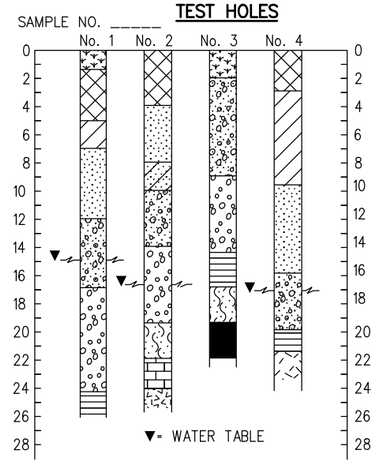
LEGEND

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

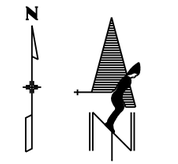
TEST HOLES



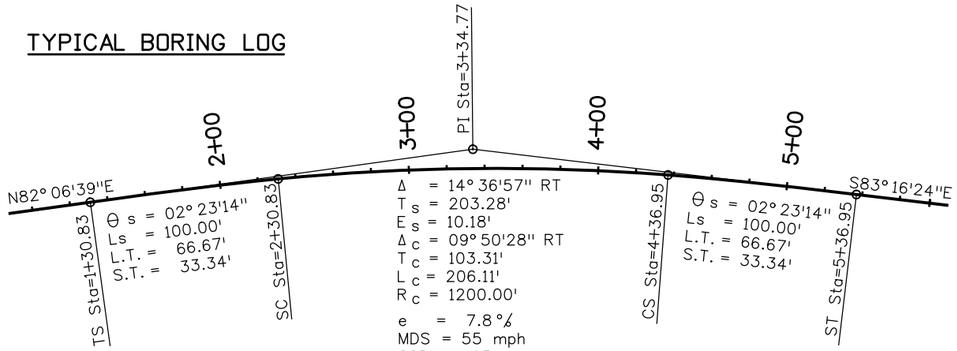
COMPOSITE MATERIALS ARE REPRESENTED BY COMBINATIONS OF THE ABOVE SYMBOLS, SUCH AS:

- SANDY CLAY

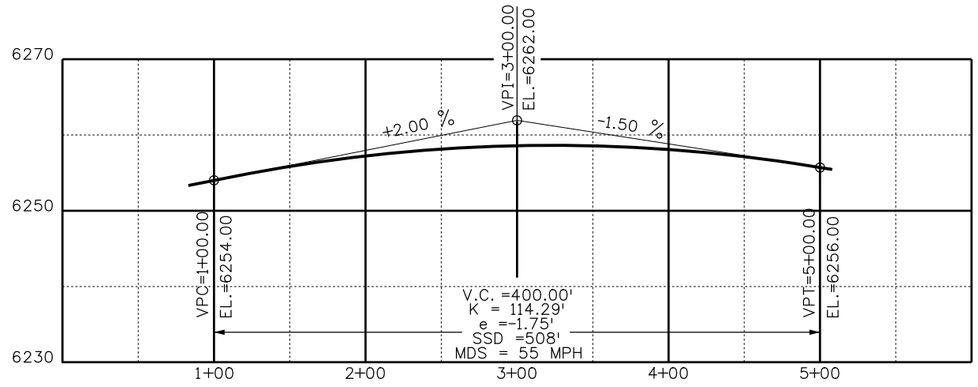
TYPICAL BORING LOG



NORTH ARROW



TYPICAL HORIZONTAL CURVE



TYPICAL VERTICAL CURVE

TERRAIN SINGLE SHOTS

TOP OF CUT

TOE OF FILL

TERRAIN

GRAVEL ROAD OR DRIVEWAY

INTERNATIONAL SYMBOL OF ACCESS

SIDEWALK WITH RAMP

EDGE OF PAVEMENT

CENTERLINE OF DIRT ROAD

ROADWAY

SECTION CORNER

QUARTER, SIXTEENTH, AND SECTION CORNERS

PROTECT EXISTING MARKER

SET EASEMENT MONUMENT

TEMPORARY EASEMENT POINT

RIGHT OF WAY MARKER

BLM MARKER

PP PROPERTY PIN

NOAA MARKER

QUARTER, SIXTEENTH, AND SECTION CORNERS

FED FEDERAL MONUMENT

WC WITNESS CORNER

BM BENCH MARK

USGS MARKER

LOCAL OR PLSS MONUMENT

SECONDARY CONTROL MONUMENT

ROW RIGHT OF WAY MARKER

N 9.88
E 3.81
EL 0.00
PROJECT CONTROL MONUMENT

N 10.13
E 3.81
EL 0.00
DENSIFICATION CONTROL MONUMENT

N 10.38
E 3.81
EL 0.00
HIGH ACCURACY REFERENCE NETWORK CONTROL MONUMENT

PERMANENT, PROPERTY, SLOPE, & UTILITY EASEMENT LINE

TEMPORARY EASEMENT LINE (EXISTING)

PROPERTY BOUNDARY LINE (EXISTING AND PROPOSED)

ACCESS CONTROL LINE

BARRIER ACCESS CONTROL LINE

RIGHT OF WAY LINE

VIRGIN RIGHT OF WAY LINE (PROPOSED)

CITY LIMIT LINE (EXISTING)

COUNTY LINE (EXISTING)

QUARTER SECTION LINE

SECTION LINE

SIXTEENTH SECTION LINE

STATE LINE (EXISTING)

TOWNSHIP LINE (EXISTING)

SURVEY/ROW

GENERAL NOTES

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

BACK OF CURB
TOP OF CURB
FLOW LINE (FL)
EDGE OF PAVEMENT

CURB AND GUTTER

CURB AND GUTTER-TYPE 2, 4 OR 6

GUTTER

CURB CUT

CURB, GUTTER OR OTHER

CURB AND GUTTER

GUARDRAIL END ANCHOR

GUARD POST

GUARDRAIL-TYPE 3 OR 6

GUARDRAIL-TYPE 4 OR 7

GUARDRAIL-TYPE 5 OR HANDRAIL

GUARDRAIL-TYPE 3A DOUBLE OR TYPE 6 DOUBLE

CABLE BARRIER

GUARDRAIL

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STANDARD SYMBOLS

Issued By: Project Development Branch November 1, 2018

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ROCK, MASONRY OR MECHANICALLY STABILIZED WALL (FACE)

BRIDGE CURB

BRIDGE RAIL

BRIDGE RAIL-TYPE 3A

FLOW LINE CBC

STRUCTURES MISCELLANEOUS

STRUCTURE

MISCELLANEOUS BUILDING STRUCTURE (PRIMARY)

MISCELLANEOUS STRUCTURE (SECONDARY)

FOUNDATION OR PAD (CONCRETE OR BLOCK)

BUILDING STRUCTURES

RR TELEGRAPH POLE

RR SWITCH

RR GUY POLE

RR SIGNALS WITH OR WITHOUT GATE

RR CROSS BUCK SIGN

RR SIGNAL CONTROLLER CABINET

RR MISCELLANEOUS SYMBOL

RR TRACK CENTERLINE

RAILROAD

BOULDER UNDER 6FT

GEOLOGY MISC SYMBOL

MINESHAFT SYMBOL

ROCK OUTCROP

BOULDER FIELD OR ROCK OVERHANG

GEOLOGY

COMBINATION WIRE FENCE WITH GATE

CHAIN LINK FENCE WITH GATE

BARBED WIRE FENCE WITH GATE

SOUND OR BARRIER FENCE WITH GATE

DEER FENCE WITH GATE

WOOD FENCE WITH GATE

SNOW FENCE WITH GATE

PF PF PF PF PF PF PF

PLASTIC FENCE

SF SF SF SF SF SF SF

SILT FENCE

DEBRIS FENCE

FENCE

MISCELLANEOUS TREES

DECIDUOUS TREE

DECIDUOUS SHRUB

TEETER TOTTER SYMBOL

SWING SET SYMBOL

CONIFEROUS TREE

CONIFEROUS SHRUB

BENCH

SPRINKLER HEAD

TREES GROVE

HEDGE OR SHRUB GROVE

EDGE OF WETLANDS

LANDSCAPING

HAZARD WASTE MONITORING WELL

ENVIRONMENTAL CONCERN SITE

EROSION LOG

ROCK CHECK DAM

CONCRETE WASHOUT STRUCTURE

DROP INLET EROSION PROTECTION

TEMPORARY BERM

SOIL RETENTION BLANKET

PIPE INLET EROSION PROTECTION

RIGID INLET PROTECTION

STORM DRAIN INLET PROTECTION

EROSION CHECK

EROSION LOG DITCH CHECK

SILT DIKE

SEDIMENT TRAP/ DEWATERING STRUCTURE

EXISTING WETLAND PATTERN

TEMPORARY SLOPE DRAIN

STABILIZED CONSTRUCTION ENTRANCE

LDA LDA LDA LDA LDA LDA

LIMITS OF DISTRUBED AREA

ENVIRONMENTAL CONCERN

HAZARDOUS WASTE SITE

NW NW NW NW

NOXIOUS WEED

FLOW ARROW

ENVIRONMENTAL

SA SA

SANITARY SEWER MANHOLE

SANITARY SEWER MISCELLANEOUS SYMBOL

SIZE, MATERIAL, OWNER

SANITARY SEWER PIPE

SANITARY SEWER PIPE MISCELLANEOUS

SANITARY SEWER

METAL CONCRETE

PIPE WITH END SECTION

HEADWALL

PIPE MISCELLANEOUS

PIPES

CHECK DAM UNDER 4 FT

HEADGATE 1

DIVERSION BOX SYMBOL

SPRING SYMBOL

FLOW GAUGE

MISCELLANEOUS WATERWAYS

DITCH WITH FLOW

EDGE OF WATER, CANALS, PONDS, STREAM OR RIVER

DITCHES AND WATERWAY

INLET TYPE 13

INLET TYPE C

INLET TYPE D

INLET VANE GRATE

INLET TYPE R XX FT LENGTH

ST ST

STORM SEWER MANHOLE

G

MANHOLE EXISTING

ST

STORM SEWER MISCELLANEOUS

STORM SEWER PIPE

STORM SEWER PIPE MISCELLANEOUS

STORM SEWER

W

WATER SPIGOT

WATER VALVE

W W

WATER MANHOLE

FIRE HYDRANT

WATER METER

W

WATER WELL SYMBOL

SIZE, MATERIAL, OWNER

W W W W W W W

WATER LINE

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

WATER MISCELLANEOUS LINE

WATER

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STANDARD SYMBOLS

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PROPANE TANK

GAS JUNCTION BOX

GAS VAULT

GAS LINE MARKER OR AIR VENT

GAS METER LOW PRESSURE

GAS METER HIGH PRESSURE

G GAS MISCELLANEOUS

GAS LIGHT

GAS VALVE HIGH OR LOW PRESSURE

G — G — G — G (SIZE) G — G — G — G

GAS LINE LOW PRESSURE

G — HP — G (SIZE) HP — G — HP — G

GAS LINE HIGH PRESSURE

PG — PG — PG — PG — PG — PG — PG

PROPANE GAS LINE

G? — G? — G? — G? — G? — G? — G?

GAS LINES MISCELLANEOUS

GAS

OIL METER HIGH AND LOW PRESSURE

OIL VALVE HIGH AND LOW PRESSURE

O OIL MISCELLANEOUS

O — O — O — O — O — O — O

OIL LINE LOW OR HIGH PRESSURE

O? — O? — O? — O? — O? — O? — O?

OIL MISCELLANEOUS LINE

OIL

GRAVE HEADSTONE SYMBOL

MAIL DROP BOX

FLAG POLE

TRASH BARREL POST

GRAVE SYMBOL

RADIO STATION ANTENNA

MISCELLANEOUS TOPOGRAPHY

MISCELLANEOUS TOPOGRAPHY

CAMPSITE MARKER

E TRAILER ELECTRIC HOOKUP

TRAILER DUMP STATION

CAMPFIRE RING

S TRAILER SEWER INLET

W TRAILER WATER HOOKUP

CAMPSITE GRILL

CAMPSITE TABLE

CAMPING

LIGHT STANDARD

HIGH MAST LIGHT STANDARD

SPOT OR FLOOD LIGHT

LIGHTING

ELECTRICAL PEDESTAL OR PULL BOX

TRANSMISSION TOWER

WIND POWERED GENERATOR

RELOCATED LIGHT STANDARD

DECORATIVE LIGHT STANDARD

CATENARY POLE FOUNDATION

E ELECTRICAL MANHOLE

POWER POLE

TRANSFORMER ON POLE

E ELECTRICAL OUTLET

E ELECTRICAL MISCELLANEOUS

GUY WIRE

ELECTRICAL VAULT OR TRANSFORMER

GUY POST

FIRE ALARM BOX

E — E — E — E — E — E — E

ELECTRICAL UNDERGROUND LINE

E — OH — E — OH — E — OH — E

ELECTRICAL OVERHEAD LINE

ELECTRICAL MISCELLANEOUS LINE

ELECTRICAL

CABLE TV POLE

CABLE TV RISER

COMBINATION POLE-POWER,TELEPHONE

TV ANTENNA

TV MISCELLANEOUS

TV MANHOLE

TV — TV — TV — TV — TV — TV — TV

TV UNDERGROUND CABLE

TV — OH — TV — OH — TV — OH — TV

TV OVERHEAD CABLE

TV? — TV? — TV? — TV? — TV? — TV? — TV?

TV MISCELLANEOUS CABLE

TELEVISION

TELEPHONE GUY POLE

FIBER OPTIC CABLE MARKER

T TELEPHONE MANHOLE

COMBINATION POLE-POWER

T TELEPHONE MISCELLANEOUS

COMBINATION GUY POLE-POWER

T — T — T — T — T — T — T

TELEPHONE UNDERGROUND CONDUIT OR CABLE

FO — FO — FO — FO — FO — FO — FO

FIBER OPTICS UNDERGROUND CABLE

T — OH — T — OH — T — OH — T

TELEPHONE OVERHEAD LINE

T? — T? — T? — T? — T? — T? — T?

TELEPHONE MISCELLANEOUS LINE

TELEPHONE

FIBER MARKER DOME

FIBER MARKER SLATE

RWIS - REMOTE WEATHER SENSOR

VMS-BUTTERFLY

VMS-GROUND

VMS-CANTILEVER

VMS-SIGN BRIDGE

ITS — ITS — ITS — ITS — ITS — ITS — ITS

ITS CONDUIT

INTELLIGENT TRANSPORTATION SYSTEM

CENTER YELLOW SOLID DOUBLE

CENTER YELLOW SOLID BROKEN (NO PASS)

4 INCH WIDE

8 INCH WIDE

LANE LINE BROKEN

LANE DROP

CHANNELIZING OR EDGE LINE

4 INCH WIDE

8 INCH WIDE

DOTTED BROKEN

STOP LINE

- INTERNATIONAL SYMBOL OF ACCESS

R R - RAILROAD CROSSING

- BICYCLE PED ACCESS

TRAFFIC STRIPING

TRAVEL DIRECTION

BARRIER LIGHT

FLAGGER

G B CRY R Y DELINEATOR-TYPE I

SEQUENCING ARROW PANEL

FLASHING BEACON

CRY-R BK2BK Y-R BK2BK Y-Y BK2BK Y-Y BK2BK CRY-CRY CRY-CRY BK2BK DELINEATOR-TYPE II

CRY-CRY-R BK2BK Y-Y-R BK2BK Y-Y-Y BK2BK DELINEATOR-TYPE III

BUTTERFLY SIGN

HALF BUTTERFLY SIGN

IMPACT ATTENUATOR

SIGN ASSEMBLY

SINGLE POST SIGN

DOUBLE POST SIGN

SIGN-WITH FLASHING BEACON

ROAD CLOSURE GATE BEACON SYMBOL

ROAD CLOSURE GATE SYMBOL

DEER REFLECTORS

TRAFFIC CONTROL MISCELLANEOUS DEVICE

TRAFFIC CONTROL DEVICE

TRAFFIC CONTROL

SIGNAL SPAN WIRE POLE

DOUBLE MAST ARM POLE

LUMINAIRE

SIGNAL FACE

SIGNAL POLE WITH MAST ARM

SIGNAL FACE WITH BACKPLATE

SIGNAL CONTROLLER AND CABINET (4 FT)

TELEMETRY ANTENNA

PULL BOX

MICRODETECTOR

VIDEO DETECTION CAMERA

FIRE PREEMPTION UNIT AND TIMER

PEDESTRIAN SIGNAL FACE

PEDESTRIAN PUSH BUTTON

PEDESTAL POLE

PULL BOX SPECIAL

TR — TR — TR — TR — TR — TR — TR

TRAFFIC CONDUIT

TRAFFIC SIGNAL

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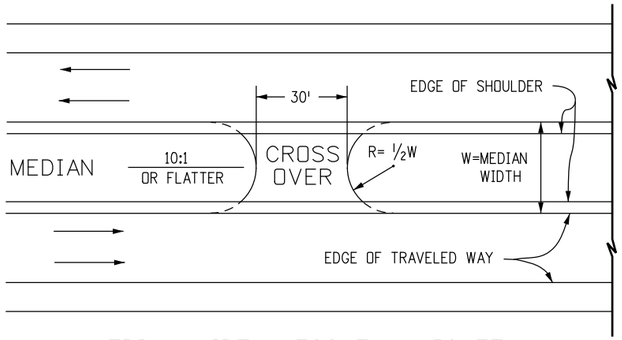
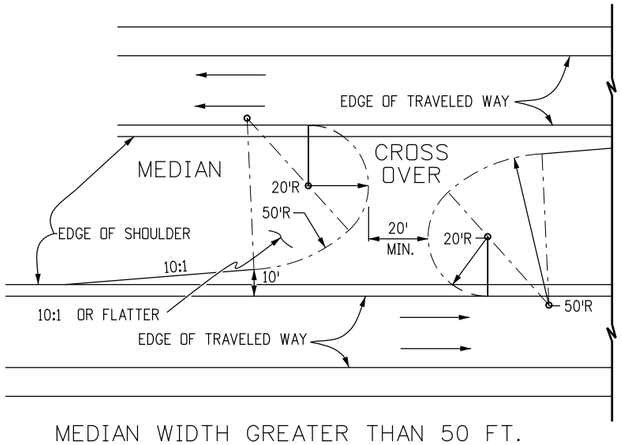
STANDARD SYMBOLS

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.
M-100-1
Sheet No. 3 of 3



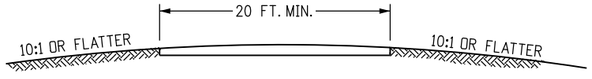
MEDIAN WIDTH LESS THAN 50 FT.



MEDIAN WIDTH GREATER THAN 50 FT.

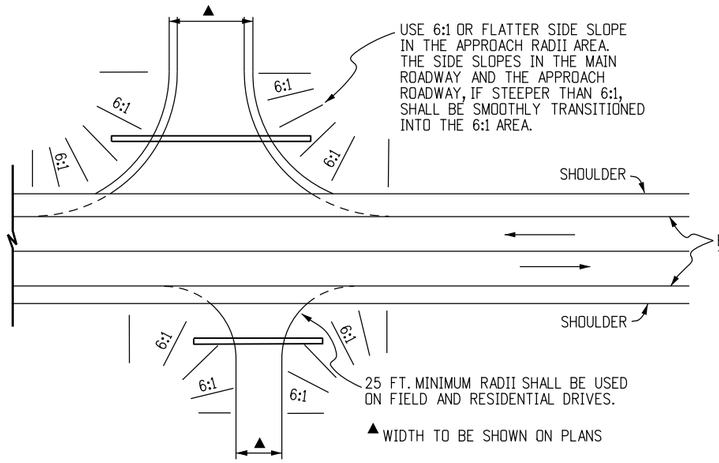
TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER

LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT



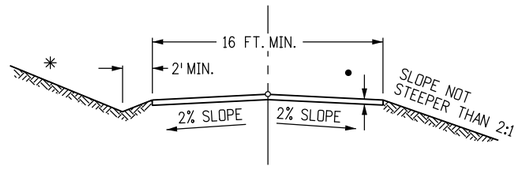
TYPICAL SECTION FOR MEDIAN CROSS OVER

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

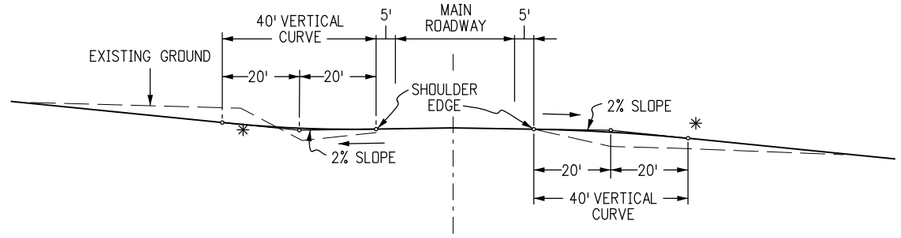


1/2 CUT SECTION 1/2 FILL SECTION

TYPICAL SECTION FOR APPROACH (ACCESS) ROAD

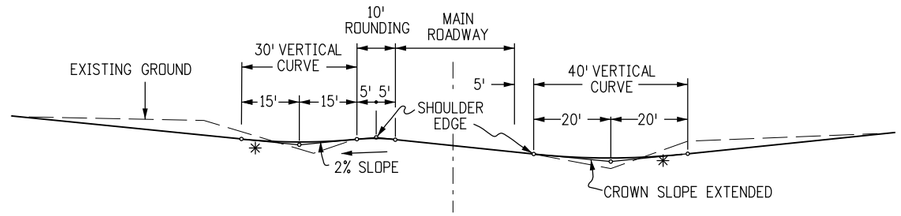
NOTE: ROAD APPROACHES WHICH REQUIRE HMA (ASPHALT) PAVEMENT SHALL BE PLACED AT THE FOLLOWING DISTANCES BACK FROM THE ROADWAY EDGE OF PAVEMENT:

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.

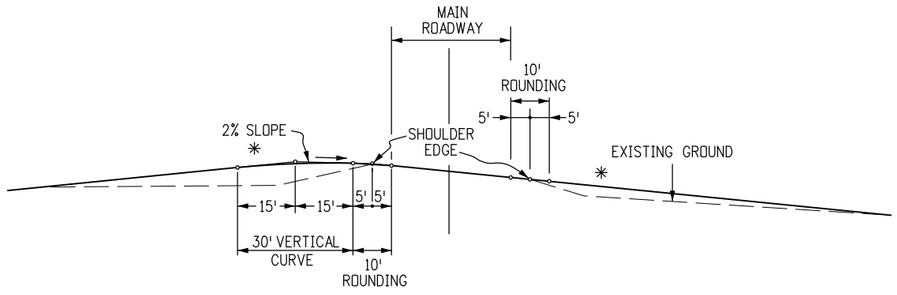


1/2 CUT SECTION 1/2 FILL SECTION

STANDARD CROWNED SECTION



SUPERELEVATED CUT SECTION



SUPERELEVATED FILL SECTION

VERTICAL ALIGNMENT SIDE APPROACH ROADS INTERSECTING MAIN ROADWAY

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

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Drawing File Name: 203010101.dgn	(R-X)		
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APPROACH ROADS

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-203-1
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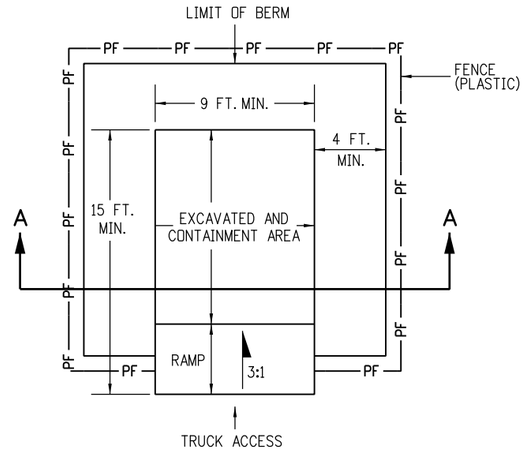
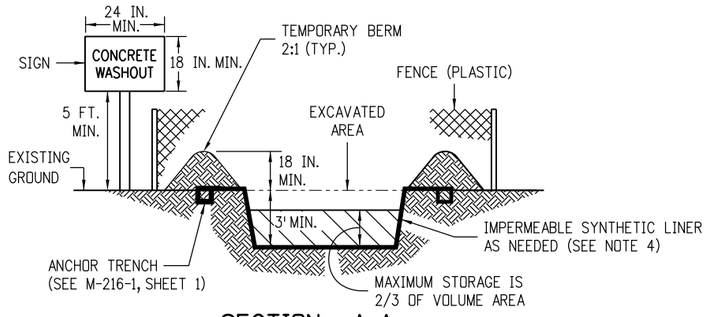


PLAN VIEW

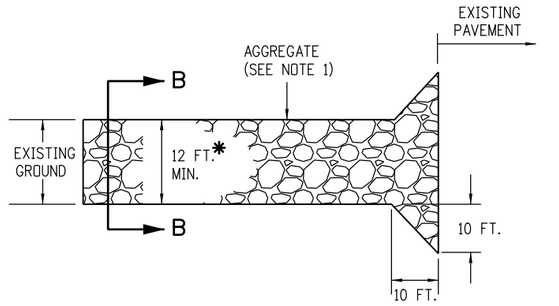


SECTION A-A

NOTES:

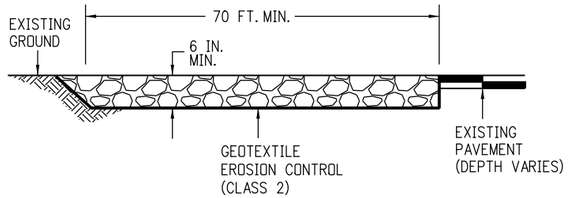
1. A FENCE (PLASTIC) CONFORMING TO SECTION 607 SHALL BE INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT AT THE OPENING.
2. THE CONCRETE WASHOUT SIGN SHALL HAVE LETTERS AT LEAST 3 INCHES HIGH AND CONFORM TO SUBSECTION 630.02.
3. ALL MATERIALS AND LABOR TO COMPLETE THE CONCRETE WASHOUT STRUCTURE SHALL 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

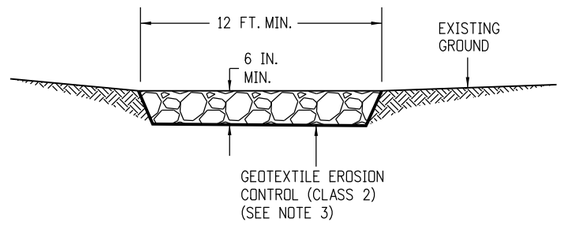


PLAN VIEW

* SHALL EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION.



ELEVATION SECTION



SECTION B-B

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

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Last Modification Date: 04/01/19 Initials: LTA	(R-X)	07/16/15	Deleted the two Soil Retention Blanket detail sheets. They are now standard M-216-1 Soil Retention Covering.
Full Path: www.codot.gov/business/designsupport	(R-X)	03/29/16	Minor revisions to some dimensions and General Notes.
Drawing File Name: 2080101011.dgn	(R-X)	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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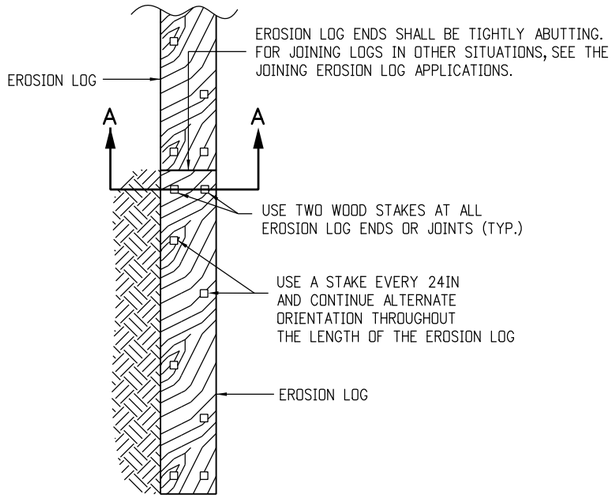
TEMPORARY EROSION CONTROL

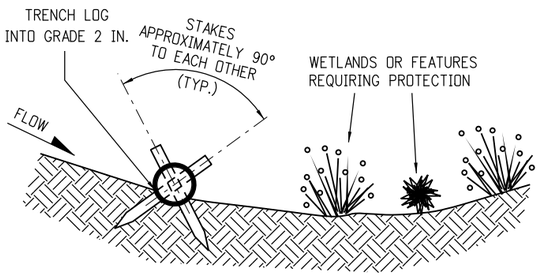
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

M-208-1



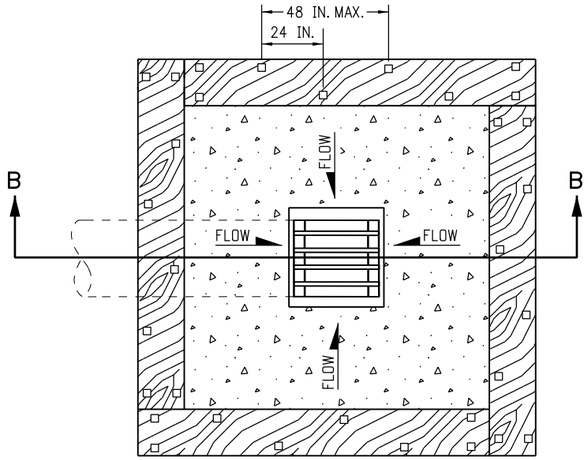
PLAN VIEW



SECTION A-A

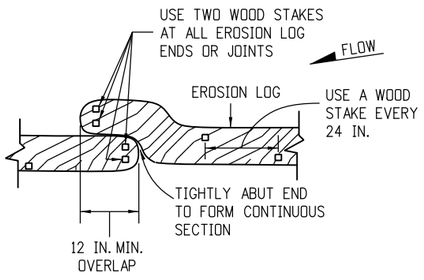
TYPICAL STAKE INSTALLATION

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.)

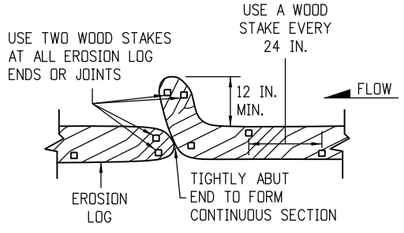


PLAN VIEW

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

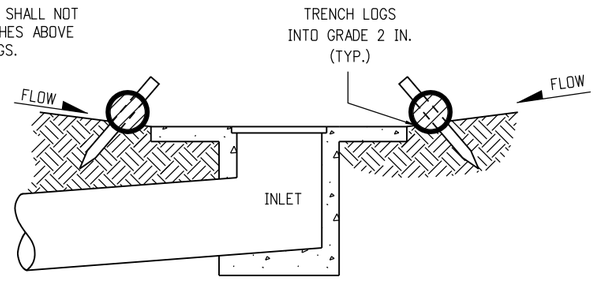


OVERLAP JOINING DETAIL



J-HOOK JOINING DETAIL

JOINING EROSION LOG APPLICATIONS



SECTION B-B

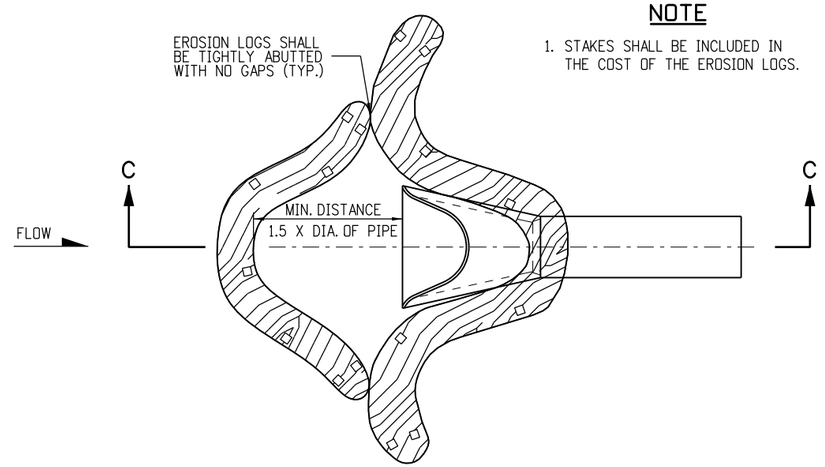
NOTE: LOCATE EROSION LOGS AT THE OUTSIDE EDGE OF THE CONCRETE APRON.

EROSION LOG FILTER AT DROP INLET

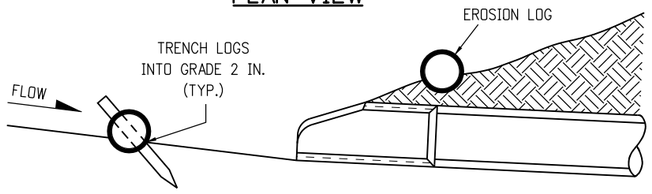
EROSION LOG APPLICATIONS

NOTE

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



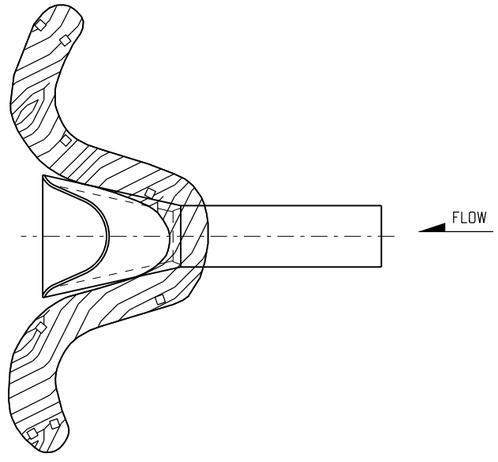
PLAN VIEW



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



EROSION LOG CULVERT OUTLET PROTECTION

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	03/29/16	Minor revisions to some dimensions. Added Erosion Logs Pay Item table.
Full Path: www.codot.gov/business/designsupport	(R-X)	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
Drawing File Name: 2080102011.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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TEMPORARY EROSION CONTROL

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STANDARD PLAN NO.
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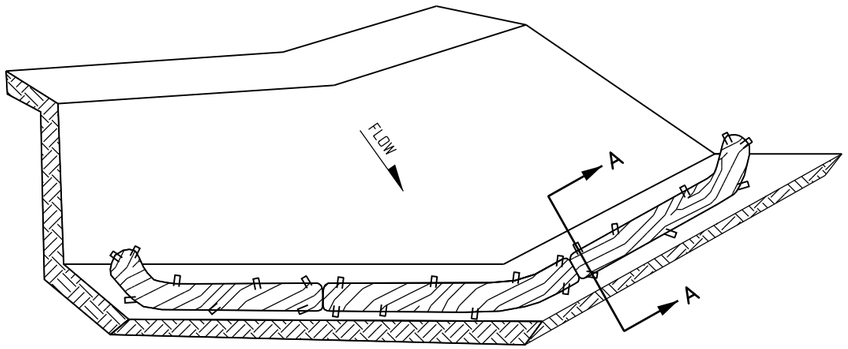
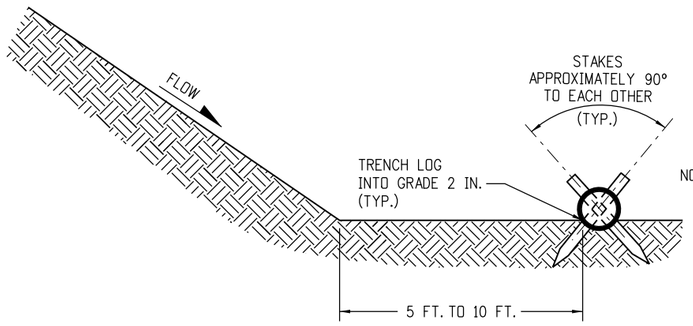
Sheet No. 2 of 11



ISOMETRIC VIEW



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

SECTION A-A

NOTES:

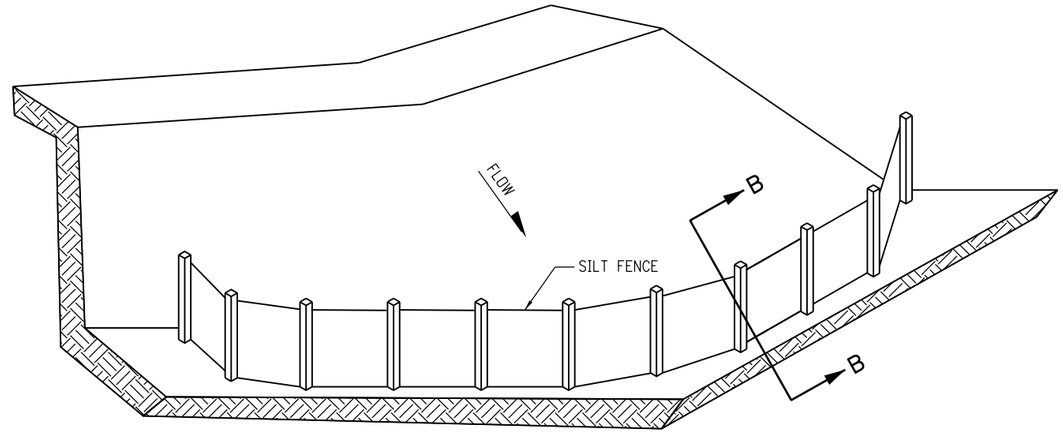
1. EROSION LOGS USED AT TOE OF SLOPE SHALL BE PLACED 5 TO 10 FEET BEYOND TOE OF SLOPE TO PROVIDE STORAGE CAPACITY.
2. EROSION LOGS SHALL BE PLACED ON THE CONTOUR WITH ENDS FLARED UP SLOPE.
3. SEE SHEET 2 OF 11 FOR JOINING LOGS DETAIL.

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.)

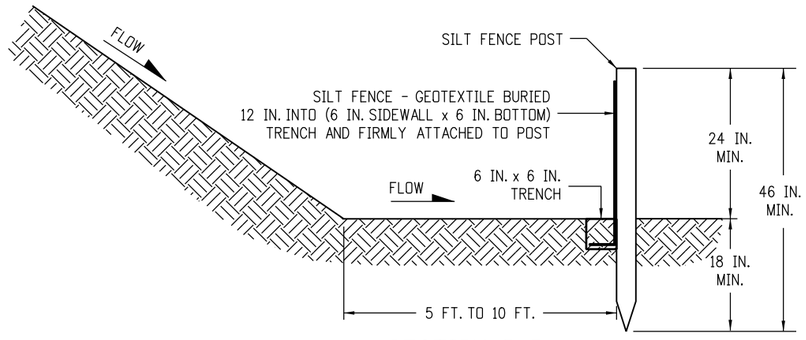
EROSION LOG TOE OF SLOPE PROTECTION

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 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	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	03/29/16	Minor revisions to some dimensions. Added Erosion Logs Pay Item table.
Full Path: www.codot.gov/business/designsupport	(R-X)	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
Drawing File Name: 2080103011.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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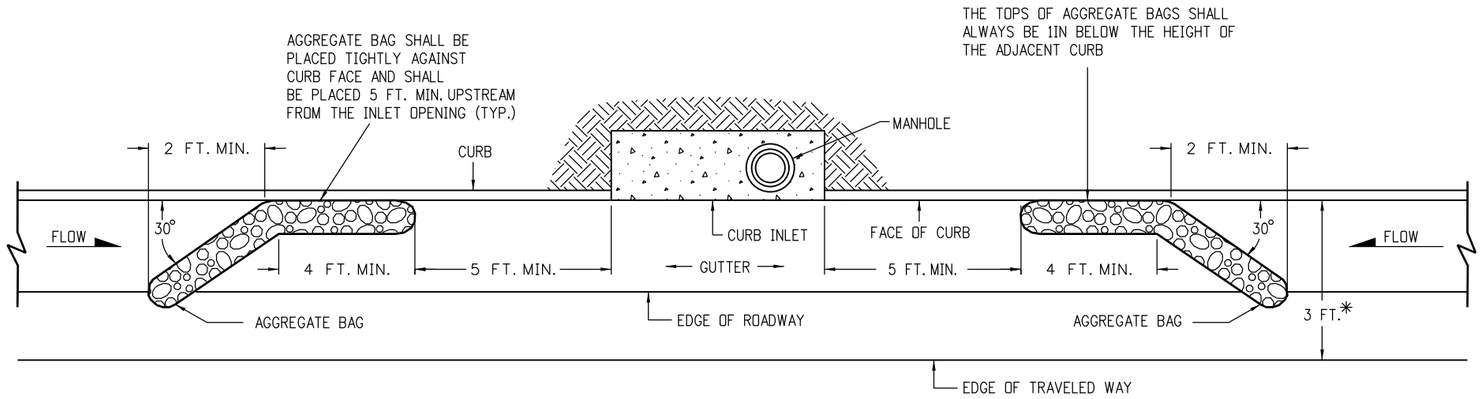
M-208-1
Sheet No. 3 of 11

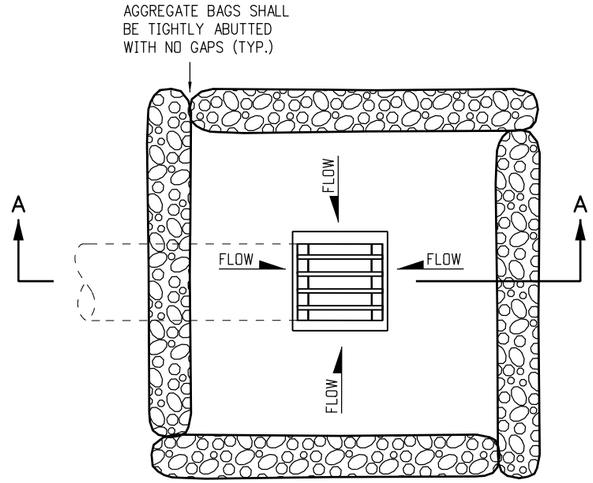


PLAN VIEW

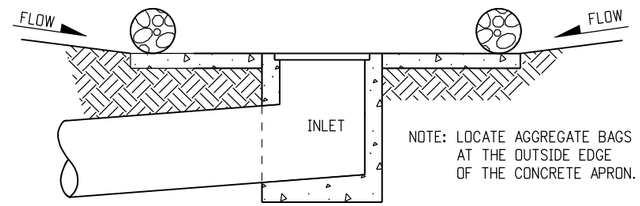
* NOTE: USE AGGREGATE BAGS ONLY WHEN THERE IS A MINIMUM CLEARANCE OF 3 FEET FROM THE EDGE OF THE TRAVELED WAY (INCLUDING CONDITIONS DURING DETOURS) TO THE FACE OF CURB.

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	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	R-X	03/29/16	Added some dimensions and Note.
Full Path: www.codot.gov/business/designsupport	R-X	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
Drawing File Name: 2080104011.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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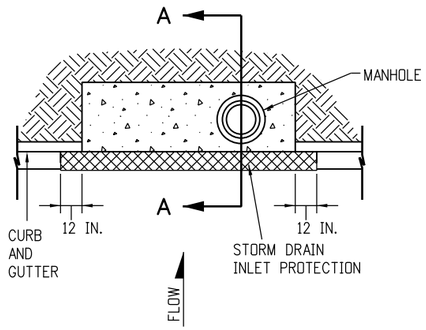
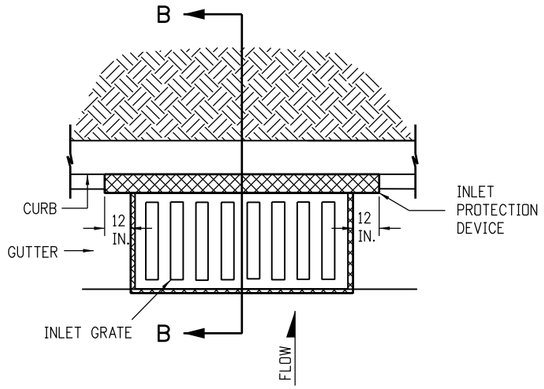
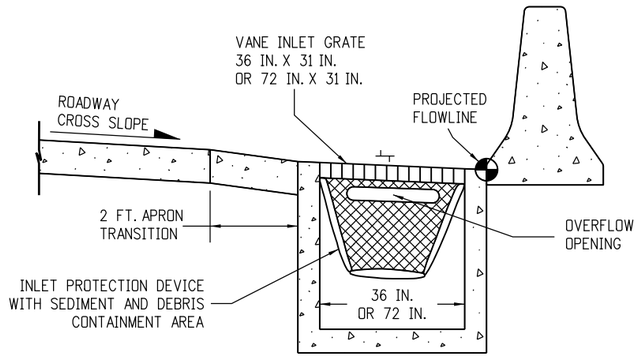


PLAN VIEW

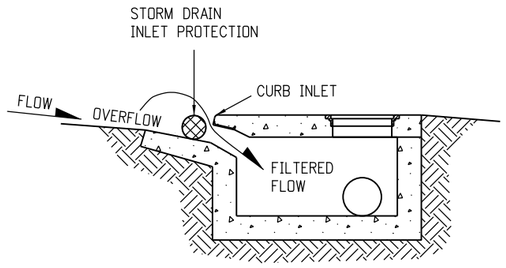


PLAN VIEW



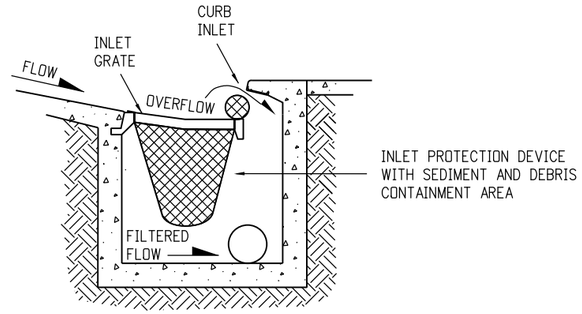
OPTION A

STORM DRAIN INLET PROTECTION (TYPE III)



SECTION A-A

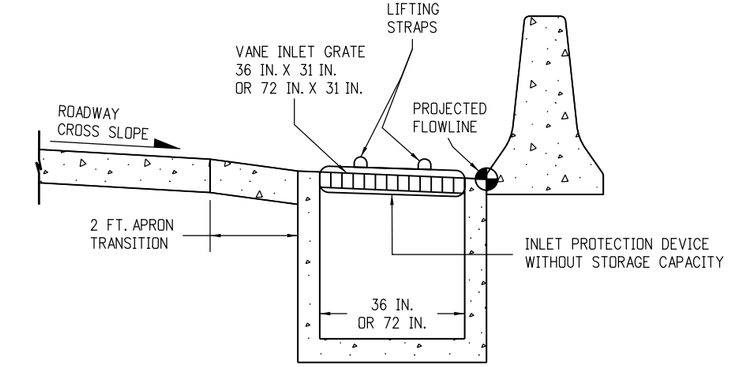
STORM DRAIN INLET PROTECTION (TYPE I)



SECTION B-B

OPTION A

STORM DRAIN INLET PROTECTION (TYPE II)



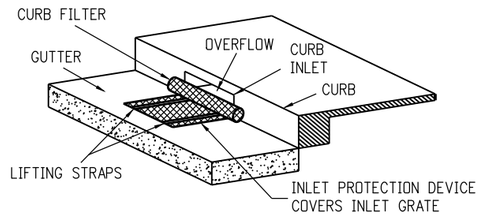
OPTION B

STORM DRAIN INLET PROTECTION (TYPE III)

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

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.



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).

STORM DRAIN INLET PROTECTION TYPES

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	03/29/16	Added Note 3.
Full Path: www.codot.gov/business/designsupport	(R-X)	08/10/17	Added new Pay Item numbers for Type I and II.
Drawing File Name: 2080105011.dgn	(R-X)	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
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TEMPORARY EROSION CONTROL

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STANDARD PLAN NO.

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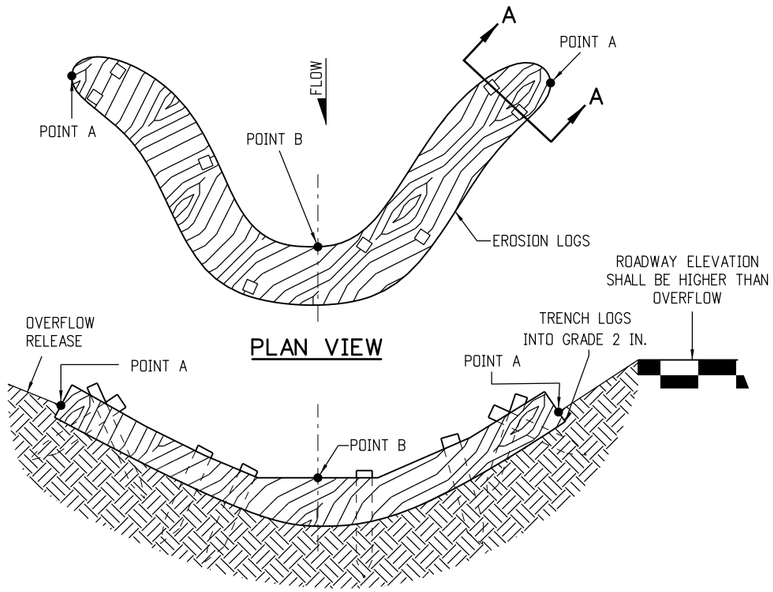
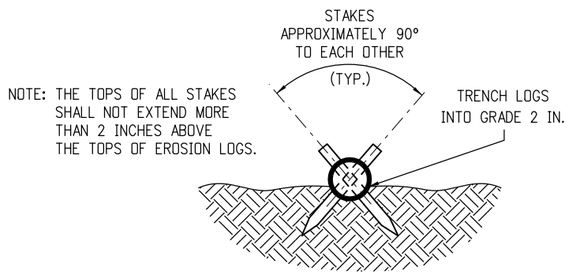


PLAN VIEW

NOTE: POINTS "A" SHALL BE A MINIMUM 4 IN. HIGHER THAN POINT "B".

ELEVATION

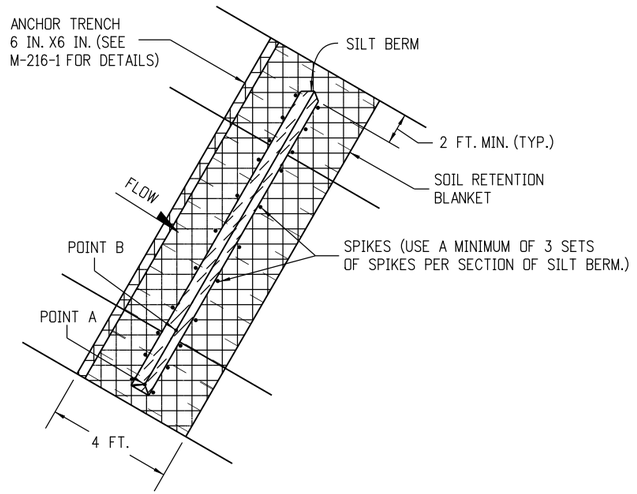


SECTION A-A

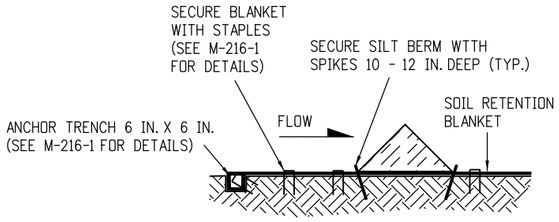
NOTES:

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 SHAL BE GRADED IN A PARABOLIC OR TRAPEZOIDAL SHAPE.

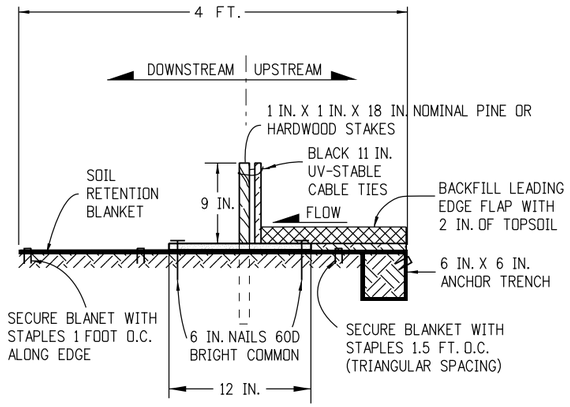
EROSION LOG INSTALLATION



PLAN VIEW



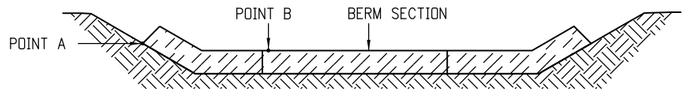
SILT BERM (1) SECTION VIEW



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



POINT "A" SHALL BE HIGHER THAN POINT "B" TO ENSURE THAT WATER FLOWS OVER THE BERM AND NOT AROUND THE ENDS.

FRONT 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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
Full Path: www.codot.gov/business/designsupport	(R-X)		
Drawing File Name: 2080106011.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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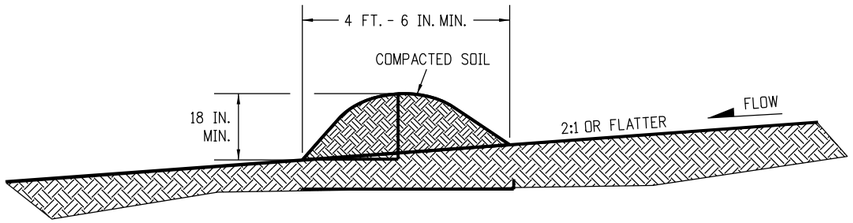
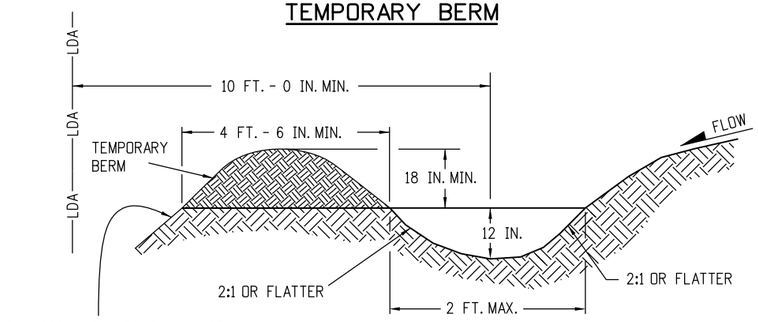


NOTES:

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

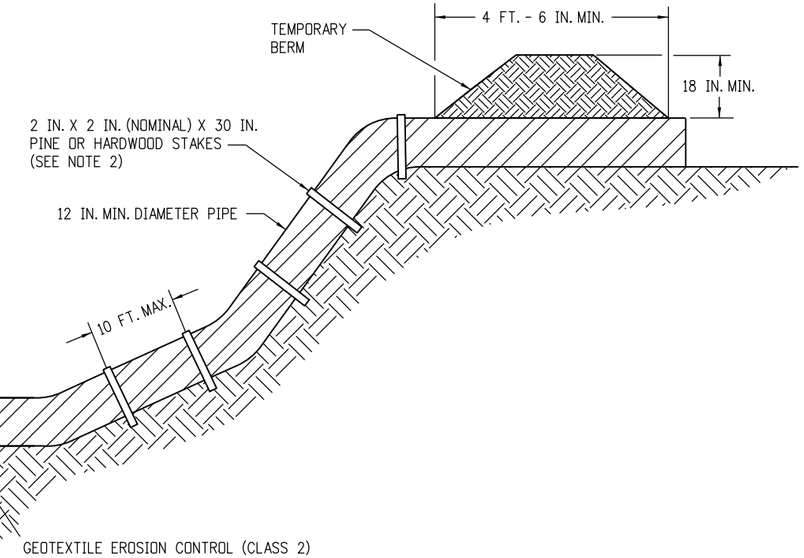


FOR BERMS TALLER THAN 2 FT.,
INSTALL TOE OF SLOPE CONTOL MEASURES.
SEE SHEET 3 OF 11 FOR DETAILS.

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.
6. DIVERSION BERMS SHALL BE CONSTRUCTED OUT OF EMBANKMENT (SUBSOIL) AND IN NO CIRCUMSTANCE CONSTRUCTED OUT OF SALVAGED TOPSOIL.
5. THE PAY ITEM NUMBER FOR TEMPORARY DIVERSION (LF) IS 208-00301.

TEMPORARY DIVERSION



NOTES:

1. ANCHOR SIZE VARIES ACCORDING TO PIPE SIZE
2. TO SECURE THE PIPE, DRIVE STAKES INTO GROUND, THEN TIE A 12 GUAGE 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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	03/29/16	Revisions to some dimensions and Notes.
Full Path: www.codot.gov/business/designsupport	(R-X)	04/01/19	Revised to comply with the updated Stormwater Construction Permit (SCP) requirements.
Drawing File Name: 2080107011.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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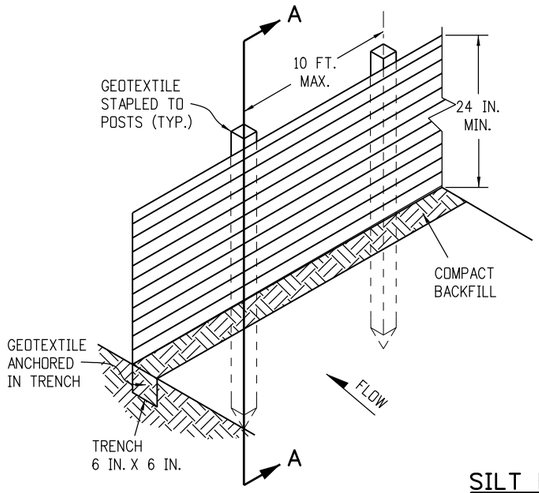
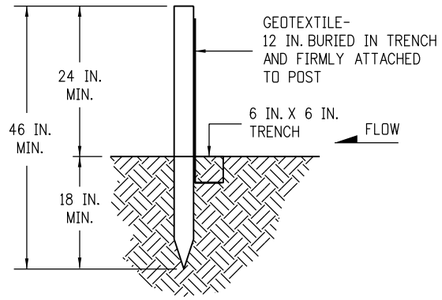
TEMPORARY EROSION CONTROL

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-208-1



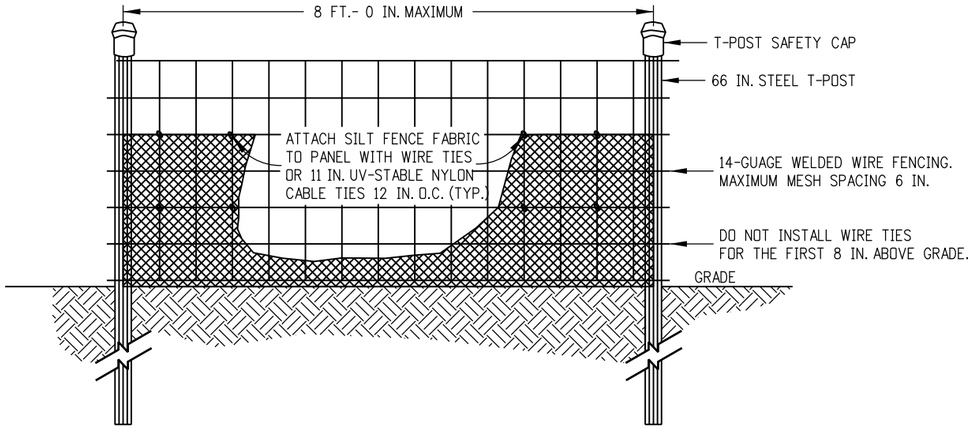


SECTION A-A

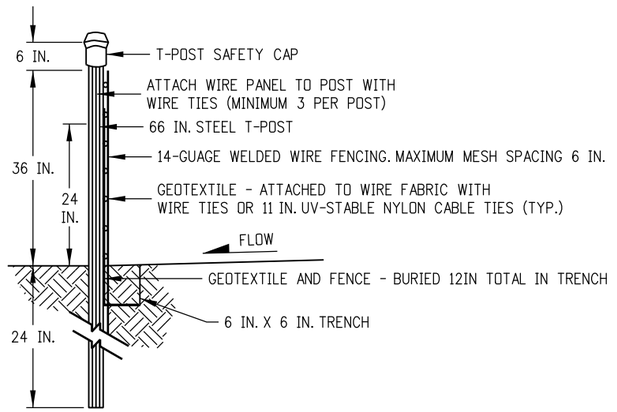
SILT FENCE

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.).



ELEVATION VIEW

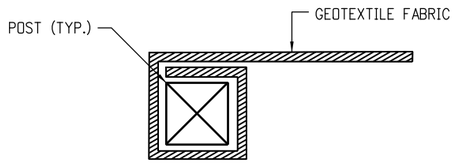


SIDE VIEW

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.

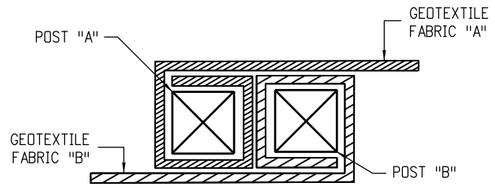
SILT FENCE (REINFORCED)



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.

SILT FENCE APPLICATIONS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	03/29/16	Minor revisions to some dimensions and Notes.
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Drawing File Name: 2080108011.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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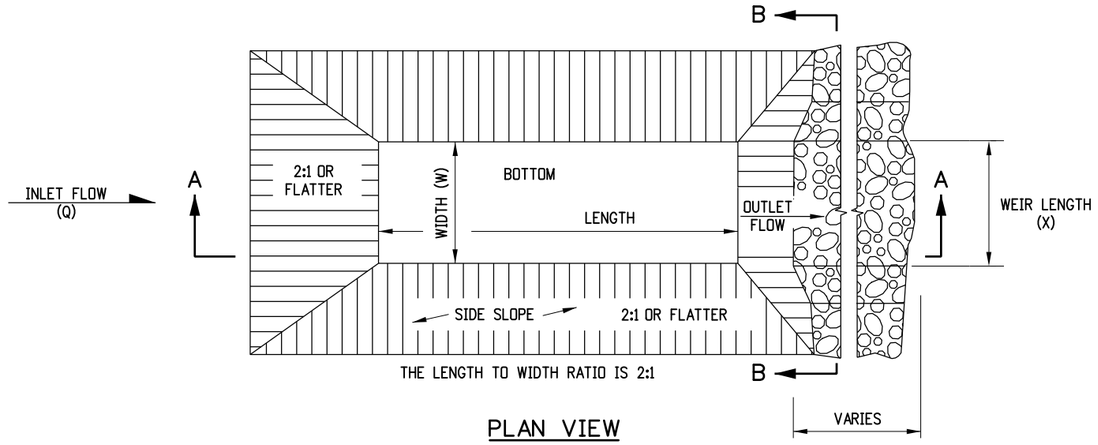
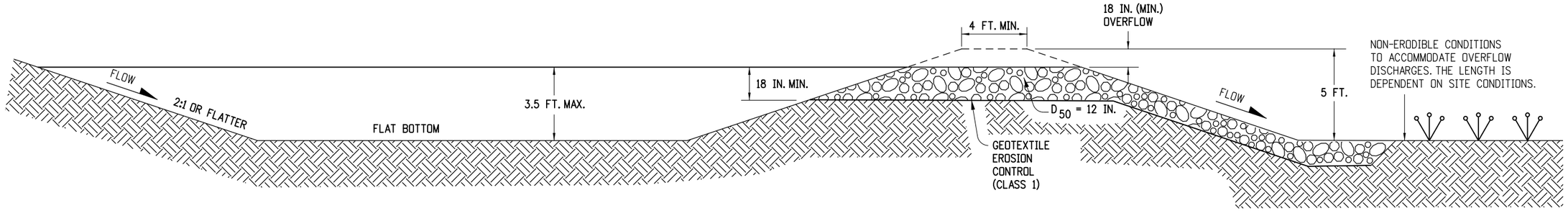


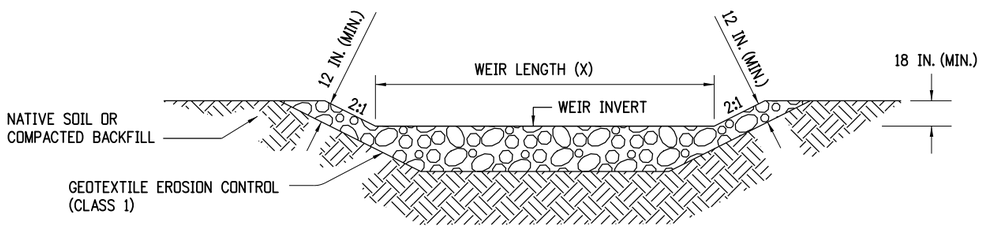
PLAN VIEW

NOTES

1. THE MAXIMUM DRAINAGE AREA IS 5 ACRES.
2. THE MAXIMUM STRUCTURE LIFE IS 2 YEARS.
3. THE STORAGE AREA IS 1800 CUBIC FEET PER ACRE.
4. THE MAXIMUM EMBANKMENT HEIGHT SHALL BE 5 FT. MEASURED ON THE DOWNSTREAM SIDE.
5. THE LENGTH/WIDTH RATIO MAY BE ADJUSTED TO MEET SITE CONDITIONS WHEN APPROVED BY THE ENGINEER.
6. WIDTH (W) OF SEDIMENT TRAP IS APPROXIMATELY EQUAL TO THE WEIR LENGTH (X).
7. SEDIMENT TRAP DESIGN SHALL BE APPROVED BY THE ENGINEER.
8. THE DOWN GRADE FROM WEIR SHALL BE STABLE AND NON-ERODIABLE.
9. THE PAY ITEM NUMBER FOR SEDIMENT TRAP (LF) IS 208-00033.



SECTION A-A



SECTION B-B

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

WEIR LENGTH TABLE

SEDIMENT TRAP

Computer File Information	
Creation Date: 07/04/12 Initials: JBK	
Last Modification Date: 04/01/19 Initials: LTA	(R-X)
Full Path: www.codot.gov/business/designsupport	(R-X)
Drawing File Name: 2080109010.dgn	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments
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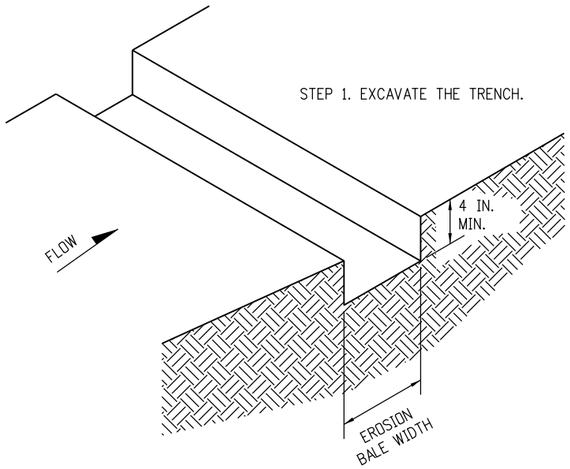
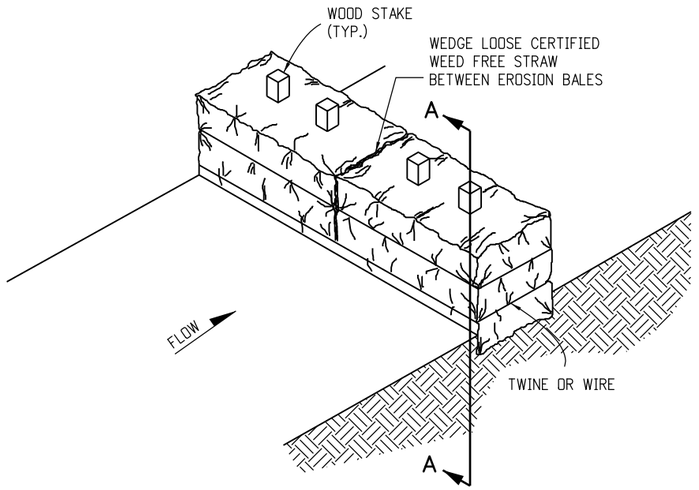
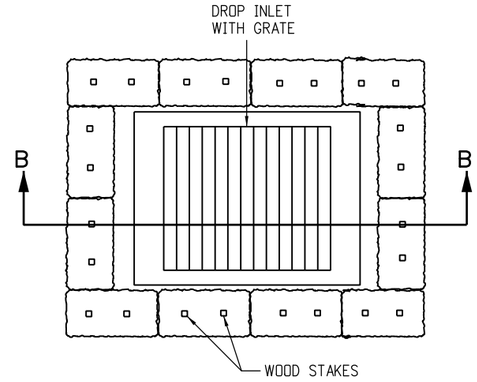


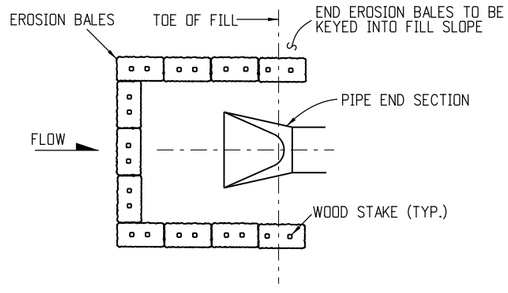


NOTES

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, THIGHTLY 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.

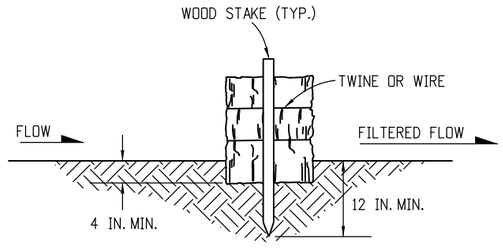


PLAN VIEW



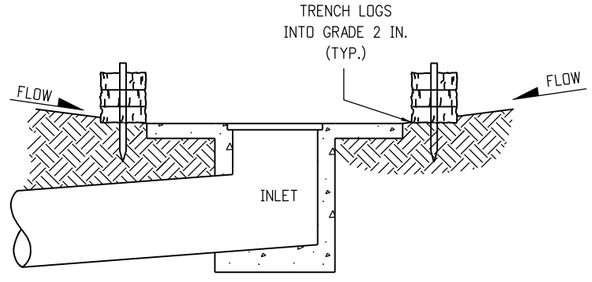
PLAN VIEW

EROSION BALE CULVERT INLET PROTECTION



SECTION A-A

EROSION BALE TRENCHING AND STAKING



SECTION B-B

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

EROSION LOG FILTER AT DROP INLET

EROSION BALE APPLICATIONS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
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TEMPORARY EROSION CONTROL

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STANDARD PLAN NO.
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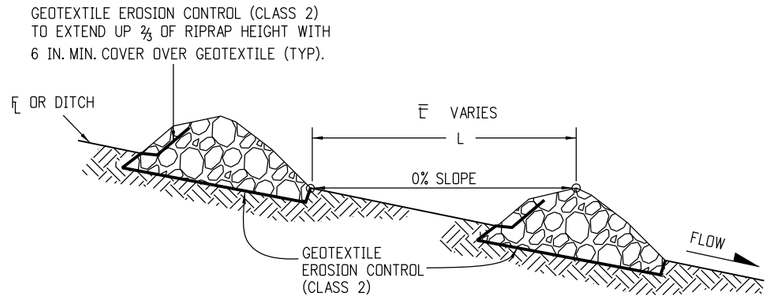
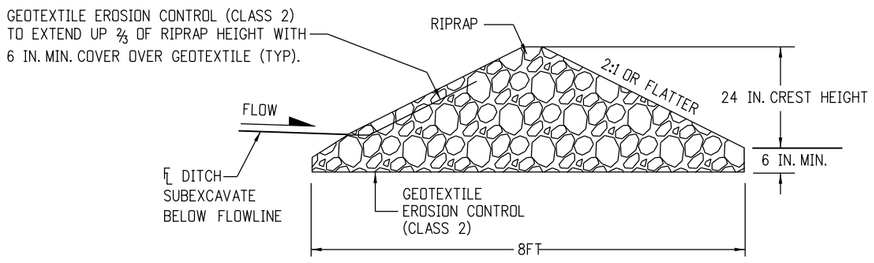
Sheet No. 10 of 11



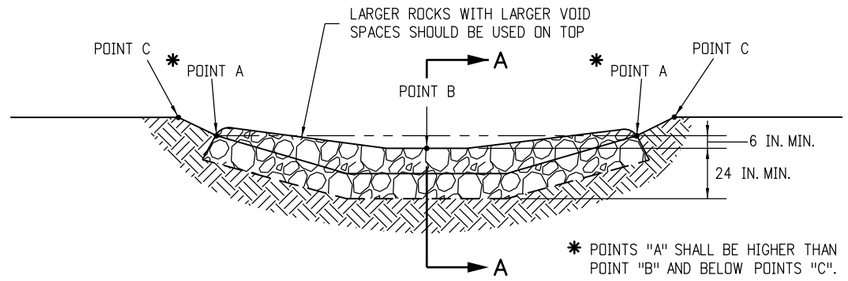
SECTION VIEW ALONG DITCH FLOWLINE



SECTION A-A

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.



TYPICAL SECTION VIEW

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

ROCK CHECK DAM

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 04/01/19 Initials: LTA	(R-X)	03/29/16	Minor revisions to some Notes.
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Drawing File Name: 20801011011.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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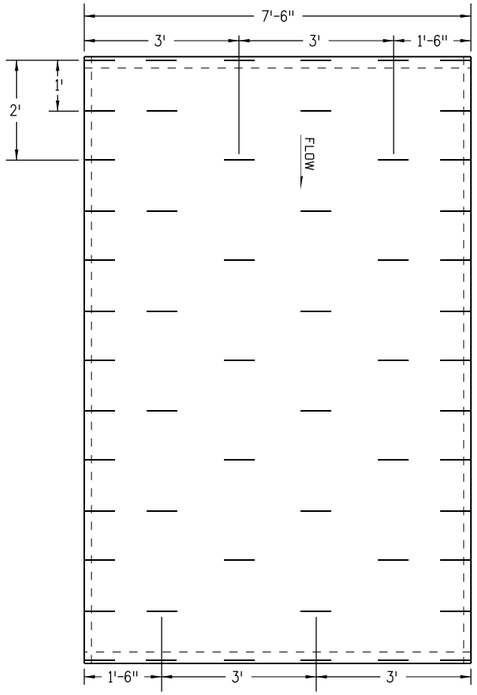
TEMPORARY EROSION CONTROL

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-208-1
Sheet No. 11 of 11

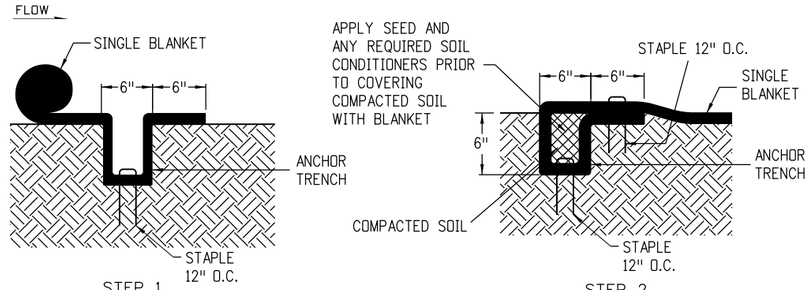


TYPICAL STAPLE PATTERN FOR CHANNEL APPLICATION

SEE SUBSECTION 216.05.

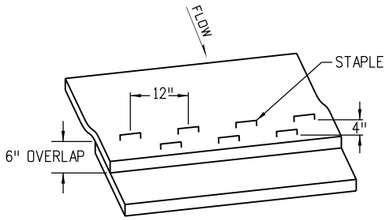
SOIL FILLED TRM APPLICATION

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



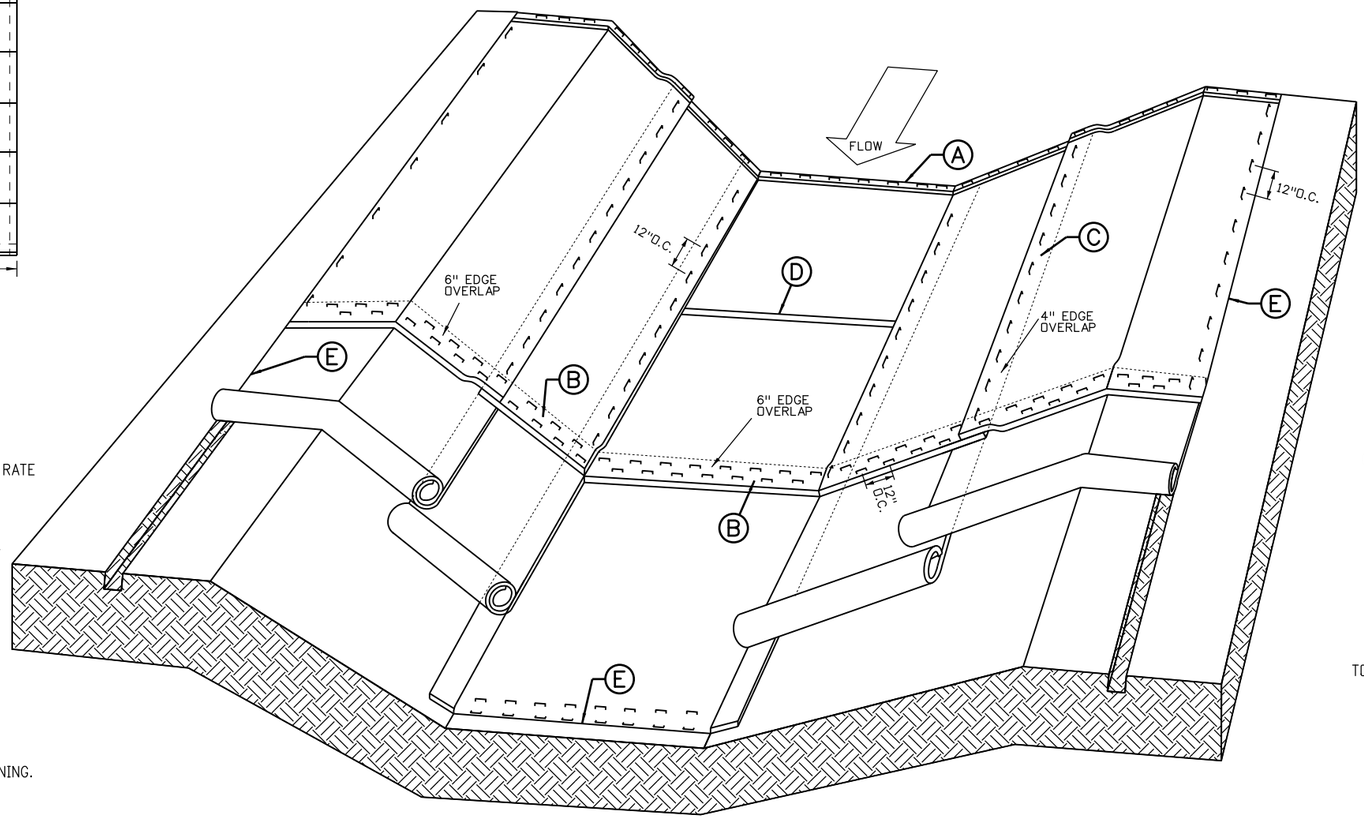
ANCHOR TRENCH (A)

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.

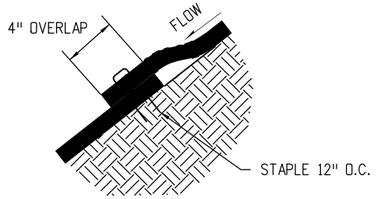


SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) CHANNEL APPLICATION

IN ACCORDANCE WITH SECTION 216.

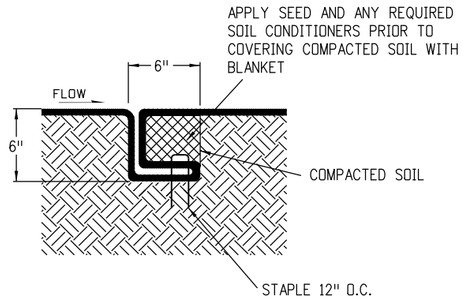
GENERAL NOTES

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.



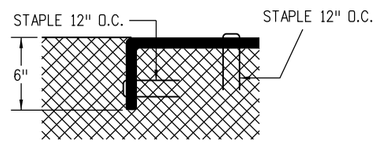
SIDE SEAM OVERLAP (C)

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.



CHANNEL CHECK SLOT (D)

TO BE USED AT 30' INTERVALS IN CHANNEL FLOWLINE.



TERMINATION OF CHANNEL (E)

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 07/16/15 Initials: LTA	R-X		
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Drawing File Name: 2016010102.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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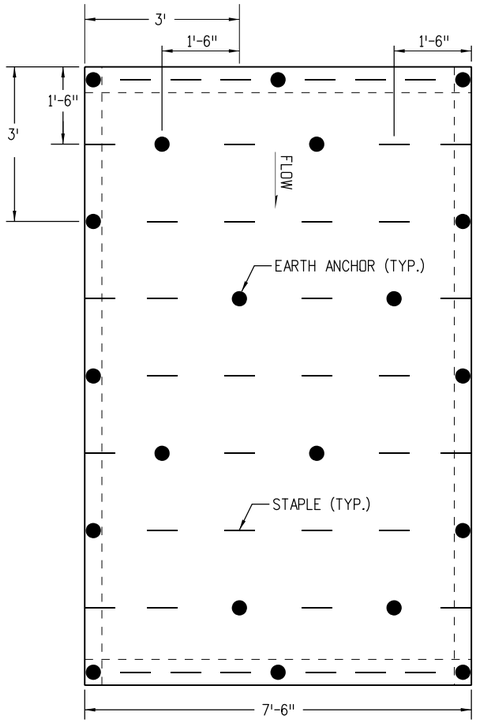
SOIL RETENTION COVERING

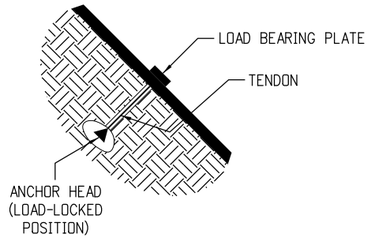
Issued By: Project Development Branch on July 16, 2015

STANDARD PLAN NO.
M-216-1
Sheet No. 1 of 2



TYPICAL STAPLE OR EARTH ANCHOR PATTERN FOR SLOPE APPLICATION

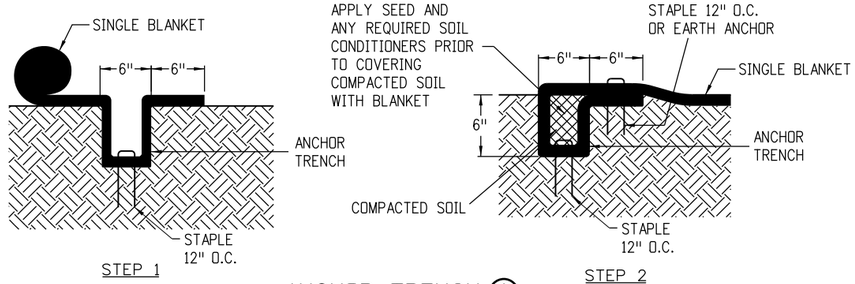
IF EARTH ANCHORS ARE NOT SPECIFIED ON THE PLANS, ONLY STAPLES SHALL BE USED.
SEE SUBSECTION 216.04



EARTH ANCHOR

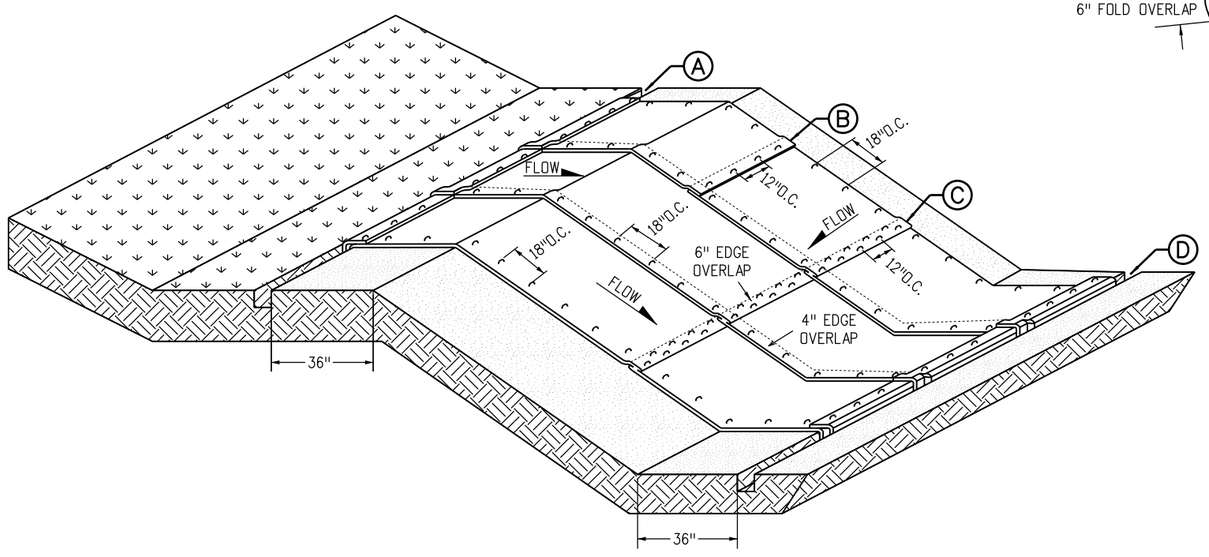
NOTES: 1. EARTH ANCHORS WILL BE USED INSTEAD OF STAPLES WHEN SPECIFIED IN THE PLANS.

2. EARTH ANCHORS SHALL BE PAID FOR SEPERATLY AS SPECIFIED IN SECTION 216.



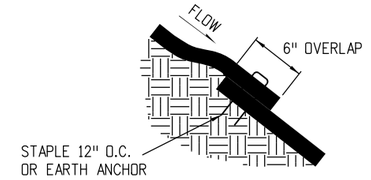
ANCHOR TRENCH (A)

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).



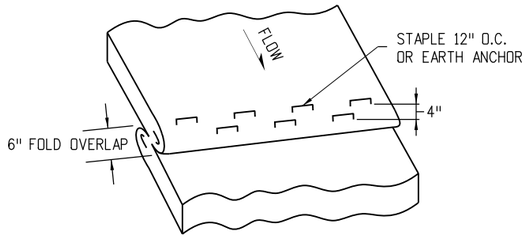
SOIL RETENTION BLANKETS/TURF REINFORCEMENT MATS (TRM) SLOPE APPLICATION

IN ACCORDANCE WITH SECTION 216.

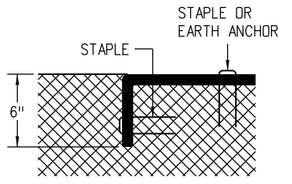


CONSECUTIVE ROLL OVERLAP (B)

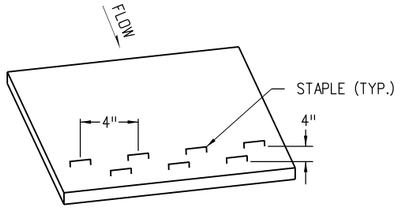
TO BE USED WHEREVER ONE ROLL OF BLANKET ENDS AND ANOTHER BEGINS WITH THE UPHILL BLANKET PLACED ON TOP OF THE BLANKET ON THE DOWNHILL SIDE.



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		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 07/16/15 Initials: LTA	R-X		
Full Path: www.coloradodot.info/business/designsupport	R-X		
Drawing File Name: 2016010202.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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SOIL RETENTION COVERING

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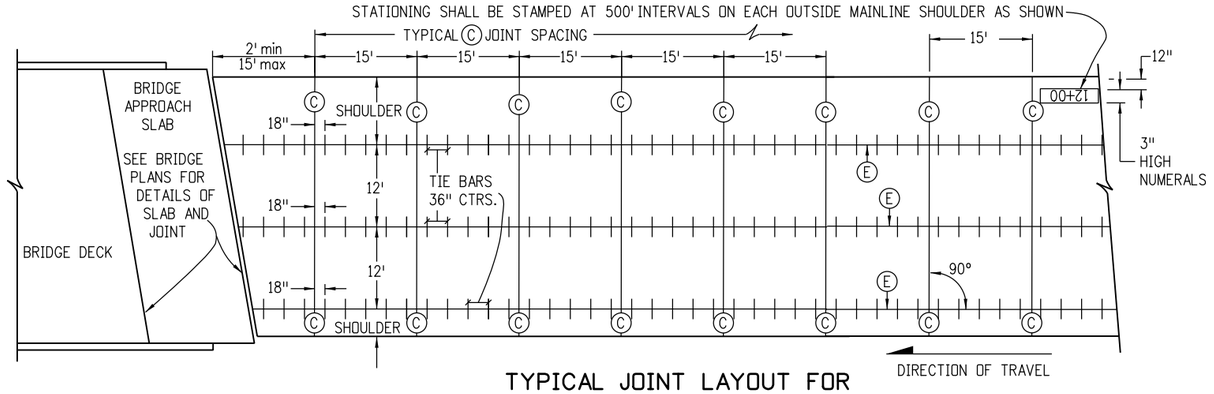
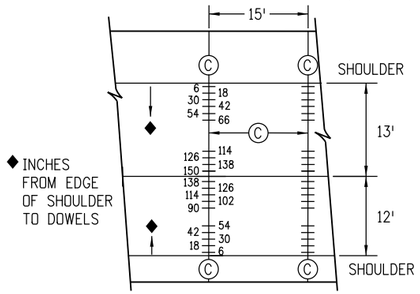


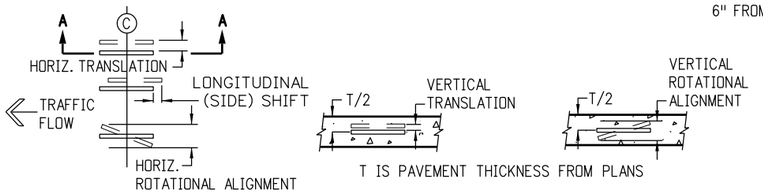
TYPICAL JOINT LAYOUT FOR CONCRETE ROADWAY WITH CONCRETE SHOULDERS

GENERAL NOTES

1. THIS STANDARD PLAN DOES NOT APPLY TO THIN CONCRETE OVERLAYS (WHITETOPPING).
2. TRANSVERSE CONSTRUCTION JOINTS SHALL BE LOCATED AT A Ⓒ 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 Ⓔ LONGITUDINAL SAWED CONTRACTION JOINTS.
5. ON MULTILANE DIVIDED HIGHWAYS SEPARATED BY A CONCRETE BARRIER, A Ⓓ JOINT SHALL BE CONSTRUCTED AT ONE OF THE BARRIER FACES.
6. Ⓓ 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. Ⓛ 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 Ⓒ JOINTS ARE SHOWN IN THE SHOULDER, THE DOWEL BARS WILL BE PLACED ON 12" CENTERS STARTING 6" FROM THE ROADWAY Ⓔ JOINT.



