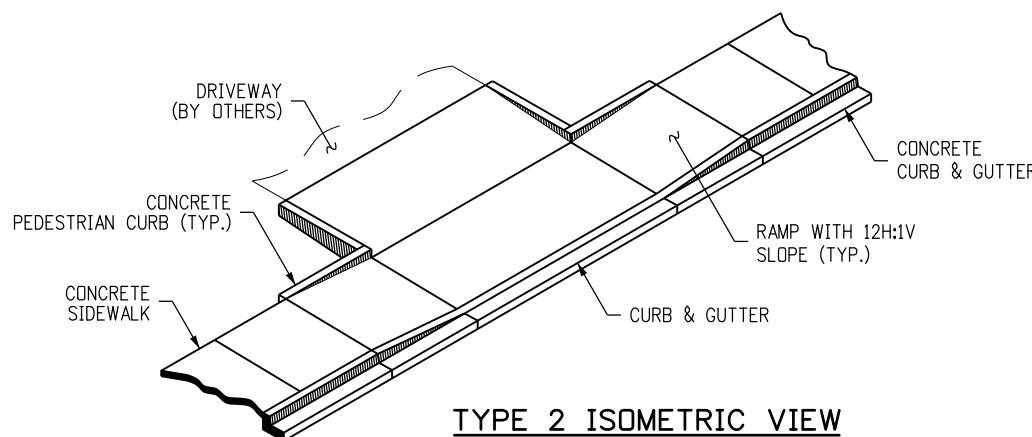
**SECTION A-A**



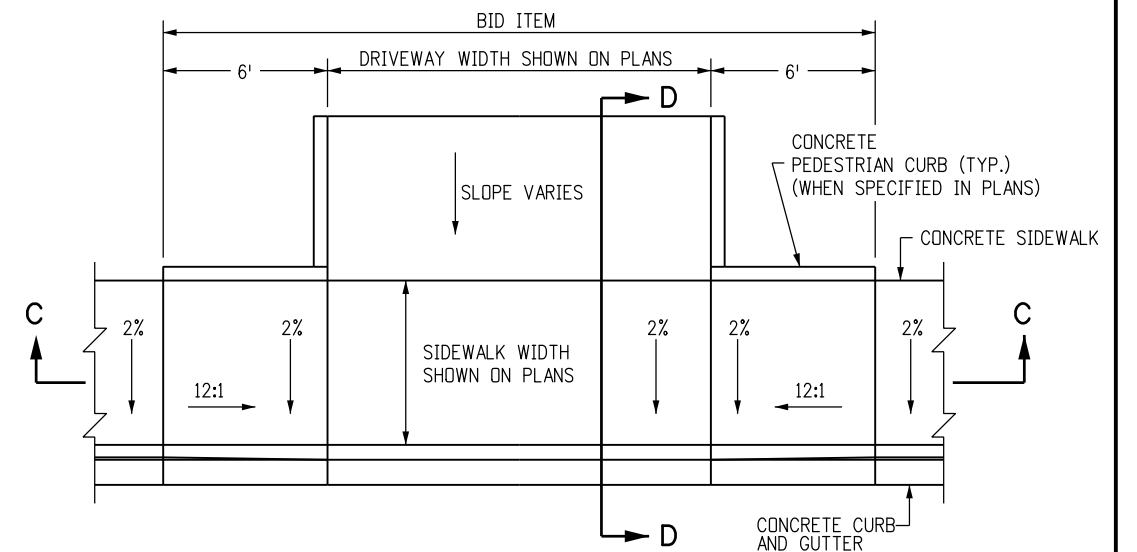
**SECTION B-B**



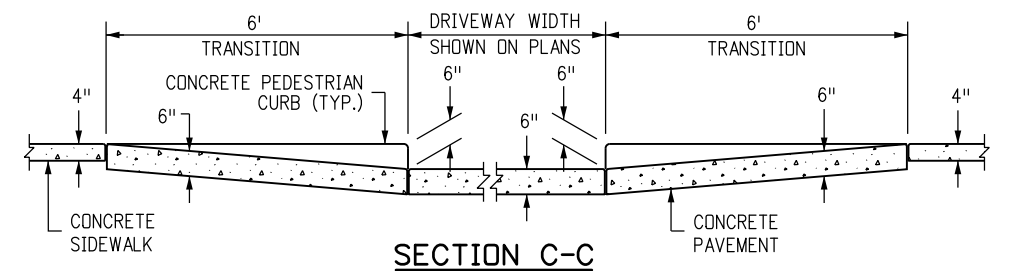
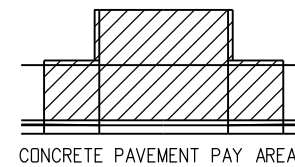
**TYPE 1 ISOMETRIC VIEW**



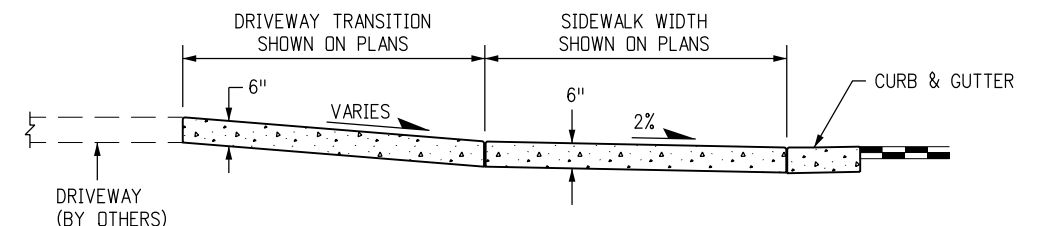
**TYPE 2 ISOMETRIC VIEW**



**CONCRETE DRIVEWAY ENTRANCE TYPE 2**



**SECTION C-C**



**SECTION D-D**

**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.

**Computer File Information**

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Designer Initials: JBK	(R-X)
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Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

Date:	Comments

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**CURB, GUTTERS, AND SIDEWALKS**

Issued by the Project Development Branch: July 31, 2019

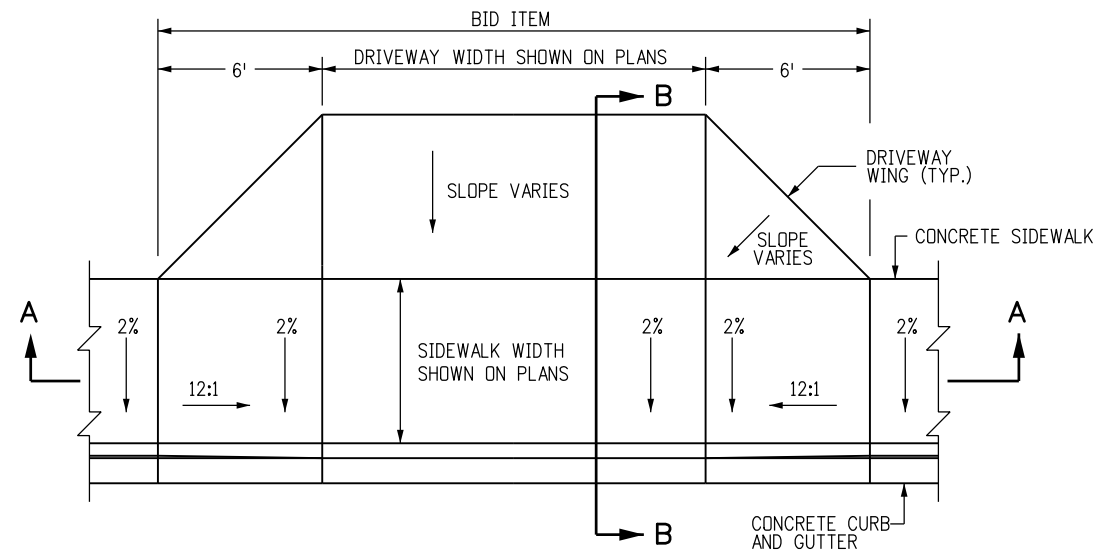
STANDARD PLAN NO.

M-609-1

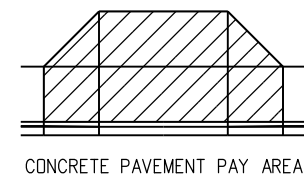
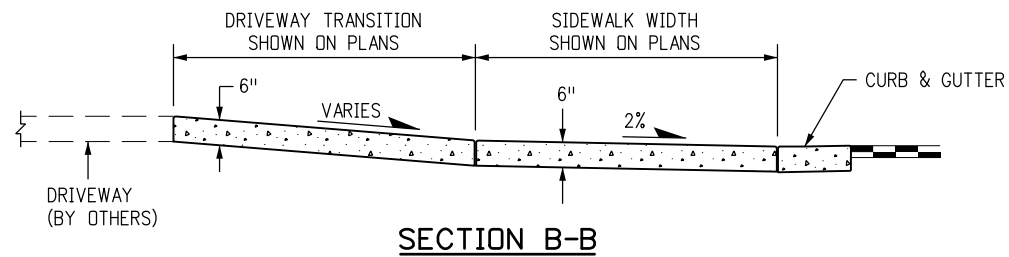
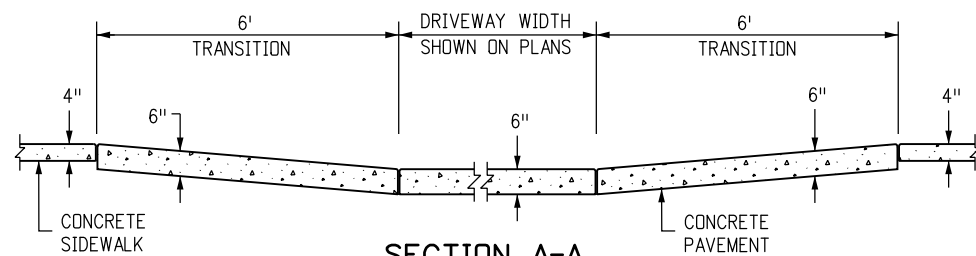
Standard Sheet No. 3 of 4

Project Sheet Number:



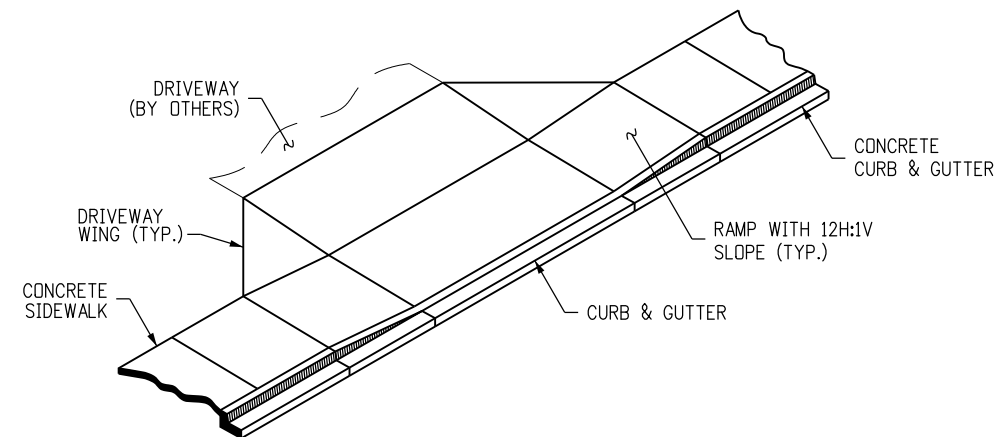


**CONCRETE DRIVEWAY ENTRANCE TYPE 3**



**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.



**TYPE 3 ISOMETRIC VIEW**

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

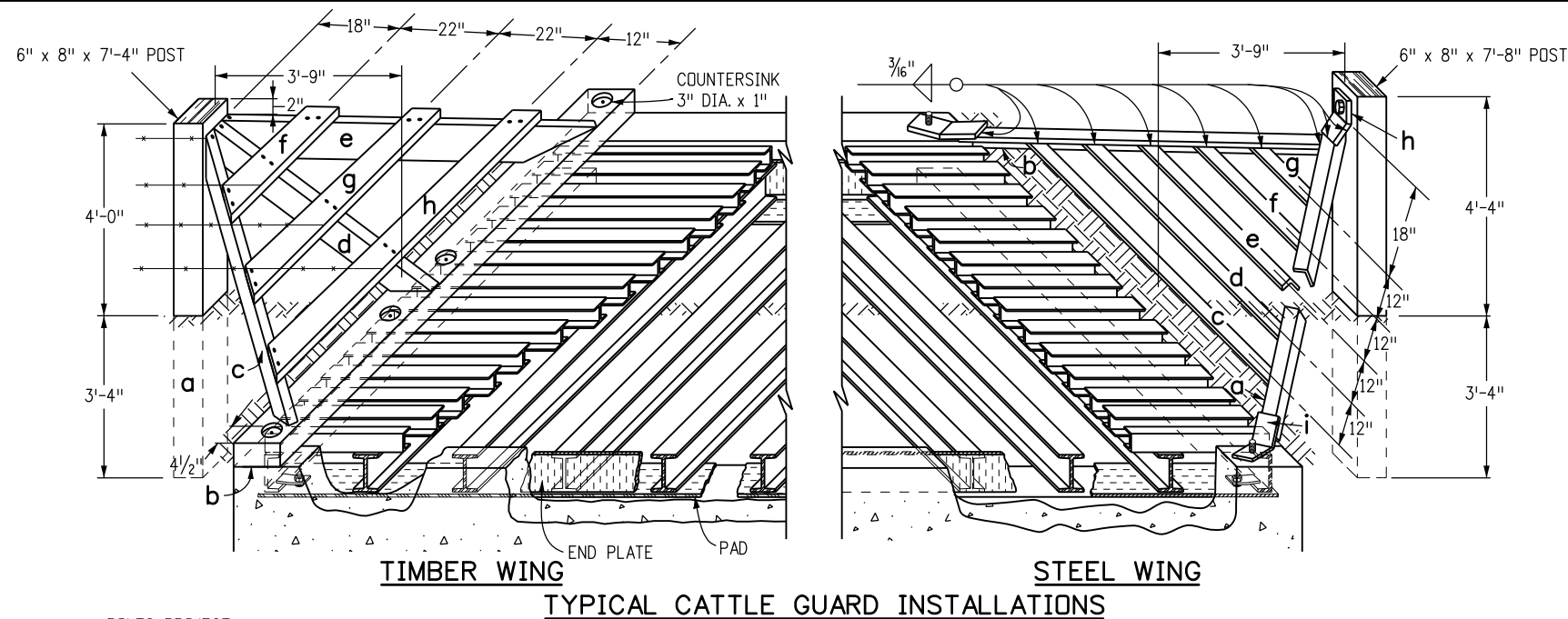
Colorado Department of Transportation  
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 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868

Project Development Branch JBK

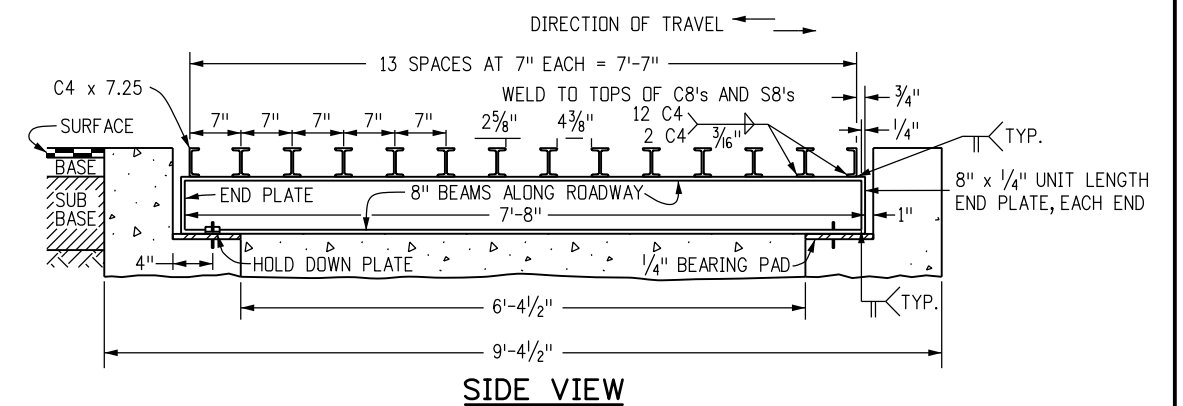
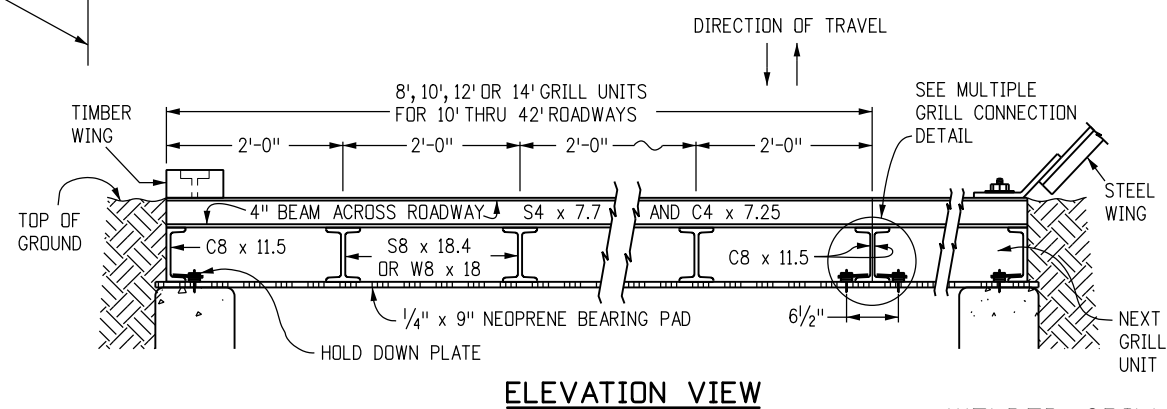
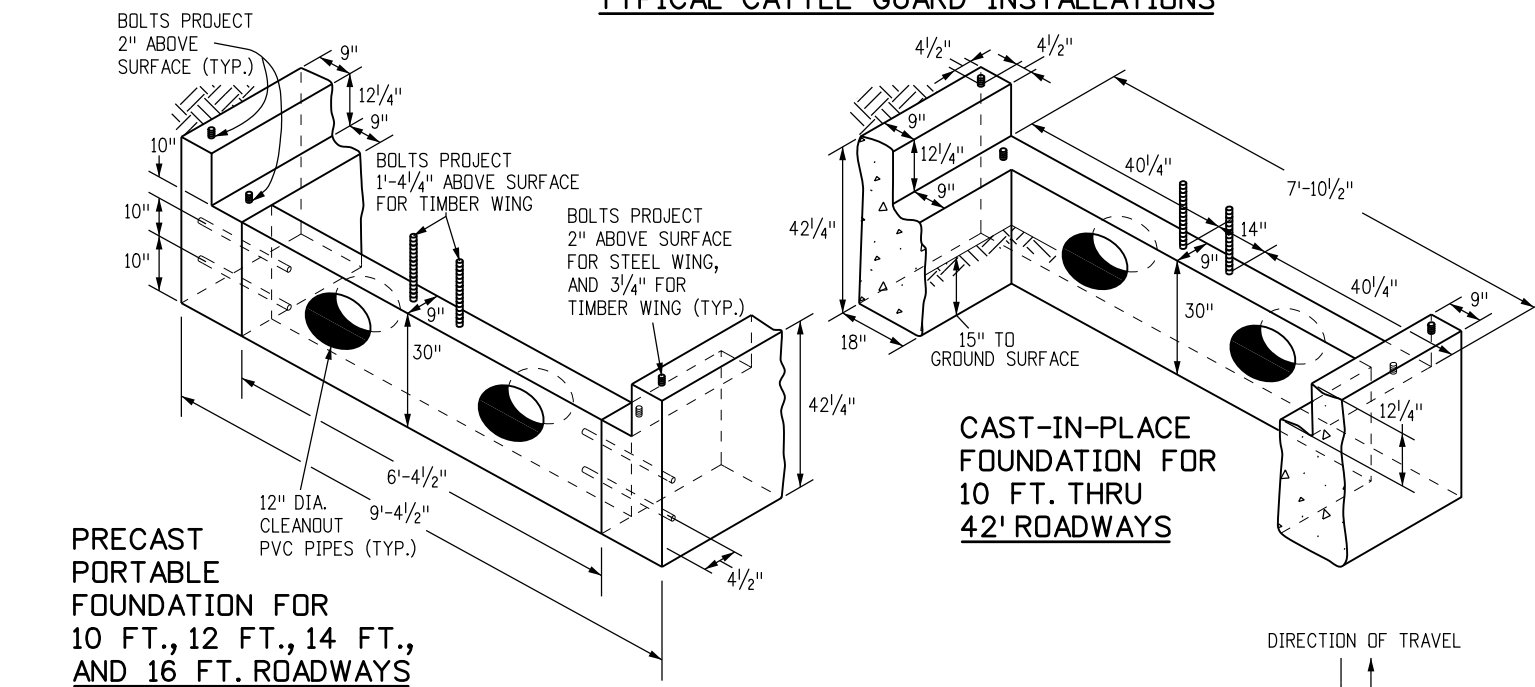
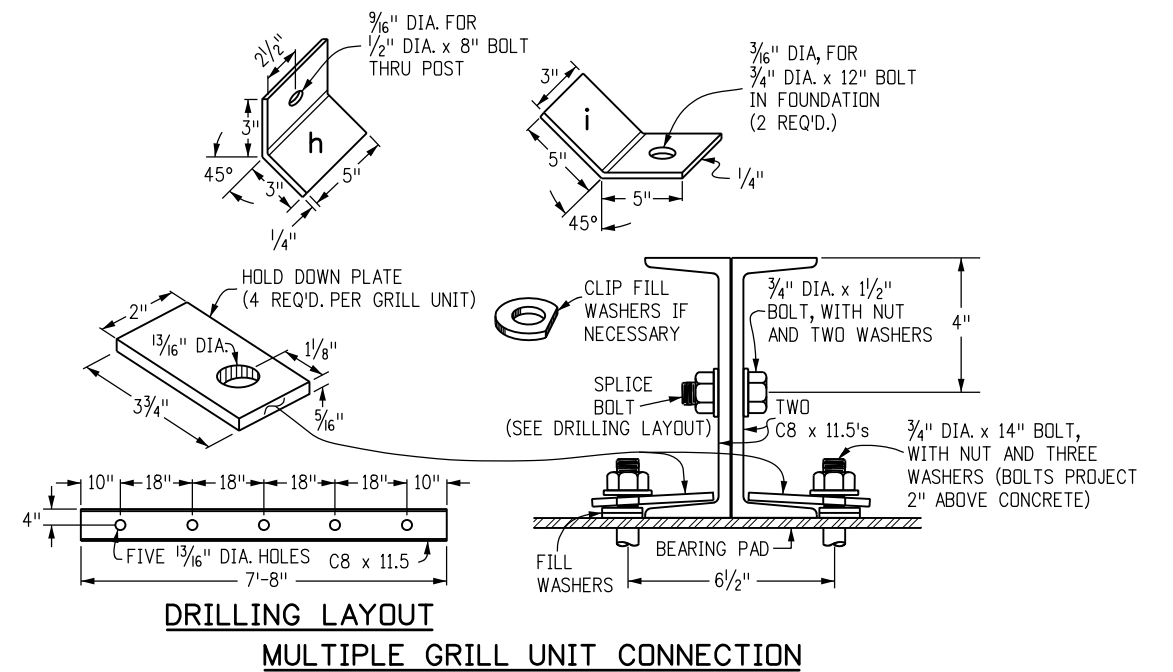
**CURB, GUTTERS,  
AND SIDEWALKS**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-609-1
Standard Sheet No. 4 of 4
Project Sheet Number:



- ### 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 CONFORMANCE WITH ASSHTO 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.
  11. ALTERNATIVE CATTLE GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.



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

Sheet Revisions	
Date:	Comments

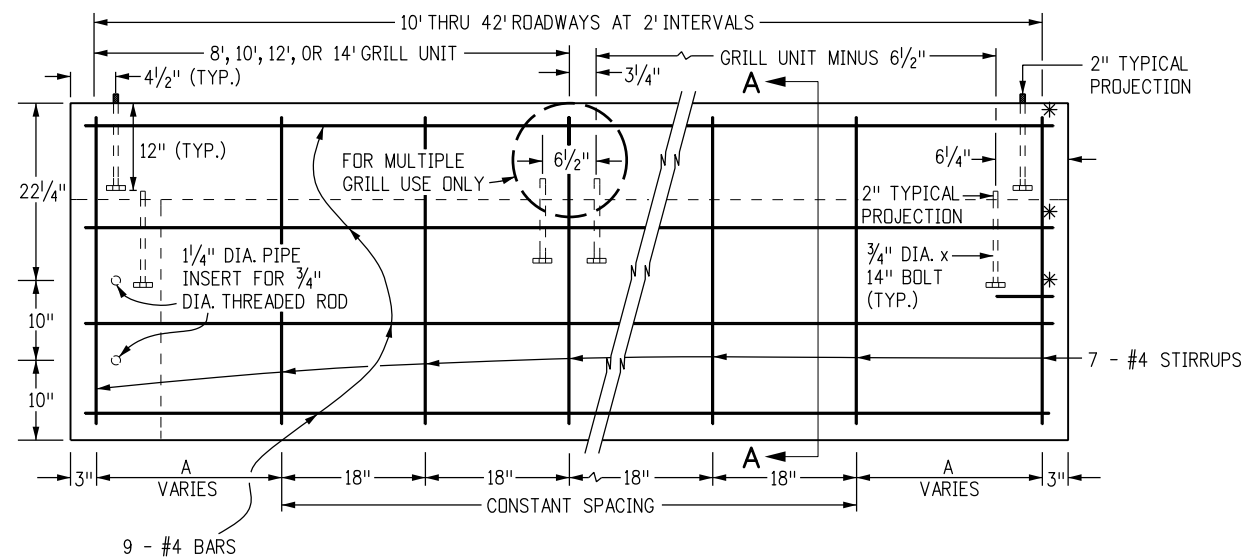
Colorado Department of Transportation  
 2829 West Howard Place  
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 Denver, CO 80204  
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**Project Development Branch**      **JBK**

# CATTLE GUARD

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-611-1**  
 Standard Sheet No. 1 of 2  
 Project Sheet Number:



**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 PERPENDICULAR 10 IN. FROM THE BEND

- a - 6" x 8" x 7'-4"
- b - 4" x 8" x 9'-4 1/2"
- 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 1/4" x 79" } 63.26 LBS.
- b - 2" x 2" x 1/4" x 79" }
- c - 2" x 2" x 1/4" x 84" }
- d - 1/2" x 1/2" x 1/4" x 69" } 36.86 LBS.
- e - 1/2" x 1/2" x 1/4" x 55" }
- f - 1/2" x 1/2" x 1/4" x 40" }
- g - 1/2" x 1/2" x 1/4" x 25" }
- h - 5" x 6" x 1/4" x BAR - 2.13 LBS.
- i - TWO 3" x 10" x 1/4" x BARS - 4.25 LBS.
- 6" x 8" x 7'-8" TIMBER POST
- TOTAL LBS. STEEL = ~106.5

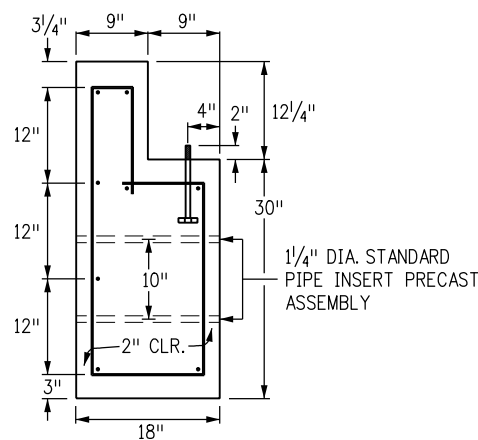
**ONE STEEL WING WING QUANTITIES**

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	10	5.6	295	5.6	316	24	1946
12	12	6.5	342	6.5	364	18	2328
14	14	7.4	378	7.4	399	21	2170
16	8 8	8.1	414	8.1	435	24	3128
18	8 10			9.0	482	18	3434
20	10 10			9.8	518	21	3806
22	10 12			10.6	553	24	4274
24	12 12			11.5	601	18	4656
26	12 14			12.3	636	21	5038
28	14 14			13.1	672	24	5420
30	10 10 10			13.9	719	18	5838
32	10 12 10			14.8	755	21	6220
34	12 10 12			15.5	790	24	6602
36	12 12 12			16.4	838	18	6984
38	12 14 12			17.3	873	21	7366
40	14 12 14			18.0	909	24	7748
42	14 14 14			18.9	956	18	8130

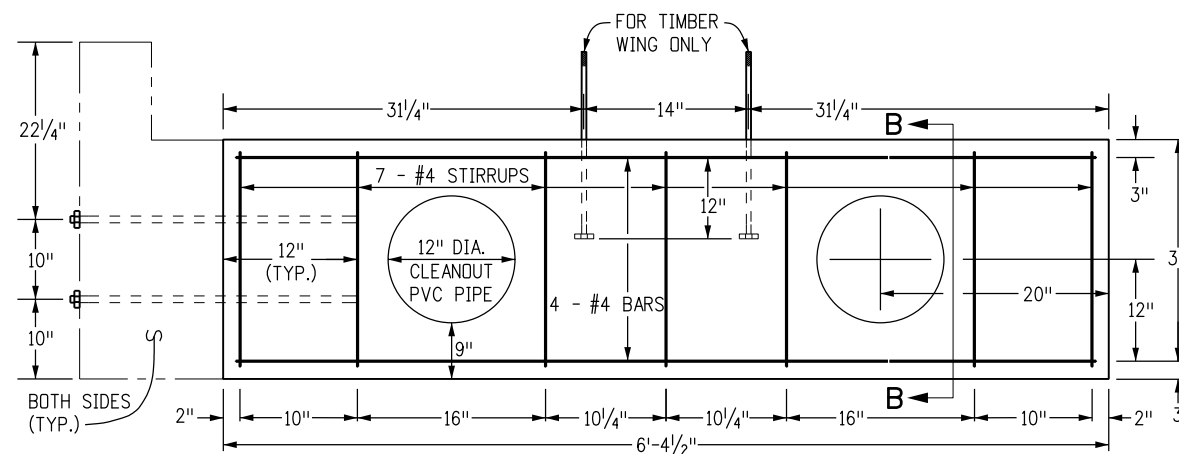
**FOUNDATION QUANTITIES**

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

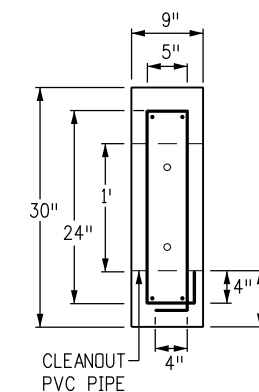
**WELDED GRILL UNITS**



**END SECTION OF FOUNDATION SECTION A-A**

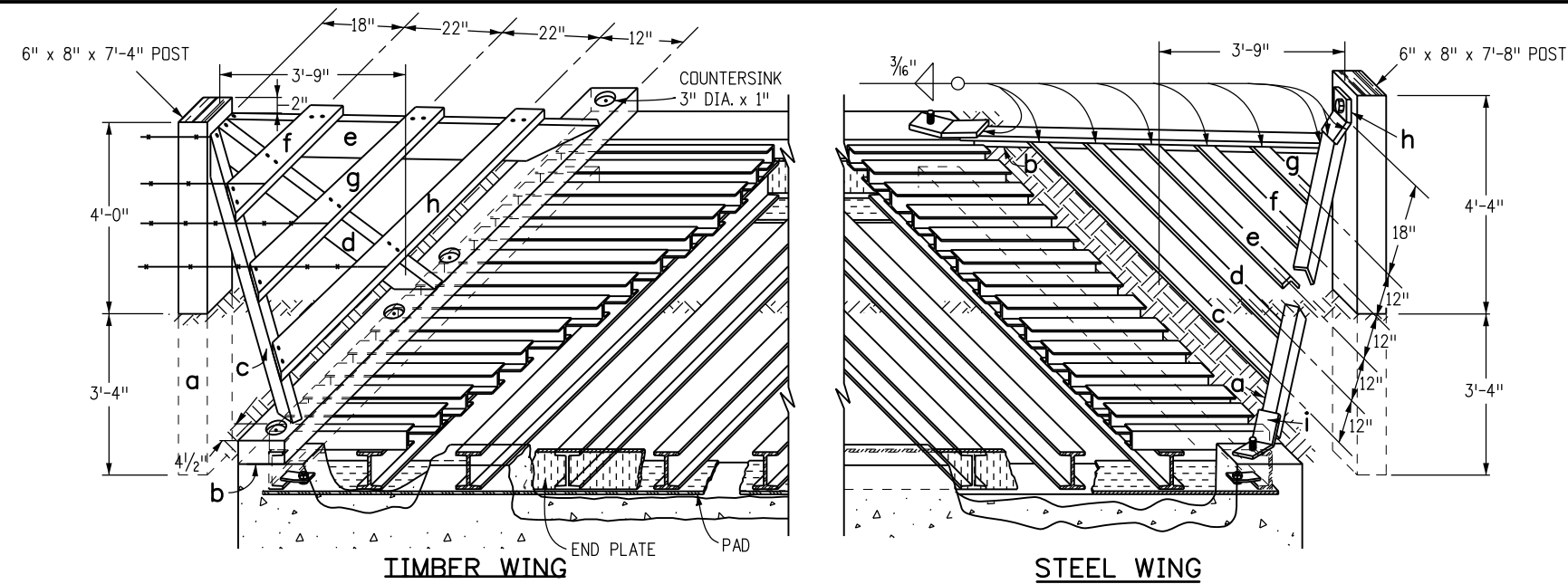


**ELEVATION OF LATERAL SUPPORT**

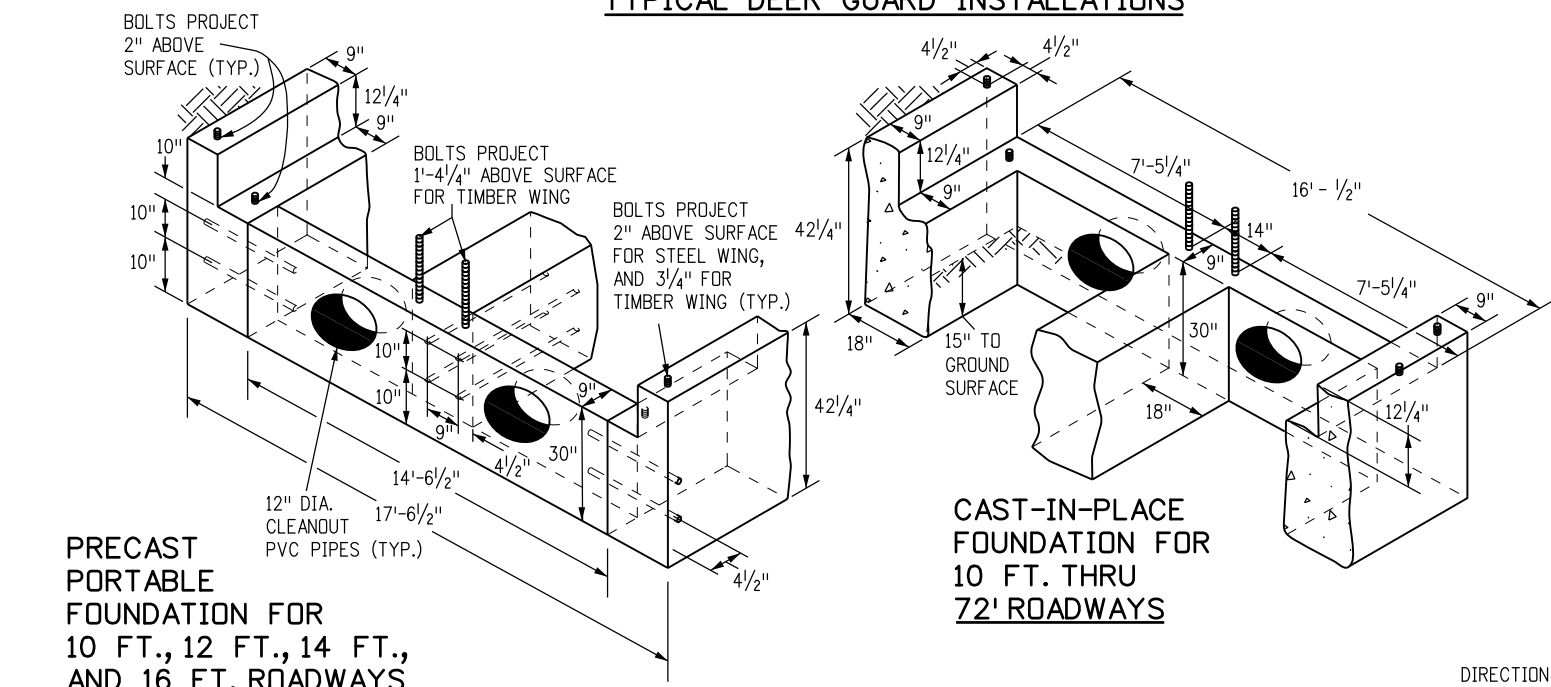


**LATERAL SUPPORT SECTION B-B**

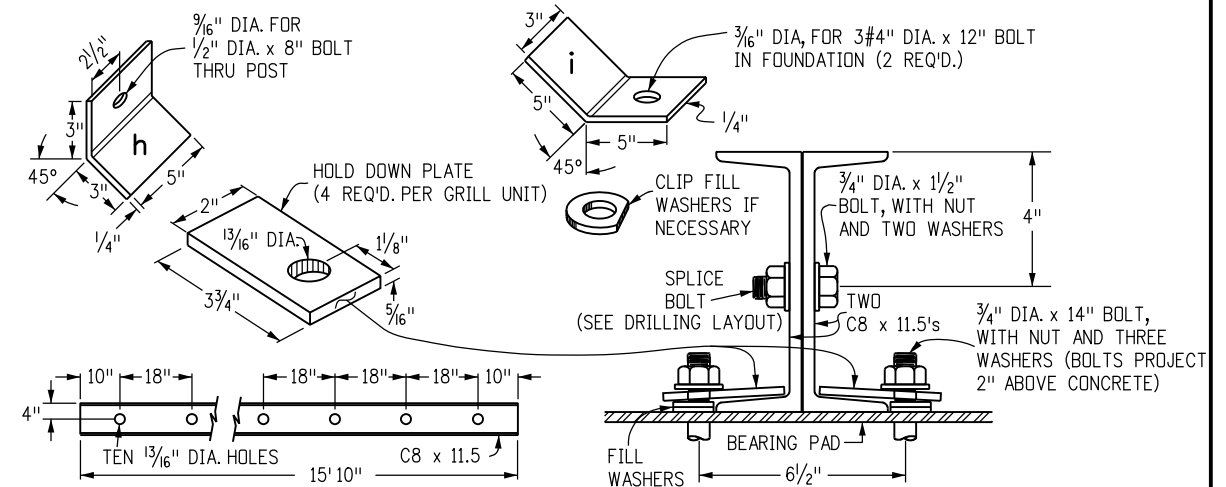
Computer File Information		Sheet Revisions		Colorado Department of Transportation		CATTLE GUARD	STANDARD PLAN NO.	
Creation Date: 07/31/19	(R-X)	Date:	Comments	2829 West Howard Place	CDOT		M-611-1	Standard Sheet No. 2 of 2
Designer Initials: JBK	(R-X)			CDOT HQ, 3rd Floor		Project Development Branch		JBK
Last Modification Date: 07/31/19	(R-X)			Denver, CO 80204	Issued by the Project Development Branch: July 31, 2019			
Detailer Initials: LTA	(R-X)			Phone: 303-757-9021 FAX: 303-757-9868				
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)							