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

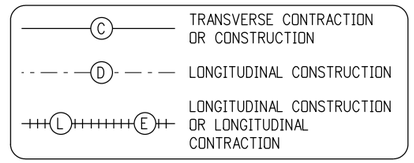


PLAN VIEW
SHOWING HORIZ. TRANSLATION, LONGITUDINAL (SIDE) SHIFT AND HORIZ. ROTATIONAL ALIGNMENT

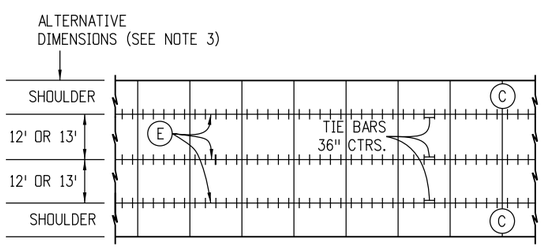
SECTION A-A
SHOWING VERTICAL TRANSLATION TOLERANCE

SECTION A-A
SHOWING VERTICAL ROTATIONAL ALIGNMENT

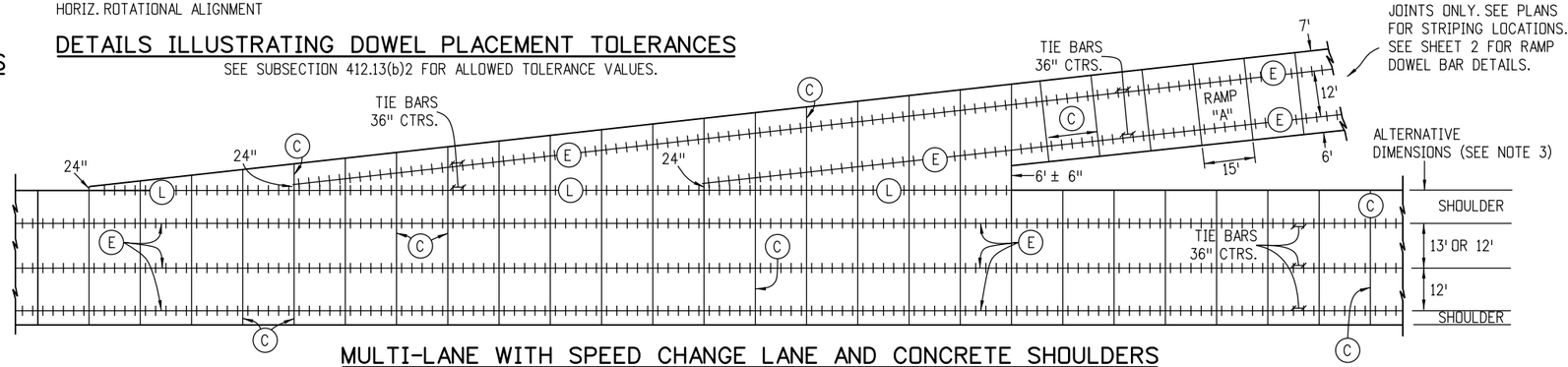
JOINT LEGEND
(SEE SHEET 5 FOR JOINT DETAILS)



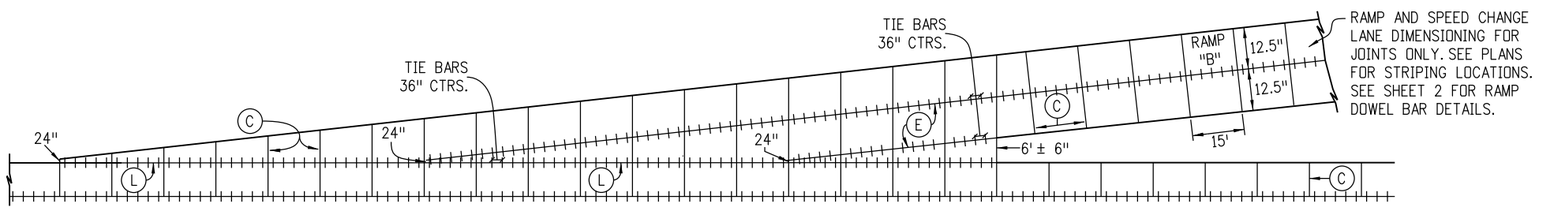
DETAILS ILLUSTRATING DOWEL PLACEMENT TOLERANCES
SEE SUBSECTION 412.13(b)2 FOR ALLOWED TOLERANCE VALUES.



RURAL TWO-LANE



MULTI-LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS



OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE SPEED CHANGE LANE

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	(R-X)	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	(R-X)	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
Drawing File Name: 412010105.dgn	(R-X)		
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CONCRETE PAVEMENT JOINTS

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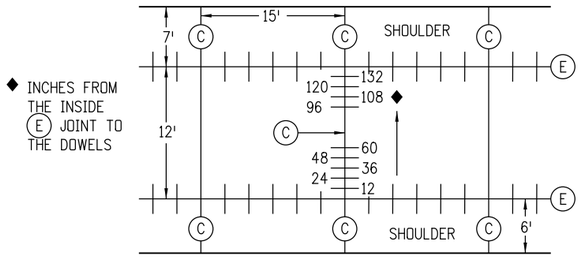
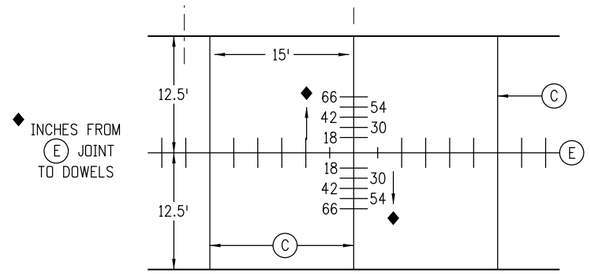


RAMP "A" DOWEL BAR DETAIL
FOR C JOINT WITH A 12 FT. LANE

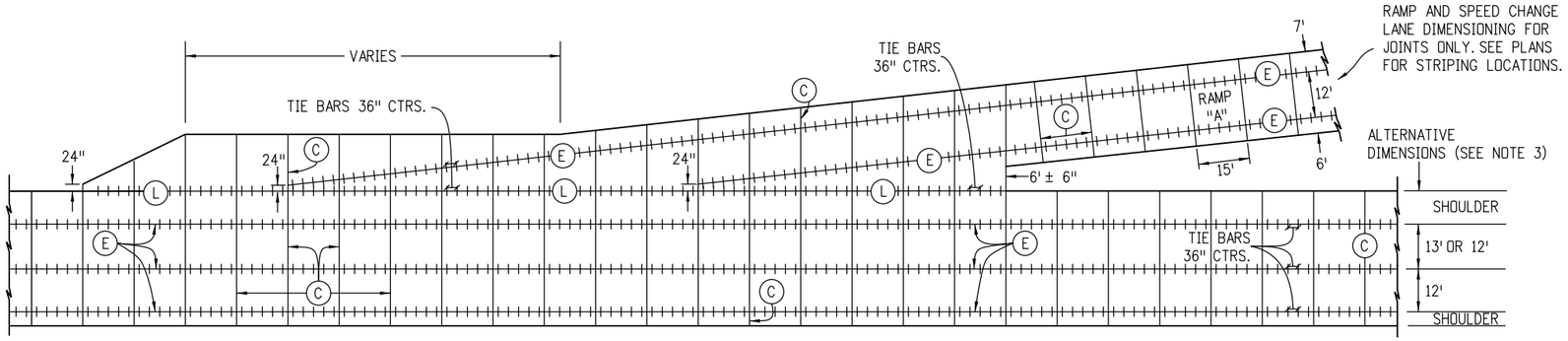


RAMP "B" DOWEL BAR DETAIL FOR C JOINT
WITH CENTER LONGITUDINAL SPLIT LANE

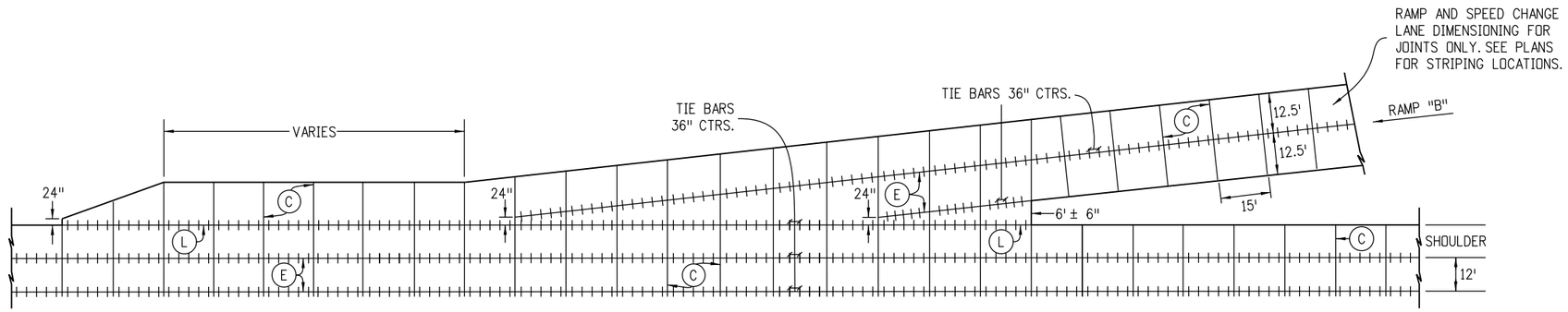
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

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



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		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	(R-X)	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	(R-X)	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
Drawing File Name: 412010205.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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CONCRETE PAVEMENT JOINTS

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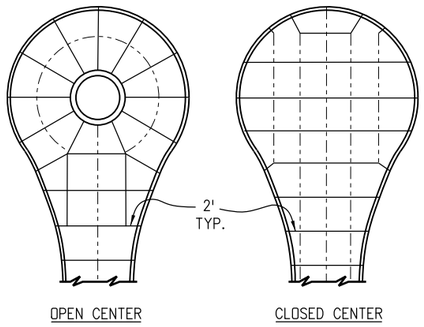
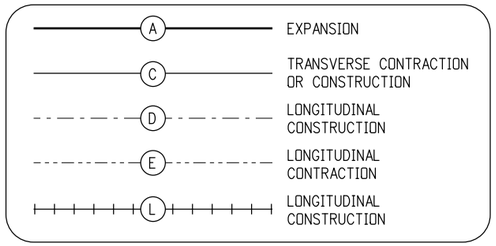


CUL-DE-SAC

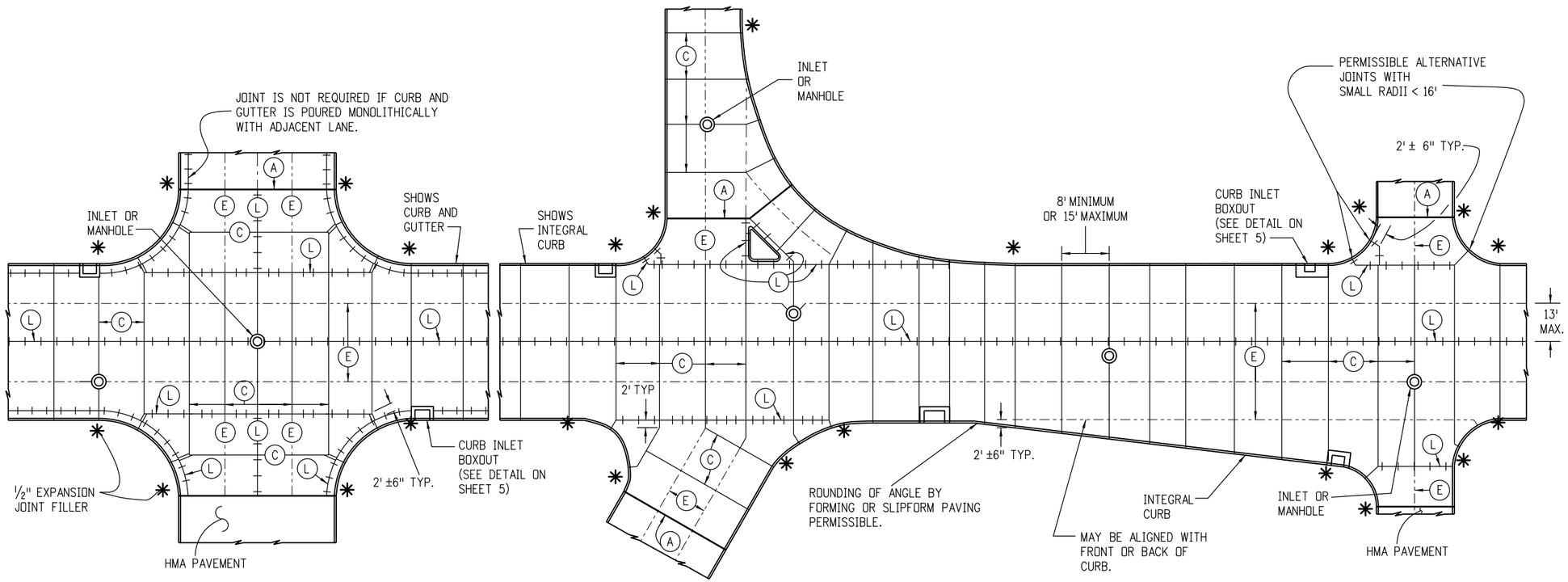
JOINT LEGEND

(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 ½ IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES SHALL NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT PASSES LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.
7. 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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	(R-X)	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
Full Path: www.coloradodot.info/business/designsupport	(R-X)		
Drawing File Name: 412010305.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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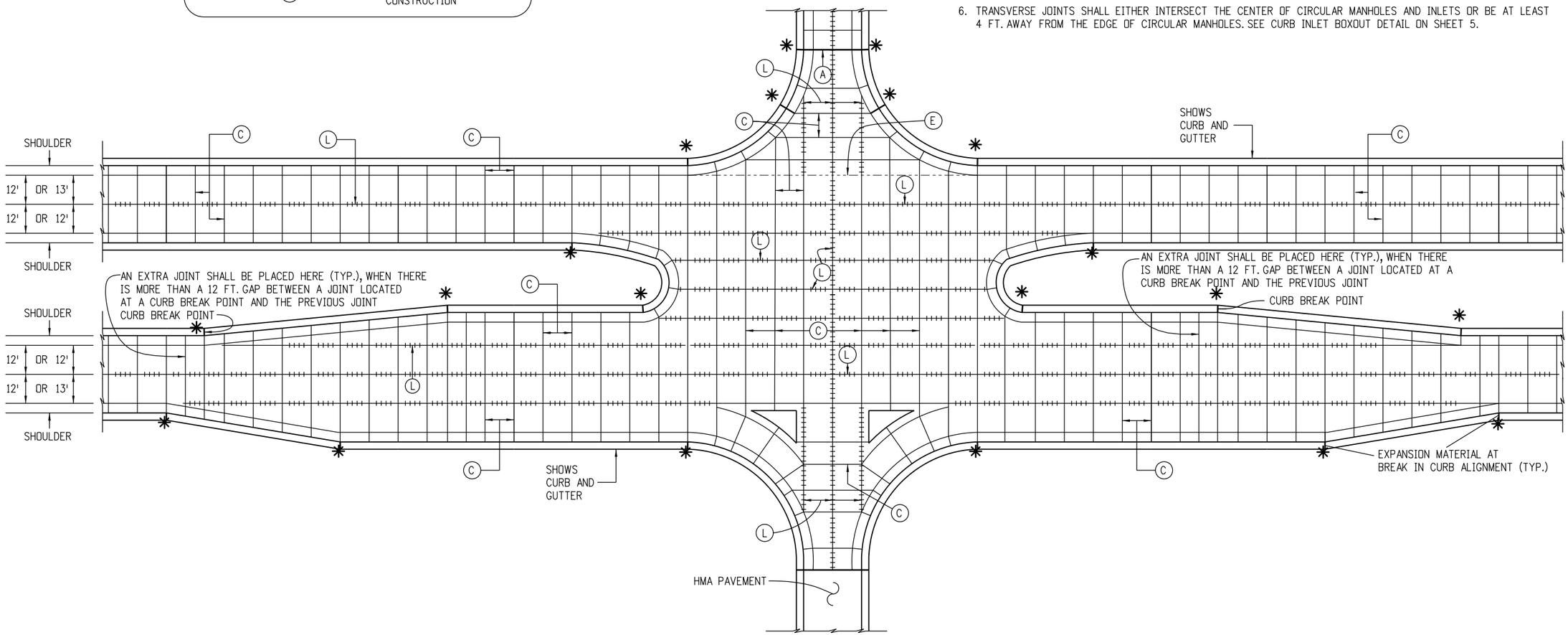
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

- (A) EXPANSION
- (C) TRANSVERSE CONTRACTION OR CONSTRUCTION
- (D) LONGITUDINAL CONSTRUCTION
- (E) LONGITUDINAL CONTRACTION
- (L) LONGITUDINAL CONSTRUCTION

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 ½ IN. MIN. EXPANSION JOINT FILLER IN TOP 6 IN. OF CURB JOINT AT INTERSECTION RETURN RADIUS POINTS.
4. THE CONTRACTOR SHALL, UNLESS OTHERWISE SHOWN ON THE PLANS, SELECT AND USE A BOND BREAKER AT INLETS, MANHOLES AND SIMILAR SIZE STRUCTURES. SMALLER STRUCTURES SUCH AS VALVE AND MONUMENT BOXES DO NOT REQUIRE A BOND BREAKER.
5. WHERE A LONGITUDINAL JOINT WOULD PASS LESS THAN 1 FT. FROM A CAST-IN-PAVEMENT MANHOLE OR SIMILAR SIZE STRUCTURE, A TYPICAL 2 FT. RADIAL JOINT, AS SHOWN IN THE DETAILS, SHALL BE USED.
6. TRANSVERSE JOINTS SHALL EITHER INTERSECT THE CENTER OF CIRCULAR MANHOLES AND INLETS OR BE AT LEAST 4 FT. AWAY FROM THE EDGE OF CIRCULAR MANHOLES. SEE CURB INLET BOXOUT DETAIL ON SHEET 5.



MULTI-LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	R-X	01/18/18	Changed all (DC) and (T) joints to (C) joints. Reduced all 14 foot slabs to 13 feet.
Full Path: www.coloradodot.info/business/designsupport	R-X		
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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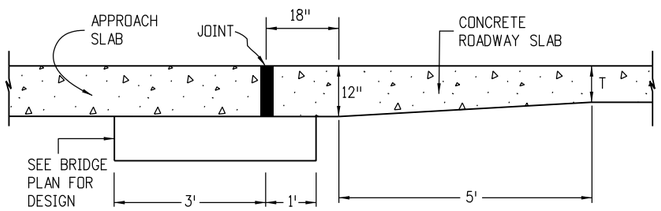
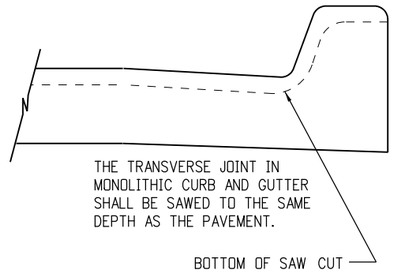


BRIDGE APPROACH



NOTE

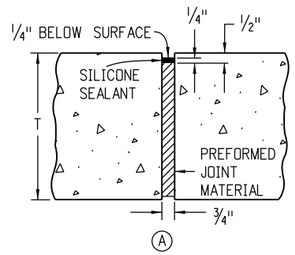
PAVEMENT THICKNESS (T), SHALL BE AS SHOWN ON THE PLANS.

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.

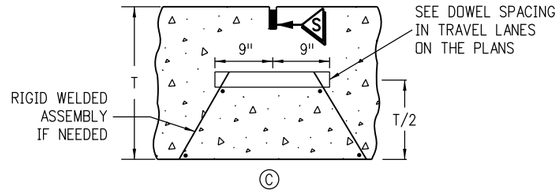
REINFORCING SIZE TABLE

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.

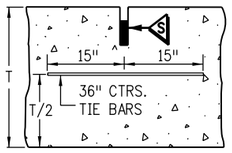


EXPANSION JOINT



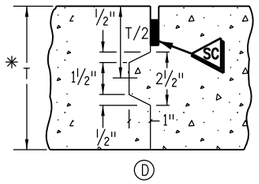
DOWELED TRANSVERSE CONSTRUCTION OR CONTRACTION JOINT

(TRANSVERSE WEAKENED PLANE JOINT)



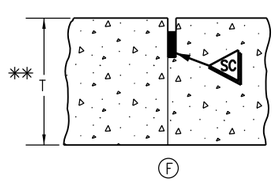
LONGITUDINAL CONTRACTION JOINT

(LONGITUDINAL WEAKENED PLANE JOINT)



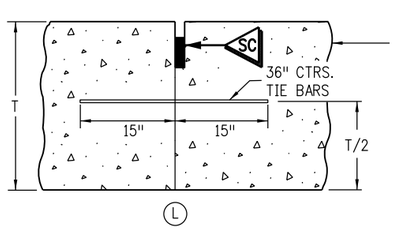
LONGITUDINAL CONSTRUCTION JOINT

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



LONGITUDINAL CONSTRUCTION JOINT

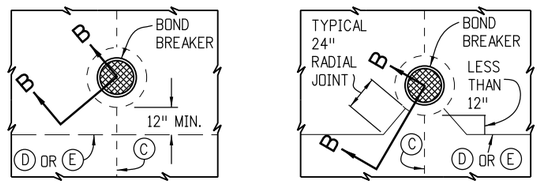
** USE ONLY IF T < 8 IN.



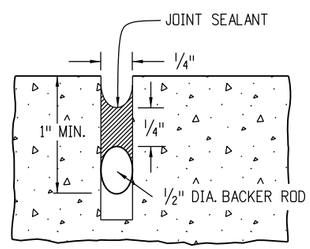
LONGITUDINAL CONSTRUCTION JOINT

CURB INLET BOXOUT

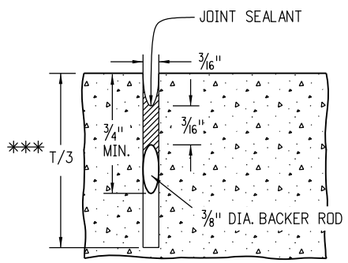
INSTALL TRANSVERSE JOINT AT BOTH BOXOUT CORNERS IF BOXOUT IS 8 FT. OR LONGER.



INLET OR MANHOLE CAST IN PAVEMENT

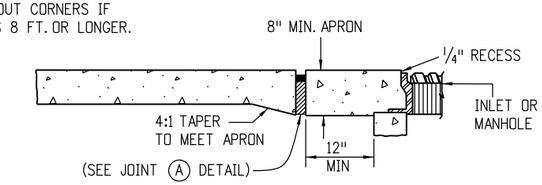


SEAL AT CONSTRUCTION JOINT

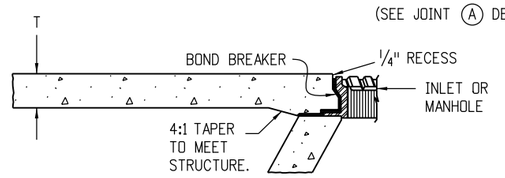


SAWED JOINT

*** USE T/4 WHEN T < 8 IN.



SECTION A-A



SECTION B-B

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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 01/18/18 Initials: LTA	R-X	07/24/12	Changed Tie Bar spacing from 30" to 36".
Full Path: www.coloradodot.info/business/designsupport	R-X		Modified the Reinforcing Size Table.
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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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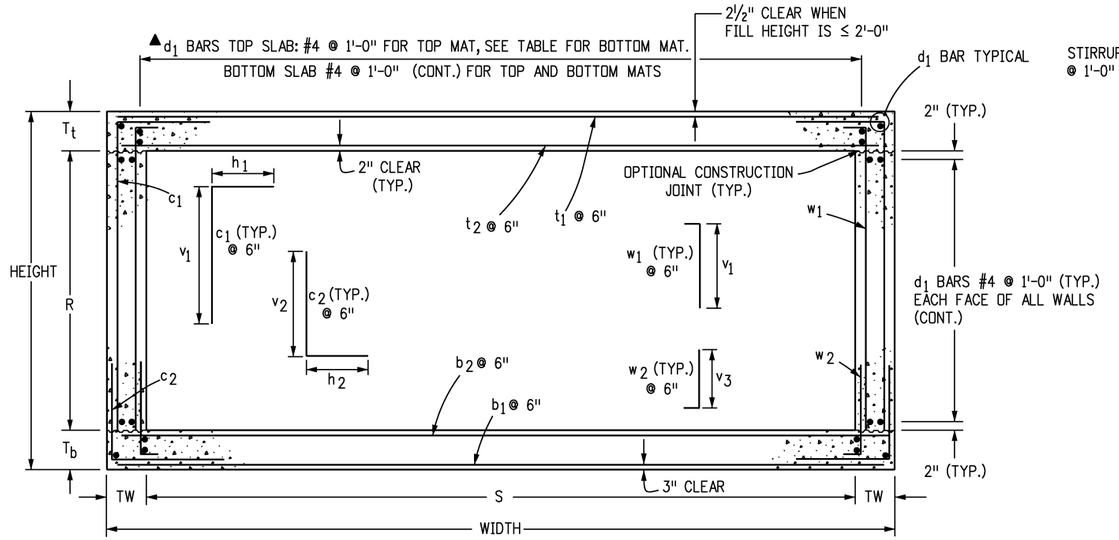
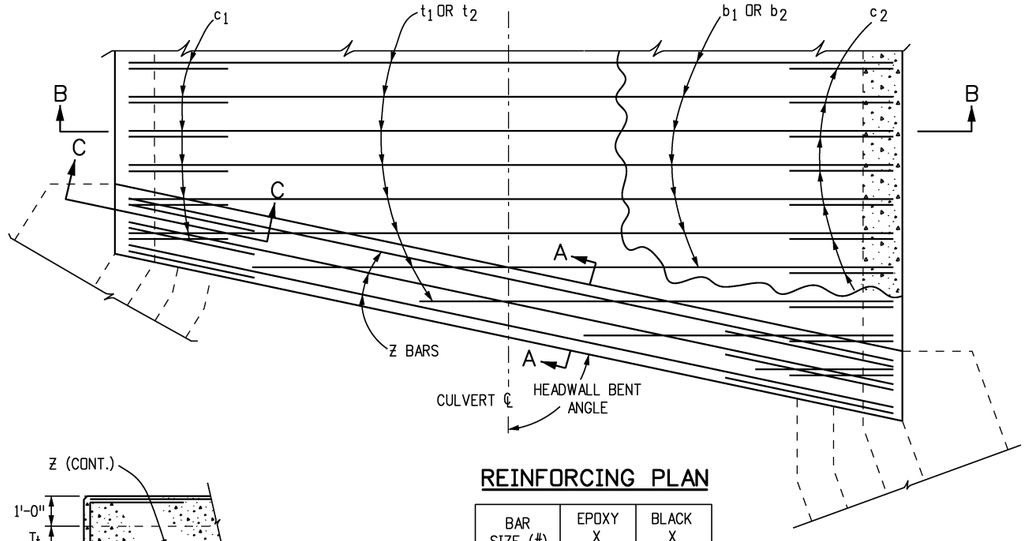
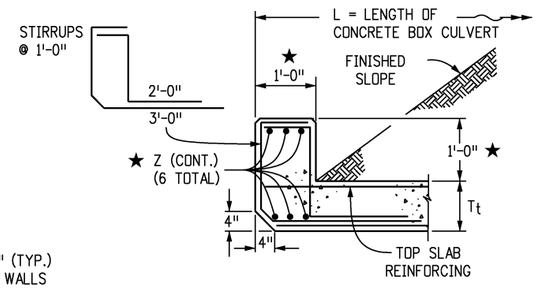
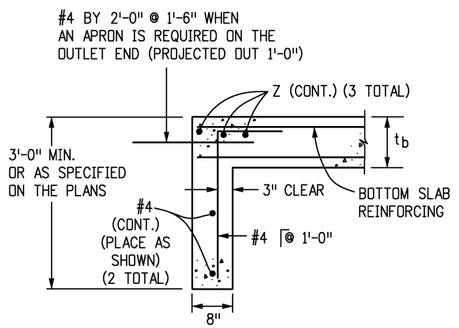


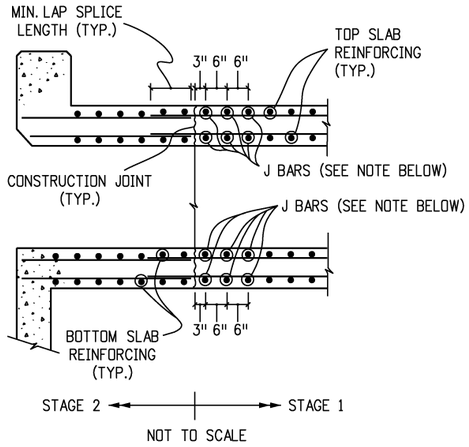
SECTION B-B





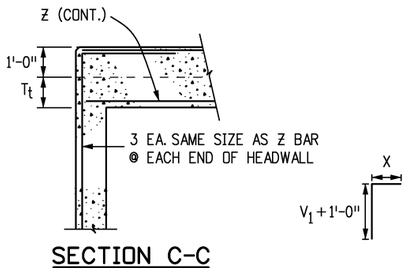


SECTION A-A



CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ℄ 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.



SECTION C-C

HEADWALL CORNER REINFORCING DETAIL

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

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. 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. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
14.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾".
16. 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.
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, 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_y = 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 CDOT 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 20, 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 20.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 20.
- 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: 04/05/19	Initials: JBE
Full Path: www.codot.gov/business/designsupport	
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CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English

Sheet Revisions		
	Date:	Comments
(R-X)	08/27/13	LRFD Design
(R-X)	08/01/15	Analysis Program Updates
(R-X)	04/05/19	Clarified this sheet is for Cast-in-Place CBC only, not for Pre-Cast CBC. Changed title and added Gen. Note 18.
(R-X)		

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Division of Project Support DDG/Bridge

SINGLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

M-601-1

Sheet No. 1 of 2

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

BOX SIZE			FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INHES)			BAR SIZES						d_1 ▲	DIMENSIONS					QUANTITIES			RATING FACTORS			
S	R	HT.	WIDTH				t_1* & b_1	t_2	b_2	w_1* & w_2	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL	WATERPROOFING	HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE
FT	FT	FT-IN	FT-IN	FT-FT	T_t	T_b	TW	#	#	#	#	#	#	NO.	FT-IN	FT-IN	FT-IN	FT-IN	FT-IN	CY/LF	LBS/LF	SY/LF				
6	7	8-8	7-8	< 2	10	10	10	4	6	6	4	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	64	3-10	4-4	7-6	2-11	1-9	0.823	199		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	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	64	3-8	2-4	7-6	3-0	1-9	0.834	190		♦	♦	♦	♦
8	6	7-9	9-8	< 2	11	10	10	4	7	7	4	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
		7-6	9-8	2 TO 8	8.5	9.5	10	4	6	6	4	5	5	66	4-8	2-4	6-6	3-1	1-10	0.907	220		1.59	2.07	2.39	2.46
		7-6	9-8	8 TO 15	8.5	9.5	10	4	6	6	4	5	5	66	3-7	2-4	6-6	3-1	1-10	0.907	216		♦	♦	♦	♦
		7-6	9-8	15 TO 20	8.5	9.5	10	4	6	6	4	5	5	66	3-7	2-4	6-6	3-1	1-10	0.907	216		♦	♦	♦	♦
	8	9-9.5	9-8	< 2	11.5	10	10	4	7	7	4	5	5	76	5-8	5-4	8-9	3-1	1-11	1.135	287	1.407	1.07	1.38	1.60	1.58
		9-7	9-8	2 TO 8	9	10	10	4	6	6	4	5	5	74	4-8	2-4	8-7	3-1	1-11	1.061	240		1.61	2.09	2.54	2.57
		9-7	9-8	8 TO 15	9	10	10	4	6	6	4	5	5	74	3-7	2-4	8-7	3-1	1-11	1.061	235		♦	♦	♦	♦
		9-7	9-8	15 TO 20	9	10	10	4	6	6	4	5	5	74	3-7	2-4	8-7	3-1	1-11	1.061	235		♦	♦	♦	♦
	10	11-10	9-8	< 2	11.5	10.5	10	4	7	7	4	5	5	84	3-5	2-4	10-9	3-2	2-0	1.274	285	1.407	1.12	1.46	1.69	1.66
		11-7	9-8	2 TO 8	9	10	10	4	6	6	4	5	5	82	5-6	2-4	10-7	3-1	1-11	1.184	262		1.61	2.09	2.52	2.56
		11-7	9-8	8 TO 15	9	10	10	4	6	6	4	5	5	82	4-6	2-4	10-7	3-1	1-11	1.184	258		♦	♦	♦	♦
		11-9	9-11	15 TO 20	10	11	11.5	4	6	6	4	6	6	85	4-7	2-5	10-8	3-1	1-11	1.353	302		♦	♦	♦	♦
10	6	7-11.5	11-8	< 2	12.5	11	10	4	8	8	4	5	5	87	5-8	2-7	6-10	3-2	2-0	1.217	321	1.630	1.05	1.36	1.49	1.48
		7-7	11-8	2 TO 10	9	10	10	4	6	6	4	5	5	72	5-5	2-7	6-7	3-1	1-11	1.055	246		1.25	1.62	1.88	1.84
		7-8	11-8	10 TO 15	10	10	10	4	6	6	4	5	5	72	4-2	2-7	6-8	3-1	1-11	1.091	242		♦	♦	♦	♦
		8-1	11-10	15 TO 20	13	12	11	4	6	6	4	5	5	75	4-7	2-9	6-11	3-3	2-1	1.320	251		♦	♦	♦	♦
	8	9-11.5	11-8	< 2	12.5	11	10	4	9	9	4	5	5	95	5-8	2-7	8-10	3-2	2-0	1.340	383	1.630	1.02	1.32	1.44	1.43
		9-7.5	11-8	2 TO 10	9.5	10	10	4	6	6	4	5	5	80	5-5	2-7	8-7	3-1	1-11	1.196	265		1.21	1.57	1.82	1.78
		9-8	11-8	10 TO 15	10	10	10	4	6	6	4	5	5	80	4-3	2-7	8-8	3-1	1-11	1.214	261		♦	♦	♦	♦
		10-0	12-0	15 TO 20	12	12	12	4	6	6	4	5	5	83	4-7	2-10	8-10	3-3	2-1	1.481	271		♦	♦	♦	♦
	10	12-0	11-8	< 2	12.5	11.5	10	4	9	9	4	5	5	103	6-7	6-5	10-10	3-3	2-1	1.481	423	1.630	1.07	1.39	1.51	1.50
		11-7.5	11-8	2 TO 10	9.5	10	10	4	6	6	4	5	5	88	5-5	2-7	10-7	3-1	1-11	1.319	285		1.16	1.51	1.74	1.71
		11-9	11-10	10 TO 15	10	11	11	4	6	6	4	5	5	91	4-4	2-8	10-8	3-2	1-11	1.446	285		♦	♦	♦	♦
		12-0.5	12-0	15 TO 20	12	12.5	12	4	6	6	5	5	5	91	4-7	2-10	10-10	3-4	2-6	1.648	315		♦	♦	♦	♦
12	6	8-1.5	13-8	< 2	13.5	12	10	4	9	9	4	6	6	97	5-5	3-0	6-11	3-7	2-1	1.446	433	1.852	1.03	1.33	1.42	1.39
		7-7.5	13-8	2 TO 8	9.5	10	10	4	7	7	4	6	6	78	6-4	3-0	6-7	3-5	1-11	1.193	339		1.27	1.65	1.89	1.84
		7-9	13-8	8 TO 12	9.5	11.5	10	4	7	7	4	6	6	78	5-1	3-0	6-7	3-7	2-0	1.256	333		2.28	2.95	3.25	3.54
		8-0.5	13-10	12 TO 16	12	12.5	11	4	7	7	4	6	6	81	5-0	3-1	6-10	3-7	2-0	1.453	339		♦	♦	♦	♦
		8-0.5	14-0	16 TO 20	12	12.5	12	5	7	7	5	6	6	81	5-2	3-2	6-10	3-8	2-6	1.503	361		♦	♦	♦	♦
	8	10-1.5	13-8	< 2	13.5	12	10	4	9	9	4	6	6	105	6-6	3-0	8-11	3-7	2-1	1.569	462	1.852	1.00	1.29	1.37	1.35
		9-8	13-8	2 TO 8	9.5	10.5	10	4	7	7	4	6	6	86	5-1	3-0	8-7	3-6	1-11	1.337	355		1.21	1.57	1.77	1.73
		9-9.5	13-8	8 TO 12	10	11.5	10	4	7	7	4	6	6	86	5-5	3-0	8-8	3-7	2-0	1.401	358		2.32	3.01	3.31	3.60
		9-9.5	13-10	12 TO 16	10	11.5	11	4	7	7	4	6	6	89	5-0	3-1	8-8	3-7	2-0	1.461	360		♦	♦	♦	♦
		10-0.5	14-0	16 TO 20	12	12.5	12	5	7	7	4	6	6	89	5-1	3-1	8-10	3-7	2-1	1.651	385		♦	♦	♦	♦
	10	12-2	13-8	< 2	13.5	12.5	10	4	9	9	4	6	6	113	7-10	6-3	10-11	3-8	2-2	1.714	513	1.852	1.04	1.35	1.43	1.41
		11-8	13-8	2 TO 8	9.5	10.5	10	4	7	7	4	6	6	94	6-4	3-0	10-7	3-6	1-11	1.461	385		1.15	1.50	1.69	1.65
		11-9.5	13-8	8 TO 12	10	11.5	10	4	7	7	4	6	6	94	5-1	3-0	10-8	3-7	2-0	1.524	379		2.08	2.70	2.97	2.16
		11-9.5	13-10	12 TO 16	10	11.5	11	5	7	7	4	7	7	97	5-1	3-2	10-8	4-0	2-0	1.597	456		♦	♦	♦	♦
		12-1	14-0	16 TO 20	12.5	12.5	12	5	7	7	4	7	7	97	5-2	3-3	10-10	4-0	2-1	1.821	462		♦	♦	♦	♦
14	6	8-3.5	15-8	< 2	14	13.5	10	4	9	9	4	6	6	107	5-10	3-5	6-11	3-9	2-0	1.700	479	2.074	1.10	1.43	1.48	1.41
		7-8	15-8	2 TO 6	9.5	10.5	10	4	8	8	4	7	7	84	7-3	3-5	6-7	3-11	1-11	1.337	460		1.13	1.47	1.65	1.59
		7-8.5	15-8	6 TO 8	9.5	11	10	4	8	8	4	7	7	84	5-9	3-5	6-7	3-11	2-0	1.362	448		1.67	2.16	2.50	3.01
		7-10.5	15-8	8 TO 10	10.5	12	10	4	8	8	4	7	7	84	5-9	3-5	6-8	4-0	2-1	1.458	450		2.66	3.45	3.89	4.43
		7-11.5	15-8	10 TO 12	11	12.5	10	4	8	8	4	7	7	84	5-9	3-5	6-9	4-1	2-1	1.507	452		2.65	3.44	3.79	4.11
		8-1.5	15-8	12 TO 14	12	13.5	10	4	8	8	4	7	7	84	5-9	3-5	6-10	4-2	2-2	1.603	453		3.13	4.05	4.38	4.89
		8-1.5	15-10	14 TO 18	12	13.5	11	5	8	8	5	7	7	87	5-9	3-6	6-10	4-2	2-7	1.654	500		♦	♦	♦	♦
	8	10-4	15-8	< 2	14	14	10	4	9	9	4	6	6	115	5-10	3-6	8-11	3-9	2-0	1.848	502	2.074	1.12	1.46	1.60	1.52
		9-8	15-8	2 TO 6	9.5	10.5	10	4	8	8	4	7	7	92	7-3	3-5	8-7	3-11	1-11	1.461	487		1.16	1.51	1.69	1.63
		9-9	15-8	6 TO 8	9.5	11.5	10	4	8	8	4	7	7	92	5-9	3-5	8-7	4-0	2-0	1.509	476		1.70	2.21	2.56	3.08
		9-10.5	15-8	8 TO 10	10.5	12	10	4	8	8	4	7	7	92	5-9	3-5	8-8	4-0	2-1	1.582	477		2.78	3.61	4.08	4.64
		9-11.5	15-8	10 TO 12	11	12.5	10	4	8	8	4	7	7	92	5-9	3-5	8-9	4-1	2-1	1.630	479		2.62	3.40	3.74	4.07
		10-1.5	15-8	12 TO 14	12	13.5	10	4	8	8	4	7	7	92	5-9	3-5	8-10	4-2	2-2	1.727	480		2.51	3.25	3.51	3.92
		10-1.5	15-10	14 TO 18	12	13.5	11	5	8	8	5	7	7	95	5-9	3-6	8-10	4-2	2-7	1.789	530		♦	♦	♦	♦
	10	12-4	15-8	< 2	14	14	10	4	9	9	5	6	6	123	7-4	3-6	10-11	3-9	2-3	1.971	558	2.074	1.10	1.42	1.50	1.42
		11-8.5	15-8	2 TO 6	9.5	11	10	4	8	8	5	7	7	100	7-3	3-5	10-7	3-11	2-5	1.609	538		1.17	1.51	1.67	1.63
		11-9	15-8	6 TO 8	9.5	11.5	10	4	8	8	5	7	7	100	5-9	3-5	10-7	4-0	2-3	1.633	526		1.64	2.13	2.47	2.97
		11-10.5	15-8	8 TO 10	10.5	12	10	4	8	8	5	7	7	100	5-9	3-5	10-8	4-0	2-5	1.705	528		2.53	3.28	3.71	2.77
		12-0	15-8	10 TO 12	11	13	10	4	8	8	5	7	7	100	5-9	3-5	10-9	4-1	2-6	1.778	530		2.40	3.11	3.20	2.27
		12-1.5	15-8	12 TO 14	12	13.5	10	4	8	8	5	7	7	100	5-9	3-5	10-10	4-2	2-5	1.850	531		1.78	2.31	2.23	1.58
		12-1.5	15-10	14 TO 18	12	13.5	11	5	8	8	5	7	7	103	5-9	3-6	10-10	4-2	2-7	1.925	560		♦	♦	♦	♦
16	6	8-5.5	17-8	< 2	15	14.5	10	4	9	9	5	7	7	117	6-7	3-10	7-0	4-3	2-3	1.979	596	2.296	1.11	1.44	1.46	1.37
		7-10	17-8	2 TO 6	10.5	11.5	10	4	8	8	5	7	7	90	8-3	3-10	6-8	4-0	2-3	1.570	522		1.02	1.32	1.36	1.32
		7-10.5	17-8	6 TO 8	10.5	12	10	4	8	8	5	8	8	90	6-6	3-10	6-8	4-9	2-5	1.597	569		1.78	2.32	2.63	3.15
		8-0	17-8	8 TO 10	11.5	12.5	10	4	8	8	5	8	8	90	6-6	3-10	6-9	4-10	2-4	1.679	570		2.00	2.60	2.88	3.27
	8	10-6	17-8	< 2	15	15	10	4	9	9	5	7	7	125	6-7	3-10	9-0	4-3	2-3	2.130	626	2.296	1.17	1.51	1.62	1.51
		9-10	17-8	2 TO 6	10.5	11.5	10	4	8	8	5	7	7	98	8-3	3-10	8-8	4-0	2-3	1.693	552		1.09	1.42	1.49	1.45
		9-10.5	17-8	6 TO 8	10.5	12	10	4	8	8	5	8	8	98	6-6	3-10	8-8	4-9	2-5	1.721	604		1.77	2.29	2.52	3.02
		10-0	17-8	8 TO 10	11.5	12.5	10	4	8	8	5	8	8	98	6-6	3-10	8-9	4-10	2-4	1.802	606		1.64	2.13	2.35	2.68
	10	12-6	17-8	< 2	15	15	10	4	9	9	5	7	7	133	8-3	3-10	11-0	4-3	2-3	2.253	669	2.296	1.12	1.46	1.47	1.38
		11-10	17-8	2 TO 6	10.5	11.5	10	4	8	8	5	7	7	106	8-3	3-10	10-8	4-0	2-3	1.817	582		1.04	1.35	1.43	1.38
		11-10.5	17-8	6 TO 8	10.5	12	10	4	8	8	5	8	8	106	6-6	3-10	10-8	4-9	2-5	1.844	639		1.59	2.06	2.26	2.72
		12-0.5	17-8	8 TO 10	11.5	13	10	4	8	8	5	8	8	106	6-6	3-10	10-9	4-10	2-6	1.953	641		1.47	1.91	2.11	2.40
18	8	10-8	19-8	< 2	16	16	10	4	10	10	5	8	8	135	7-3	4-3	9-1	5-1	2-3	2.436	817	2.519	1.17	1.51	1.50	1.36
		9-11	19-8	2 TO 5	10.5	12.5	10	4	9	9	5	8	8	104	9-2	4-3	8-8	4-10	2-4	1.890	724		1.12	1.45	1.43	1.37
		9-11.5	19-8	5 TO 7	11	12.5	10	4	9	9	5	8	8	104	7-3	4-3	8-9	4-10	2-4	1.920	705		1.60	2.08	2.24	2.71
	10	12-8	19-8	< 2	16	16	10	4	10	10	5	8	8	143	7-3	4-3	11-1	5-1	2-3	2.560	852	2.519	1.14	1.47	1.46	1.32
		11-11	19-8	2 TO 5	10.5	12.5	10	4	9	9	5	8	8	112	9-2	4-3	10-8	4-10	2-4	2.013	759		1.11	1.44	1.50	1.42
		12-0.5	19-8	5 TO 7	11.5	13	10	4	9	9	5	8	8	112	7-3	4-3	10-9	4-10	2-6	2.104	741		1.89	2.45	2.60	3.18
20	8	10-9.5	21-8	< 2	16.5	17	10	4	10	10	5	8	8	145	8-0	4-9	9-2	5-2	2-10	2.734	883	2.741	1.19	1.55	1.48	1.35
		10-0	21-8	2 TO 3	11.5	12.5	10	4	9	9	5	8	8	110	8-0	4-8	8-9	4-10	2-4	2.099	754		1.00	1.29	1.25	1.17
		10-2	21-8	3 TO 6	12.5	13.5	10	4	9	9	5	8	8	110	8-0	4-8	8-10	4-10	2-5	2.233	756		1.37	1.78	1.71	1.59
		10-3	21-10	6 TO 8	13	14	11	4	9	9	5	8	8	113	8-0	4-8	8-11	4-11	2-7	2.363	763		1.66	2.16	2.16	2.51
		10-5.5	22-1	8 TO 10	14	15.5	12.5	4	9	9	5	8	8	113	8-0	4-10	9-0	5-11	2-7	2.628	781		1.99	2.58	2.69	3.02
	10	12-10	21-10	< 2	17	17	11	4	10	10	5	8	8	210	8-0	4-9	11-2	5-2	2-10	2.970	980	2.759	1.14	1.48	1.41	1.29
		12-0	21-8	2 TO 3	11.5	12.5	10	4	9	9	5	8	8	118	8-0	4-8	10-9	4-10	2-4	2.222	789		1.01	1.31	1.33	1.23
		12-2	21-8	3 TO 6	12.5	13.5	10	4	9	9	5	8	8	118	8-0	4-8	10-10	4-11	2-5	2.356	792		1.30	1.69	1.74	1.58
		12-3.5	21-10	6 TO 8	13	14.5	11	4	9	9	5	8	8	121	8-0	4-10	10-11	5-10	2-7	2.532	810		1.80	2.34	2.40	2.73
		12-5.5	22-1	8 TO 10	14	15.5	12.5	4	9	9	5	8	8	121	8-0	4-10	11-0	5-11	2-7	2.782	816		2.12	2.75	2.89	3.17

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

■ 1. SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.

2. 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.

★ 3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

4. FOR HEADWALL AND TOEWALL DETAILS SEE M-601-1, SHEET 1 OF 2.

5. 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_1 BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

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

7. 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).

▲ 8. 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 d_1 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.

♦ 9. LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDOT RATING MANUAL.

10. FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDOT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDOT RATING MANUAL.

Computer File Information	
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Full Path: www.codot.gov/business/designsupport	
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	Sheet Revisions	
	Date:	Comments
(R-X)	08/27/13	LRFD Design
(R-X)	08/01/15	Analysis Program Updates
(R-X)	04/05/19	Clarified this sheet is for Cast-In-Place CBC only, not for Pre-Cast CBC. Changed title and added Gen. Note 18.
(R-X)		

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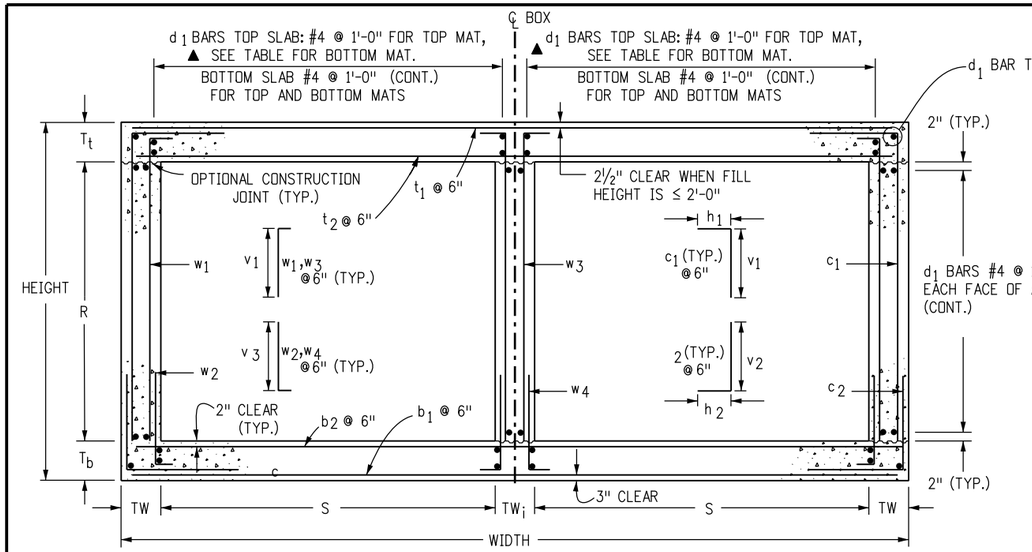
SINGLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

Issued By: Project Development Branch July 4, 2012

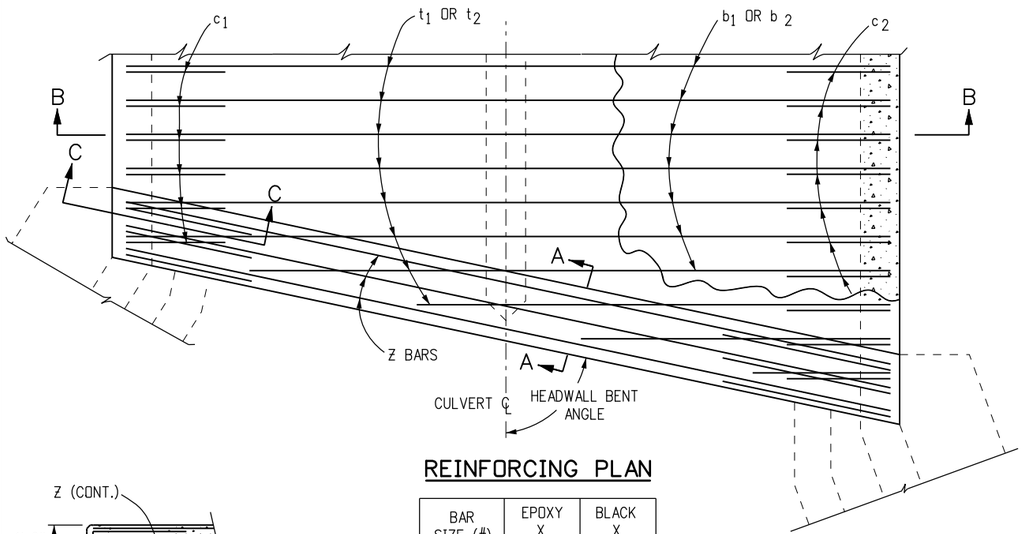
STANDARD PLAN NO.

M-601-1

Sheet No. 2 of 2

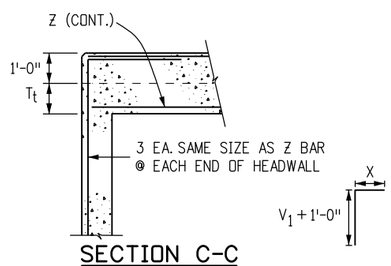


SECTION B-B



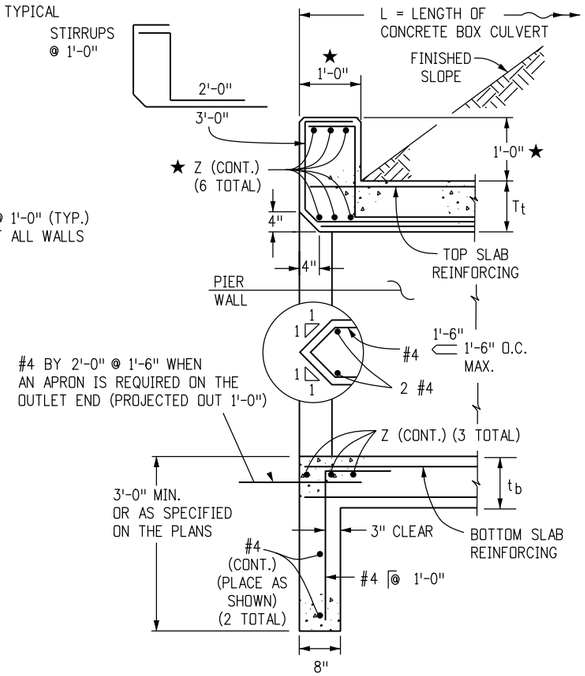
REINFORCING PLAN

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

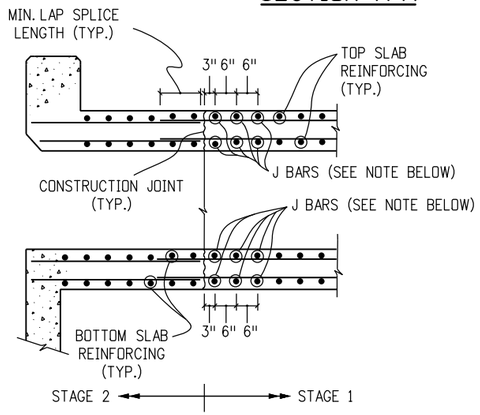


SECTION C-C

HEADWALL CORNER REINFORCING DETAIL



SECTION A-A



NOT TO SCALE

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ℄ 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 ¾".
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 HIEGHTS 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 CDOT 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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Sheet Revisions	
Date:	Comments
08/27/13	LRFD Design
08/01/15	Analysis Program Updates
04/05/19	Clarified this sheet is for Cast-In-Place CBC only, not for Pre-Cast CBC. Changed title and added Gen. Note 18.

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DOUBLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

Issued By: Project Development Branch July 4, 2012

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

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

BOX SIZE			FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INHES)			BAR SIZES									DIMENSIONS					QUANTITIES			RATING FACTORS			
S	R	HT.	WIDTH				t_1*	t_2	b_1	b_2	w_1* & w_2	w_3* & w_4	c_1*	c_2	d_1▲	h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL	MEMBRANE	HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE
FT	FT	FT-IN	FT-IN	FT-FT	T_t	T_b	TW & TW_i	#	#	#	#	#	#	#	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	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	300		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	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	258		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	5	5	102	2-6	2-4	6-8	3-1	1-11	1.451	258		◆	◆	◆	◆
	8	9-9	14-6	< 2	11	10	10	5	6	5	6	4	4	5	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	5	5	114	2-6	2-4	8-8	3-1	1-11	1.613	327		1.82	2.36	2.85	2.77
		9-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.613	285		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	5	5	114	2-6	2-4	8-8	3-1	1-11	1.636	317		◆	◆	◆	◆
	10	11-9	14-6	< 2	11	10	10	5	6	5	6	4	4	5	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	5	5	126	2-6	2-4	10-8	3-1	1-11	1.799	354		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	5	5	126	2-6	2-4	10-8	3-1	1-11	1.799	312		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	5	5	126	2-6	2-4	10-8	3-2	2-0	2.006	336		◆	◆	◆	◆
8	6	7-10.5	18-6	< 2	12.5	10	10	5	6	5	6	4	4	5	5	134	3-5	2-4	6-10	3-1	1-11	1.840	394	2.389	1.20	1.56	1.76	1.65
		7-8	18-6	2 TO 10	10	10	10	5	5	5	5	4	4	5	5	118	2-6	2-4	6-8	3-1	1-11	1.698	344		1.47	1.90	2.19	2.15
		7-10	18-6	10 TO 15	10	12	10	5	4	5	5	4	4	5	5	118	2-6	2-4	6-8	3-3	2-1	1.812	332		2.89	3.74	4.00	4.38
		7-11	18-9	15 TO 16.8	10.5	12.5	11	5	4	5	5	4	4	5	5	118	2-6	2-5	6-8	3-4	2-2	1.942	335		3.37	4.37	4.60	4.86
		7-11	18-9	16.8 TO 20	10.5	12.5	11	5	4	5	5	4	4	5	5	118	2-6	2-4	6-8	3-4	2-2	1.942	335		◆	◆	◆	◆
	8	9-10.5	18-6	< 2	12.5	10	10	5	6	5	6	4	4	5	5	146	3-5	2-4	8-10	3-1	1-11	2.025	421	2.389	1.21	1.57	1.71	1.61
		9-8	18-6	2 TO 10	10	10	10	5	5	5	5	4	4	5	5	130	2-6	2-4	8-8	3-1	1-11	1.883	371		1.46	1.89	2.18	2.13
		9-10	18-6	10 TO 15	10	12	10	5	4	5	5	4	4	5	5	130	2-6	2-4	8-8	3-3	2-1	1.997	359		2.96	3.83	4.10	4.37
		9-11	18-9	15 TO 16.8	10.5	12.5	11	5	4	5	5	4	4	5	5	130	2-6	2-5	8-8	3-4	2-2	2.146	362		3.44	4.46	4.70	4.96
		9-11	18-9	16.8 TO 20	10.5	12.5	11	5	4	5	5	4	4	5	5	130	2-6	2-5	8-8	3-4	2-2	2.146	362		◆	◆	◆	◆
10	6	8-0.5	22-6	< 2	13.5	11	10	5	6	5	6	4	4	5	5	134	3-5	2-4	6-11	3-2	2-0	2.257	444	2.833	1.15	1.49	1.65	1.49
		8-1.5	22-6	2 TO 5	13	12.5	10	5	6	5	6	4	4	5	5	134	2-6	2-4	6-11	3-4	2-2	2.326	434		1.52	1.98	1.82	1.84
		8-2	22-6	5 TO 10	13	13	10	5	4	6	6	4	4	5	5	134	2-6	2-4	6-11	3-5	2-2	2.361	417		1.77	2.29	2.65	3.77
		8-2.5	22-9	10 TO 15	13	13.5	11	6	5	6	6	5	5	5	5	134	2-6	2-5	6-11	3-5	2-7	2.472	495		3.57	4.63	4.62	5.05
		8-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	5	5	5	5	134	2-6	2-6	7-0	3-7	2-9	2.761	501		3.36	4.36	4.38	4.52
	8	10-1	22-6	< 2	14	11	10	5	6	5	6	4	4	5	5	146	3-5	2-5	8-11	3-2	2-0	2.477	472	2.833	1.22	1.58	1.60	1.44
		10-1.5	22-6	2 TO 5	13	12.5	10	5	6	5	6	4	4	5	5	146	2-6	2-4	8-11	3-4	2-2	2.512	461		1.52	1.97	1.79	1.79
		10-3	22-6	5 TO 10	13	14	10	5	4	5	6	4	4	5	5	146	2-6	2-4	8-11	3-5	2-3	2.616	425		1.74	2.25	2.61	3.53
		10-3	22-9	10 TO 15	13	14	11	6	5	6	5	5	5	5	5	146	2-6	2-5	8-11	3-5	2-7	2.711	508		3.95	5.12	5.26	5.69
		10-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	6	6	5	5	146	2-6	2-6	9-0	3-7	2-9	2.983	588		3.46	4.48	4.51	4.64
	10	12-2	22-6	< 2	14	12	10	5	6	5	6	4	4	5	5	158	3-5	2-5	10-11	3-3	2-1	2.731	499	2.833	1.24	1.60	1.79	1.61
		12-2	22-6	2 TO 5	13	13	10	5	6	5	6	4	4	5	5	158	2-6	2-4	10-11	3-4	2-2	2.731	488		1.64	2.12	1.89	1.88
		12-3	22-6	5 TO 10	13	14	10	5	4	5	6	4	4	5	5	158	2-6	2-4	10-11	3-5	2-3	2.801	452		1.72	2.23	2.58	2.74
		12-5.5	22-9	10 TO 15	14	15.5	11	5	6	6	4	5	5	5	5	158	2-6	2-5	11-0	3-7	2-9	3.090	527		2.42	3.14	3.18	2.25
		12-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	5	5	5	5	158	2-6	2-5	11-0	3-7	2-9	3.205	567		2.11	2.73	2.64	1.86
12	6	8-3.5	26-6	< 2	14.5	13	10	5	6	5	6	4	4	5	5	150	3-5	2-5	7-0	3-4	2-2	2.805	500	3.278	1.16	1.51	1.51	1.59
		8-5	26-6	2 TO 5	14	15	10	5	6	6	6	4	4	5	5	150	2-6	2-4	7-0	3-6	2-4	2.927	512		1.22	1.59	1.43	1.54
		8-5.5	26-6	5 TO 10	14	15.5	10	6	5	6	6	4	4	5	5	150	2-6	2-4	7-0	3-6	2-5	2.968	488		2.10	2.72	3.13	3.89
		8-6.5	26-9	10 TO 15	15	15.5	11	6	6	7	6	5	5	5	5	150	3-3	2-5	7-1	3-7	2-9	3.129	610		1.86	2.42	2.36	2.53
	8	10-4	26-6	< 2	14.5	13.5	10	5	6	5	6	4	4	5	5	162	3-5	2-5	9-0	3-5	2-3	3.031	528	3.278	1.16	1.51	1.56	1.59
		10-5.5	26-6	2 TO 5	14	15.5	10	5	6	5	6	4	4	5	5	162	2-6	2-4	9-0	3-7	2-5	3.154	515		1.22	1.58	1.43	1.51
		10-7.5	26-6	5 TO 10	16	15.5	10	5	6	6	6	4	4	5	5	162	3-3	2-4	9-2	3-7	2-5	3.317	544		1.70	2.21	2.16	2.39
		10-7.5	26-9	10 TO 15	16	15.5	11	6	6	7	6	5	5	5	5	162	3-3	2-5	9-2	3-7	2-9	3.416	644		2.83	3.67	3.54	3.80
	10	12-5	26-6	< 2	15	14	10	5	6	5	6	4	4	5	5	174	3-9	2-5	11-0	3-5	2-3	3.298	556	3.278	1.23	1.60	1.66	1.69
		12-5.5	26-6	2 TO 5	14	15.5	10	5	6	5	6	4	4	5	5	174	2-6	2-5	11-0	3-7	2-5	3.339	543		1.22	1.58	1.43	1.52
		12-7.5	26-6	5 TO 10	16	15.5	10	5	6	6	6	4	4	5	5	174	3-3	2-4	11-2	3-7	2-5	3.502	571		1.82	2.36	2.31	2.56
		12-7.5	26-9	10 TO 15	16	15.5	11	6	6	7	6	5	5	5	5	174	3-3	2-5	11-2	3-7	2-9	3.619	678		2.33	3.02	2.92	2.08
14	6	8-5.5	30-6	< 2	15.5	14	10	6	7	6	7	5	5	6	6	166	4-4	2-9	7-1	3-9	2-7	3.333	766	3.722	1.15	1.49	1.54	1.53
		8-4.5	30-6	2 TO 5	14	14.5	10	6	7	6	7	5	5	6	6	166	2-10	2-8	7-0	3-10	2-8	3.238	731		1.28	1.66	1.41	1.50
		8-6.5	30-6	5 TO 10	15.5	15	10	6	7	7	7	5	5	6	6	166	3-8	2-8	7-1	3-10	2-8	3.427	770		1.37	1.78	1.65	1.83
		8-8	30-6	10 TO 12	16	16	10	7	6	7	7	5	5	6	6	166	3-8	2-9	7-2	3-11	2-9	3.568	773		2.27	2.95	2.50	2.66
	8	10-5.5	30-6	< 2	15.5	14	10	6	7	6	7	5	5	6	6	178	4-4	2-9	9-1	3-9	2-7	3.518	803	3.722	1.15	1.49	1.49	1.50
		10-4.5	30-6	2 TO 5	14	14.5	10	6	7	6	7	5	5	6	6	178	2-10	2-8	9-0	3-10	2-8	3.424	768		1.26	1.64	1.38	1.46
		10-6.5	30-6	5 TO 10	15.5	15	10	6	7	7	7	5	5	6	6	178	3-8	2-8	9-1	3-10	2-8	3.612	807		1.37	1.77	1.65	1.83
		10-8.5	30-6	10 TO 12	16	16.5	10	7	5	7	7	5	5	6	6	178	3-8	2-8	9-2	4-0	2-10	3.800	783		1.46	1.90	2.09	2.27
	10	12-5.5	30-6	< 2	15.5	14	10	6	7	6	7	5	5	6	6	190	4-4	2-9	11-1	3-9	2-7	3.703	839	3.722	1.15	1.50	1.46	1.48
		12-5	30-9	2 TO 5	14	15	11	6	7	6	7	5	5	6	6	190	2-10	2-9	11-0	3-10	2-8	3.771	809		1.30	1.69	1.42	1.57
		12-6.5	30-6	5 TO 7	15.5	15	10	6	5	7	7	5	5	6	6	190	3-8	2-8	11-1	3-10	2-8	3.797	783		1.49	1.93	2.18	2.78
		12-8.5	30-6	7 TO 12	16	16.5	10	7	5	7	7	5	5	6	6	190	3-8	2-8	11-2	4-0	2-10	3.985	820		1.47	1.91	2.11	2.02
16	6	8-6.5	34-9	< 2	16	14.5	11	6	7	6	7	5	5	6	6	182	4-4	2-9	7-1	3-9	2-8	3.882	825	4.194	1.12	1.46	1.44	1.44
		8-5	34-6	2 TO 5	14	15	10	7	6	6	7	5	5	6	6	182	2-10	2-8	7-0	3-10	2-8	3.644	799		1.00	1.29	1.09	1.02
		8-6	34-6	5 TO 7	14	16	10	7	6	7	6	5	5	6	6	182	2-10	2-8	7-0	3-11	2-9	3.750	800		1.66	2.16	1.94	2.21
		8-7.5	34-9	7 TO 10	15.5	16	11	7	6	8	6	5	5	6	6	182	3-8	2-9	7-1	3-11	2-9	3.990	853		1.64	2.13	1.89	2.06
	8	10-7.5	34-9	< 2	16.5	15	11	6	7	6	7	5	5	6	6	194	4-4	2-9	9-2	3-10	2-8	4.193	864	4.194	1.18	1.54	1.45	1.46
		10-6	34-6	2 TO 5	15	15	10	8	6	7	6	5	5	6	6	194	2-10	2-8	9-1	3-10	2-8	3.935	880		1.02	1.32	1.42	1.36
		10-7	34-6	5 TO 7	15	16	10	8	6	7	6	5	5	6	6	194	2-10	2-8	9-1	3-11	2-9	4.042	881		1.72	2.23	2.23	2.13
		10-8	34-9	7 TO 10	15.5	16.5	11	7	6	8	6	5	5	6	6	194	3-8	2-9	9-1	4-0	2-10	4.247	891		1.60	2.07	1.84	2.00
	10	12-7.5	34-9	< 2	16.5	15	11	6	7	6	7	5	5	6	6	206	4-4	2-9	11-2	3-10	2-8	4.397	901	4.194	1.19	1.54	1.41	1.42
		12-6.5	34-6	2 TO 5	15.5	15	10	8	6	7	6	5	5	6	6	206	2-10	2-8	11-1	3-10	2-8	4.174	916		1.02	1.33	1.43	1.37
		12-7.5	34-6	5 TO 7	15.5	16	10	8	6	7	6	5	5	6	6	206	2-10	2-8	11-1	3-11	2-9	4.280	918		1.74	2.26	2.23	2.12
18	6	8-8	38-9	< 2	17	15	11	7	8	7	8	5	5	6	6	198	4-4	2-10	7-2	3-10	2-9	4.438	1094	4.639	1.14	1.47	1.27	1.32
		8-6.5	38-9	2 TO 5	15	15.5	11	8	8	8	8	5	5	6	6	198	3-8	2-9	7-1	3-11	2-9	4.259	1153		1.32	1.71	1.73	1.65
		8-7.5	38-9	5 TO 7	15.5	16	11	8	8	8	8	5	5	6	6	198	3-8	2-9	7-1	3-11	2-9	4.378	1153		2.23	2.89	2.57	2.58
	8	10-9	38-9	< 2	17.5	15.5	11	7	8	7	8	5	5	6	6	210	4-4	2-9	9-3	3-10	2-9	4.762	1132	4.639	1.19	1.55	1.28	1.33
		10-7	38-9	2 TO 5	15	16	11	8	9	8	9	5	5	6	6	210	3-8	2-9	9-1	3-11	2-9	4.522	1302		1.47	1.90	1.80	1.83
		10-7	38-9	5 TO 7	15	16	11	8	9	8	9	5	5	6	6	210	3-8	2-9	9-1	3-11	2-9	4.522	1302		2.20	2.85	2.45	2.46
	10	12-9	38-9	< 2	17.5	15.5	11	7	8	7	8	5	5	6	6	222	4-4	2-9	11-3	3-10	2-9	4.965	1168	4.639	1.16	1.51	1.24	1.29
		12-7	38-9	2 TO 5	15	16	11	8	9	8	9	6	6	6	6	222	3-8	2-9	11-1	3-11	3-1	4.726	1404		1.53	1.98	1.78	1.88
		12-7	38-9	5 TO 7	15	16	11	8	9	8	9	6	6	6	6	222	3-8	2-9	11-1	3-11	3-1	4.726	1404		2.20	2.85	2.39	2.39
20	6	8-10	43-0	< 2	18	16	12	8	9	8	9	6	6	7	7	214	5-0	3-3	7-3	4-3	3-1	5.179	1546	5.111	1.16	1.51	1.22	1.31
		8-7.5	43-0	2 TO 5	15.5	16	12	8	9	8	9	6	6	7	7	214	4-3	3-3	7-1	4-4	3-1	4.847	1480		1.48	1.91	1.51	1.70
	8	10-10	43-0	< 2	18	16	12	8	9	8	9	6	6	7	7	226	5-0	3-3	9-3	4-4	3-1	5.401	1595	5.111	1.14	1.48	1.16	1.24
		10-7.5	43-0	2 TO 5	15.5	16	12	8	9	8	9	6	6	7	7	226	4-3	3-3	9-1	4-4	3-1	5.069	1528		1.52	1.97	1.46	1.68
	10	12-10.5	43-0	< 2	18	16.5	12	8	9	8	9	6	6	7	7	238	5-0	3-3	11-3	4-4	3-2	5.690	1645	5.111	1.16	1.50	1.20	1.28
		12-7.5	43-0	2 TO 5	15.5	16	12	8	9	8	9	6	6	7	7	238	5-4	3-3	11-1	4-4	3-1	5.292	1585		1.52	1.97	1.43	1.64

HEADWALL AND TOEWALL QUANTITIES

HEADWALL BENT ANGLE	90° TO 75°			74° TO 60°			59° TO 45°		
CLEAR SPAN (S)	℄	STIRRUPS	REBAR QUANT.	℄	STIRRUPS	REBAR QUANT.	℄	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

■ 1. SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.

2. 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.

★ 3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

4. FOR HEADWALL AND TOEWALL DETAILS SEE M-601-2, SHEET 1 OF 2.

5. 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_1 BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

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

7. 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).

▲ 8. 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_1 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.

◆ 9. LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDOT RATING MANUAL.

10. FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDOT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDOT RATING MANUAL.

Computer File Information

Creation Date: 07/04/12	Initials: DDG
Last Modification Date: 04/05/19	Initials: JBE (R-X)
Full Path: www.codot.gov/business/designsupport	(R-X)
Drawing File Name: 601020202.dgn	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions

Date:	Comments
08/27/13	LRFD Design
08/01/15	Analysis Program Updates
04/05/19	Clarified this sheet is for Cast-In-Place CBC only, not for Pre-Cast CBC. Changed title and added Gen. Note 18.

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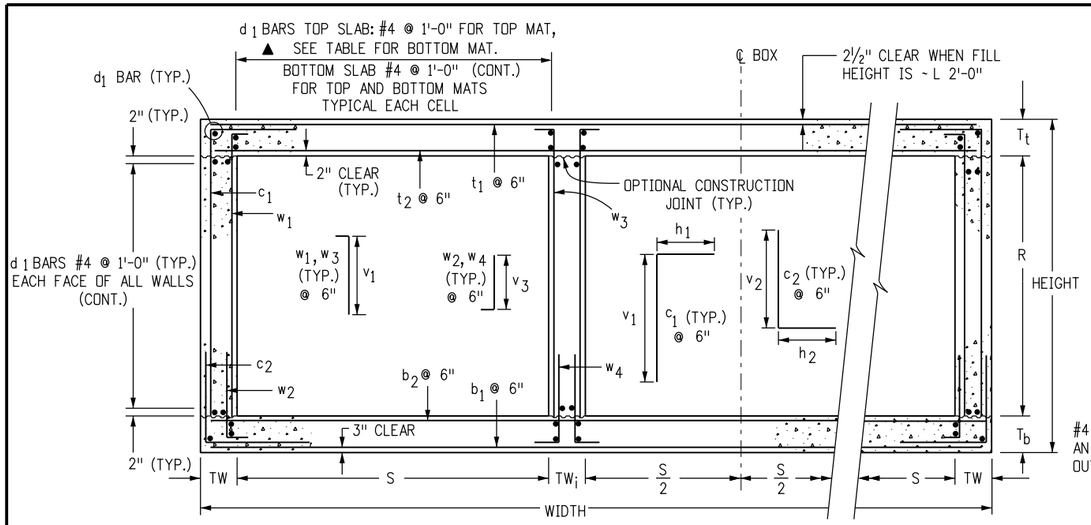
Division of Project Support DDG/Bridge

DOUBLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

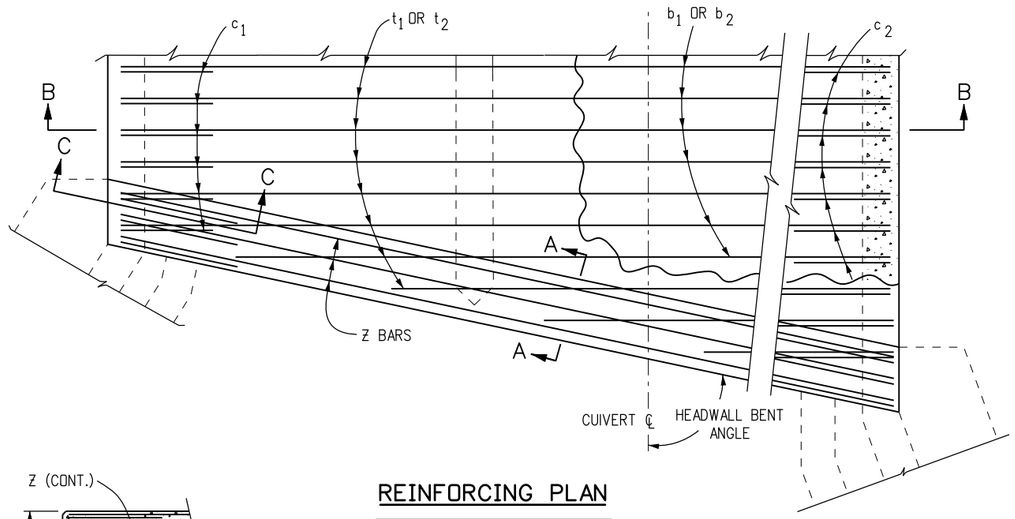
Issued By: Project Development Branch July 4, 2012

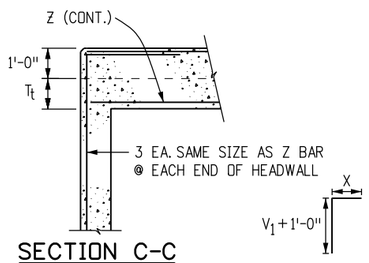
STANDARD PLAN NO.

M-601-2



SECTION B-B



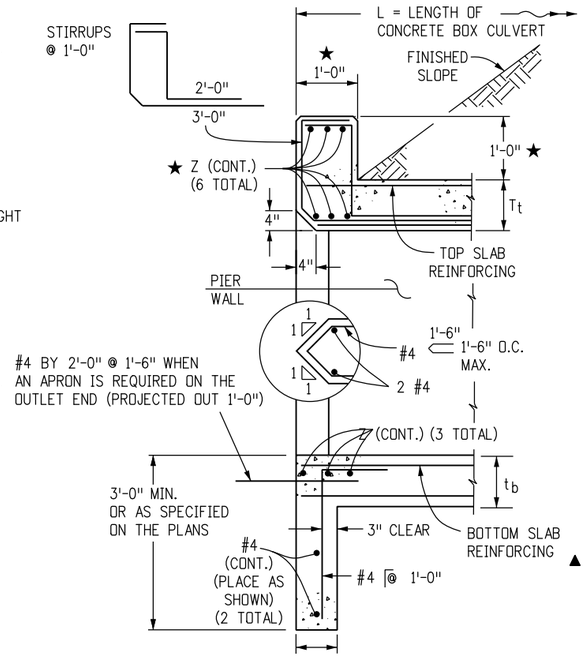


SECTION C-C

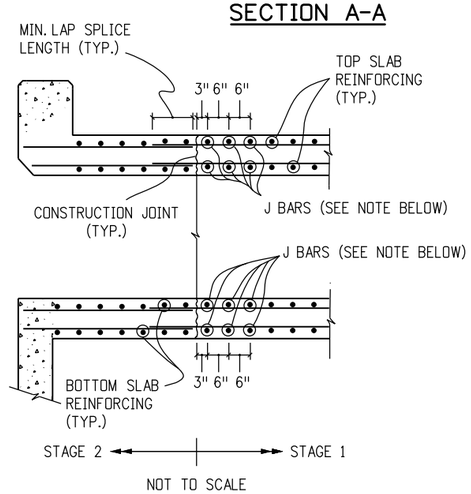
REINFORCING PLAN

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

HEADWALL CORNER REINFORCING DETAIL



SECTION A-A



CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ℄ 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 ¾ IN.
16. FOR FILL HIEGHTS 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 HIEGHTS 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
f_y = 60,000 psi.,

LOADING DATA: 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 CDOT 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: 07/04/12	Initials: DDG	
Last Modification Date: 04/05/19	Initials: JBE	(R-X)
Full Path: www.codot.gov/business/designsupport		(R-X)
Drawing File Name: 601030102.dgn		(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)

Sheet Revisions	
Date:	Comments
08/27/13	LRFD Design
08/01/15	Analysis Program Updates
04/05/19	Clarified this sheet is for Cast-In-Place CBC only, not for Pre-Cast CBC. Changed title and added Gen. Note 18.

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TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

M-601-3

Sheet No. 1 of 2

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

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES								d_1▲	DIMENSIONS					QUANTITIES			RATING FACTORS			
S	R	HT.	WIDTH		T_t	T_b	TW & TW_i	t_1*	t_2	b_1	b_2	w_1* & w_2	w_3* & w_4	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL	WATERPROOFING	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	SY/LF				
8	6	7-10.5	27-4	< 2	12.5	10	10	5	6	5	6	4	4	5	5	168	3-5	2-4	6-10	2-4	1-11	2.639	531	3.370	1.21	1.57	1.82	1.69
		7-9.5	27-4	2 TO 8	10.5	11	10	4	5	4	5	4	4	5	5	168	2-6	2-4	6-8	3-2	2-0	2.555	429		1.47	1.90	2.07	1.83
		8-0	27-4	8 TO 12	11	13	10	4	5	4	5	4	4	5	5	168	2-6	2-4	6-9	3-4	2-2	2.765	432		3.38	4.39	4.80	5.22
		8-0	27-4	12 TO 16	11	13	10	5	4	4	4	5	5	5	5	168	2-6	2-4	6-9	3-4	2-2	2.765	462		6.80	8.81	9.35	8.63
		8-0	27-4	16 TO 20	11	13	10	5	4	5	4	5	5	5	5	168	2-4	2-4	6-9	3-5	2-2	2.765	482		1.69	2.19	2.20	2.27
		8-3.5	27-4	20 TO 25.9	13	14.5	10	5	5	5	5	5	5	5	5	168	2-6	2-4	6-11	2-4	2-3	3.061	523		6.80	8.82	8.50	5.95
		8-4.5	27-10	26 TO 30	13.5	15	11.5	5	6	5	6	5	5	5	5	168	3-3	2-6	6-11	3-6	2-4	3.300	587		◆	◆	◆	◆
	8	9-10.5	27-4	< 2	12.5	10	10	5	6	5	6	4	4	5	5	184	3-5	2-4	8-10	3-1	1-11	2.886	566	3.370	1.21	1.57	1.82	1.65
		9-9.5	27-4	2 TO 8	10.5	11	10	4	5	4	5	4	4	5	5	175	2-6	2-4	8-8	3-2	2-0	2.801	461		1.46	1.89	2.00	1.82
		10-0	27-4	8 TO 12	11	13	10	4	5	4	5	4	4	5	5	184	2-6	2-4	8-9	3-4	2-2	3.012	464		3.45	4.47	4.89	5.12
		10-0	27-4	12 TO 16	11	13	10	5	4	4	5	4	4	5	5	184	2-6	2-4	8-9	2-4	2-2	3.012	460		2.53	3.27	3.47	3.73
		10-4	27-4	16 TO 20	13.5	14.5	10	5	4	5	5	4	4	5	5	184	3-3	2-4	8-11	3-5	2-2	3.350	490		3.07	3.98	3.84	2.72
		10-4	27-6	20 TO 25.9	13.5	14.5	10.5	5	6	5	5	6	6	5	5	184	3-3	2-4	8-11	3-6	2-3	3.414	675		1.78	2.32	2.23	1.56
		10-4.5	27-10	26 TO 30	13.5	15	11.5	5	5	5	5	5	5	5	5	184	3-3	2-6	8-11	3-6	2-4	3.584	578		◆	◆	◆	◆
10	6	8-0	33-4	< 2	14	10	10	6	7	6	7	5	5	5	5	192	3-5	2-4	6-11	3-1	1-11	3.210	796	4.037	1.20	1.55	1.44	1.37
		7-9	33-4	2 TO 8	11	10	10	6	7	6	7	5	5	5	5	192	2-6	2-4	6-9	2-4	1-11	2.901	774		1.56	2.02	1.81	1.73
		8-1	33-4	8 TO 12	11.5	13.5	10	5	7	5	7	5	5	5	5	192	2-6	2-4	6-9	3-4	2-2	3.313	721		2.81	3.65	3.73	4.04
		8-2.5	33-4	12 TO 16	12	14.5	10	6	6	5	7	5	5	5	5	192	2-6	2-4	6-10	3-7	2-4	3.467	720		2.67	3.47	3.58	3.84
		8-6	33-4	16 TO 22	14	16	10	6	5	6	5	5	5	5	5	192	2-6	2-4	7-0	3-7	2-5	3.827	658		2.44	3.17	3.04	3.14
	8	10-0	33-6	< 2	14	10	10.5	6	7	6	7	5	5	5	5	208	3-5	2-4	8-11	3-1	1-11	3.519	840	4.056	1.20	1.56	1.40	1.33
		9-11.5	33-4	2 TO 6	11.5	12	10	6	7	6	7	5	5	5	5	208	2-6	2-4	8-9	2-4	2-0	3.405	817		1.65	2.14	2.44	2.39
		10-1	33-4	6 TO 8	11.5	13.5	10	5	7	5	7	5	5	5	5	208	2-6	2-4	8-9	3-3	2-0	3.560	760		3.11	4.04	3.99	4.60
		10-1	33-4	8 TO 12	11.5	13.5	10	5	7	5	7	5	5	5	5	208	2-6	2-4	8-9	3-5	2-2	3.560	763		2.85	3.69	3.76	4.07
		10-5	33-4	12 TO 16	13.5	15.5	10	5	7	5	7	5	5	5	5	208	2-6	2-4	8-11	3-7	2-4	3.971	768		3.36	4.36	4.60	4.04
		10-6	33-4	16 TO 22	14	16	10	6	7	6	7	5	5	5	5	208	2-6	2-4	9-0	3-7	2-5	4.074	831		2.37	3.08	2.93	2.10
	10	12-0	33-6	< 2	14	10	10.5	6	7	6	7	5	5	5	5	224	3-5	2-4	10-11	2-4	1-11	3.778	879	4.056	1.17	1.52	1.36	1.30
		11-10.5	33-6	2 TO 8	11.5	11	10.5	6	7	6	7	5	5	5	5	224	2-6	2-4	10-9	3-2	2-0	3.623	864		1.65	2.14	2.15	2.06
		12-0.5	33-8	8 TO 12	11.5	13	11	5	7	5	7	5	5	5	5	224	2-6	2-5	10-9	3-4	2-2	3.904	808		3.09	4.00	3.92	3.08
		12-3	33-4	12 TO 14	12.5	14.5	10	5	5	5	5	5	5	5	5	224	2-6	2-4	10-10	3-6	2-3	4.012	675		1.68	2.17	2.10	1.50
		12-5	33-6	14 TO 16	13.5	15.5	10.5	5	7	5	7	5	5	5	5	224	2-6	2-4	10-11	3-7	2-4	4.295	812		1.59	2.06	1.99	1.41
		12-6	34-0	16 TO 22	14	16	12	6	7	6	7	5	5	6	6	224	2-10	2-8	11-0	2-4	2-5	4.630	914		1.40	1.82	1.75	1.24
12	6	8-1	39-6	< 2	15	10	10.5	6	7	6	7	5	5	5	5	216	3-9	2-4	7-0	3-1	1-11	3.826	905	4.722	1.03	1.33	1.14	1.15
		7-11.5	39-4	2 TO 4	12.5	11	10	6	7	6	7	5	5	5	5	203	2-6	2-4	6-10	3-2	2-0	3.594	881		1.34	1.74	1.46	1.55
		8-2	39-4	4 TO 8	13.5	12.5	10	5	7	5	7	5	5	5	5	216	2-6	2-4	6-11	3-7	2-5	3.897	818		1.10	1.42	1.27	1.36
		8-6.5	39-4	8 TO 10	14.5	16	10	5	7	5	7	5	5	5	5	216	3-3	2-4	7-0	3-7	2-5	4.443	823		2.22	2.88	2.82	3.06
		8-8	39-6	10 TO 12	16	16	10.5	6	5	6	5	5	5	5	5	216	3-3	2-4	7-2	2-4	2-3	4.679	735		3.48	4.51	4.97	5.27
		8-8	39-8	12 TO 16	16	16	11	6	5	6	5	5	5	5	5	216	3-3	2-5	7-2	3-7	2-5	4.733	745		2.48	3.22	3.40	3.59
		8-11	39-8	16 TO 18	17	18	11	6	5	6	5	5	5	5	5	216	3-3	2-4	7-3	3-9	2-7	5.100	748		2.09	2.71	2.79	2.86
	8	10-1.5	39-6	< 2	15	10.5	10.5	6	7	6	7	5	5	6	6	232	3-9	2-8	9-0	3-5	1-11	4.146	984	4.722	1.07	1.39	1.19	1.20
		9-11.5	39-4	2 TO 4	12.5	11	10	6	7	6	7	5	5	5	5	232	2-6	2-4	8-10	3-2	2-0	3.841	923		1.31	1.70	1.44	1.52
		10-2.5	39-4	4 TO 8	13.5	13	10	5	5	5	5	5	5	5	5	232	2-6	2-4	8-11	2-4	2-2	4.205	695		1.15	1.50	1.34	1.43
		10-9.5	39-8	8 TO 12	16	17.5	11	5	5	5	5	5	5	5	5	232	3-3	2-5	9-2	3-9	2-6	5.188	716		2.51	3.26	2.93	3.11
		10-11	39-8	12 TO 18	17	18	11	6	5	6	5	5	5	5	5	232	3-3	2-5	9-3	3-9	2-7	5.371	790		1.98	2.57	2.63	2.71
	10	12-3	39-6	< 2	16	11	10.5	6	7	6	7	5	5	6	6	248	4-4	2-8	11-1	2-8	2-0	4.588	1030	4.722	1.11	1.44	1.23	1.24
		11-11.5	39-4	2 TO 4	12.5	11	10	6	7	6	7	5	5	5	5	248	2-6	2-4	10-10	3-2	2-0	4.087	964		1.30	1.69	1.43	1.50
		12-4.5	39-4	4 TO 8	13.5	15	10	5	5	5	5	5	5	5	5	248	2-6	2-4	10-11	2-4	2-4	4.694	739		1.60	2.07	2.17	2.61
		12-9.5	39-8	8 TO 12	16	17.5	11	5	5	5	5	5	5	5	5	248	3-3	2-5	11-2	3-9	2-6	5.459	757		2.57	3.34	3.00	3.06
		12-11	39-8	12 TO 18	17	18	11	6	5	6	5	5	5	5	5	248	3-3	2-5	11-3	3-9	2-7	5.643	832		1.36	1.77	1.70	1.21
14	6	8-3	45-6	< 2	16	11	10.5	7	8	7	8	5	5	5	5	240	3-9	2-4	7-1	3-2	2-0	4.569	1243	5.389	1.00	1.30	1.10	1.12
		8-1	45-4	2 TO 4	13	12	10	7	8	7	8	5	5	5	5	240	2-6	2-4	6-11	3-3	2-1	4.239	1196		1.31	1.69	1.67	1.69
		8-2	45-4	4 TO 8	13	13	10	7	8	7	8	5	5	5	5	240	2-6	2-4	6-11	2-4	2-2	4.379	1193		1.98	2.57	2.82	2.90
		8-5	45-8	8 TO 12	14	15	11	7	8	7	8	5	5	6	6	240	2-10	2-9	7-0	3-10	2-4	4.902	1242		3.51	4.54	3.93	4.17
	8	10-3.5	45-6	< 2	16	11.5	10.5	7	8	7	8	5	5	5	5	256	3-9	2-4	9-1	3-2	2-0	4.899	1284	5.389	1.04	1.35	1.14	1.16
		10-1	45-4	2 TO 4	13	12	10	7	8	7	8	5	5	5	5	256	2-6	2-4	8-11	3-3	2-1	4.486	1237		1.43	1.86	1.63	1.65
		10-2	45-4	4 TO 8	13	13	10	7	8	7	8	5	5	5	5	256	2-6	2-4	8-11	3-4	2-2	4.626	1238		2.10	2.73	2.76	2.84
		10-5	46-0	8 TO 12	14	15	12	7	8	7	8	5	5	6	6	256	2-10	2-10	9-0	2-4	2-4	5.302	1285		3.52	4.56	3.95	4.19
	10	12-4.5	45-6	< 2	16.5	12	10.5	7	8	7	8	5	5	5	5	272	3-9	2-4	11-2	3-2	2-1	5.299	1328	5.389	1.07	1.39	1.18	1.20
		12-1	45-4	2 TO 4	13	12	10	7	8	7	8	5	5	5	5	272	2-6	2-4	10-11	3-3	2-1	4.733	1278		1.41	1.83	1.61	1.62
		12-2	45-4	4 TO 8	13	13	10	7	8	7	8	5	5	5	5	272	2-6	2-4	10-11	3-4	2-2	4.872	1280		1.95	2.53	2.62	2.81
		12-5.5	46-0	8 TO 12	14	15.5	12	7	8	7	8	7	7	6	6	272	2-10	2-10	11-0	3-11	2-4	5.670	1561		3.77	4.89	4.56	3.99
16	6	8-5	51-6	< 2	16.5	12.5	10.5	7	8	7	8	5	5	6	6	264	4-4	2-8	7-2	2-4	2-1	5.387	1410	6.056	1.07	1.39	1.13	1.18
		8-1.5	51-4	2 TO 4	13	12.5	10	7	8	7	8	5	5	6	6	264	2-10	2-8	6-11	3-8	2-1	4.781	1359		1.25	1.62	1.31	1.37
		8-2	51-4	4 TO 6	13	13	10	7	8	7	8	5	5	6	6	264	2-10	2-10	6-11	3-8	2-2	4.860	1361		1.64	2.13	1.75	1.77
		8-3.5	51-4	6 TO 8	13.5	14	10	7	8	7	8	5	5	6	6	264	2-10	2-8	6-11	3-9	2-3	5.098	1361		1.75	2.27	1.87	1.92
		8-6	51-8	8 TO 10	14.5	15.5	11	7	8	7	8	5	5	6	6	264	3-8	2-9	7-0	3-11	2-4	5.599	1377		2.06	2.68	2.21	2.28
	8	10-5	51-6	< 2	16.5	12.5	10.5	7	8	7	8	5	5	6	6	280	4-4	2-8	9-2	2-4	2-1	5.647	1455	6.056	1.02	1.33	1.08	1.13
		10-3	51-4	2 TO 4	14	13	10	7	8	7	8	5	5	6	6	280	2-10	2-8	9-0	3-8	2-2	5.265	1406		1.31	1.70	1.38	1.44
		10-3	51-4	4 TO 6	14	13	10	7	8	7	8	5	5	6	6	280	2-10	2-8	9-0	3-8	2-2	5.265	1406		1.57	2.03	1.67	1.70
		10-4.5	51-4	6 TO 8	14	14.5	10	7	8	7	8	5	5	6	6	280	2-10	2-8	9-0	3-10	2-4	5.503	1410		2.01	2.61	2.15	2.21
		10-6.5	51-8	8 TO 10	15	15.5	11	7	8	7	8	6	6	6	6	280	3-8	2-9	9-1	3-11	2-4	5.950	1519		1.99	2.58	2.13	2.21
	10	12-6	51-6	< 2	17	13	10.5	7	8	7	8	5	5	6	6	296	4-4	2-8	11-2	2-4	2-1	6.065	1500	6.056	1.06	1.37	1.12	1.16
		12-3	51-4	2 TO 4	14	13	10	7	8	7	8	5	5	6	6	296	2-10	2-8	11-0	3-8	2-2	5.512	1452		1.30	1.68	1.36	1.43
		12-3	51-4	4 TO 6	14	13	10	7	8	7	8	5	5	6	6	296	2-10	2-8	11-0	3-8	2-2	5.512	1452		1.54	2.00	1.64	1.68
		12-5	51-4	6 TO 8	14	15	10	7	8	7	8	5	5	6	6	296	2-10	2-8	11-0	3-10	2-4	5.829	1455		2.24	2.91	2.50	2.57
		12-7	51-8	8 TO 10	15	16	11	7	8	7	8	5	5	6	6	296	3-8	2-9	11-1	3-11	2-5	6.301	1469		2.35	3.05	2.52	2.61
18	6	8-6.5	57-6	< 2	17	13.5	10.5	7	8	7	8	5	5	7	7	288	5-0	3-1	7-2	2-4	2-1	6.191	1589	6.722	1.07	1.39	1.09	1.16
		8-5	57-4	2 TO 4	15	14	10	7	8	7	8	5	5	6	6	288	3-8	2-8	7-1	3-9	2-3	5.872	1499		1.15	1.50	1.15	1.25
		8-6.5	57-8	4 TO 6	15.5	15	11	7	8	7	8	5	5	6	6	288	3-8	2-9	7-1	3-10	2-4	6.243	1507		1.50	1.94	1.52	1.57
		8-9	57-8	6 TO 8	16	17	11	7	8	7	8	5	5	6	6	288	3-8	2-9	7-2	4-0	2-6	6.688	1512		1.91	2.48	1.98	2.04
	8	10-6.5	57-6	< 2	17	13.5	10.5	7	8	7	8	5	5	7	7	304	5-0	3-1	9-2	4-1	2-1	6.450	1653	6.722	1.02	1.33	1.05	1.11
		10-5	57-4	2 TO 4	15	14	10	7	8	7	8	5	5	6	6	304	3-8	2-8	9-1	2-4	2-3	6.119	1535		1.13	1.46	1.13	1.22
		10-6.5	57-8	4 TO 6	15.5	15	11	7	8	7	8	5	5	6	6	304	3-8	2-9	9-1	3-10	2-4	6.515	1552		1.44	1.87	1.47	1.52
		10-9	57-8	6 TO 8	16	17	11	7	8	7	8	5	5	6	6	304	3-8	2-9	9-2	4-0	2-6	6.960	1557		1.88	2.44	1.93	1.99
	10	12-7	57-6	< 2	17	14	10.5	7	8	7	8	5	5	7	7	320	5-0	3-1	11-2	4-1	2-2	6.798	1703	6.722	1.06	1.38	1.08	1.15
		12-5	57-4	2 TO 4	15	14	10	7	8	7	8	5	5	6	6	320	3-8	2-8	11-1	3-9	2-3	6.366	1589		1.11	1.44	1.11	1.20
		12-6.5	57-8	4 TO 6	15.5	15	11	7	8	7	8	5	5	6	6	320	3-8	2-9	11-1	2-4	2-4	6.787	1588		1.41	1.83	1.43	1.49
		12-9	57-8	6 TO 8	16	17	11	7	8	7	8	5	5	6	6	320	3-8	2-9	11-2	4-0	2-6	7.231	1602		1.85	2.40	1.90	1.97
20	6	8-8	63-8	< 2	18	14	11	8	9	8	9	6	6	7	7	312	5-0	3-2	7-3	4-2	2-6	7.103	2195	7.407	1.00	1.30	1.00	1.07
		8-8	63-8	2 TO 4	16	16	11	7	8	7	8	5	5	6	6	312	3-8	2-9	7-2	3-11	2-5	7.103	1639		1.14	1.47	1.13	1.25
		8-8	63-8	4 TO 6	16	16	11	8	8	8	8	5	5	6	6	312	3-8	2-9	7-2	3-11	2-5	7.103	1798		1.61	2.09	2.00	2.27
	8	10-8.5	63-8	< 2	18	14.5	11	8	9	8	9	6	6	7	7	328	5-0	3-2	9-3	2-4	2-6	7.473	2259	7.407	1.02	1.33	1.02	1.09
		10-8	63-8	2 TO 4	16	16	11	7	8	7	8	5	5	6	6	328	3-8	2-9	9-2	3-11	2-5	7.374	1684		1.14	1.48	1.10	1.22
		10-8	63-8	4 TO 6	16	16	11	8	8	8	8	5	5	6	6	328	3-8	2-9	9-2	3-11	2-5	7.374	1843		1.83	2.38	2.08	2.21
	10	12-9	63-8	< 2	18	15	11	8	9	8	9	6	6	7	7	344	5-0	3-2	11-3	4-3	2-6	7.843	2335	7.407	1.06	1.37	1.05	1.13
		12-8	63-8	2 TO 4	16	16	11	7	8	7	8	5	5	6	6	344	3-8	2-9	11-2	3-11	2-5	7.646	1729		1.12	1.46	1.09	1.20
		12-8	63-8	4 TO 6	16	16	11	8	8	8	8	5	5	6	6	344	3-8	2-9	11-2	2-4	2-5	7.646	1878		1.87	2.43	2.05	2.18

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

■ 1. SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.

2. 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.

★ 3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

4. FOR HEADWALL AND TOEWALL DETAILS SEE M-601-3, SHEET 1 OF 2.

5. 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_1 BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

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

7. 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).

▲ 8. 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_1 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.

◆ 9. LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDOT RATING MANUAL.

10. FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDOT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDOT RATING MANUAL.

Computer File Information		
Creation Date: 07/04/12	Initials: DDG	
Last Modification Date: 04/05/19	Initials: JBE	(R-X)
Full Path: www.codot.gov/business/designsupport		(R-X)
Drawing File Name: 601030202.dgn		(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English		(R-X)

Sheet Revisions	
Date:	Comments
08/27/13	LRFD Design
08/01/15	Analysis Program Updates
04/05/19	Clarified this sheet is for Cast-In-Place CBC only, not for Pre-Cast CBC. Changed title and added Gen. Note 18.

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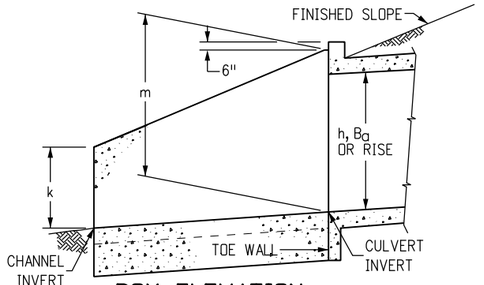
TRIPLE CONCRETE BOX CULVERT (CAST-IN-PLACE)

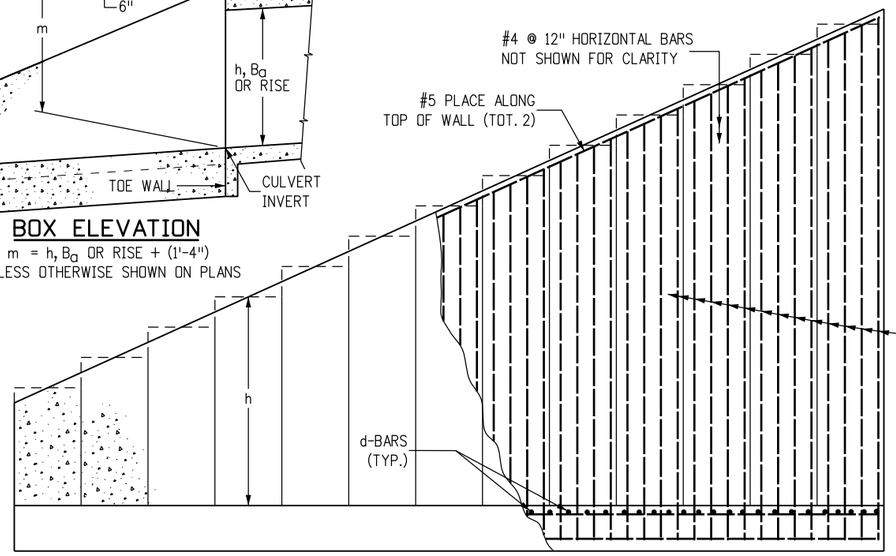
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-601-3



BOX ELEVATION

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

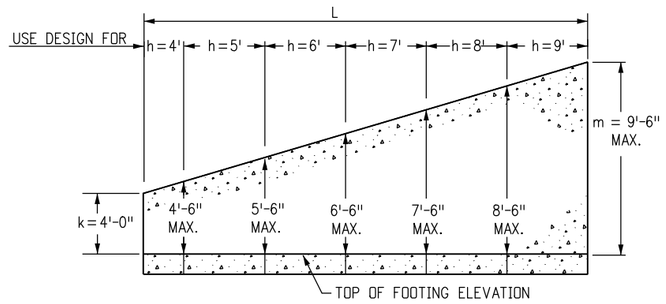


h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	■ 12'	■ 13'	■ 14'
a =	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	2'-8"	2'-10"	3'-0"
b =	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	5'-0"	5'-4"	5'-8"
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	7'-8"	8'-2"	8'-8"
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

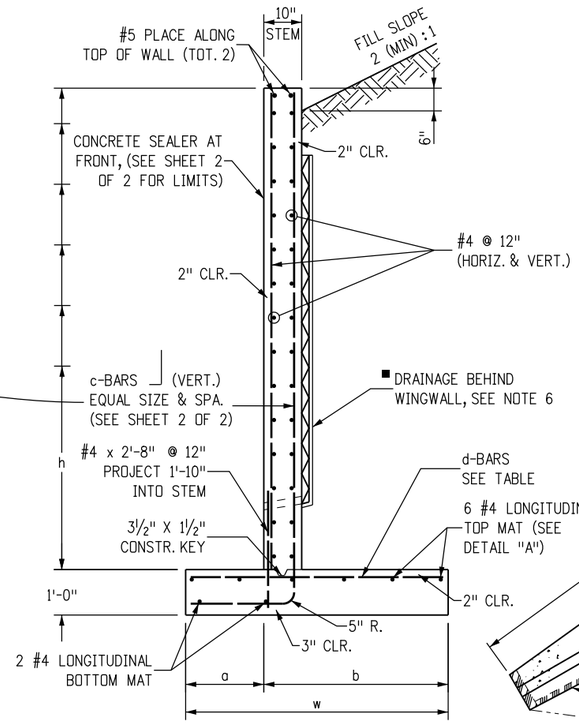
✳ DOES NOT INCLUDE TOE WALL QUANTITIES
SEE SHEET 2 OF 2 FOR REINFORCING STEEL QUANTITY

■ REQUIRED DRAINAGE BEHIND WINGWALLS
SEE NOTE 6

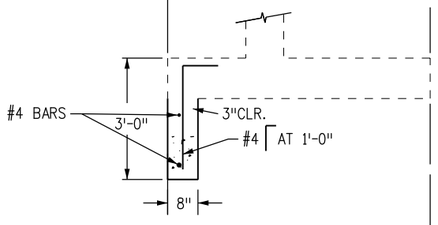
PLAN



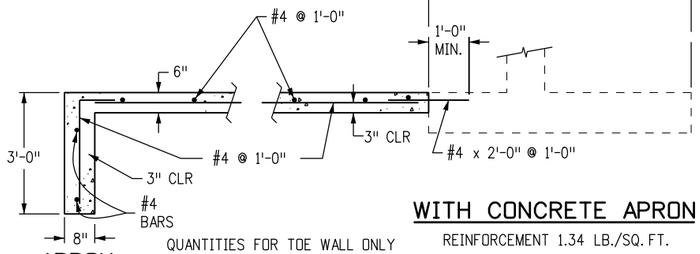
ELEVATION
DESIGN EXAMPLE



TYPICAL SECTION



WITH TOE WALL

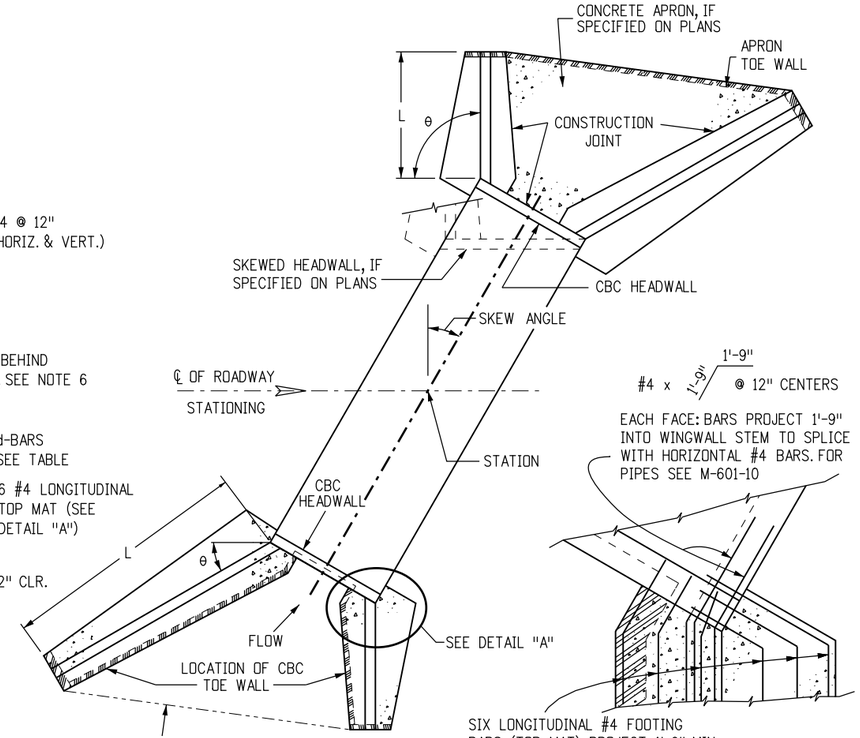


APRON TOE WALL

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

WITH CONCRETE APRON

REINFORCEMENT 1.34 LB./SQ. FT.



TYPICAL CULVERT LAYOUT

DETAIL "A"

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 PSI
REINFORCING STEEL: f_y = 60,000 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:

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
2. WINGWALL FOOTING AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
3. DIMENSIONS "h", "k", "L", "m" AND ANGLE "θ" FOR WINGWALL SHALL BE AS SHOWN ON THE PLANS.
4. 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"

5. DESIGN DOES NOT CONSIDER ANY SCOUR EFFECTS.
6. WINGWALL DRAIN SHALL BE REQUIRED IF "h" ≥ 12.0 FT., SEE SHEET 2 OF 2 FOR DETAILS.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: HHB		Date:	Comments
Last Modification Date: 09/04/18 Initials:	(R-X)	09/04/18	LRFD Design
Full Path: www.codot.gov/business/designsupport	(R-X)		
Drawing File Name: 6010200102.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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WINGWALLS FOR PIPE OR BOX CULVERTS

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-601-20
Sheet No. 1 of 2

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

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

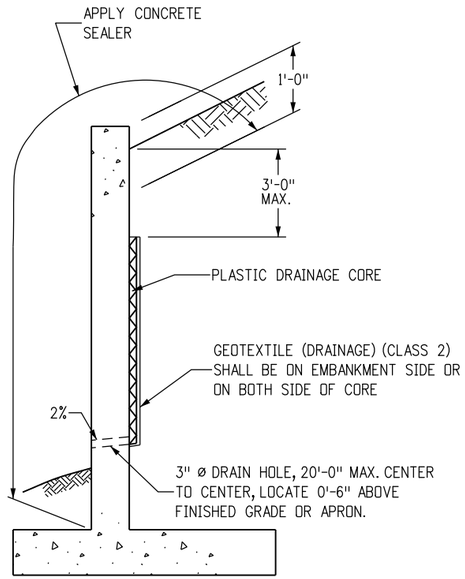
L (MULTIPLE OF m)		≤ (1.0 x m)		≤ (1.25 x m)		≤ (1.5 x m)		≤ (1.75 x m)		≤ (2.0 x m)		≤ (2.25 x m)		≤ (2.5 x m)		≤ (2.75 x m)		≤ (3.0 x m)		≤ (3.25 x m)		≤ (3.5 x m)	
m (FT)	k (FT)	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.	c-BARS	✳ REINF. LB./L.F.
14	4	#4 @ 10"	53.60	#5 @ 10"	57.95	#5 @ 10"	57.10	#5 @ 8"	60.22	#5 @ 7"	62.43	#5 @ 7"	62.09	#5 @ 6"	65.38	#5 @ 6"	65.15	#6 @ 8"	67.10	#6 @ 8"	66.94	#6 @ 7"	70.66
	5	#4 @ 10"	55.86	#5 @ 10"	60.46	#5 @ 10"	59.60	#5 @ 8"	62.89	#5 @ 7"	65.23	#5 @ 7"	64.88	#5 @ 6"	68.34	#5 @ 6"	68.11	#6 @ 8"	70.17	#6 @ 8"	70.00	#6 @ 7"	73.90
	6	#5 @ 10"	64.43	#6 @ 10"	70.60	#6 @ 10"	69.69	#6 @ 8"	74.93	#6 @ 8"	74.45	#6 @ 7"	78.30	#6 @ 6"	83.64	#6 @ 6"	83.40	#6 @ 6"	83.22	#6 @ 6"	83.05	#7 @ 7"	89.64
	7	#5 @ 10"	67.29	#6 @ 10"	73.76	#6 @ 10"	72.83	#6 @ 8"	78.32	#6 @ 8"	77.84	#6 @ 7"	81.87	#6 @ 6"	87.45	#6 @ 6"	87.21	#6 @ 6"	87.02	#6 @ 6"	86.86	#7 @ 7"	93.73
	8	#5 @ 8"	74.71	#6 @ 8"	83.46	#6 @ 7"	87.09	#6 @ 6"	92.54	#7 @ 7"	99.47	#7 @ 7"	99.08	#7 @ 6"	107.11	#7 @ 6"	106.86	#7 @ 6"	106.66	#7 @ 6"	106.49	#7 @ 6"	106.35
	9	#5 @ 8"	78.10	#6 @ 8"	87.23	#6 @ 7"	91.03	#6 @ 6"	96.72	#7 @ 7"	103.93	#7 @ 7"	103.54	#7 @ 6"	111.90	#7 @ 6"	111.65	#7 @ 6"	111.45	#7 @ 6"	111.28	#7 @ 6"	111.13
13	4	#4 @ 10"	50.51	#4 @ 10"	49.25	#5 @ 10"	53.71	#5 @ 10"	53.09	#5 @ 10"	52.36	#5 @ 9"	53.85	#5 @ 8"	55.54	#5 @ 7"	57.85	#5 @ 7"	57.67	#5 @ 7"	57.51	#6 @ 9"	59.93
	5	#4 @ 10"	52.66	#4 @ 10"	51.37	#5 @ 10"	56.09	#5 @ 10"	55.46	#5 @ 10"	54.99	#5 @ 9"	56.29	#5 @ 8"	58.08	#5 @ 7"	60.51	#5 @ 7"	60.33	#5 @ 7"	60.17	#6 @ 9"	62.72
	6	#4 @ 10"	54.92	#5 @ 10"	59.48	#5 @ 9"	60.31	#6 @ 9"	67.56	#6 @ 9"	67.08	#6 @ 9"	66.70	#6 @ 8"	69.53	#6 @ 8"	69.28	#6 @ 7"	73.12	#6 @ 7"	72.95	#6 @ 7"	72.81
	7	#4 @ 10"	57.36	#5 @ 10"	62.16	#5 @ 9"	63.05	#6 @ 9"	70.66	#6 @ 9"	70.16	#6 @ 9"	69.78	#6 @ 8"	72.75	#6 @ 8"	72.50	#6 @ 7"	76.52	#6 @ 7"	76.35	#6 @ 7"	76.20
	8	#5 @ 10"	66.39	#6 @ 10"	72.82	#6 @ 8"	77.97	#6 @ 7"	81.68	#6 @ 7"	81.19	#6 @ 6"	86.67	#6 @ 6"	86.37	#7 @ 7"	93.18	#7 @ 7"	92.97	#7 @ 7"	92.80	#7 @ 7"	92.64
	9	#5 @ 10"	69.37	#6 @ 10"	76.10	#6 @ 8"	81.49	#6 @ 7"	85.37	#6 @ 7"	84.87	#6 @ 6"	90.59	#6 @ 6"	90.29	#7 @ 7"	97.39	#7 @ 7"	97.18	#7 @ 7"	97.00	#7 @ 7"	96.85
12	2	#4 @ 10"	43.91	#4 @ 10"	42.65	#4 @ 10"	41.82	#4 @ 10"	41.22	#4 @ 10"	40.78	#4 @ 9"	41.29	#5 @ 10"	44.61	#5 @ 10"	44.37	#5 @ 10"	44.18	#5 @ 10"	44.01	#5 @ 10"	43.87
	3	#4 @ 10"	45.82	#4 @ 10"	44.55	#4 @ 10"	43.71	#4 @ 10"	43.11	#4 @ 10"	42.66	#4 @ 9"	43.22	#5 @ 10"	46.75	#5 @ 10"	46.51	#5 @ 10"	46.32	#5 @ 10"	46.15	#5 @ 10"	46.01
	4	#4 @ 10"	47.80	#4 @ 10"	46.51	#4 @ 10"	45.65	#5 @ 10"	50.06	#5 @ 10"	49.59	#5 @ 10"	49.23	#5 @ 10"	48.94	#5 @ 10"	48.69	#5 @ 9"	50.00	#5 @ 8"	51.72	#5 @ 8"	51.57
	5	#4 @ 10"	49.84	#4 @ 10"	48.53	#4 @ 10"	47.66	#5 @ 10"	52.33	#5 @ 10"	51.85	#5 @ 10"	51.48	#5 @ 10"	51.19	#5 @ 10"	50.94	#5 @ 9"	52.33	#5 @ 8"	54.14	#5 @ 8"	54.00
	6	#4 @ 10"	51.99	#4 @ 10"	50.65	#5 @ 10"	55.34	#5 @ 8"	58.41	#5 @ 8"	57.93	#6 @ 10"	60.60	#6 @ 10"	60.29	#6 @ 9"	62.42	#6 @ 9"	62.22	#6 @ 9"	62.04	#6 @ 8"	64.89
	7	#4 @ 10"	54.30	#5 @ 10"	58.80	#5 @ 10"	57.87	#5 @ 8"	61.10	#5 @ 8"	60.61	#6 @ 10"	63.43	#6 @ 10"	63.11	#6 @ 9"	65.35	#6 @ 9"	65.15	#6 @ 9"	64.97	#6 @ 8"	67.96
	8	#5 @ 10"	62.91	#5 @ 10"	61.45	#5 @ 7"	67.46	#5 @ 6"	70.68	#5 @ 6"	70.20	#6 @ 7"	76.44	#6 @ 7"	76.13	#6 @ 7"	75.87	#6 @ 6"	81.30	#6 @ 6"	81.12	#6 @ 6"	80.98
	9	#5 @ 10"	65.64	#5 @ 10"	64.15	#5 @ 7"	70.44	#5 @ 6"	73.82	#5 @ 6"	73.33	#6 @ 7"	79.86	#6 @ 7"	79.54	#6 @ 7"	79.28	#6 @ 6"	84.95	#6 @ 6"	84.77	#6 @ 6"	84.62
11	2	#4 @ 10"	41.70	#4 @ 10"	40.42	#4 @ 10"	39.57	#4 @ 10"	38.96	#4 @ 10"	38.50	#4 @ 10"	38.15	#4 @ 10"	37.87	#4 @ 10"	37.63	#4 @ 9"	38.25	#5 @ 10"	41.46	#5 @ 10"	41.31
	3	#4 @ 10"	43.57	#4 @ 10"	42.27	#4 @ 10"	41.40	#4 @ 10"	40.79	#4 @ 10"	40.33	#4 @ 10"	39.97	#4 @ 10"	39.69	#4 @ 10"	39.45	#4 @ 9"	40.12	#5 @ 10"	43.54	#5 @ 10"	43.39
	4	#4 @ 10"	45.48	#4 @ 10"	44.16	#4 @ 10"	43.28	#4 @ 10"	42.66	#4 @ 9"	43.09	#5 @ 10"	46.57	#5 @ 10"	46.27	#5 @ 10"	46.02	#5 @ 10"	45.82	#5 @ 10"	45.65	#5 @ 10"	45.50
	5	#4 @ 10"	47.46	#4 @ 10"	46.10	#4 @ 10"	45.21	#4 @ 10"	44.58	#4 @ 9"	45.06	#5 @ 10"	48.74	#5 @ 10"	48.44	#5 @ 10"	48.19	#5 @ 10"	47.99	#5 @ 10"	47.81	#5 @ 10"	47.67
	6	#4 @ 10"	49.52	#4 @ 10"	48.14	#4 @ 9"	48.23	#5 @ 10"	51.88	#5 @ 10"	51.38	#5 @ 9"	52.57	#5 @ 9"	52.27	#5 @ 8"	53.99	#5 @ 8"	53.79	#5 @ 7"	56.16	#5 @ 7"	56.01
	7	#4 @ 10"	51.73	#4 @ 10"	50.31	#4 @ 9"	50.43	#5 @ 10"	54.29	#5 @ 10"	53.78	#5 @ 9"	55.04	#5 @ 9"	54.73	#5 @ 8"	56.55	#5 @ 8"	56.35	#5 @ 7"	58.84	#5 @ 7"	58.70
	8	#4 @ 10"	54.00	#5 @ 10"	58.44	#5 @ 10"	57.45	#5 @ 8"	60.64	#5 @ 7"	62.92	#5 @ 6"	66.25	#5 @ 6"	65.94	#5 @ 6"	65.69	#6 @ 8"	67.76	#6 @ 8"	67.57	#6 @ 7"	71.45
	9	#4 @ 10"	56.20	#5 @ 10"	60.87	#5 @ 10"	59.85	#5 @ 8"	63.21	#5 @ 7"	65.60	#5 @ 6"	69.09	#5 @ 6"	68.78	#5 @ 6"	68.52	#6 @ 8"	70.69	#6 @ 8"	70.51	#6 @ 7"	74.57
10	2	#4 @ 10"	39.84	#4 @ 10"	38.53	#4 @ 10"	37.65	#4 @ 10"	37.03	#4 @ 10"	36.57	#4 @ 10"	36.20	#4 @ 10"	35.91	#4 @ 10"	35.67	#4 @ 10"	35.48	#4 @ 9"	36.07	#4 @ 9"	35.93
	3	#4 @ 10"	41.68	#4 @ 10"	40.35	#4 @ 10"	39.47	#4 @ 10"	38.84	#4 @ 10"	38.36	#4 @ 10"	38.00	#4 @ 10"	37.71	#4 @ 10"	37.46	#4 @ 10"	37.27	#4 @ 9"	37.91	#4 @ 9"	37.76
	4	#4 @ 10"	43.58	#4 @ 10"	42.22	#4 @ 10"	41.31	#4 @ 10"	40.67	#4 @ 10"	40.19	#4 @ 10"	39.82	#4 @ 10"	39.53	#4 @ 10"	39.28	#4 @ 10"	39.08	#4 @ 9"	39.77	#4 @ 9"	39.63
	5	#4 @ 10"	45.53	#4 @ 10"	44.14	#4 @ 10"	43.21	#4 @ 10"	42.56	#4 @ 10"	42.07	#5 @ 10"	46.44	#5 @ 10"	46.13	#5 @ 10"	45.87	#5 @ 10"	45.67	#5 @ 10"	45.49	#5 @ 10"	45.34
	6	#4 @ 10"	47.58	#4 @ 10"	46.14	#4 @ 10"	45.20	#4 @ 10"	44.53	#4 @ 10"	44.03	#5 @ 10"	48.67	#5 @ 10"	48.35	#5 @ 10"	48.08	#5 @ 10"	47.88	#5 @ 10"	47.69	#5 @ 10"	47.54
	7	#4 @ 10"	49.79	#4 @ 10"	48.31	#4 @ 10"	47.34	#5 @ 10"	51.97	#5 @ 10"	51.45	#5 @ 10"	51.04	#5 @ 9"	52.29	#5 @ 9"	52.03	#5 @ 8"	53.79	#5 @ 8"	53.61	#5 @ 7"	56.00
	8	#4 @ 10"	52.06	#4 @ 10"	50.54	#4 @ 10"	49.54	#5 @ 10"	54.43	#5 @ 10"	53.89	#5 @ 10"	53.47	#5 @ 9"	54.80	#5 @ 9"	54.53	#5 @ 8"	56.39	#5 @ 8"	56.20	#5 @ 7"	58.72
9	2	#4 @ 10"	38.01	#4 @ 10"	36.75	#4 @ 10"	35.85	#4 @ 10"	35.21	#4 @ 10"	34.73	#4 @ 10"	34.36	#4 @ 10"	34.06	#4 @ 10"	33.81	#4 @ 10"	33.61	#4 @ 10"	33.44	#4 @ 10"	33.30
	3	#4 @ 10"	39.93	#4 @ 10"	38.56	#4 @ 10"	37.64	#4 @ 10"	36.99	#4 @ 10"	36.51	#4 @ 10"	36.13	#4 @ 10"	35.83	#4 @ 10"	35.58	#4 @ 10"	35.38	#4 @ 10"	35.21	#4 @ 10"	35.06
	4	#4 @ 10"	41.81	#4 @ 10"	40.40	#4 @ 10"	39.47	#4 @ 10"	38.81	#4 @ 10"	38.31	#4 @ 10"	37.93	#4 @ 10"	37.63	#4 @ 10"	37.37	#4 @ 10"	37.17	#4 @ 10"	36.99	#4 @ 10"	36.84
	5	#4 @ 10"	43.75	#4 @ 10"	42.30	#4 @ 10"	41.35	#4 @ 10"	40.67	#4 @ 10"	40.17	#4 @ 10"	39.78	#4 @ 10"	39.47	#4 @ 10"	39.20	#4 @ 9"	39.86	#5 @ 10"	43.28	#5 @ 10"	43.12
	6	#4 @ 10"	45.79	#4 @ 10"	44.30	#4 @ 10"	43.31	#4 @ 10"	42.62	#4 @ 10"	42.10	#4 @ 10"	41.71	#4 @ 10"	41.39	#4 @ 10"	41.12	#4 @ 9"	41.82	#5 @ 10"	45.46	#5 @ 10"	45.30
	7	#4 @ 10"	48.04	#4 @ 10"	46.50	#4 @ 10"	45.49	#4 @ 10"	44.77	#5 @ 10"	49.29	#5 @ 10"	48.86	#5 @ 10"	48.53	#5 @ 10"	48.24	#5 @ 10"	48.03	#5 @ 10"	47.84	#5 @ 10"	47.67
	8	#4 @ 10"	50.43	#4 @ 10"	48.84	#4 @ 10"	47.80	#4 @ 10"	47.06	#5 @ 10"	51.83	#5 @ 10"	51.40	#5 @ 10"	51.05	#5 @ 10"	50.77	#5 @ 10"	50.54	#5 @ 10"	50.35	#5 @ 10"	50.18
8	2	#4 @ 10"	36.41	#4 @ 10"	35.01	#4 @ 10"	34.08	#4 @ 10"	33.42	#4 @ 10"	32.92	#4 @ 10"	32.54	#4 @ 10"	32.23	#4 @ 10"	31.97	#4 @ 10"	31.77	#4 @ 10"	31.59	#4 @ 10"	31.44
	3	#4 @ 10"	38.23	#4 @ 10"	36.80	#4 @ 10"	35.85	#4 @ 10"	35.18	#4 @ 10"	34.67	#4 @ 10"	34.28	#4 @ 10"	33.97	#4 @ 10"	33.70	#4 @ 10"	33.50	#4 @ 10"	33.32	#4 @ 10"	33.17
	4	#4 @ 10"	40.09	#4 @ 10"	38.61	#4 @ 10"	37.64	#4 @ 10"	36.95	#4 @ 10"	36.44	#4 @ 10"	36.04	#4 @ 10"	35.72	#4 @ 10"	33.45	#4 @ 10"	35.25	#4 @ 10"	35.07	#4 @ 10"	34.91
	5	#4 @ 10"	41.99	#4 @ 10"	40.47	#4 @ 10"	39.47	#4 @ 10"	38.76	#4 @ 10"	38.24	#4 @ 10"	37.83	#4 @ 10"	37.50	#4 @ 10"	37.23	#4 @ 10"	37.02	#4 @ 10"	36.84	#4 @ 10"	36.68
	6	#4 @ 10"	43.97	#4 @ 10"	42.40	#4 @ 10"	41.36	#4 @ 10"	40.64	#4 @ 10"	40.10	#4 @ 10"	39.68	#4 @ 10"	39.35	#4 @ 10"	39.07	#4 @ 9"	43.33	#5 @ 10"	43.13	#5 @ 10"	42.96
	7	#4 @ 10"	46.19	#4 @ 10"	44.56	#4 @ 10"	43.49	#4 @ 10"	42.74	#4 @ 10"	42.18	#4 @ 10"	41.75	#4 @ 10"	41.41	#4 @ 10"	41.13	#4 @ 9"	45.65	#5 @ 10"	45.45	#5 @ 10"	45.28
7	2	#4 @ 10"	34.90	#4 @ 10"	33.44	#4 @ 10"	32.47	#4 @ 10"	31.78	#4 @ 10"	31.27	#4 @ 10"	30.86	#4 @ 10"	30.54	#4 @ 10"	30.27	#4 @ 10"	30.06	#4 @ 10"	29.88	#4 @ 10"	29.72
	3	#4 @ 10"	36.73	#4 @ 10"	35.23	#4 @ 10"	34.23	#4 @ 10"	33.53	#4 @ 10"	33.00	#4 @ 10"	32.59	#4 @ 10"	32.26	#4 @ 10"	31.99	#4 @ 10"	31.78	#4 @ 10"	31.59	#4 @ 10"	31.43
	4	#4 @ 10"	38.59	#4 @ 10"	37.04	#4 @ 10"	36.01	#4 @ 10"	35.29	#4 @ 10"	34.75	#4 @ 10"	34.33	#4 @ 10"	33.99	#4 @ 10"	33.71	#4 @ 10"	33.50	#4 @ 10"	33.31	#4 @ 10"	33.14
	5	#4 @ 10"	40.48	#4 @ 10"	38.86	#4 @ 10"	37.80	#4 @ 10"	37.06	#4 @ 10"	36.50	#4 @ 10"	36.07	#4 @ 10"	35.73	#4 @ 10"	35.44	#4 @ 10"	35.22	#4 @ 10"	35.03	#4 @ 10"	34.86
	6	#4 @ 10"	42.39	#4 @ 10"	40.71	#4 @ 10"	39.61	#4 @ 10"	38.84	#4 @ 10"	38.26	#4 @ 10"	37.82	#4 @ 10"	37.47	#4 @ 10"	37.17	#4 @ 10"	36.95	#4 @ 10"	36.75	#4 @ 10"	36.58

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
   L = (2.12 x m), USE L ≤ (2.25 x m)
2. ROUND TO REAREST WHOLE NUMBER FOR m AND k:
   m = 11.8 FT., USE m = 12.0 FT.
   k = 6.3 FT., USE k = 6.0 FT.
3. DETERMINE c-BARS BY USING THE TABLE:
   L ≤ (2.25 x m)
   m = 12
   k = 6
   c-BARS: #6 @ 10"
   REINF. STEEL = 60.60 LB / LF
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	
Creation Date: 07/04/12	Initials: HHB
Last Modification Date: 09/04/18	Initials:
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Drawing File Name: 6010200202.dgn	
CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English

Sheet Revisions		
	Date:	Comments
(R-X)	09/04/18	LRFD Design
(R-X)		
(R-X)		
(R-X)		

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WINGWALLS FOR PIPE OR BOX CULVERTS

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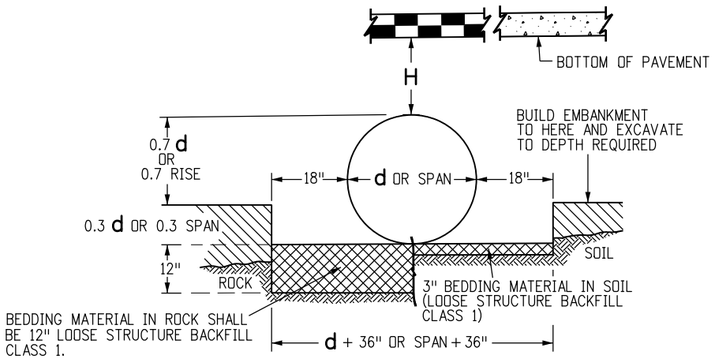
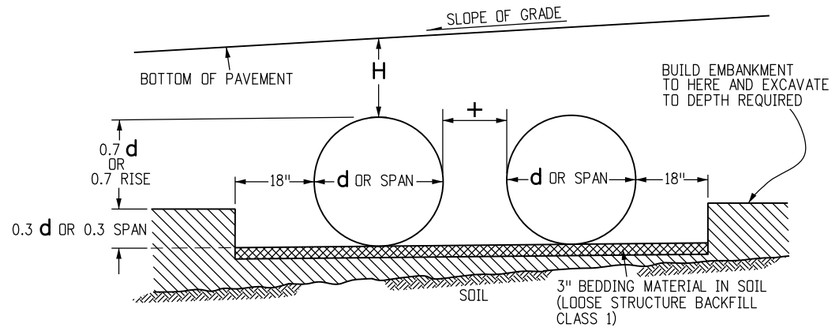


INSTALLATION OF METAL PIPE



INSTALLATION OF MULTIPLE METAL PIPES

GENERAL NOTES

1. STEEL PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M36. ALUMINUM PIPES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M196. ALUMINIZED STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M274.
2. MINIMUM COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE STRUCTURE FROM DAMAGE.
3. PIPE SHALL BE PLACED WITH LONGITUDINAL SEAMS AT THE SIDES OR QUARTER POINTS BUT NOT ALONG TOP OF VERTICAL AXIS.
4. STRUCTURAL PLATE PIPES OF EQUAL OR GREATER DIAMETER THAT CONFORM TO SECTION 510 MAY BE SUBSTITUTED FOR THE PIPES ON THESE SHEETS AT THE CONTRACTOR'S EXPENSE.
5. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
6. EXTENSIONS FOR CMP ARCH PIPE SHALL MATCH THE CORRUGATIONS, AND THE SPAN AND RISE DIMENSIONS OF THE PIPE TO BE EXTENDED.
7. WHEN INSTALLING A GUARDRAIL OR A SIGN POST DIRECTLY ABOVE A PIPE, THE BOTTOM OF THE POST MUST BE AT LEAST 1 FOOT ABOVE THE TOP OF THE PIPE. THE HOLE FOR THE POST SHALL BE DRILLED INTO THE SOIL.
8. PIPE ARCH WITH EQUAL PERIPHERY AND WITH SPAN AND RISE DIMENSIONS APPROXIMATELY EQUAL TO THOSE SPECIFIED ON THE PLANS WILL BE PERMITTED.
9. PIPE ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. WHEN COVER EXCEEDS 11 FT. USE ROUND PIPE.
10. PIPE COVER GREATER THAN 90 FT. SHALL REQUIRE AN INVESTIGATION OF THE FOUNDATION MATERIAL.

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

MINIMUM COVER FOR CONSTRUCTION LOADS

LEGEND

H = 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.

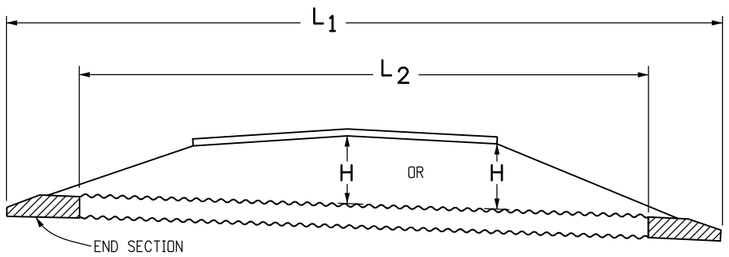
THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

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

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

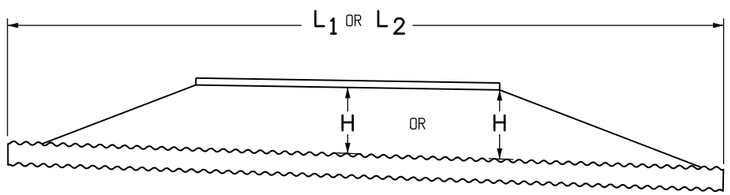
L_2 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.

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



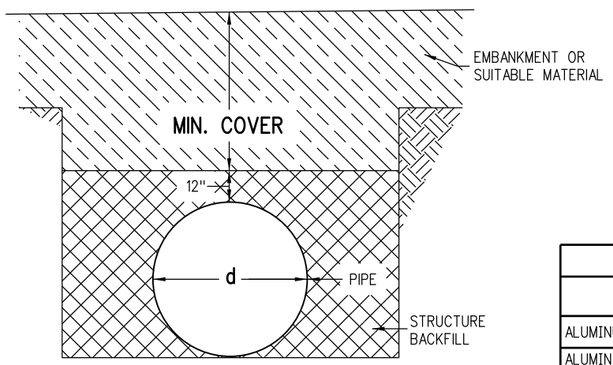
METAL PIPE WITH END SECTIONS

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.



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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 10/02/14 Initials: LTA	(R-X)	03/05/14	Deleted "H MIN." dim. Revised Gen Note 2 and 1st note in Legend.
Full Path: www.coloradodot.info/business/designsupport	(R-X)	04/29/14	Added applicable coating types notes to all sheets.
Drawing File Name: 603010104.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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METAL PIPE

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.
M-603-1
Sheet No. 1 of 4

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

2-⅔" X ½" 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

2-⅔" X ½" 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

1-½" X ¼" 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

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

¾" X ¾ 7-½" 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

¾" X ¾ 7-½" CORRUGATIONS
CORRUGATED STEEL PIPE ARCH *

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R-X		

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METAL PIPE

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STANDARD PLAN NO.
M-603-1

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

1-½" X ¼" 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

¾" X ¾" 7-½" 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

¾" X ¾" 7-½" 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

2-⅔" X ½" 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

2-⅔" X ½" 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 *

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METAL PIPE

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STANDARD PLAN NO.
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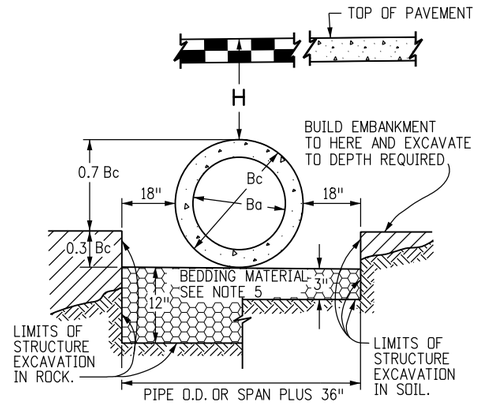


NOTE: Bc IS THE OUTSIDE DIMENSION FOR DIAMETER, SPAN OR RISE.

PIPE INSTALLATION
(WITH 0.7 PROJECTION RATIO)

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

△ ALSO EQUIVALENT ROUND DIMENSION FOR ELLIPTICAL PIPE.

DIMENSIONS FOR REINFORCED CONCRETE PIPE
(FOR INFORMATION ONLY)

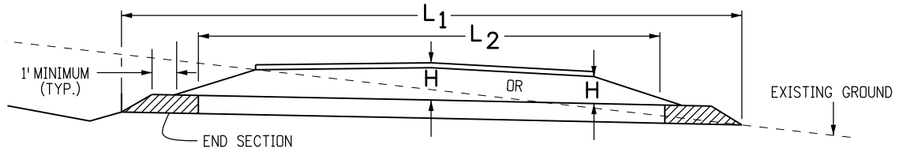
GENERAL NOTES

REINFORCED CONCRETE PIPE

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

NONREINFORCED CONCRETE PIPE

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



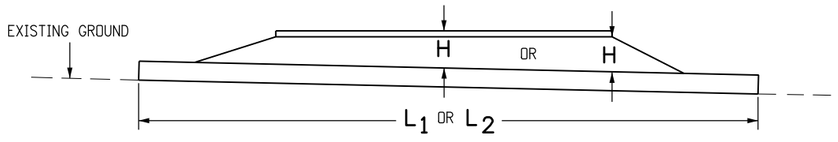
CONCRETE PIPE WITH END SECTIONS

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

H = HEIGHT OF FILL OVER TOP OF PIPE, INCLUDING PAVEMENT THICKNESS.

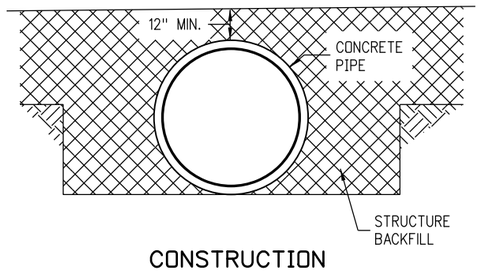
L_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

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



CONCRETE PIPE WITHOUT END SECTIONS

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



CONSTRUCTION
MINIMUM COVER FOR RIGID PIPE

TYPE OF PIPE	HEIGHT OF FILL OVER TOP OF PIPE, H (FEET)				
	CLASS OF PIPE (0.01 IN. CRACK D-LOAD)				
	CLASS CIR II CLASS VE II CLASS HE II 1000 D	CLASS CIR III CLASS VE III CLASS HE III 1350 D	CLASS CIR IV CLASS VE IV CLASS HE IV 2000 D	CLASS CIR V CLASS VE V 3000 D	CLASS VE VI 4000 D
CIRCULAR (CIR)	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)

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	Date:	Comments
(R-X)	3/25/14	Made Min. Cover for Rigid Pipe detail like others. Deleted Gen Note 1 & renumbered.
(R-X)	4/11/14	Changed "Min." to 1 in Heights table.
(R-X)		
(R-X)		

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REINFORCED CONCRETE PIPE

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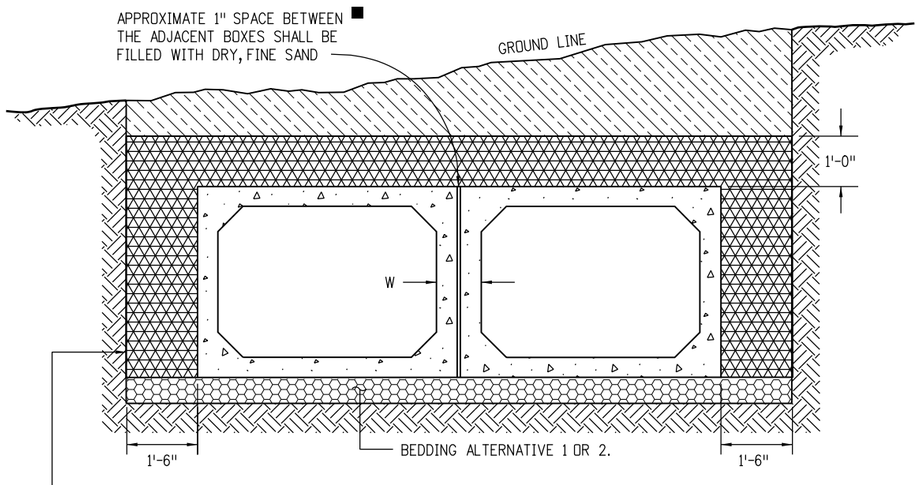
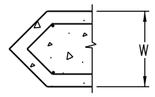
STANDARD PLAN NO.
M-603-2
Sheet No. 1 of 1



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

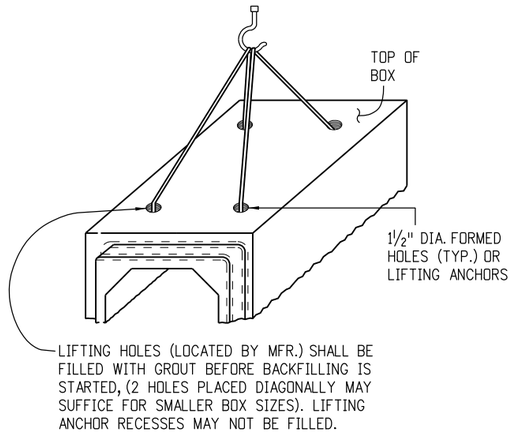
EXCAVATION & BACKFILL

(DOUBLE PARALLEL PRECAST BOX CULVERT INSTALLATION SHOWN)

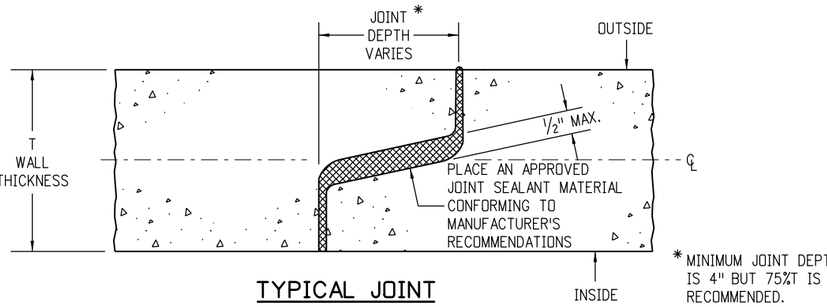


NOSE ANGLE DETAIL

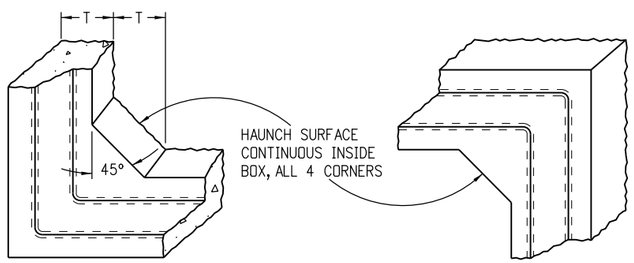
SEE STANDARD PLANS M-601-2, AND 3 TYPICAL AT ADJACENT BOXES DRILL AND GROUT REINFORCING BARS (TYP.)



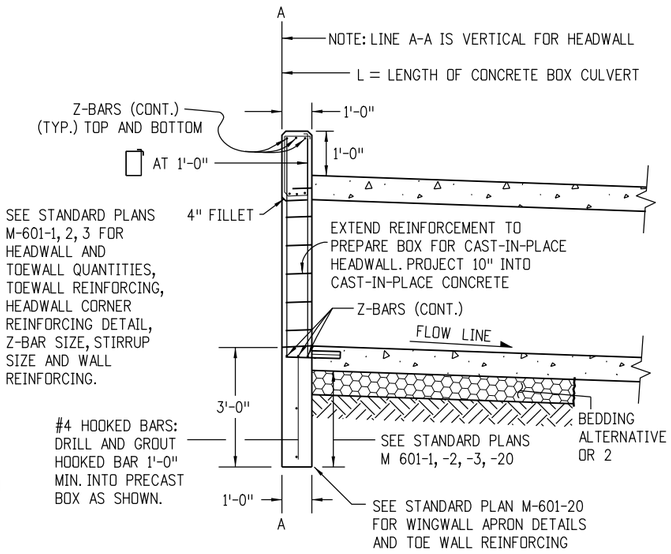
LIFTING



TYPICAL JOINT

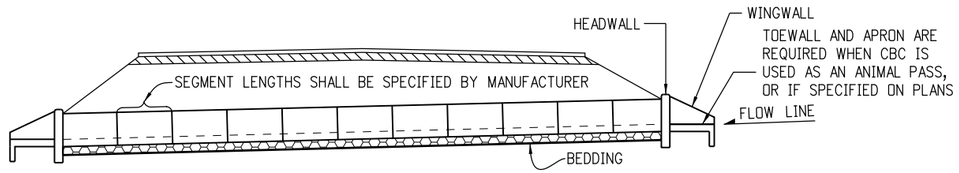


CORNERS



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

Computer File Information		Sheet Revisions	
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PRECAST CONCRETE BOX CULVERT

Issued By: Project Development Branch July 4, 2012

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

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 POLYLEHTELENE 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.

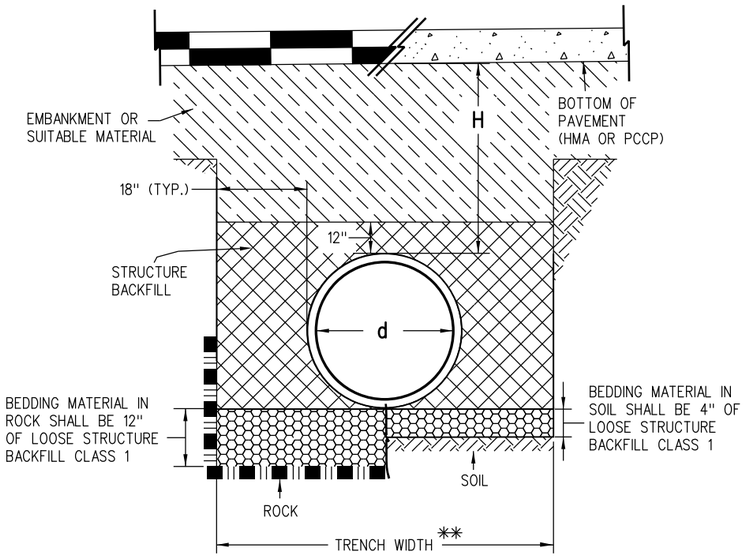
THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

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_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

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

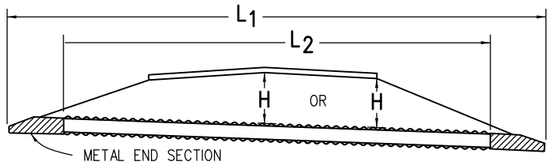
\+ = THE MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR ½(d), WHICHEVER IS GREATER.



INSTALLATION OF PIPE

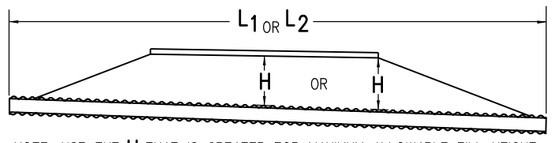
GENERAL NOTES

1. ALL PIPES SHALL MEET THE REQUIREMENTS OF AASHTO M294 FOR POLYETHELENE 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.



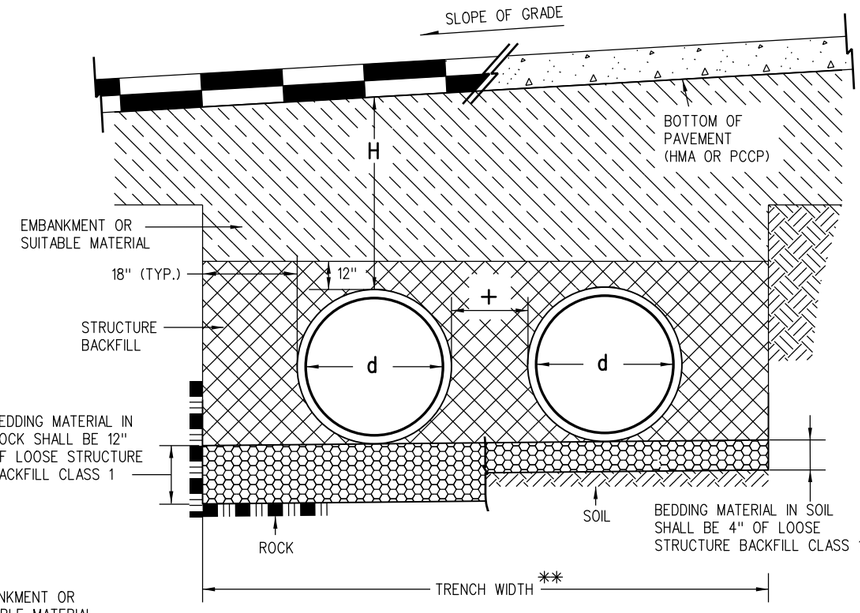
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

PIPE WITH END SECTIONS



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

PIPE WITHOUT END SECTIONS



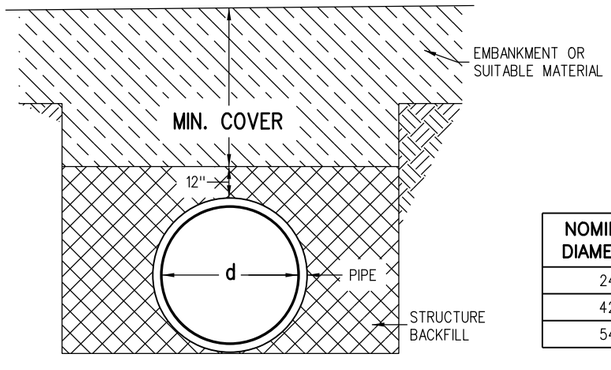
INSTALLATION OF MULTIPLE PIPES

** 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	*2*	27	*25*	19	*17*
15	2	*2*	29	*27*	20	*20*
18	2	*2*	24	*23*	17	*17*
24	2	*2*	21	*20*	15	*14*
30	2	*2*	18	*23*	12	*17*
36	2	*2*	20	*20*	13	*14*
42	2	*2*	19	*18*	13	*13*
48	3	*2*	17	*20*	12	*13*
60	3	*2.5*	20	*21*	13	*14*

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

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
42 - 48	36.0	36.0	42.0	48.0
54 - 60	36.0	36.0	42.0	48.0

AASHTO MINIMUM COVER FOR CONSTRUCTION LOADS

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11/07/13	Edited Legend and General Notes, Details, and Min. and Max. Cover table for addition of the Polypropylene pipe.

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CORRUGATED POLYETHYLENE PIPE (AASHTO M294) AND POLYPROPYLENE PIPE (AASHTO M330)

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.

M-603-4

Sheet No. 1 of 1

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%.

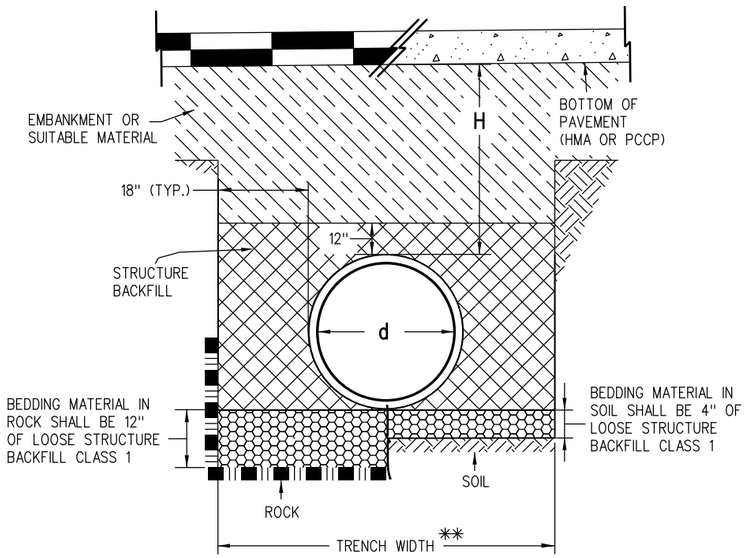
FILL HEIGHTS, FOR INSTALLATION WITH HIGH WATER TABLE, REQUIRE A SPECIAL DESIGN. THE MAXIMUM HEIGHT IN HIGHWATER LOCATIONS SHOULD BE 15 FEET OR BASED ON AASHTO LRFD DESIGN SPECIFICATIONS.

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_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

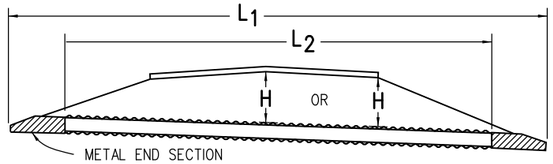
L_2 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.



INSTALLATION OF PIPE

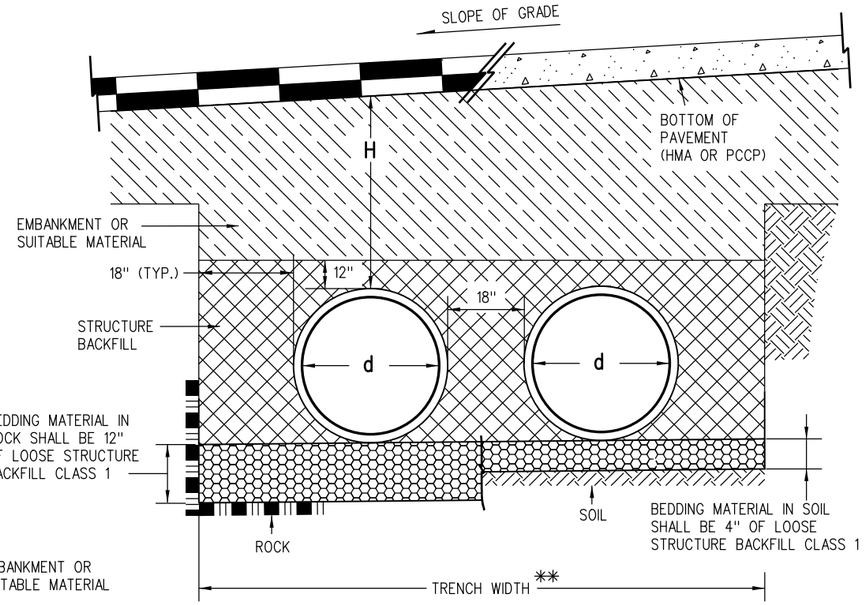
GENERAL NOTES

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



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

PIPE WITH END SECTIONS

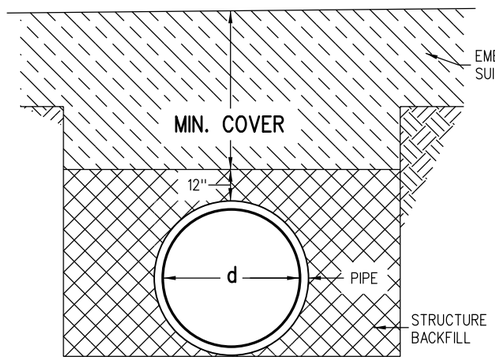


INSTALLATION OF MULTIPLE PIPES

** 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

Computer File Information		Sheet Revisions	
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Division of Project Support DLM/LTA

POLYVINYL CHLORIDE (PVC) PIPE (AASHTO M304)

Issued By: Project Development Branch on July 4, 2012

STANDARD PLAN NO.
M-603-5
Sheet No. 1 of 1

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.

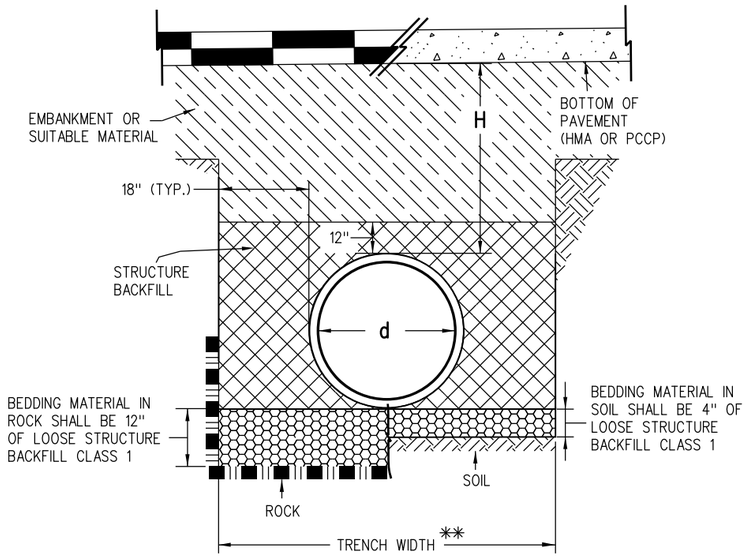
THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.

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_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 624.

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

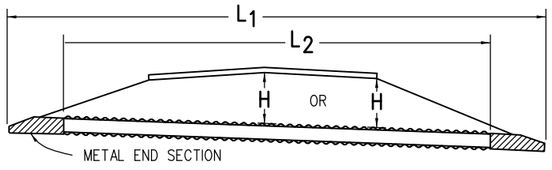
\+ = THE MINIMUM SPACING BETWEEN THE OUTSIDE WALLS OF MULTIPLE PIPES OR END SECTIONS IS 18" OR d/2, WHICHEVER IS GREATER.



INSTALLATION OF PIPE

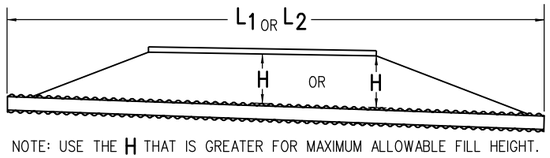
GENERAL NOTES

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.



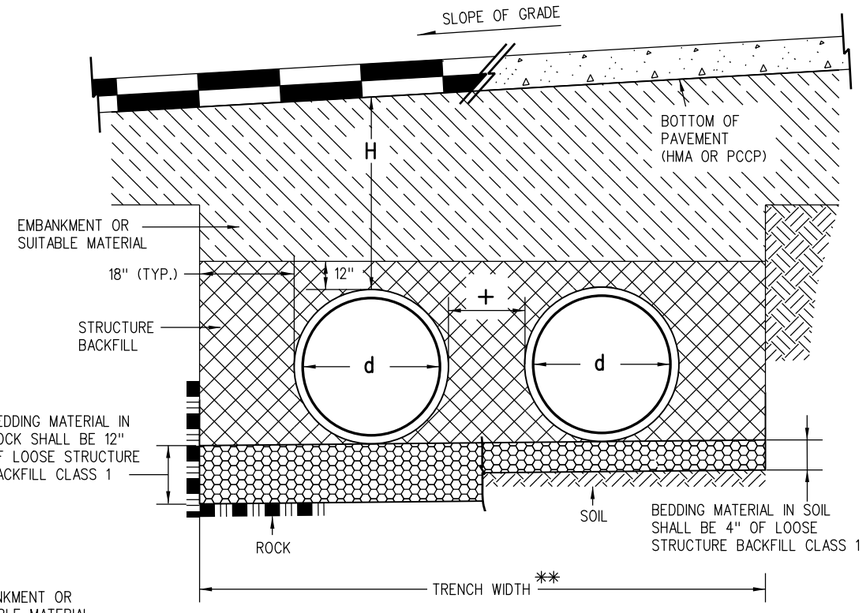
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

PIPE WITH END SECTIONS



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

PIPE WITHOUT END SECTIONS



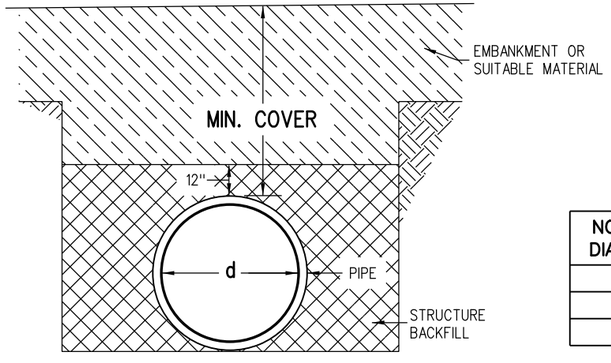
INSTALLATION OF MULTIPLE PIPES

** TRENCH WIDTH ASSUMES STABLE IN-SITU SIDE WALL

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



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
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

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Creation Date: 03/06/15	Initials: DLM	
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Sheet Revisions	
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03/06/15	Created M-603-6
04/30/15	Revised 4th and 6th paragraph in Legend. Deleted Gen. Note 6. Added footnote and revised quantities in Min. and Max. Cover Table. Change dia from 24 to 30 in AASHTO Min. Cover for Construtions Loads table.

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Division of Project Support DLM/LTA

STEEL REINFORCED POLYETHYLENE RIBBED PIPE (AASHTO MP 20)

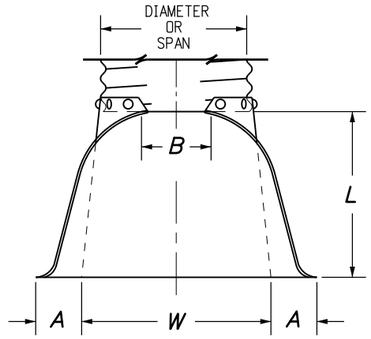
Issued By: Project Development Branch on March 6, 2015

STANDARD PLAN NO.

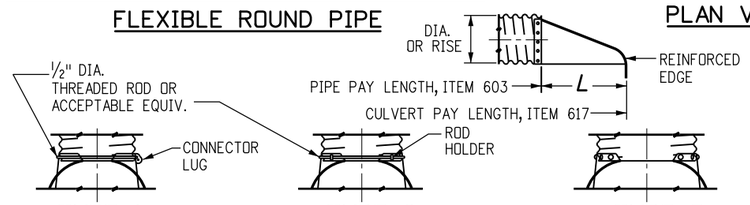
M-603-6

FLEXIBLE ROUND PIPE

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



PLAN VIEW



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.

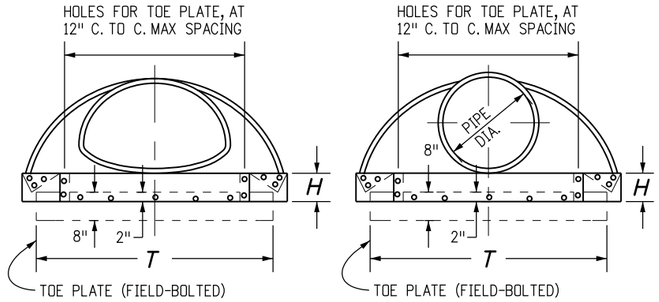
TYPE 3

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

FLEXIBLE PIPE ARCH

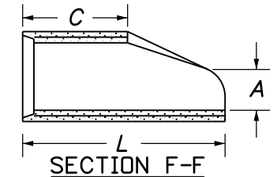
PIPE ARCH SPAN x RISE	THICK-NESS	DIMENSIONS					
		A (±1")	B (MAX.)	H (±1")	L (±1.5")	W (±2")	T
		IN.					
21 x 15	0.064	7	10	6	23	36	46
24 x 18	0.064	8	12	6	28	42	52
28 x 20	0.064	9	14	6	32	48	58
35 x 24	0.079	10	16	6	39	60	70
42 x 29	0.079	12	18	8	46	75	85
49 x 33	0.109	13	21	9	53	85	103
57 x 38	0.109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



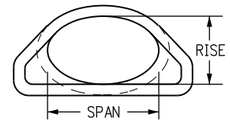
ELEVATIONS

GENERAL NOTES

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

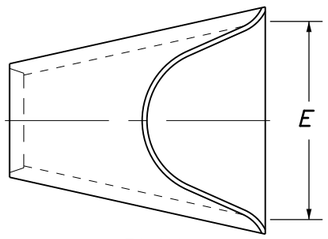


SECTION F-F



END VIEW

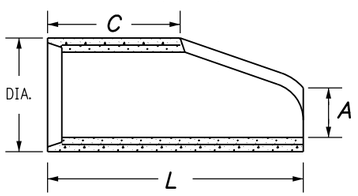
END SECTION AND CONNECTION DETAILS FOR ROUND AND ARCH METAL PIPES



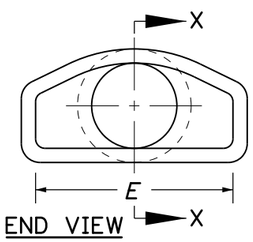
PLAN

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

REINFORCED CONCRETE CIRCULAR PIPE

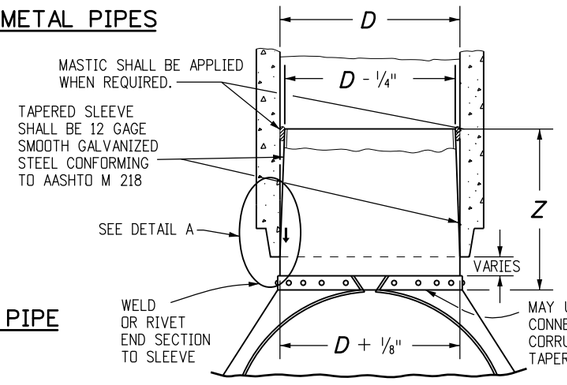


SECTION X-X



END VIEW

END SECTION FOR REINFORCED CONCRETE CIRCULAR PIPE

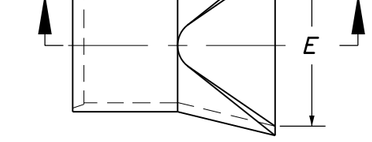


D	Z (MIN.)
IN.	
18 - 24	12
30 AND 36	16
42 AND LARGER	24

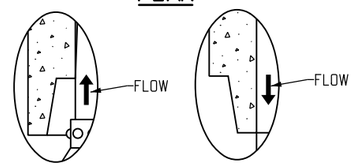
NOTE: METAL END SECTION SHALL BE FIRMLY WEDGED INTO PIPE END BEFORE BACKFILLING.

STEEL END SECTION FOR CONCRETE CIRCULAR PIPE

(ALTERNATIVE FOR CONCRETE END SECTION)



PLAN

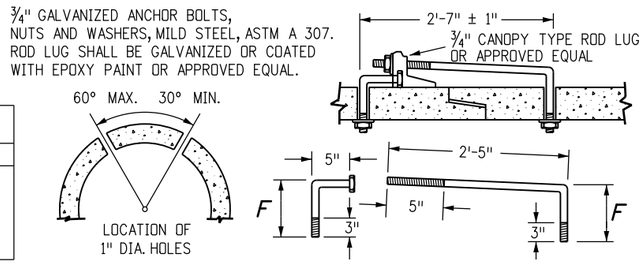


DETAIL A

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

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

END SECTION FOR REINFORCED CONCRETE ELLIPTICAL PIPE



CONCRETE JOINT FASTENER (TWO PER JOINT)

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 05/01/18 Initials: LTA	(R-X)	5/01/18	Added General Note 13.
Full Path: www.codot.gov/business/designsupport	(R-X)		
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CONCRETE AND METAL END SECTIONS

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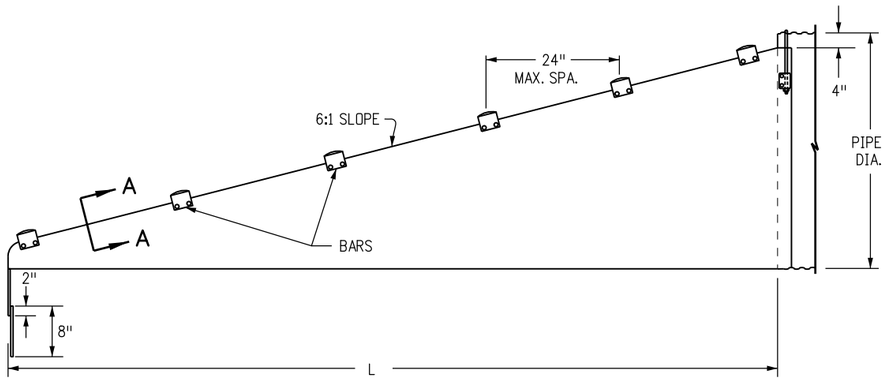
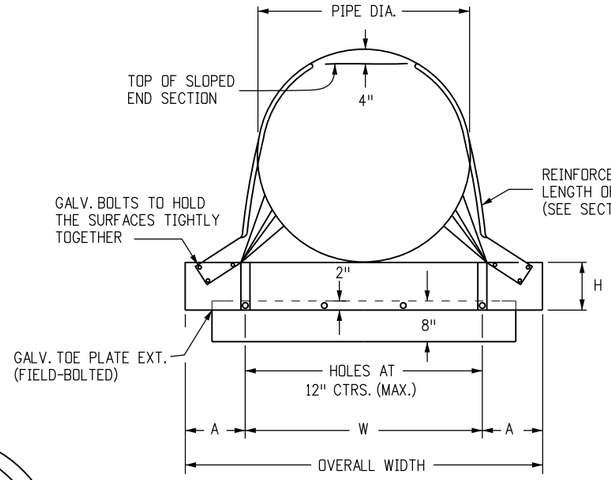
M-603-10



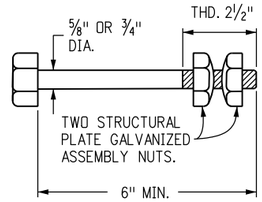
SIDE VIEW OF END SECTION - ALTERNATIVE 1



FRONT VIEW - ALTERNATIVE 1

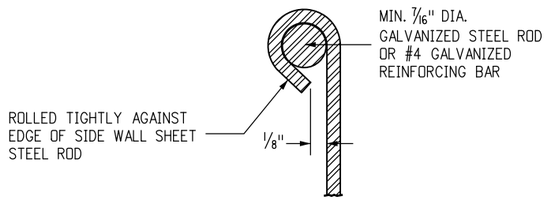
(BARS NOT SHOWN)

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

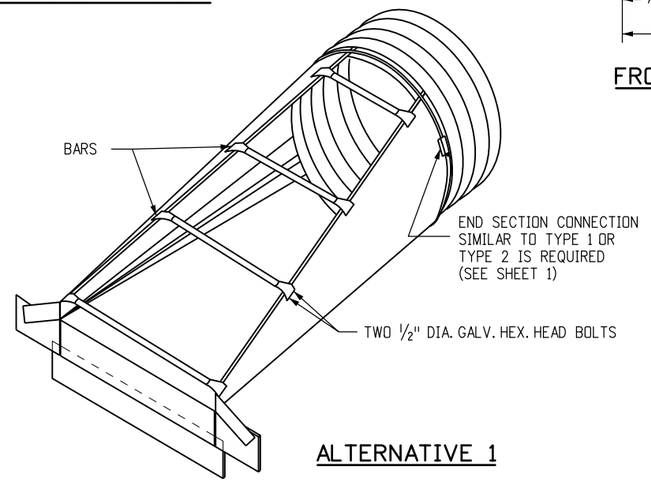


TYPICAL ANCHOR BOLT

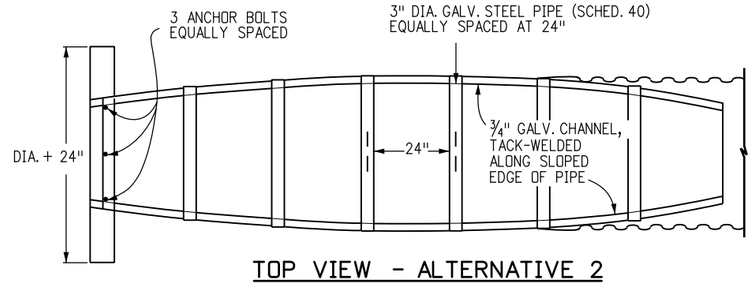
(GALVANIZED)



SECTION A-A



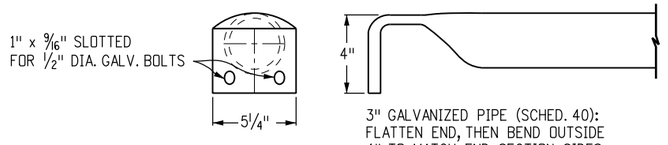
ALTERNATIVE 1



TOP VIEW - ALTERNATIVE 2

END SECTIONS FOR CIRCULAR PIPES

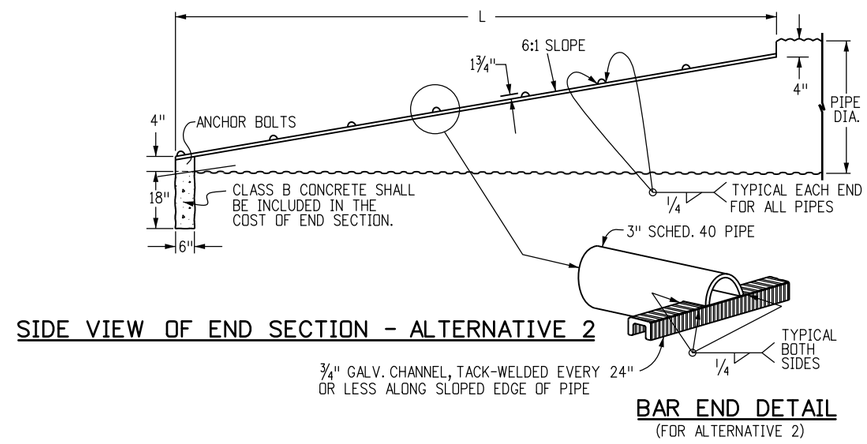
PIPE DIA. (IN.)	MIN. THICK (IN.)	DIMENSION (IN.)					
		A	H	W	OVERALL WIDTH	SLOPE	LENGTH (L)
15	.064	8	6	21	37	6:1	30
18	.064	8	6	24	40	6:1	48
21	.064	8	6	27	43	6:1	66
24	.079	8	6	30	46	6:1	84
30	.079	12	9	36	60	6:1	120
36	.109	12	9	42	66	6:1	156



BAR END DETAILS

(FOR ALTERNATIVE 1)

TYPE SD END SECTIONS FOR SIDE DRAIN



SIDE VIEW OF END SECTION - ALTERNATIVE 2

BAR END DETAIL

(FOR ALTERNATIVE 2)

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Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 05/01/18 Initials: LTA	(R-X)		
Full Path: www.codot.gov/business/designsupport	(R-X)		
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CONCRETE AND METAL END SECTIONS

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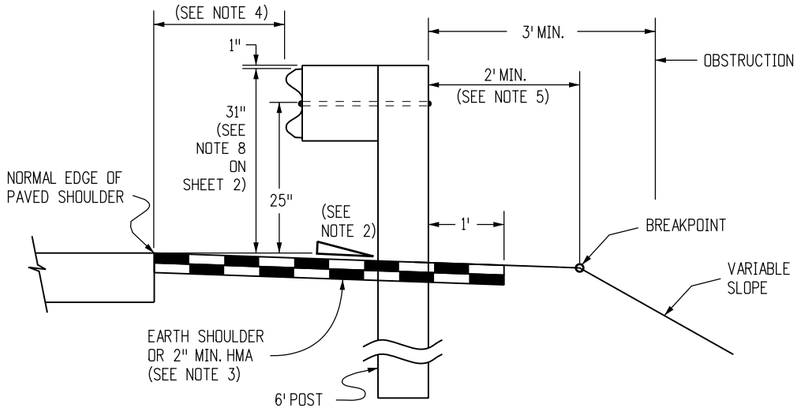
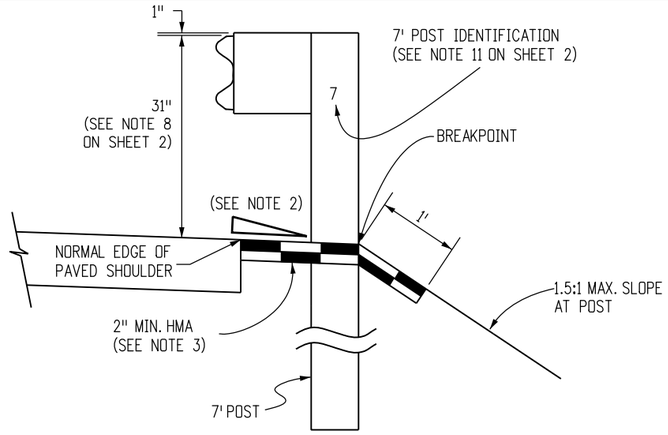
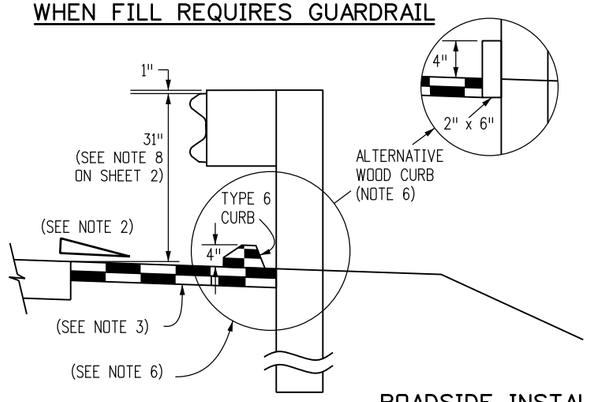


NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL

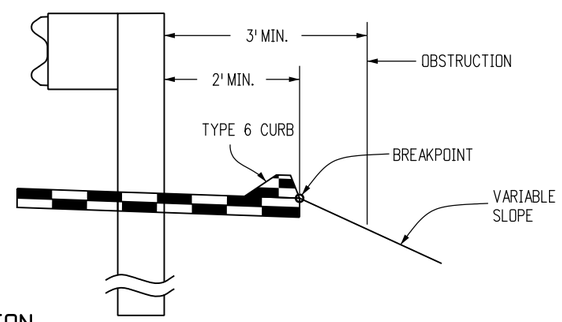


RESTRICTIVE ROADSIDE INSTALLATION WITH 7 FOOT GUARDRAIL POSTS

(SEE NOTE 5)

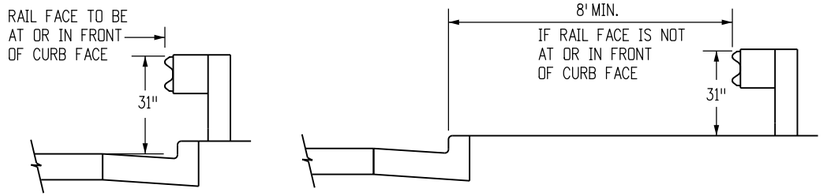


OPTION A



OPTION B (PREFERRED)

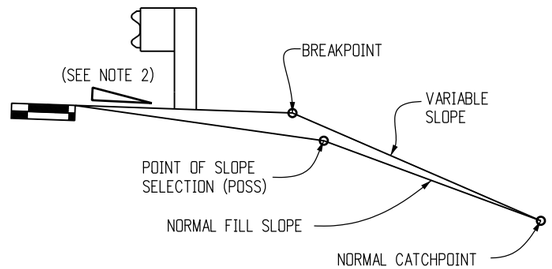
ROADSIDE INSTALLATION WITH EROSION CONTROL CURB



URBAN ROADSIDE INSTALLATION WITH CURB AND GUTTER

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

NORMAL CENTER-TO-CENTER POST SPACING



EMBANKMENT WITH GUARDRAIL

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

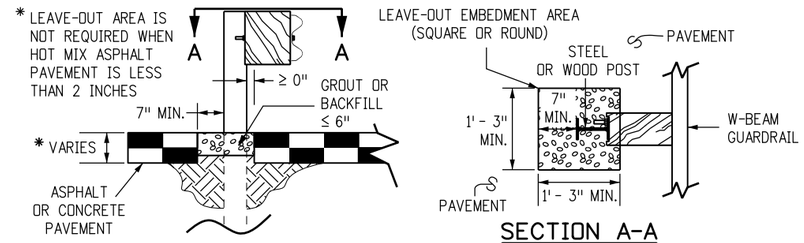
GENERAL NOTES (CONTINUE ON SHEET 2)

1. TOLERANCE FOR TOP OF GUARDRAIL BEAM IS ±1 IN.
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. 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 ½ 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.
4. THE MINIMUM GUARDRAIL OFFSET FROM PAVED SHOULDER EDGE SHALL BE:
   0 FT. FOR SHOULDERS 8 FT. OR WIDER
   2 FT. FOR SHOULDERS 6 FT. OR LESS

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

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

   USE OF GREATER THAN MINIMUM OFFSET DIMENSIONS IS ENCOURAGED TO MEET THE DESIRABLE GOAL OF PLACING THE GUARDRAIL AS FAR AS POSSIBLE FROM THE TRAVEL WAY, EVEN FOR SHORT DISTANCES, WHILE PROVIDING A SMOOTH CHANGE IN GUARDRAIL ALIGNMENT.
5. 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.
6. 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.

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

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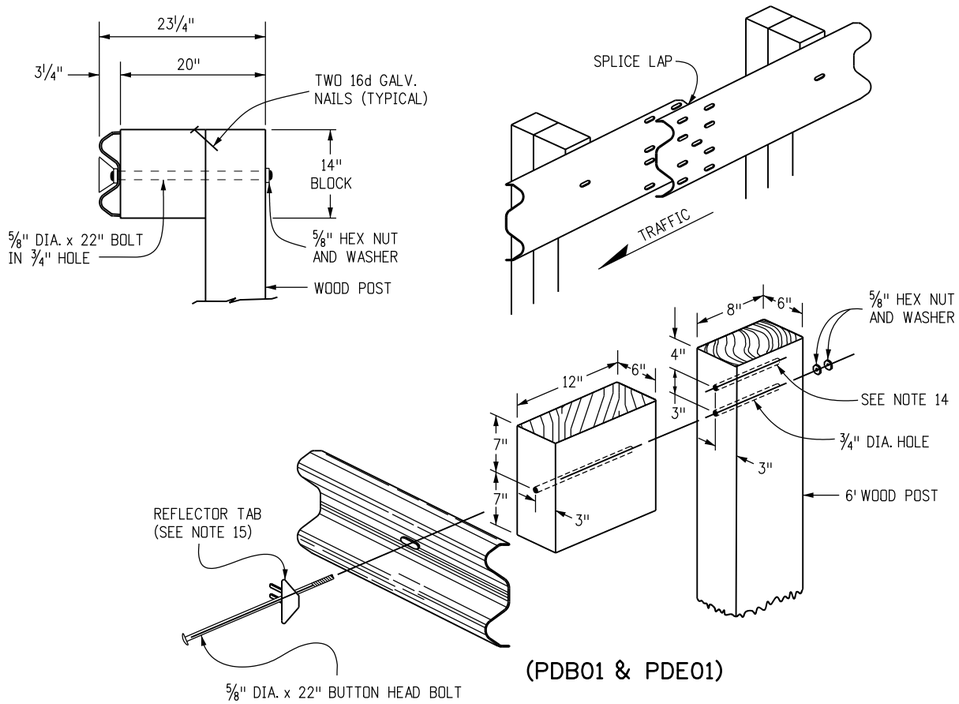
MIDWEST
GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

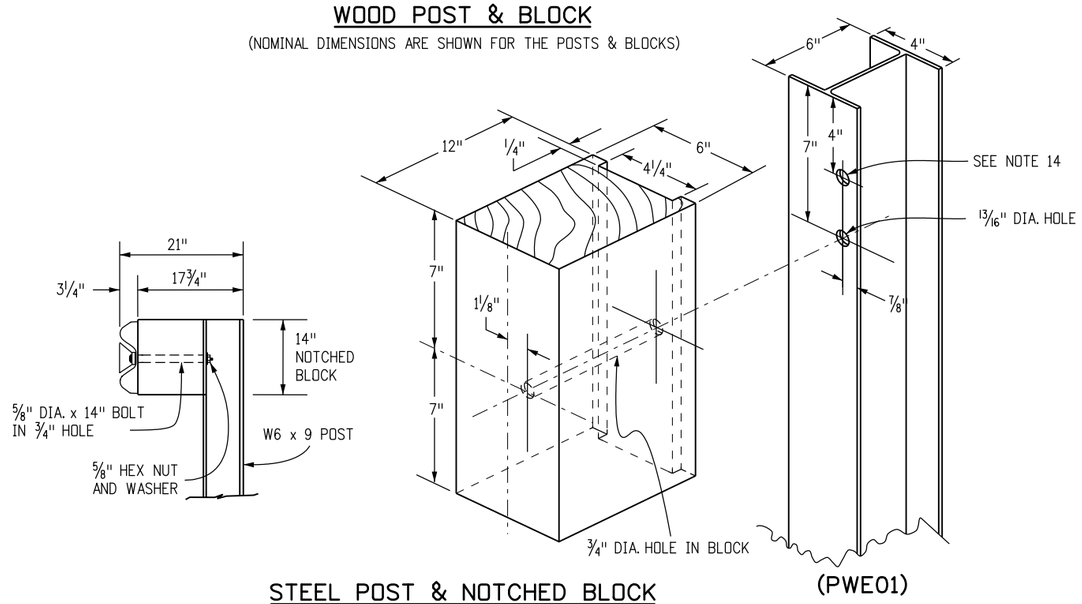
STANDARD PLAN NO.
M-606-1
Sheet No. 1 of 19



(PDB01 & PDE01)

WOOD POST & BLOCK

(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)



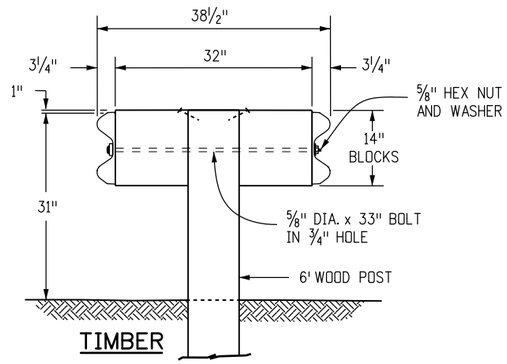
(PWE01)

STEEL POST & NOTCHED BLOCK

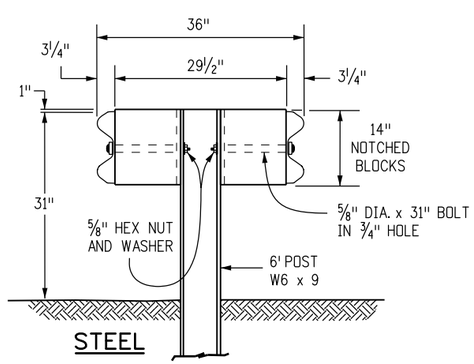
(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)

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 INDENTIFICATION. STEEL POSTS SHALL BE STAMPED PRIOR TO GALVANIZING. THE NUMBER 7 SHALL BE A MINIMUM 2 IN. TALL AND LOCATED AS SHOWN ON THE ELEVATION VIEW ON SHEET 1.
12. THE STANDARD 3 IN. X 1¾ IN. X 3/16 IN. RECTANGULAR WASHER USED UNDER POST BOLT HEADS IN THE PAST MAY REMAIN IN EXISTING INSTALLATIONS BUT SHALL NOT BE USED IN NEW CONSTRUCTION, REPAIRS, OR RESETTING OF RAIL, EXCEPT WHEN SPECIFICALLY IDENTIFIED ON THE STANDARD PLAN.
13. STANDARD GALVANIZED ROUND STEEL WASHERS SHALL BE USED UNDER ALL NUTS IN CONTACT WITH WOOD POSTS.
14. AN ADDITIONAL HOLE SHALL BE PROVIDED IN THE POSTS TO FACILITATE FUTURE RAISING OF THE RAIL ELEMENTS AND BLOCKS FOR OVERLAYS.
15. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT. INTERVALS (SEE SHEETS 6 AND 8 FOR EXCEPTIONS). RETROREFLECTOR TABS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. THE TABS SHALL BE MOUNTED SO THE BOLT SLOT FACES AWAY FROM TRAFFIC, AND THE RETROREFLECTOR SURFACE FACES THE APPROACHING TRAFFIC FOR ONE-WAY ROADS. FOR TWO-WAY ROADS, BOTH SIDES OF THE TABS SHALL BE RETROREFLECTIVE, SO THAT DELINEATION IS PROVIDED FOR BOTH DIRECTIONS OF TRAVEL. THE RETROREFLECTIVE SHEETING COLOR SHALL MATCH THE COLOR OF THE ADJACENT TRAVEL WAY EDGE LINE. SEE THE RETROREFLECTOR TAB DETAIL ON SHEET 3.
16. AT THE TIME OF INSTALLATION, WOOD POSTS OR BLOCKS WITH SEASONING CHECKS GREATER THAN ¼ IN. SHALL NOT BE USED WHEN THE CHECK EXTENDS THE FULL LENGTH OF THE PIECE.
17. WOOD BLOCKS SHALL BE CUT FROM THE SAME CROSS-SECTION, SPECIES, AND GRADE, AND SHALL RECEIVE THE SAME PRESERVATIVE TREATMENT AS THE POSTS WHEN WOOD POSTS ARE USED.
18. REFERENCES SUCH AS "θθPDB01", "θθPDE01", AND "θθPWE01" IN THIS STANDARD PLAN SPECIFY HARDWARE DETAILS FROM "θθA 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 SPELTER COATING HAS BEEN DAMAGED SHALL BE EITHER REGALVANIZED OR RECOATED IN CONFORMANCE WITH AASHTO M 36, OR PAINTED WITH ONE FULL BRUSH COAT OF ZINC RICH PAINT CONFORMING TO MILITARY SPECIFICATION DOD-P-21035A.