TYPICAL DEER GUARD INSTALLATIONS

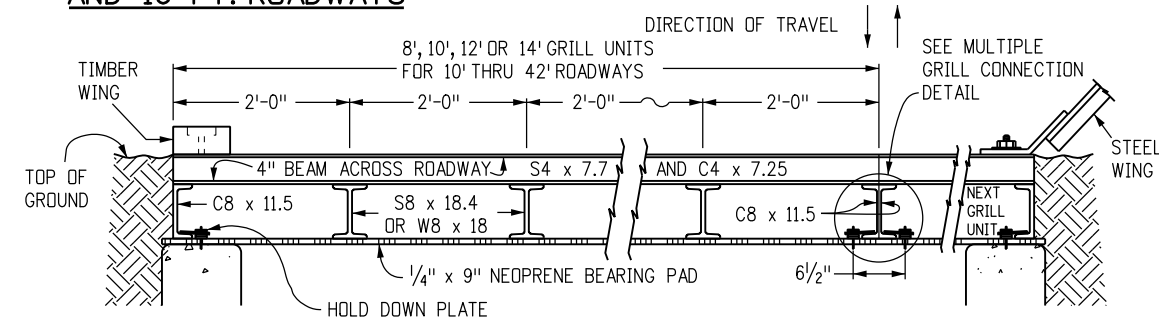


CAST-IN-PLACE FOUNDATION FOR 10 FT. THRU 72' ROADWAYS

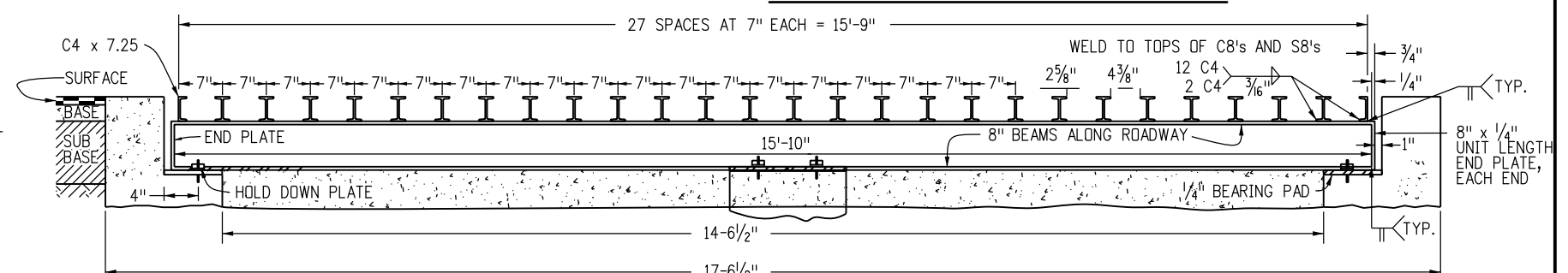


DRILLING LAYOUT

MULTIPLE GRILL UNIT CONNECTION



ELEVATION VIEW



WELDED GRILL CROSS SECTIONS

SIDE 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 ASHTO M 133 AND AWP C14.
4. WING POSTS MAY BE MADE FROM 6 IN. DIAMETER AND TREATED IN ACCORDANCE WITH 710.07
5. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND PAINTED WITH ALUMINUM PAINT IN ACCORDANCE WITH SECTION 509. ALL HARDWARE SHALL BE GALVANIZED IN CONFORMANCE WITH ASHTO 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. OUTLET PIPES WILL BE REQUIRED AND PAID FOR AS SHOWN IN THE PLANS. A 6 INCH SLEEVE MAY BE USED THROUGH THE CENTRAL SUPPORT TO DRAIN FROM ONE CELL TO THE OTHER TO MINIMIZE THE NUMBER OF OUTLET PIPES.
9. TYPE OF WING (TIMBER OR STEEL) SHALL BE STEEL UNLESS OTHERWISE SHOWN ON THE PLANS.
10. STRUCTURE EXCAVATION, STRUCTURE BACKFILL, AND SURVEY WORK WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
11. A 4 IN. CONCRETE FLOOR SHALL BE PLACED IN THE DEER GUARD AND SHALL BE GRADED TO DRAIN. THIS QUANTITY WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
12. EXPANSION JOINT MATERIAL SHALL BE USED BETWEEN THE 4 INCH CONCRETE FLOOR AND THE FOUNDATION. THIS QUANTITY WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.
13. TOOLED OR SAWCUT JOINTS WILL BE REQUIRED IN THE 4 INCH CONCRETE FLOOR AS DIRECTED. DETAIL. THIS WORK WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THIS WORK
14. HIGHWAY LOADING DESIGN DATA:  
HL-93 (DESIGN TRUCK OR TANDEM, AND DESIGN LANE LOAD)
15. A TREATED 2X6 MAY BE USED AT THE OPEN END OF THE DEER GUARD TO KEEP FILL MATERIAL FROM FALLING IN.
16. ALTERNATIVE DEER GUARDS MAY BE CONSTRUCTED UPON APPROVAL BY THE PROJECT ENGINEER.

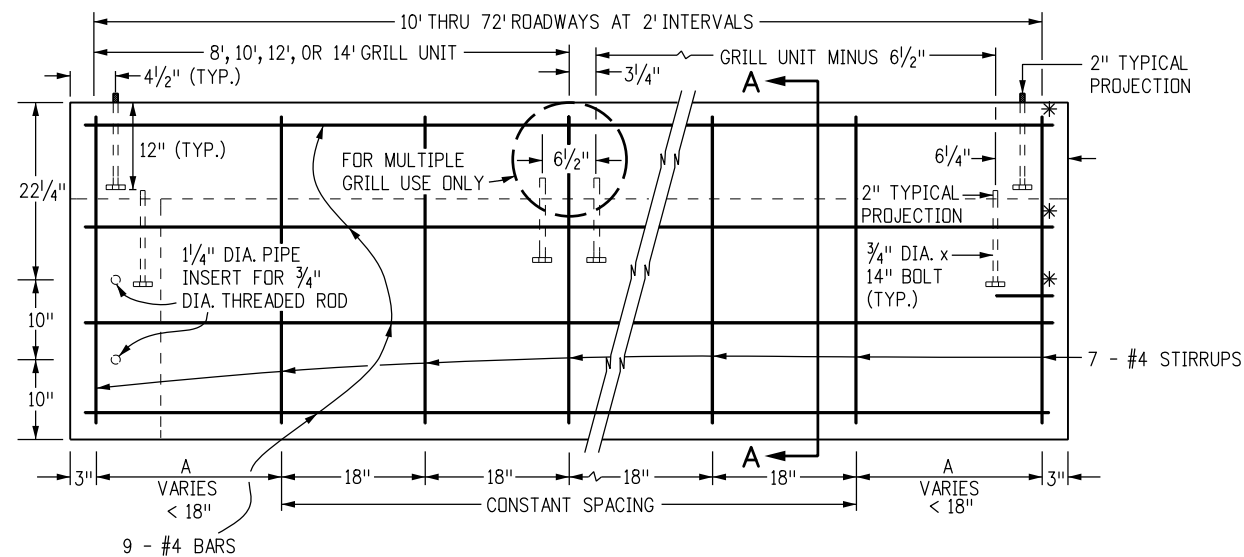
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Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**DEER GUARD**  
 Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.  
**M-611-2**  
 Standard Sheet No. 1 of 2  
 Project Sheet Number:

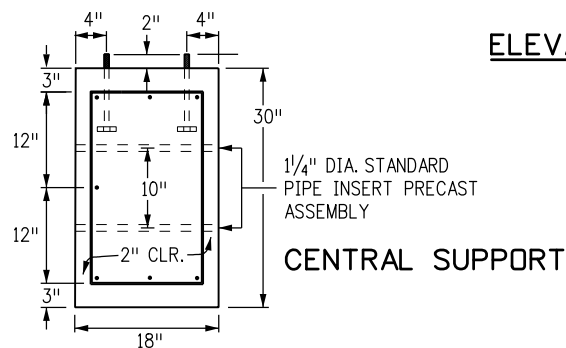


**PRECAST PORTABLE FOUNDATION**

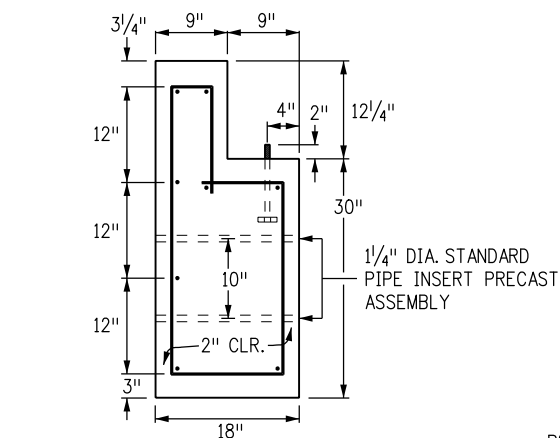
**CAST-IN-PLACE FOUNDATION**

**ELEVATION OF FOUNDATION**

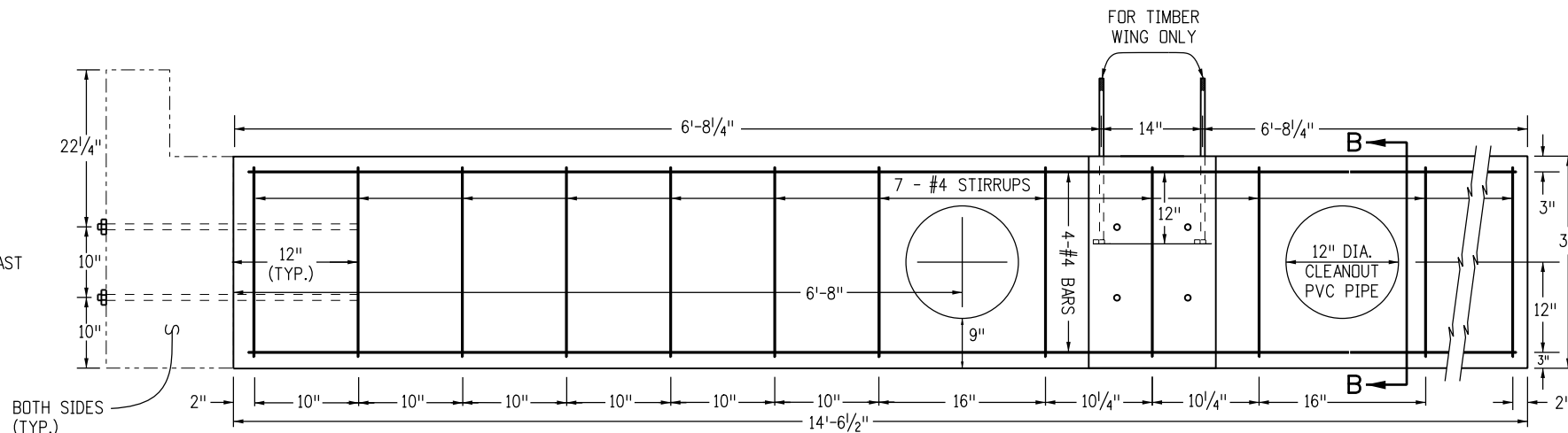
\* WHEN CAST IN PLACE, LONGITUDINAL BARS EXTENDING FROM AND INTO THE LATERAL SUPPORT SHALL BE BENT 90° WITH A 2 IN. RADIUS AND CONTINUE PERPENDICULAR 10 IN. FROM THE BEND



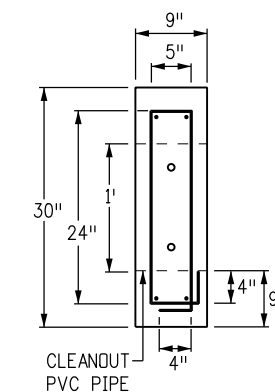
**CENTRAL SUPPORT**



**SECTION A-A  
END SECTION OF FOUNDATION**



**ELEVATION OF LATERAL SUPPORT**



**SECTION B-B  
LATERAL SUPPORT**

- a - 6" x 8" x 7'-4"
  - b - 4" x 8" x 9'-4 1/2"
  - 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 1/4" x 123.70"	32.88 LBS.
b - 2" x 2" x 1/4" x 123.70"	32.88 LBS.
c - 2" x 2" x 1/4" x 177.93"	47.30 LBS.
d - 1/2" x 1/2" x 1/4" x 141.99"	43.19 LBS.
e - 1/2" x 1/2" x 1/4" x 106.04"	32.25 LBS.
f - 1/2" x 1/2" x 1/4" x 70.09"	21.32 LBS.
g - 1/2" x 1/2" x 1/4" x 34.15"	10.39 LBS.
h - 5" x 6" x 1/4" x BAR	- 2.13 LBS.
i - TWO 3" x 10" x 1/4" x BARS	- 4.25 LBS.
6" x 8" x 7'-8" TIMBER POST	
TOTAL LBS. STEEL = ~226.6	

**ONE STEEL WING**

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.)		
16	8 8	9.4	670	9.4	670	15	5905
20	10 10	11.2	821	11.2	821	15	7345
24	12 12	13.1	934	13.1	934	15	8785
28	14 14	15.0	1059	15.0	1059	15	10224
30	10 10 10	14.1	1136	14.1	1136	12	10809
32	10 12 10	16.9	1184	16.9	1184	15	11737
38	12 14 12	17.3	1353	17.3	1353	12	13628
40	14 12 14	20.7	1419	20.7	1419	15	14617

**FOUNDATION QUANTITIES**

SIZE	WEIGHT (LBS.)
8'	2952
10'	3672
12'	4392
14'	5112

**WELDED GRILL UNITS  
FULL LENGTH**

SIZE	WEIGHT (LBS.)
8'	1476
10'	1836
12'	2196
14'	2556

**WELDED GRILL UNITS  
HALF LENGTH**

HALF GRILLS SHALL BE BOLTED ON 18 INCH CENTERS MAX. (SEE MULTIPLE GRILL UNIT CONNECTION DETAIL ON SHEET ONE)

**WING QUANTITIES**

Computer File Information	
Creation Date: 07/31/19	
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

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 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868

**Project Development Branch**      **JBK**

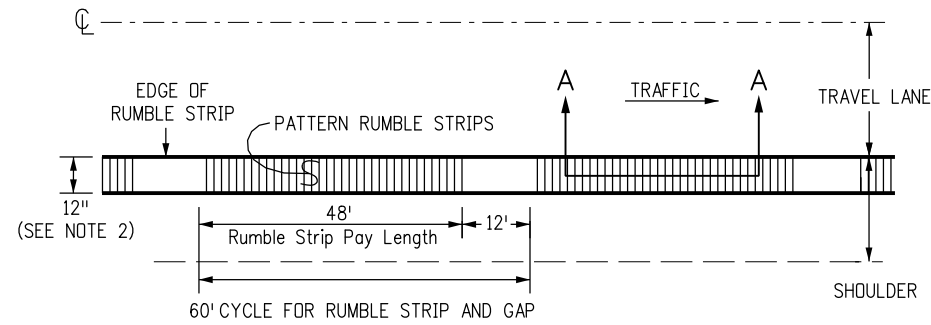
**DEER GUARD**

Issued by the Project Development Branch: July 31, 2019

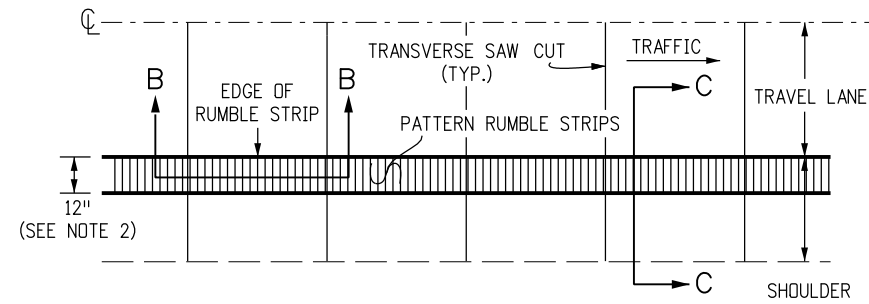
STANDARD PLAN NO.
M-611-2
Standard Sheet No. 2 of 2
Project Sheet Number:

**GENERAL NOTES**

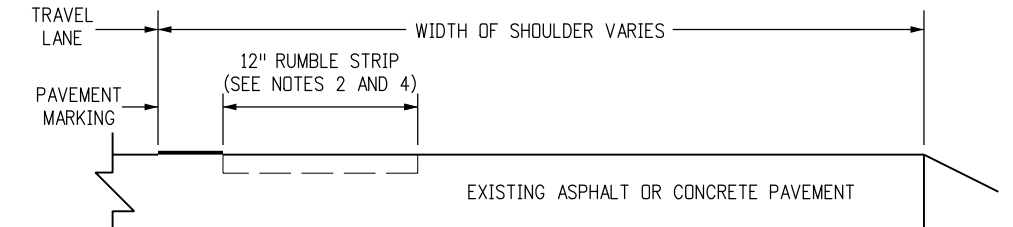
- RUMBLE STRIPS SHALL BE OMITTED AT TURN AND AUXILIARY LANES, ROAD APPROACHES, RESIDENCES, 250 FT. BEFORE ROAD INTERSECTIONS, AND OTHER INTERRUPTIONS AS DIRECTED BY THE ENGINEER.
- RUMBLE STRIPS MAY BE INSTALLED BY GRINDING, ROLLING, OR FORMING ON CONCRETE PAVEMENT, AND BY GRINDING ONLY ON HMA PAVEMENT.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