TIMBER



STEEL

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

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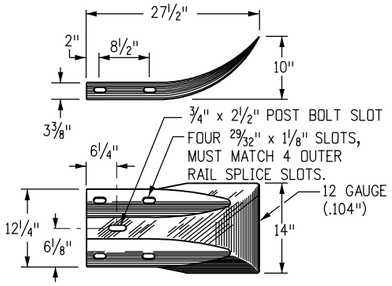
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

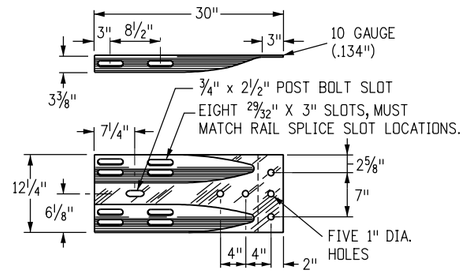
Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO. M-606-1

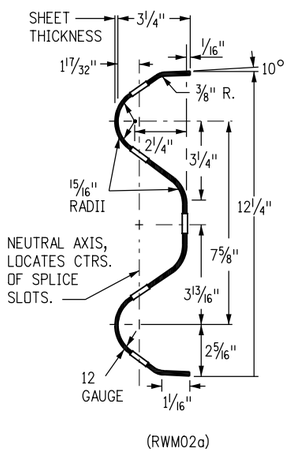


(RWE01a)

TERMINAL SECTION (FLARED)

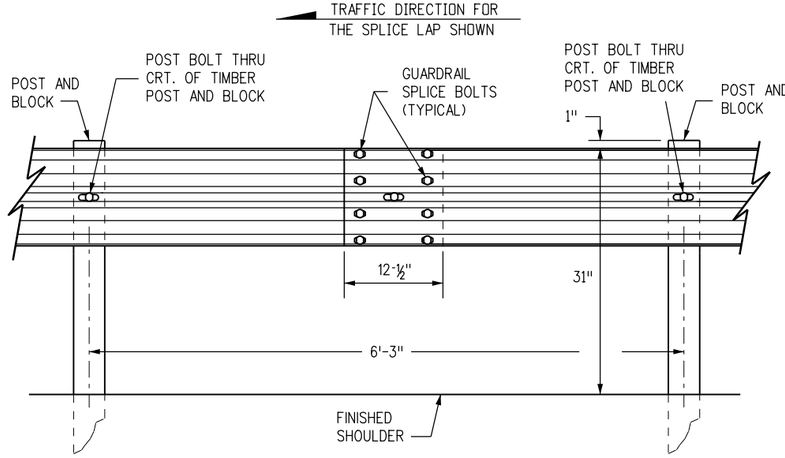


TERMINAL SECTION (CONNECTOR)



(RWM02a)

W-BEAM RAIL SECTION

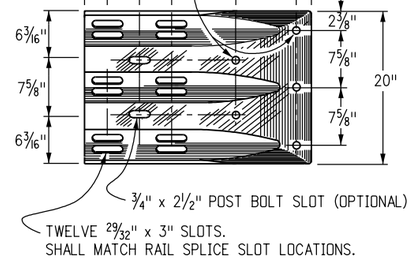


W-BEAM RAIL SPLICE

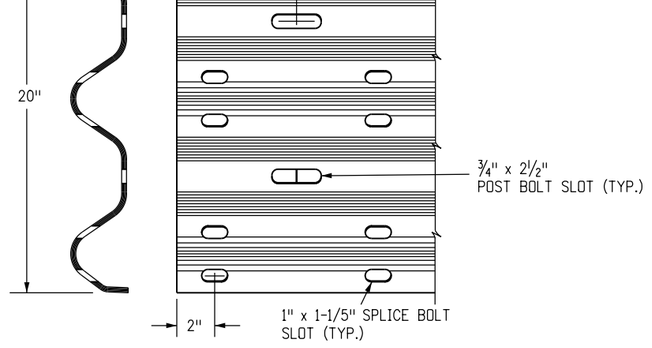
PART	MATERIAL SPEC.	GALVANIZING SPEC.	CORROSION-RESISTANT SPEC.
W-BEAM RAIL & TERMINAL SECTIONS	AASHTO M 180, CLASS A OR B	AASHTO M 180, TYPE 1 OR 2	AASHTO M 180, TYPE 4
BASE PLATE	ASTM A 36	AASHTO M 111	N.A.
NUTS, BOLTS & STUDS FOR GENERAL USE	ASTM A 307	AASHTO M 232, CLASS C OR ASTM B 695 CLASS 50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

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

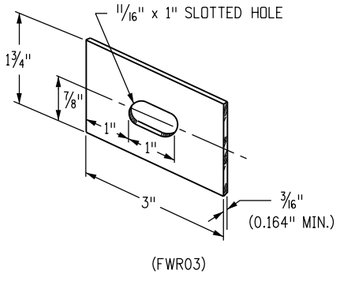
STEEL POSTS SHALL HAVE THE SAME CORROSION PROTECTION AS SPECIFIED FOR THE METAL BEAM RAIL. PUNCHING, DRILLING, CUTTING, OR WELDING OF POSTS WILL NOT BE PERMITTED AFTER GALVANIZING.



THRIE BEAM TERMINAL SECTION (CONNECTOR)



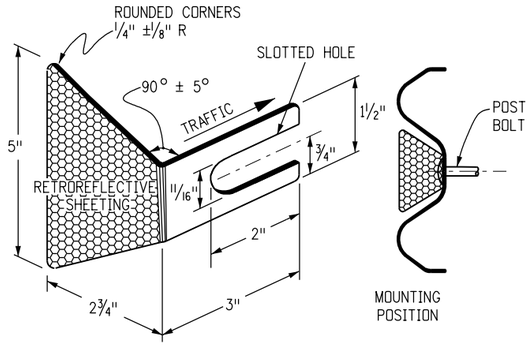
THRIE BEAM DETAIL



(FWR03)

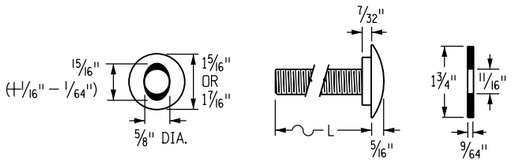
RECTANGULAR WASHER

(TO BE USED ONLY WHERE SPECIFIED.)



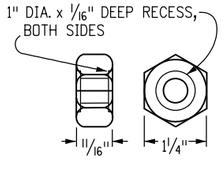
RETROREFLECTOR TAB

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



BUTTON HEAD BOLT WITH OVAL SHOULDER

WASHER



HEX NUT

DIAMETER & TYPE (INCHES)	12" BLOCKS L = LENGTH (INCHES)	THREAD LENGTH (INCHES)	INTENDED USE	AASHTO-AGC-ARTBA STANDARD NUMBER	NO. BOLTS, NUTS & WASHERS
⅝	1¼	FULL (1 1/32)	ALL RAIL SPLICES	FBB01	8 PER SPLICE*
BUTTONHEAD OVAL SHLDR.	22	MIN. 2½	SINGLE BLOCK & POST (TIMBER)	FBB04	1 PER POST
	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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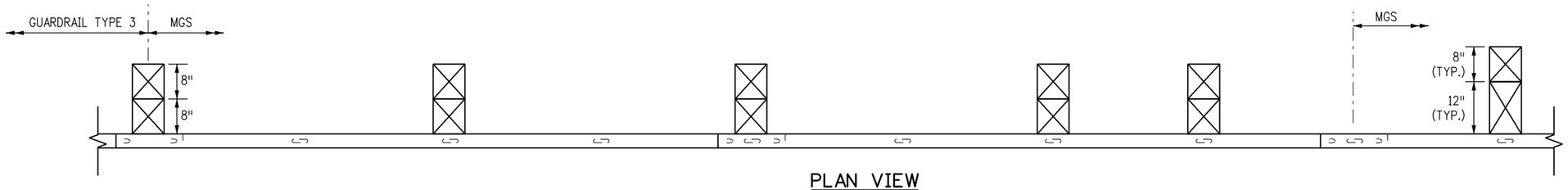
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

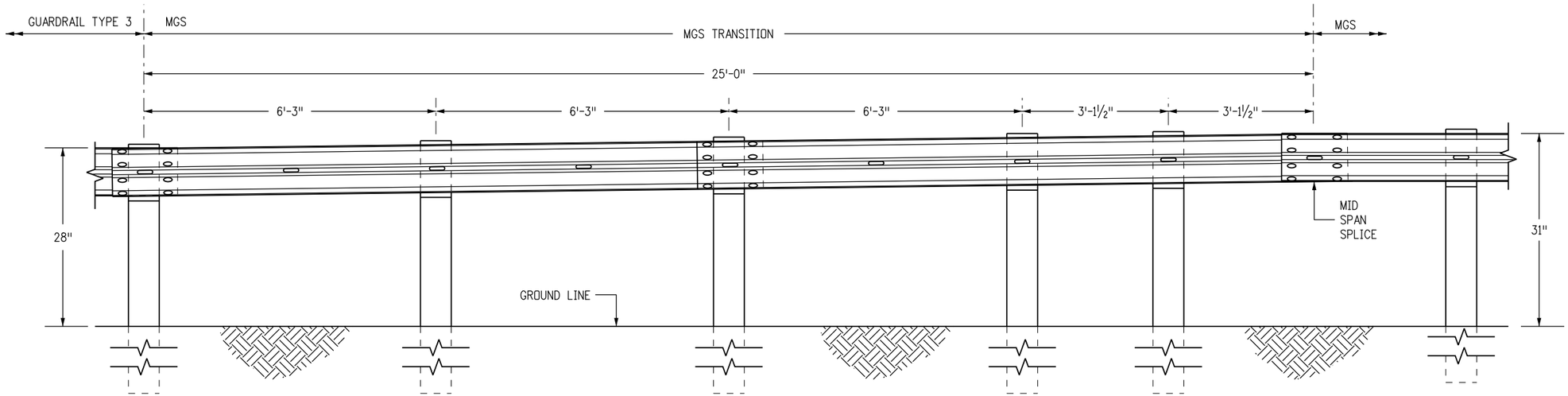
STANDARD PLAN NO. M-606-1

NOTES

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

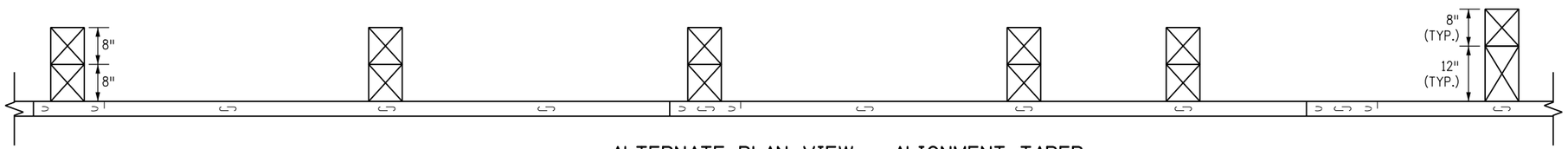


PLAN VIEW



ELEVATION VIEW

TRANSITION FROM 28 INCH GUARDRAIL TO 31 INCH MGS



ALTERNATE PLAN VIEW - ALIGNMENT TAPER

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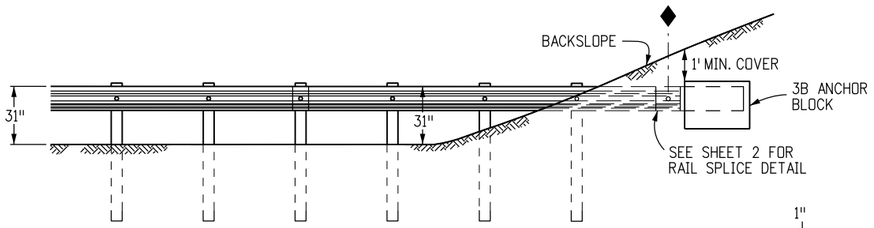
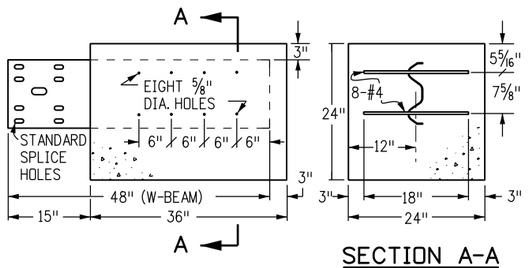
M-606-1



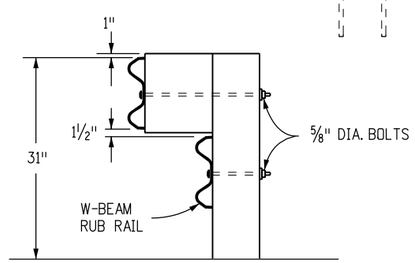
SEE TYPE 3B (RUB RAIL) PLAN VIEW FOR ALIGNMENT. THE 100 FT. FLARE LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

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



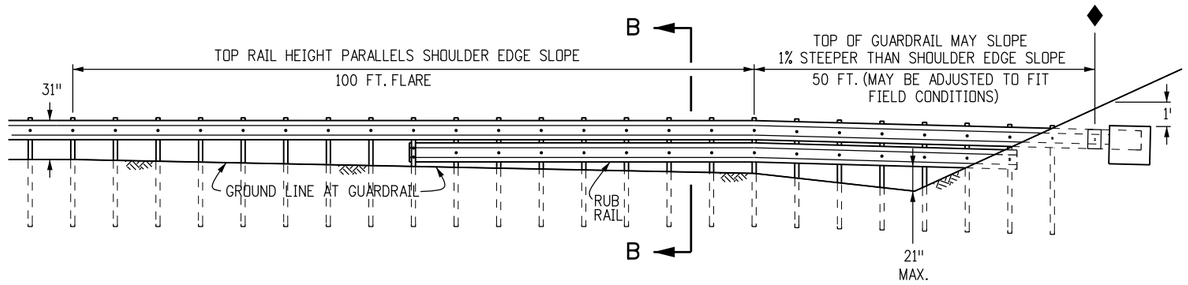
SECTION A-A

TYPE 3B ANCHOR BLOCK DETAIL

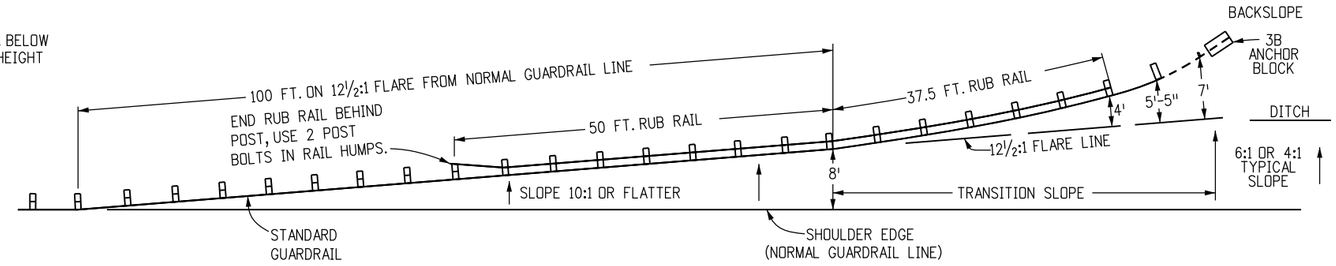


SECTION B-B

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



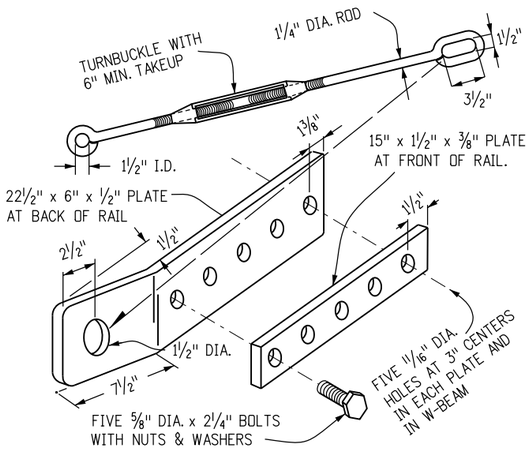
ELEVATION VIEW



PLAN VIEW

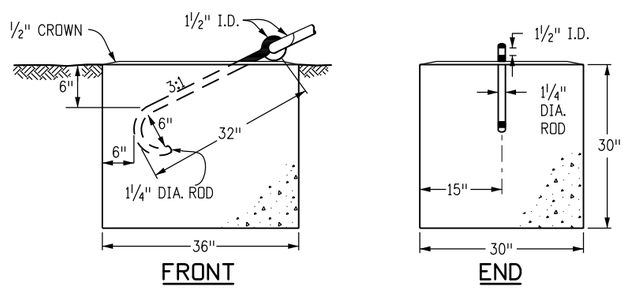
◆ END OF GUARDRAIL PAY LENGTH

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



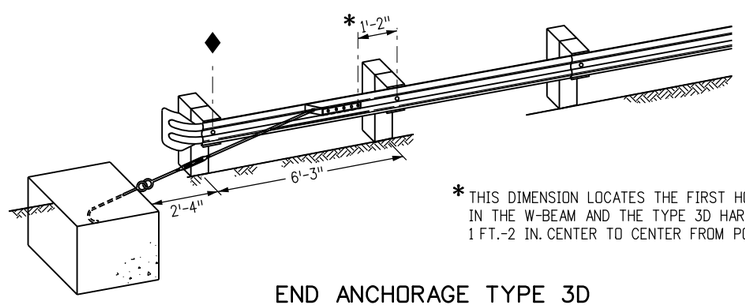
TYPE 3D HARDWARE DETAILS

NOTE: ALL PARTS SHALL BE GALVANIZED



FRONT END

TYPE 3D ANCHOR BLOCK DETAIL



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

END ANCHORAGE TYPE 3D DEPARTURE TERMINAL

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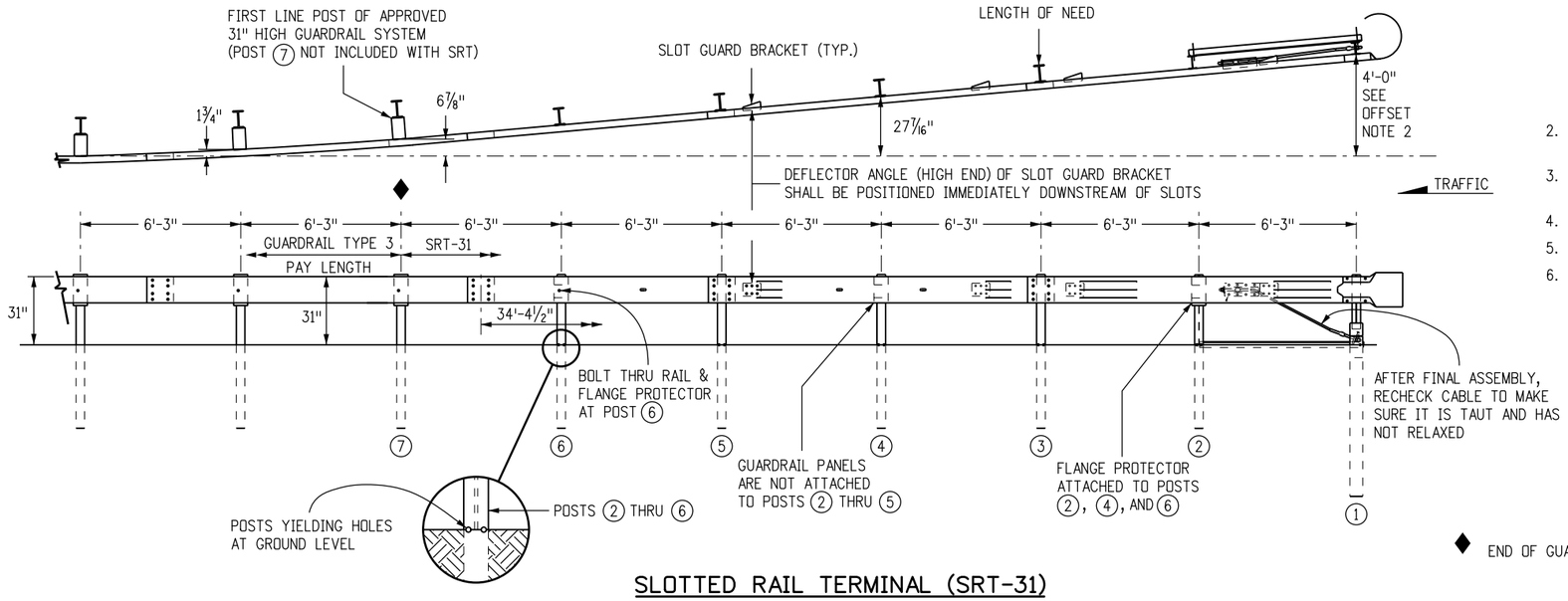
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.
M-606-1
Sheet No. 5 of 19

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.

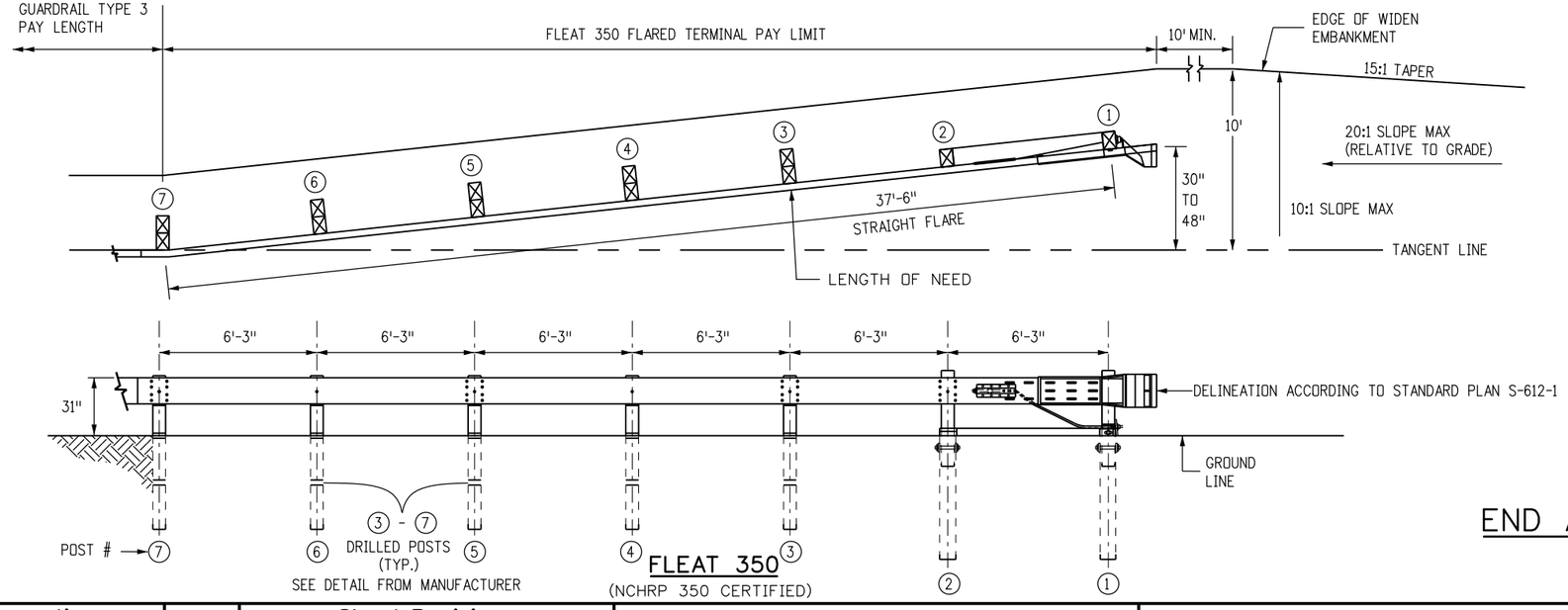


SLOTTED RAIL TERMINAL (SRT-31)

(NCHRP 350 CERTIFIED)

NOTES

1. THE END ANCHORAGES (FLARED) SHALL EITHER BE THE SLOTTED RAIL TERMINAL SRT-31 AS MANUFACTURED BY TRINITY HIGHWAY PRODUCTS LLC (TELEPHONE #: 800-772-7976), 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 (FLARES) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO INSTALLATION OF THE DEVICE.
2. IN HEAVY SNOW LOCATIONS, TRIM POSTS (1) AND (2) (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.



FLEAT 350

(NCHRP 350 CERTIFIED)

END ANCHORAGES (FLARED)

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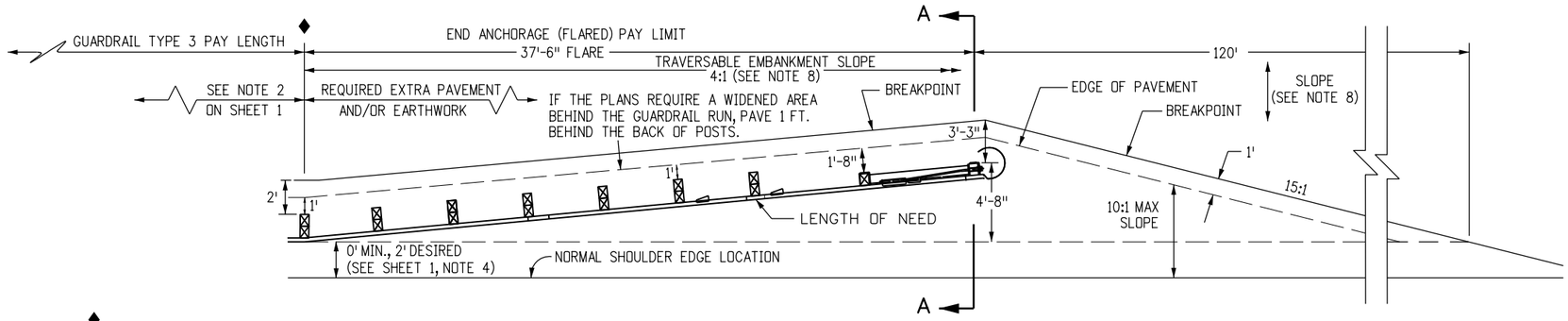
MIDWEST
GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

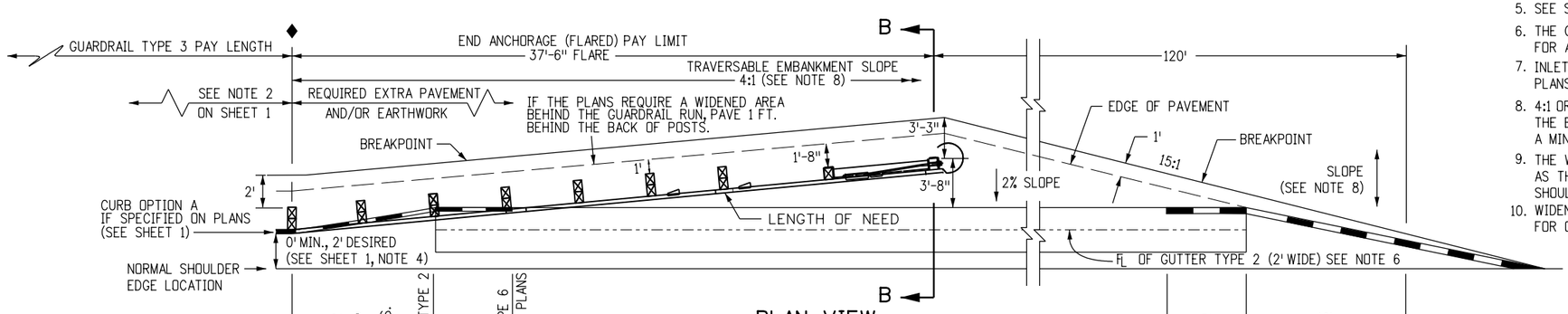
STANDARD PLAN NO.
M-606-1



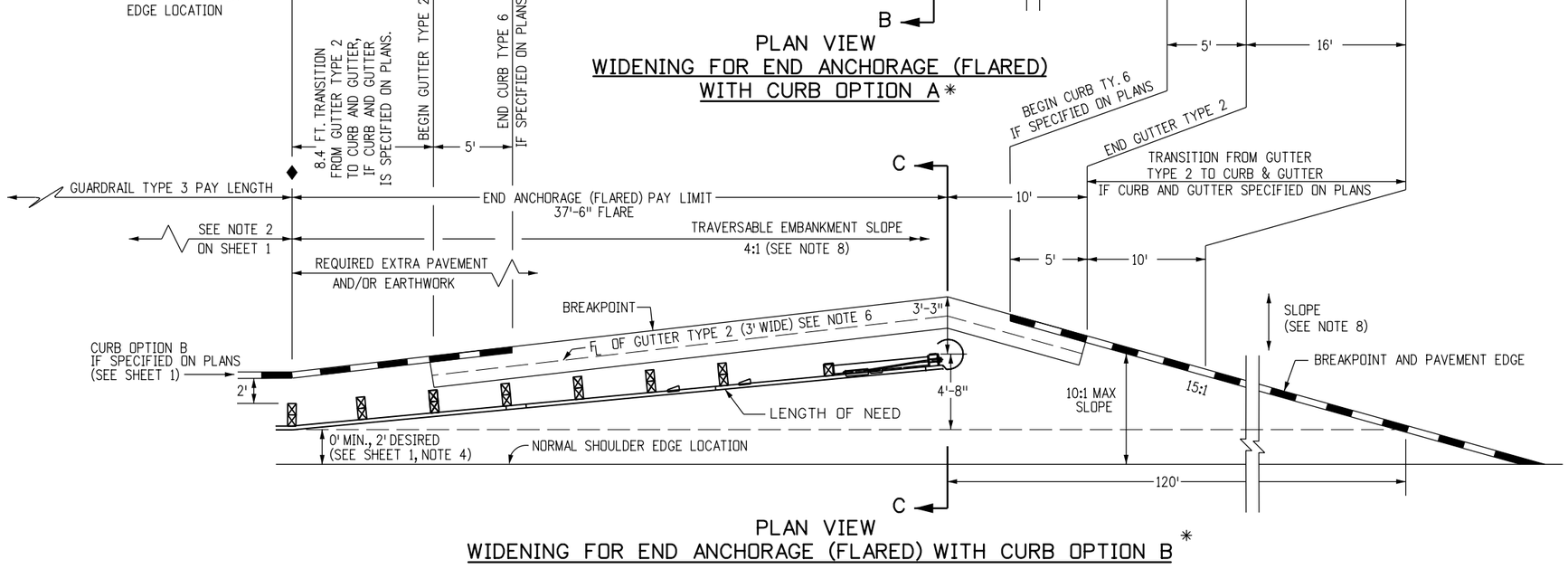
◆ END OF GUARDRAIL PAY LENGTH

PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) *

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



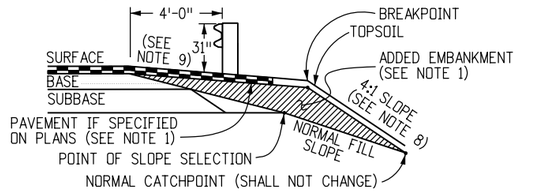
PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION A *



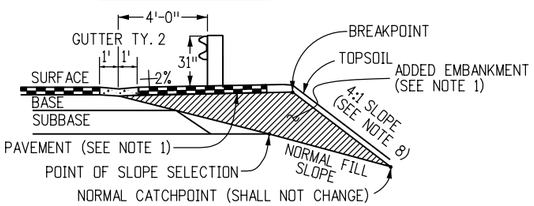
PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION B *

NOTES

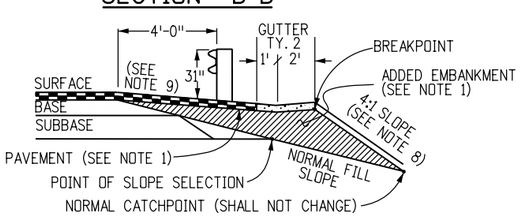
1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 45 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLANS DO NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL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



SECTION A-A



SECTION B-B



SECTION C-C

Computer File Information		Sheet Revisions	
Creation Date: 11/01/18 Initials: JJP		Date:	Comments
Last Modification Date: 12/21/18 Initials: LTA	(R-X)		
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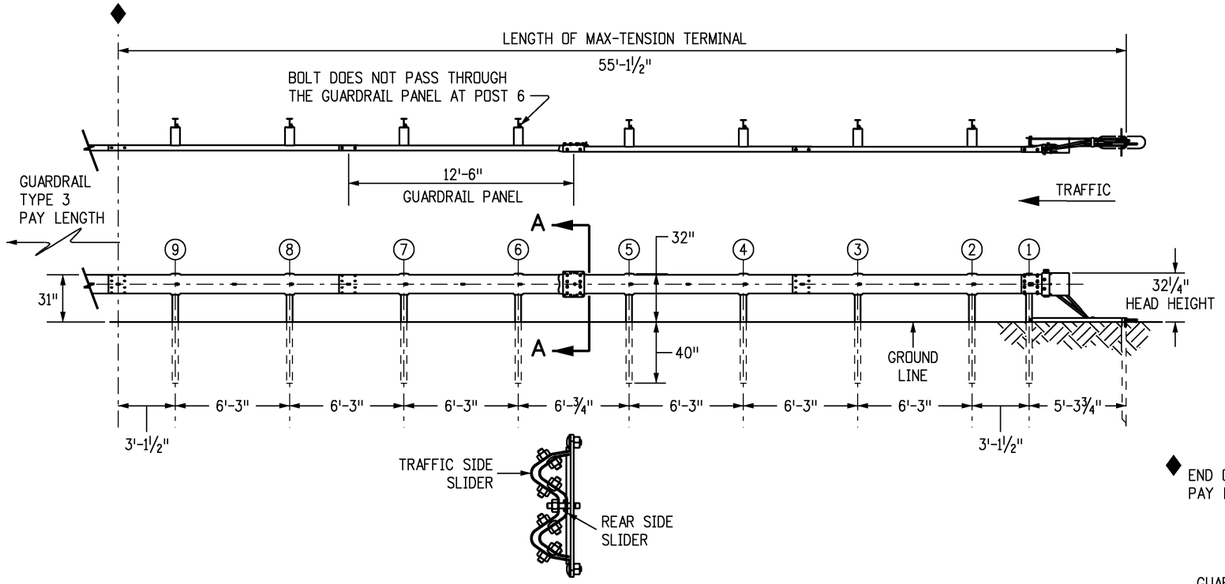
MIDWEST
GUARDRAIL SYSTEM (MGS)
TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.
M-606-1



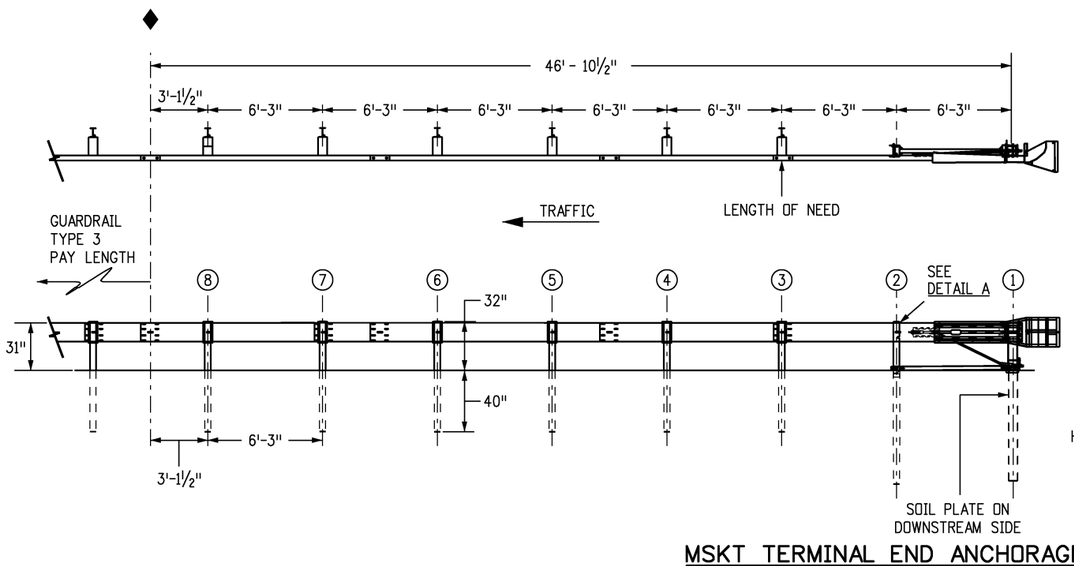
SECTION A-A

MAX-TENSION TERMINAL END ANCHORAGE (NONFLARED)

(MASH CERTIFIED)

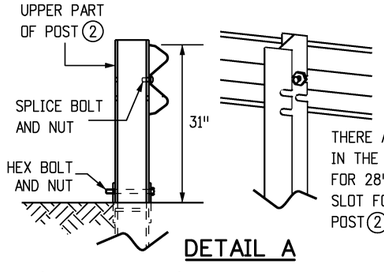
NOTES FOR NONFLARED

1. THE END ANCHORAGE (NONFLARED) SHALL EITHER BE THE SOFTSTOP AS MANUFACTURED BY TRINITY INDUSTRIES, INC. (TEL. #: 800-772-7976), 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'-1½", 9'-4½", OR 15'-7½" 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. HINGED BREAK AWAY (HBA) STEEL POSTS MAY BE USED CONFORMING TO THE MANUFACTURER'S INSTRUCTIONS.
6. RETROREFLECTOR TABS SHALL NOT BE USED ON END ANCHORAGE POSTS.
7. 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.



MSKT TERMINAL END ANCHORAGE (NONFLARED)

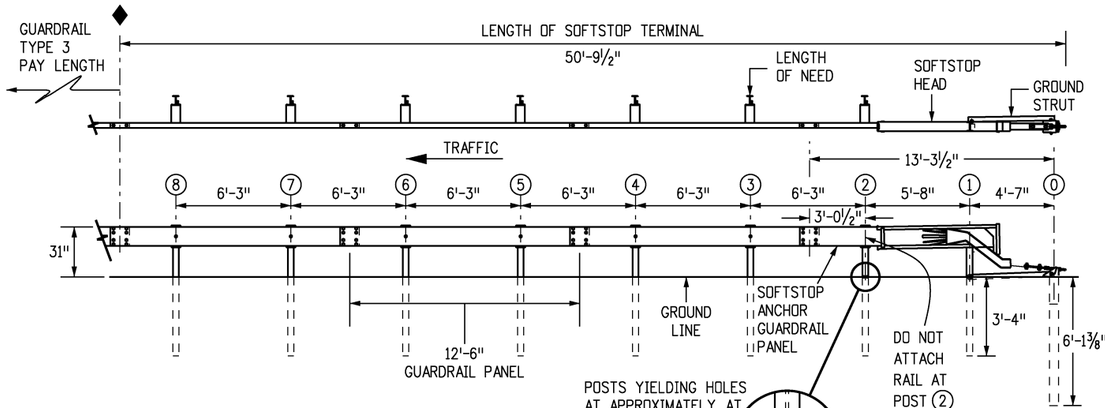
(MASH CERTIFIED)

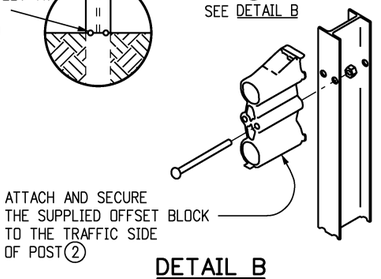


DETAIL A

THERE ARE TWO SETS OF OPEN-ENDED SLOTS IN THE UPPER PART OF POST (2). THESE ARE FOR 28" AND 31" RAIL HEIGHTS. USE THE TOP SLOT FOR THE 31" MSKT TERMINAL. INSTALL POST (2) WITH THE SLOTS FACING POST (1)

END OF GUARDRAIL
PAY LENGTH





DETAIL B

SOFTSTOP TERMINAL END ANCHORAGE (NONFLARED)

(MASH CERTIFIED)

END ANCHORAGES (NONFLARED)

Computer File Information		Sheet Revisions	
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STANDARD PLAN NO.
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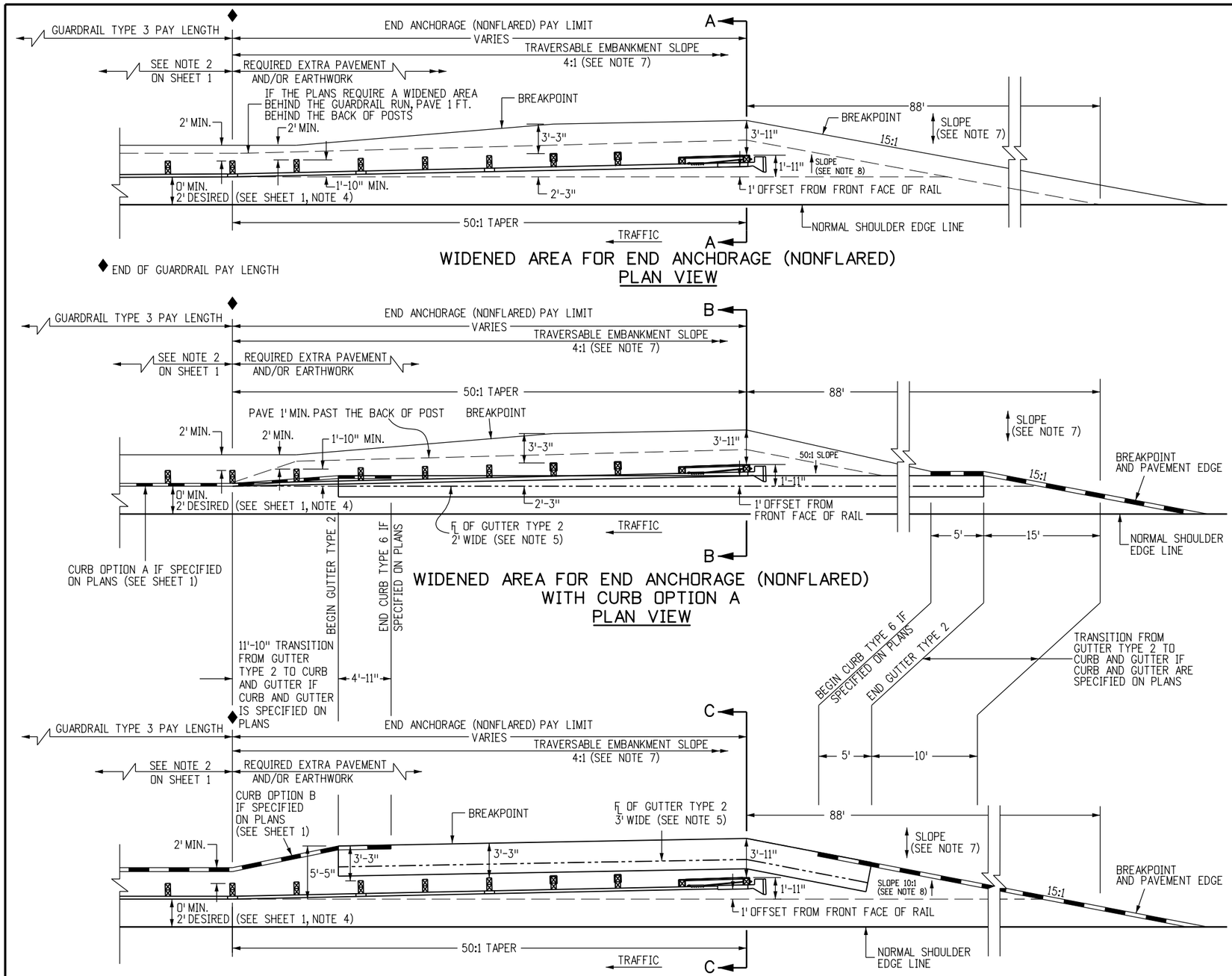
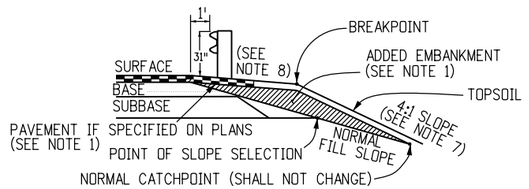
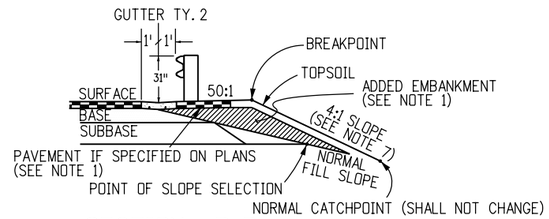


NOTES

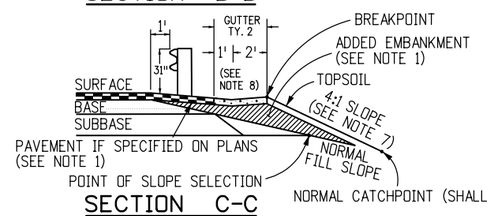
1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 25 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203.
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (NONFLARED) WHEN THE CONTRACT PLANS DOES NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT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



SECTION A-A



SECTION B-B



SECTION C-C

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

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.
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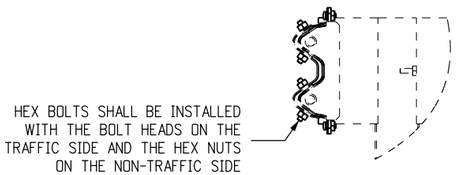
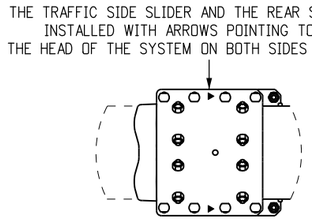


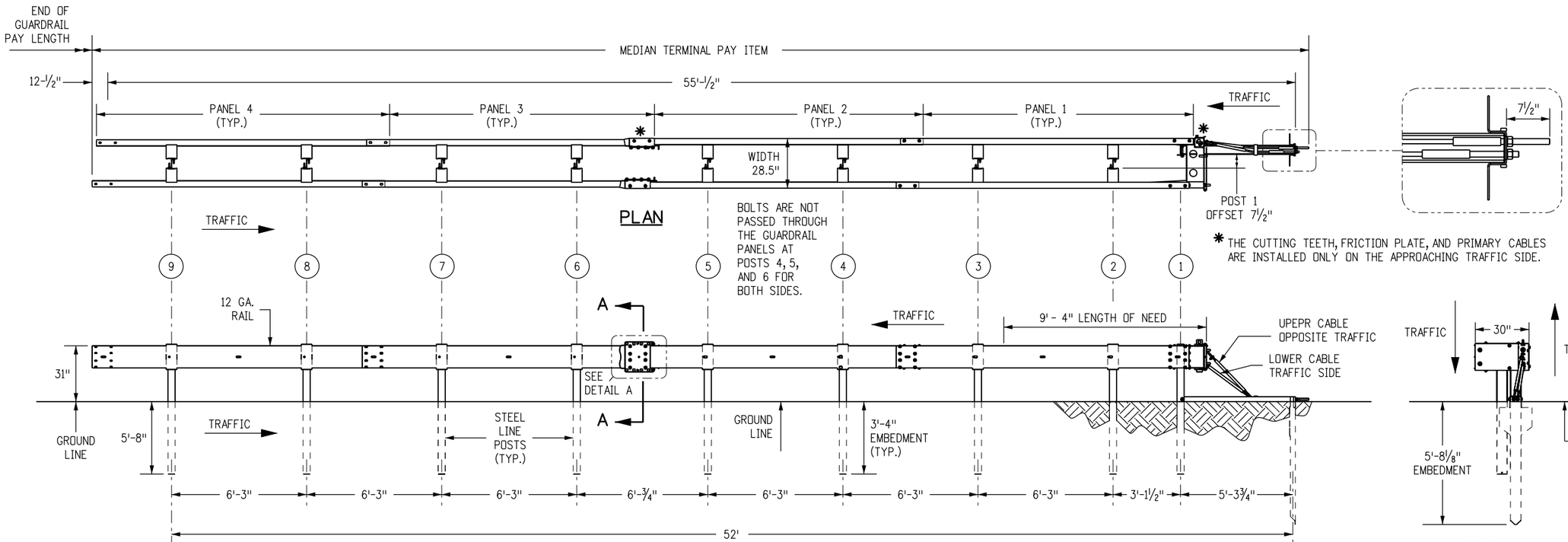
SECTION A-A



DETAIL A

MEDIAN TERMINAL NOTES

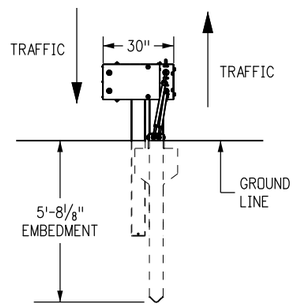
1. THE MEDIAN TERMINAL SHALL BE THE MAX-TENSION MEDIAN AS MANUFACTURED BY BY BARRIER SYSTEM BY LINDSAY (LINDSAY TRANSPORTATION SOLUTIONS) (TEL #: 888 800-3691).
2. THE MAX-TENSION SHALL BE APPLIED DIRECTLY TO W-BEAM GUARDRAIL SYSTEMS AT, OR TRANSITIONED TO, 31 INCH WITH PANELS AND POST SPACING CONFIGURED 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. IF NO CERTIFICATION IS AVAILABLE, THE PROJECT ENGINEER OR DESIGNEE MAY INSPECT AND CERTIFY INSTALLATION.
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.



PLAN

ELEVATION

* THE CUTTING TEETH, FRICTION PLATE, AND PRIMARY CABLES ARE INSTALLED ONLY ON THE APPROACHING TRAFFIC SIDE.



SIDE VIEW

MAX-TENSION MEDIAN

(MASH CERTIFIED)

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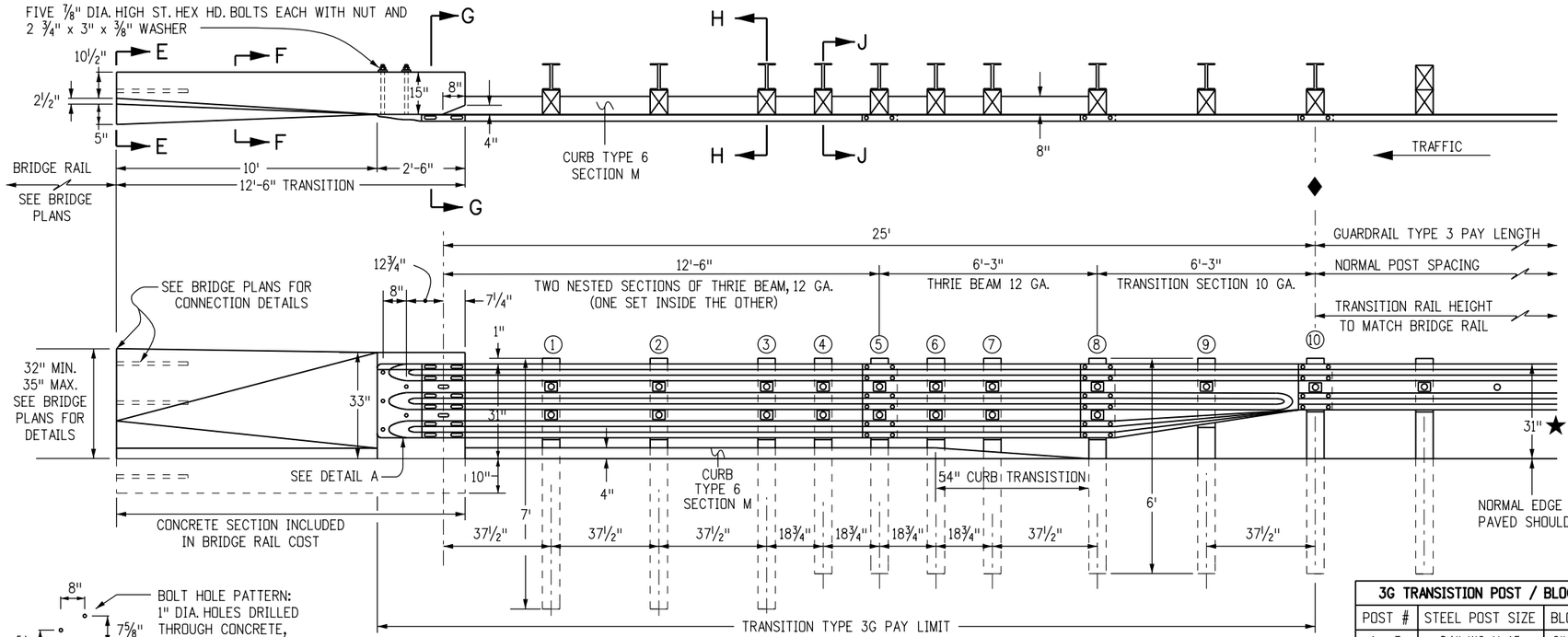
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.

M-606-1

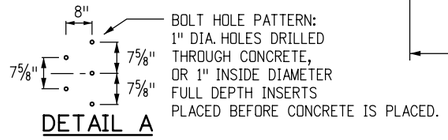


TRANSITION TYPE 3G

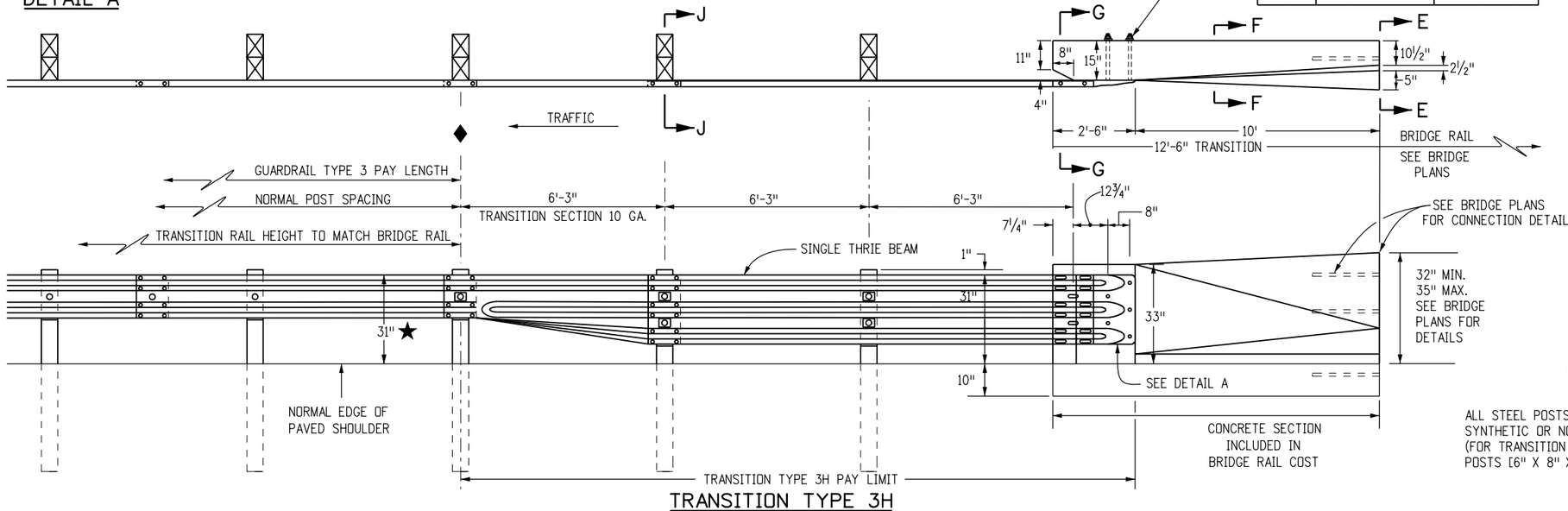
ALL POSTS SHALL BE STEEL

★ DETERMINED BY BRIDGE PLANS

◆ END OF GUARDRAIL PAY LENGTH

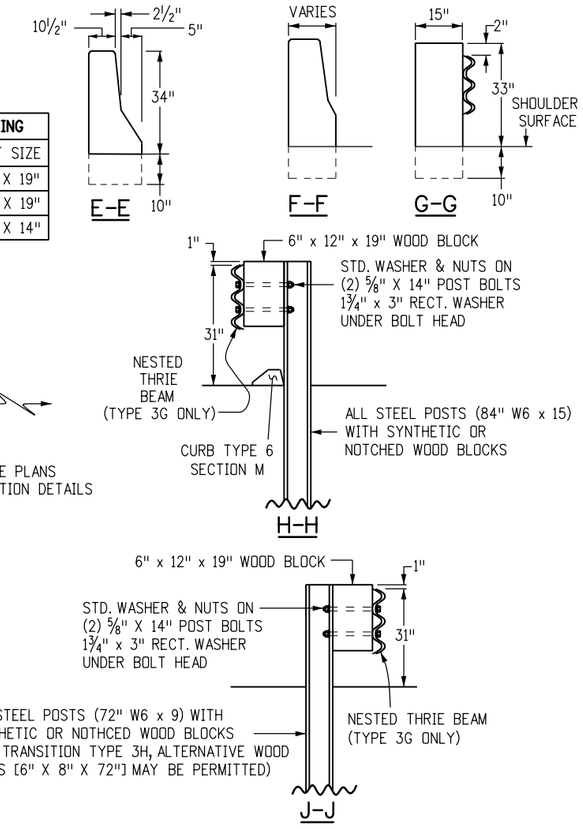


DETAIL A



TRANSITION TYPE 3H

3G TRANSITION POST / BLOCK SIZING		
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"



NOTES

1. TRANSITION TYPE 3G IS FOR USE AT BOTH ENDS OF BRIDGES ON TWO-WAY HIGHWAYS AND AT THE APPROACH END OF BRIDGES ON ONE-WAY HIGHWAYS.
2. TRANSITION TYPE 3H IS FOR USE AT THE TRAILING END OF BRIDGES ON ONE-WAY HIGHWAYS.
3. THE THRIE BEAM SECTION IN TRANSITIONS TYPES 3G AND 3H MAY BE SHOP BENT TO FIT CURVES THAT ARE GREATER THAN OR EQUAL TO A 10 FT. RADIUS. HOWEVER, THE 6 FT.-3 IN. TRANSITION SECTION SHALL NOT BE BENT.
4. A 12 FT.-6 IN. CONCRETE TRANSITION IS REQUIRED BETWEEN THE TYPE 3G OR 3H AND TYPE 7 BRIDGE RAIL. SEE STANDARD PLAN M-606-13 FOR THE TRANSITION BETWEEN TYPE 3 GUARDRAIL AND TYPE 7 GUARDRAIL.
5. TRANSITIONS TYPE 3G AND TYPE 3H ARE ALSO USED TO CONNECT TO TYPE 8 AND TYPE 10 BRIDGE RAIL. SEE BRIDGE PLANS FOR CONNECTION DETAILS.
6. BACKUP PLATE IS NOT REQUIRED AT POSTS ON TYPE 3G AND 3H.
7. ▣ THIS SYMBOL IN THE ELEVATION DRAWINGS SHOWS THE LOCATIONS WHERE A RECTANGULAR WASHER IS REQUIRED UNDER THE POST BOLT HEAD.
8. CURB TYPE 6 SECTION M, MAY BE ASPHALT OR CONCRETE. THE COST OF CURB IS INCLUDED IN THE WORK, UNLESS A SEPARATE PAY ITEM IS INCLUDED IN THE BID SCHEDULE.
9. 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.

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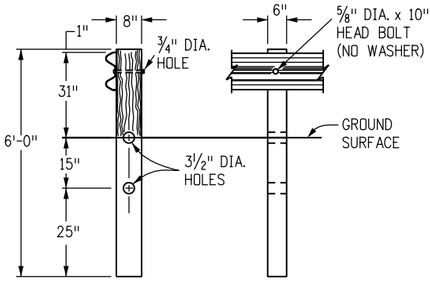
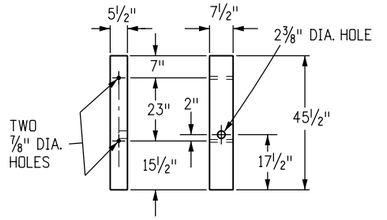


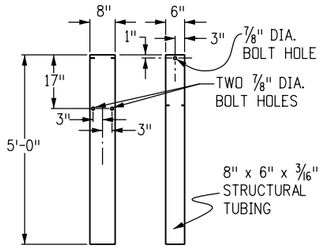
CONTROLLED RELEASING TERMINAL (CRT) POST ①



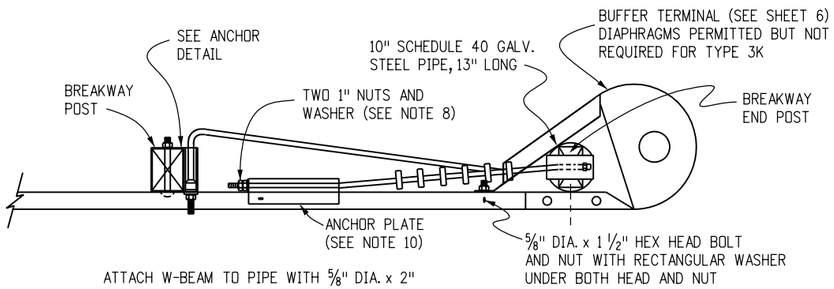
WOOD BREAKAWAY POST ②

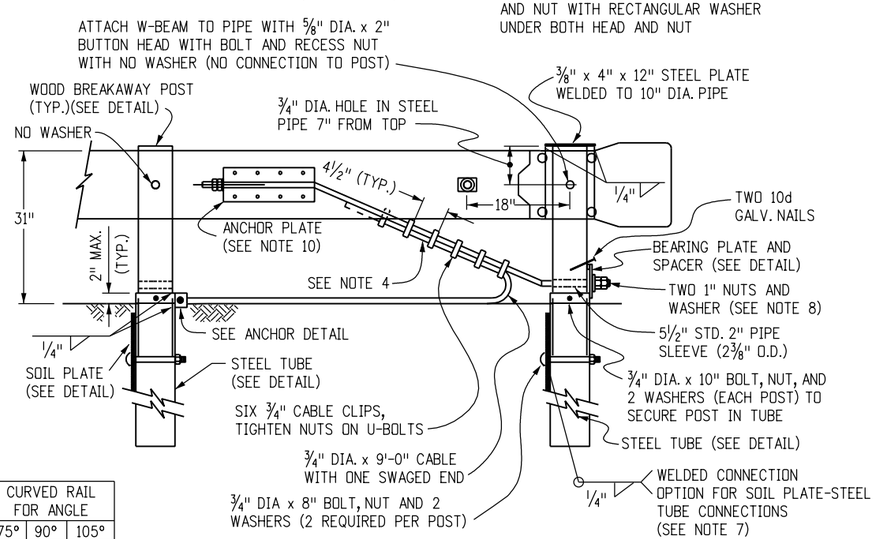
POST	DIMENSIONS	TYPE
①	6" x 8" x 6'	CRT
②	5½" x 7½" x 45½"	BREAKAWAY

POSTS

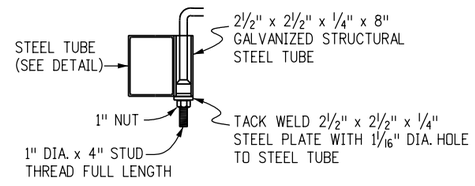


STEEL TUBE

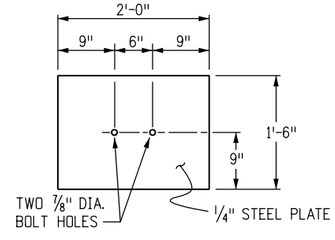




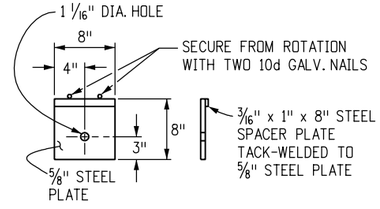
LOW SPEED END ANCHORAGE - TYPE 3K



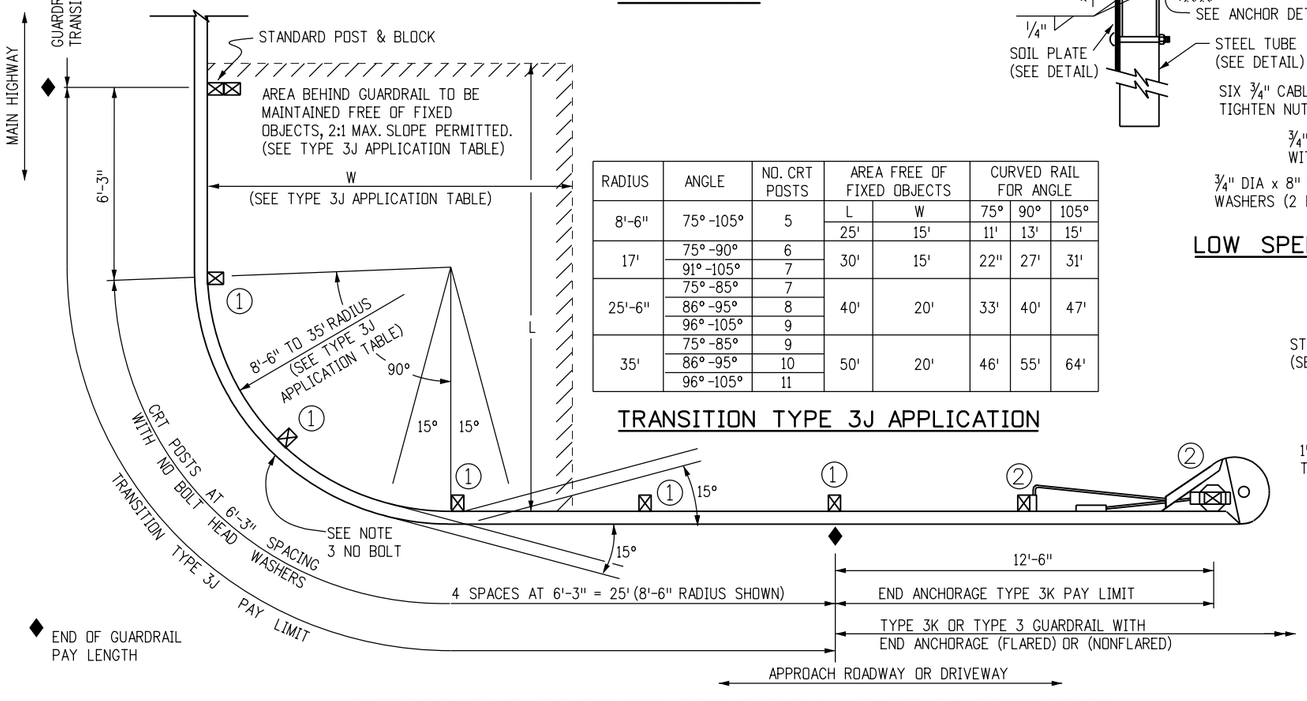
ANCHOR DETAIL



SOIL PLATE



BEARING PLATE FOR STEEL TUBE



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

TRANSITION TYPE 3J APPLICATION

INTERSECTING ROADWAYS TRANSITION - TYPE 3J TRANSITION

NOTES

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

   THE LOW SPEED (<45 MPH) END ANCHORAGE TYPE 3K SHALL BE USED ONLY ON DRIVEWAYS AND LOW SPEED SERVICE ROADS. WHEN AN APPROVED CRASH-TESTED END TREATMENT IS REQUIRED USE THE END ANCHORAGE (FLARED) OR (NONFLARED) WITH 37 FT.-6 IN. LENGTH.
2. GRADING AND PAVING FOR THE 3J & 3K SHALL MATCH THE GRADING AND PAVING OF THE GUARDRAIL TO WHICH THEY ARE ATTACHED, AND SHALL BE IN ACCORDANCE WITH SHEET ONE OF THIS STANDARD. MAXIMUM FILL SLOPE SHALL BE 2:1.
3. THE RAIL IS NOT BOLTED TO THE CRT POST AT THE CENTER OF THE CURVE FOR THE 8 FT.-6 IN., 17 FT., AND 25 FT.-6 IN. RADII. PLATES SHALL CONFORM TO ASTM A 36, AND THE STRUCTURAL TUBING TO ASTM A 500.
4. THE ¾IN. GALVANIZED WIRE ROPE (CABLE) SHALL CONFORM TO AASHTO M 30 TYPE II.
5. PLATES SHALL CONFORM TO ASTM A 36, AND STRUCTURAL TUBING TO ASTM A 500. WELDING SHALL MEET ALL REQUIREMENTS OF THE AMERICAN WELDING SOCIETY.
6. ALL STRUCTURAL STEEL SHALL BE GALVANIZED IN CONFORMANCE WITH ASTM A 123. POSTS SHALL NOT BE PUNCHED, DRILLED, CUT, OR WELDED AFTER GALVANIZING.
7. WHEN THE SOIL PLATE WELDED OPTION IS SELECTED, SOIL PLATE CONNECTION BOLT HOLES ARE NOT REQUIRED.
8. OUTSIDE NUT SHALL BE TORQUED AGAINST INSIDE NUT WITH THE CABLE INSTALLED TAUT BETWEEN THE ANCHOR PLATE AND FIRST POST.
9. ALL CURVED GUARDRAIL SHALL BE SHOP BENT.
10. SEE SHEET 5 FOR ANCHOR PLATE AND OTHER DETAILS.
11. THE STEEL TUBE MAY BE DRIVEN WITH WOOD POST INSERTED IF NO DAMAGE OCCURS TO THE POST OR BOLTS.

Computer File Information		
Creation Date: 11/01/18	Initials: JJP	
Last Modification Date: 12/21/18	Initials: LTA	(R-X)
Full Path: www.codot.gov/business/designsupport		(R-X)
Drawing File Name: 60601012019.dgn		(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English	(R-X)

Sheet Revisions	
Date:	Comments
12/21/18	Removed reference to Transistion Type 3L guardrail.

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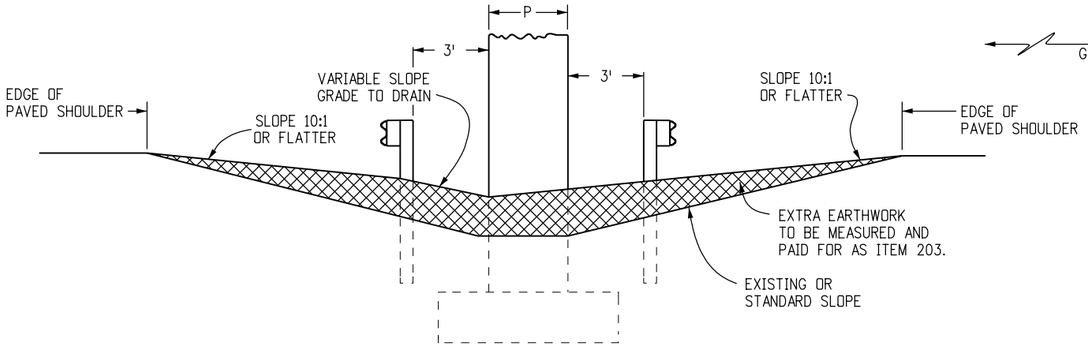
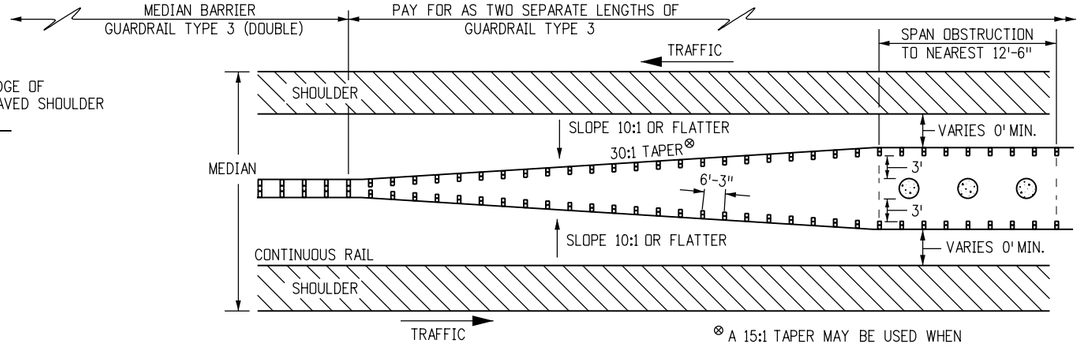
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.
M-606-1

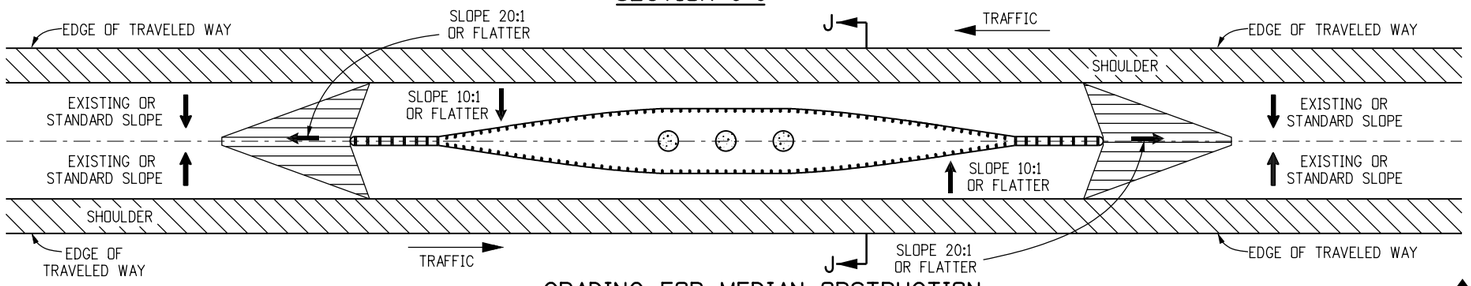


SECTION J-J

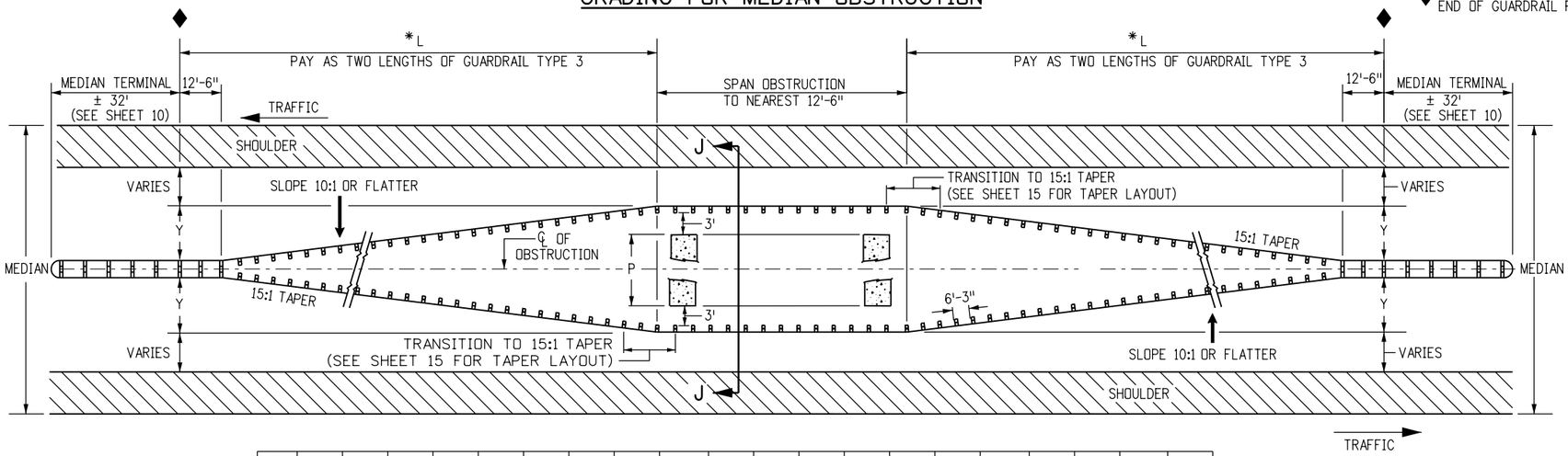


⊗ A 15:1 TAPER MAY BE USED WHEN THE BARRIER ENDS IN THE MEDIAN TERMINAL

OBSTRUCTION IN MEDIAN 30 FT. WIDE OR LESS



GRADING FOR MEDIAN OBSTRUCTION



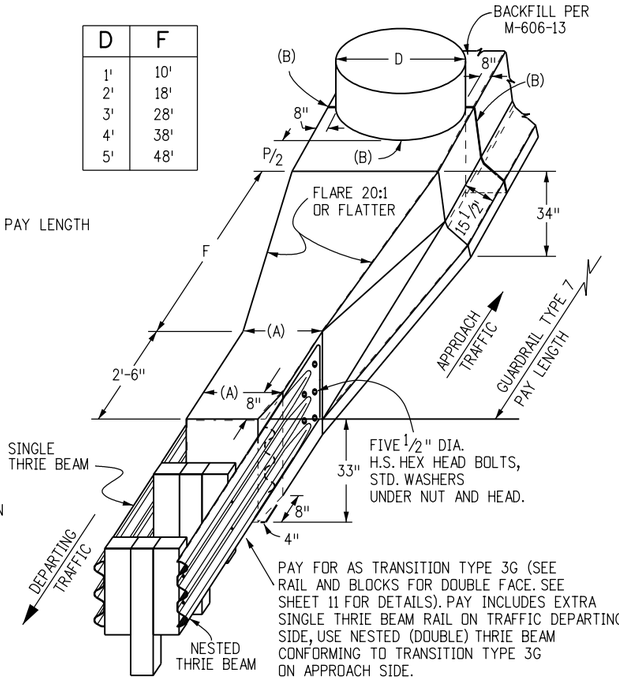
P	1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'
Y	4'-1"	4'-7"	5'-1"	5'-7"	6'-1"	6'-7"	7'-1"	7'-7"	8'-1"	8'-7"	9'-1"	9'-7"	10'-1"	10'-7"	11'-1"	11'-7"	12'-1"	12'-7"	13'-1"	13'-7"
L	75'	87'-6"		100'	112'-6"		125'		137'-6"	150'		162'-6"		175'		187'-6"	200'		212'-6"	225'

*L IS MEASURED ALONG FACE OF GUARDRAIL

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.

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

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



(A). TIMBER POSTS 2 FT., STEEL POSTS 1 FT.-9 1/2 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

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Drawing File Name: 606010l3019.dgn	(R-X)		
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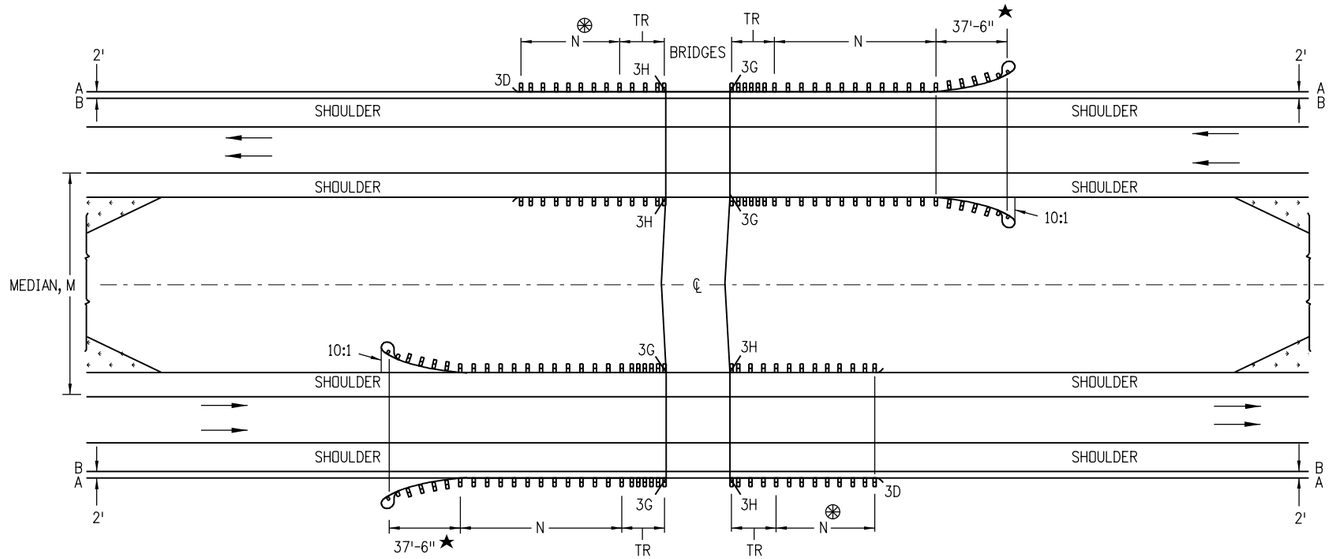
MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.

M-606-1



MULTILANE DIVIDED HIGHWAYS FOR STEEP EMBANKMENTS IN MEDIAN

NOTES

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

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

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

TR — 18 FT.-9 IN. FOR 3G AND 3H.

A — EDGE OF 8 FT. OR 10 FT. SHOULDER.

B — EDGE OF 6 FT. OR LESS SHOULDER.

★ — END ANCHORAGE CAN BE FLARED OR NONFLARED.

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Last Modification Date: 12/21/18 Initials: LTA	(R-X)		
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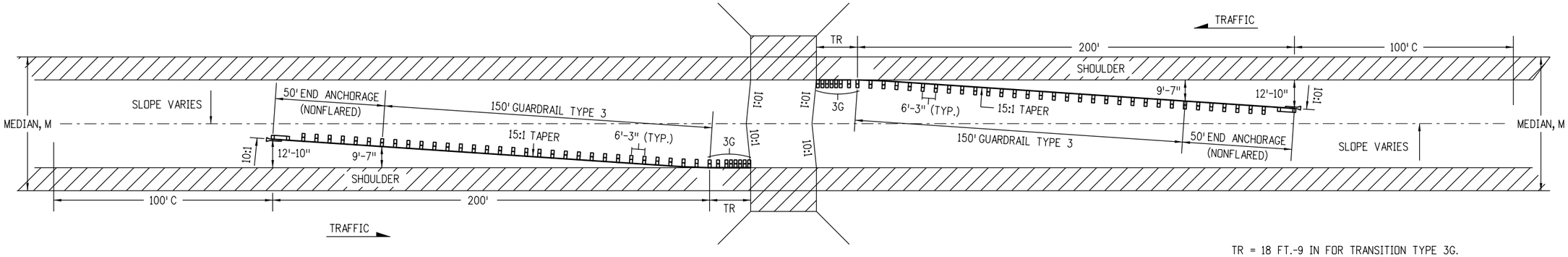
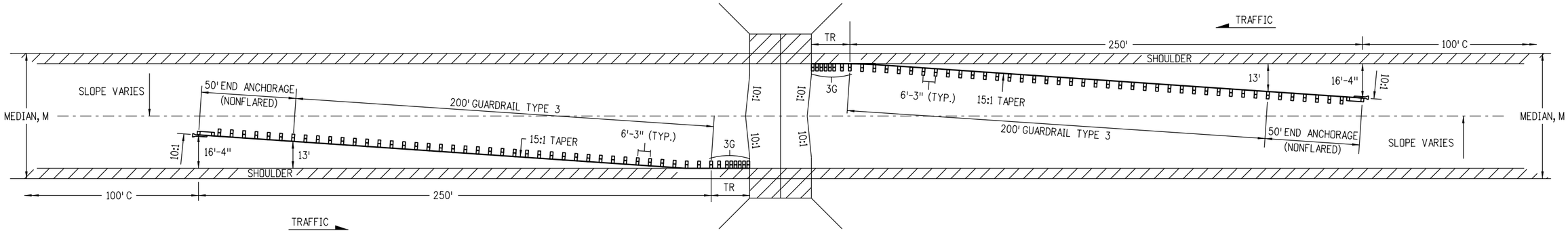
M-606-1

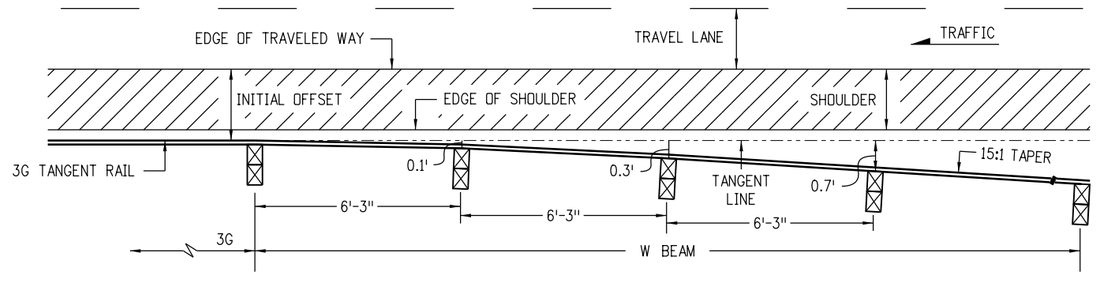


MEDIANS 60 FT. AND OVER WITH 10 FT. OR WIDER SHOULDERS.

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



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



TRANSITION TO TYPICAL 15:1 TAPER

NOTES

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

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

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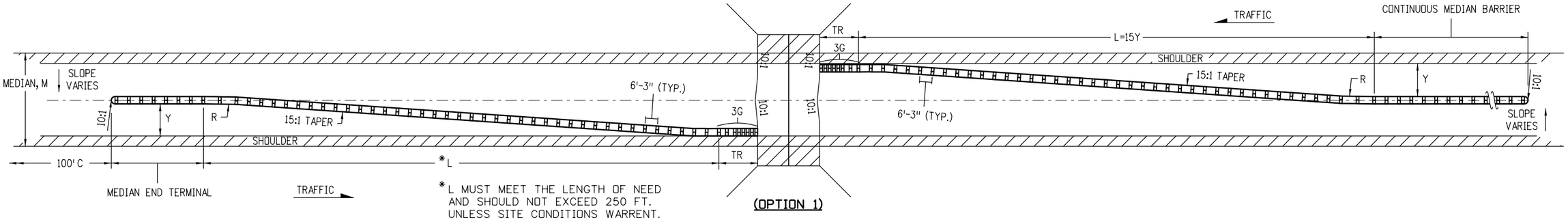
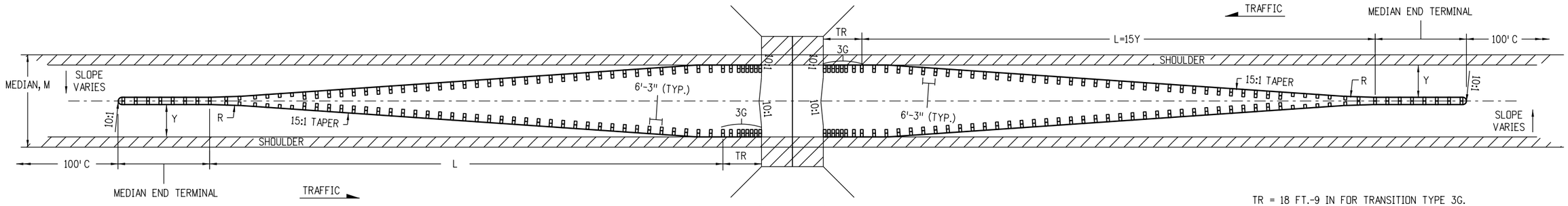
NOTES

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

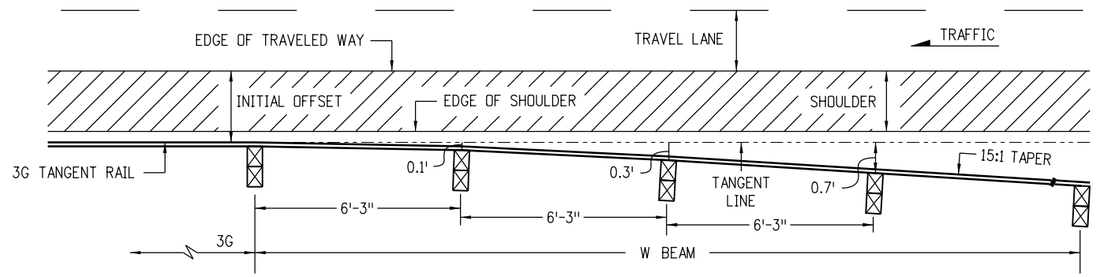


* L MUST MEET THE LENGTH OF NEED AND SHOULD NOT EXCEED 250 FT. UNLESS SITE CONDITIONS WARRENT.

(OPTION 1)



(OPTION 2)



TRANSITION TO TYPICAL 15:1 TAPER

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

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

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Creation Date: 11/01/18 Initials: JJP		Date:	Comments
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MIDWEST GUARDRAIL SYSTEM (MGS) TYPE 3 W-BEAM 31 INCHES

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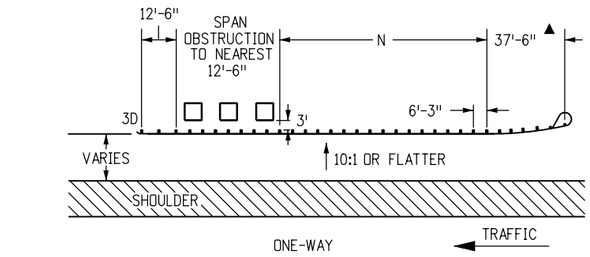
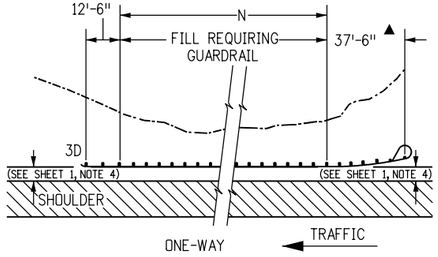
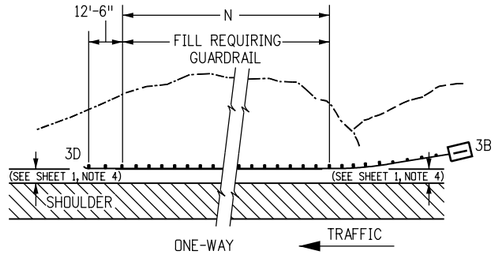
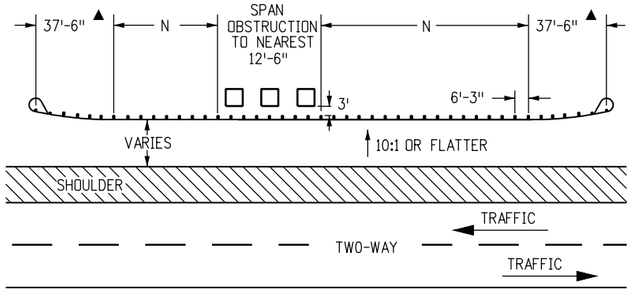
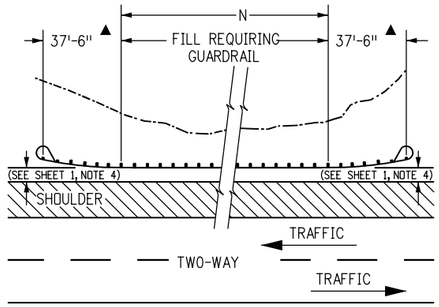




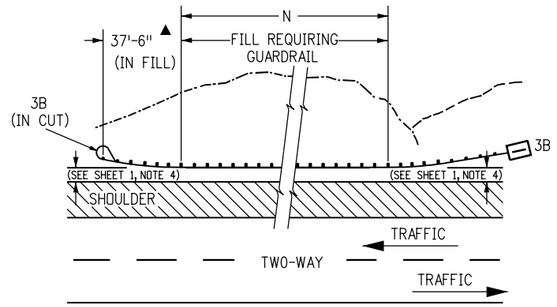




GUARDRAIL FOR ROADSIDE OBSTRUCTIONS



GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION

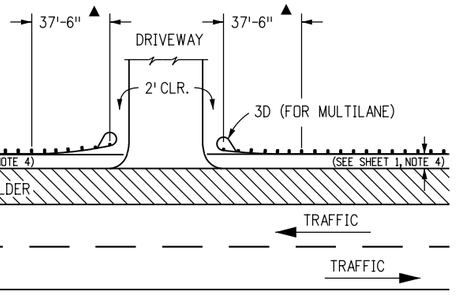


GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION

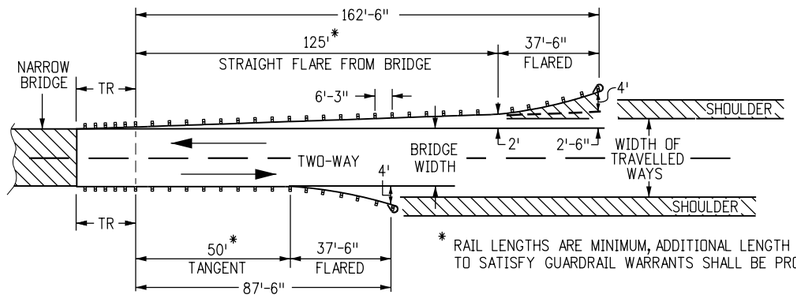
NOTES

1. THE TYPE 3G OR 3H TRANSITIONS (SEE SHEET 11) SHALL BE USED TO CONNECT A TYPE 3 W-BEAM TO TYPE 7 CONCRETE BARRIER OR TO A TYPE 7, 8, OR 10 BRIDGE RAIL.
2. "TR" WILL BE 18 FT.-9 IN. FOR THE TRANSITIONS TYPE 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

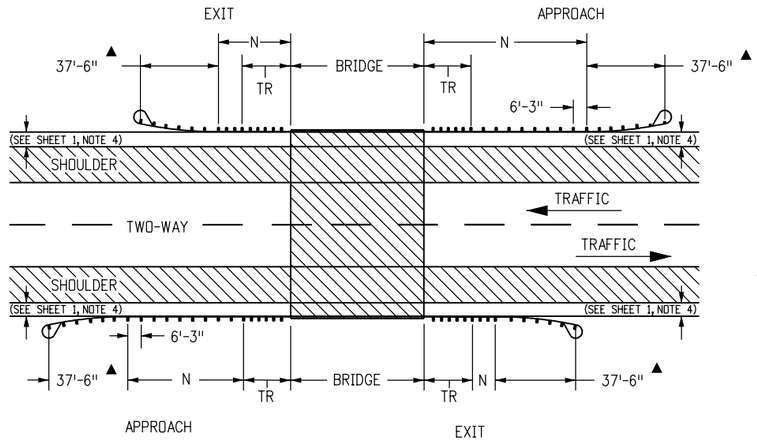


LAYOUT FOR DRIVEWAY APPROACH

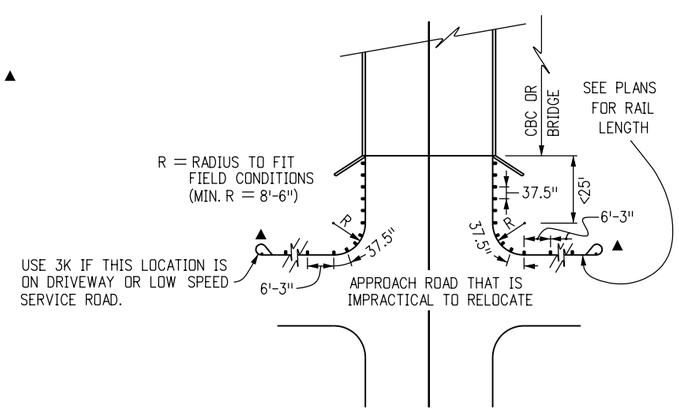


* RAIL LENGTHS ARE MINIMUM, ADDITIONAL LENGTH TO SATISFY GUARDRAIL WARRANTS SHALL BE PROVIDED

2-WAY NARROW APPLICATION



2-WAY NORMAL BRIDGE APPLICATION



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

INTERRUPTED STRUCTURE APPROACH

(USE TYPE 3J ON SHEET 12 WHEN PRACTICAL)

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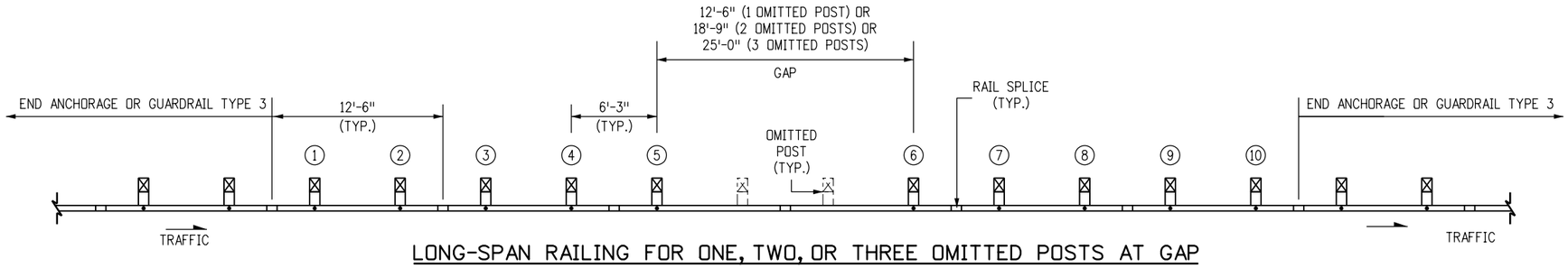
STANDARD PLAN NO.

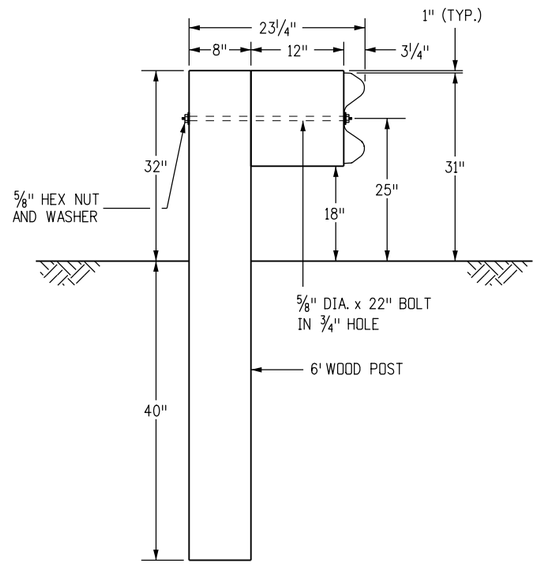
M-606-1

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.

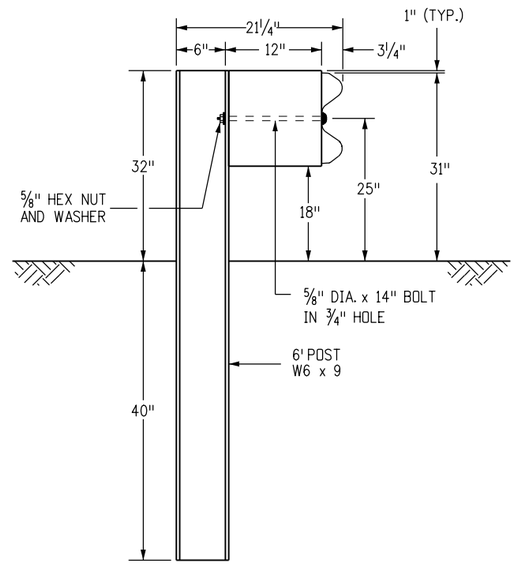


LONG-SPAN RAILING FOR ONE, TWO, OR THREE OMITTED POSTS AT GAP



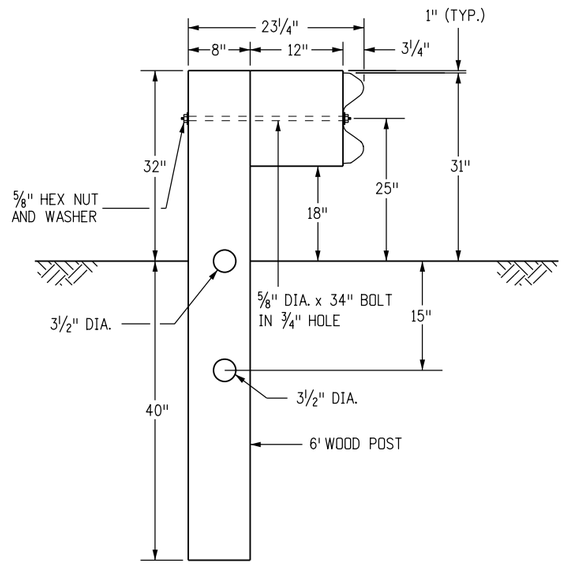
TIMBER POST

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

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MIDWEST
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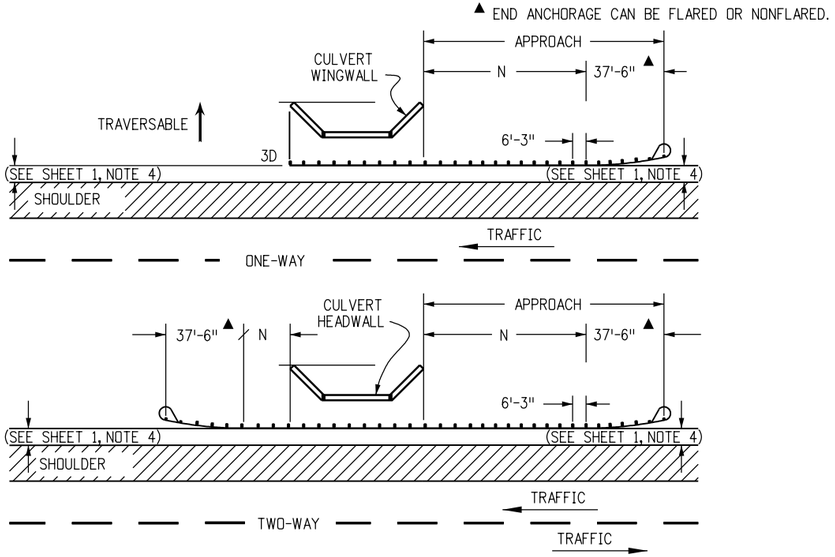
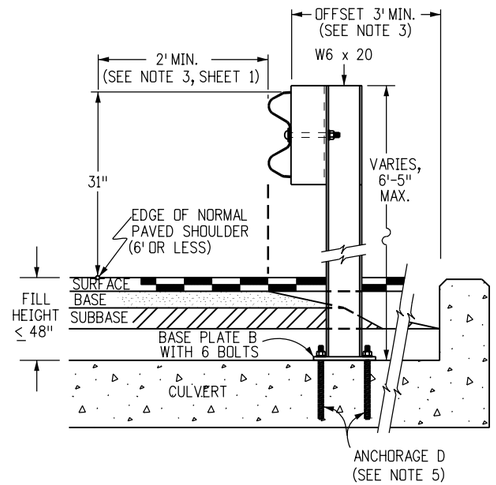
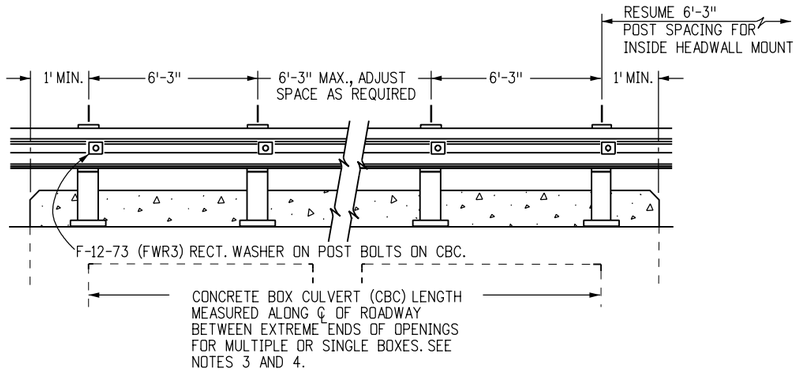


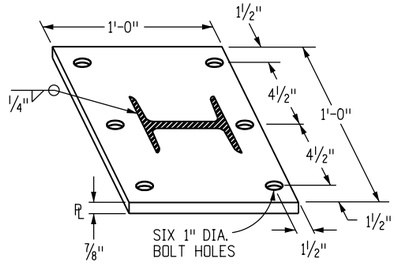
GUARDRAIL FOR CULVERTS



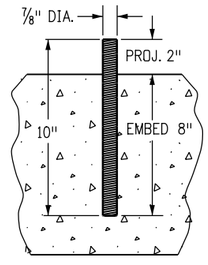
INSIDE MOUNT ON CBC



RAIL PLACEMENT FOR INSIDE MOUNT



BASE PLATE B
(FOR INSIDE MOUNT)



ANCHORAGE D
(FOR INSIDE MOUNT)

NOTES

1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND WINGWALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 15. THE GUARDRAIL TYPE 3 SHALL CONTINUE ACROSS THE CULVERT AS SHOWN ON THIS SHEET.
2. RIGHT SHOULDER BOX CULVERT TREATMENT IS SHOWN ON THIS SHEET FOR CULVERTS 20 FT. OR LESS IN LENGTH.
3. GUARDRAIL ACROSS CULVERTS WITH A LENGTH OF 20 FT. OR LESS SHALL BE AS FOLLOWS:
   A. FILL HEIGHT AT GUARDRAIL POST 48 IN. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE AS GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POST LESS THAN 48 IN. AND BLOCK FACE TO HEADWALL OFFSET OF 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT AS GUARDRAIL TYPE 3.
   C. FILL HEIGHT AT GUARDRAIL POST 48 IN. OR LESS AND BLOCK FACE TO HEADWALL OFFSET LESS THAN 3 FT: CONSTRUCTION ACCORDING TO HEADWALL MOUNT DETAILS AND PAYMENT AS BRIDGE RAIL TYPE 3.
4. GUARDRAIL ACROSS CULVERTS WITH LENGTH GREATER THAN 20 FT. SHALL BE AS FOLLOWS:
   A. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE FOR STANDARD GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR LESS: CONSTRUCTION AND PAYMENT IN ACCORDANCE WITH THE CONTRACT BRIDGE PLANS. WHEN BLOCK FACE TO HEADWALL OFFSET IS 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT AS GUARDRAIL TYPE 3.
5. ANCHORAGE D: SIX BOLTS FOR BASE PLATE "B" WITH INSIDE MOUNT. THE BOLTS SHALL BE 7/8 IN. DIA X 10 IN. HIGH STRENGTH RODS THREADED FULL LENGTH AND ALL GALVANIZED. RODS SHALL BE CAST-IN-PLACE FOR A NEW STRUCTURE. FOR AN EXISTING STRUCTURE, THE RODS SHALL BE INSTALLED IN 1-1/4 IN. DIA HOLES WITH NON-SHRINK GROUT OR EPOXY CONFORMING TO ASTM C 881.
6. 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.
7. 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 INACCORDANCE WITH SECTION 509. CONCRETE, REINFORCING STEEL, AND STRUCTURAL STEEL ELEMENTS SHALL BE IN ACCORDANCE WITH SECTIONS 601, 602, AND 509, RESPECTIVELY.
8. POST ANCHORS, ENCASED IN CONCRETE, SHALL BE ASTM A 36 STEEL, AND NEED NOT BE GALVANIZED.
9. PRIOR TO FABRICATION OF BRIDGE RAIL, THREE SETS OF WORKING DRAWINGS WHICH COMPLY WITH THE REQUIREMENTS OF SECTION 105 SHALL BE SUBMITTED TO THE ENGINEER FOR INFORMATION ONLY.

Computer File Information		Sheet Revisions	
Creation Date: 11/01/18 Initials: JJP		Date:	Comments
Last Modification Date: 12/21/18 Initials: LTA	(R-X)	12/21/18	Deleted the Transition Type 3L and Guardrail Type 3 Approach, Headwall Mount on CBC, Headwall Mount Post, Backing Tubes End and Anchor details. Deleted previous Gen. Notes 6, 9, and 11.
Full Path: www.codot.gov/business/designsupport	(R-X)		
Drawing File Name: 60601019019.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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

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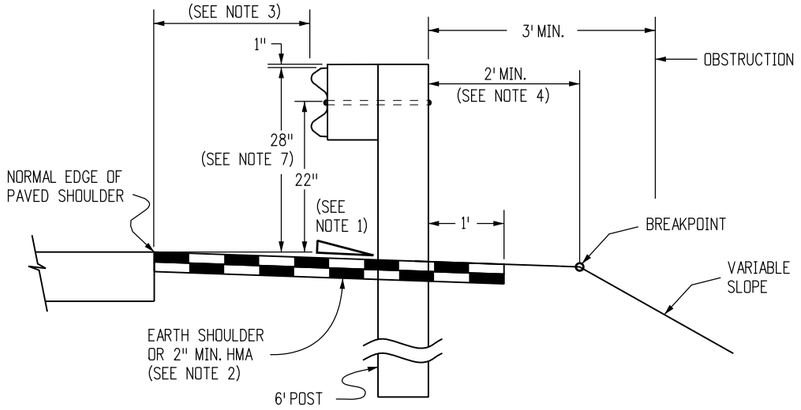
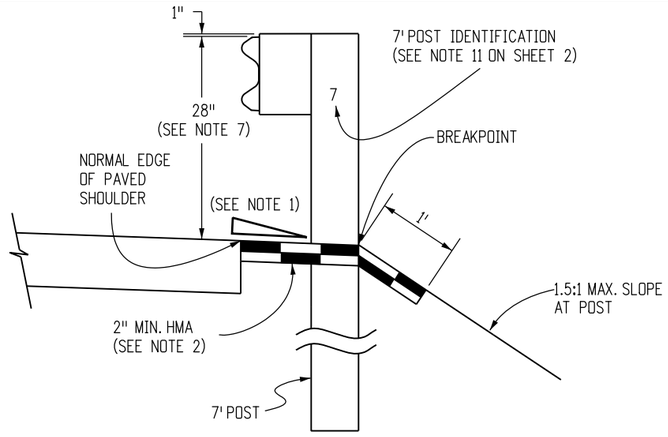
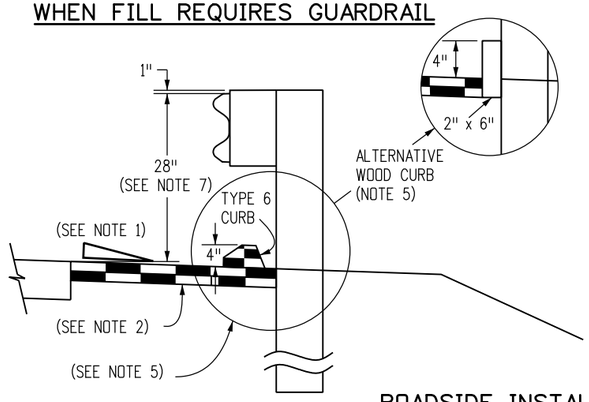


NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL

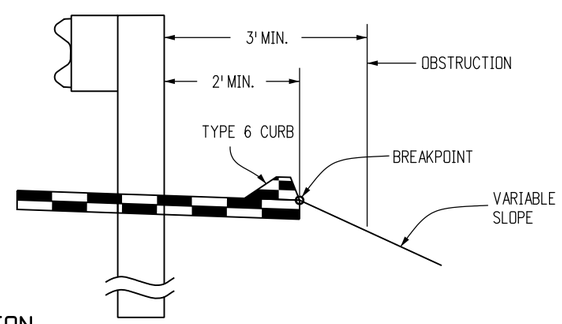


RESTRICTIVE ROADSIDE INSTALLATION WITH 7 FOOT GUARDRAIL POSTS

(SEE NOTE 4)

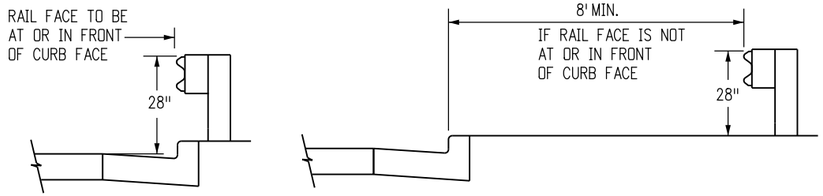


OPTION A



OPTION B

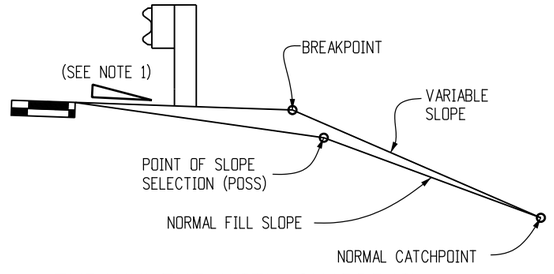
ROADSIDE INSTALLATION WITH EROSION CONTROL CURB



URBAN ROADSIDE INSTALLATION WITH CURB AND GUTTER

LOCATION	SPACING
ALL LOCATIONS EXCEPT BRIDGE RAIL LOCATIONS	6'-3"
BRIDGE OR STRUCTURE APPROACH	SEE SHEETS 12 & 20

NORMAL CENTER-TO-CENTER POST SPACING



EMBANKMENT WITH GUARDRAIL

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

GENERAL NOTES

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

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

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

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

THE GENERAL NOTES ARE CONTINUED ON SHEET 2.

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 10/27/14 Initials: LTA	(R-X)	10/09/14	Added details of the X-Lite flared and non-flared end terminals to sheets 6 and 8.
Full Path: www.codot.gov/business/designsupport	(R-X)	10/27/14	Removed the Et-Plus End Anchorage (non-flared) from sheet 8.
Drawing File Name: 6010101020.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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GUARDRAIL TYPE 3 W-BEAM

Issued By: Project Development Branch November 1, 2018

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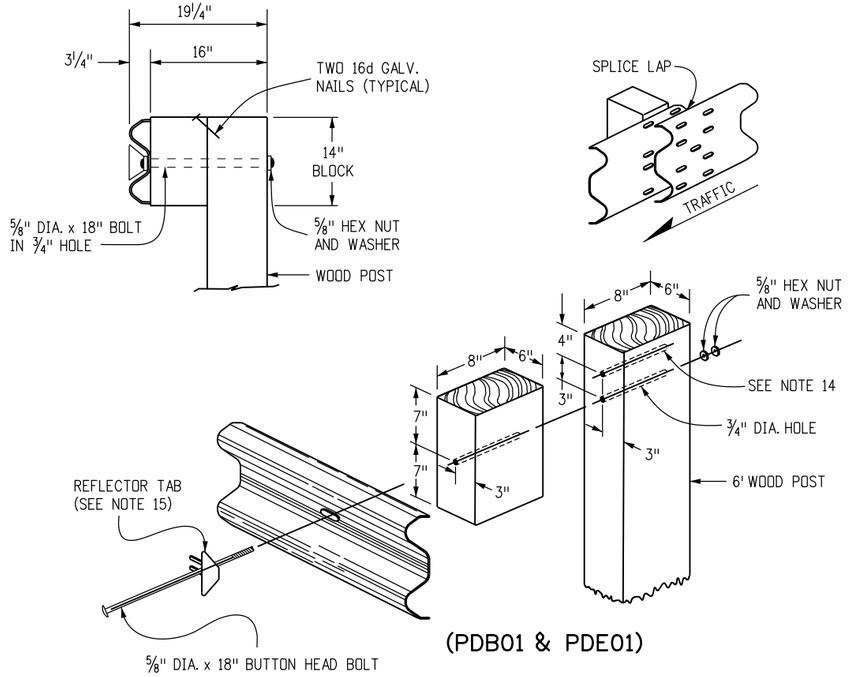
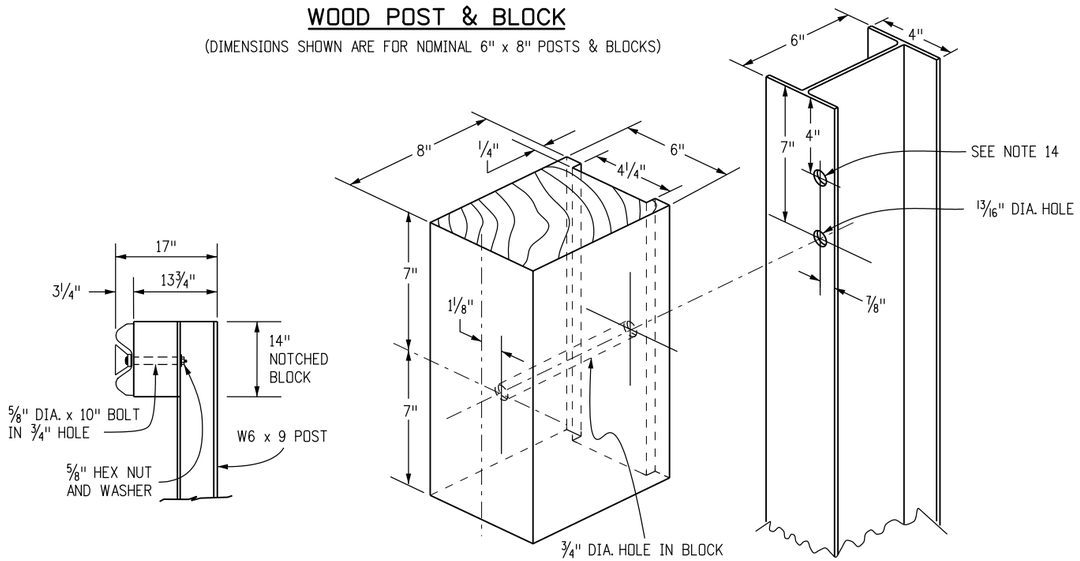


(PDB01 & PDE01)

WOOD POST & BLOCK

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



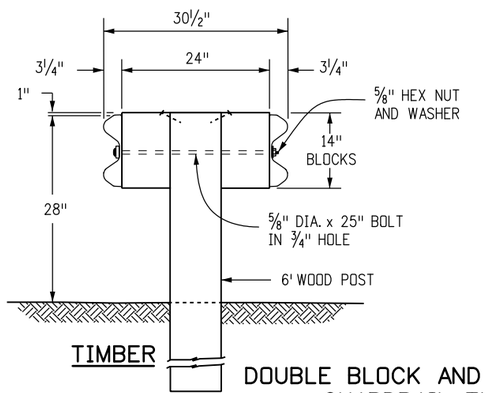
STEEL POST & NOTCHED BLOCK

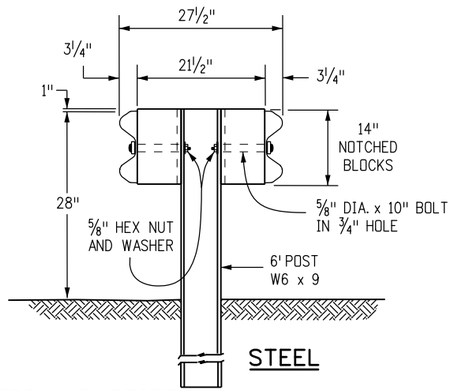
(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)

(PWE01)

GENERAL NOTES (CONTINUED FROM SHEET 1)

10. CONCRETE MAY BE READY-MIXED OR FIELD-MIXED AND SHALL CONSIST OF A MINIMUM OF 1 PART CEMENT TO 6 PARTS AGGREGATE BY VOLUME.
11. WHEN SPECIFIED IN THE CONTRACT, 7 FT. POSTS SHALL BE INSTALLED INSTEAD OF THE STANDARD 6 FT. POSTS. THE 7 FT. POSTS SHALL BE MARKED WITH THE NUMBER 7 TO ENSURE PERMANENT INDENTIFICATION. STEEL POSTS SHALL BE STAMPED PRIOR TO GALVANIZING. THE NUMBER 7 SHALL BE A MINIMUM 2 IN. TALL AND LOCATED AS SHOWN ON THE ELEVATION VIEW ON SHEET 1.
12. THE STANDARD 3 IN. X 1¾ IN. X 3/16 IN. RECTANGULAR WASHER USED UNDER POST BOLT HEADS IN THE PAST MAY REMAIN IN EXISTING INSTALLATIONS BUT SHALL NOT BE USED IN NEW CONSTRUCTION, REPAIRS, OR RESETTING OF RAIL, EXCEPT WHEN SPECIFICALLY IDENTIFIED ON THE STANDARD PLAN.
13. STANDARD GALVANIZED ROUND STEEL WASHERS SHALL BE USED UNDER ALL NUTS IN CONTACT WITH WOOD POSTS.
14. AN ADDITIONAL HOLE SHALL BE PROVIDED IN THE POSTS TO FACILITATE FUTURE RAISING OF THE RAIL ELEMENTS AND BLOCKS FOR OVERLAYS.
15. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT. INTERVALS (SEE SHEETS 6 AND 8 FOR EXCEPTIONS). RETROREFLECTOR TABS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. THE TABS SHALL BE MOUNTED SO THE BOLT SLOT FACES AWAY FROM TRAFFIC, AND THE RETROREFLECTOR SURFACE FACES THE APPROACHING TRAFFIC FOR ONE-WAY ROADS. FOR TWO-WAY ROADS, BOTH SIDES OF THE TABS SHALL BE RETROREFLECTIVE, SO THAT DELINEATION IS PROVIDED FOR BOTH DIRECTIONS OF TRAVEL. THE RETROREFLECTIVE SHEETING COLOR SHALL MATCH THE COLOR OF THE ADJACENT TRAVEL WAY EDGE LINE. SEE THE RETROREFLECTOR TAB DETAIL ON SHEET 3.
16. AT THE TIME OF INSTALLATION, WOOD POSTS OR BLOCKS WITH SEASONING CHECKS GREATER THAN ¼ IN. SHALL NOT BE USED WHEN THE CHECK EXTENDS THE FULL LENGTH OF THE PIECE.
17. WOOD BLOCKS SHALL BE CUT FROM THE SAME CROSS-SECTION, SPECIES, AND GRADE, AND SHALL RECEIVE THE SAME PRESERVATIVE TREATMENT AS THE POSTS WHEN WOOD POSTS ARE USED.
18. REFERENCES SUCH AS 00PDB01", 00PDE01", AND 00PWE01" IN THIS STANDARD PLAN SPECIFY HARDWARE DETAILS FROM 00A GUIDE TO STANDARDIZED HIGHWAY BARRIER HARDWARE" PREPARED BY THE AASHTO-AGC-ARTBA JOINT COOPERATIVE COMMITTEE.
19. NOTCHED RAIL BLOCKS MANUFACTURED FROM SYNTHETIC MATERIAL WILL BE ACCEPTED AS ALTERNATIVES TO WOOD NOTCHED BLOCKS FOR USE WITH STEEL POSTS PROVIDED THAT THE BLOCKS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL.
20. WOOD POSTS SHALL BE MADE OF TIMBER WITH AN EXTREME FIBER STRESS IN BENDING OF 1200 PSI STRESS GRADING AND POST DIMENSIONS SHALL CONFORM WITH THE RULES OF THE WEST COAST INSPECTION BUREAU, OR THE SOUTHERN PINE BUREAU, OR THE WESTERN WOOD PRODUCTS ASSOCIATION. TIMBER FOR POSTS SHALL BE EITHER ROUGH SAWN (UNPLANED) OR S4S (SURFACED FOUR SIDES) WITH NOMINAL DIMENSIONS INDICATED. ONLY ONE TYPE OF SURFACE FINISH SHALL BE USED FOR POSTS AND BLOCKS IN ANY ONE CONTINUOUS LENGTH OF GUARDRAIL.
21. GLULAM POSTS AND BLOCKS WILL BE ACCEPTED AS ALTERNATIVES PROVIDED THAT THE SUPPLIED MATERIALS HAVE RECEIVED FHWA APPROVAL AND ARE CERTIFIED AS IDENTICAL TO THE SPECIMENS USED FOR TESTING AND APPROVAL.
22. PRESSURE TREATMENT OF POSTS AND BLOCKS SHALL CONFORM TO AASHTO M 133 EXCEPT THAT BLOCKS NEED NOT BE INCISED. PRESERVATION ASSAY RETENTION REPORTS SHALL BE SUBMITTED TO THE ENGINEER. THE CONTRACTOR SHALL CERTIFY THAT THE SPECIES AND GRADE MEET THE REQUIREMENTS OF THE CONTRACT.
23. W-BEAM AND THRIE-BEAM GUARDRAIL POSTS SHALL BE MANUFACTURED USING AASHTO M 270 (ASTM A 709) GRADE 36 STEEL UNLESS CORROSION RESISTANT STEEL IS REQUIRED, IN WHICH CASE THE POST SHALL BE MANUFACTURED FROM AASHTO M 270 (ASTM A 709) GRADE 50W STEEL. THE DIMENSIONS OF THE CROSS-SECTION SHALL CONFORM TO A W6 X 9 SECTION AS DEFINED IN AASHTO M 160 (ASTM A 6). W6 X 8.5 WIDE FLANGE STEEL POSTS ARE AN ACCEPTABLE ALTERNATIVE TO THE W6 X 9.
24. AFTER THE SECTION IS CUT AND ALL HOLES ARE DRILLED OR PUNCHED THE COMPONENT SHALL BE ZINC-COATED CONFORMING TO AASHTO M 111 (ASTM A 123) UNLESS CORROSION-RESISTANT STEEL IS USED. WHEN CORROSION-RESISTANT STEEL IS USED THE PORTION OF THE POST TO BE EMBEDDED IN SOIL SHALL BE ZINC-COATED CONFORMING TO AASHTO M 111 (ASTM A 123) AND THE PORTION ABOVE THE SOIL SHALL NOT BE ZINC-COATED, PAINTED OR OTHERWISE TREATED.
25. FIELD MODIFICATION TO RAIL ELEMENTS ONLY IS ALLOWED BY SAWING AND DRILLING OF HOLES. FLAME CUTTING IS NOT PERMITTED. POSTS SHALL NOT BE MODIFIED. COMPONENTS ON WHICH THE SPELTER COATING HAS BEEN DAMAGED SHALL BE EITHER REGALVANIZED OR RECOATED IN CONFORMANCE WITH AASHTO M 36, OR PAINTED WITH ONE FULL BRUSH COAT OF ZINC RICH PAINT CONFORMING TO MILITARY SPECIFICATION DOD-P-21035A.





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

Computer File Information		Sheet Revisions	
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Last Modification Date: 10/27/14 Initials: LTA	(R-X)		
Full Path: www.codot.gov/business/designsupport	(R-X)		
Drawing File Name: 6060102020.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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GUARDRAIL TYPE 3 W-BEAM

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STANDARD PLAN NO.

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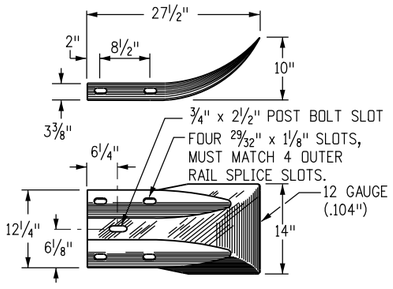
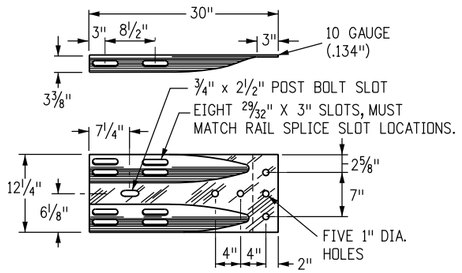
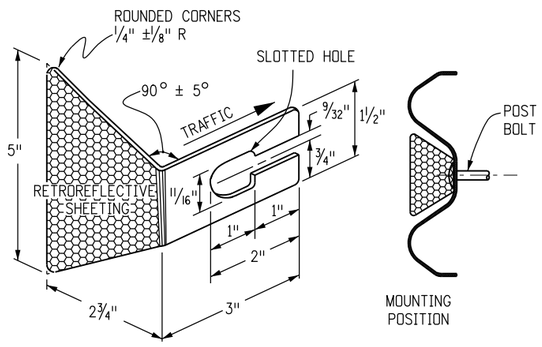


(RWE01a)

TERMINAL SECTION (FLARED)

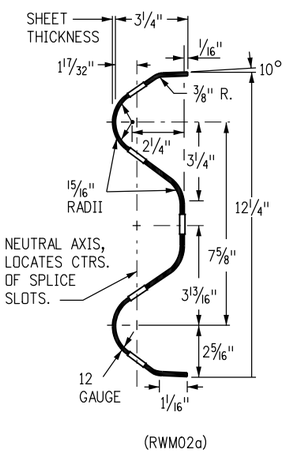


TERMINAL SECTION (CONNECTOR)



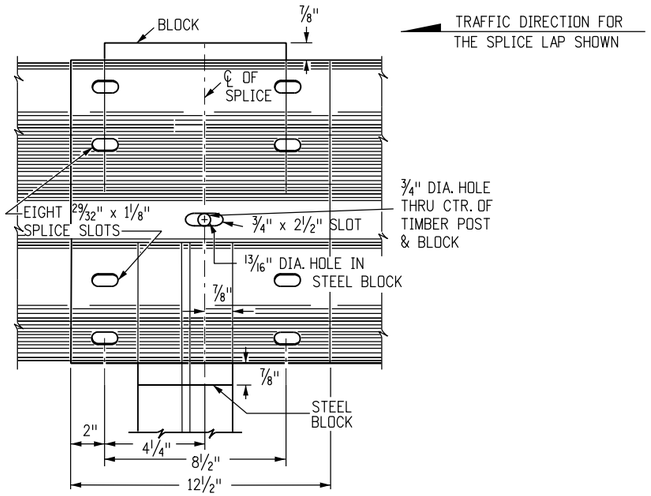
RETROREFLECTOR TAB

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

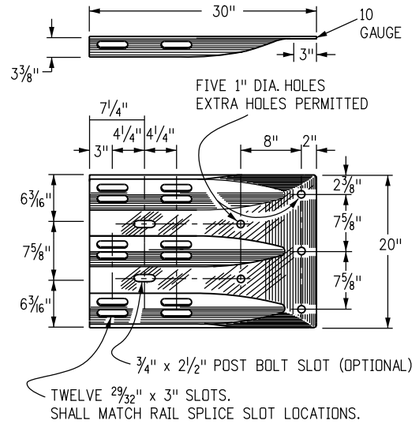


(RWM02a)

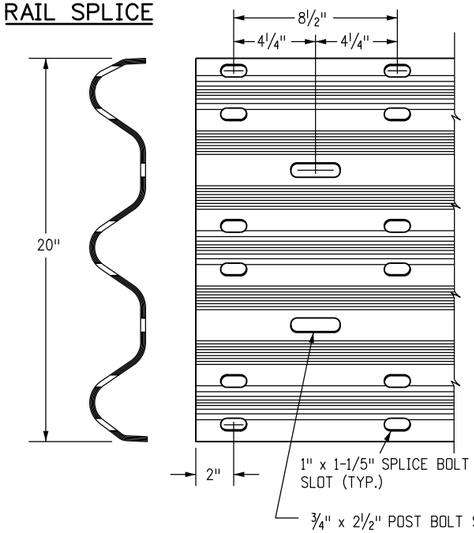
W-BEAM RAIL SECTION



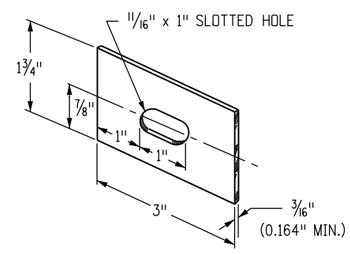
RAIL SPLICE



THRIE BEAM TERMINAL SECTION (CONNECTOR)



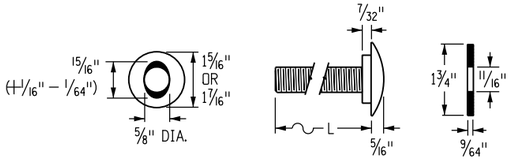
THRIE BEAM DETAIL



(FWR03)

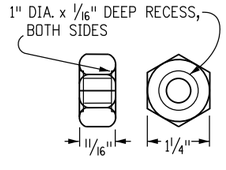
RECTANGULAR WASHER

(TO BE USED ONLY WHERE SPECIFIED.)



BUTTON HEAD BOLT WITH OVAL SHOULDER

WASHER



HEX NUT

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

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

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

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

* WASHERS NOT USED AT RAIL SPLICES

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Sheet Revisions	
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GUARDRAIL TYPE 3 W-BEAM

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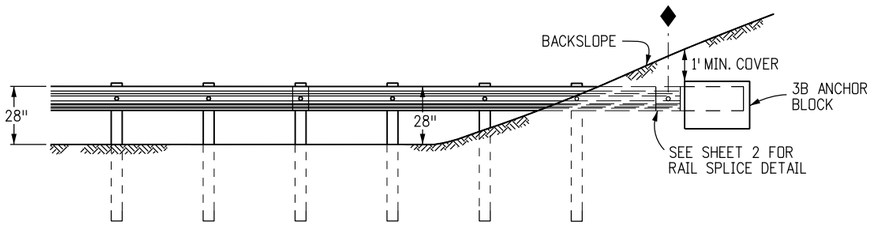
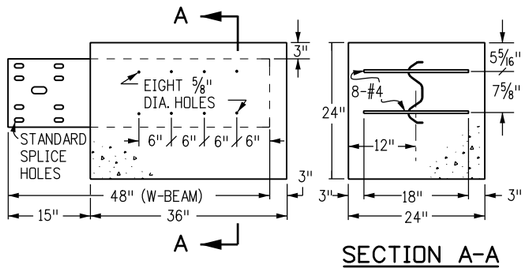


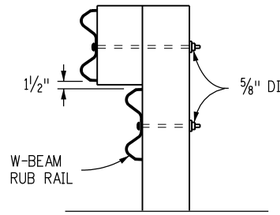
SEE TYPE 3B (RUB RAIL) PLAN VIEW FOR ALIGNMENT. THE 100 FT. FLARE LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

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



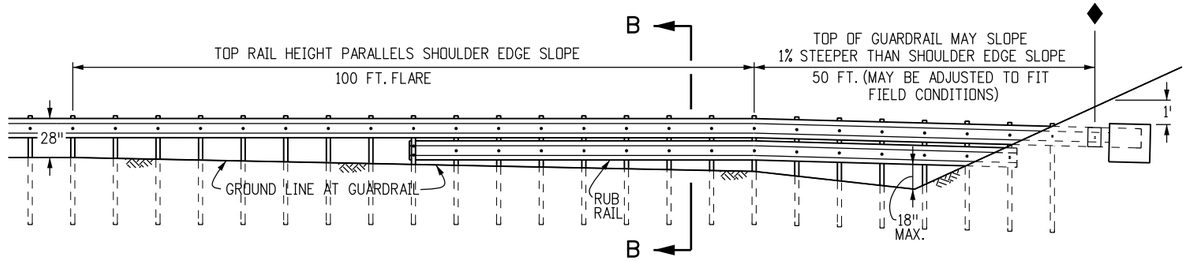
SECTION A-A

TYPE 3B ANCHOR BLOCK DETAIL

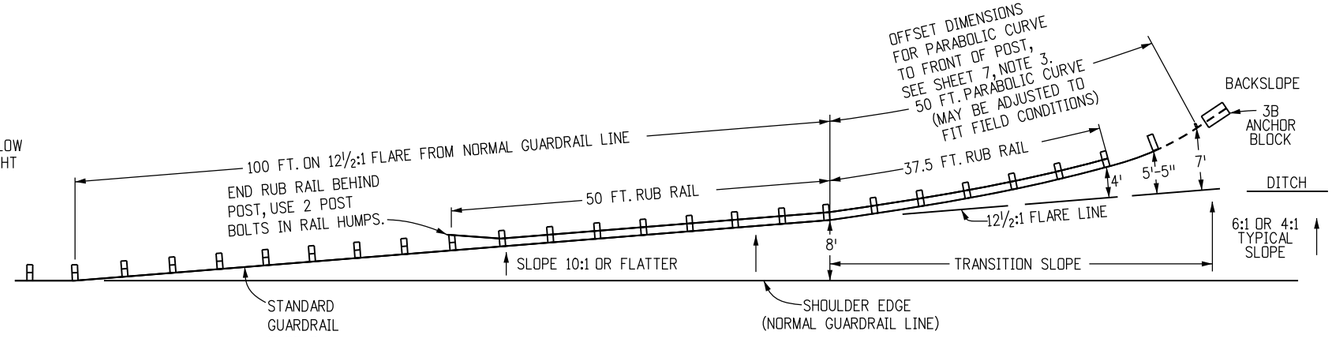


SECTION B-B

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



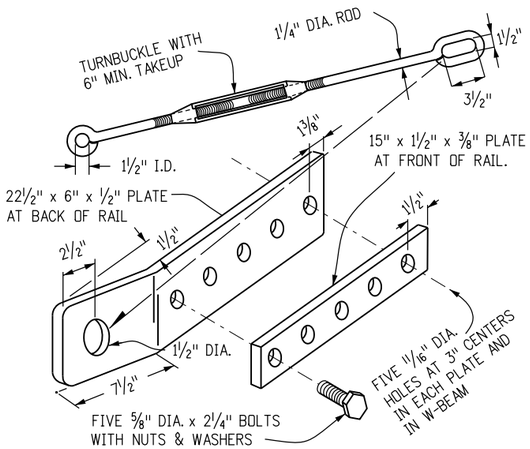
ELEVATION VIEW



PLAN VIEW

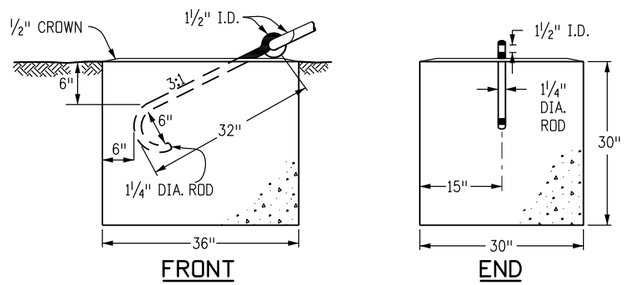
◆ END OF GUARDRAIL PAY LENGTH

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



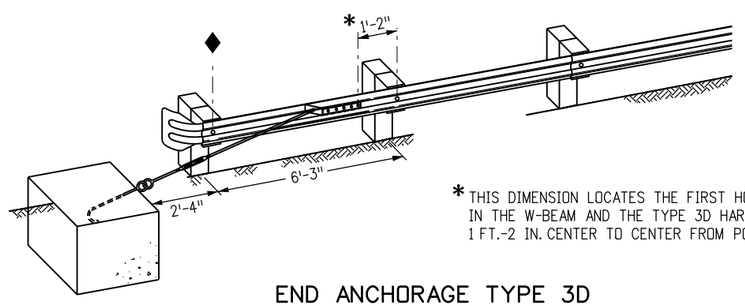
TYPE 3D HARDWARE DETAILS

NOTE: ALL PARTS SHALL BE GALVANIZED



FRONT END

TYPE 3D ANCHOR BLOCK DETAIL



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

END ANCHORAGE TYPE 3D DEPARTURE TERMINAL

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Creation Date: 07/04/12 Initials: DLM		Date:	Comments
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GUARDRAIL TYPE 3 W-BEAM

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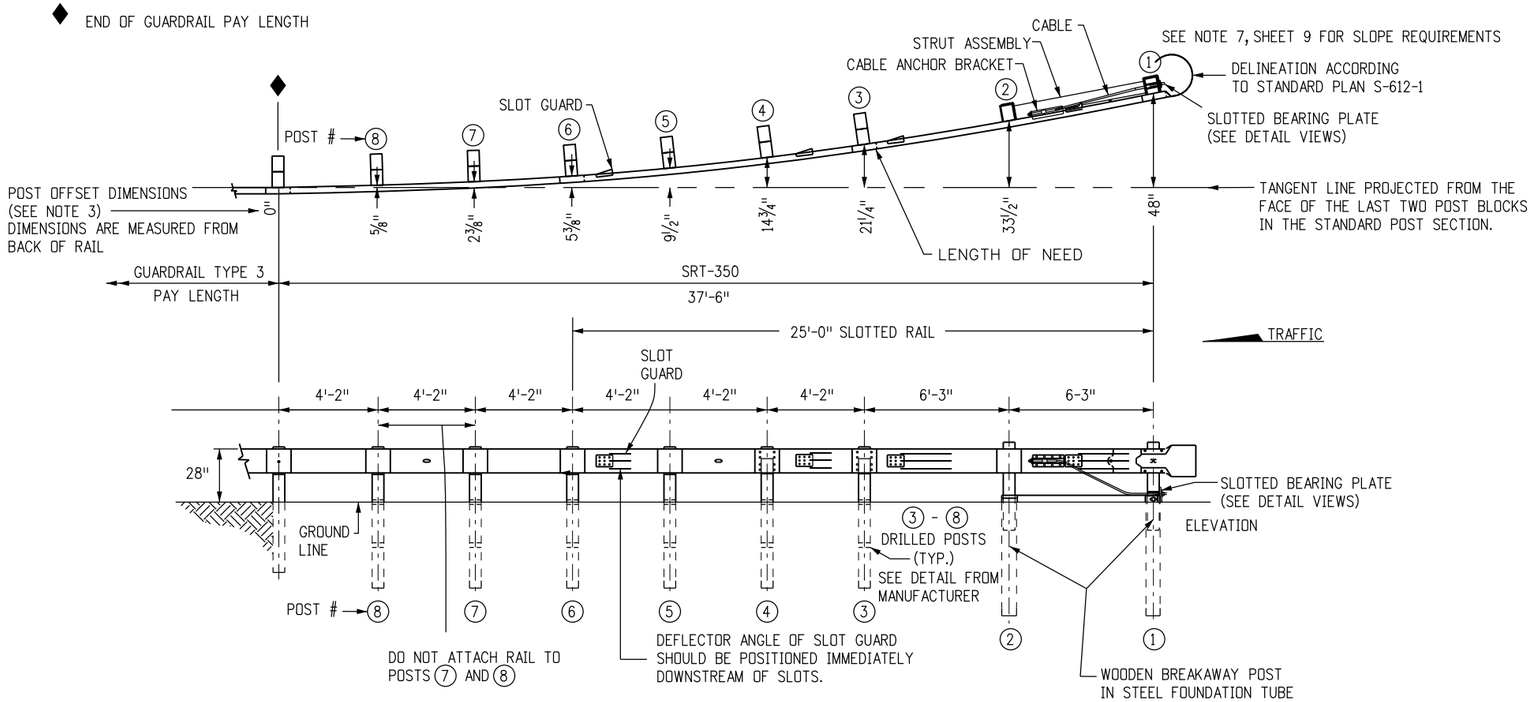
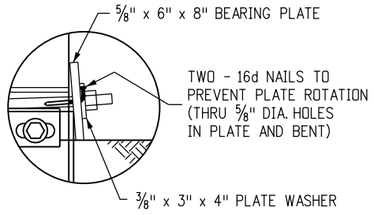
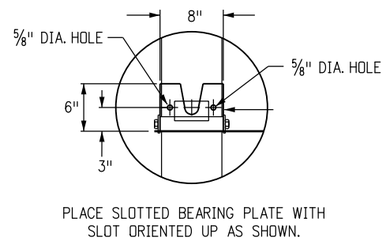


SLOTTED RAIL TERMINAL (SRT)



SRT DETAIL VIEW



SRT FRONT VIEW

SLOTTED BEARING PLATE DETAIL

NOTES FOR FLARED

1. THE END ANCHORAGE (FLARED) SHALL EITHER BE THE SLOTTED RAIL TERMINAL (SRT-350), AS MANUFACTURED BY TRINITY INDUSTRIES, INC. (TELEPHONE #: 800-772-7976), THE FLEAT-350, AS MANUFACTURED BY ROAD SYSTEMS INC. (TELEPHONE #: 432-263-2435), OR THE X-LITE AS MANUFACTURED BY BARRIER SYSTEMS, INC. (TELEPHONE #: 888-800-3691). ONE END ANCHORAGE (FLARED) SHALL INCLUDE ALL POST, RAIL, AND ALL HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (FLARES) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO INSTALLATION OF THE DEVICE.
2. IN HEAVY SNOW LOCATIONS, TRIM POSTS (1) AND (2) FLUSH WITH RAIL TOP AND TREAT END WITH SEALANT, IN CONFORMANCE WITH AASHTO M 133.
3. THE POST OFFSET DIMENSIONS ARE GIVEN TO THE CENTER OF THE TRAFFIC FACE OF THE BLOCKOUTS FROM THE PROJECTED RAIL TANGENT LINE, EXCEPT AT THE FIRST TWO POSTS WHERE THE DIMENSION IS TO THE CENTER OF THE TRAFFIC FACE OF THE POST. OFFSET POINTS SHALL BE LOCATED BY CHORD MEASUREMENTS AT THE BACK OF THE RAIL AND BE EQUAL TO THE NOMINAL POST SPACINGS SHOWN. POSTS ARE TO BE SET APPROXIMATELY RADIAL TO THE RAILING AT EACH POST LOCATION.
4. THE SRT SLOTTED BEARING PLATE SHALL BE INSTALLED WITH THE SLOT FACING UP.
5. POSTS SHALL BE DRILLED FOR BREAKAWAY ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
6. SEE SHEETS 1, 3 AND 4 FOR STANDARD GUARDRAIL TYPE 3 AND INSTALLATION DETAILS.
7. RETROREFLECTOR TABS SHALL NOT BE USED ON POSTS (1) THROUGH (8).
8. SRT PANELS SHALL BE SUPPLIED IN EITHER THREE 12 FT. - 6 IN. RAIL PANELS, OR ONE 25 FT. - 0 IN. AND ONE 12 FT. - 6 IN. RAIL PANELS.
9. SRT - STRAIGHT FLARED OPTION. SEE MANUFACTURER'S DETAILS.
10. HINGED BREAK AWAY (HBA) STEEL POSTS MAY BE USED AS AN ALTERNATIVE ON THE SRT FOR POSTS (2) THRU (8). SEE MANUFACTURER'S DETAILS.
11. HINGED BREAK AWAY (HBA) STEEL POSTS OR WELDED POSTS (PW) MAY BE USED AS AN ALTERNATIVE ON THE FLEAT FOR POSTS (3) THRU (7). SEE MANUFACTURER'S DETAILS.
12. USE MANUFACTURE'S SUPPLIED POSTS FOR X-LITE END ANCHORAGE AS FOLLOWS:
    POST 1 - X-LITE, CRIMPED POST SLOTS, GALVANIZED.
    POST 2 - X-LITE, POST II, GALVANIZED.
    POSTS 3 THRU 6 - X-LITE, CRIMPED POST HOLES, GALVANIZED.
13. DELINEATION SHALL BE APPLIED TO THE END PIECE, AND SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

END ANCHORAGE (FLARED)

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 10/27/14 Initials: LTA	(R-X)	10/09/14	Moved FLEAT 350 To Sheet 6.
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Drawing File Name: 6060105020.dgn	(R-X)		
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GUARDRAIL TYPE 3 W-BEAM

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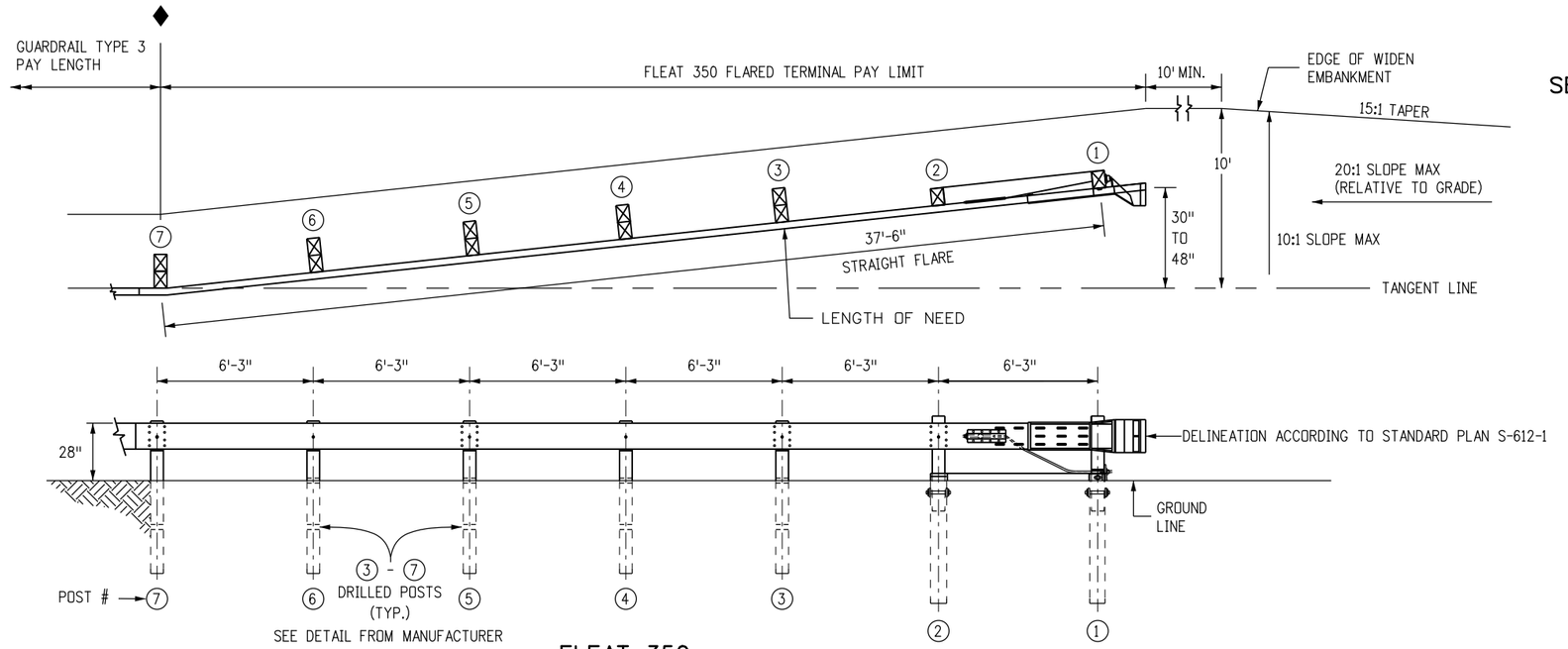
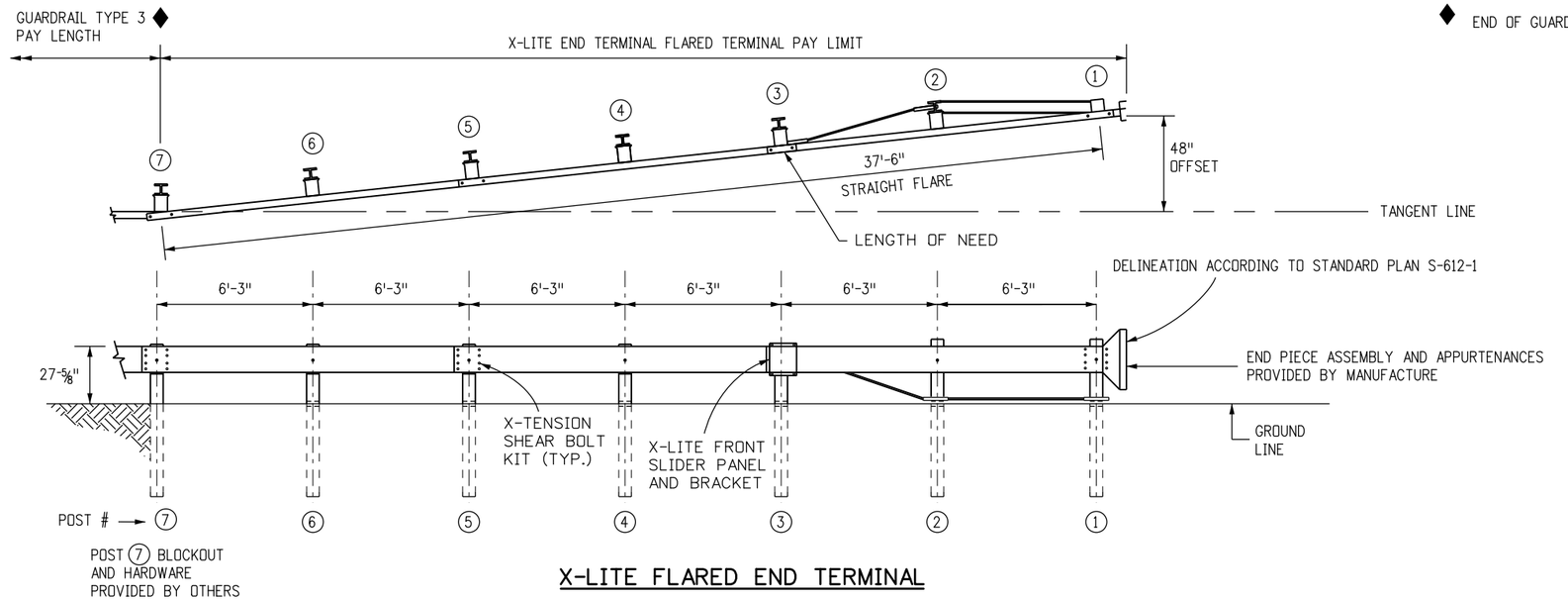


FLEAT 350



X-LITE FLARED END TERMINAL

SEE M-606-1, SHEET 5 OF 20, FOR "NOTES".

◆ END OF GUARDRAIL PAY LENGTH

END ANCHORAGES (FLARED)

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 10/27/14 Initials: LTA	R-X	10/09/14	Added X-Lite End Terminal
Full Path: www.codot.gov/business/designsupport	R-X	10/09/14	Moved Notes to Sheet 5 of 20
Drawing File Name: 6060106020.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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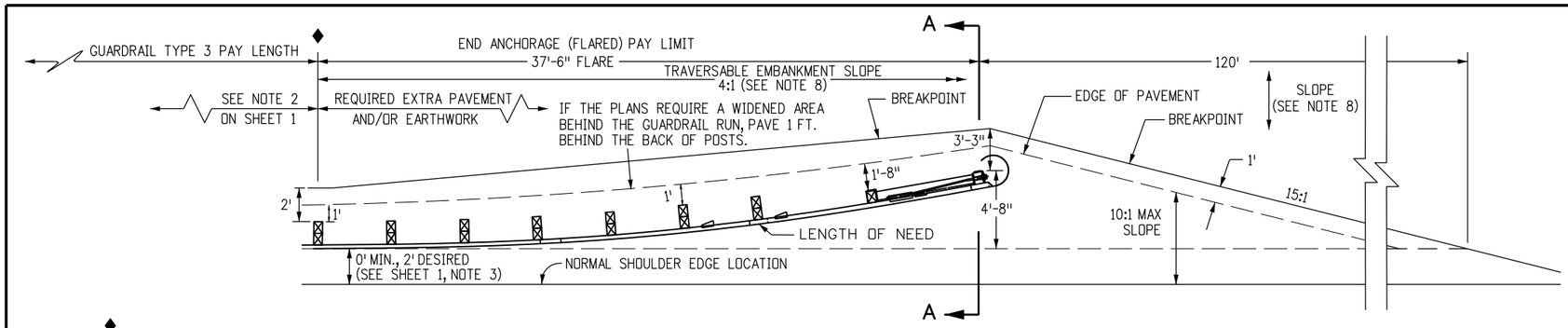
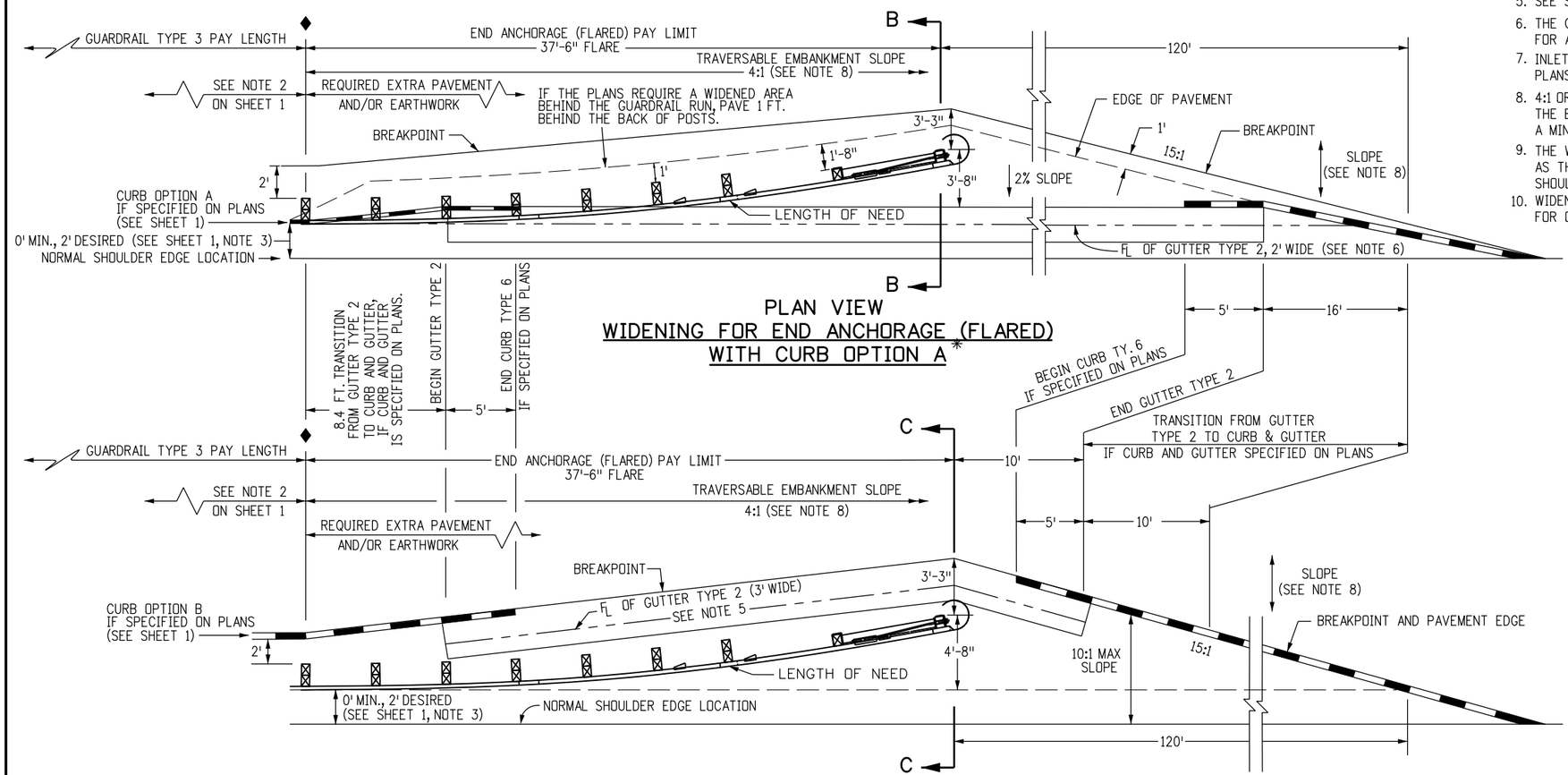
M-606-1
Sheet No. 6 of 20



◆ END OF GUARDRAIL PAY LENGTH

PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) *

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

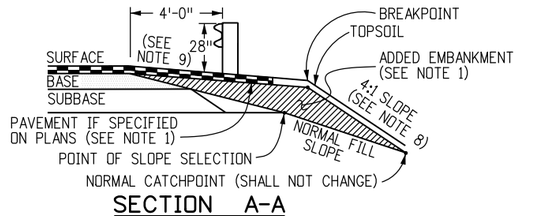


PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION A *

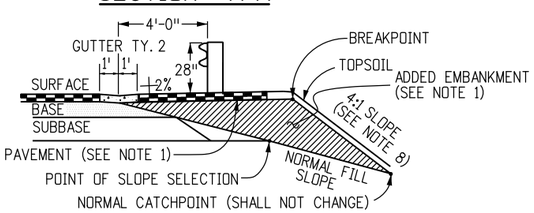
PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION B *

NOTES

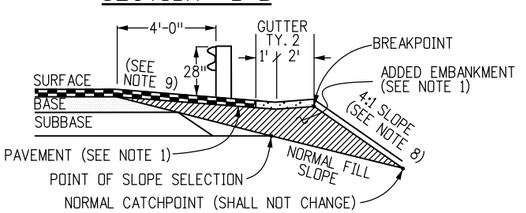
1. PAYMENT FOR THE ADDED EMBANKMENT (APPROXIMATELY 45 CU. YDS.) FOR THE FLARE SHALL BE AS FOLLOWS:
   A. UNDER PAY ITEM 203 WHEN THE CONTRACT PLAN INCLUDES PAY ITEM 203
   B. INCLUDED IN THE COST OF THE END ANCHORAGE (FLARED) WHEN THE CONTRACT PLANS DO NOT INCLUDE PAY ITEM 203. THE ADDED EMBANKMENT SHALL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



SECTION A-A



SECTION B-B



SECTION C-C

Computer File Information		Sheet Revisions	
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Last Modification Date: 10/27/14 Initials: LTA	(R-X)		
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Drawing File Name: 6060107020.dgn	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)		

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GUARDRAIL TYPE 3 W-BEAM

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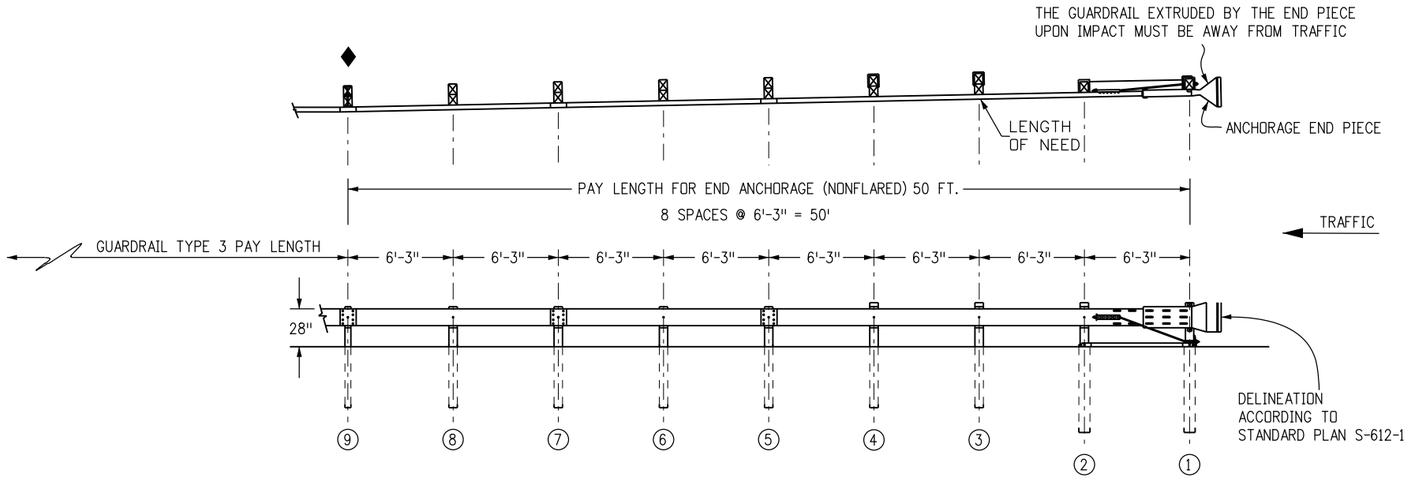
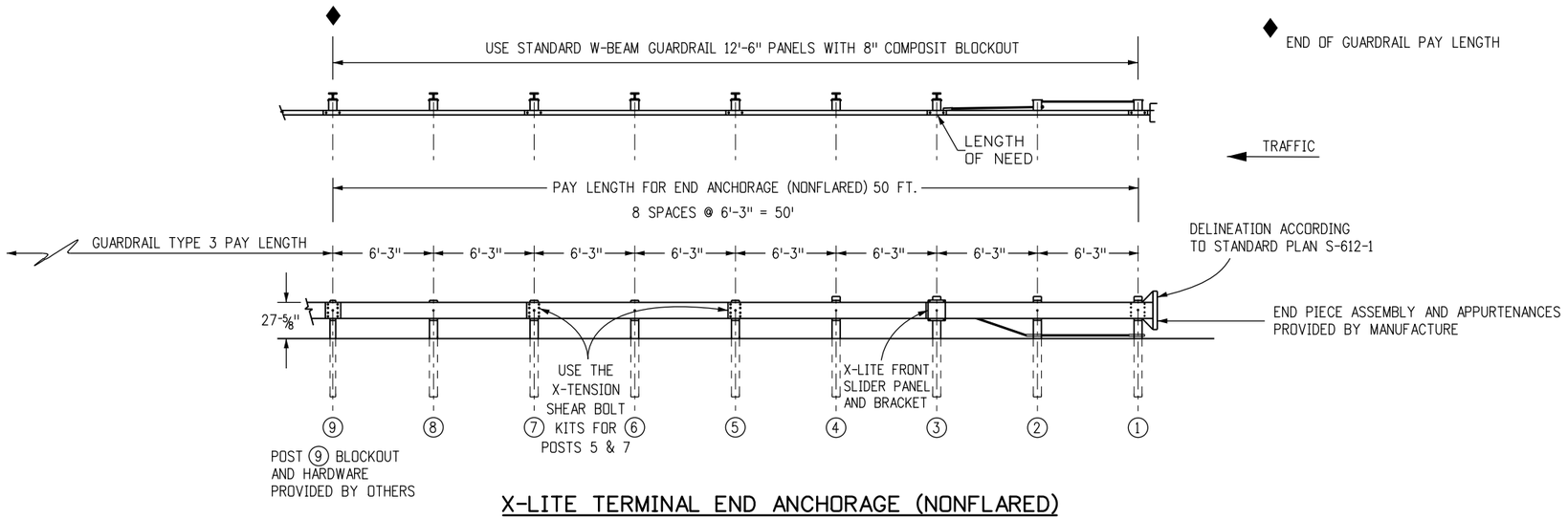


SKT END ANCHORAGE (NONFLARED)

NOTES FOR NONFLARED

1. THE END ANCHORAGE (NONFLARED) SHALL EITHER BE THE SKT GUARDRAIL AS MANUFACTURED BY ROAD SYSTEMS, INC. (TEL. #: 432-263-2435), OR THE X-LITE AS MANUFACTURED BY BARRIER SYSTEMS, INC. (TEL. #: 888-800-3691). THE END ANCHORAGE (NONFLARED) SHALL INCLUDE ALL POST, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE END ANCHORAGE (NONFLARED) SHALL BE INSTALLED CONFORMING TO THE MANUFACTURER'S RECOMMENDATIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LIST TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE DEVICE.
2. WOOD POSTS SHALL BE DRILLED FOR BREAKAWAY CONFORMING TO THE MANUFACTURER'S INSTRUCTIONS.
3. HINGED BREAK AWAY (HBA) STEEL POSTS MAY BE USED CONFORMING TO THE MANUFACTURER'S INSTRUCTIONS.
4. RETROREFLECTOR TABS SHALL NOT BE USED ON THE LAST SEVEN POSTS OF THE END ANCHORAGE (NONFLARED).
5. USE THE MANUFACTURER'S SPECIFIED STEEL FOUNDATION TUBE FOR POSTS (1) AND (2) FOR SKT END ANCHORAGES (NONFLARED).
6. USE THE MANUFACTURE'S SUPPLIED POSTS FOR X-LITE END ANCHORAGE AS FOLLOWS:
   POST 1 - X-LITE, CRIMPED POST SLOTS, GALVANIZED.
   POST 2 - X-LITE, POST II, GALVANIZED.
   POST 3 - X-LITE, CRIMPED POST HOLES, GALVANIZED.
   FOR POSTS 4 THRU 8 - USE STANDARD LINE POST, GALVANIZED.
7. 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.



X-LITE TERMINAL END ANCHORAGE (NONFLARED)

END ANCHORAGES (NONFLARED)

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
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Drawing File Name: 60600108020.dgn	R-X	10/27/14	Removed the ET-Plus End Anchorage (non-flared).
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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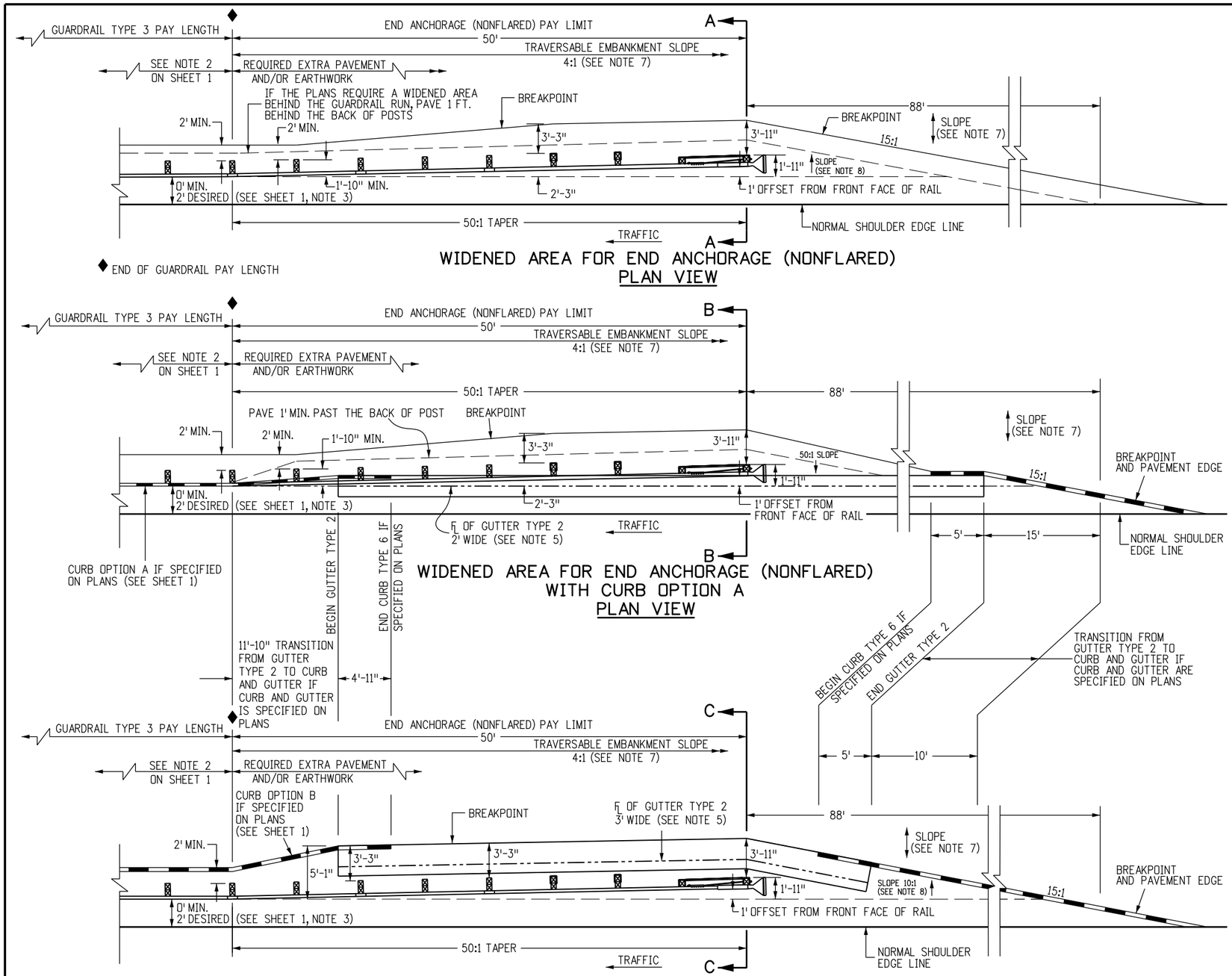
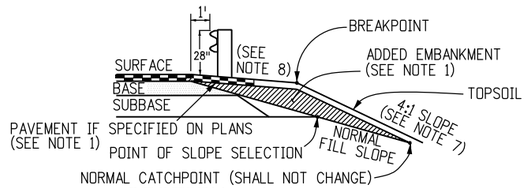
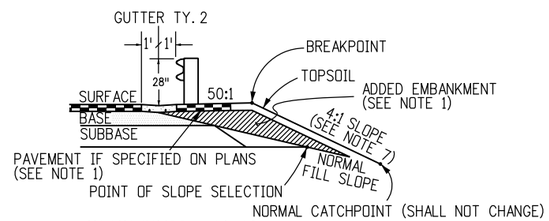


NOTES

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



SECTION A-A



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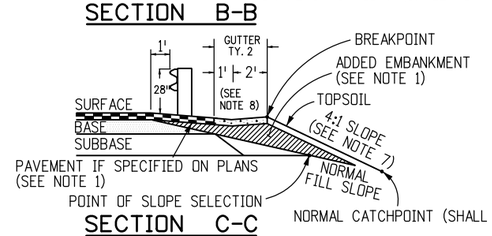

SECTION C-C

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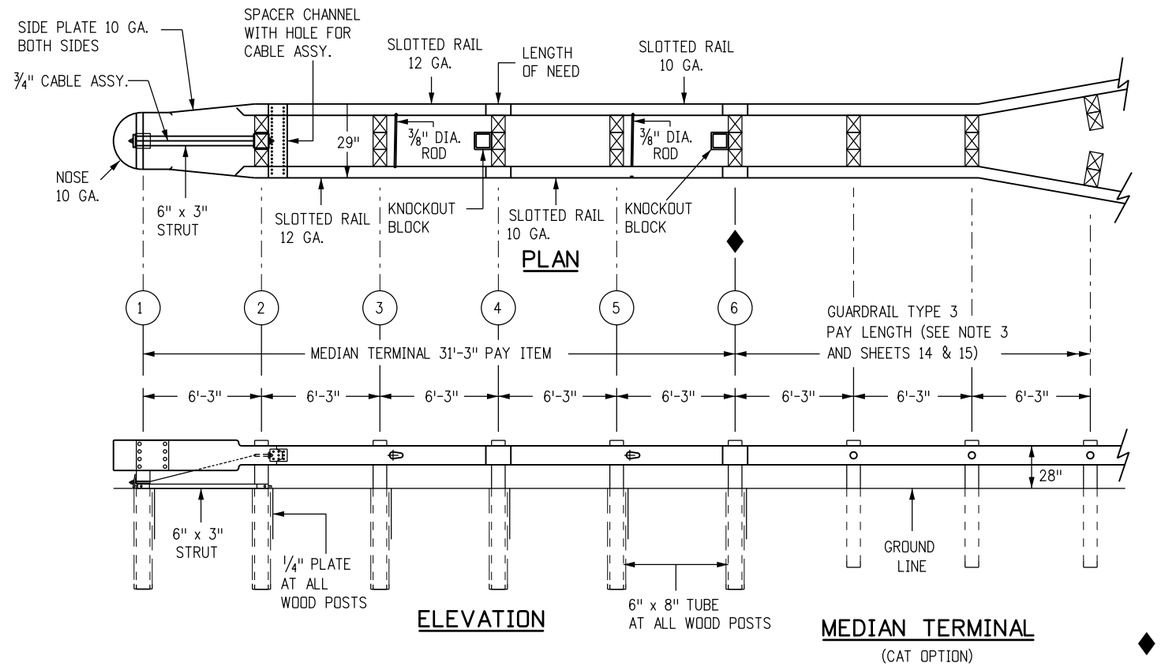
GUARDRAIL TYPE 3 W-BEAM

Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.
M-606-1



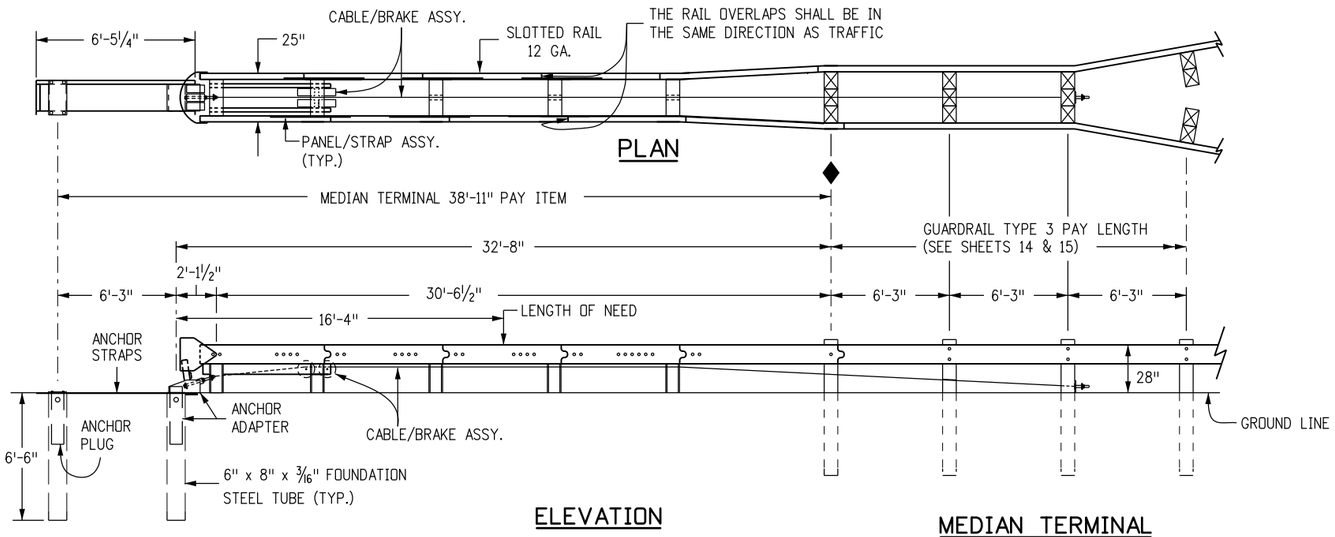
MEDIAN TERMINAL

(CAT OPTION)

◆ END OF GUARDRAIL PAY LENGTH

MEDIAN TERMINAL NOTES

1. THE MEDIAN TERMINAL SHALL BE THE CAT 350 AS MANUFACTURED BY TRINITY INDUSTRIES INC. (TEL #: 800-722-7976), OR THE BRAKEMASTER AS MANUFACTURED BY ENERGY ABSORPTION SYSTEMS, INC. AS DISTRIBUTED BY INTERWEST SAFETY SUPPLY (TEL #: 303-733-8447), OR THE FLEAT-MT MEDIAN TERMINAL AS MANUFACTURED BY ROAD SYSTEM INC. (TEL. #: 432-263-2435).
2. ONE MEDIAN TERMINAL SHALL INCLUDE ALL POSTS, RAIL, AND HARDWARE ITEMS REQUIRED FOR A COMPLETE UNIT. THE DEVICE SHALL BE INSTALLED IN CONFORMANCE WITH THE MANUFACTURER'S INSTRUCTIONS. THE CONTRACTOR SHALL PROVIDE A COPY OF THE MANUFACTURER'S INSTALLATION INSTRUCTIONS AND PARTS LISTS TO THE ENGINEER PRIOR TO THE INSTALLATION OF THE DEVICE.
3. UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL BE INSTALLED FOR BIDIRECTIONAL TRAFFIC APPLICATION.
4. MEDIAN GUARDRAIL POSTS MAY BE STEEL OR WOOD.
5. EACH INSTALLATION SHALL BE SUPERVISED AND CERTIFIED AS CORRECT UPON COMPLETION BY A REPRESENTATIVE OF THE DEVICE MANUFACTURER OR BY AN EMPLOYEE OF THE CONTRACTOR WHO IS A CERTIFIED INSTALLER. THE CERTIFIED INSTALLER SHALL HAVE COMPLETED DEVICE TRAINING AND SHALL BE REGISTERED WITH THE MANUFACTURER AS A CERTIFIED INSTALLER. IF NO CERTIFICATION IS AVAILABLE, THE PROJECT ENGINEER OR DESIGNEE MAY INSPECT AND CERTIFY INSTALLATION.
6. DELINEATION, IF REQUIRED, SHALL BE APPLIED TO THE END PIECE AND WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK. SEE STANDARD PLAN S-612-1.



MEDIAN TERMINAL

(BRAKEMASTER OPTION)

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GUARDRAIL TYPE 3 W-BEAM

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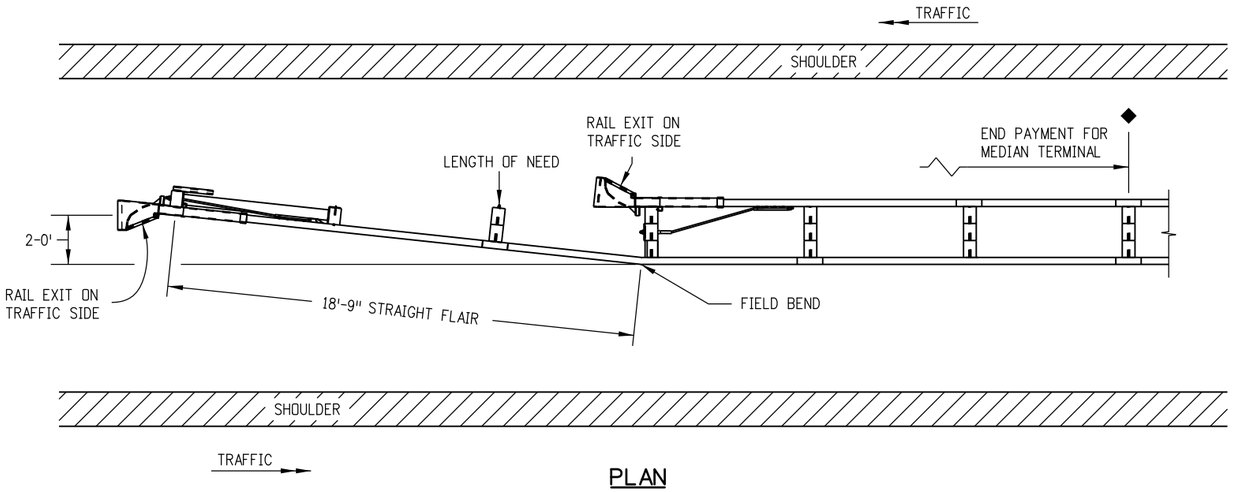
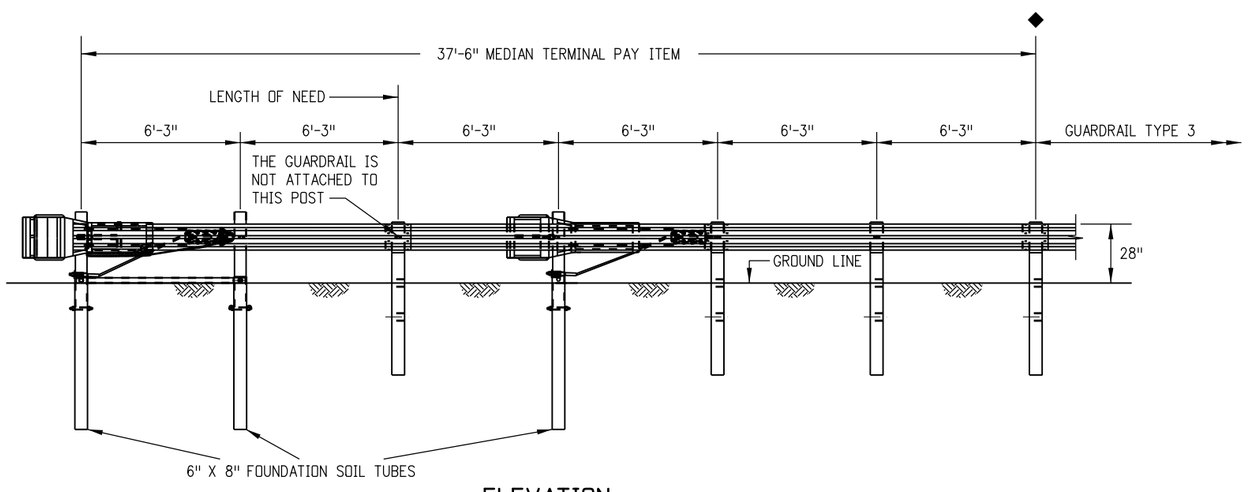
M-606-1



PLAN



ELEVATION

MEDIAN TERMINAL
(FLEAT-MT OPTION)

FLEAT- MT NOTES

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

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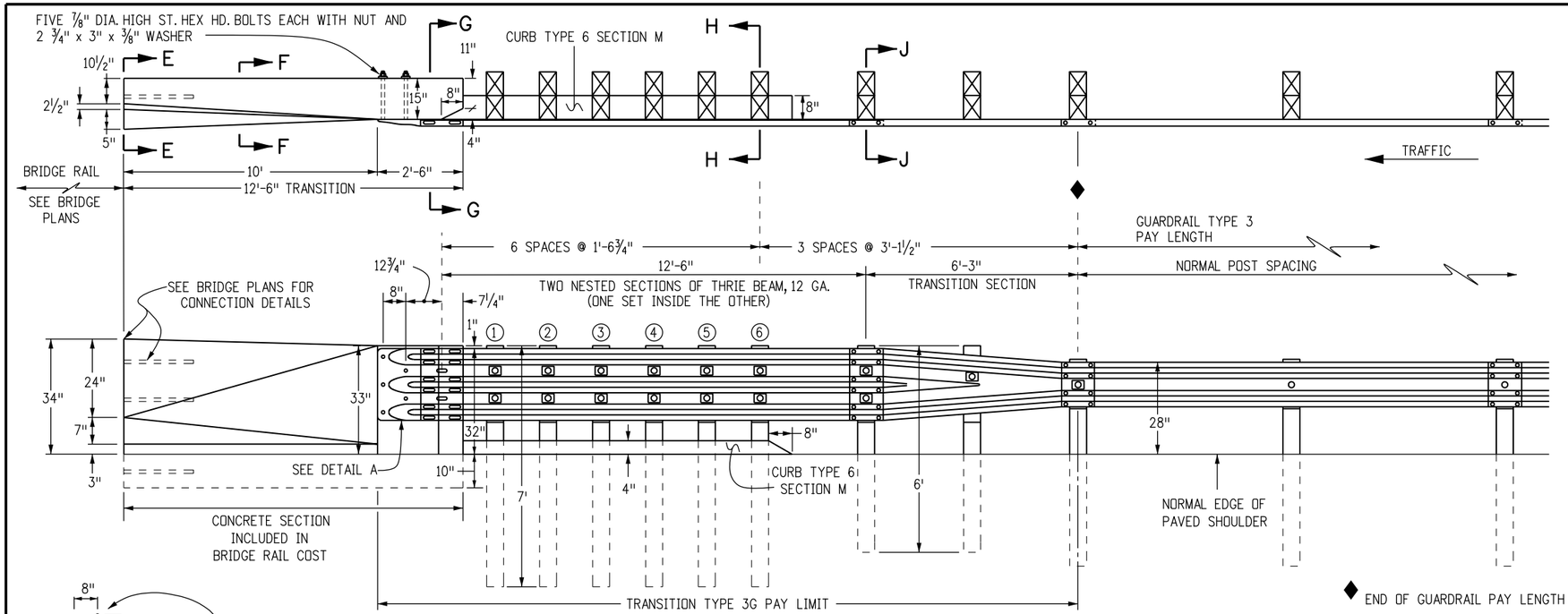
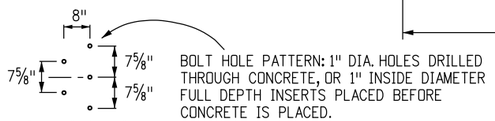
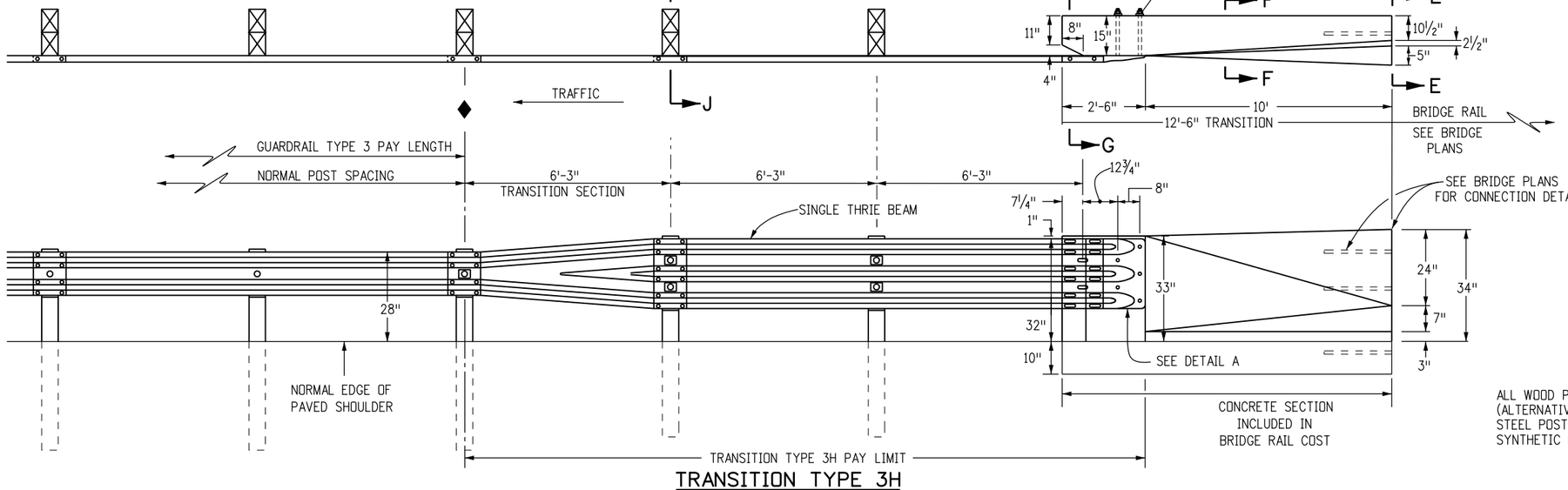


TRANSITION TYPE 3G



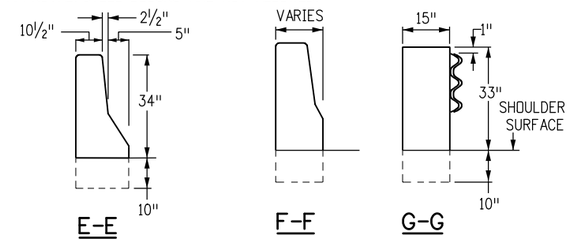
DETAIL A

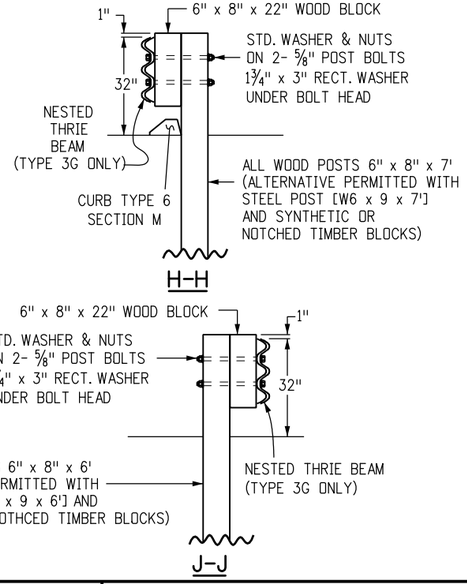


TRANSITION TYPE 3H

NOTES

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





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GUARDRAIL TYPE 3 W-BEAM

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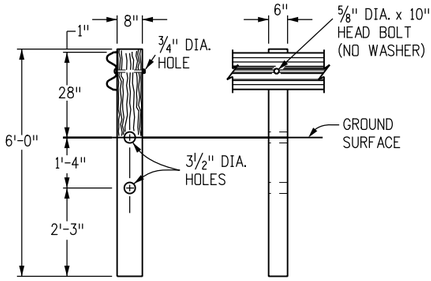
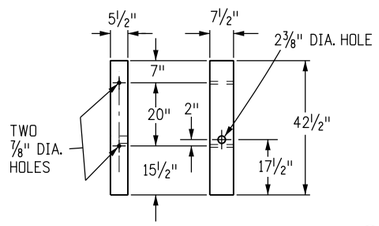


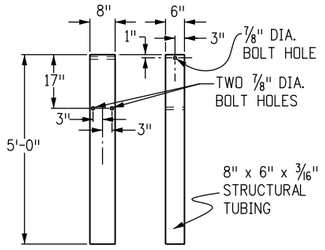
CONTROLLED RELEASING TERMINAL (CRT) POST ①



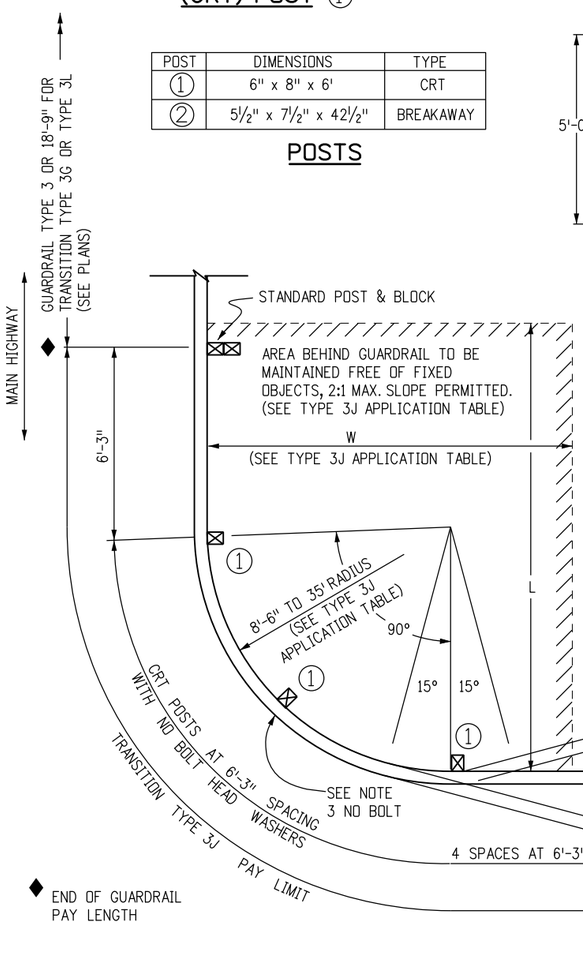
WOOD BREAKAWAY POST ②

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

POSTS



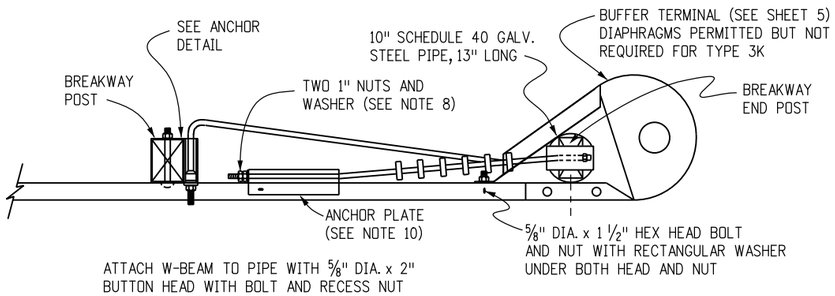
STEEL TUBE

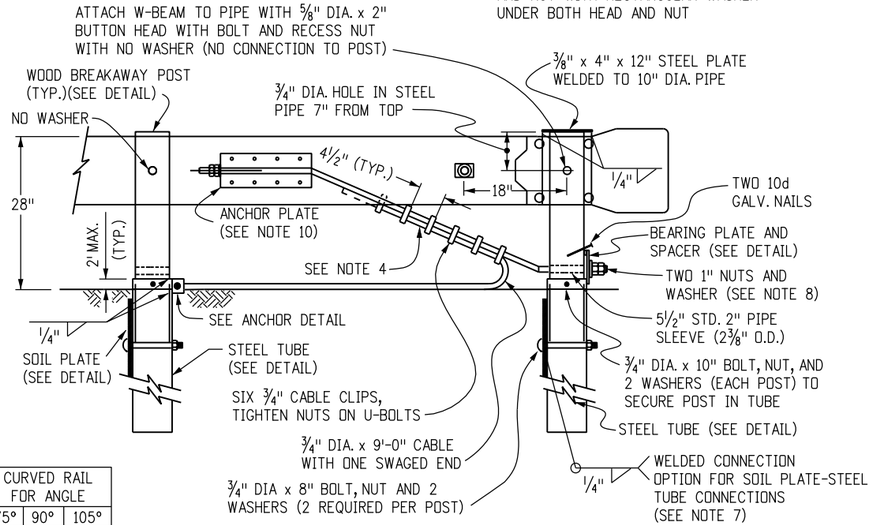


RADIUS	ANGLE	NO. CRT POSTS	AREA FREE OF FIXED OBJECTS		CURVED RAIL FOR ANGLE		
			L	W	75°	90°	105°
8'-6"	75°-105°	5	25'	15'	11'	13'	15'
17'	75°-90°	6	30'	15'	22"	27'	31'
	91°-105°	7					
25'-6"	75°-85°	7	40'	20'	33'	40'	47'
	86°-95°	8					
	96°-105°	9					
35'	75°-85°	9	50'	20'	46'	55'	64'
	86°-95°	10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

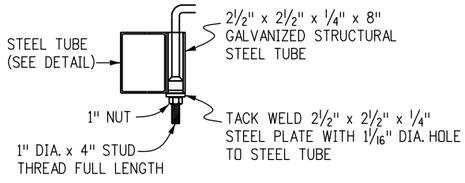
TRANSITION TYPE 3J APPLICATION

INTERSECTING ROADWAYS TRANSITION - TYPE 3J TRANSITION

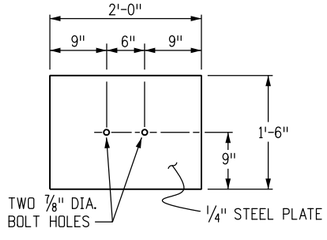




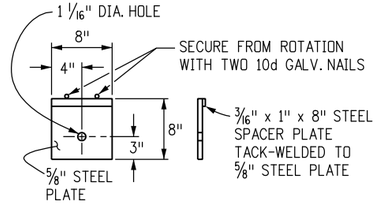
LOW SPEED END ANCHORAGE - TYPE 3K



ANCHOR DETAIL



SOIL PLATE



BEARING PLATE FOR STEEL TUBE

NOTES

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

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

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GUARDRAIL TYPE 3 W-BEAM

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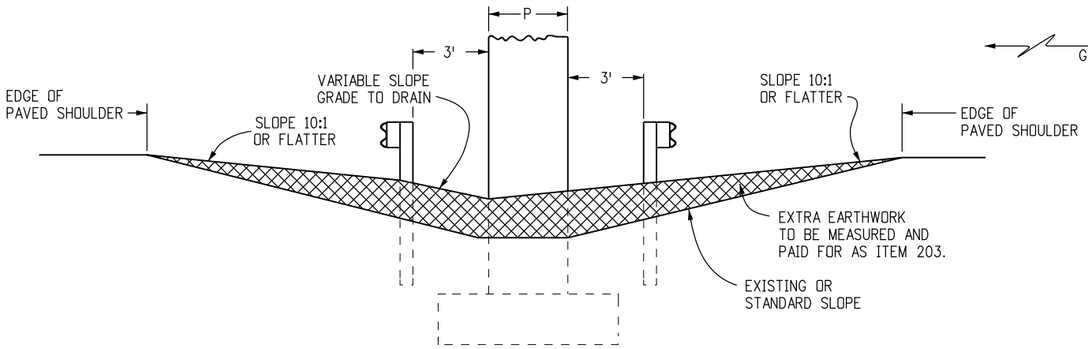
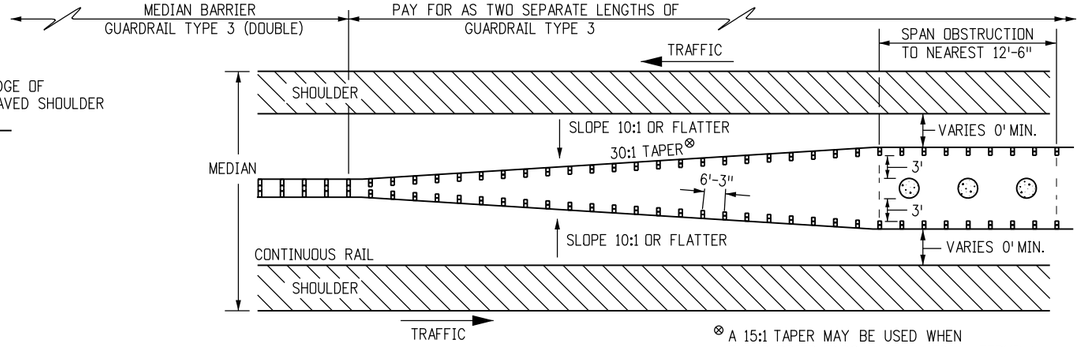
STANDARD PLAN NO.
M-606-1
Sheet No. 13 of 20

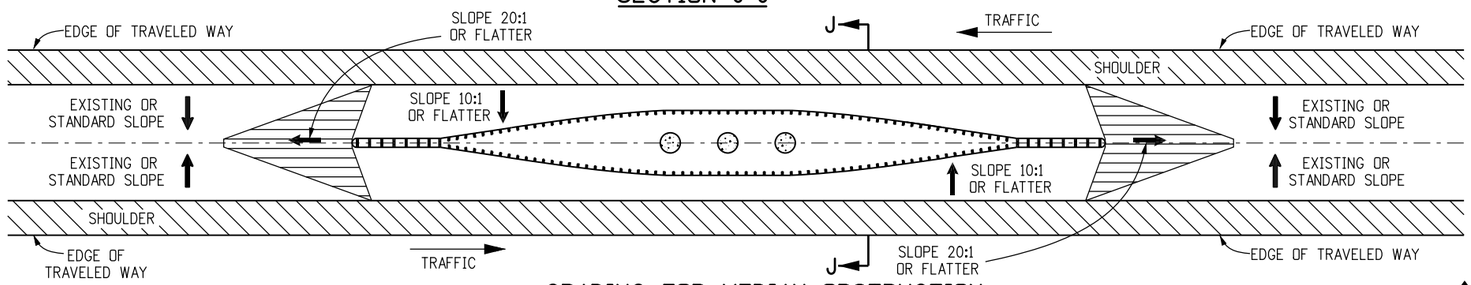


SECTION J-J

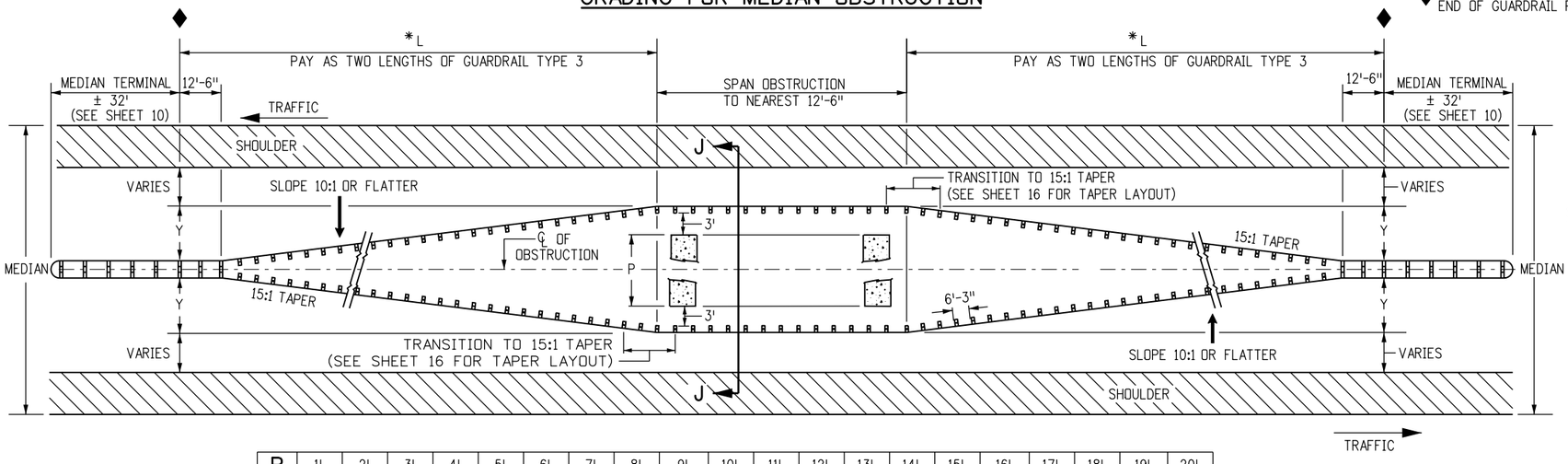


⊗ A 15:1 TAPER MAY BE USED WHEN THE BARRIER ENDS IN THE MEDIAN TERMINAL

OBSTRUCTION IN MEDIAN 30 FT. WIDE OR LESS



GRADING FOR MEDIAN OBSTRUCTION



◆ END OF GUARDRAIL PAY LENGTH

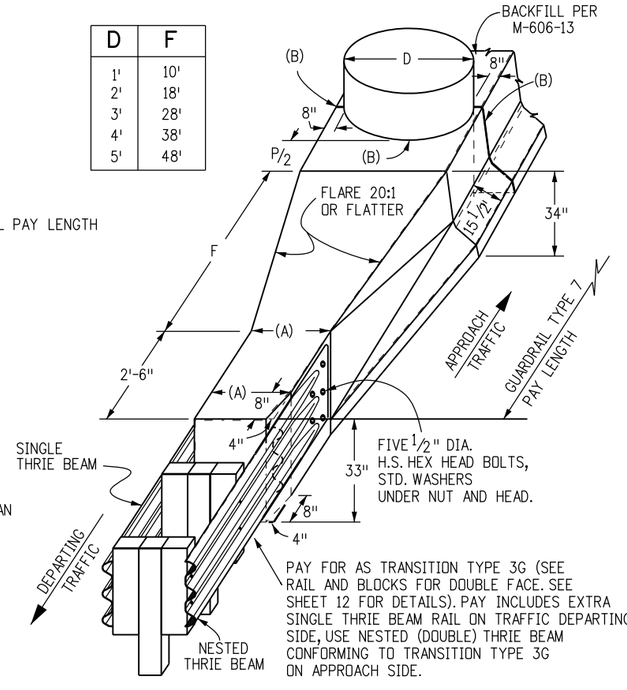
P	1'	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	12'	13'	14'	15'	16'	17'	18'	19'	20'
Y	4'-1"	4'-7"	5'-1"	5'-7"	6'-1"	6'-7"	7'-1"	7'-7"	8'-1"	8'-7"	9'-1"	9'-7"	10'-1"	10'-7"	11'-1"	11'-7"	12'-1"	12'-7"	13'-1"	13'-7"
L	75'	87'-6"		100'	112'-6"		125'		137'-6"	150'		162'-6"		175'		187'-6"	200'		212'-6"	225'

*L IS MEASURED ALONG FACE OF GUARDRAIL

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.

NOTE: FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 20 FT. IN MEDIANS USE SHEET 17.

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



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

(B). ½ IN. PREFORMED JOINT MATERIAL

NARROW MEDIAN DETAIL

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

OBSTRUCTIONS IN MEDIANS

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

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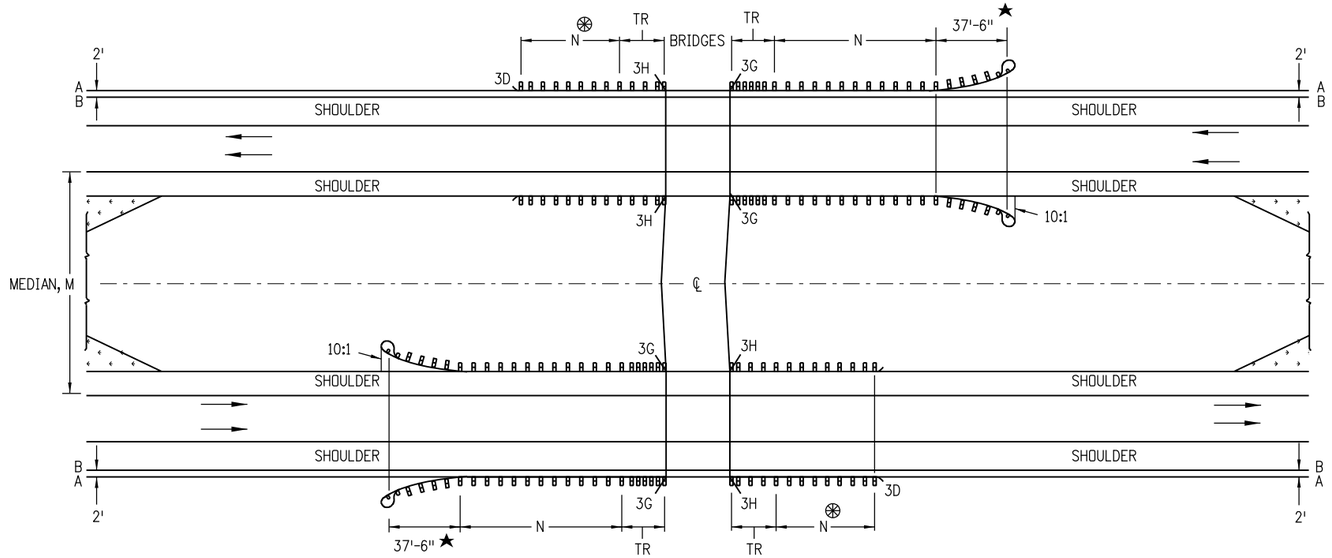
STANDARD PLAN NO.

M-606-1



MULTILANE DIVIDED HIGHWAYS FOR STEEP EMBANKMENTS IN MEDIAN

NOTES:

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

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

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

TR — 18 FT.-9 IN. FOR 3G AND 3H.

A — EDGE OF 8 FT. OR 10 FT. SHOULDER.

B — EDGE OF 6 FT. OR LESS SHOULDER.

★ — END ANCHORAGE CAN BE FLARED OR NONFLARED.

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GUARDRAIL TYPE 3 W-BEAM

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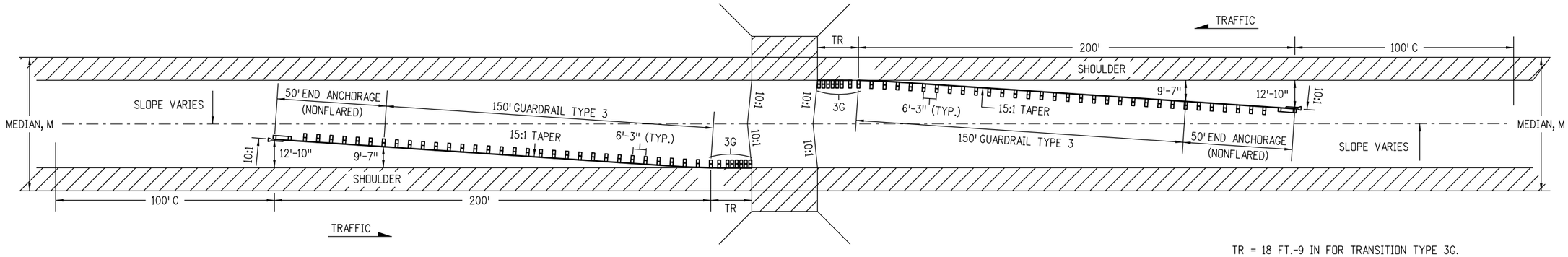
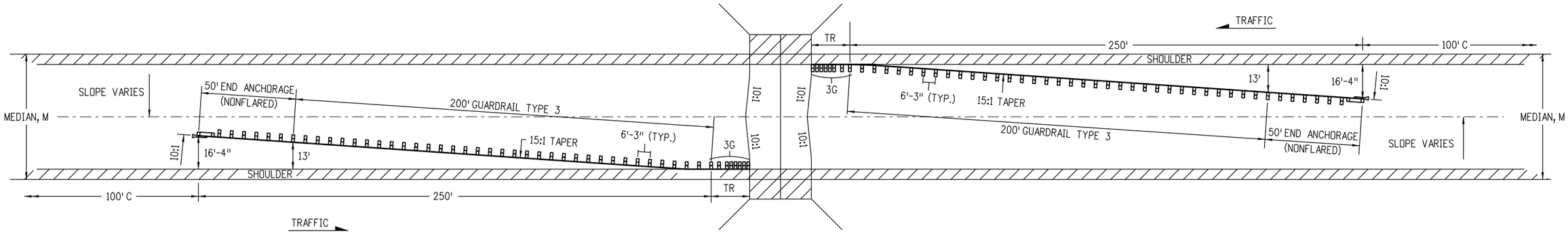
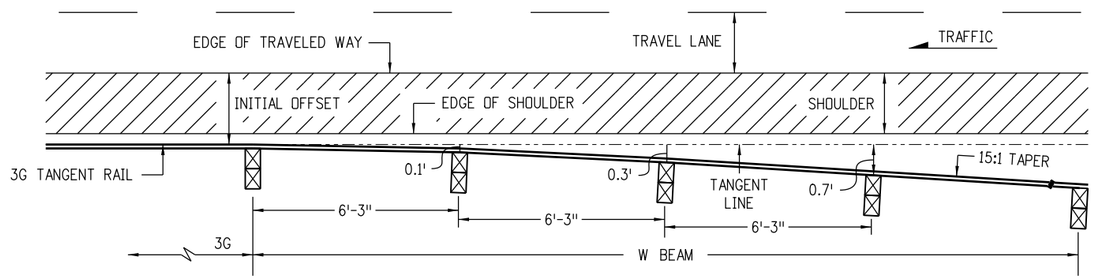


MEDIANS 60 FT. AND OVER WITH 10 FT. OR WIDER SHOULDERS.

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



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



TRANSITION TO TYPICAL 15:1 TAPER

NOTES:

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

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

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GUARDRAIL TYPE 3
W-BEAM

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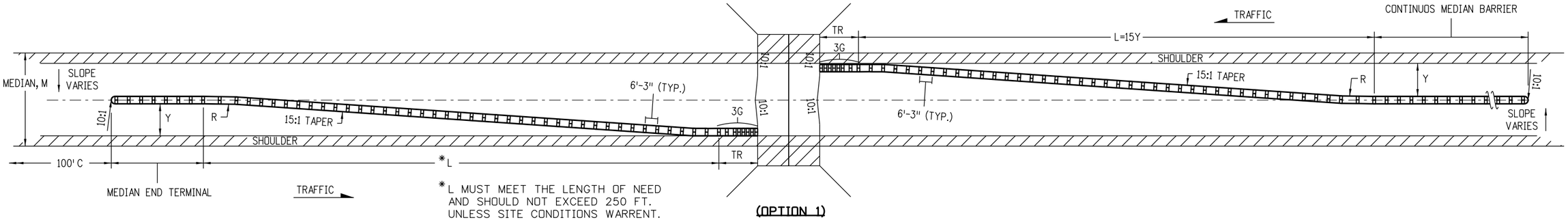
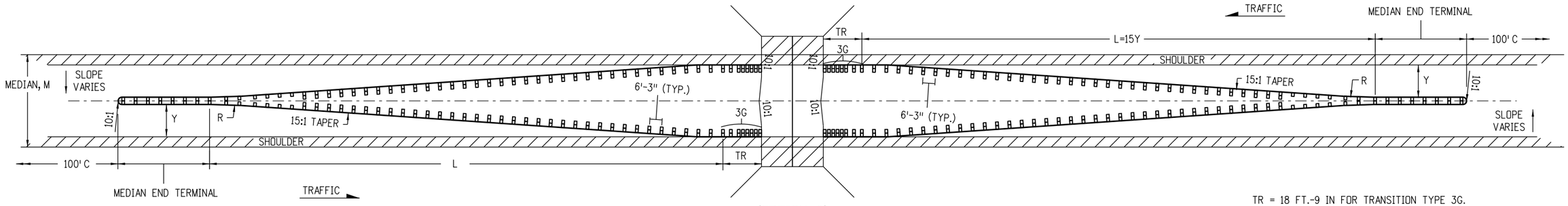
NOTES

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



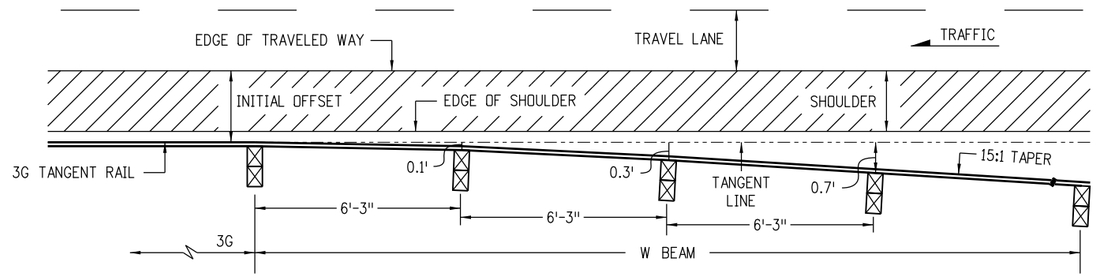
* L MUST MEET THE LENGTH OF NEED AND SHOULD NOT EXCEED 250 FT. UNLESS SITE CONDITIONS WARRENT.

(OPTION 1)



(OPTION 2)

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



TRANSITION TO TYPICAL 15:1 TAPER

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

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GUARDRAIL TYPE 3 W-BEAM

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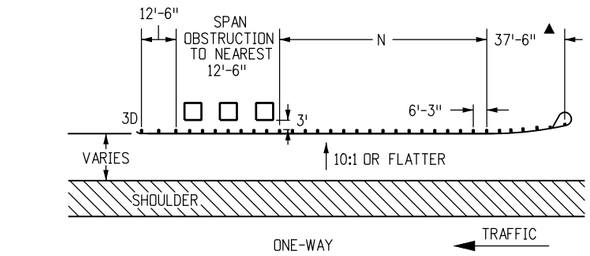
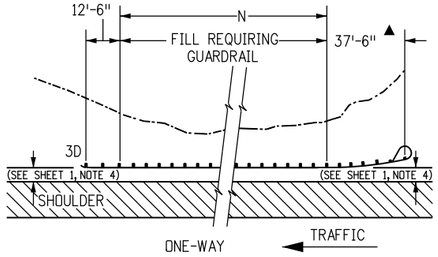
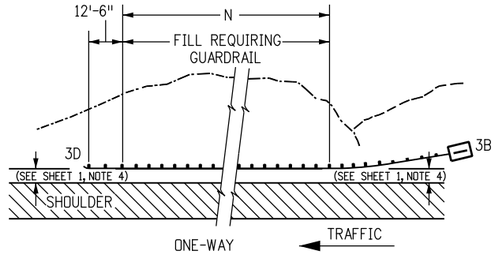
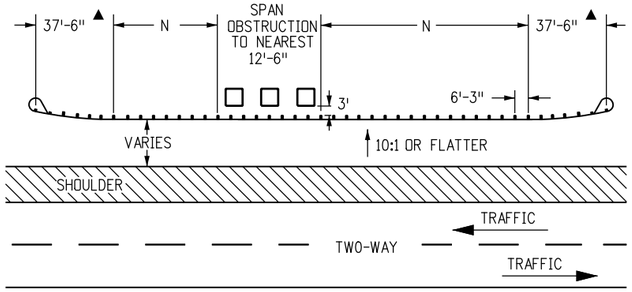
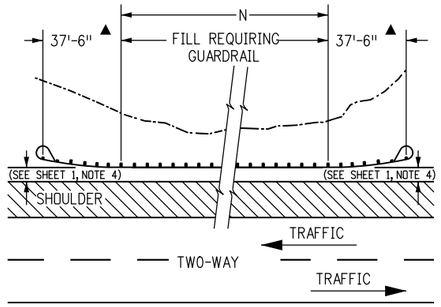




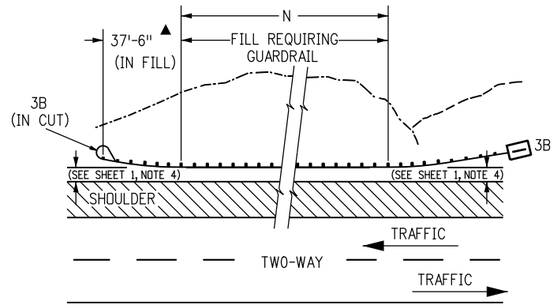




GUARDRAIL FOR ROADSIDE OBSTRUCTIONS



GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION

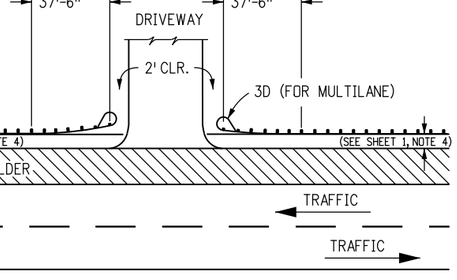


GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION

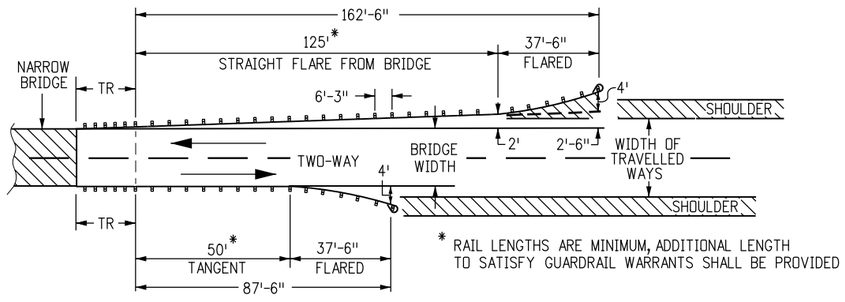
NOTES

1. THE TYPE 3G OR 3H TRANSITIONS (SEE SHEET 12) SHALL BE USED TO CONNECT A TYPE 3 W-BEAM TO TYPE 7 CONCRETE BARRIER OR TO A TYPE 7, 8, OR 10 BRIDGE RAIL. FOR A TRANSITION FROM A ROADWAY TYPE 3 W-BEAM TO A BRIDGE RAIL TYPE 3 WITH BACKING TUBES, THE TRANSITION TYPE 3L SHOWN ON SHEET 20 SHALL BE USED.
2. "TR" WILL BE 18 FT.-9 IN. FOR THE TRANSITIONS TYPE 3G AND 3H, AND 25 FT. FOR THE TRANSITION TYPE 3L.
3. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT. A TRAVERSABLE SLOPE SHALL BE PROVIDED BEHIND THE TERMINAL TO DIMENSION "N" PRIOR TO THE OBSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER.

▲ END ANCHORAGE CAN BE FLARED OR NONFLARED

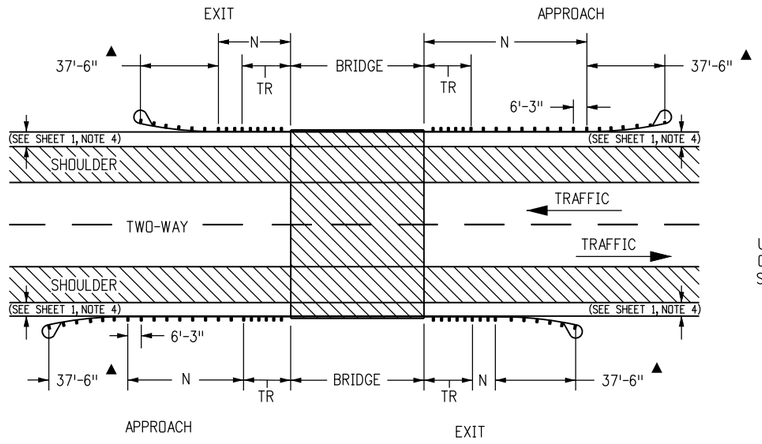


LAYOUT FOR DRIVEWAY APPROACH

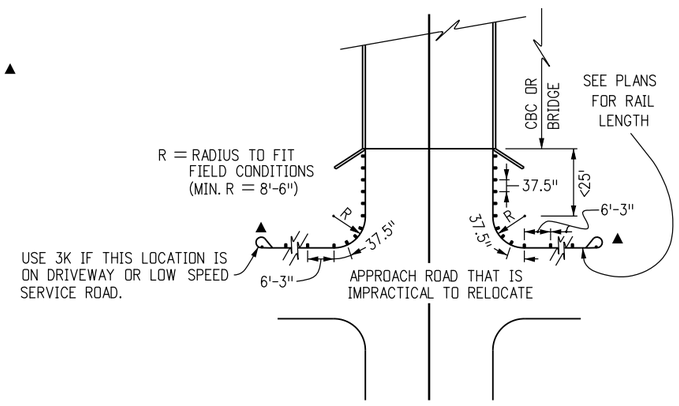


* RAIL LENGTHS ARE MINIMUM, ADDITIONAL LENGTH TO SATISFY GUARDRAIL WARRANTS SHALL BE PROVIDED

2-WAY NARROW APPLICATION



2-WAY NORMAL BRIDGE APPLICATION



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

INTERRUPTED STRUCTURE APPROACH

(USE TYPE 3J ON SHEET 13 WHEN PRACTICAL)

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GUARDRAIL TYPE 3 W-BEAM

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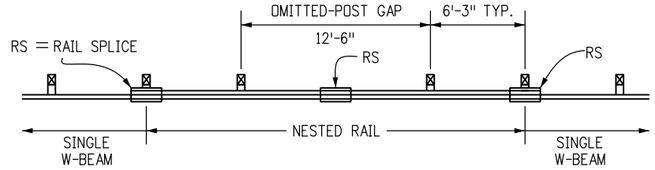
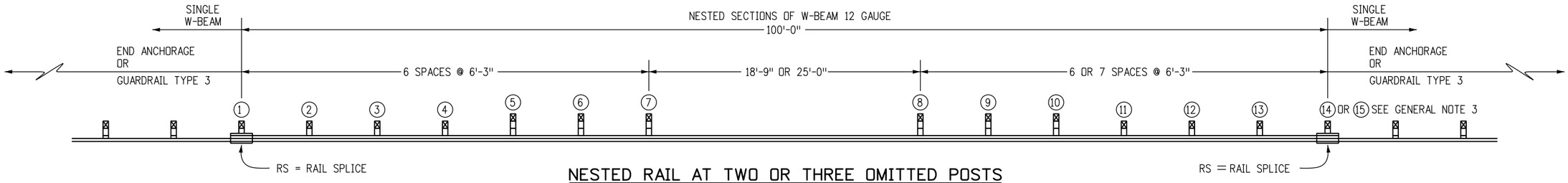
M-606-1



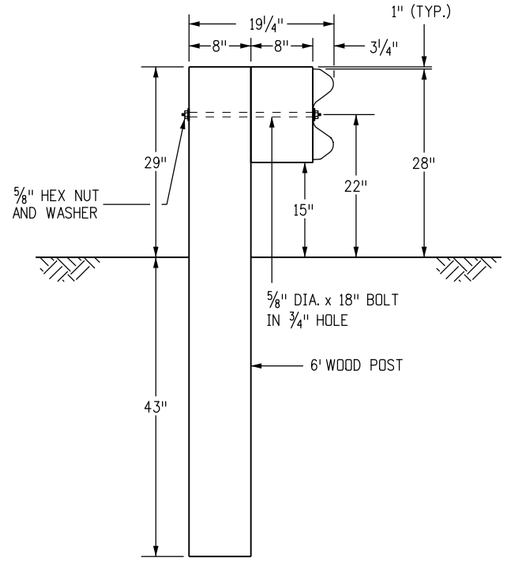
NESTED RAIL AT ONE OMITTED POST

NOTES

1. FOR ONE OMITTED POST IN THE GUARDRAIL RUN, i.e. AT A PIPE CULVERT WITH MINIMUM COVER, SEE THE "NESTED RAIL AT ONE OMITTED POST" DETAIL ON THIS SHEET. THE W-BEAM RAILS SPANNING THE OMITTED-POST GAP SHALL BE DOUBLED (ONE RAIL NESTED IN THE OTHER), AND SHALL EXTEND A MINIMUM OF 6 FT.-3 IN. ON EITHER SIDE OF THE GAP. USING 12 FT.-6 IN. SECTIONS OF RAIL, AND DEPENDING ON THE SPLICE LOCATION, ONE OMITTED POST SECTION REQUIRES EITHER 25 FT. OR 37 FT. - 6 IN. OF NESTED RAIL.
2. FOR TWO OR THREE OMITTED POSTS, SEE THE "NESTED RAIL AT TWO OR THREE OMITTED POSTS" DETAIL ON THIS SHEET. RAIL SPLICES IN THE 100 FT. NESTED SECTION MAY BE PLACED TO FACILITATE CONSTRUCTABILITY. HOWEVER ONLY ONE RAIL SPLICE MAY BE PLACED IN THE OMITTED POSTS SECTION, AND ONLY AT THE MIDPOINT OF THE 25 FT. LENGTH.
3. POST (15) REQUIRED WHEN TWO POSTS ARE OMITTED FOR THE 18 FT.-9 IN. LENGTH.
4. ONLY TIMBER POSTS AND BLOCKS ARE ALLOWED FOR WEAKENED POSTS 5 THROUGH 10.

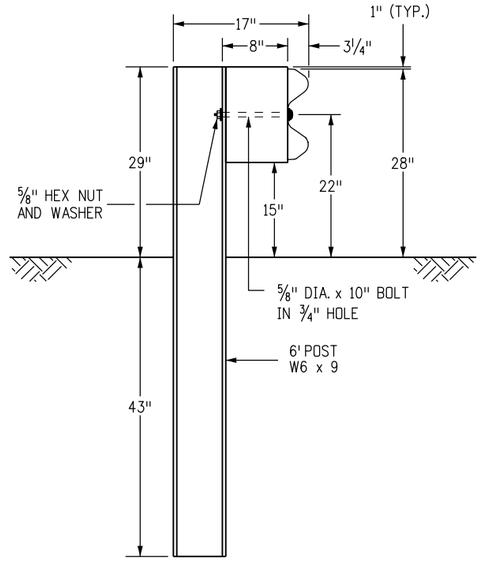


NESTED RAIL AT TWO OR THREE OMITTED POSTS



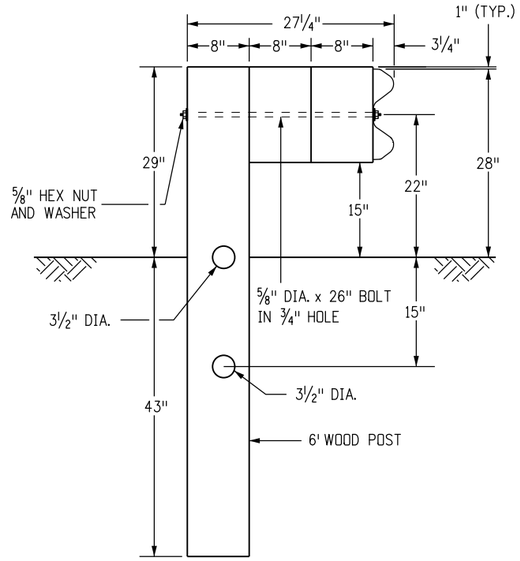
TIMBER

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



STEEL

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



TIMBER

POSTS (5) - (10)

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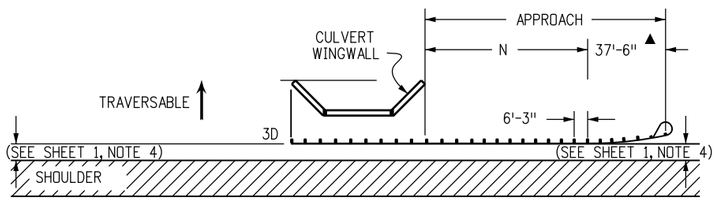
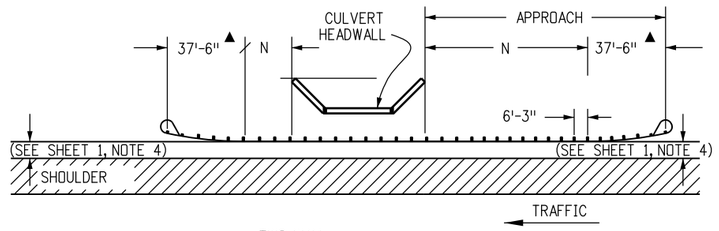
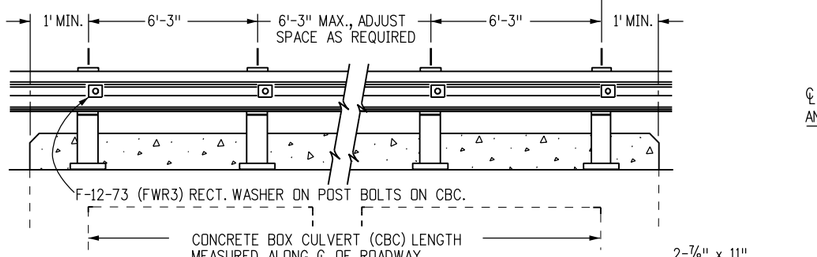
▲ END ANCHORAGE CAN BE FLARED OR NONFLARED.



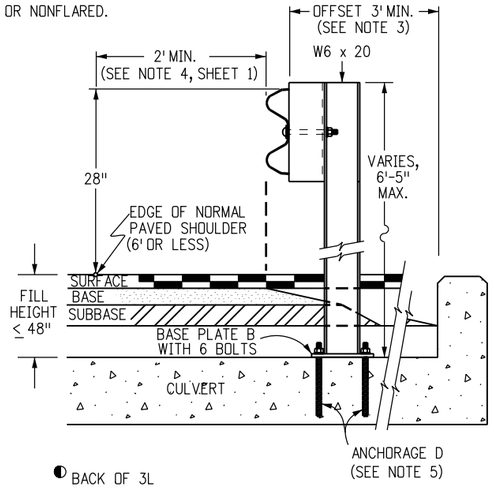


GUARDRAIL FOR CULVERTS

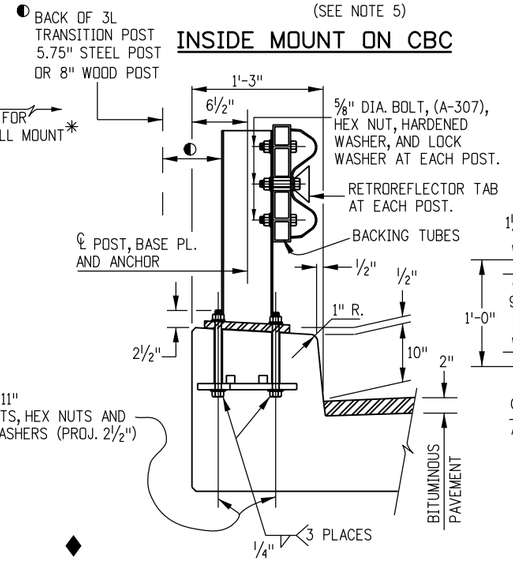


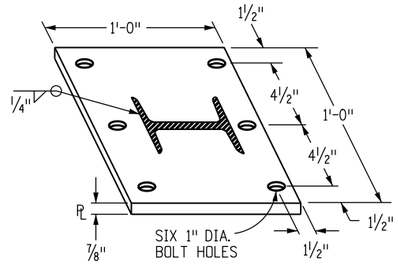
RAIL PLACEMENT FOR INSIDE OR HEADWALL MOUNT

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



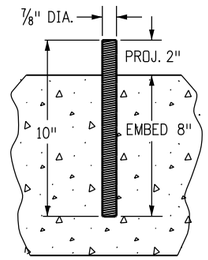
INSIDE MOUNT ON CBC





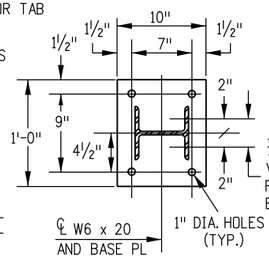
BASE PLATE B

(FOR INSIDE MOUNT)

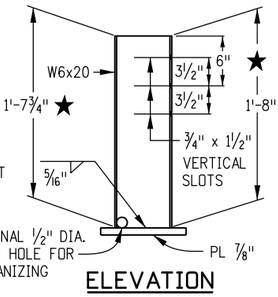


ANCHORAGE D

(FOR INSIDE MOUNT)

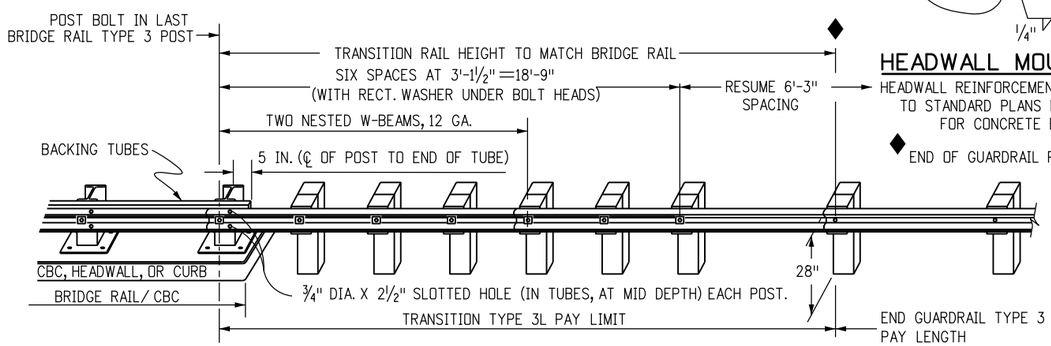


PLAN



ELEVATION

HEADWALL MOUNT POST DETAIL

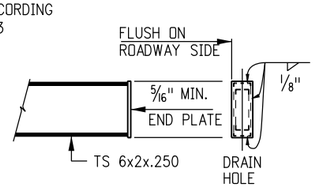


TRANSITION TYPE 3L AND GUARDRAIL TYPE 3 APPROACH

HEADWALL MOUNT ON CBC

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

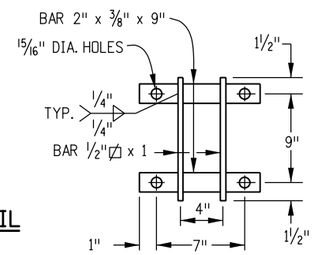
◆ END OF GUARDRAIL PAY LENGTH



BACKING TUBES END DETAIL

(FOR HEADWALL MOUNT)

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



● ANCHOR DETAIL

(FOR HEADWALL MOUNT)

NOTES

1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND WINGWALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 16. THE GUARDRAIL TYPE 3 SHALL CONTINUE ACROSS THE CULVERT AS SHOWN ON THIS SHEET.
2. RIGHT SHOULDER BOX CULVERT TREATMENT IS SHOWN ON THIS SHEET FOR CULVERTS 20 FT. OR LESS IN LENGTH.
3. GUARDRAIL ACROSS CULVERTS WITH A LENGTH OF 20 FT. OR LESS SHALL BE AS FOLLOWS:
   A. FILL HEIGHT AT GUARDRAIL POST 48 IN. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE AS GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POST LESS THAN 48 IN. AND BLOCK FACE TO HEADWALL OFFSET OF 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT AS GUARDRAIL TYPE 3.
   C. FILL HEIGHT AT GUARDRAIL POST 48 IN. OR LESS AND BLOCK FACE TO HEADWALL OFFSET LESS THAN 3 FT: CONSTRUCTION ACCORDING TO HEADWALL MOUNT DETAILS AND PAYMENT AS BRIDGE RAIL TYPE 3.
4. GUARDRAIL ACROSS CULVERTS WITH LENGTH GREATER THAN 20 FT. SHALL BE AS FOLLOWS:
   A. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE FOR STANDARD GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR LESS: CONSTRUCTION AND PAYMENT IN ACCORDANCE WITH THE CONTRACT BRIDGE PLANS. WHEN BLOCK FACE TO HEADWALL OFFSET IS 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT AS GUARDRAIL TYPE 3.
5. ANCHORAGE D: SIX BOLTS FOR BASE PLATE "B" WITH INSIDE MOUNT. THE BOLTS SHALL BE 7/8 IN. DIA X 10 IN. HIGH STRENGTH RODS THREADED FULL LENGTH AND ALL GALVANIZED. RODS SHALL BE CAST-IN-PLACE FOR A NEW STRUCTURE. FOR AN EXISTING STRUCTURE, THE RODS SHALL BE INSTALLED IN 1-1/4 IN. DIA HOLES WITH NON-SHRINK GROUT OR EPOXY CONFORMING TO ASTM C 881.
6. TYPE 3L POSTS SHALL BE STEEL OR WOOD TO MATCH POSTS USED ON THE APPROACH GUARDRAIL.
7. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT.
8. ALL BRIDGE RAIL TYPE 3 BACKING TUBES SHALL BE FABRICATED FROM ASTM A 500 GRADE B. ALL POSTS, BASE PLATES, AND ANCHOR BOLTS SHALL BE FABRICATED FROM ASTM A 36 STEEL. THE ABOVE MATERIAL, W-BEAM, AND ALL ANCHOR BOLTS AND MISCELLANEOUS BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED AFTER FABRICATION IN ACCORDANCE WITH SECTION 509. CONCRETE, REINFORCING STEEL, AND STRUCTURAL STEEL ELEMENTS SHALL BE IN ACCORDANCE WITH SECTIONS 601, 602, AND 509, RESPECTIVELY.
9. POST ANCHORS, ENCASED IN CONCRETE, SHALL BE ASTM A 36 STEEL, AND NEED NOT BE GALVANIZED.
10. PRIOR TO FABRICATION OF BRIDGE RAIL, THREE SETS OF WORKING DRAWINGS WHICH COMPLY WITH THE REQUIREMENTS OF SECTION 105 SHALL BE SUBMITTED TO THE ENGINEER FOR INFORMATION ONLY.
11. IF HEADWALL MOUNT GUARDRAIL IS USED, SEE STANDARD PLAN M-601, AND NOTES BELOW:
    A. ALL ITEMS ABOVE TOP OF CBC HEADWALL WILL BE MEASURED AND PAID FOR AS LINEAR FEET OF BRIDGE RAIL TYPE 3.
    B. HEADWALL MOUNTING OF RAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.

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

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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: DLM		Date:	Comments
Last Modification Date: 10/27/14 Initials: LTA	(R-X)		
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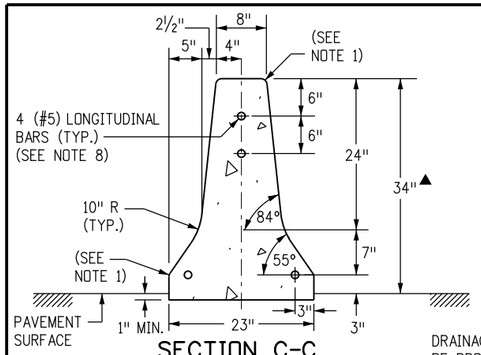
GUARDRAIL TYPE 3 W-BEAM

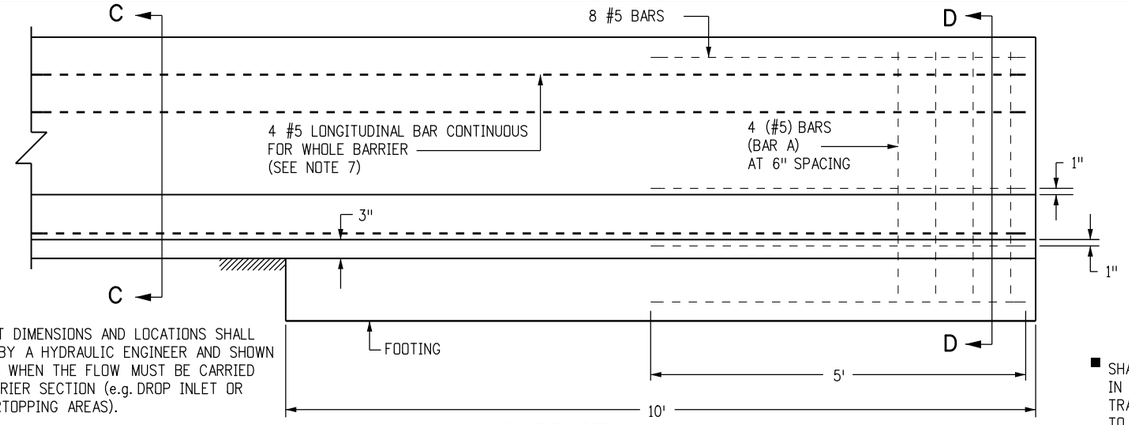
Issued By: Project Development Branch November 1, 2018

STANDARD PLAN NO.

M-606-1



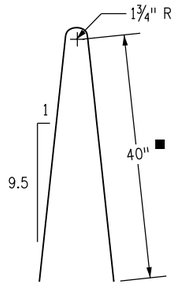
SECTION C-C
STYLE CA
CONCRETE BARRIER (TYP.)



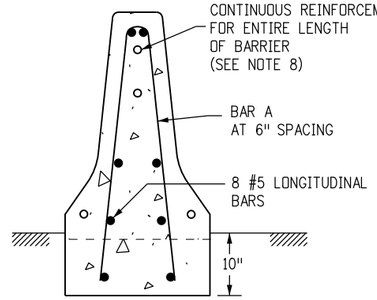
ANCHORAGE

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

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).

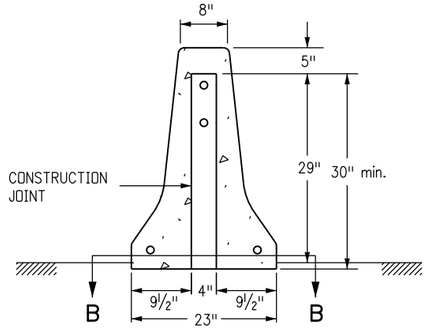


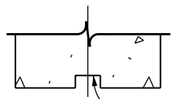
BAR A (#5)



*SECTION D-D
ANCHORAGE

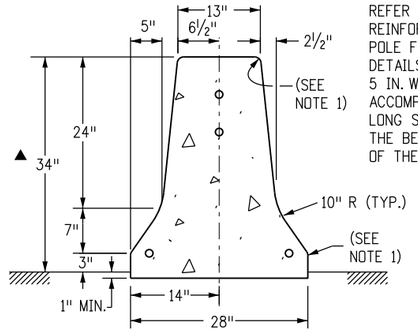
■ SHALL BE 38 IN. IN ANCHORAGE THAT TRANSITIONS FROM TYPE 7 TO TYPE 3G-THRIE BEAM (SEE SHEET 2)





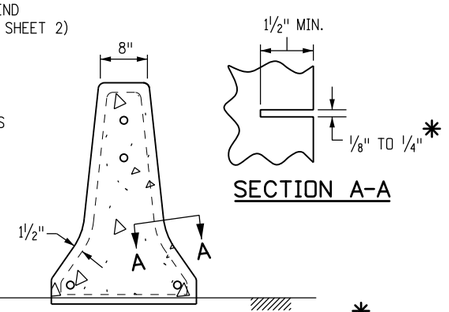
SECTION B-B
CONSTRUCTION JOINT *

* SEE STYLE CA DETAIL FOR TYPICAL DIMENSIONS.



STYLE CL
BARRIER FOR MOUNTED LIGHT POLES

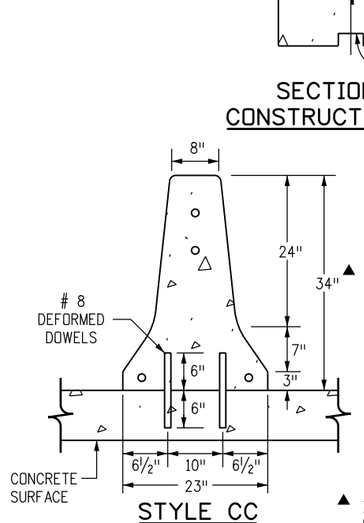
REFER TO THE PLANS FOR THE REINFORCING, WIRING, AND LIGHT POLE FOUNDATION INSTALLATION DETAILS. THE TRANSITION TO THIS 5 IN. WIDER SECTION SHALL BE ACCOMPLISHED IN ONE 10 FT. LONG SEGMENT OF BARRIER AT THE BEGINNING AND THE END OF THE RUN OF LIGHT POLES.



SECTION A-A

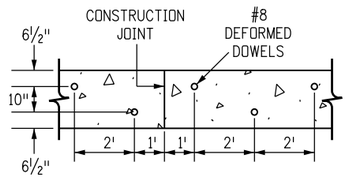
TRANSVERSE CONTRACTION JOINTS *

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

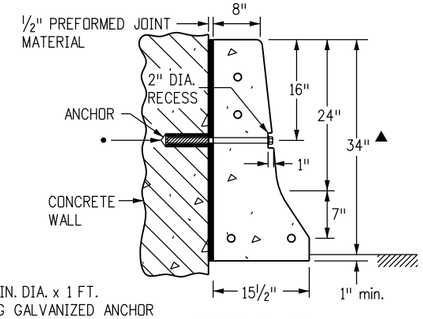


STYLE CC
BARRIER DOWELLED TO CONCRETE SURFACE

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

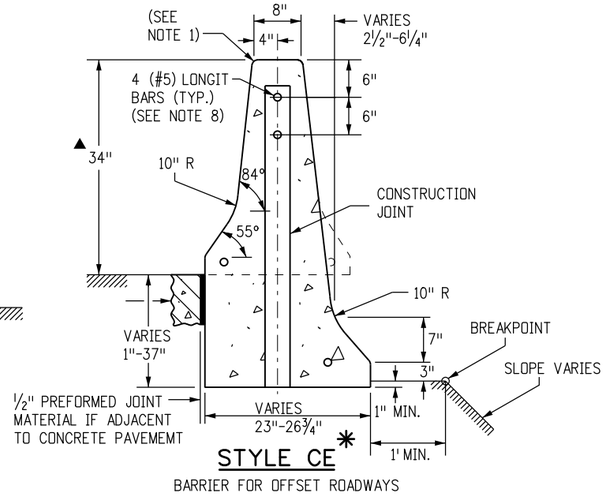


DOWEL PLACEMENT LAYOUT
FOR STYLE CC BARRIER (PLAN VIEW)



STYLE CD
BARRIER AGAINST WALL

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



STYLE CE
BARRIER FOR OFFSET ROADWAYS

GENERAL NOTES

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

Computer File Information		
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Sheet Revisions	
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08/30/13	Revised Sheet 2 of 4.

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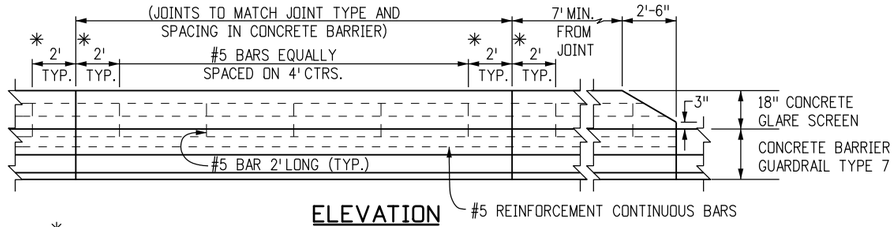
GUARDRAIL TYPE 7 F-SHAPE BARRIER

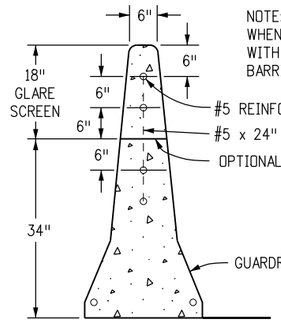
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-606-13
Sheet No. 1 of 4



ELEVATION

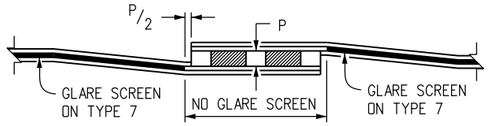
✱ 2 FT. IS TYPICAL FOR CAST-IN-PLACE BARRIERS.
1 FT. IS TYPICAL FOR PRECAST BARRIERS.
THE MINIMUM ACCEPTABLE DIMENSION IS 6 IN.



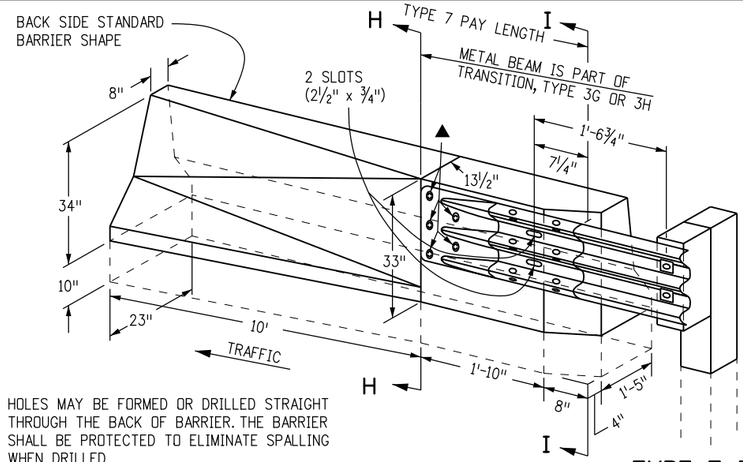
NOTE: VERTICAL TIE BARS ARE NOT REQUIRED WHEN THE GLARE SCREEN IS POURED MONOLITHICALLY WITH THE BARRIER. SEE SHEETS 1 AND 2 FOR BARRIER DIMENSIONS.

#5 REINFORCEMENT CONTINUOUS BARS
#5 x 24" TIE BARS SPACED AT 4' CENTERS
OPTIONAL CONSTRUCTION JOINT

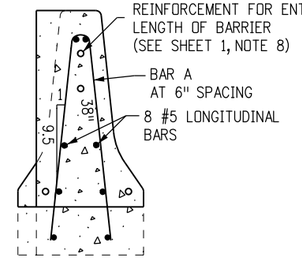
CONCRETE GLARE SCREEN



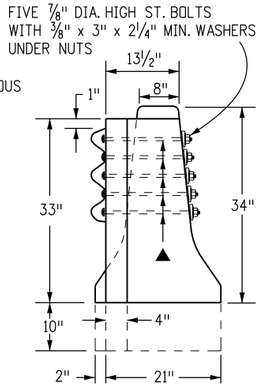
GLARE SCREEN AT MEDIAN OBSTRUCTIONS



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



SECTION H-H

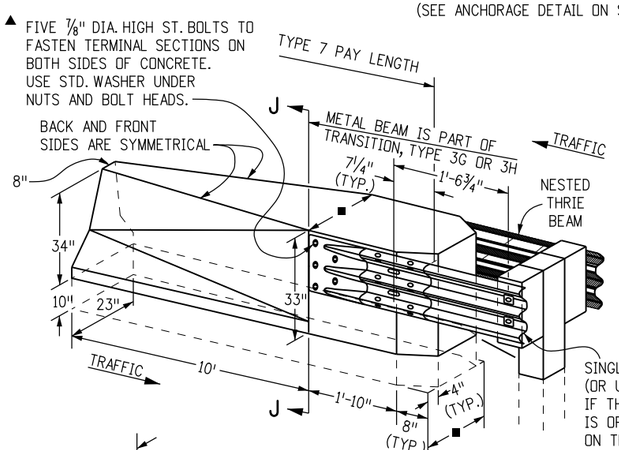


SECTION I-I

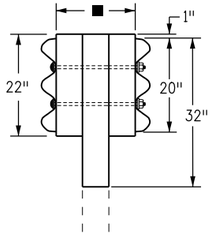
TYPE 7 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE

(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)

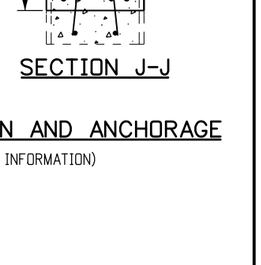
▲ FIVE ⅞" DIA. HIGH ST. BOLTS TO FASTEN TERMINAL SECTIONS ON BOTH SIDES OF CONCRETE. USE STD. WASHER UNDER NUTS AND BOLT HEADS.



■ 24" WOOD POSTS OR 2½" STEEL POSTS WITH WOOD BLOCKS



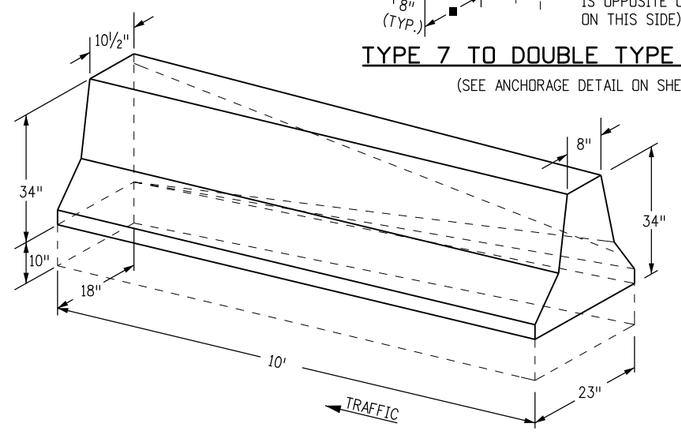
4 #5 LONGITUDINAL CONTINUOUS REINFORCEMENT FOR ENTIRE LENGTH OF BARRIER (SEE SHEET 1, NOTE 7)

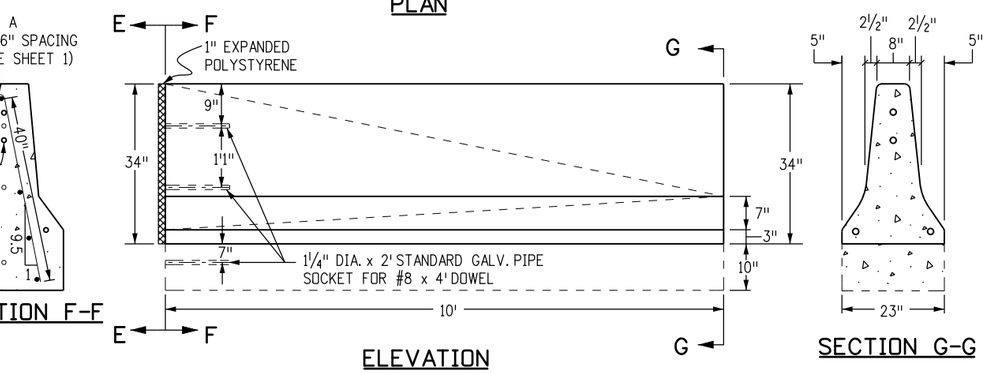


SECTION J-J

TYPE 7 TO DOUBLE TYPE 3G TRANSITION AND ANCHORAGE

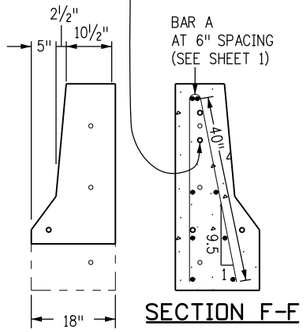
(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)





PLAN

4 #5 LONGITUDINAL CONTINUOUS REINFORCEMENT FOR ENTIRE LENGTH OF BARRIER (SEE SHEET 1, NOTE 7)



SECTION F-F

SECTION E-E

ELEVATION

SECTION G-G

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

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

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Drawing File Name: 6060130204.dgn	(R-X)		
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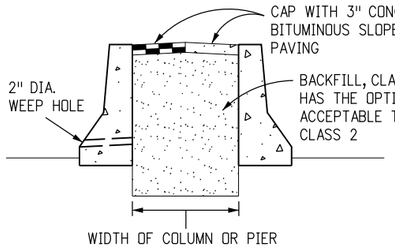
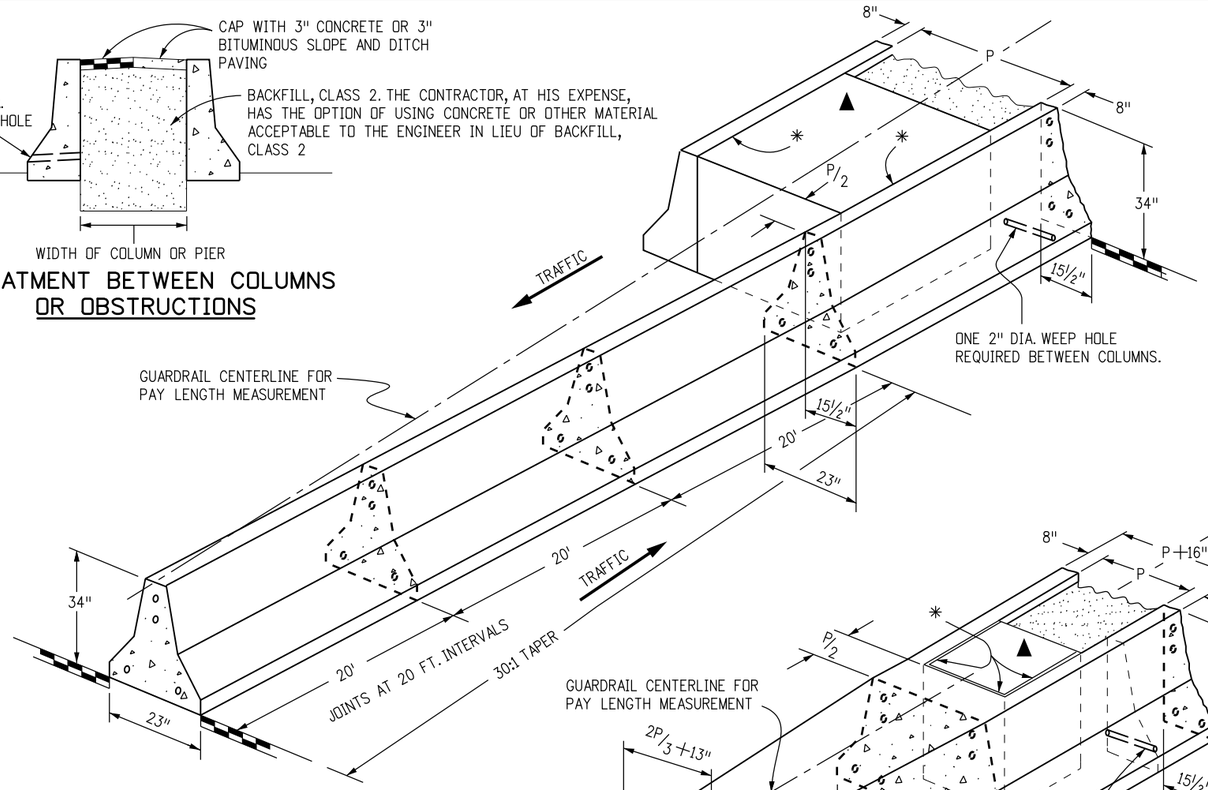
GUARDRAIL TYPE 7 F-SHAPE BARRIER

Issued By: Project Development Branch July 4, 2012

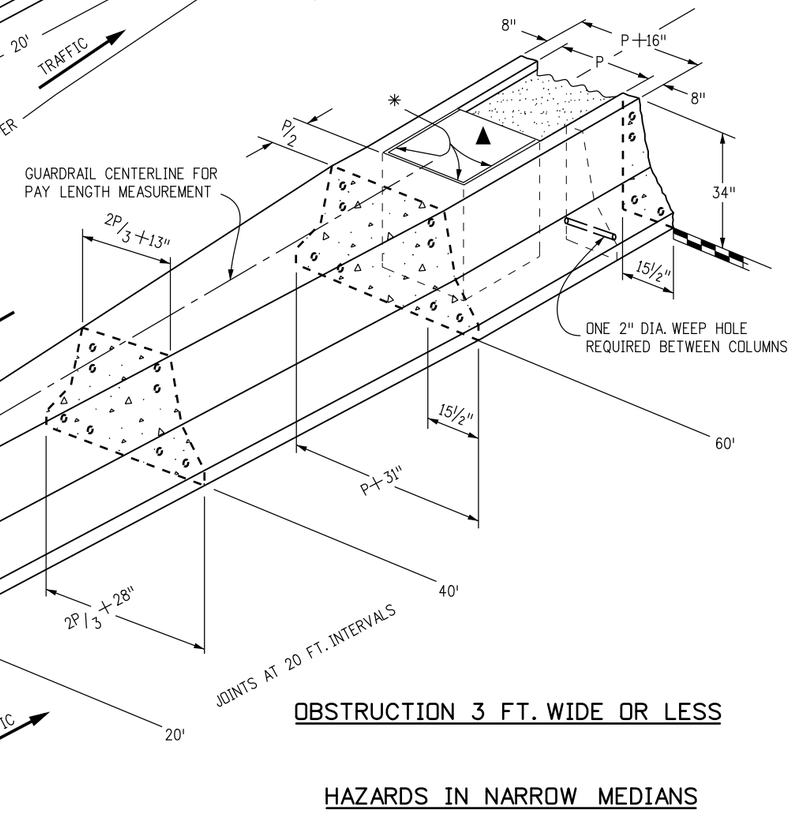
STANDARD PLAN NO.
M-606-13
Sheet No. 2 of 4



TREATMENT BETWEEN COLUMNS OR OBSTRUCTIONS



OBSTRUCTION WIDER THAN 3 FT.



✱ ½" PREFORMED JOINT MATERIAL

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

OBSTRUCTION 3 FT. WIDE OR LESS

HAZARDS IN NARROW MEDIANS

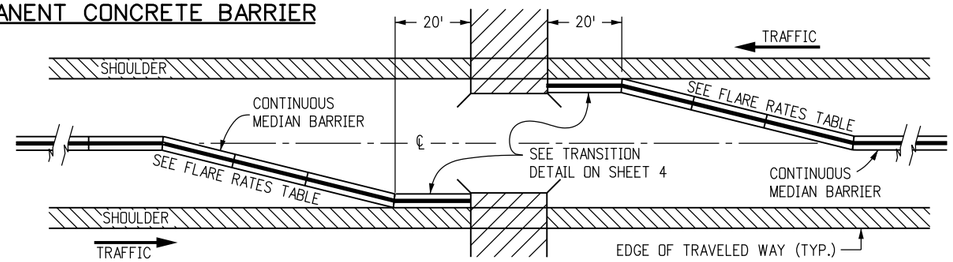
DESIGN SPEED (MPH)	SHY LINE OFFSET (FT.)✱	FLARE RATE FOR BARRIER INSIDE SHY LINE	FLARE RATE FOR BARRIER OUTSIDE SHY LINE
80	12	30:1	20:1
75	10	30:1	20:1
70	9	30:1	20:1
60	8	26:1	18:1
55	7	24:1	16:1
50	6.5	21:1	14:1
45	6	18:1	12:1
40	5	16:1	10:1
30	4	13:1	8:1

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

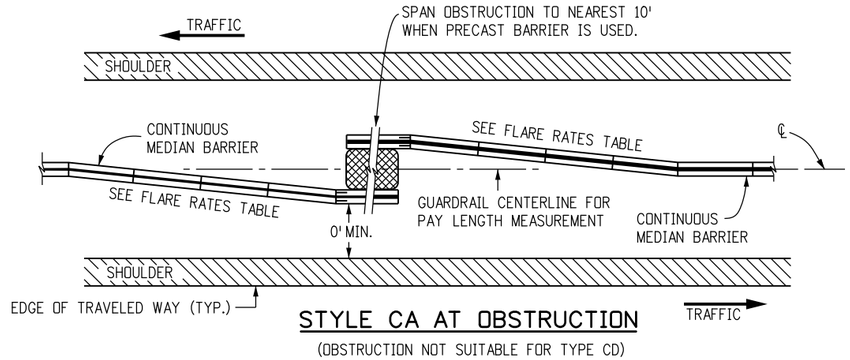
TABLE OF FLARE RATES FOR PERMANENT CONCRETE BARRIER

NOTES

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

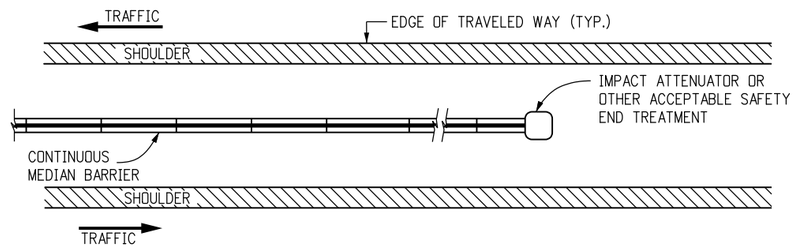


BRIDGE APPROACH



STYLE CA AT OBSTRUCTION

(OBSTRUCTION NOT SUITABLE FOR TYPE CD)



MEDIAN BARRIER END TREATMENT

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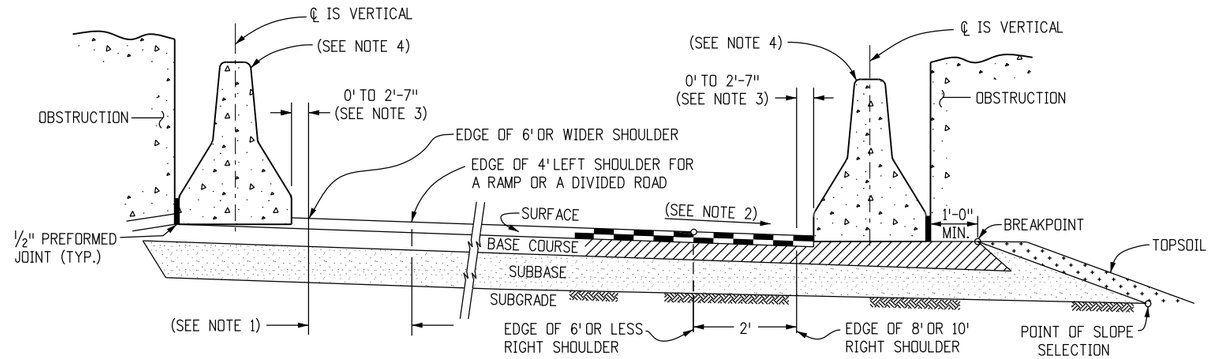
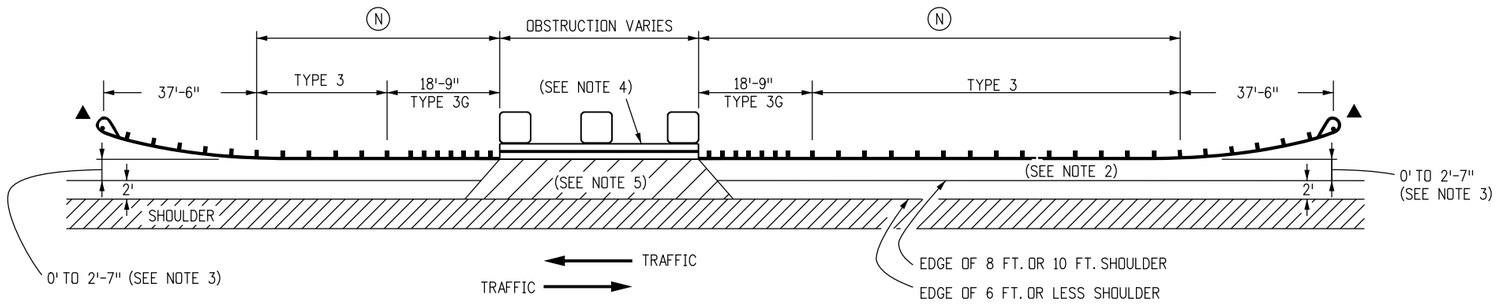
GUARDRAIL TYPE 7 F-SHAPE BARRIER

Issued By: Project Development Branch July 4, 2012

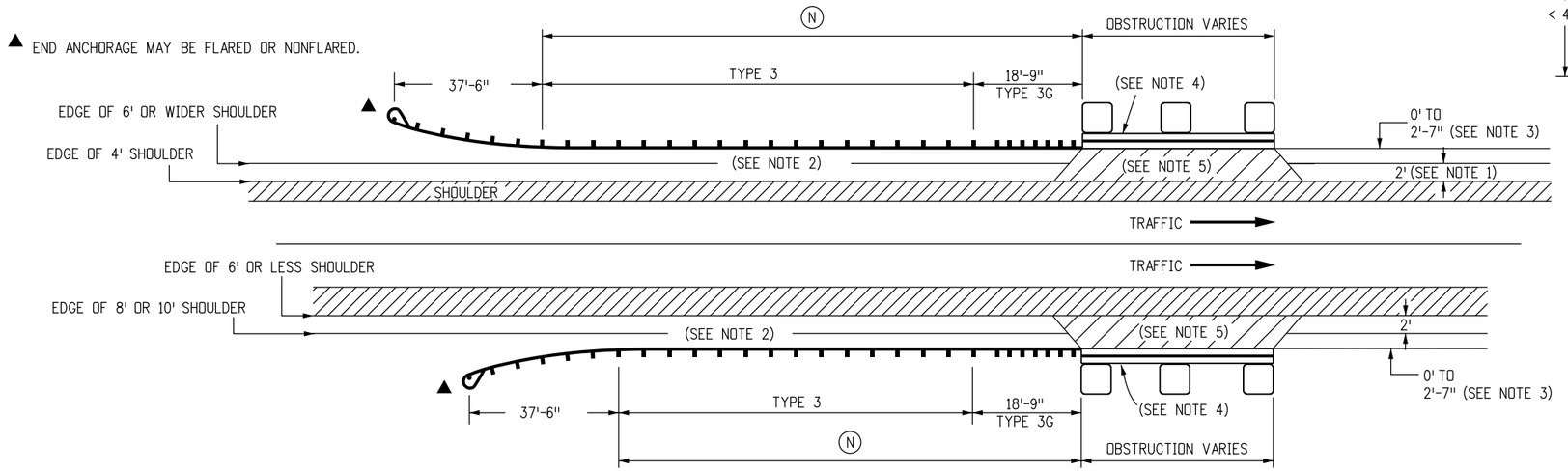
STANDARD PLAN NO.
M-606-13



TYPE 7 ON LEFT AND RIGHT SHOULDERS AT OBSTRUCTIONS



2-LANE 2-WAY ROADS

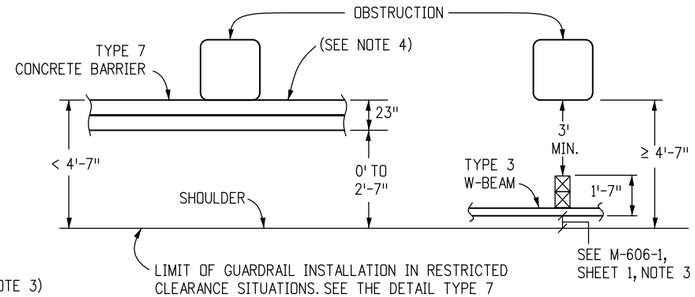


DIRECTIONAL ROADWAYS AND RAMPS

NOTES

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

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



HAZARDS ON ROADSIDES

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GUARDRAIL TYPE 7 F-SHAPE BARRIER

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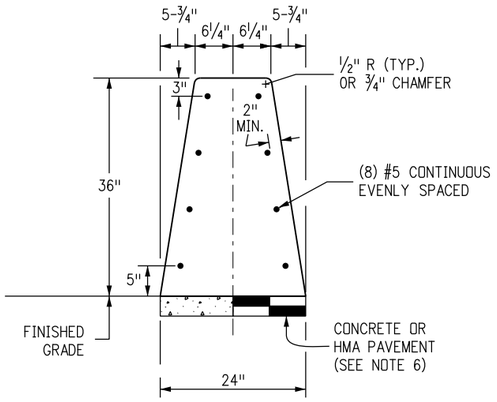
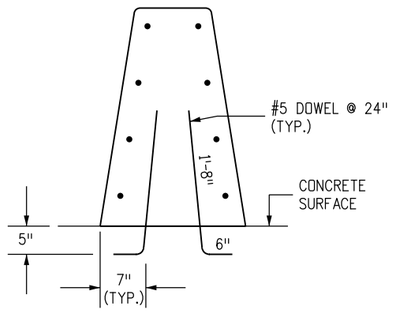
STANDARD PLAN NO.
M-606-13
Sheet No. 4 of 4

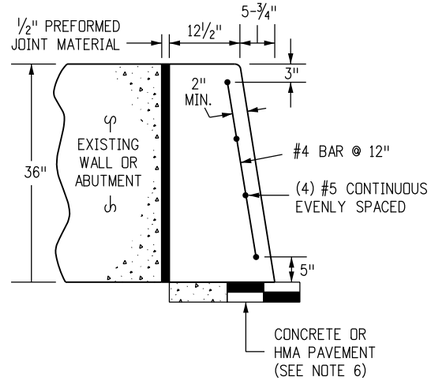


CONCRETE BARRIER STYLE CA



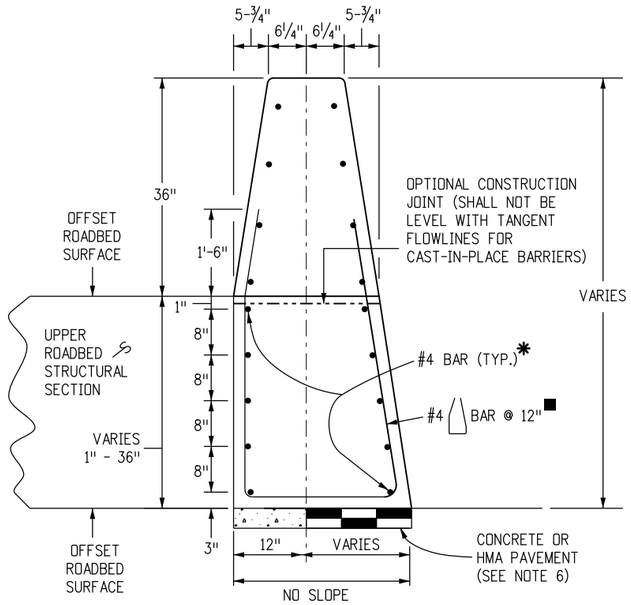
CONCRETE BARRIER STYLE CC

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



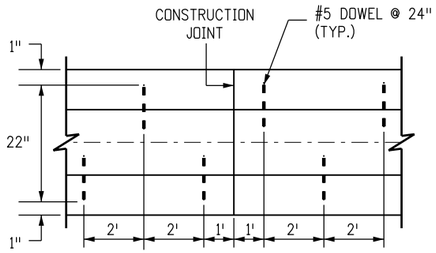
CONCRETE BARRIER STYLE CD

BARRIER AGAINST WALLS.



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.



FOR STYLE CC BARRIER.
PLAN VIEW

DOWEL PLACEMENT LAYOUT

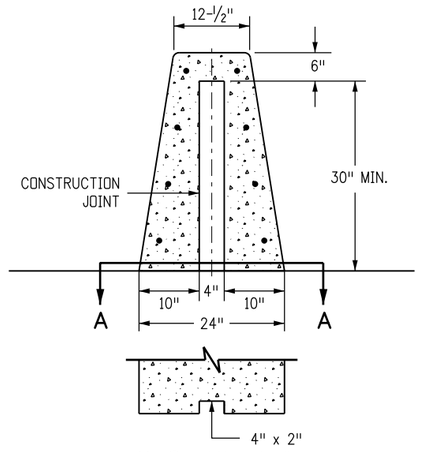
* FOR SURFACES OFFSETS LESS THAN OR EQUAL TO 3 INCHES, NO ADDITIONAL REINFORCEMENT IS REQUIRED.

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 TRANSISTIONING 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.



SECTION A-A
CONSTRUCTION JOINT

DETAILS SIMILAR TO STYLE CA EXCEPT AS NOTED.
SEE NOTE 15.

GENERAL NOTES

1. SEE SHEET 2 FOR DETAILS OF CONCRETE BARRIER STYLE CA END ANCHOR CONNECTIONS TO STRUCTURES OR TRANSITION TO GUARDRAIL TYPE 7.
2. SEE SHEET 6 FOR CONCRETE BARRIER STYLE CA TRANSITIONS AT BRIDGE COLUMNS AND SIGN PEDESTALS IN MEDIANS.
3. WHERE GLARE SCREENS ARE REQUIRED, USE CONCRETE BARRIER STYLE CG ON SHEET 4.
4. WHERE ROADBED OFFSET IS GREATER THAN 1½ INCH, SEE CONCRETE BARRIER STYLE CE
5. BARRIER MAY BE CAST-IN-PLACE OR SLIP FORMED.
6. BARRIER FOUNDATION SHALL BE PAVEMENT, OR COMPACTED AGGREGATE BASE, OR COMPACTED EMBANKMENT MATERIAL.
7. NO ANCHORAGE IS REQUIRED (TYP.) EXCEPT FOR THE 10 FOOT ANCHORAGE. SEE SHEETS 2 AND 3 FOR DETAILS.
8. 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.
9. 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.
10. 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.
11. TRANSITION TO EXISTING CONCRETE BARRIER INSTALLATIONS OF DISSIMILAR SHAPE SHALL BE ACCOMPLISHED IN ONE 15 FOOT LONG SEGMENT OF BARRIER.
12. CONCRETE SHALL BE CLASS D.
13. ADDITIONAL MATERIAL FOR BARRIER EMBEDMENT GREATER THAN 1 INCH WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
14. 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.
15. CONSTRUCTION JOINTS SHALL BE USED ON ALL BARRIER TYPES 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.
16. 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.
17. RETROREFLECTORIZATION IS REQUIRED ON ALL BARRIER TYPES. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.

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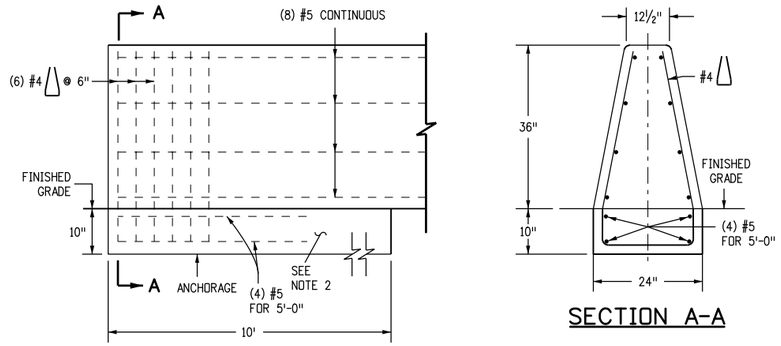
GUARDRAIL TYPE 9
SINGLE SLOPE BARRIER

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-606-15

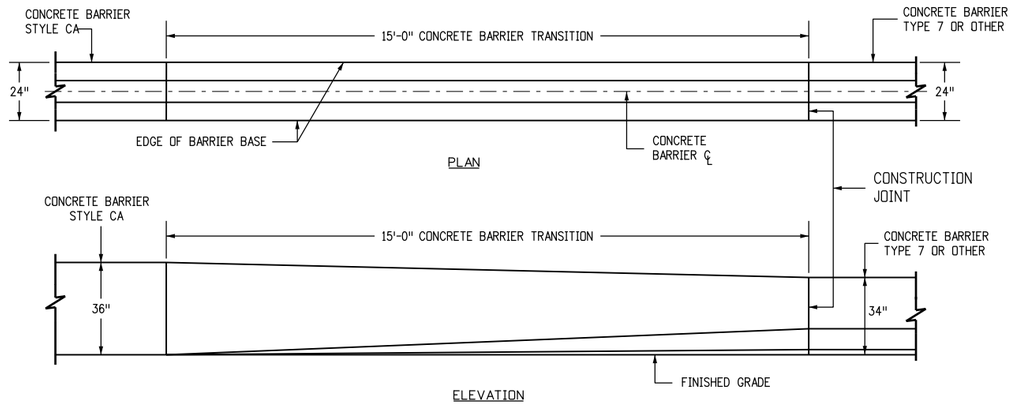
NOTES

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.



SECTION A-A

END ANCHORAGE



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

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GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER

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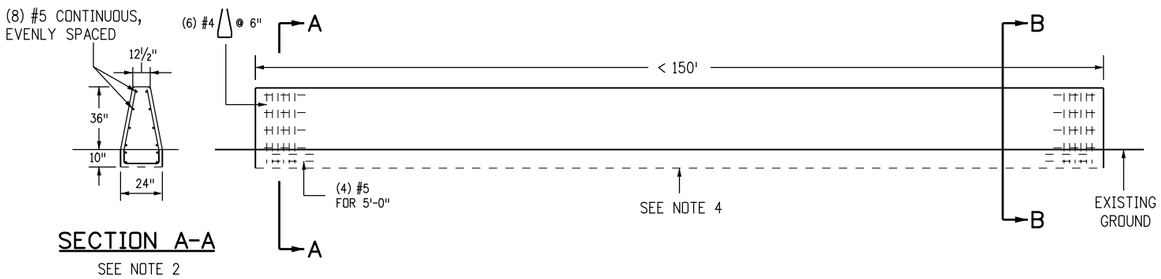
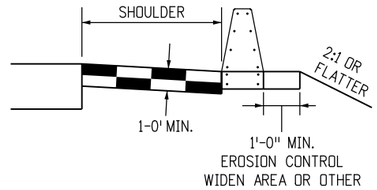
STANDARD PLAN NO.
M-606-15



SECTION A-A

SEE NOTE 2

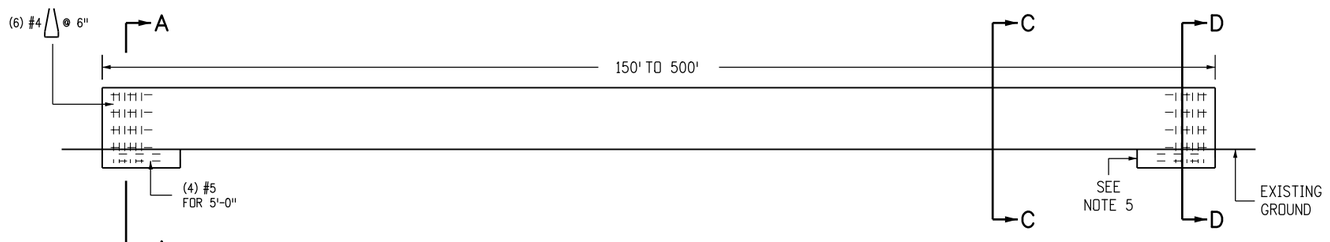
CONCRETE BARRIER END ANCHORAGE UNDER 150 FEET



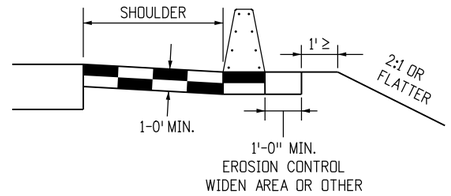
SECTION B-B

NOTES

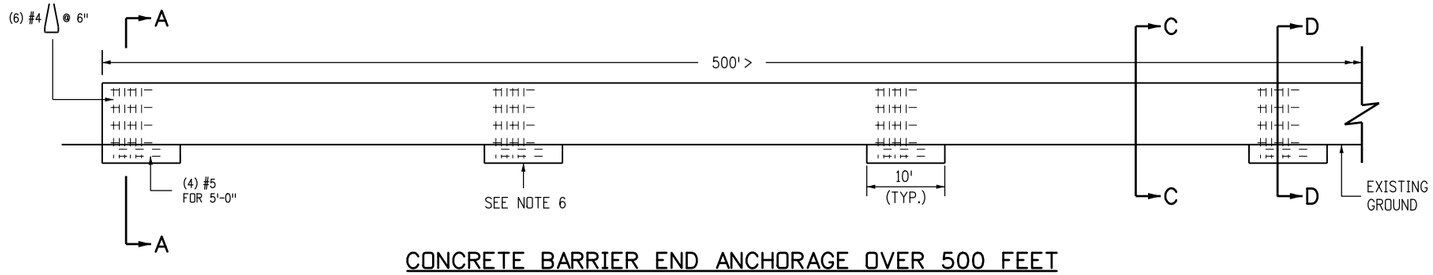
1. SEE PLANS FOR CONCRETE BARRIER LENGTHS LESS THAN 150 FEET AND/OR HINGE WIDTHS EQUAL TO OR LESS THAN 1 FOOT BEHIND THE CONCRETE BARRIER.
2. SEE SHEET 2 FOR REINFORCING BAR DETAILS.
3. NEW CONCRETE BARRIERS UNDER 150 FEET SHALL BE DOWELED INTO EXISTING CONCRETE BRIDGE BARRIERS OR WINGWALLS TO MINIMIZE 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.



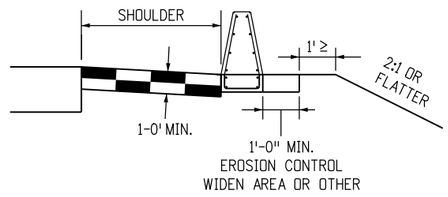
CONCRETE BARRIER END ANCHORAGE BETWEEN 150 FEET AND 500 FEET



SECTION C-C



CONCRETE BARRIER END ANCHORAGE OVER 500 FEET



SECTION D-D

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GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER

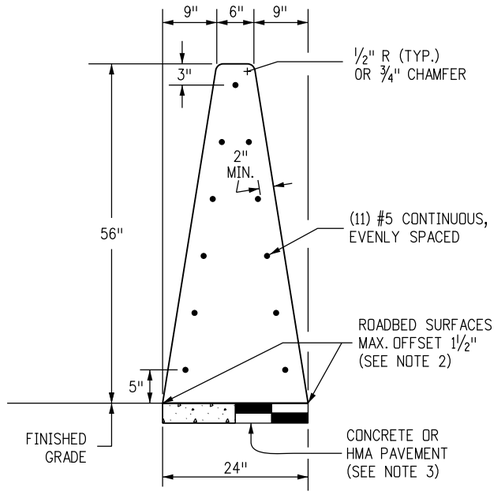
Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.

M-606-15

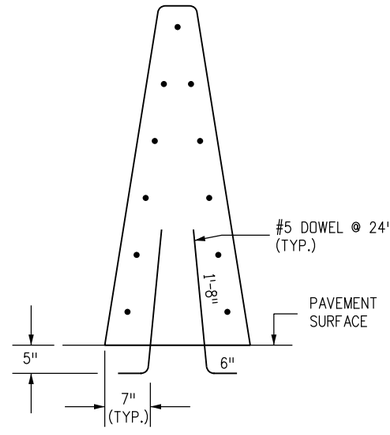
NOTES

1. SEE SHEET 5 FOR DETAILS OF CONCRETE BARRIER STYLE CEG/CG END ANCHORS CONNECTIONS TO STRUCTURES AND TRANSITIONS TO GUARDRAIL TYPE 7.
2. WHERE ROADBED OFFSET IS GREATER THAN 1½ 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.



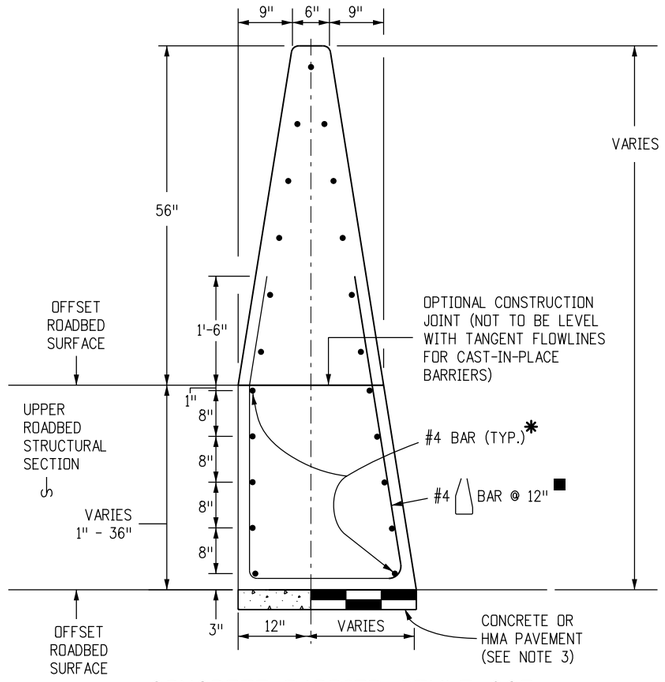
CONCRETE BARRIER STYLE CG (56")

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 CE 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.

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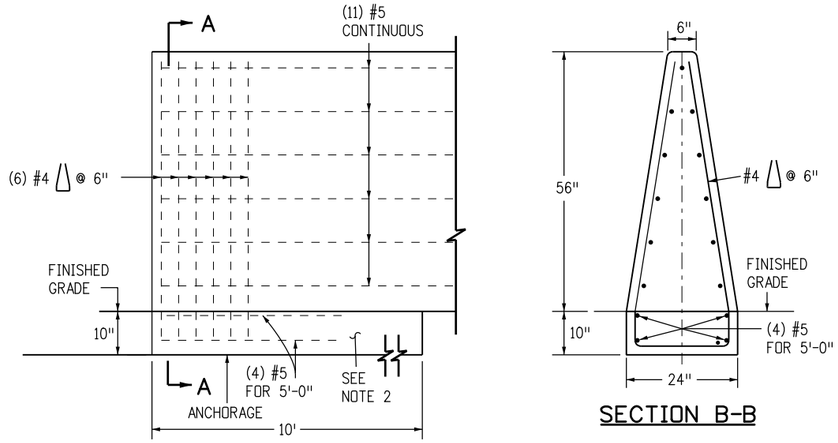
GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-606-15

NOTES

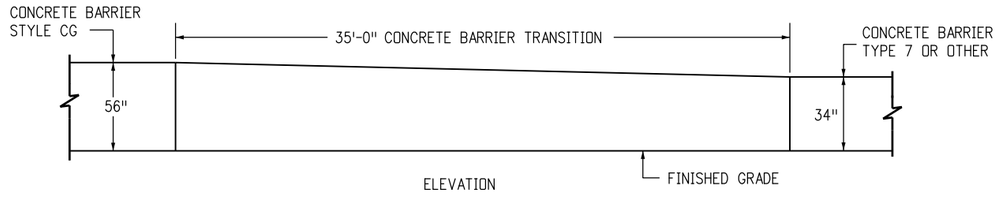
1. SEE SHEET 3 FOR END ANCHORAGE REQUIREMENTS. AT A MINIMUM, THE BARRIER SHALL BE ANCHORED AT THE ENDS AND AT INTERRUPTIONS WITH THE 10 FOOT ANCHORAGE. ANCHORAGE SHALL BE MONOLITHIC OR DOWELED WITH 2-#8 X 8" @ 2'-0 BARS.
2. SEE SHEET 4 FOR CONCRETE BARRIER STYLE CG AND STYLE CGC.
3. SEE SHEET 9 FOR TRANSITION 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.



SECTION B-B

ANCHORAGE

BARRIER ELEVATION VIEW INCLUDING REINFORCED ANCHORAGE AT END.



TRANSITION CONCRETE BARRIER STYLE CEG/CG TO CONCRETE BARRIER TYPE 7 OR EXISTING

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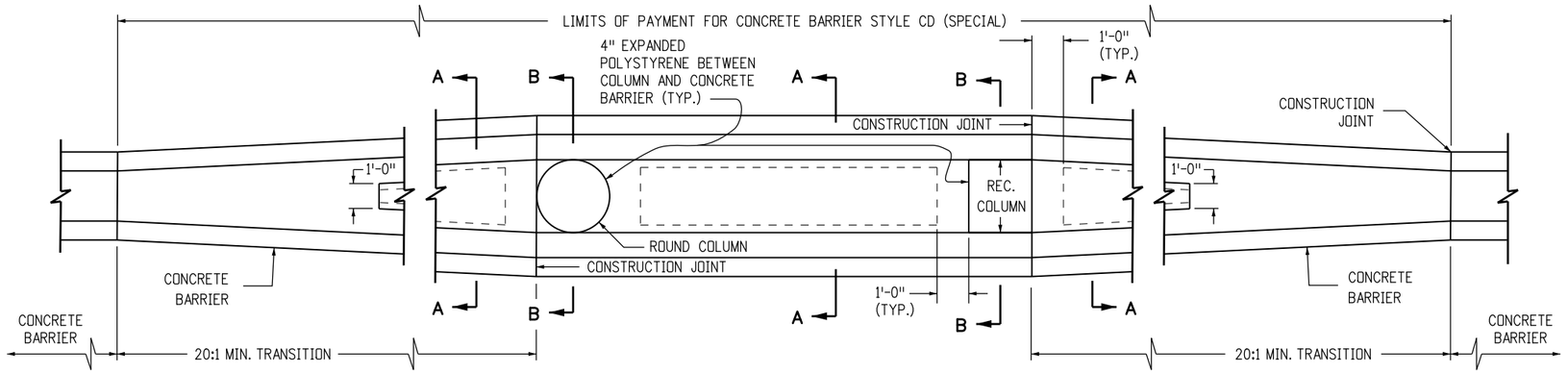
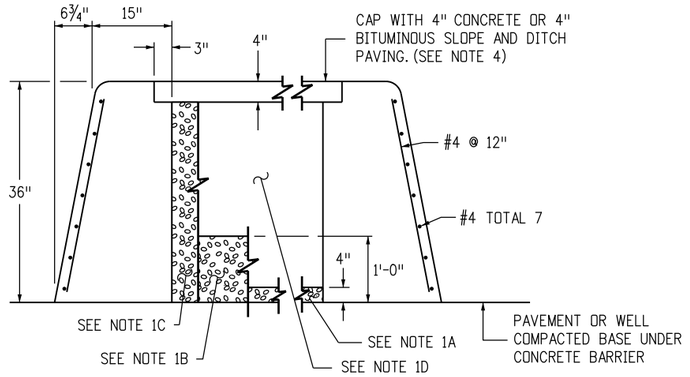
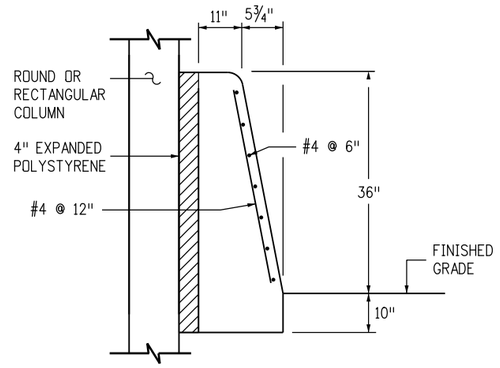


CONCRETE BARRIER TRANSITION AT BRIDGE COLUMNS



SECTION A-A



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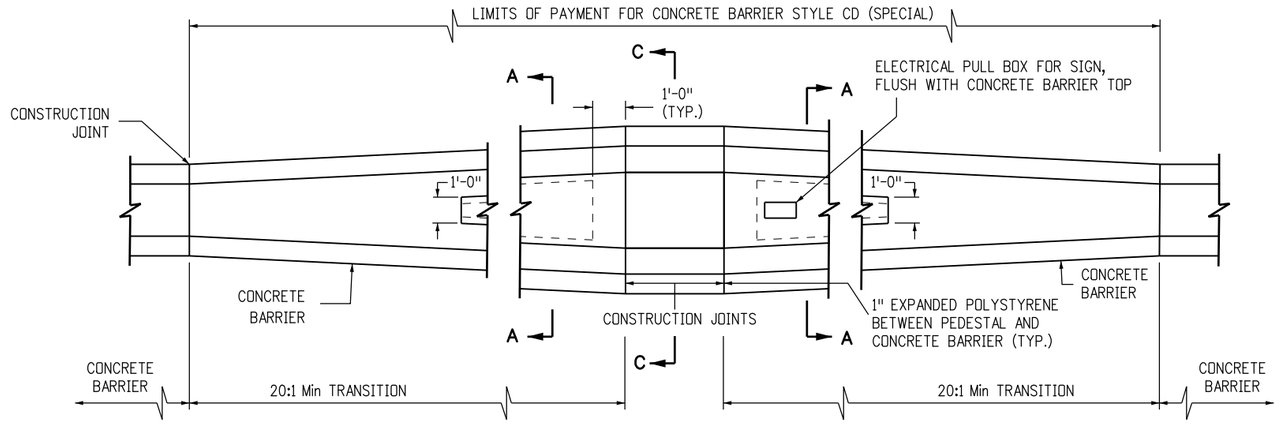
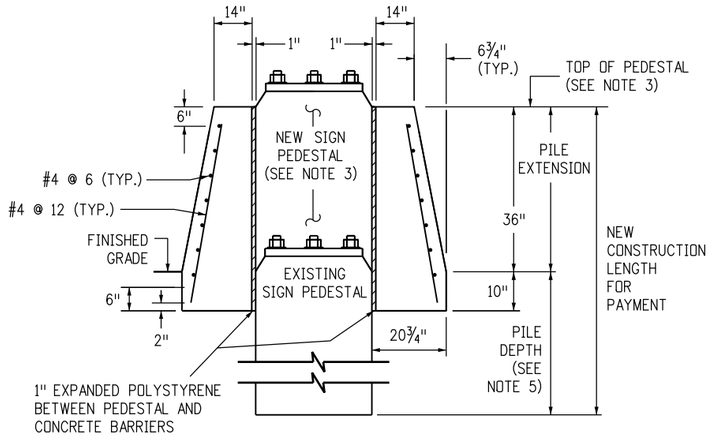


CONCRETE BARRIER TRANSITION AT SIGN PEDESTAL



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.

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GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER

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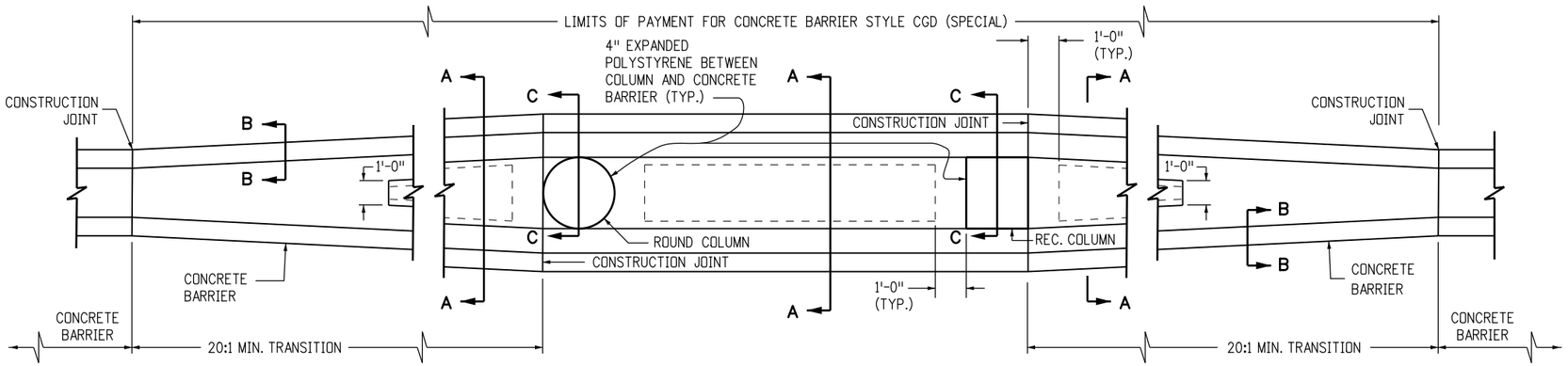
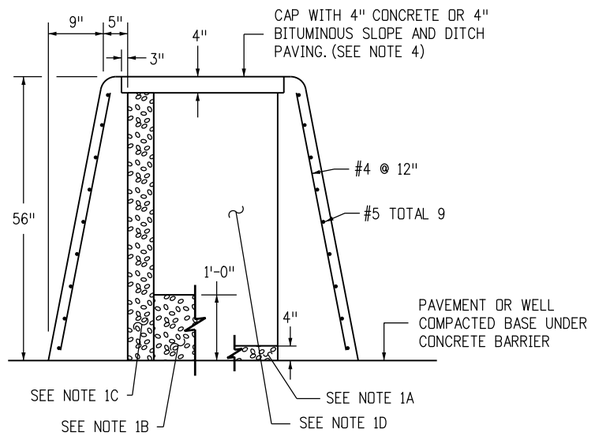
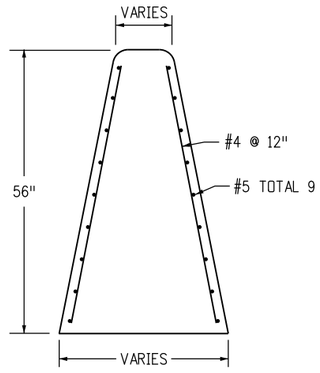


CONCRETE BARRIER TRANSITION AT BRIDGE COLUMNS



SECTION A-A



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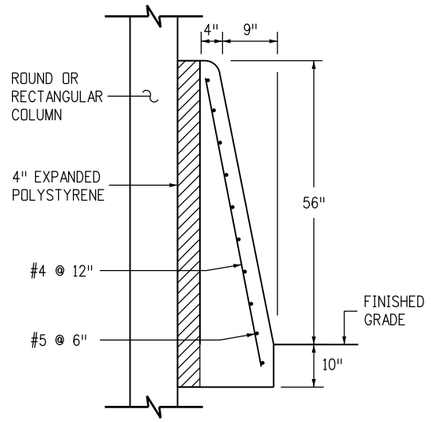
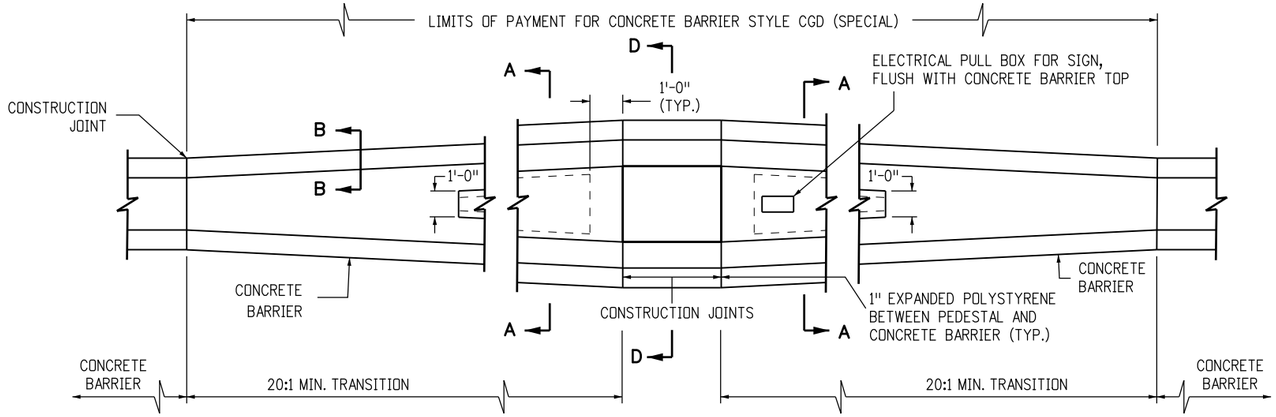
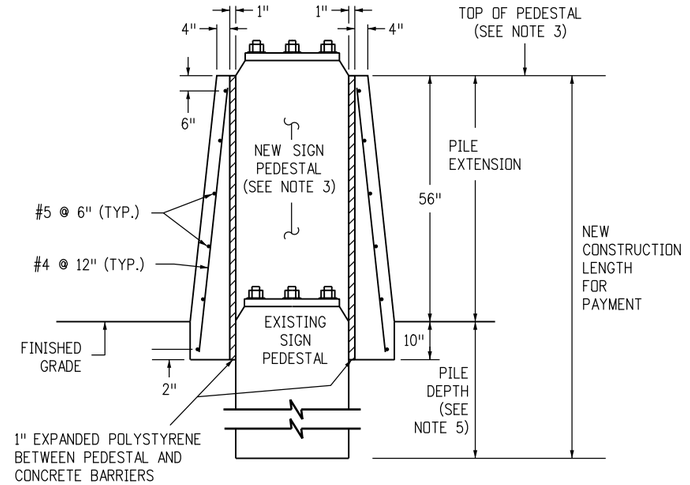


SECTION C-C



CONCRETE BARRIER TRANSITION AT SIGN PEDESTAL



SECTION D-D

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.

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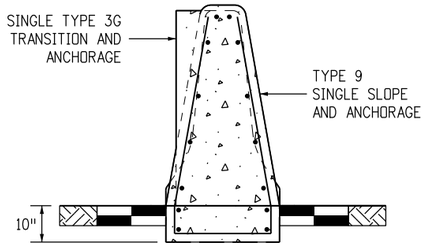
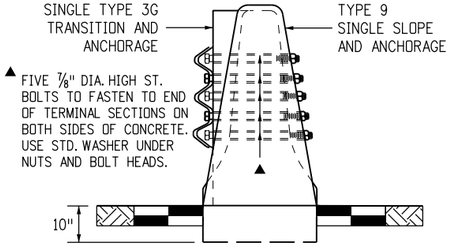
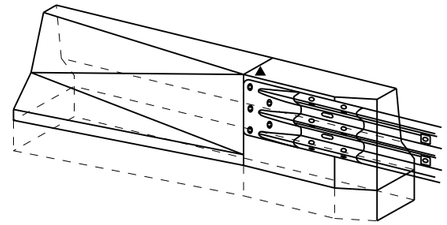


CONCRETE AND
REINFORCEMENT DETAIL



CONNECTION DETAIL



SINGLE TYPE 3G ISOMETRIC VIEW

TYPE 9 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE OPTION

SEE SHEET 1 FOR REINFORCEMENT INFORMATION AND SHEET 3 FOR ANCHORAGE DETAILS

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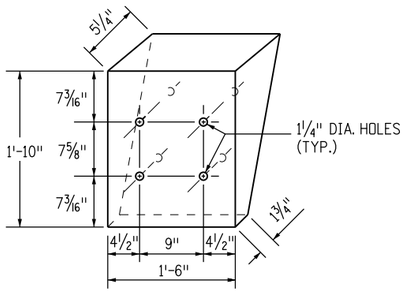
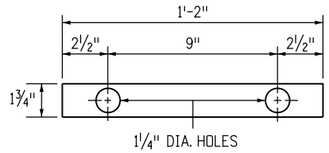


DETAIL A
BEVELED METAL BOX SPACE
(SEE NOTE 1)



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.

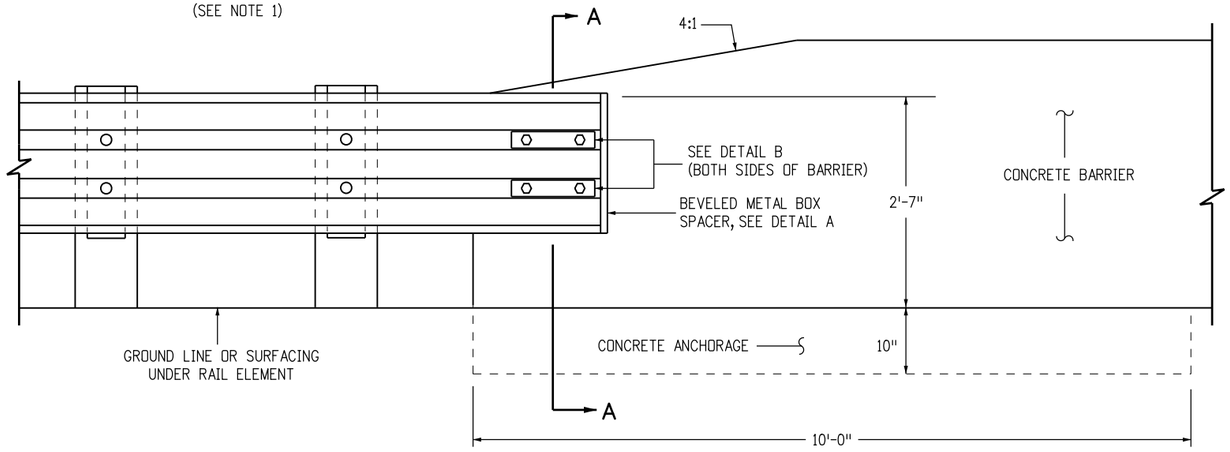
(C) ONE 12 GAUGE THRIE BEAM ELEMENT.

10 GAUGE = 0.135" THICK

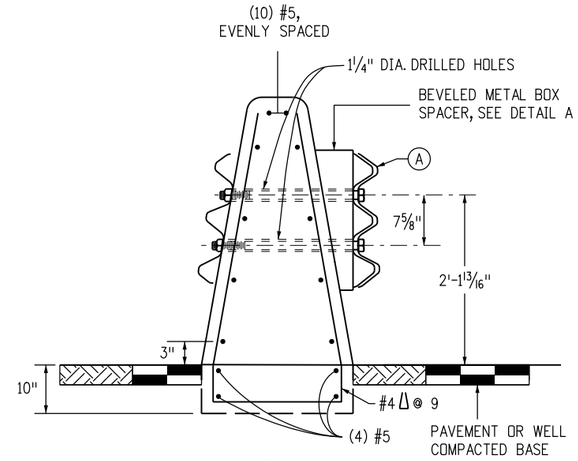
12 GAUGE = 0.108" THICK

NOTES

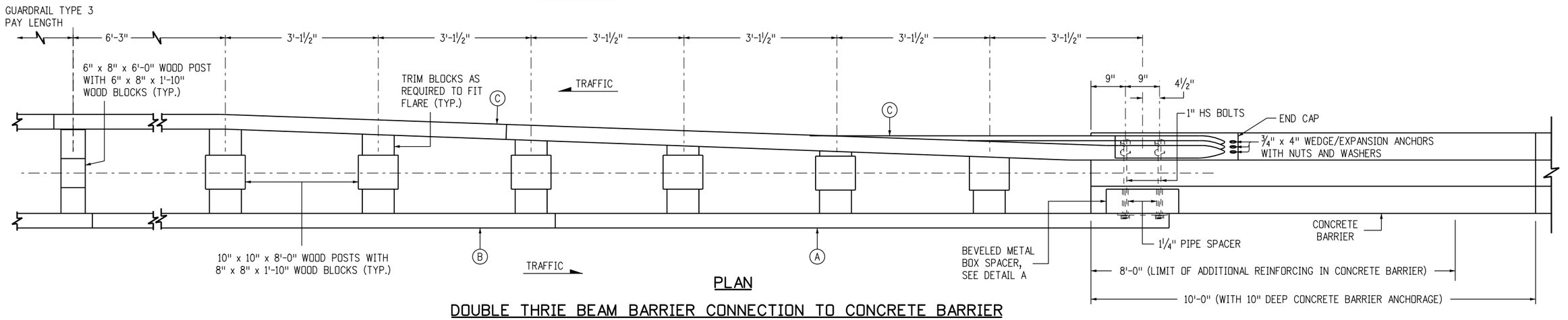
1. WHERE BEVELED METAL BOX SPACERS ARE INSTALLED, PLACE A 11¼ INCH X 3¼ INCH AND A 1¼ INCH X 2 INCH PIPE SPACERS ON 1 INCH HS BOLTS PASSING THROUGH THE INTERIOR OF BOX.
2. ALL METAL BOXES SHALL BE GALVANIZED.



ELEVATION



SECTION A-A



PLAN

DOUBLE THRIE BEAM BARRIER CONNECTION TO CONCRETE BARRIER

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GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER

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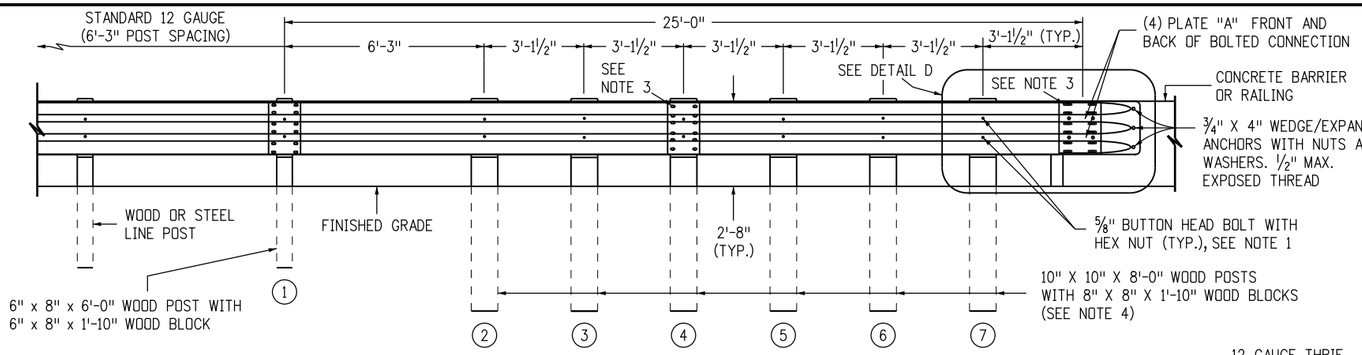

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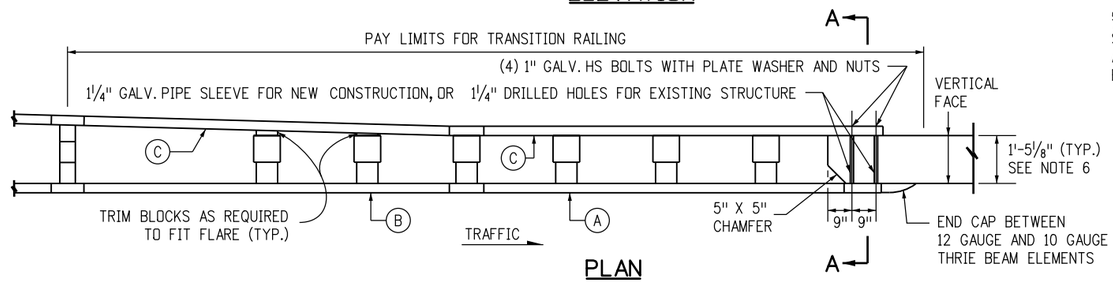
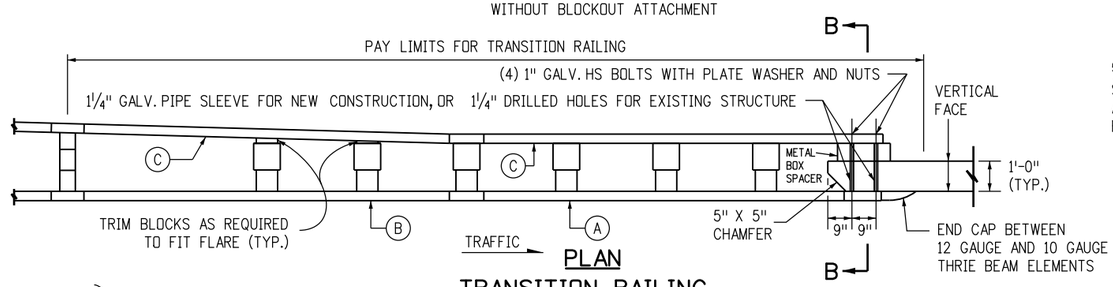


PLAN
TRANSITION RAILING
WITHOUT BLOCKOUT ATTACHMENT



PLAN
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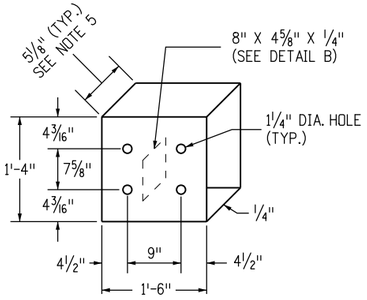
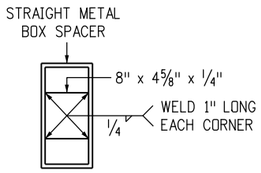
WITH BLOCKOUT ATTACHMENT



DETAIL A
PLACEMENT OF HOLES FOR FRONT AND BACK PANELS



DETAIL B

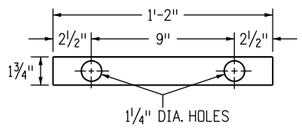
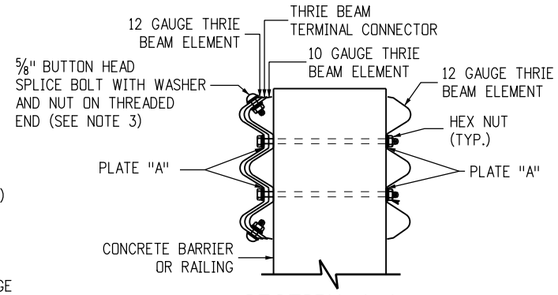
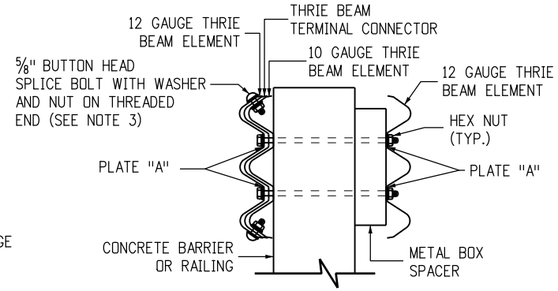


PLATE "A"
DETAIL C

STRAIGHT METAL BOX SPACER



SECTION A-A



SECTION B-B

LEGEND

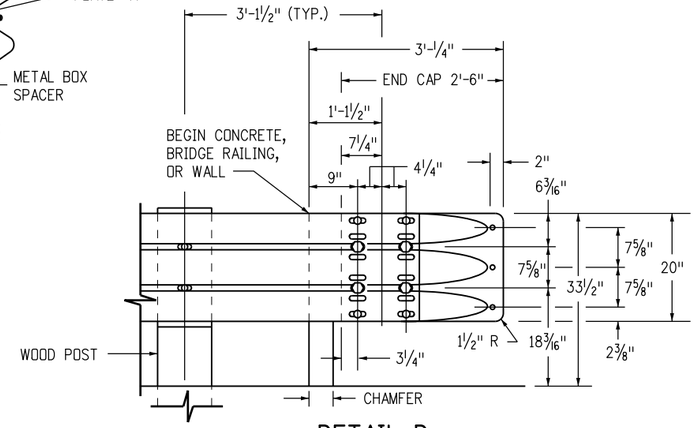
Ⓐ NESTED THRIE BEAM ELEMENTS (ONE 12 GAUGE ELEMENT NESTED OVER ONE 10 GAUGE ELEMENT)

Ⓑ ONE 10 GAUGE THRIE BEAM ELEMENT

Ⓒ ONE 12 GAUGE THRIE BEAM ELEMENT
10 GAUGE = 0.135" THICK
12 GAUGE = 0.108" THICK

NOTES

1. USE ⅝" 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 29⁄32" X 1⅛" SLOT SIZE. INTERIOR SPLICE BOLT HOLES AT THESE LOCATIONS MAY BE INCREASED UP TO 1¼". 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 5⅛" TO 1½" 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 17⅛". WHERE THE SPACE BETWEEN THE BACKSIDE OF THE CONCRETE RAILING OR WALL AND THE REAR THRIE BEAM ELEMENT IS LESS THAN 1½", METAL PLATES SIMILAR TO PLATE "A" ARE BE USED AS SPACERS.
6. WHERE THE WIDTH OF THE CONCRETE RAILING OR WALL IS GREATER THAN 17⅛", 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.



DETAIL D
SEE MANUFACTURER'S DETAILS FOR EXACT DIMENSIONS

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GUARDRAIL TYPE 9 SINGLE SLOPE BARRIER

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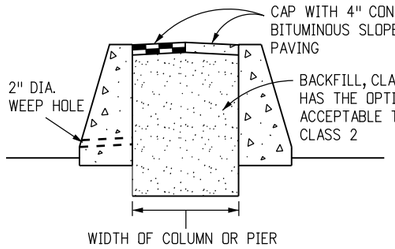
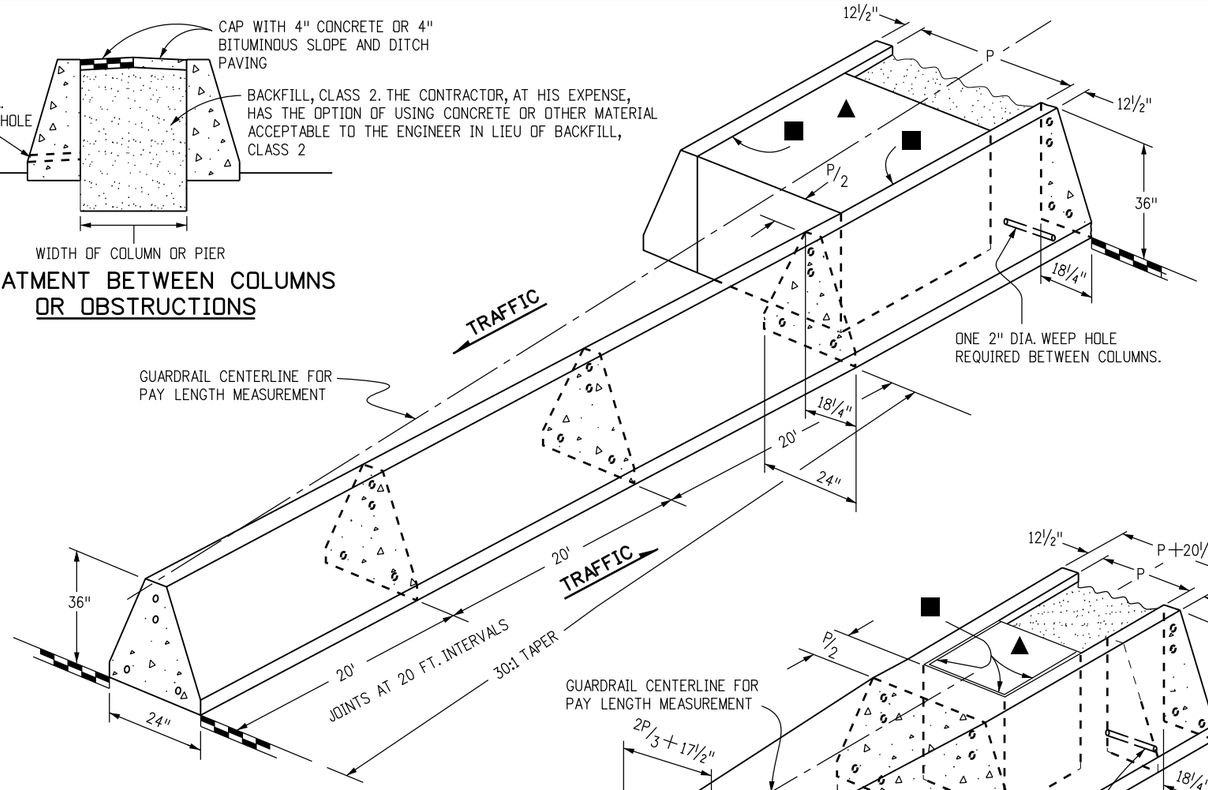
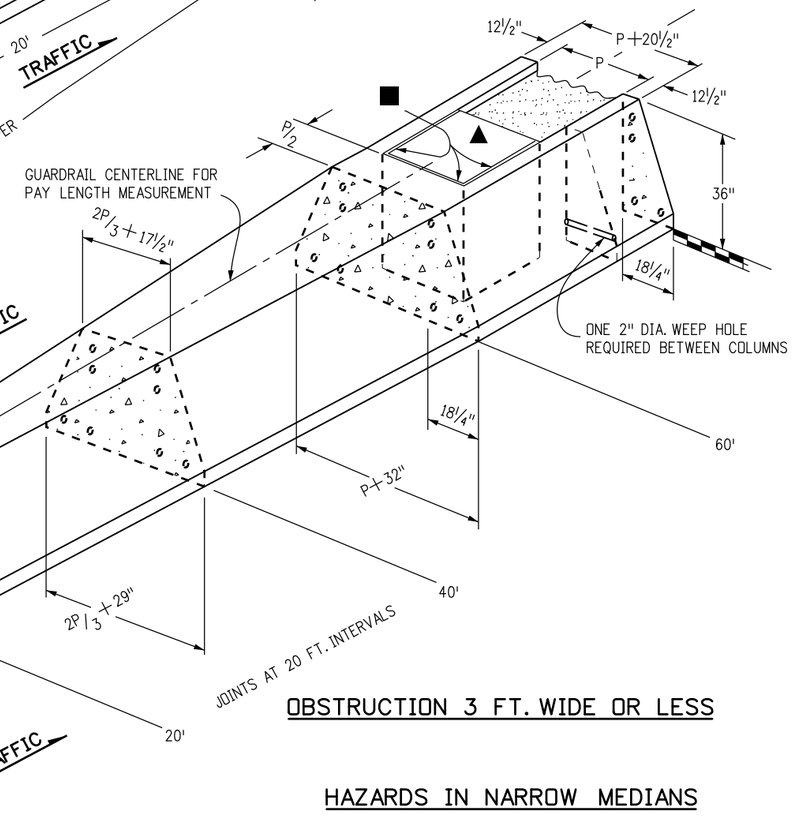


TREATMENT BETWEEN COLUMNS OR OBSTRUCTIONS



OBSTRUCTION WIDER THAN 3 FT.



■ ½" PREFORMED JOINT MATERIAL

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

OBSTRUCTION 3 FT. WIDE OR LESS

HAZARDS IN NARROW MEDIANS

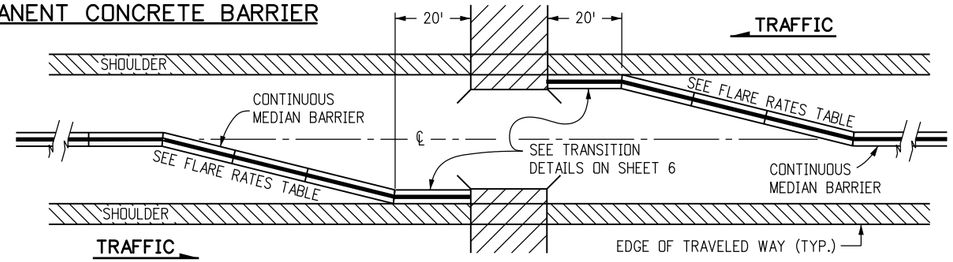
DESIGN SPEED (MPH)	SHY LINE OFFSET (FT.)*	FLARE RATE FOR BARRIER INSIDE SHY LINE	FLARE RATE FOR BARRIER OUTSIDE SHY LINE
80	12	30:1	20:1
75	10	30:1	20:1
70	9	30:1	20:1
60	8	26:1	18:1
55	7	24:1	16:1
50	6.5	21:1	14:1
45	6	18:1	12:1
40	5	16:1	10:1
30	4	13:1	8:1

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

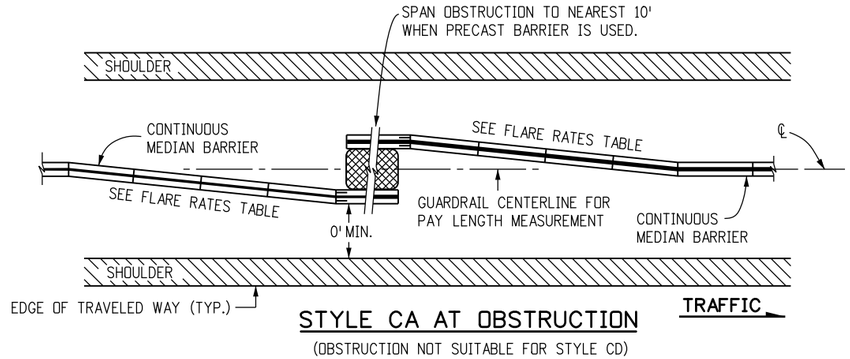
TABLE OF FLARE RATES FOR PERMANENT CONCRETE BARRIER

NOTES

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

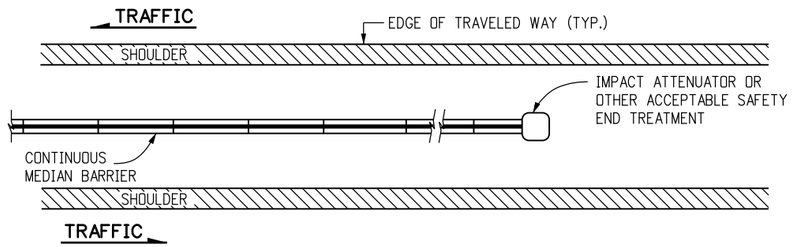


BRIDGE APPROACH



STYLE CA AT OBSTRUCTION

(OBSTRUCTION NOT SUITABLE FOR STYLE CD)



MEDIAN BARRIER END TREATMENT

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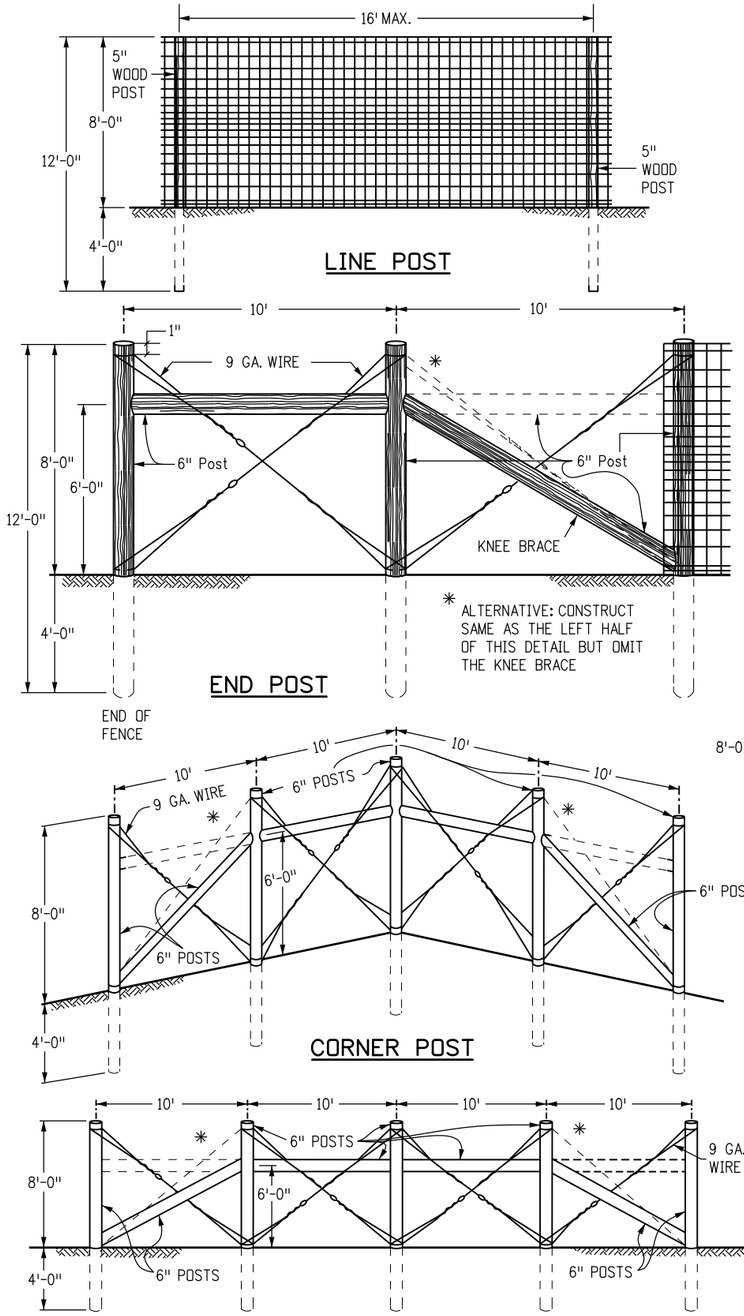
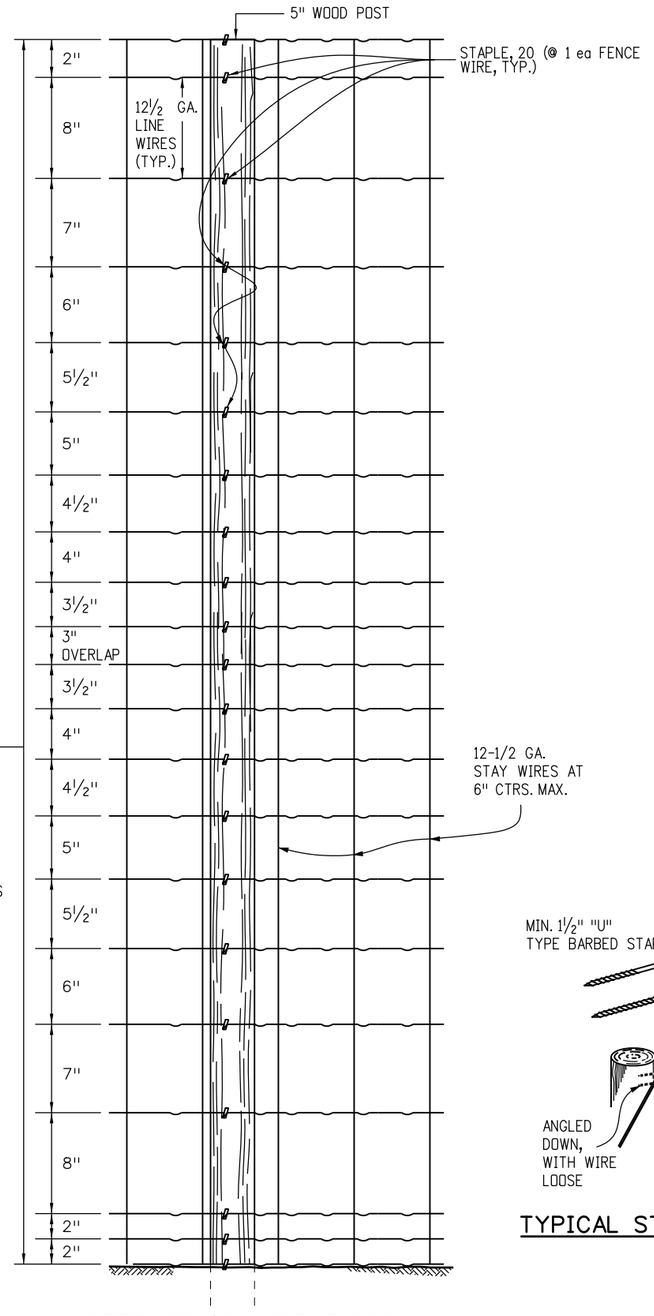
Sheet No. 11 of 11

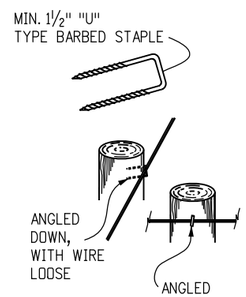




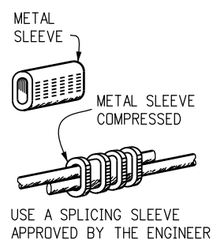
DEER FENCE WIRE FABRIC

GENERAL NOTES

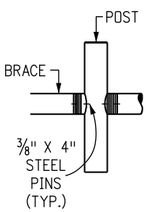
1. AT EACH LOCATION WHERE AN ELECTRIC TRANSMISSION, DISTRIBUTION OR SECONDARY LINE CROSSES A BARRIER FENCE, THE CONTRACTOR SHALL FURNISH AND INSTALL A GROUND CONFORMING TO ARTICLE 250 OF THE NATIONAL ELECTRICAL CODE. THE GROUND ROD SHALL BE A MINIMUM DIAMETER OF ½ IN. AND 8 FT. IN LENGTH, AND DRIVEN AT LEAST 7½ FT. INTO THE GROUND. THE ROD SHALL BE CONNECTED TO EACH WIRE WITH A MINIMUM AWG NO. 8 STRANDED COPPER WIRE. GROUNDING WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
2. 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.
3. LINE BRACE POSTS SHALL BE SPACED AT 400 FT. INTERVALS, WHERE FENCING IS CONTINUOUS AND WHERE END, CORNER & LINE BRACE POSTS ARE NOT SPECIFIED.
4. 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.
5. 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.
6. 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 ½ IN. ROUND BARS AND EMBEDDED A MINIMUM OF 6 IN. WITH A HOOKED OR BENT END. IN EXISTING CONCRETE, THE ½ 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.
7. WOVEN WIRE FENCE FABRIC SHALL CONFORM TO AASHTO M 279 (ASTM A 116). DESIGN NO. 2096-6-12½, GRADE 60, COATING TYPE ZA, COATING CLASS 80.
8. ALL FENCE WIRE TIES, BRACE WIRES, STAPLES AND OTHER WIRE APPURTENANCES SHALL BE GALVANIZED IN CONFORMANCE WITH AASHTO M 232.
9. THE CONTRACTOR SHALL RE-ESTABLISH DISTURBED OR DESTROYED SURVEY MONUMENTS TO THE APPROPRIATE ACCURACY IN ACCORDANCE WITH SUBSECTION 625.08 OF THE STANDARD SPECIFICATIONS.
10. 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.
11. 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



WIRE SPLICE



CROSS BRACE DOWELING

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DEER FENCE, GATES, AND GAME RAMPS

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STANDARD PLAN NO.

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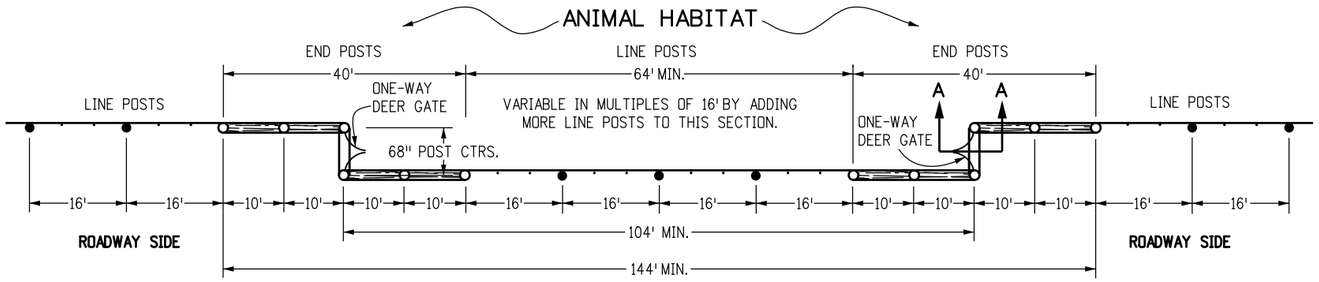


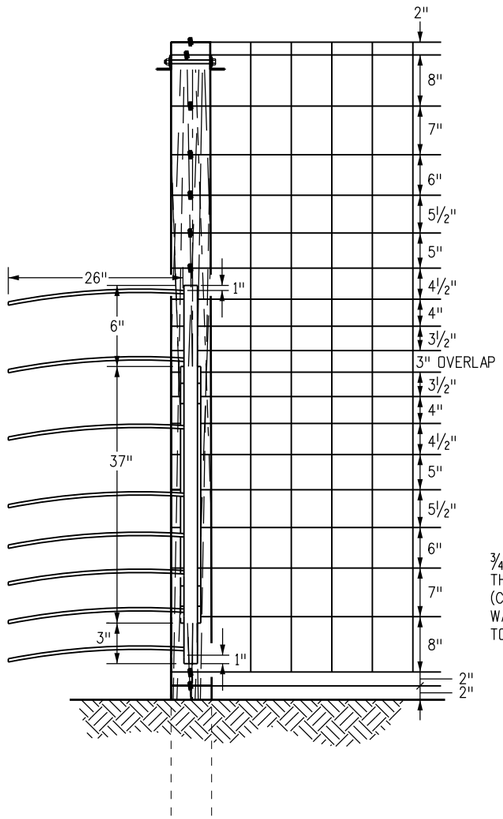
PLAN VIEW - TYPICAL DEER GATE INSTALLATION

LEGEND

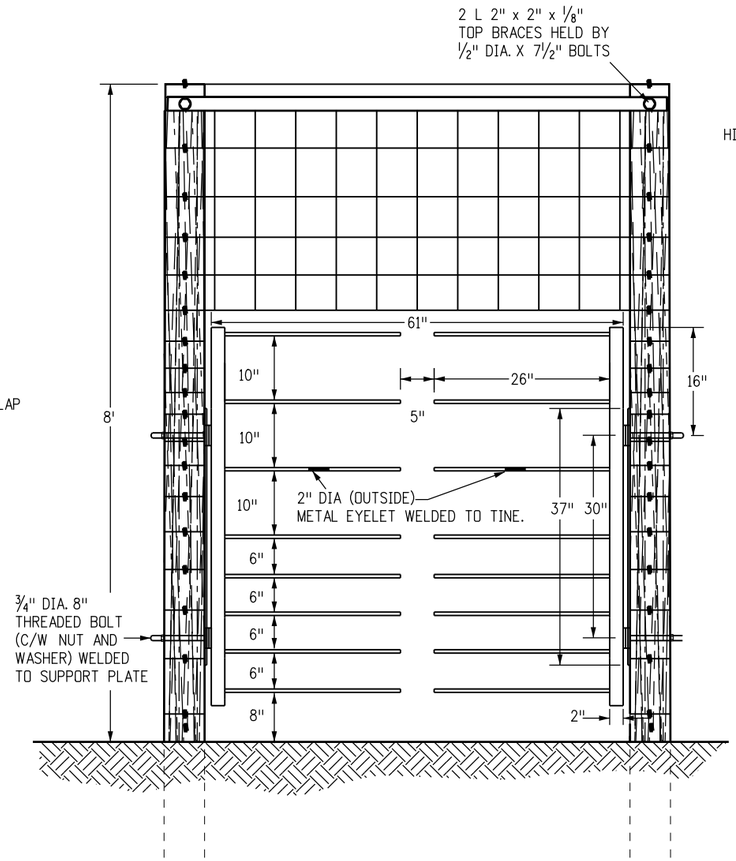
- =LINE POST
- =WOODEN STAY
- =END POST
- =BRACE

NOTES

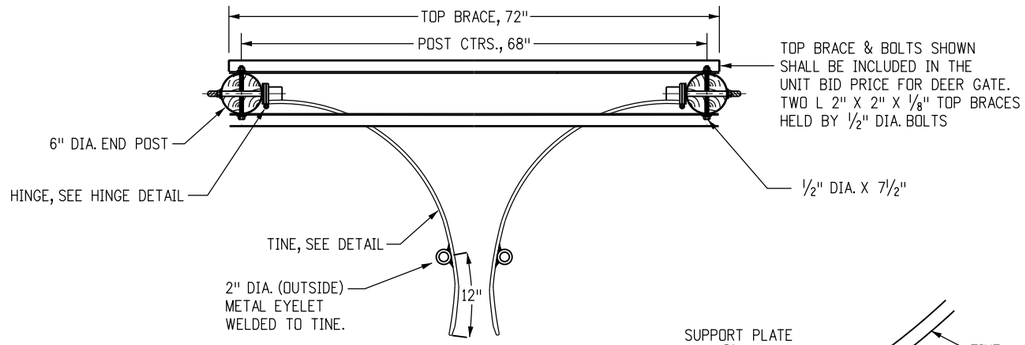
1. SIX IN. DOUBLE ACTING SPRING DOOR HINGE WITH FLAT BUTTON TIPS CUT IN TWO SHALL BE USED AS A SINGLE SWING HINGE AND BE PROVIDED WITH A GREASING NIPPLE AND WELDED TO SUPPORT PLATE.
2. TINES SHALL BE MOLDED IN ONE PIECE OF STEEL (AASHTO M 169, GRADE 1050), WITH NO WELDS ALLOWED.



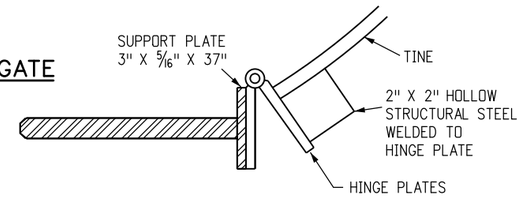
SECTION A-A



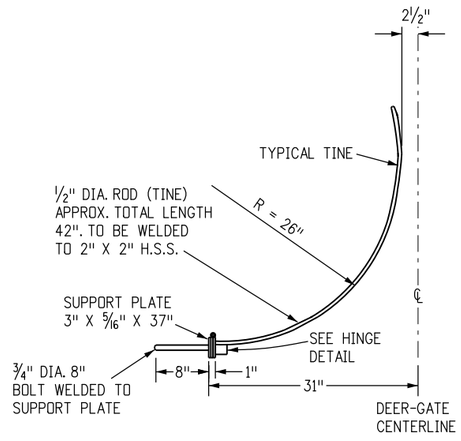
FRONT VIEW - DEER GATE



TOP VIEW - DEER GATE



TYPICAL HINGE DETAIL



TYPICAL TINE DETAIL

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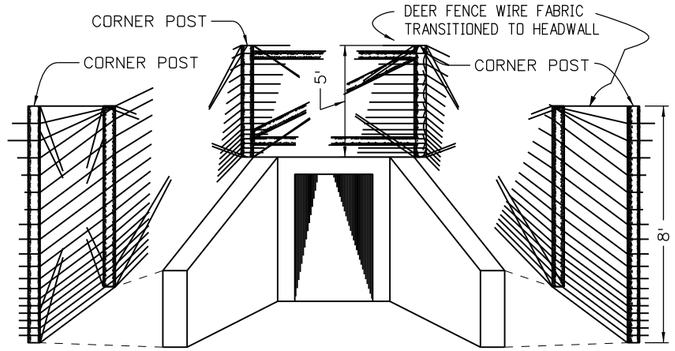
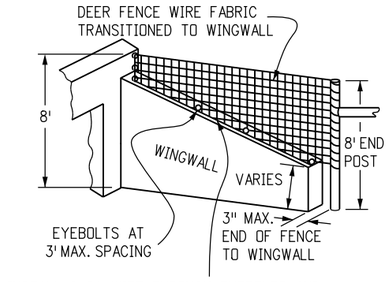


FENCE DEER (SPECIAL) OVER CONCRETE BOX CULVERT

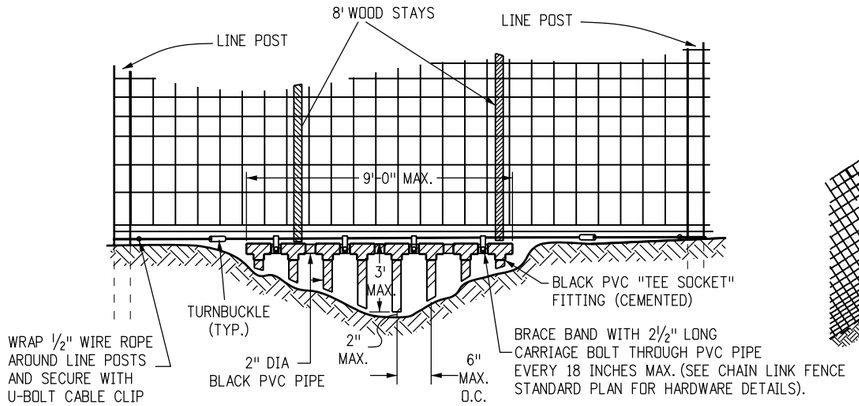
FIVE FOOT POSTS AND WIRE FABRIC SHALL BE INSTALLED WHERE THE FENCE PASSES OVER A CBC AT LOCATIONS SHOWN IN THE PLANS. THIS WORK WILL BE PAID FOR AS FENCE DEER (SPECIAL).

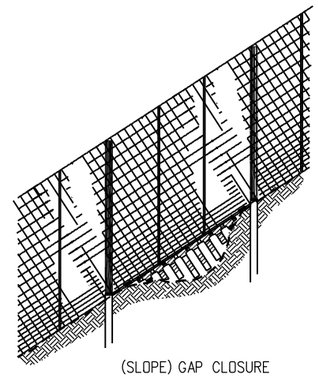


INSTALL 9 GA. WIRE THROUGH EYEBOLTS AND ATTACH FENCE FABRIC TO WIRE AT 1 FT. INTERVALS

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.

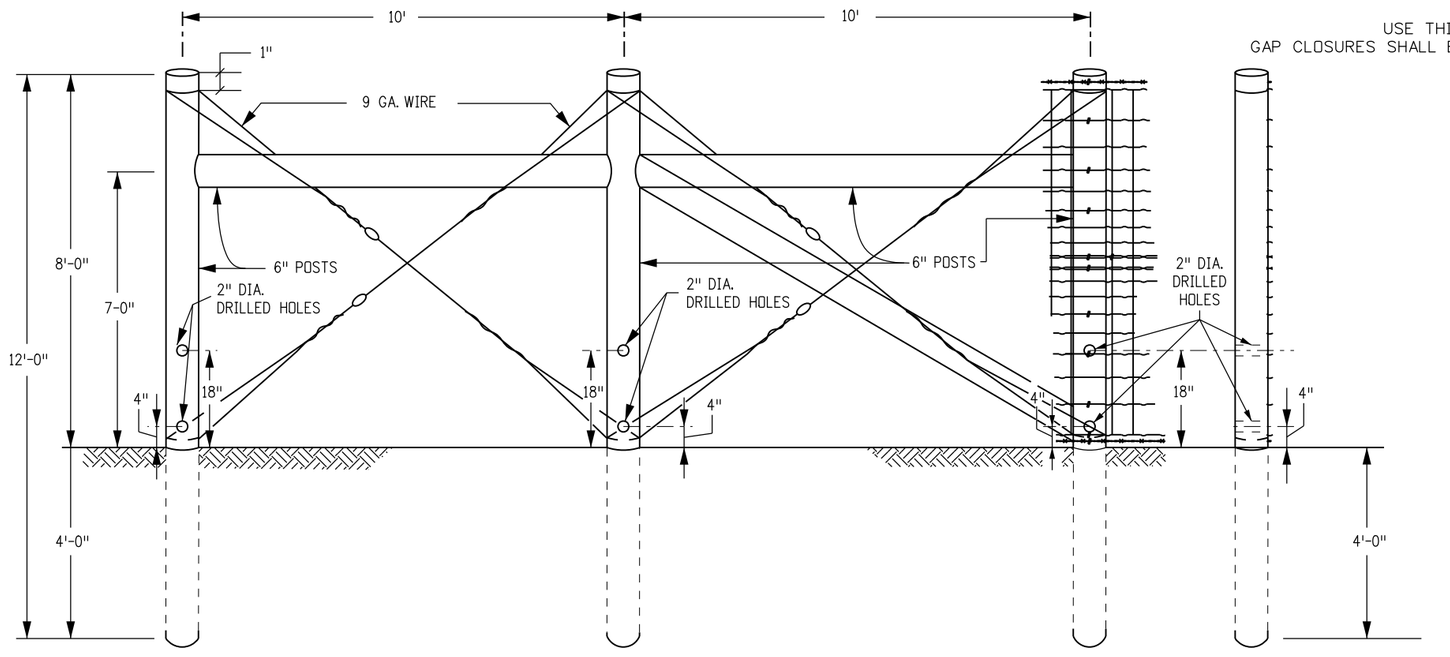




(SLOPE) GAP CLOSURE

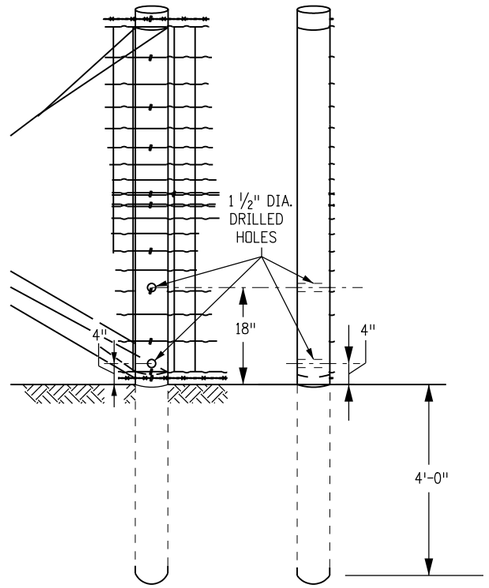
GAP CLOSURE

USE THIS DETAIL TO CLOSE ALL GAPS BEWTEEN 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

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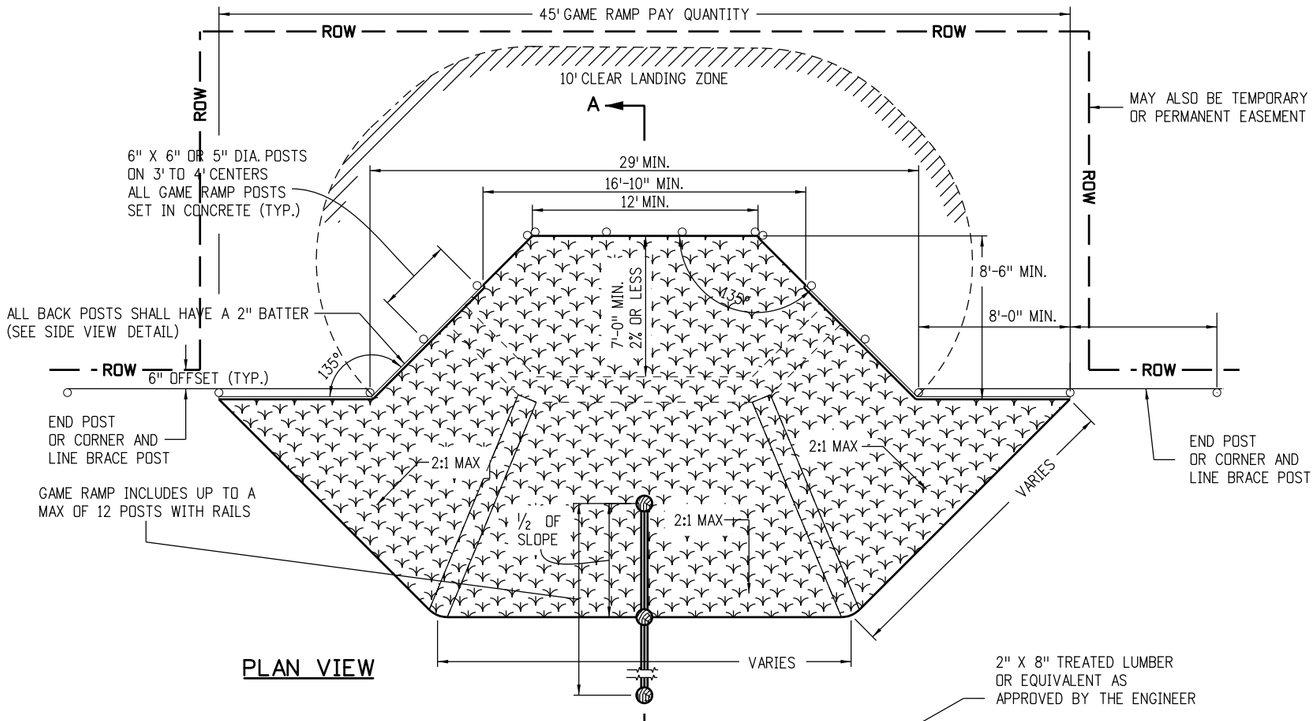
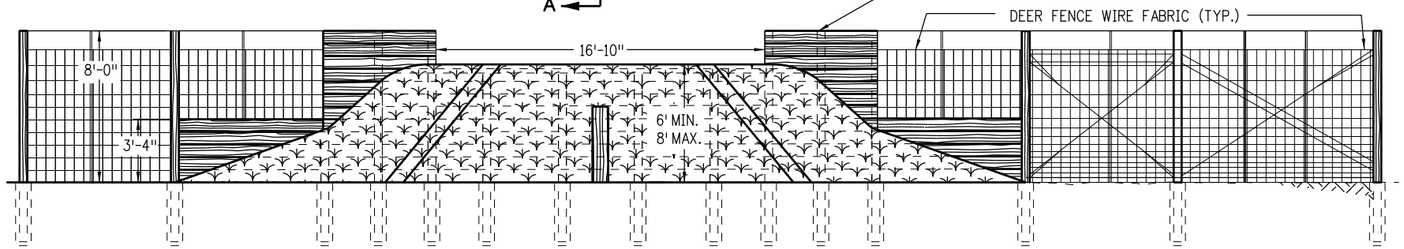
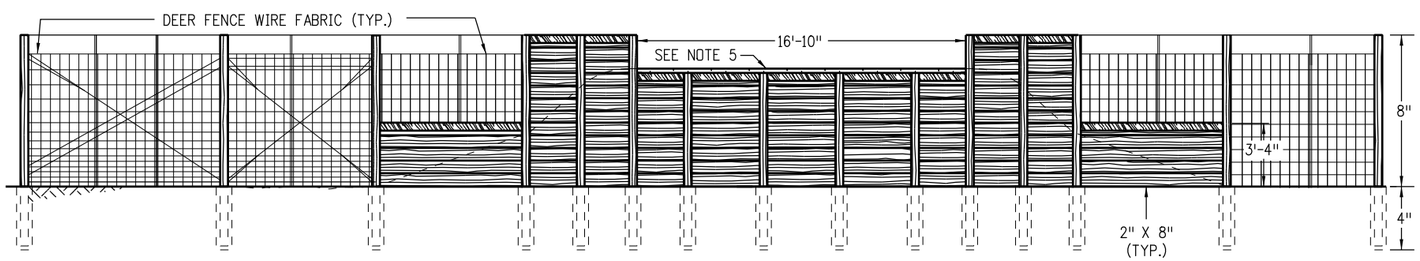


PLAN VIEW



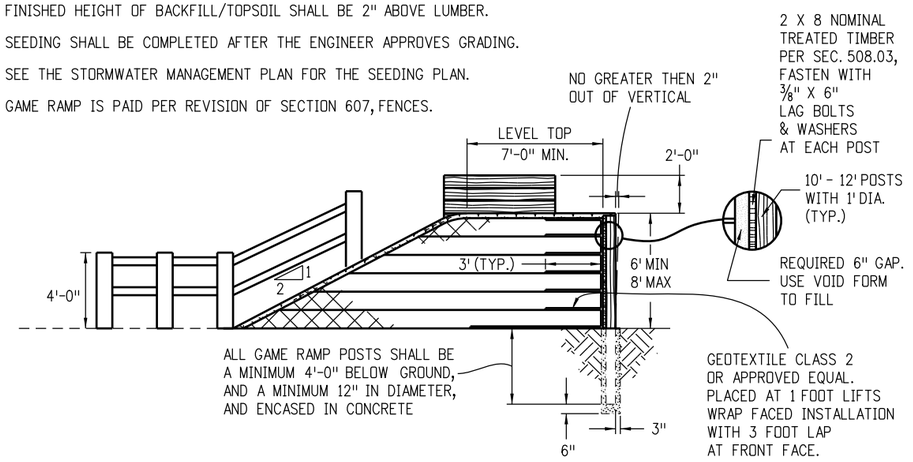
FRONT ELEVATION VIEW



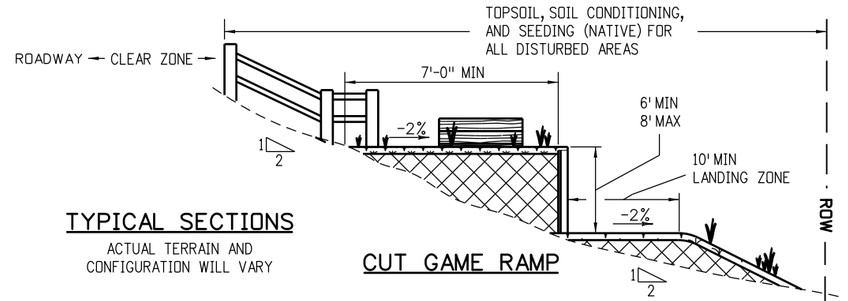
REAR ELEVATION VIEW

NOTES

1. THE LANDING ZONE SHALL BE FLAT, STABLE, AND EARTHEN. THE AREA SHALL BE VOID OF OBJECTS THAT MAY HINDER OR ENDANGER WILDLIFE. THE ENGINEER MAY ADJUST THE GAME RAMP LOCATION AS NEEDED.
2. THERE SHALL BE NO DISTURBANCE BEYOND THE ROW OR TEMPORARY/PERMANANT EASETMENTS.
3. FILL MATERIAL SHALL BE STRUCTURE BACKFILL (CLASS 2) AND MEET THE REQUIREMENTS OF SECTION 206 WITH A MINIMUM COMPACTION OF 90%.
4. FOUR INCHES OF TOPSOIL SHALL BE PLACED IN ACCORDANCE WITH SECTION 207.
5. FINISHED HEIGHT OF BACKFILL/TOPSOIL SHALL BE 2" ABOVE LUMBER.
6. SEEDING SHALL BE COMPLETED AFTER THE ENGINEER APPROVES GRADING.
7. SEE THE STORMWATER MANAGEMENT PLAN FOR THE SEEDING PLAN.
8. GAME RAMP IS PAID PER REVISION OF SECTION 607, FENCES.



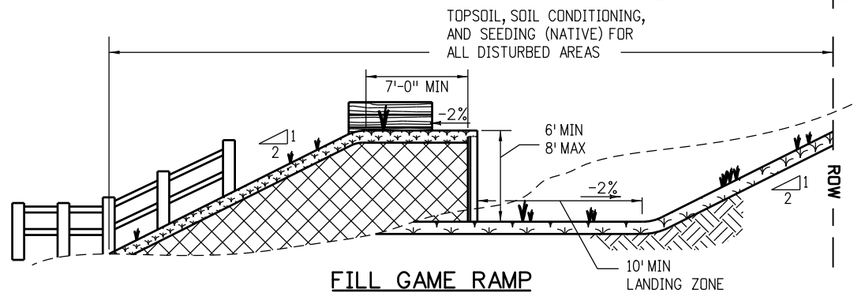
SECTION A-A



TYPICAL SECTIONS

ACTUAL TERRAIN AND CONFIGURATION WILL VARY

CUT GAME RAMP



FILL GAME RAMP

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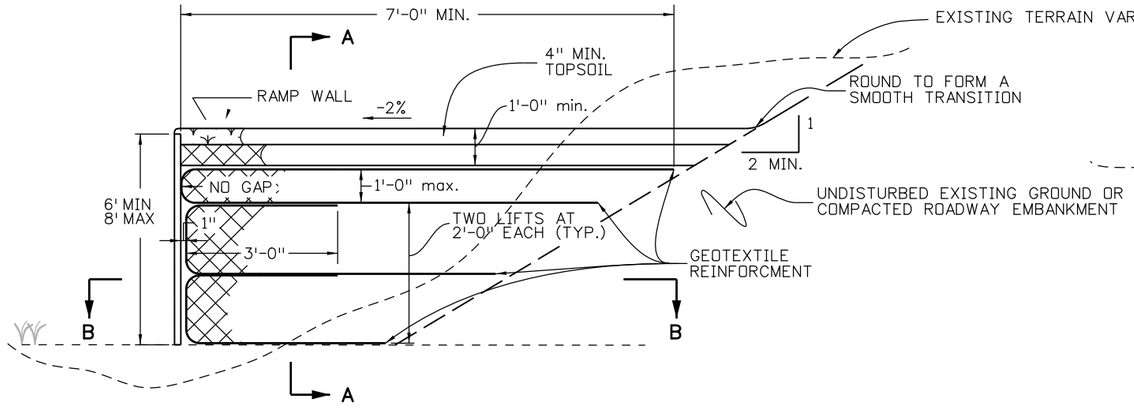
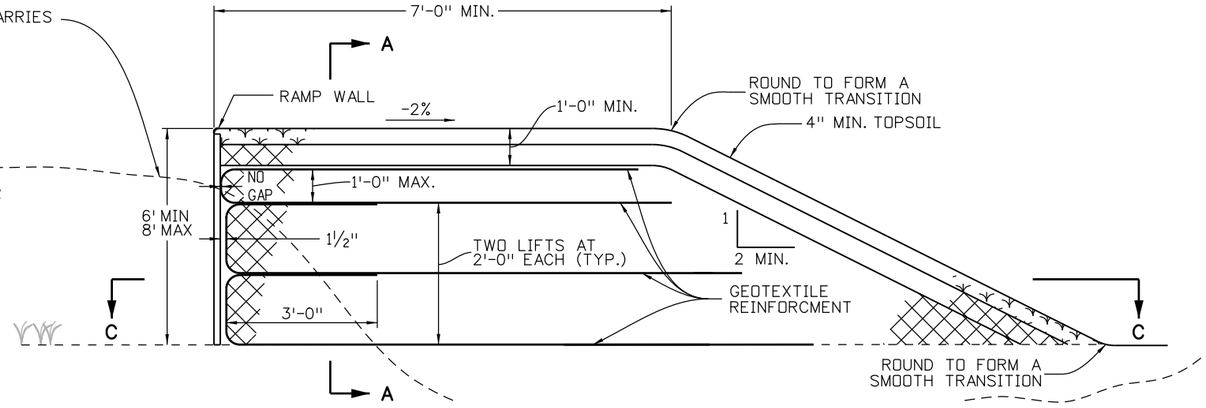


CUT SECTION PERPENDICULAR TO GAME RAMP



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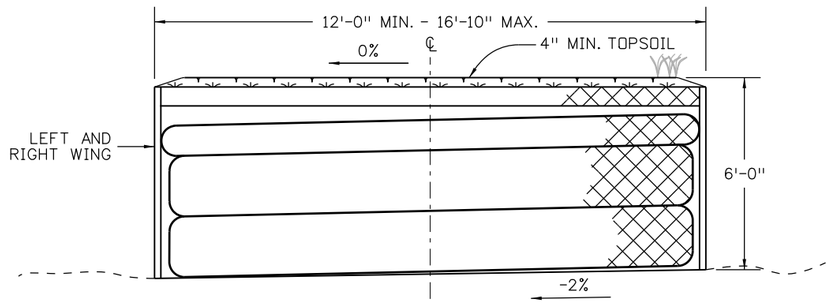
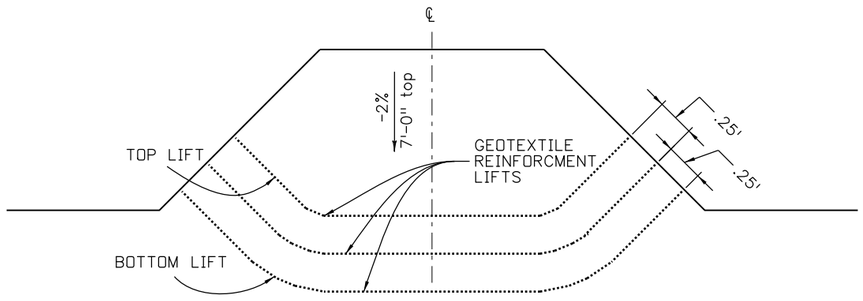
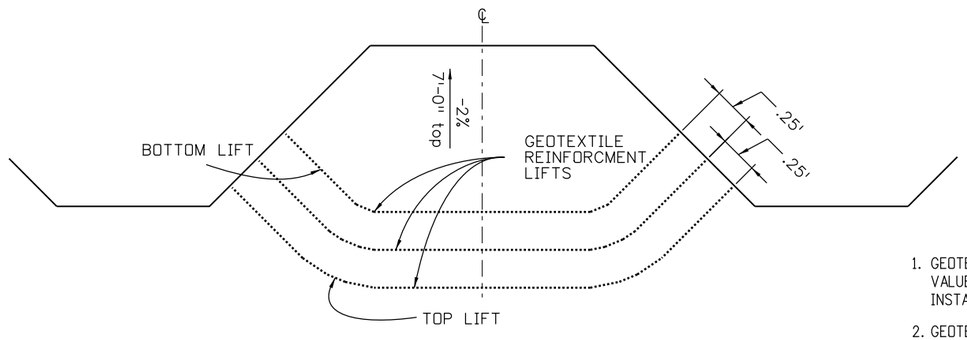


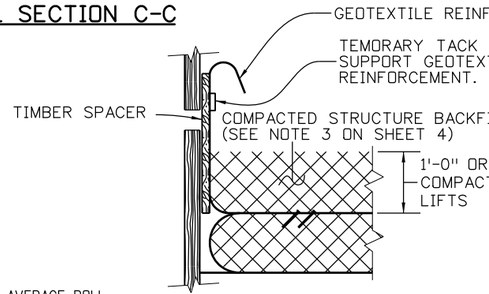
SECTION A-A



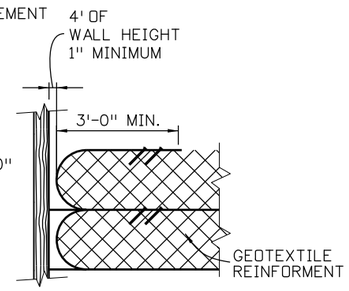
FILL SECTION C-C



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.

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DEER FENCE, GATES, AND GAME RAMPS

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STANDARD PLAN NO.
M-607-4
Sheet No. 5 of 5

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 WARNINGS 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.

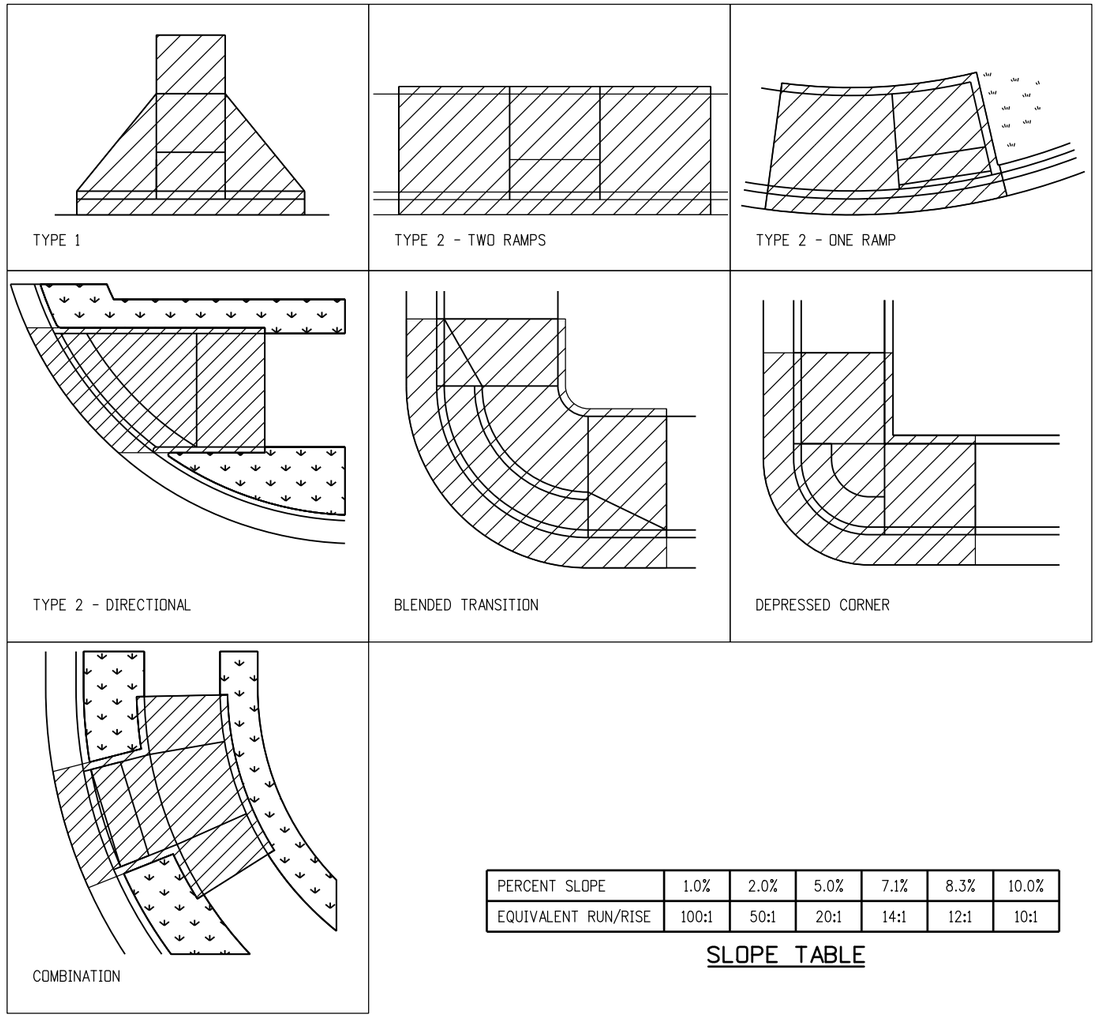
19. DESIGN AND CONSTRUCT CURB RAMPS, TURNING SPACES, AND FLARE SLOPES WITH THE FLATTEST SLOPES POSSIBLE. THE SLOPES INDICATED IN THESE DETAILS SHOW THE MAXIMUM SLOPES ALLOWABLE. PREFERRED VALUES TO BE USED DURING DESIGN, LAYOUT, AND CONSTRUCTION ARE:
   - RAMP RUNNING SLOPE 7.5%
   - RAMP CROSS SLOPE 1.5%
   - 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 ACCOMODATE 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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/12 Initials: JBK		Date:	Comments
Last Modification Date: 05/03/19 Initials: LTA	R-X	05/03/19	Completely revised every sheet.
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Drawing File Name: 6080101010.dgn	R-X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	R-X		

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CURB RAMPS

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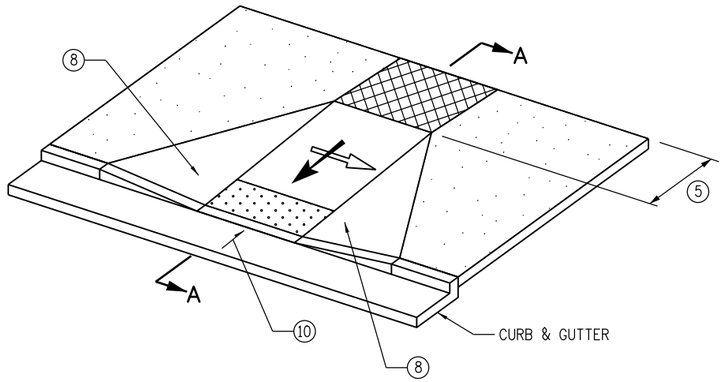
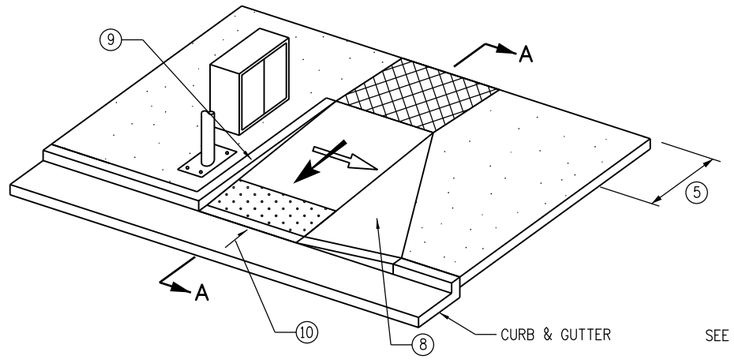
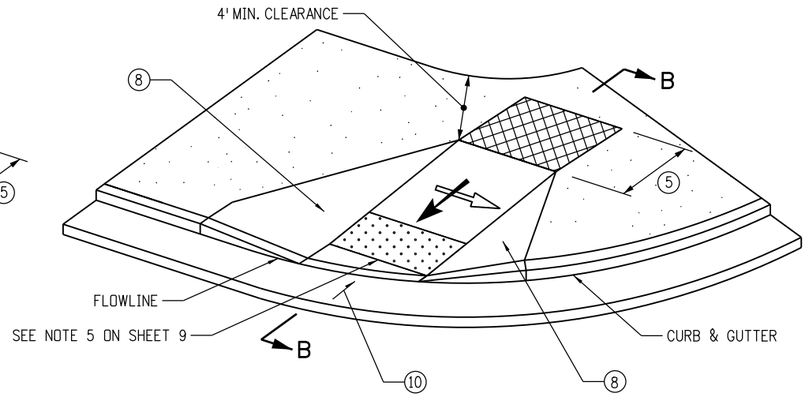


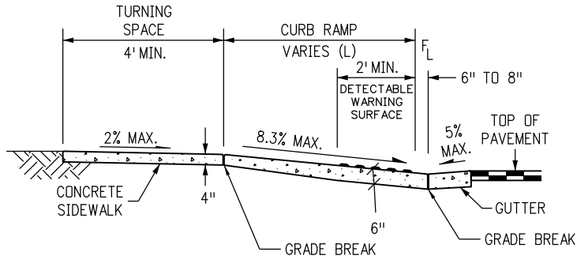
PERPENDICULAR RAMP
(TYPICAL)



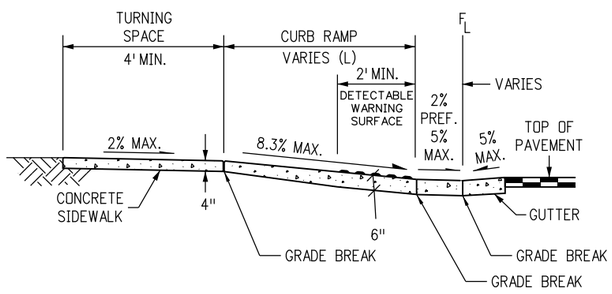
PERPENDICULAR RAMP
(WITH VERTICAL RETURN CURB)



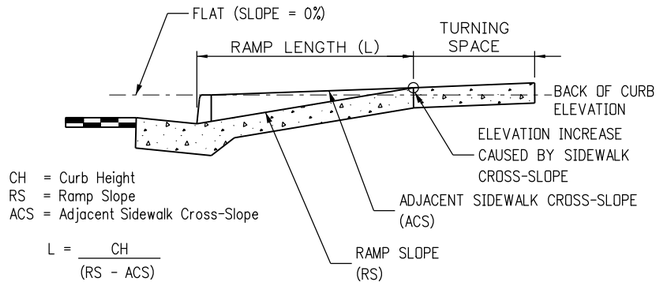
PERPENDICULAR RAMP
(DIRECTIONAL)



SECTION A-A



SECTION B-B



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

SIDEWALK

TURNING SPACE (3) (4) (5)

DETECTABLE WARNING SURFACE (DWS)

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.

TYPE 1 PERPENDICULAR CURB RAMPS

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CURB RAMPS

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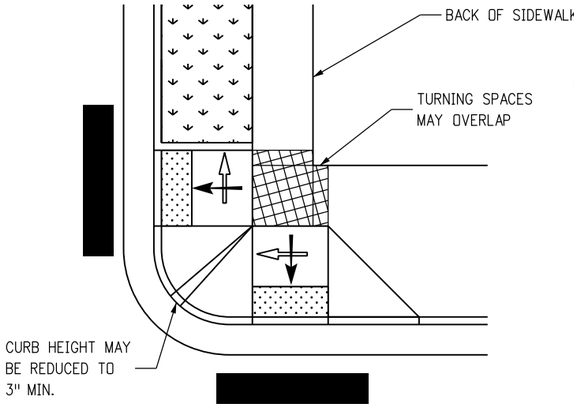
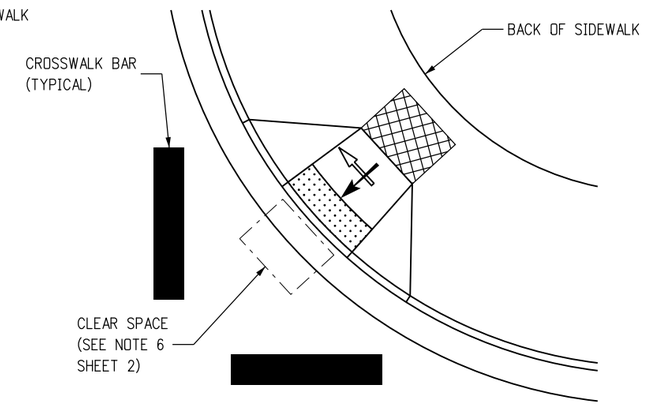
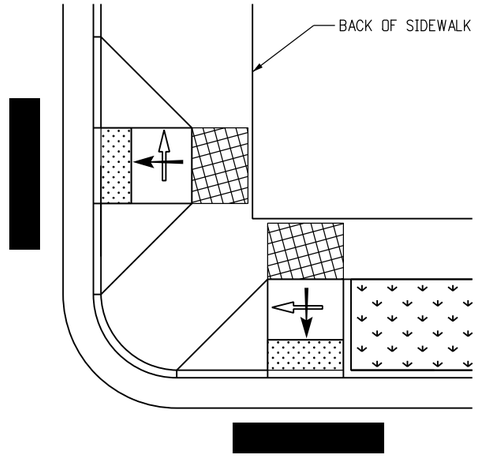


TYPE 1 RAMPS FOR WIDE SIDEWALK
(3" REDUCED CURB)



TYPE 1 RAMP
(DIAGONAL)

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



TYPE 1 RAMPS FOR WIDE SIDEWALK

TURNING SPACE
(SEE NOTES 3, 4, 5 - SHEET 2)

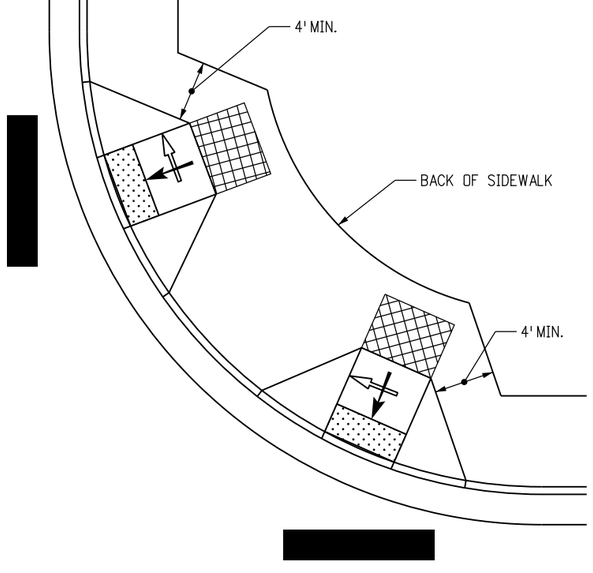
DETECTABLE WARNING SURFACE (DWS)
SEE DWS SHEETS FOR PLACEMENT DETAILS

RAMP RUNNING SLOPE

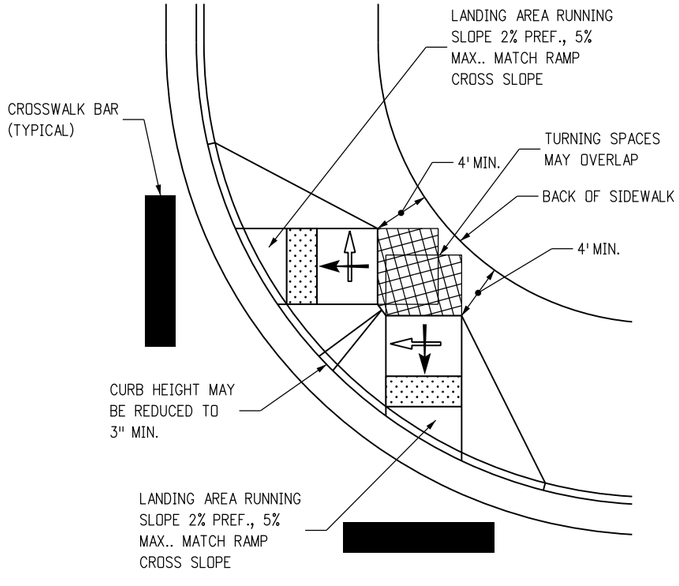
RAMP CROSS SLOPE

NOTE

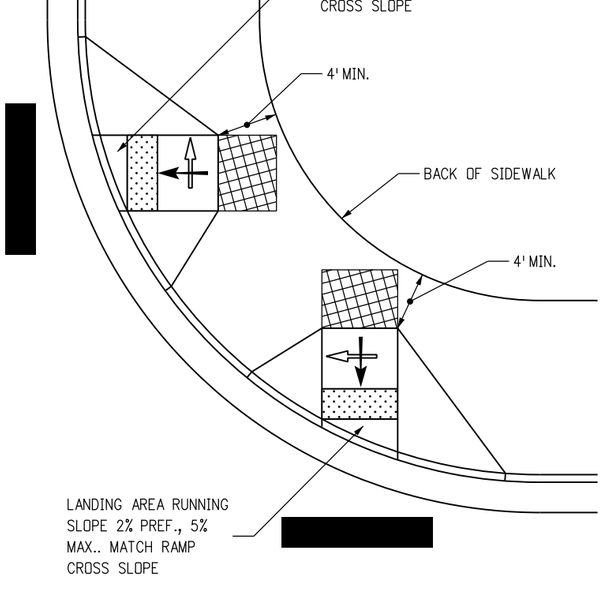
PLACEMENTS SHOWN ARE TYPICAL CONFIGURATIONS ONLY AND NOT INDICATIVE OF ALL OPTIONS. OTHER RAMP CONFIGURATIONS MAY BE ACCEPTABLE AS LONG AS THEY CONFORM TO THE CRITERIA IN THESE STANDARDS, AND ARE APPROVED BY THE ENGINEER.



TYPE 1 PERPENDICULAR RAMPS



TYPE 1 DIRECTIONAL RAMPS
(3" REDUCED CURB)



TYPE 1 DIRECTIONAL RAMPS
(LARGE RADIUS)

TYPE 1 CURB RAMPS TYPICAL CONFIGURATIONS

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CURB RAMPS

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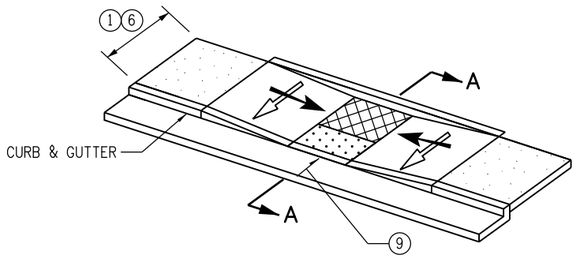
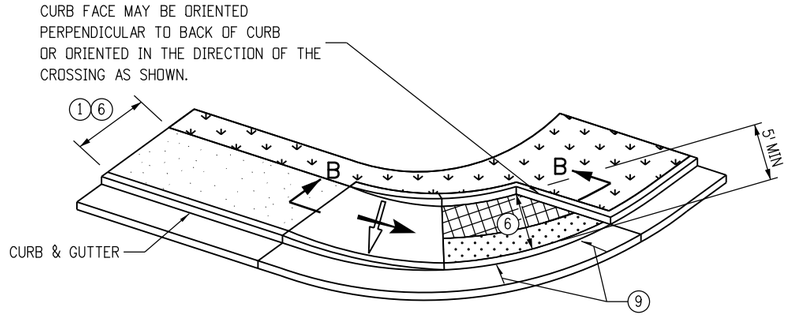
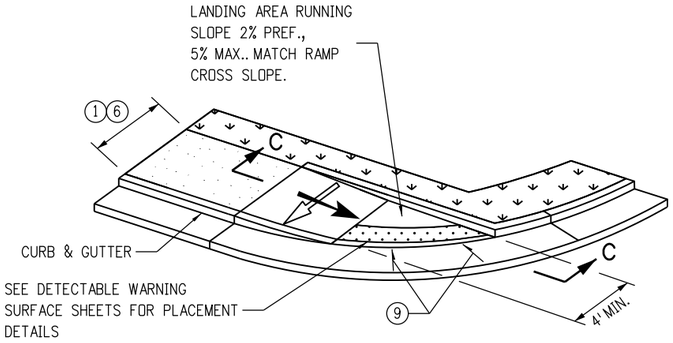


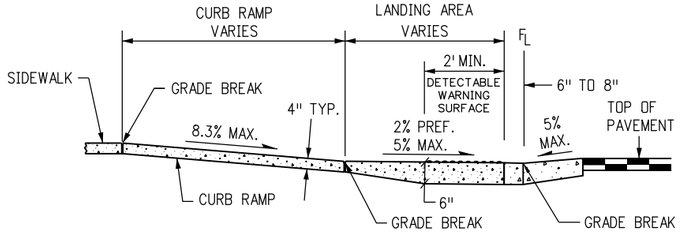
PARALLEL RAMP
(TYPICAL)



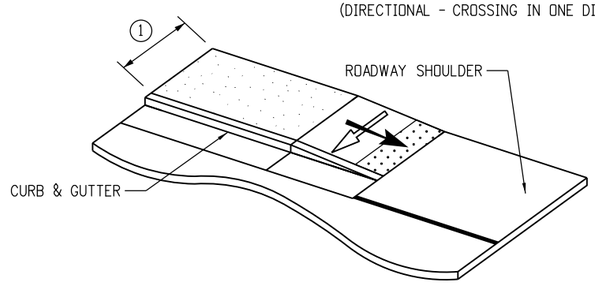
PARALLEL RAMP
(SIDEWALK ENDS)



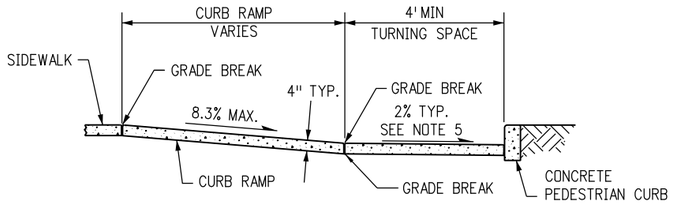
PARALLEL RAMP
(DIRECTIONAL - CROSSING IN ONE DIRECTION ONLY)



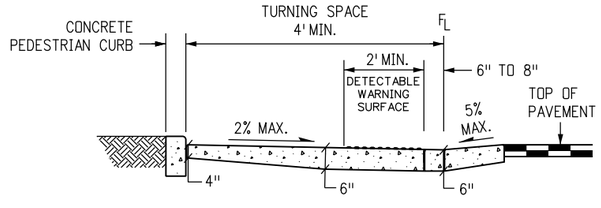
SECTION C-C



SIDEWALK TO SHOULDER TRANSITION



SECTION B-B



SECTION A-A

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.

TYPE 2 PARALLEL CURB RAMPS

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Full Path: www.codot.gov/business/designsupport	(R-X)		
Drawing File Name: 6080104010.dgn	(R-X)		
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CURB RAMPS

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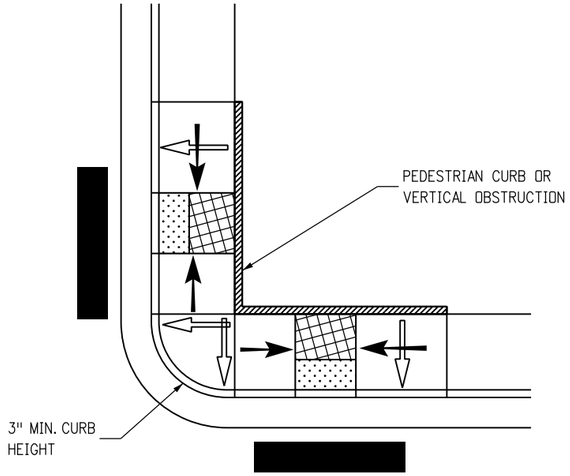
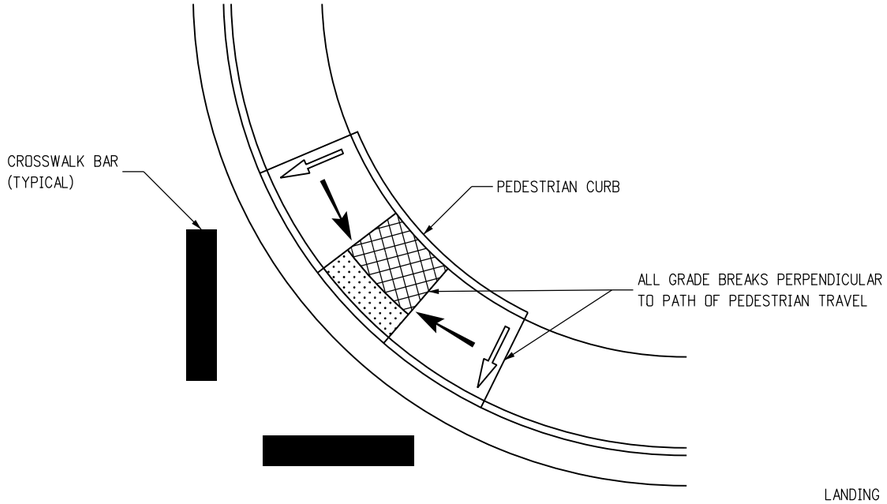
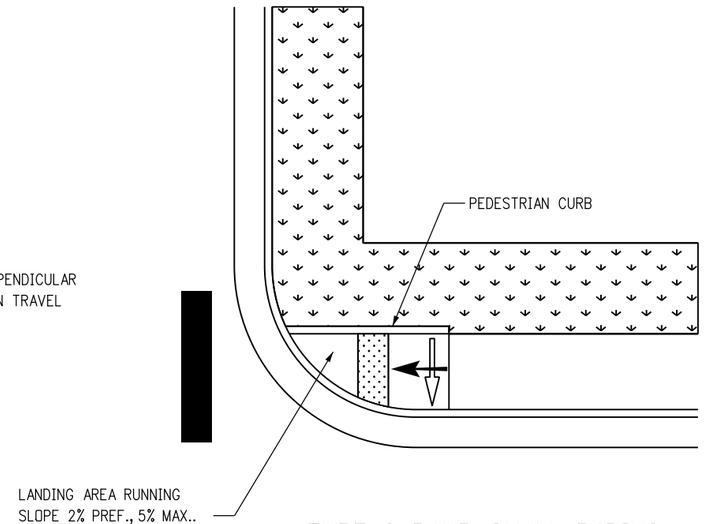


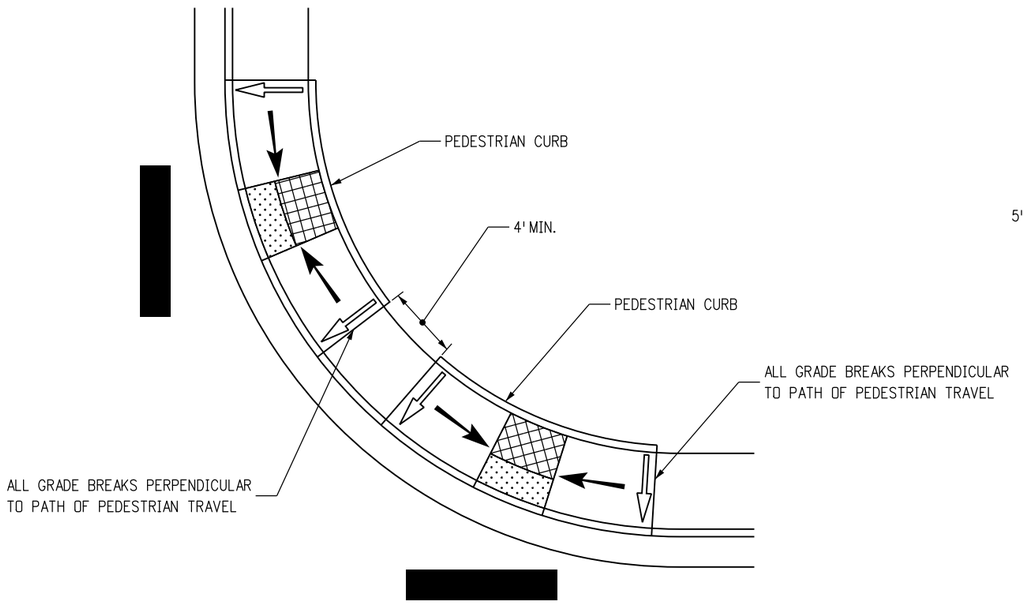
TYPE 2 RAMPS SMALL RADIUS
(3" REDUCED CURB)



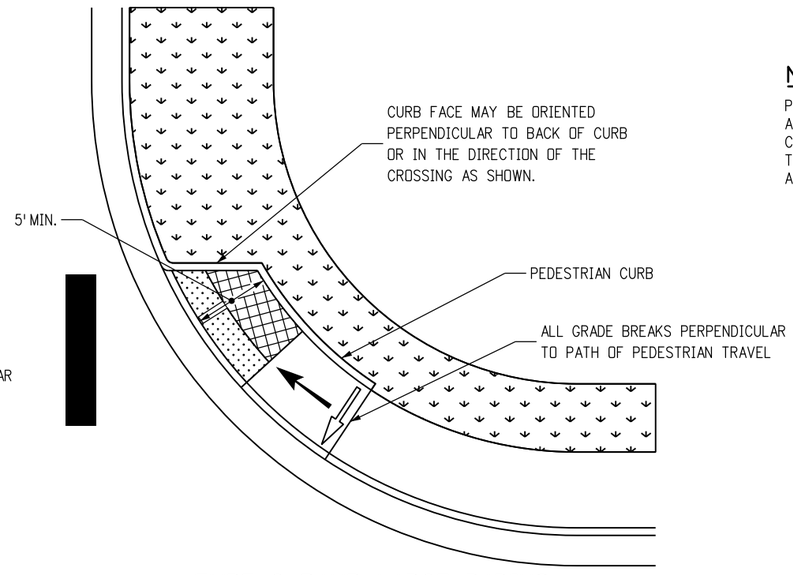
TYPE 2 RAMP (DIAGONAL)
NOT ALLOWABLE IN NEW CONSTRUCTION/FULL-DEPTH RECONSTRUCTION
SEE NOTE GENERAL NOTE 4



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

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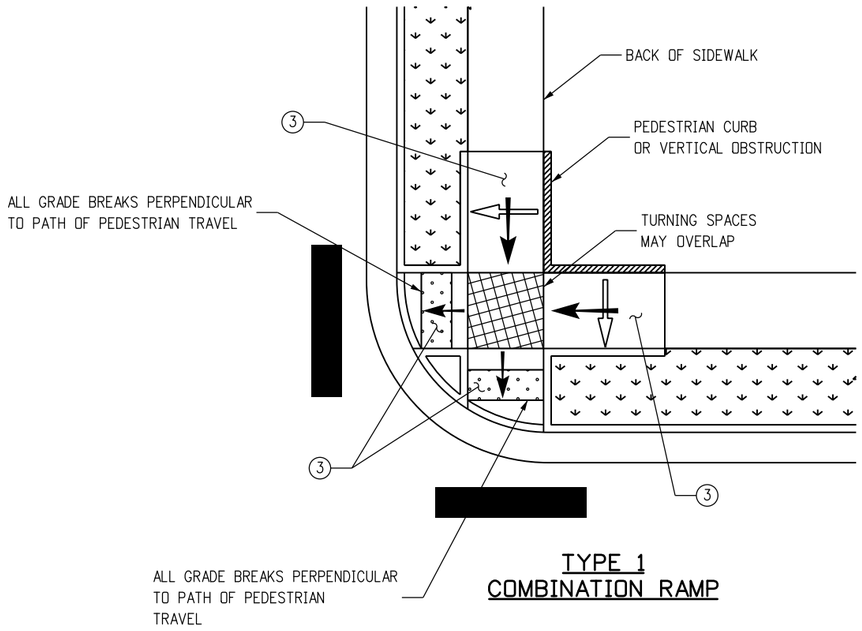
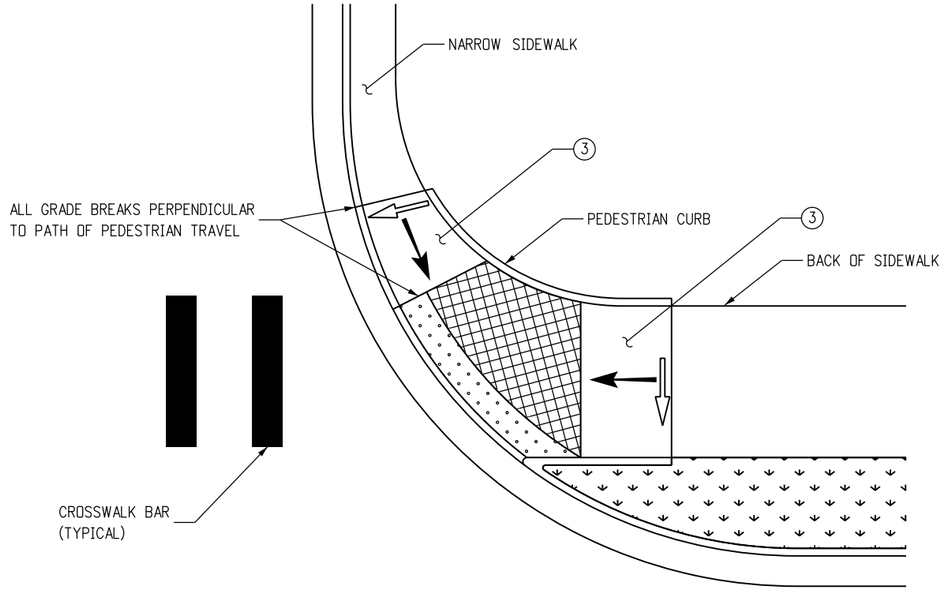
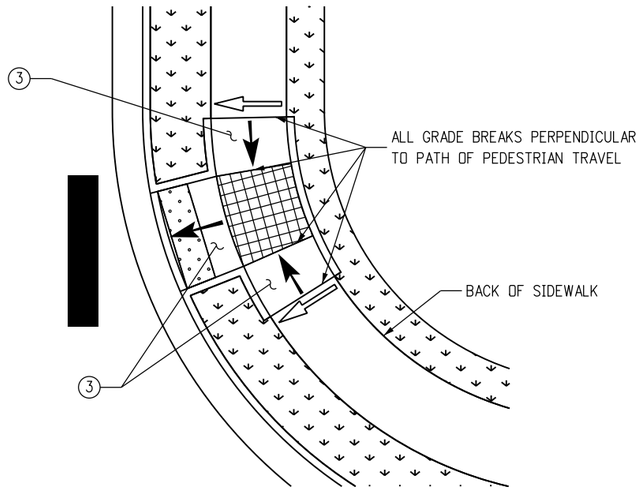


TYPE 1
COMBINATION RAMP



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 EQUALTHE 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

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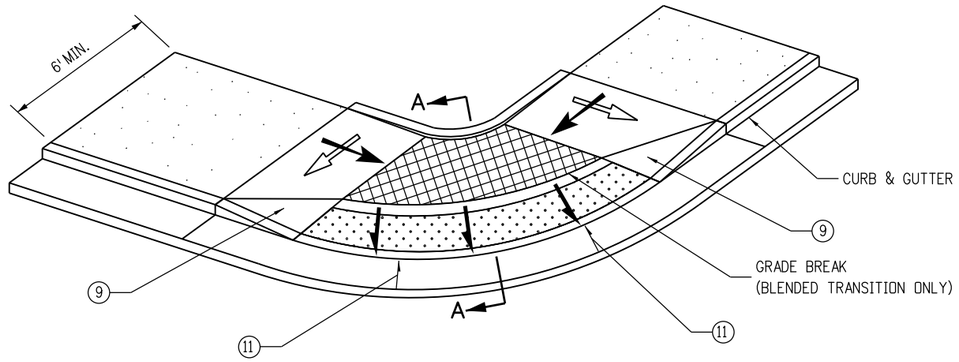
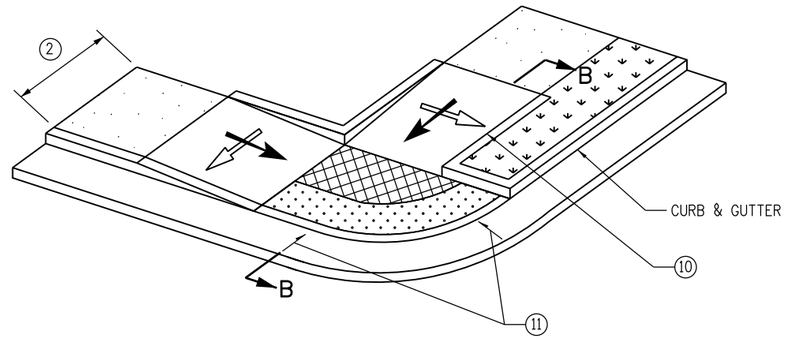
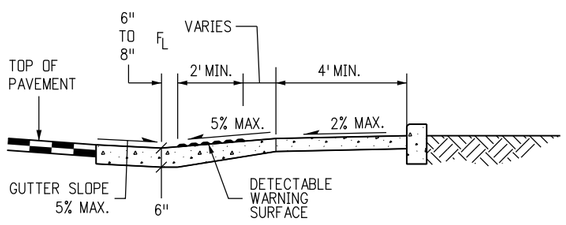


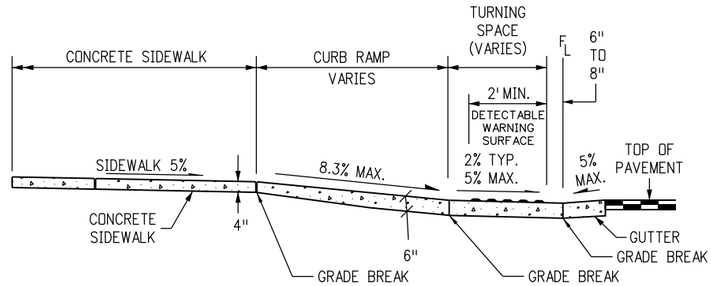
BLENDED TRANSITION



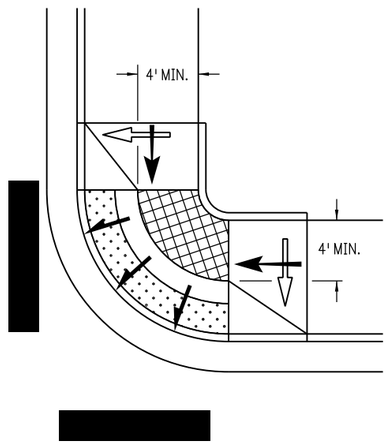
DEPRESSED CORNER



SECTION A-A



SECTION B-B



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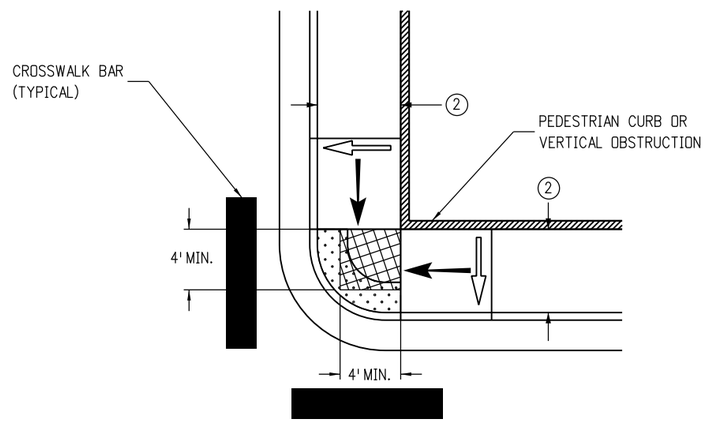

DEPRESSED CORNER

SIDEWALK

TURNING SPACE (4) (5) (6)

DETECTABLE WARNING SURFACE (DWS)

BLENDED TRANSITION & DEPRESSED CORNER NOTES

(1) PERPENDICULAR AND PARALLEL RAMP CONFIGURATIONS ARE PREFFERED. BLENDED TRANSITIONS AND DEPRESSED CORNERS SHOULD ONLY BE USED WHERE SITE CONDITIONS MAKE THEM A MORE APPROPRIATE OPTION, OR WHERE PERPENDICULAR OR PARALLEL RAMPS 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 4FT. WIDTH MINIMUM. RAMPS SERVICING SHARED USE PATHS SHALL MATCH THE WIDTH OF THE PATH.

(3) RAMP RUNNING SLOPE - 8.3% MAX.

(4) BLENDED 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 RAMPS 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 BLENDED TRANSITION AND DEPRESSED CORNER RAMPS.

TYPE 5 - DEPRESSED CORNER/BLENDED TRANSITION

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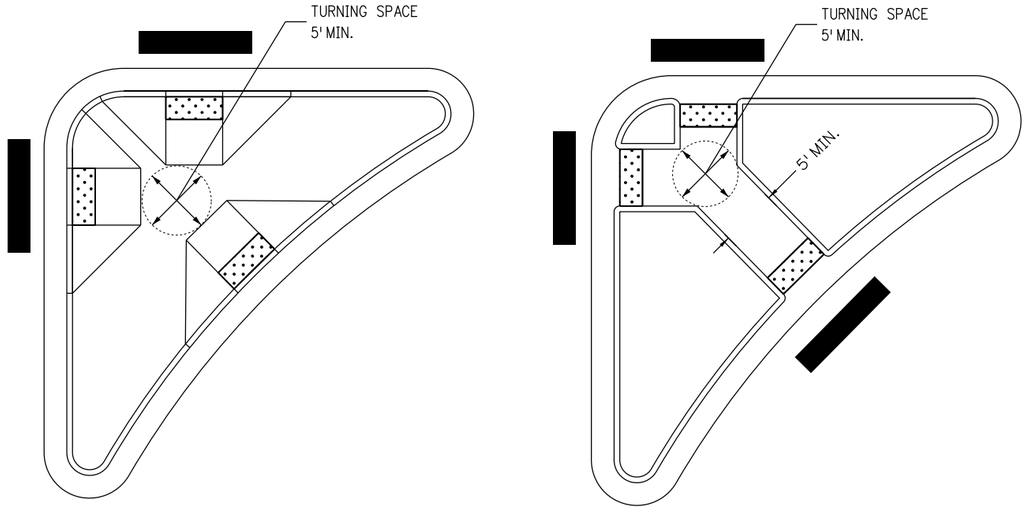
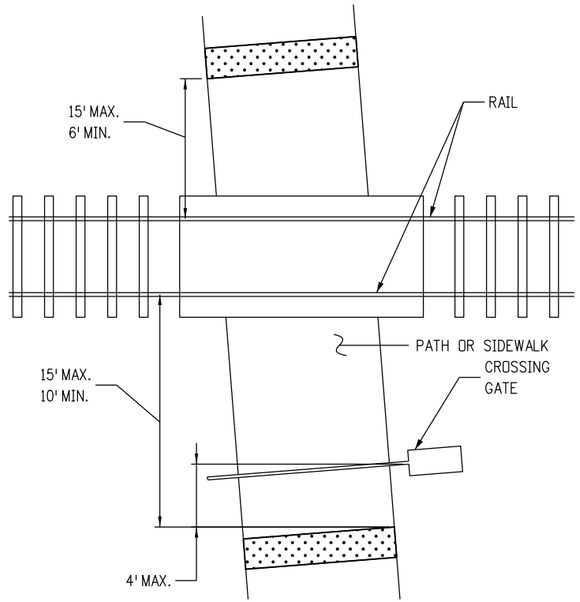


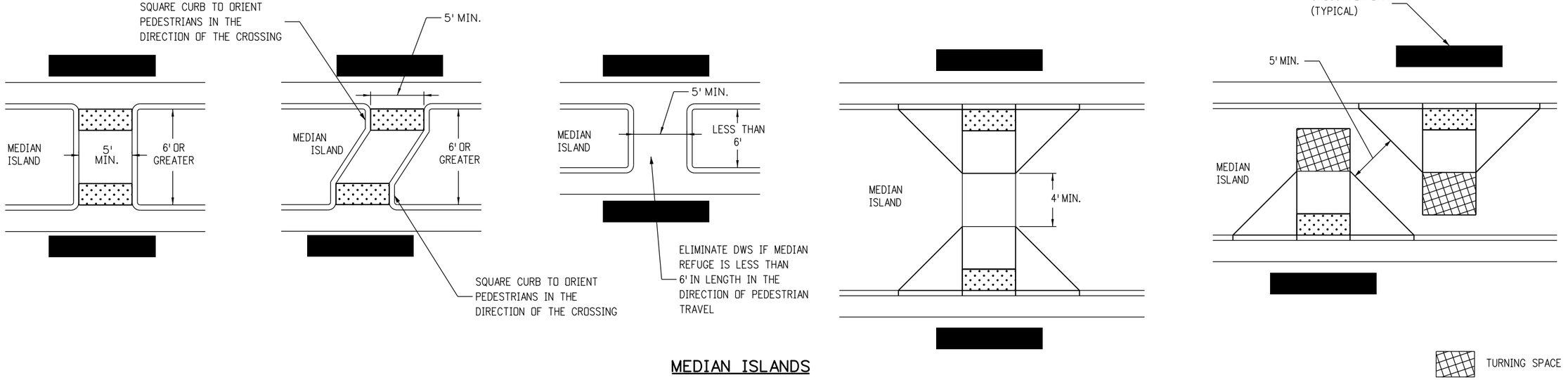
INTERSECTION ISLANDS



AT-GRADE RAIL CROSSING

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.



MEDIAN ISLANDS

MEDIANS / RAILROADS / ISLANDS

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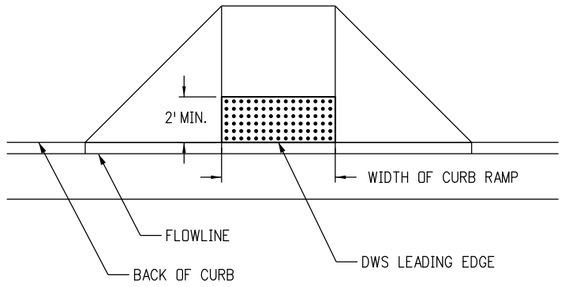
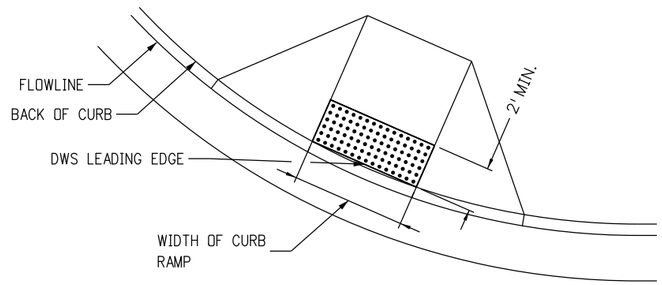
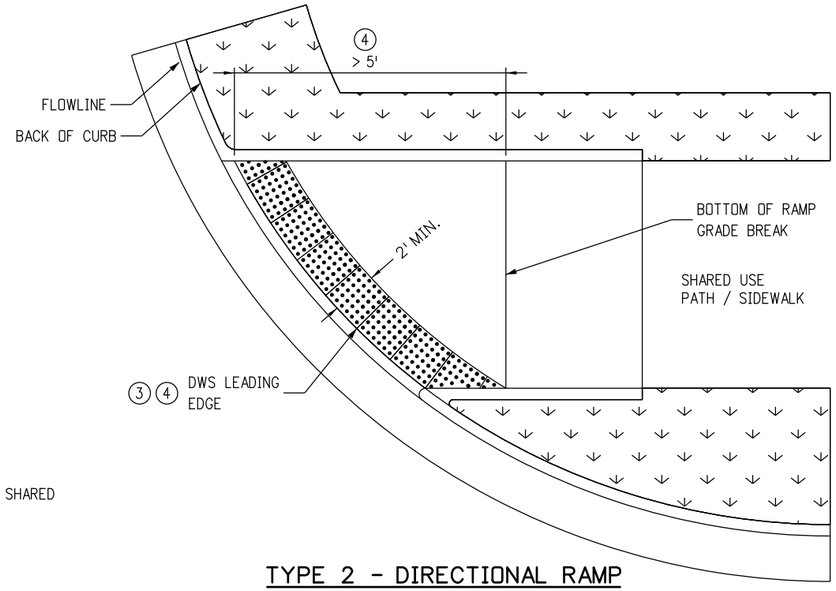


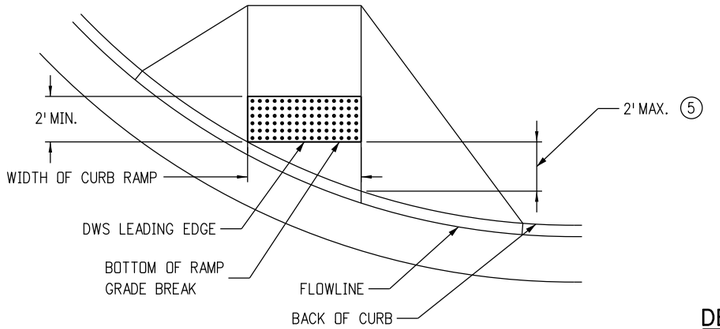
TYPE 1 CURB RAMP
(PERPENDICULAR ON TANGENT)



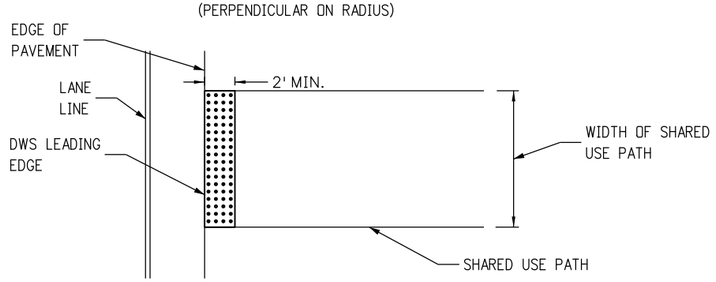
TYPE 1 CURB RAMP
(PERPENDICULAR ON RADIUS)



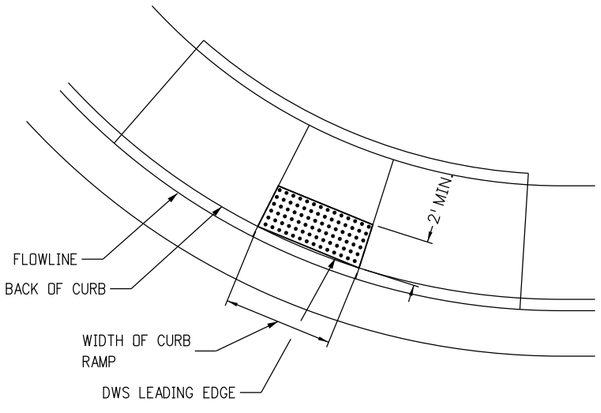
TYPE 2 - DIRECTIONAL RAMP



TYPE 1 CURB RAMP
(DIRECTIONAL ON RADIUS)



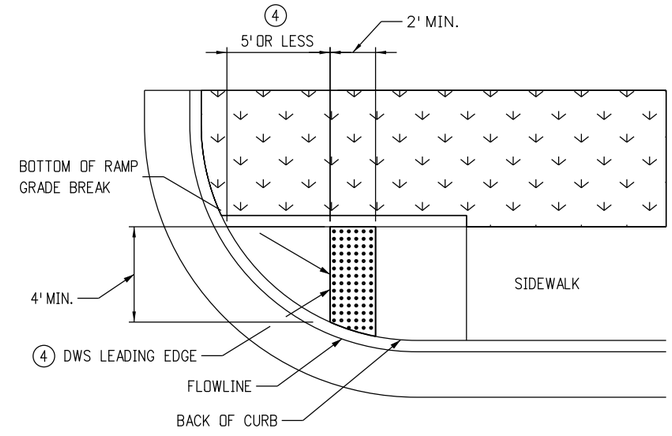
SHARED USE PATH CROSSING



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 EMBEDED 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

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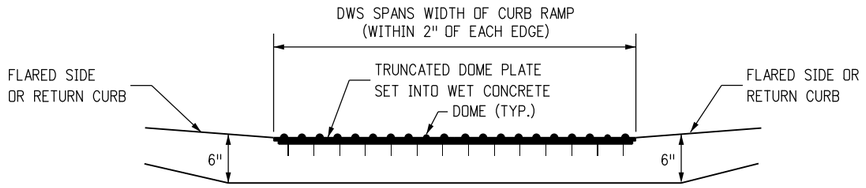
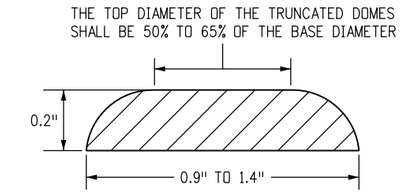
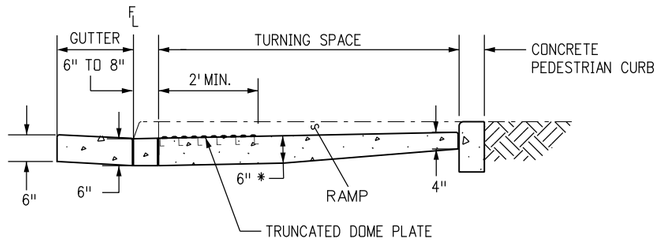


SECTION VIEW OF DETECTABLE WARNING SURFACE PLATE

(LOOKING AT PERPENDICULAR RAMP
RUN FROM STREET)

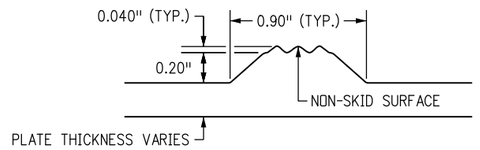


ELEVATION VIEW OF SINGLE TRUNCATED DOME

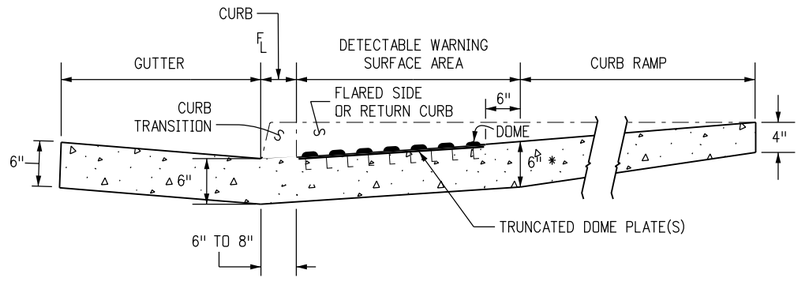


SECTION VIEW FOR PARALLEL CURB RAMP TYPES

(LOOKING PERPENDICULAR TO TURNING SPACE)

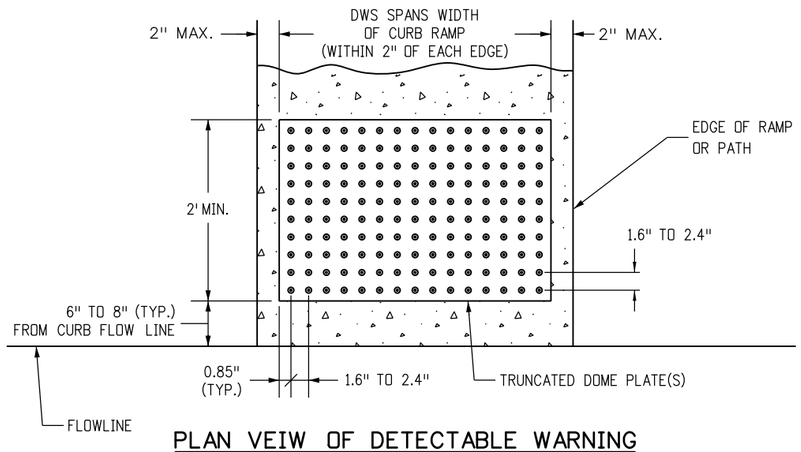


ELEVATION VIEW OF TRUNCATED DOME FOR DETECTABLE WARNING PLATE



SECTION VIEW FOR PERPENDICULAR CURB RAMP TYPES

(LOOKING PERPENDICULAR TO RAMP RUN)



PLAN VEIW OF DETECTABLE WARNING SURFACE PLATE

DETECTABLE WARNING SURFACE DETAILS

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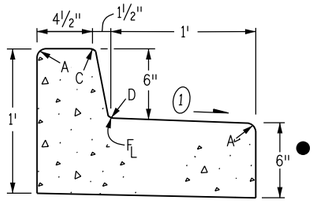
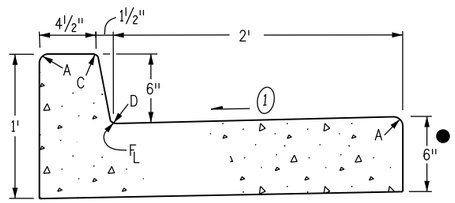
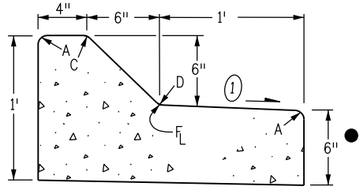


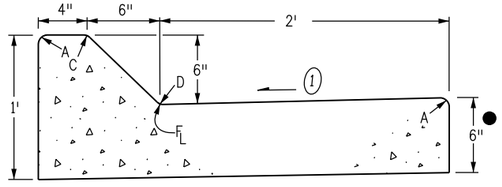
CURB AND GUTTER TYPE 2
(SECTION IB)
(6 IN. BARRIER - 1 FT. GUTTER)



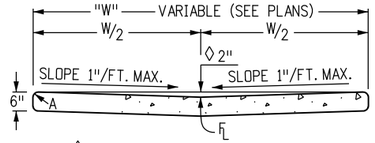
CURB AND GUTTER TYPE 2
(SECTION IIB)
(6 IN. BARRIER - 2 FT. GUTTER)



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

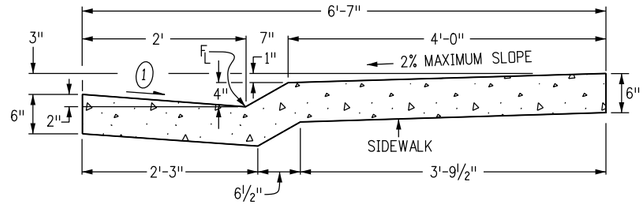


CURB AND GUTTER TYPE 2
(SECTION IIM)
(6 IN. MOUNTABLE - 2 FT. GUTTER)



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

GUTTER TYPE 2



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

GENERAL NOTES

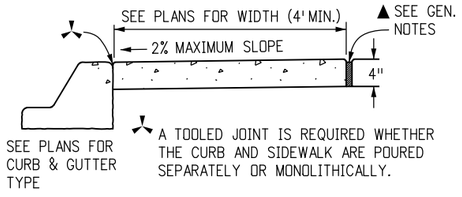
1. ON ROADWAY CURVES WITH A RADIUS OF 1,900 FT. OR LESS, CURBS AND GUTTERS ARE TO BE PLACED ON THE ARC OF THE CURVE, UNLESS OTHERWISE NOTED ON THE PLANS. A MAXIMUM CHORD LENGTH OF 10 FT. MAY BE USED WHEN THE CURVE RADIUS IS GREATER THAN 1,900 FT.
2. CONCRETE SHALL BE CLASS B.
3. PROFILE GRADE OF CURBS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

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

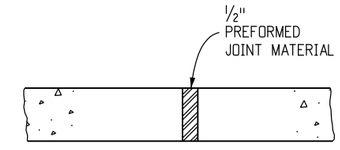
(1) GUTTER CROSS SLOPES SHALL BE ½ IN./FT. WHEN DRAINING AWAY FROM CURB AND 1 IN./FT. WHEN DRAINING TOWARD CURB (WITH EXCEPTION TO IMMEDIATELY ADJACENT TO CURB RAMPS - SEE STANDARD PLAN M-608-1 FOR SLOPE REQUIREMENTS).

● 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.

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



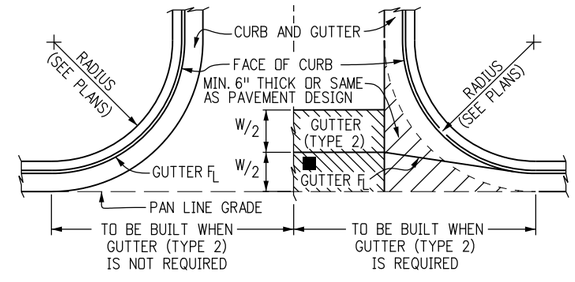
CONCRETE SIDEWALK



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

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

SIDEWALK EXPANSION JOINT



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

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

CONSTRUCTION OF CONCRETE GUTTERS AT INTERSECTION

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Last Modification Date: 07/24/12 Initials: LTA	(R-X)	07/24/12	Changed Tie Bar spacing from 30" to 36".
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CURB, GUTTERS, AND SIDEWALKS

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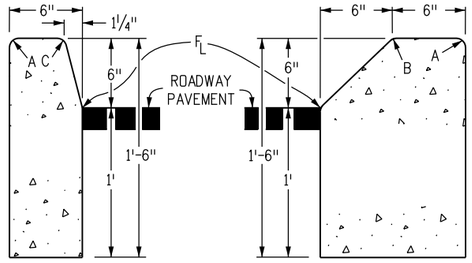
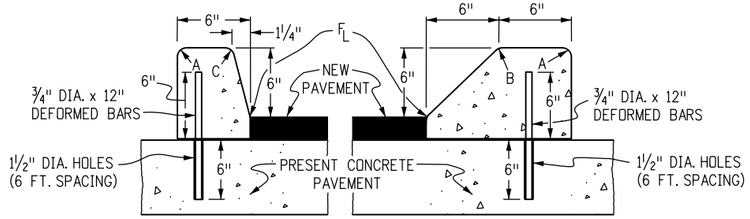


CURB TYPE 2
(SECTION B)
6 IN. BARRIER

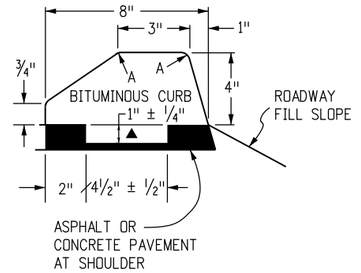
CURB TYPE 2
(SECTION M)
6 IN. MOUNTABLE

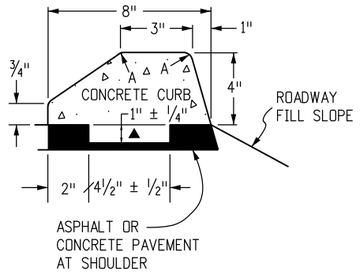


¾" DIA. x 12" DEFORMED REINFORCING BARS AT 6 FT. SPACING SHALL BE GROUTED IN 1¼" DIA. HOLES IN EXISTING CONCRETE. GROUT SHALL CONSIST OF 2 PARTS CLEAN SAND AND 1 PART CEMENT. COST OF INSTALLATION SHALL BE INCLUDED IN THE PRICE BID FOR CURB.

CURB TYPE 4
(SECTION B)
6 IN. BARRIER

CURB TYPE 4
(SECTION M)
6 IN. MOUNTABLE

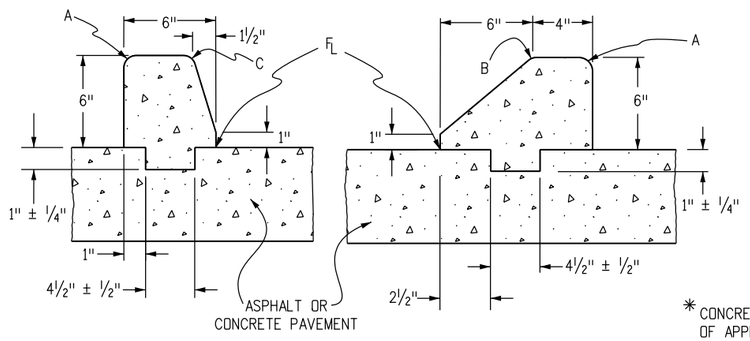




CURB TYPE 6
(SECTION M)
4 IN. MOUNTABLE

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

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



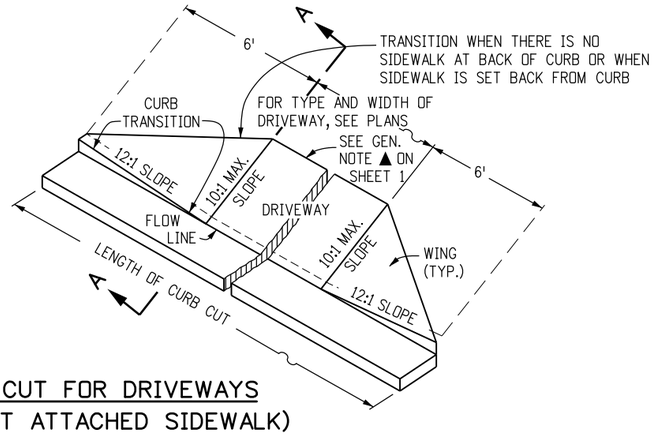
(SECTION B)

(SECTION M)

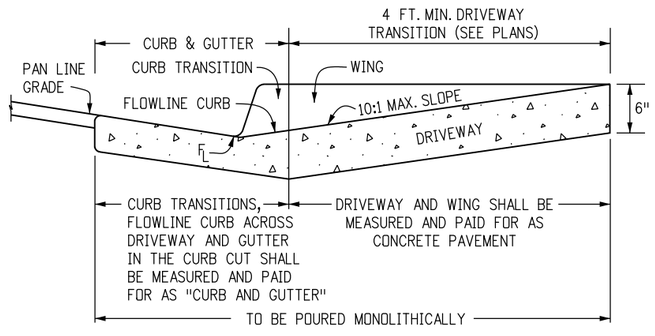
CURB TYPE 4 (KEY-WAY)*

LEGEND FOR RADII
A = ⅛ TO ¼"
B = 1"
C = 1½"
D = 1½" TO 2"

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

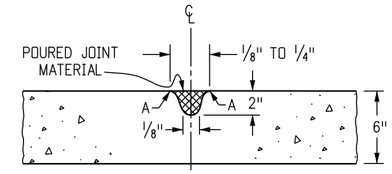


CURB CUT FOR DRIVEWAYS
(WITHOUT ATTACHED SIDEWALK)



SECTION A-A

CONCRETE PAVEMENT (DRIVEWAYS)



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

TRANSVERSE CONTRACTION JOINT
FOR CONCRETE PAVEMENT (DRIVEWAYS)

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CURB, GUTTERS, AND SIDEWALKS

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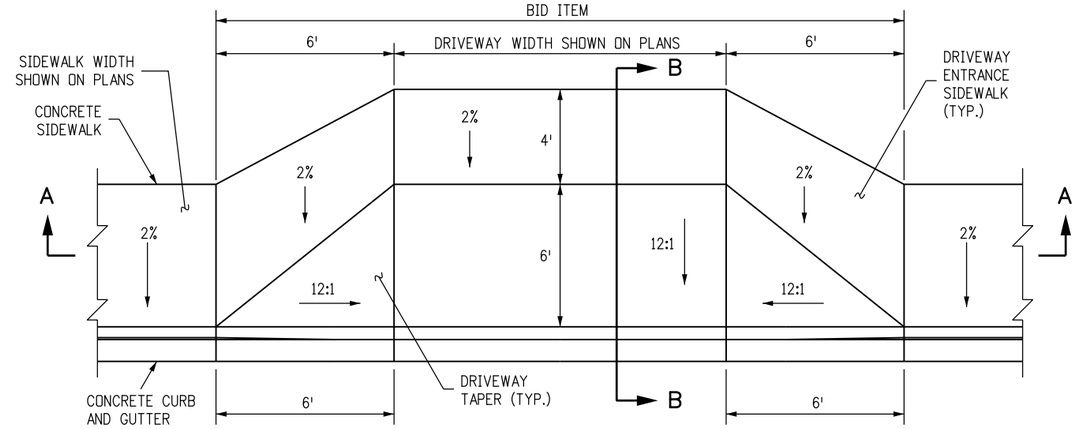
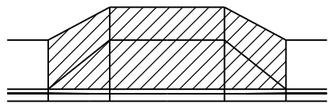
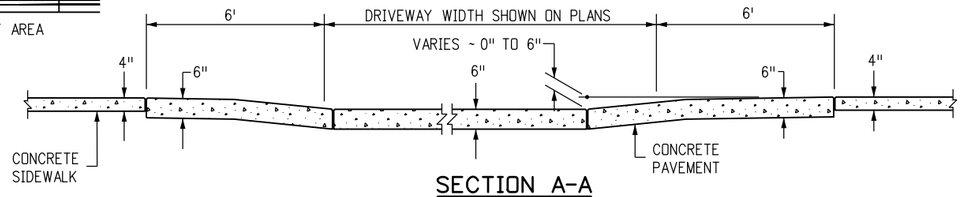
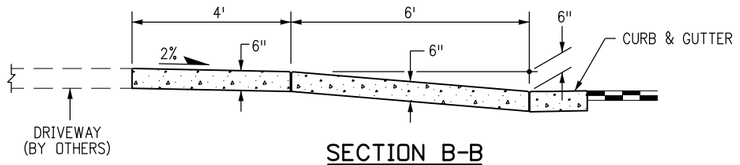


CONCRETE DRIVEWAY ENTRANCE TYPE 1

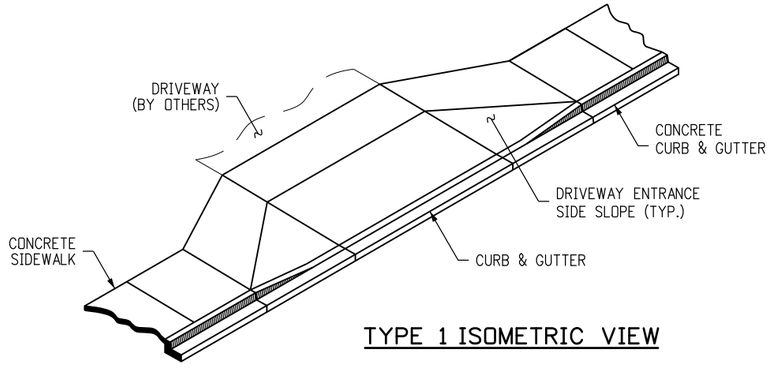




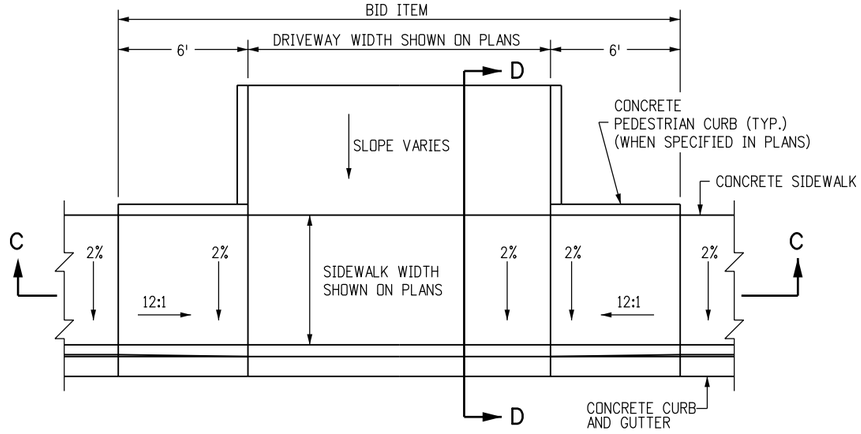
SECTION A-A



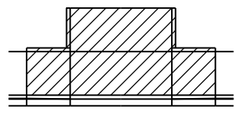
SECTION B-B

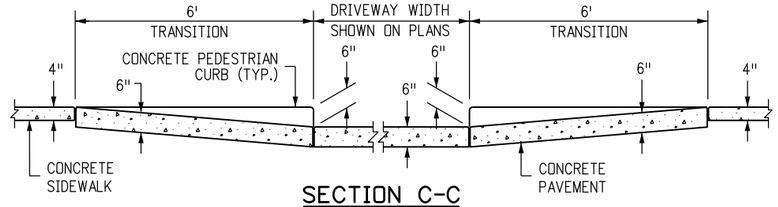


TYPE 1 ISOMETRIC VIEW

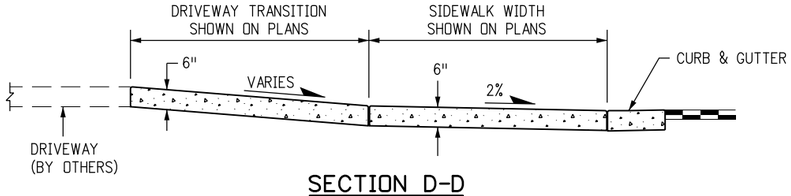


CONCRETE DRIVEWAY ENTRANCE TYPE 2

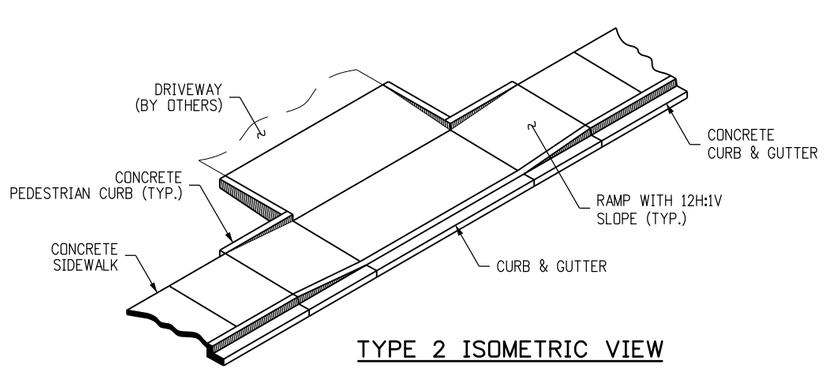




SECTION C-C



SECTION D-D



TYPE 2 ISOMETRIC VIEW

NOTES

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

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CURB, GUTTERS, AND SIDEWALKS

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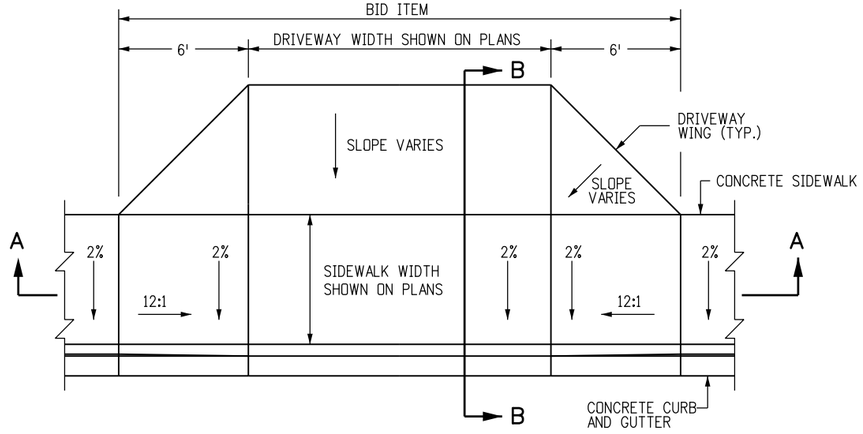

CONCRETE DRIVEWAY ENTRANCE TYPE 3

SECTION A-A

SECTION B-B

CONCRETE PAVEMENT PAY AREA

NOTES

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

TYPE 3 ISOMETRIC VIEW

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CURB, GUTTERS, AND SIDEWALKS

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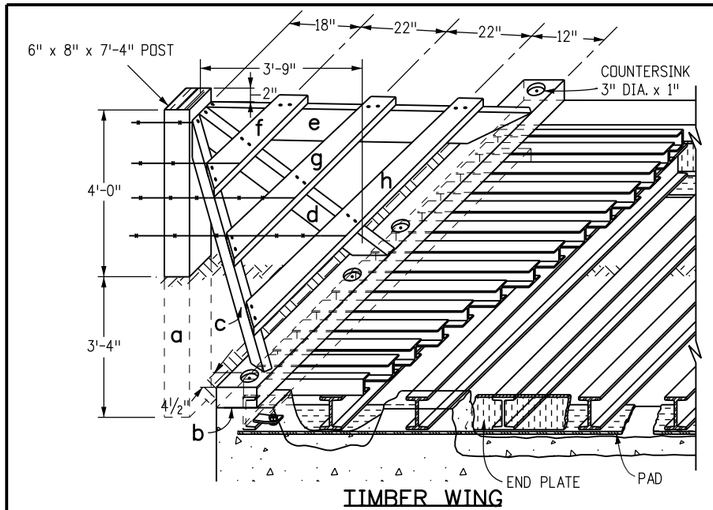
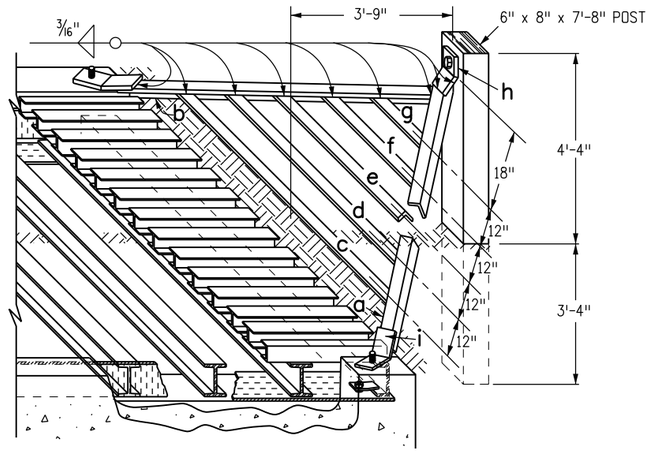
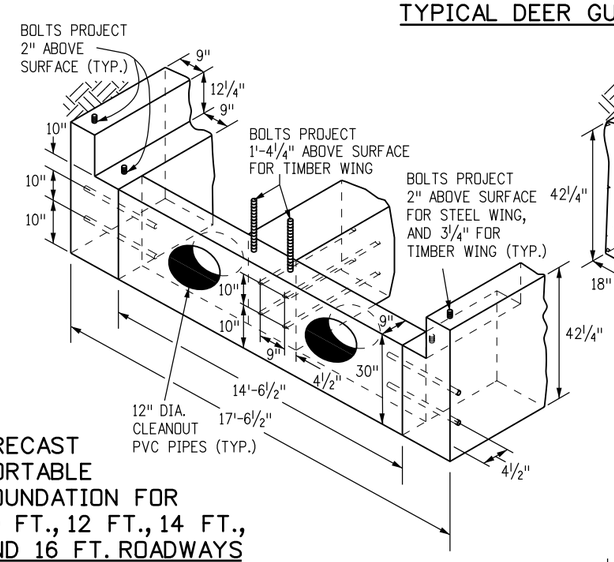


TIMBER WING

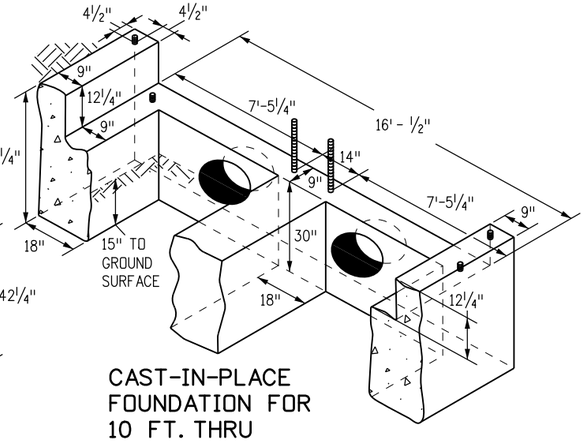


STEEL WING

TYPICAL DEER GUARD INSTALLATIONS



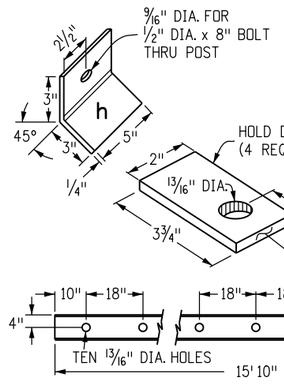
PRECAST PORTABLE FOUNDATION FOR 10 FT., 12 FT., 14 FT., AND 16 FT. ROADWAYS

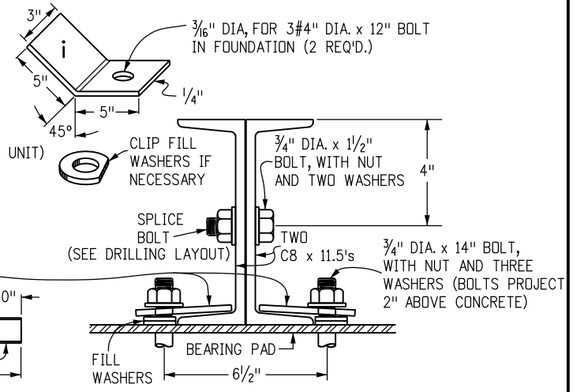


CAST-IN-PLACE FOUNDATION FOR 10 FT. THRU 72' ROADWAYS

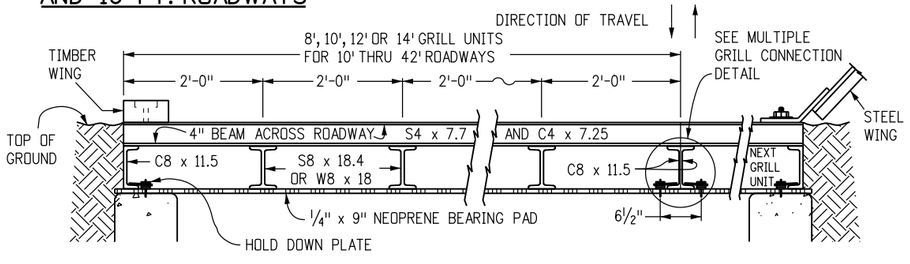
GENERAL NOTES

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 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 CONFOMRANCE WITH AASHTO M 111 OR PAINTED WITH ZINC-RICH PAINT MEETING MILITARY SPECIFICATION DOD-P-21035
6. ALL STRUCTURAL STEEL SHALL CONFORM TO AASHTO M 270 (ASTM A 709) GRADE 36.
7. WELDING SHALL CONFORM TO THE AWS STRUCTURAL WELDING CODE AND AASHTO STANDARD SPECIFICATIONS FOR WELDING OF STRUCTURAL STEEL HIGHWAY BRIDGES.
8. 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 SEPERATELTY, 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 SEPERATELY, BUT SHALL BE INCLUDED IN THE WORK.
13. TOOLED OR SAWCUT JOINTS WILL BE REQUIRED IN THE 4 INCH CONRETE FLOOR AS DIRECTED. DETAIL. THIS WORK WILL NOT BE PAID FOR SEPERATELY, 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.



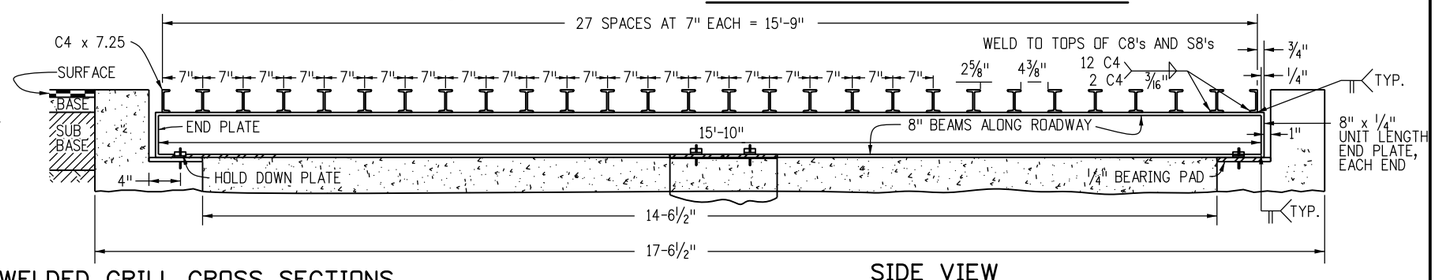


DRILLING LAYOUT



ELEVATION VIEW

MULTIPLE GRILL UNIT CONNECTION



WELDED GRILL CROSS SECTIONS

SIDE VIEW

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DEER GUARD

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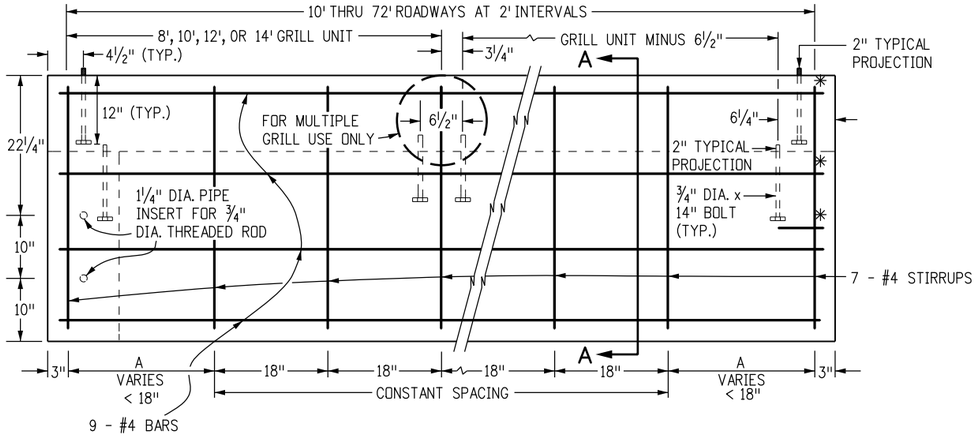
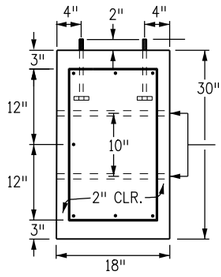
Sheet No. 1 of 2



PRECAST PORTABLE FOUNDATION

CAST-IN-PLACE FOUNDATION



CENTRAL SUPPORT

ELEVATION OF FOUNDATION

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

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

ONE TIMBER WING

a - 2" x 2" x ¼" x 123.70"	32.88 LBS.
b - 2" x 2" x ¼" x 123.70"	32.88 LBS.
c - 2" x 2" x ¼" x 177.93"	47.30 LBS.
d - 1½" x 1½" x ¼" x 141.99"	43.19 LBS.
e - 1½" x 1½" x ¼" x 106.04"	32.25 LBS.
f - 1½" x 1½" x ¼" x 70.09"	21.32 LBS.
g - 1½" x 1½" x ¼" x 34.15"	10.39 LBS.
h - 5" x 6" x ¼" x BAR - 2.13 LBS.	
i - TWO 3" x 10" x ¼" x BARS - 4.25 LBS.	
6" x 8" x 7'-8" TIMBER POST	———
TOTAL LBS. STEEL =	~ 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

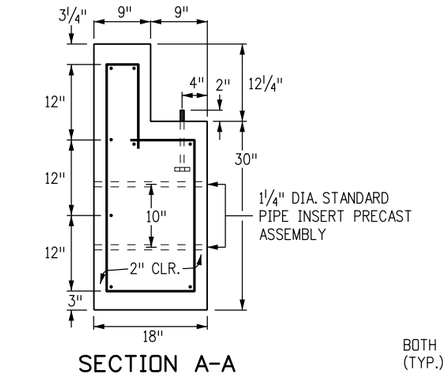
WELDED GRILL UNITS FULL LENGTH

SIZE	WEIGHT (LBS.)
8'	1476
10'	1836
12'	2196
14'	2556

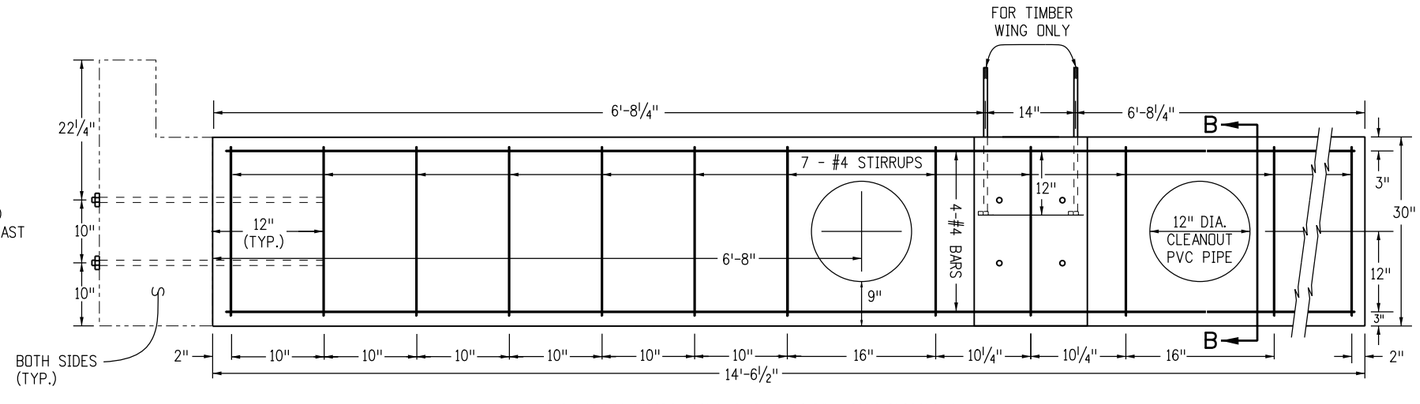
WELDED GRILL UNITS HALF LENGTH

HALF GRILLS SHALL BE BOLTED ON 18 INCH CENTERS MAX. (SEE MULTIPLE GRILL UNIT CONNECTION DETAIL ON SHEET ONE)

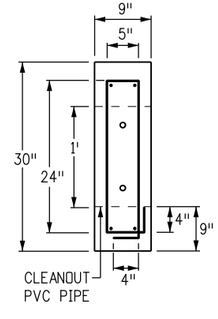
WING QUANTITIES



SECTION A-A
END SECTION OF FOUNDATION



ELEVATION OF LATERAL SUPPORT



SECTION B-B
LATERAL SUPPORT

Computer File Information		Sheet Revisions	
Creation Date: 07/18/14 Initials: DLM		Date:	Comments
Last Modification Date: 04/30/15 Initials: LTA	R-X		
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DEER GUARD

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STANDARD PLAN NO.
M-611-2
Sheet No. 2 of 2