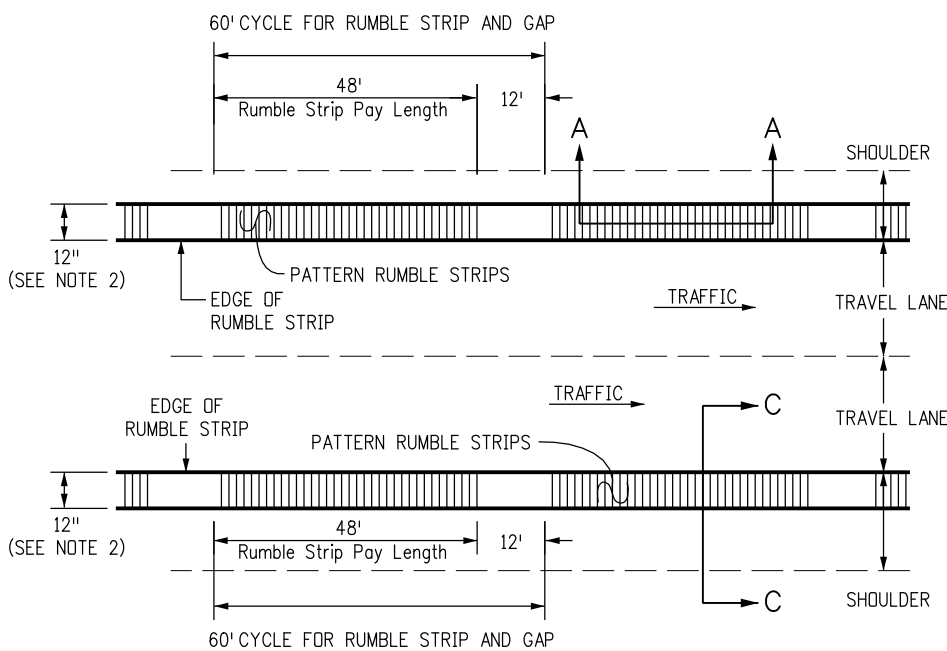
**INTERMITTENT RUMBLE STRIP  
TWO-LANE ROADWAY (HMA)**



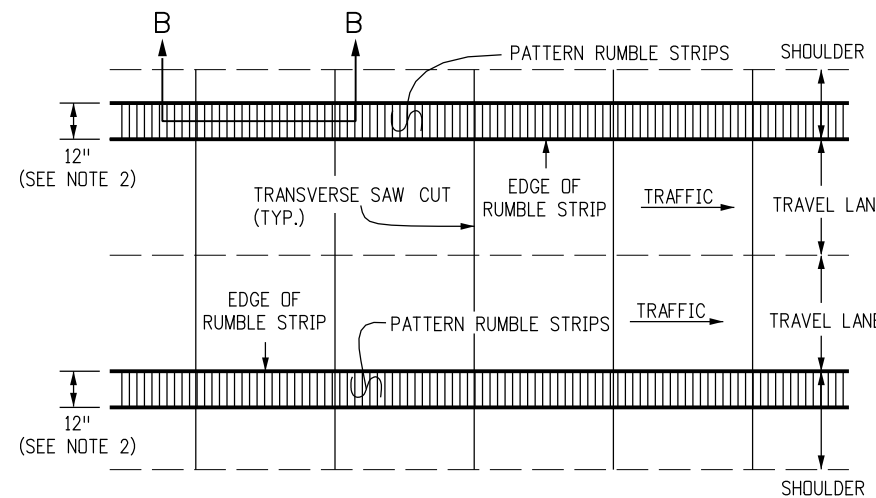
**CONTINUOUS RUMBLE STRIP  
TWO-LANE ROADWAY (CONCRETE)**



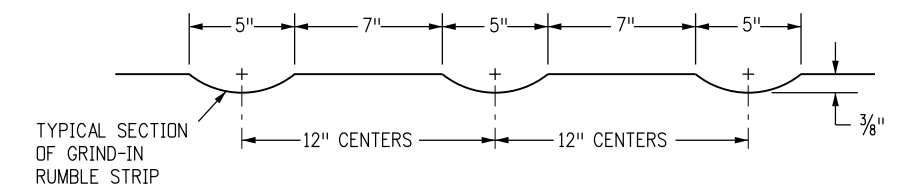
**TYPICAL SECTION C-C**



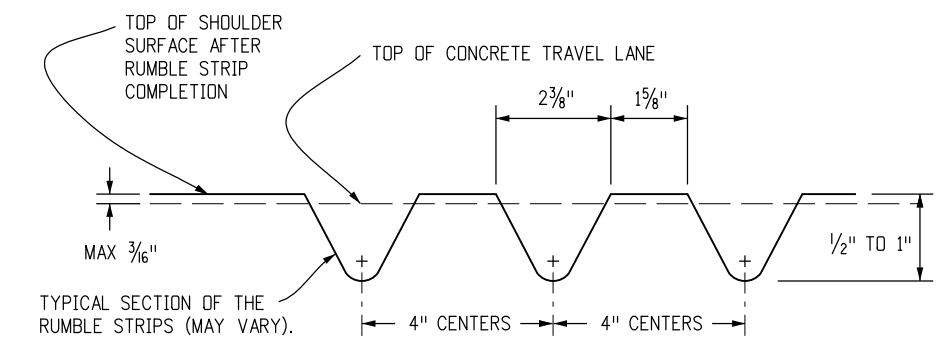
**INTERMITTENT RUMBLE STRIP  
FOUR-LANE DIVIDED ROADWAY (HMA)**



**CONTINUOUS RUMBLE STRIP  
FOUR-LANE DIVIDED ROADWAY (CONCRETE)**

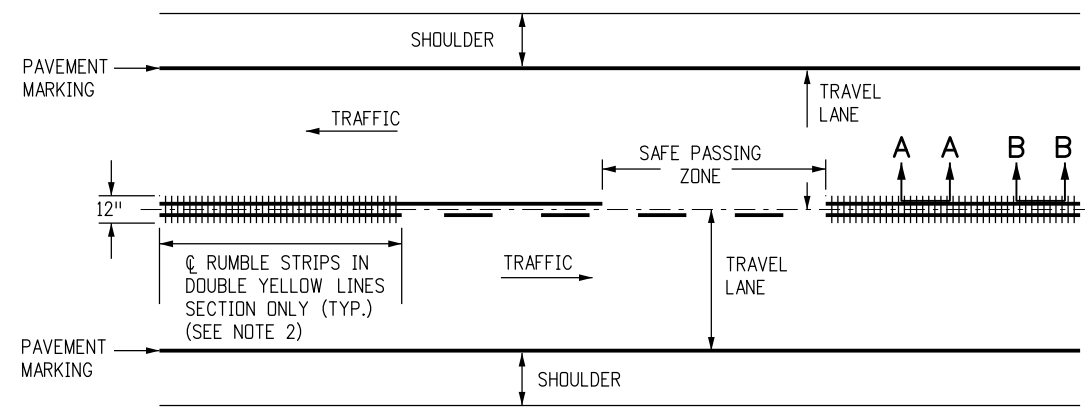


**TYPICAL SECTIONS A-A AND B-B  
FOR GRIND-IN RUMBLE STRIP  
ON EXISTING HMA OR CONCRETE PAVEMENT**

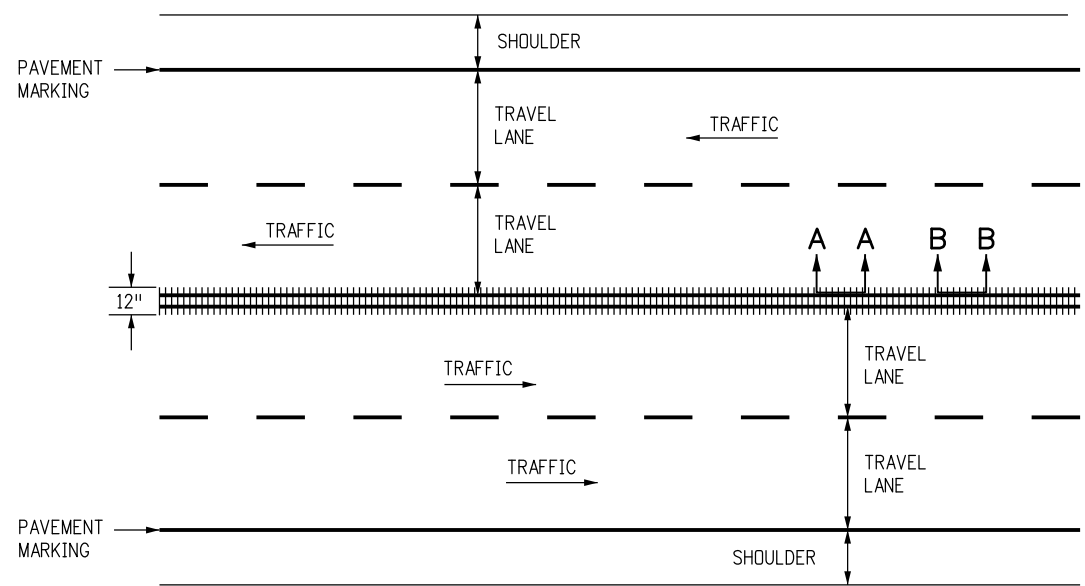


**TYPICAL SECTION B-B  
FOR FORMED OR ROLLED ON CONCRETE PAVEMENTS ONLY**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b> 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>RUMBLE STRIPS</b> Issued by the Project Development Branch: July 31, 2019	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-614-1	
Designer Initials: JBK		(R-X)				Standard Sheet No. 1 of 3	
Last Modification Date: 07/31/19		(R-X)				Project Sheet Number:	
Detailer Initials: LTA		(R-X)					
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		JBK			



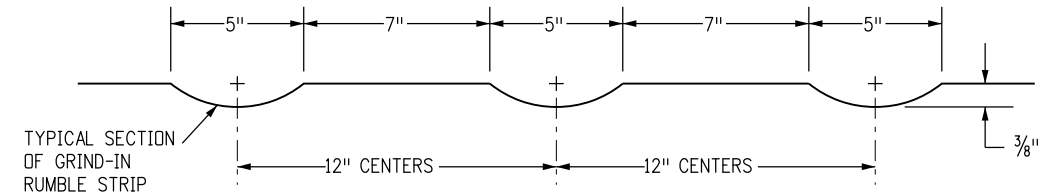
**TWO LANE HIGHWAY (HMA AND CONCRETE)  
CONTINUOUS CENTER LINE RUMBLE STRIPS**



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

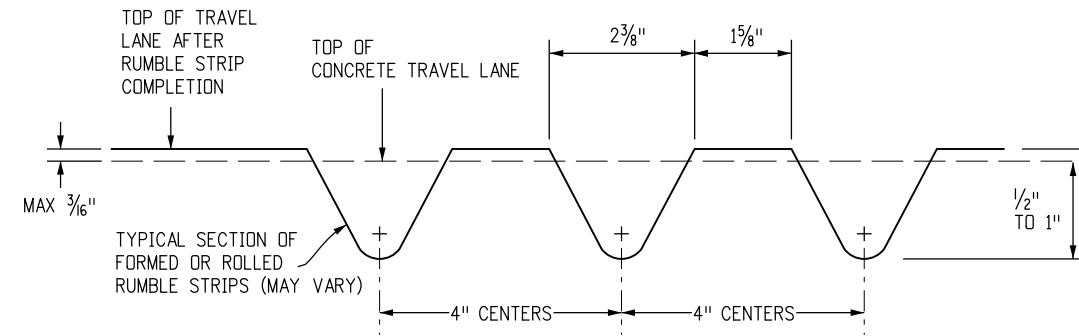
**NOTES**

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**

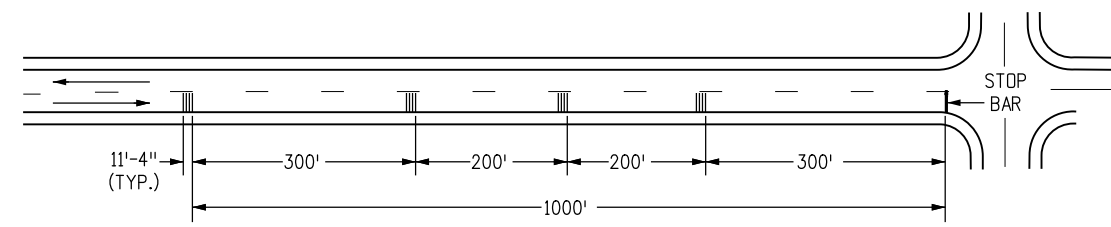
FOR FORMED OR ROLLED ON CONCRETE PAVEMENTS ONLY

**DETAILS FOR CENTER LINE RUMBLE STRIPS**

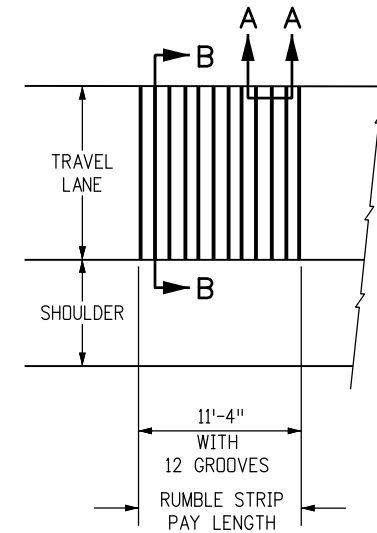
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Creation Date: 07/31/19		Date:	Comments	2829 West Howard Place			M-614-1
Designer Initials: JBK		(R-X)		CDOT HQ, 3rd Floor			Standard Sheet No. 2 of 3
Last Modification Date: 07/31/19		(R-X)		Denver, CO 80204			
Detailer Initials: LTA		(R-X)		Phone: 303-757-9021 FAX: 303-757-9868		Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		<b>Project Development Branch</b> <b>JBK</b>			

**NOTES**

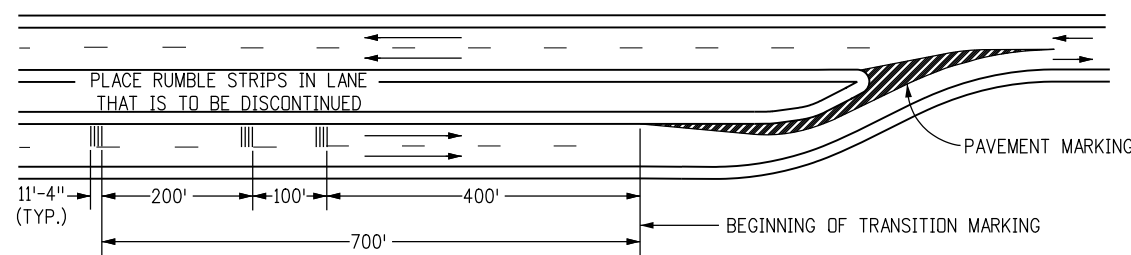
1. GROOVED RUMBLE STRIP SKEW OR CLUSTER SPACING SHALL BE MODIFIED TO AVOID LOCATING A GROOVE ON A CONCRETE PAVEMENT TRANSVERSE JOINT.
2. PERMANENT TRAVEL LANE RUMBLE STRIPS SHALL BE THE GROOVE DESIGN, AND MAY BE CUT IN EXISTING, NEW HMA, OR CONCRETE PAVEMENT. THE GROOVES MAY BE CUT BY SAWING, GRINDING, 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  $\frac{3}{8}$  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.



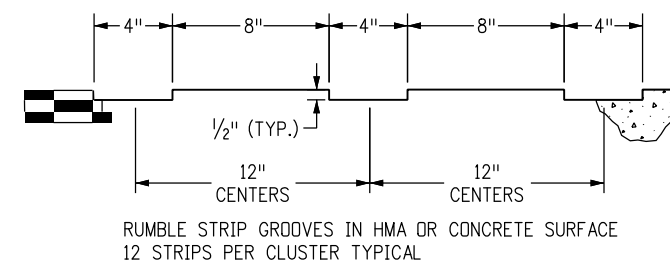
**STOP SIGN APPROACH**



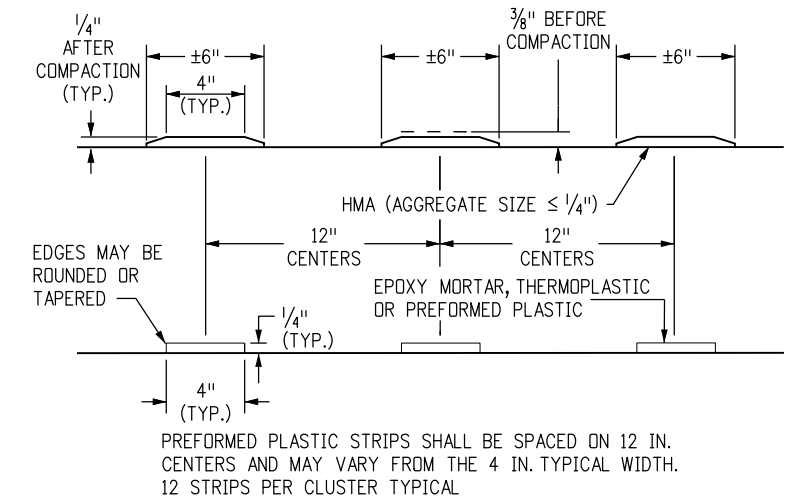
**TYPICAL RUMBLE STRIP CLUSTER**



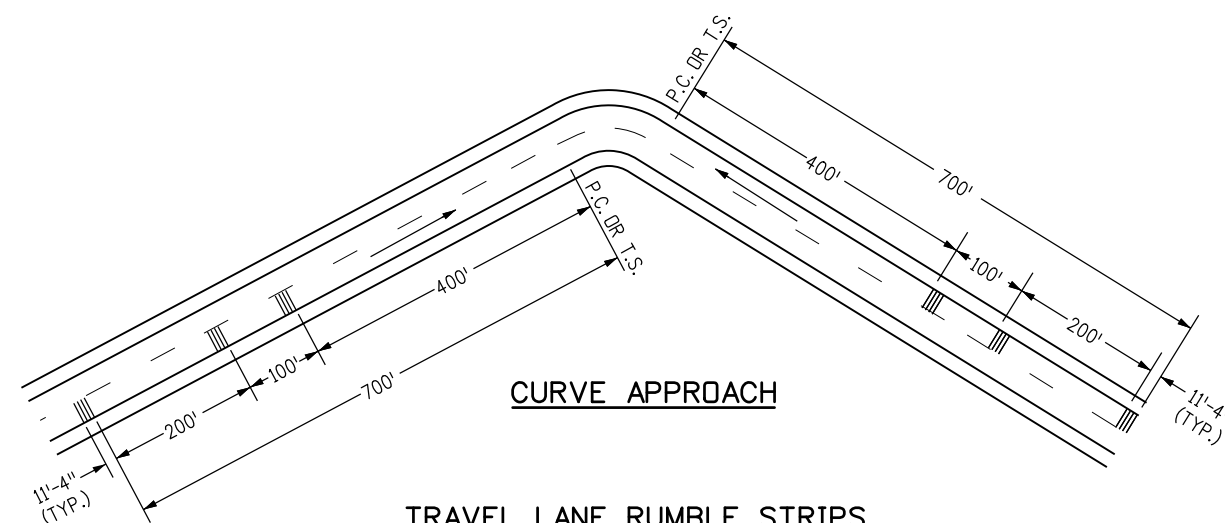
**LANE REDUCTION TRANSITION**



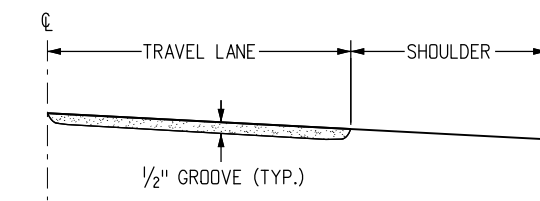
**SECTION A-A (GROOVED)**



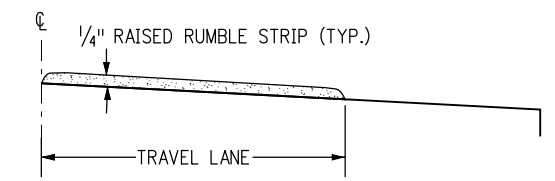
**SECTION A-A (RAISED)**



**TRAVEL LANE RUMBLE STRIPS**



**SECTION B-B (GROOVED)**



**SECTION B-B (RAISED)**

**PERMANENT GROOVED RUMBLE STRIPS**

**TEMPORARY RAISED RUMBLE STRIPS**

**Computer File Information**

Creation Date: 07/31/19	(R-X)
Designer Initials: JBK	(R-X)
Last Modification Date: 07/31/19	(R-X)
Detailer Initials: LTA	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

**Sheet Revisions**

Date:	Comments

Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**RUMBLE STRIPS**

Issued by the Project Development Branch: July 31, 2019

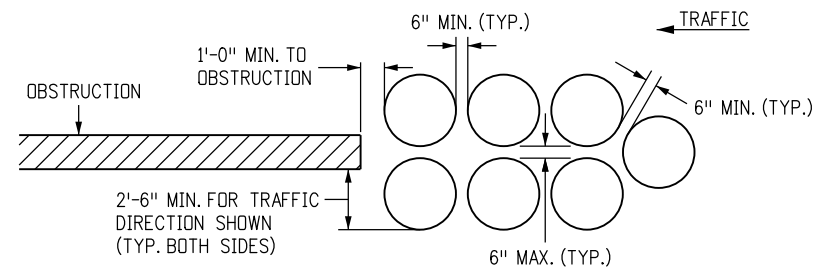
**STANDARD PLAN NO.**

M-614-1

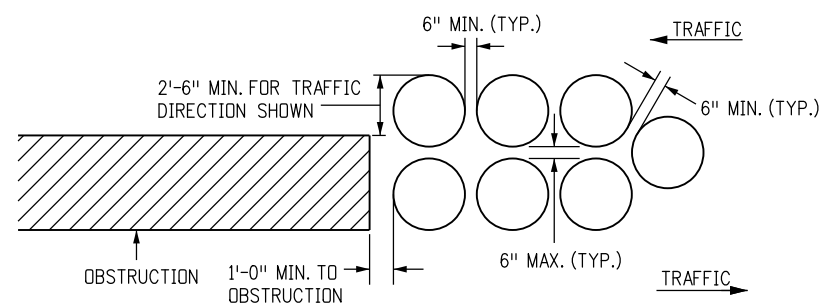
**Standard Sheet No. 3 of 3**

Project Sheet Number:

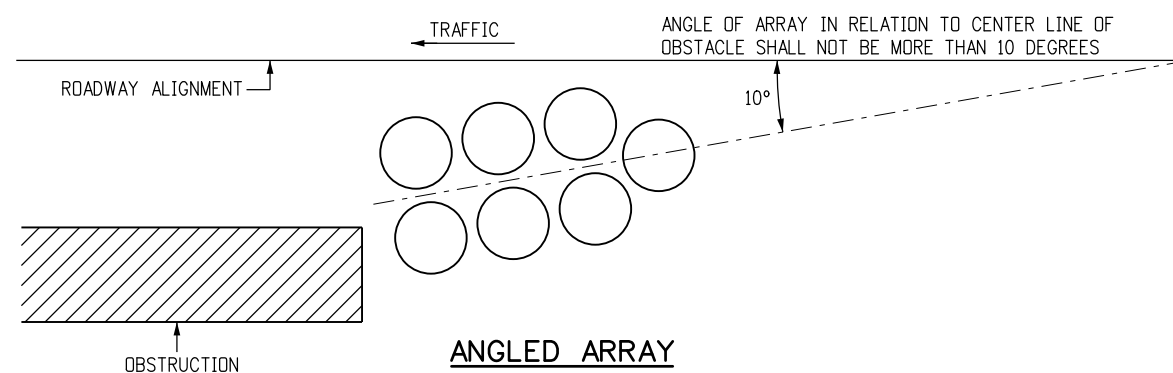




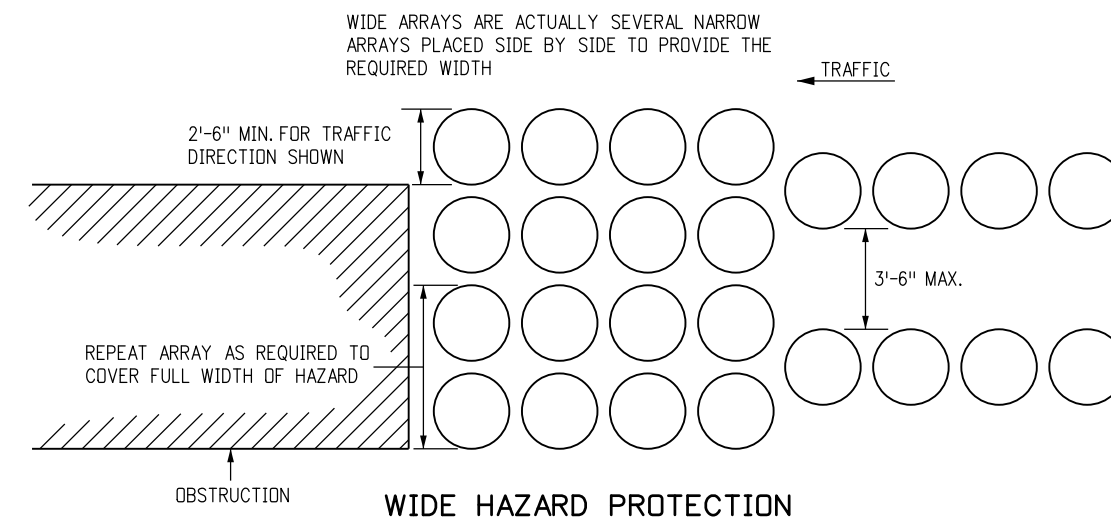
**UNIDIRECTIONAL**



**BIDIRECTIONAL**



**ANGLED ARRAY**

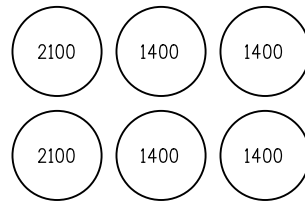


**WIDE HAZARD PROTECTION**

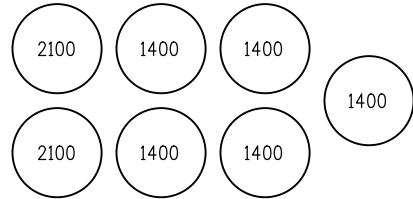
**GENERAL NOTES**

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.

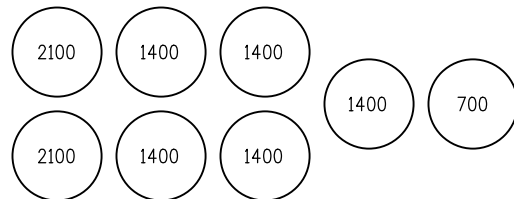
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<h1>SAND BARREL ARRAYS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-614-2	
Designer Initials: JBK	(R-X)					Standard Sheet No. 1 of 2	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)					Issued by the Project Development Branch: July 31, 2019	
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)		JBK			



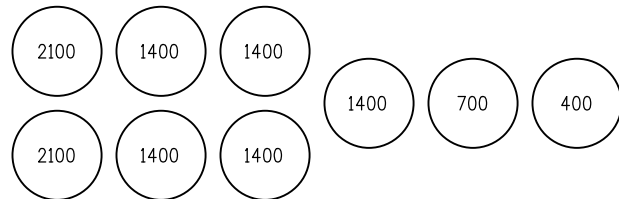
**DESIGN SPEED 25 MPH**



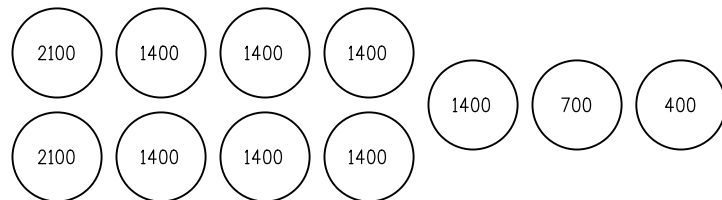
**DESIGN SPEED 30 MPH**



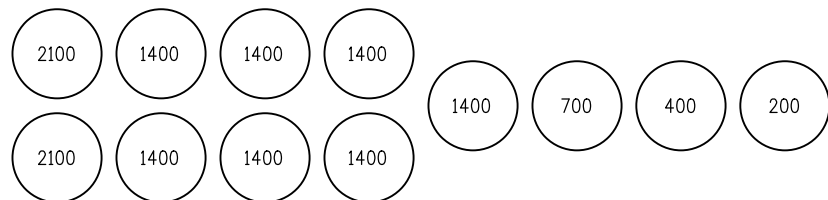
**DESIGN SPEED 35 MPH**



**DESIGN SPEED 40 MPH**



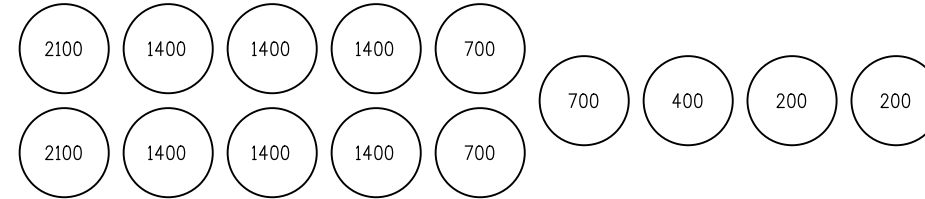
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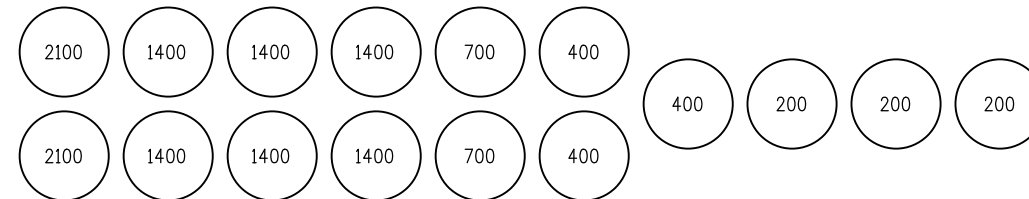
**DESIGN SPEED 50 MPH**

**NOTES**

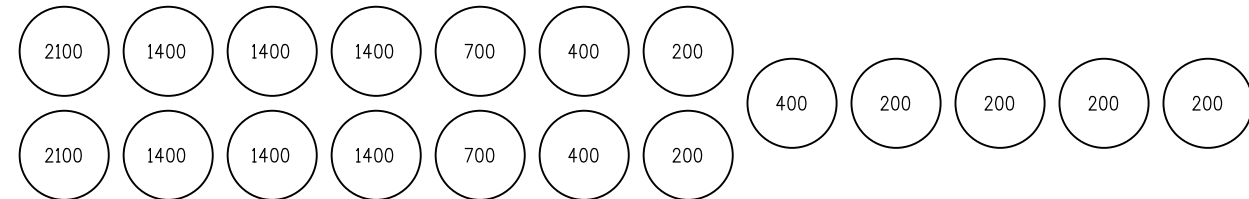
1. SAND WEIGHT (LBS) IN MODULES IS DENOTED BY THE NUMBERS IN THE ARRAY DETAILS.
2. ARRAY CONFIGURATION MAY VARY IN LAYOUT AND SAND WEIGHT (LBS) PROVIDED THEY CONFORM TO MANUFACTURER'S DETAILS.



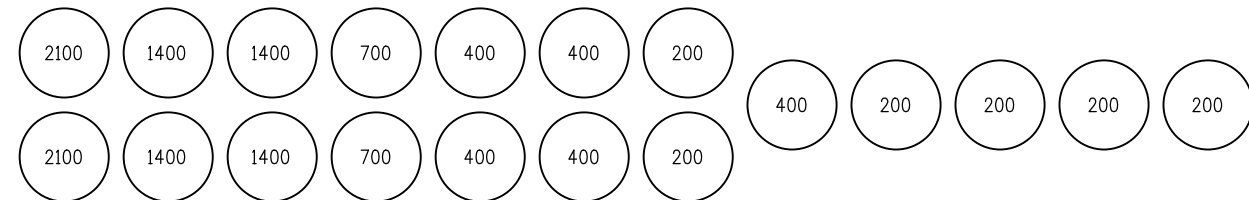
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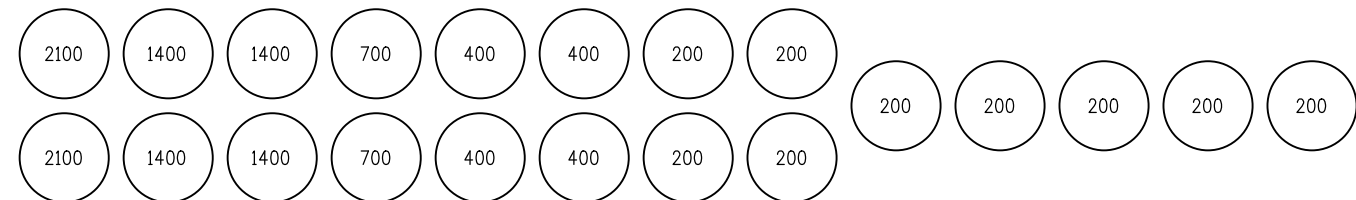
**DESIGN SPEED 60 MPH**



**DESIGN SPEED 65 MPH**

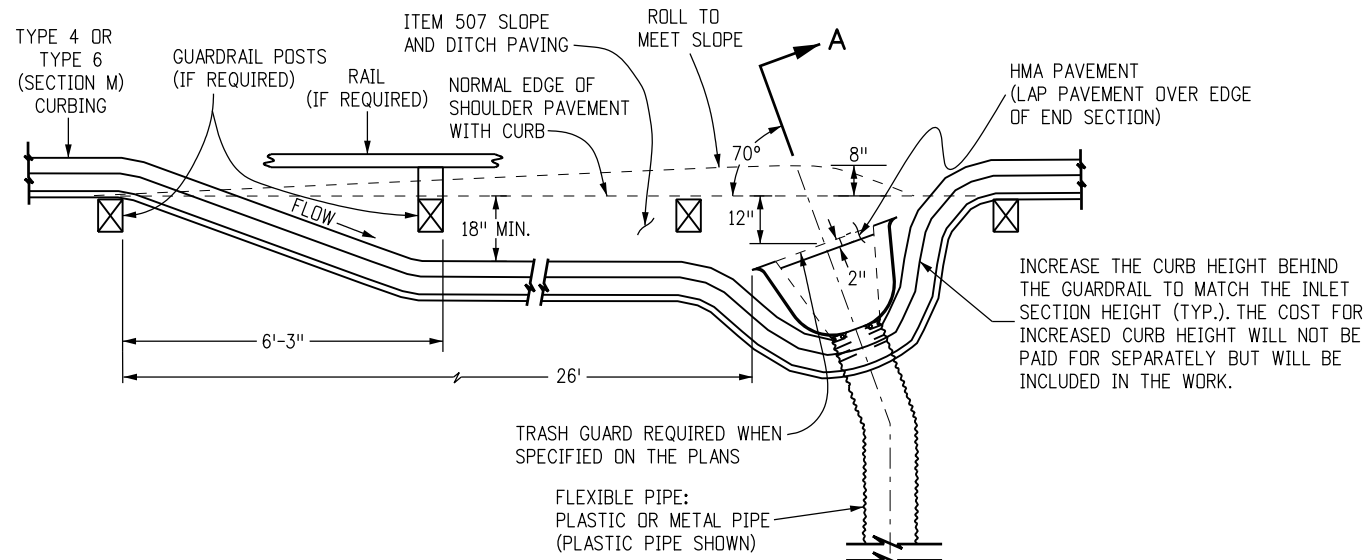


**DESIGN SPEED 70 MPH**



**DESIGN SPEED 75 MPH**

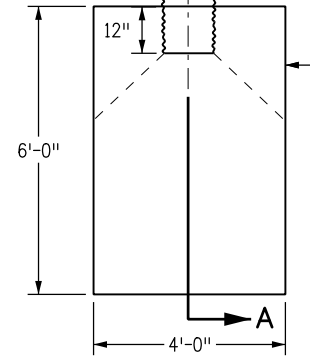
<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b> <b>JBK</b>	<h1>SAND BARREL ARRAYS</h1>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19	(R-X)	Date:	Comments:			M-614-2	
Designer Initials: JBK	(R-X)					Standard Sheet No. 2 of 2	
Last Modification Date: 07/31/19	(R-X)					Project Sheet Number:	
Detailer Initials: LTA	(R-X)						
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)			Issued by the Project Development Branch: July 31, 2019		



**TYPE 3 PLAN VIEW**

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

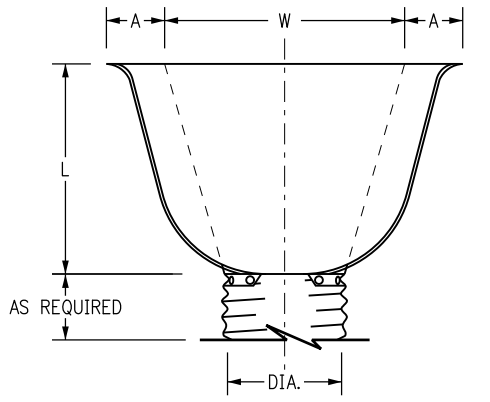
TYPE OF APRON MATERIAL	THICKNESS IN.
SLOPE AND DITCH PAVING (507)	
DRY RUBBLE	6
CONCRETE	4
HMA	4
GROUTED RUBBLE	4
RIPRAP (506)	9 (MIN.)



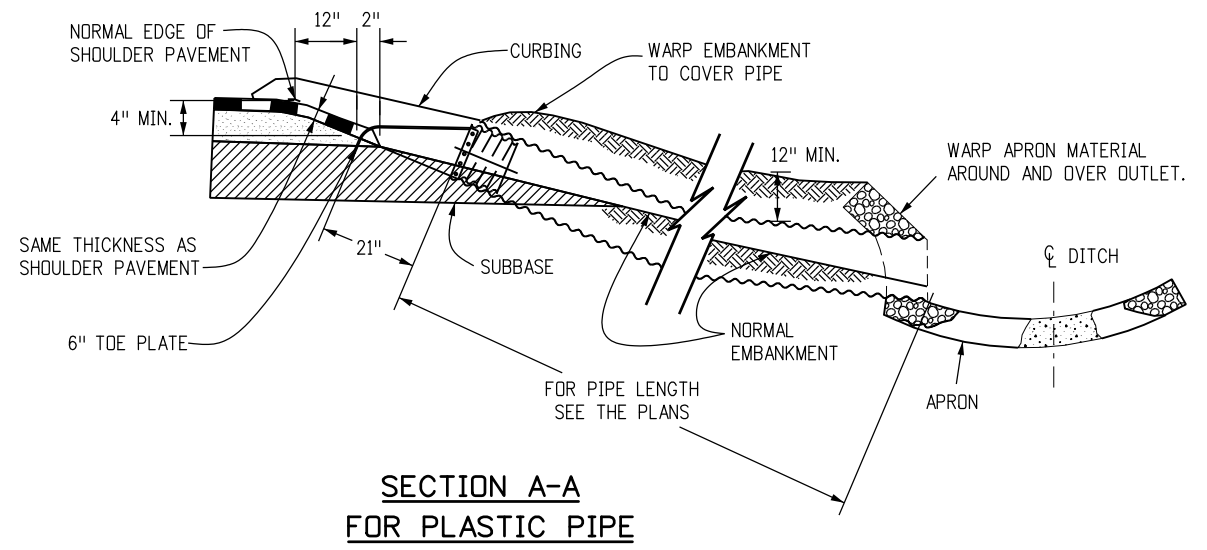
- GENERAL NOTES**
1. IF THE EMBANKMENT PROTECTOR IS LOCATED IN THE BOTTOM OF A VERTICAL CURVE, FLARE THE CURB ON EACH SIDE OF THE INLET TO ALLOW FOR FLOW FROM BOTH DIRECTIONS.
  2. DETAILS OF GUARD RAIL INSTALLATION ARE SHOWN IN STANDARD PLAN M-606-1.
  3. THE END SECTION-TO-PIPE STUB JOINT FOR CORRUGATED 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:

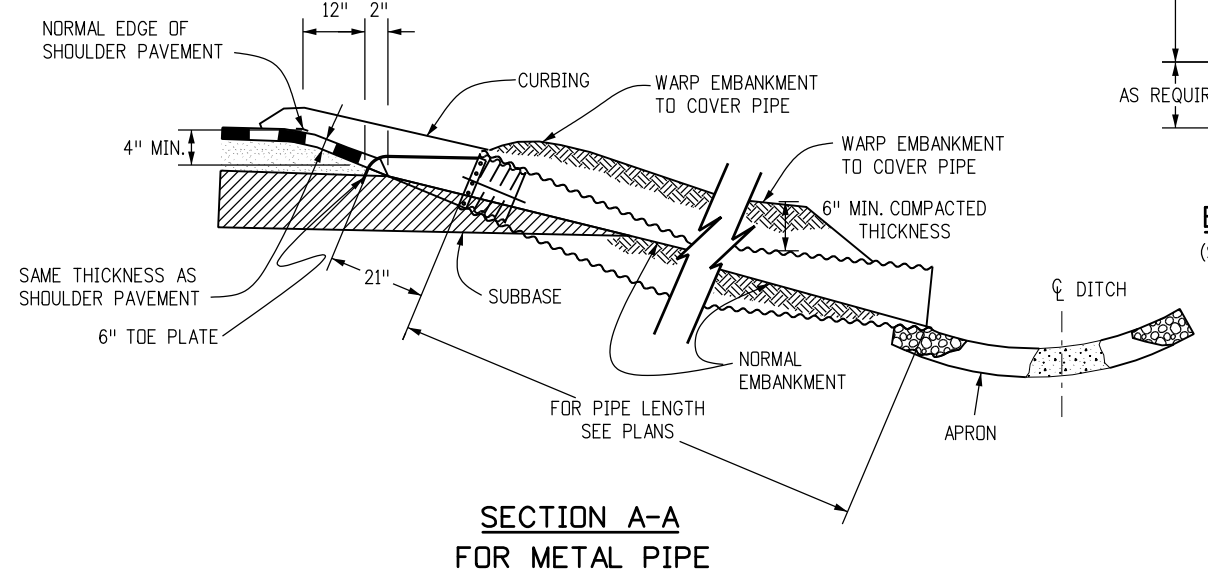
- 506 OR 507 - PAY ITEMS AS SPECIFIED ON THE PLANS.
  - 609 - CURB, TYPE 4 OR TYPE 6 (SECTION M) .....LINEAR FT.
  - 615 - EMBANKMENT PROTECTOR (TYPE 3) .....EACH
- NOTE: THIS PAYMENT INCLUDES THE END SECTION, THE TRASH GUARD (WHEN SPECIFIED ON THE PLANS), PIPE CONNECTION, STRUCTURE EXCAVATION, EMBANKMENT MATERIAL AND ANY EXTRA WORK REQUIRED TO MODIFY OTHER PAY ITEMS.
- 603 - 12 IN. TO 18 IN. PIPE .....LINEAR FT.



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



**SECTION A-A FOR PLASTIC PIPE**



**SECTION A-A FOR METAL PIPE**

**Computer File Information**

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Last Modification Date: 07/31/19
Detailer Initials: LTA
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

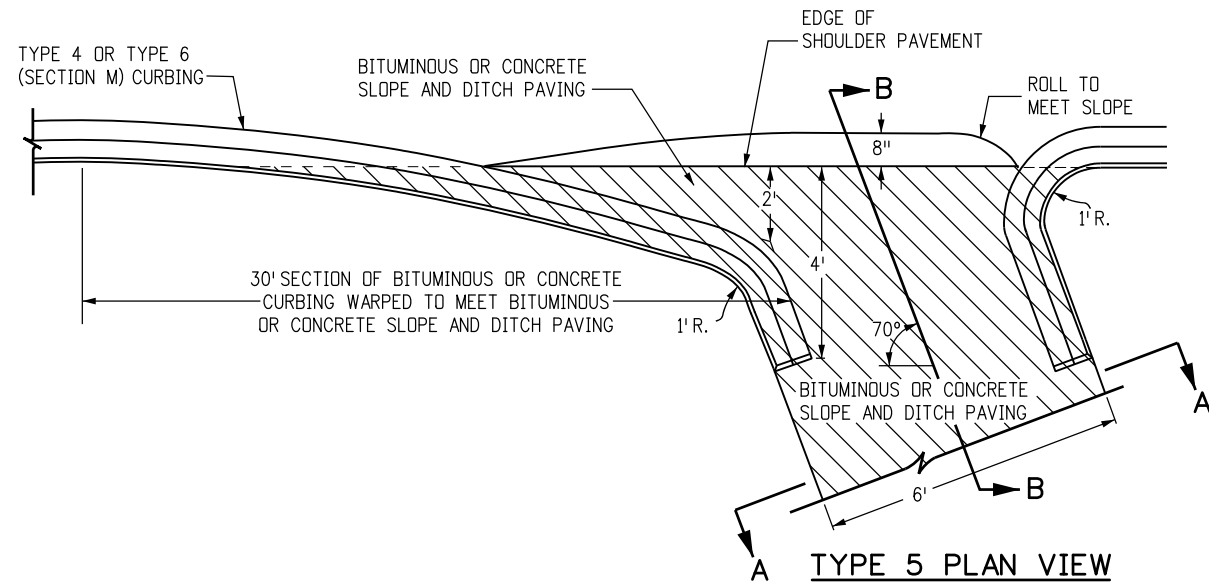
**Sheet Revisions**

Date:	Comments
(R-X)	
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(R-X)	
(R-X)	

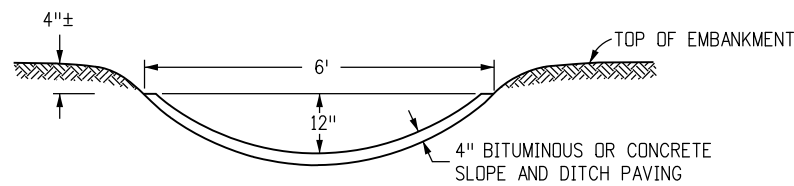
Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch **JBK**

**EMBANKMENT PROTECTOR TYPE 3**  
 Issued by the Project Development Branch: July 31, 2019

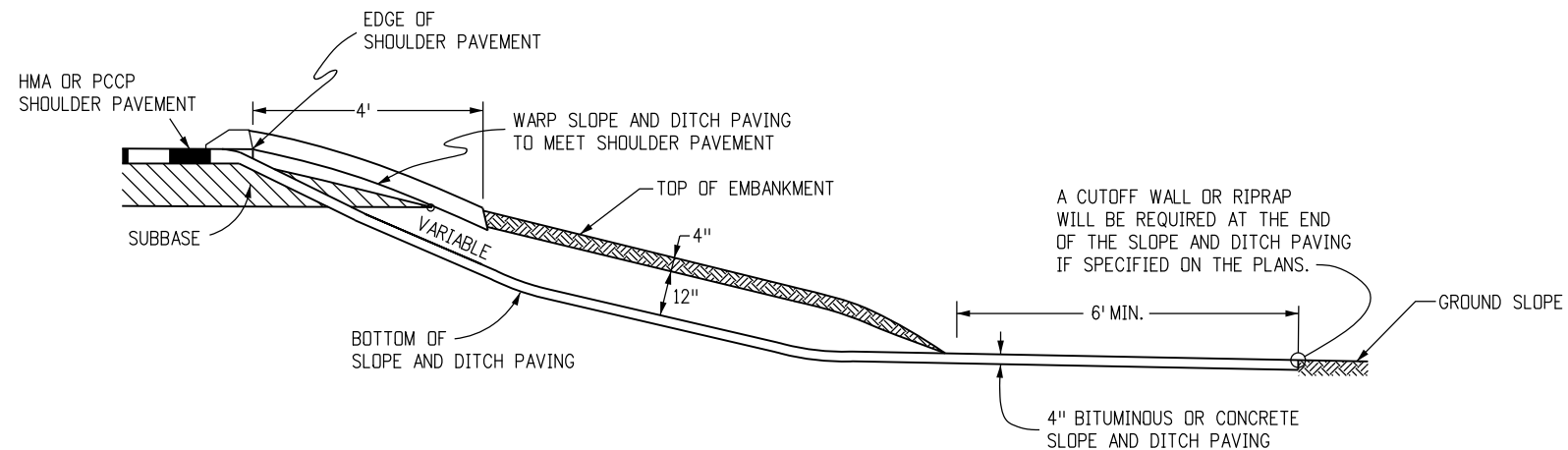
**STANDARD PLAN NO. M-615-1**  
**Standard Sheet No. 1 of 1**  
 Project Sheet Number:



**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.

Computer File Information	
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Sheet Revisions	
Date:	Comments

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 2829 West Howard Place  
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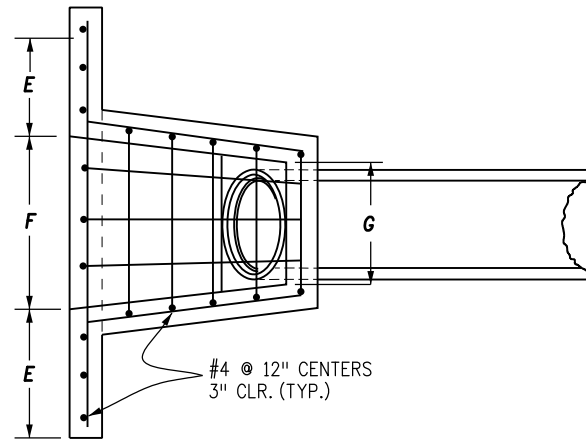
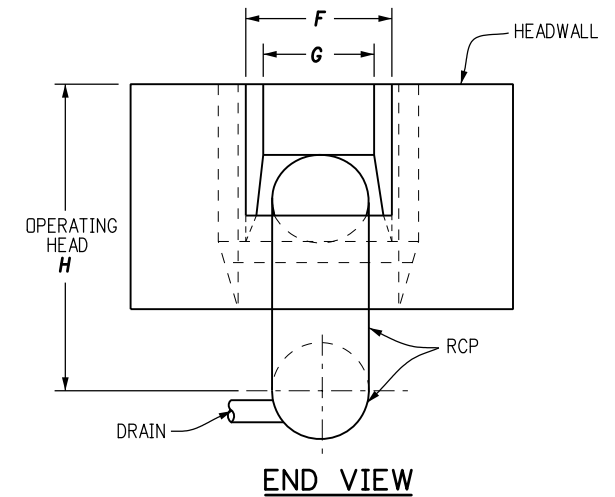
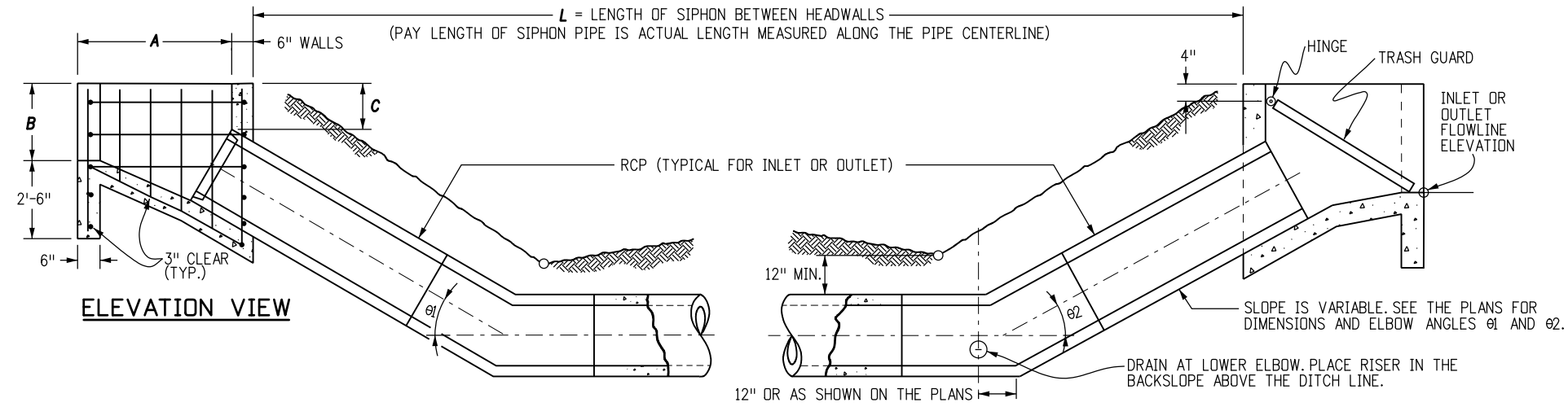


Project Development Branch JBK

**EMBANKMENT  
PROTECTOR TYPE 5**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO.
M-615-2
Standard Sheet No. 1 of 1
Project Sheet Number:



PIPE DIAMETER IN.	DIMENSIONS					
	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"

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

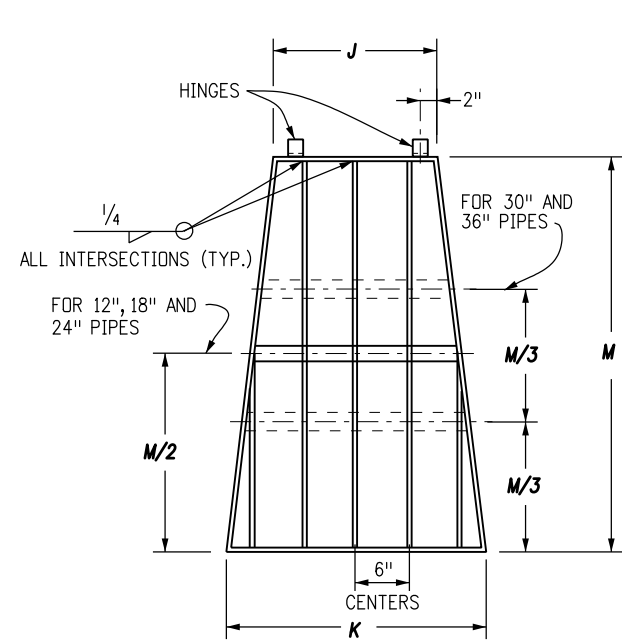
**HEADWALL DIMENSIONS**

**HEADWALL QUANTITIES**

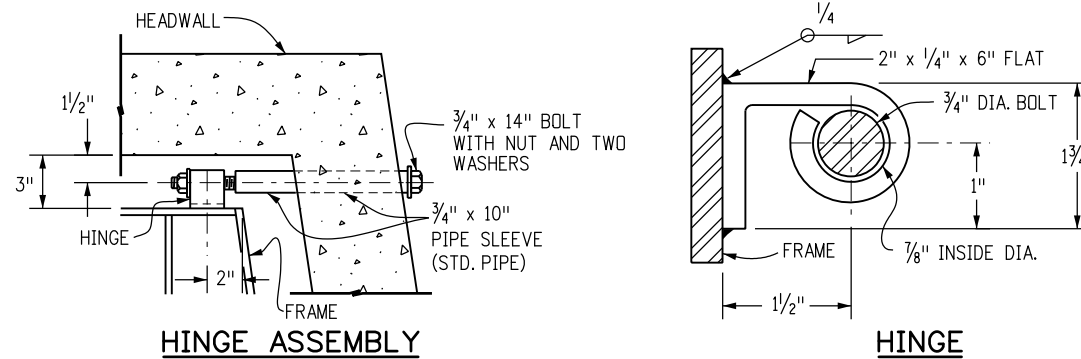
QUANTITIES FOR ONE HEADWALL AFTER DEDUCTION FOR PIPE.

**GENERAL NOTES**

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



**TRASH GUARD DETAILS**

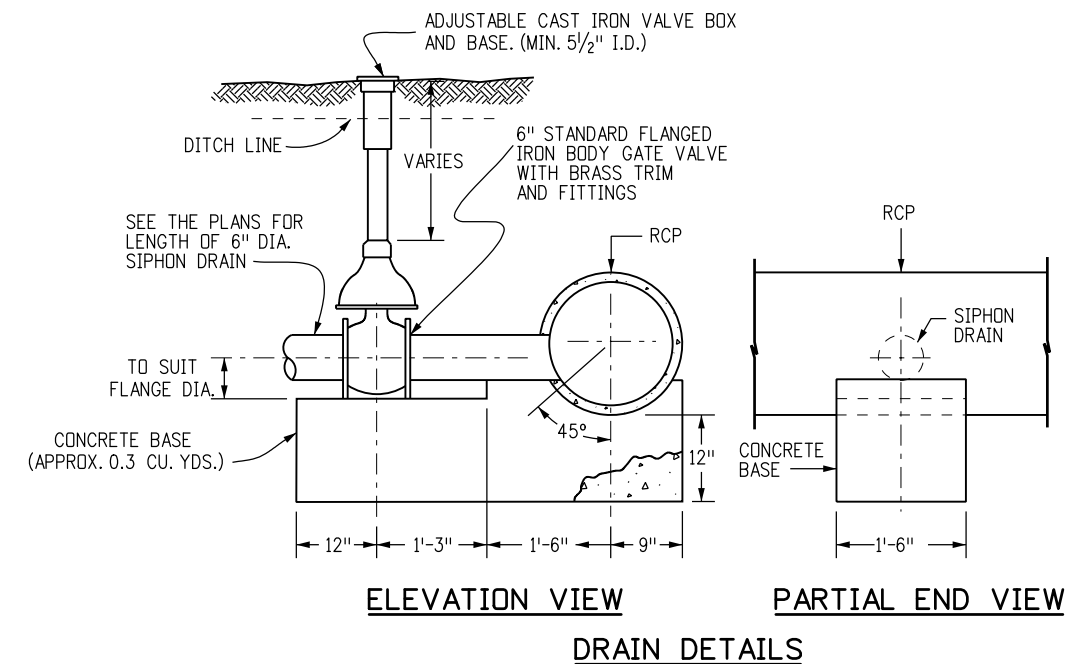


**HINGE ASSEMBLY**

**HINGE**

PIPE DIAMETER INCHES	BAR AND BRACE SIZE	NO. OF BRACES EACH	DIMENSIONS			WEIGHT LBS.
			J	K	M	
12	3/8" x 2"	1	1'-0"	1'-6"	2'-6"	35.1
18	3/8" x 2"	1	1'-7"	2'-6"	3'-10"	74.4
24	3/8" x 2"	1	2'-2"	3'-6"	5'-2"	120.5
30	3/8" x 2 1/2"	2	2'-9"	4'-6"	6'-6"	235.9
36	3/8" x 2 1/2"	2	3'-4"	5'-6"	7'-10"	317.6

**TRASH GUARD DIMENSIONS AND QUANTITIES**



**ELEVATION VIEW**

**PARTIAL END VIEW**

**DRAIN DETAILS**

**Computer File Information**

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**Sheet Revisions**

Date:	Comments

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 Project Development Branch JBK

**INVERTED  
SIPHON**

Issued by the Project Development Branch: July 31, 2019

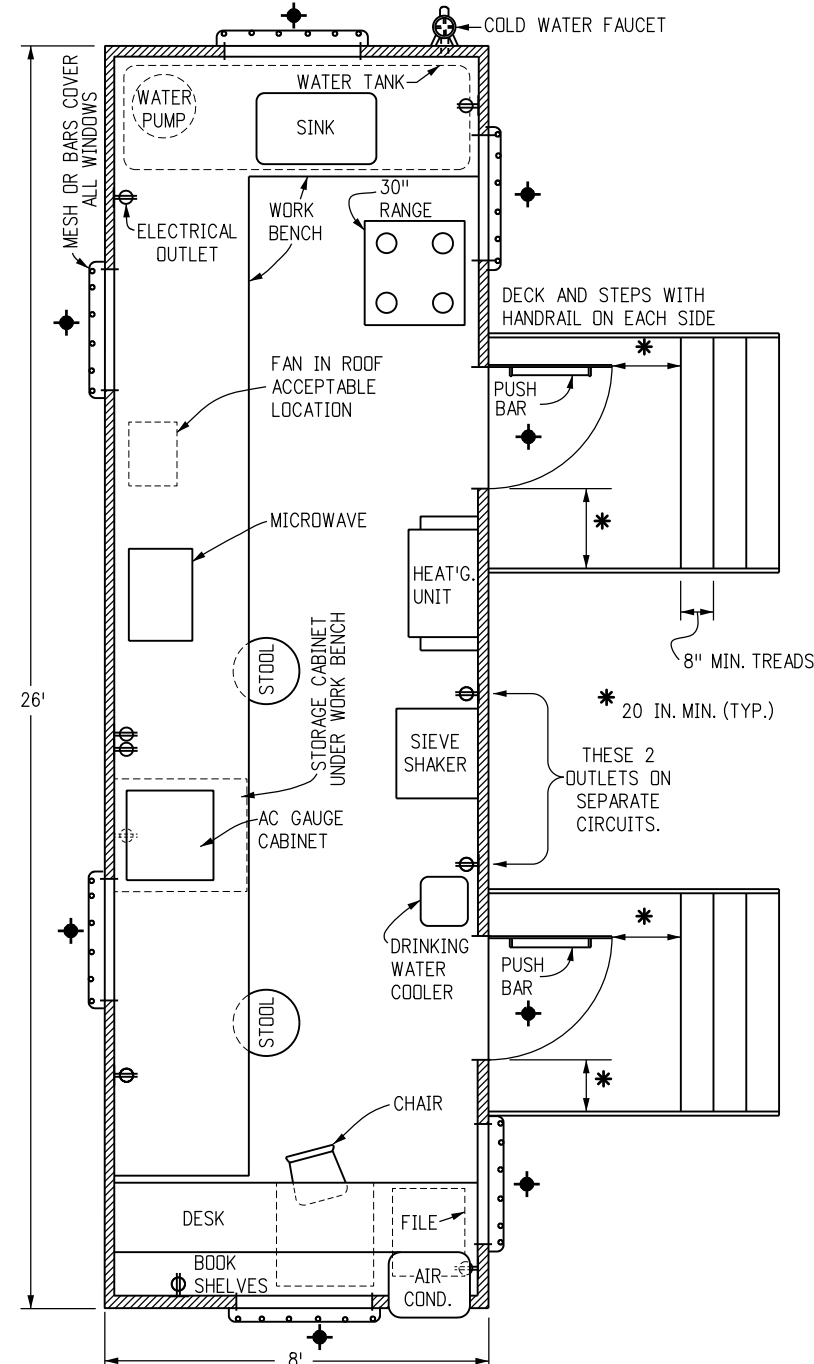
STANDARD PLAN NO.

M-616-1

Standard Sheet No. 1 of 1

Project Sheet Number:

**GENERAL NOTES**




**FLOOR PLAN**

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 1/2 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.

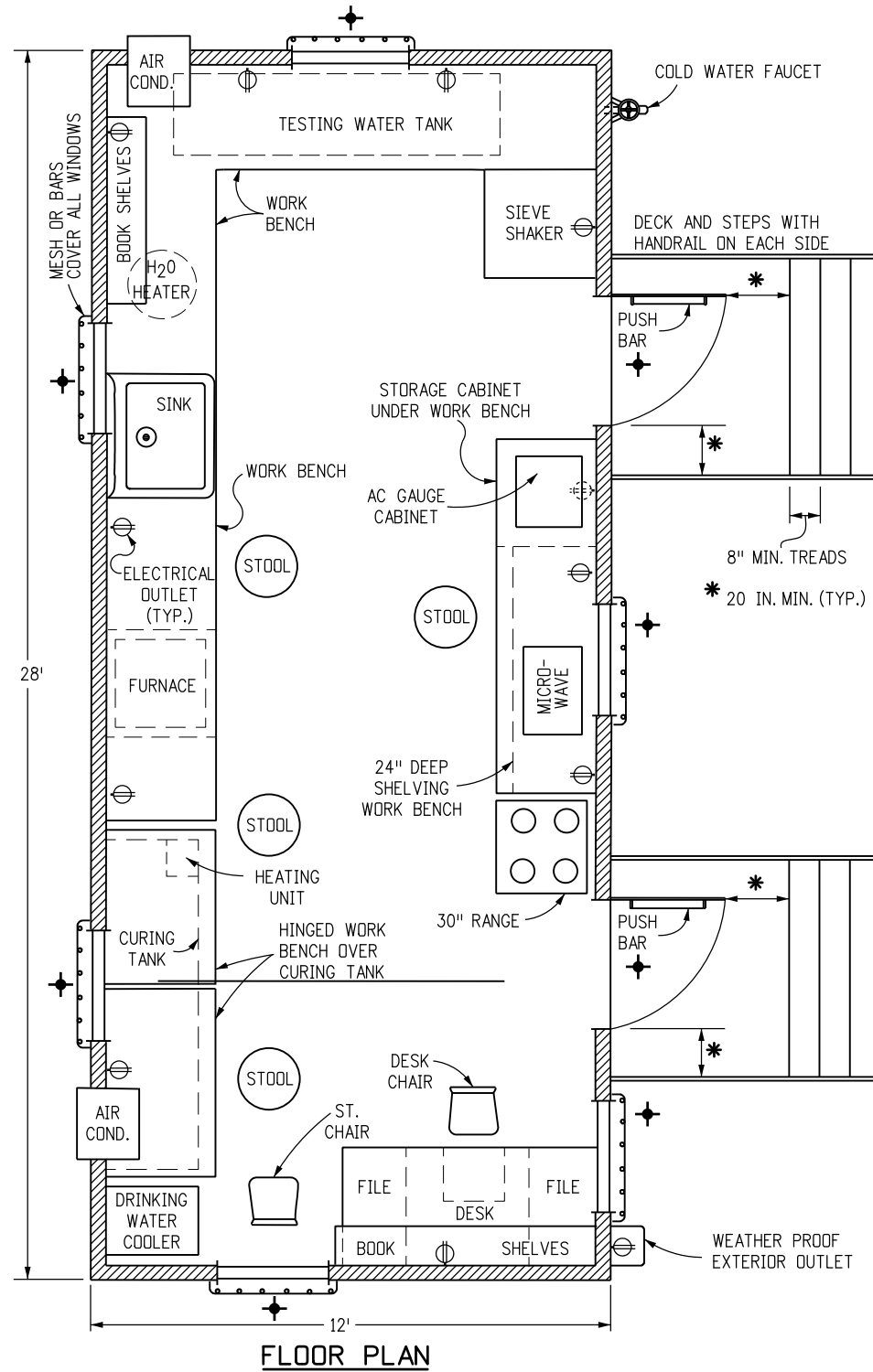
THE SHAKER SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES AS WELL AS 12 IN. SIEVES, AND SHALL BE MOUNTED 24 IN. ABOVE THE FLOOR IN A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

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.
    - WEIGHING MODES: GRAMS, POUNDS, AND PERCENT OF TARGET MASS (WEIGHT).
    - WEIGHING SURFACE DIMENSION: MINIMUM OF 9 IN. WIDE BY 12 IN. DEEP.
    - 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 CDDT 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.

<b>Computer File Information</b>		<b>Sheet Revisions</b>		 Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>FIELD LABORATORY CLASS 1</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-620-1	
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English				JBK	Issued by the Project Development Branch: July 31, 2019	Project Sheet Number:	

**GENERAL NOTES**



**FLOOR PLAN**

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 6 1/2 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 RD-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 CDDT 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.

<b>Computer File Information</b>		<b>Sheet Revisions</b>	<b>Colorado Department of Transportation</b>	<b>FIELD LABORATORY</b>		<b>STANDARD PLAN NO.</b>
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Designer Initials: JBK	(R-X)	Comments:	CDDT HQ, 3rd Floor			Standard Sheet No. 1 of 2
Last Modification Date: 07/31/19	(R-X)		Denver, CO 80204			
Detailer Initials: LTA	(R-X)		Phone: 303-757-9021 FAX: 303-757-9868			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		<b>Project Development Branch</b>	<b>JBK</b>		Project Sheet Number:
						Issued by the Project Development Branch: July 31, 2019

**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.

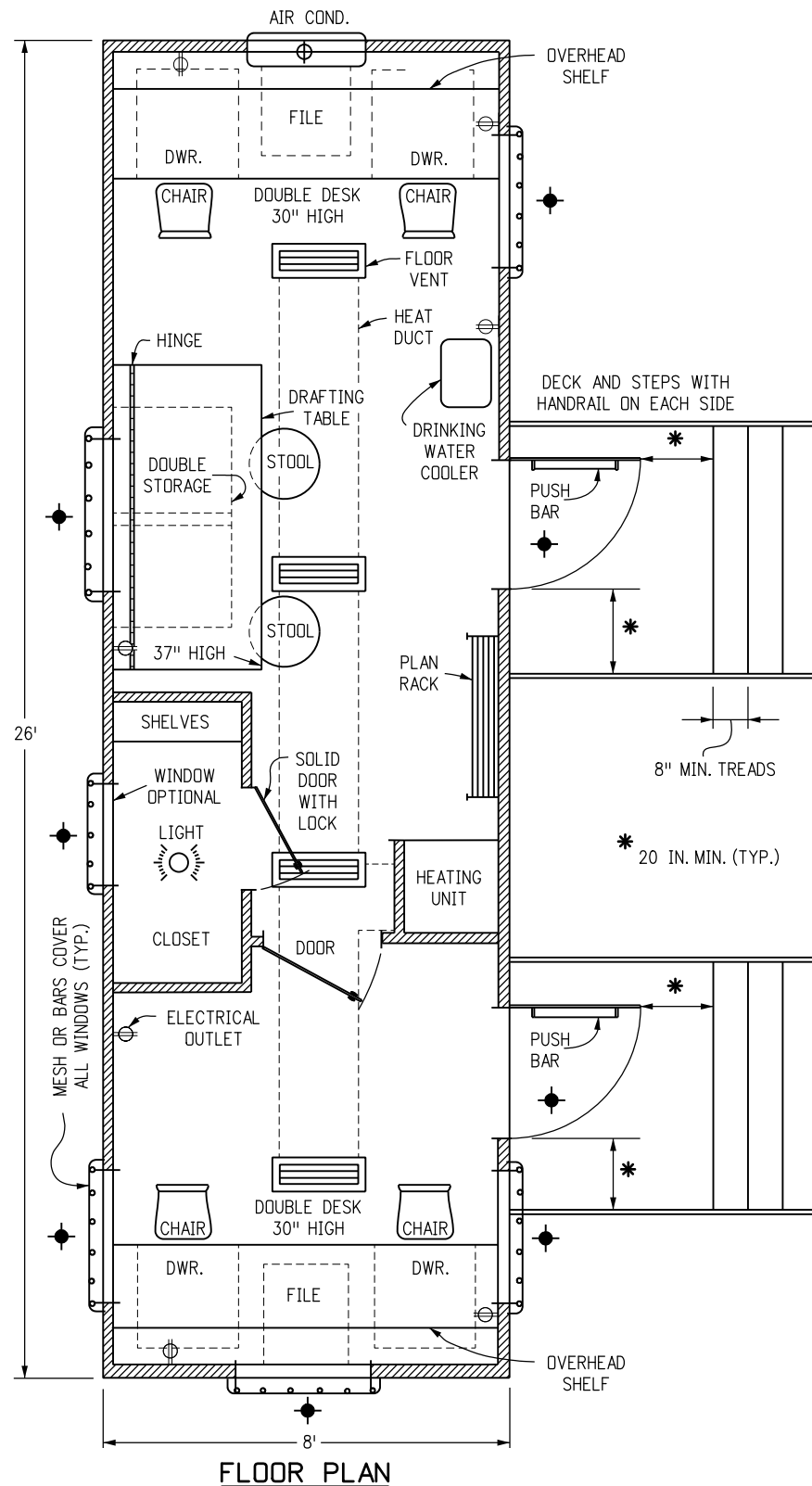
IN ADDITION TO THE ABOVE FORCED AIR CONVECTION OVEN, A HOT PLATE CONFORMING TO THE FOLLOWING SHALL BE PROVIDED:

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.

<b>Computer File Information</b>		<b>Sheet Revisions</b>		 Colorado Department of Transportation 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868 <b>Project Development Branch</b>	<b>FIELD LABORATORY CLASS 2</b>	<b>STANDARD PLAN NO.</b>	
Creation Date: 07/31/19		Date:	Comments			M-620-2	
Designer Initials: JBK		(R-X)				Standard Sheet No. 2 of 2	
Last Modification Date: 07/31/19		(R-X)					
Detailer Initials: LTA		(R-X)					
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### 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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Sheet Revisions	
Date:	Comments


Colorado Department of Transportation  
 2829 West Howard Place  
 CDDT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch **JBK**

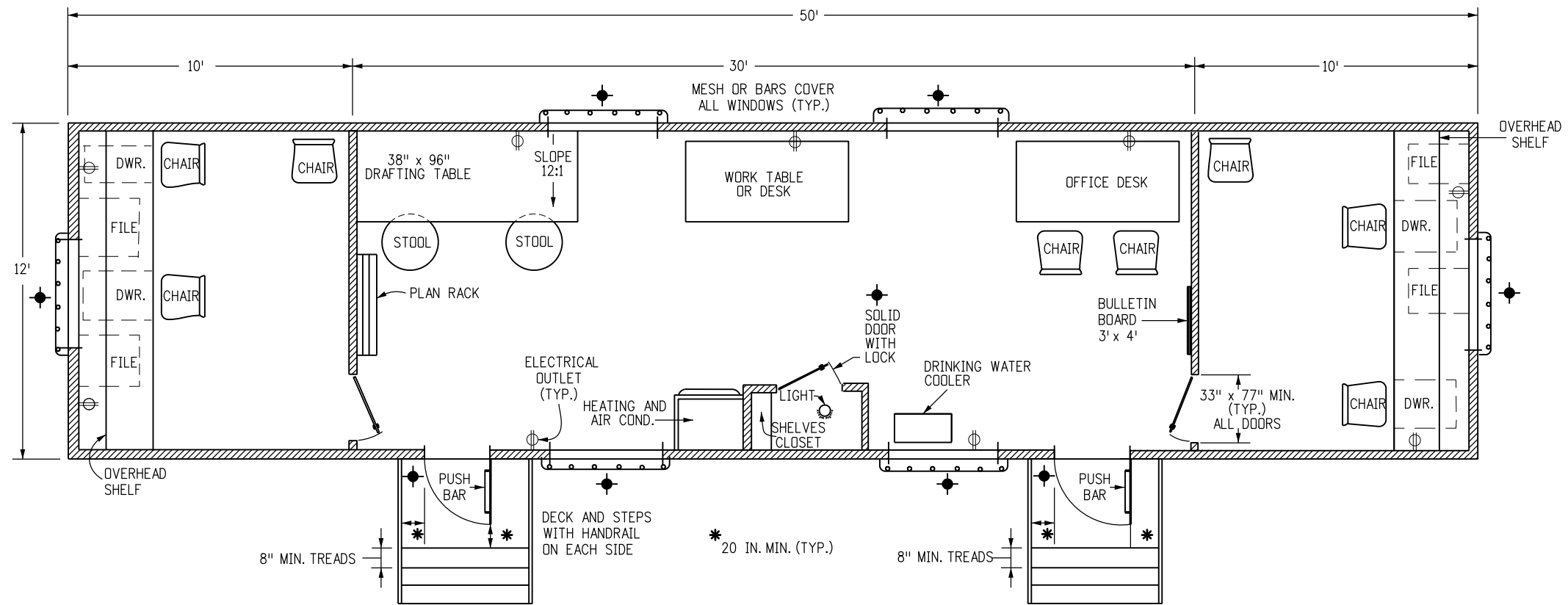
**FIELD OFFICE  
CLASS 1**

Issued by the Project Development Branch: July 31, 2019

STANDARD PLAN NO. M-620-11
Standard Sheet No. 1 of 1
Project Sheet Number:

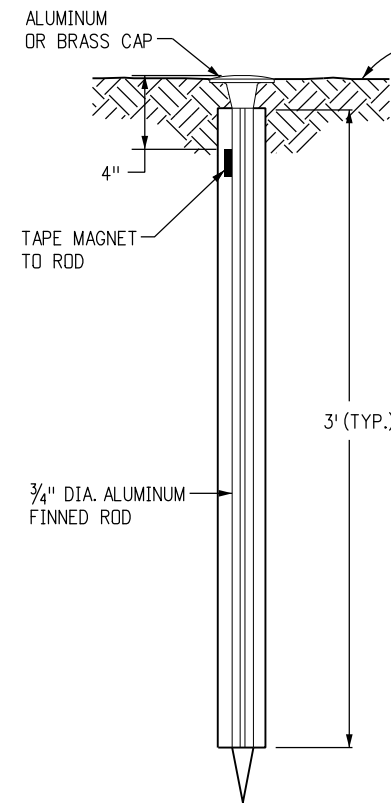
### GENERAL NOTES

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 (1FB) 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.

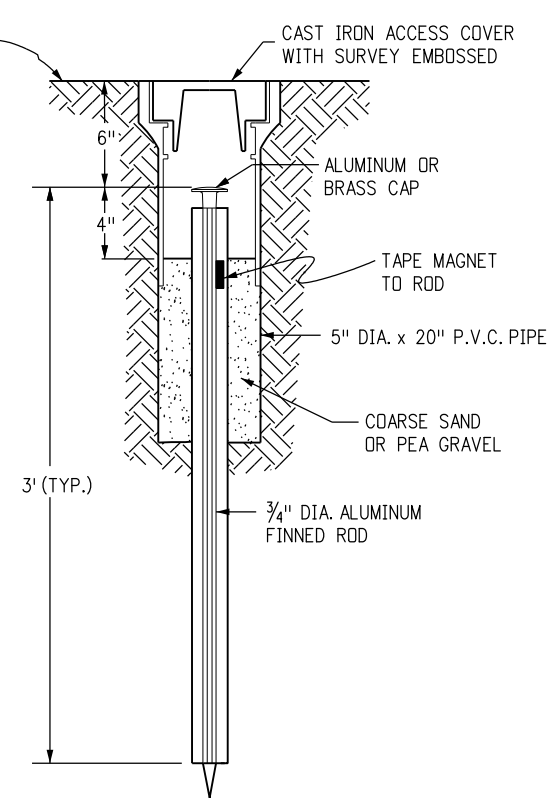


**FLOOR PLAN**

<b>Computer File Information</b>		<b>Sheet Revisions</b>	<b>Colorado Department of Transportation</b>	<b>FIELD OFFICE CLASS 2</b>		<b>STANDARD PLAN NO.</b>
Creation Date: 07/31/19		Date: _____	 2829 West Howard Place CDDT HQ, 3rd Floor Denver, CO 80204 Phone: 303-757-9021 FAX: 303-757-9868			M-620-12
Designer Initials: JBK	(R-X)	Comments: _____				Standard Sheet No. 1 of 1
Last Modification Date: 07/31/19	(R-X)					
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)			<b>Project Development Branch</b>	<b>JBK</b>	
				Issued by the Project Development Branch: July 31, 2019		

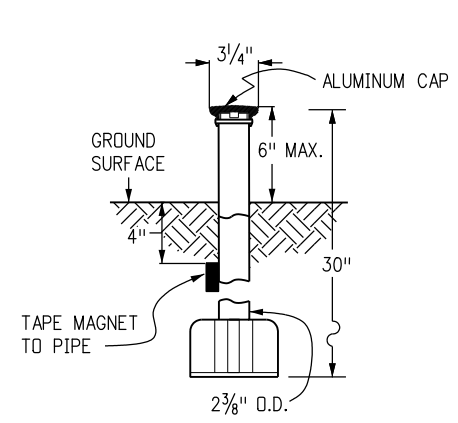


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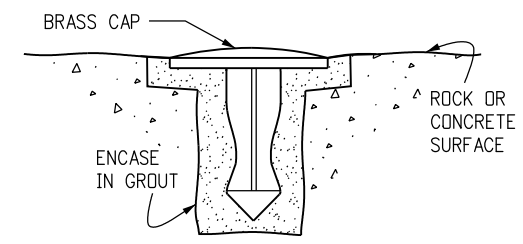


**TYPE 1A MONUMENT**

INCLUDES MONUMENT BOX

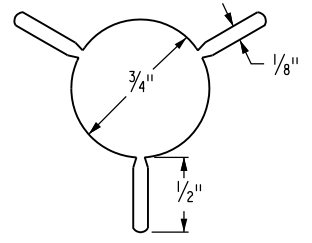


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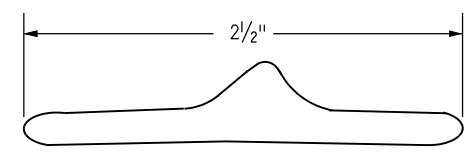


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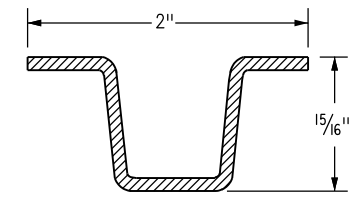
ALUMINUM CAP AND TYPE 5(S) DETAILS SHOWN ON SHEET 2



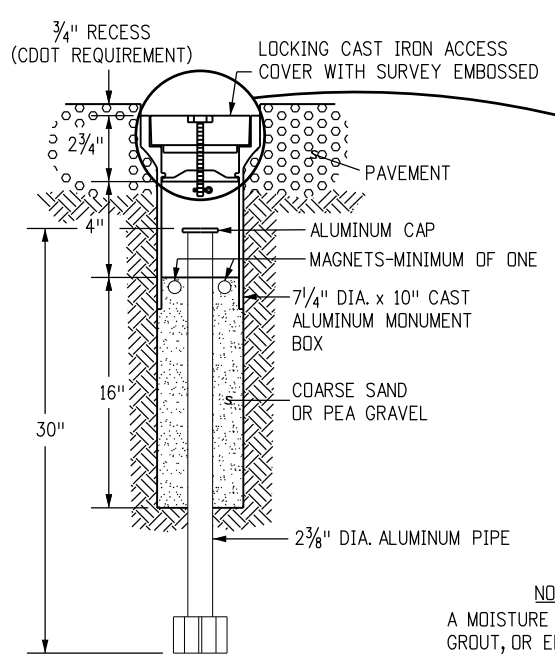
**SECTION A-A**



**SECTION B-B**

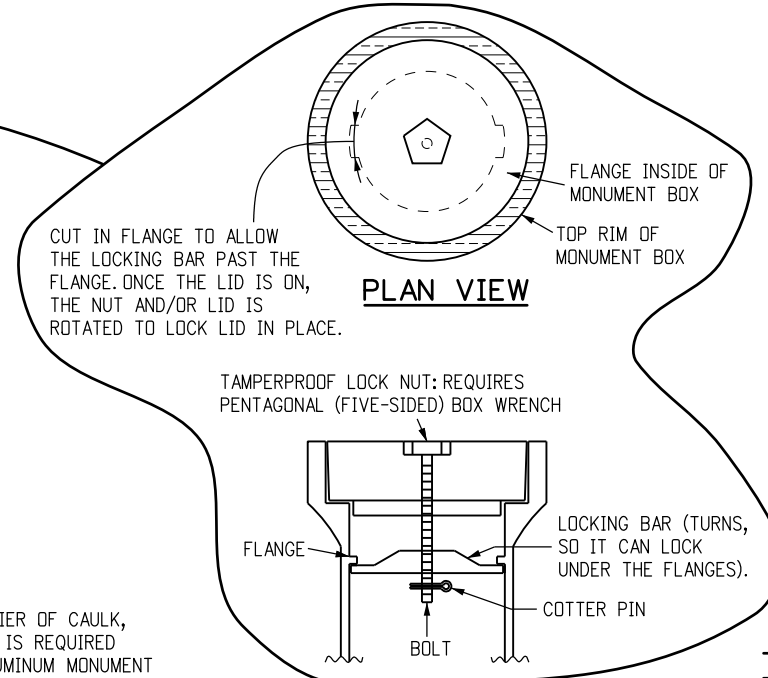


**DELINEATOR POST SECTION C-C**



**TYPE 3A MONUMENT**

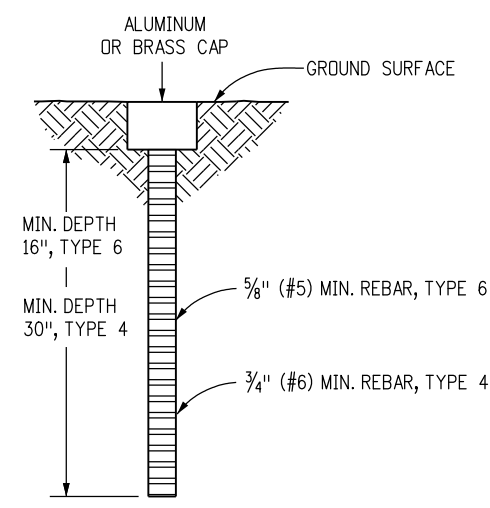
ROADWAY INSTALLATION INCLUDES MONUMENT BOX



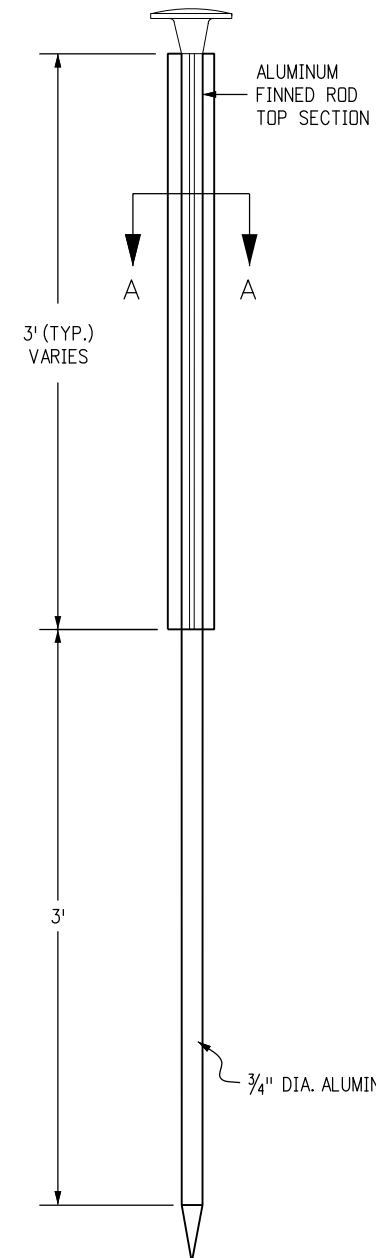
**PLAN VIEW**

**LOCKING CAST IRON ACCESS COVER**

NOTE:  
A MOISTURE BARRIER OF CAULK, GROUT, OR EPOXY IS REQUIRED BETWEEN THE ALUMINUM MONUMENT BOX AND THE PAVEMENT.

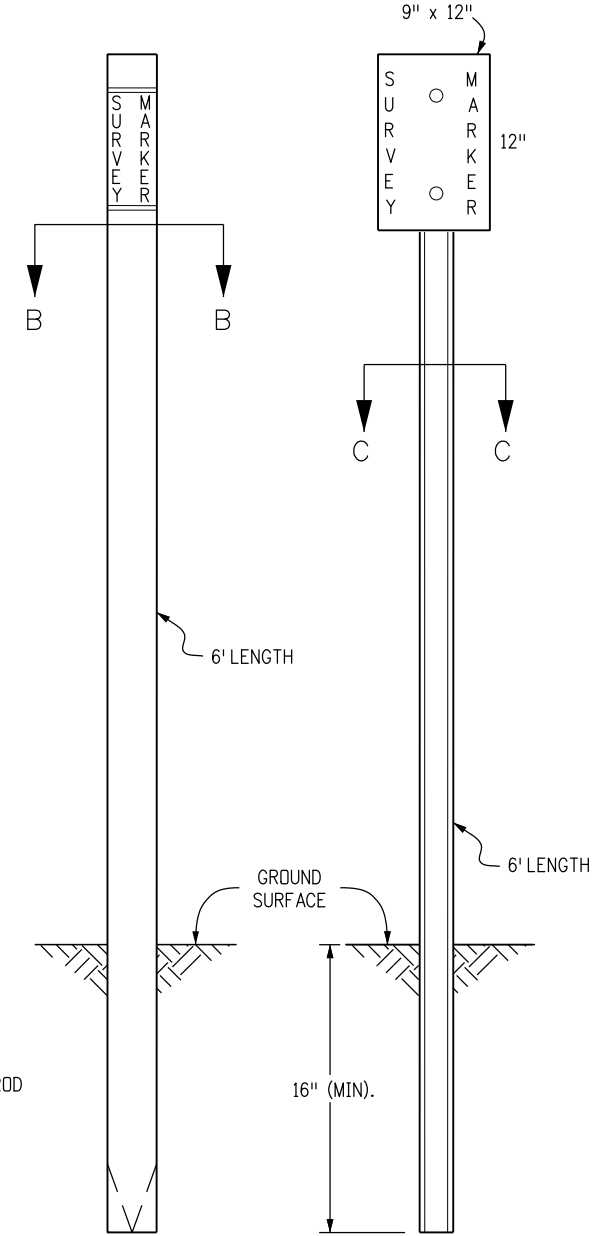


**TYPE 4 AND TYPE 6 MONUMENT**



**TYPE 2 MONUMENT**

TYPE 2A INCLUDES MONUMENT BOX



**WITNESS POSTS**

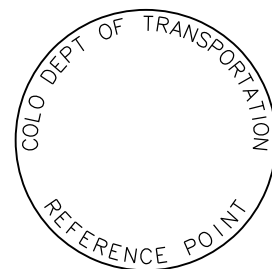
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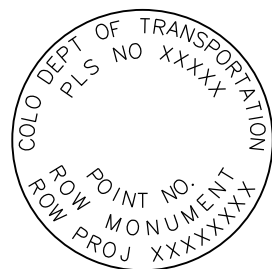
Colorado Department of Transportation  
 2829 West Howard Place  
 CDOT HQ, 3rd Floor  
 Denver, CO 80204  
 Phone: 303-757-9021 FAX: 303-757-9868  
 Project Development Branch JBK

**SURVEY MONUMENTS**  
 Issued by the Project Development Branch: July 31, 2019

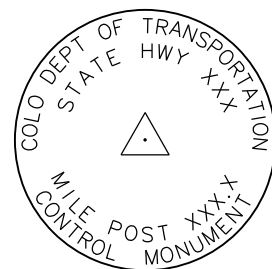
STANDARD PLAN NO.  
**M-629-1**  
 Standard Sheet No. 1 of 2  
 Project Sheet Number:



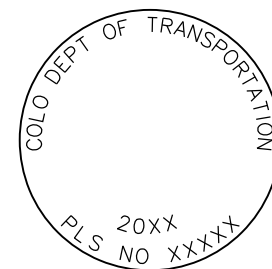
**REFERENCE MONUMENT CAP**



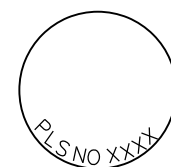
**ROW MONUMENT CAP**



**CONTROL MONUMENT CAP**

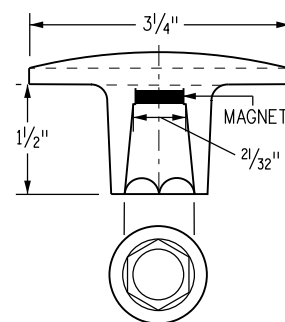


**ALIQUOT CORNER MONUMENT CAP**

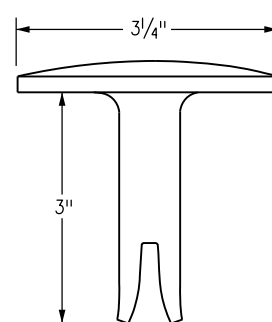


**ALUMINUM CAP**

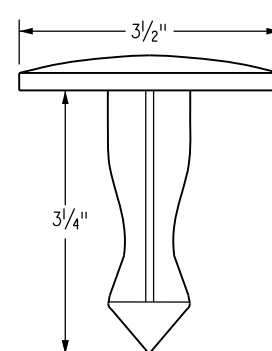
NOTE: A BLANK CAP MAY BE SUBSTITUTED IF THE APPROPRIATE CAP SHOWN ABOVE IS NOT AVAILABLE. IF A BLANK CAP IS USED, ALL INFORMATION NORMALLY INCLUDED ON THE APPROPRIATE STANDARD CAP, SHALL BE STAMPED ON THE BLANK CAP ALONG WITH SPECIFIC PROJECT INFORMATION SUCH AS PROJECT NO., DATE, POINT NO., ETC..



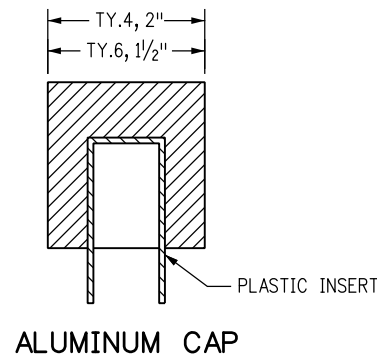
**ALUMINUM CAP USED WITH ALUMINUM ROD**



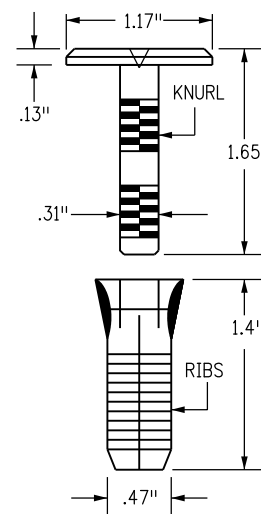
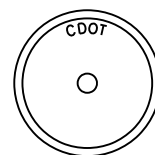
**ALUMINUM CAP TYPE 5 FOR PLACING IN EXISTING CONCRETE OR ROCK**



**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**

**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 3/4 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 3/4 IN. DIA. ROD, THEN DRIVING THE ROD AT LEAST 30 IN. INTO THE GROUND. ADDITIONAL 3 FT. LONG X 3/4 IN. FINNED ROD SECTIONS SHALL BE ADDED AND DRIVEN FLUSH WITH THE GROUND UNTIL THE MONUMENT IS IN A STABLE POSITION. THE FINNS 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 3/4 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 1/2 IN., SHALL BE USED ON 5/8 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.

**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		

**Computer File Information**

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

**Sheet Revisions**

Date:	Comments

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**STANDARD PLAN NO.**

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**Standard Sheet No. 2 of 2**

Project Sheet Number: