APPLICATION OF STANDARD PLANS

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

These Standard Plans are essential contract documents as described in subsection 105.08 of CDOT's Standard Specifications for Road and Bridge Construction.

Standard Plans that are applicable to a specific project will be identified on the project plans and will not be physically attached to those plans. The designer who specifies any of these Standard Plans for a specific project accepts the responsibility of determining their applicability.

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

These Standard Plans are adopted for use as of July 4, 2006.

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APPLICATION OF STANDARD PLANS

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STANDARD PLAN NO.

Sheet No. 1 of 1

PLAN NUMBER	M STANDARD TITLE	PAGE NUMBER
☐ M-100-1	STANDARD SYMBOLS (3 SHEETS)	1-3
☐ M-203-1	APPROACH ROADS	4
☐ M-203-2	DITCH TYPES	5
☐ M-203-11	SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS (3 SHEETS)	6-8
☐ M-203-12	SUPERELEVATION STREETS (2 SHEETS)	9-10
☐ M-206-1	EXCAVATION AND BACKFILL FOR STRUCTURES (2 SHEETS)	11-12
☐ M-206-2	EXCAVATION AND BACKFILL FOR BRIDGES (2 SHEETS)	13-14
☐ M-208-1	TEMPORARY EROSION CONTROL (7 SHEETS)	15-21
☐ M-210-1	MAILBOX SUPPORTS (2 SHEETS)	22-23
☐ M-214-1	PLANTING DETAILS	24
☐ M-412-1	CONCRETE PAVEMENT JOINTS (5 SHEETS)	25-29
☐ M-510-1	STRUCTURAL PLATE PIPE H-20 LOADING	30
☐ M-601-1	SINGLE CONCRETE BOX CULVERT (2 SHEETS)	31-32
☐ M-601-2	DOUBLE CONCRETE BOX CULVERT (2 SHEETS)	33-34
☐ M-601-3	TRIPLE CONCRETE BOX CULVERT (2 SHEETS)	35-36
☐ M-601-10	HEADWALL FOR PIPES	37
☐ M-601-11	TYPE "S" SADDLE HEADWALLS FOR PIPE	38
☐ M-601-12	HEADWALLS AND PIPE OUTLET PAVING	39
☐ M-601-20	WINGWALLS FOR PIPE OR BOX CULVERTS	40
☐ M-603-1	METAL AND PLASTIC PIPE (2 SHEETS)	41-42
☐ M-603-2	REINFORCED CONCRETE PIPE	43
☐ M-603-3	PRECAST CONCRETE BOX CULVERT	44
☐ M-603-10	CONCRETE AND METAL END SECTIONS (2 SHEETS)	45-46
☐ M-604-10	INLET, TYPE C	47
☐ M-604-11	INLET, TYPE D	48
☐ M-604-12	CURB INLET TYPE R (2 SHEETS)	49-50
☐ M-604-13	CONCRETE INLET TYPE 13	51
☐ M-604-20	MANHOLES (3 SHEETS)	52-54
☐ M-604-25	VANE GRATE INLET (5 SHEETS)	55-59
☐ M-605-1	SUBSURFACE DRAINS	60
☐ M-606-1	GUARDRAIL TYPE 3 W-BEAM (16 SHEETS)	61-76
☐ M-606-13	GUARDRAIL TYPE 7 F-SHAPE BARRIER (4 SHEETS)	77-80
☐ M-606-14	PRECAST TYPE 7 CONCRETE BARRIER (3 SHEETS)	81-83
☐ M-607-1	WIRE FENCES AND GATES (3 SHEETS)	84-86
☐ M-607-2	CHAIN LINK FENCE (3 SHEETS)	87-89
☐ M-607-3	BARRIER FENCE	90
☐ M-607-4	DEER FENCE AND GATES (2 SHEETS)	91-92
☐ M-607-10	PICKET SNOW FENCE	93
☐ M-607-15	ROAD CLOSURE GATE (9 SHEETS)	94-102
☐ M-608-1	CURB RAMPS (4 SHEETS)	103-106
☐ M-609-1	CURBS, GUTTERS, AND SIDEWALKS (3 SHEETS)	107-109
☐ M-611-1	CATTLE GUARD (2 SHEETS)	110-111
☐ M-613-1	ROADWAY LIGHTING (4 SHEETS)	112-115
☐ M-614-1	RUMBLE STRIPS (3 SHEETS)	116-118
☐ M-614-2	SAND BARREL ARRAYS (2 SHEETS)	119-120
☐ M-615-1	EMBANKMENT PROTECTOR TYPE 3	121
☐ M-615-2	EMBANKMENT PROTECTOR TYPE 5	122
☐ M-616-1	INVERTED SIPHON	123
☐ M-620-1	FIELD LABORATORY CLASS 1	124
☐ M-620-2	FIELD LABORATORY CLASS 2	125
☐ M-620-11	FIELD OFFICE CLASS 1	126
☐ M-620-12	FIELD OFFICE CLASS 2	127
☐ M-629-1	SURVEY MONUMENTS (2 SHEETS)	128-129

PLAN NUMBER	S STANDARD TITLE	PAGE NUMBER
☐ S-612-1	DELINEATOR INSTALLATIONS (5 SHEETS)	131-135
☐ S-614-1	GROUND SIGN PLACEMENT (2 SHEETS)	136-137
☐ S-614-2	CLASS I SIGNS	138
☐ S-614-3	CLASS II SIGNS	139
☐ S-614-4	CLASS III SIGNS (3 SHEETS)	140-142
☐ S-614-5	BREAK-AWAY SIGN SUPPORT DETAILS FOR GROUND SIGNS (2 SHEETS)	143-144
☐ S-614-6	CONCRETE FOOTINGS AND SIGN ISLANDS FOR CLASS III SIGNS (2 SHEETS)	145-146
☐ S-614-8	TUBULAR STEEL SIGN SUPPORT DETAILS (5 SHEETS)	147-151
☐ S-614-10	MARKER ASSEMBLY INSTALLATIONS	152
☐ S-614-12	STRUCTURE NUMBER INSTALLATION	153
☐ S-614-14	FLASHING BEACON AND SIGN INSTALLATIONS (3 SHEETS)	154-156
☐ S-614-20	TYPICAL POLE MOUNT SIGN INSTALLATIONS	157
☐ S-614-21	CONCRETE BARRIER SIGN POST INSTALLATIONS	158
☐ S-614-22	TYPICAL MULTI-SIGN INSTALLATIONS	159
☐ S-614-40	TYPICAL TRAFFIC SIGNAL INSTALLATION DETAILS (7 SHEETS)	160-166
☐ S-614-40A	ALTERNATIVE TRAFFIC SIGNAL INSTALLATION DETAILS (5 SHEETS)	167-171
☐ S-614-50	MONOTUBE OVERHEAD SIGNS (14 SHEETS)	172-185
☐ S-627-1	PAVEMENT MARKINGS (5 SHEETS)	186-190
☐ S-630-1	TRAFFIC CONTROLS FOR HIGHWAY CONSTRUCTION (12 SHEETS)	191-202
☐ S-630-2	BARRICADES, DRUMS, CONCRETE BARRIERS (TEMP) AND VERTICAL PANELS	203
☐ S-630-3	FLASHING BEACON (PORTABLE) DETAILS	204

THE STANDARD PLAN SHEETS INDICATED HEREON BY A MARKED BOX ARE TO BE USED TO CONSTRUCT THIS PROJECT.

COLORADO
DEPARTMENT OF TRANSPORTATION

STANDARD PLANS LIST
M&S STANDARDS
JULY 4, 2006

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TABLE OF CONTENTS

Issued By: Project Development Branch on July 04, 2006

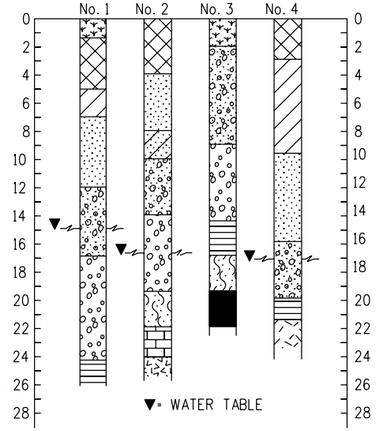
STANDARD PLAN NO.

Sheet No. 1 of 1

LEGEND

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

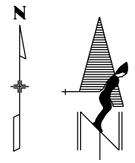
TEST HOLES



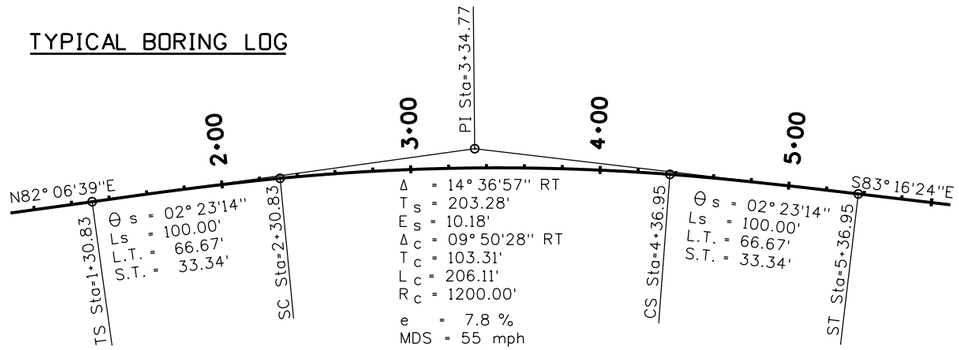
COMPOSITE MATERIALS ARE REPRESENTED BY COMBINATIONS OF THE ABOVE SYMBOLS, SUCH AS:

- SANDY CLAY

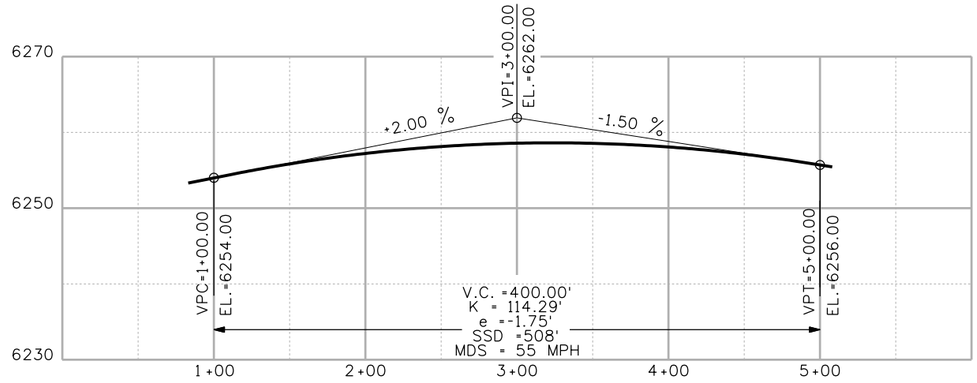
TYPICAL BORING LOG



NORTH ARROW



TYPICAL HORIZONTAL CURVE



TYPICAL VERTICAL CURVE

TERRAIN

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

ROADWAY

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

SURVEY/ROW

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

GENERAL NOTES

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

CURB AND GUTTER

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

GUARDRAIL

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

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

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 WITH GATE

WOOD FENCE WITH GATE

SNOW FENCE WITH GATE

SF SILT FENCE

DEBRIS FENCE

FENCE

DECIDUOUS TREE

DECIDUOUS SHRUB

TEETER TOTTER SYMBOL

SWING SET SYMBOL

CONIFEROUS TREE

CONIFEROUS SHRUB

MISCELLANEOUS TREES

BENCH

SPRINKLER HEAD

TREES GROVE

HEDGE OR SHRUB GROVE

EDGE OF WETLANDS

LANDSCAPING

HAZARD WASTE MONITORING WELL

ENVIRONMENTAL CONCERN SITE

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

PF PLASTIC FENCE

SF SILT FENCE

DEBRIS FENCE

ENVIRONMENTAL CONCERN

HAZARDOUS WASTE SITE

NW NOXIOUS WEED

ENVIRONMENTAL

SA SANITARY SEWER MANHOLE

SIZE, MATERIAL, OWNER

SANITARY SEWER MISCELLANEOUS SYMBOL

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 STORM SEWER MANHOLE

ST STORM SEWER MISCELLANEOUS

STORM SEWER PIPE

STORM SEWER PIPE MISCELLANEOUS

STORM SEWER

W WATER SPIGOT

WATER VALVE

W WATER MANHOLE

FIRE HYDRANT

WATER METER

W WATER WELL SYMBOL

SIZE, MATERIAL, OWNER

W WATER LINE

W? WATER MISCELLANEOUS LINE

WATER

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STANDARD PLAN NO.
M-100-1
Sheet No. 2 of 3

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

GAS

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

OIL

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

MISCELLANEOUS TOPOGRAPHY

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

CAMPING

LIGHT STANDARD
HIGH MAST LIGHT STANDARD
SPOT OR FLOOD LIGHT

LIGHTING

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

ELECTRICAL

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

TELEVISION

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

TELEPHONE

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

TRAFFIC STRIPING

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

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
TRAFFIC CONDUIT

TRAFFIC SIGNAL

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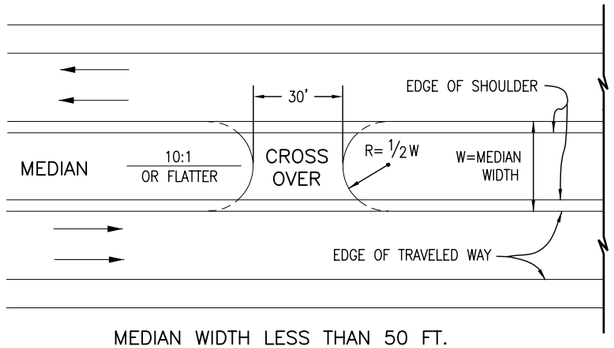
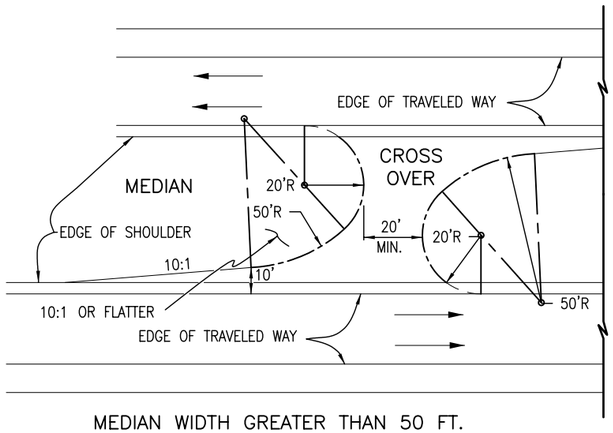
M-100-1
Sheet No. 3 of 3



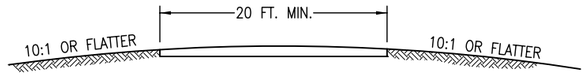
MEDIAN WIDTH LESS THAN 50 FT.



MEDIAN WIDTH GREATER THAN 50 FT.

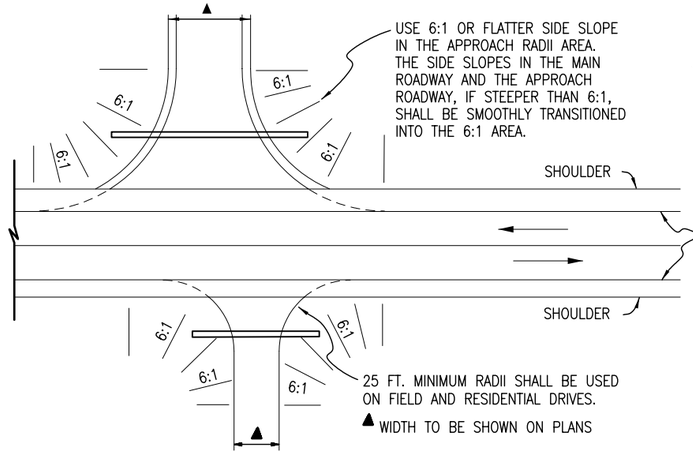
TYPICAL PLANS FOR EMERGENCY MEDIAN CROSS OVER

LOCATION OF RADIUS POINTS MAY BE ADJUSTED FOR BEST FIT



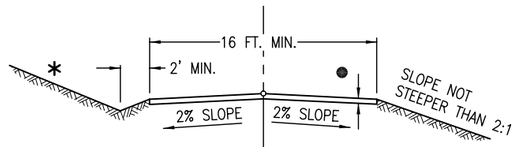
TYPICAL SECTION FOR MEDIAN CROSS OVER

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

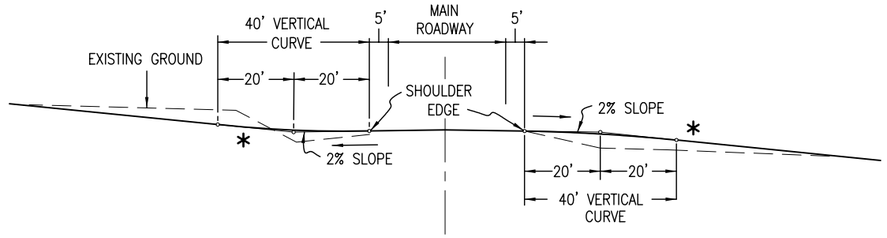


1/2 CUT SECTION 1/2 FILL SECTION

TYPICAL SECTION FOR APPROACH ROAD

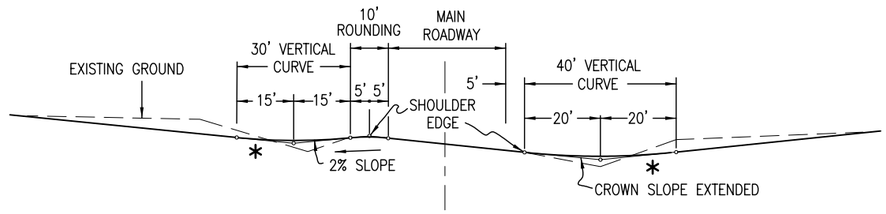
- ROAD APPROACHES WHICH REQUIRE HMA PAVEMENT, SHALL BE PLACED AS FOLLOWS:

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

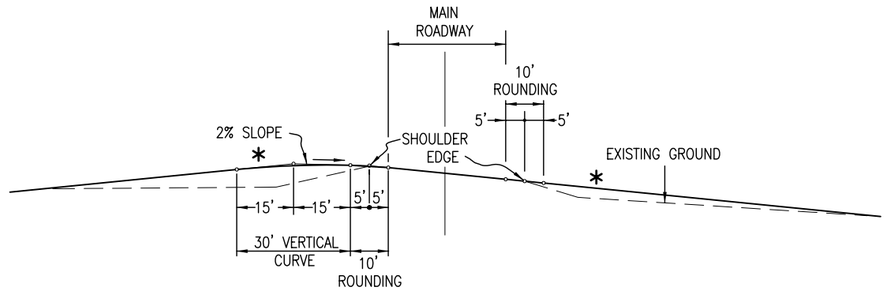


1/2 CUT SECTION 1/2 FILL SECTION

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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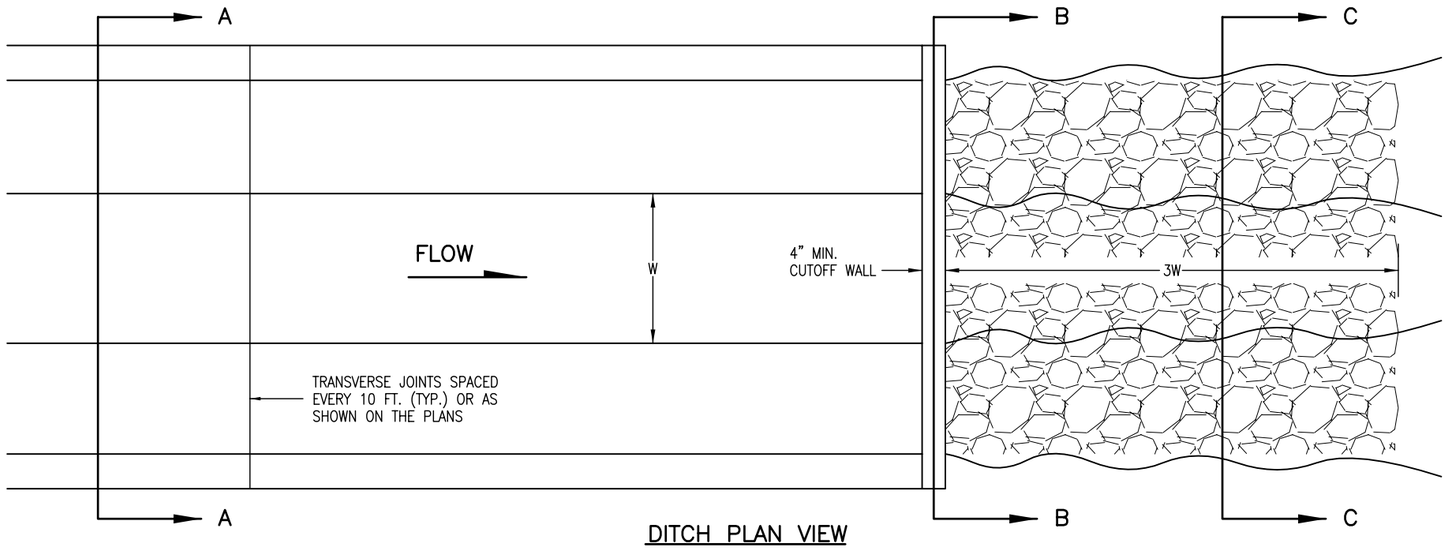
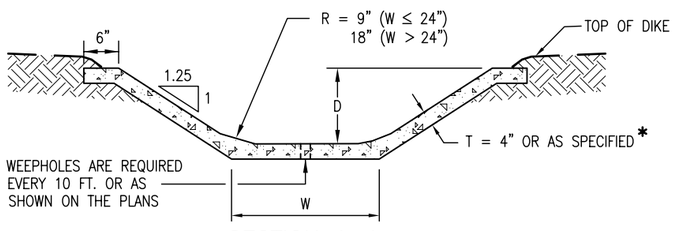
APPROACH ROADS

Issued By: Project Development Branch on July 04, 2006

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



DITCH PLAN VIEW

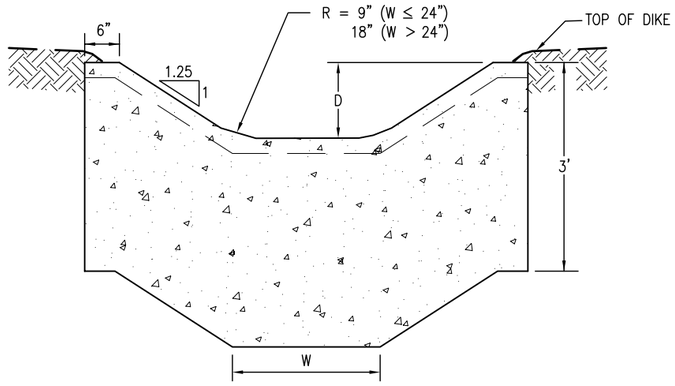


SECTION A–A
CONCRETE–LINED DITCH

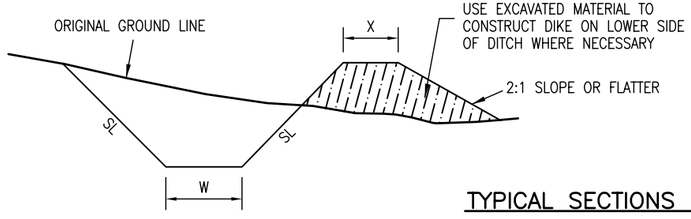
* FOR SECTIONS WHERE W ≤ 18"
AND D ≤ 18" USE T=3"

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

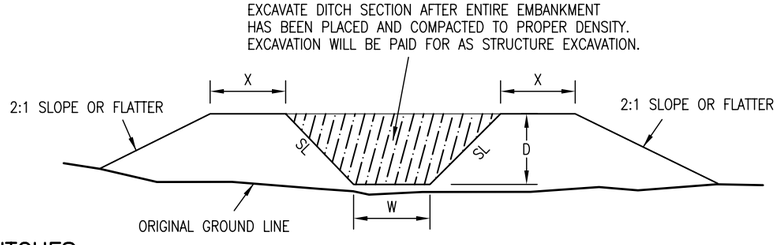
CONCRETE–LINED DITCH
QUANTITIES



SECTION B–B
CUTOFF WALL



CUT SECTIONS



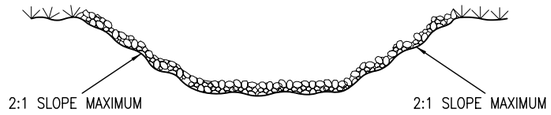
EMBANKMENT SECTIONS

TYPICAL SECTIONS FOR DITCHES

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

GENERAL NOTES

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



SECTION C–C
RIPRAP–LINED DITCH

RIPRAP GRADATION SHALL BE AS SPECIFIED IN THE CONTRACT.

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CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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DITCH TYPES

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

$e_{max} = 8\%$ TABLE CONTINUES ON SHEET 2.

	V_d = 15 mph			V_d = 20 mph			V_d = 25 mph			V_d = 30 mph			V_d = 35 mph			V_d = 40 mph			V_d = 45 mph			V_d = 50 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)	
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	676–<932	31	46	1190–<1640	32	49	1720–<2370	34	51	2370–<3240	36	55	3120–<4260	39	58	3970–<5410	41	62	4930–<6710	44	67	5990–<8150	48	72	2.0
2.2	605–<676	34	51	1070–<1190	36	54	1550–<1720	38	57	2130–<2370	40	60	2800–<3120	43	64	3570–<3970	46	68	4440–<4930	49	73	5400–<5990	53	79	2.2
2.4	546–<605	37	55	959–<1070	39	58	1400–<1550	41	62	1930–<2130	44	65	2540–<2800	46	70	3240–<3570	50	74	4030–<4440	53	80	4910–<5400	58	86	2.4
2.6	496–<546	40	60	872–<959	42	63	1280–<1400	45	67	1760–<1930	47	71	2320–<2540	50	75	2960–<3240	54	81	3690–<4030	58	87	4490–<4910	62	94	2.6
2.8	453–<496	43	65	796–<872	45	68	1170–<1280	48	72	1610–<1760	51	76	2130–<2320	54	81	2720–<2960	58	87	3390–<3690	62	93	4130–<4490	67	101	2.8
3.0	415–<453	46	69	730–<796	49	73	1070–<1170	51	77	1480–<1610	55	82	1960–<2130	58	87	2510–<2720	62	93	3130–<3390	67	100	3820–<4130	72	108	3.0
3.2	382–<415	49	74	672–<730	52	78	985–<1070	55	82	1370–<1480	58	87	1820–<1960	62	93	2330–<2510	66	99	2900–<3130	71	107	3550–<3820	77	115	3.2
3.4	352–<382	52	78	620–<672	55	83	911–<985	58	87	1270–<1370	62	93	1690–<1820	66	99	2170–<2330	70	106	2700–<2900	76	113	3300–<3550	82	122	3.4
3.6	324–<352	55	83	572–<620	58	88	845–<911	62	93	1180–<1270	65	98	1570–<1690	70	105	2020–<2170	74	112	2520–<2700	80	120	3090–<3300	86	130	3.6
3.8	300–<324	58	88	530–<572	62	92	784–<845	65	98	1100–<1180	69	104	1470–<1570	74	110	1890–<2020	79	118	2360–<2520	84	127	2890–<3090	91	137	3.8
4.0	277–<300	62	92	490–<530	65	97	729–<784	69	103	1030–<1100	73	109	1370–<1470	77	116	1770–<1890	83	124	2220–<2360	89	133	2720–<2890	96	144	4.0
4.2	255–<277	65	97	453–<490	68	102	678–<729	72	108	955–<1030	76	115	1280–<1370	81	122	1660–<1770	87	130	2080–<2220	93	140	2560–<2720	101	151	4.2
4.4	235–<255	68	102	418–<453	71	107	630–<678	75	113	893–<955	80	120	1200–<1280	85	128	1560–<1660	91	137	1960–<2080	98	147	2410–<2560	106	158	4.4
4.6	215–<235	71	106	384–<418	75	112	585–<630	79	118	834–<893	84	125	1130–<1200	89	134	1470–<1560	95	143	1850–<1960	102	153	2280–<2410	110	166	4.6
4.8	193–<215	74	111	349–<384	78	117	542–<585	82	123	779–<834	87	131	1060–<1130	93	139	1390–<1470	99	149	1750–<1850	107	160	2160–<2280	115	173	4.8
5.0	172–<193	77	115	314–<349	81	122	499–<542	86	129	727–<779	91	136	991–<1060	97	145	1310–<1390	103	155	1650–<1750	111	167	2040–<2160	120	180	5.0
5.2	154–<172	80	120	284–<314	84	126	457–<499	89	134	676–<727	95	142	929–<991	101	151	1230–<1310	108	161	1560–<1650	116	173	1930–<2040	125	187	5.2
5.4	139–<154	83	125	258–<284	88	131	420–<457	93	139	627–<676	98	147	870–<929	105	157	1160–<1230	112	168	1480–<1560	120	180	1830–<1930	130	194	5.4
5.6	126–<139	86	129	236–<258	91	136	387–<420	96	144	582–<627	102	153	813–<870	108	163	1090–<1160	116	174	1390–<1480	124	187	1740–<1830	134	202	5.6
5.8	115–<126	89	134	216–<236	94	141	358–<387	99	149	542–<582	105	158	761–<813	112	168	1030–<1090	120	180	1320–<1390	129	193	1650–<1740	139	209	5.8
6.0	105–<115	92	138	199–<216	97	146	332–<358	103	154	506–<542	109	164	713–<761	116	174	965–<1030	124	186	1250–<1320	133	200	1560–<1650	144	216	6.0
6.2	97–<105	95	143	184–<199	101	151	308–<332	106	159	472–<506	113	169	669–<713	120	180	909–<965	128	192	1180–<1250	138	207	1480–<1560	149	223	6.2
6.4	89–<97	98	148	170–<184	104	156	287–<308	110	165	442–<472	116	175	628–<669	124	186	857–<909	132	199	1110–<1180	142	213	1400–<1480	154	230	6.4
6.6	82–<89	102	152	157–<170	107	161	267–<287	113	170	413–<442	120	180	590–<628	128	192	808–<857	137	205	1050–<1110	147	220	1330–<1400	158	238	6.6
6.8	76–<82	105	157	146–<157	110	165	248–<267	117	175	386–<413	124	185	553–<590	132	197	761–<808	141	211	990–<1050	151	227	1260–<1330	163	245	6.8
7.0	70–<76	108	162	135–<146	114	170	231–<248	120	180	360–<386	127	191	518–<553	135	203	716–<761	145	217	933–<990	156	233	1190–<1260	168	252	7.0
7.2	64–<70	111	166	125–<135	117	175	214–<231	123	185	336–<360	131	196	485–<518	139	209	672–<716	149	223	878–<933	160	240	1120–<1190	173	259	7.2
7.4	59–<64	114	171	115–<125	120	180	198–<214	127	190	312–<336	135	202	451–<485	143	215	628–<672	153	230	822–<878	164	247	1060–<1120	178	266	7.4
7.6	54–<59	117	175	105–<115	123	185	182–<198	130	195	287–<312	138	207	417–<451	147	221	583–<628	157	236	765–<822	169	253	980–<1060	182	274	7.6
7.8	48–<54	120	180	94–<105	126	190	164–<182	134	201	261–<287	142	213	380–<417	151	226	533–<583	161	242	701–<765	173	260	901–<980	187	281	7.8
8.0	38–<48	123	185	76–<94	130	195	134–<164	137	206	214–<261	145	218	314–<380	155	232	444–<533	166	248	587–<701	178	267	758–<901	192	288	8.0

SUPERELEVATION NOTES

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

e = SUPERELEVATION RATE

R – RADIUS OF CURVE

V_d – ASSUMED DESIGN SPEED

L – LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH

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SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS

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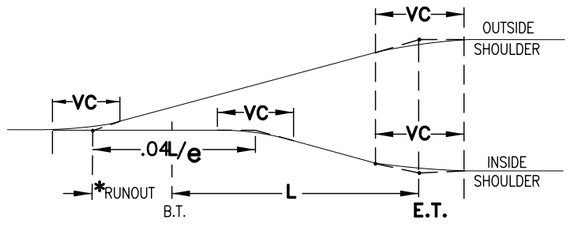
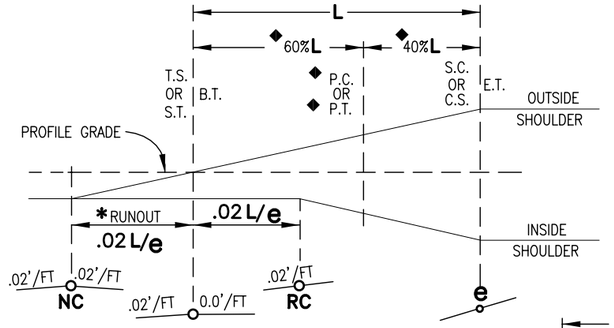
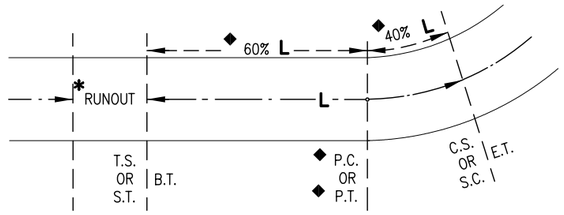
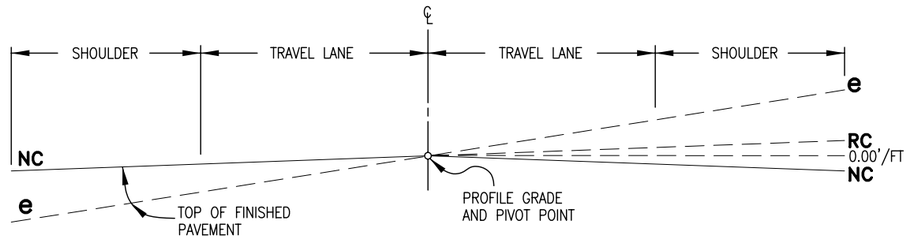
STANDARD PLAN NO. M-203-11

Sheet No. 1 of 3









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

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

○ = PIVOT

◆ = WHEN CURVE IS NOT SPIRALLED.

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

SUPERELEVATION DIAGRAMS FOR CROWNED HIGHWAYS

e_{max} = 8% TABLE CONTINUED FROM SHEET 1.

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

R – RADIUS OF CURVE
V_d – ASSUMED DESIGN SPEED
L – LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH
NC – NORMAL CROWN SECTION
RC – REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE
VC – VERTICAL CURVE

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

SUPERELEVATION NOTES

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

Computer File Information		Sheet Revisions	
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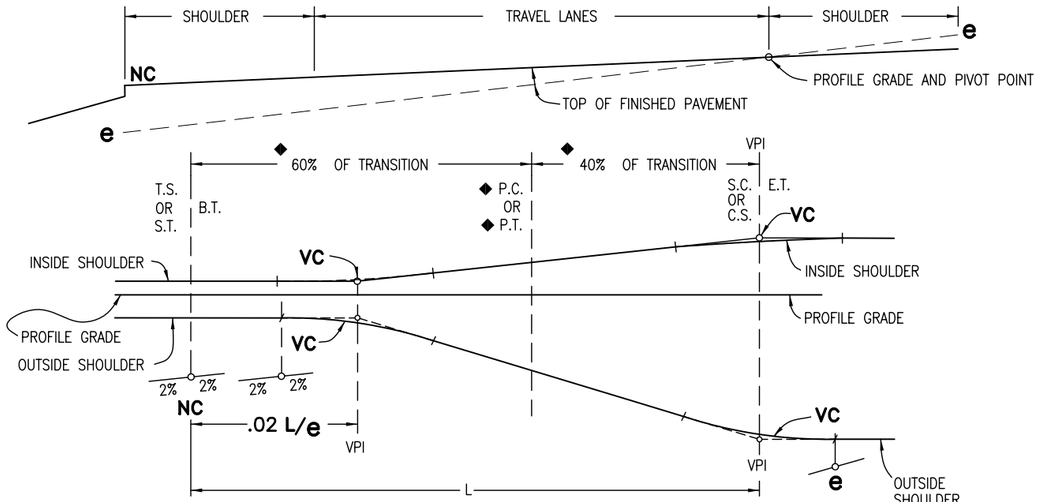
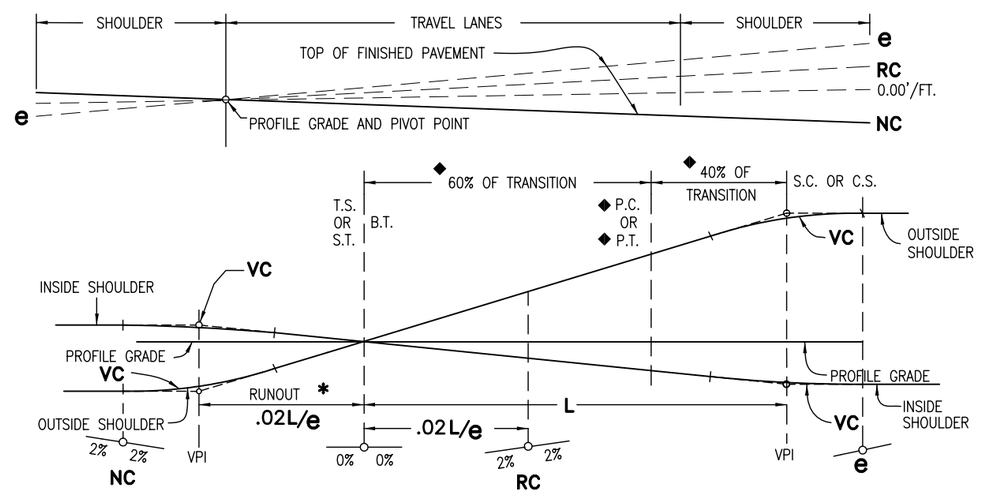
SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS

Issued By: Project Development Branch on July 04, 2006

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



DIAGRAMMATIC PROFILE FOR SUPERELEVATION OF INSIDE LANES



DIAGRAMMATIC PROFILE FOR SUPERELEVATION OF OUTSIDE LANES

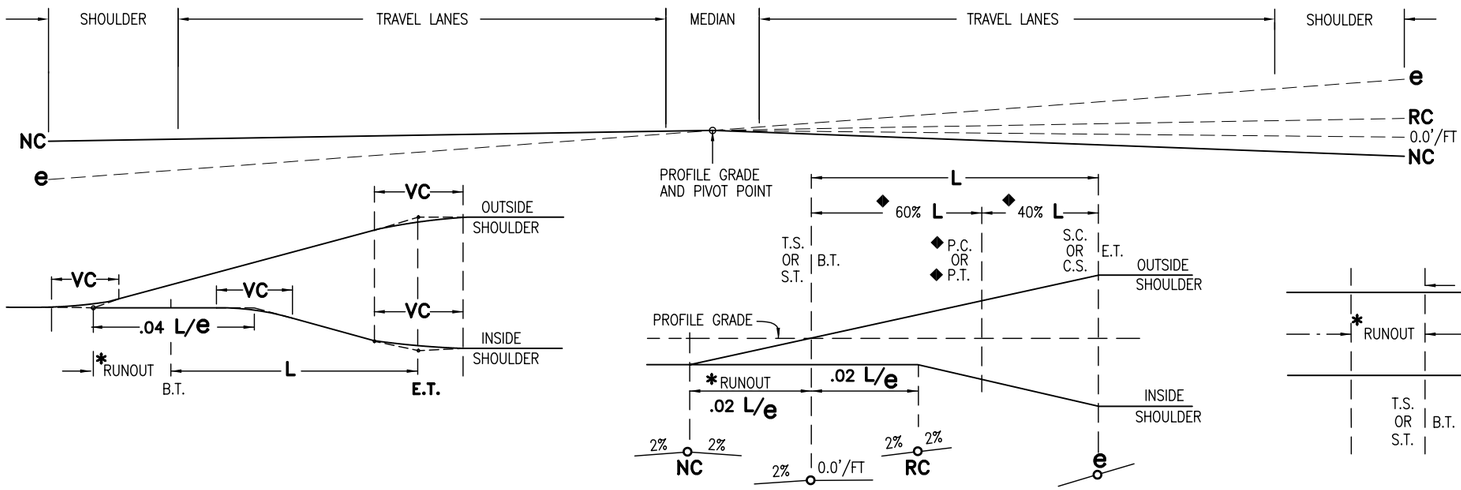
SUPERELEVATION DIAGRAMS FOR DIVIDED HIGHWAYS SHOULDER PIVOT

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

R – RADIUS OF CURVE
V_d – ASSUMED DESIGN SPEED
L – LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH
NC – NORMAL CROWN SECTION
RC – REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE

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

PT – POINT OF TANGENT
CS – CURVE TO SPIRAL
SC – SPIRAL TO CURVE



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

SUPERELEVATION DIAGRAMS FOR DIVIDED HIGHWAY CENTER PIVOT

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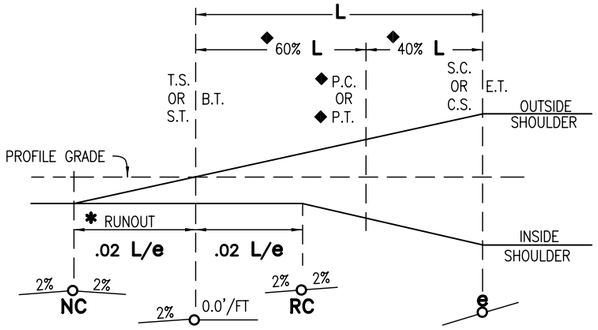
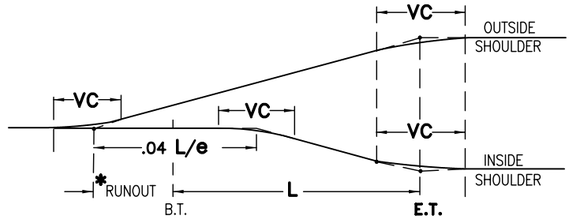
SUPERELEVATION CROWNED AND DIVIDED HIGHWAYS

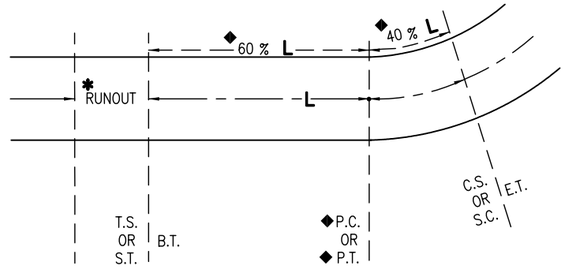
Issued By: Project Development Branch on July 04, 2006

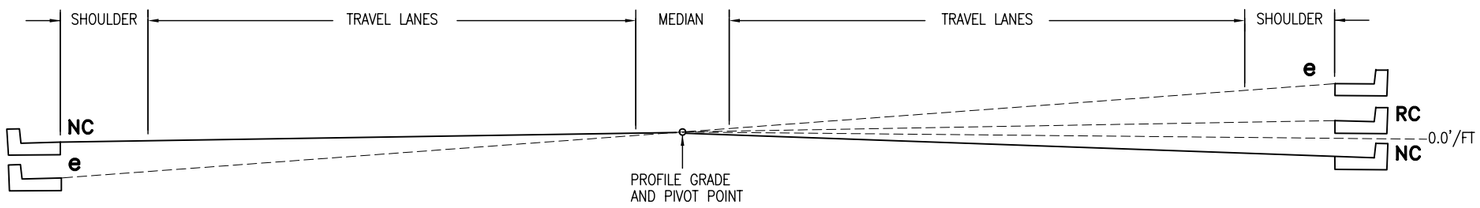
STANDARD PLAN NO.
M-203-11
Sheet No. 3 of 3





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





o = PIVOT

◆ = WHEN CURVE IS NOT SPIRALLED.

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

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

R – RADIUS OF CURVE
V_d – ASSUMED DESIGN SPEED
L – LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH
NC – NORMAL CROWN SECTION
RC – REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE
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ST – SPIRAL TO TANGENT
PC – POINT OF CURVATURE
PI – POINT OF INTERSECTION
PT – POINT OF TANGENT
CS – CURVE TO SPIRAL
SC – SPIRAL TO CURVE

SUPERELEVATION DIAGRAMS

e_{max} = 4%

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

	V_d = 15 mph			V_d = 20 mph			V_d = 25 mph			V_d = 30 mph			V_d = 35 mph			V_d = 40 mph			V_d = 45 mph			V_d = 50 mph			V_d = 55 mph			V_d = 60 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	506–<796	31	46	902–<1410	32	49	1340–<2050	34	51	1880–<2830	36	55	2490–<3730	39	58	3220–<4770	41	62	4040–<5930	44	67	4940–<7220	48	72	5950–<8650	51	77	7080–<10300	53	80	2.0
2.2	399–<506	34	51	723–<902	36	54	1110–<1340	38	57	1580–<1880	40	60	2120–<2490	43	64	2760–<3220	46	68	3480–<4040	49	73	4280–<4940	53	79	5180–<5950	56	84	6190–<7080	59	88	2.2
2.4	271–<399	37	55	513–<723	39	58	838–<1110	41	62	1270–<1580	44	65	1760–<2120	46	70	2340–<2760	50	74	2980–<3480	53	80	3690–<4280	58	86	4500–<5180	61	92	5410–<6190	64	96	2.4
2.6	201–<271	40	60	388–<513	42	63	650–<838	45	67	1000–<1270	47	71	1420–<1760	50	75	1930–<2340	54	81	2490–<2980	58	87	3130–<3690	62	94	3870–<4500	66	100	4700–<5410	69	104	2.6
2.8	157–<201	43	65	308–<388	45	68	524–<650	48	72	817–<1000	51	76	1170–<1420	54	81	1620–<1930	58	87	2100–<2490	62	93	2660–<3130	67	101	3310–<3870	71	107	4060–<4700	75	112	2.8
3.0	127–<157	46	69	251–<308	49	73	433–<524	51	77	681–<817	55	82	982–<1170	58	87	1370–<1620	62	93	1800–<2100	67	100	2290–<2660	72	108	2860–<3310	77	115	3530–<4060	80	120	3.0
3.2	105–<127	49	74	209–<251	52	78	363–<433	55	82	576–<681	58	87	835–<982	62	93	1180–<1370	66	99	1550–<1800	71	107	1980–<2290	77	115	2490–<2860	82	123	3090–<3530	85	128	3.2
3.4	88–<105	52	78	175–<209	55	83	307–<363	58	87	490–<576	62	93	714–<835	66	99	1010–<1180	70	106	1340–<1550	76	113	1720–<1980	82	122	2170–<2490	87	130	2700–<3090	91	136	3.4
3.6	73–<88	55	83	147–<175	58	88	259–<307	62	93	416–<490	65	98	610–<714	70	105	865–<1010	74	112	1150–<1340	80	120	1480–<1720	86	130	1880–<2170	92	138	2350–<2700	96	144	3.6
3.8	61–<73	58	88	122–<147	62	92	215–<259	65	98	348–<416	69	104	512–<610	74	110	730–<865	79	118	970–<1150	84	127	1260–<1480	91	137	1660–<1880	97	146	2010–<2350	101	152	3.8
4.0	42–<61	62	92	86–<122	65	97	154–<215	69	103	250–<348	73	109	371–<512	77	116	533–<730	83	124	711–<970	89	133	926–<1260	96	144	1190–<1660	102	153	1500–<2010	107	160	4.0

SUPERELEVATION NOTES

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

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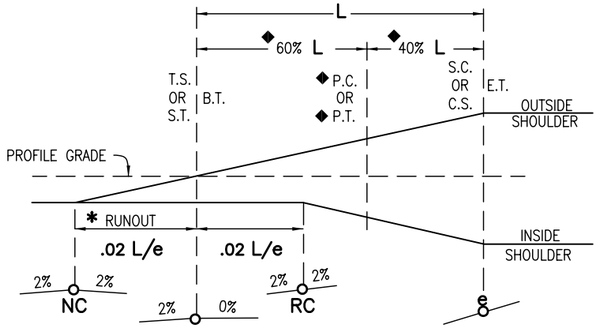
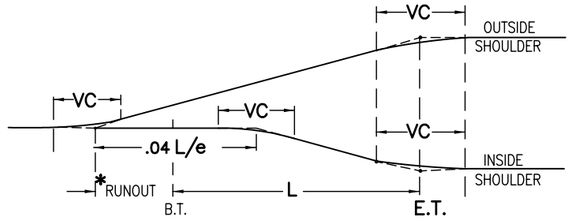
SUPERELEVATION STREETS

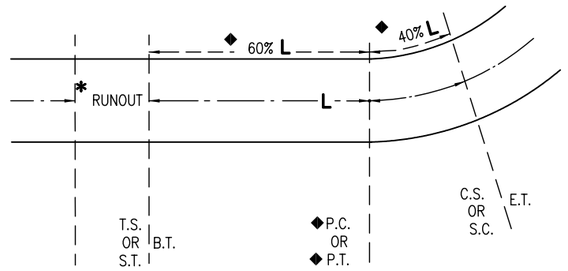
Issued By: Project Development Branch on July 04, 2006

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





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



R – RADIUS OF CURVE

V_d – ASSUMED DESIGN SPEED

L – LENGTH OF SUPERELEVATION RUNOFF OR SPIRAL LENGTH

NC – NORMAL CROWN SECTION

RC – REMOVE ADVERSE CROWN, SUPERELEVATE AT NORMAL CROWN SLOPE

VC – VERTICAL CURVE

BT – BEGINNING OF TRANSITION

ET – ENDING OF TRANSITION

TS – TANGENT TO SPIRAL

ST – SPIRAL TO TANGENT

PC – POINT OF CURVATURE

PI – POINT OF INTERSECTION

PT – POINT OF TANGENT

CS – CURVE TO SPIRAL

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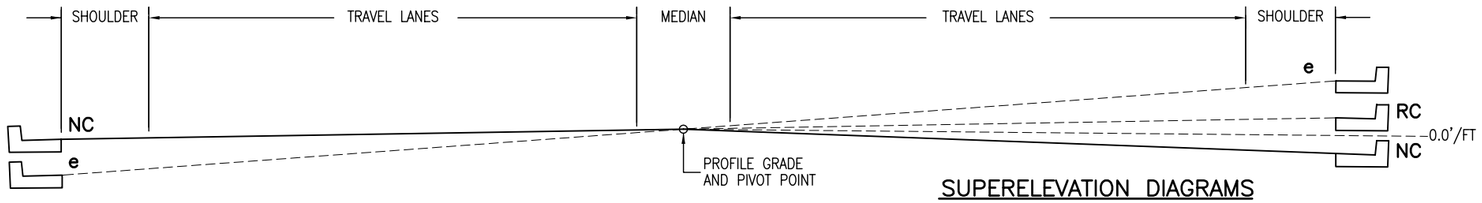

SUPERELEVATION DIAGRAMS

o = PIVOT

◆ = WHEN CURVE IS NOT SPIRALLED.

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

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

e_{max} = 6%

	V_d = 15 mph			V_d = 20 mph			V_d = 25 mph			V_d = 30 mph			V_d = 35 mph			V_d = 40 mph			V_d = 45 mph			V_d = 50 mph			V_d = 55 mph			V_d = 60 mph			
		L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)			L (FT.)		
e (%)	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	R (FT.)	1 LN	2 LNS	e (%)
2.0	614–<868	31	46	1120–<1580	32	49	1630–<2290	34	51	2240–<3130	36	55	2950–<4100	39	58	3770–<5230	41	62	4680–<6480	44	67	5700–<7870	48	72	6820–<9410	51	77	8060–<11100	53	80	2.0
2.2	543–<614	34	51	991–<1120	36	54	1450–<1630	38	57	2000–<2240	40	60	2630–<2950	43	64	3370–<3770	46	68	4190–<4680	49	73	5100–<5700	53	79	6110–<6820	56	84	7230–<8060	59	88	2.2
2.4	482–<543	37	55	884–<991	39	58	1300–<1450	41	62	1790–<2000	44	65	2360–<2630	46	70	3030–<3370	50	74	3770–<4190	53	80	4600–<5100	58	86	5520–<6110	61	92	6540–<7230	64	96	2.4
2.6	430–<482	40	60	791–<884	42	63	1170–<1300	45	67	1610–<1790	47	71	2130–<2360	50	75	2740–<3030	54	81	3420–<3770	58	87	4170–<4600	62	94	5020–<5520	66	100	5950–<6540	69	104	2.6
2.8	384–<430	43	65	709–<791	45	68	1050–<1170	48	72	1460–<1610	51	76	1930–<2130	54	81	2490–<2740	58	87	3110–<3420	62	93	3800–<4170	67	101	4580–<5020	71	107	5440–<5950	75	112	2.8
3.0	341–<384	46	69	635–<709	49	73	944–<1050	51	77	1320–<1460	55	82	1760–<1930	58	87	2270–<2490	62	93	2840–<3110	67	100	3480–<3800	72	108	4200–<4580	77	115	4990–<5440	80	120	3.0
3.2	300–<341	49	74	566–<635	52	78	850–<944	55	82	1200–<1320	58	87	1600–<1760	62	93	2080–<2270	66	99	2600–<2840	71	107	3200–<3480	77	115	3860–<4200	82	123	4600–<4990	85	128	3.2
3.4	256–<300	52	78	498–<566	55	83	761–<850	58	87	1080–<1200	62	93	1460–<1600	66	99	1900–<2080	70	106	2390–<2600	76	113	2940–<3200	82	122	3560–<3860	87	130	4250–<4600	91	136	3.4
3.6	209–<256	55	83	422–<498	58	88	673–<761	62	93	972–<1080	65	98	1320–<1460	70	105	1740–<1900	74	112	2190–<2390	80	120	2710–<2940	86	130	3290–<3560	92	138	3940–<4250	96	144	3.6
3.8	176–<209	58	88	358–<422	62	92	583–<673	65	98	864–<972	69	104	1190–<1320	74	110	1590–<1740	79	118	2010–<2190	84	127	2490–<2710	91	137	3040–<3290	97	146	3650–<3940	101	152	3.8
4.0	151–<176	62	92	309–<358	65	97	511–<583	69	103	766–<864	73	109	1070–<1190	77	116	1440–<1590	83	124	1840–<2010	89	133	2300–<2490	96	144	2810–<3040	102	153	3390–<3650	107	160	4.0
4.2	131–<151	65	97	270–<309	68	102	452–<511	72	108	684–<766	76	115	960–<1070	81	122	1310–<1440	87	130	1680–<1840	93	140	2110–<2300	101	151	2590–<2810	107	161	3140–<3390	112	168	4.2
4.4	116–<131	68	102	238–<270	71	107	402–<452	75	113	615–<684	80	120	868–<960	85	128	1190–<1310	91	137	1540–<1680	98	147	1940–<2110	106	158	2400–<2590	112	169	2920–<3140	117	176	4.4
4.6	102–<116	71	106	212–<238	75	112	360–<402	79	118	555–<615	84	125	788–<868	89	134	1090–<1190	95	143	1410–<1540	102	153	1780–<1940	110	166	2210–<2400	117	176	2710–<2920	123	184	4.6
4.8	91–<102	74	111	189–<212	78	117	324–<360	82	123	502–<555	87	131	718–<788	93	139	995–<1090	99	149	1300–<1410	107	160	1640–<1780	115	173	2050–<2210	123	184	2510–<2710	128	192	4.8
5.0	82–<91	77	115	169–<189	81	122	292–<324	86	129	456–<502	91	136	654–<718	97	145	911–<995	103	155	1190–<1300	111	167	1510–<1640	120	180	1890–<2050	128	191	2330–<2510	133	200	5.0
5.2	73–<82	80	120	152–<169	84	126	264–<292	89	134	413–<456	95	142	595–<654	101	151	833–<911	108	161	1090–<1190	116	173	1390–<1510	125	187	1750–<1890	133	199	2160–<2330	139	208	5.2
5.4	65–<73	83	125	136–<152	88	131	237–<264	93	139	373–<413	98	147	540–<595	105	157	759–<833	112	168	995–<1090	120	180	1280–<1390	130	194	1610–<1750	138	207	1990–<2160	144	216	5.4
5.6	58–<65	86	129	121–<136	91	136	212–<237	96	144	335–<373	102	153	487–<540	108	163	687–<759	116	174	903–<995	124	187	1160–<1280	134	202	1470–<1610	143	214	1830–<1990	149	224	5.6
5.8	51–<58	89	134	106–<121	94	141	186–<212	99	149	296–<335	105	158	431–<487	112	168	611–<687	120	180	806–<903	129	193	1040–<1160	139	209	1320–<1470	148	222	1650–<1830	155	232	5.8
6.0	39–<51	92	138	81–<106	97	146	144–<186	103	154	231–<296	109	164	340–<431	116	174	485–<611	124	186	643–<806	133	200	833–<1040	144	216	1060–<1320	153	230	1330–<1650	160	240	6.0

SUPERELEVATION NOTES

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

Computer File Information			Sheet Revisions	
Creation Date: 07/04/06	Initials: SJR	(R–X)	Date:	Comments
Last Modification Date: 07/04/06	Initials: LTA	(R–X)		
Full Path: www.dot.state.co.us/DesignSupport/		(R–X)		
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CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English			

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SUPERELEVATION STREETS

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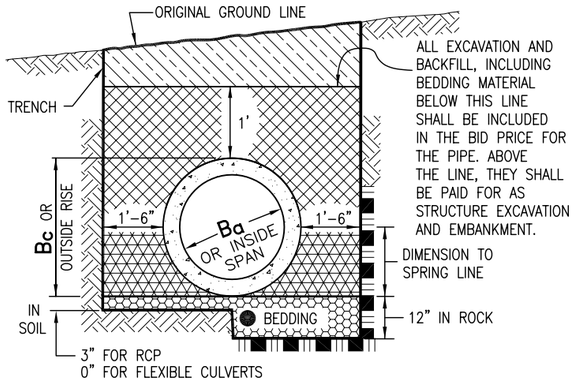
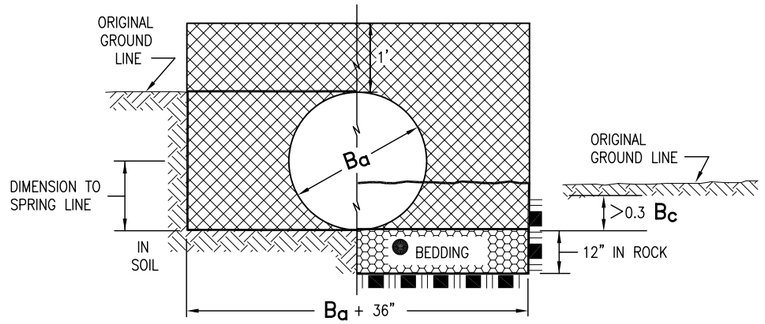
STANDARD PLAN NO.
M-203-12
Sheet No. 2 of 2



PIPE IN TRENCH

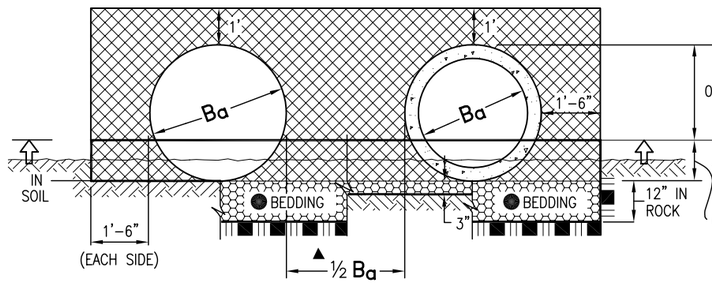


CIRCULAR PIPE

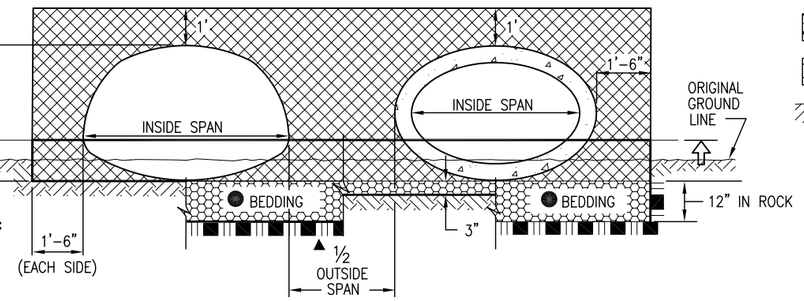
(WHERE ORIGINAL GROUND LINE IS BETWEEN 0.3 B_c AND B_c + 1 FT. ABOVE FLOWLINE)

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

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



CIRCULAR PIPE IN FILL



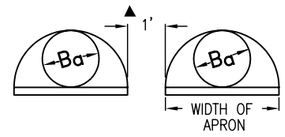
ARCH OR ELLIPTICAL PIPE IN FILL

GENERAL NOTES

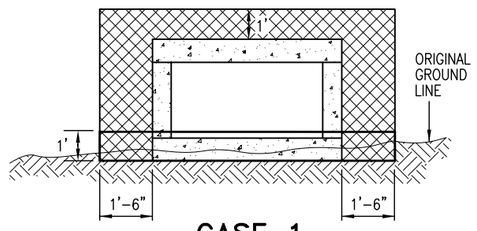
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THESE SHEETS WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. EXCAVATION FOR CHANNEL CHANGE OR CHANNEL IMPROVEMENT WILL BE EITHER UNCLASSIFIED EXCAVATION OR MUCK EXCAVATION AND WILL BE NOTED ON THE PLANS. EXCAVATION FROM THE CHANNEL FLOWLINE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

LEGEND

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

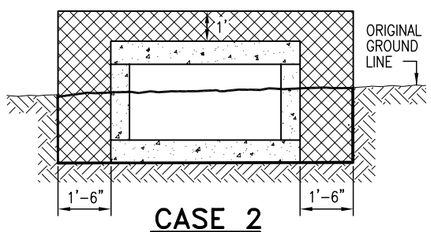


CONDUIT WITH END SECTIONS



CASE 1

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

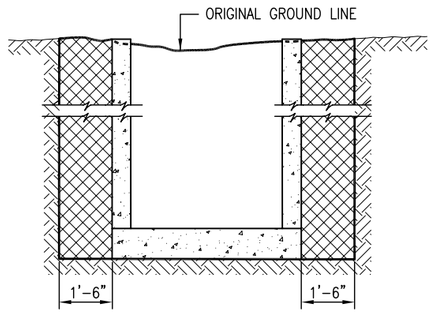


CASE 2

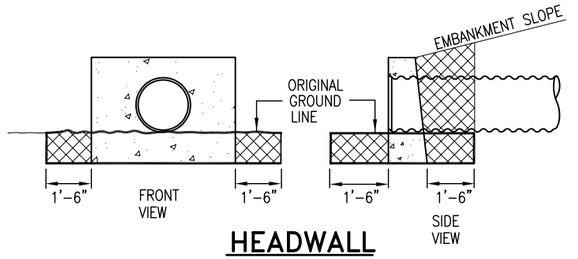
APPLIES WHEN THE ORIGINAL GROUND LINE IS MORE THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT.

CONCRETE BOX CULVERT

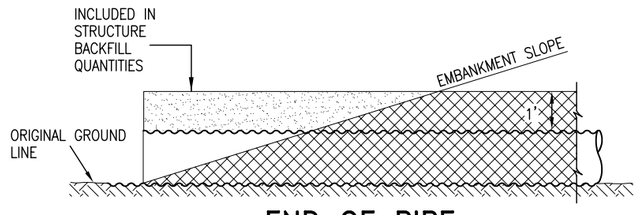
IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.



DROP INLETS AND DIVISION BOXES



HEADWALL



END OF PIPE

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Last Modification Date: 07/04/06 Initials: LTA	(R-X)		
Full Path: www.dot.state.co.us/DesignSupport/	(R-X)		
Drawing File Name: 206010102.dwg	(R-X)		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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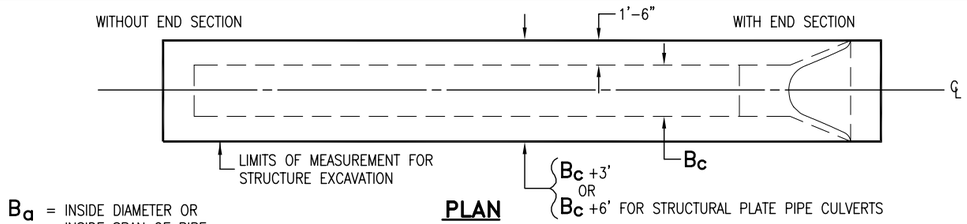
EXCAVATION AND BACKFILL FOR STRUCTURES

Issued By: Project Development Branch on July 04, 2006

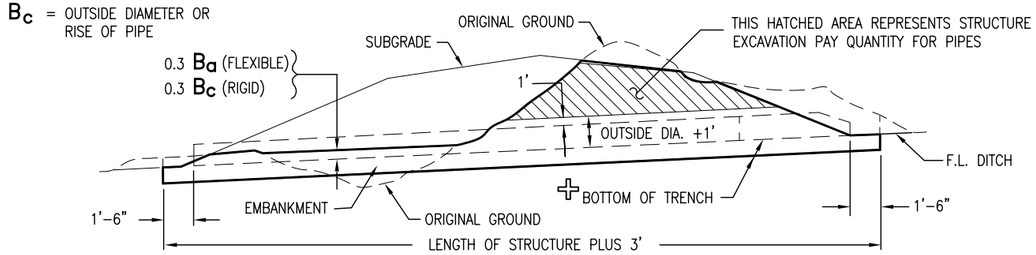
STANDARD PLAN NO.
M-206-1
Sheet No. 1 of 2



PLAN

B_a = INSIDE DIAMETER OR INSIDE SPAN OF PIPE

B_c = OUTSIDE DIAMETER OR RISE OF PIPE

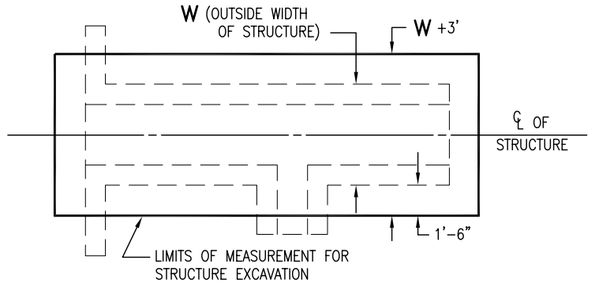


PROFILE

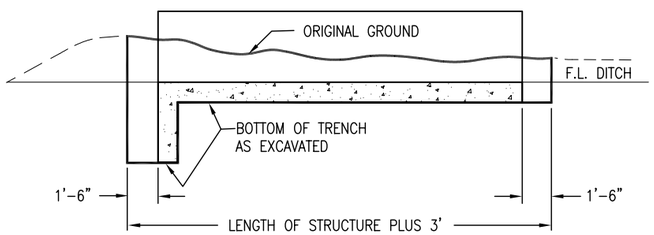
✙ FOR APPLICABLE LIMITS OF STRUCTURE EXCAVATION, SEE BEDDING DETAILS ON SHEET 1 OF THESE DETAILS.

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

STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS

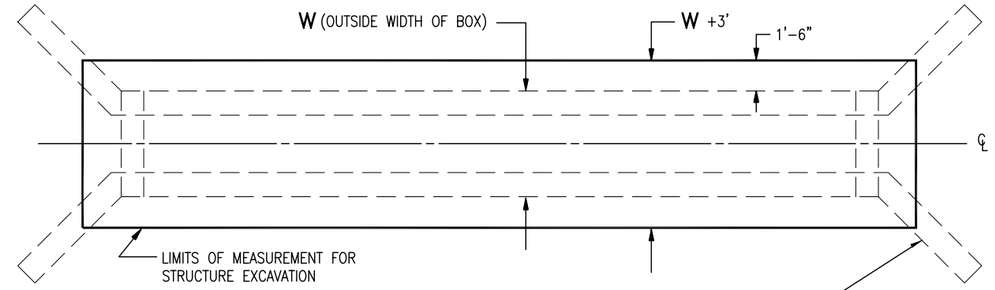


PLAN

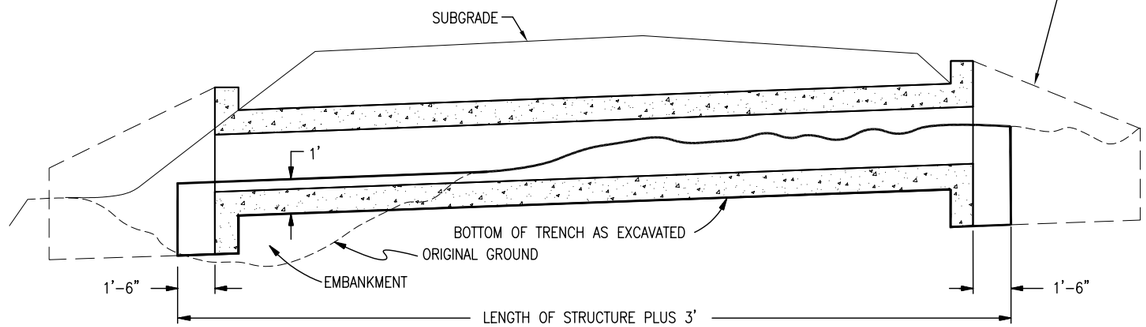


PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR DIVISION BOXES

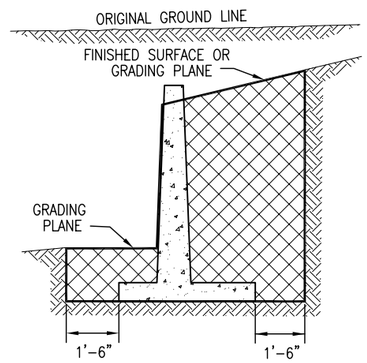


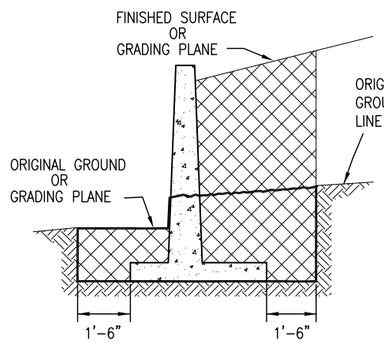
PLAN

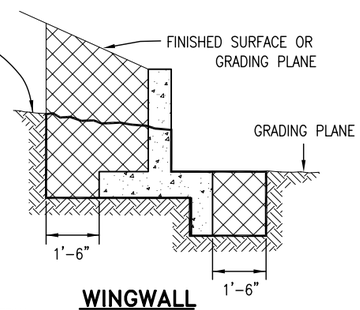


PROFILE

STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS







WINGWALL

RETAINING WALL IN CUT & IN PARTIAL CUT

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

LEGEND

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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/06	Initials: SJR	Date:	Comments
Last Modification Date: 07/04/06	Initials: LTA		
Full Path: www.dot.state.co.us/DesignSupport/			
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CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English		

R–X R–X R–X R–X

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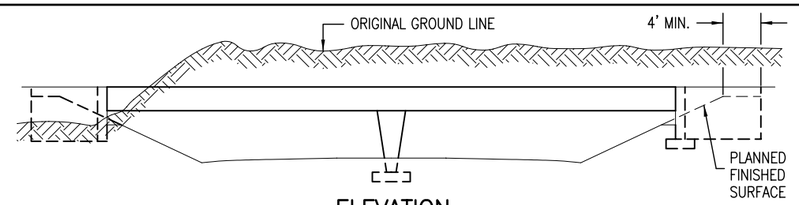
EXCAVATION AND BACKFILL FOR STRUCTURES

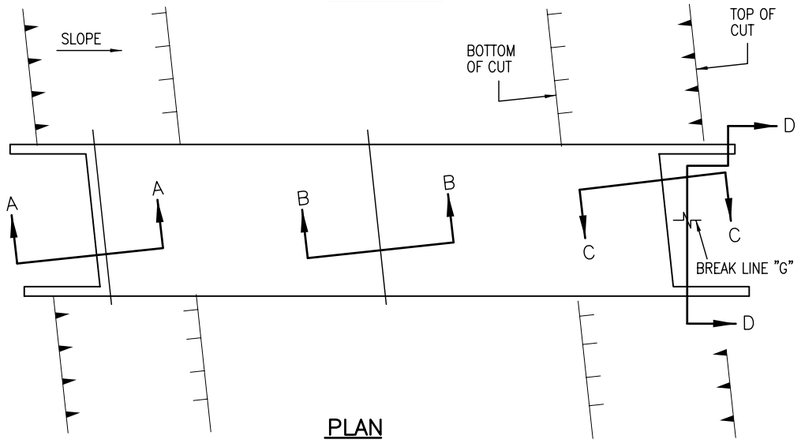
Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO. M-206-1

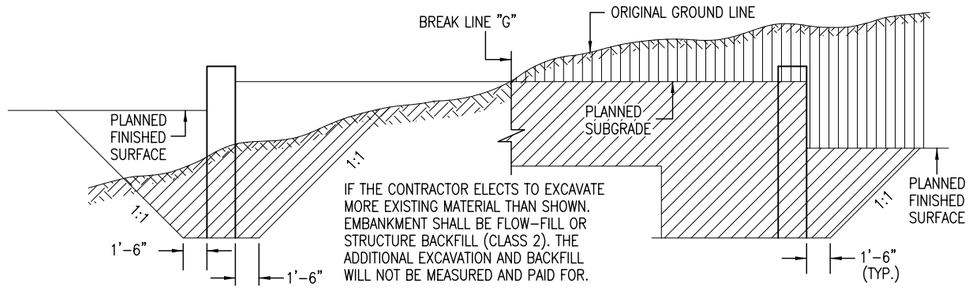
Sheet No. 2 of 2



ELEVATION



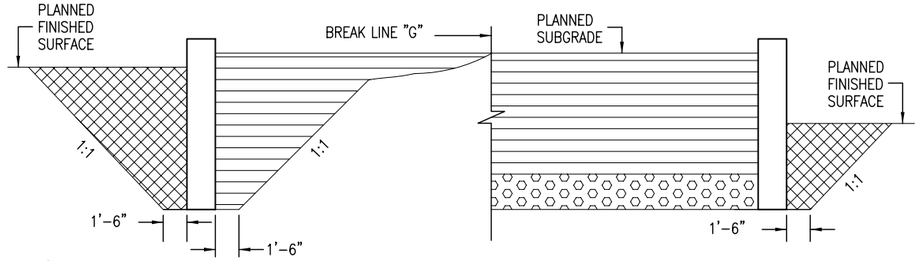
PLAN



▲ NEAR END OF WINGWALL

NEAR BACKFILL OF ABUTMENT

SECTION D-D (EXCAVATION)



▲ NEAR END OF WINGWALL

NEAR BACKFILL OF ABUTMENT

SECTION D-D (BACKFILL)

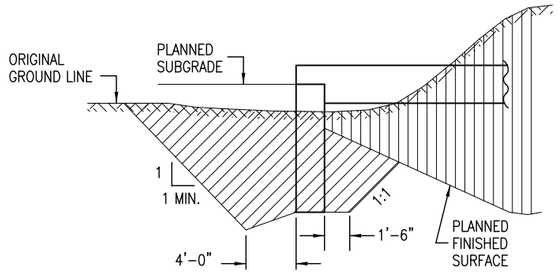
GENERAL NOTES

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

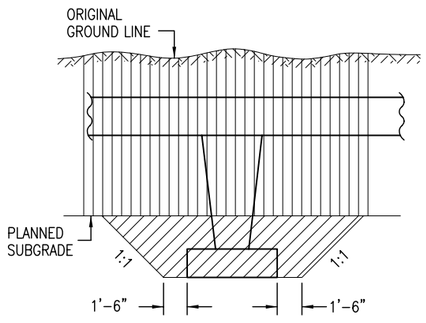
LEGEND

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

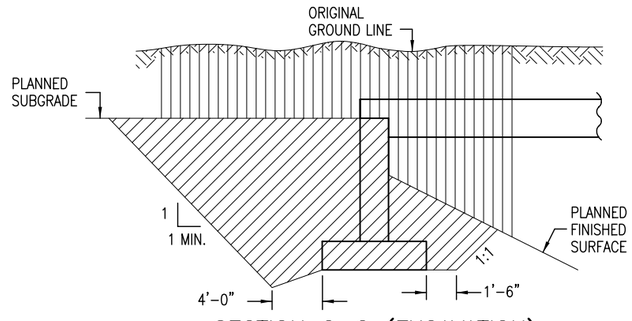
▲ FOR PURPOSES OF QUANTITY CALCULATIONS THIS TEMPLATE APPLIES TO END OF WINGWALL.



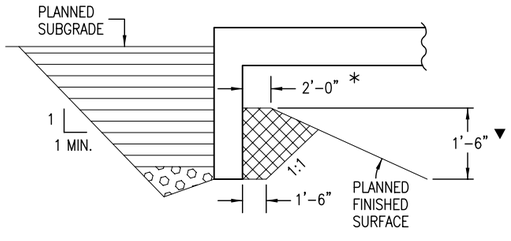
SECTION A-A (EXCAVATION)



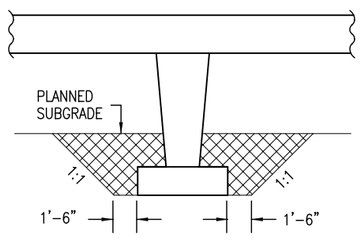
SECTION B-B (EXCAVATION)



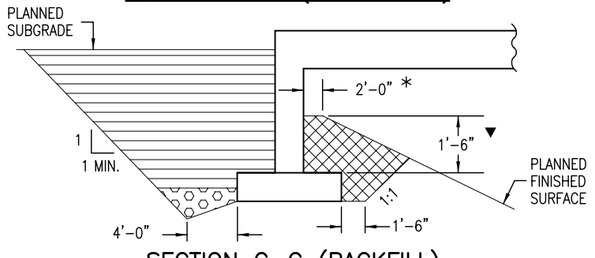
SECTION C-C (EXCAVATION)



SECTION A-A (BACKFILL)



SECTION B-B (BACKFILL)



SECTION C-C (BACKFILL)

* MINIMUM BERM DIMENSION

▼ MINIMUM EMBEDMENT OF ABUTMENT, IN STRUCTURE BACKFILL

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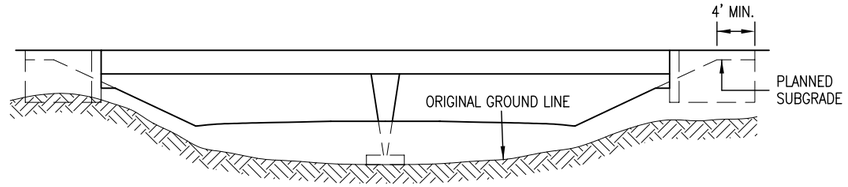
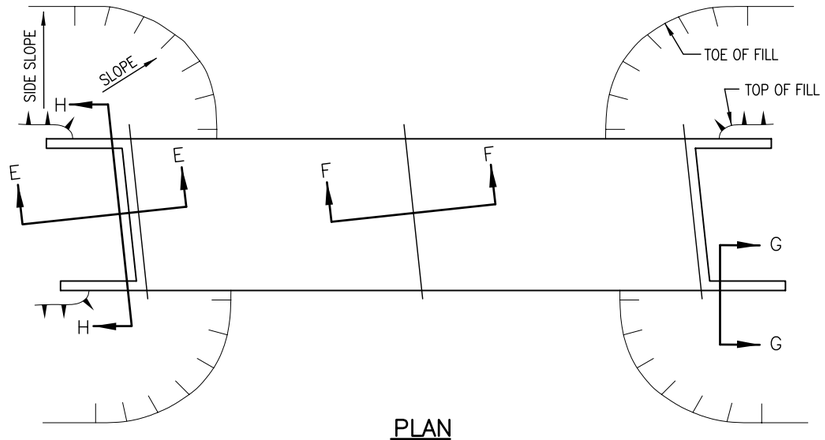
EXCAVATION AND BACKFILL FOR BRIDGES

Issued By: Project Development Branch on July 04, 2006

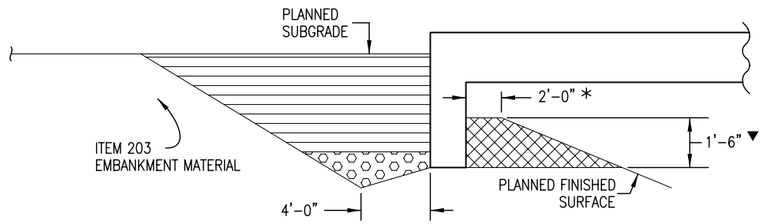
STANDARD PLAN NO.
M-206-2
Sheet No. 1 of 2



ELEVATION



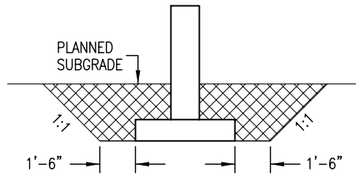
PLAN



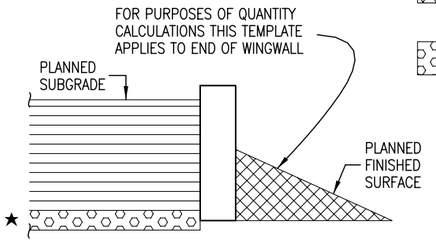
* MINIMUM BERM DIMENSION

▼ MINIMUM EMBEDMENT OF ABUTMENT INTO STRUCTURE BACKFILL

SECTION E–E (BACKFILL)



SECTION F–F (BACKFILL)



SECTION G–G (BACKFILL)

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

GENERAL NOTES

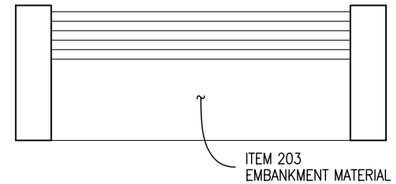
1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THIS SHEET WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09.
3. STRUCTURE EXCAVATION FOR SLOPE PAVING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

LEGEND

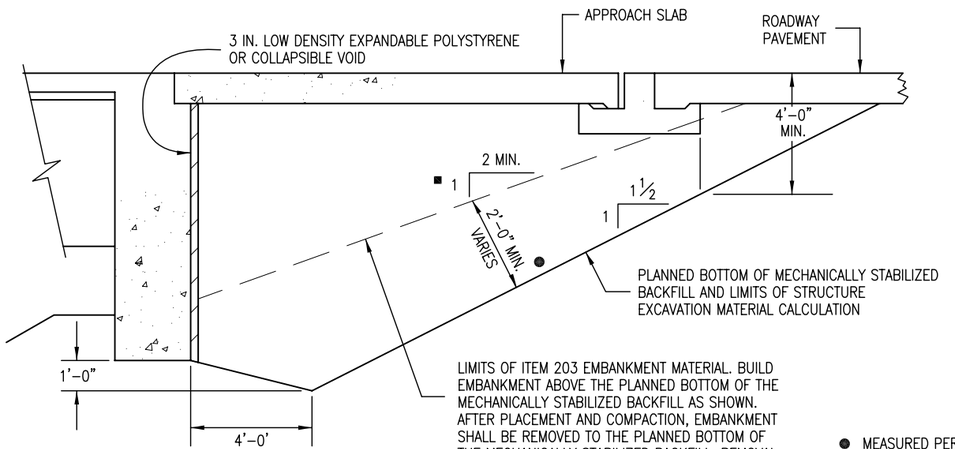
STRUCTURE BACKFILL (FLOW–FILL), OR STRUCTURE BACKFILL (CLASS 1) WITH MECHANICAL REINFORCEMENT AS SHOWN ON THE PLANS

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

FILTER MATERIAL



SECTION H–H (BACKFILL)

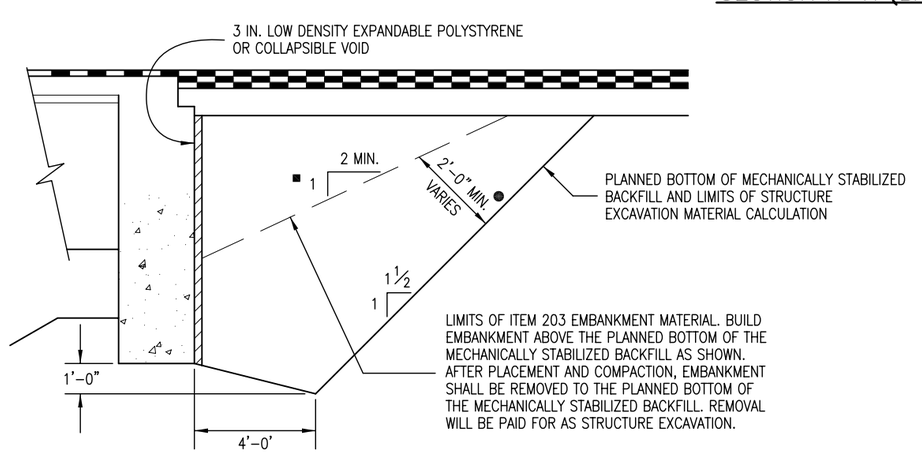


DETAIL 1

(WITH APPROACH SLAB)

● MEASURED PERPENDICULAR TO PLANNED BOTTOM OF MECHANICALLY STABILIZED BACKFILL.

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



DETAIL 2

(WITHOUT APPROACH SLAB)

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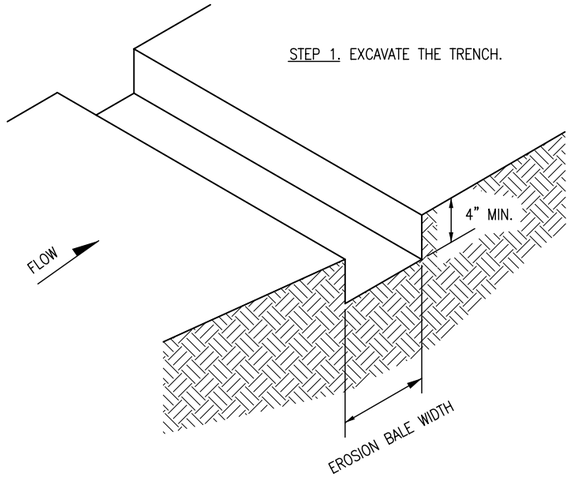
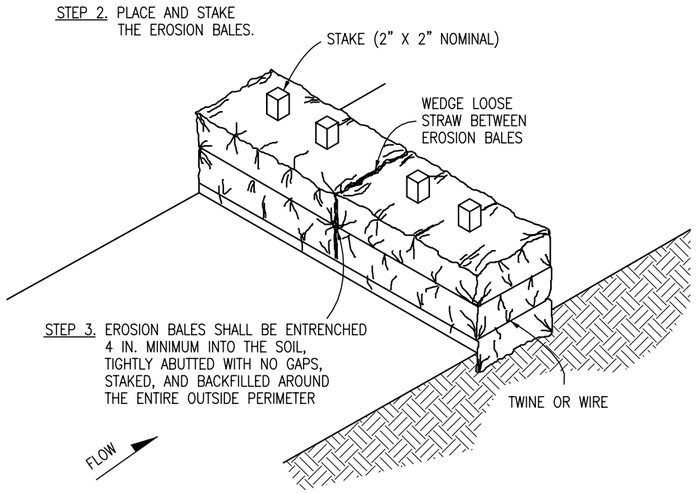
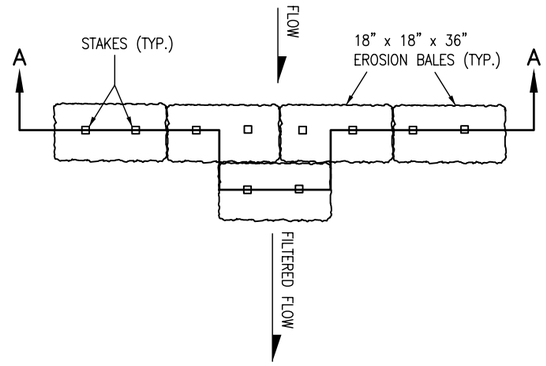
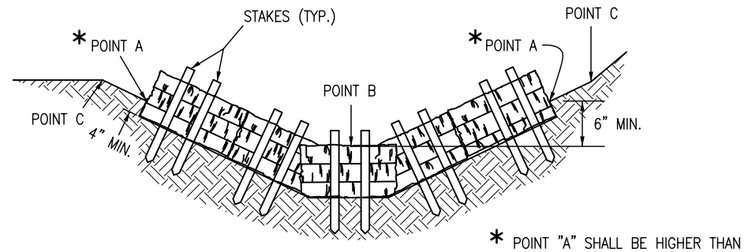
Full Path: www.dot.state.co.us/DesignSupport/	R–X					
Drawing File Name: 206020202.dwg	R–X			Project Development Branch SRJ/LTA	Issued By: Project Development Branch on July 04, 2006	Sheet No. 2 of 2
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English						





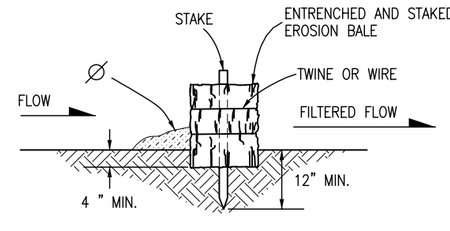


PLAN

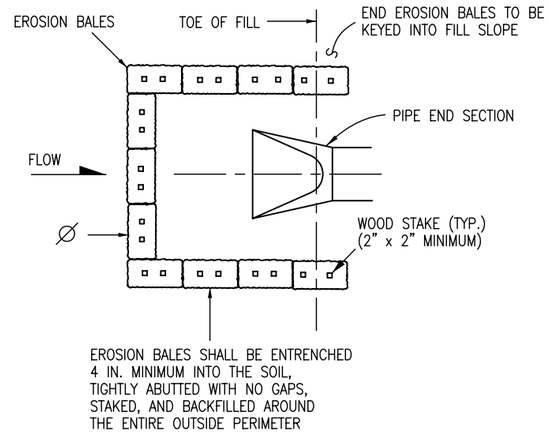


* POINT "A" SHALL BE HIGHER THAN POINT "B" AND BELOW POINT "C".

SECTION A–A

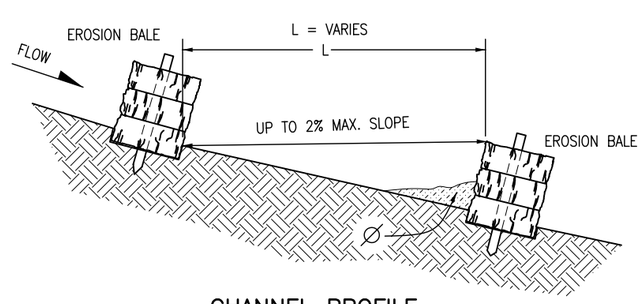


TYPICAL EROSION BALE TRENCHING AND STAKING



PLAN VIEW

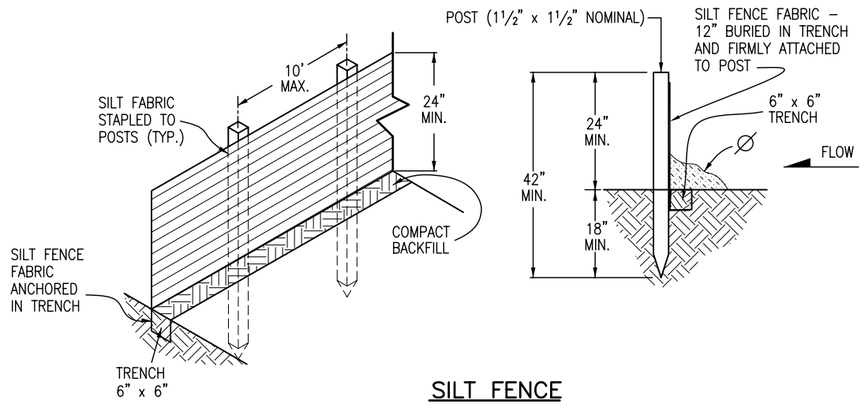
CULVERT EROSION BALE INLET PROTECTION



CHANNEL PROFILE

SPACING BETWEEN EROSION BALES

NOTE: EROSION BALES SHALL BE ENTRENCHED 4 IN. MINIMUM INTO THE SOIL, TIGHTLY ABUTTED WITH NO GAPS, STAKED, AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER.



SILT FENCE

∅ REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF EXPOSED SILT FENCE OR BALE HEIGHT. INSPECTION SHALL BE PERFORMED CONTINUOUSLY FOR PROPER FUNCTION.

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TEMPORARY EROSION CONTROL

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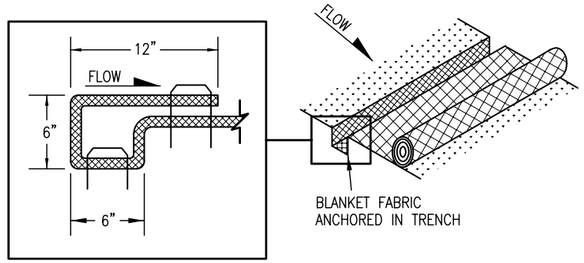
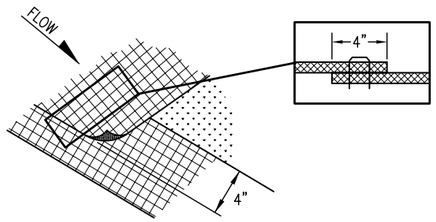
STANDARD PLAN NO.
M-208-1
Sheet No. 1 of 7

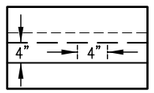
STEP 1. PLACE UPSLOPE END OF BLANKET IN A TRENCH 6 IN. DEEP BY 6 IN. WIDE.



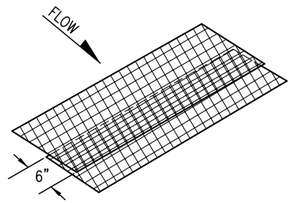
STEP 2. USE A 4 IN. OVERLAP WHENEVER TWO WIDTHS OF BLANKET ARE INSTALLED SIDE BY SIDE. STAPLE PATTERN: MINIMUM 3 PER SQUARE YARD.



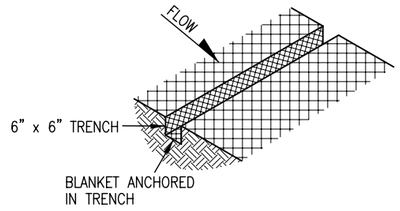
STEP 3. USE A 6 IN. OVERLAP WHEREVER ONE ROLL OF BLANKET ENDS AND ANOTHER BEGINS.

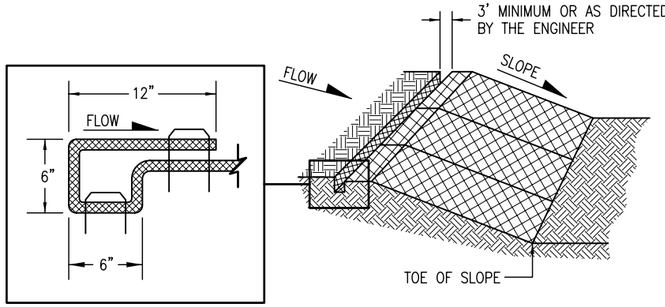


STAPLE PATTERN

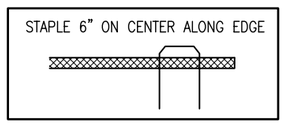


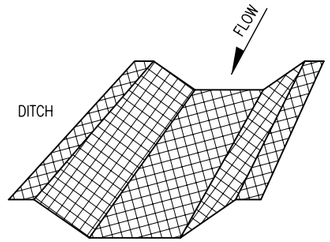
STEP 4. CHECK SLOTS SHOULD BE MADE EVERY 35 FT. AND AT TERMINAL ENDS. INSERT A FOLD OF THE BLANKET INTO A TRENCH 6 IN. WIDE BY 6 IN. DEEP AND COMPACT IN CONFORMANCE WITH MANUFACTURER'S RECOMMENDATION LAY THE BLANKET SMOOTHLY ON THE SURFACE OF THE SOIL, DO NOT STRETCH THE BLANKET, AND DO NOT ALLOW WRINKLES. INSTALL STAPLES 12 IN. ON CENTER IN TRENCH.





PLACE BLANKET PARALLEL WITH THE DIRECTION OF FLOW AND ANCHOR SECURELY. BRING BLANKET TO THE TOE OF SLOPE OR AS DIRECTED BY THE ENGINEER BEFORE TERMINATING THE INSTALLATION.





PLACE BLANKET WITH THE DIRECTION OF FLOW. DO NOT JOIN STRIPS IN THE CENTER OF THE DITCH. PLACE CHECK SLOTS AS REQUIRED.

SOIL RETENTION BLANKETS

IN ACCORDANCE WITH SECTION 216.

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TEMPORARY EROSION CONTROL

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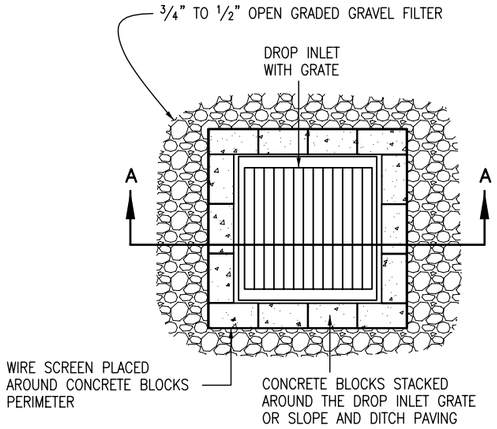
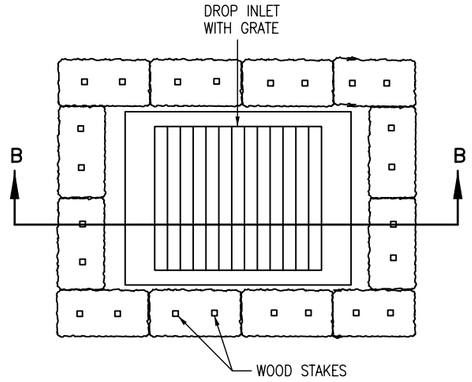
STANDARD PLAN NO.
M-208-1
Sheet No. 2 of 7



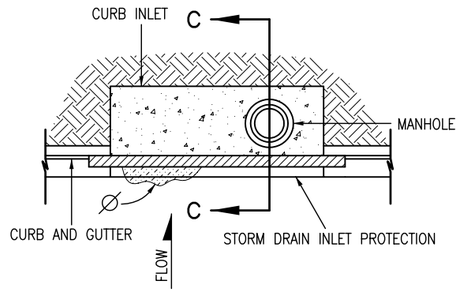
PLAN VIEW



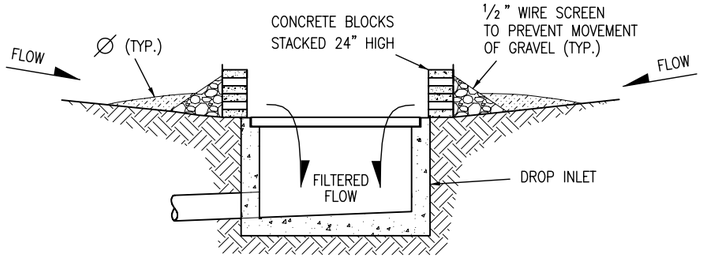
PLAN VIEW

NOTE

Ø REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF EXPOSED INLET PROTECTION HEIGHT. INSPECTION SHALL BE PERFORMED CONTINUOUSLY FOR PROPER FUNCTION.

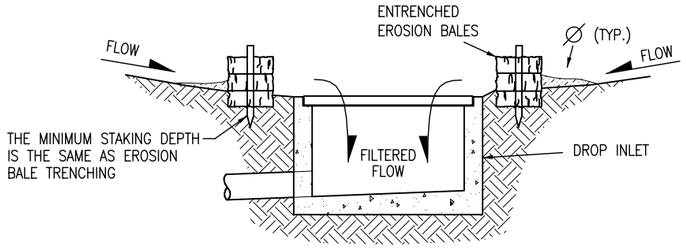


PLAN VIEW



SECTION A–A

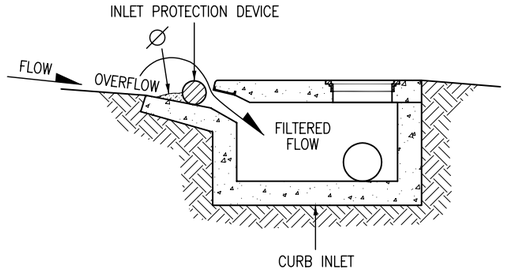
STORM DRAIN INLET PROTECTION (TYPE C OR D)



SECTION B–B

INLET EROSION BALE FILTER (TYPE C OR D)

NOTE: EROSION BALES ARE TO BE ENTRENCHED 4 IN. INTO THE SOIL, TIGHTLY ABUTTING WITH NO GAPS, STAKED AND BACKFILLED AROUND THE ENTIRE OUTSIDE PERIMETER OF GRATE OR SLOPE AND DITCH PAVING.



SECTION C–C

STORM DRAIN INLET PROTECTION (TYPE R)

NOTES:

1. INLET PROTECTION SHALL EXTEND 12 IN. PAST EACH END OF THE INLET AND BE 4 IN. TO 6 IN. IN DIAMETER.
2. INLET PROTECTION MAY CONSIST OF CONTINUOUS FILTER TUBING FILLED WITH GRAVEL OR PREMANUFACTURED DEVICE.

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TEMPORARY EROSION CONTROL

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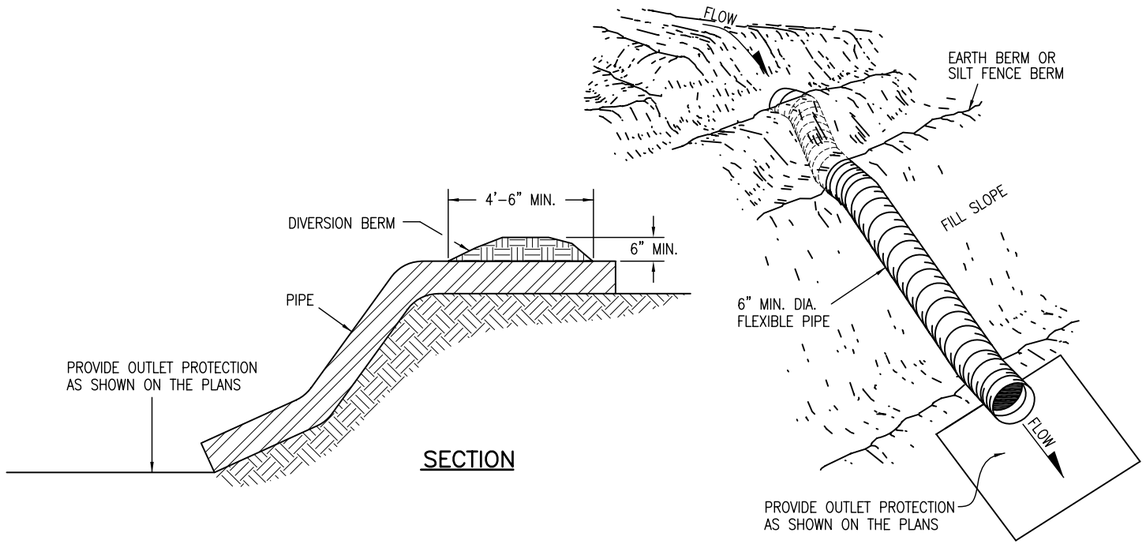
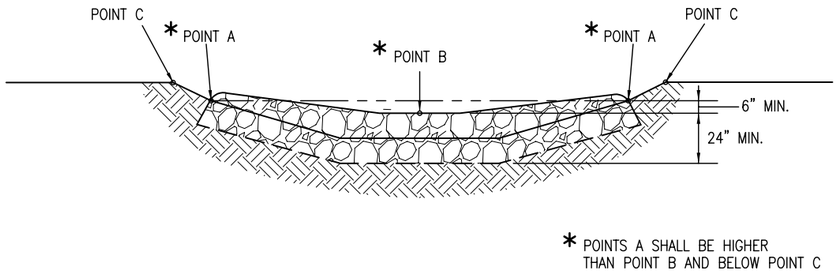
STANDARD PLAN NO.
M-208-1
Sheet No. 3 of 7



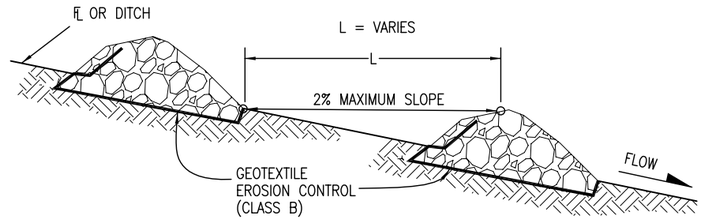
SECTION

EARTH BERM

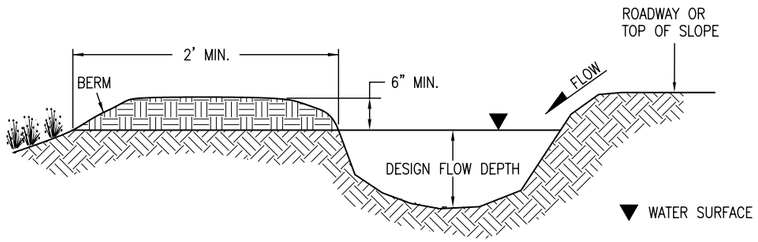
TEMPORARY SLOPE DRAIN



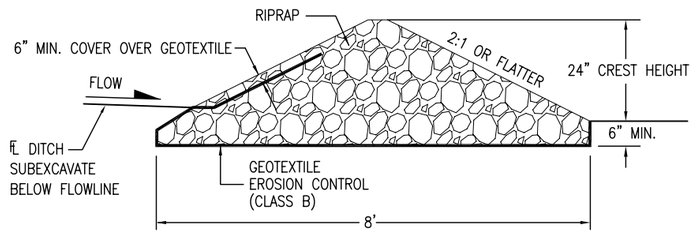
TYPICAL SECTION VIEW



SECTION VIEW ALONG DITCH FLOWLINE



DIVERSION DAM



SECTION DETAIL

CHECK DAM FOR EROSION CONTROL

NOTES:

1. RIPRAP SIZE DS50 = 6 IN. OR AS SHOWN ON THE PLANS.
2. THE ENDS OF RIPRAP CHECK DAM SHALL BE A MINIMUM OF 6 IN. HIGHER THAN CENTER OF CHECK DAM.
3. SEDIMENT SHALL BE REMOVED WHEN THE DEPTH UPSTREAM FROM CHECK DAM IS ½ THE CREST HEIGHT.
4. CHECK DAMS MAY BE TEMPORARY OR PERMANENT AS SHOWN ON THE PLANS.

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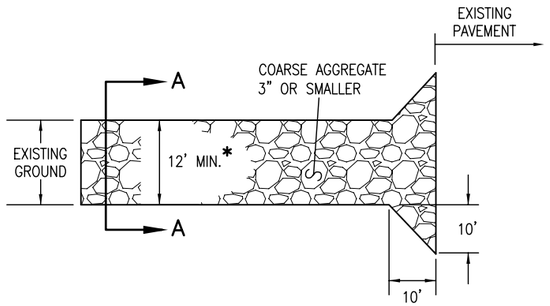
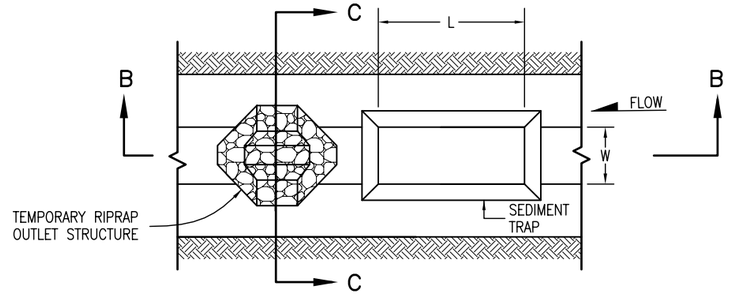


PLAN VIEW

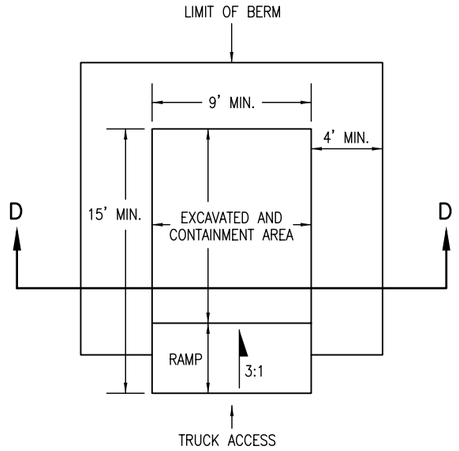
* SHALL EXTEND FULL WIDTH OF INGRESS AND EGRESS OPERATION.



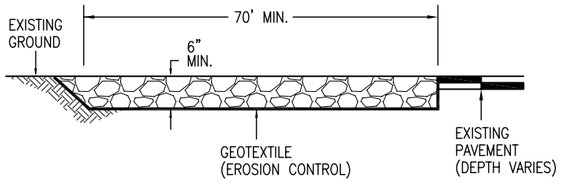
NOTE: SEE PLAN SHEETS FOR THE FOLLOWING:
RIPRAP SIZE
DEPTH (D1 AND D2)
LENGTH (L)
WIDTH (W)
DITCH TYPE, SIZE AND LOCATION

PLAN VIEW

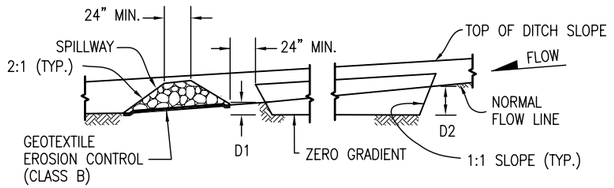
∅ REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF STRUCTURE HEIGHT. INSPECTION SHALL BE PERFORMED CONTINUOUSLY FOR PROPER FUNCTION.



PLAN VIEW



ELEVATION SECTION



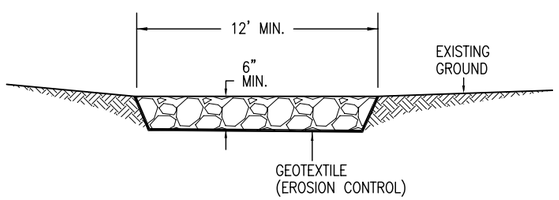
CROSS SECTION B–B

SECTION D–D

CONCRETE WASHOUT STRUCTURE

NOTES:

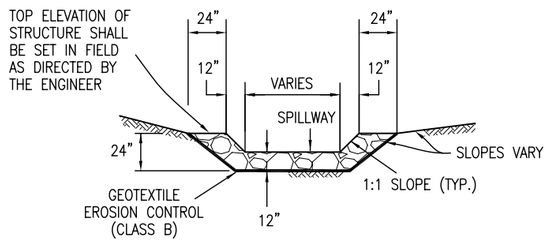
1. SIGN MATERIAL, EXCAVATION, AND RESTORATION ARE INCLUDED IN THE COST OF THE CONCRETE WASHOUT STRUCTURE.
2. EROSION BALES MAY BE USED AS AN ALTERNATIVE FOR THE BERM.



SECTION A–A

STABILIZED CONSTRUCTION ENTRANCE

NOTE: THE CONTRACTOR SHALL PROTECT ANY CURB AND GUTTER THAT CROSSES THE ENTRANCE. PROTECTION OF THE CURB AND GUTTER WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE WORK.



SECTION C–C

SEDIMENT TRAP/DEWATERING STRUCTURE

NOTE: THE RIPRAP AND GEOTEXTILE ARE INCLUDED IN THE COST OF THE BID ITEM.

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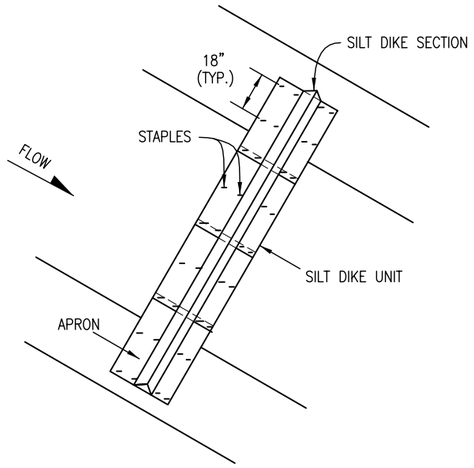
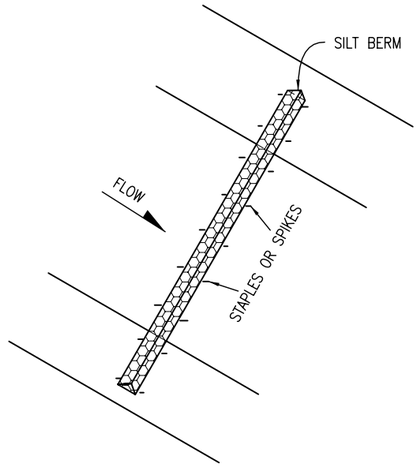
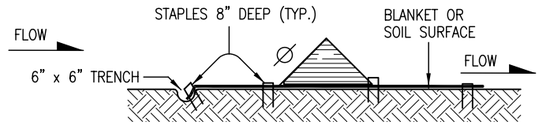
STANDARD PLAN NO.
M-208-1
Sheet No. 5 of 7



PLAN VIEW



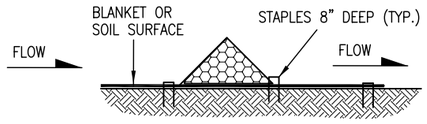
PLAN VIEW



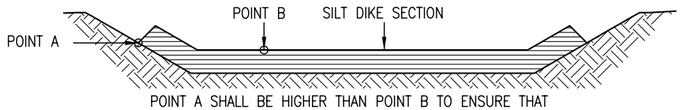
NOTE: APRON ANCHORED INTO TRENCH WITH STAPLES AND COMPACTED BACKFILL.

TYPICAL SECTION

∅ REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF STRUCTURE HEIGHT. INSPECTION SHALL BE PERFORMED CONTINUOUSLY FOR PROPER FUNCTION.



TYPICAL SECTION VIEW

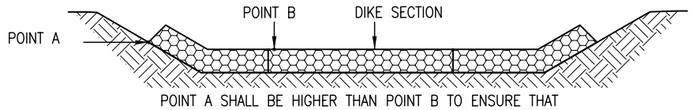


POINT A SHALL BE HIGHER THAN POINT B TO ENSURE THAT WATER FLOWS OVER THE DIKES AND NOT AROUND THE ENDS.

FRONT VIEW

SILT DIKE–INSTALLATION FOR DRAINAGE DITCH

NOTE: SECTIONS OF THE SILT DIKE SHALL BE TIGHTLY ABUTTED WITH NO GAPS.



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

FRONT VIEW

SILT BERM–VELOCITY CHECKS FOR DRAINAGE DITCH

NOTE: SECTIONS OF THE SILT BERM SHALL BE TIGHTLY ABUTTED WITH NO GAPS.

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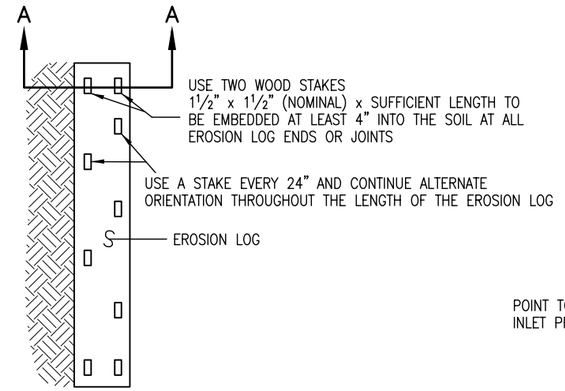
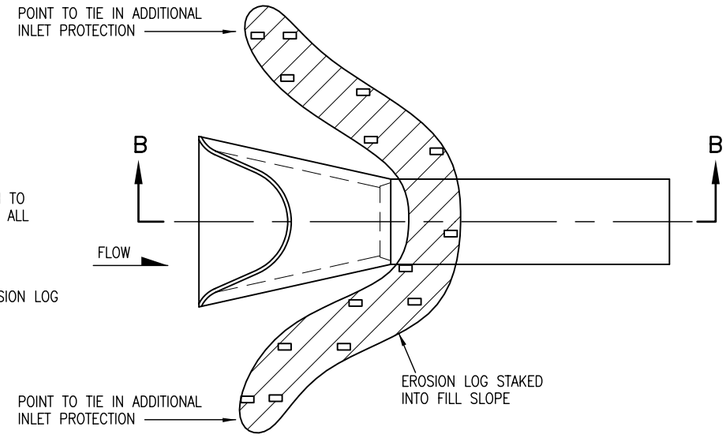
STANDARD PLAN NO.
M-208-1
Sheet No. 6 of 7



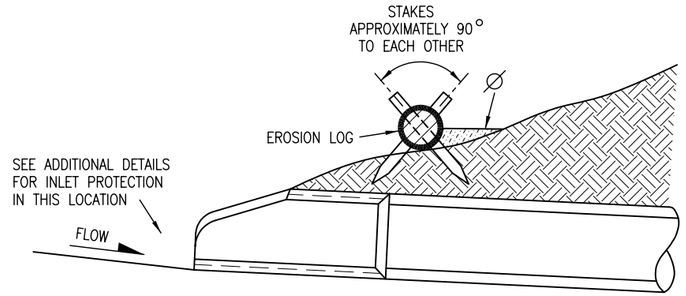
TYPICAL STAKE INSTALLATION



PLAN VIEW

NOTE

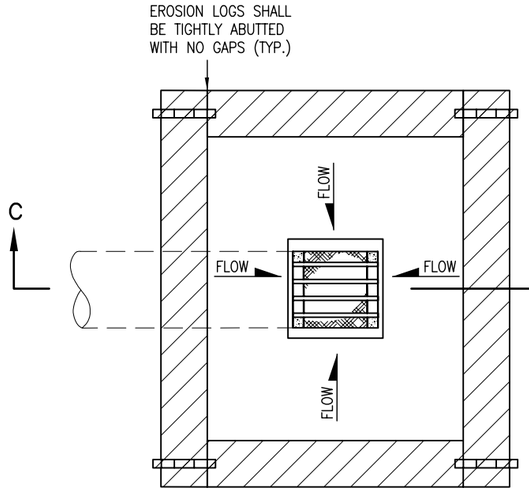
Ø REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE HALF OF PROTECTION FEATURE HEIGHT. INSPECTION SHALL BE PERFORMED CONTINUOUSLY FOR PROPER FUNCTION.



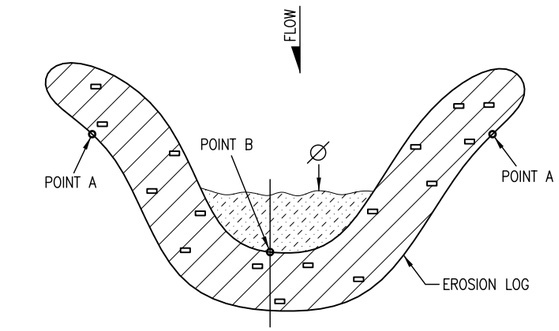
SECTION B–B

CULVERT EROSION LOG INLET PROTECTION

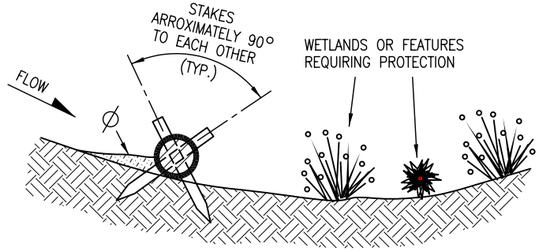
(FOR SLOPES 3:1 OR STEEPER)



PLAN VIEW

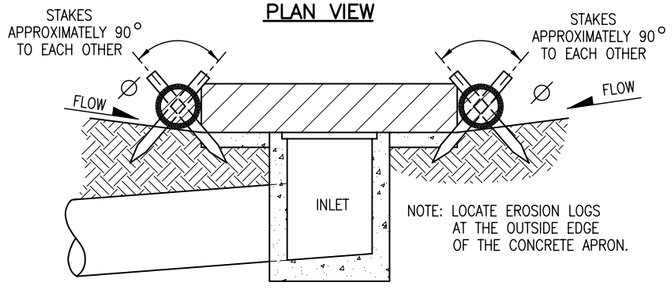


PLAN VIEW



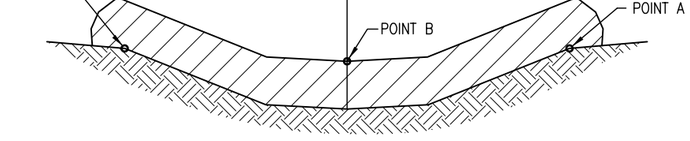
SECTION A–A

EROSION LOG APPLICATION



SECTION C–C

DROP INLET EROSION LOG FILTER



POINTS A SHALL BE HIGHER THAN POINT B.

ELEVATION

EROSION LOG DETAIL DITCH INSTALLATION

NOTE: EROSION LOGS SHALL BE TIGHTLY ABUTTED WITH NO GAPS.

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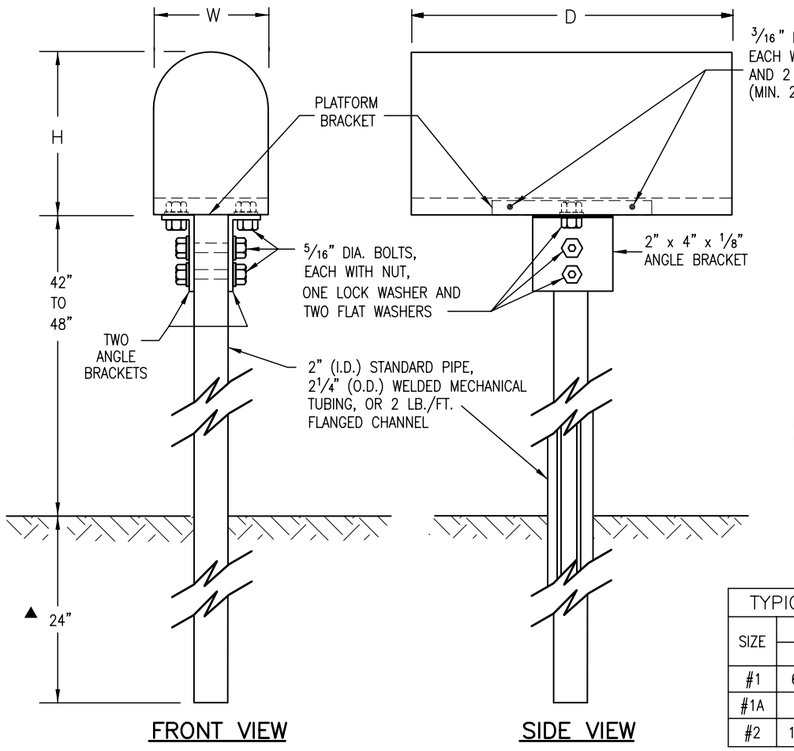
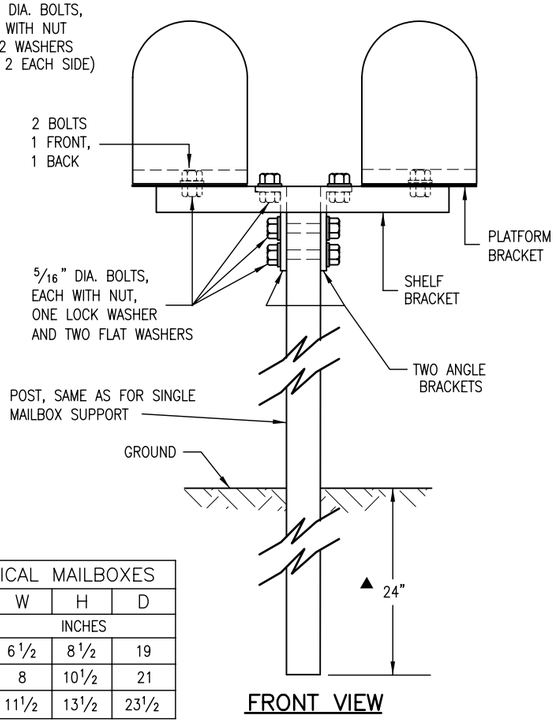
STANDARD PLAN NO.
M-208-1
Sheet No. 7 of 7



FRONT VIEW

SIDE VIEW

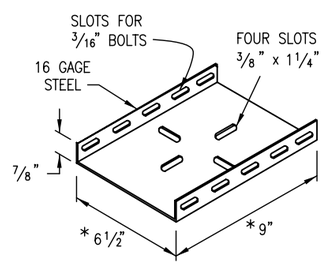


FRONT VIEW

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

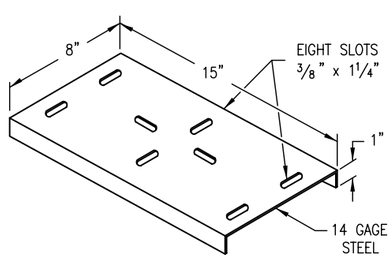
▲ 30 IN. WITH POST MOUNTING SOCKET MAY BE USED, SEE DETAIL ON SHEET 2 OF 2.

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



* DIMENSIONS VARY TO FIT SIZE OF MAILBOX USED

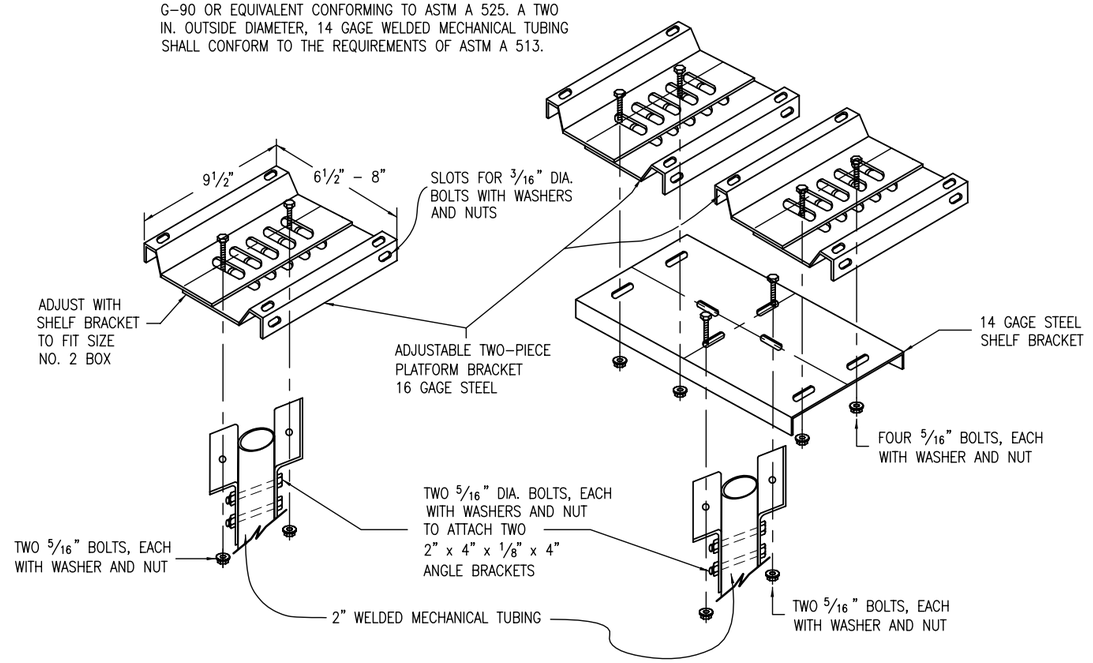
PLATFORM BRACKET



SHELF BRACKET

GENERAL NOTES

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



SINGLE AND DOUBLE MAILBOX SUPPORTS ALTERNATIVE

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MAILBOX SUPPORTS

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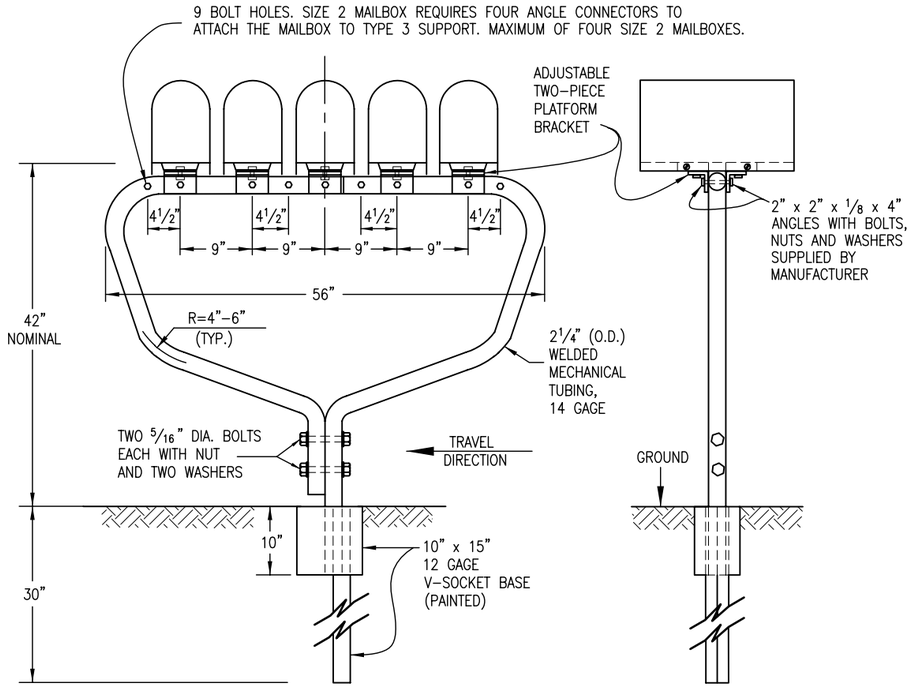
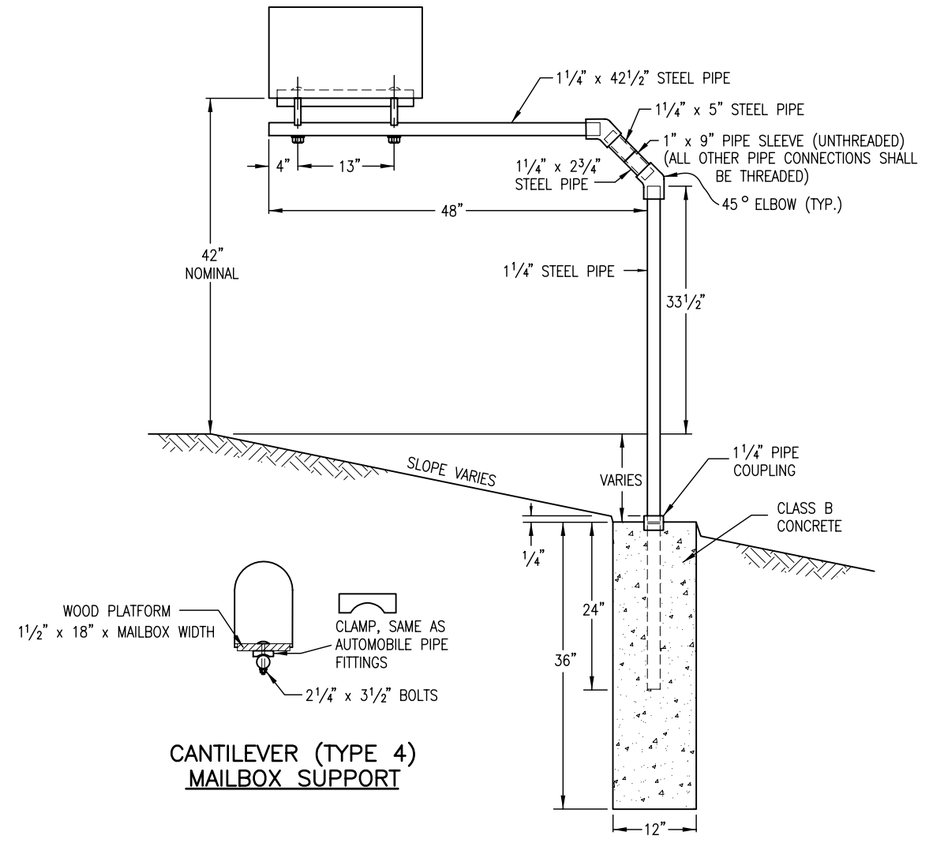
STANDARD PLAN NO. M-210-1

Sheet No. 1 of 2

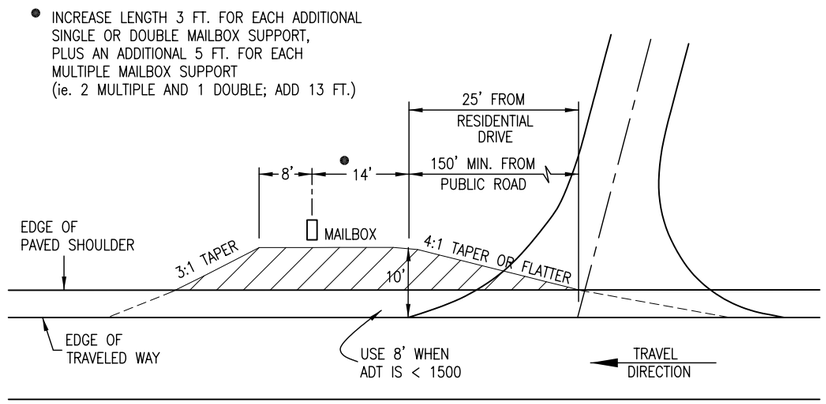


MULTIPLE (TYPE 3) MAILBOX SUPPORT
FOR 3, 4, OR 5 MAILBOXES OR APPROVED EQUAL

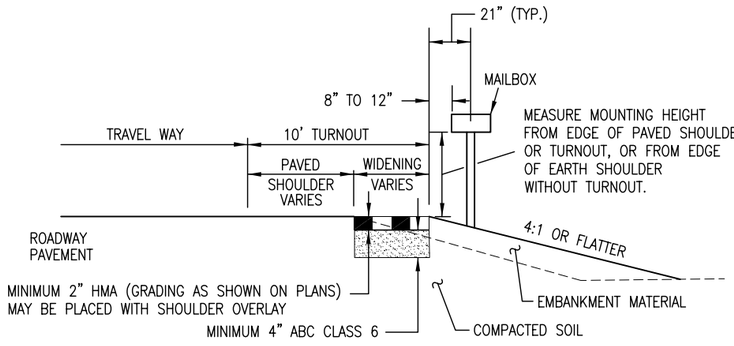
FIVE SIZE 1 MAILBOXES SHOWN.



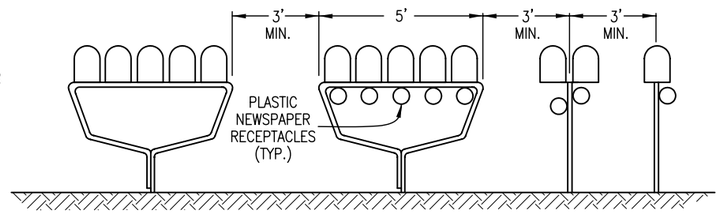
CANTILEVER (TYPE 4)
MAILBOX SUPPORT



MAILBOX TURNOUT



TURNOUT TYPICAL SECTION



SUPPORT SPACING

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

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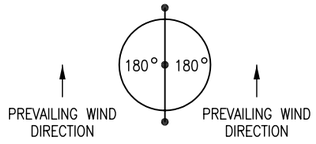
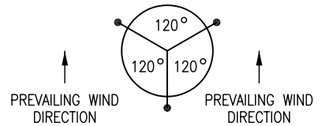
M-210-1
Sheet No. 2 of 2

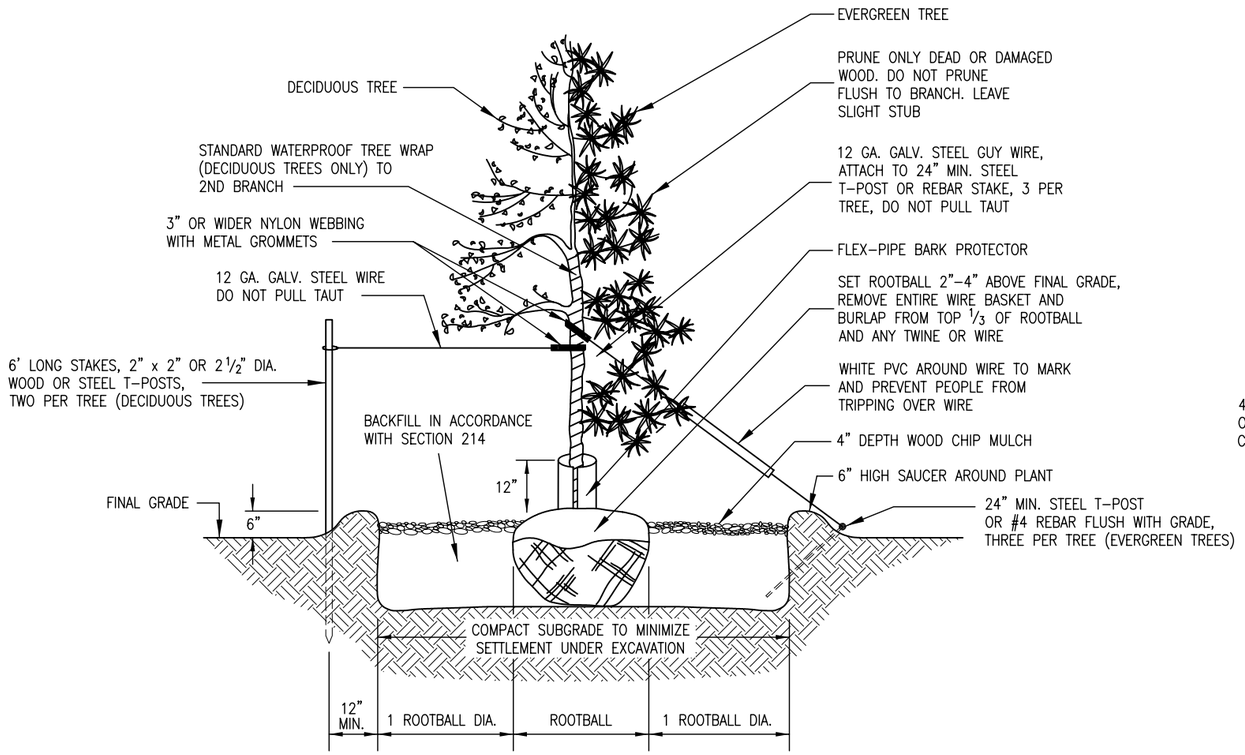


GUYING PATTERN FOR DECIDUOUS TREE PLANTING



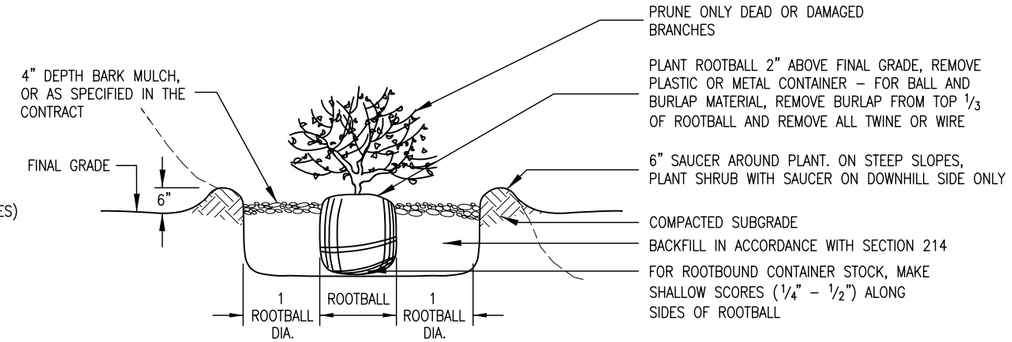
NOTE: FOR TREES ON 4:1 OR STEEPER SLOPES, PLACE TWO GUYS UPSLOPE AND ONE DOWN SLOPE. OTHERWISE, PLACE FOR PREVAILING WIND.

GUYING PATTERN FOR EVERGREEN TREE PLANTING



DECIDUOUS AND EVERGREEN TREE PLANTING AND GUYING DETAIL

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



SHRUB PLANTING DETAIL

NOT TO SCALE

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PLANTING DETAILS

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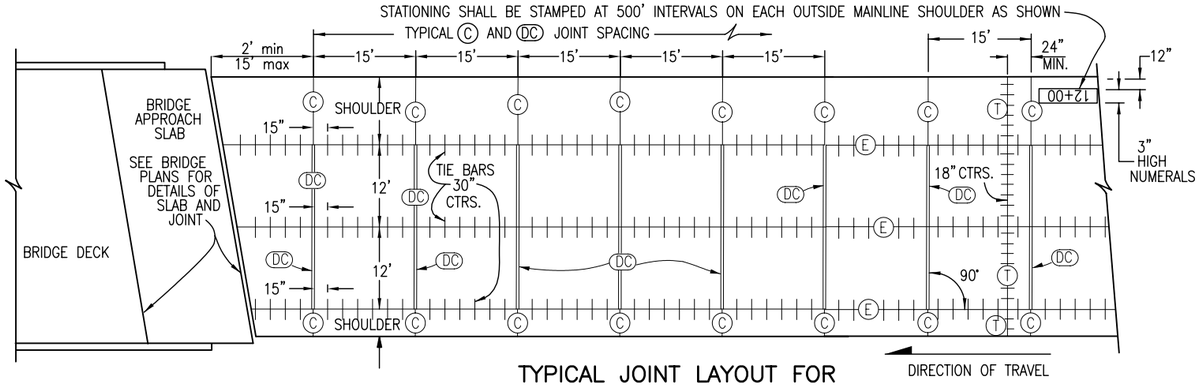
STANDARD PLAN NO.
M-214-1
Sheet No. 1 of 1



TYPICAL JOINT LAYOUT FOR CONCRETE ROADWAY WITH CONCRETE SHOULDERS

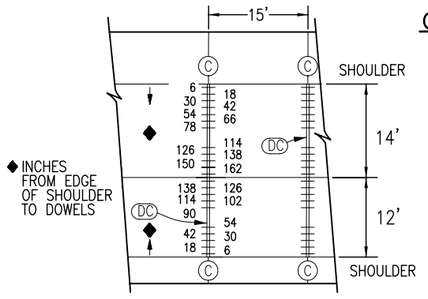
GENERAL NOTES

1. THIS STANDARD PLAN DOES NOT APPLY TO THIN CONCRETE OVERLAYS (WHITETOPPING).
2. LOCATE (T) JOINT AT A (C) JOINT OR A MINIMUM OF 2 FT. FROM A (C) JOINT.
3. THIS JOINT LAYOUT SHALL BE USED AS A STANDARD FOR THE JOINT LAYOUT FOR THE PROJECT. IF THE CONTRACTOR PROPOSES VARIATIONS FROM THIS STANDARD OR THE PROJECT HAS UNUSUAL OR IRREGULAR CONDITIONS NOT COVERED HEREIN, THE CONTRACTOR SHALL PREPARE A PAVEMENT JOINT LAYOUT FOR APPROVAL BY THE ENGINEER. SLABS 14 FT. IN WIDTH SHALL BE CONSTRUCTED ONLY WHERE DESIGNATED ON THE PLANS.
4. WHEN A CONTINUOUS WIDTH OF PAVEMENT IS POURED WIDER THAN 40 FT., THE JOINT NEAREST THE CENTERLINE SHALL BE AN UNTIED (D) JOINT.
5. ON 4 LANE DIVIDED HIGHWAYS, THE 2 LANE DIRECTIONAL PAVEMENT AND BOTH SHOULDERS SHALL BE PLACED WITH (E) LONGITUDINAL SAWED CONTRACTION JOINTS.
6. ON VARIABLE WIDTH SLABS, THE 2 FT. OR 4 FT. END OF SLAB WIDTH DIMENSION MAY VARY ±6 INCHES.
7. (L) TO BE USED WHEN TRAFFIC LANE IS ADDED SEPARATELY OR FOR TAPERS OR SPEED CHANGE LANES. ALTERNATIVE LONGITUDINAL JOINT LOCATIONS AT SPEED CHANGE LANE MAY BE USED IF APPROVED.

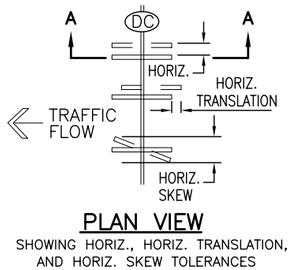
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

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

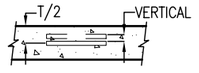


DOWEL BAR DETAIL FOR (DC) JOINT WITH 14 FT. AND 12 FT. LANES



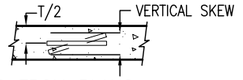
PLAN VIEW

SHOWING HORIZ., HORIZ. TRANSLATION, AND HORIZ. SKEW TOLERANCES



SECTION A–A

SHOWING VERTICAL TOLERANCE



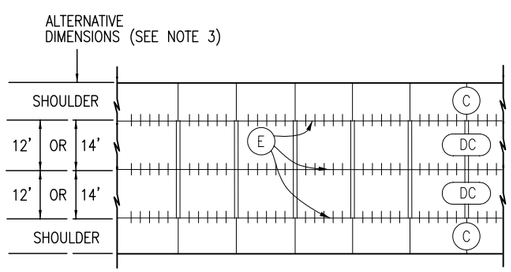
SECTION A–A

SHOWING VERTICAL SKEW TOLERANCE

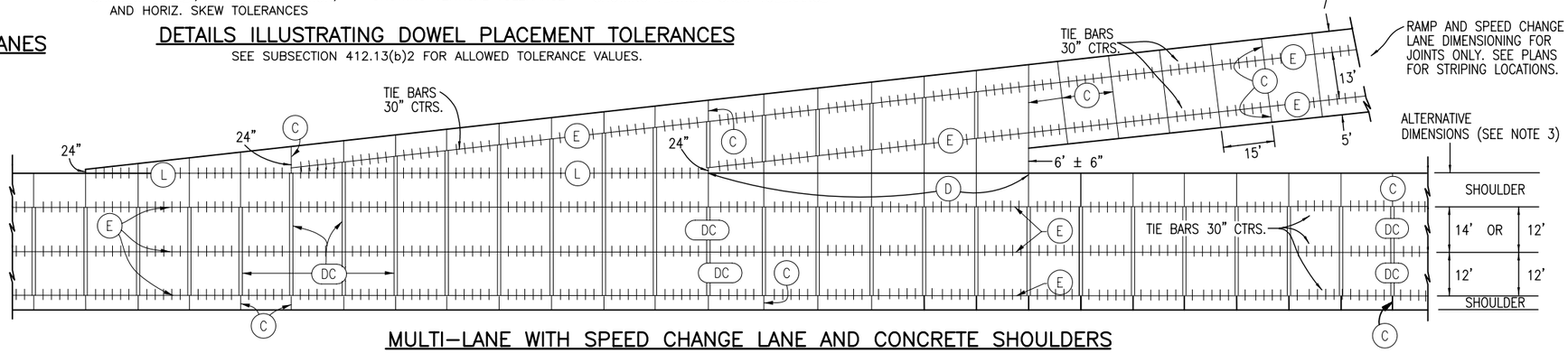
T IS PAVEMENT THICKNESS FROM PLANS

DETAILS ILLUSTRATING DOWEL PLACEMENT TOLERANCES

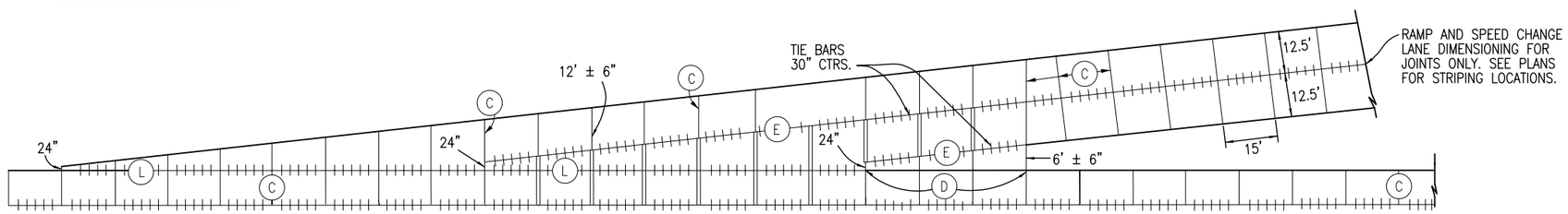
SEE SUBSECTION 412.13(b)2 FOR ALLOWED TOLERANCE VALUES.



RURAL TWO–LANE



MULTI–LANE WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS



OPTIONAL LONGITUDINAL JOINT IN CENTER FOR SINGLE LANE SPEED CHANGE LANE

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CONCRETE PAVEMENT JOINTS

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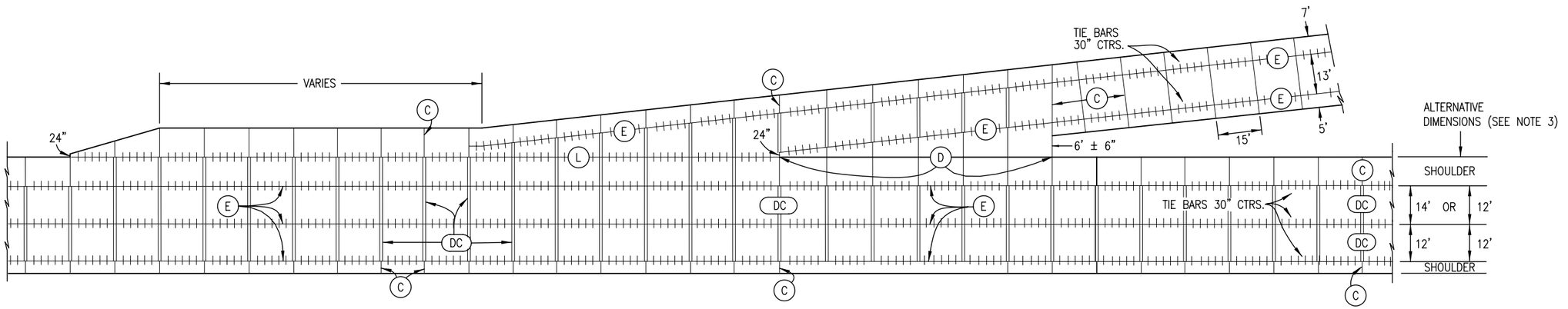
STANDARD PLAN NO.
M-412-1
Sheet No. 1 of 5

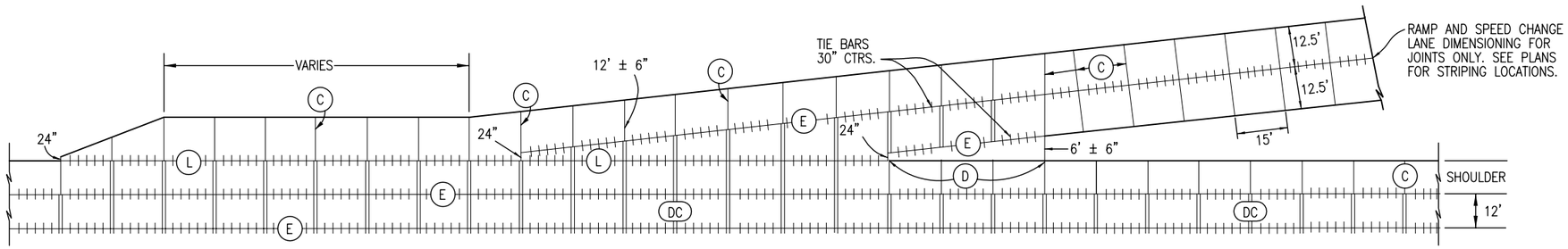
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

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



MULTI–LANE WITH ACCELERATION AND DECELERATION LANES AND CONCRETE SHOULDERS



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

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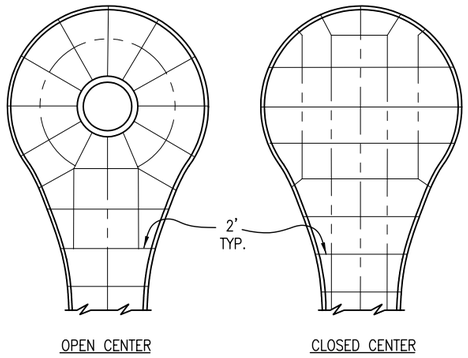
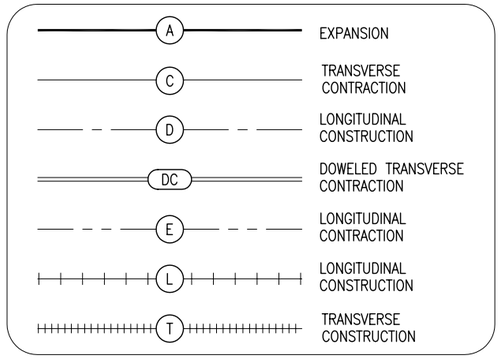
STANDARD PLAN NO.
M-412-1
Sheet No. 2 of 5



CUL–DE–SAC

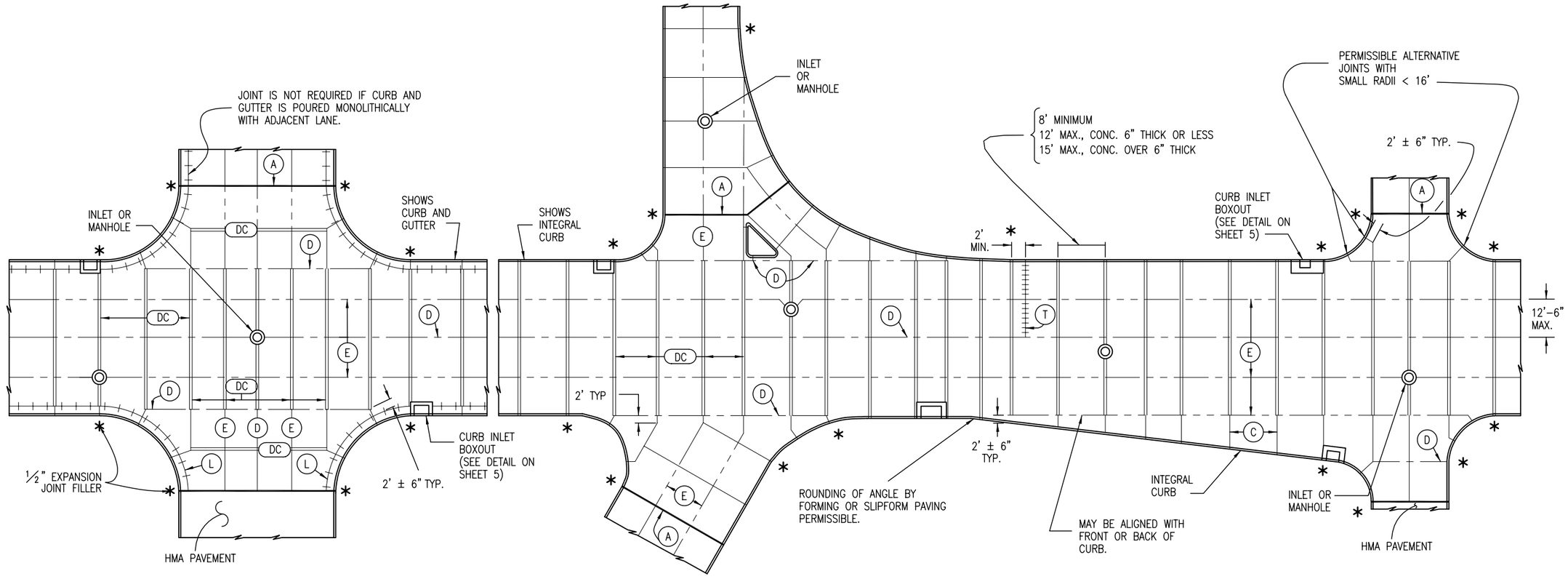
JOINT LEGEND

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



TYPICAL CURBED PAVEMENT JOINT LAYOUT

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STANDARD PLAN NO.
M-412-1
Sheet No. 3 of 5

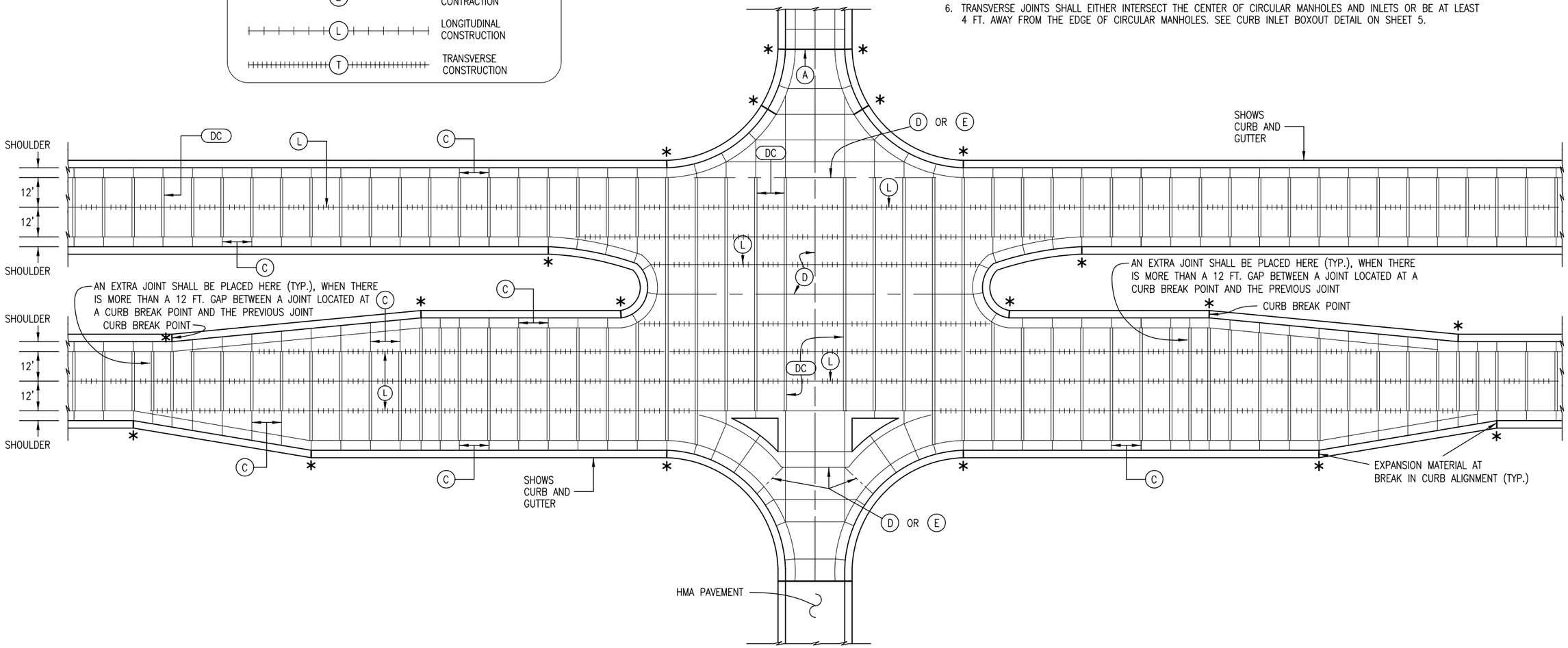
JOINT LEGEND

(SEE SHEET 5 FOR JOINT DETAILS)

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

NOTES

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



MULTI–LANE INTERSECTION WITH SPEED CHANGE LANE AND CONCRETE SHOULDERS

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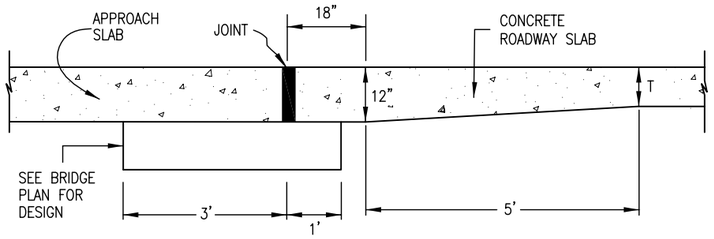
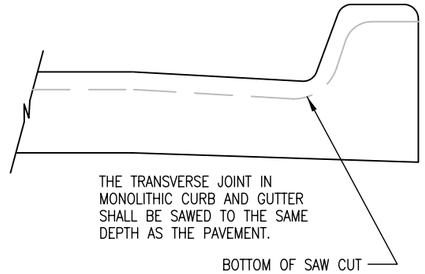
STANDARD PLAN NO.
M-412-1
Sheet No. 4 of 5



BRIDGE APPROACH

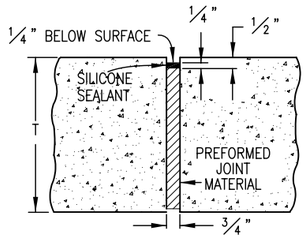


NOTE

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

PAVEMENT THICKNESS (T)	TIE BAR SIZE	DOWEL BAR DIAMETER
T < 8 IN.	No. 4	1 IN.
8 IN. ≥ T ≤ 10 IN.	No. 5	1.25 IN.
10 IN. > T ≤ 15 IN.	No. 6	1.50 IN.

REINFORCING SIZE TABLE



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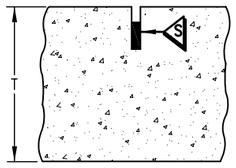
EXPANSION JOINT



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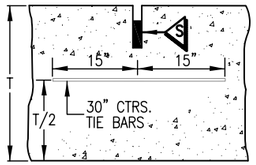
TRANSVERSE CONTRACTION JOINT

(TRANSVERSE WEAKENED PLANE JOINT)



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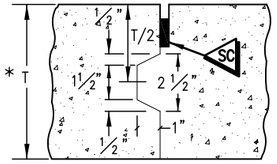
LONGITUDINAL CONTRACTION JOINT

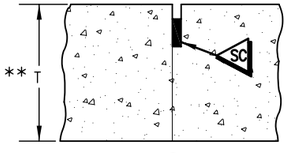
(LONGITUDINAL WEAKENED PLANE JOINT)



Ⓓ

LONGITUDINAL CONSTRUCTION JOINT

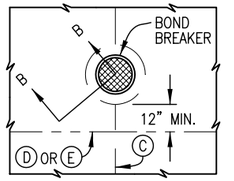
* USE ONLY IF T ≥ 8 IN.
FORM ONLY FEMALE KEYWAY

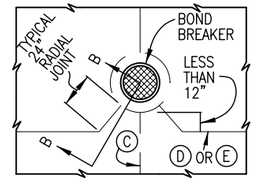


Ⓕ

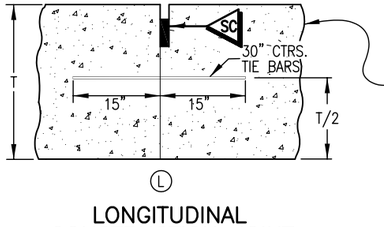
LONGITUDINAL CONSTRUCTION JOINT

** USE ONLY IF T < 8 IN.





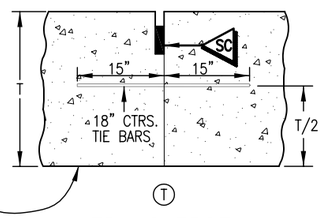
INLET OR MANHOLE CAST IN PAVEMENT



Ⓛ

LONGITUDINAL CONSTRUCTION JOINT

A KEYWAY IS ALLOWED TO FACILITATE USE OF BENT GRADE 40 TIE BARS OR APPROVED TWO PIECE CONNECTORS



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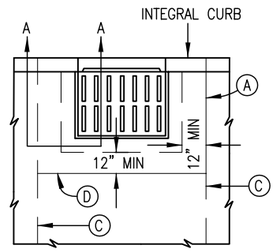
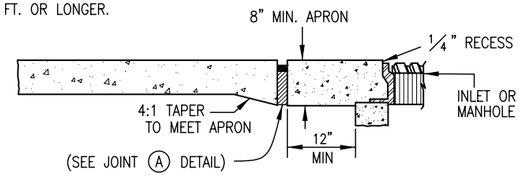
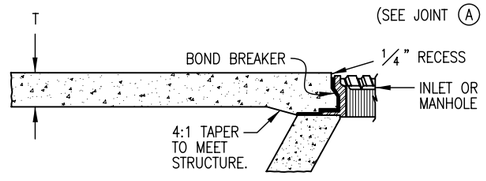
TRANSVERSE CONSTRUCTION JOINT



CURB INLET BOXOUT

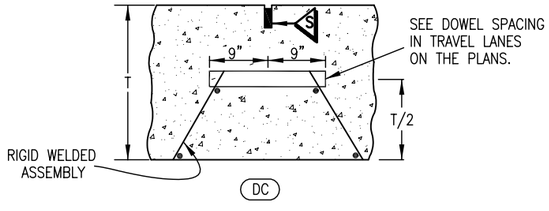


SECTION A–A



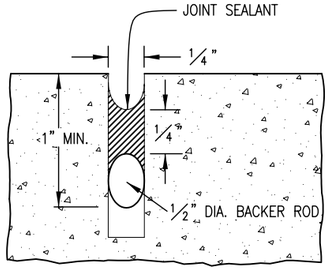
SECTION B–B

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



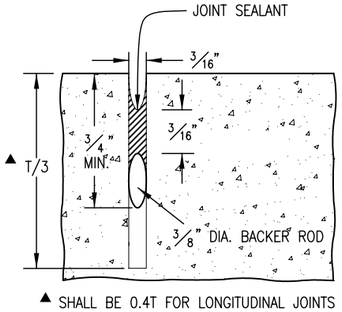
DC

DOWELED TRANSVERSE CONTRACTION JOINT



SEAL AT CONSTRUCTION JOINT

SC



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

SAWED JOINT

S

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CONCRETE PAVEMENT JOINTS

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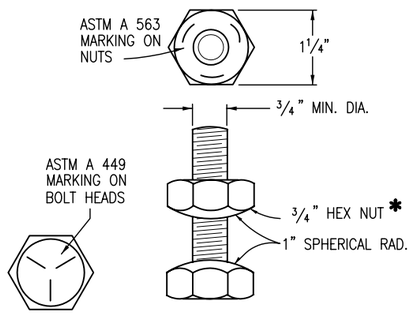
STANDARD PLAN NO.
M-412-1
Sheet No. 5 of 5

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

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



PIPE BOLT AND NUT

✱ INSTALL CULVERT NUTS AS SHOWN.
DO NOT INVERT.

NOTES:

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

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

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

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

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

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

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

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

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

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

GENERAL NOTES

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

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

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

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

Computer File Information	
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R–X	

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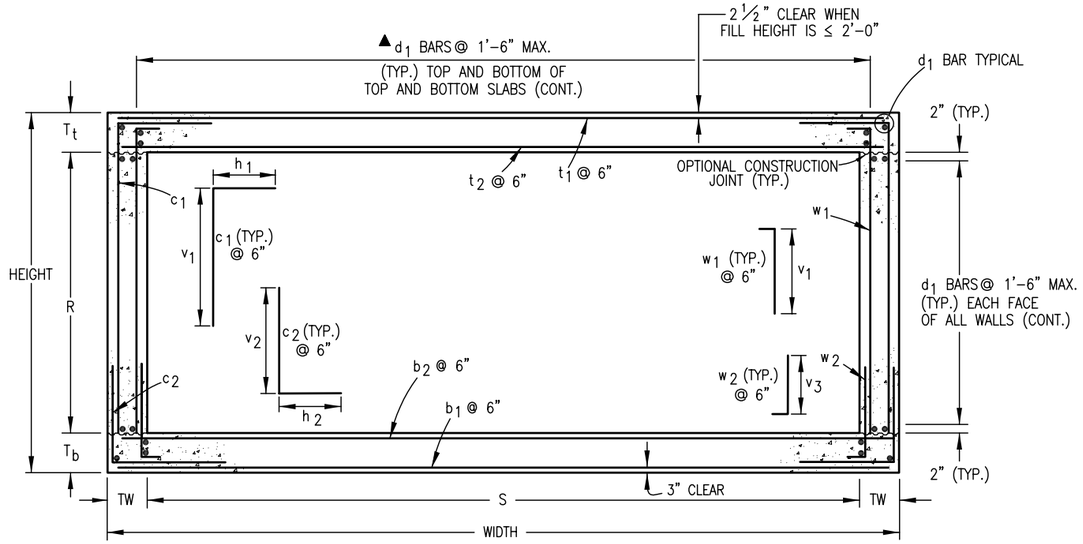
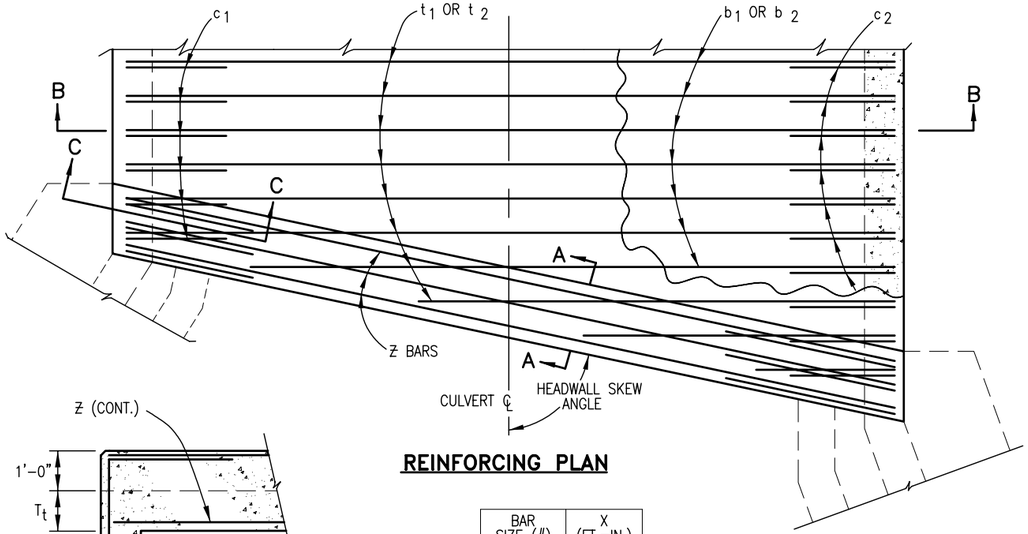
STRUCUTRAL PLATE PIPE H-20 LOADING

Issued By: Project Development Branch on July 04, 2006

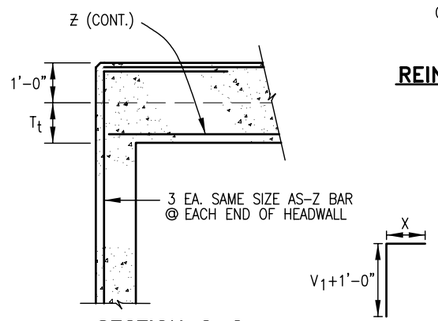
STANDARD PLAN NO.
M-510-1
Sheet No. 1 of 1



SECTION B–B



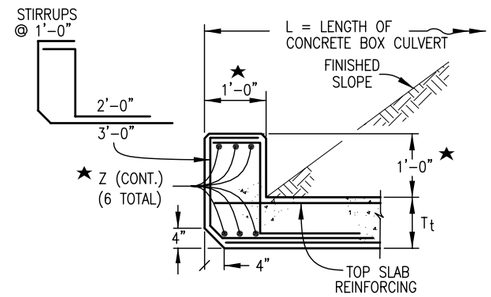
REINFORCING PLAN

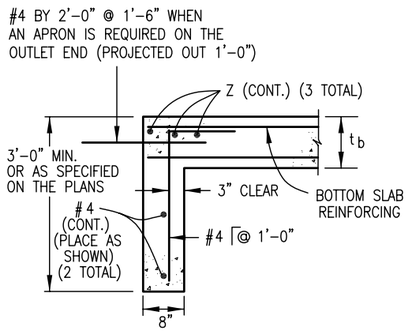


SECTION C–C

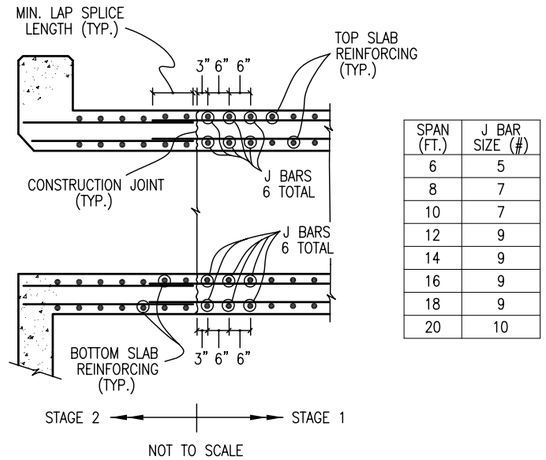
BAR SIZE (#)	X (FT.-IN.)
4	1-9
5	2-2
6	2-7
7	3-1
8	4-0
9	5-1
10	6-5
11	7-11

HEADWALL CORNER REINFORCING DETAIL





SECTION A–A



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

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

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

GENERAL NOTES

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

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

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

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

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

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

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

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

SERVICE LOAD DESIGN METHOD

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

LOADING DATA:

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

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

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

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

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

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

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

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SINGLE CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 04, 2006

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

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

BOX SIZE			FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES						d_1▲	DIMENSIONS					QUANTITIES	
S	R	HT.	WIDTH				t_1* & b_1	t_2	b_2	w_1* & w_2	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL
FT.	FT.	FT.–IN.	FT.–IN.	FT.–FT.	T_t	T_b	TW	#	#	#	#	#	#	NO.	FT.–IN.	FT.–IN.	FT.–IN.	FT.–IN.	FT.–IN.	CU.YDS./LIN.FT.	LBS./LIN.FT.
6	7	8–5	7–8	0 TO 10	8	9	10	4	5	5	4	4	4		2–7	2–11	7–6	2–3	2–3	0.834	153
		8–7	7–8	>10 TO 15	8.5	10.5	10	4	5	5	4	4	4	48	2–7	3–1	7–6	2–4	2–4	0.882	154
		8–10	7–8	>15 TO 20	10	12.0	10	4	5	5	4	4	4		2–7	3–3	7–9	2–6	2–6	0.953	156
8	6	7–7.5	9–8	0 TO 10	9	10.5	10	4	6	6	4	4	4		3–4	2–10	6–7	2–4	2–4	0.952	184
		7–11	9–8	>10 TO 15	10.5	12.5	10	4	6	6	4	4	4	52	3–0	2–10	6–8	2–6	2–6	1.057	184
		8–3	9–8	>15 TO 20	12.5	14.5	10	4	7	7	4	4	4		3–2	2–11	6–10	2–8	2–8	1.176	207
	8	9–7.5	9–8	0 TO 10	9.0	10.5	10	4	6	6	4	5	4		4–5	3–5	8–7	2–4	2–4	1.076	224
		9–11	9–8	>10 TO 15	10.5	12.5	10	4	6	6	4	5	4	60	2–9	3–7	8–8	2–6	2–6	1.180	218
		10–3	9–8	>15 TO 20	12.5	14.5	10	4	6	6	4	5	4		2–9	3–9	8–10	2–8	2–8	1.299	221
	10	11–8	9–8	0 TO 10	9	11	10	4	6	5	5	5	5		2–9	2–9	10–7	2–10	2–10	1.214	253
		11–11	9–8	>10 TO 15	10.5	12.5	10	4	6	6	5	5	5	64	2–9	2–9	10–8	2–11	2–11	1.303	267
		12–3	9–11	>15 TO 20	12.5	14.5	11.5	4	6	6	5	5	5		2–11	5–1	10–10	3–1	3–1	1.536	282
10	6	7–10.5	11–8	0 TO 10	10.5	12.0	10	4	6	7	4	5	5		3–4	3–0	6–8	2–11	2–6	1.181	243
		8–3	11–8	>10 TO 15	12.5	14.5	10	4	7	7	4	5	4	56	3–4	2–11	6–10	3–1	2–8	1.343	248
		8–10	11–8	>15 TO 20	15.5	18.5	10	4	7	7	4	4	5		3–1	2–9	7–1	3–5	3–0	1.395	244
	8	9–10.5	11–8	0 TO 10	10.5	12.0	10	4	6	7	4	5	5		3–11	3–5	8–8	2–11	2–6	1.304	266
		10–3.5	11–8	>10 TO 15	13	14.5	10	4	7	7	4	5	5	64	4–1	3–6	8–11	3–1	2–8	1.484	282
		10–9	11–8	>15 TO 20	15.5	17.5	10	4	7	7	4	5	5		3–6	2–11	9–1	3–4	2–11	1.682	280
	10	11–11	11–8	0 TO 10	10.5	12.5	10	4	6	6	4	5	5		2–11	4–6	10–8	2–11	2–6	1.445	270
		12–3.5	11–8	>10 TO 15	12.5	15.0	10	4	7	7	5	6	5	68	3–4	4–10	10–10	3–7	3–2	1.608	354
		12–8	11–11	>15 TO 20	15.0	17.5	11.5	4	7	7	5	5	5		3–8	3–4	11–1	3–4	3–4	1.905	328
12	6	7–11	13–8	0 TO 8	10.5	12.5	10	4	7	7	4	6	5		3–11	3–8	6–8	3–4	2–6	1.341	306
		8–4	13–8	>8 TO 12	13	15	10	4	8	8	4	5	5	60	2–10	2–9	6–11	3–2	2–9	1.551	313
		8–9.5	13–8	>12 TO 16	15.5	18	10	4	8	8	4	5	5		3–6	2–9	7–1	3–5	3–0	1.783	319
		9–3.5	13–8	>16 TO 20	19.0	20.5	10	4	8	9	4	5	5		3–6	2–9	7–5	3–7	3–2	2.037	341
	8	9–11	13–8	0 TO 8	10.5	12.5	10	4	7	7	5	6	5		4–1	3–9	8–8	3–4	2–11	1.464	351
		10–4	13–8	>8 TO 12	13	15	10	4	8	8	4	6	5	68	3–4	2–9	8–11	3–6	2–9	1.675	358
		10–9.5	13–8	>12 TO 16	15.5	18	10	4	8	8	4	5	5		3–6	2–10	9–1	3–5	3–0	1.907	338
		11–3.5	13–8	>16 TO 20	18.5	21	10	4	8	8	4	5	5		3–6	3–0	9–4	3–8	3–3	2.160	342
	10	12–0	13–8	0 TO 8	11	13	10	4	7	7	4	6	5		5–3	4–4	10–8	3–5	2–7	1.630	360
		12–4.5	13–8	>8 TO 12	13	15.5	10	4	8	8	4	6	6	72	3–4	3–4	10–11	3–7	2–9	1.819	393
		12–9.5	13–9	>12 TO 16	15.5	18	10.5	4	8	8	4	6	5		4–3	3–2	11–1	3–10	3–0	2.070	390
		13–2	13–11	>16 TO 20	18	20	11.5	4	8	8	4	6	5		4–4	3–5	11–4	4–0	3–2	2.342	396
14	6	7–11.5	15–8	0 TO 6	11	12.5	10	4	8	8	5	6	6		4–3	4–0	6–9	3–4	2–11	1.507	408
		8–2	15–8	>6 TO 8	12	14	10	4	8	8	4	6	6		4–1	3–4	6–10	3–6	2–8	1.628	386
		8–5	15–8	>8 TO 10	13.5	15.5	10	4	8	8	4	6	5	68	3–4	2–9	6–11	3–7	2–9	1.773	368
		8–9	15–8	>10 TO 12	15.5	17.5	10	4	9	9	4	6	5		4–3	2–10	7–1	3–9	2–11	1.966	421
		9–4.5	15–8	>12 TO 16	19.5	21	10	4	9	9	4	5	5		3–6	2–10	7–5	3–8	3–3	2.329	400
		9–7.5	15–8	>16 TO 18	21	22.5	10	4	9	9	4	5	5		3–6	2–11	7–7	3–9	3–4	2.474	402
	8	10–0	15–8	0 TO 6	11	13	10	4	8	8	5	6	6		4–4	4–1	8–9	3–5	3–0	1.654	435
		10–2	15–8	>6 TO 8	12	14	10	4	8	8	4	6	6		4–2	3–7	8–10	3–6	2–8	1.751	410
		10–5.5	15–8	>8 TO 10	13.5	16	10	4	8	8	4	6	5	76	3–4	2–11	8–11	3–8	2–10	1.920	394
		10–10	15–8	>10 TO 12	15.5	18.5	10	4	9	9	4	6	5		4–3	2–11	9–1	3–10	3–0	2.138	444
		11–3.5	15–9	>12 TO 16	18.5	21	10.5	4	9	9	4	5	5		3–7	3–1	9–4	3–8	3–3	2.439	421
		11–6.5	15–8	>16 TO 18	20	22.5	10	4	9	9	4	5	5		3–6	3–1	9–6	3–9	3–4	2.549	419
	10	12–0	15–8	0 TO 6	11	13	10	4	8	8	5	6	6		4–10	4–4	10–9	3–5	3–0	1.778	455
		12–2.5	15–8	>6 TO 8	12	14.5	10	4	8	8	4	6	6		4–10	4–3	10–10	3–6	2–8	1.899	439
		12–5.5	15–9	>8 TO 10	13.5	16	10.5	4	8	8	4	6	6	80	3–4	3–5	10–11	3–8	2–10	2.082	426
		12–9.5	15–9	>10 TO 12	15.5	18	10.5	4	8	8	4	6	6		4–3	3–4	11–1	3–10	3–0	2.277	436
		13–4	15–10	>12 TO 16	18.5	21.5	11	4	9	9	4	6	5		4–4	3–5	11–4	4–1	3–3	2.634	443
		13–6.5	15–11	>16 TO 18	20	22.5	11.5	4	9	9	4	6	5		4–4	3–6	11–6	4–2	3–4	2.798	477
16	6	8–2.5	17–9	0 TO 6	12.5	14	10.5	4	8	8	4	7	6		4–7	3–11	6–10	3–6	2–8	1.841	452
		8–5.5	17–11	>6 TO 8	13.5	16	11.5	4	8	8	5	7	6	72	3–10	3–5	6–11	3–8	3–3	2.057	463
		8–9	17–10	>8 TO 10	15.5	17.5	11	4	9	9	5	7	6		4–10	3–5	7–1	3–9	3–4	2.242	524
	8	10–3.5	17–9	0 TO 6	12.5	15	10.5	4	8	8	5	7	6		4–7	3–10	8–10	3–7	3–2	2.025	497
		10–6.5	17–10	>6 TO 8	14.0	16.5	11.0	4	9	9	4	7	6	80	3–8	3–4	9–0	4–2	2–10	2.189	522
		10–11	17–9	>8 TO 10	16.5	18.5	10.5	4	9	9	4	6	5		4–3	3–2	9–2	3–10	3–0	2.436	484
	10	12–4.5	17–8	0 TO 6	13.5	15	10	4	8	9	5	7	6		4–9	4–3	10–11	3–7	3–2	2.171	554
		12–8	17–9	>6 TO 8	15	17	10.5	4	9	9	4	6	6	84	4–3	3–4	11–1	3–9	2–11	2.401	515
		12–11	17–9	>8 TO 10	16.5	18.5	10.5	4	9	9	4	6	6		4–3	3–4	11–2	3–10	3–0	2.566	516
18	8	10–5	19–11	0 TO 5	13.5	15.5	11.5	4	8	9	5	7	7	84	5–2	4–5	8–11	4–1	3–2	2.351	588
		10–9	19–10	>5 TO 7	15.5	17.7	11	4	9	9	4	7	6		4–10	3–11	9–1	3–9	2–11	2.563	565
	10	12–6	19–10	0 TO 5	14	16	11	4	9	9	4	7	6	88	5–1	4–6	11–0	3–8	2–10	2.515	598
		12–9	19–11	>5 TO 7	15.5	17.5	11.5	4	9	9	4	7	6		5–0	4–5	11–1	3–10	2–11	2.738	597
20	8	10–3.5	22–0	0 TO 3	13.5	15	12	5	9	9	5	7	8		5–9	5–2	8–11	4–1	3–2	2.528	700
		10–9.5	22–2	>3 TO 6	16	17.5	13	4	9	9	4	7	7	92	5–5	4–9	9–2	4–3	2–11	2.934	646
		11–0.5	22–3	>6 TO 8	17	19.5	13.5	4	9	10	4	8	7		5–8	4–7	9–3	4–5	3–1	3.173	727
		11–5.5	22–2	>8 TO 10	19.5	22	13	4	10	10	4	7	6		5–0	4–4	9–4	4–2	3–4	3.481	702
	10	12–5.5	21–11	0 TO 3	15	15.5	11.5	4	9	9	5	7	7		5–4	4–11	11–1	4–1	3–2	2.773	692
		12–9	22–1	>3 TO 6	15	18	12.5	4	9	10	4	8	7	96	5–8	4–9	11–1	4–4	3–0	3.021	751
		13–0.5	22–1	>6 TO 8	17	19.5	12.5	4	10	10	4	8	7		5–7	4–7	11–3	4–5	3–1	3.259	792
		13–5.5	22–2	>8 TO 10	19.5	22	13	4	10	10	4	7	6		5–1	4–7	11–5	4–2	3–4	3.642	728

HEADWALL AND TOEWALL QUANTITIES

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

NOTES

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

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

3. FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.

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

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

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

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

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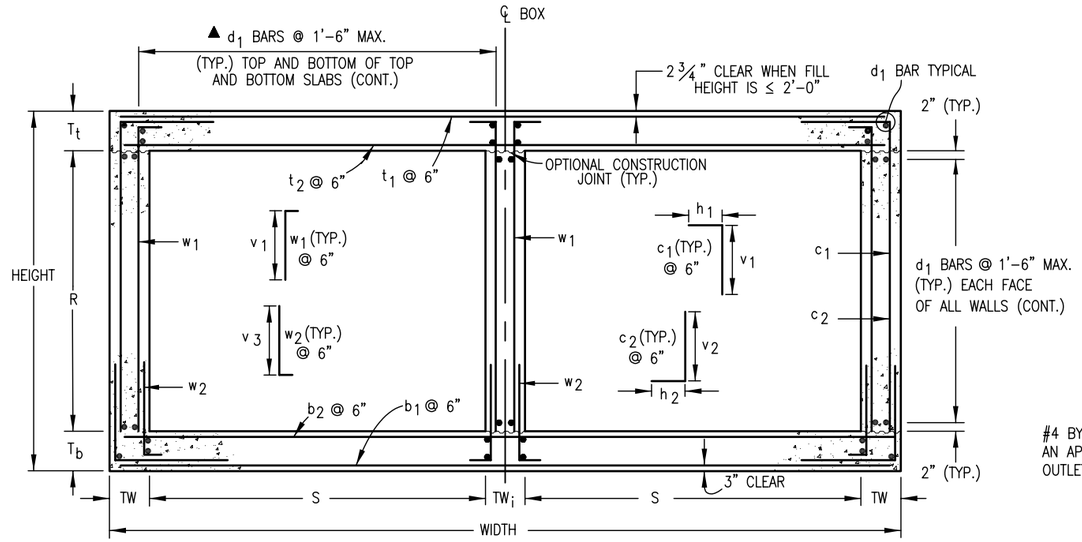
SINGLE CONCRETE BOX CULVERT

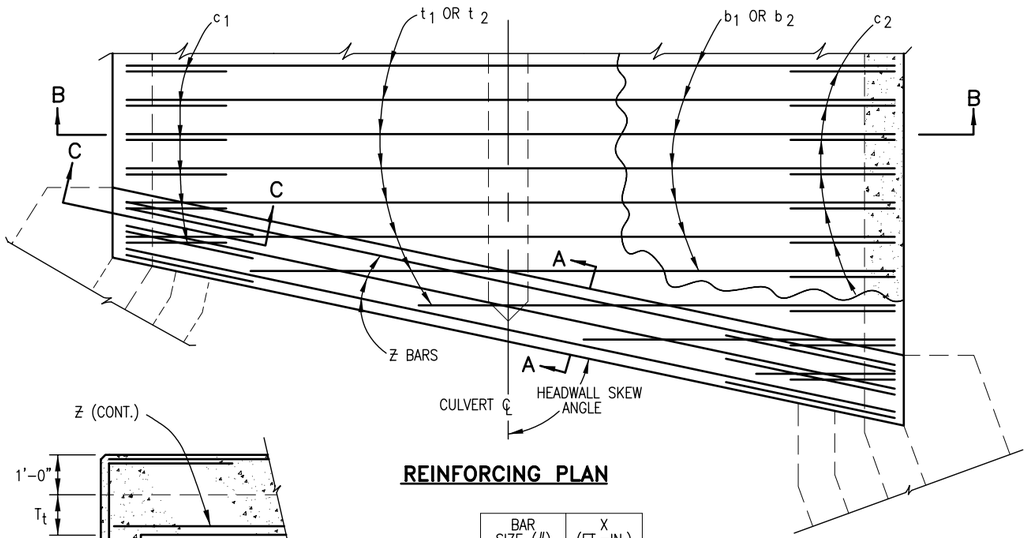
Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO. M-601-1

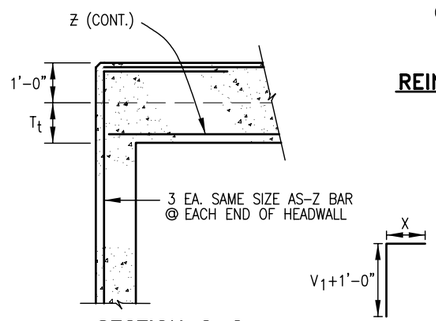
Sheet No. 2 of 2



SECTION B–B



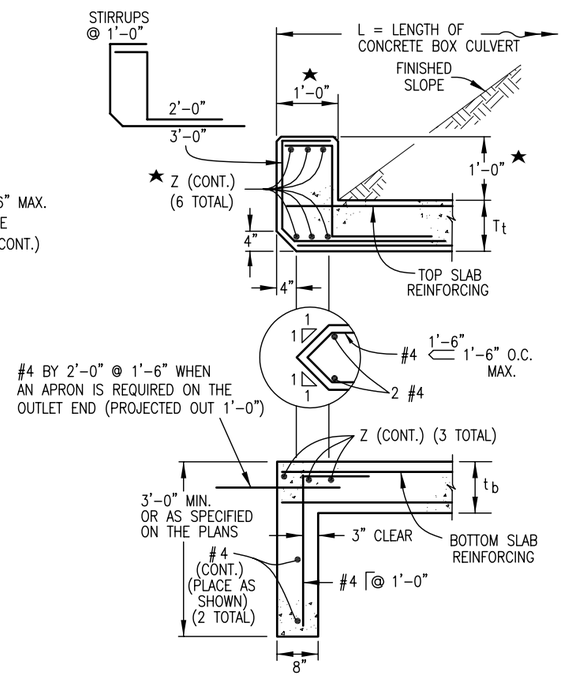
REINFORCING PLAN



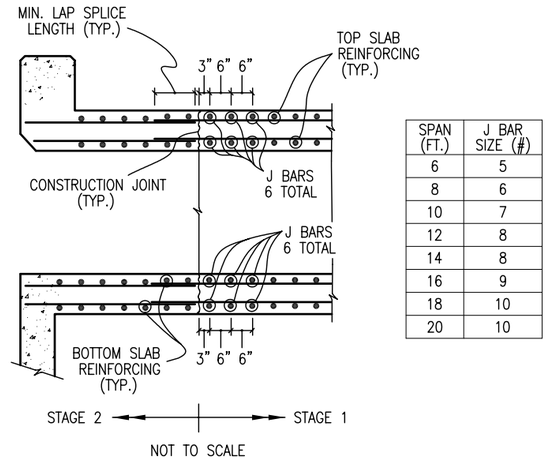
SECTION C–C

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

HEADWALL CORNER REINFORCING DETAIL



SECTION A–A



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

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

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

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

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

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

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

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

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

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

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

SERVICE LOAD DESIGN METHOD

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

LOADING DATA:

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

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

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

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

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

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

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

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DOUBLE CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 04, 2006

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

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

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INCHES)			BAR SIZES							d_1▲	DIMENSIONS					QUANTITIES	
S	R	HT.	WIDTH		T_t	T_b	TW & TW_i	t_1*	t_2	b_1	b_2	w_1* & w_2	c_1*	c_2		h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL
FT.	FT.	FT.–IN.	FT.–IN.	FT.–FT.				#	#	#	#	#	#	#	NO.	FT.–IN.	FT.–IN.	FT.–IN.	FT.–IN.	FT.–IN.	CU.YDS./LIN.FT.	LBS./LIN.FT.
6	6	7–5	14–6	0 TO 10	8	9	10	5	5	5	4	4	4	4	74	2–7	2–7	6–6	2–3	2–3	1.316	248
		7–8	14–6	>10 TO 15	9	11	10	5	5	5	4	4	4	4		2–7	2–7	6–7	2–5	2–5	1.457	250
		7–11	14–6	>15 TO 20	11	12	10	5	4	5	4	4	4	4		2–7	2–7	6–9	2–6	2–6	1.585	241
	8	9–5	14–6	0 TO 10	8	9	10	5	5	5	4	4	4	4	86	2–7	2–7	8–6	2–3	2–3	1.502	272
		9–8	14–6	>10 TO 15	9	11	10	5	5	4	4	4	4	4		2–7	2–7	8–7	2–5	2–5	1.636	264
		9–11	14–6	>15 TO 20	11	12	10	5	4	5	4	4	4	4		2–7	2–7	8–9	2–6	2–6	1.770	263
	10	11–6	14–6	0 TO 10	8	10	10	4	5	4	4	4	5	5	92	2–9	2–9	10–6	2–9	2–4	1.731	299
		11–8	14–6	>10 TO 15	9	11	10	4	5	4	4	5	5	5		2–9	2–9	10–7	2–10	2–11	1.821	353
		12–0	14–10.5	>15 TO 20	11	13	11.5	4	4	5	4	5	5	5		2–11	2–11	10–9	3–0	3–0	2.167	360
8	6	7–9	18–6	0 TO 10	10	11	10	6	5	6	5	4	4	5	90	2–7	2–9	6–8	2–10	2–5	1.755	349
		8–2	18–6	>10 TO 15	12	14	10	6	5	6	5	4	4	4		2–7	2–7	6–10	2–8	2–8	2.040	342
		8–6	18–6	>15 TO 20	14	16	10	6	5	6	5	4	4	4		2–7	2–7	7–0	2–11	2–11	2.269	344
	8	9–9	18–6	0 TO 10	10	11	10	6	5	6	4	4	4	5	102	2–7	2–9	8–8	2–10	2–5	1.940	357
		10–2	18–6	>10 TO 15	12	14	10	6	5	5	5	4	4	4		2–7	2–7	8–10	2–8	2–8	2.225	348
		10–6	18–6	>15 TO 20	14	16	10	6	5	6	5	4	4	4		2–7	2–7	9–0	2–11	2–11	2.454	368
10	6	7–7	22–6	0 TO 5	9	10	10	7	6	7	5	4	5	6	98	2–9	3–4	6–7	3–2	2–4	1.875	490
		8–1	22–6	>5 TO 10	12	13	10	7	5	7	5	4	4	5		2–7	2–9	6–10	3–0	2–7	2.292	435
		8–7	22–6	>10 TO 15	15	16	10	7	5	7	5	4	4	4		3–1	2–7	7–1	2–10	2–10	2.708	439
		9–1	22–6	>15 TO 20	18	19	10	7	6	7	6	4	5	5		3–6	2–9	7–4	3–6	3–1	3.125	512
	8	9–7	22–6	0 TO 5	9	10	10	7	6	7	5	4	5	6	110	2–9	3–4	8–7	3–2	2–4	2.060	519
		10–1	22–6	>5 TO 10	12	13	10	7	5	7	5	4	4	5		2–7	2–9	8–10	3–0	2–7	2.477	470
		10–7	22–6	>10 TO 15	15	16	10	7	5	7	5	4	4	4		3–1	2–7	9–1	2–10	2–10	2.894	465
		11–0	22–6	>15 TO 20	17	19	10	7	6	7	5	4	5	5		3–6	2–9	9–3	3–6	3–1	3.241	520
	10	11–8	22–6	0 TO 5	9	11	10	7	6	6	5	4	5	6	116	2–9	3–4	10–7	3–3	2–5	2.315	519
		12–1	22–6	>5 TO 10	12	13	10	6	5	7	5	4	5	5		2–9	2–9	10–10	3–0	2–7	2.662	487
		12–6	22–6	>10 TO 15	14	16	10	7	5	6	5	4	5	5		2–9	2–9	11–0	3–3	2–10	3.009	491
		13–0	22–10.5	>15 TO 20	17	19	11.5	7	5	7	5	5	5	5		3–8	2–11	11–3	3–6	3–6	3.606	582
12	6	7–9	26–6	0 TO 5	10	11	10	8	6	8	5	4	6	6	106	2–9	3–4	6–8	3–3	2–5	2.273	634
		8–5	26–6	>5 TO 10	14	15	10	7	6	8	6	4	4	5		2–7	2–9	7–0	3–2	2–9	2.927	583
		9–0	26–6	>10 TO 15	17	19	10	8	6	8	6	4	5	5		3–6	2–9	7–3	3–6	3–2	3.500	640
	8	9–10	26–6	0 TO 5	10	12	10	8	6	7	5	4	6	6	118	2–9	3–4	8–8	3–4	2–6	2.540	633
		10–5	26–6	>5 TO 10	14	15	10	7	6	8	6	4	4	5		2–7	2–9	9–0	3–2	2–9	3.113	607
		11–0	26–6	>10 TO 15	17	19	10	8	6	7	6	4	5	5		3–6	2–9	9–3	3–6	3–1	3.685	633
	10	11–11	26–6	0 TO 5	11	12	10	8	6	7	5	4	5	6	124	2–9	3–4	10–9	3–4	2–6	2.807	635
		12–5	26–6	>5 TO 10	14	15	10	7	6	7	6	4	5	6		2–9	3–4	11–0	3–7	2–9	3.298	632
		13–0	26–6	>10 TO 15	17	19	10	8	6	7	6	4	5	5		3–6	2–9	11–3	3–6	3–1	3.870	656
14	6	8–2	30–6	0 TO 5	13	13	10	8	6	8	6	4	5	6	122	2–9	3–4	6–11	3–5	2–7	3.003	722
		9–0	30–6	>5 TO 10	17	19	10	8	6	8	6	4	5	5		3–6	2–9	7–3	3–6	3–1	3.944	717
		9–2	30–6	>10 TO 12	19	19	10	8	6	8	6	4	5	5		3–6	2–9	7–5	3–6	3–1	4.133	718
	8	10–1	30–6	0 TO 5	12	13	10	8	6	8	6	4	5	6	134	2–9	3–4	8–10	3–5	2–7	3.094	753
		10–11	30–6	>5 TO 10	17	18	10	8	6	8	6	4	5	5		3–6	2–9	9–3	3–5	3–0	4.035	743
		11–2	30–6	>10 TO 12	19	19	10	8	6	8	6	4	5	5		3–6	2–9	9–5	3–6	3–1	4.318	746
	10	12–0	30–6	0 TO 5	12	13	10	8	6	8	6	4	5	6	140	2–9	3–4	10–10	3–5	2–7	3.279	772
		12–4	30–6	>5 TO 7	13	15	10	8	6	8	6	4	5	6		2–9	3–4	10–11	3–7	2–9	3.562	774
		13–1	30–6	>7 TO 12	18	19	10	8	6	8	6	4	5	5		3–6	2–9	11–4	3–6	3–1	4.409	768
16	6	8–5	34–6	0 TO 5	14	15	10	9	7	9	6	4	6	6	130	3–4	3–4	7–0	3–7	2–9	3.644	955
		8–9	34–6	>5 TO 7	16	17	10	9	7	9	7	4	5	5		3–6	2–9	7–2	3–4	2–11	4.069	960
		9–5	34–6	>7 TO 10	19	22	10	9	7	8	7	4	5	5		3–6	2–9	7–5	3–9	3–4	4.921	917
	8	10–5	34–6	0 TO 5	14	15	10	9	7	9	6	4	5	6	142	2–9	3–4	9–0	3–7	2–9	3.829	961
		10–9	34–6	>5 TO 7	16	17	10	9	7	9	7	4	5	5		3–6	2–9	9–2	3–4	3–0	4.255	987
		11–4	34–6	>7 TO 10	19	21	10	9	7	9	7	4	5	5		3–6	2–9	9–5	3–8	3–3	5.000	993
	10	12–1	34–6	0 TO 2	12	13	10	8	7	8	6	4	6	7	148	3–4	3–8	10–10	3–11	2–7	3.588	930
		12–5	34–6	>2 TO 5	14	15	10	9	7	9	6	4	6	6		3–4	3–4	11–0	3–7	2–9	4.014	1013
		12–10	34–6	>5 TO 7	16	18	10	9	7	8	6	4	6	5		4–3	2–9	11–2	3–10	3–0	4.546	957
18	6	8–5	38–6	0 TO 2	14	15	10	9	8	9	6	5	7	7	138	3–8	3–8	7–0	4–1	3–2	4.002	1179
		8–7	38–6	>2 TO 5	15	16	10	10	7	10	7	4	6	6		4–3	3–4	7–1	3–8	2–10	4.239	1229
		9–2	38–6	>5 TO 7	19	19	10	9	7	10	7	4	5	5		3–6	2–9	7–5	3–6	3–1	5.071	1125
	8	10–5	38–6	0 TO 2	14	15	10	9	8	9	7	4	7	7	150	3–8	3–8	9–0	4–1	2–11	4.187	1209
		10–9	38–6	>2 TO 5	15	18	10	10	7	9	7	4	6	6		4–3	3–4	9–1	3–10	3–0	4.662	1193
		11–2	38–6	>5 TO 7	19	19	10	9	7	10	7	4	5	5		3–6	2–9	9–5	3–6	3–2	5.256	1152
	10	12–7	38–6	0 TO 2	14	17	10	9	8	8	6	4	7	7	156	3–8	3–8	11–0	4–3	2–9	4.610	1151
		12–9	38–6	>2 TO 5	15	18	10	10	7	9	7	4	6	6		4–3	3–4	11–1	3–10	3–0	4.847	1222
		13–4	38–6	>5 TO 7	19	21	10	9	7	9	9	4	5	5		3–6	2–9	11–5	3–8	3–3	5.679	1214
20	6	8–7	42–6	0 TO 2	15	16	10	10	8	10	7	5	7	7	154	4–9	3–8	7–1	4–2	3–3	4.622	1487
		9–1	42–6	>2 TO 5	19	18	10	9	8	10	7	4	5	6		3–6	3–4	7–5	3–10	3–0	5.409	1300
	8	10–9	42–6	0 TO 2	15	18	10	10	8	9	7	4	7	6	166	4–9	3–4	9–1	4–4	3–0	5.069	1387
		11–0	42–6	>2 TO 5	18	18	10	10	8	10	7	4	5	6		3–6	3–4	9–4	3–10	3–0	5.463	1402
	10	12–8	42–6	0 TO 2	15	17	10	10	8	9	7	4	7	7	172	4–9	3–8	11–1	4–3	2–11	5.123	1437
		12–11	42–6	>2 TO 5	17	18	10	10	8	10	7	4	6	6		4–3	3–4	11–3	3–10	3–0	5.517	1456

HEADWALL AND TOEWALL QUANTITIES

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

NOTES

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

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

3. FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.

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

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

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

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

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(R–X) (R–X) (R–X) (R–X)

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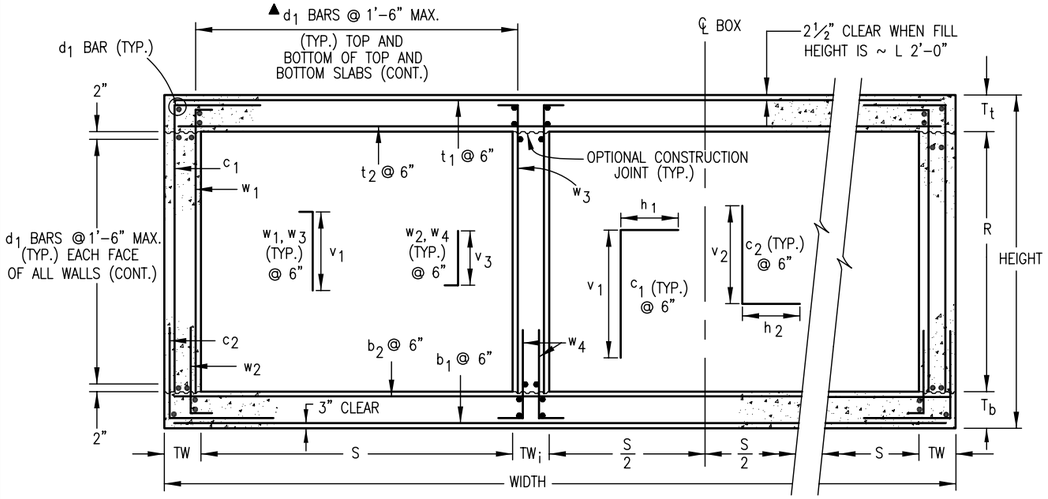
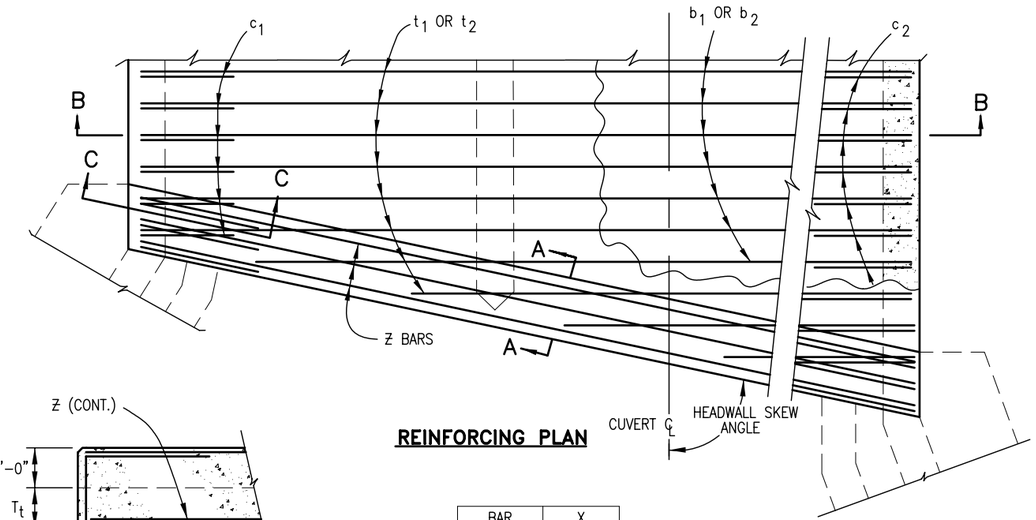
DOUBLE CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 04, 2006

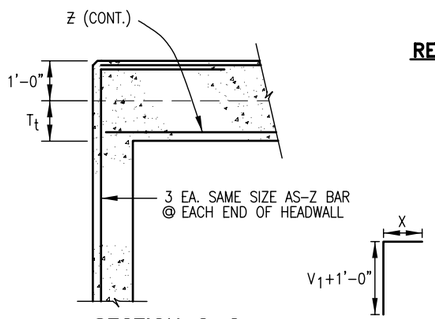
STANDARD PLAN NO.
M-601-2
Sheet No. 2 of 2



SECTION B–B



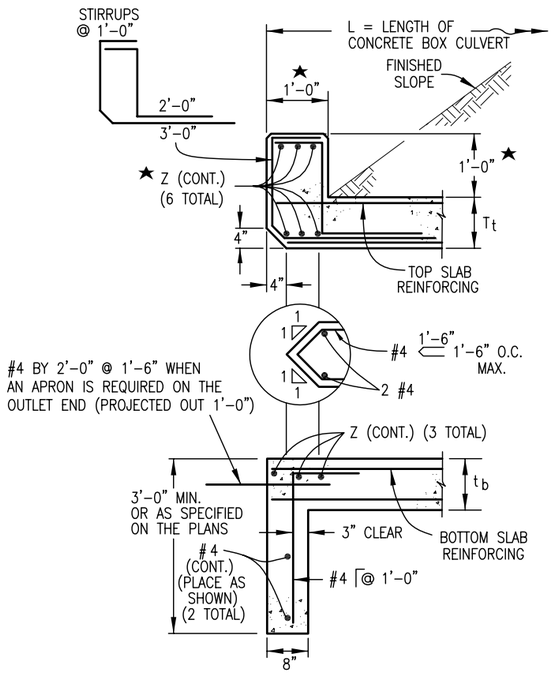
REINFORCING PLAN



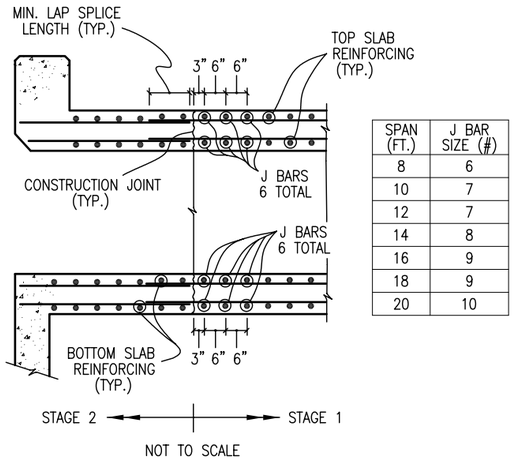
SECTION C–C

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

HEADWALL CORNER REINFORCING DETAIL



SECTION A–A



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

CONSTRUCTION JOINT DETAIL FOR STAGED CONSTRUCTION

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

GENERAL NOTES

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

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

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

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

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

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

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

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

SERVICE LOAD DESIGN METHOD

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

LOADING DATA:

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

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

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

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

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

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

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

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TRIPLE CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 04, 2006

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

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

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

HEADWALL AND TOEWALL QUANTITIES

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

NOTES

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

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

3. FOR HEADWALL AND TOEWALL DETAILS SEE SHEET 1.

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

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

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

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

Computer File Information		Sheet Revisions	
Creation Date: 07/04/06	Initials: SJR	Date:	Comments
Last Modification Date: 07/04/06	Initials: LTA		
Full Path: www.dot.state.co.us/DesignSupport/			
Drawing File Name: 601030202.dwg			
CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English		

(R–X) (R–X) (R–X) (R–X)

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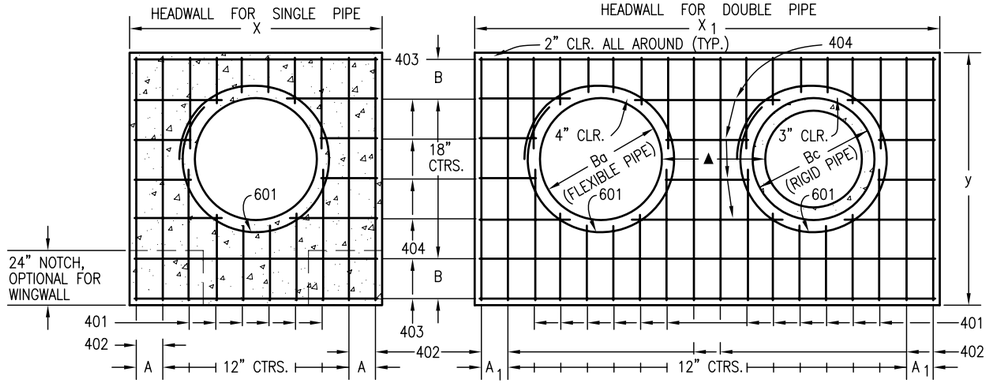
TRIPLE CONCRETE BOX CULVERT

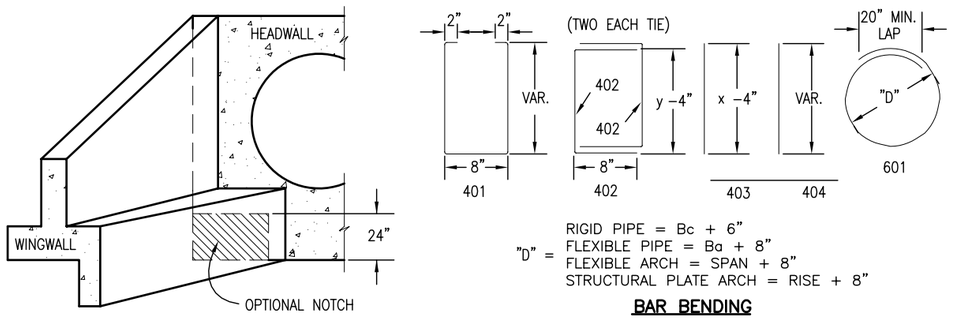
Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO. M-601-3

Sheet No. 2 of 2



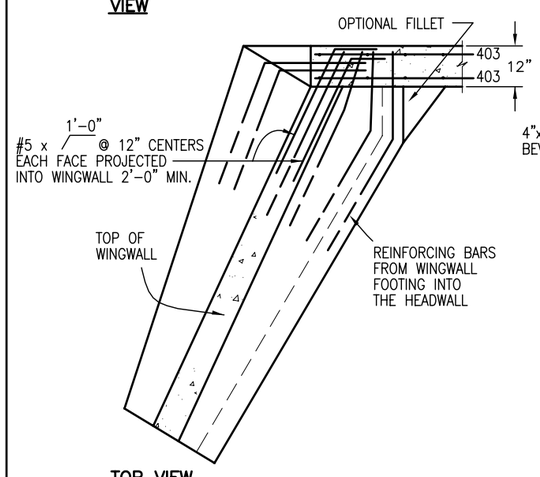
TYPICAL BAR LAYOUT FOR CONCRETE HEADWALLS



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

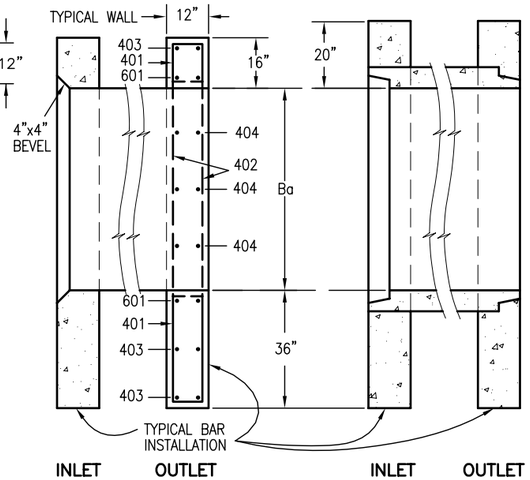
BAR BENDING

FRONT VIEW



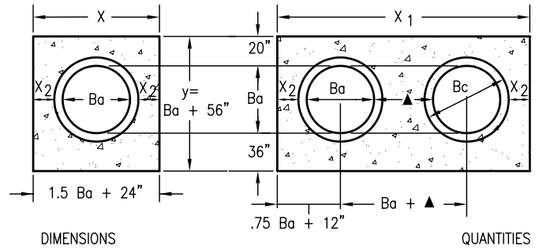
TOP VIEW

WINGWALL CONNECTION



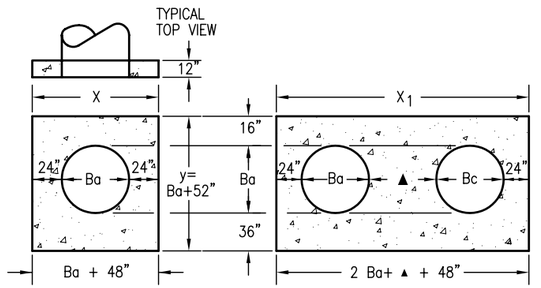
ENDS OF FLEXIBLE PIPE

ENDS OF RIGID PIPE



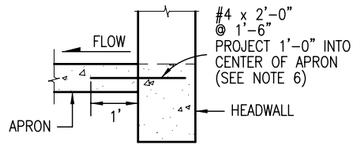
DIMENSIONS									QUANTITIES			
Ba IN.	Bc IN.	X FT.–IN.	A IN.	X_1 FT.–IN.	A_1 IN.	y FT.–IN.	B IN.	X_2 IN.	CONCRETE SGL CU.YD.	CONCRETE DBL CU.YD.	STEEL ■ SGL LBS.	STEEL ■ DBL LBS.
54	65	8–9	8½	15–6	7	9–2	17	20	2.12	3.55	209	364
60	72	9–6	7	17–0	10	9–8	11	21	2.35	3.99	236	414
66	79	10–3	11½	18–6	7	10–2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

HEADWALL FOR RIGID ROUND PIPE



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

HEADWALL FOR FLEXIBLE ROUND PIPE



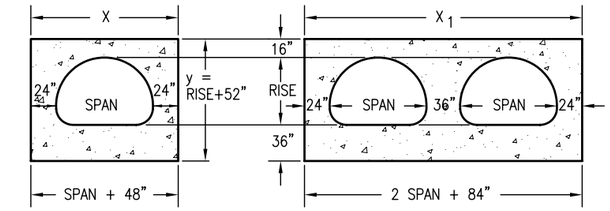
WHEN APRON IS REQUIRED

GENERAL NOTES

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

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

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



DIMENSIONS									QUANTITIES			
EQUIV. Ba IN.	SPAN IN.	RISE IN.	X FT.–IN.	A IN.	X_1 FT.–IN.	A_1 IN.	y FT.–IN.	B IN.	CONCRETE SGL CU. YD.	CONCRETE DBL CU. YD.	STEEL ■ SGL LBS.	STEEL ■ DBL LBS.
72	81	59	10–9	8½	20–6	7	9–3	17½	2.72	5.10	250	467
78	87	63	11–3	11½	21–6	7	9–7	10½	2.85	5.34	275	531
84	95	67	11–9	8½	22–10	9	9–11	12½	3.08	5.79	290	547
90	103	71	12–7	7½	24–2	11	10–3	15	3.30	6.21	321	591
96	112	75	13–4	12	25–8	8	10–7	16½	3.52	6.65	314	606
102	117	79	13–9	8½	26–6	7	10–11	9 ½	3.63	6.86	356	672
108	128	83	14–8	8	28–4	12	11–3	11½	3.96	7.51	376	699

HEADWALL FOR FLEXIBLE PIPE ARCH

DIMENSIONS									QUANTITIES			
EQUIV. Ba IN.	SPAN FT.–IN.	RISE FT.–IN.	X FT.–IN.	A IN.	X_1 FT.–IN.	A_1 IN.	y FT.–IN.	B IN.	CONCRETE SGL CU. YD.	CONCRETE DBL CU. YD.	STEEL ■ SGL LBS.	STEEL ■ DBL LBS.
66	6–1	4–7	10–1	10½	19–2	11	8–11	15½	2.52	4.70	232	424
75	7–0	5–1	11–0	10	21–0	10	9–5	9 ½	2.80	5.25	282	509
84	7–11	5–7	11–11	9½	22–10	9	9–11	12½	3.08	5.79	291	540
93	8–10	6–1	12–10	9	24–8	8	10–5	15½	3.36	6.33	309	622
102	9–9	6–7	13–9	8½	26–6	7	10–11	9 ½	3.63	6.86	379	673
111	10–11	7–1	14–11	9½	28–10	9	11–5	12½	4.05	7.67	377	711
120	11–10	7–7	15–10	9	30–8	8	11–11	15½	4.36	8.28	395	731
132	12–10	8–4	16–10	9	32–8	8	12–8	11	4.75	9.03	441	839
141	14–1	8–9	18–1	10½	35–2	11	13–1	13½	5.17	9.86	448	931
150	15–4	9–3	19–4	12	37–8	8	13–7	16½	5.69	10.88	490	953
159	15–10	9–10	19–10	9	38–8	8	14–2	11	5.89	11.25	534	1019

HEADWALL FOR STRUCTURAL PLATE ARCH

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

SKEW FACTOR TABLE

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Last Modification Date: 07/04/06	Initials: LTA
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CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English

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

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HEADWALLS FOR PIPES

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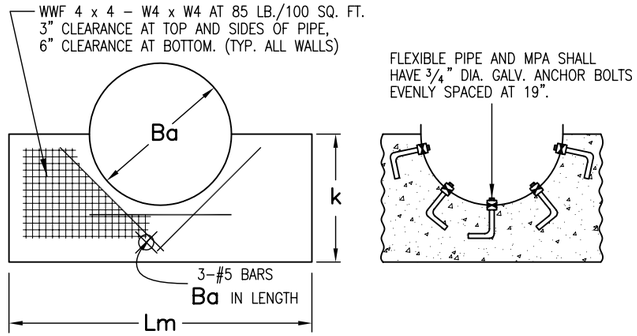
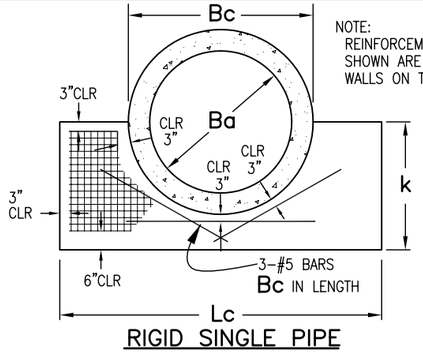
STANDARD PLAN NO.
M-601-10
Sheet No. 1 of 1

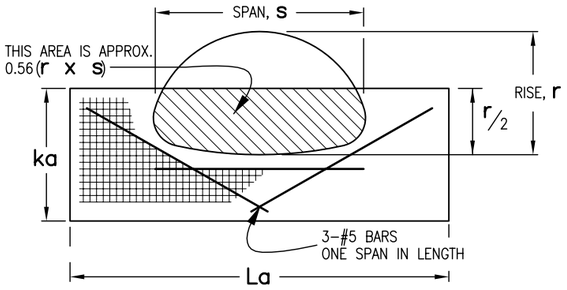


FLEXIBLE SINGLE PIPE



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

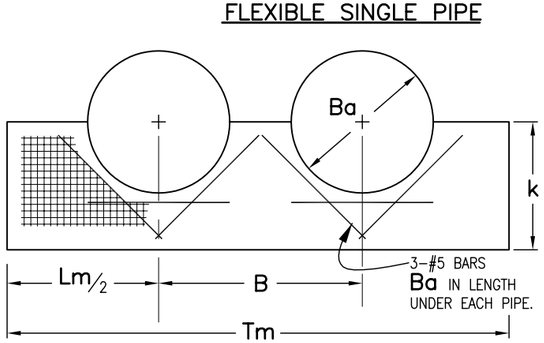
RIGID SINGLE PIPE



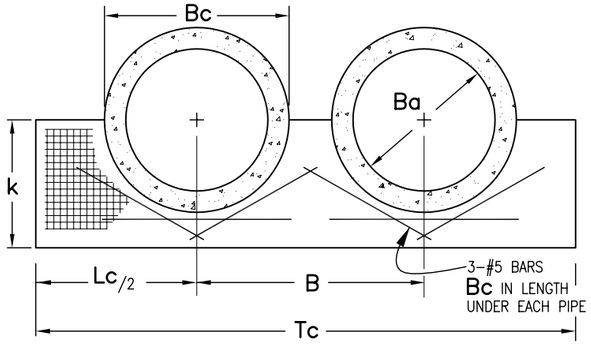
SINGLE MPA

GENERAL NOTES

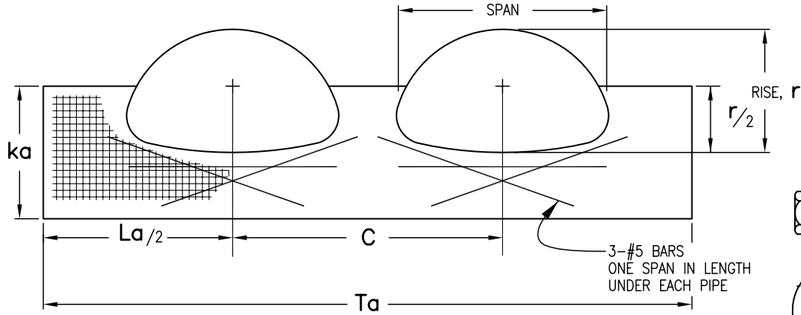
1. CONCRETE SHALL BE CLASS B.
2. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN.
3. IF A PRECAST HEADWALL IS USED, A PERMANENT EPOXY BOND, APPROVED BY THE ENGINEER, SHALL BE USED BETWEEN PIPE AND HEADWALL.
4. HEADWALL SHALL BE PERPENDICULAR TO THE CULVERT CENTERLINE UNLESS OTHERWISE SPECIFIED. TABULATED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



FLEXIBLE DOUBLE PIPE



RIGID DOUBLE PIPE



DOUBLE MPA

RANGE OF EQUIV. DIAMS.	RANGE OF SPANS s	RANGE OF RISES r	ka	La	C	Ta	SINGLE CONCRETE CU. YDS.	SINGLE STEEL LBS.	DOUBLE CONCRETE CU. YDS.	DOUBLE STEEL LBS.
IN.										
36–42	39–47	30–36	48	94	71	165	1.01	32.9	1.73	61.5
42–48	48–59	31–41	48	118	89	207	1.25	41.4	2.14	77.3
54–60	60–71	40–51	51	142	107	249	1.53	52.2	2.61	97.2
60–75	72–83	44–69	69	166	119	285	2.49	78.3	4.14	142.0
72–81	84–95	63–72	72	190	131	321	2.93	93.1	4.76	166.5
84–90	96–107	69–76	76	214	143	357	3.42	110.1	5.45	194.6

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

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

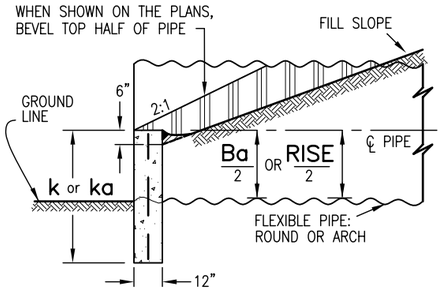
Ø HEADWALL FOR METAL PIPE ARCH (MPA)

NOM. DIA. Ba	RCP O.D. Bc	k	Lm	Lc	B	Tm	Tc	FLEXIBLE PIPE SINGLE CONCRETE CU. YDS.	FLEXIBLE PIPE SINGLE STEEL LBS.	FLEXIBLE PIPE DOUBLE CONCRETE CU. YDS.	FLEXIBLE PIPE DOUBLE STEEL LBS.	RIGID PIPE SINGLE CONCRETE CU. YDS.	RIGID PIPE SINGLE STEEL LBS.	RIGID PIPE DOUBLE CONCRETE CU. YDS.	RIGID PIPE DOUBLE STEEL LBS.
IN.															
36	44	48	81	99	56	137	155	0.87	27.0	1.43	49.3	1.03	33.3	1.52	57.2
42	51	48	94	114	63	157	177	0.99	31.4	1.58	56.9	1.15	38.3	1.66	66.1
48	58	48	108	130	72	180	202	1.10	36.0	1.76	64.4	1.27	43.6	1.81	75.3
54	65	54	121	146	81	202	227	1.39	44.6	2.22	80.1	1.60	54.1	2.30	92.5
60	72	60	134	161	90	224	251	1.70	54.1	2.73	96.8	1.96	65.7	2.83	111.2
66	79	66	148	177	99	247	276	2.07	64.9	3.31	115.4	2.37	78.1	3.42	131.9
72	86	72	161	193	108	269	301	2.46	76.4	3.93	135.2	2.83	91.9	4.08	154.4
78	93	78	175	208	114	289	322	2.90	89.1	4.57	155.8	3.30	106.5	4.71	177.1
84	100	84	188	224	120	308	344	3.35	102.4	5.23	177.4	3.83	122.5	5.41	201.6
90	107	90	202	240	126	328	366	3.86	117.1	5.96	200.8	4.40	139.7	6.16	227.8
96	114	96	215	255	132	347	387	4.38	132.3	6.71	225.1	4.98	157.5	6.93	254.9

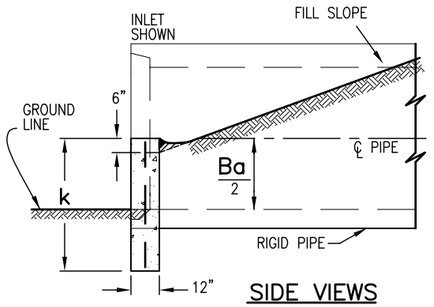
HEADWALL FOR ROUND PIPE

◪

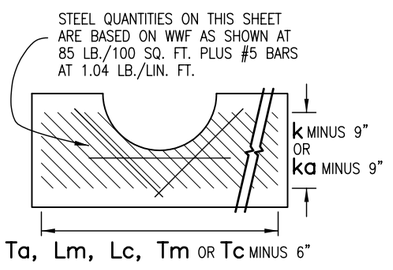
SKEW°	FACTOR
90	1.000
85	1.004
80	1.015
75	1.035
70	1.064
65	1.103
60	1.155
55	1.221
50	1.305
45	1.414
40	1.556
35	1.743
30	2.000



TYPICAL GALVANIZED ANCHOR BOLTS



SIDE VIEWS



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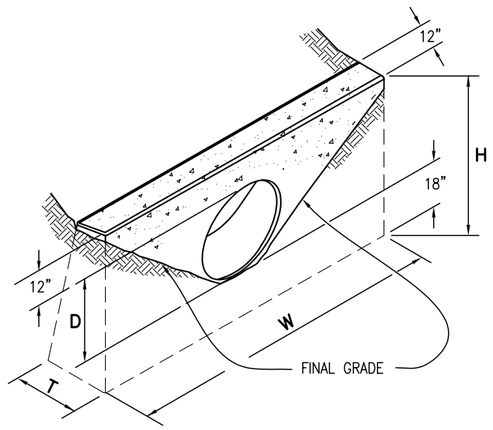
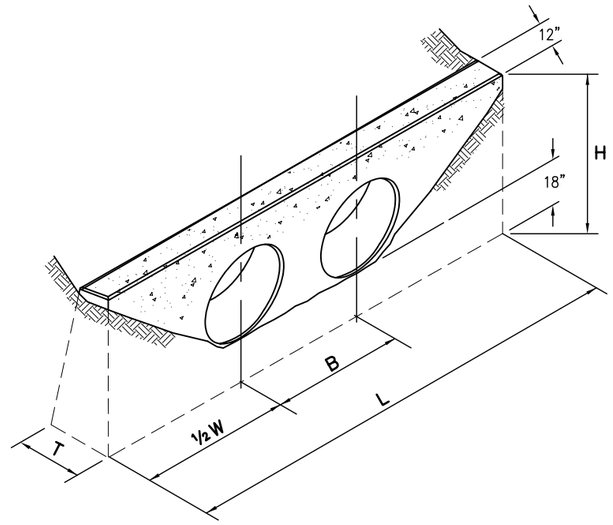
TYPE "S" SADDLE HEADWALLS FOR PIPE

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-601-11
Sheet No. 1 of 1



SINGLE PIPE



DOUBLE PIPE

GENERAL NOTES

1. FOR SIZE AND LOCATION OF PIPES, SEE THE PLANS.
2. ALL CONCRETE SHALL BE CLASS B.
3. FOOTINGS IN ROCK SHALL BE POURED OUT TO ROCK AND NOT FORMED IN ACCORDANCE WITH SUBSECTION 601.09(b).
4. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.

CONCRETE HEADWALL INSTALLATIONS

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

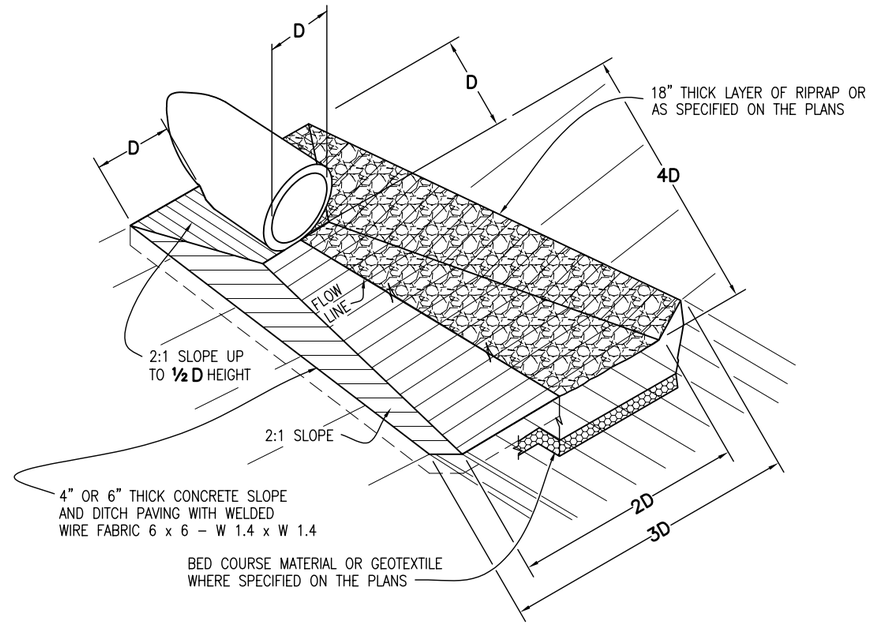
PIPE		PIPE DIAMETER (AND EQUIVALENT DIAMETER) (IN.)											
		18		24		30		36		42		48	
TYPE	MATERIAL	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE	SINGLE	DOUBLE
CIRCULAR	RIGID	1.0	1.3	1.5	2.0	2.0	2.7	2.8	3.6	3.6	4.6	4.6	6.0
	FLEXIBLE	1.1	1.4	1.6	2.1	2.2	3.0	3.0	4.0	3.9	5.3	5.0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

CONCRETE QUANTITIES FOR ONE CONCRETE HEADWALL (CUBIC YARDS)

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

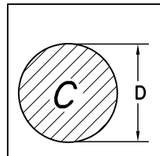
PIPE OUTLET PAVING (CUBIC YARDS)

NOTE: VOLUME OCCUPIED BY PIPE HAS BEEN DEDUCTED.



PIPE OUTLET PAVING

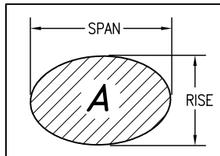
MAY BE USED WITH MULTIPLE PIPES.



CIRCULAR

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

TYPE OF PIPE — HEADWALL DIMENSIONS



ARCH OR ELLIPTICAL

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

TYPE OF PIPE — HEADWALL DIMENSIONS

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Last Modification Date: 07/04/06	Initials: LTA
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HEADWALLS AND PIPE OUTLET PAVING

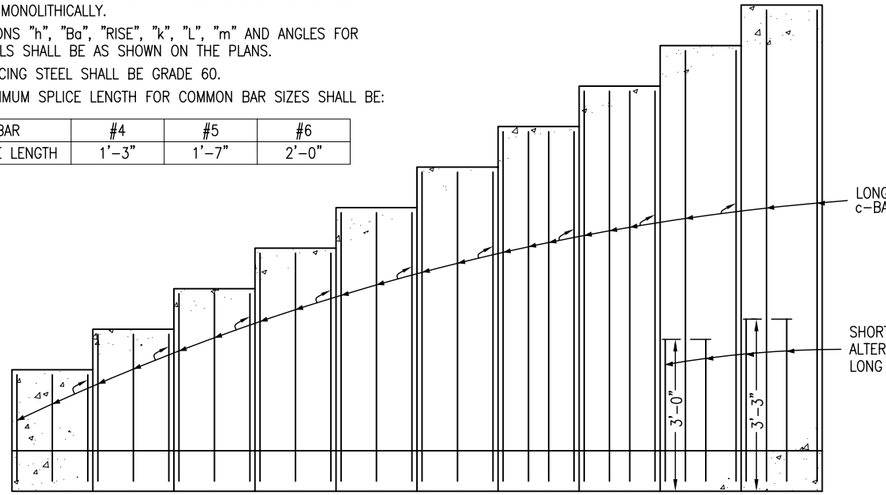
Issued By: Project Development Branch on July 04, 2006

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

GENERAL NOTES

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

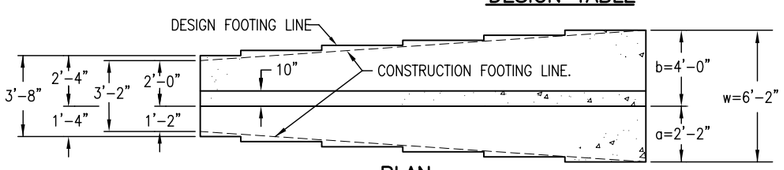
BAR	#4	#5	#6
SPLICE LENGTH	1'-3"	1'-7"	2'-0"



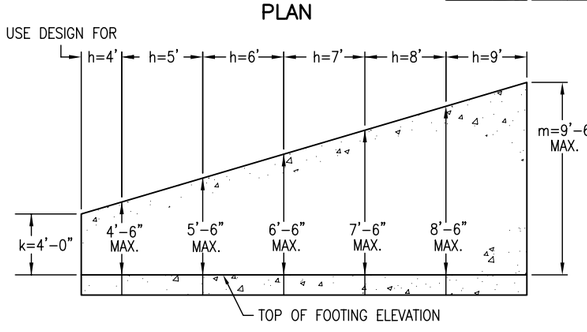
e =	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-4"	1'-3"	11"	9"	7" CTRS.
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'
a =	1'-0"	1'-2"	1'-4"	1'-6'	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"
b =	1'-8"	2'-0"	2'-4'	2'-8'	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"
c & d BARS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

* DOES NOT INCLUDE TOE WALL QUANTITIES

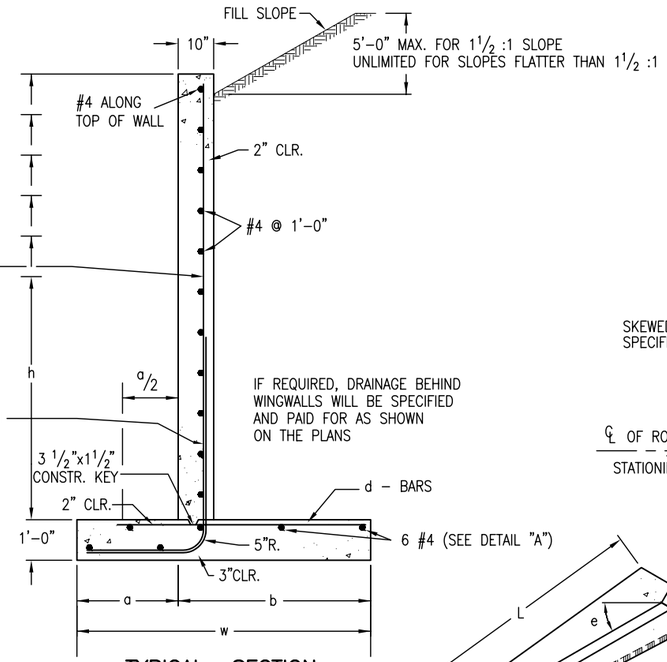
DESIGN TABLE



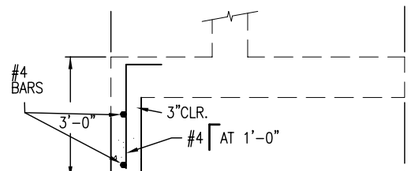
PLAN



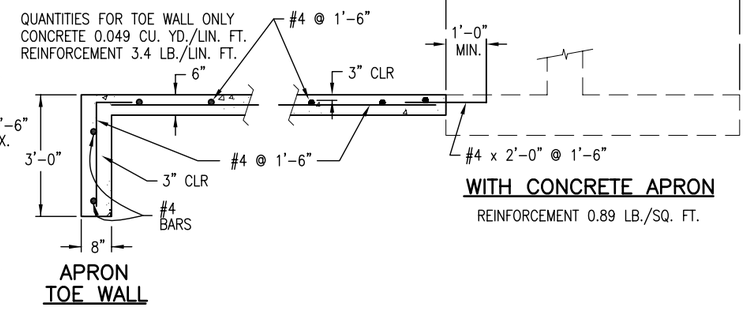
DESIGN EXAMPLE



TYPICAL SECTION



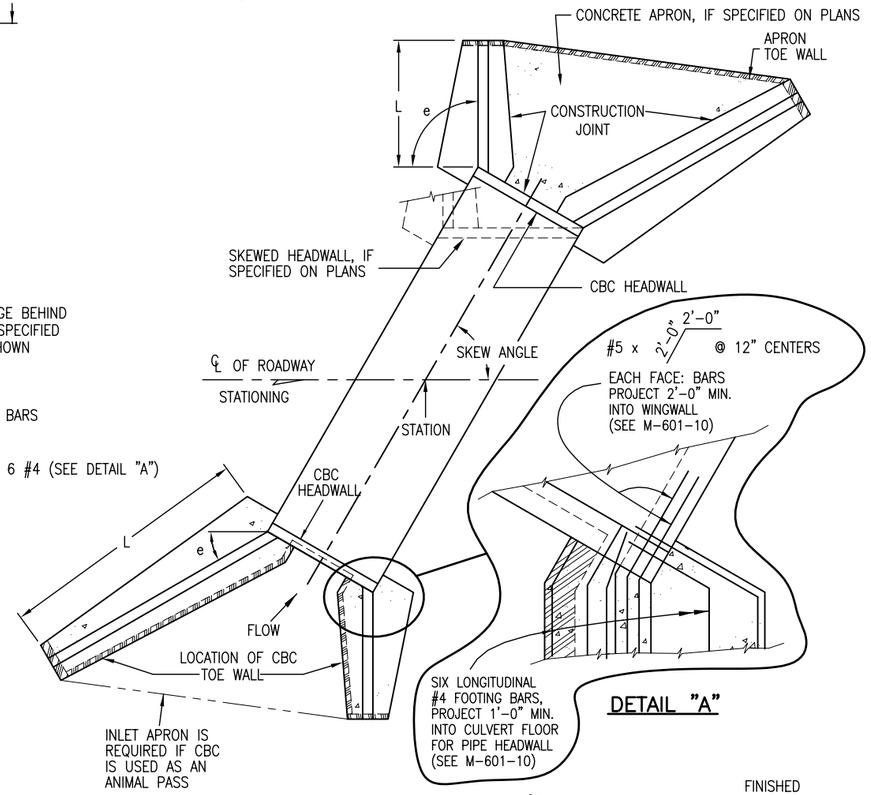
WITH TOE WALL



APRON TOE WALL

WITH CONCRETE APRON

REINFORCEMENT 0.89 LB./SQ. FT.



DETAIL "A"

TYPICAL CULVERT LAYOUT

DESIGN DATA:

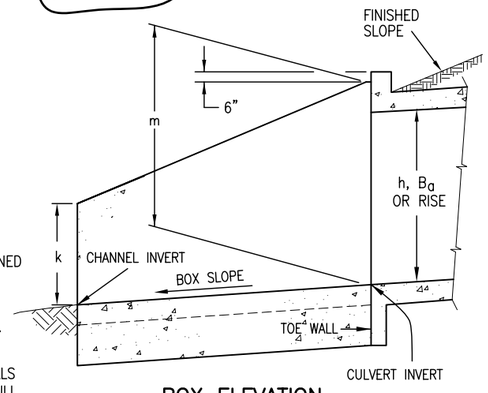
UNIT STRESSES: f_s = 24,000 PSI
f_c = 1,200 PSI
n = 9

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

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

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

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



BOX ELEVATION

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

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WINGWALLS FOR PIPE OR BOX CULVERTS

Issued By: Project Development Branch on July 04, 2006

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

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER, H (FT.) ⌀				
		WALL THICKNESS (IN.)				
IN.		0.064	0.079	0.109	0.138	0.168
12	12	92	100	100	100	100
15	12	74	80	100	100	100
18	12	61	67	86	90	94
21	12	53	57	74	77	81
24	12	46	50	65	68	71
27	12	41	44	57	60	63
30	12	37	40	52	54	56
36	12	30	33	43	45	47
42	12	34	47	74	77	81
48	12	30	41	65	68	71
54	12		36	57	60	63
60	12			52	54	57
66	12				49	51
72	12				45	47
78	12					43
84	12					40

$2\frac{2}{3}$ IN. x $\frac{1}{2}$ IN. CORRUGATIONS
ROUND STEEL PIPE

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER, H (FT.) ⌀				
		WALL THICKNESS (IN.)				
IN.		0.064	0.079	0.109	0.138	0.168
36	12	53	66	98	100	100
42	12	45	56	84	100	100
48	12	39	49	73	88	98
54	12	35	44	65	78	87
60	12	31	39	58	70	78
66	12	28	36	53	64	71
72	12	26	33	49	58	65
78	12	24	30	45	54	60
84	12	22	28	42	50	56
90	12	21	26	39	47	52
96	12		24	36	44	49
102	18		23	34	41	46
108	18			32	39	43
114	18			30	37	41
120	18			29	35	39

3 IN. x 1 IN. CORRUGATIONS
ROUND STEEL PIPE

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER, H (FT.) ⌀				
		WALL THICKNESS (IN.)				
IN.		0.064	0.079	0.109	0.138	0.168
48	12	39	49	73	88	98
54	12	35	44	65	78	87
60	12	31	39	58	70	78
66	12	28	36	53	64	71
72	12	26	33	49	58	65
78	12	24	30	45	54	60
84	12	22	28	42	50	56
90	12	21	26	39	47	52
96	12		24	36	44	49
102	18		23	34	41	46
108	18			32	39	43
114	18			30	37	41
120	18			29	35	39

5 IN. x 1 IN. CORRUGATIONS
ROUND STEEL PIPE

GENERAL NOTES

1. ADEQUATE COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE. THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR FLEXIBLE PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENTS (HMA OR PCCP).
2. PIPE SHALL BE PLACED WITH LONGITUDINAL SEAMS AT THE SIDES OR QUARTER POINTS BUT NOT ALONG TOP OF VERTICAL AXIS.
3. STRUCTURAL PLATE PIPES OF EQUAL OR GREATER DIAMETER IN CONFORMANCE TO SECTION 510 MAY BE SUBSTITUTED FOR THE PIPES ON THESE SHEETS AT THE CONTRACTOR'S EXPENSE.
4. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL INSTALLATION SHALL BE USED.
5. EXTENSIONS FOR CMP ARCH PIPE SHALL MATCH THE CORRUGATIONS AND THE SPAN AND RISE DIMENSIONS OF THE PIPE TO BE EXTENDED.
6. BACKFILL AND COMPACTION SHALL BE IN ACCORDANCE WITH SECTION 206.

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

◪ PIPE ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. WHEN COVER EXCEEDS 11 FT. USE ROUND PIPE.

⌀ COVER GREATER THAN 90 FT. SHALL BE USED ONLY AFTER A THOROUGH INVESTIGATION OF FOUNDATION MATERIAL.

PIPE SIZE ▽ SPAN x RISE	EQUIV. DIA.	WALL THICKNESS	MIN. COVER	MAX. HEIGHT OF COVER H (FT.)
IN.				CORNER BEARING PRESSURE 2 TONS PER SQ. FT.
17 x 13	15	0.064	12	11
21 x 15	18	0.064	12	9
24 x 18	21	0.064	12	8
28 x 20	24	0.064	12	7
35 x 24	30	0.064	12	5
42 x 29	36	0.064	12	5
49 x 33	42	0.079	12	5
57 x 38	48	0.109	12	5
64 x 43	54	0.109	15	6
71 x 47	60	0.138	15	6
77 x 52	66	0.168	18	6
83 x 57	72	0.168	18	7

$2\frac{2}{3}$ IN. x $\frac{1}{2}$ IN. CORRUGATIONS
STEEL PIPE ARCH ◪

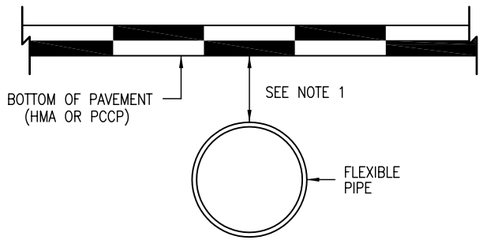
PIPE SIZE ▽ SPAN x RISE	EQUIV. DIA.	WALL THICKNESS	MIN. COVER	MAX. HEIGHT OF COVER H (FT.)
IN.				CORNER BEARING PRESSURE 2 TONS PER SQ. FT.
40 x 31	36	0.064	12	8
46 x 36	42	0.064	12	8
53 x 41	48	0.064	12	8
60 x 46	54	0.064	15	8
66 x 51	60	0.064	15	9
73 x 55	66	0.064	18	10
81 x 59	72	0.064	18	11
87 x 63	78	0.064	18	10
95 x 67	84	0.079	18	11
103 x 71	90	0.109	18	10
112 x 75	96	0.109	21	10
117 x 79	102	0.109	21	10
128 x 83	108	0.138	24	9
137 x 87	114	0.138	24	8
142 x 91	120	0.168	24	8

3 IN. x 1 IN. AND 5 IN. x 1 IN. CORRUGATIONS
STEEL PIPE ARCH ◪

TYPE AND MATERIAL	DIA. (IN.)	MAX. HEIGHT OF COVER H (FT.)
CORRUGATED POLYETHYLENE (HDPE)	12 TO 48	30
RIBBED POLYETHYLENE (HDPE)	18 TO 60	20
RIBBED POLYVINYL CHLORIDE (PVC)	4 TO 15	25

FILL HEIGHT REQUIREMENTS GREATER THAN THE MAXIMUM ALLOWABLE HEIGHT OF COVER LISTED REQUIRE SPECIAL DESIGN.

PLASTIC PIPE



MINIMUM COVER FOR FLEXIBLE PIPE

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METAL AND PLASTIC PIPE

Issued By: Project Development Branch on July 04, 2006

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

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER, H (FT.) Ø				
		WALL THICKNESS (IN.)				
IN.		0.060	0.075	0.105	0.135	0.164
12	12	50	50	86	90	93
15	12	40	40	69	72	74
18	12	33	33	57	60	62
21	12	28	28	49	51	53
24	12	25	25	43	45	46
27	15	22	22	38	40	41
30	15		20	34	36	37
36	18		16	28	30	31
42	21			44	52	53
48	24			38	45	47
54	24			34	40	41
60	24				36	37
66	24				33	34
72	24					31

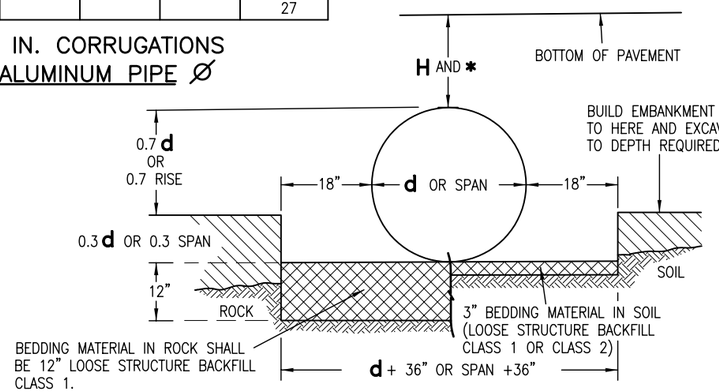
2⅔ IN. x ½ IN. CORRUGATIONS
ROUND ALUMINUM PIPE Ø

PIPE DIA.	MIN. COVER	MAX. HEIGHT OF COVER, H (FT.) Ø				
		WALL THICKNESS (IN.)				
IN.		0.060	0.075	0.105	0.135	0.164
30	15	36	45	62	93	100
36	18	30	37	51	77	100
42	21	26	32	44	66	86
48	24	22	28	38	58	72
54	24	20	25	34	51	63
60	24	18	22	31	46	57
66	24		20	28	42	51
72	24		18	25	38	47
78	24			23	35	43
84	24			22	32	40
90	24			20	30	37
96	24			19	28	34
102	24				26	32
108	24				24	30
114	24					28
120	24					27

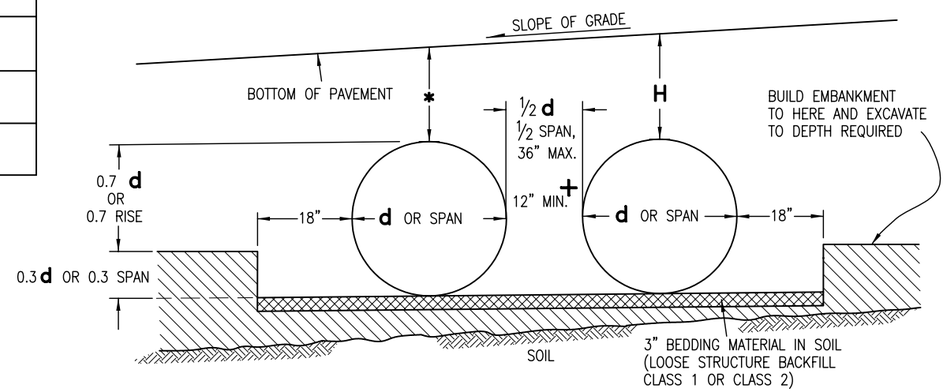
3 IN. x 1 IN. CORRUGATIONS
ROUND ALUMINUM PIPE Ø

PIPE SIZE ∇ SPAN x RISE	EQUIV. DIA.	MIN. COVER	WALL THICKNESS	MAX. HEIGHT OF COVER H (FT.)	
				CORNER RADII	CORNER BEARING PRESSURE 2 TONS PER SQ. FT.
IN.					
17 x 13	15	12	0.060	3	11
21 x 15	18	12	0.060	3	9
24 x 18	21	12	0.060	3	8
28 x 20	24	15	0.075	3	7
35 x 24	30	18	0.075	3	5
42 x 29	36	21	0.105	3½	5
49 x 33	42	24	0.105	4	5
57 x 38	48	24	0.135	5	5
64 x 43	54	24	0.135	6	6
71 x 47	60	24	0.164	7	6

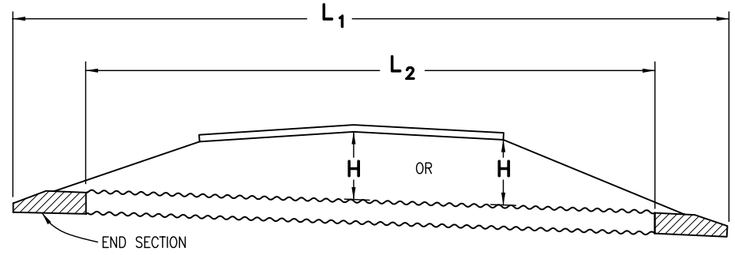
2⅔ IN. x ½ IN. CORRUGATIONS
ALUMINUM PIPE ARCH ◪



INSTALLATION OF METAL OR PLASTIC PIPES

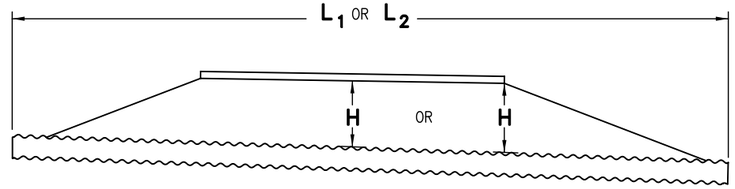


INSTALLATION OF MULTIPLE METAL OR PLASTIC PIPES



METAL OR PLASTIC PIPE WITH END SECTIONS

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



METAL OR PLASTIC PIPE WITHOUT END SECTIONS

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

LEGEND

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

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

L_1 = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 617 OR 624.

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

\+ = MINIMUM SPACING BETWEEN OUTSIDE WALLS OF PIPE OR END SECTION.

∇ = PIPE ARCH WITH EQUAL PERIPHERY AND WITH SPAN AND RISE DIMENSIONS APPROXIMATELY EQUAL TO THOSE REQUIRED BY PLANS WILL BE PERMITTED.

◪ = PIPE ARCH IS INTENDED FOR USE WHERE MINIMUM COVER REQUIREMENTS FOR ROUND PIPE CANNOT BE MET. WHEN COVER EXCEEDS 11 FT. USE ROUND PIPE.

Ø = COVER GREATER THAN 90 FT. SHALL BE USED ONLY AFTER THOROUGH INVESTIGATION OF FOUNDATION MATERIAL.

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METAL AND PLASTIC PIPE

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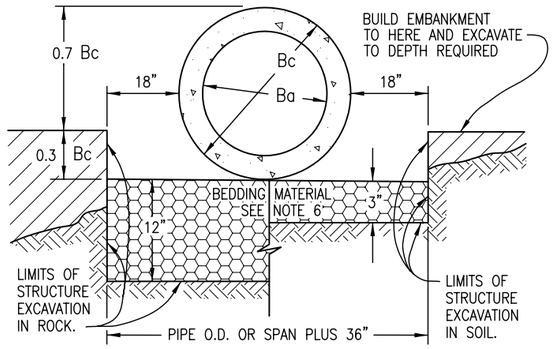
STANDARD PLAN NO.
M-603-1
Sheet No. 2 of 2



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

PIPE INSTALLATION

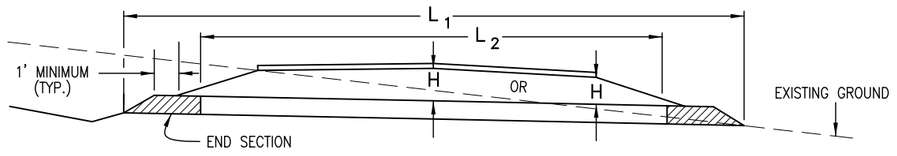
(WITH 0.7 PROJECTION RATIO)

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

△ ALSO EQUIVALENT ROUND DIMENSION FOR ELLIPTICAL PIPE.

DIMENSIONS FOR REINFORCED CONCRETE PIPE

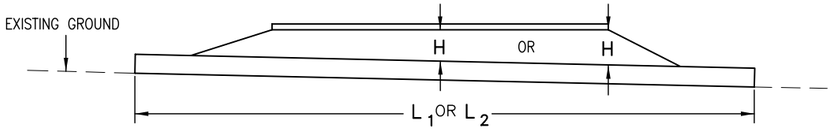
(FOR INFORMATION ONLY)



CONCRETE PIPE WITH END SECTIONS

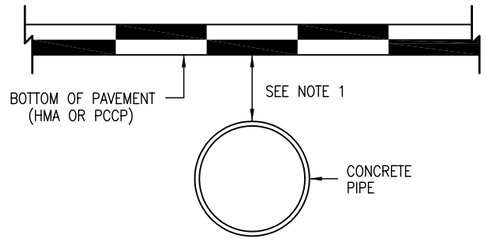
NOTE: USE THE H THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

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



CONCRETE PIPE WITHOUT END SECTIONS

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



MINIMUM COVER FOR RIGID PIPE

GENERAL NOTES

REINFORCED CONCRETE PIPE

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

NONREINFORCED CONCRETE PIPE

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

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

ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE

(ALL SIZES)

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REINFORCED CONCRETE PIPE

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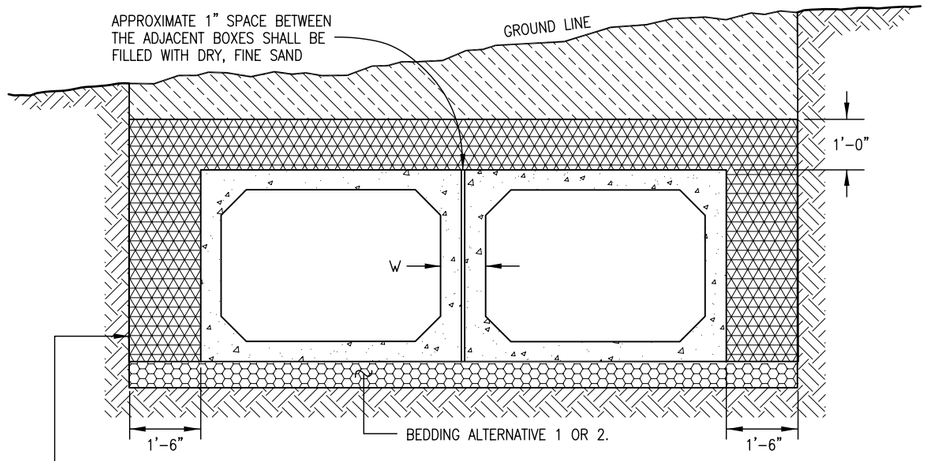
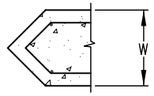
Sheet No. 1 of 1



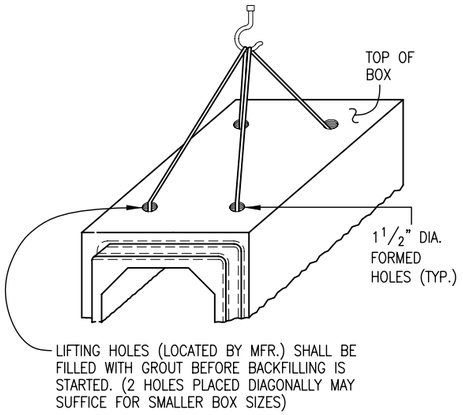
EXCAVATION & BACKFILL

(PARALLEL PRECAST BOX CULVERT INSTALLATION)

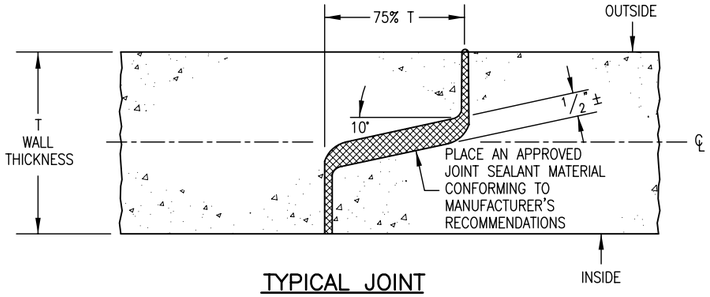


NOSE ANGLE DETAIL

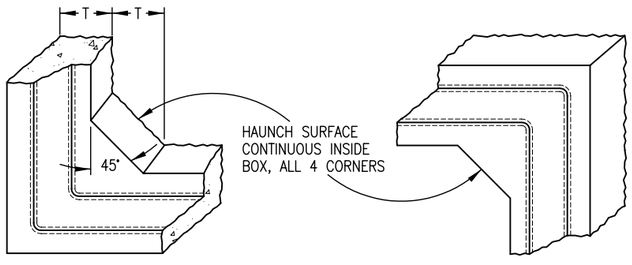
SEE STANDARD PLANS M-601-2, AND 3 TYPICAL AT ADJACENT BOXES DRILL AND GROUT REINFORCING BARS (TYP.)



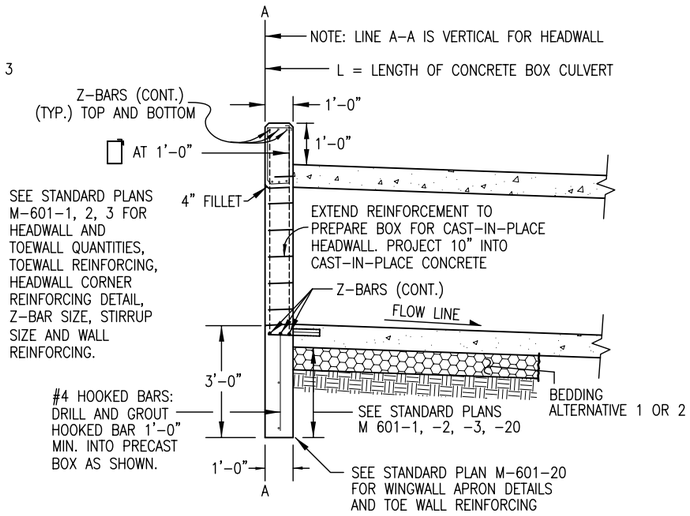
LIFTING



TYPICAL JOINT

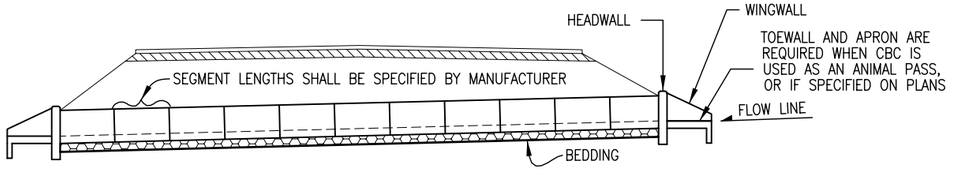


CORNERS



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

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

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.

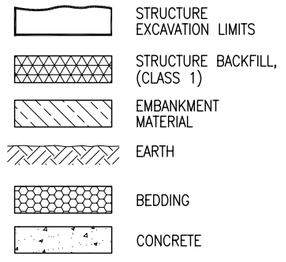
   BEDDING ALTERNATIVE 2 CONSISTS OF AN 3 IN. THICK, MINIMUM, LEAN CONCRETE BASE. CEMENT CONTENT = 250 LBS./CU. YD.

   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. CLASS A DRAINAGE GEOTEXTILE SHALL BE COMPLETELY WRAPPED AROUND ALL CBC JOINTS. 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.

LEGEND



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Drawing File Name: 603030101.dwg	R-X		
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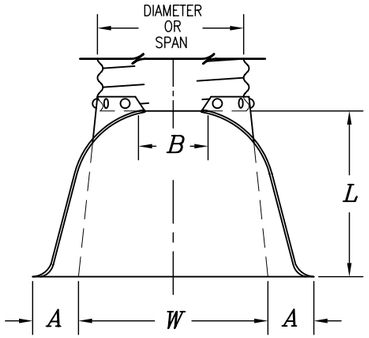
Project Development Branch SRJ/LTA

PRECAST CONCRETE BOX CULVERT

Issued By: Project Development Branch on July 04, 2006

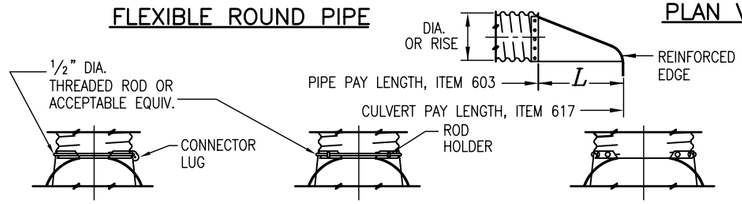
STANDARD PLAN NO.
M-603-3
Sheet No. 1 of 1

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

FLEXIBLE ROUND PIPE



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

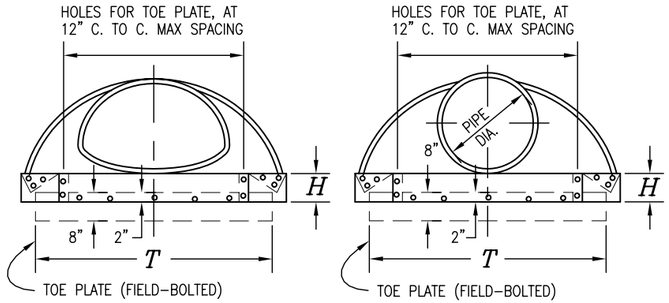
TYPE 2
FOR 30 IN. THRU 36 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS. NOT TO BE USED ON HELICALLY–FORMED PIPE UNLESS RECORRUGATED.

TYPE 3
FOR 42 IN. THRU 84 IN. ROUND PIPE WITH ANNULAR CORRUGATIONS AND ALL SIZES WITH HELICAL CORRUGATIONS AND FOR ALL METAL PIPE ARCH CULVERTS. SHOP ATTACH A 24 IN. MIN. LENGTH OF ANNULAR PIPE WITH GALV. RIVETS OR BOLTS, SPOT WELDS, OR 2 IN. LONG SKIP WELDS ON 8 IN. CTRS. REPAIR BURNT GALVANIZING IN ACCORDANCE WITH SUBSECTION 707.09.

TYPICAL CONNECTIONS

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

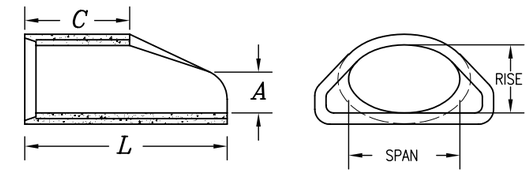
FLEXIBLE PIPE ARCH



ELEVATIONS

GENERAL NOTES

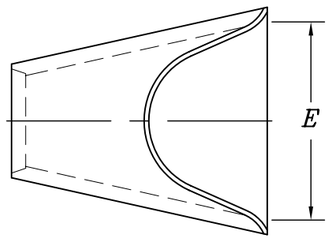
1. DIMENSIONS OF END SECTIONS MAY VARY SLIGHTLY FROM THOSE SHOWN ON THE TABLES DUE TO DIFFERENT MANUFACTURERS' CONFIGURATIONS.
2. CONCRETE END SECTIONS SHALL BE FURNISHED WITH TONGUE OR GROOVE AS REQUIRED.
3. DESIGN LENGTH OF PIPE OR SIDE DRAIN IS BASED ON LENGTH OF END SECTION SHOWN IN TABLE. ANY ADDITIONAL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



SECTION F–F

END VIEW

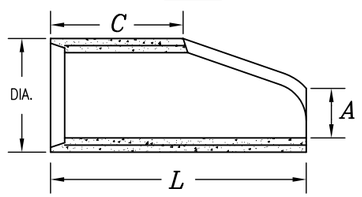
END SECTION AND CONNECTION DETAILS FOR ROUND AND ARCH METAL PIPES



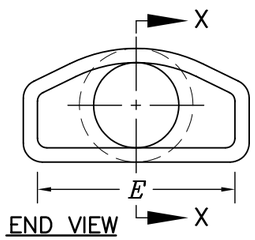
PLAN

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

REINFORCED CONCRETE CIRCULAR PIPE

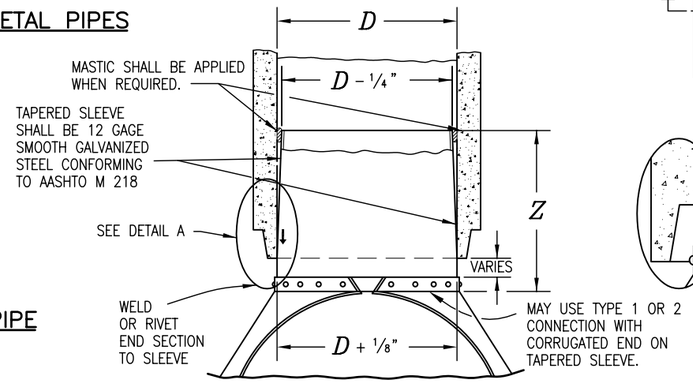


SECTION X–X



END VIEW

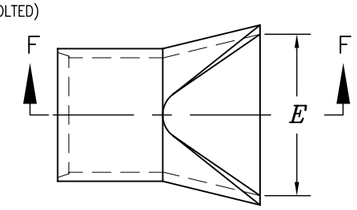
END SECTION FOR REINFORCED CONCRETE CIRCULAR PIPE



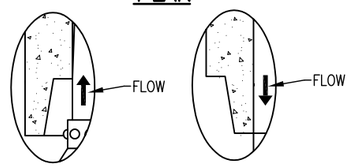
D	*Z* (MIN.)
IN.	
18 – 24	12
30 AND 36	16
42 AND LARGER	24

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

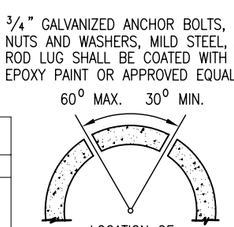


DETAIL A

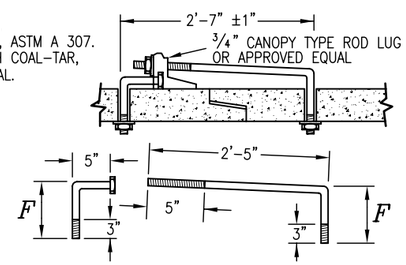
EQUIVALENT CIRCULAR DIA.	DIMENSIONS					
	NOMINAL SPAN x RISE	*A*	*C*	*L*	*E*
	IN.					
24	30 x 19	9	33	72	48
30	38 x 24	10	18	72	60
36	45 x 29	12	24	84	72
42	53 x 34	16	36	96	78
48	60 x 38	21	36	96	84
54	68 x 43	26	36	96	90
60	76 x 48	30	36	96	96

END SECTION FOR REINFORCED CONCRETE ELLIPTICAL PIPE

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



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



CONCRETE JOINT FASTENER (TWO PER JOINT)

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Last Modification Date: 07/04/06	Initials: LTA		
Full Path: www.dot.state.co.us/DesignSupport/			
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(R–X) (R–X) (R–X) (R–X)

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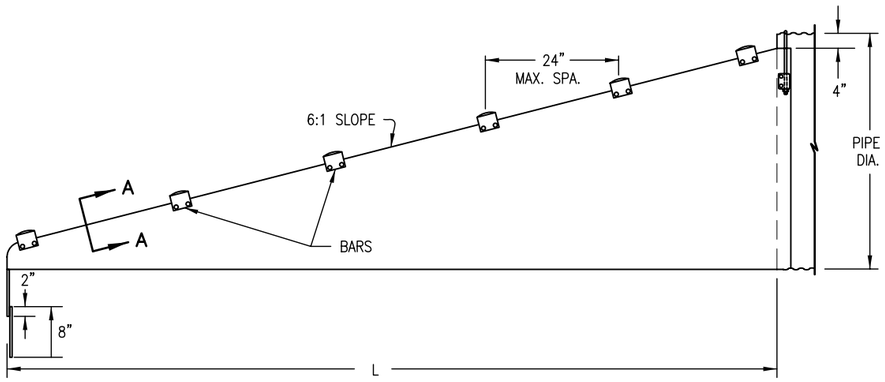
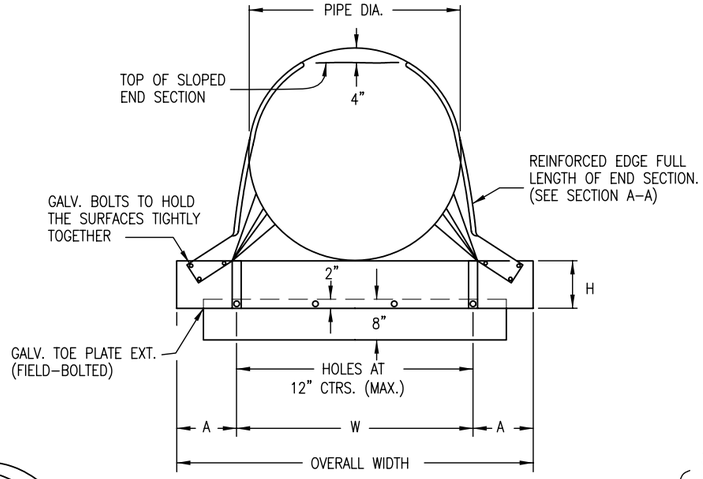
CONCRETE AND METAL END SECTIONS

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-603-10
Sheet No. 1 of 2



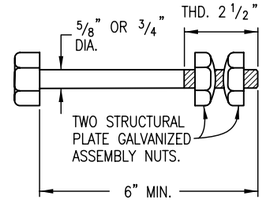
SIDE VIEW OF END SECTION – ALTERNATIVE 1



FRONT VIEW – ALTERNATIVE 1

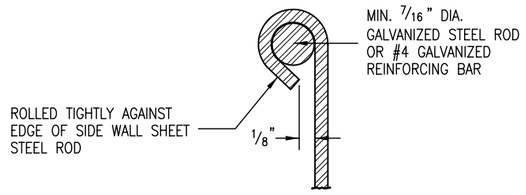
(BARS NOT SHOWN)

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

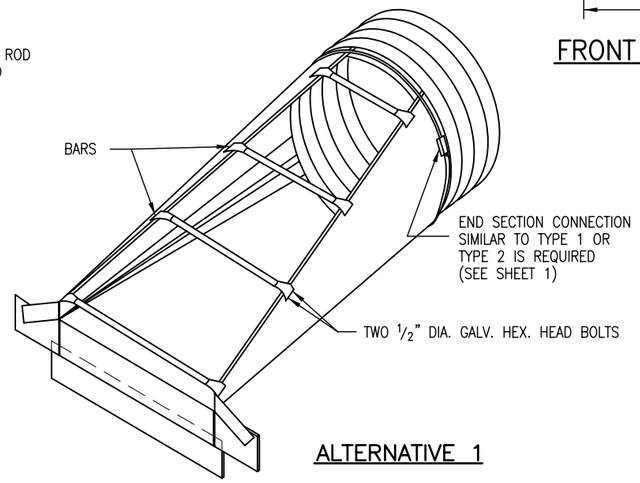


TYPICAL ANCHOR BOLT

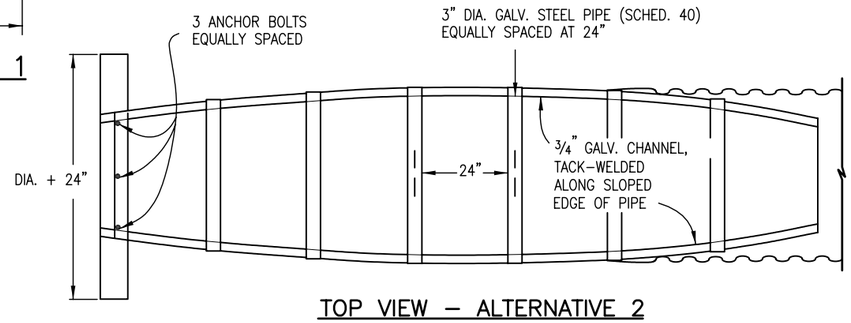
(GALVANIZED)



SECTION A–A



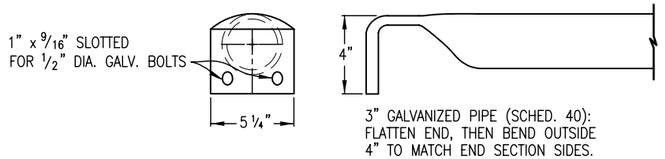
ALTERNATIVE 1



TOP VIEW – ALTERNATIVE 2

END SECTIONS FOR CIRCULAR PIPES

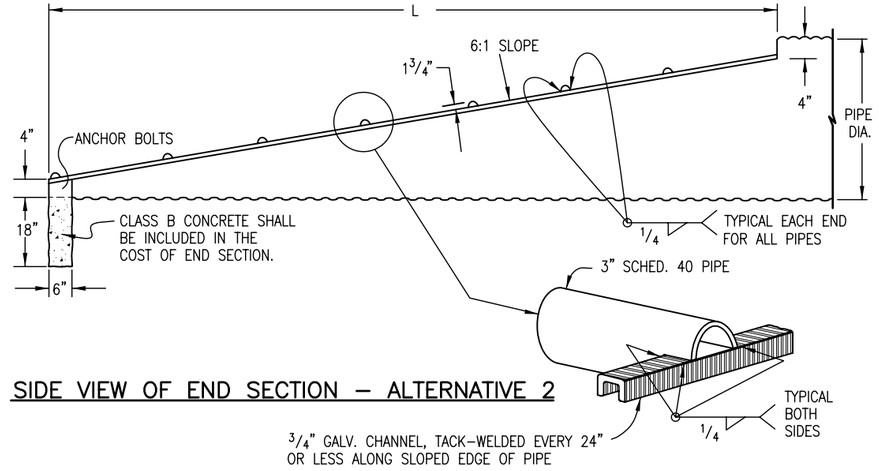
PIPE DIA. (IN.)	MIN. THICK (IN.)	DIMENSION (IN.)					
		A	H	W	OVERALL WIDTH	SLOPE	LENGTH (L)
15	.064	8	6	21	37	6:1	30
18	.064	8	6	24	40	6:1	48
21	.064	8	6	27	43	6:1	66
24	.079	8	6	30	46	6:1	84
30	.079	12	9	36	60	6:1	120
36	.109	12	9	42	66	6:1	156



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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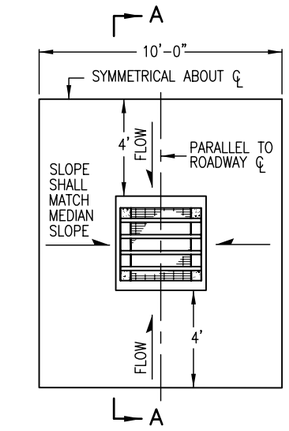
CONCRETE AND METAL END SECTIONS

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-603-10
Sheet No. 2 of 2

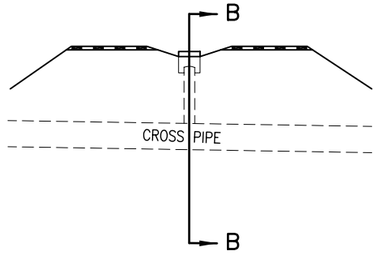


INLET WITH DITCH PAVING

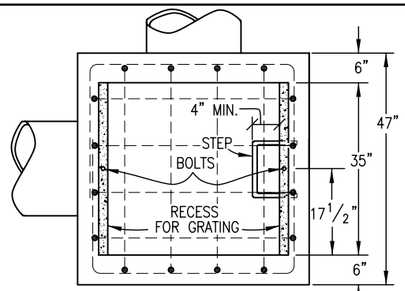
STEEL GRATE QUANTITIES

NO. PIECES	DESCRIPTION	LENGTH	LBS PER FT.	WEIGHT (LBS.)
4	S4 x 7.7 BEAM	40"	7.70	103
2	$3\frac{1}{2}$" x $\frac{1}{4}$" FLAT	$26\frac{5}{8}$"	2.98	13
2	3" x $\frac{1}{4}$" FLAT	$26\frac{5}{8}$"	2.55	12

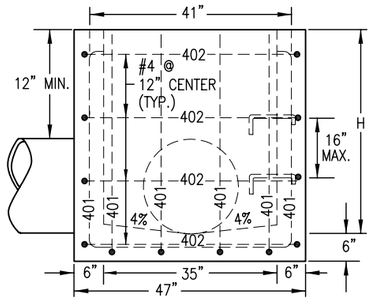
TOTAL LBS. – 128



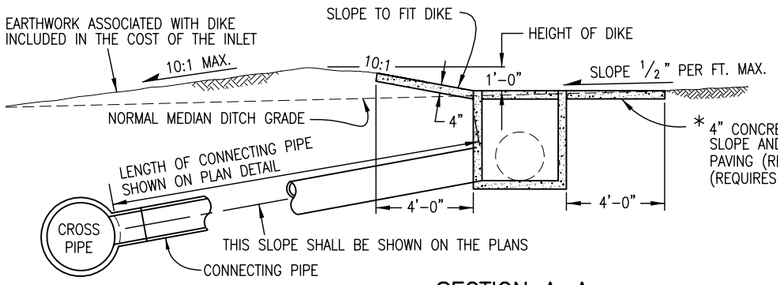
SECTION VIEW



PLAN



ELEVATION
CONCRETE INLET

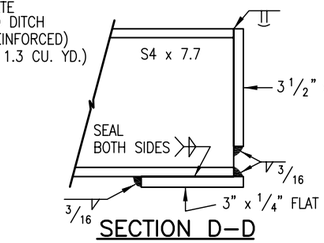


SECTION B–B

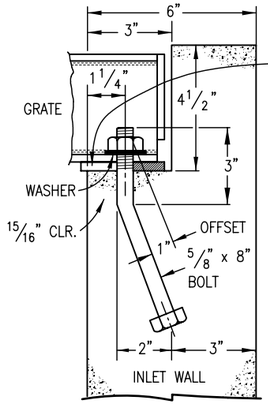
INLET CONNECTED
TO A CROSS PIPE

SECTION A–A

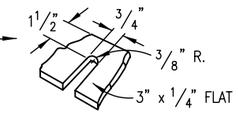
INLET ON GRADE
(FLOW FROM ONE DIRECTION)



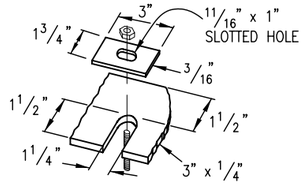
SECTION D–D



GRATE INSTALLATION
DETAIL



SLOT DETAIL



ALTERNATE SLOT
AND HOLD DOWN
PLATE DETAIL

GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST–IN–PLACE OR PRECAST.
2. REINFORCING BARS SHALL BE EPOXY COATED AND DEFORMED #4, AND SHALL HAVE A MINIMUM 2 IN. CLEARANCE. CUT OR BEND AROUND PIPES AS REQUIRED.
3. CONCRETE SLOPE AND DITCH PAVING SHALL BE IN ACCORDANCE WITH SECTION 507. REINFORCEMENT FOR CONCRETE SLOPE PAVING SHALL BE 6 X 6 – W1.4 X W1.4 OR 6 X 6 – W2.1 X W2.1.
4. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED, AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
5. THE STANDARD INLET GRATES SHALL BE USED ON ALL TYPE C INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
6. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT. – 6 IN., AND SHALL CONFORM TO AASHTO M 199.
7. SEE STANDARD PLAN M–604–11, FOR REINFORCEMENT AROUND THE PIPE OPENING.

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

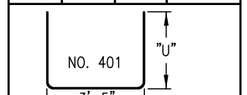
QUANTITIES FOR ONE INLET

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

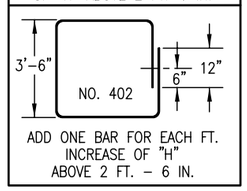
▼ PIPE INSIDE DIAMETER SHALL BE 30 IN. OR LESS. CONCRETE AND STEEL QUANTITIES ARE FOR ONE ENTIRE INLET BEFORE DEDUCTION FOR VOLUME OCCUPIED BY PIPE. WEIGHT OF STEEL INCLUDES A RING FOR THE MAXIMUM PIPE DIAMETER.

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

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

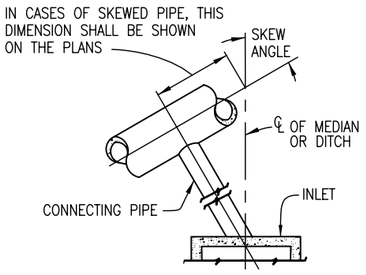


"U" INCREASE DIMENSION 6 IN. FOR EACH 6 IN. INCREASE OF "H" ABOVE 2 FT.–6 IN.

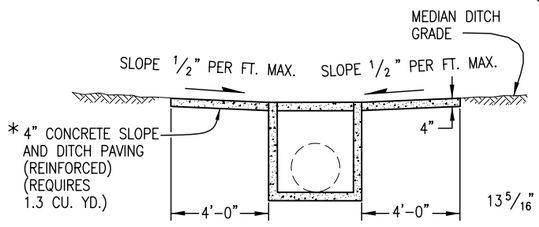


ADD ONE BAR FOR EACH FT. INCREASE OF "H" ABOVE 2 FT. – 6 IN.

402 BARS SHALL BE EQUALLY SPACED FROM EACH OTHER.

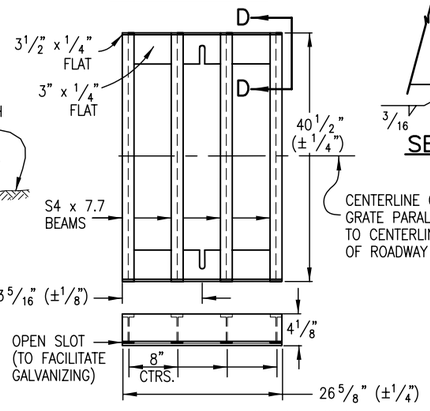


INLET CONNECTED TO A
SKEWED CROSS PIPE

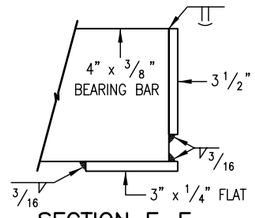


SECTION A–A

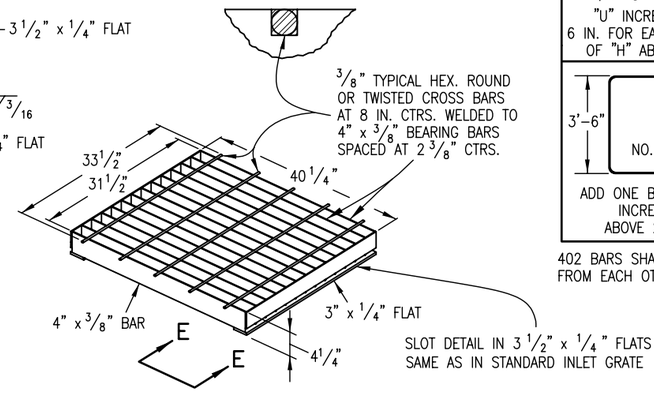
INLET AT BOTTOM
OF VERTICAL CURVE
(FLOW FROM TWO DIRECTIONS)



STANDARD INLET GRATE



SECTION E–E



CLOSE MESH GRATE

USE FOR PEDESTRIAN AND BICYCLE AREAS ONLY.

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INLET, TYPE C

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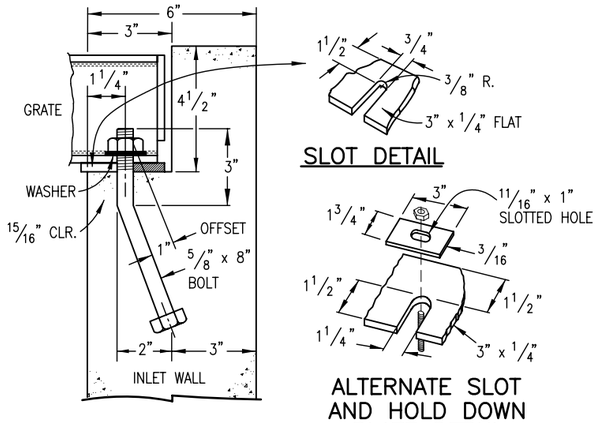
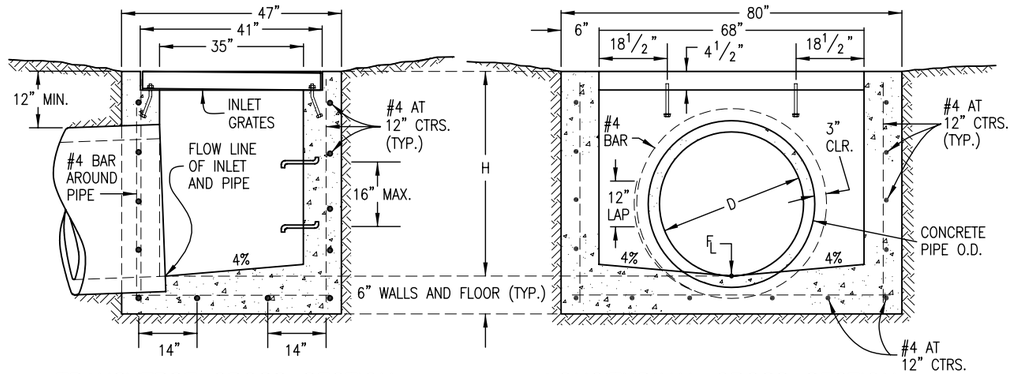
STANDARD PLAN NO.
M-604-10
Sheet No. 1 of 1



SLOT DETAIL

ALTERNATE SLOT AND HOLD DOWN PLATE DETAIL

GRATE INSTALLATION DETAIL



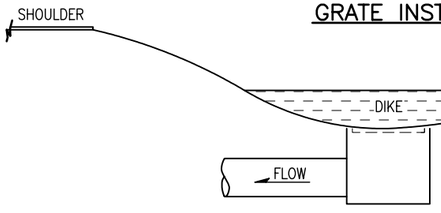
TRANSVERSE CROSS SECTION

LONGITUDINAL CROSS SECTION

LEVEL GRATE INSTALLATION

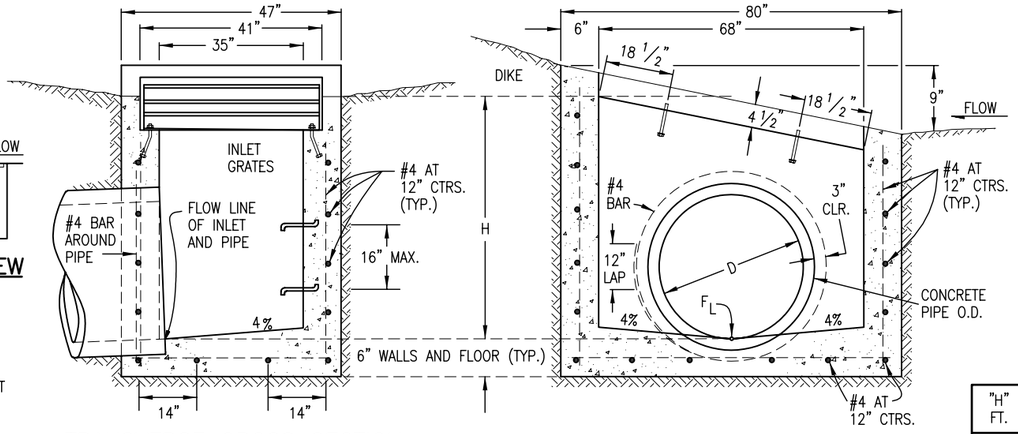
GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST-IN-PLACE OR PRECAST.
2. SEE PLANS FOR SIZE AND LOCATION OF PIPE.
3. STRUCTURAL STEEL FOR GRATES AND GRATE INSTALLATION HARDWARE SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.
4. STANDARD INLET GRATES SHALL BE USED ON ALL TYPE D INLETS UNLESS CLOSE MESH GRATES ARE SPECIFIED ON THE PLANS.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT.-6 IN. AND SHALL CONFORM WITH AASHTO M 199.
6. REINFORCING BARS SHALL BE EPOXY COATED AND DEFORMED #4, AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. CUT OR BEND BARS AROUND PIPE AS REQUIRED.



TRANSVERSE VIEW

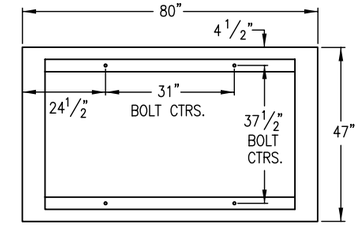
LONGITUDINAL VIEW



TRANSVERSE CROSS SECTION

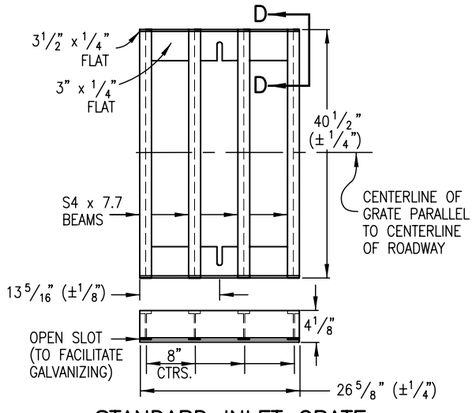
LONGITUDINAL CROSS SECTION

SLOPING GRATE INSTALLATION



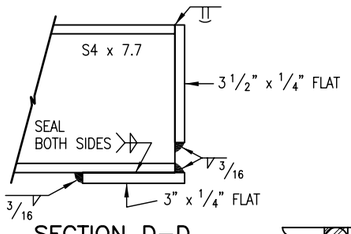
PLAN VIEW

(SHOWING ANCHOR BOLT LAYOUT)

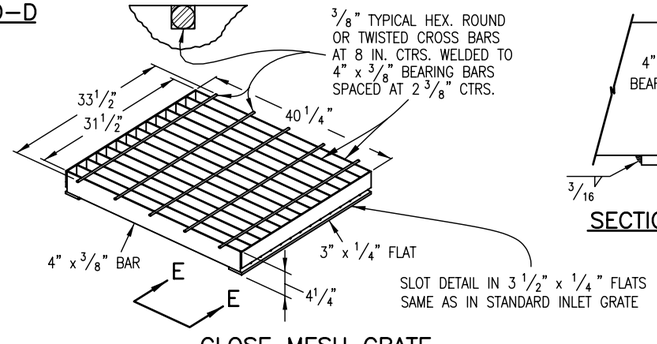


STANDARD INLET GRATE

DIKE

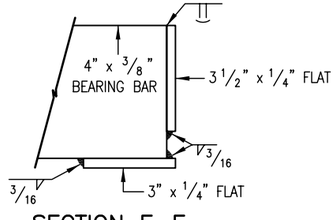


SECTION D-D



CLOSE MESH GRATE

USE FOR PEDESTRIAN AND BICYCLE AREAS ONLY.



SECTION E-E

TWO STEEL GRATE PER INLET QUANTITIES

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

TOTAL LBS. - 256

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

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

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

QUANTITIES FOR ONE INLET

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R-X

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INLET, TYPE D

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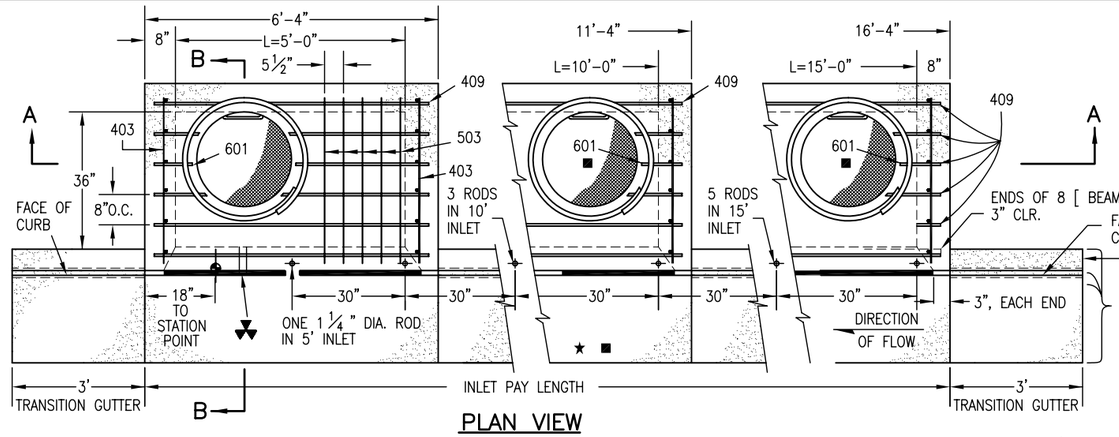
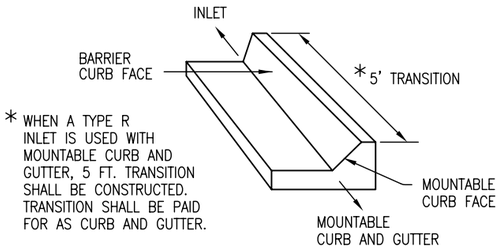
STANDARD PLAN NO.
M-604-11
Sheet No. 1 of 1



PLAN VIEW

★ FOR LENGTH (L) GREATER THAN 5 FT. PROVIDE MAINTENANCE ACCESS AT BOTH ENDS.

■ ADDITIONAL MANHOLE RING AND COVER REQUIRED WHEN L=10 FT. OR MORE. CUT REINFORCEMENT BAR ACCORDINGLY.

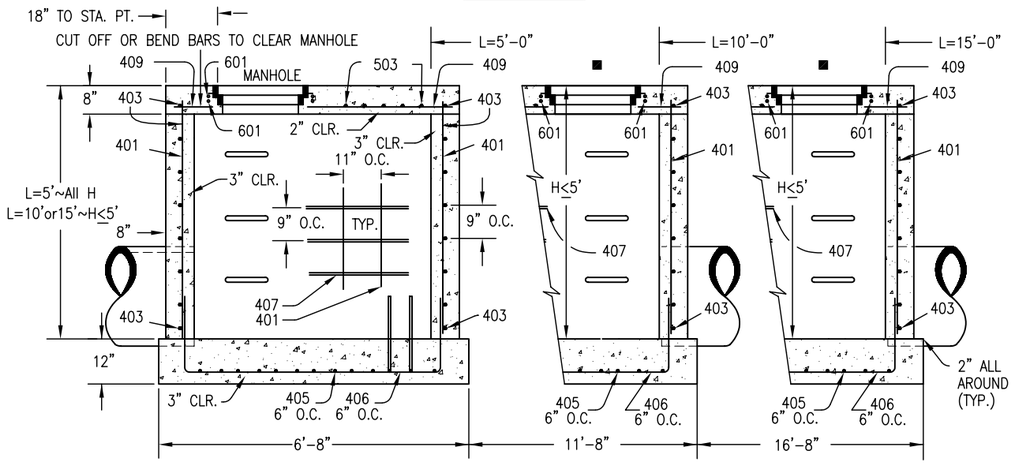


* WHEN A TYPE R INLET IS USED WITH MOUNTABLE CURB AND GUTTER, 5 FT. TRANSITION SHALL BE CONSTRUCTED. TRANSITION SHALL BE PAID FOR AS CURB AND GUTTER.

TRANSITION CURB

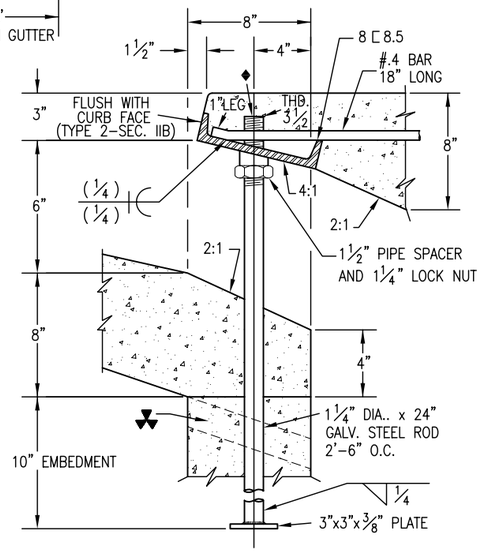
GENERAL NOTES:

SEE SHEET 2.



SECTION A–A REGULAR INLET

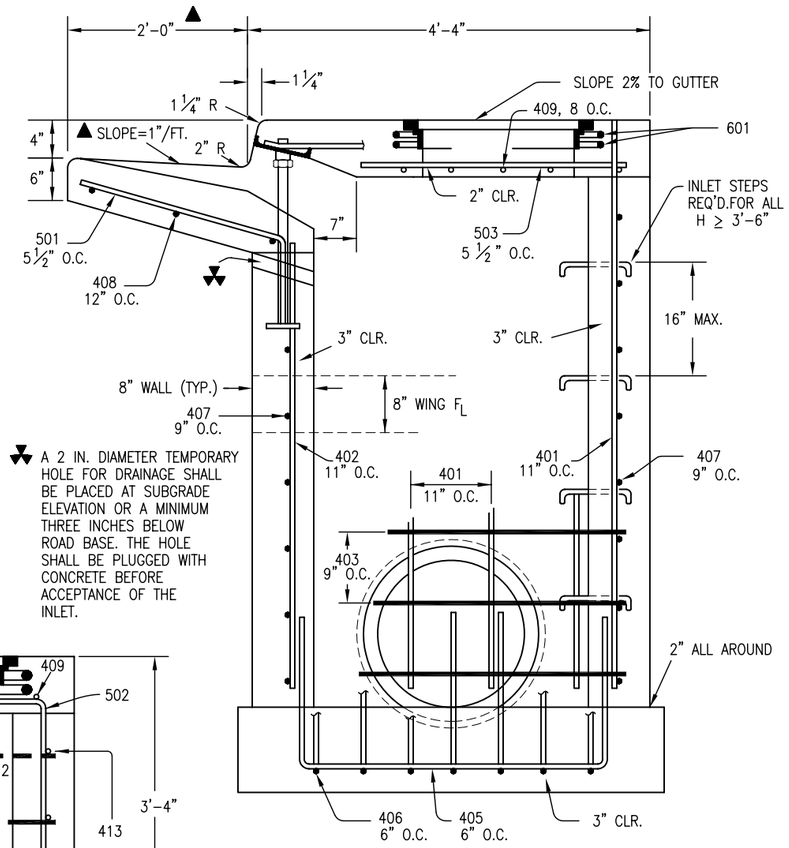
SEE CHANNEL LAYOUT ON SHEET 2.



CURB FACE ASSEMBLY

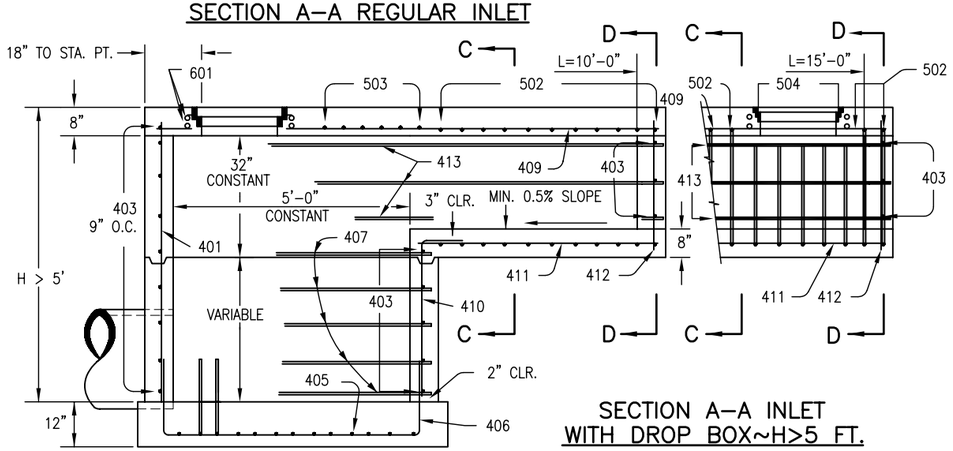
◆ PLACE ENTIRE ASSEMBLY BEFORE POURING CONCRETE.

▲ – FOR A 1'–0" PAN SLOPE 2" PER FT.

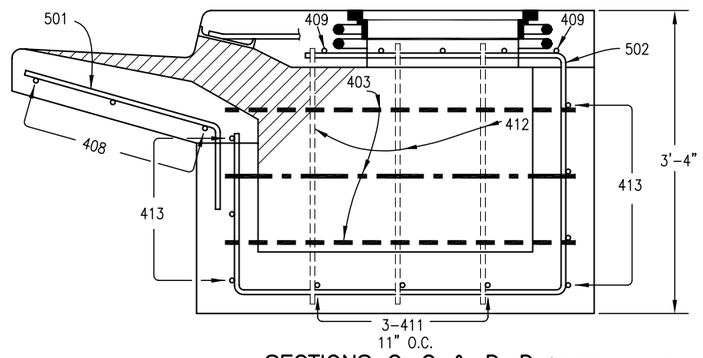


SECTION B–B END VIEW

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



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



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

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

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CURB INLET TYPE R

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STANDARD PLAN NO.
M-604-12
Sheet No. 1 of 2

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

* VARIABLE REFER TO TABLE TWO.

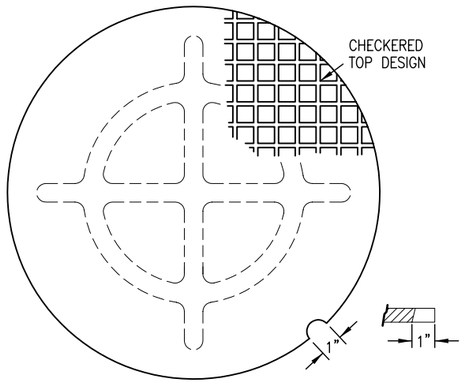
■ INCLUDE #4, 18 IN. BARS (SEE CHANNEL LAYOUT).

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

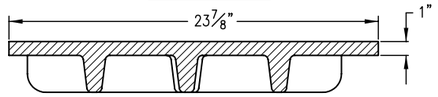
"H"	LENGTH 401	LENGTH 402	LENGTH 410	NO. REQ'D. REGULAR 403	NO. REQ'D. REGULAR 407	NO. REQ'D. DROP BOX 403	NO. REQ'D. DROP BOX 407	L = 5 FT. CONC. CU. YDS.	L = 5 FT. STEEL LBS.	L = 10 FT. CONC. CU. YDS.	L = 10 FT. STEEL LBS.	L = 15 FT. CONC. CU. YDS.	L = 15 FT. STEEL LBS.
3'–0"	2'–8"	1'–8"		10	7			3.2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

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

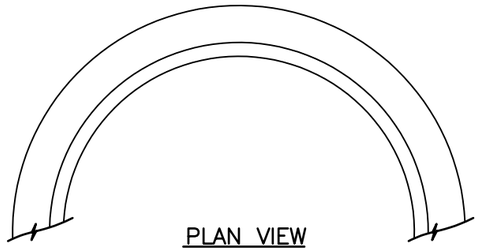
TABLE TWO ~ BARS AND QUANTITIES VARIABLE WITH "H"



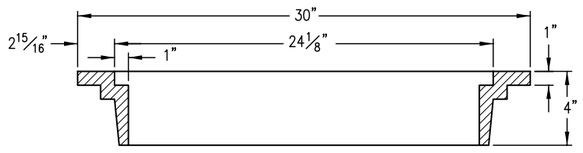
PLAN VIEW



ELEVATION VIEW
MANHOLE COVER (TYP.)



PLAN VIEW

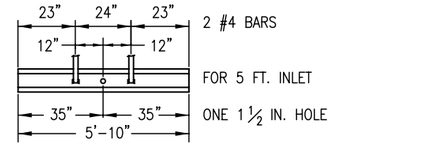


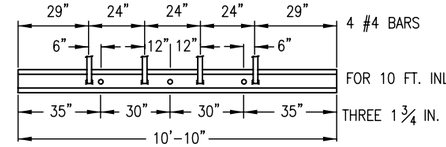
ELEVATION VIEW
MANHOLE RING (TYP.)

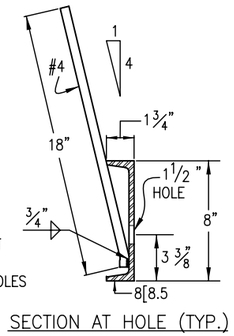
WEIGHTS: COVER = 125 LBS.
+ RING = 135 LBS.
TOTAL = 260 LBS.

GENERAL NOTES

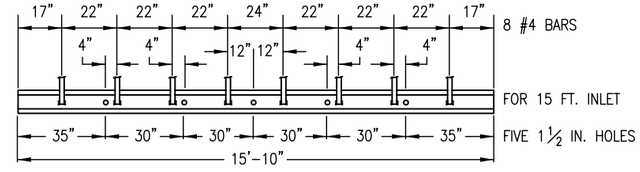
1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST–IN–PLACE OR PRECAST.
2. CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES AND SHALL BE 8 IN. THICK.
3. INLET STEPS SHALL BE IN CONFORMANCE WITH AASHTO M 199.
4. CURB FACE ASSEMBLY SHALL BE GALVANIZED AFTER WELDING.
5. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN. CURB AND GUTTER CORNERS SHALL BE FINISHED TO MATCH THE EXISTING CURB AND GUTTER BEYOND THE TRANSITION GUTTER.
6. REINFORCING BARS SHALL BE DEFORMED AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
7. DIMENSIONS AND WEIGHTS OF TYPICAL MANHOLE RING AND COVER ARE NOMINAL.
8. MATERIAL FOR MANHOLE RINGS AND COVERS SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.
9. SINCE PIPE ENTRIES INTO THE INLET ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK. QUANTITIES INCLUDE VOLUMES OCCUPIED BY PIPES.
10. STRUCTURAL STEEL SHALL BE GALVANIZED AND SHALL BE IN ACCORDANCE WITH SUBSECTION 712.06.





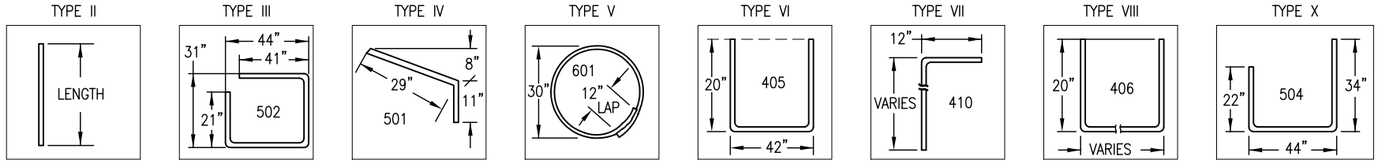


SECTION AT HOLE (TYP.)



CHANNEL LAYOUT DETAILS

SEE CURB FACE ASSEMBLY ON SHEET 1.



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

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Last Modification Date: 07/04/06	Initials: LTA		
Full Path: www.dot.state.co.us/DesignSupport/			
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CURB INLET TYPE R

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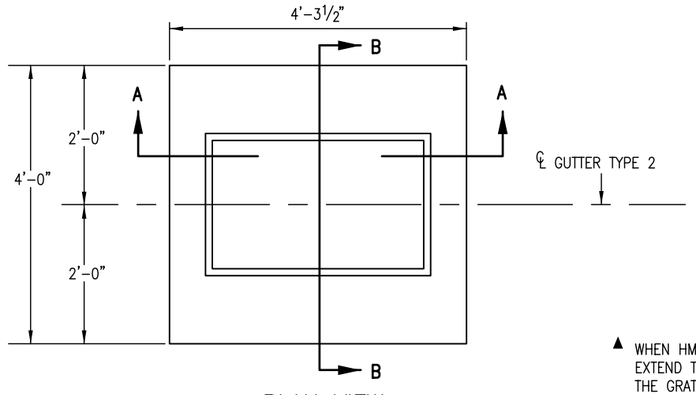
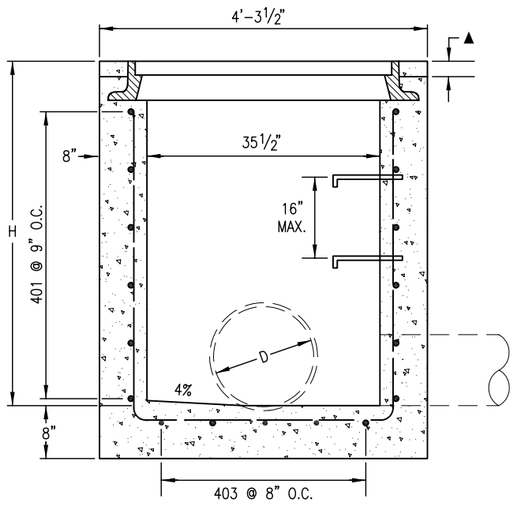
STANDARD PLAN NO.
M-604-12
Sheet No. 2 of 2

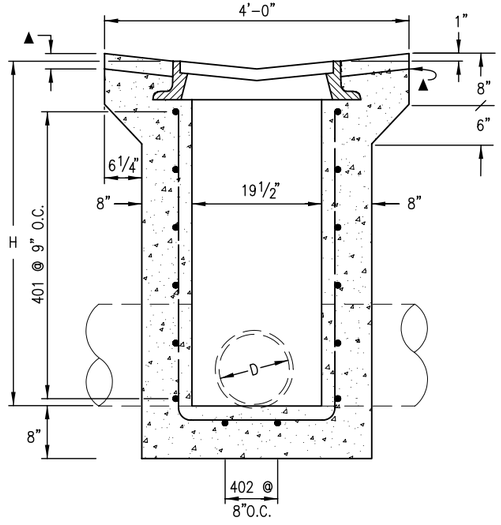


▲ WHEN HMA MATERIAL IS TO EXTEND TO THE EDGE OF THE GRATING FRAME, CONCRETE MAY BE DEPRESSED.

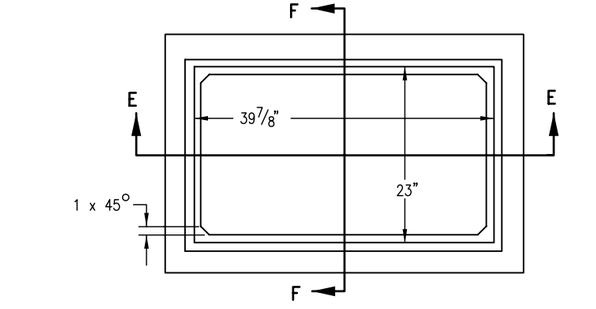
PLAN VIEW
TYPE 13 INLET FOR GUTTER TYPE 2



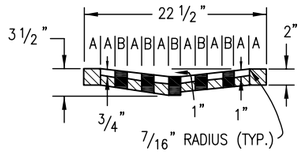
SECTION A–A
D_{MAX} = 30 IN. FOR H≥ 4 FT.



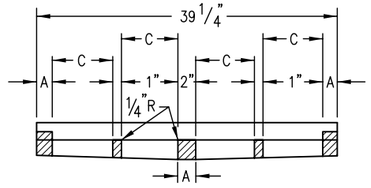
SECTION B–B
D_{MAX} = 18 IN. FOR ALL H



NO. 13 GRATE



SECTION C–C
A = 1 3/4"
B = 11 11/16"
C = 7 15/16"



SECTION D–D

NO. 13 GRATING & FRAMES

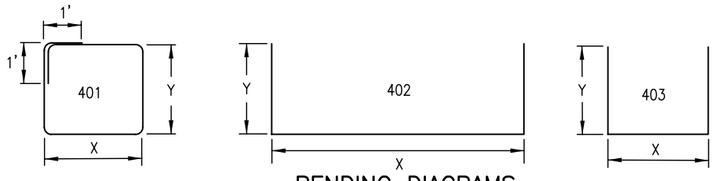
GENERAL NOTES

1. CONCRETE SHALL BE CLASS B. INLET MAY BE CAST–IN–PLACE OR PRECAST.
2. CAST–IN–PLACE CONCRETE WALLS SHALL BE FORMED ON BOTH SIDES.
3. EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
4. REINFORCING BARS SHALL BE DEFORMED #4 AND SHALL HAVE A 2 IN. MINIMUM CLEARANCE. ALL REINFORCING BARS SHALL BE EPOXY COATED.
5. STEPS SHALL BE PROVIDED WHEN INLET DIMENSION "H" IS EQUAL TO OR GREATER THAN 3 FT.–6 IN. AND SHALL CONFORM TO AASHTO M 199.
6. ALL GRATES AND FRAMES SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06. GRATES AND FRAMES SHALL BE DESIGNED TO WITHSTAND HS 20 LOADING.
7. STATION POINT IS AT THE CENTER OF THE INLET.

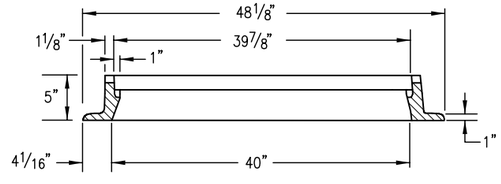
H	CONCRETE	REINFORCING STEEL	NO. OF 401 BARS REQ'D.	MAXIMUM PIPE I.D.	
				SEC. A–A	SEC. B–B
	CU. YDS.	θ LB.		IN.	IN.
3'–0"	1.3	72	4	18	18
3'–6"	1.5	76	4	24	18
4'–0"	1.6	90	5	30	18
4'–6"	1.8	104	6	30	18
5'–0"	1.9	109	6	30	18
5'–6"	2.1	122	7	30	18
6'–0"	2.2	136	8	30	18
6'–6"	2.4	141	8	30	18
7'–0"	2.5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

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

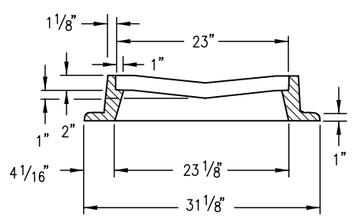
QUANTITIES FOR ONE INLET



BENDING DIAGRAMS
ALL DIMENSIONS ARE OUT–TO–OUT OF BAR.



SECTION E–E
APPROXIMATE WEIGHT = 590 LBS.



SECTION F–F

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

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

BAR LIST FOR H=3 FT.–0 IN.

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CONCRETE INLET TYPE 13

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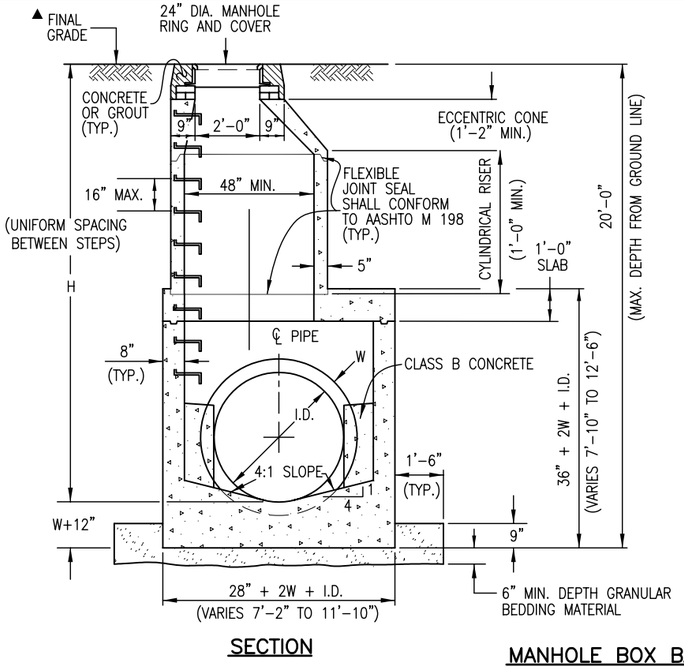
STANDARD PLAN NO.
M-604-13
Sheet No. 1 of 1



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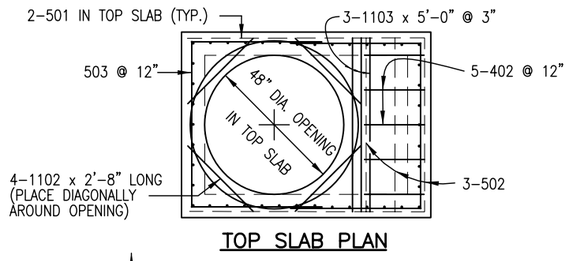
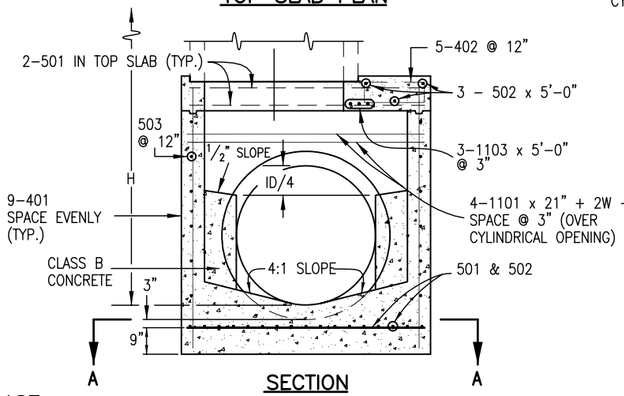


TOP SLAB PLAN



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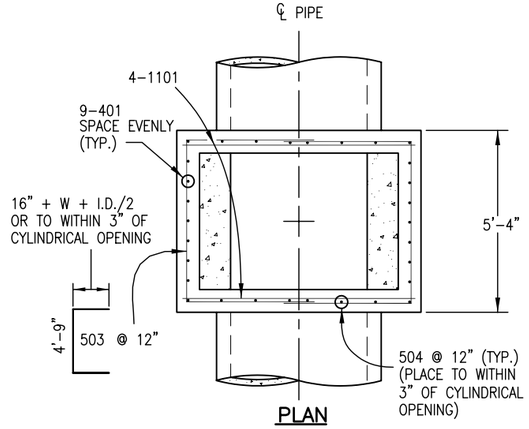
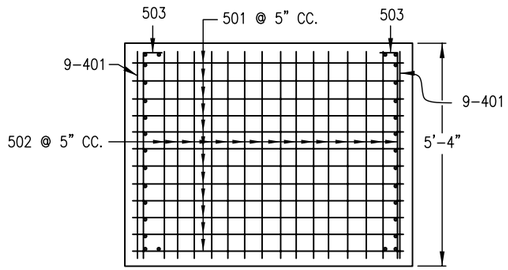


PLAN



SECTION A-A
(STEEL IN BOTTOM OF BASE)

MANHOLE BOX BASE

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

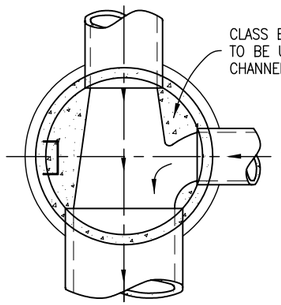
NOTE: QUANTITIES ARE BASED ON SAME SIZE PIPE ENTRANCE TO AND EXIT FROM, BASE AND A 4 FT. MANHOLE ENTRANCE INTO TOP SLAB OF BASE.

QUANTITIES FOR CONCRETE MANHOLE BOX BASE

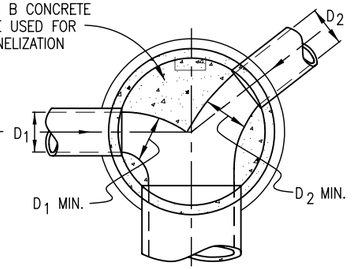
GENERAL NOTES

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

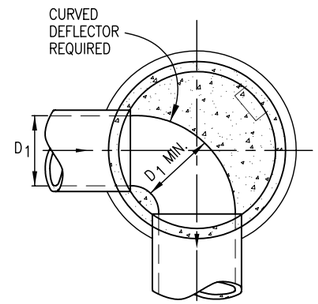
▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.



THROUGH PIPE ONE LATERAL



ANGLED LATERALS



SHARP ANGLE

TYPICAL CHANNELIZATION DETAILS

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MANHOLES

STANDARD PLAN NO.
M-604-20
Sheet No. 1 of 3

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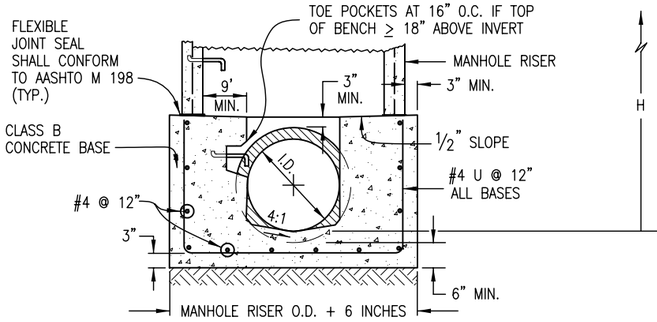
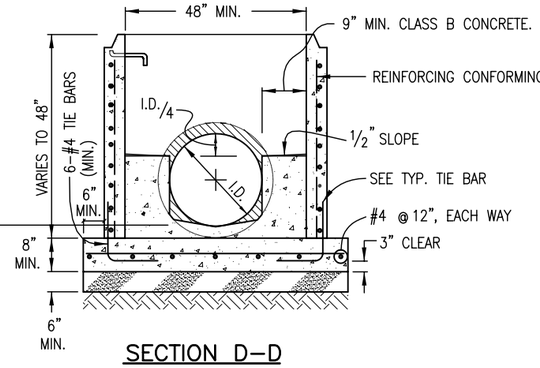
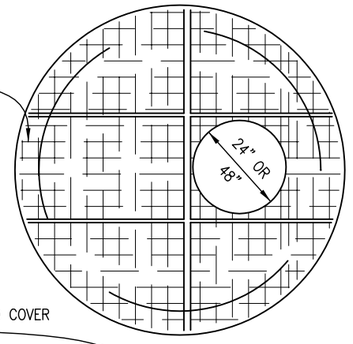
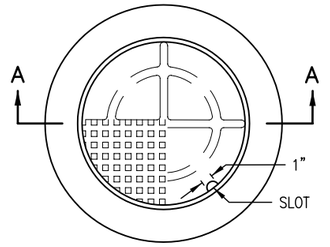


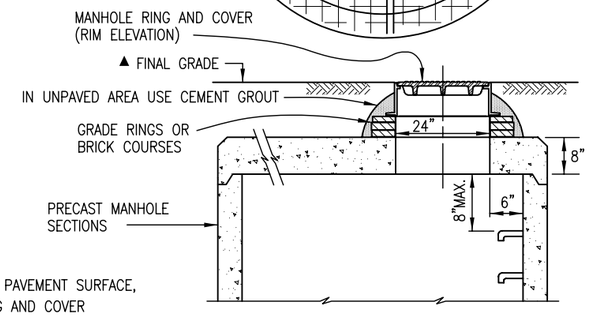
SECTION B–B



SECTION D–D

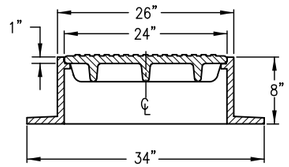






▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.

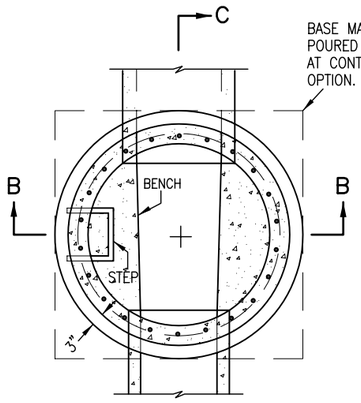
FLAT TOP SECTION DETAIL



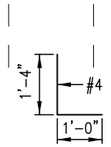
TOTAL WEIGHT: APPROXIMATELY 400 LBS. SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.

SECTION A–A

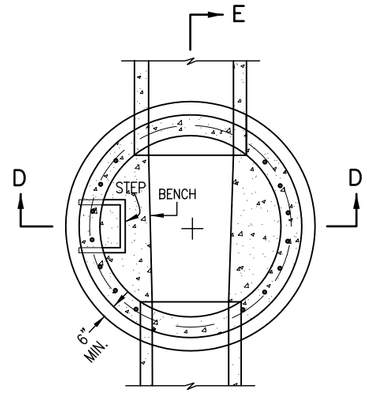
MANHOLE RING AND COVER



PLAN



TYPICAL TIE BAR



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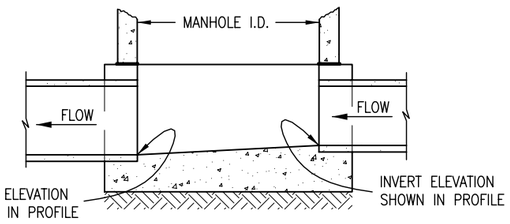
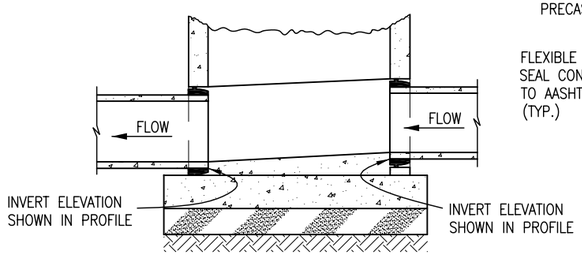


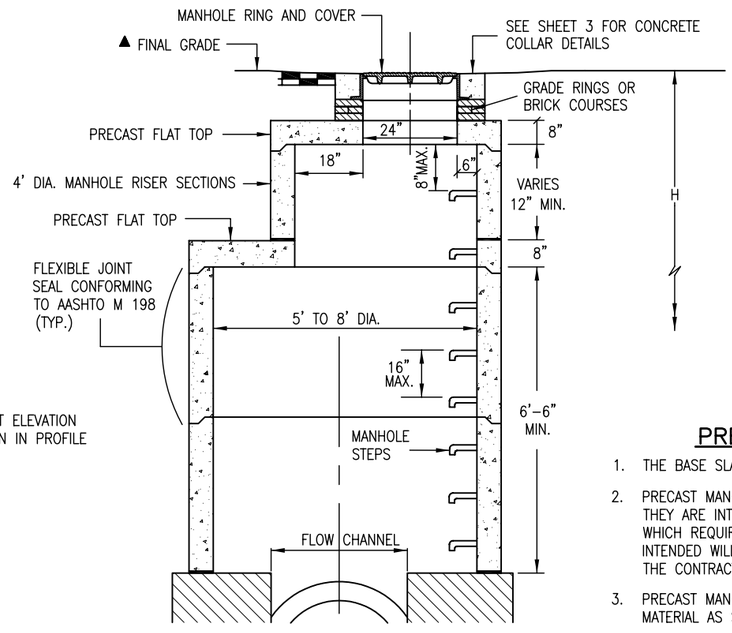
SECTION C–C

CAST–IN–PLACE SLAB BASE



SECTION E–E

PRECAST SLAB BASE



MANHOLE RISER DETAIL

LEGEND

- SUITABLE SUBGRADE
- GRANULAR BEDDING MATERIAL
- CONCRETE

PRECAST MANHOLE BASES NOTES:

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

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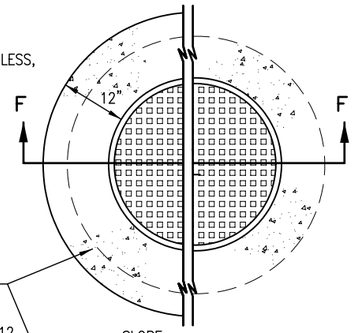
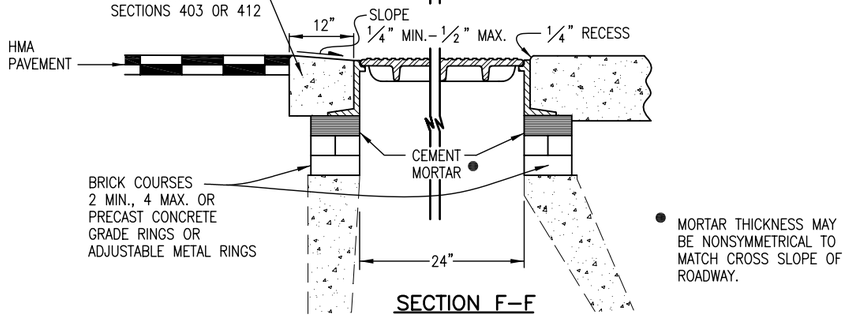
STANDARD PLAN NO.
M-604-20
Sheet No. 2 of 3

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

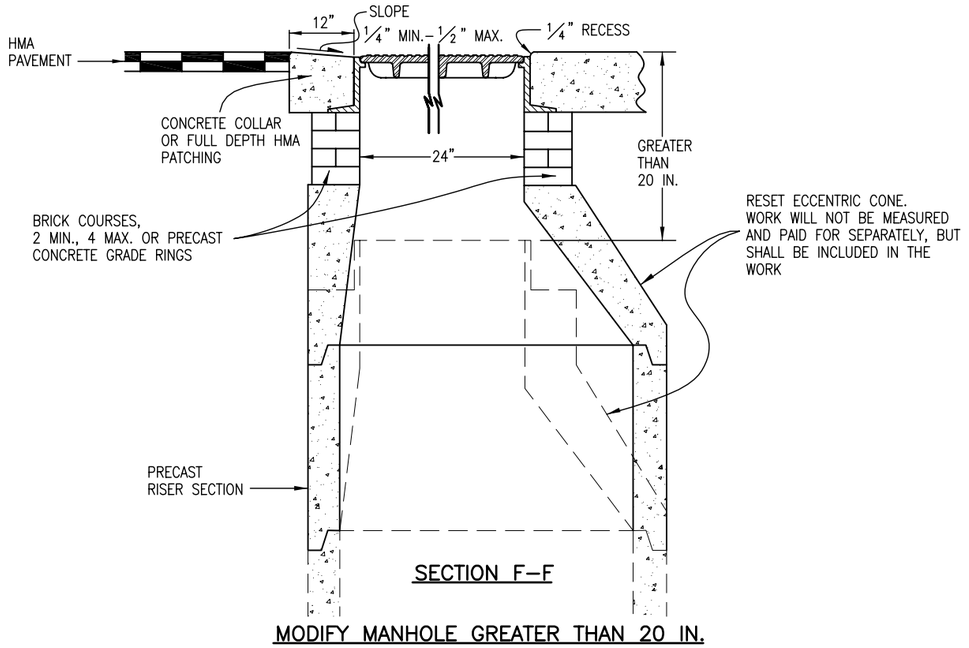




● MORTAR THICKNESS MAY BE NONSYMMETRICAL TO MATCH CROSS SLOPE OF ROADWAY.

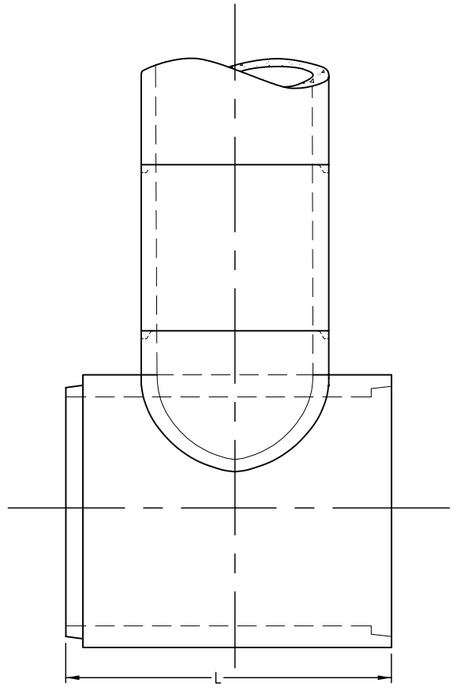
SECTION F–F

ADJUST MANHOLE 20 IN. OR LESS



SECTION F–F

MODIFY MANHOLE GREATER THAN 20 IN.

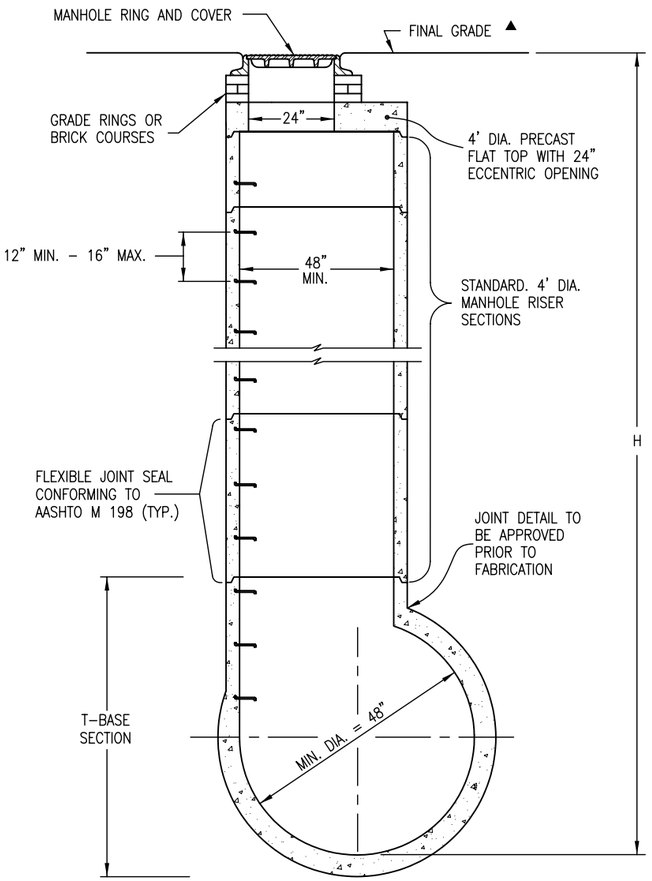


CIRCULAR RIGID PIPE (LONGITUDINAL SECTION)

T–BASE MANHOLES NOTES

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

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



CIRCULAR RIGID PIPE (TRANSVERSE SECTION)

MANHOLE T–BASE

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R–X
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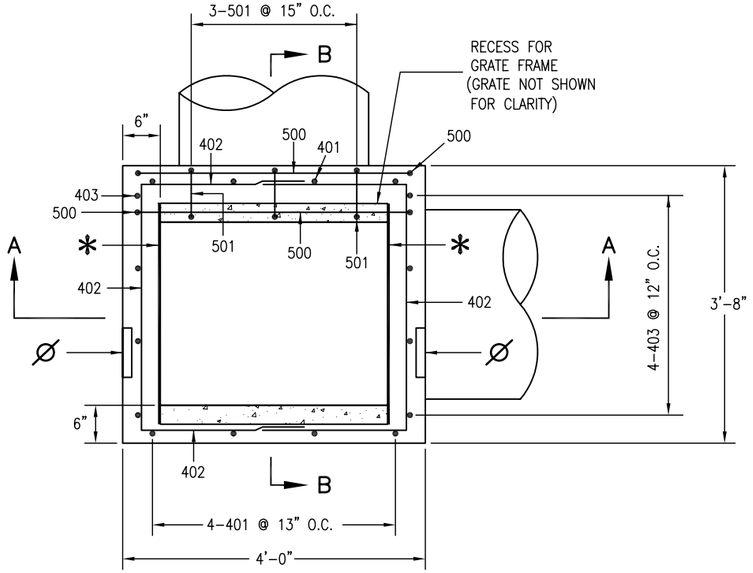
M-604-20
Sheet No. 3 of 3



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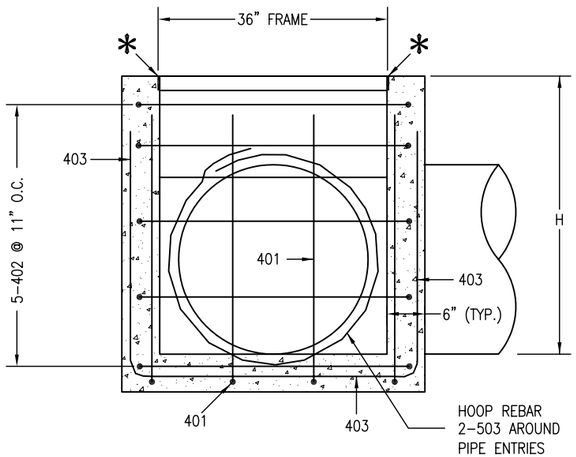
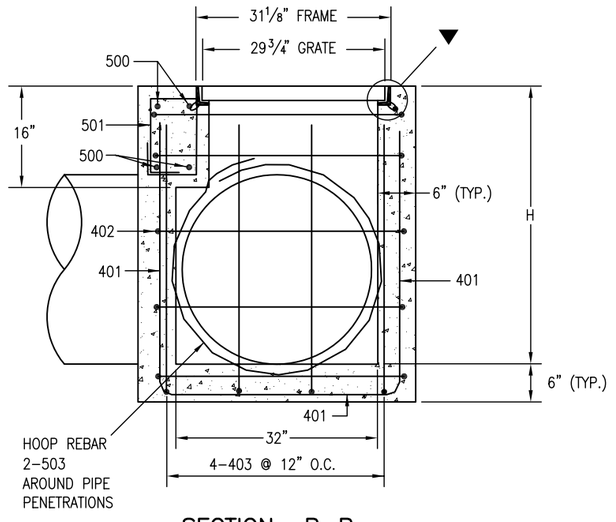


SECTION A–A



SECTION B–B

GENERAL NOTES

1. FOR THE 32 INCH AND 36 INCH INSIDE INLET DIMENSIONS, THE ALLOWABLE PIPE I.D. IS 30 INCHES OR LESS. FOR THE 72 INCH INSIDE INLET DIMENSION, THE ALLOWABLE PIPE I.D. IS "H" MINUS 18 INCHES, OR LESS, UP TO A MAXIMUM OF 66 INCHES FOR "H" OF 7 FEET OR MORE.
2. ALL CONCRETE SHALL BE CLASS B.
3. INLET MAY BE CAST–IN–PLACE OR PRECAST.
4. REINFORCING BARS SHALL BE #4 UNLESS SHOWN OTHERWISE.
5. ALL REINFORCING BARS SHALL BE GRADE 40 AND EPOXY COATED. REINFORCING BARS SHALL HAVE A MINIMUM CLEARANCE OF 2 IN.
6. ALL EDGE DISTANCES NOT MARKED "CLEAR" ARE TO THE CENTERLINE OF THE BAR.
7. CUT OR BEND REINFORCING BARS AROUND PIPES AS REQUIRED.
8. STEPS SHALL BE REQUIRED WHEN THE INLET DEPTH "H" IS EQUAL TO OR GREATER THAN 4 FT. AND SHALL CONFORM TO AASHTO M 199.
9. THE INVERT OF THE BOX SHALL BE SLOPED TO DRAIN.
10. THE CONTRACTOR SHALL STAMP FLOW ARROWS INTO THE TOP SURFACE OF THE INLET BOX SIDEWALLS TO INDICATE THE DIRECTION OF RUNOFF. THE STAMPED ARROWS SHALL BE 6 IN. LONG, 1 IN. HIGH, AND 3/8 IN. DEEP. FOR INLETS IN SUMP CONDITIONS, THE STAMPED FLOW ARROWS SHALL INDICATE THE PREDOMINATE DIRECTION OF RUNOFF FLOW.

LEGEND

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

* TO FACILITATE REMOVAL OF THE GRATE, PLACE PLYWOOD 3 IN. x 1/4 IN. x 31– 3/8 IN. ALONG EDGE OF THE GRATE AS SHOWN.

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

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VANE GRATE INLET

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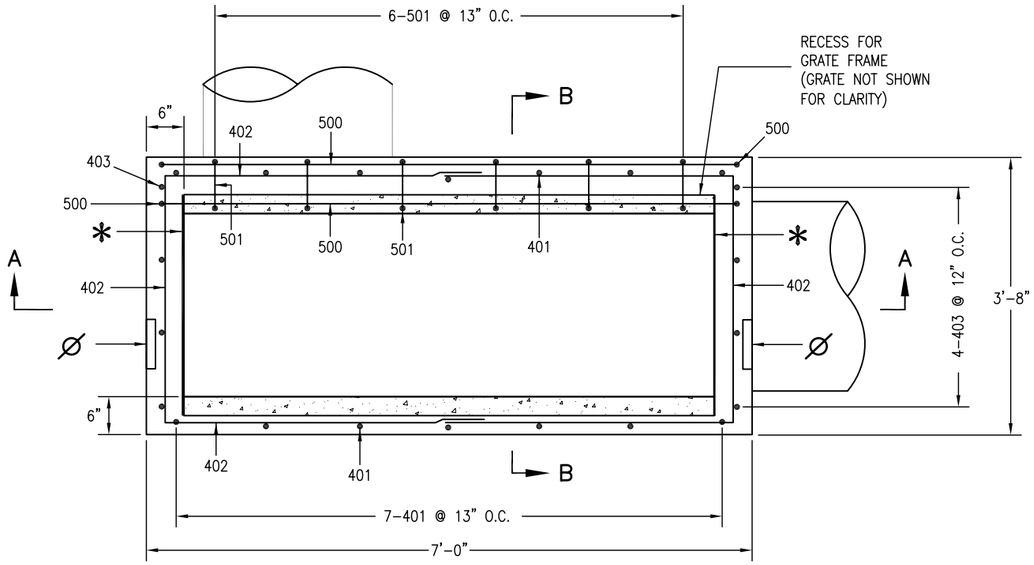
STANDARD PLAN NO.
M-604-25
Sheet No. 1 of 5



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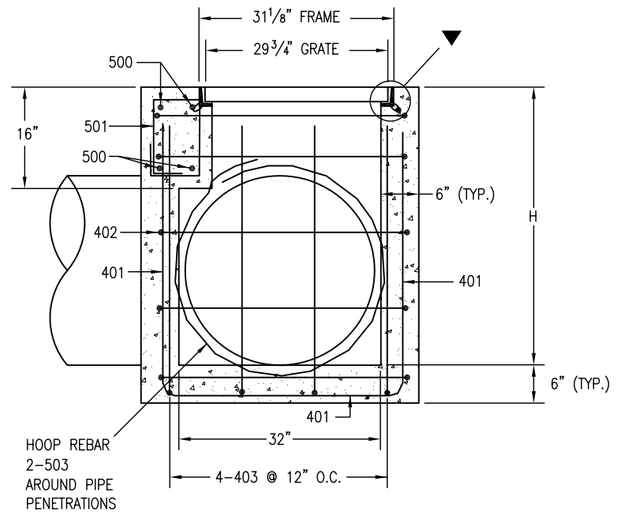


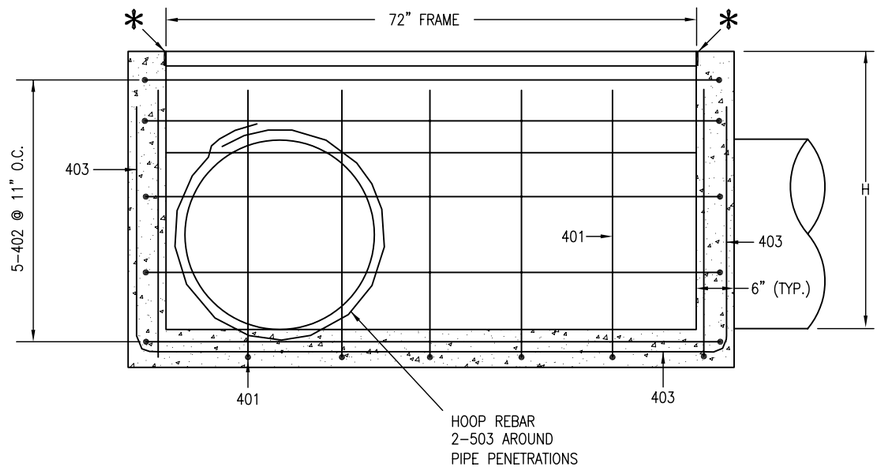
SECTION B–B

LEGEND

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

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

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



SECTION A–A

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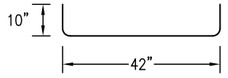
M-604-25
Sheet No. 2 of 5



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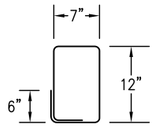

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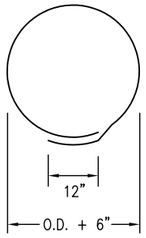

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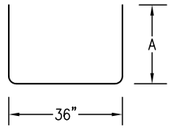
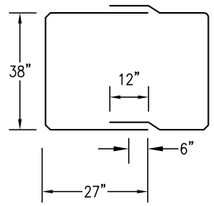


INCREASE DIMENSION "A" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

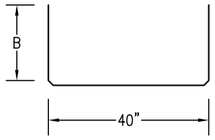
401



(2–402 BARS SHOWN TO INDICATE PROPER PLACEMENT)

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

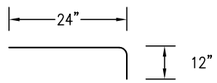
402



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

403

36 IN. INLET BOX BENDING DIAGRAM



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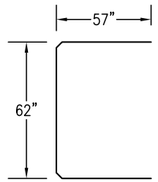

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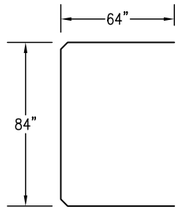


407

INLET APRON BENDING DIAGRAM FOR 36 IN. INLET

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

BAR LIST FOR CONCRETE APRON

(FOR INFORMATION ONLY)

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

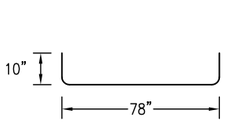
BAR LIST FOR H = 4'–0" 36 IN. INLET

QUANTITIES FOR ONE 36 IN. INLET

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

NOTES

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



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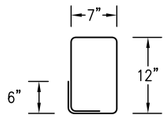

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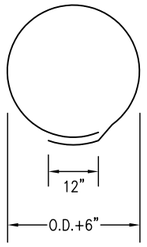

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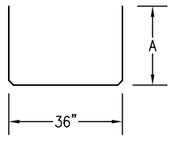
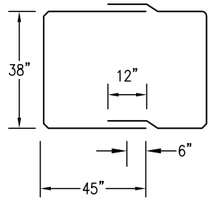


INCREASE DIMENSION "A" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

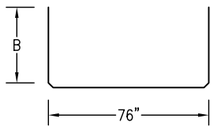
401



(2–402 BARS SHOWN TO INDICATE PROPER PLACEMENT)

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

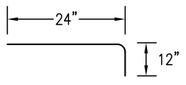
402



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

403

72 IN. INLET BOX BENDING DIAGRAM



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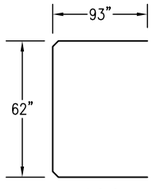

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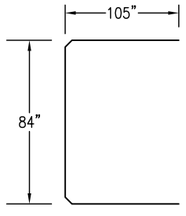

407

INLET APRON BENDING DIAGRAM FOR 72 IN. INLET

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

BAR LIST FOR CONCRETE APRON

(FOR INFORMATION ONLY)

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

BAR LIST FOR H = 4'–0" 72 IN. INLET

QUANTITIES FOR ONE 72 IN. INLET

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

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VANE GRATE INLET

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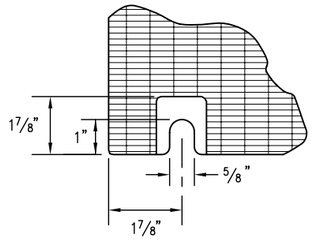
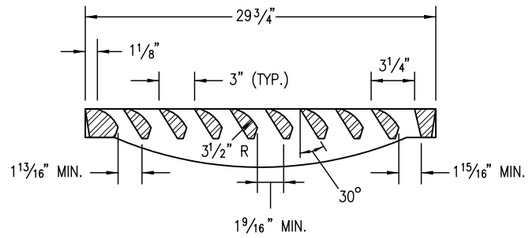
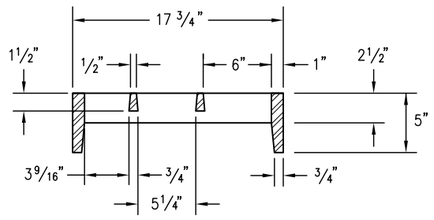
STANDARD PLAN NO.
M-604-25
Sheet No. 3 of 5



DETAIL A
BOLT SLOT AT CORNER (TYP.)



SECTION A–A



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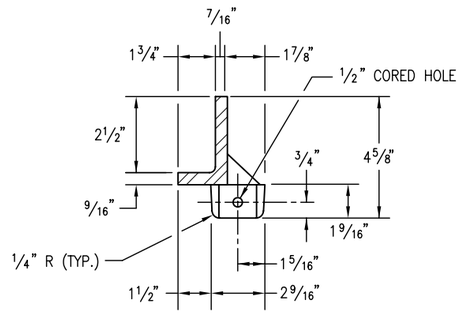
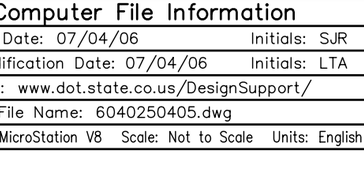


DETAIL B

NOTES

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



GRATE PLAN

MULTIPLE GRATE WITH FRAME PLAN

SECTION C–C

SECTION D–D

Computer File Information		Sheet Revisions	
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R–X
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VANE GRATE INLET

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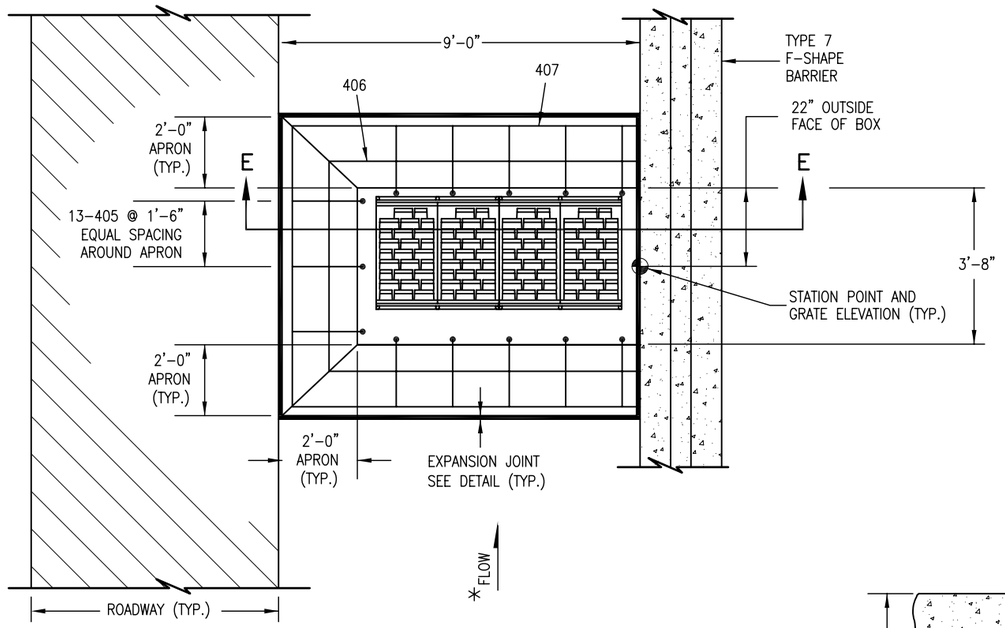
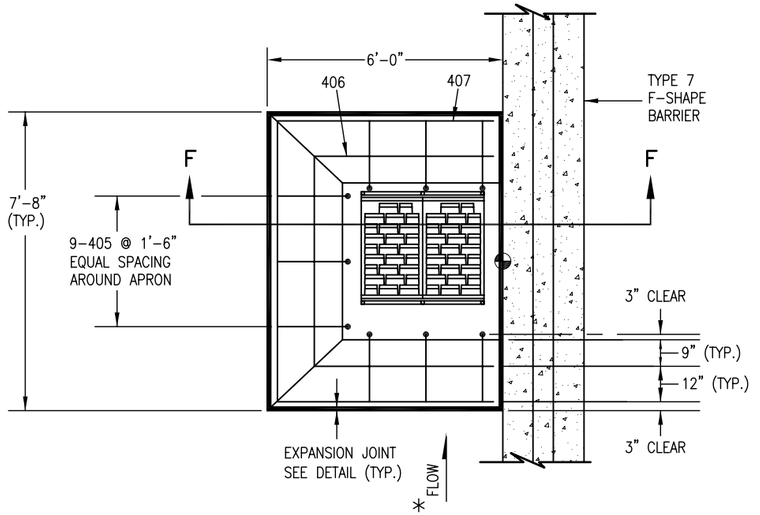
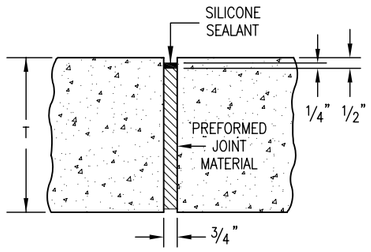
STANDARD PLAN NO.
M-604-25
Sheet No. 4 of 5



CONCRETE APRON FOR 72 IN. INLET



CONCRETE APRON FOR 36 IN. INLET

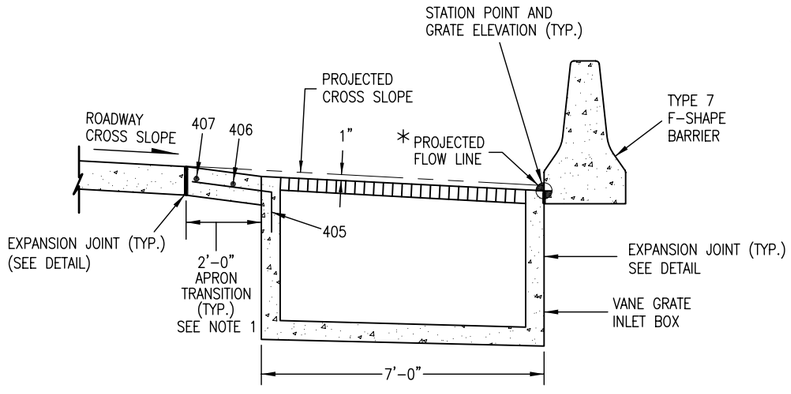


EXPANSION JOINT (TYP.)

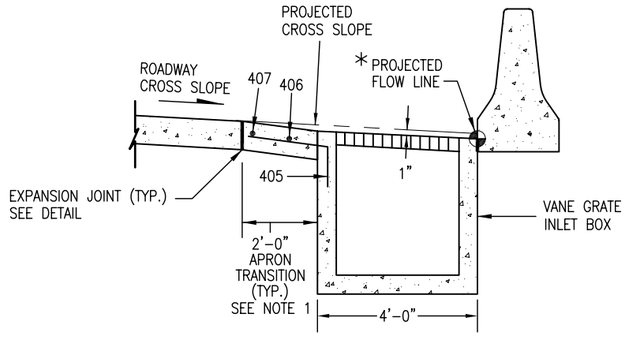
NOTES

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

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



SECTION E-E



SECTION F-F

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VANE GRATE INLET

STANDARD PLAN NO.
M-604-25
Sheet No. 5 of 5

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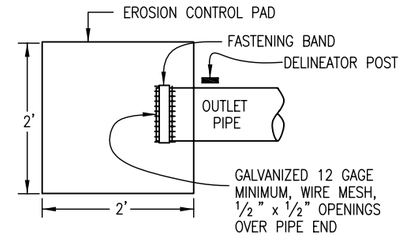
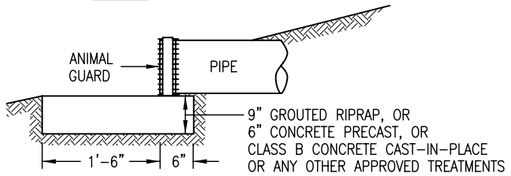
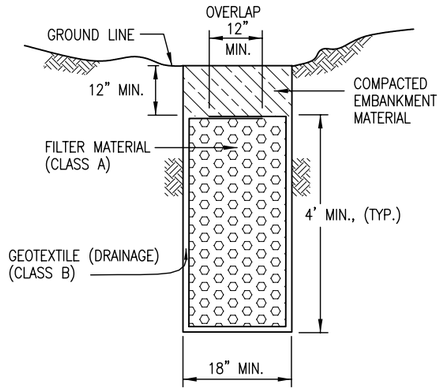


PLAN

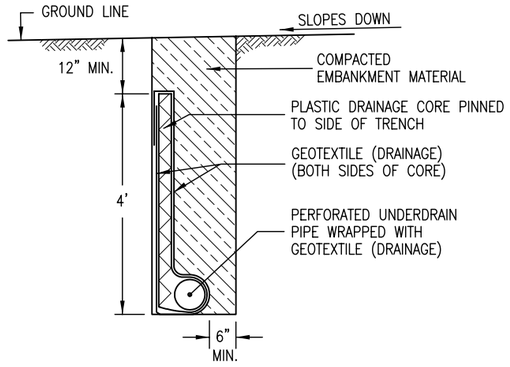


PROFILE

OUTLET PIPE END TREATMENT



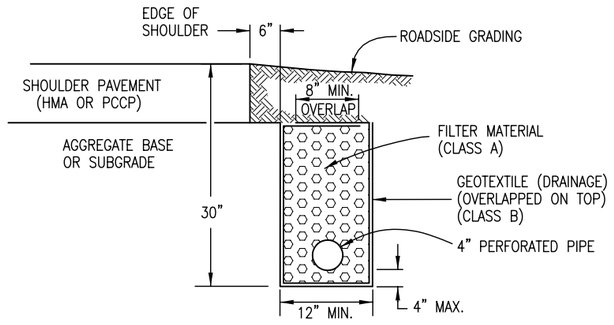
FRENCH DRAIN



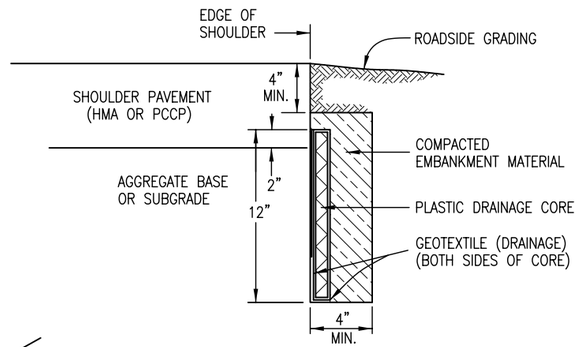
GEOCOMPOSITE UNDERDRAIN

GENERAL NOTES

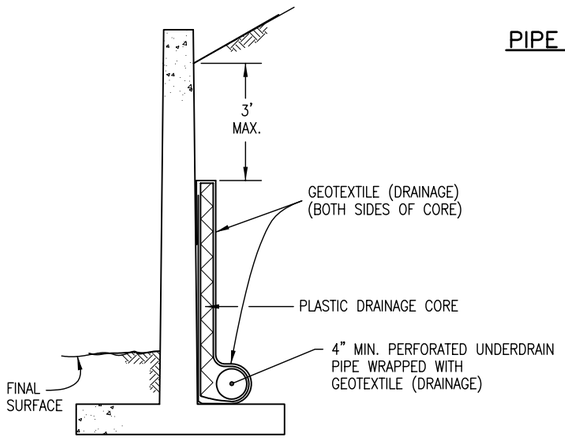
1. THE LOCATION AND GRADE OF SUBSURFACE DRAINS AND OUTLET PIPES WILL BE AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
2. OUTLETS FOR THE EDGE DRAINS ARE TO BE SPACED AT MAXIMUM 600 FT. INTERVALS OR AS SHOWN ON THE PLANS. GEOCOMPOSITE OUTLET CONNECTIONS SHALL CONFORM TO MANUFACTURER'S RECOMMENDATIONS.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



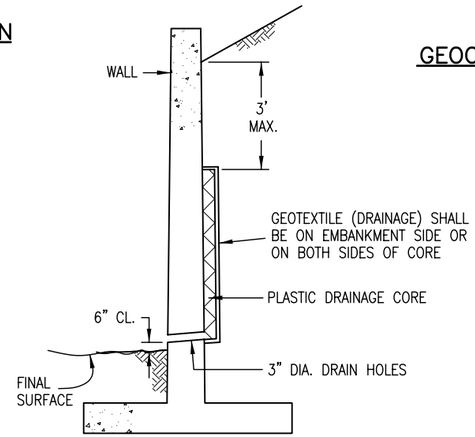
PIPE EDGE DRAIN



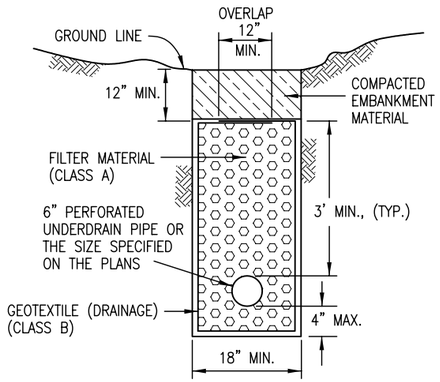
GEOCOMPOSITE EDGE DRAIN



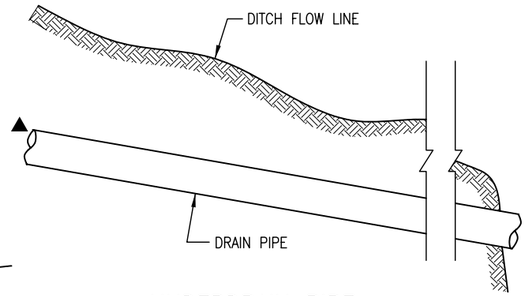
GEOCOMPOSITE DRAIN WITH PIPE



GEOCOMPOSITE DRAIN WITHOUT PIPE



PIPE UNDERDRAIN



UNDERDRAIN PIPE

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

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

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SUBSURFACE DRAINS

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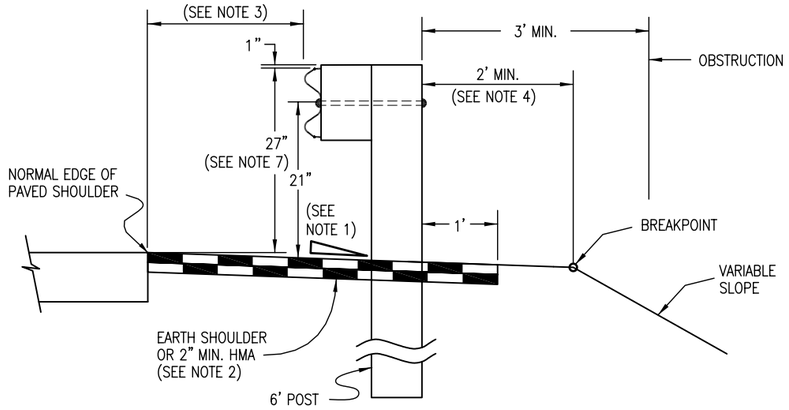
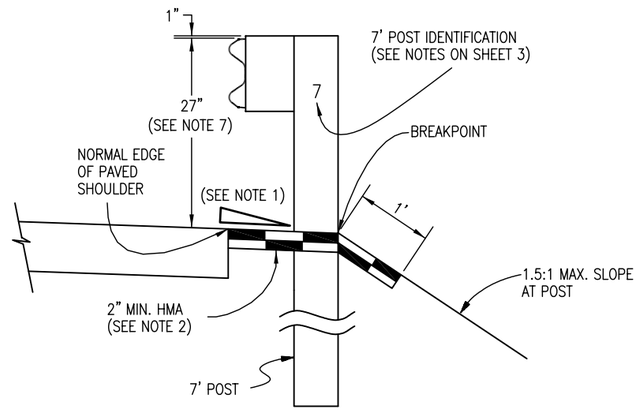
STANDARD PLAN NO.
M-605-1
Sheet No. 1 of 1

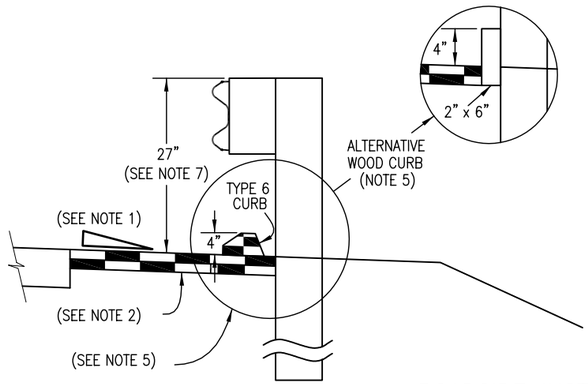


NORMAL ROADSIDE INSTALLATION WHEN FILL REQUIRES GUARDRAIL

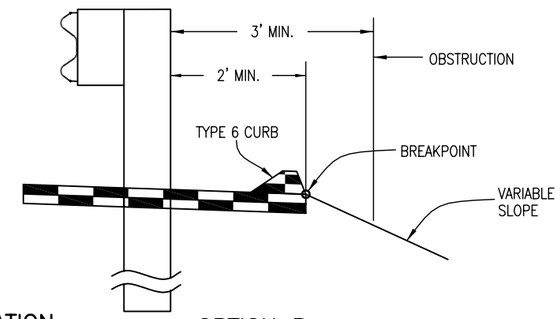


RESTRICTIVE ROADSIDE INSTALLATION WITH 7 FOOT GUARDRAIL POSTS

(SEE NOTE 4)

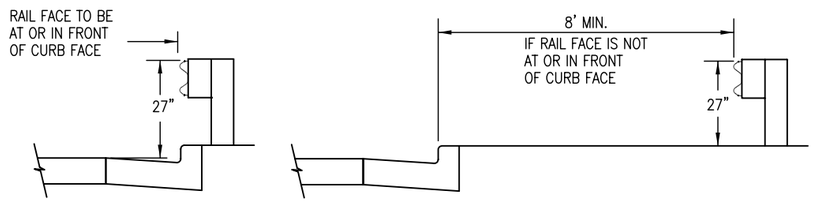


OPTION A



OPTION B

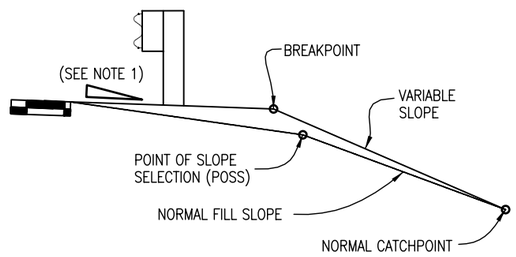
ROADSIDE INSTALLATION WITH EROSION CONTROL CURB



URBAN ROADSIDE INSTALLATION WITH CURB AND GUTTER

LOCATION	SPACING
ALL LOCATIONS EXCEPT BRIDGE RAIL LOCATIONS	6'-3"
BRIDGE OR STRUCTURE APPROACH	SEE SHEETS 10 & 16

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. ASHALT 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.
3. THE MINIMUM GUARDRAIL OFFSET FROM PAVED OUTSIDE 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 OF RAIL IS 0 FT. AND 4 FT. MINIMUM 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 ¼ IN. DIA. BOLT WITH WASHER AND NUT AT EACH STEEL POST. IF THE 2 IN. x 6 IN. WOOD CURB IS SPECIFIED, IT WILL BE INCLUDED IN THE COST OF THE GUARDRAIL. IF APPROVED BY THE ENGINEER, A 2 IN. x 4 IN. TREATED WOOD CURB MAY BE SUBSTITUTED FOR THE 2 IN. x 6 IN. CURB AND SET ON TOP OF PAVEMENT SURFACE AND ATTACHED AS DESCRIBED ABOVE. NO SPLICING SHALL BE ALLOWED IN WOOD CURBS. ADJACENT BOARDS SHALL BE BUTTED TOGETHER AND BOLTED AT A POST LOCATION. JOINTS SHALL BE LOCATED AT THE POSTS.
6. SEE SHEET 6 FOR CURB TREATMENTS AT GUARDRAIL TERMINALS.
7. RESET GUARDRAIL IF THIS DIMENSION WILL BE LESS THAN 24 IN.
8. ALL W-BEAM SPLICES, AND SPLICES OF TERMINAL CONNECTORS TO W-BEAM SHALL BE LAPPED IN THE DIRECTION OF TRAFFIC UNLESS OTHERWISE NOTED.
9. MATERIAL TYPE AND SHAPE OF POSTS AND BLOCKS SHALL BE THE SAME THROUGHOUT THE PROJECT EXCEPT WHEN SPECIFIC POSTS AND BLOCKS ARE SPECIFIED, i.e. AT END ANCHORAGES AND BOX CULVERTS.
10. CONCRETE MAY BE READY-MIXED OR FIELD-MIXED AND SHALL CONSIST OF A MINIMUM OF 1 PART CEMENT TO 6 PARTS AGGREGATE BY VOLUME.

THE GENERAL NOTES ARE CONTINUED ON SHEET 2.

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GUARDRAIL TYPE 3 W-BEAM

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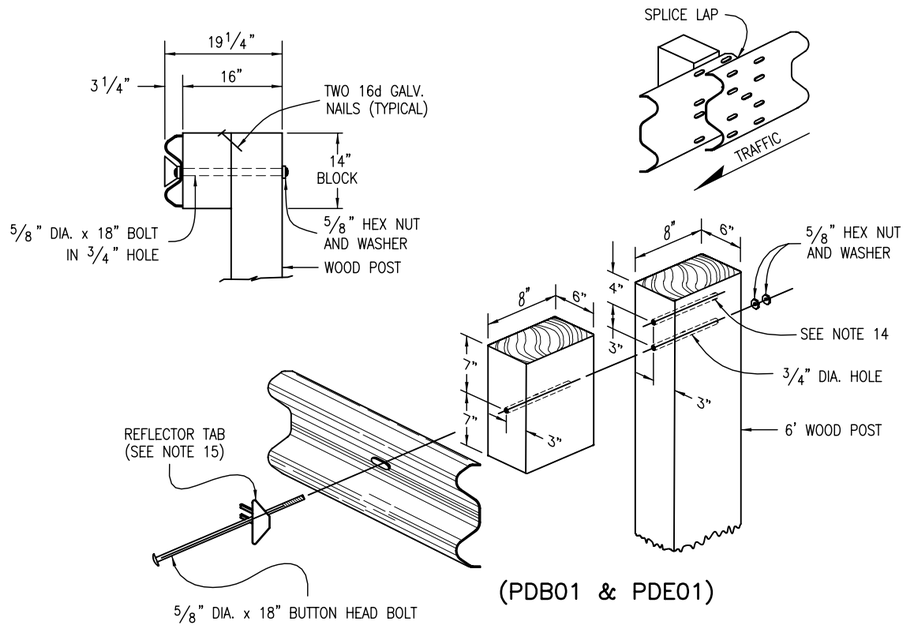
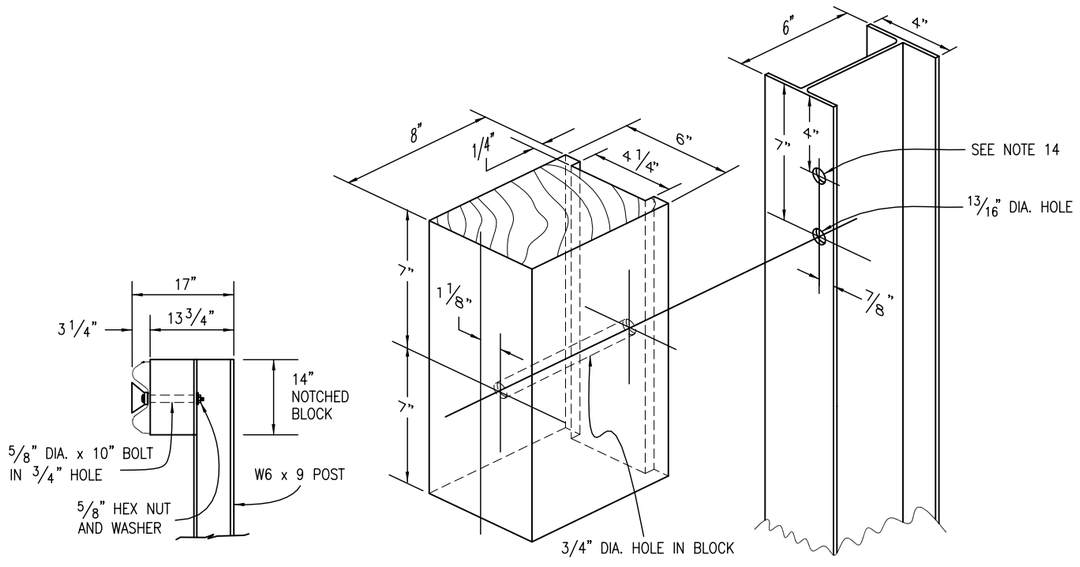
STANDARD PLAN NO.
M-606-1
Sheet No. 1 of 16



(PDB01 & PDE01)

WOOD POST & BLOCK

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



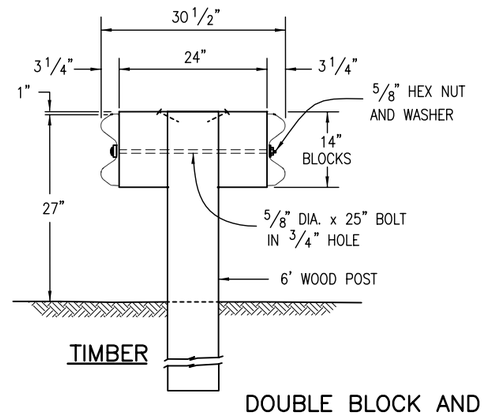
STEEL POST & NOTCHED BLOCK

(NOMINAL DIMENSIONS ARE SHOWN FOR THE POSTS & BLOCKS)

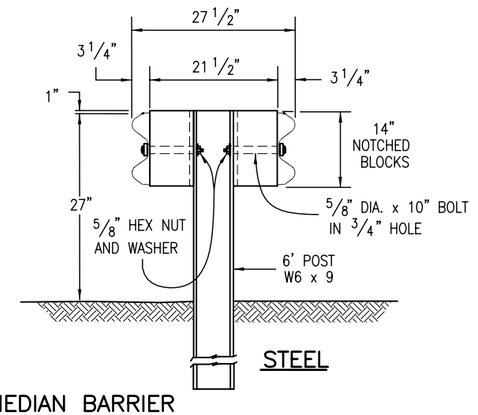
(PWE01)

GENERAL NOTES (CONTINUED FROM SHEET 1)

11. WHEN SPECIFIED IN THE CONTRACT, 7 FT. POSTS SHALL BE INSTALLED INSTEAD OF THE STANDARD 6 FT. POSTS. THE 7 FT. POSTS SHALL BE MARKED WITH THE NUMBER 7 TO ENSURE PERMANENT INDENTIFICATION. STEEL POSTS SHALL BE STAMPED PRIOR TO GALVANIZING. THE NUMBER 7 SHALL BE A MINIMUM 2 IN. TALL AND LOCATED AS SHOWN ON THE ELEVATION VIEW ON SHEET 1.
12. THE STANDARD 3 IN. X $1\frac{3}{4}$ IN. X $\frac{3}{16}$ IN. RECTANGULAR WASHER USED UNDER POST BOLT HEADS IN THE PAST MAY REMAIN IN EXISTING INSTALLATIONS BUT SHALL NOT BE USED IN NEW CONSTRUCTION, REPAIRS, OR RESETTING OF RAIL, EXCEPT WHEN SPECIFICALLY IDENTIFIED ON THE STANDARD PLAN.
13. STANDARD GALVANIZED ROUND STEEL WASHERS SHALL BE USED UNDER ALL NUTS IN CONTACT WITH WOOD POSTS.
14. AN ADDITIONAL HOLE SHALL BE PROVIDED IN THE POSTS TO FACILITATE FUTURE RAISING OF THE RAIL ELEMENTS AND BLOCKS FOR OVERLAYS.
15. RETROREFLECTOR TABS SHALL BE INSTALLED AT 25 FT. INTERVALS (SEE SHEETS 5 AND 7 FOR EXCEPTIONS). RETROREFLECTOR TABS WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. THE TABS SHALL BE MOUNTED SO THE BOLT SLOT FACES AWAY FROM TRAFFIC, AND THE RETROREFLECTOR SURFACE FACES THE APPROACHING TRAFFIC FOR ONE-WAY ROADS. FOR TWO-WAY ROADS, BOTH SIDES OF THE TABS SHALL BE RETROREFLECTIVE, SO THAT DELINEATION IS PROVIDED FOR BOTH DIRECTIONS OF TRAVEL. THE RETROREFLECTIVE SHEETING COLOR SHALL MATCH THE COLOR OF THE ADJACENT TRAVEL WAY EDGE LINE. SEE THE RETROREFLECTOR TAB DETAIL ON SHEET 3.
16. AT THE TIME OF INSTALLATION, WOOD POSTS OR BLOCKS WITH SEASONING CHECKS GREATER THAN $\frac{1}{4}$ IN. SHALL NOT BE USED WHEN THE CHECK EXTENDS THE FULL LENGTH OF THE PIECE.
17. WOOD BLOCKS SHALL BE CUT FROM THE SAME CROSS-SECTION, SPECIES, AND GRADE, AND SHALL RECEIVE THE SAME PRESERVATIVE TREATMENT AS THE POSTS WHEN WOOD POSTS ARE USED.
18. REFERENCES SUCH AS "PDB01", "PDE01", AND "PWE01" IN THIS STANDARD PLAN SPECIFY HARDWARE DETAILS FROM "A 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 IS ALLOWED ONLY 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.



TIMBER



STEEL

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

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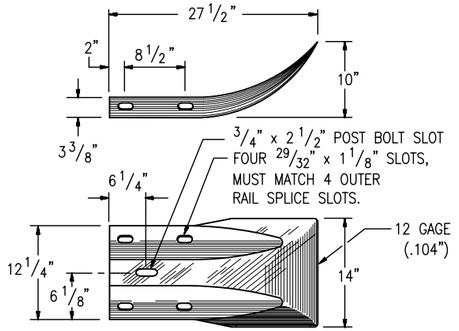
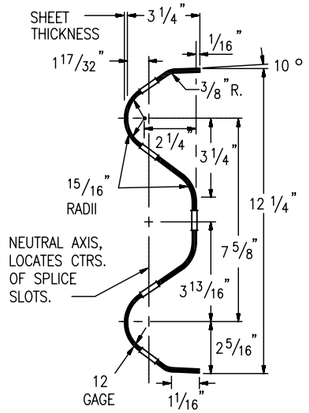
STANDARD PLAN NO.
M-606-1
Sheet No. 2 of 16



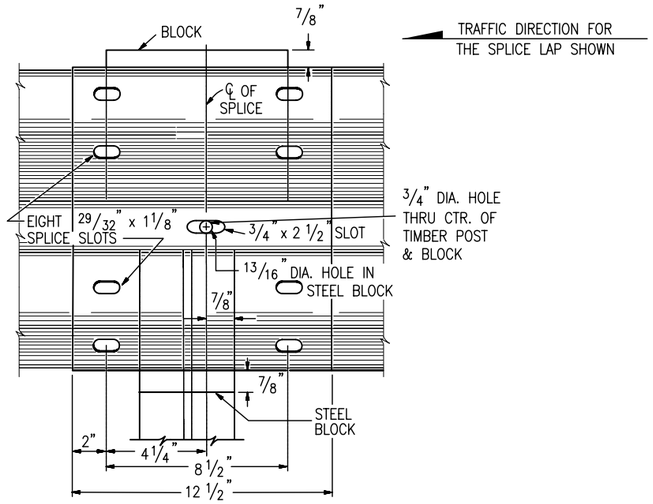
(RWE01a)

TERMINAL SECTION (FLARED)

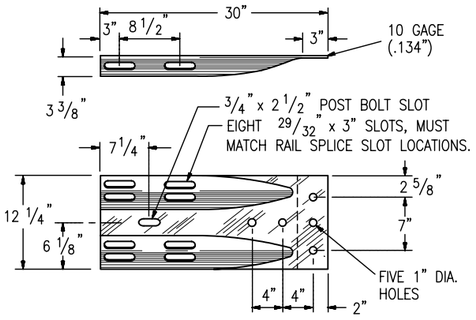


(RWM02a)

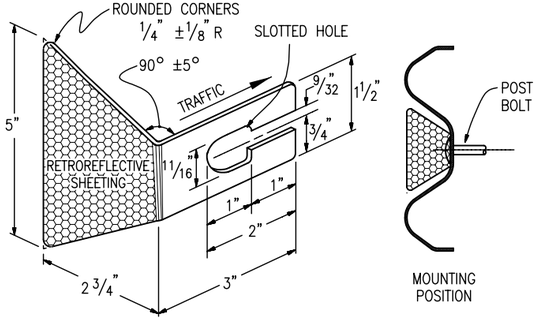
W-BEAM RAIL SECTION



RAIL SPLICE

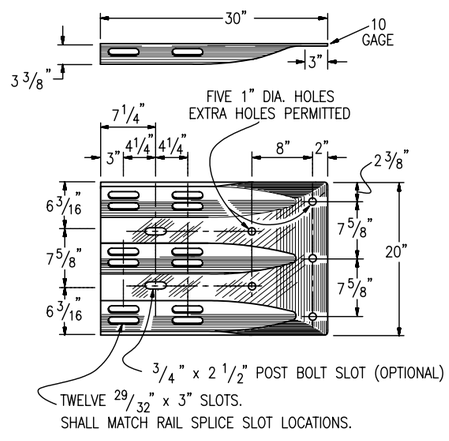


TERMINAL SECTION (CONNECTOR)

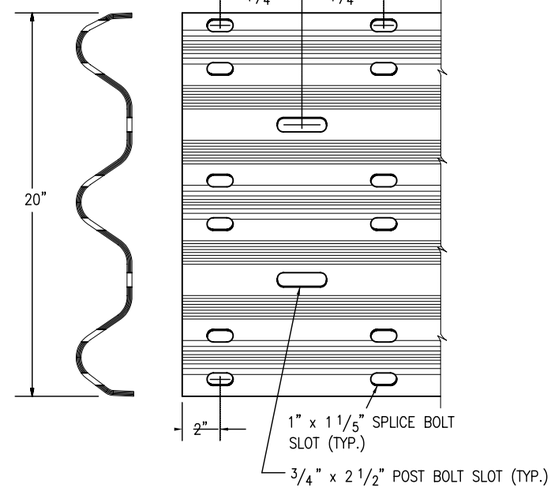


RETROREFLECTOR TAB

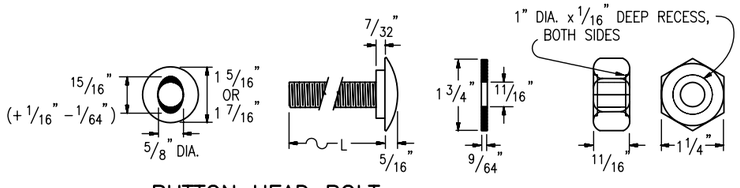
RETROREFLECTOR TABS SHALL BE MANUFACTURED FROM 12 TO 14 GAUGE STEEL. RETROREFLECTIVE SHEETING SHALL CONFORM TO ASTM D4956 TYPE III. SEE NOTE 7 ON SHEET 3



THRIE BEAM
TERMINAL SECTION (CONNECTOR)



THRIE BEAM DETAIL



BUTTON HEAD BOLT
WITH OVAL SHOULDER

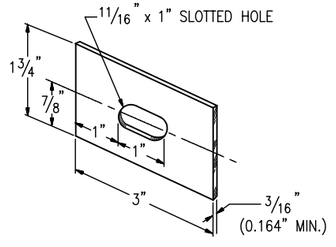
WASHER

HEX NUT

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

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

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



(FWR03)

RECTANGULAR WASHER
(TO BE USED ONLY WHERE SPECIFIED.)

DIAMETER & TYPE (INCHES)	LENGTH L (INCHES)	THREAD LENGTH (INCHES)	INTENDED USE	AASHTO–AGC–ARTBA STANDARD NUMBER	NO. BOLTS, NUTS & WASHERS
5/8 BUTTON HEAD	1 1/4	FULL (1 1/32)	ALL RAIL SPLICES	FBB01	8 PER SPLICE *
OVAL SHLDR.	18	MIN. 2 1/2	SINGLE BLOCK & POST (TIMBER)	FBB04	1 PER POST
	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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GUARDRAIL TYPE 3 W-BEAM

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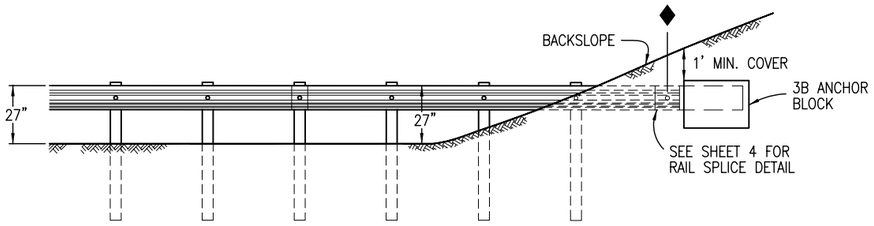
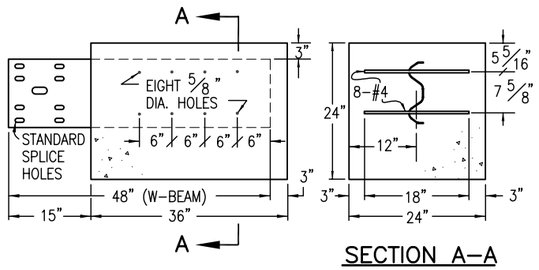
STANDARD PLAN NO.
M-606-1
Sheet No. 3 of 16

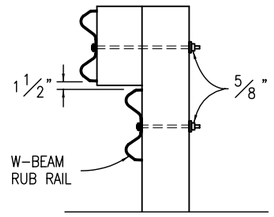


SEE TYPE 3B (RUB RAIL) PLAN VIEW FOR ALIGNMENT. THE 100 FT. FLARE LENGTH MAY BE SHORTENED IF THE SLOPE IS LESS THAN 8 FT. WIDE.

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

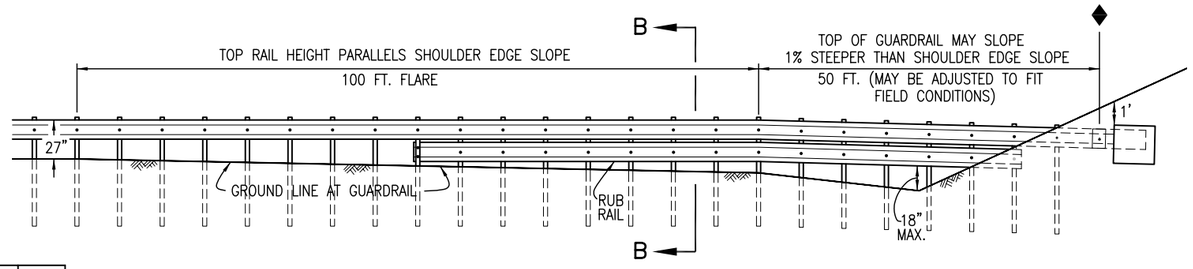


TYPE 3B ANCHOR BLOCK DETAIL

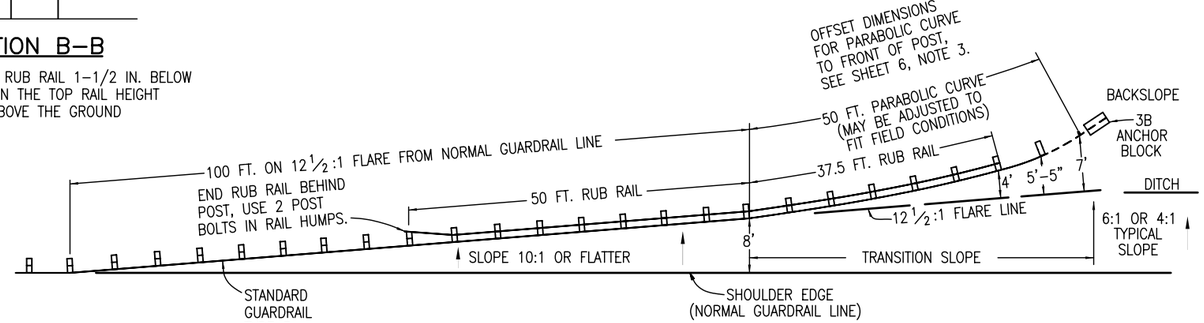


SECTION B–B

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



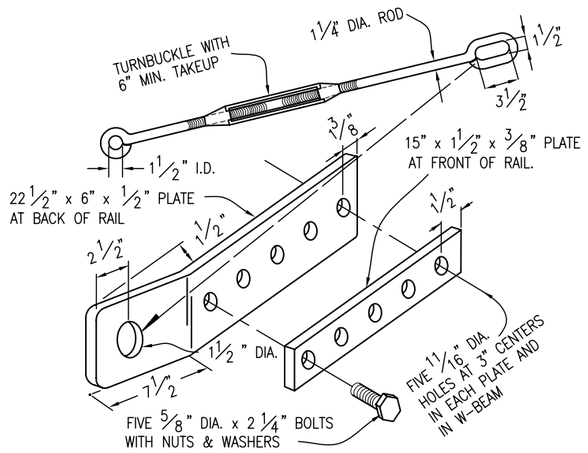
ELEVATION VIEW



PLAN VIEW

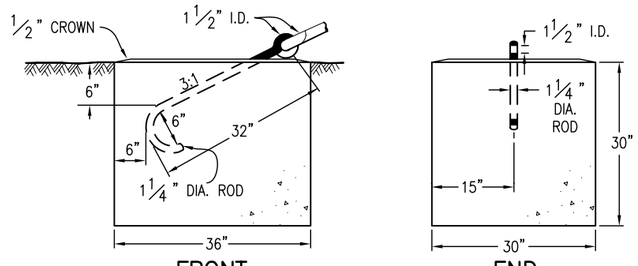
♦ END OF GUARDRAIL PAY LENGTH

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



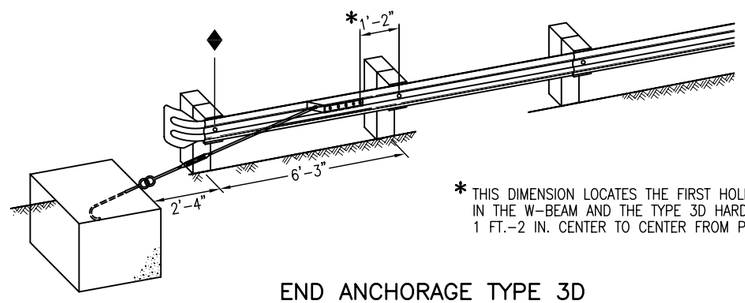
TYPE 3D HARDWARE DETAILS

NOTE: ALL PARTS SHALL BE GALVANIZED



FRONT END

TYPE 3D ANCHOR BLOCK DETAIL



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

END ANCHORAGE TYPE 3D DEPARTURE TERMINAL

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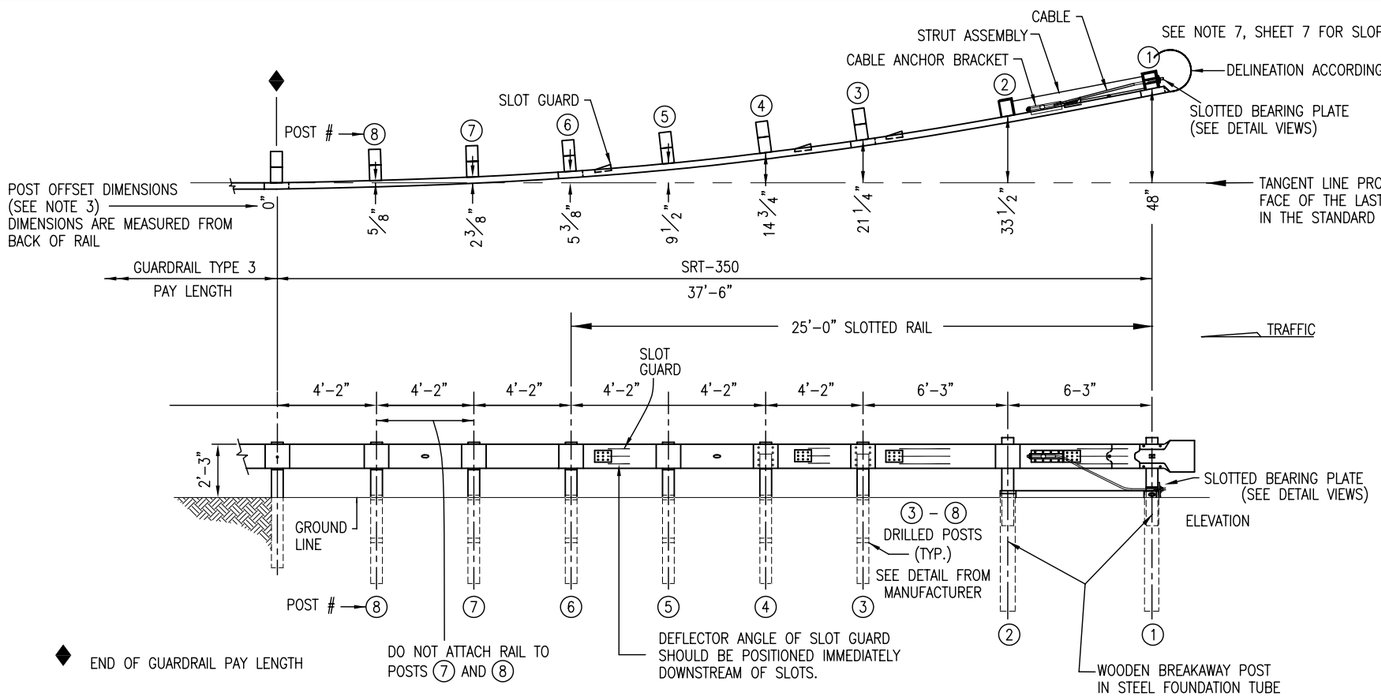
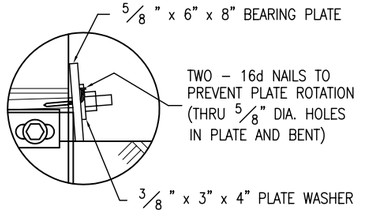
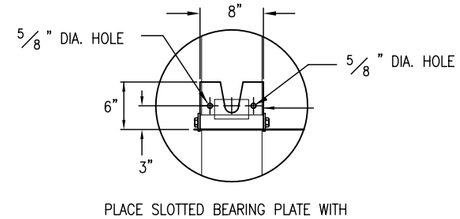
STANDARD PLAN NO.
M-606-1
Sheet No. 4 of 16



SLOTTED RAIL TERMINAL (SRT)



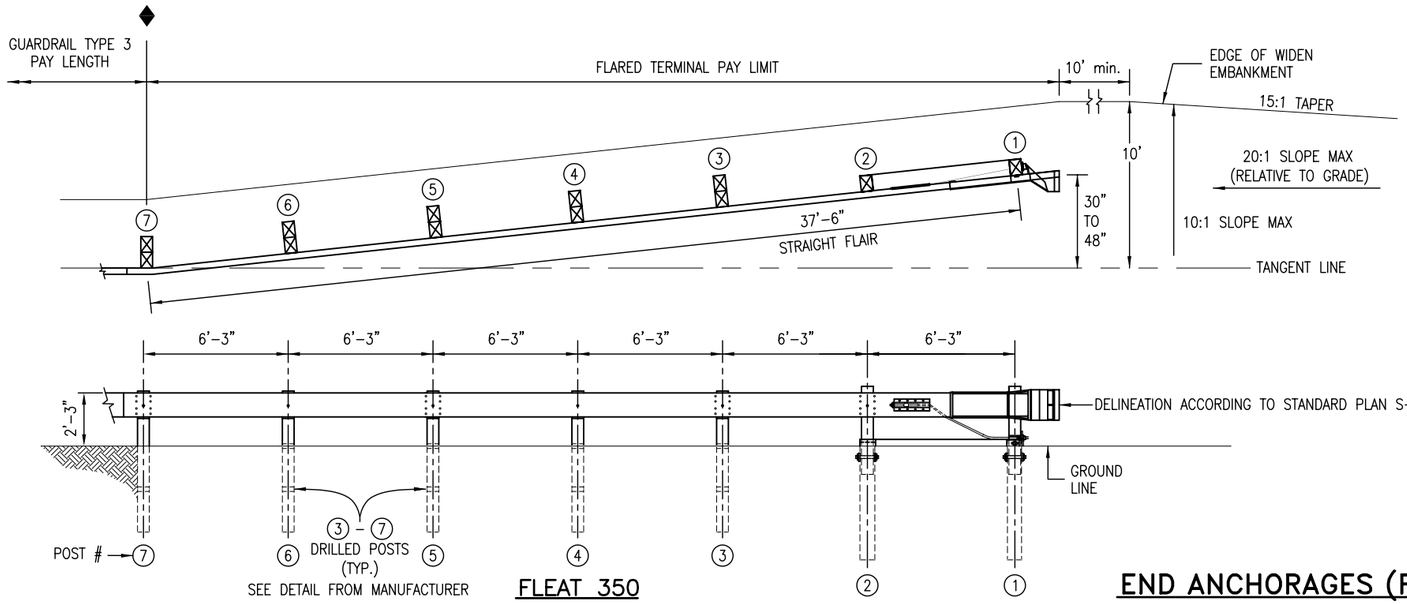
SRT DETAIL VIEW



PLACE SLOTTED BEARING PLATE WITH SLOT ORIENTED UP AS SHOWN.

SRT FRONT VIEW

SLOTTED BEARING PLATE DETAIL



FLEAT 350

END ANCHORAGES (FLARED)

NOTES

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

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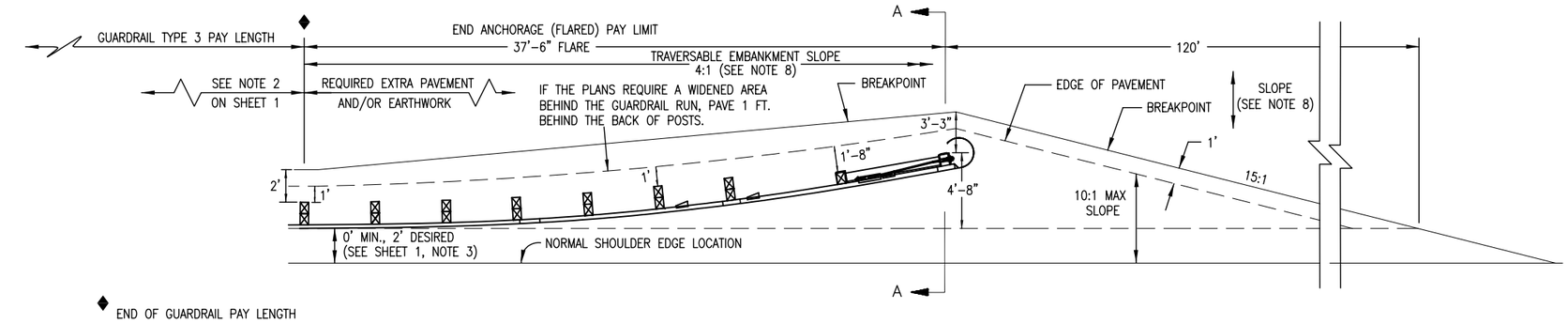
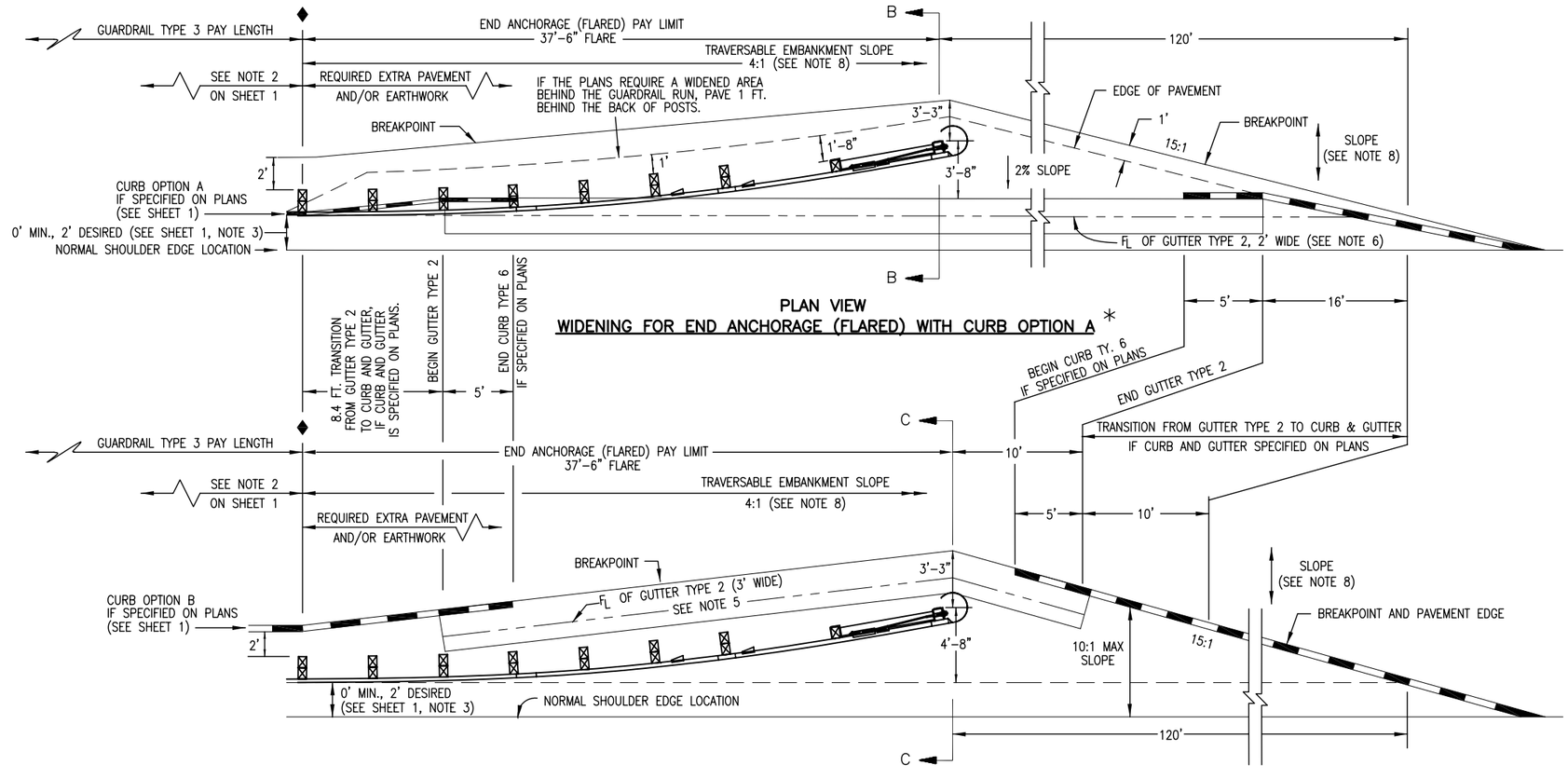
STANDARD PLAN NO.
M-606-1
Sheet No. 5 of 16



PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) *

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

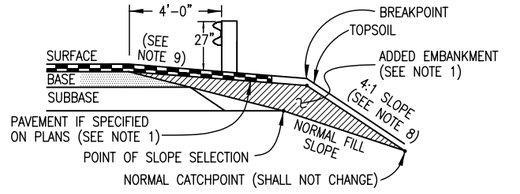


PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION A *

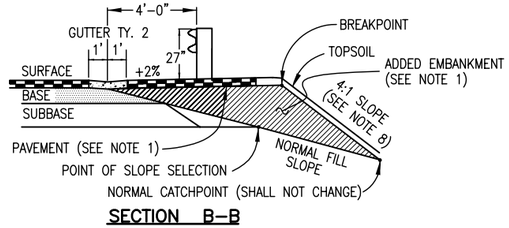
PLAN VIEW
WIDENING FOR END ANCHORAGE (FLARED) WITH CURB OPTION B *

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 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



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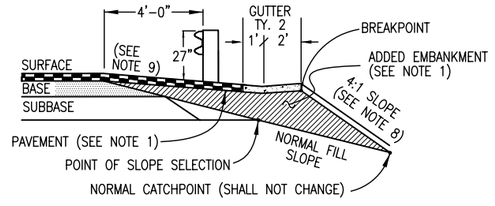

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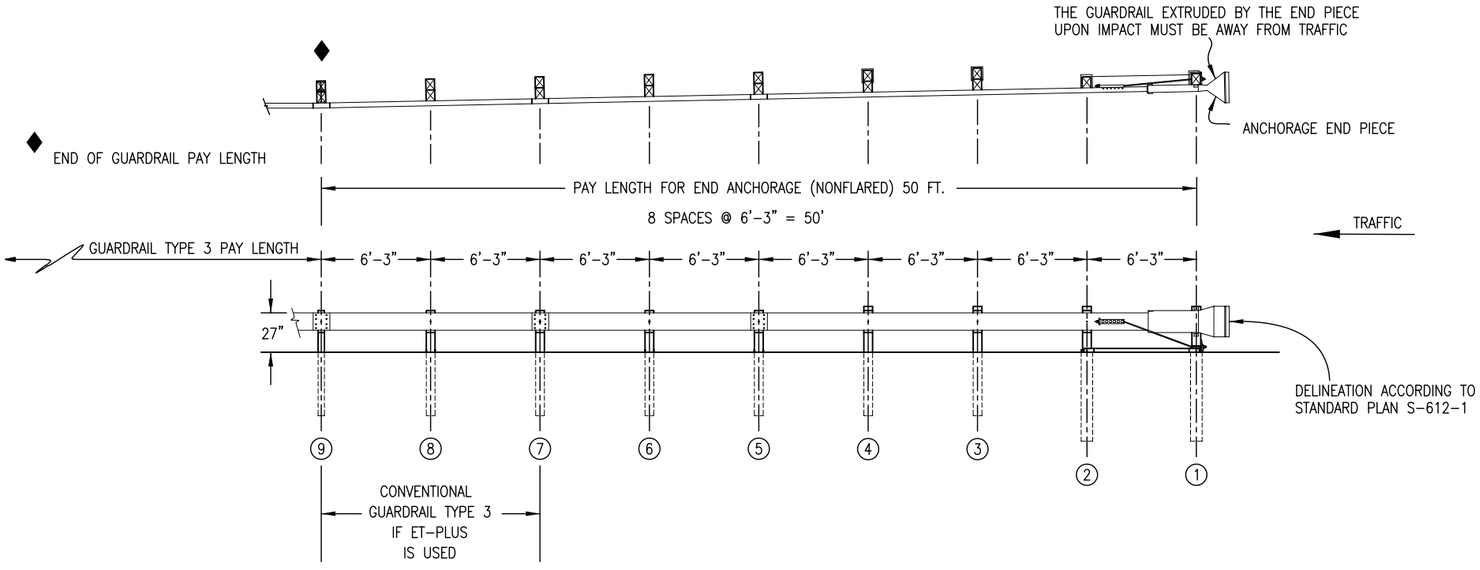
GUARDRAIL TYPE 3 W-BEAM

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-606-1
Sheet No. 6 of 16

NOTES

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



END ANCHORAGE (NONFLARED)

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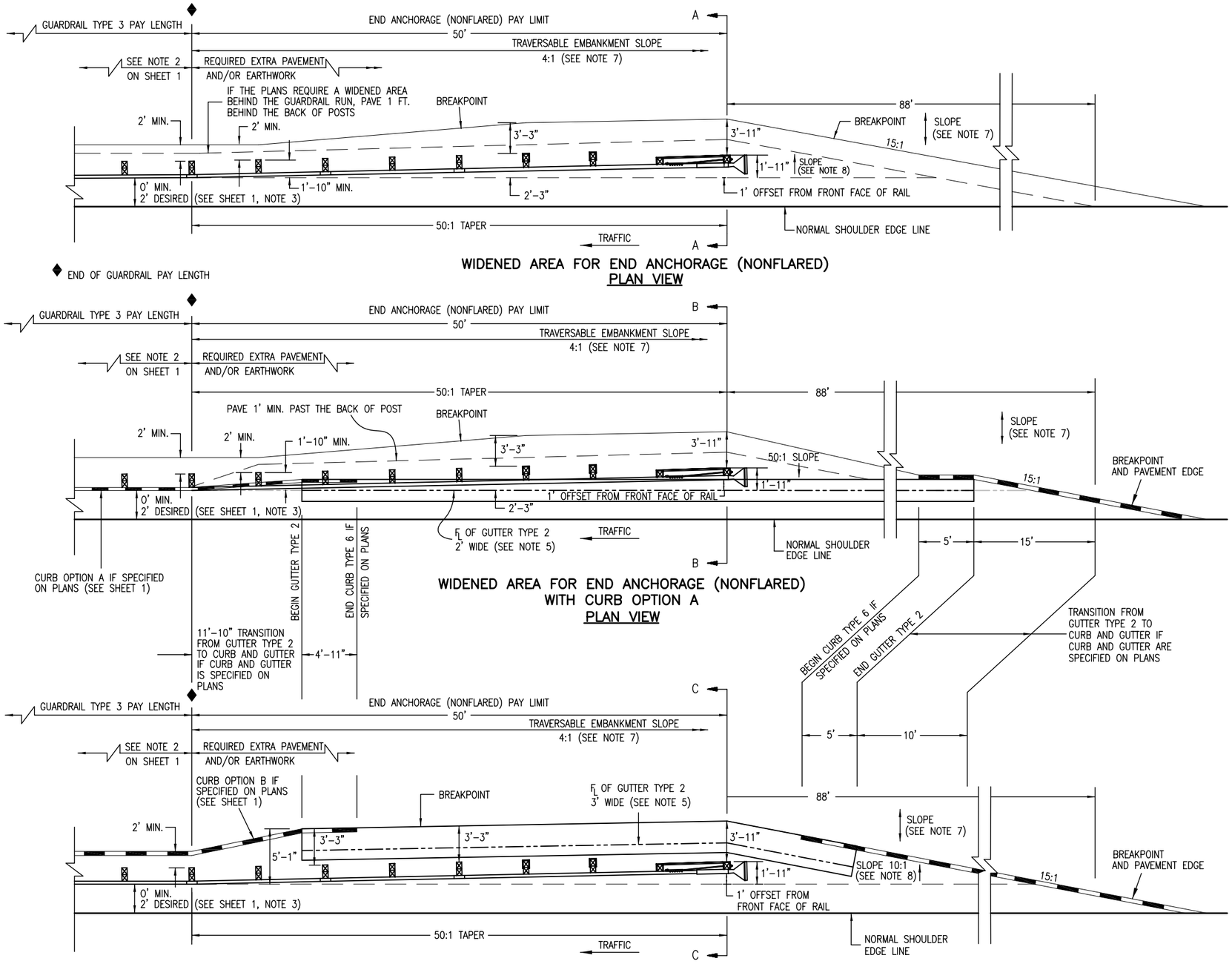
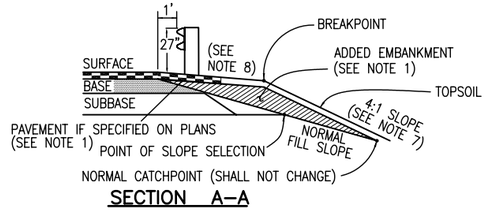
STANDARD PLAN NO.
M-606-1
Sheet No. 7 of 16

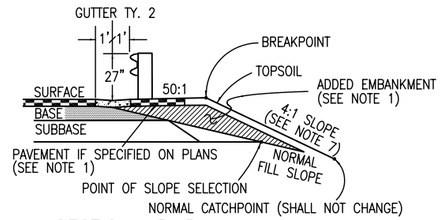


NOTES

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 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. 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 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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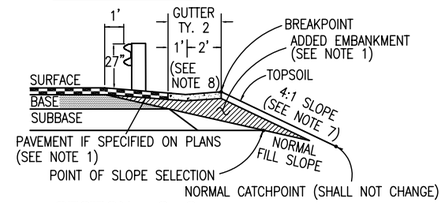

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GUARDRAIL TYPE 3 W-BEAM

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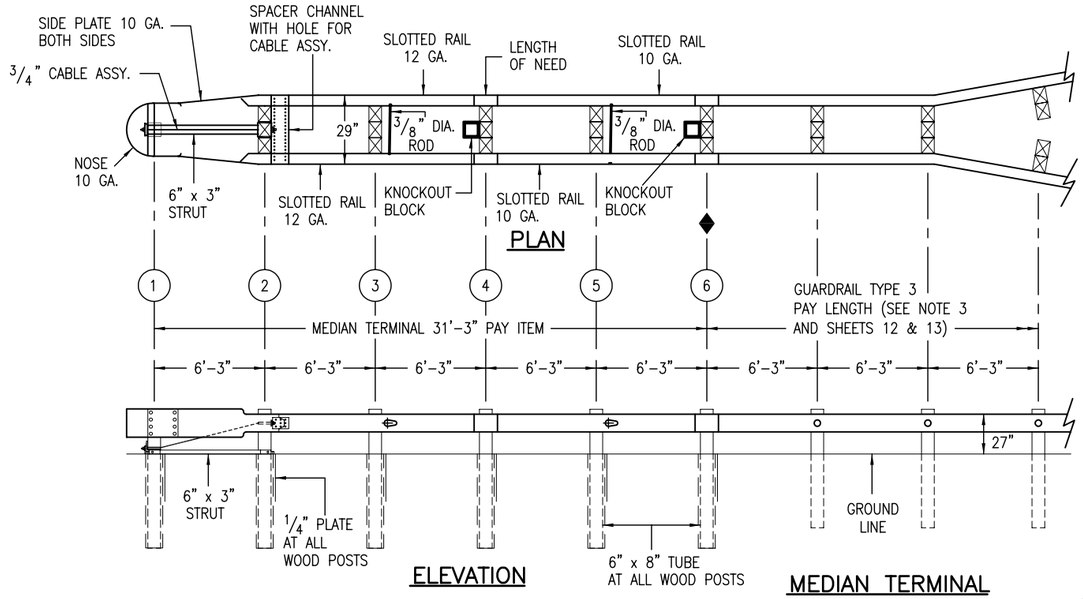
STANDARD PLAN NO.
M-606-1
Sheet No. 8 of 16

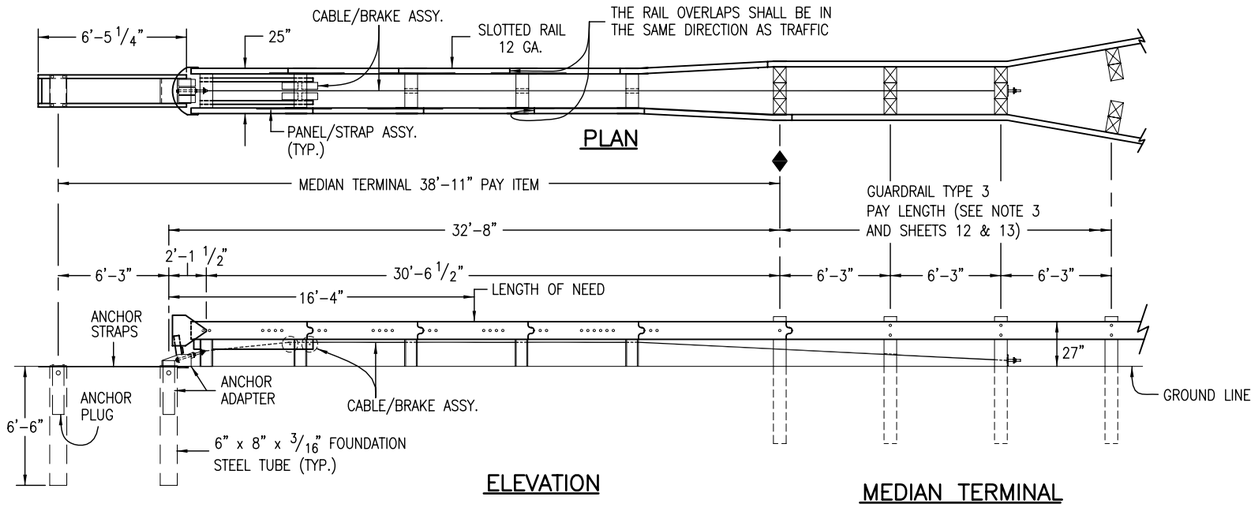


MEDIAN TERMINAL
(CAT OPTION)

NOTES

1. THE MEDIAN TERMINAL SHALL BE THE CAT 350 AS MANUFACTURED BY TRINITY INDUSTRIES INC. (TEL #: 800-644-7976), OR THE BRAKEMASTER AS MANUFACTURED BY ENERGY ABSORPTION SYSTEMS, INC. AS DISTRIBUTED BY INTERWEST SAFETY SUPPLY (TEL #: 303-733-8447). 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.
2. UNLESS OTHERWISE SPECIFIED ON THE PLANS, THE MEDIAN TERMINAL SHALL BE INSTALLED FOR BIDIRECTIONAL TRAFFIC APPLICATION.
3. MEDIAN GUARDRAIL POSTS MAY BE STEEL OR WOOD.
4. 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.
5. DELINEATION, IF REQUIRED, SHALL BE APPLIED TO THE END PIECE AND WILL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK. SEE STANDARD PLAN S-612-1.

◆ END OF GUARDRAIL PAY LENGTH



MEDIAN TERMINAL
(BRAKEMASTER OPTION)

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GUARDRAIL TYPE 3 W-BEAM

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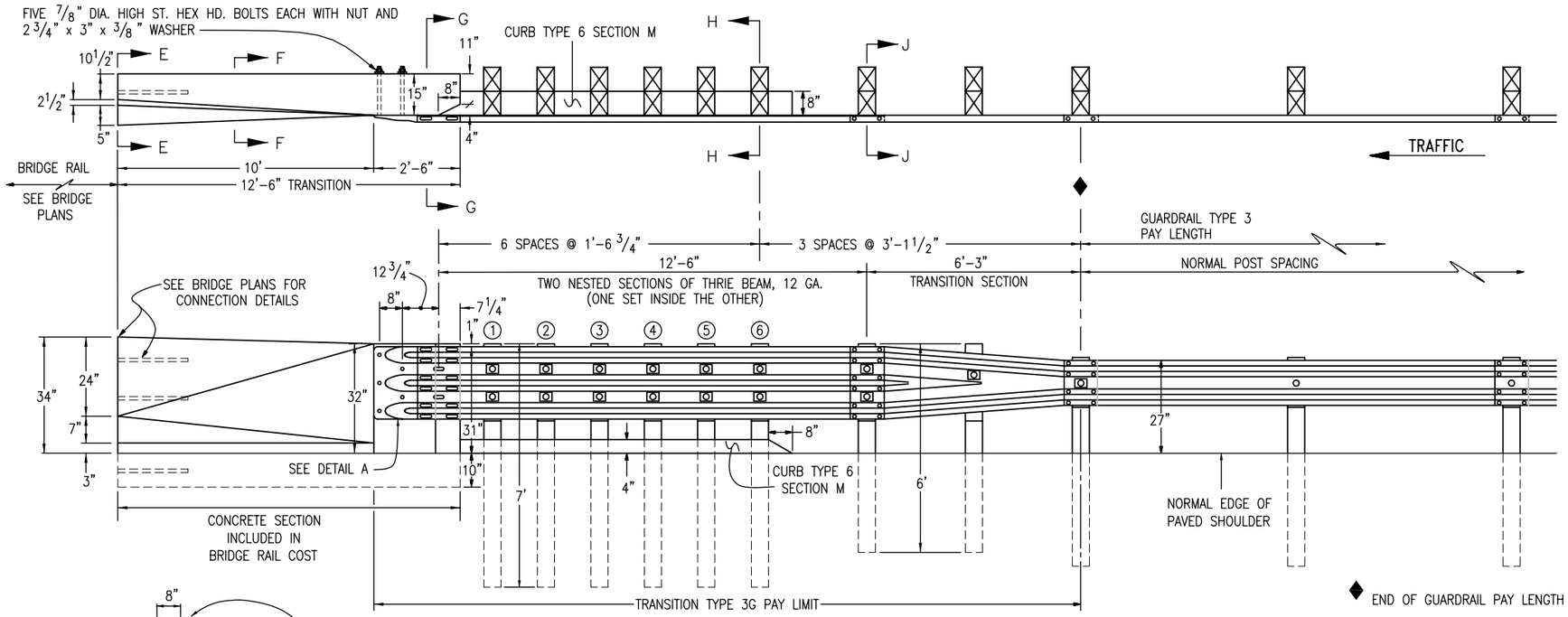
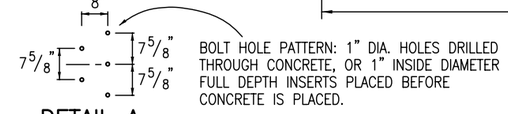
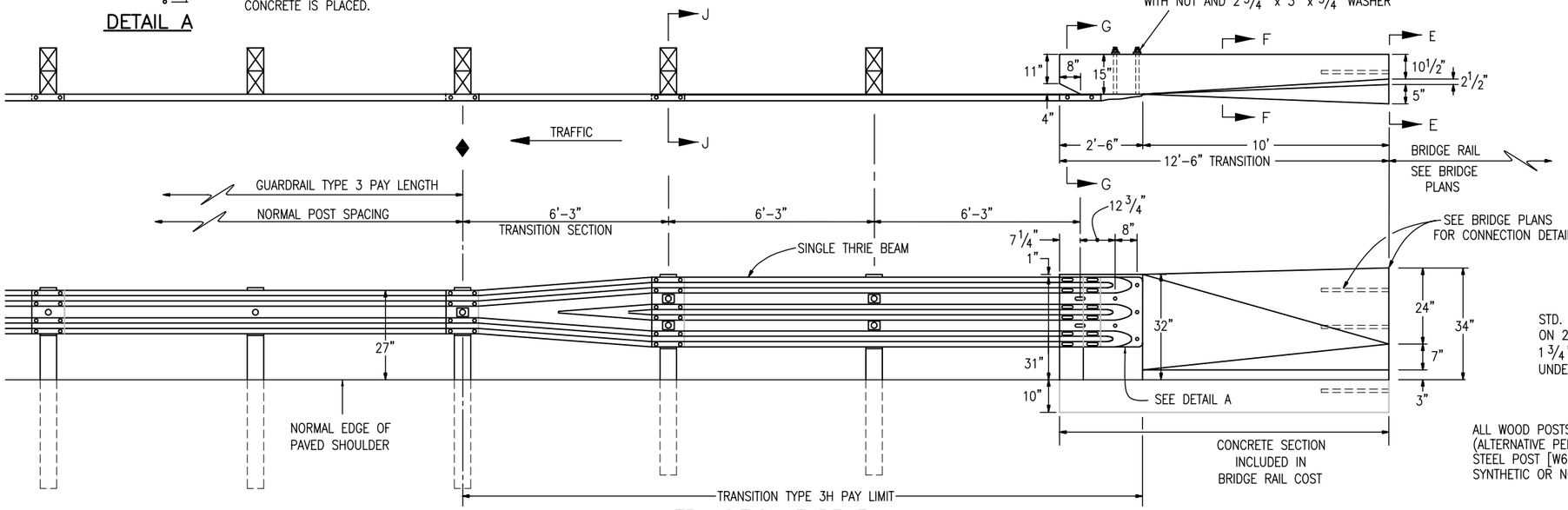
M-606-1
Sheet No. 9 of 16



TRANSITION TYPE 3G



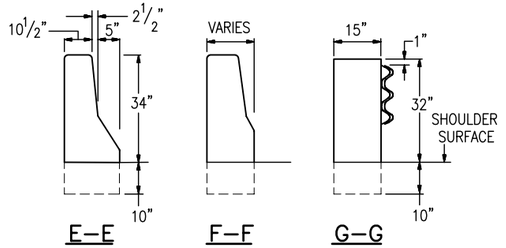
DETAIL A



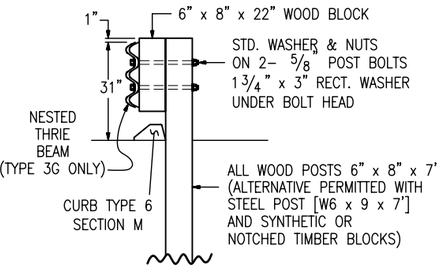
TRANSITION TYPE 3H

NOTES

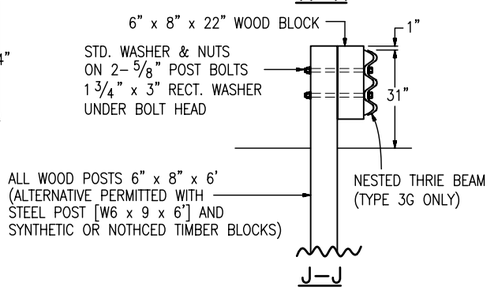
1. TRANSITION TYPE 3G IS FOR USE AT BOTH ENDS OF BRIDGES ON TWO-WAY HIGHWAYS AND AT THE APPROACH END OF BRIDGES ON ONE-WAY HIGHWAYS.
2. TRANSITION TYPE 3H IS FOR USE AT THE TRAILING END OF BRIDGES ON ONE-WAY HIGHWAYS.
3. THE THRIE BEAM SECTION IN TRANSITIONS TYPES 3G AND 3H MAY BE SHOP BENT TO FIT CURVES 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.



E-E F-F G-G



H-H



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GUARDRAIL TYPE 3 W-BEAM

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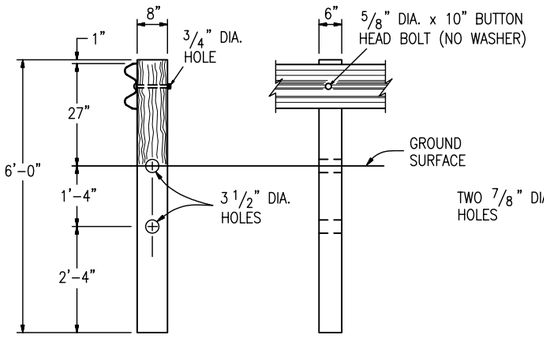
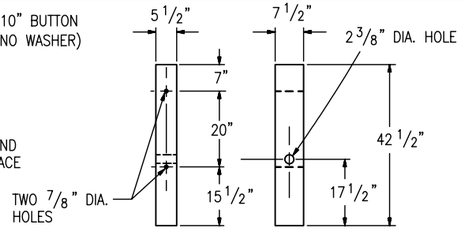
STANDARD PLAN NO.
M-606-1
Sheet No. 10 of 16



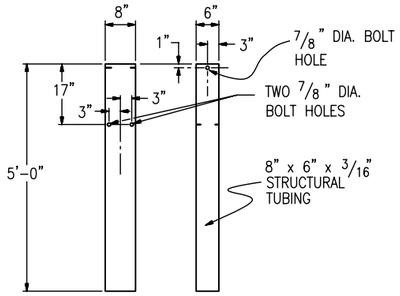
CONTROLLED RELEASING TERMINAL (CRT) POST (1)



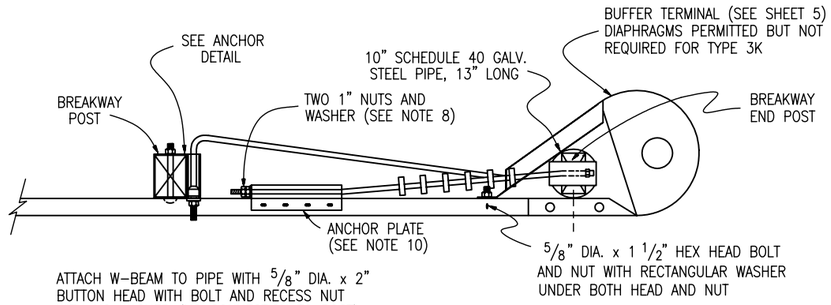
WOOD BREAKAWAY POST (2)

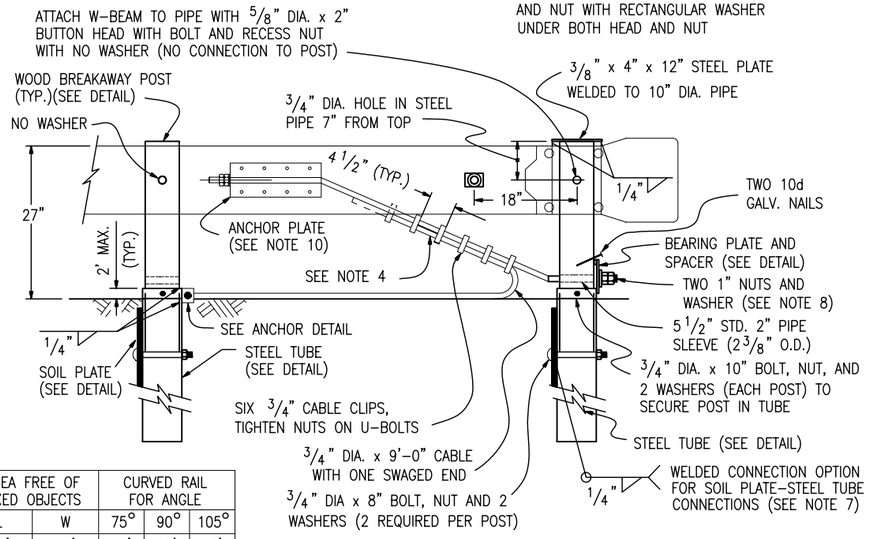
POST	DIMENSIONS	TYPE
(1)	6" x 8" x 6'	CRT
(2)	5 1/2"x 7 1/2"x 42 1/2"	BREAKAWAY

POSTS

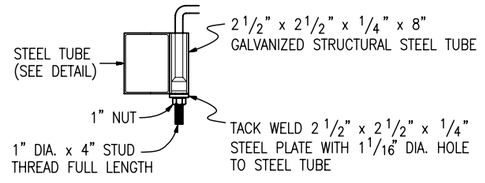


STEEL TUBE





LOW SPEED TERMINAL – TYPE 3K



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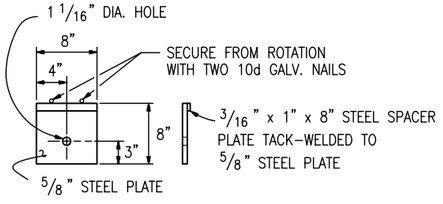
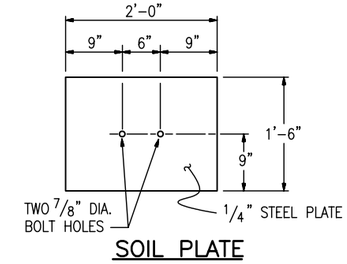


BEARING PLATE FOR STEEL TUBE



SOIL PLATE

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

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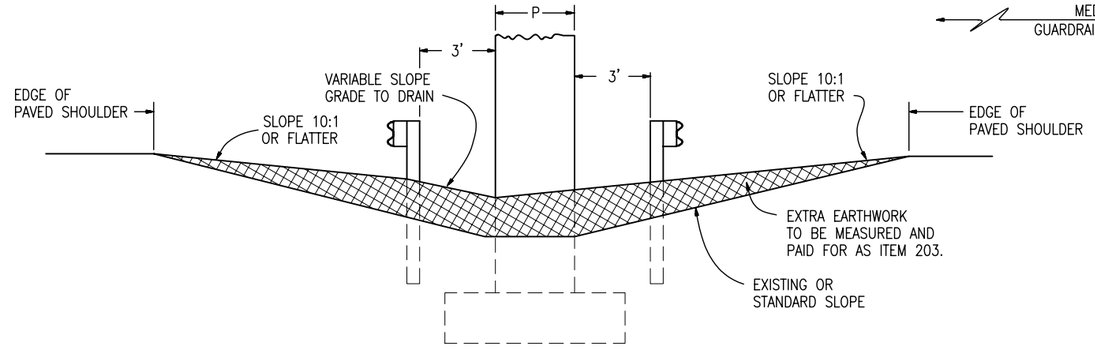
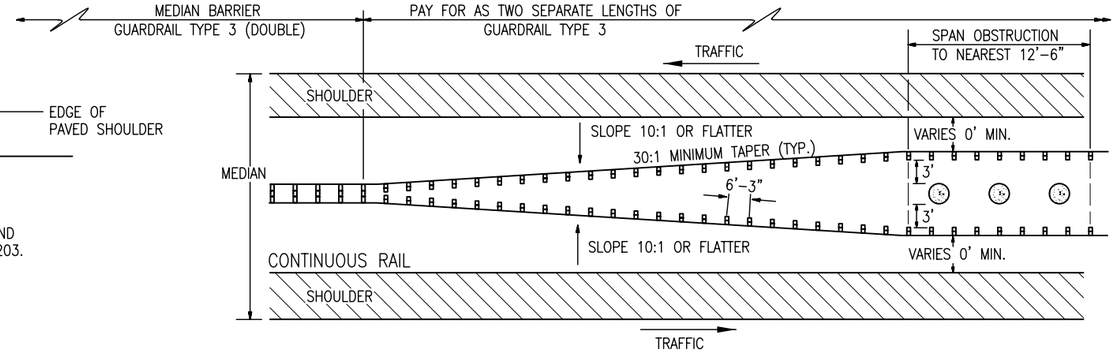
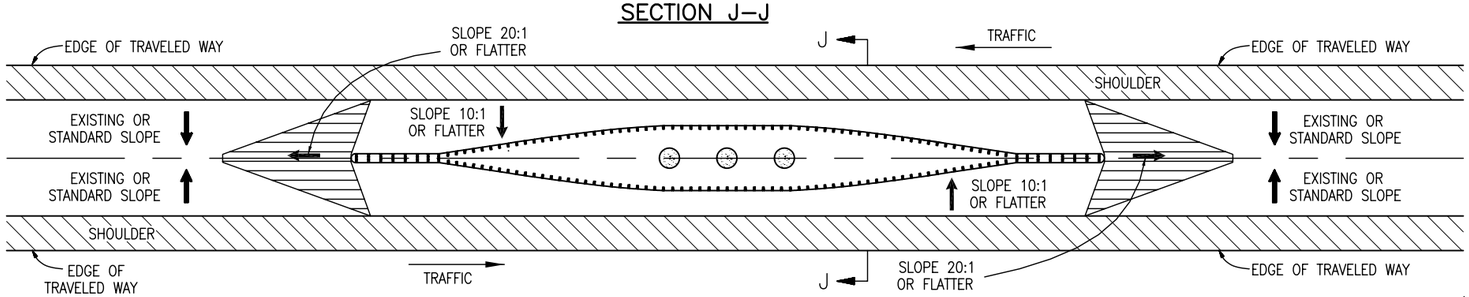
STANDARD PLAN NO.
M-606-1
Sheet No. 11 of 16



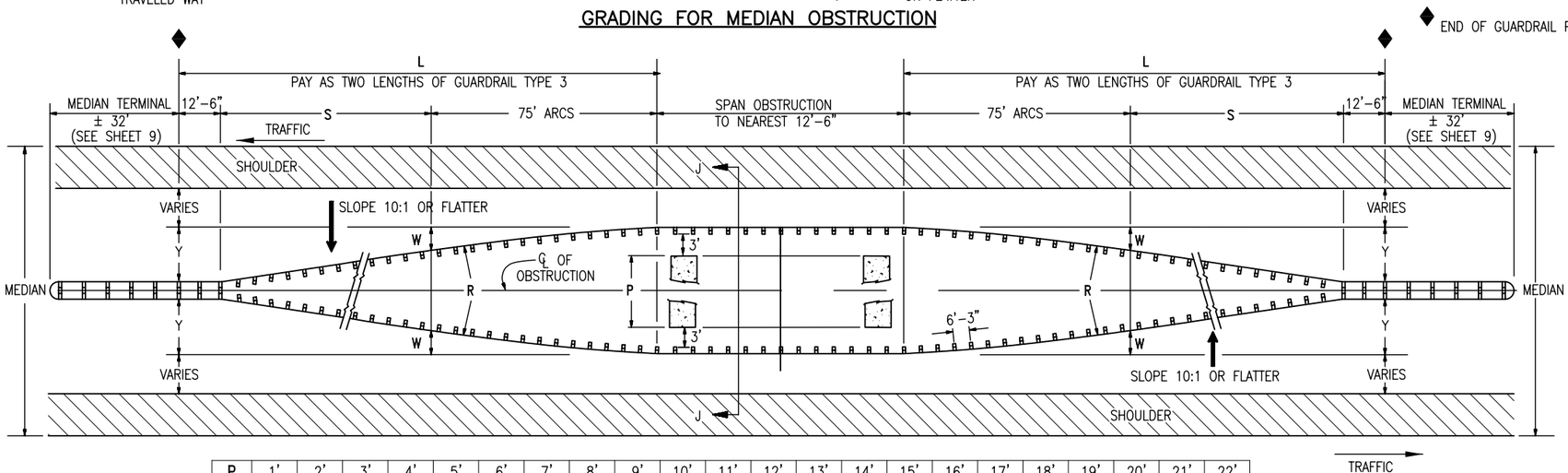
SECTION J–J



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'	21'	22'
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"	14'–1"	14'–7"
W	1'–5"	1'–11"	2'–5"	2'–11"	3'–5"	3'–11"	3'–4"	3'–8"	4'–1"	3'–7"	3'–11"	3'–6"	3'–8"	4'–0"	3'–7"	3'–10"	4'–0"	3'–8"	3'–11"	3'–7"	3'–10"	4'–0"
R	2009'	1480'	1171'	969'	827'	720'	852'	760'	685'	781'	720'	803'	760'	702'	781'	739'	702'	760'	720'	781'	739'	702'
S	25'						37'–6"			50'		62'–6"			75'			87'–6"		100'		
L	112'–6"						125'			137'–6"		150'			162'–6"			175'		187'–6"		

GUARDRAIL FOR OBSTRUCTION IN MEDIANS WIDER THAN 30 FT.

NOTE: FOR OBSTRUCTIONS (P) THAT ARE WIDER THAN 22 FT. USE THE DETAILS OF MEDIANS 31 FT. OR WIDER ON SHEET 14.

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

(A). TIMBER POSTS 2 FT., STEEL POSTS 1 FT.–9 ½ IN.

(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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GUARDRAIL TYPE 3 W-BEAM

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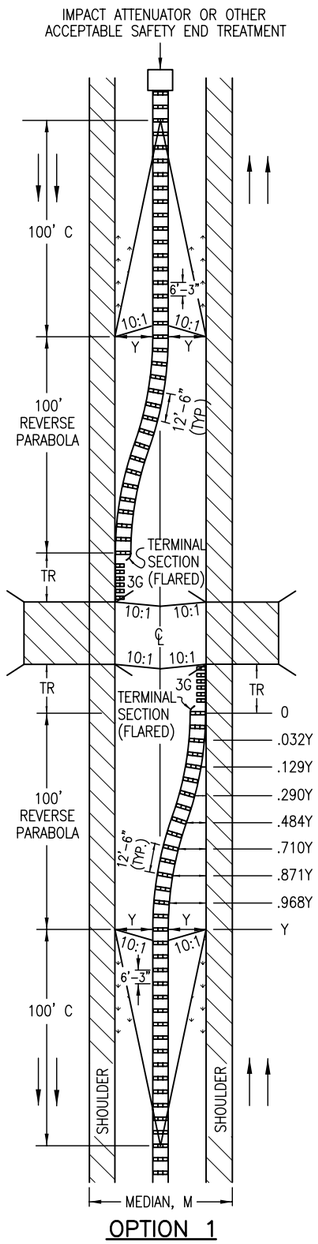
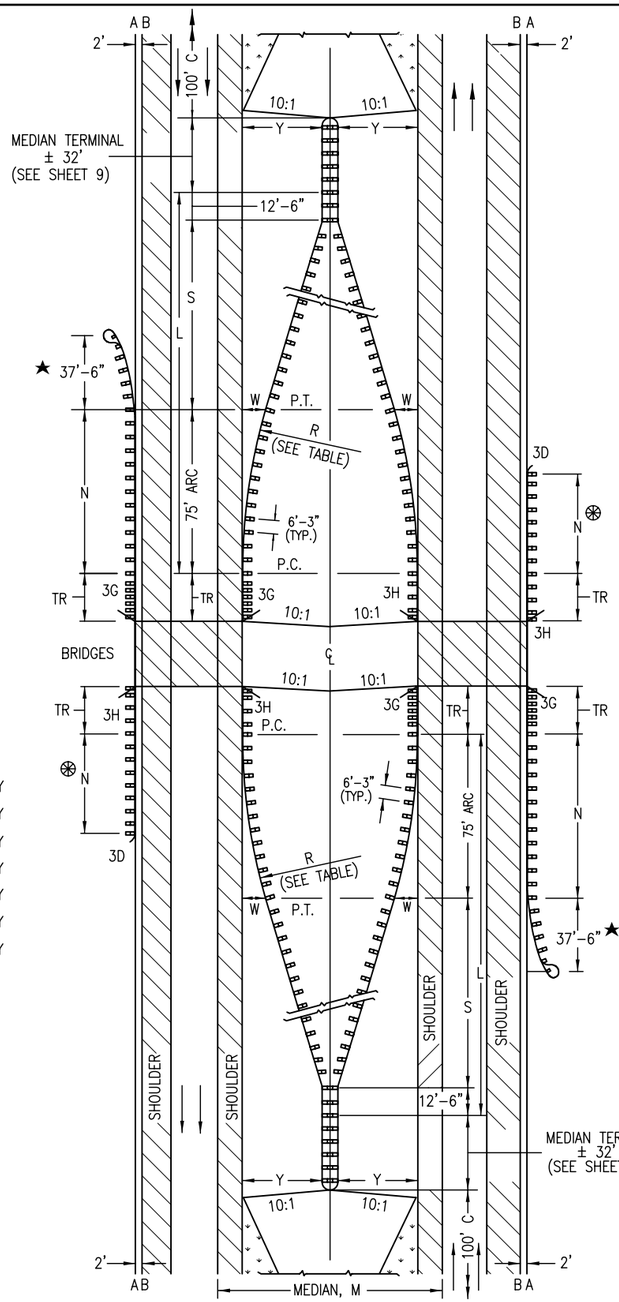
STANDARD PLAN NO.
M-606-1
Sheet No. 12 of 16

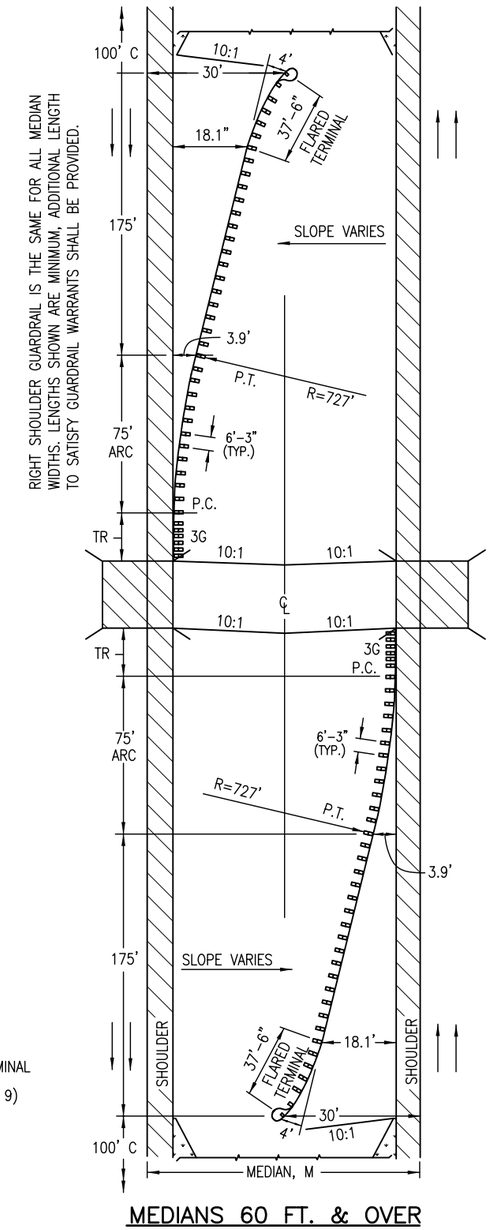


OPTION 1



OPTION 2

MEDIANS 21 FT. – 59 FT.



MEDIANS 60 FT. & OVER

MEDIANS 21 FT. – 59 FT.

MULTILANE DIVIDED HIGHWAYS – (DEPRESSED MEDIAN WITH OPEN HAZARDS OR OBSTRUCTIONS)

▼ 31 FT. – 59 FT. MEDIANS

MEDIAN **M** FT.	END **Y** FT.	ARC. **W** FT.	RADIUS **R** FT.	EXTENS. **S** FT.	LENGTH **L** FT.
31	10.5	3.9	720	62.5	150.0
32	11.0	4.2	669		
33	11.5	3.8	739	75.0	162.5
34	12.0	4.0	702		
35	12.5	4.2	669		
36	13.0	3.9	720	87.5	175.0
37	13.5	4.1	685		
38	14.0	3.8	739	100.0	187.5
39	14.5	3.9	720		
40	15.0	4.1	685		
41	15.5	3.9	720	112.5	200.0
42	16.0	4.0	702		
43	16.5	4.2	669		
44	17.0	3.9	720	125.0	212.5
45	17.5	4.0	702		
46	18.0	3.8	739	137.5	225.0
47	18.5	4.0	702		
48	19.0	4.1	685		
49	19.5	3.9	720	150.0	237.5
50	20.0	4.0	702		
51	20.5	4.1	685		
52	21.0	3.0	720	162.5	250.0
53	21.5	4.0	702		
54	22.0	3.9	739	175.0	262.5
55	22.5	4.0	702		
56	23.0	4.1	685		
57	23.5	3.0	739	187.5	275.0
58	24.0	4.0	702		
59	24.5	4.1	685		

⊛ = 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.

▼ = THE TABLE IS BASED ON 4 FT. SHOULDER.

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

B = EDGE OF 6 FT. OR LESS SHOULDER.

C = CHANGE: 100 FT. TRANSITION TO NORMAL SLOPE.

R = RADIUS OF 75 FT. ARC.

S = STRAIGHT EXTENSION, TANGENT TO ARC, FROM W TO GUARDRAIL TYPE 3 (DOUBLE) ATTACHED TO MEDIAN TERMINAL.

TR = 18 FT.–9 IN. FOR 3G AND 3H.

L = TOTAL LENGTH PAID FOR AS GUARDRAIL TYPE 3.

W = OFFSET AT END OF ARC.

Y = FINAL OFFSET AT END.

M = WIDTH OF MEDIAN.

★ = CAN USE END ANCHORAGE (FLARED) OR (NONFLARED).

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GUARDRAIL TYPE 3 W-BEAM

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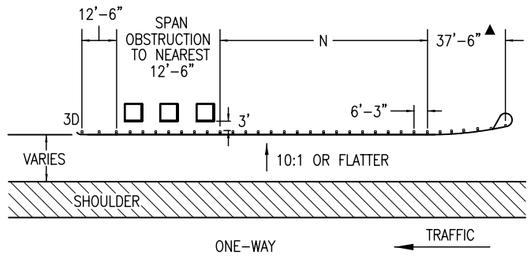
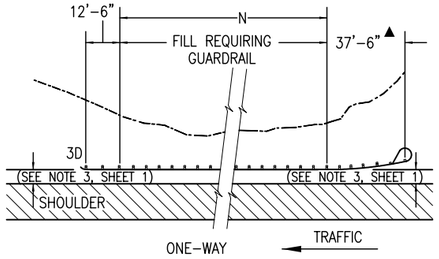
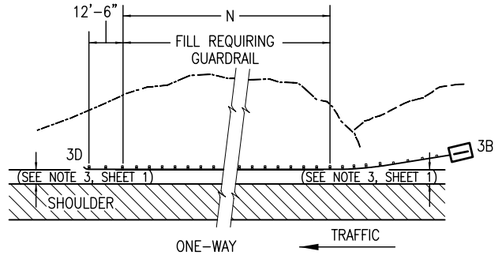
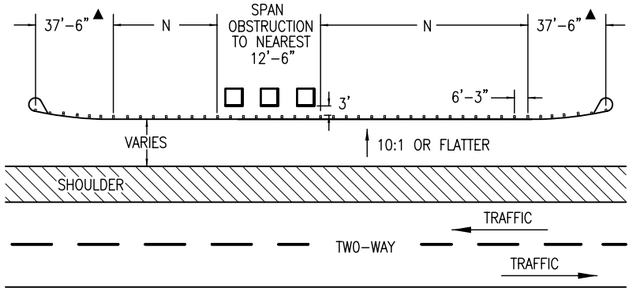
STANDARD PLAN NO.
M-606-1
Sheet No. 13 of 16

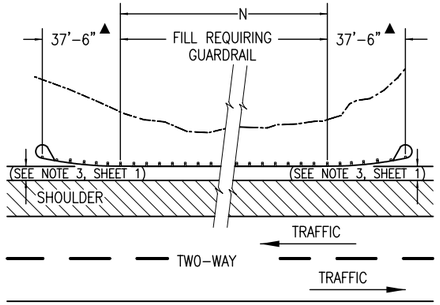




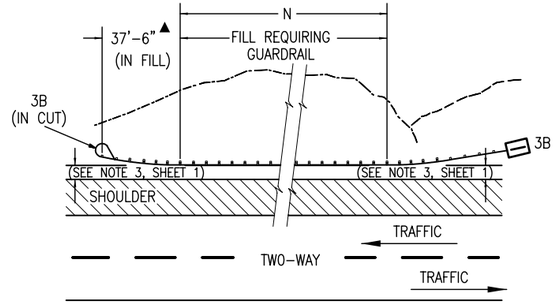




GUARDRAIL FOR ROADSIDE OBSTRUCTIONS



GUARDRAIL FOR ROADSIDE FILL CONSTRUCTION



GUARDRAIL FOR ROADSIDE CUT-TO-FILL CONDITION

NOTES

1. THE TYPE 3G OR 3H TRANSITIONS (SEE SHEET 10) SHALL BE USED TO CONNECT A TYPE 3 W-BEAM TO TYPE 7 CONCRETE BARRIER OR TO A TYPE 7, 8, OR 10 BRIDGE RAIL. FOR A TRANSITION FROM A ROADWAY TYPE 3 W-BEAM TO A BRIDGE RAIL TYPE 3 WITH BACKING TUBES, THE TRANSITION TYPE 3L SHOWN ON SHEET 16 SHALL BE USED.

2. "TR" WILL BE 18 FT.-9 IN. FOR THE TRANSITIONS TYPE 3G AND 3H, AND 25 FT. FOR THE TRANSITION TYPE 3L.

3. THE GUARDRAIL LENGTH DIMENSION "N" IS THE LENGTH AS DETERMINED BY THE LENGTH OF NEED COMPUTATION AND IS SHOWN ON THE PLANS. THE MINIMUM IS 12 FT.-6 IN. WHERE SITE CONDITIONS ALLOW. THE OVERALL REQUIRED LENGTH OF NEED CAN INCLUDE THE LENGTH OF TRANSITION, THE LENGTH OF RAIL (N), AND ANY REDIRECTIVE LENGTH IN THE RAIL END TREATMENT. A TRAVERSABLE SLOPE SHALL BE PROVIDED BEHIND THE TERMINAL TO DIMENSION "N" PRIOR TO THE OBSTRUCTION UNLESS OTHERWISE APPROVED BY THE ENGINEER.

▲ END ANCHORAGE CAN BE FLARED OR NONFLARED

LAYOUT FOR DRIVEWAY APPROACH

2-WAY NORMAL BRIDGE APPLICATION

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

2-WAY NARROW APPLICATION

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

INTERRUPTED STRUCTURE APPROACH

(USE TYPE 3J ON SHEET 11 WHEN PRACTICAL)

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R-X R-X R-X R-X

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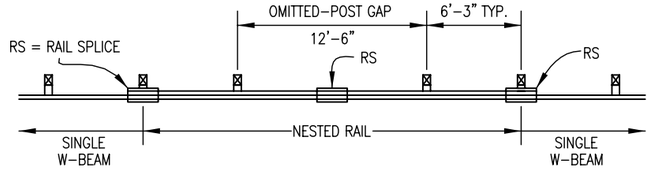
STANDARD PLAN NO. M-606-1

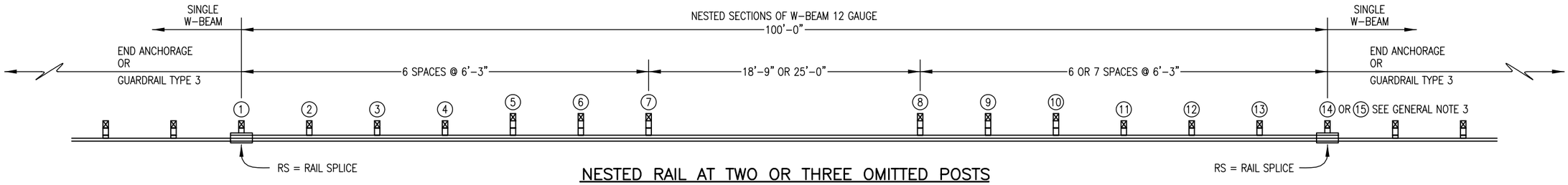
Sheet No. 14 of 16



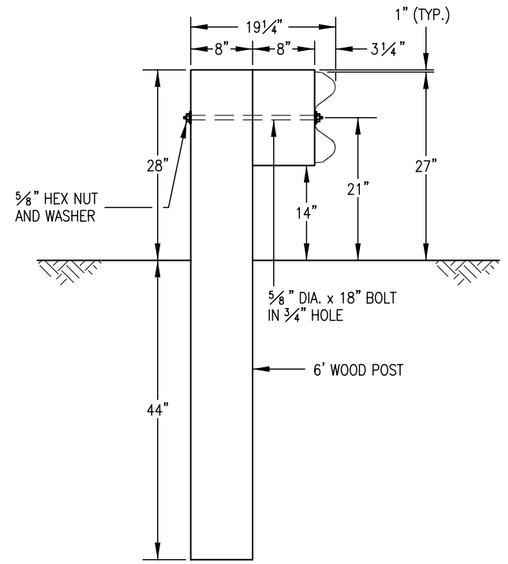
NESTED RAIL AT ONE OMITTED POST

NOTES

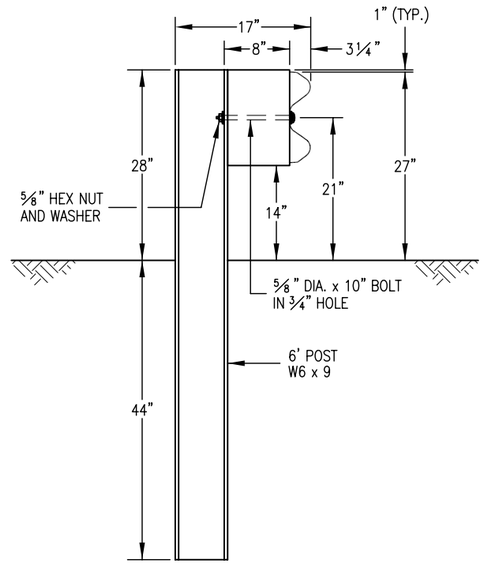
1. FOR ONE OMITTED POST IN THE GUARDRAIL RUN, i.e. AT A PIPE CULVERT WITH MINIMUM COVER, SEE THE "NESTED RAIL AT ONE OMITTED POST" DETAIL ON THIS SHEET. THE W–BEAM RAILS SPANNING THE OMITTED–POST GAP SHALL BE DOUBLED (ONE RAIL NESTED IN THE OTHER), AND SHALL EXTEND A MINIMUM OF 6 FT.–3 IN. ON EITHER 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 POSTS 5 THROUGH 10.



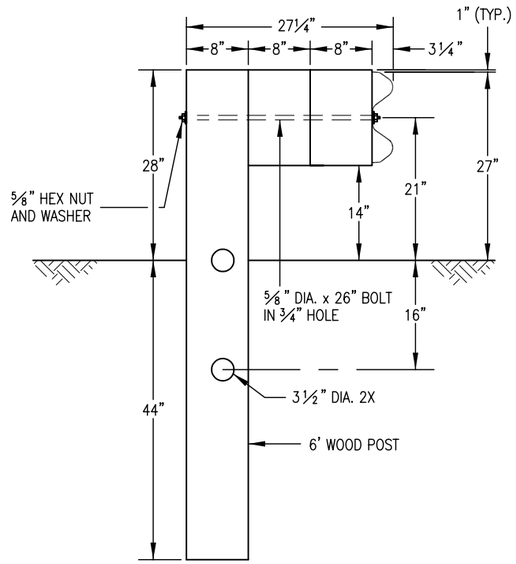
NESTED RAIL AT TWO OR THREE OMITTED POSTS



TIMBER
POSTS (1) – (4) AND (11) – (15)



STEEL
POSTS (1) – (4) AND (11) – (15)



TIMBER
POSTS (5) – (10)

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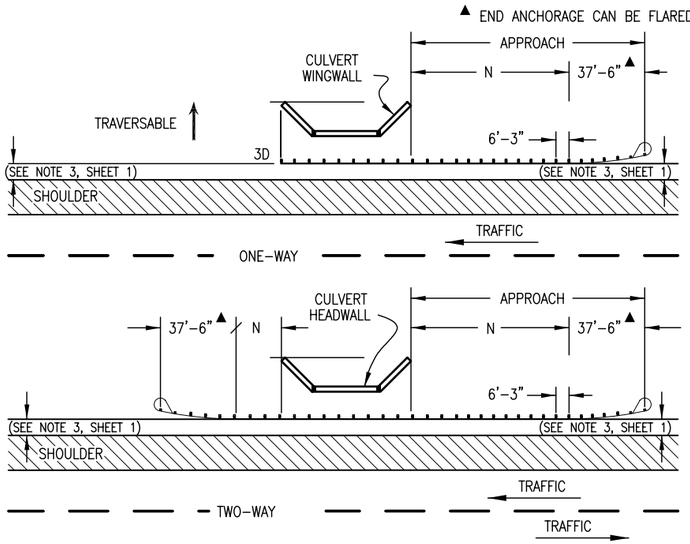
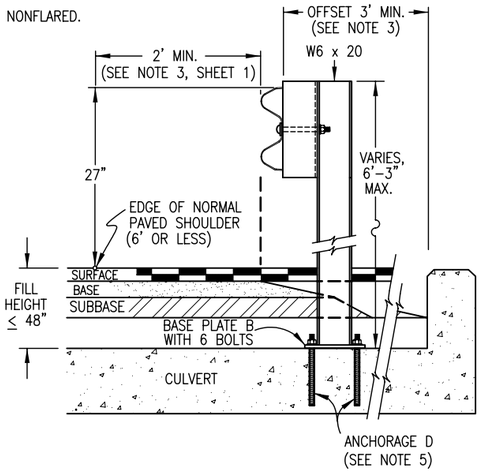
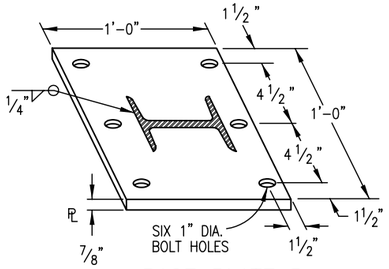
STANDARD PLAN NO.
M-606-1
Sheet No. 15 of 16



GUARDRAIL FOR CULVERTS

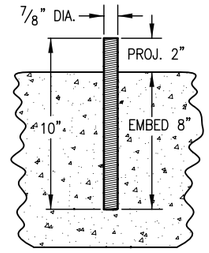


INSIDE MOUNT ON CBC



BASE PLATE B

(FOR INSIDE MOUNT)



ANCHORAGE D

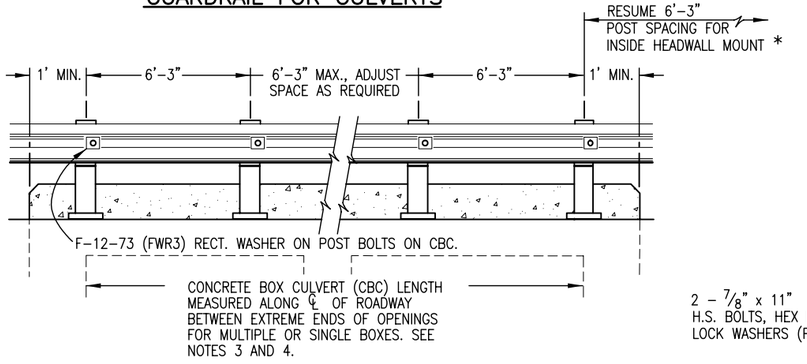
(FOR INSIDE MOUNT)

NOTES

1. LOCATION AND LENGTH OF MEDIAN GUARDRAIL APPROACHES TO CULVERTS WITH FULL HEADWALL AND WINGWALLS SHALL BE AS SHOWN FOR BRIDGES ON SHEET 14. 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 WILL BE 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 WILL BE 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 AS STANDARD GUARDRAIL TYPE 3.
   B. FILL HEIGHT AT GUARDRAIL POSTS 48 IN. OR LESS: CONSTRUCTION AND PAYMENT WILL BE IN ACCORDANCE WITH THE CONTRACT BRIDGE PLANS.
   C. FILL HEIGHT AT GUARDRAIL LESS THAN 48 IN. AND BLOCK FACE TO HEADWALL OFFSET OF 3 FT. OR GREATER: CONSTRUCTION AND PAYMENT WILL BE 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.

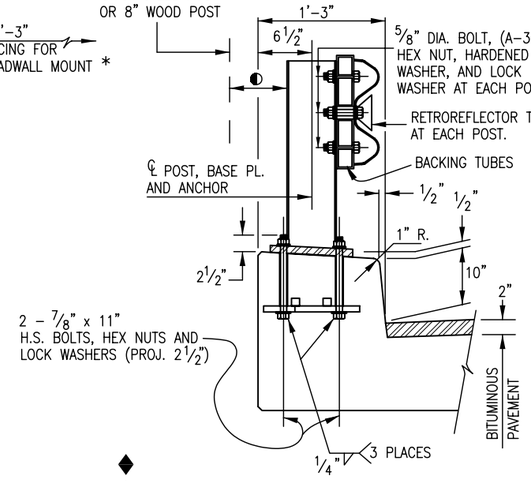
★ FOR STANDARD 12 IN. HEADWALL WITH NO PAVEMENT, THE POST HEIGHT SHALL BE 1 FT.- 5 IN. ADJUST POST HEIGHT FOR PAVEMENT THICKNESS.

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



RAIL PLACEMENT FOR INSIDE OR HEADWALL MOUNT

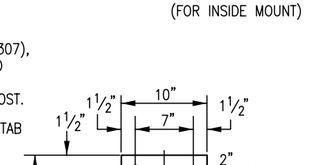
* USE 3L TRANSITION AT BOTH APPROACH AND EXIT ENDS OF BRIDGE RAIL TYPE 3 (HEADWALL MOUNT)



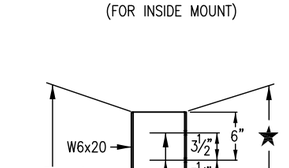
HEADWALL MOUNT ON CBC

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

◆ END OF GUARDRAIL PAY LENGTH

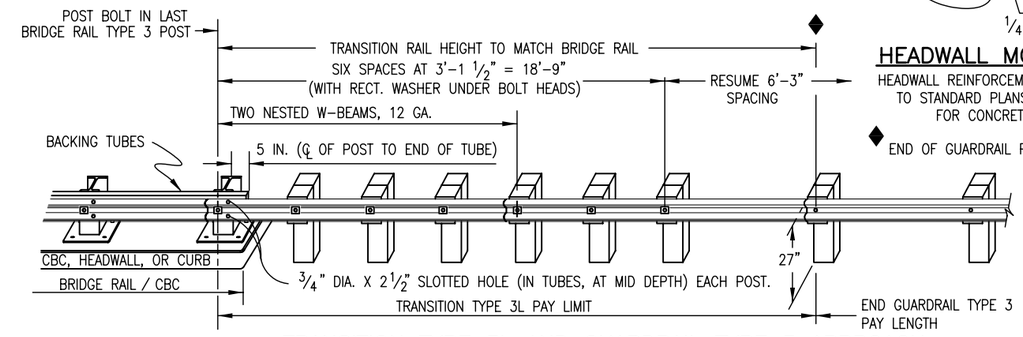


PLAN

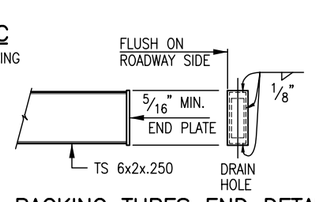


ELEVATION

HEADWALL MOUNT POST DETAIL



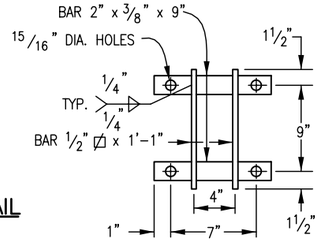
TRANSITION TYPE 3L AND GUARDRAIL TYPE 3 APPROACH



BACKING TUBES END DETAIL

(FOR HEADWALL MOUNT)

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



ANCHOR DETAIL

(FOR HEADWALL MOUNT)

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Last Modification Date: 07/04/06	Initials: LTA		
Full Path: www.dot.state.co.us/DesignSupport/			
Drawing File Name: 60601016016.dwg			
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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GUARDRAIL TYPE 3 W-BEAM

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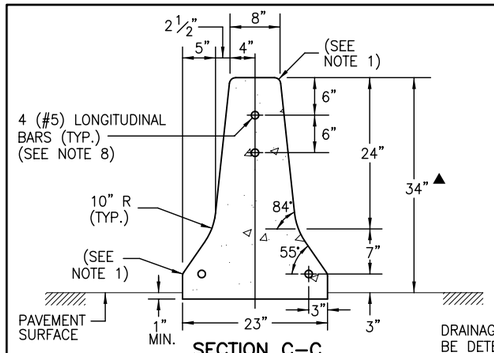
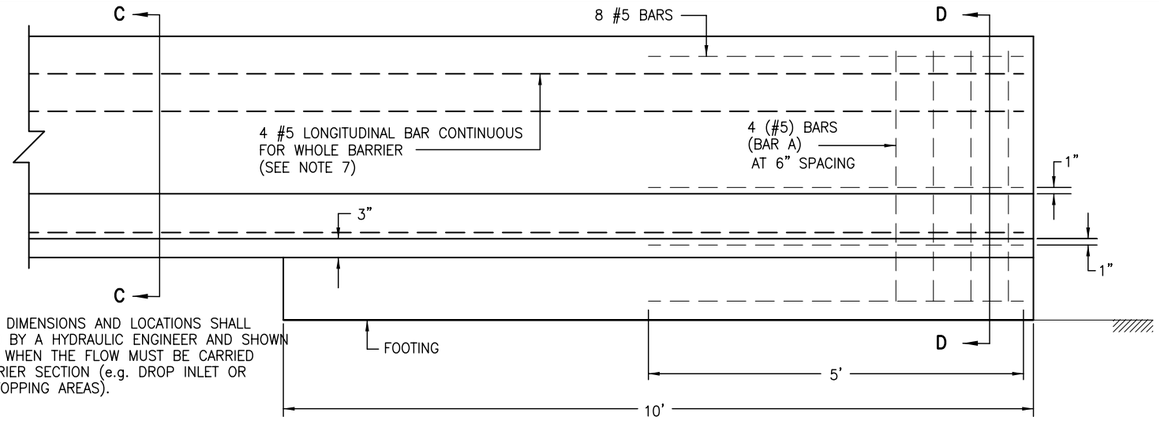
STANDARD PLAN NO.
M-606-1
Sheet No. 16 of 16



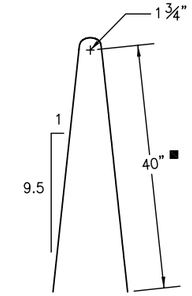
SECTION C–C
STYLE CA
CONCRETE BARRIER (TYP.)



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

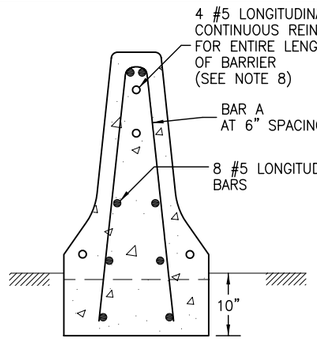
ANCHORAGE

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

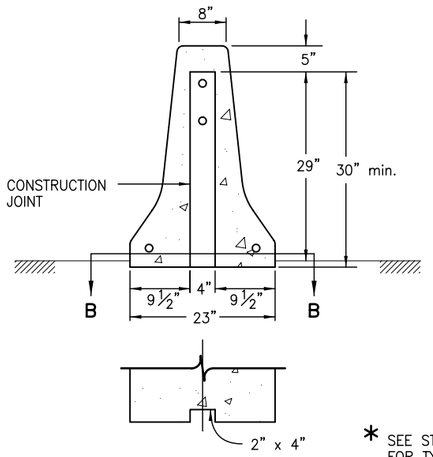


BAR A (#5)

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

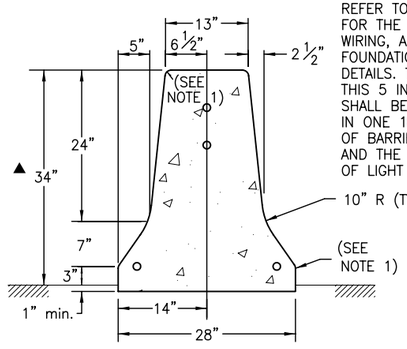


SECTION D–D * ANCHORAGE



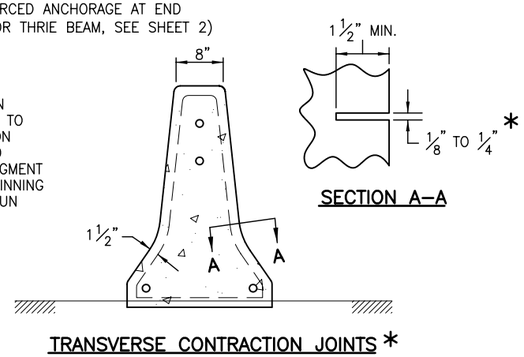
SECTION B–B
CONSTRUCTION JOINT *

* SEE STYLE CA DETAIL FOR TYPICAL DIMENSIONS.



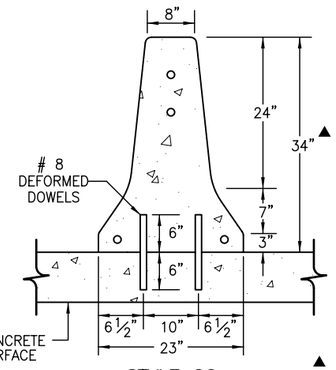
REFER TO THE PLANS FOR THE REINFORCING, WIRING, AND LIGHT POLE FOUNDATION INSTALLATION DETAILS. THE TRANSITION TO THIS 5 IN. WIDER SECTION SHALL BE ACCOMPLISHED IN ONE 10 FT. LONG SEGMENT OF BARRIER AT THE BEGINNING AND THE END OF THE RUN OF LIGHT POLES.

STYLE CL
BARRIER FOR MOUNTED LIGHT POLES



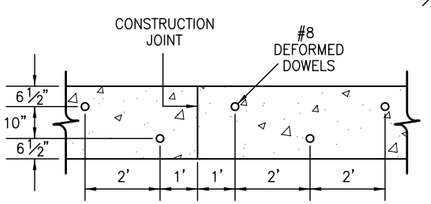
SECTION A–A
TRANSVERSE CONTRACTION JOINTS *

FORMED OR SAWED TRANSVERSE CONTRACTION JOINTS ARE REQUIRED AT 20 FT. INTERVALS

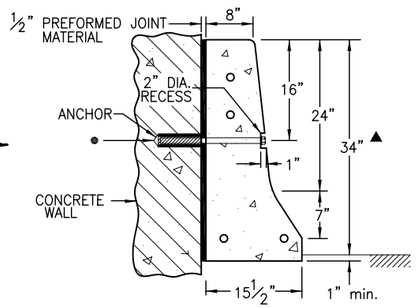


STYLE CC
BARRIER DOWELLED TO CONCRETE SURFACE

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

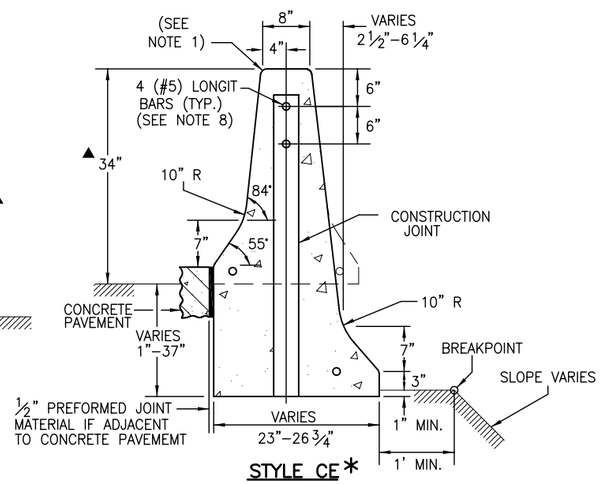


DOWEL PLACEMENT LAYOUT
FOR STYLE CC BARRIER (PLAN VIEW)



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

STYLE CD
BARRIER AGAINST WALL



STYLE CE *
BARRIER FOR OFFSET ROADWAYS

GENERAL NOTES

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

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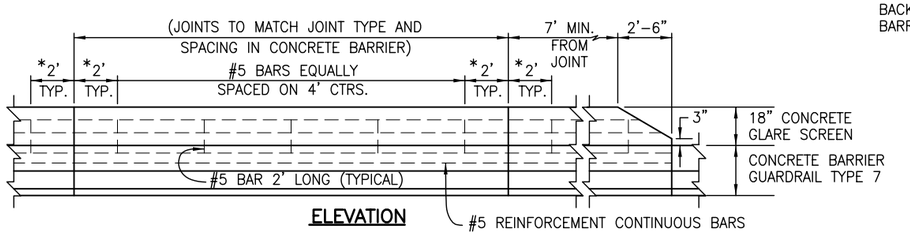
GUARDRAIL TYPE 7 F-SHAPE BARRIER

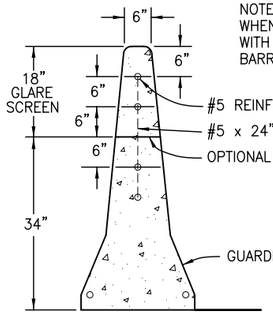
Issued By: Project Development Branch on July 04, 2006

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



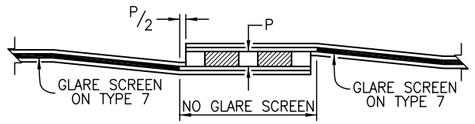
ELEVATION

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

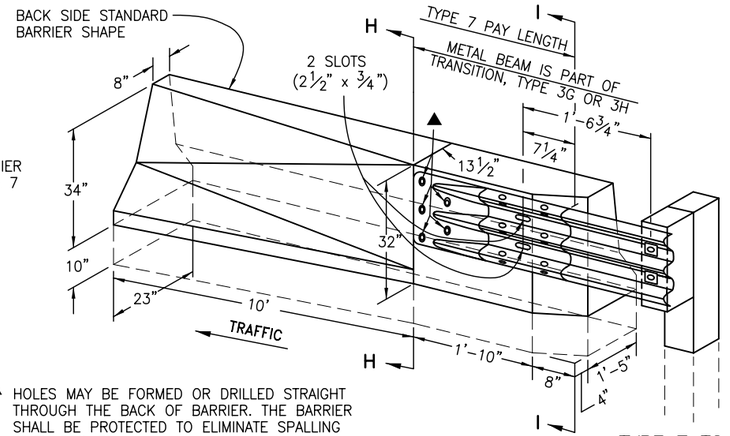


NOTE: VERTICAL TIE BARS ARE NOT REQUIRED WHEN THE GLARE SCREEN IS POURED MONOLITHICALLY WITH THE BARRIER. SEE SHEETS 1 AND 2 FOR BARRIER DIMENSIONS.

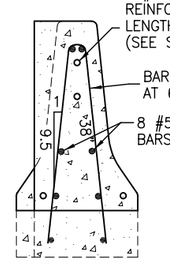
CONCRETE GLARE SCREEN



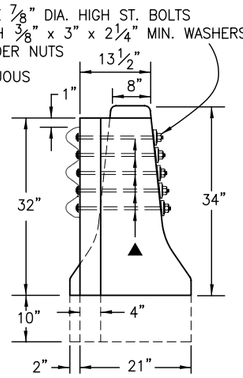
GLARE SCREEN AT MEDIAN OBSTRUCTIONS



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



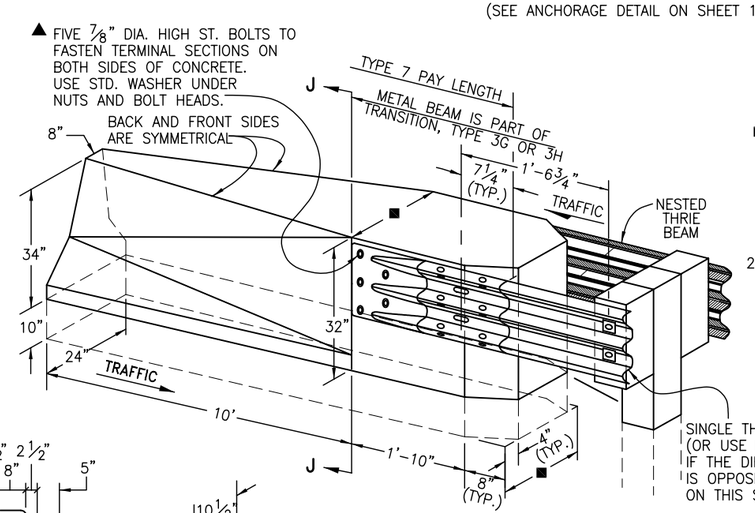
SECTION H-H

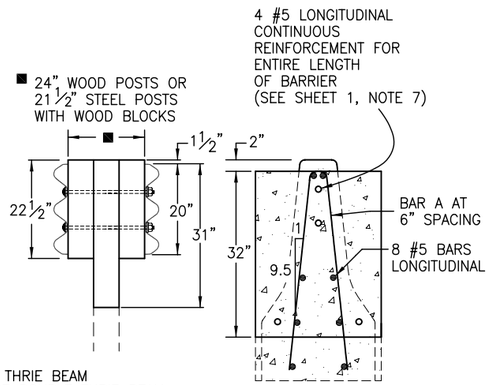


SECTION I-I

TYPE 7 TO SINGLE TYPE 3G TRANSITION AND ANCHORAGE

(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)

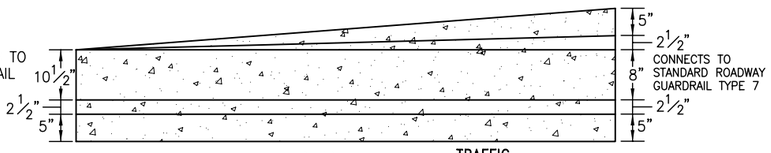




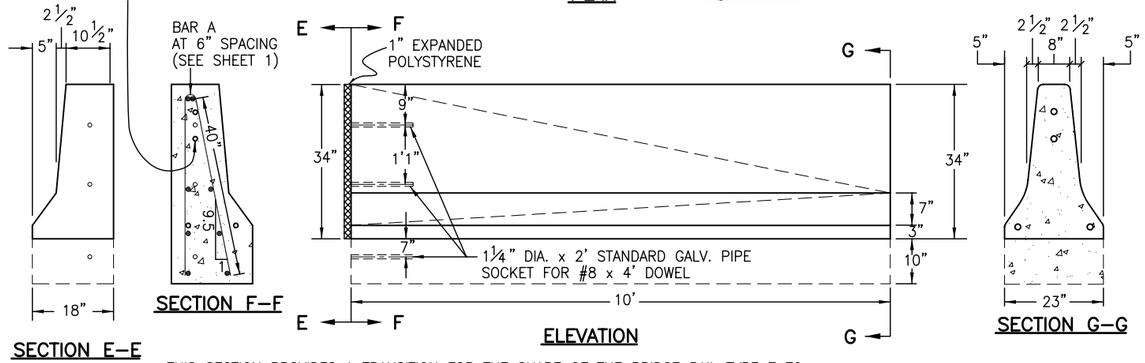
SECTION J-J

TYPE 7 TO DOUBLE TYPE 3G TRANSITION AND ANCHORAGE

(SEE ANCHORAGE DETAIL ON SHEET 1 FOR REINFORCEMENT INFORMATION)



PLAN



SECTION E-E

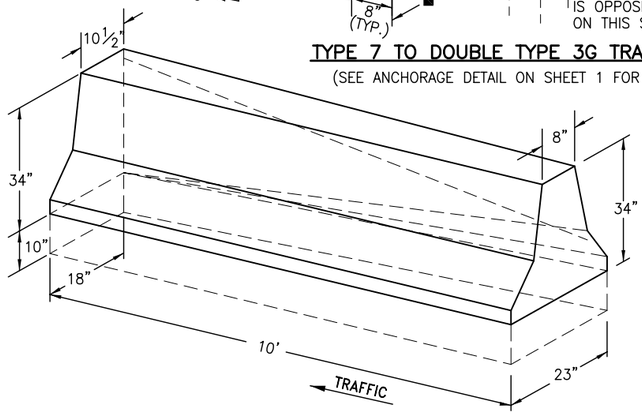
SECTION F-F

ELEVATION

SECTION G-G

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

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



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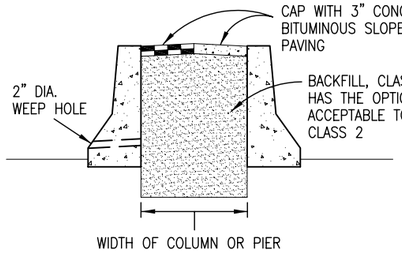
GUARDRAIL TYPE 7 F-SHAPE BARRIER

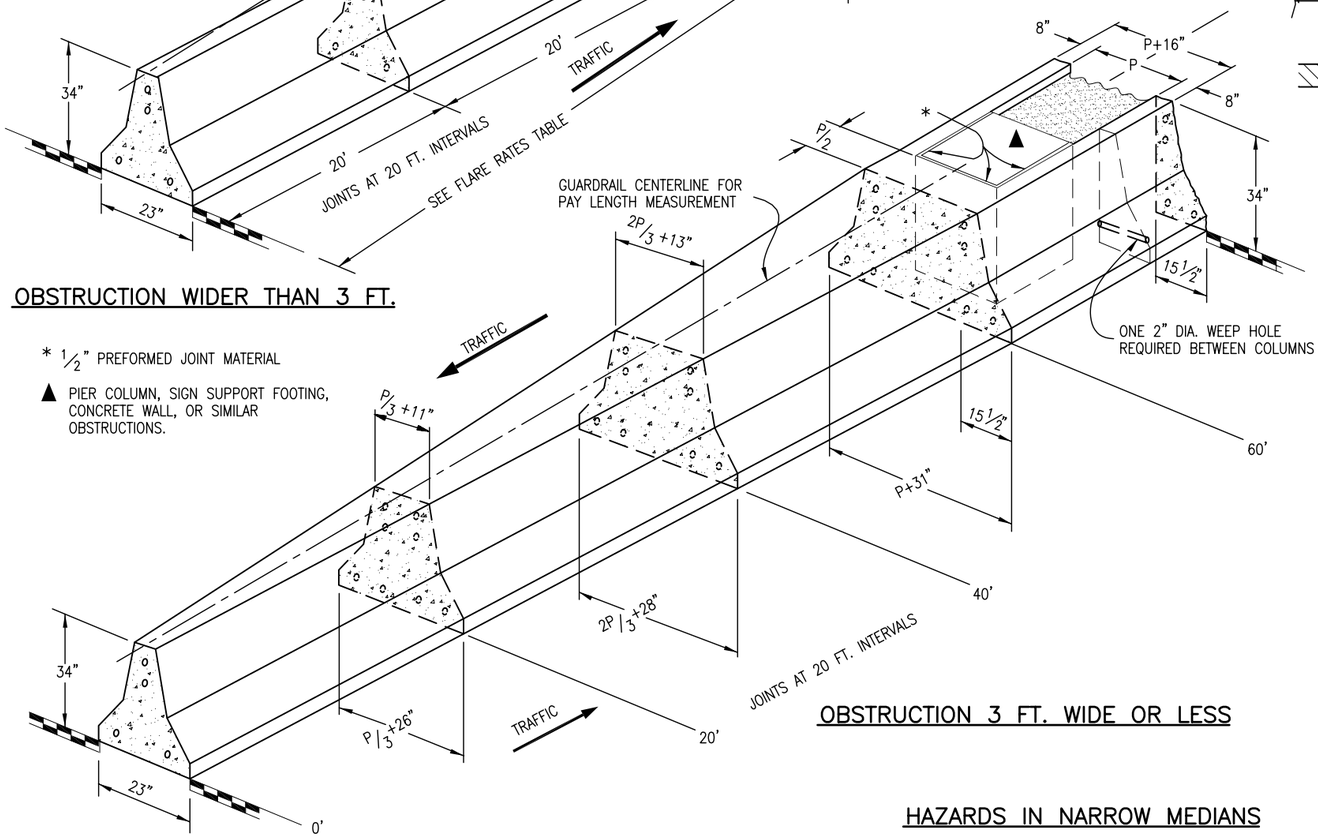
Issued By: Project Development Branch on July 04, 2006

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



TREATMENT BETWEEN COLUMNS OR OBSTRUCTIONS

OBSTRUCTION WIDER THAN 3 FT.



* 1/2" PREFORMED JOINT MATERIAL

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

OBSTRUCTION 3 FT. WIDE OR LESS

HAZARDS IN NARROW MEDIANS

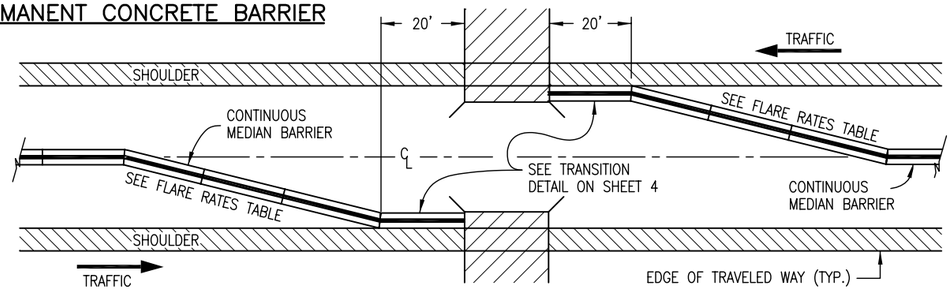
DESIGN SPEED (MPH)	SHY LINE OFFSET (FT.)*	FLARE RATE FOR BARRIER INSIDE SHY LINE	FLARE RATE FOR BARRIER OUTSIDE SHY LINE
80	12	30:1	20:1
75	10.5	30:1	20:1
70	9	30:1	20:1
60	8	26:1	18:1
55	7	24:1	16:1
50	6.5	21:1	14:1
45	5.5	18:1	12:1
40	4.5	16:1	10:1
30	3.5	13:1	8:1

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

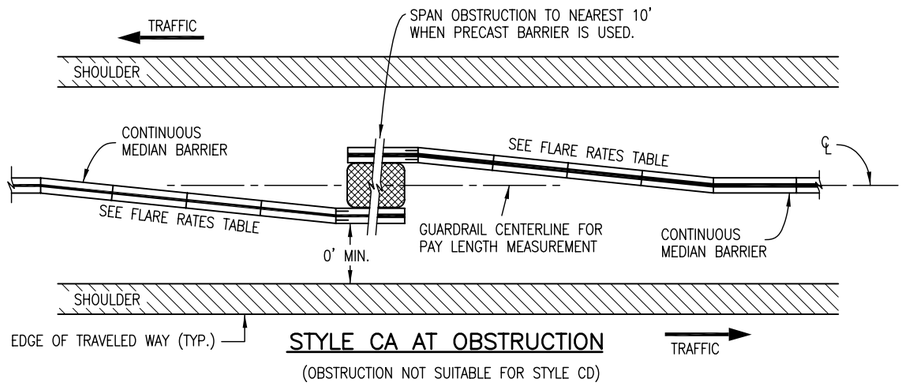
TABLE OF FLARE RATES FOR PERMANENT CONCRETE BARRIER

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.

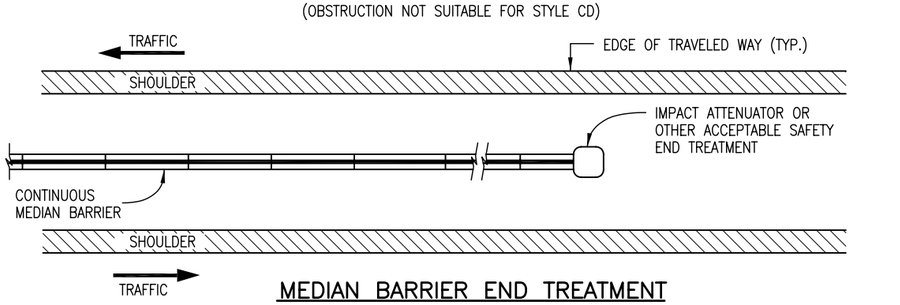


BRIDGE APPROACH



STYLE CA AT OBSTRUCTION

(OBSTRUCTION NOT SUITABLE FOR STYLE CD)



MEDIAN BARRIER END TREATMENT

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GUARDRAIL TYPE 7 F-SHAPE BARRIER

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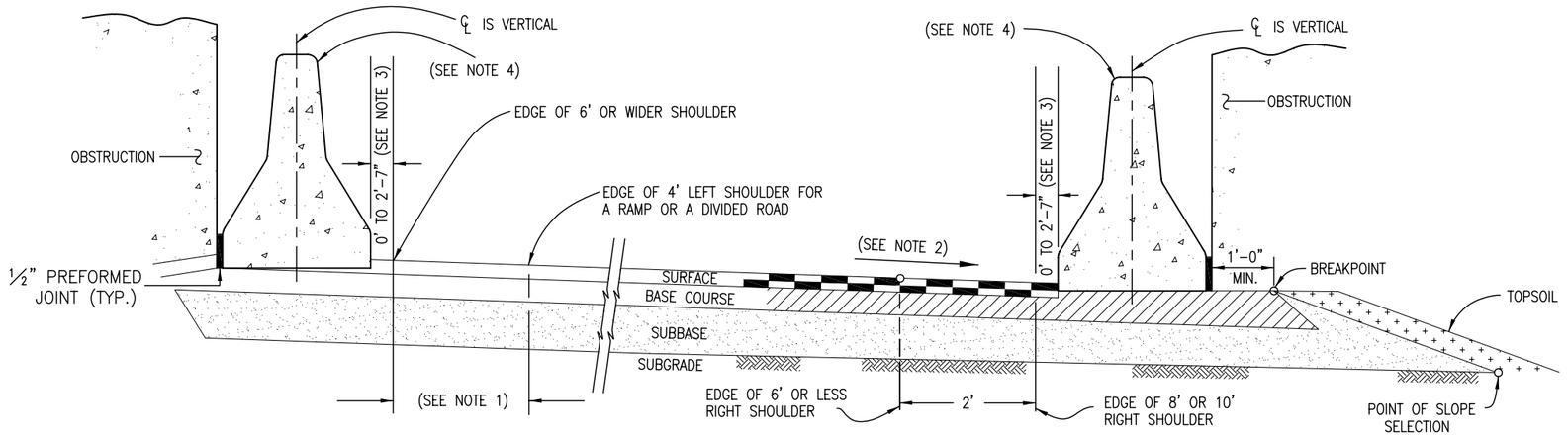
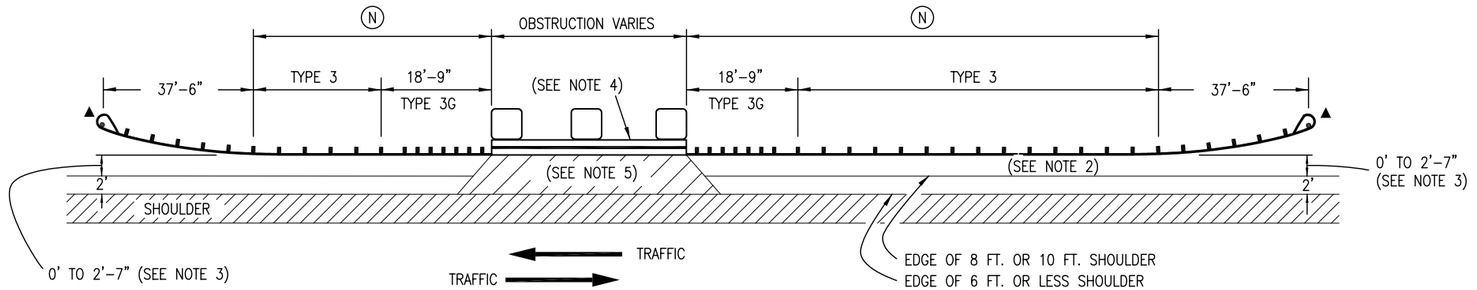
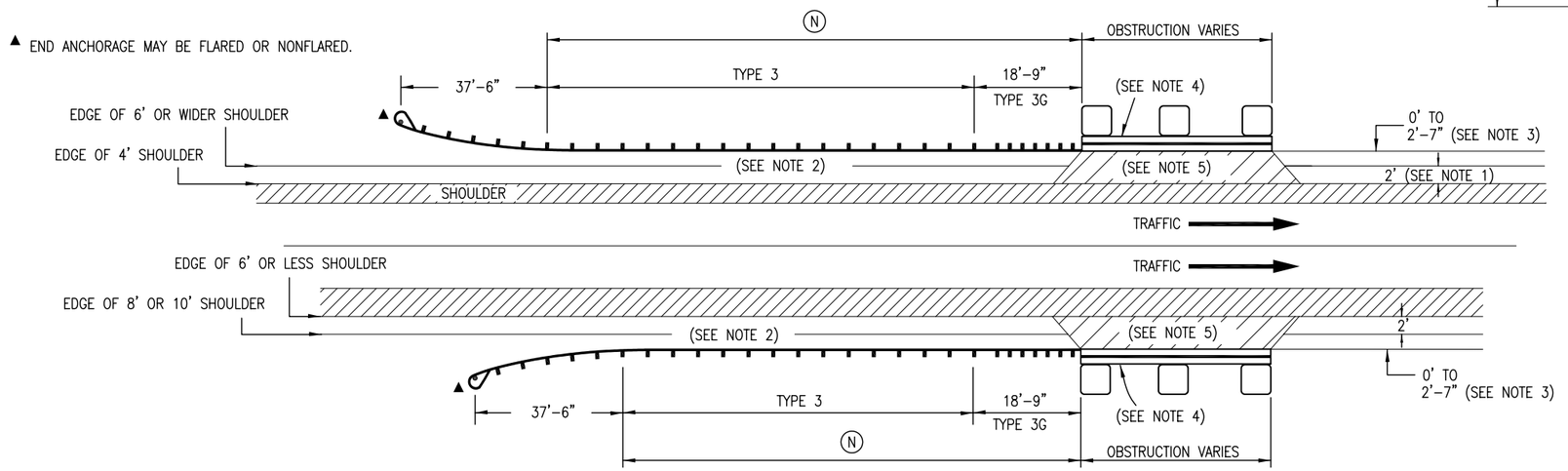
STANDARD PLAN NO.
M-606-13
Sheet No. 3 of 4



TYPE 7 ON LEFT AND RIGHT SHOULDERS AT OBSTRUCTIONS



2–LANE 2–WAY ROADS

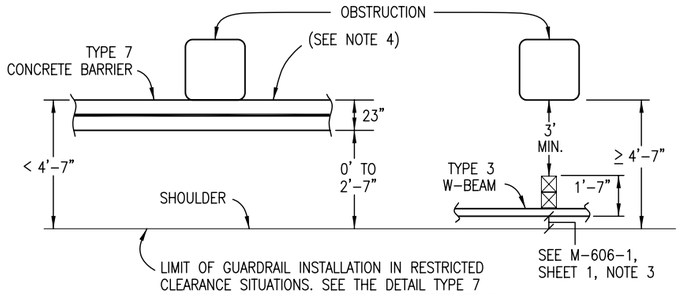


DIRECTIONAL ROADWAYS AND RAMPS

NOTES

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

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



HAZARDS ON ROADSIDES

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GUARDRAIL TYPE 7 F-SHAPE BARRIER

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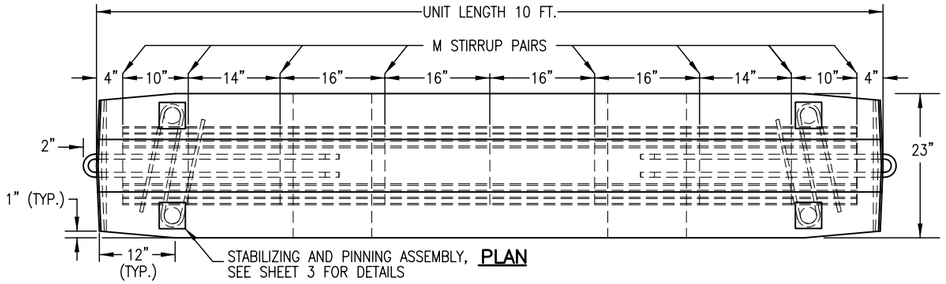
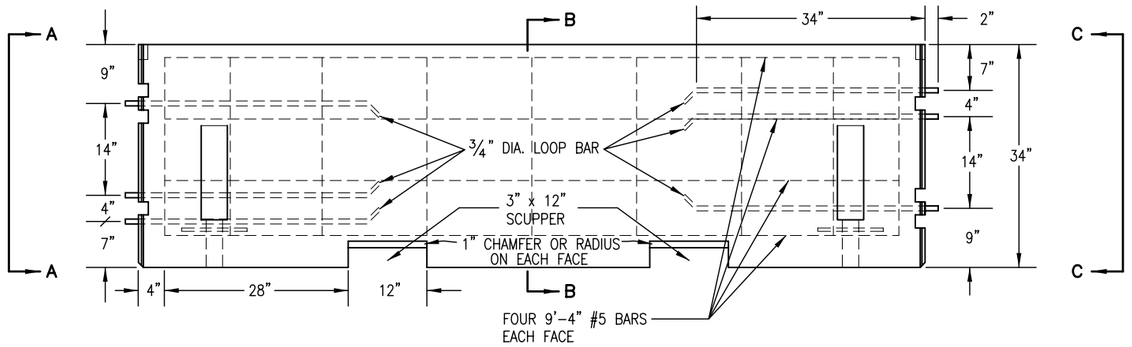
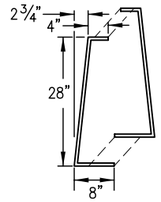
STANDARD PLAN NO.
M-606-13
Sheet No. 4 of 4



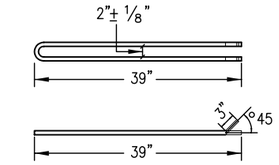
PLAN



ELEVATION BARRIER



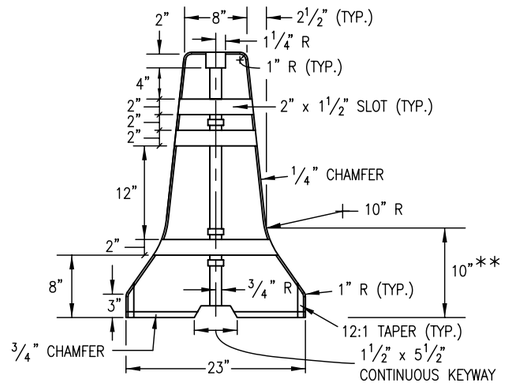
STIRRUP "M" #5 REBAR PAIR



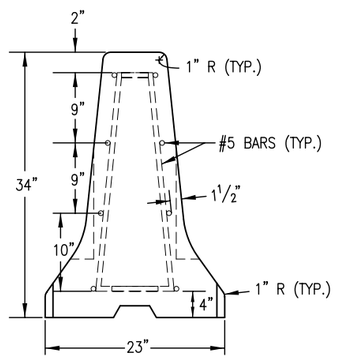
LOOP BAR BENDING DETAIL
(ASTM A36)
(HOT-DIP GALVANIZED AFTER FABRICATION)

GENERAL NOTES

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



SECTION A-A



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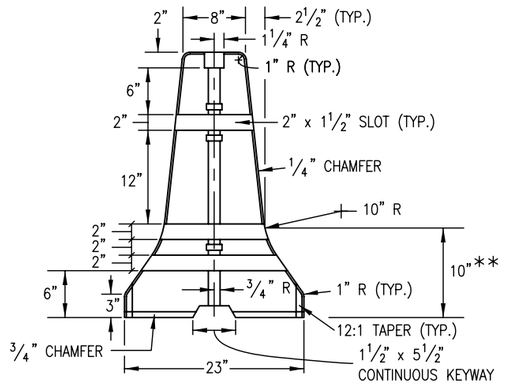

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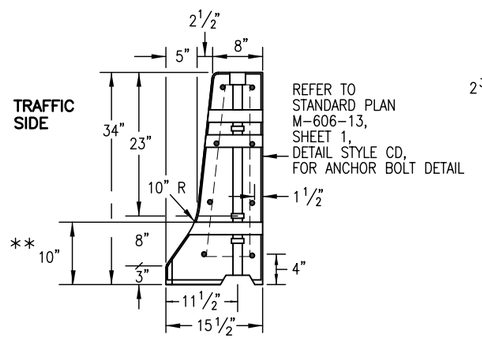
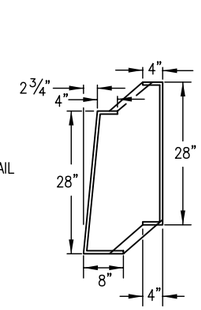


NARROW BASE
SHOULDER BARRIER



NARROW BASE
STIRRUP "M" #5 REBAR PAIR

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

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PRECAST TYPE 7 CONCRETE BARRIER

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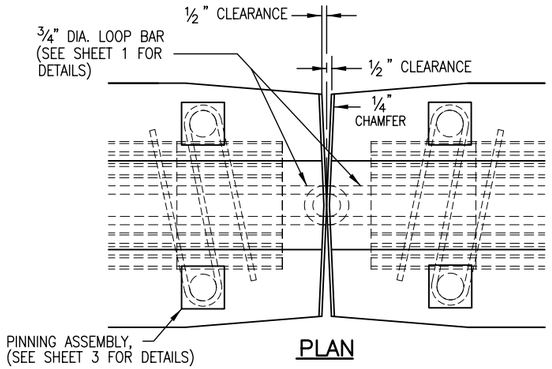
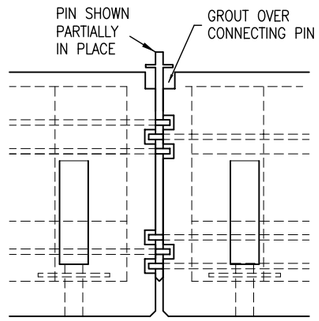
STANDARD PLAN NO.
M-606-14
Sheet No. 1 of 3



PLAN

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

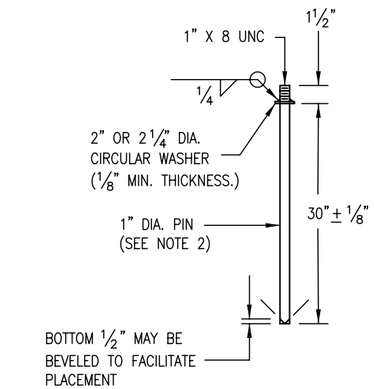


ELEVATION

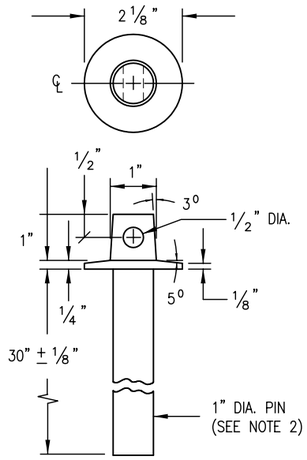
FOR DETAILS NOT SHOWN,
SEE SECTION VIEWS A–A, B–B, AND C–C
ON SHEET 1

NOTES

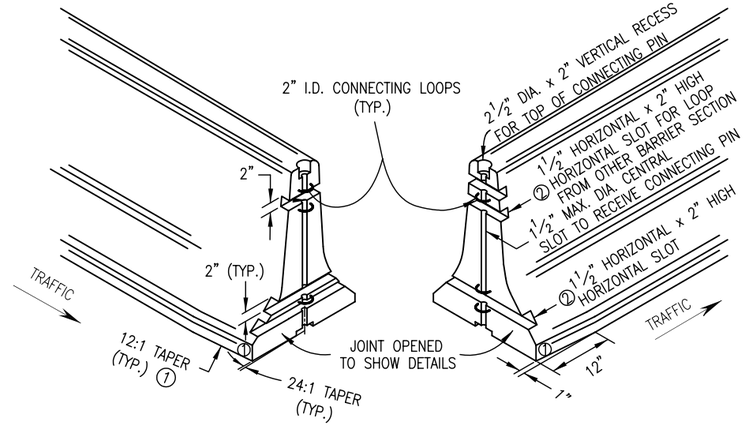
1. WASHERS SHALL BE FORGED AS AN INTEGRAL PART OF THE PIN, OR SHALL BE WELDED AS SHOWN.
2. PINS SHALL BE HOT–DIPPED GALVANIZED AFTER FABRICATION.
3. IF AN ALTERNATIVE TOP CONFIGURATION IS USED FOR LIFTING, THE LIFTING PIN SHALL BE PROVIDED. PINS SHALL CONFORM TO CRITICAL DIMENSIONS (PIN LENGTH DIAMETER).
4. PINS SHALL CONFORM TO ASTM A449.
5. APPROVED NON–SHRINK GROUT SHALL BE USED FOR GROUTING OVER ALL PINS, AND GROUTING OF SCUPPERS.
6. JOINTS BETWEEN CAST–IN–PLACE GUARDRAIL TYPE 7 AND PERMANENT INSTALLATION PRECAST TYPE 7 CONCRETE BARRIER SHALL INCLUDE ALL REGRESSES AND LOOPS IN THE CAST–IN–PLACE END, ALONG WITH THE PIN TO COMPLETE THE TYPICAL PRECAST TYPE 7 CONCRETE BARRIER JOINT.



CONNECTING PIN DETAIL



ALTERNATIVE
PIN DETAIL



JOINT STYLE

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

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

DETAILS FOR PIN AND LOOP CONNECTION

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PRECAST TYPE 7
CONCRETE BARRIER

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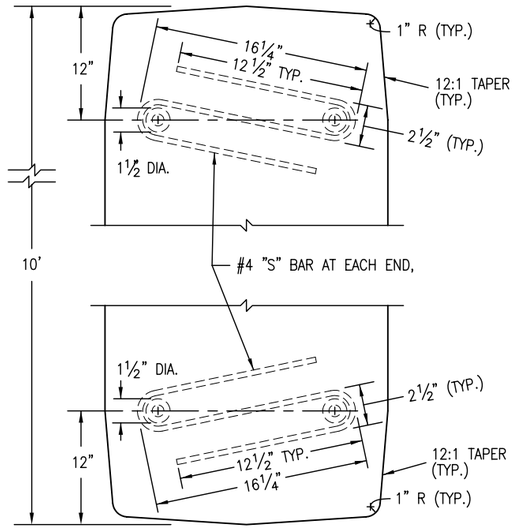
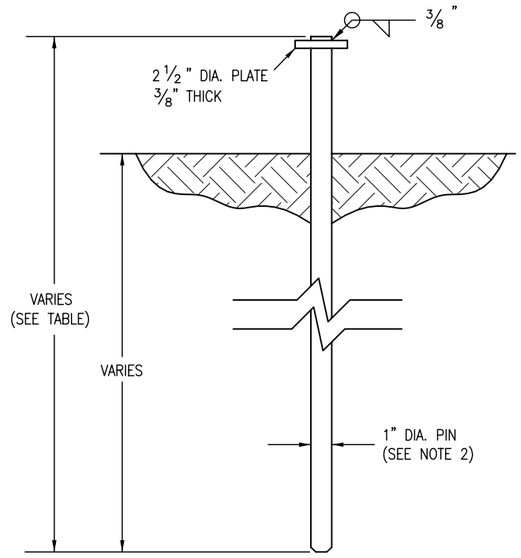
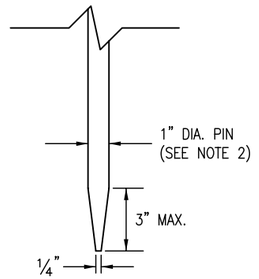
STANDARD PLAN NO.
M-606-14
Sheet No. 2 of 3



PLAN VIEW OF S BAR ENDS



STABILIZATION PIN
(ASTM A 36 STEEL)



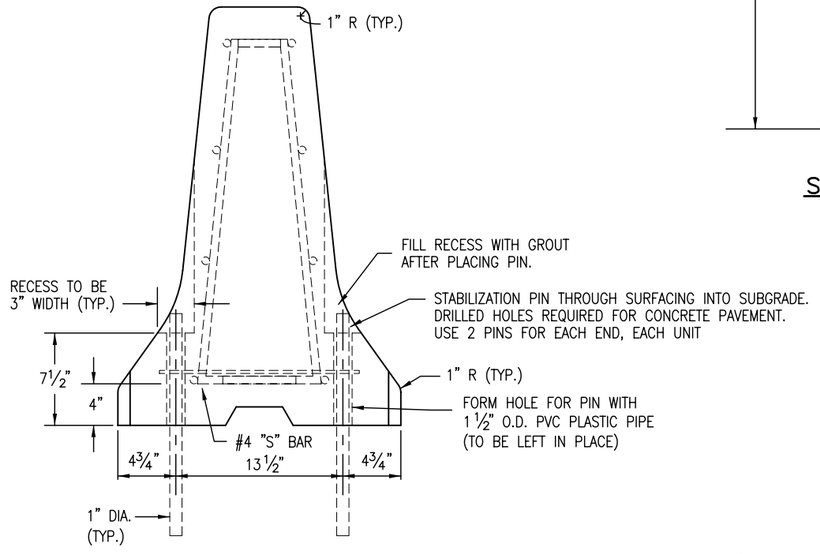
OPTIONAL TAPERED END PIN
(SEE NOTE 4)

NOTES

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

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

TABLE OF STABILIZATION PIN LENGTHS



ELEVATION VIEW WITH PINS

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

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PRECAST TYPE 7 CONCRETE BARRIER

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STANDARD PLAN NO.
M-606-14
Sheet No. 3 of 3

GENERAL NOTES

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

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

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

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

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

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

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

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

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

WOOD POSTS:

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

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

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

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

METAL POSTS:

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

CORNER AND LINE BRACE POSTS:

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

LINE POSTS:

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

METAL END POSTS AND GATE POSTS:

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

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

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

FOOTINGS OR BASES:

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

ALTERNATIVES: (CONTRACTOR'S OPTION)

END, CORNER AND LINE BRACE POSTS

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

LENGTHS SHALL BE 6 FT.-6 IN. MINIMUM

BRACES:

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

BARBED WIRE:

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

WOVEN WIRE MESH:

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

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

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

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

DRIVEWAY GATES (SINGLE):

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

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

ALTERNATIVE DRIVEWAY GATES (SINGLE PANEL):

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

GATES SHALL BE OF RIVETED CONSTRUCTION AS FOLLOWS:

MINIMUM FOUR NO. 10 RIVETS AT EACH RIGHT ANGLE CONNECTION AND WHERE DIAGONAL BRACES CONNECT TO HORIZONTAL PANELS.

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

WALK GATES:

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

ALTERNATIVE WALK GATES:

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

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

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

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

LATCHES AND HINGES:

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

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

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

WOOD STAYS:

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

Computer File Information		Sheet Revisions	
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Last Modification Date: 07/04/06	Initials: LTA		
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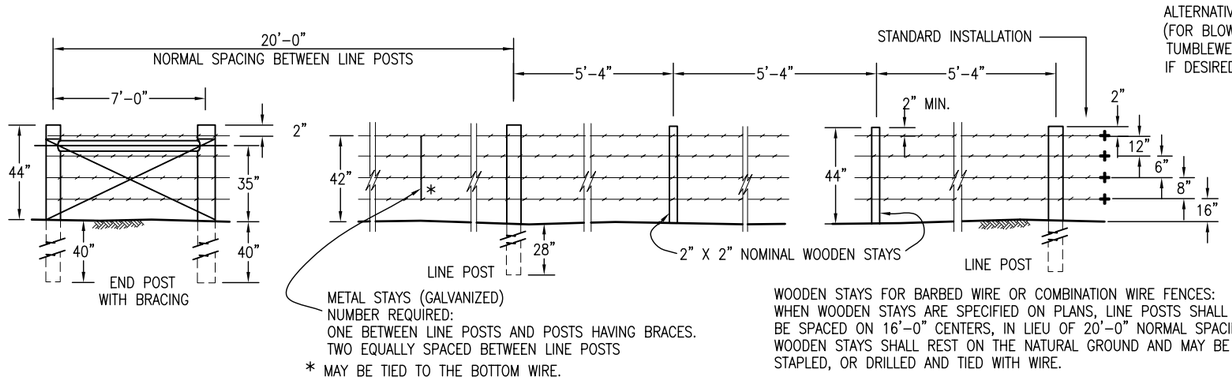
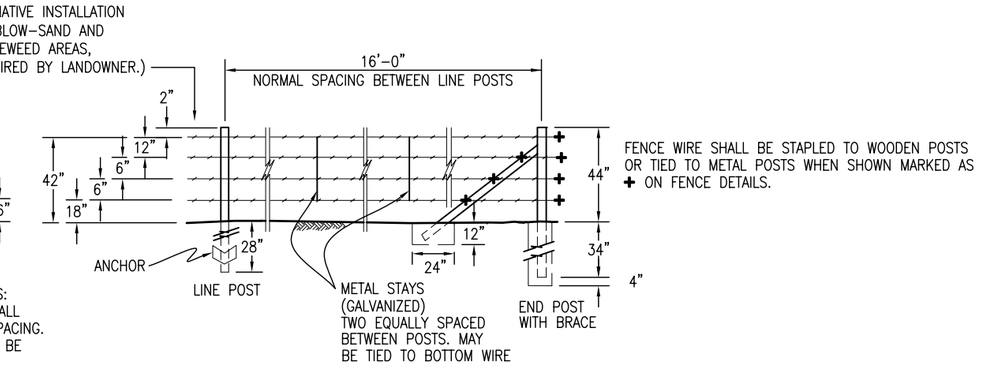
WIRE FENCES AND GATES

Issued By: Project Development Branch on July 04, 2006

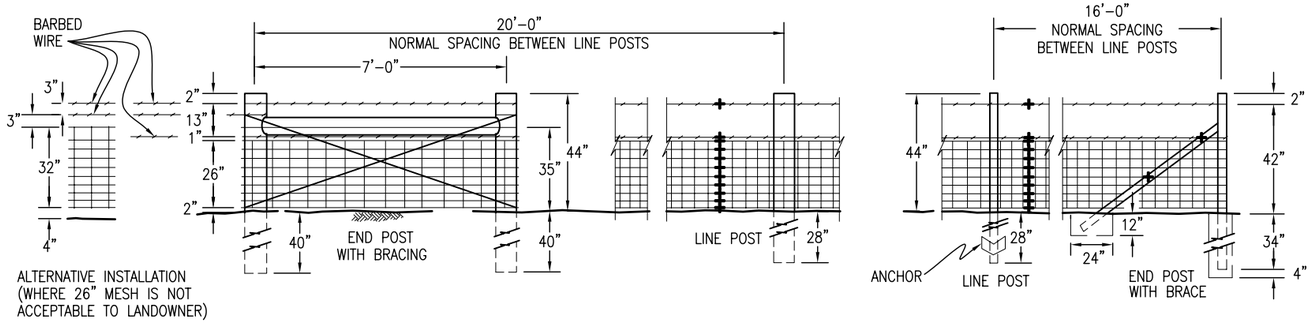
STANDARD PLAN NO.
M-607-1
Sheet No. 1 of 3



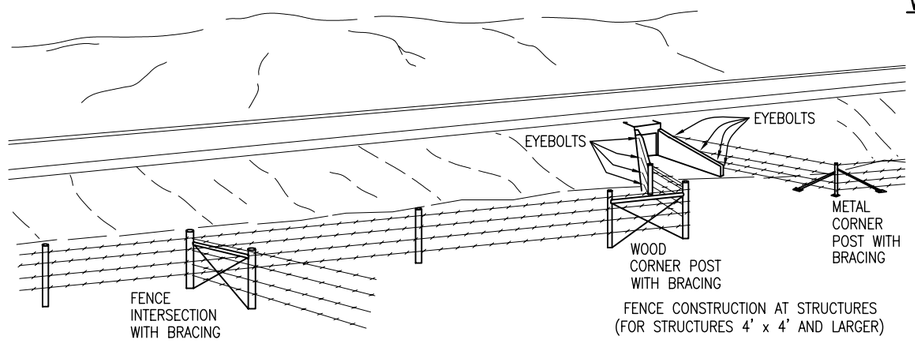
BARBED WIRE FENCE WITH WOODEN POSTS



BARBED WIRE FENCE WITH METAL POSTS

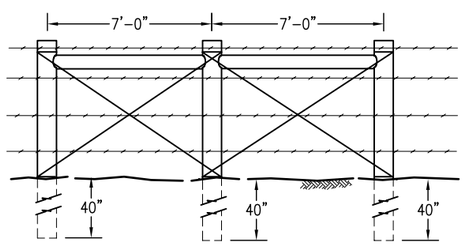


COMBINATION WIRE FENCE WITH WOODEN POSTS

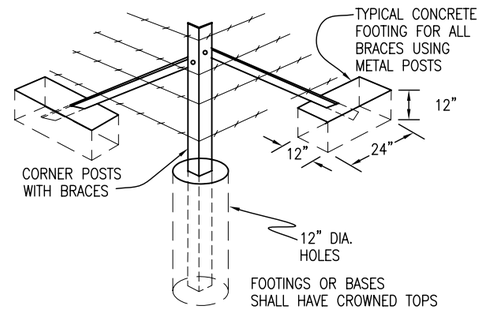


FENCE CONSTRUCTION AT STRUCTURES
(FOR STRUCTURES 4' x 4' AND LARGER)

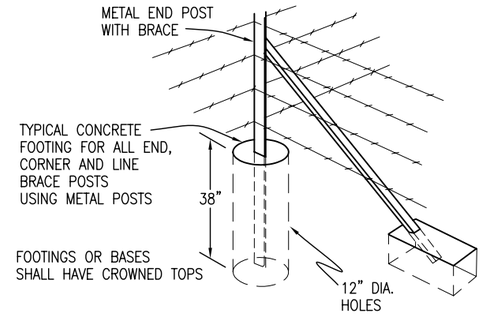
COMBINATION WIRE FENCE WITH METAL POSTS

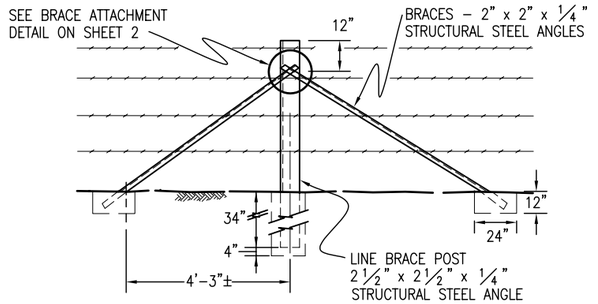


TYPICAL CORNER POST INSTALLATION



TYPICAL INSTALLATION AT FENCE INTERSECTIONS





NOTES

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

LINE BRACES

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

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WIRE FENCES AND GATES

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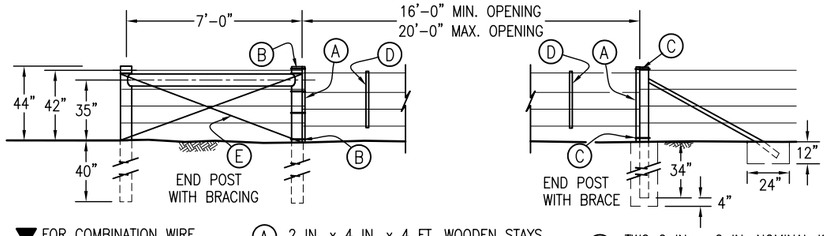
M-607-1
Sheet No. 2 of 3



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

(A) 2 IN. x 4 IN. x 4 FT. WOODEN STAYS

(B) FOUR NO. 12-1/2 GA. WIRE LOOPS TO ACT AS HINGES

(C) NO. 12-1/2 GA. WIRE LOOPS

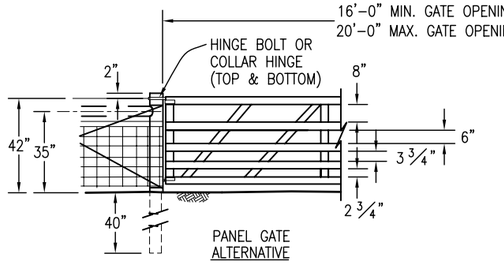
(D) TWO 2 IN. x 2 IN. NOMINAL WOODEN STAYS EQUALLY SPACED

(E) NO. 12-1/2 GA. BRACE WIRE, DOUBLE STRAND

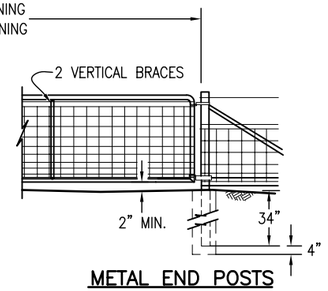
WOODEN POSTS

METAL END POSTS

▼ BARBED WIRE GATE



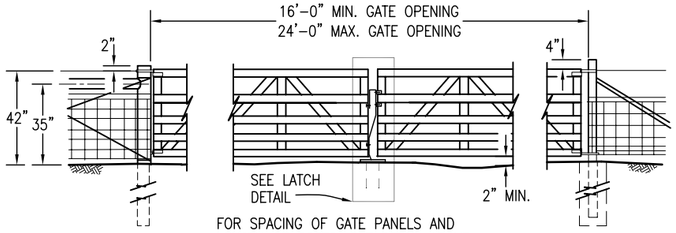
WOODEN POSTS
(16'-0" MAX.)



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

DRIVEWAY GATES

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

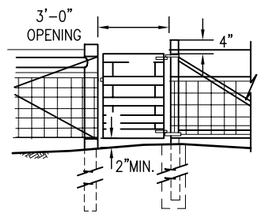


FOR SPACING OF GATE PANELS AND LENGTH OF POSTS, SEE DETAIL ABOVE.

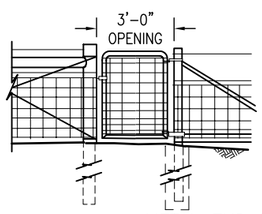
WOODEN POSTS **PANEL GATE POSTS**

TWIN DRIVEWAY GATES

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



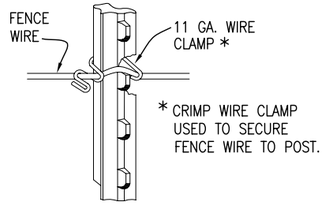
FOR LENGTH OF POSTS AND SPACING OF WIRE AND GATE PANELS, SEE DRIVEWAY GATE DETAIL ABOVE.



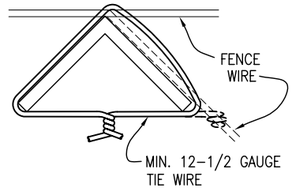
WOODEN POSTS **PANEL GATE POSTS**
WALK GATE

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

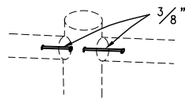
(METAL AND WOOD END POSTS SHALL BE BRACED SAME AS FOR BARBED WIRE GATES)



TIES FOR "STUDDED TEE" OR "U" POSTS

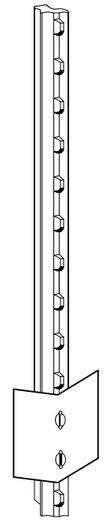


TIES FOR ANGLE POSTS FENCE WIRE TIES

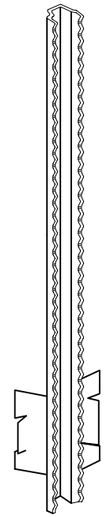


BORE A 3/8" x 2" HOLE IN EACH POST AND BRACE TO RECEIVE THE PINS. WRAP THE ENDS OF THE BRACES TIGHTLY WITH SEVERAL TURNS OF 12-1/2 GA. SMOOTH GALV. WIRE TO PREVENT SPLITTING OR NOTCH POST AND NAIL WITH 40d COMMON NAILS.

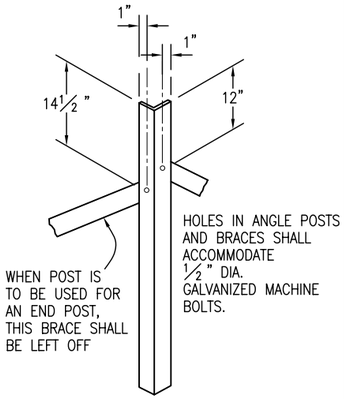
CROSS BRACE DOWELING DETAIL



STUDDED "TEE" LINE POST



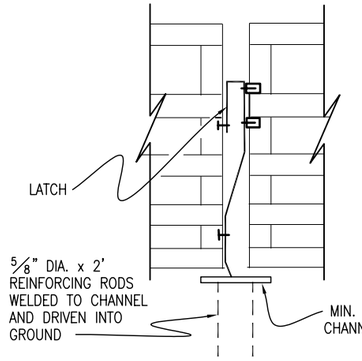
"U" LINE POST



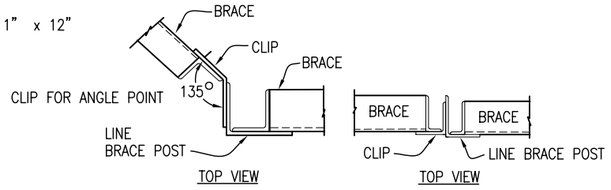
DETAILS OF HOLE SPACING FOR END, CORNER, AND LINE BRACE POSTS

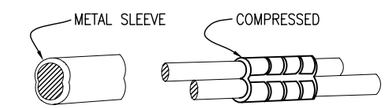
ANGLE POST

TYPICAL METAL POSTS



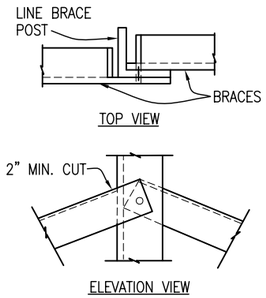
LATCH DETAIL



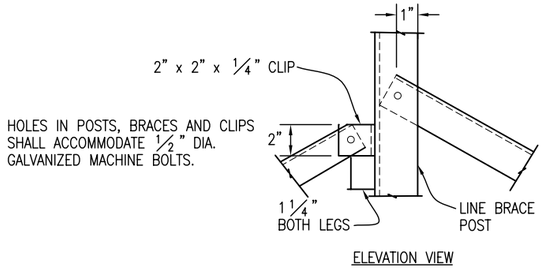


SPLICING SLEEVE SHALL BE APPROVED BY THE ENGINEER

WIRE SPLICE



⌀ BRACE ATTACHMENT DETAIL

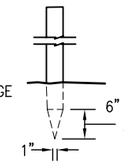


HOLES IN POSTS, BRACES AND CLIPS SHALL ACCOMMODATE 1/2" DIA. GALVANIZED MACHINE BOLTS.

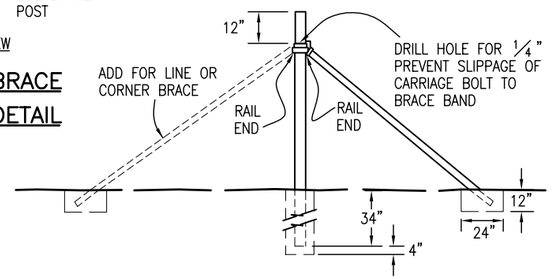
⌀ ALTERNATIVE BRACE ATTACHMENT DETAIL

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

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



POST POINTING



ALTERNATIVE POST

(FOR END, CORNER OR LINE BRACE POSTS)

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WIRE FENCES AND GATES

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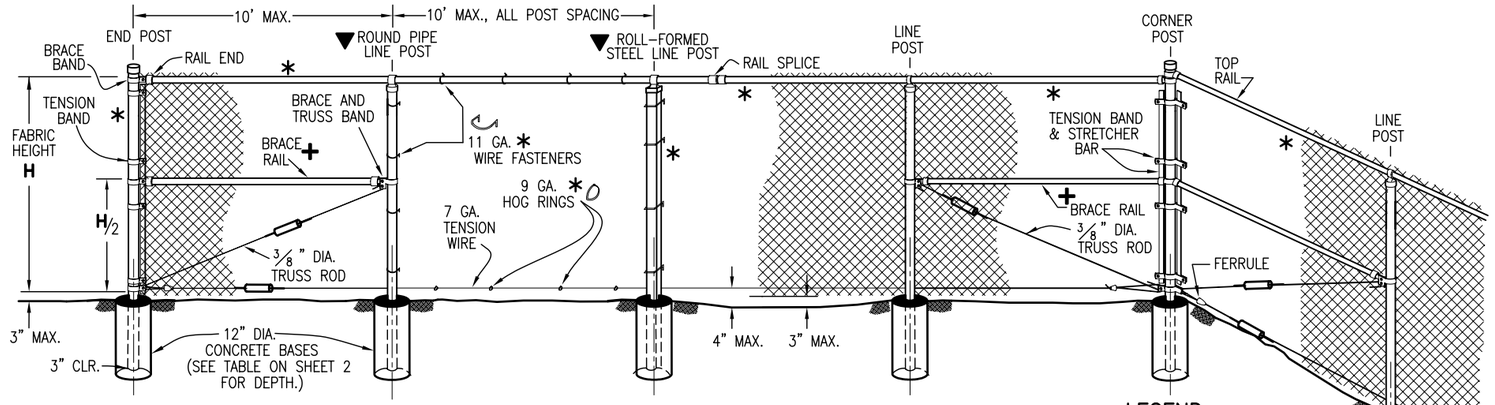
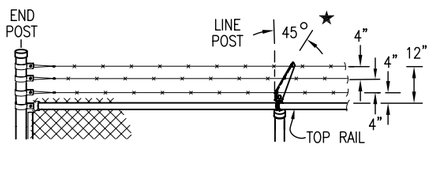
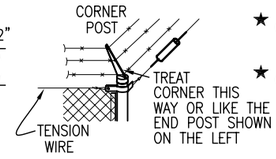
STANDARD PLAN NO.
M-607-1
Sheet No. 3 of 3



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





BARBED WIRE TOP (USE ONLY WHEN SPECIFIED ON PLANS)

★ CASE 1. TO KEEP INSIDERS IN, SLOPE TOP IN 45°

★ CASE 2. TO KEEP OUTSIDERS OUT, SLOPE TOP OUT 45°
BARBED WIRE OVER GATES SHALL NOT BE SLOPED

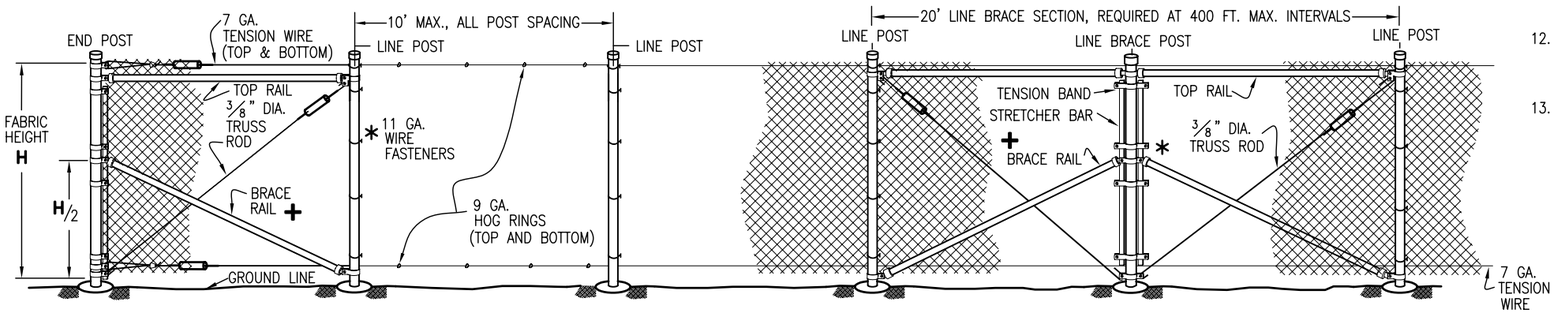
LEGEND

* ATTACH FABRIC TO ALL FENCE & GATE STRUCTURES AT 12 IN. INTERVALS VERTICALLY AND AT 20 IN. HORIZONTALLY.

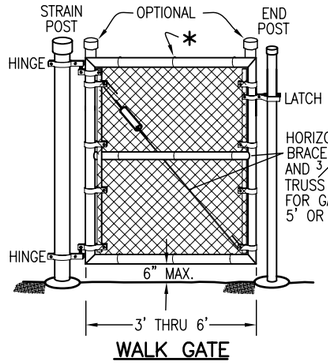
TIGHTENER OR TURNBUCKLE SYMBOL. (SEE DETAILS ON SHEETS 2 AND 3).

▼ TYPE OF LINE POST (ROUND PIPE OR ROLL-FORMED STEEL) SHALL BE AT THE OPTION OF THE CONTRACTOR UNLESS OTHERWISE SHOWN ON THE PLANS.

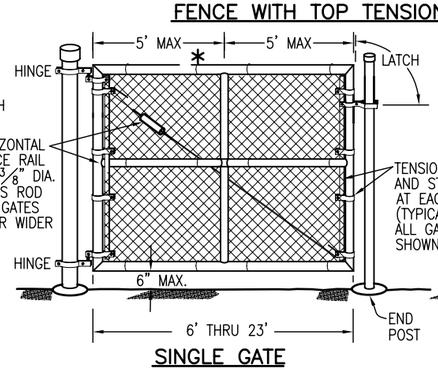
\+ BRACE RAIL IS NOT REQUIRED FOR 36 IN., 42 IN., OR 48 IN. FABRIC HEIGHTS. BRACE RAIL FOR FENCE WITH ROLL-FORMED STEEL ELEMENTS IS 12 IN. BELOW THE TOP RAIL, (SEE SHEET 3).



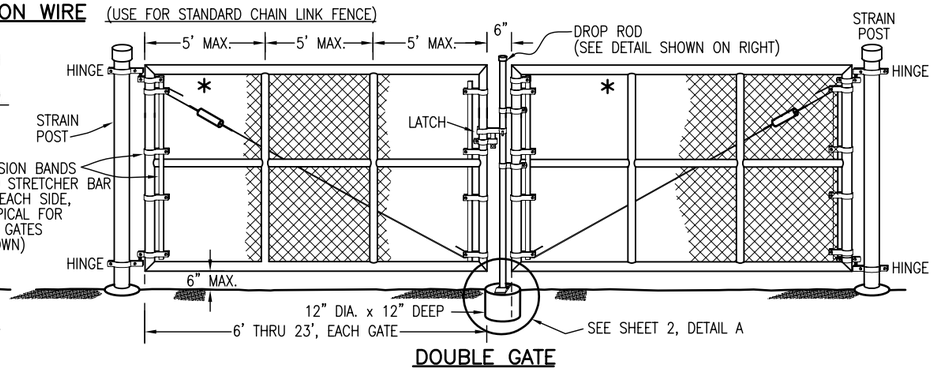
FENCE WITH TOP TENSION WIRE (USE FOR STANDARD CHAIN LINK FENCE)



WALK GATE



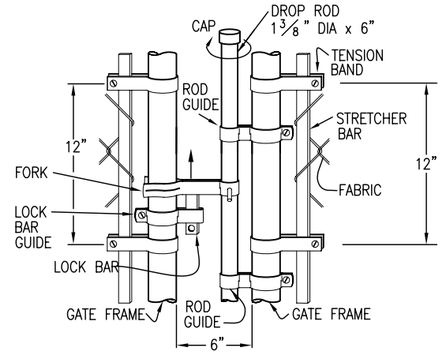
SINGLE GATE



DOUBLE GATE

GENERAL NOTES

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



TYPICAL DROP ROD ASSEMBLY

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Colorado Department of Transportation
DOT DEPARTMENT OF TRANSPORTATION
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083
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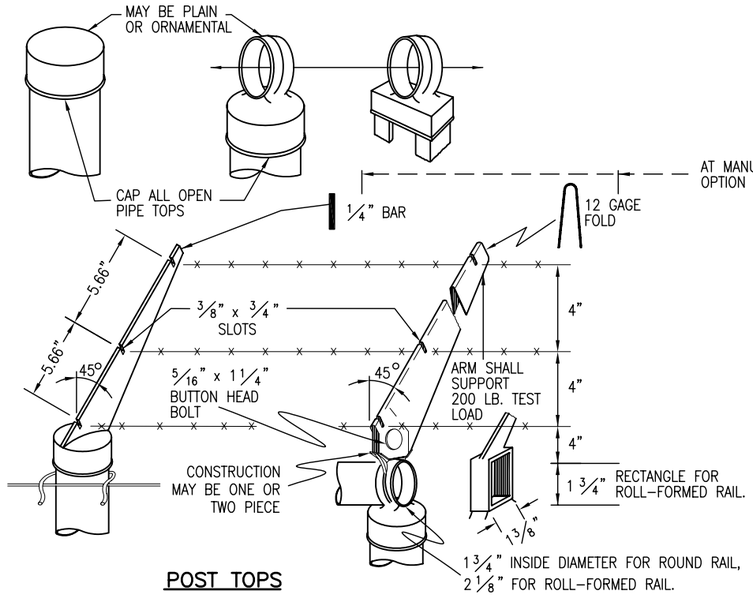
Project Development Branch SRJ/LTA

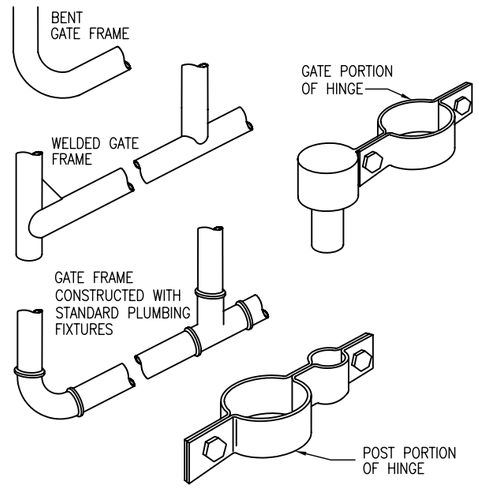
CHAIN LINK FENCE

Issued By: Project Development Branch on July 04, 2006

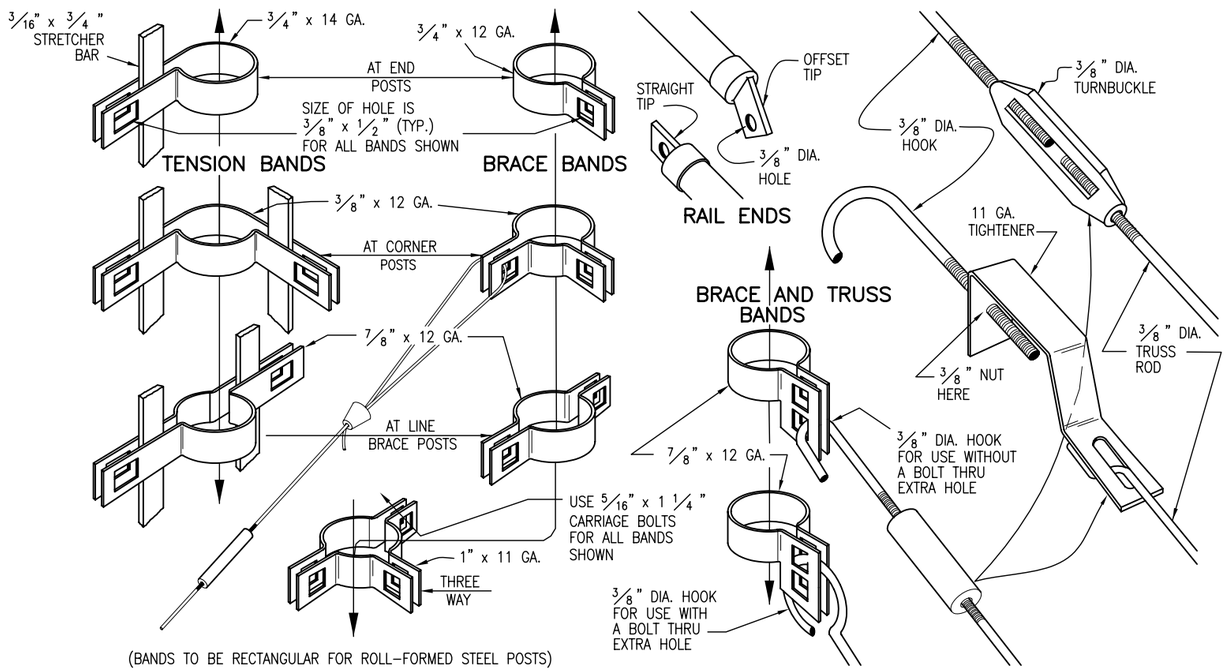
STANDARD PLAN NO.
M-607-2
Sheet No. 1 of 3



POST TOPS



GATE FRAMES & HINGE



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

FENCE MATERIAL

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

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

△ ALL POSTS 3 IN CLEAR FROM BOTTOM OF CONCRETE BASE

ORDINARY PIPE

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

ALTERNATIVE PIPE

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

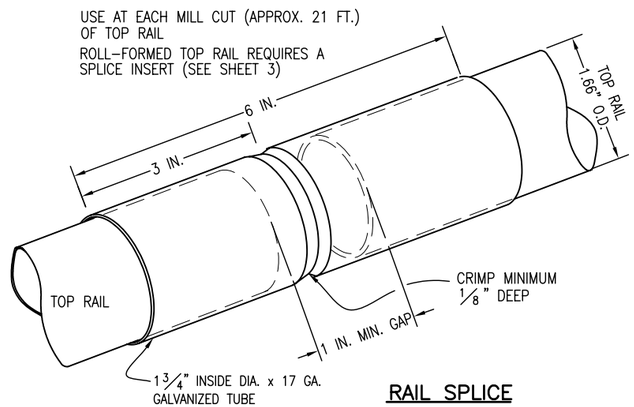
GATE MATERIAL

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

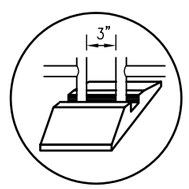
GATE FRAME		FRAME PIPE	BRACING PIPE
WIDTH	HEIGHT	I.D.	I.D.
FEET		INCHES	
3 THRU 8	3 THRU 6	1.25	1.25
> 8 THRU 23	6	1.50	1.25
> 8 THRU 23	> 6 THRU 12	1.50	1.50

ROLL-FORMED STEEL

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



RAIL SPLICE



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

DETAIL A TYPICAL CENTER REST

Computer File Information		Sheet Revisions	
Creation Date: 07/04/06	Initials: SJR	Date:	Comments
Last Modification Date: 07/04/06	Initials: LTA		
Full Path: www.dot.state.co.us/DesignSupport/			
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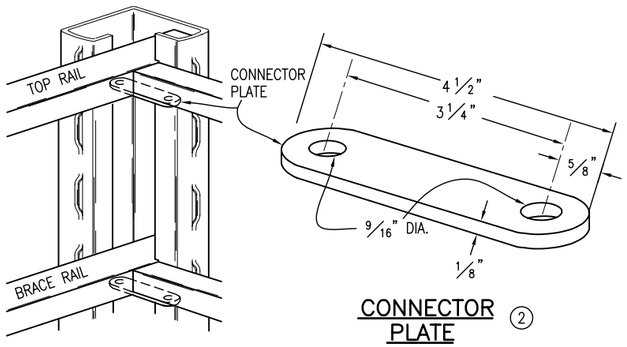
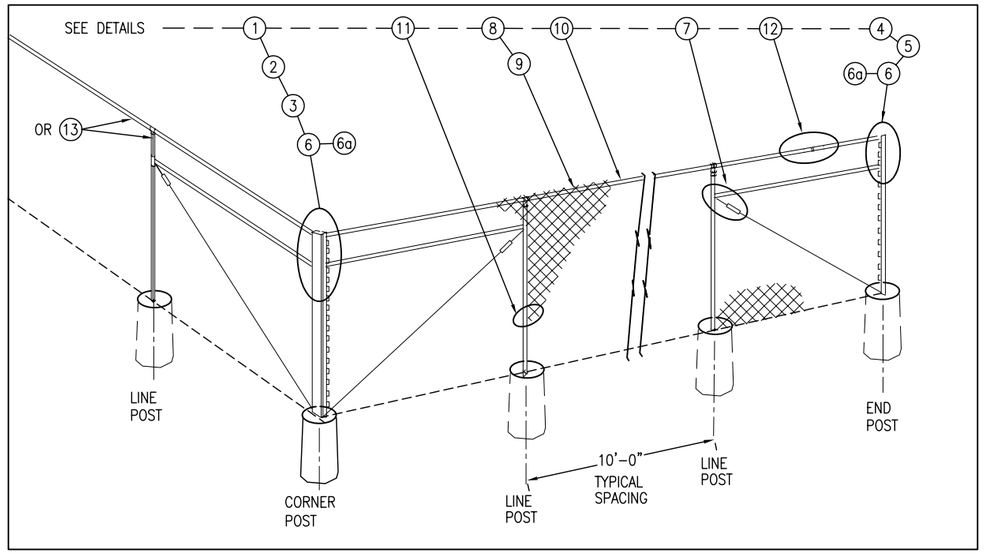
Sheet No. 2 of 3

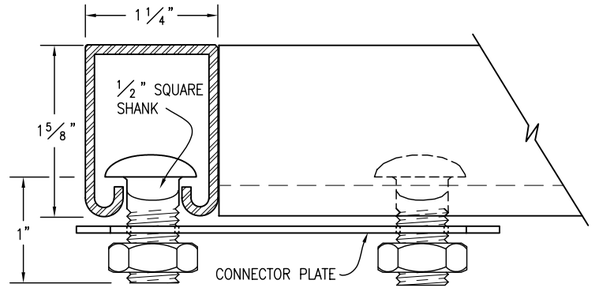


CORNER POST TREATMENT (1)

CONNECTOR PLATE (2)

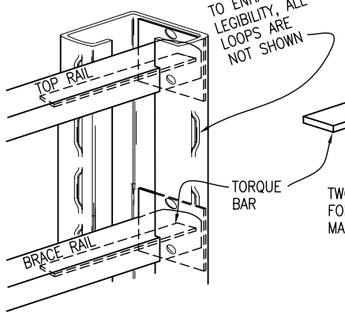


KEY TO DETAILS

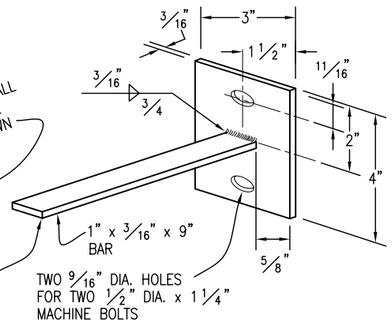


RAIL (SHOWING CORNER ASSEMBLY) (3)

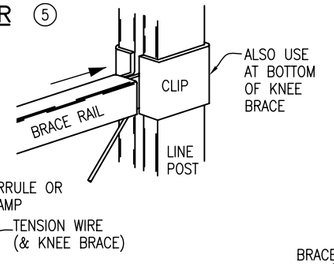
14 GAGE ROLL-FORMED STEEL, 20 FT. LENGTHS, 1.40 LB. PER LIN. FT.



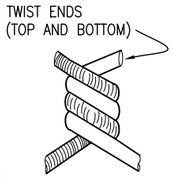
END POST TREATMENT (4)



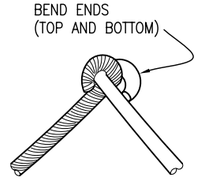
TORQUE BAR (5)



ALTERNATIVE FOR TOP RAIL

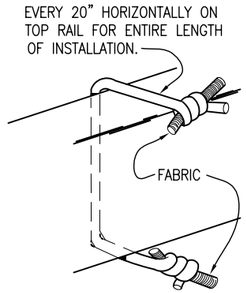


BARBED SELVAGE (8)

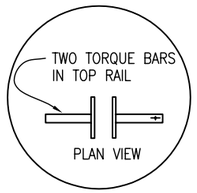


KNUCKLED SELVAGE (9)

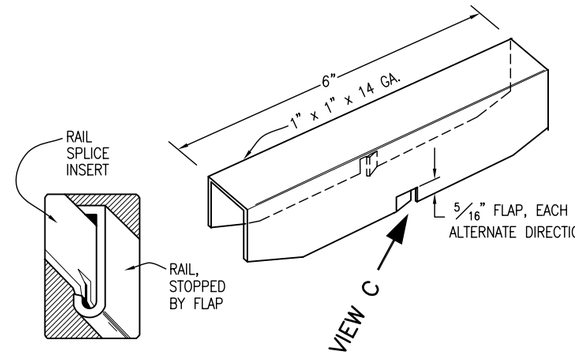
ALTERNATIVE, USE ONLY WHEN CALLED FOR ON THE PLANS



WIRE FASTENER (10)

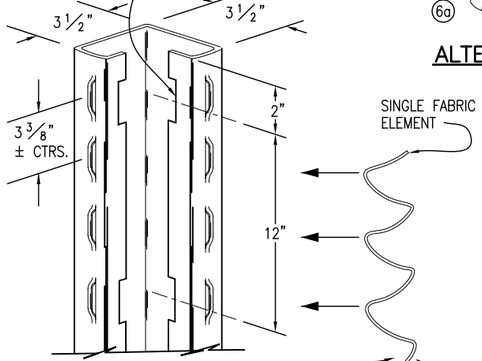


DETAIL A



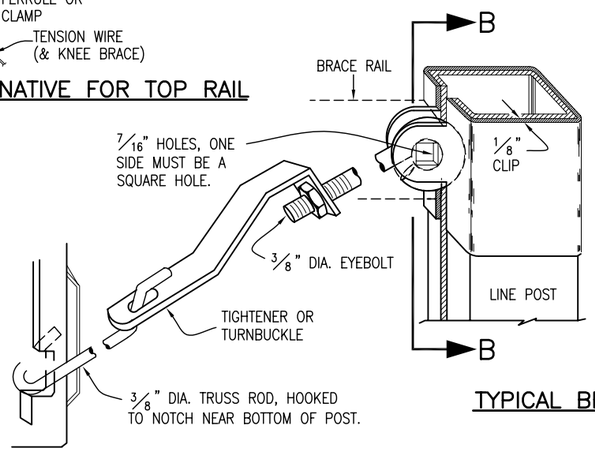
VIEW C

RAIL SPLICE INSERT (12)

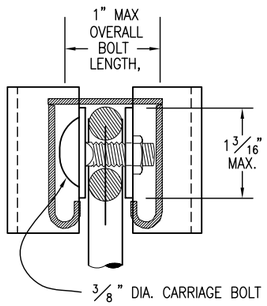


END POST OR CORNER POST

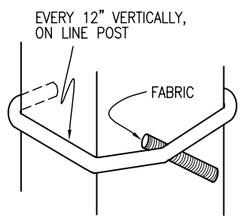
10 GAGE ROLL-FORMED STEEL, 5.10 LB. PER LINEAR FT. (6)



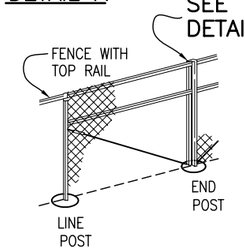
TYPICAL BRACING (7)

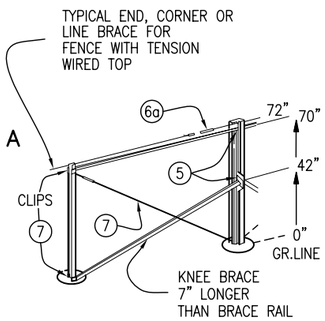


SECTION B-B



TIE CLIP (11)





LINE BRACE (ONE HALF SHOWN) (13)

400 FT. INTERVALS

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Full Path: www.dot.state.co.us/DesignSupport/	(R-X)		
Drawing File Name: 607020303.dwg	(R-X)		
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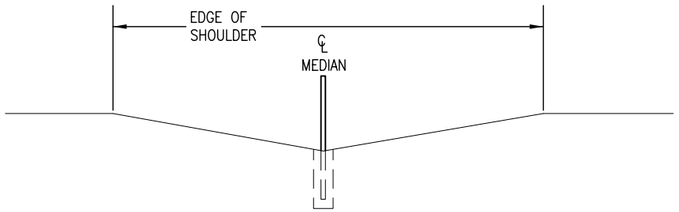
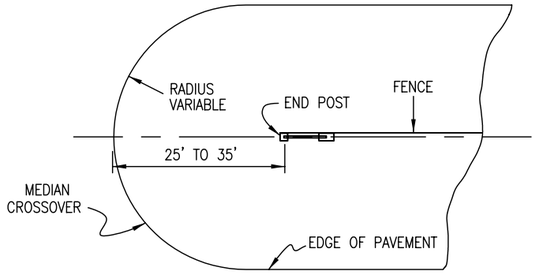
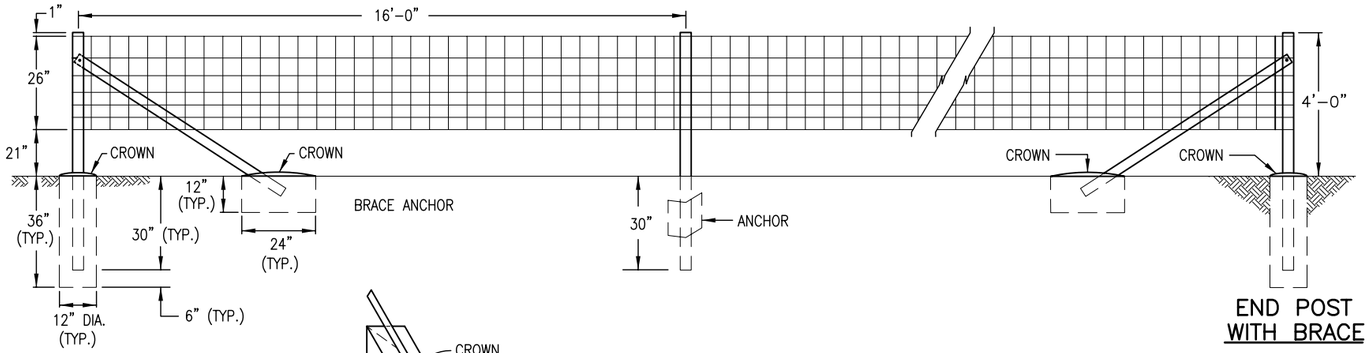
Sheet No. 3 of 3

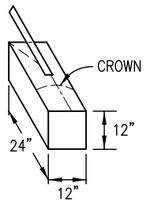




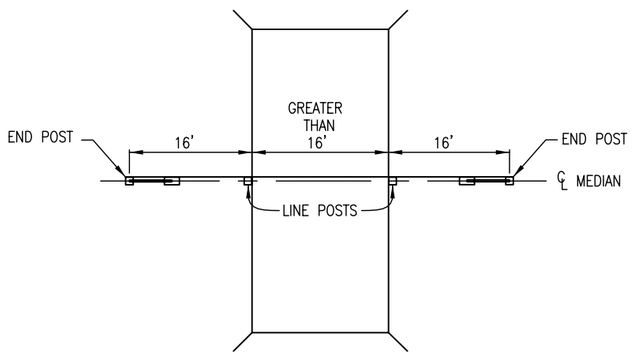


END POST
WITH BRACE

END POST
WITH BRACE



SKETCH OF BRACE
ANCHOR



LOCATION OF BARRIER FENCE AT
BOX CULVERTS WITH NO FILL

SPECIFICATIONS

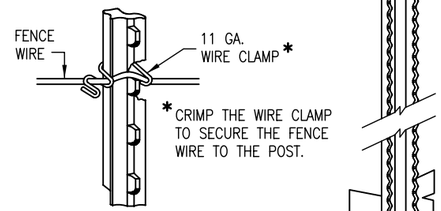
END POSTS:
- TYPE: 2 ½" x 2 ½" x ¼" STRUCTURAL STEEL ANGLES
- WEIGHT: 4.10 LBS. PER LIN. FT. NOMINAL (RAW)
- LENGTH: 6'-6" MINIMUM
- NO. OF BRACES: ONE

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

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

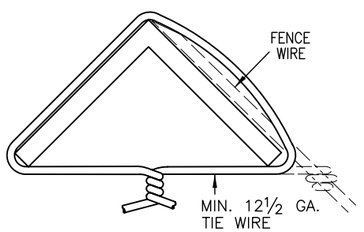
WOVEN WIRE FENCE FABRIC:
- STYLE OR DESIGN NUMBER: 726 - 6 - 12 ½

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

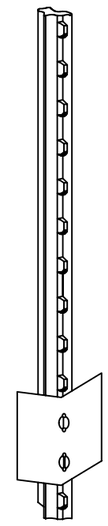


TIES FOR
"STUDDED TEE"
OR "U" POSTS

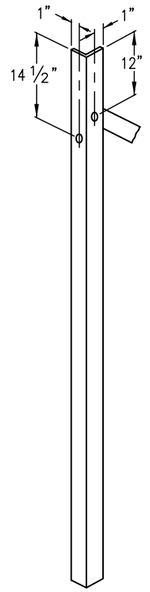
"U" LINE POST



END POST TIE



"STUDDED TEE"
LINE POST



END POST WITH
BRACING

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

GENERAL NOTES

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

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BARRIER FENCE

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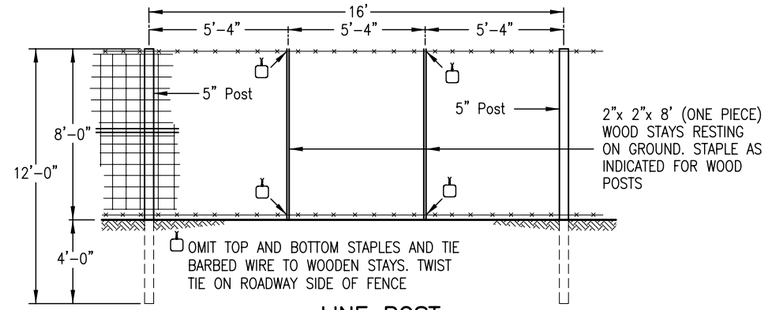
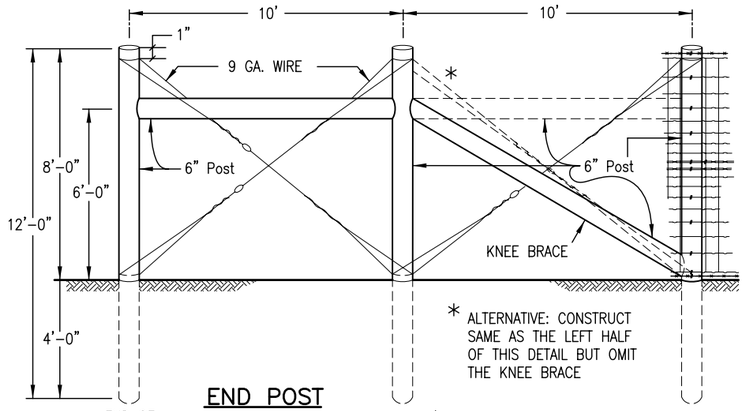
STANDARD PLAN NO.
M-607-3
Sheet No. 1 of 1

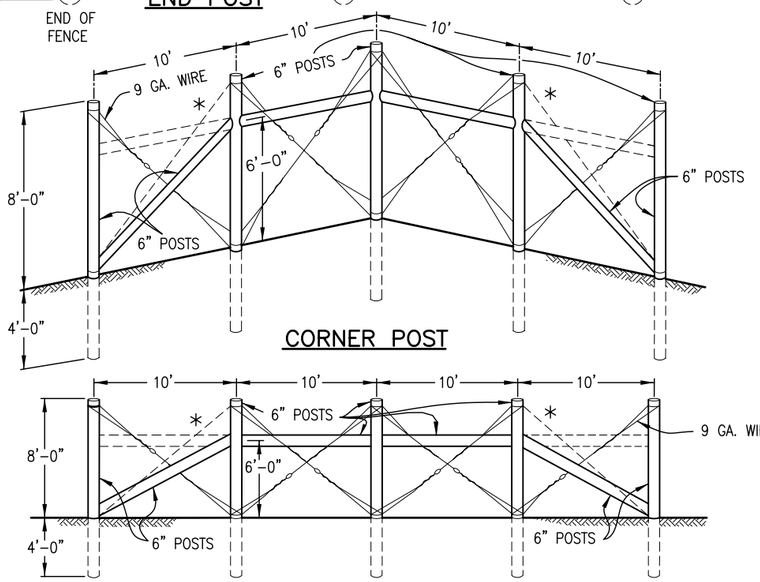


LINE POST



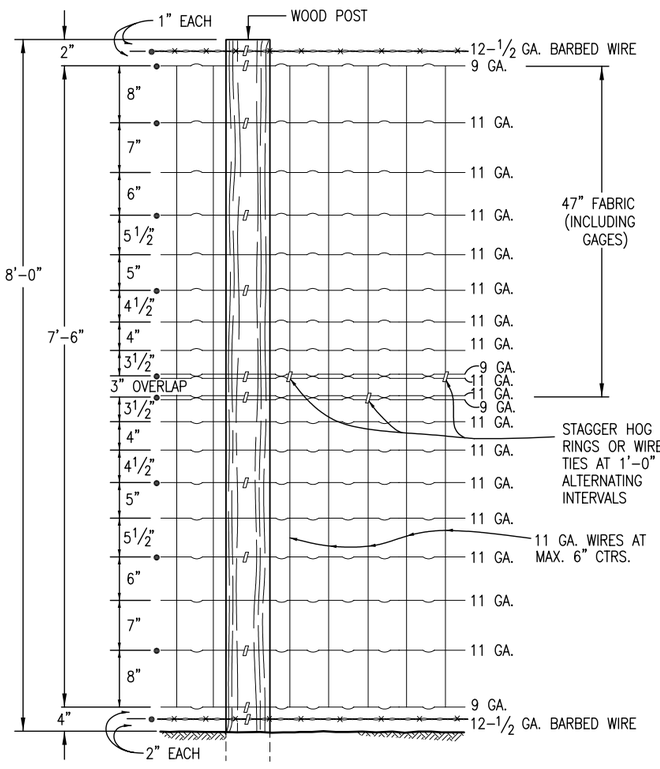
END POST

END OF FENCE



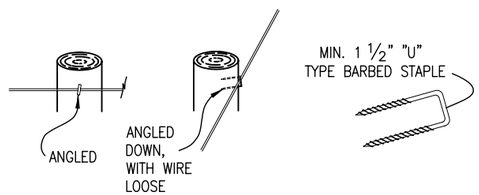
CORNER POST

LINE BRACE POST

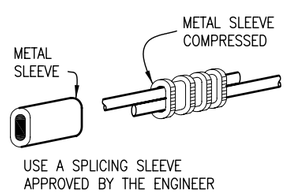


* FENCE WIRE SHALL BE STAPLED TO WOOD POSTS AND STAYS

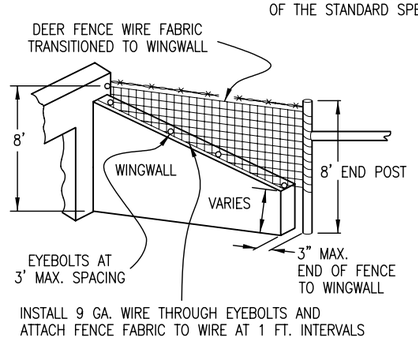
DEER FENCE WIRE FABRIC



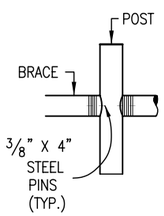
TYPICAL STAPLING



WIRE SPsplice



DEER FENCE TO WINGWALL



CROSS BRACE DOWELING

GENERAL NOTES

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

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DEER FENCE AND GATES

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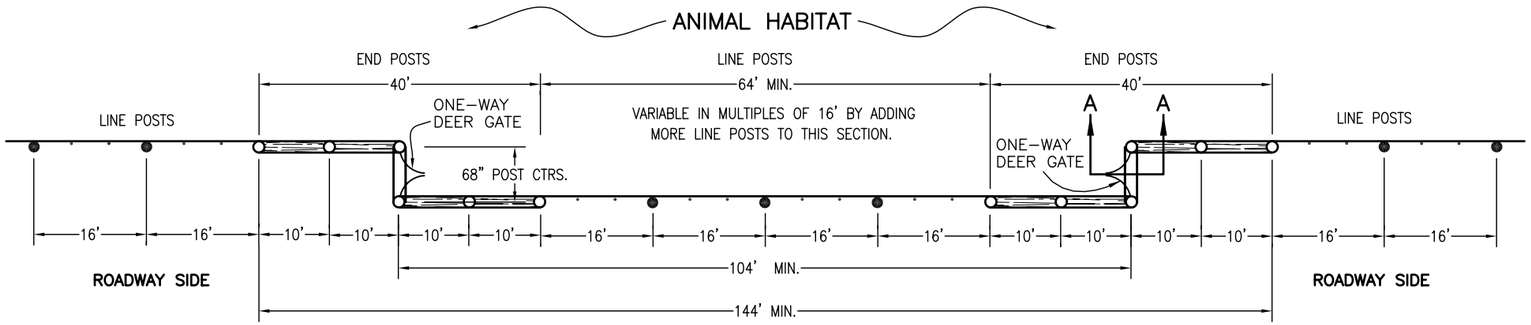
STANDARD PLAN NO.
M-607-4
Sheet No. 1 of 2



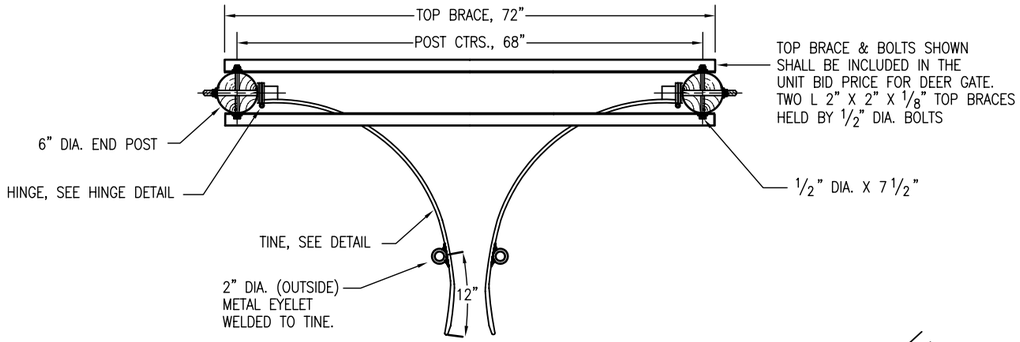
PLAN VIEW – TYPICAL DEER GATE INSTALLATION

LEGEND

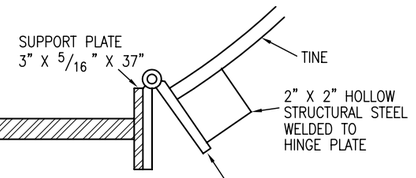
= LINE POST
= WOODEN STAY
= END POST
= BRACE

NOTES

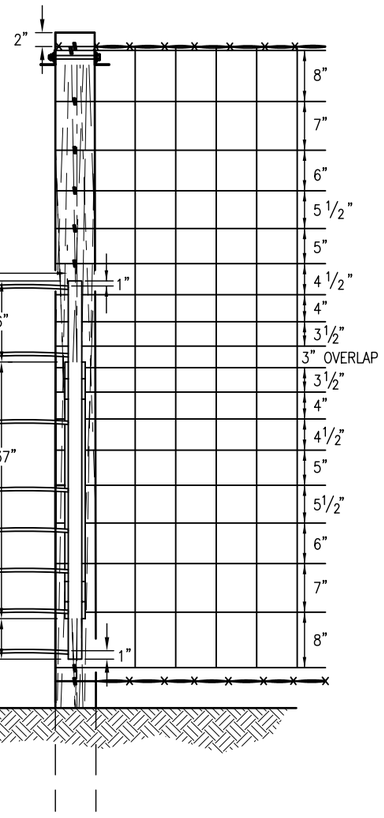
1. SIX IN. DOUBLE ACTING SPRING DOOR HINGE WITH FLAT BUTTON TIPS CUT IN TWO SHALL BE USED AS A SINGLE SWING HINGE AND BE PROVIDED WITH A GREASING NIPPLE AND WELDED TO SUPPORT PLATE.
2. TINES SHALL BE MOLDED IN ONE PIECE OF STEEL (AASHTO M 169, GRADE 1050), WITH NO WELDS ALLOWED.
3. GAP CLOSURE: EXCEPT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



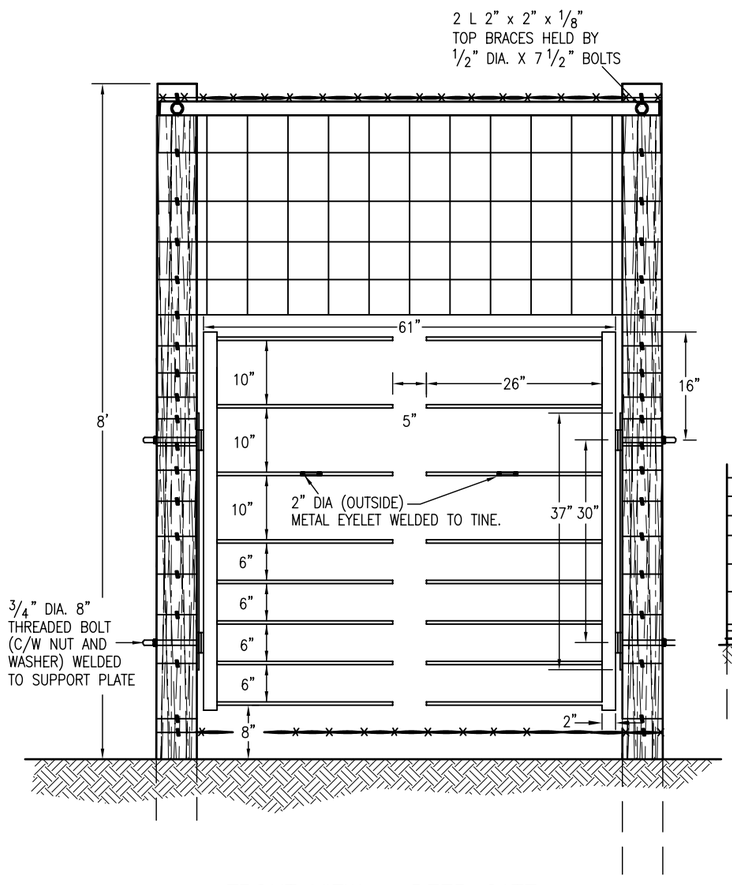
TOP VIEW – DEER GATE



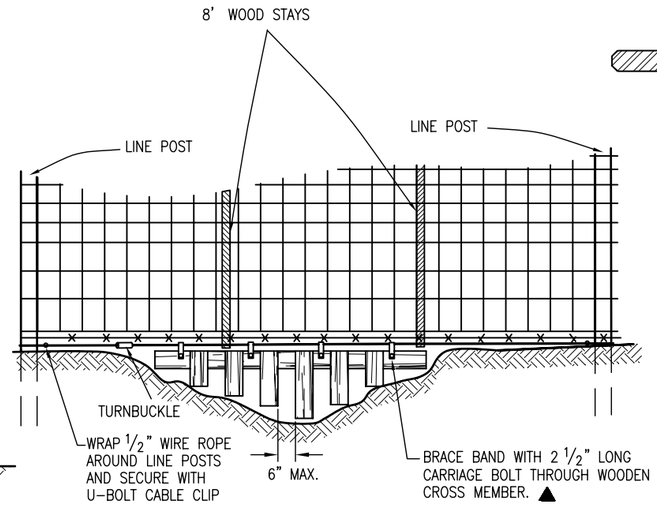
TYPICAL HINGE DETAIL



SECTION A–A

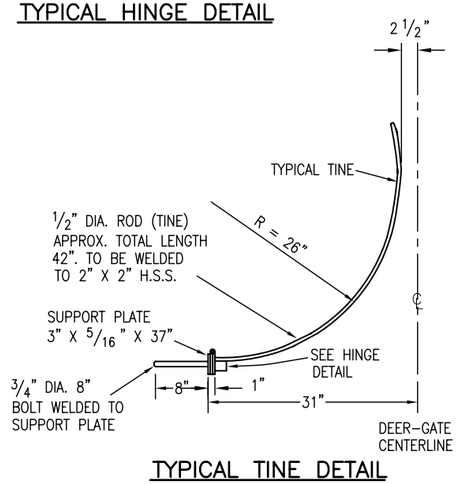


FRONT VIEW – DEER GATE



GAP CLOSURE

▲ SEE CHAIN LINK FENCE STANDARD PLAN FOR HARDWARE DETAILS.



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DEER FENCE AND GATES

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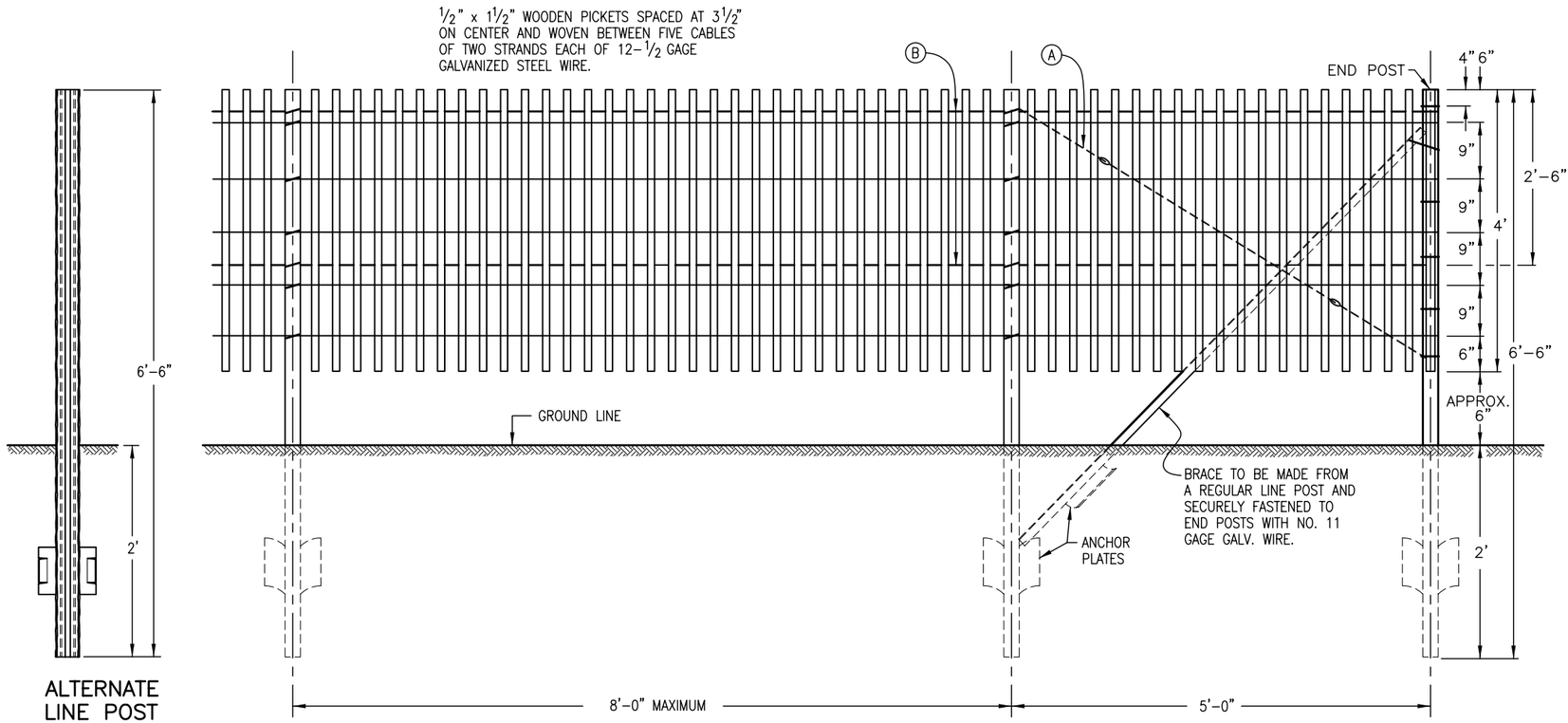
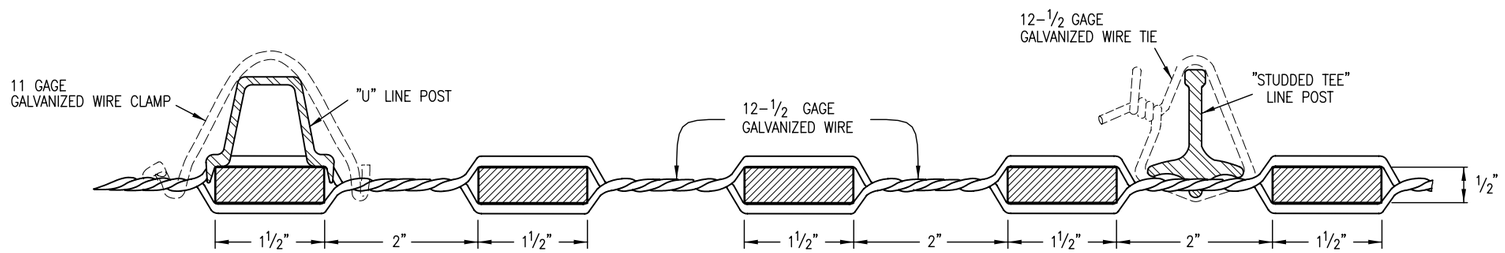
STANDARD PLAN NO.
M-607-4
Sheet No. 2 of 2



FRONT ELEVATION OF PICKET SNOW FENCE

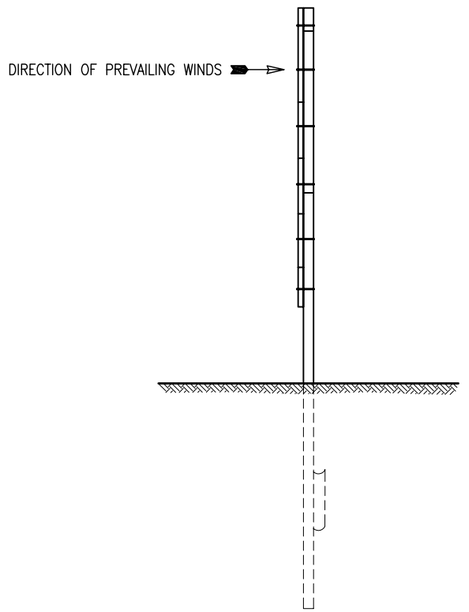


TYPICAL SECTIONS THROUGH SNOW FENCE POST AND PICKETS

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

GENERAL NOTES

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



END ELEVATION

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PICKET SNOW FENCE

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STANDARD PLAN NO.
M-607-10
Sheet No. 1 of 1

GENERAL NOTES

1. STEEL LIGHT STANDARDS SHALL HAVE AN 8 IN. OUTSIDE DIAMETER AT THE BASE WITH A $^{3}/_{16}$ IN. MINIMUM WALL THICKNESS, AND A UNIFORM TAPER THROUGHOUT. LIGHT STANDARDS SHALL BE ROUND OR TWELVE OR MORE SIDED, AND FABRICATED IN ACCORDANCE WITH SECTIONS 613 AND 715.

2. A CERTIFICATE OF COMPLIANCE (C.O.C) SHALL BE SUBMITTED TO THE ENGINEER AFTER FABRICATION OF THE LIGHT STANDARDS. THE C.O.C. SHALL BE SUBMITTED IN ACCORDANCE WITH SUBSECTION 106.12.

3. THE GATE ARM SHALL BE FABRICATED FROM HIGH STRENGTH RECTANGULAR FIBERGLASS AND 6061–T6 RECTANGULAR ALUMINUM TUBING. THE MAXIMUM ARM LENGTH SHALL BE 40 FT. THE FIBERGLASS/ALUMINUM GATE SHALL BE SUPPLIED BY SAFETRAN, B&B ELECTRONIC, OR AN APPROVED EQUIVALENT.

4. THE CONTRACTOR SHALL SURVEY THE CROSS SECTION OF THE ROADWAY, DETERMINE EACH GATE ARM LENGTH, AND SUBMIT THIS INFORMATION TO THE ENGINEER BEFORE ORDERING MATERIAL. THE LOCATION OF THE ROAD CLOSURE GATES AND THE REQUIRED MOUNTING HEIGHT OF THE GATE ARM PIVOT SHALL BE VERIFIED BY THE CONTRACTOR AND SUBMITTED TO THE ENGINEER.

5. A BREAKAWAY SHEAR PIN BASE IS REQUIRED FOR THE LIGHTWEIGHT ALUMINUM/FIBERGLASS ARMS. WHEN EXCESSIVE FORCE IS APPLIED TO THE GATE ARMS EQUIPPED WITH THE SHEAR PIN BASE, THE PIN SHALL SHEAR, AND THE ARM SHALL THEN SWING 45 DEGREES HORIZONTALLY AND DROP FREE OF THE GATE OPERATOR, MINIMIZING DAMAGE TO THE VEHICLE AND THE GATE.

6. THE HEIGHTS OF THE GATE ARM GUIDES WERE DETERMINED FOR A 29 FT. TALL TAPERED LIGHT STANDARD WITH A BASE DIAMETER OF 8 IN. AND A TOP DIAMETER OF 4 IN. GUIDE LOCATIONS MAY BE ADJUSTED FOR VARIOUS GATE ARM LENGTHS AND WARNING LIGHT SPACINGS. THE HEIGHT OF THE GATE ARM OVER THE ROADWAY SHALL BE 3 FT. – 7 IN. TO 4 FT. – 7 IN. FROM THE BOTTOM OF THE ARM TO THE ROADWAY.

7. WORM GEAR WINCH AND CABLE SHALL BE AS SUPPLIED BY DUTTON–LAWSON (STOCK NO. 4Z183) OR APPROVED EQUIVALENT.

8. WHEN THE GATE IS FULLY RAISED, THE NUT AND WASHER SHALL FIT SNUGLY AGAINST THE OUTSIDE OF THE REAR CHANNEL AND BE PADLOCKED IN PLACE. THE CONTRACTOR SHALL SUPPLY ONE HEAVY, WEATHERPROOF PADLOCK WITH TWO KEYS FOR EACH GATE ARM PIVOT. INFORMATION ON THE KEY TYPE REQUIREMENTS WILL BE PROVIDE BY THE ENGINEER. PAIRED PIVOTS FOR DIVIDED HIGHWAYS SHALL BE KEYED ALIKE.

9. ELECTRICAL CONNECTION TO THE POWER SOURCE SHOWN ON THE PLANS WILL BE PAID FOR BY FORCE ACCOUNT. IF NO POWER SOURCE IS AVAILABLE, OMIT THE LUMINAIRE AND USE BATTERY OR SOLAR PANEL POWER FOR THE LED LIGHTS AS APPROVED BY THE ENGINEER.

10. GATE WARNING LIGHTS SHALL BE RED LED (TYPE B) HIGH INTENSITY. THE LIGHT AT THE END OF THE ARM NEAR THE CENTERLINE OF THE ROADWAY SHALL BE STEADY BURN. THE OTHER TWO LIGHTS SHALL FLASH AT THE RATE REQUIRED BY THE "MUTCD". SPACING OF THE LIGHTS SHALL VARY BASED ON ROADWAY WIDTH AND GATE ARM LENGTH. THE CONTRACTOR SHALL DETERMINE THE SPACING AND SUBMIT THE LED LAYOUT TO THE ENGINEER FOR VERIFICATION PRIOR TO PLACEMENT.

11. GALVANIZING: THE STEEL LIGHT STANDARDS, MAST ARMS, DROP GATE PIVOTS, SUPPORTS, GUIDES, AND ALL ASSOCIATED HARDWARE SHALL BE GALVANIZED IN ACCORDANCE WITH SECTION 715. ALL ROUGH EDGES AND BURRS SHALL BE GROUNDED SMOOTH PRIOR TO GALVANIZING.

12. BOLTED CONNECTIONS: ALL BOLTS SHALL CONFORM TO ASTM A 307, GRADE A, UNLESS DESIGNATED AS HS (HIGH STRENGTH). HS BOLTS SHALL CONFORM TO ASTM A 325. AFTER THE ROAD CLOSURE GATE IS ASSEMBLED, ALL EXPOSED BOLT THREADS SHALL BE PAINTED WITH TWO COATS OF ALUMINUM PAINT. THE ALUMINUM PAINT SHALL MEET THE REQUIREMENTS OF SUBSECTION 708.04.

13. FIELD ASSEMBLY: IN SOME INSTALLATIONS, THE CONNECTION PLATES FOR THE LUMINAIRE ARMS MAY REQUIRE MODIFICATION TO ALLOW THE PIVOT SLEEVE TO SLIP OVER. ALL DAMAGE TO THE GLAVANIZING SHALL BE REPAIRED WITH TWO COATS OF ALUMINUM PAINT.

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ROAD CLOSURE GATE

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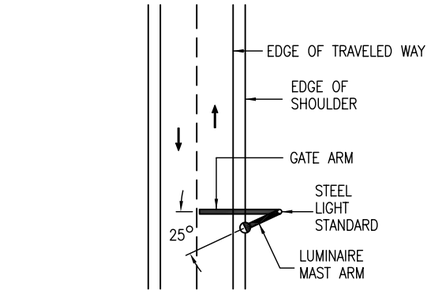
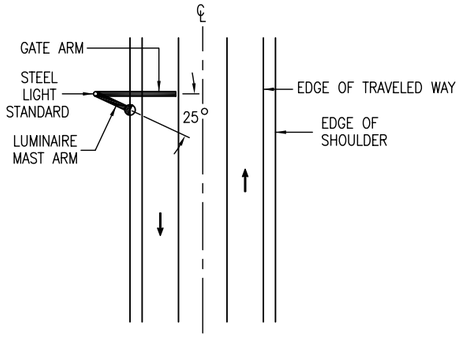
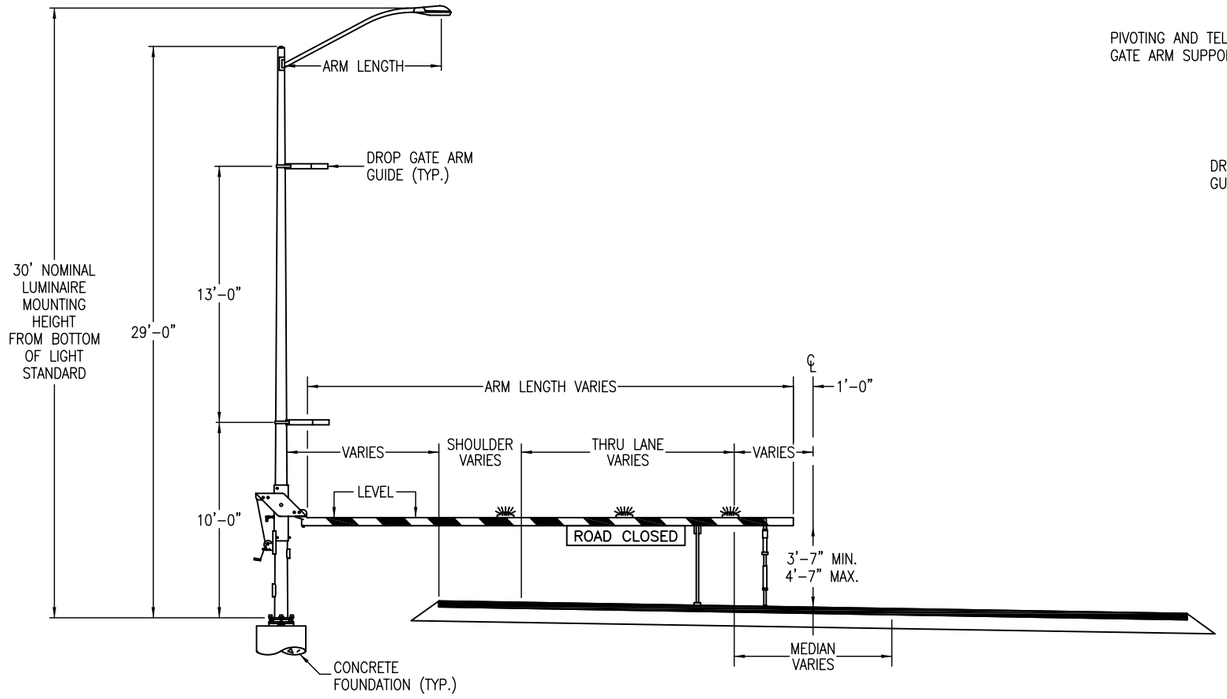
M-607-15
Sheet No. 1 of 9



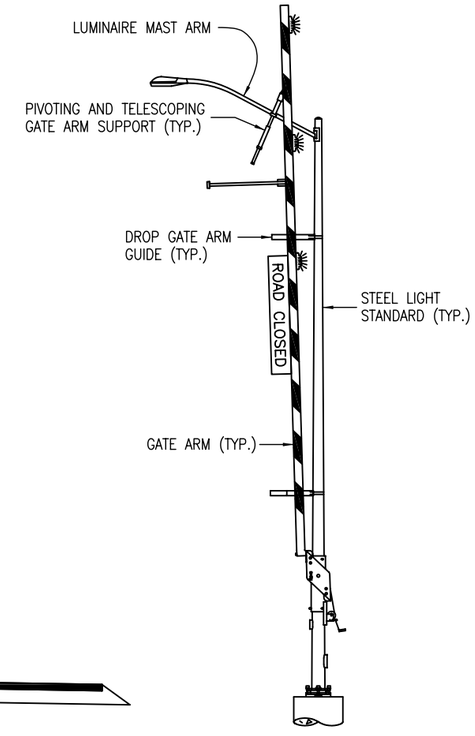
TWO–WAY HIGHWAY
(ONE GATE REQUIRED)



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



TYPICAL LOWERED POSITION



TYPICAL RAISED POSITION

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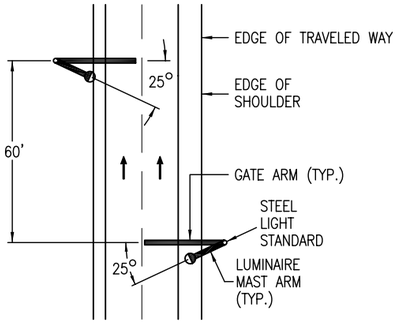
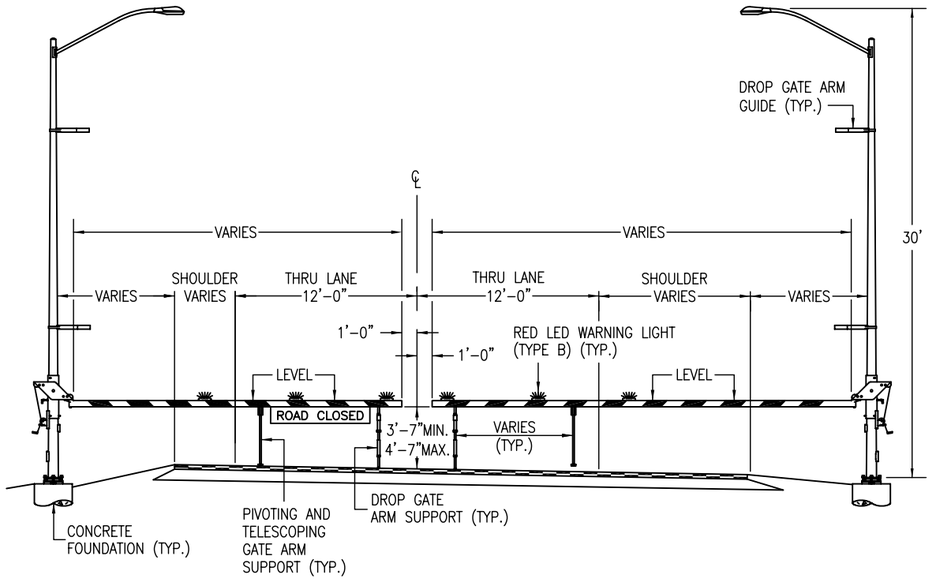
STANDARD PLAN NO.
M-607-15
Sheet No. 2 of 9



DIVIDED HIGHWAY INSTALLATION

(TWO GATES REQUIRED)



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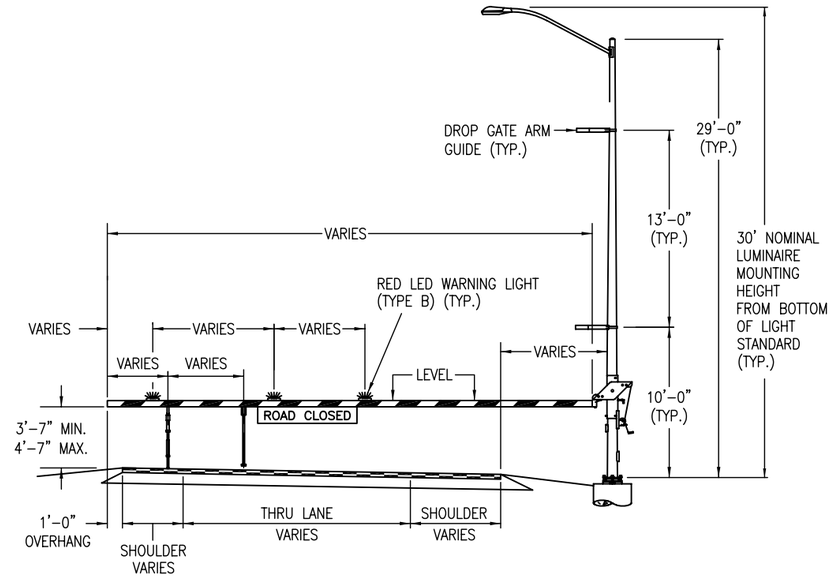

LUMINAIRE AND GATE

(RAMP LOCATIONS)

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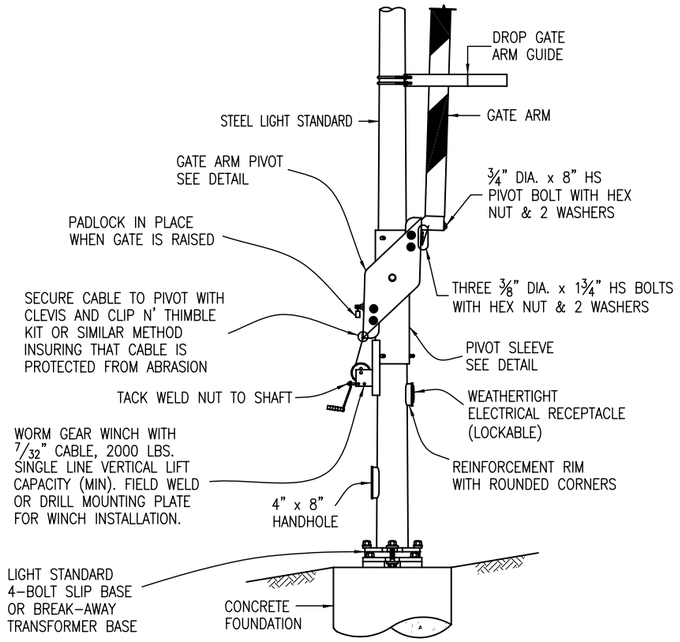

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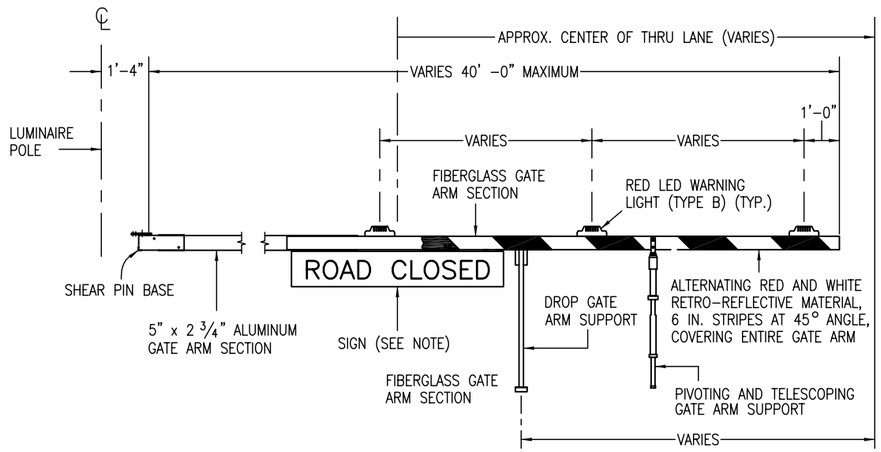
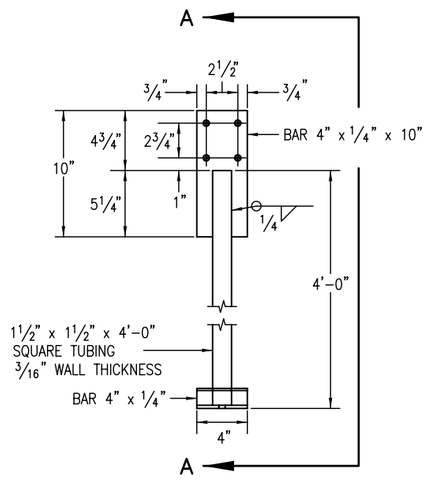


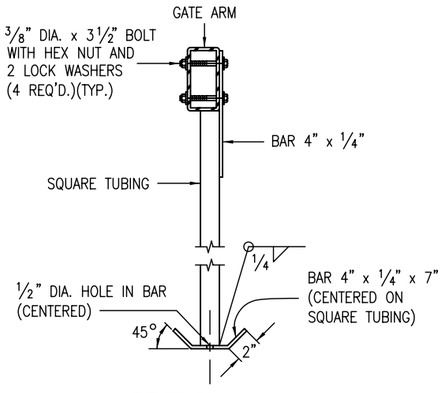
DROP GATE DETAIL

NOTE: PLACE THE "ROAD CLOSED" SIGN ON CENTER OF THE THROUGH LANE. THE SIGN IS BLACK AND WHITE.



DROP GATE ARM SUPPORT DETAIL

GATE ARM AND BOLTS NOT SHOWN.



SECTION A–A

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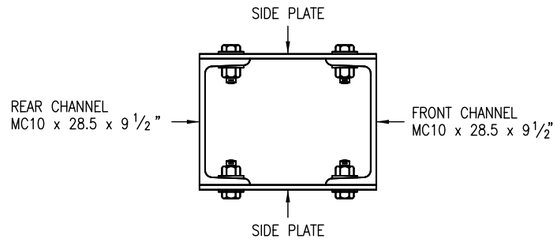
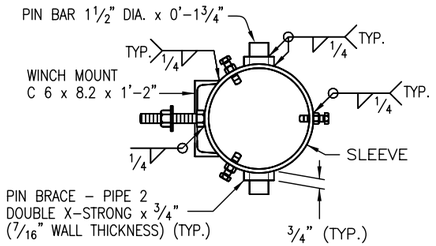
STANDARD PLAN NO.
M-607-15
Sheet No. 4 of 9



TOP VIEW



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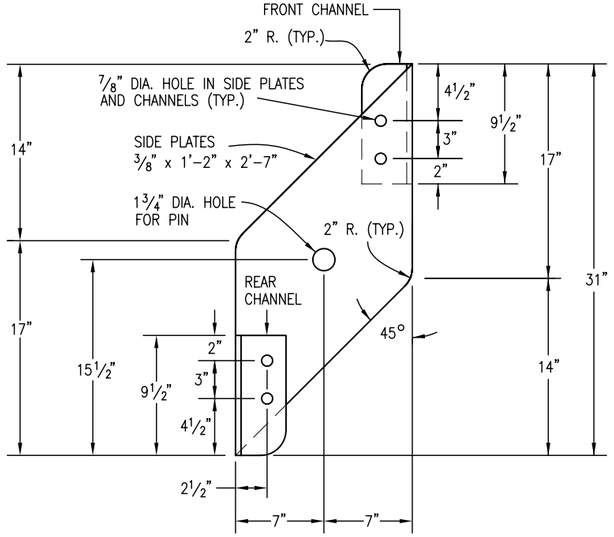

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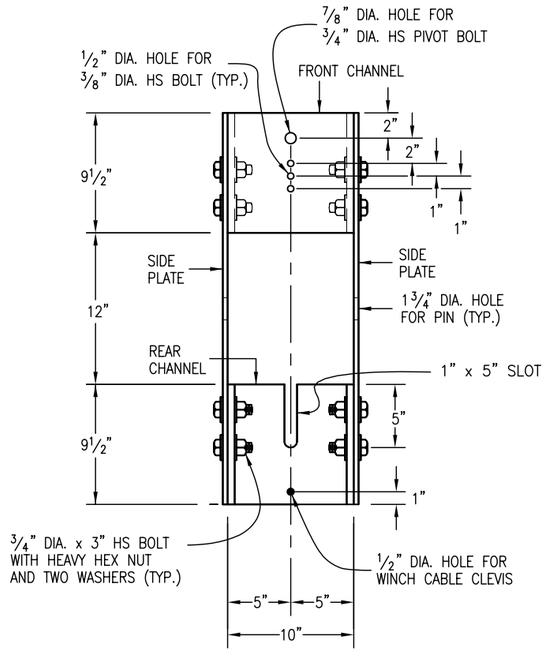
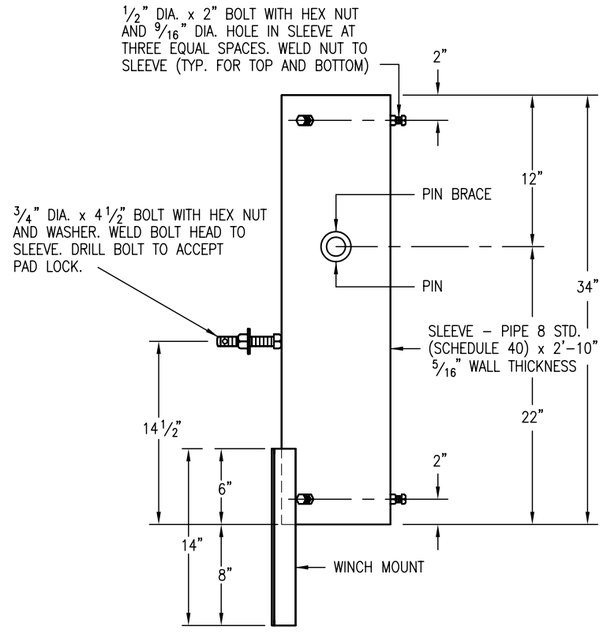


FRONT VIEW

GATE ARM PIVOT SIDE PLATE DETAIL



SIDE VIEW

PIVOT SLEEVE DETAIL

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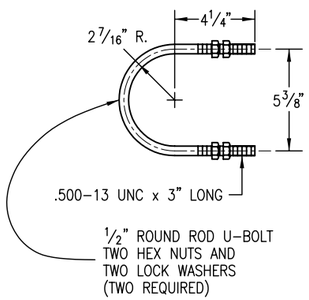
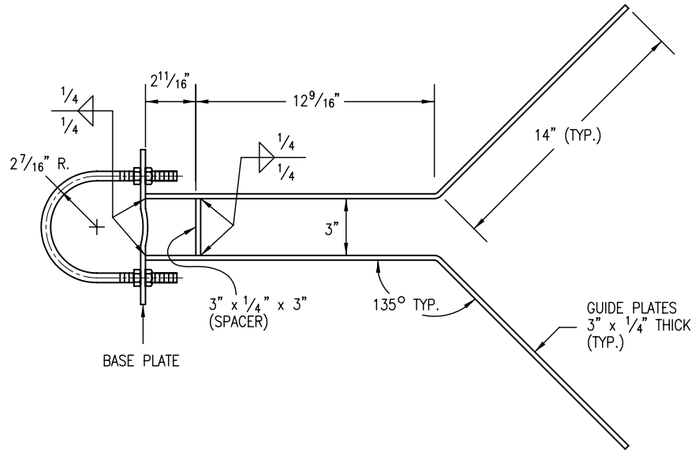
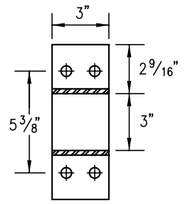
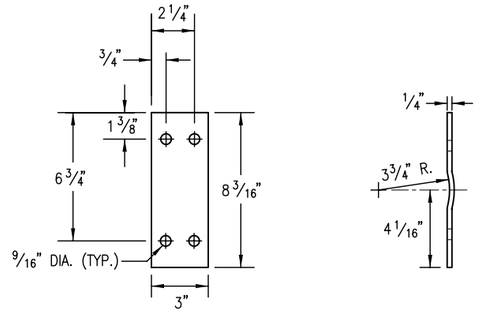


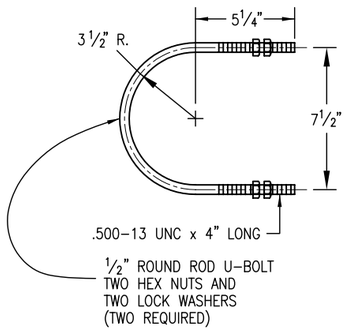


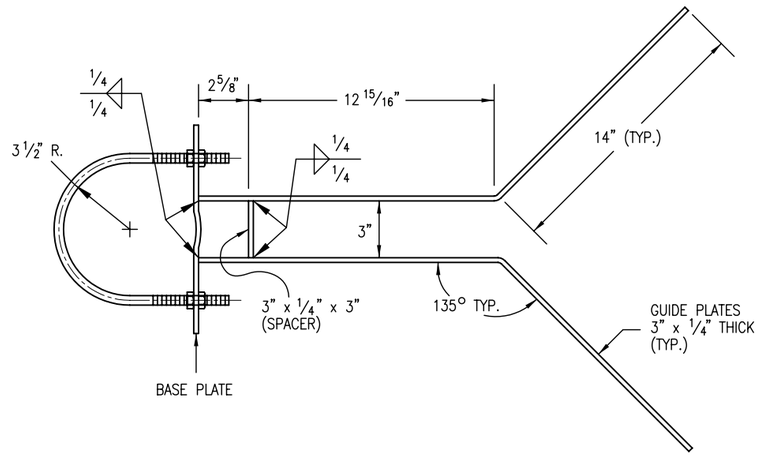
TOP GATE ARM GUIDE



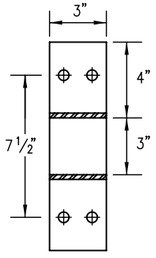


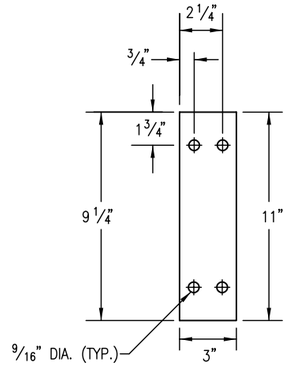
TOP BASE PLATE DETAILS

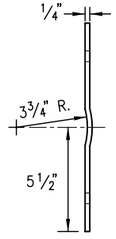




BOTTOM GATE ARM GUIDE







BOTTOM BASE PLATE DETAILS

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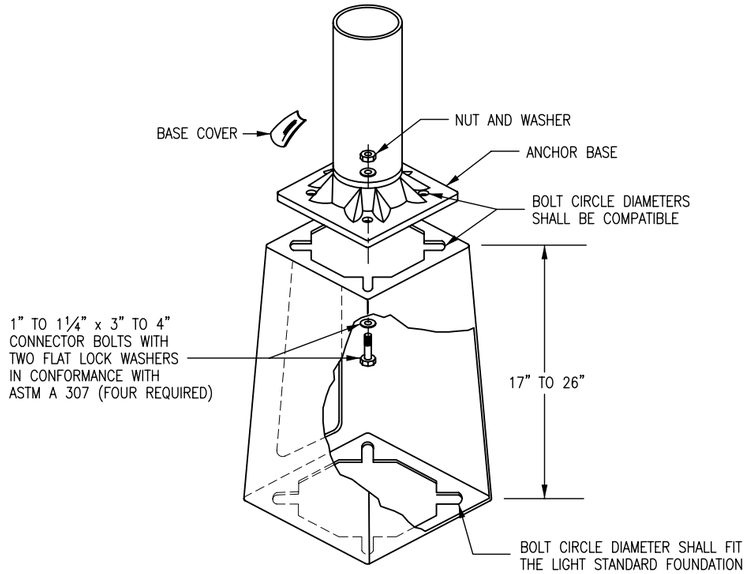
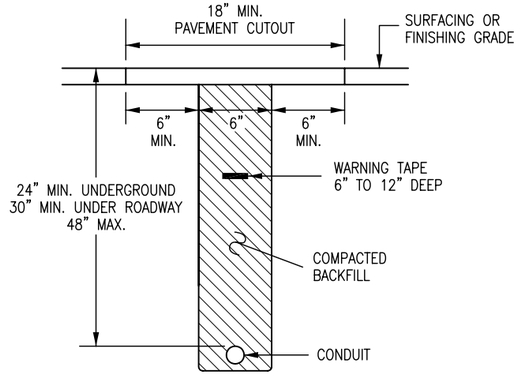
STANDARD PLAN NO.
M-607-15
Sheet No. 6 of 9



TYPICAL BREAK–AWAY TYPE TRANSFORMER BASE DETAIL

NOTES:

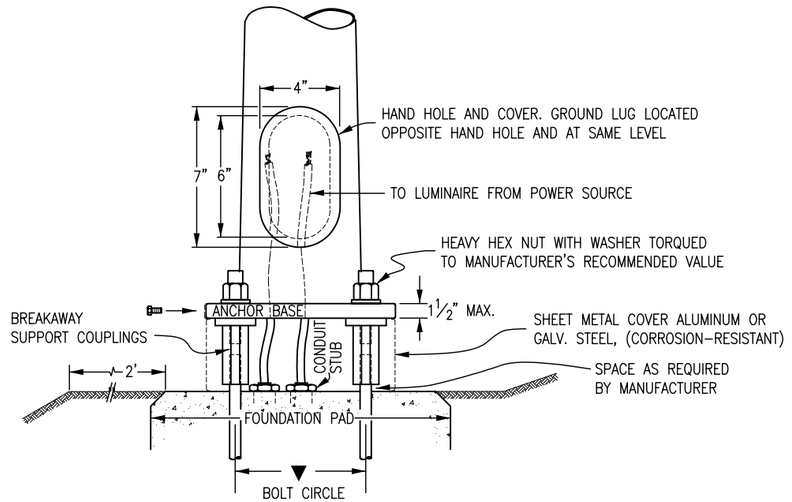
1. HARDWARE SHALL CONFORM TO MANUFACTURER'S REQUIREMENTS.
2. A HAND HOLE IS NOT REQUIRED IN POLE IF A BREAK–AWAY TRANSFORMER BASE IS USED.



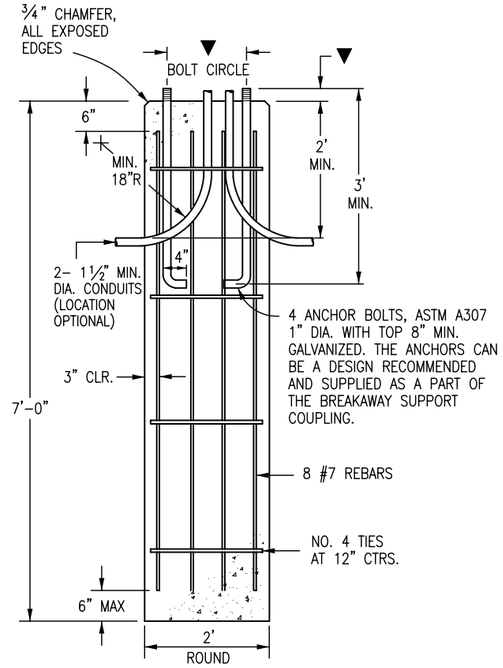
TYPICAL CONDUIT BURIAL SECTION

NOTES:

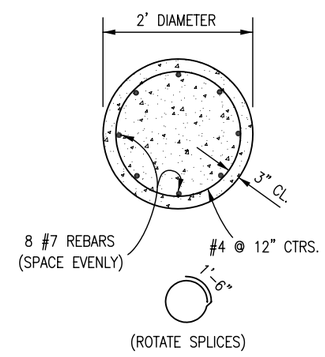
1. THE CONTRACTOR SHALL COORDINATE TRENCHING WITH OTHER UNDERGROUND UTILITIES, RAMP METERING, AND IRRIGATION. THE CONTRACTOR SHALL USE COMMON TRENCHES AT ALL ROAD CROSSINGS WHERE POSSIBLE.
2. ONE #14 AWG LOCATE WIRE AND A NYLON PULL STRING IN ALL EMPTY CONDUITS.



BREAK–AWAY SUPPORT COUPLING



TYPICAL CONCRETE FOUNDATION



TYPICAL FOUNDATION SECTION

FOUNDATION NOTES

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

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

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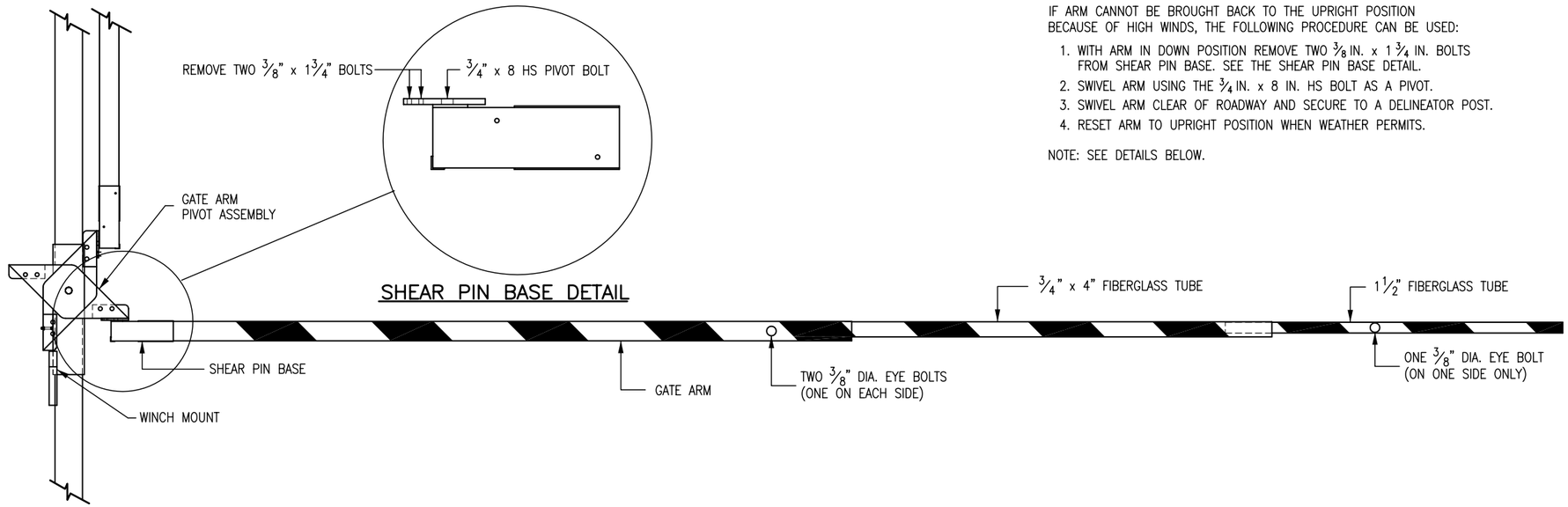
STANDARD PLAN NO.
M-607-15
Sheet No. 7 of 9

HIGH WIND STOWING PROCEDURE

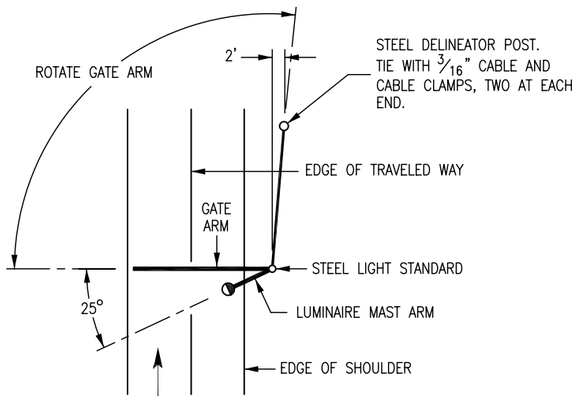
IF ARM CANNOT BE BROUGHT BACK TO THE UPRIGHT POSITION BECAUSE OF HIGH WINDS, THE FOLLOWING PROCEDURE CAN BE USED:

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

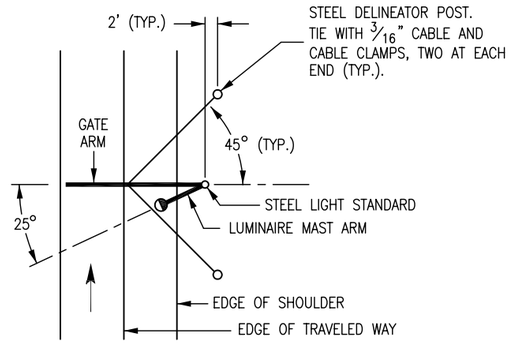
NOTE: SEE DETAILS BELOW.



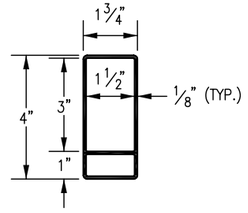
GATE ARM PROFILE



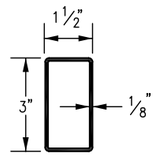
DETAIL FOR HIGH WIND STOW POSITION



DETAIL TO SECURE GATE IN HIGH WIND



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



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

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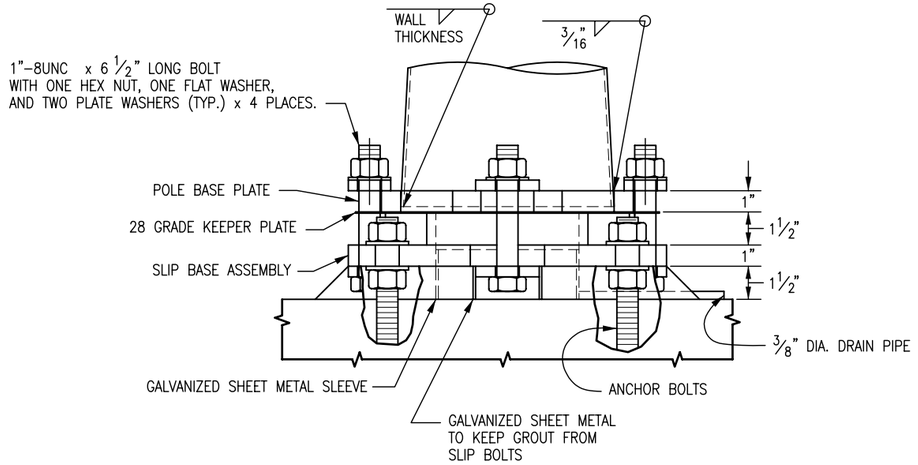
STANDARD PLAN NO.
M-607-15
Sheet No. 8 of 9



BREAK–AWAY BASE
(FOR INFORMATION ONLY)

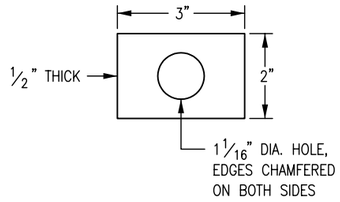
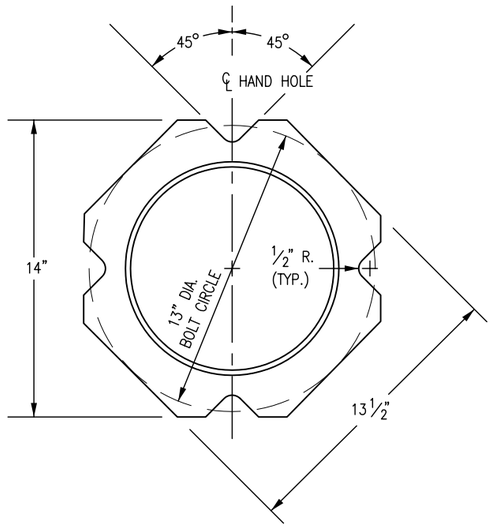


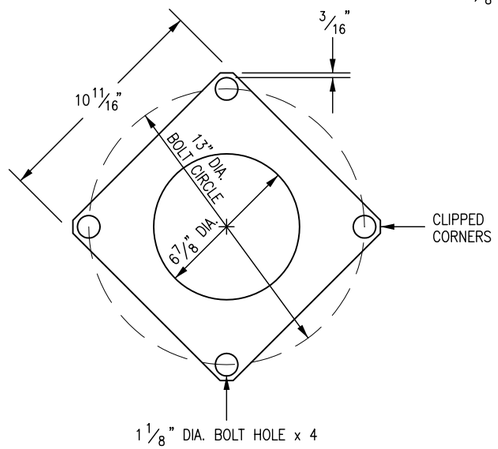
PLATE WASHER

NOTES

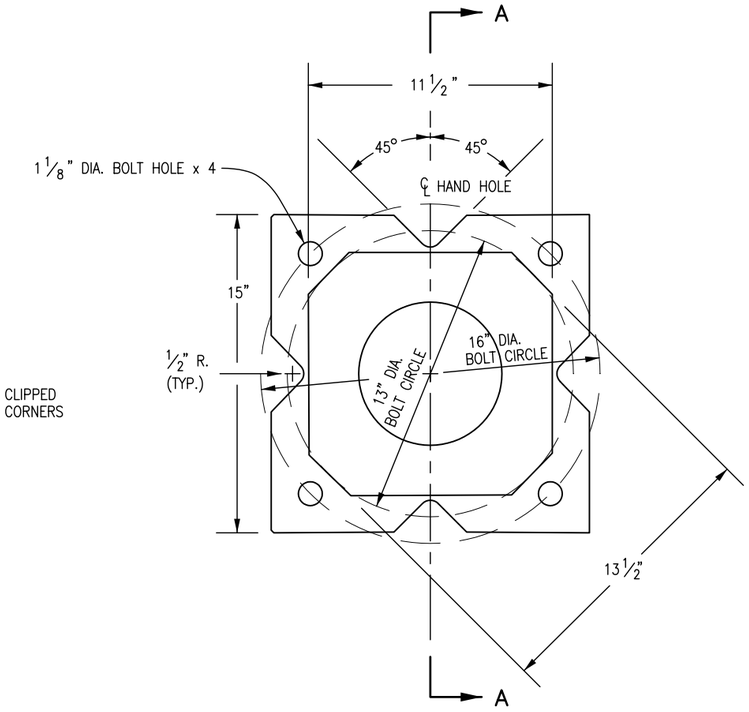
1. POLE BASE PLATE SHALL CONFORM TO ASTM A 572, GRADE 42.
2. BOTTOM PLATE OF SLIP BASE ASSEMBLY SHALL CONFORM TO ASTM A 572, GRADE 50.
3. ALL STRUCTURAL STEEL SHALL BE GALVANIZED AFTER FABRICATION IN CONFORMANCE WITH ASTM A 123. ALL CONTACT AREAS OF THE STRUCTURAL STEEL SHALL BE FREE OF GALVANIZING BEADS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



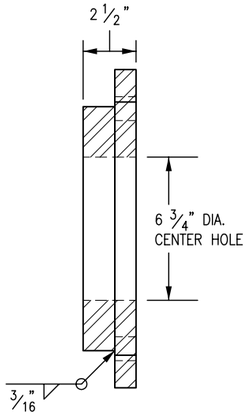
LIGHT STANDARD BASE PLATE



28 GRADE KEEPER PLATE



SLIP BASE ASSEMBLY



SECTION A–A

OPTIONAL BREAK–AWAY TYPE BASE

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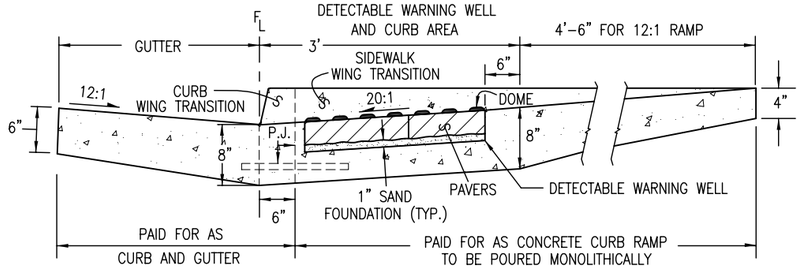
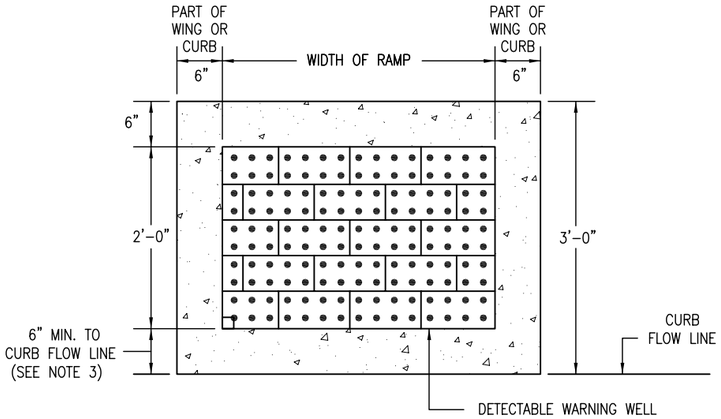
STANDARD PLAN NO.
M-607-15
Sheet No. 9 of 9



DETAIL FOR TYPES 1 AND 3 CURB RAMPS

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

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

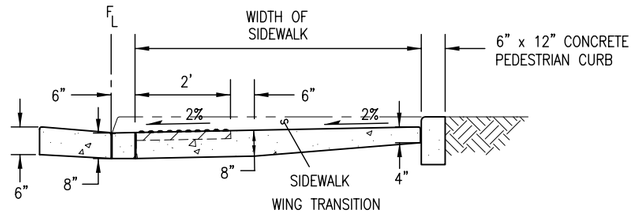


PLAN VIEW OF DETECTABLE WARNING AND WELL

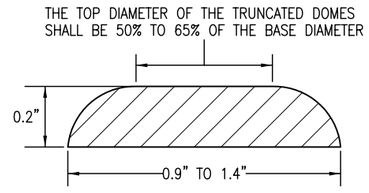
(PAVERS NOT DRAWN TO SCALE)

GENERAL NOTES

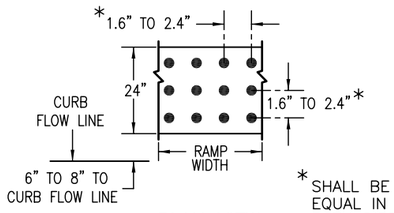
1. THE DETECTABLE WARNINGS SHALL BE INSTALLED AT SIDEWALK/STREET TRANSITIONS. THEY SHALL BE MADE OF PAVERS WITH A TRUNCATED DOME SURFACE. THE DOMES SHALL BE PLACED IN A SQUARE GRID.
2. THE TOP OF THE DRAINAGE WEEP HOLE SHALL BE LOCATED AT THE LOWEST POINT OF THE DETECTABLE WARNING WELL.
3. ALL DETECTABLE WARNING AREAS SHALL START A MINIMUM OF 6 IN. FROM THE FLOW LINE OF THE CURB AND NOT BE MORE THAN A MAXIMUM OF 8 IN. FROM ANY POINT ON THE FLOW LINE OF THE CURB. ALL DETECTABLE WARNING AREAS SHALL BE 2 FT. IN LENGTH AND COVER THE COMPLETE WIDTH OF THE RAMP AREA ONLY.
4. THE DETECTABLE WARNING AREA SHALL BE INCLUDED IN THE BID PRICE FOR THE CONCRETE CURB RAMP.
5. RAMP SLOPES SHALL BE 12:1 OR FLATTER. THE DETECTABLE WARNING AND WELL AREA SLOPES SHALL BE 20:1 OR FLATTER.



DETAIL FOR TYPE 2 CURB RAMP

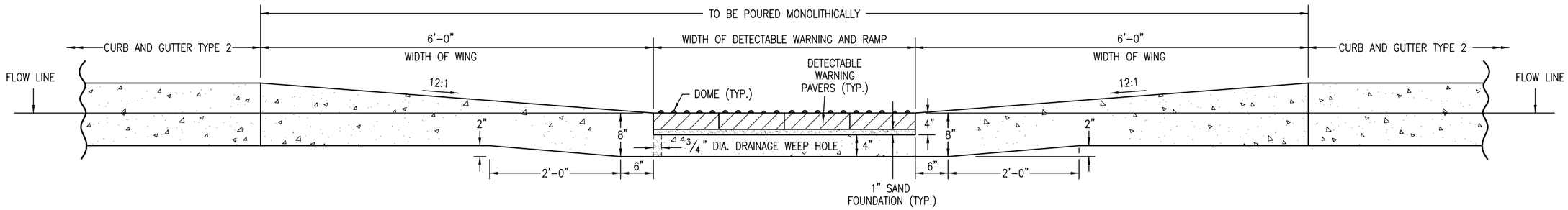


ELEVATION VIEW



PLAN VIEW

DOME AND DETECTABLE WARNING DETAILS



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

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CURB RAMPS

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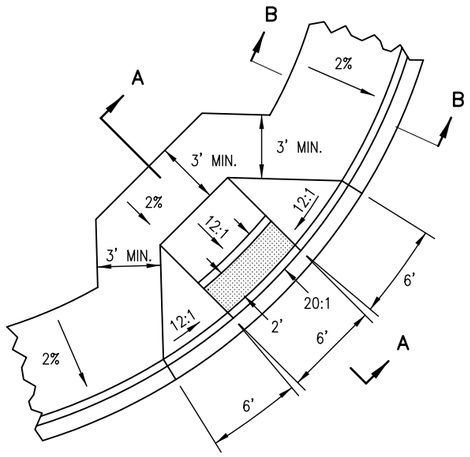
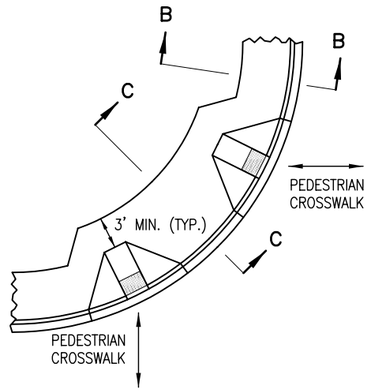
STANDARD PLAN NO.
M-608-1
Sheet No. 1 of 4



SIDEWALK RAMP TYPE 1A



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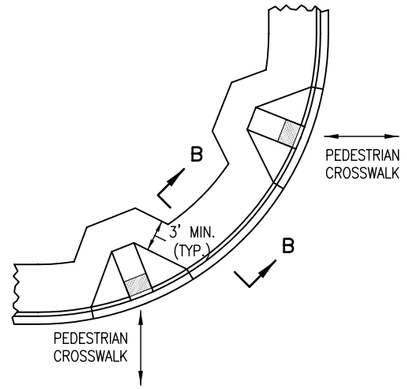

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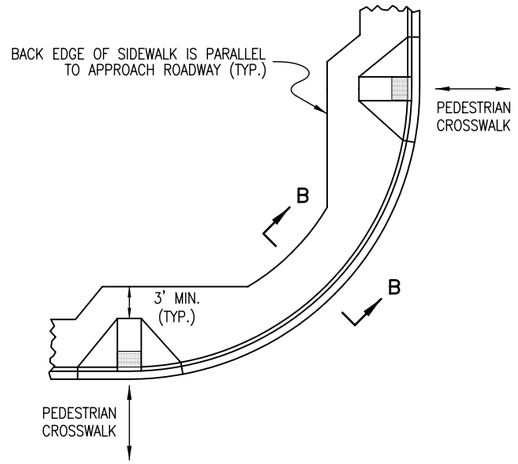

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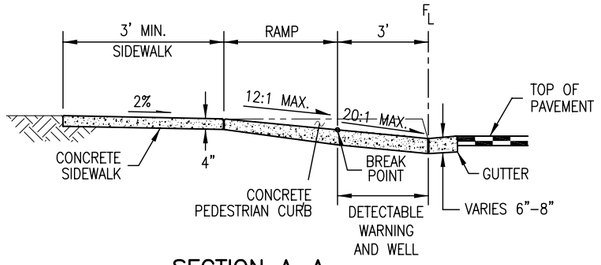
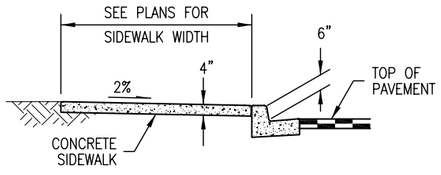


SECTION A–A



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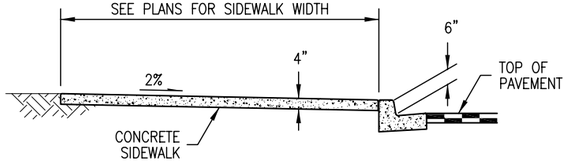
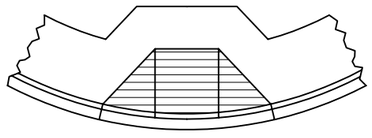


SECTION C–C

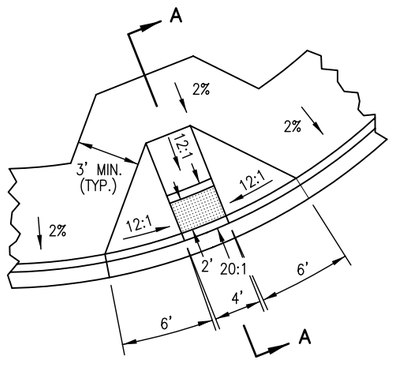
NOTES

1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE RAMP ACCESS AREAS.
2. RAMP SLOPES SHALL BE 12:1 OR FLATTER. THE DETECTABLE WARNING AND WELL AREA SLOPES SHALL BE 20:1 OR FLATTER.



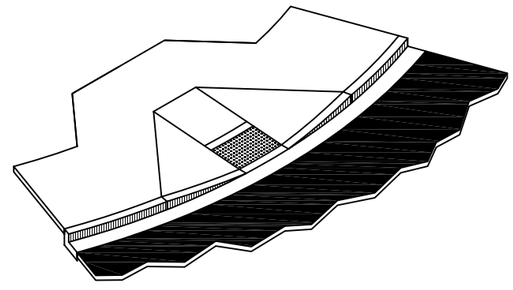
RAMP PAY AREA

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



RAMP DETAIL

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



ISOMETRIC VIEW

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CURB RAMPS

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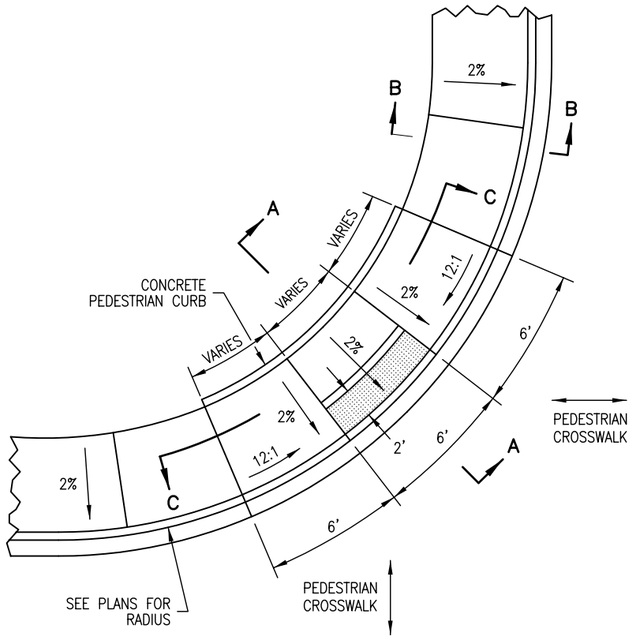
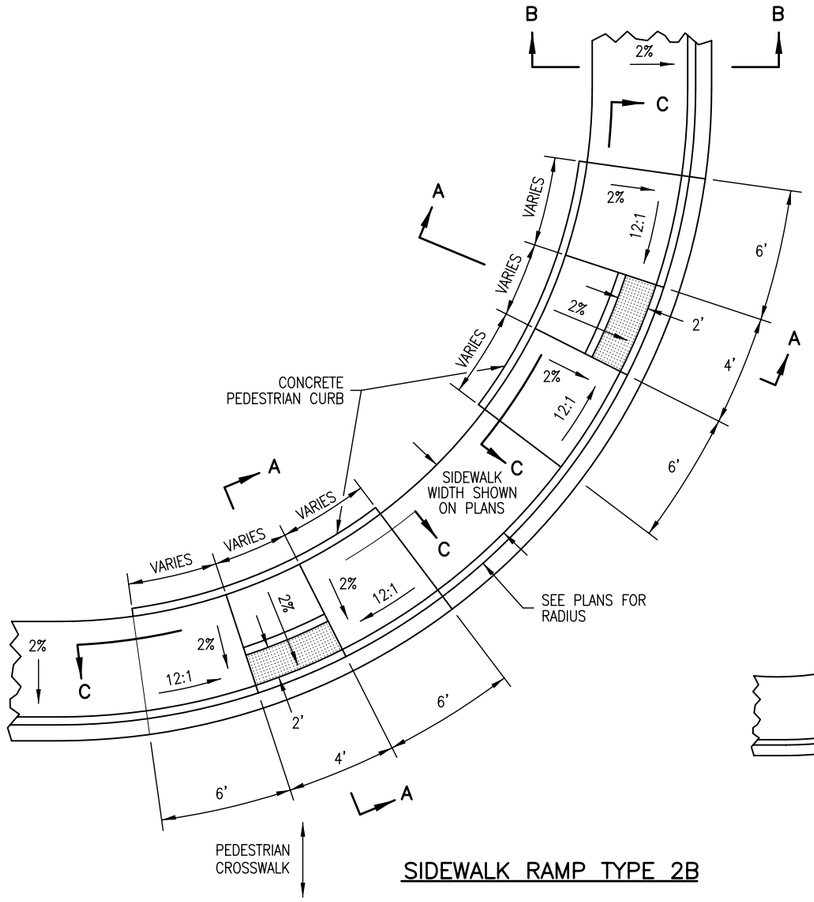
STANDARD PLAN NO.
M-608-1
Sheet No. 2 of 4

NOTES

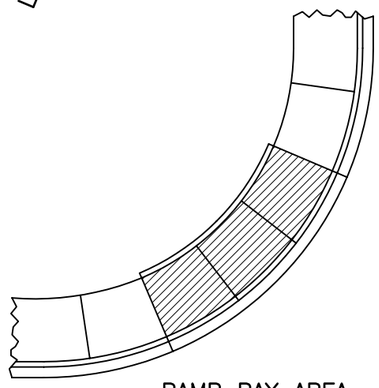
1. MINIMUM SIDEWALK WIDTH IS 3 FT.
2. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE RAMP ACCESS AREAS.
3. RAMP SLOPES SHALL BE 12:1 OR FLATTER. THE DETECTABLE WARNING AND WELL AREA SLOPES SHALL BE 20:1 OR FLATTER.
4. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE CURB RAMP.
5. SIDEWALK RAMP TYPE 2A MAY BE USED IN MID-BLOCK.



SIDEWALK RAMP TYPE 2A

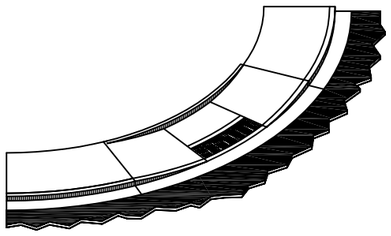


SIDEWALK RAMP TYPE 2B

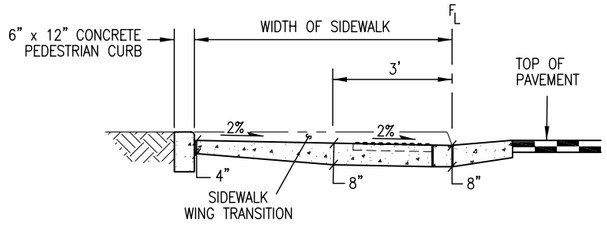


RAMP PAY AREA

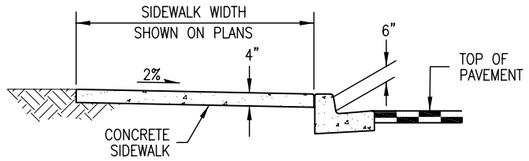
FOR SIDEWALK RAMP TYPES 2A AND 2B.



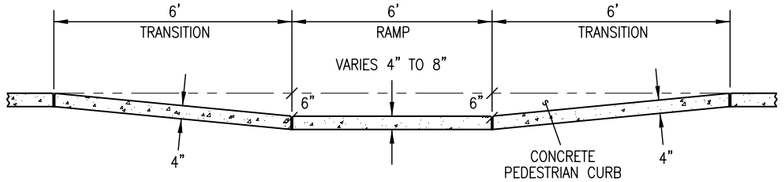
ISOMETRIC VIEW



SECTION A–A



SECTION B–B



SECTION C–C

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CURB RAMPS

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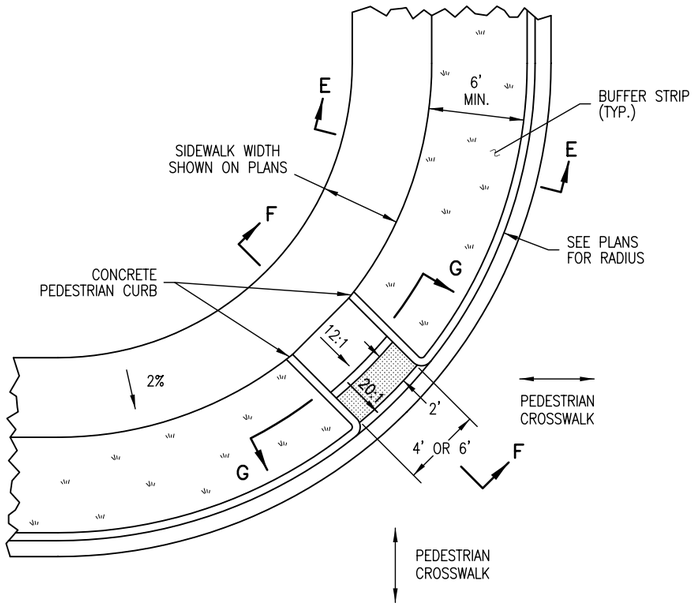
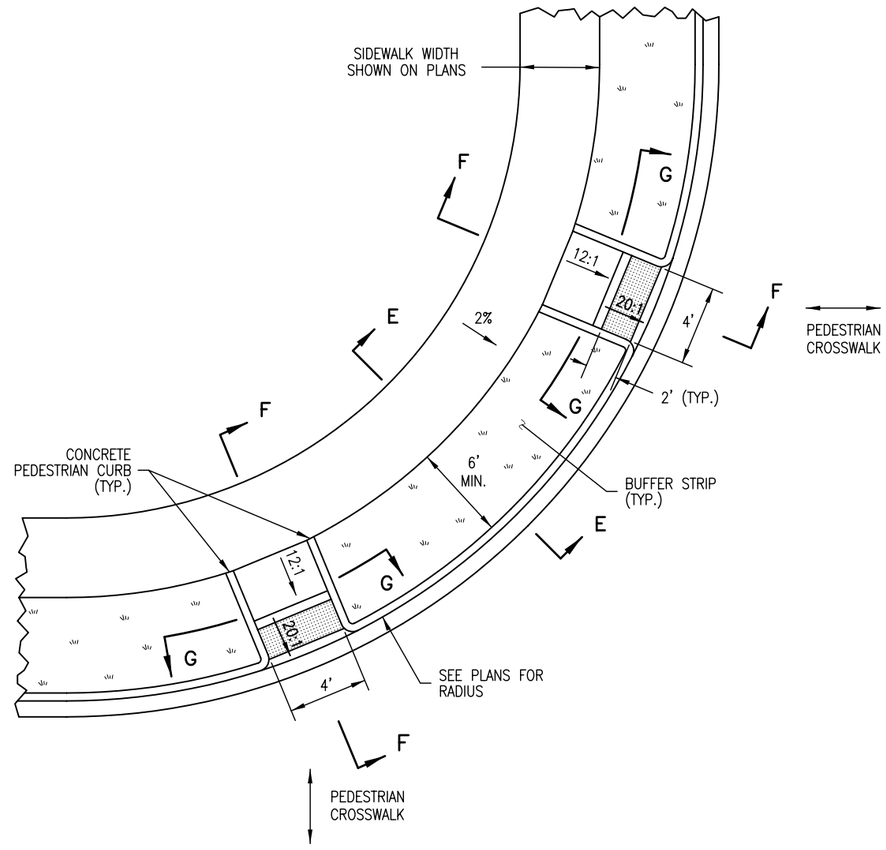
STANDARD PLAN NO.
M-608-1
Sheet No. 3 of 4



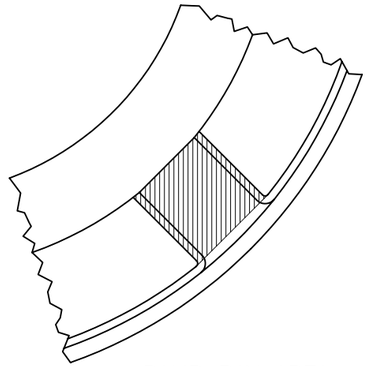
SIDEWALK RAMP TYPE 3A



SIDEWALK RAMP TYPE 3B

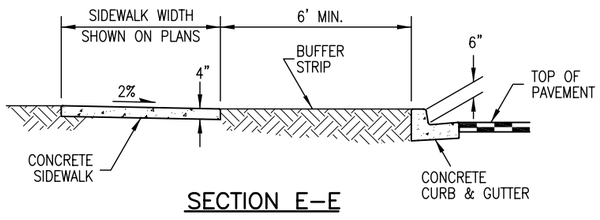
NOTES

1. DRAINAGE STRUCTURES, TRAFFIC SIGNAL EQUIPMENT, JUNCTION BOXES, AND OTHER OBSTRUCTIONS SHOULD NOT BE PLACED IN FRONT OF THE RAMP ACCESS AREAS.
2. RAMP SLOPES SHALL BE 12:1 OR FLATTER. THE DETECTABLE WARNING AND WELL AREA SLOPES SHALL BE 20:1 OR FLATTER.
3. CONSTRUCTION OF THE CONCRETE PEDESTRIAN CURB SHALL BE INCLUDED IN THE BID PRICE OF THE CONCRETE CURB RAMP.
4. SIDEWALK RAMP TYPE 3A MAY BE USED IN MID–BLOCK.

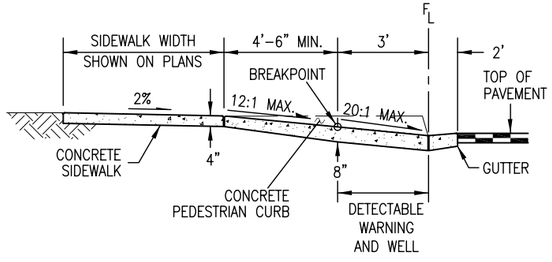


RAMP PAY AREA

FOR SIDEWALK RAMP TYPES 3A AMD 3B.



SECTION E–E



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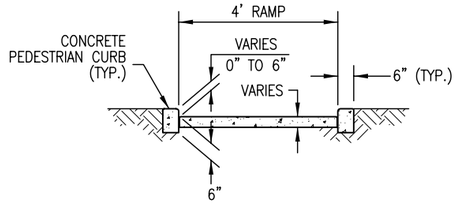
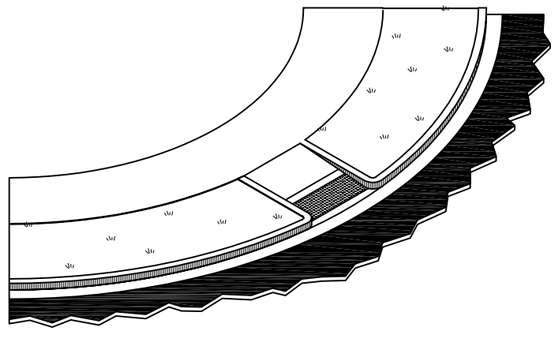


SECTION G–G



ISOMETRIC VIEW

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CURB RAMPS

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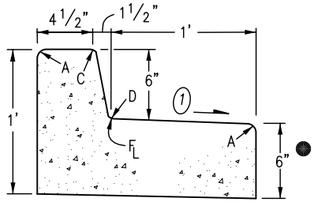
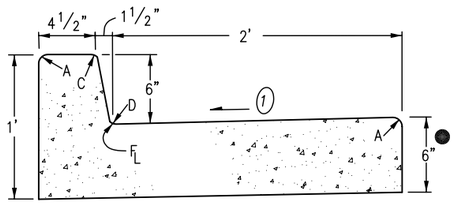
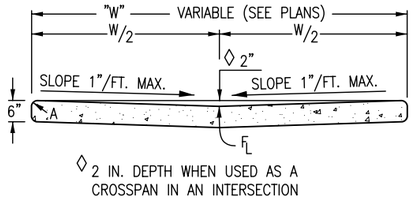
STANDARD PLAN NO.
M-608-1
Sheet No. 4 of 4



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)



GUTTER TYPE 2

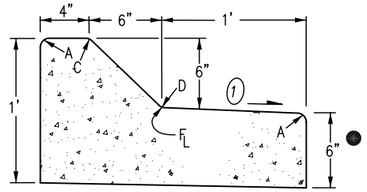
GENERAL NOTES

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) IF 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.

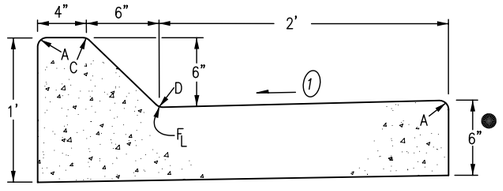
▲ EXPANSION JOINTS SHALL BE INSTALLED WHEN ABUTTING EXISTING CONCRETE OR FIXED STRUCTURE. EXPANSION JOINT MATERIAL SHALL BE 1/2 IN. THICK AND SHALL EXTEND THE FULL DEPTH OF CONTACT SURFACE.

(1) GUTTER CROSS SLOPES SHALL BE 1/2 IN./FT. WHEN DRAINING AWAY FROM CURB AND 1IN./FT. WHEN DRAINING TOWARD CURB.

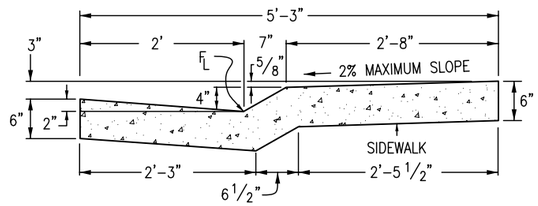
● WHEN TIE BARS ARE REQUIRED, THE GUTTER THICKNESS SHALL BE INCREASED TO THE PAVEMENT THICKNESS (T). BARS SHALL BE EPOXY-COATED #4 CONFORMING TO AASHTO M 284 AND SPACED AT 2 FT.-6 IN. INTERVALS. THEY SHALL BE INSERTED T/2 AND 1/2 LENGTH INTO THE GUTTER.



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

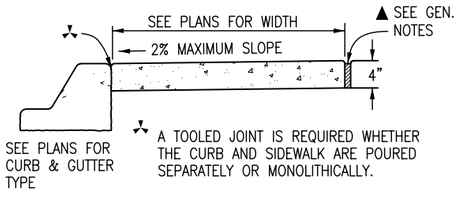


CURB AND GUTTER TYPE 2
(SECTION IIM)
(6 IN. MOUNTABLE – 2 FT. GUTTER)

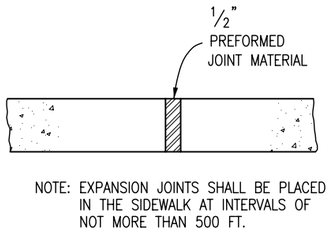


CURB AND GUTTER TYPE 2
(SECTION MS)
(4 IN. MOUNTABLE WITH SIDEWALK)

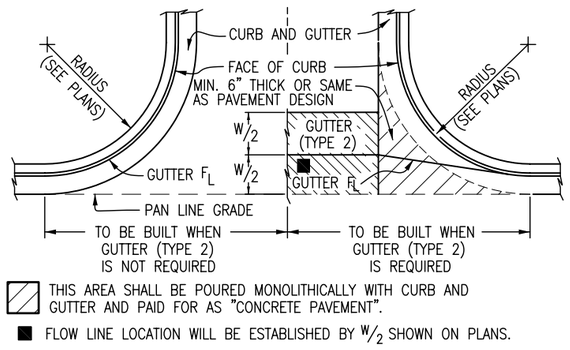
LEGEND FOR RADII
A = 1/8" TO 1/4"
B = 1"
C = 1 1/2"
D = 1 1/2" TO 2"



CONCRETE SIDEWALK



SIDEWALK EXPANSION JOINT



CONSTRUCTION OF CONCRETE
GUTTERS AT INTERSECTION

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Date:	Comments

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CURB, GUTTERS, AND SIDEWALKS

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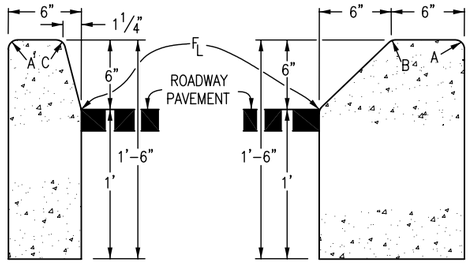
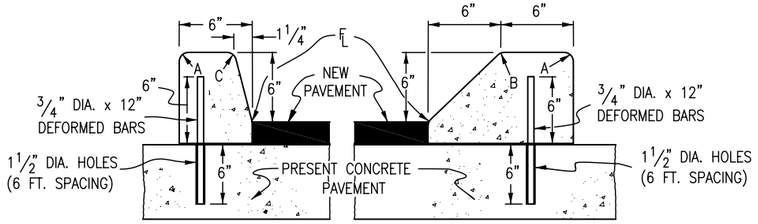
STANDARD PLAN NO.
M-609-1
Sheet No. 1 of 3



CURB TYPE 2
(SECTION B)
6 IN. BARRIER

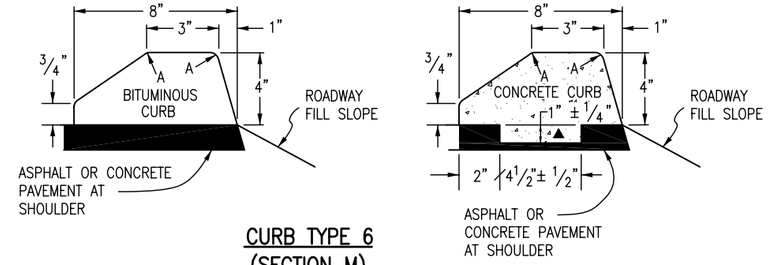
CURB TYPE 2
(SECTION M)
6 IN. MOUNTABLE



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

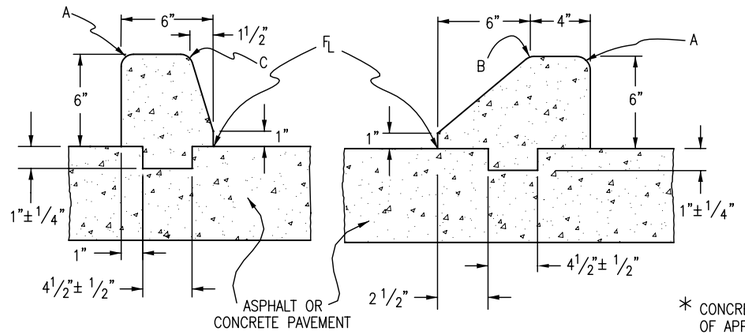
CURB TYPE 4
(SECTION M)
6 IN. MOUNTABLE



CURB TYPE 6
(SECTION M)
4 IN. MOUNTABLE

BITUMINOUS OR CONCRETE (WITH KEY–WAY*) AS SPECIFIED.

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

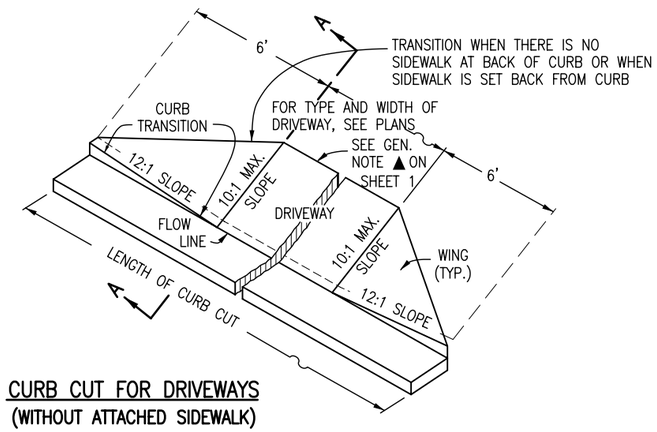


(SECTION B) (SECTION M)

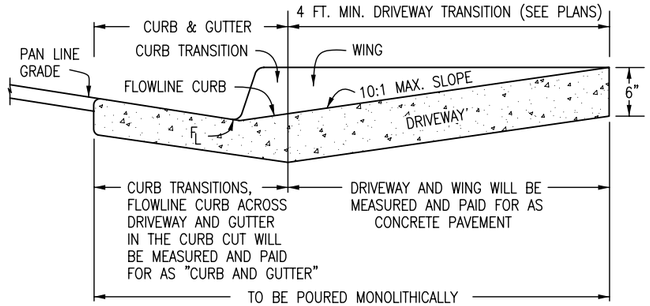
CURB TYPE 4 (KEY–WAY) *

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

* CONCRETE SHALL CONTAIN 1.5 POUNDS PER CUBIC YARD OF APPROVED POLYPROPYLENE FIBERS AND MAY HAVE A NOMINAL AGGREGATE SIZE OF ⅜ IN. THE CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI.

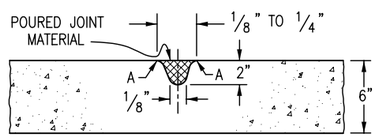


CURB CUT FOR DRIVEWAYS
(WITHOUT ATTACHED SIDEWALK)



SECTION A–A

CONCRETE PAVEMENT (DRIVEWAYS)



TRANSVERSE CONTRACTION JOINT
FOR CONCRETE PAVEMENT (DRIVEWAYS)

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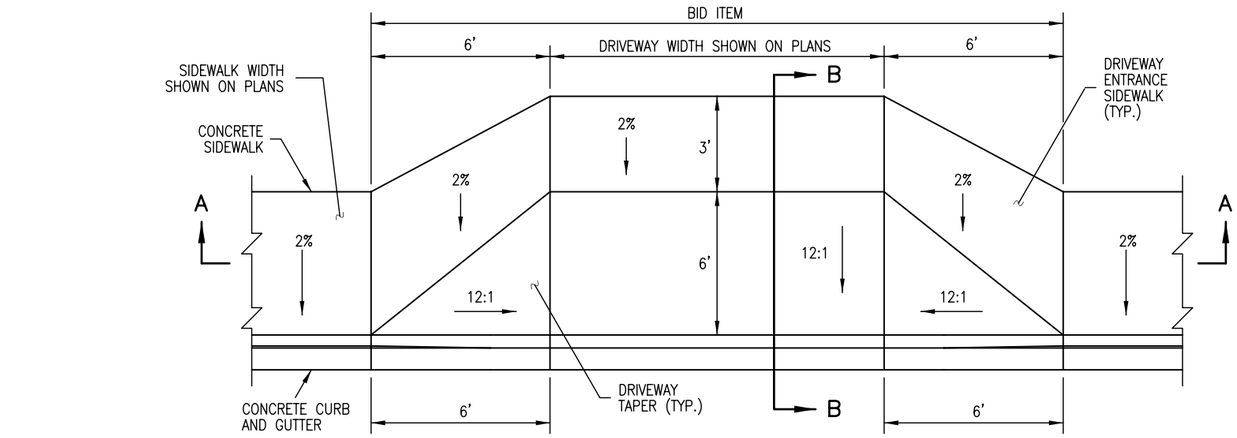
Project Development Branch SRJ/LTA

CURB, GUTTERS, AND SIDEWALKS

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-609-1
Sheet No. 2 of 3



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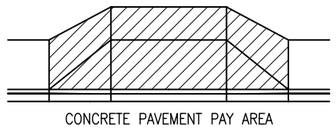

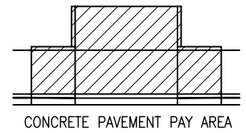

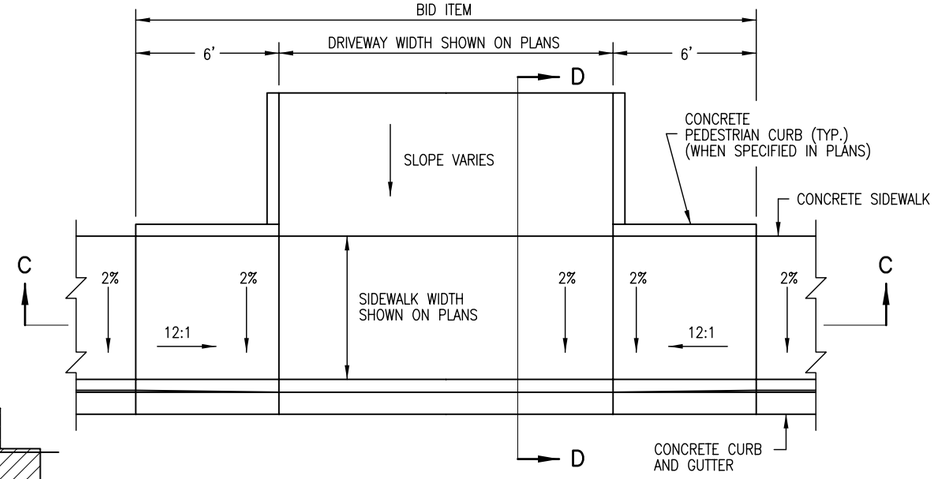

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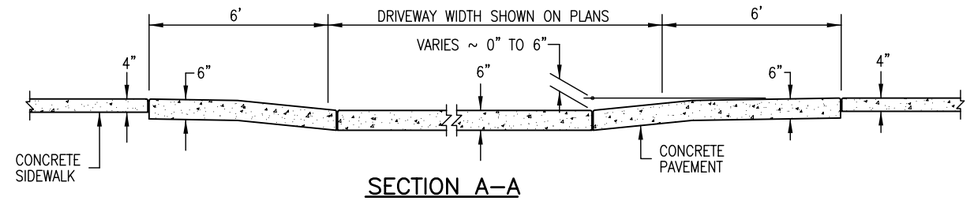

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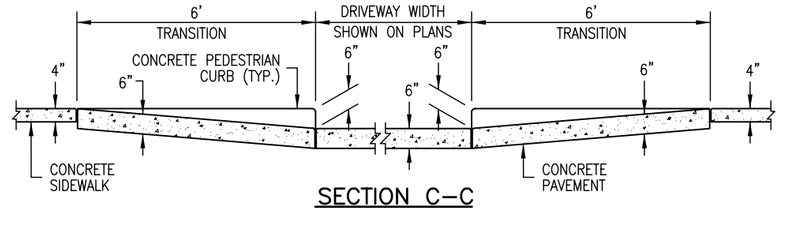

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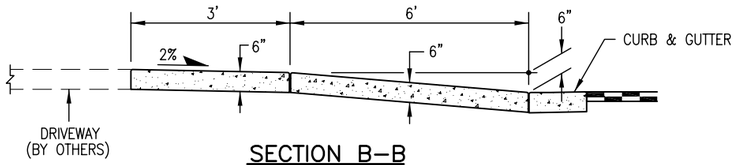

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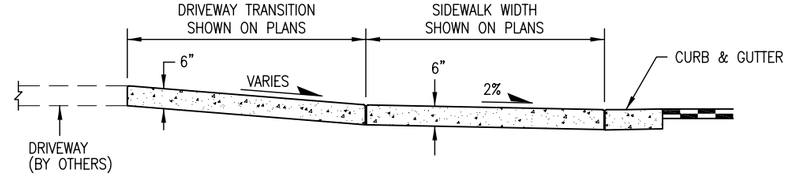

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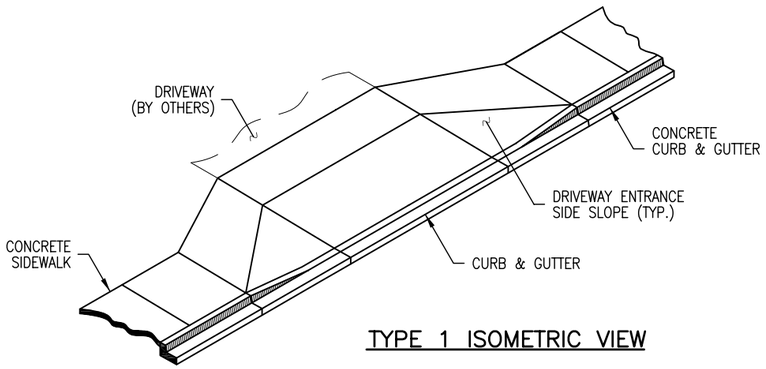
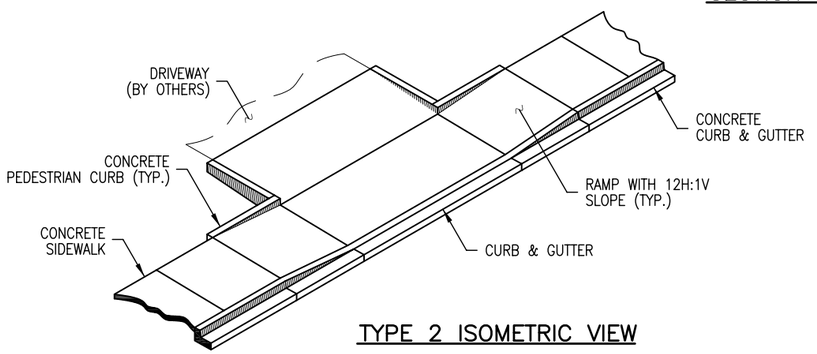


TYPE 1 ISOMETRIC VIEW



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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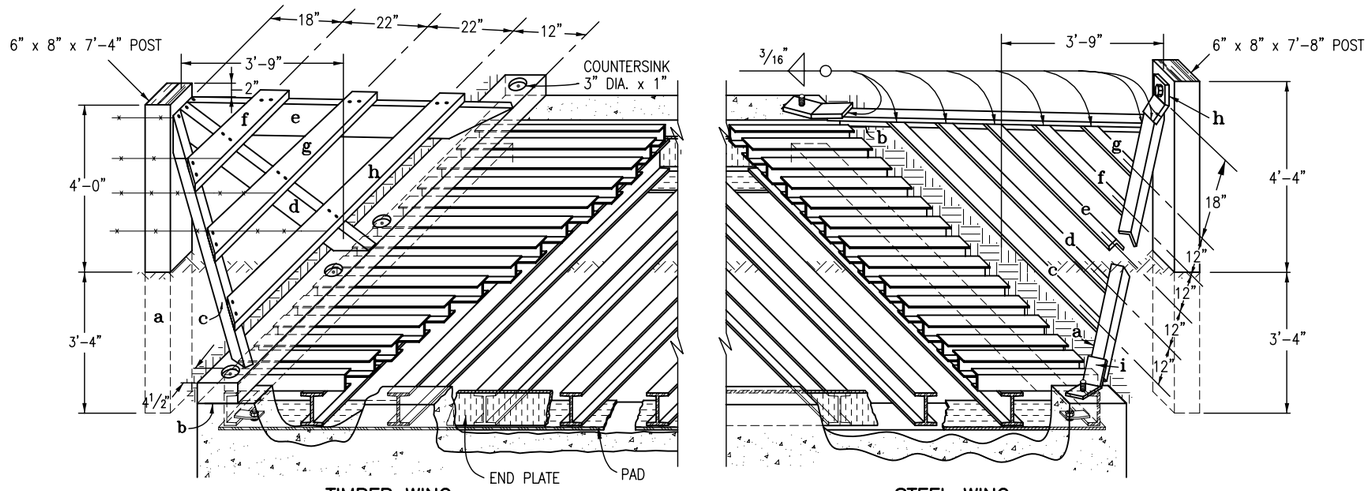
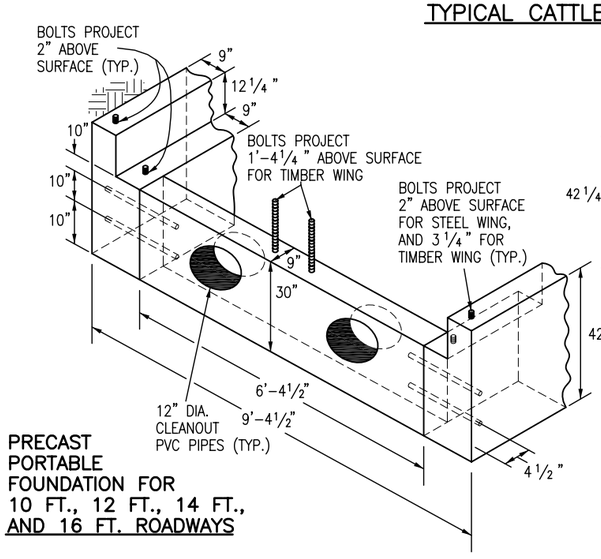
STANDARD PLAN NO.
M-609-1
Sheet No. 3 of 3



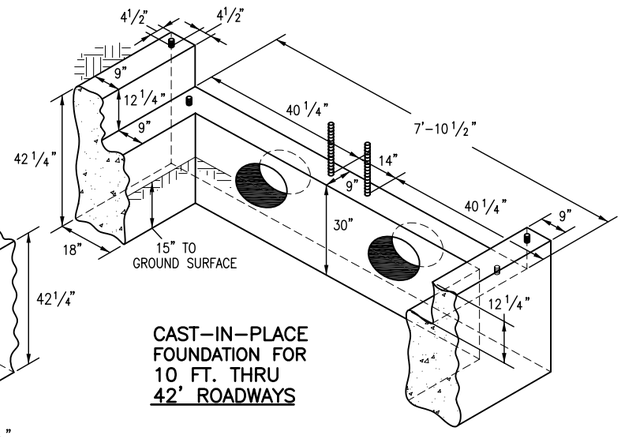
TIMBER WING

STEEL WING

TYPICAL CATTLE GUARD INSTALLATIONS



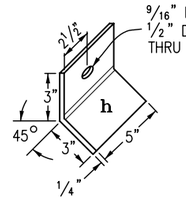
PRECAST PORTABLE FOUNDATION FOR 10 FT., 12 FT., 14 FT., AND 16 FT. ROADWAYS

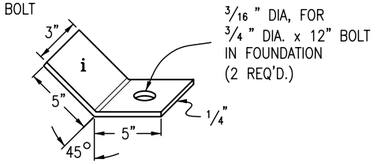


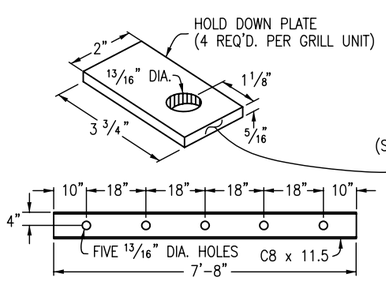
CAST-IN-PLACE FOUNDATION FOR 10 FT. THRU 42' ROADWAYS

GENERAL NOTES

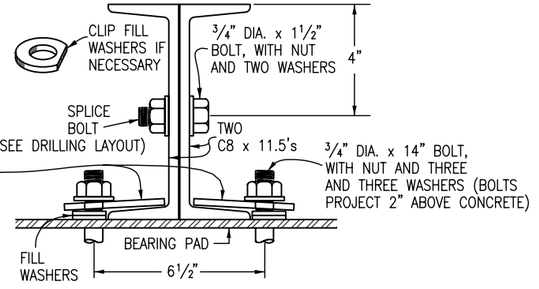
1. CONCRETE SHALL BE CLASS B. FOUNDATION MAY BE CAST-IN-PLACE OR PRECAST.
2. REINFORCING BARS SHALL BE #4, GRADE 60.
3. ALL TIMBER SHALL BE TREATED IN CONFORMANCE WITH ASSHTO M 133 AND AWPA C14.
4. WING POSTS MAY BE MADE FROM 8 IN. ROUND NATIVE TIMBER.
5. ALL STRUCTURAL STEEL SHALL BE FABRICATED AND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



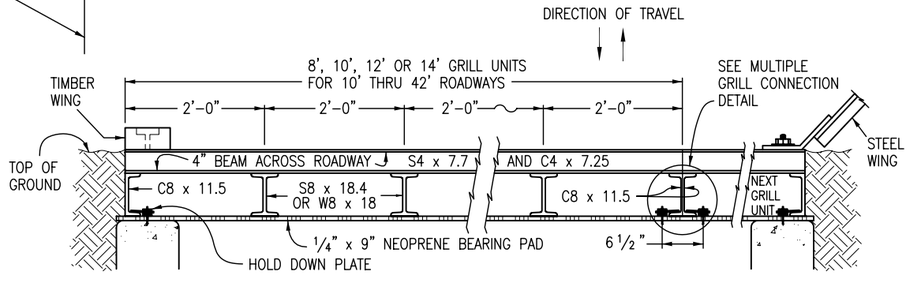




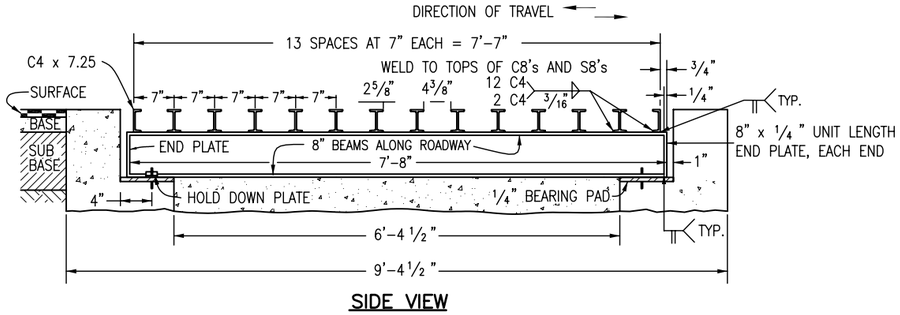
DRILLING LAYOUT



MULTIPLE GRILL UNIT CONNECTION



ELEVATION VIEW



SIDE VIEW

WELDED GRILL CROSS SECTIONS

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CATTLE GUARD

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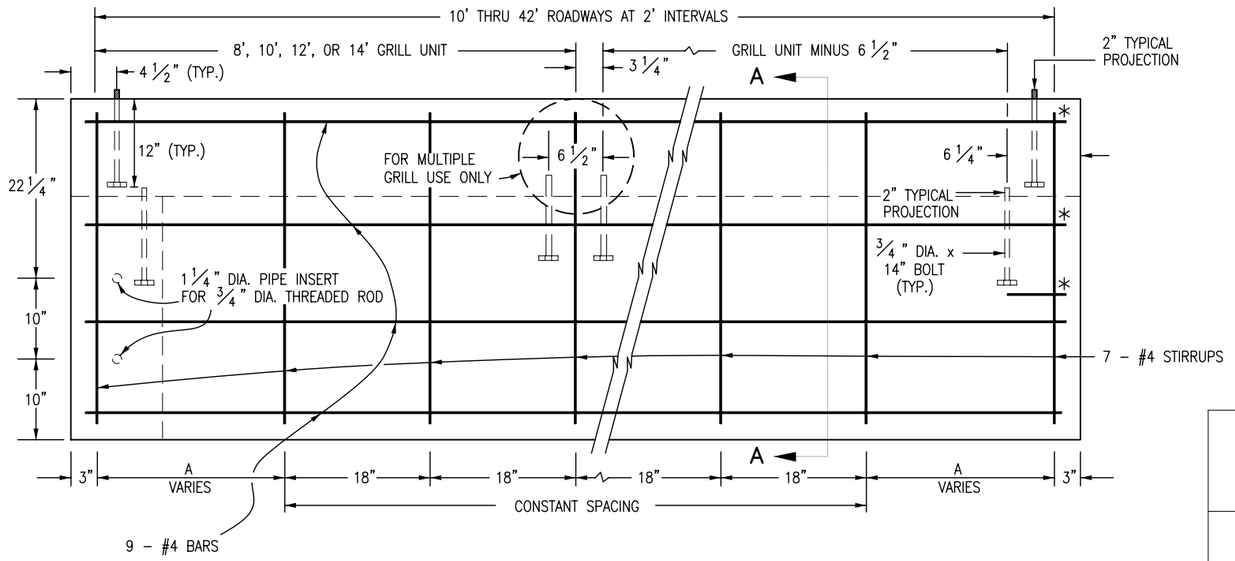
STANDARD PLAN NO.
M-611-1
Sheet No. 1 of 2



PRECAST PORTABLE FOUNDATION

CAST-IN-PLACE FOUNDATION

ELEVATION OF FOUNDATION

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

a – 6" x 8" x 7'-4"
b – 4" x 8" x 9'-4 1/2"
c – 2" x 6" x 6'-7"
d – 2" x 6" x 5'-8"
e – 2" x 6" x 6'-7"
f – 2" x 6" x 2'-5"
g – 2" x 6" x 4'-4"
h – 2" x 6" x 6'-2"
16d NAILS (GALV.) – 2 LB.

ONE TIMBER WING

a – 2" x 2" x 1/4" x 79" **b** – 2" x 2" x 1/4" x 79" **c** – 2" x 2" x 1/4" x 84"	63.26 LBS.
d – 1 1/2" x 1 1/2" x 1/4" x 69" **e** – 1 1/2" x 1 1/2" x 1/4" x 55" **f** – 1 1/2" x 1 1/2" x 1/4" x 40" **g** – 1 1/2" x 1 1/2" x 1/4" x 25"	36.86 LBS.
h – 5" x 6" x 1/4" x BAR – 2.13 LBS.	
i – TWO 3" x 10" x 1/4" x BARS – 4.25 LBS.	
6" x 8" x 7'-8" TIMBER POST	———
TOTAL LBS. STEEL = ~ 106.5	

ONE STEEL WING

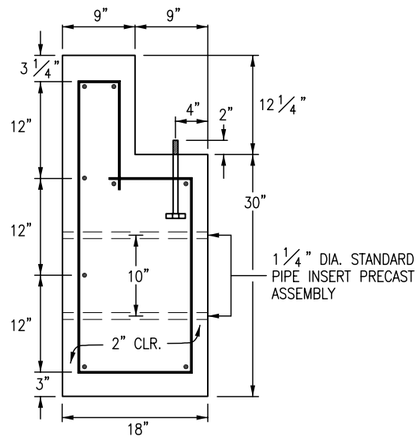
WING QUANTITIES

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

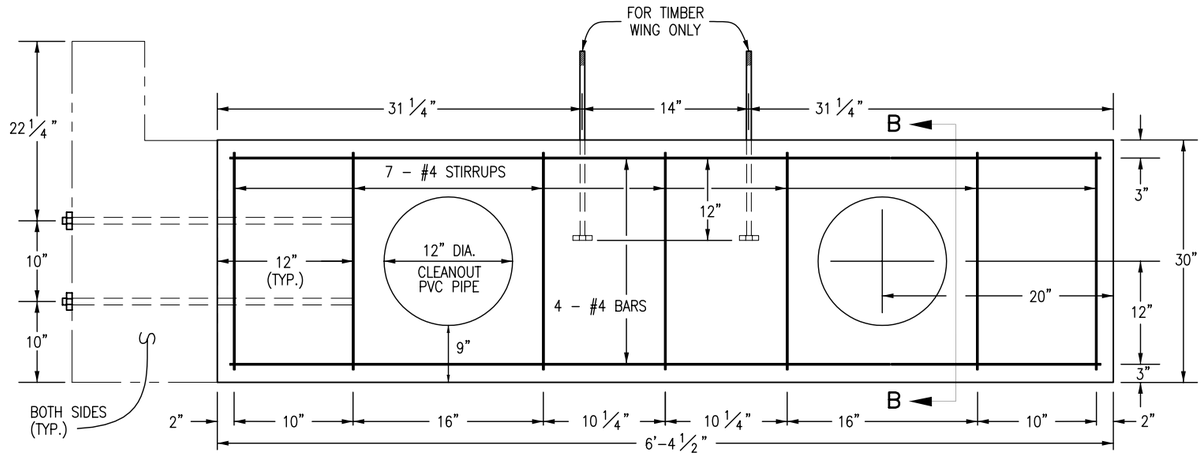
FOUNDATION QUANTITIES

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

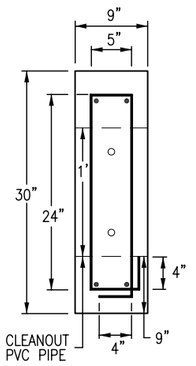
WELDED GRILL UNITS



END SECTION OF FOUNDATION
SECTION A–A



ELEVATION OF LATERAL SUPPORT



LATERAL SUPPORT
SECTION B–B

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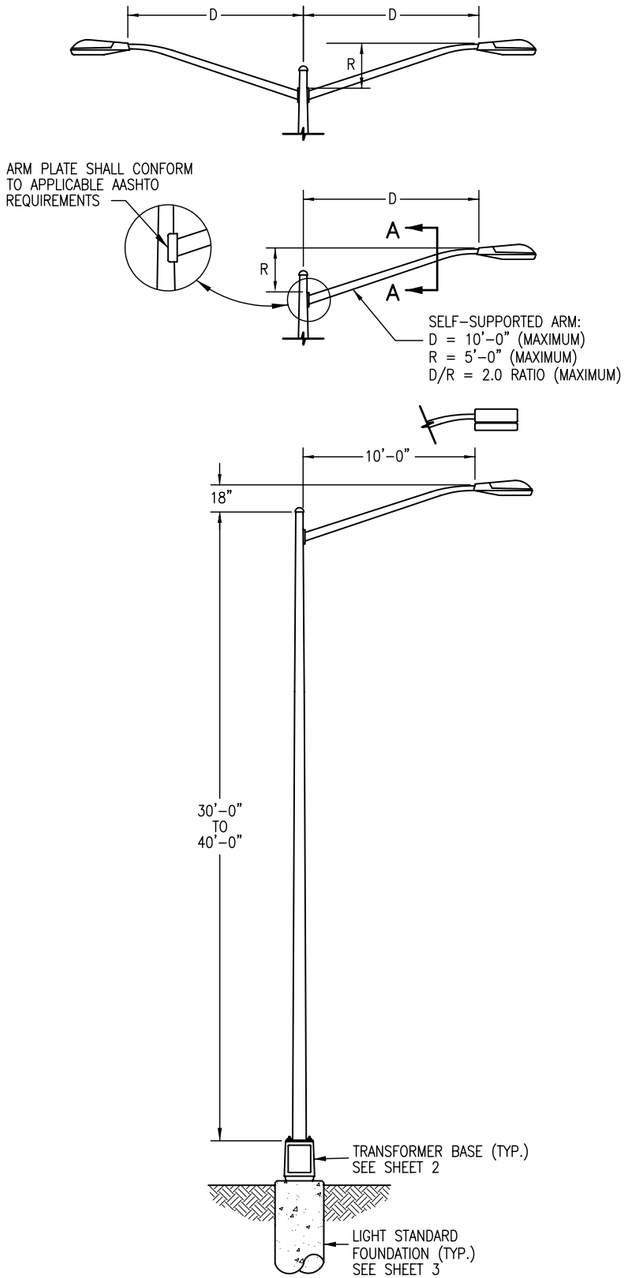
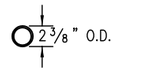
STANDARD PLAN NO.
M-611-1
Sheet No. 2 of 2



30 FT. TO 40 FT. STANDARD



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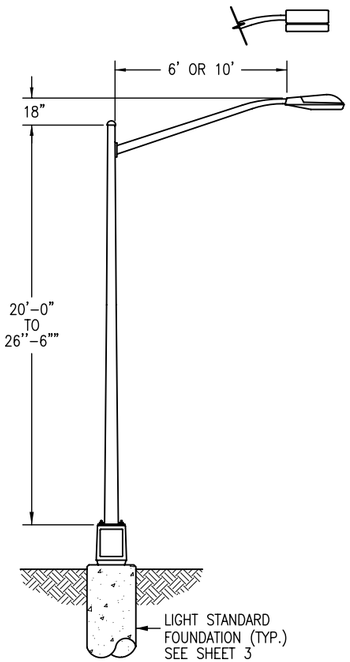
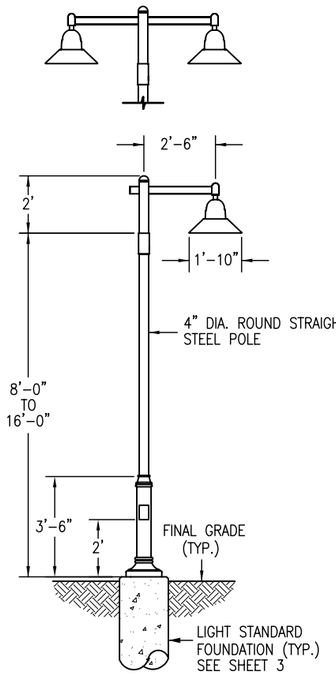


20 FT. TO 26 FT.–6 IN. STANDARD



10 FT. TO 18 FT. STANDARD

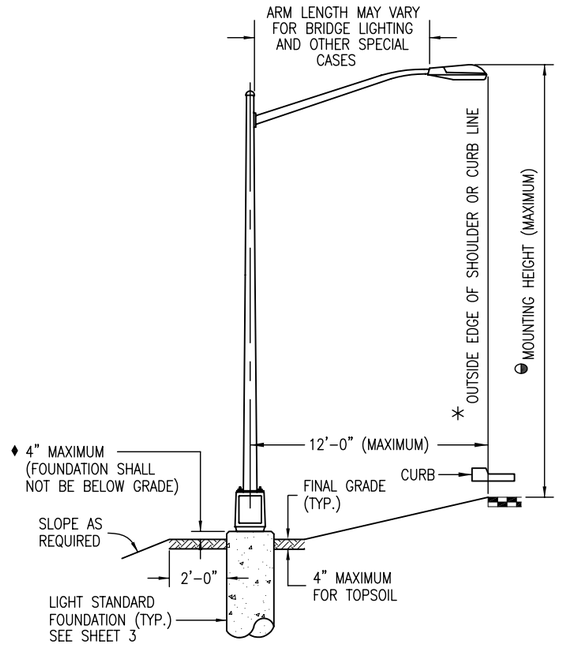
GENERAL NOTES

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

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

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

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



LIGHT STANDARD LOCATION

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ROADWAY LIGHTING

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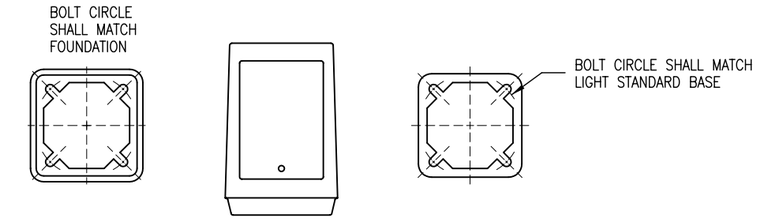
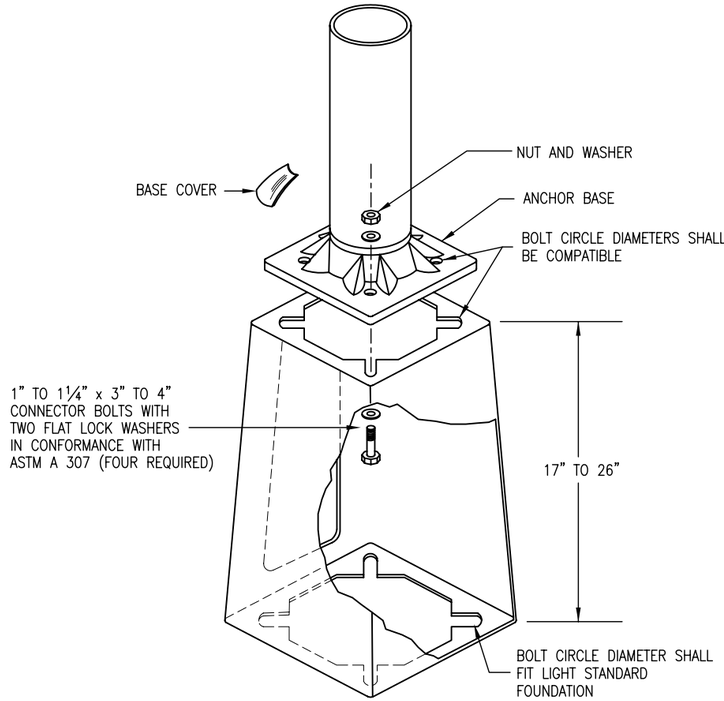
STANDARD PLAN NO.
M-613-1
Sheet No. 1 of 4



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



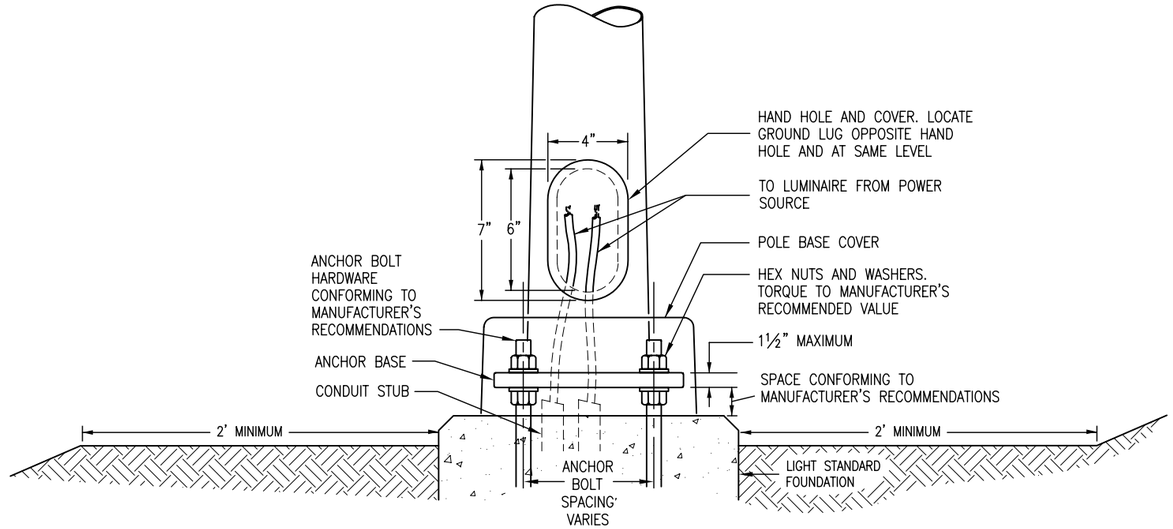
TYPICAL BREAK–AWAY TYPE TRANSFORMER BASE DETAIL

NOTES:

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

NOTES

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



TYPICAL NON–BREAKAWAY BASE DETAIL

FOR USE ONLY OUTSIDE CLEAR ZONE OR IN PROTECTED INSTALLATIONS.

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ROADWAY LIGHTING

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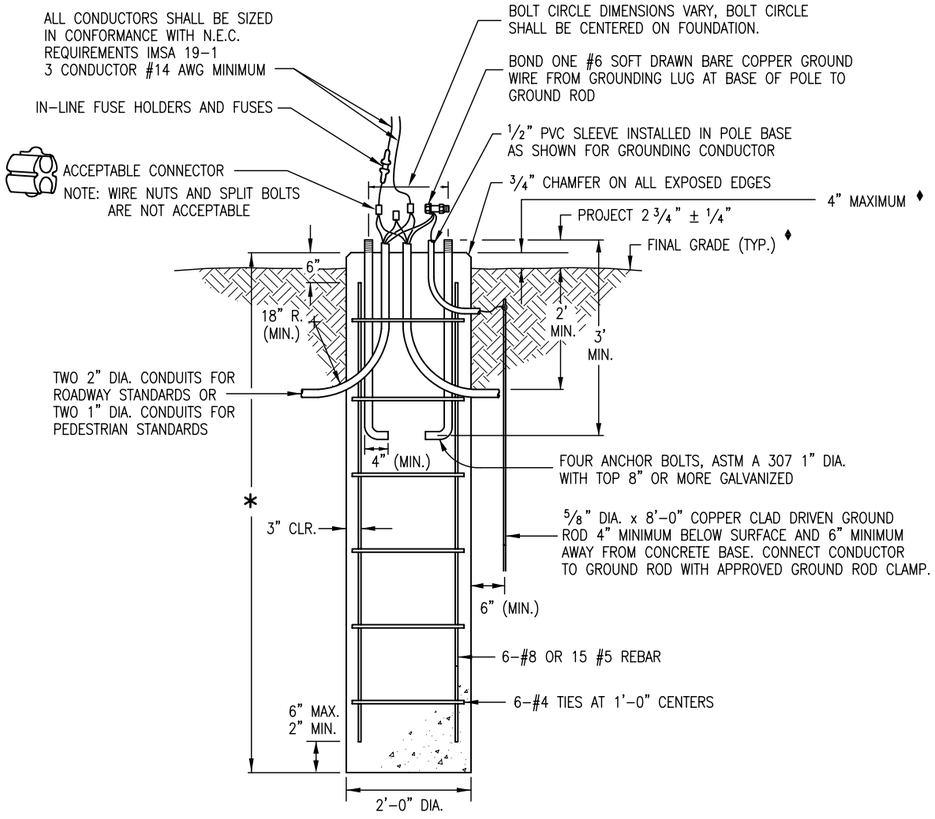
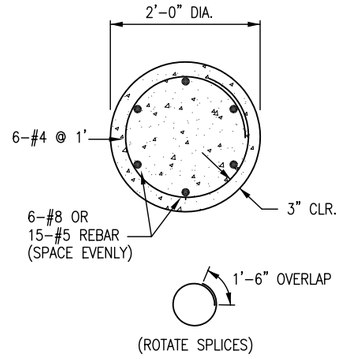
STANDARD PLAN NO.
M-613-1
Sheet No. 2 of 4



TYPICAL CONCRETE LIGHT STANDARD FOUNDATION



TYPICAL FOUNDATION SECTION

NOTES

1. DIMENSIONS FOR THE TRANSFORMER BASE, ANCHOR BASE AND ANCHOR BOLTS ARE VARIABLE FOR THE HEIGHT OF THE LIGHT STANDARD AND THE MAST ARM CONFIGURATION. ALL COMPONENTS SHALL FIT AND ACCOMMODATE THE REQUIREMENTS OF THE LIGHT STANDARD SUPPLIED.

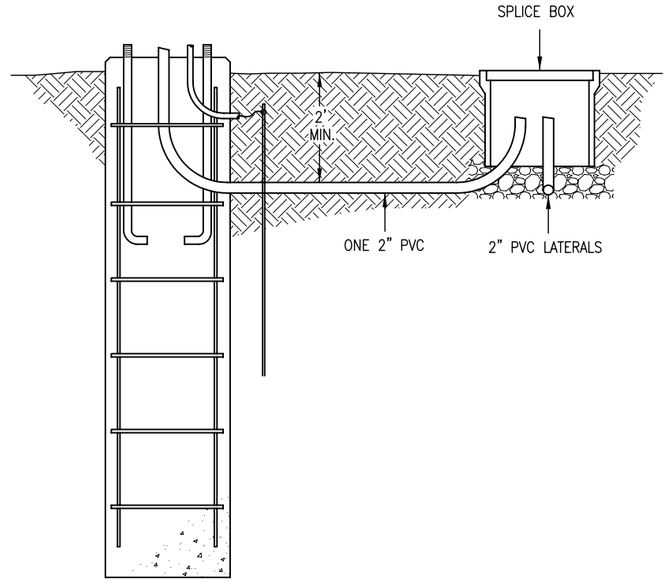
* 2. FOUNDATION SHALL BE 7 FT. FOR LIGHT STANDARDS 20 FT. THRU 40 FT., AND 6 FT. FOR LIGHT STANDARDS LESS THAN 20 FT.

3. LIGHT STANDARD FOUNDATION DEPTH IS BASED ON A MAXIMUM POLE HEIGHT OF 40 FT. IN STIFF CLAY WITH N > 8 OR MEDIUM SAND WITH N > 15 AS DETERMINED BY ASTM D 1586 STANDARD PENETRATION TEST.

4. CONCRETE SHALL BE CLASS B.

5. FOUNDATIONS FOR LIGHT STANDARDS HIGHER THAN 40 FT. OR LIGHT STANDARDS WITH MULTIPLE LUMINAIRES OR BANNERS, OR VARYING SOIL OR WIND CONDITIONS, SHALL BE DESIGNED BY THE CONTRACTOR'S ENGINEER IF NOT SHOWN ON THE PLANS.

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



ALTERNATIVE CONCRETE LIGHT STANDARD FOUNDATION WITH SPLICE BOX

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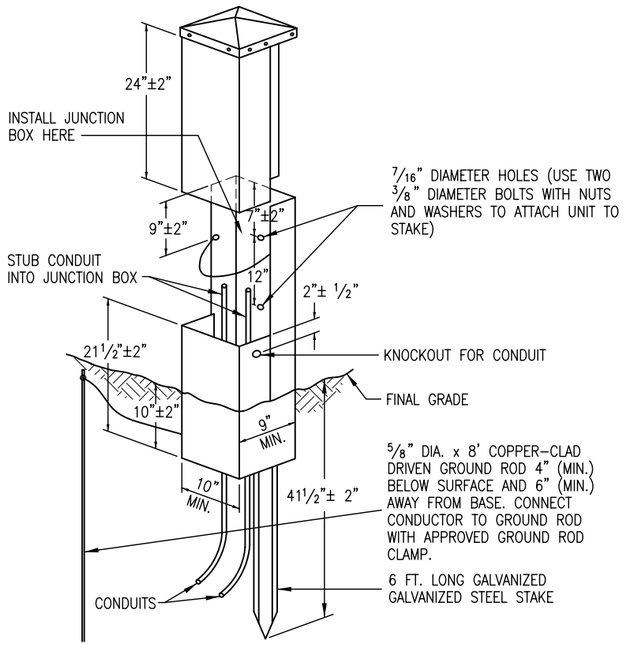
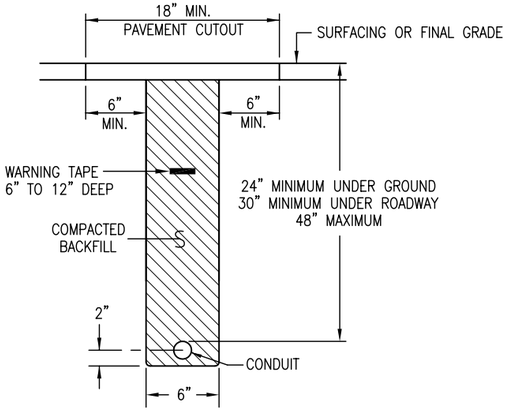
STANDARD PLAN NO.
M-613-1
Sheet No. 3 of 4



SECONDARY SERVICE PEDESTAL

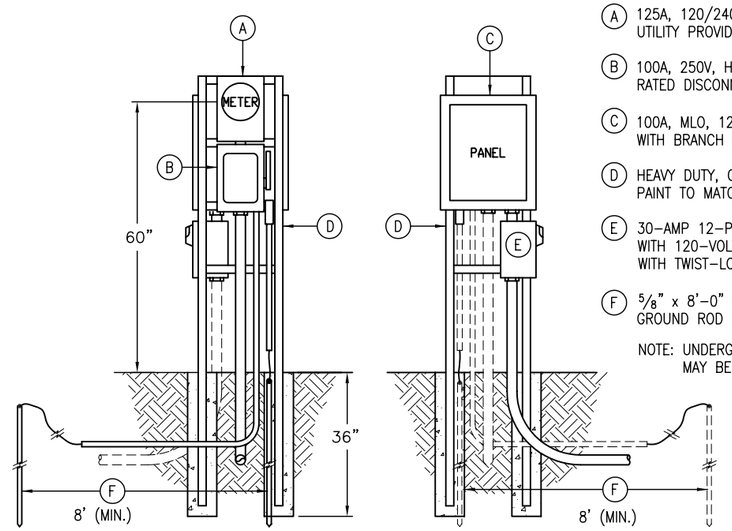
(FRONT VIEW WITH COVER LIFTED)



SECTION–TYPICAL CONDUIT BURIAL

NOTES:

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



FRONT ELEVATION REAR ELEVATION

LIGHTING CONTROL CENTER (PEDESTAL)

PEDESTAL COMPONENT LIST

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

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

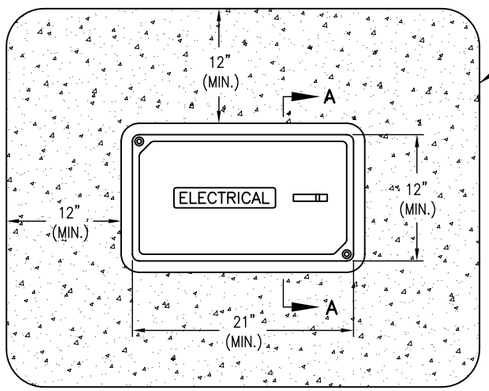
(C) 100A, MLO, 120/240V–1ø–3W, 8–SPACE, NEMA 3R LOAD CENTER WITH BRANCH BREAKERS AS LISTED ON THE PANEL SCHEDULE.

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

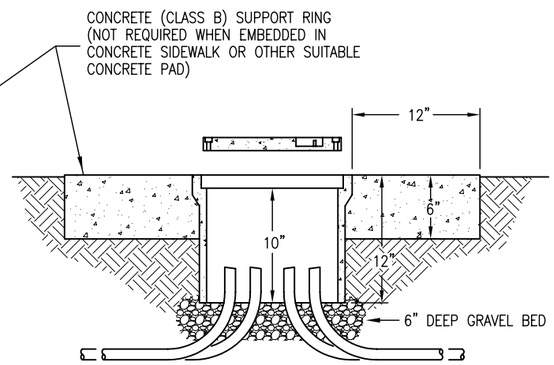
(E) 30–AMP 12–POLE ELECTRICALLY HELD LIGHTING CONTACTOR FURNISHED WITH 120–VOLT COIL AND NEMA 3R 120V PHOTO ELECTRIC CONTROL WITH TWIST–LOCK RECEPTACLE BASE.

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

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



PLAN VIEW

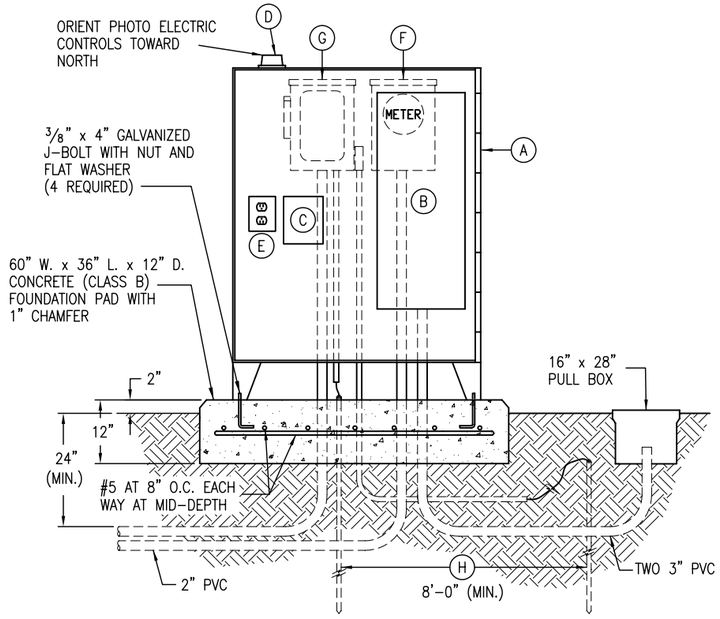


SECTION A–A

TYPICAL PULL OR SPLICE BOX

NOTES:

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



LIGHTING CONTROL CENTER (CABINET)

CABINET COMPONENT LIST

(A) 30 IN. W. x 48 IN. H. x 12 IN. D. NEMA 3R HINGED ENCLOSURE WITH 6 IN. LEGS ANCHORED TO THE CONCRETE FOUNDATION PAD. THE BACK OF THE CABINET SHALL BE LOCATED 6 IN. MAXIMUM FROM THE EDGE OF THE CONCRETE PAD.

(B) NEMA 1, 100–AMP MLO 120V/240V 1ø 3W LOAD CENTER (SEE PANEL SCHEDULE). MINIMUM SPACES AS REQUIRED PLUS A MINIMUM OF TWO AVAILABLE SPACES FOR FUTURE USE. INSTALL IN CABINET WITH FULL–SIZE GROUND, COVER, AND BRANCH BREAKERS AS LISTED ON THE SCHEDULE.

(C) ELECTRICALLY HELD LIGHTING CONTACTOR FURNISHED WITH 120–VOLT COIL AND NUMBER OF POLES REQUIRED. INSTALL INSIDE CABINET.

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

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

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

(G) NEMA 3R, 100–AMP, 2–POLE FUSED DISCONNECT, UL LISTED FOR SERVICE EQUIPMENT AND FRN FUSES AS SHOWN ON ONE–LINE DIAGRAM WITH NEUTRAL AND GROUND BARS. MOUNTED ON BACK SIDE OF ENCLOSURE.

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

NOT SHOWN IN THE DETAIL:

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

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ROADWAY LIGHTING

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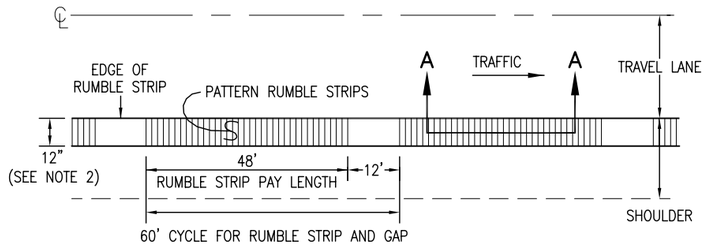
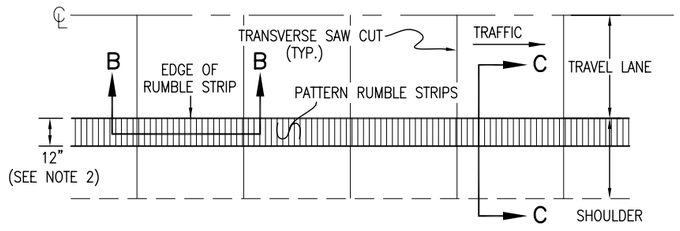
STANDARD PLAN NO.
M-613-1
Sheet No. 4 of 4

GENERAL NOTES

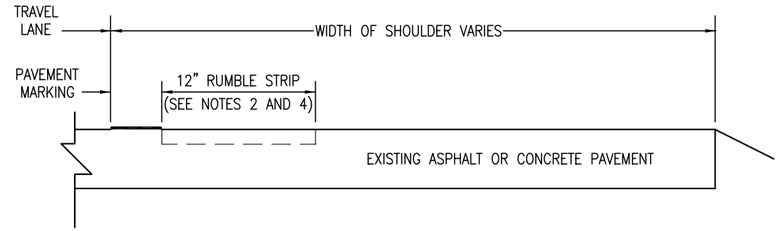
1. RUMBLE STRIPS SHALL BE OMITTED AT TURN AND AUXILIARY LANES, ROAD APPROACHES, RESIDENCES, 250 FT. BEFORE ROAD INTERSECTIONS, AND OTHER INTERRUPTIONS AS DIRECTED BY THE ENGINEER.
2. RUMBLE STRIPS MAY BE INSTALLED BY GRINDING, ROLLING, OR FORMING ON CONCRETE PAVEMENT, AND BY GRINDING ONLY ON HMA PAVEMENT.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



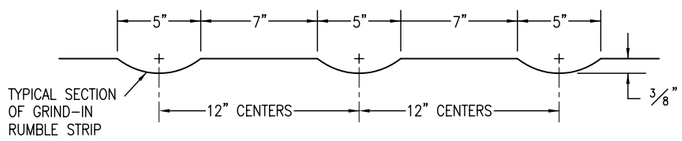
INTERMITTENT RUMBLE STRIP
TWO–LANE ROADWAY (HMA)



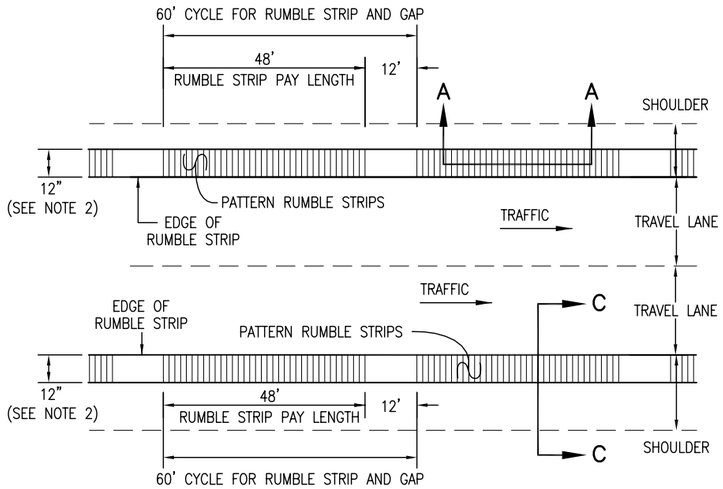
CONTINUOUS RUMBLE STRIP
TWO–LANE ROADWAY (CONCRETE)



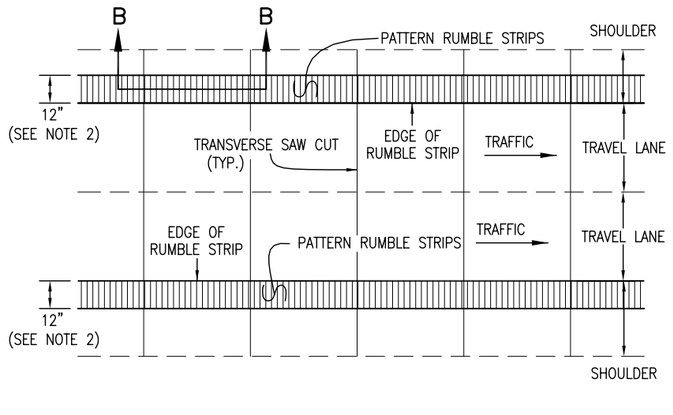
TYPICAL SECTION C–C



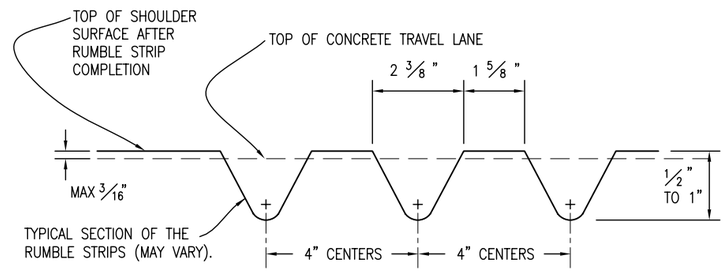
TYPICAL SECTIONS A–A AND B–B
FOR GRIND–IN RUMBLE STRIP
ON EXISTING HMA OR CONCRETE PAVEMENT



INTERMITTENT RUMBLE STRIP
FOUR–LANE DIVIDED ROADWAY (HMA)



CONTINUOUS RUMBLE STRIP
FOUR–LANE DIVIDED ROADWAY (CONCRETE)



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

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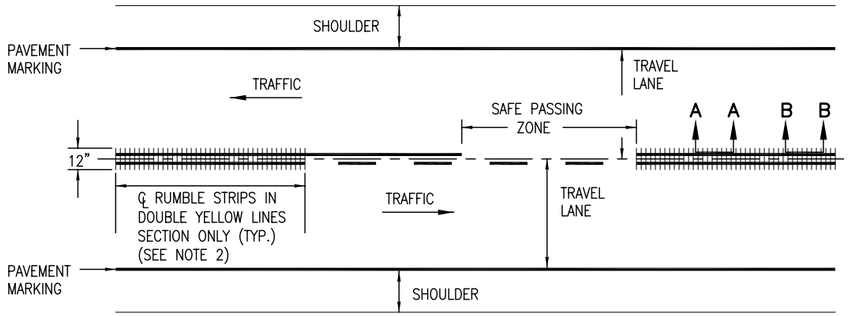
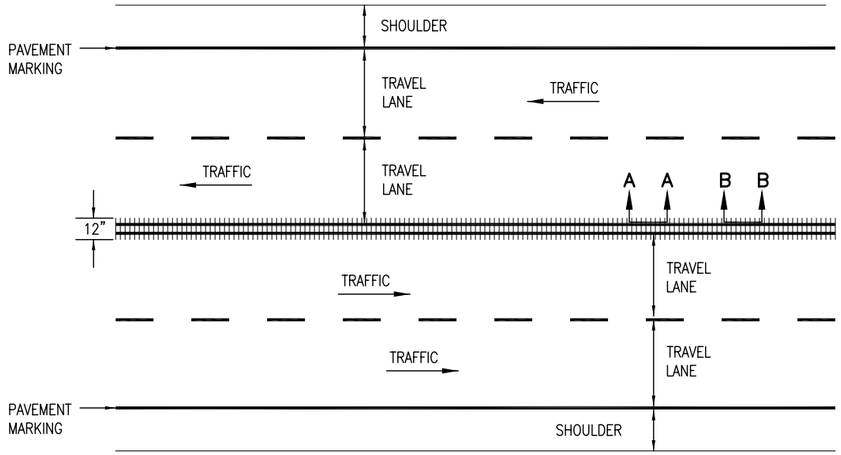
STANDARD PLAN NO.
M-614-1
Sheet No. 1 of 3



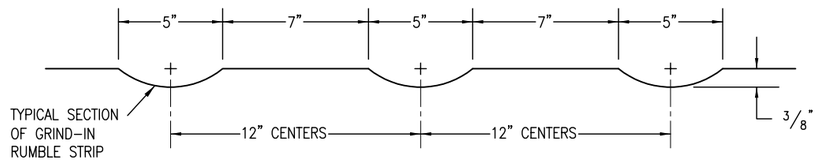
TWO LANE HIGHWAY (HMA AND CONCRETE)
CONTINUOUS CENTER LINE RUMBLE STRIPS



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

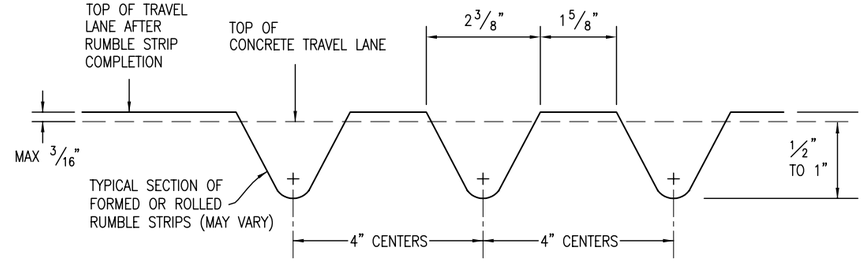
NOTES

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



TYPICAL SECTIONS A-A AND B-B

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



TYPICAL SECTION B-B

FOR FORMED OR ROLLED ON CONCRETE PAVEMENTS ONLY

DETAILS FOR CENTER LINE RUMBLE STRIPS

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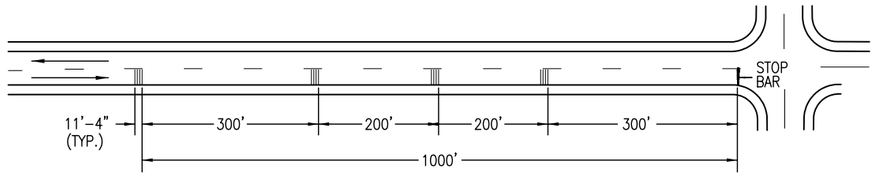
STANDARD PLAN NO.
M-614-1
Sheet No. 2 of 3



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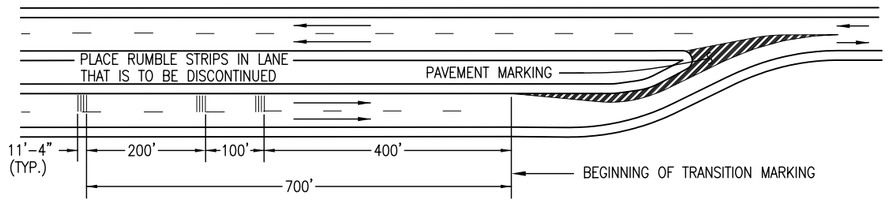
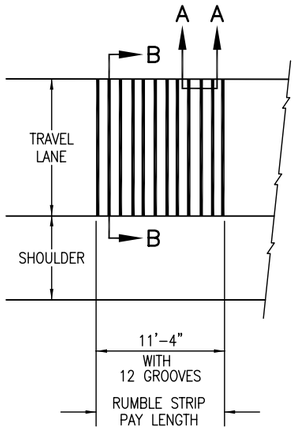


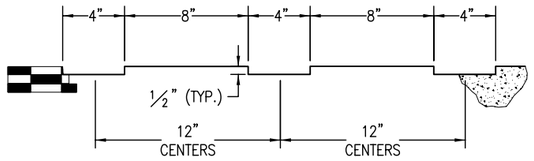
LANE REDUCTION TRANSITION



TYPICAL RUMBLE STRIP CLUSTER

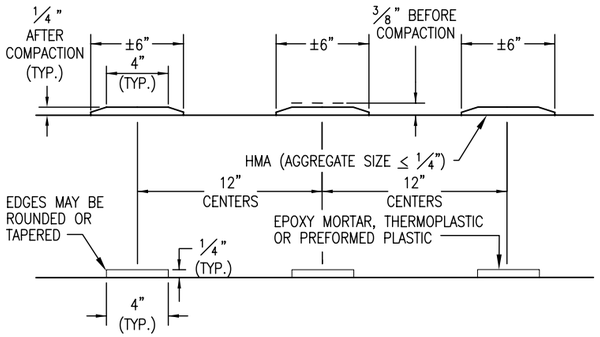
NOTES

1. GROOVED RUMBLE STRIP SKEW OR CLUSTER SPACING SHALL BE MODIFIED TO AVOID LOCATING A GROOVE ON A CONCRETE PAVEMENT TRANSVERSE JOINT.
2. PERMANENT TRAVEL LANE RUMBLE STRIPS SHALL BE THE GROOVE DESIGN, AND MAY BE CUT IN EXISTING OR NEW HMA OR CONCRETE PAVEMENT. THE GROOVES MAY BE CUT BY SAWING, GRINDING, OR OTHER METHOD AS APPROVED.
3. TEMPORARY RUMBLE STRIPS SHOULD NORMALLY BE THE RAISED DESIGN. THEY MAY BE GROOVES IF LOCATED IN A PAVEMENT THAT WILL BE REMOVED OR COVERED WITH A PAVEMENT COURSE BEFORE COMPLETION OF THE PROJECT. TYPICAL USES OF TEMPORARY RUMBLE STRIPS ARE FOR LANE CLOSURES OR ALIGNMENT CHANGES IN CONSTRUCTION ZONES.
4. THE HMA (RAISED RUMBLE STRIPS) SHALL BE PLACED ON A CLEAN, TACK COATED TREATED PAVEMENT IN $\frac{3}{8}$ IN. HIGH FORMS. THE FORMS SHALL BE REMOVED AND THE ASPHALT COMPACTED BY ROLLING ALONG THE STRIPS. EPOXY MORTAR SHALL BE FORMED, TROWELED, AND LEVELED WITH A ROLLER AND THE TOP EDGES ROUNDED, THERMOPLASTIC STRIPS SHALL BE APPLIED BY THE EXTRUSION PROCESS. PREFORMED PLASTIC SHALL BE INSTALLED IN CONFORMANCE WITH THE INSTRUCTIONS OF THE MANUFACTURER.



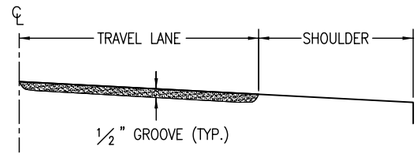
RUMBLE STRIP GROOVES IN HMA OR CONCRETE SURFACE
12 STRIPS PER CLUSTER TYPICAL

SECTION
A–A
(GROOVED)



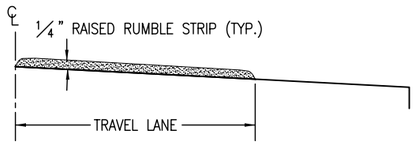
PREFORMED PLASTIC STRIPS SHALL BE SPACED ON 12 IN. CENTERS AND MAY VARY FROM THE 4 IN. TYPICAL WIDTH.
12 STRIPS PER CLUSTER TYPICAL

SECTION
A–A
(RAISED)



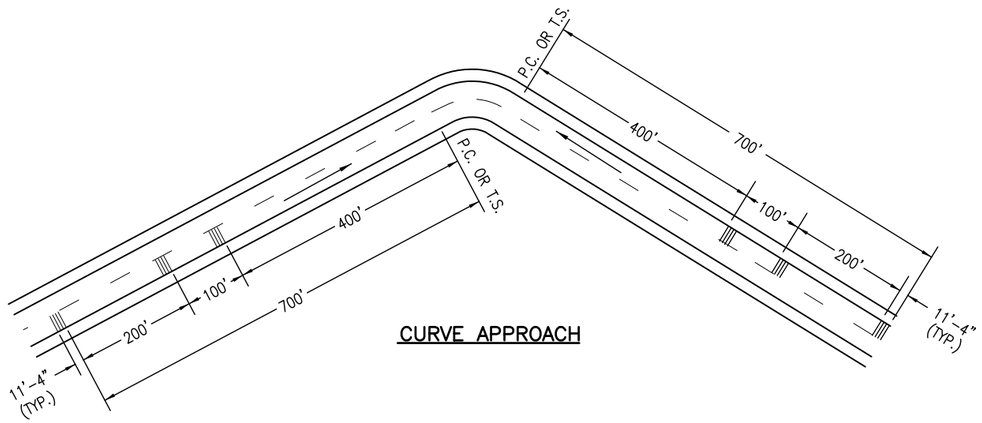
SECTION
B–B
(GROOVED)

PERMANENT GROOVED RUMBLE STRIPS



SECTION
B–B
(RAISED)

TEMPORARY RAISED RUMBLE STRIPS



CURVE APPROACH

TRAVEL LANE RUMBLE STRIPS

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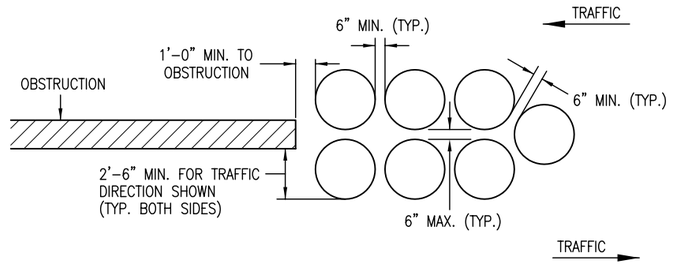
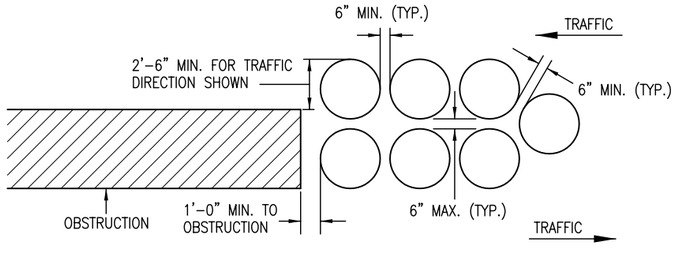
STANDARD PLAN NO.
M-614-1
Sheet No. 3 of 3



UNIDIRECTIONAL



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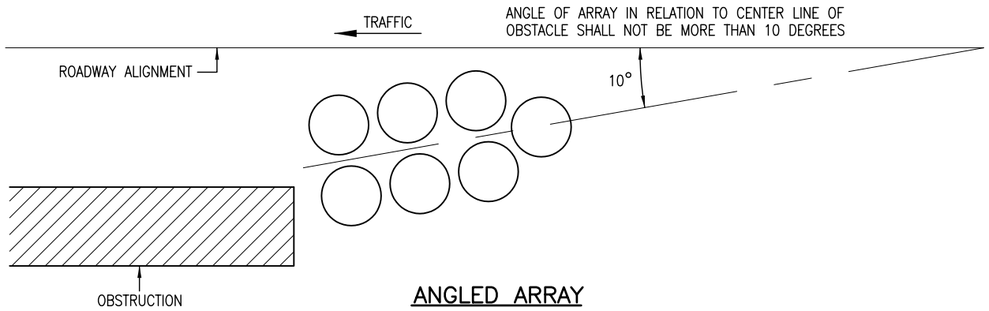
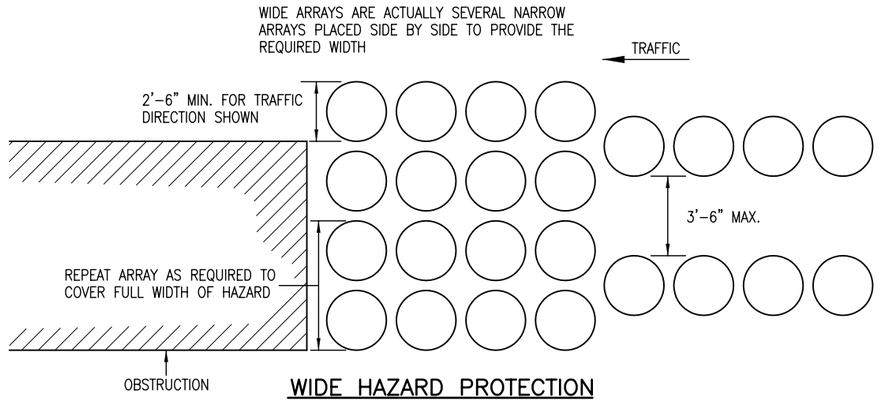


ANGLED ARRAY

GENERAL NOTES

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



WIDE HAZARD PROTECTION

Computer File Information		Sheet Revisions	
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SAND BARREL ARRAYS

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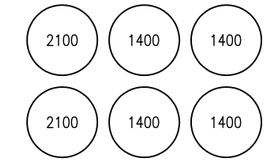
STANDARD PLAN NO.
M-614-2
Sheet No. 1 of 2



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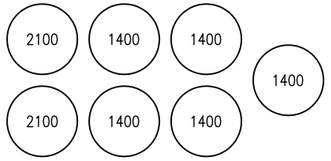

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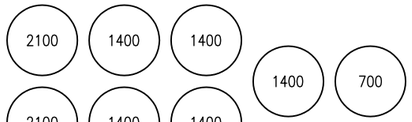

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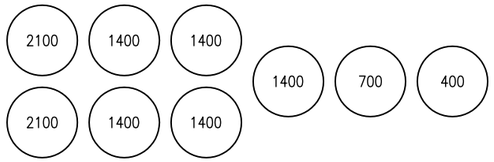

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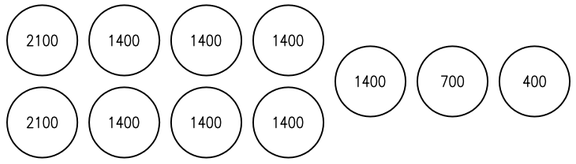

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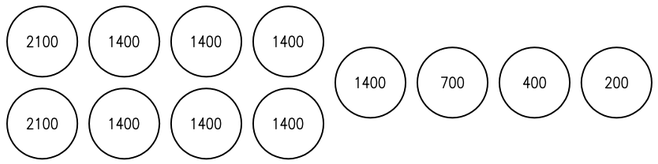
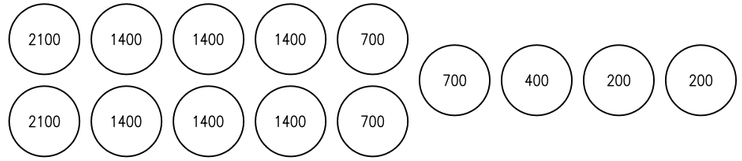


DESIGN SPEED 50 MPH

NOTES

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



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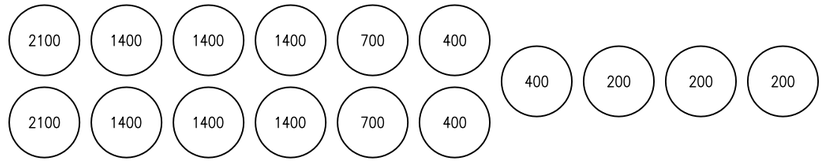

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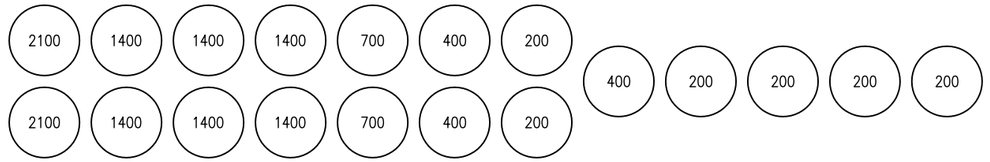

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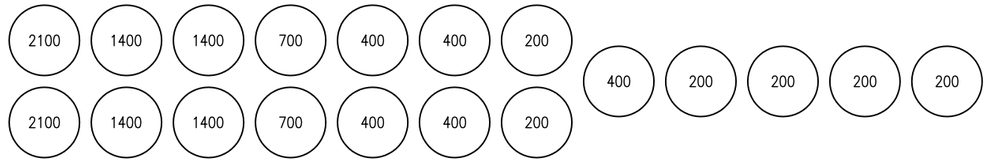

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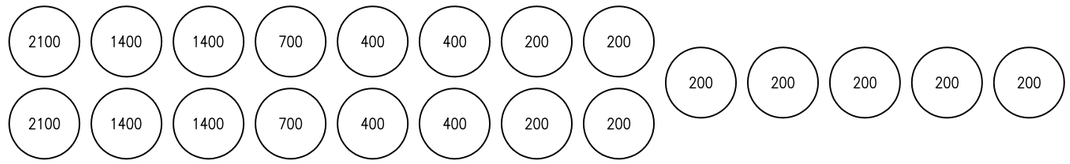

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SAND BARREL ARRAYS

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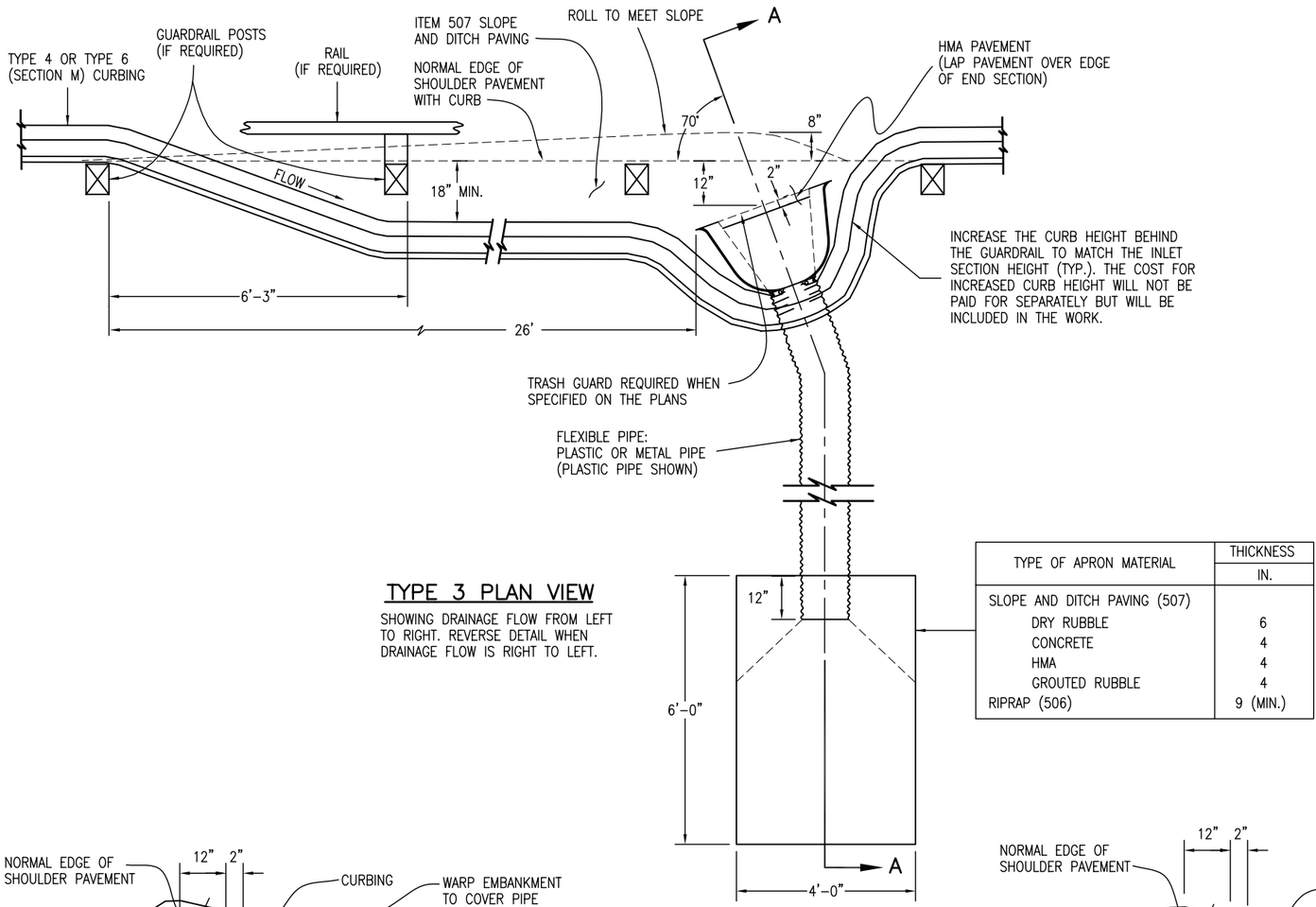
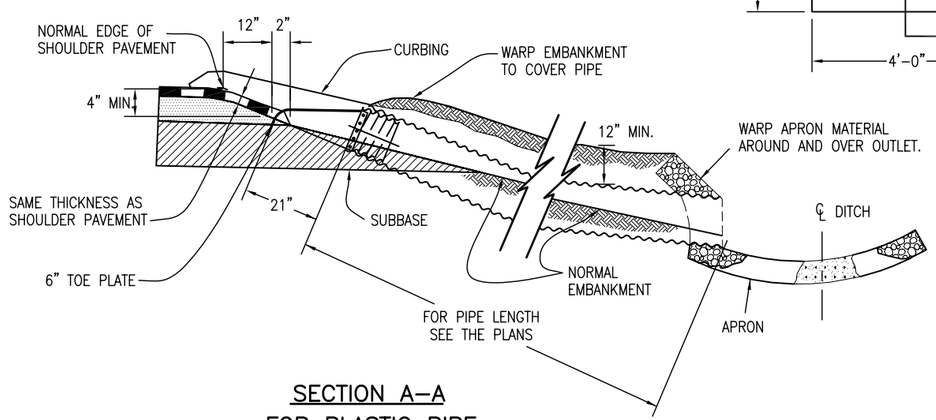
STANDARD PLAN NO.
M-614-2
Sheet No. 2 of 2



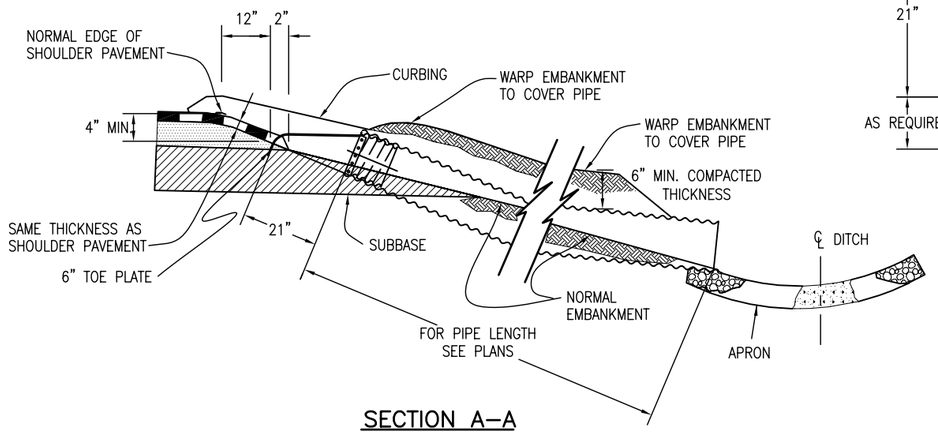
TYPE 3 PLAN VIEW

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

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



SECTION A–A
FOR PLASTIC PIPE



SECTION A–A
FOR METAL PIPE

GENERAL NOTES

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

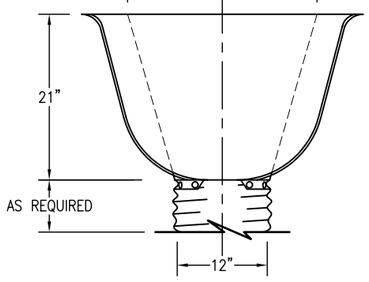
PAYMENT FOR THE QUANTITIES SHOWN ON
THE PLANS FOR THIS WORK SHALL BE AS FOLLOWS:

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

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

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

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



END SECTION
(STUB SHOWN)

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EMBANKMENT PROTECTOR TYPE 3

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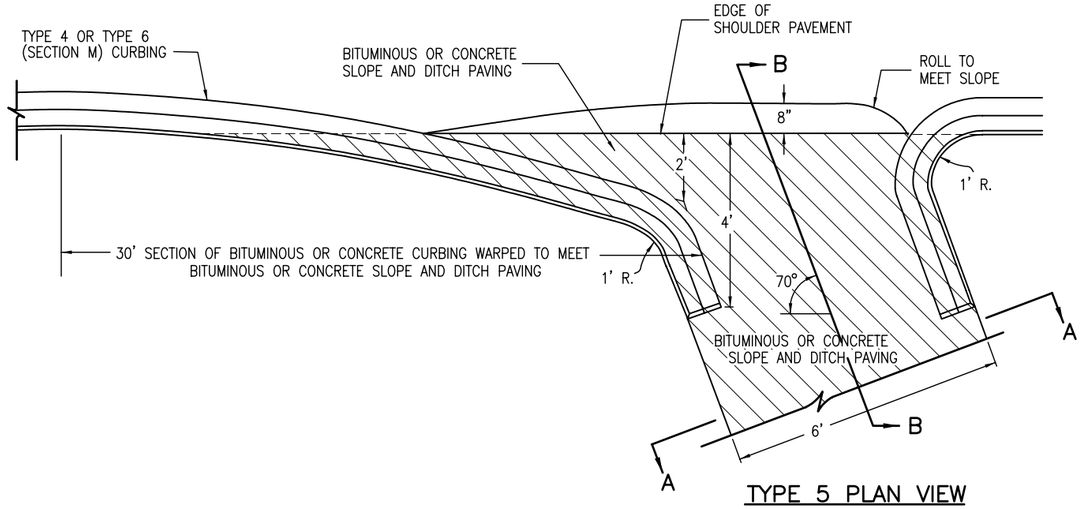
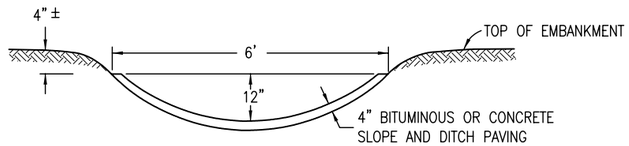
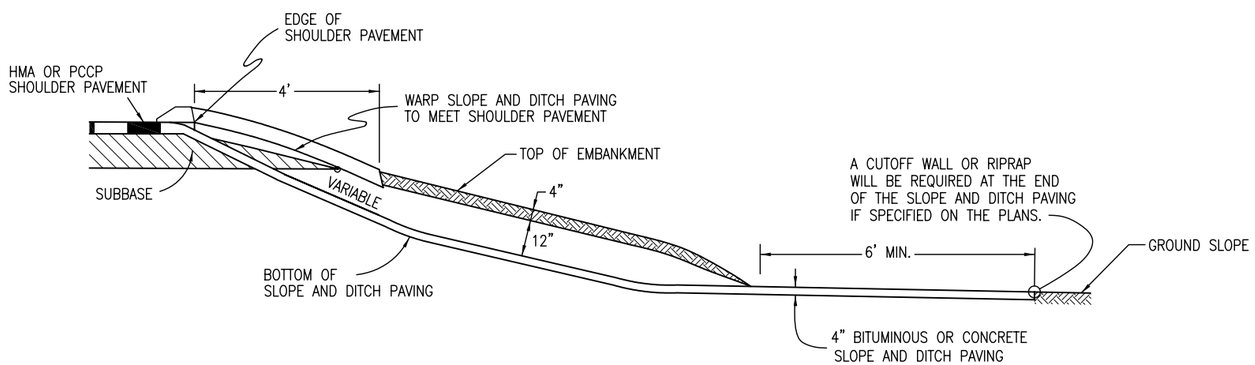
STANDARD PLAN NO.
M-615-1
Sheet No. 1 of 1



TYPE 5 PLAN VIEW



SECTION A–A



SECTION B–B

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

GENERAL NOTES

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

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

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

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

   615 – EMBANKMENT PROTECTOR (TYPE 3) . . . . . .EACH
   NOTE: THIS PAYMENT INCLUDES THE STRUCTURE EXCAVATION, ANY OTHER EARTHWORK, AND ANY EXTRA WORK REQUIRED TO MODIFY OTHER PAY ITEMS.

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Full Path: www.dot.state.co.us/DesignSupport/	(R–X)					
Drawing File Name: 615020101.dwg	(R–X)			Project Development Branch SRJ/LTA	Issued By: Project Development Branch on July 04, 2006	Sheet No. 1 of 1
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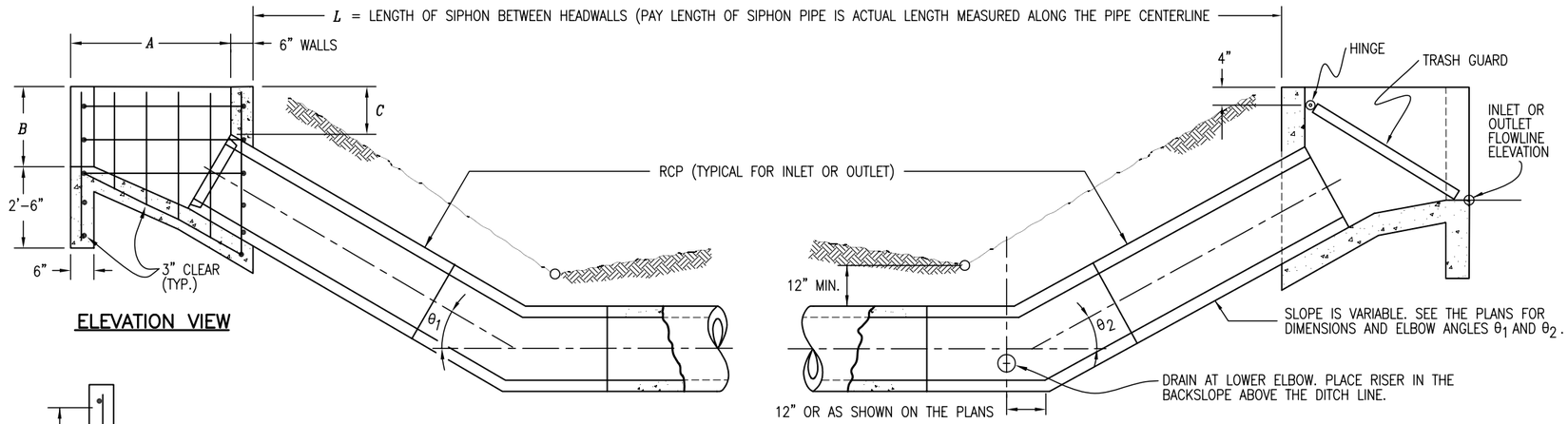
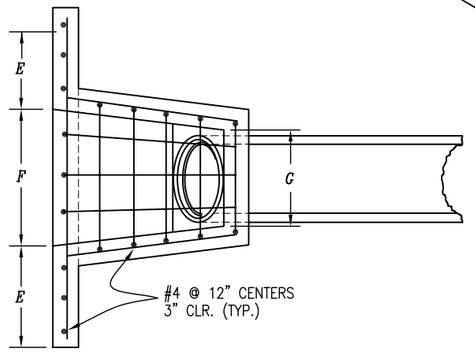
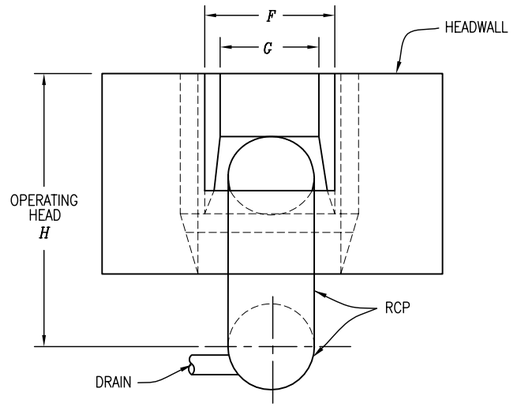


ELEVATION VIEW



PLAN VIEW



END VIEW

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

HEADWALL DIMENSIONS

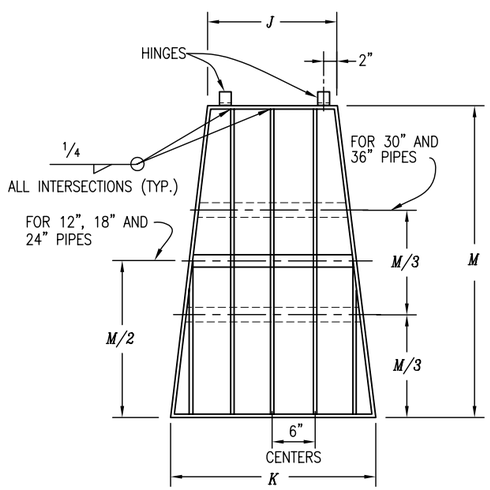
PIPE DIAMETER	CONCRETE	REINFORCED STEEL
IN.	CU. YDS.	LBS.
12	0.62	55
18	1.17	88
24	1.92	146
30	2.72	203
36	3.74	275

HEADWALL QUANTITIES

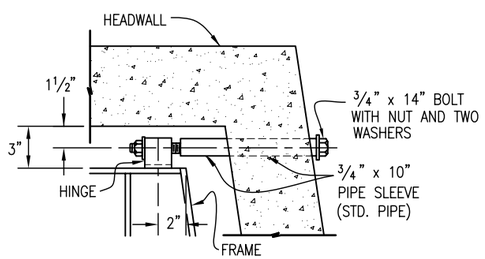
QUANTITIES FOR ONE HEADWALL AFTER DEDUCTION FOR PIPE.

GENERAL NOTES

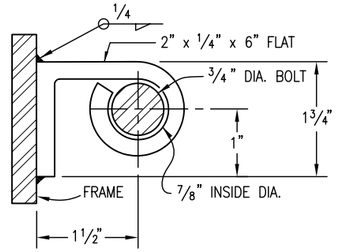
1. SIPHON DRAIN, VALVE AND VALVE BOX, AND TRASH GUARDS ARE TO BE PROVIDED ONLY WHEN CALLED FOR ON THE PLANS.
2. CONCRETE SHALL BE CLASS B.
3. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4 IN.
4. THE LOCATION, SIZE, PIPE MATERIAL AND GOVERNING DIMENSIONS OF SIPHONS WILL BE SHOWN ON THE PLANS.
5.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



TRASH GUARD DETAILS



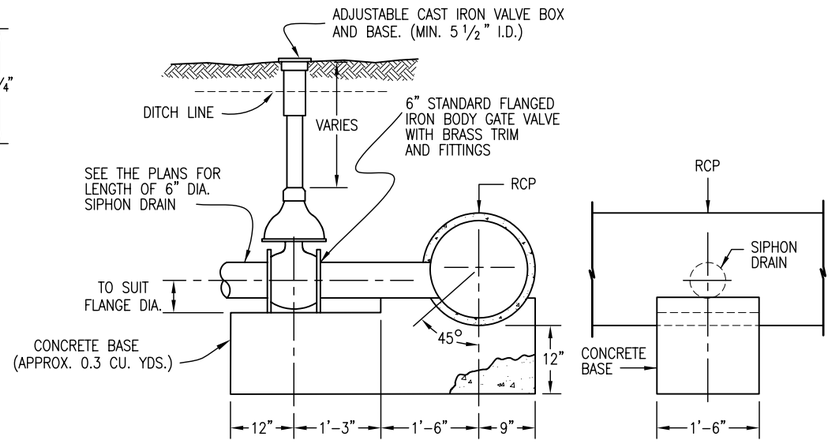
HINGE ASSEMBLY



HINGE

PIPE DIAMETER	BAR AND BRACE SIZE	NO. OF BRACES	DIMENSIONS			WEIGHT
INCHES		EACH	*J*	*K*	*M*	LBS.
12	3/8" x 2"	1	1'-0"	1'-6"	2'-6"	35.1
18	3/8" x 2"	1	1'-7"	2'-6"	3'-10"	74.4
24	3/8" x 2"	1	2'-2"	3'-6"	5'-2"	120.5
30	3/8" x 2 1/2"	2	2'-9"	4'-6"	6'-6"	235.9
36	3/8" x 2 1/2"	2	3'-4"	5'-6"	7'-10"	317.6

TRASH GUARD DIMENSIONS AND QUANTITIES



ELEVATION VIEW

PARTIAL END VIEW

DRAIN DETAILS

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INVERTED SIPHON

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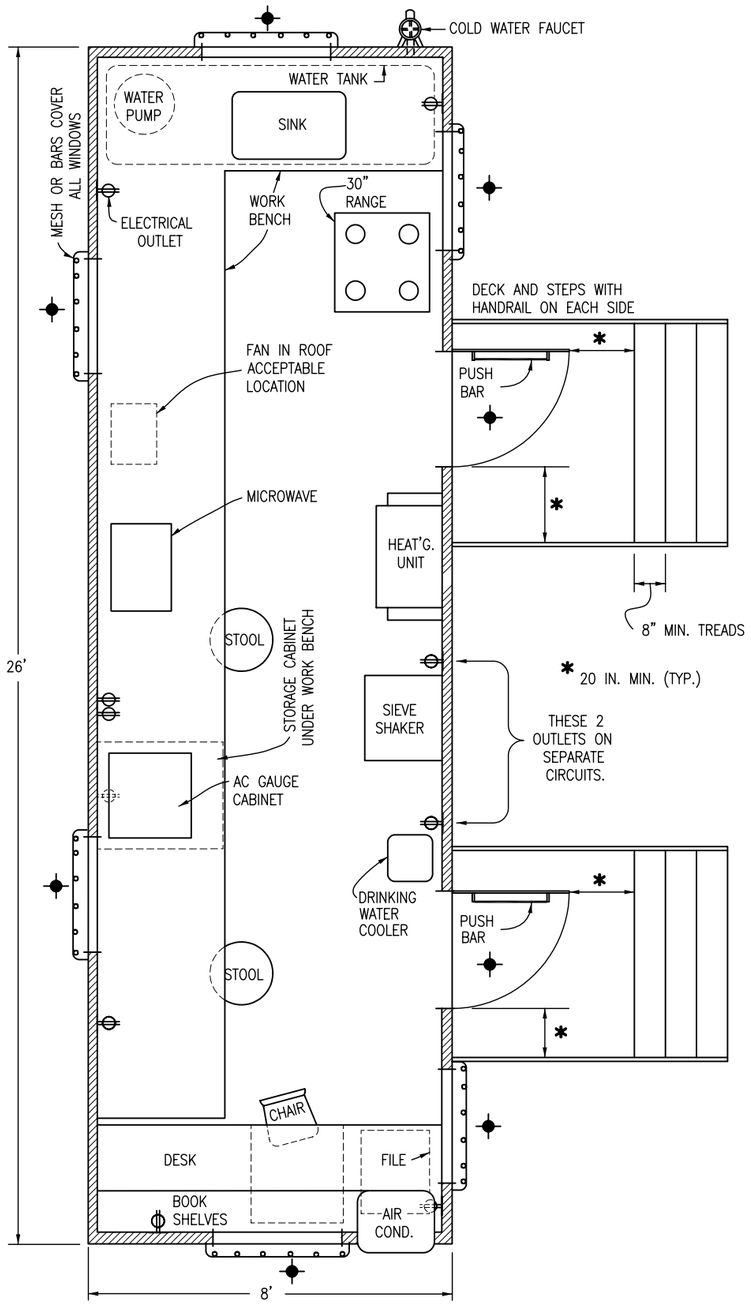
STANDARD PLAN NO.
M-616-1
Sheet No. 1 of 1



FLOOR PLAN

GENERAL NOTES

1. CLASS 1 FIELD LABORATORIES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODE SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 26 FT. LONG x 8 FT. WIDE OUTSIDE, 7 FT.–6 IN. HEIGHT INSIDE.
3. **WINDOWS:** A MINIMUM OF 4, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.
4. **DOORS:** TWO, EQUIPPED WITH DEADBOLT LOCKS, 36 IN. x 80 IN., INSULATED STEEL WITH A SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, HEAVY DUTY DOOR CLOSER, AND PULL HANDLE MOUNTED ABOVE PUSH BAR. EACH DOOR SHALL HAVE A SET OF STEPS WITH DECK, AND HANDRAILS. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **FLOOR:** ADEQUATE INSULATION UNDER THE FLOOR. FLOOR COVERING SHALL BE SKID RESISTANT.
6. **HEATING:** FURNACE, 41,000 BTU, FORCED AIR TYPE.
7. **AIR CONDITIONING:** ONE, 8,300 BTU MINIMUM.
8. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 HZ, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD LABORATORY EQUIPMENT. ALL TRAILERS CONSTRUCTED AFTER JULY 1, 2006 SHALL HAVE AN APPROPRIATELY SIZED CIRCUIT BREAKER TO HANDLE THE LOAD OF ALL LABORATORY AND ENVIRONMENTAL EQUIPMENT OPERATING AT ONE TIME. PROVIDE A SEPARATE ELECTRICAL CIRCUIT TO SUPPLY POWER TO THE ASPHALT CONTENT GAUGE AND THE OUTLET IN THE STORAGE CABINET UNDER THE WORK BENCH.
9. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING DIRECTLY OVER ALL WORK BENCH AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
10. **VENT FAN:** ONE, GENERAL VENTILATION WITH 500 CFM CAPACITY AND TWO–SPEED SWITCH. MOUNTED IN THE ROOF OR AT TOP OF WALL NEAR THE RANGE. THE THREE FANS AND TWO WORK BENCH GRILLES PREVIOUSLY REQUIRED MAY BE RETAINED IN THOSE CLASS 1 FIELD LABORATORIES PURCHASED BEFORE THE DATE OF THIS STANDARD.
11. **FURNITURE:** ONE, TWO–DRAWER, LEGAL SIZE FILE CABINET BUILT INTO DESK AREA. DESK SHALL BE BUILT–IN WITH ONE CENTER DRAWER. ONE DESK CHAIR WITH ROLLERS. TWO STOOLS FOR WORK AREA WITH HEIGHT COMPATIBLE WITH WORK BENCHES. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
12. **BOOK SHELVES:** MINIMUM 10 LINEAR FT. LONG AND 10 IN. DEEP, BUILT OVER DESK AREA. TOP SHELF SHALL BE AT LEAST 14 IN. BELOW CEILING.
13. **WORK BENCHES:** 30 IN. WIDE x 36 IN. HIGH WITH A DURABLE WORKING SURFACE SUCH AS FORMICA.
14. **STORAGE CABINETS:** TWO, ONE BUILT–IN UNDER THE WORK BENCH WITH A 28 IN. x 28 IN. LOCK EQUIPPED DOOR, WITH ELECTRICAL OUTLET INSIDE. ONE REMOVABLE, WITH OPEN BOTTOM, LOCK EQUIPPED TO SECURE CABINET TO TOP OF WORK BENCH, LARGE ENOUGH TO COVER A 22 IN. x 18 IN. x 18 IN. HIGH ASPHALT CONTENT (AC) GAUGE.
15. **SINK:** ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x 6 $\frac{1}{2}$ IN. EQUIPPED WITH SPRAY NOZZLE, ONE COMBINATION (MIXING) HOT AND COLD WATER FAUCET AND ONE SINGLE COLD WATER FAUCET. ALL FAUCETS SHALL BE EQUIPPED WITH STANDARD HOSE THREAD SPIGOTS. DRAINS SHALL HAVE NO TRAP.
16. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
17. **TESTING WATER SUPPLY:** ONE HUNDRED GALLON WATER CAPACITY, VENTED, WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, MINIMUM 30 PSI DELIVERY PRESSURE. ONE COLD WATER FAUCET WITH BACK FLOW PREVENTER LOCATED OUTSIDE OF TRAILER. WATER PIPES SHALL BE LOCATED SO THEY ARE UNEXPOSED AND PROTECTED FROM DAMAGE. WATER SHALL BE SUPPLIED BY THE CONTRACTOR.
18. **TELEPHONES:** TWO TELEPHONES. TWO PRIVATE LINES (1FB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND A FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FAX. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ–11 JACKS (TWO WIRE PAIRS PER JACK). TWO AT EACH END OF THE TRAILER. WHERE PRIVATE LINE SERVICE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE TELEPHONE LINE.
19. **FIRE EXTINGUISHER:** ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
20. **SIEVE SHAKER:** ONE MOTOR DRIVEN STANDARD PORTABLE SHAKER INCLUDING:

    A. A SAFETY SHIELD ON DRIVE BELT.
    B. AN ADJUSTABLE TIMED – ON/OFF SWITCH LOCATED NEAR THE SHAKER.
    C. ADAPTERS TO HANDLE EITHER 8 IN. OR 12 IN. SIEVES.

    THE SHAKER SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES AS WELL AS 12 IN. SIEVES, AND SHALL BE MOUNTED 24 IN. ABOVE THE FLOOR IN A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

    THE SIEVE SHAKER SHALL BE A RO–TAP, ENDOCOTT FROM SOILTEST, SS–12R FROM GILSON OR APPROVED EQUAL.
21. **RANGE:** 30 IN. KITCHEN RANGE, ELECTRIC OR GAS, HAVING FOUR SURFACE BURNERS AND A 3.5 CU. FT. OVEN WITH REINFORCED OVEN RACKS.
22. **FORCED AIR OVEN:** IF A FORCED AIR OVEN IS REQUIRED, THE LOCATION WHERE THE OVEN IS PLACED SHALL HAVE A MINIMUM 3 IN. DIAMETER PIPE INSTALLED AND VENTED TO THE OUTSIDE.
23. **MICROWAVE OVEN:** ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.
24. **ELECTRONIC BALANCE:** THE BALANCE SHALL COMPLY WITH AASHTO M 231 FOR GENERAL PURPOSE, CLASS G2 BALANCES, AND THE FOLLOWING:

    A. POWER: 115 VAC
    B. MODEL: TOP LOADING
    C. CAPACITY: MINIMUM OF 35 LBS.
    D. READABILITY AND SENSITIVITY: 0.0005 LB.
    E. ACCURACY: 0.001 LB. OR 0.1%
    F. DISPLAY PANEL SHALL BE EQUIPPED WITH THE FOLLOWING:
       LED DISPLAY ON/OFF KEY, PRINT KEY, RE–ZERO KEY, WEIGHING MODE KEY, SAMPLE % KEY, SERIAL RS–232C I/O PORT, AND A CALIBRATION SWITCH.
    G. WEIGHING MODES: GRAMS, POUNDS, AND PERCENT OF TARGET MASS (WEIGHT).
    H. WEIGHING SURFACE DIMENSION: MINIMUM OF 9 IN. WIDE BY 12 IN. DEEP.
    I. BASE: SHALL HAVE ADJUSTABLE LEVELING FEET AND A LEVEL VIAL ATTACHED.

    THE BALANCE SHALL BE EQUIPPED WITH AN UNDERHOOK WEIGHING DEVICE AND ONE COPY OF THE OWNER'S MANUAL.
25. **SECURITY:** THIS SYMBOL ⌖ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.
26. THE REQUIREMENTS LISTED HEREIN ARE INTENDED TO MEET THE NEEDS OF THE CDOT TESTING PERSONNEL CONCERNING TESTING FACILITIES. THERE IS NO INTENT TO SPECIFY ANY STRUCTURAL PORTIONS OF THE LABORATORY EXCEPT AS NEEDED TO SATISFACTORILY PERFORM THE REQUIRED TESTING OF MATERIALS. THE CONTRACTOR MAY SUBSTITUTE CLASS 2 FIELD LABORATORY FOR CLASS 1 FIELD LABORATORY.

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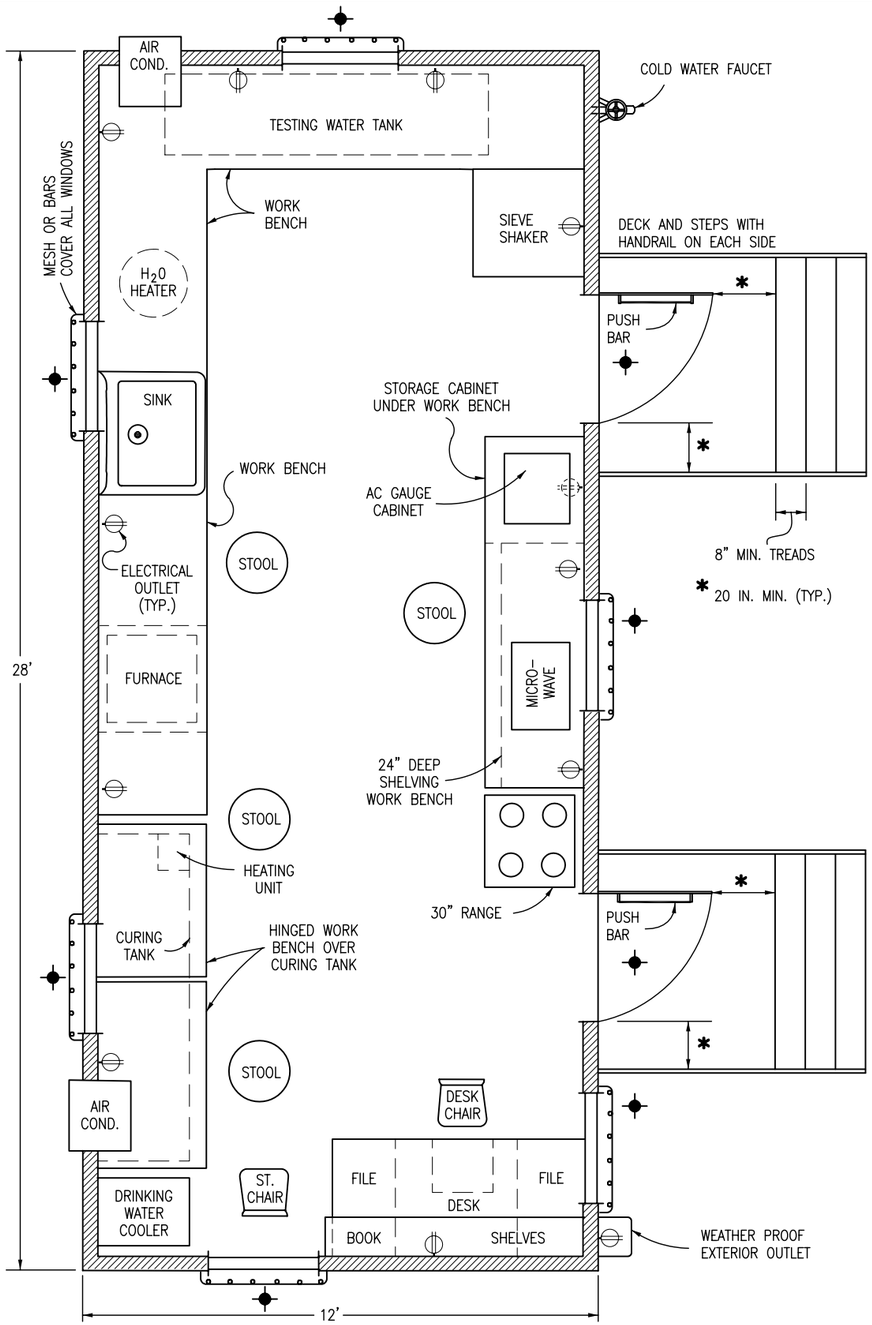
FIELD LABORATORY CLASS 1

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-620-1
Sheet No. 1 of 1



FLOOR PLAN

GENERAL NOTES

1. CLASS 2 FIELD LABORATORIES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODE SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 28 FT. LONG x 12 FT. WIDE OUTSIDE, 7 FT.–6 IN. HEIGHT INSIDE.
3. **WINDOWS:** SIX, 30 IN x 27 IN., CAPABLE OF OPENING AND LOCKING.
4. **DOORS:** TWO, EQUIPPED WITH DEADBOLT LOCKS, 36 IN. x 80 IN., INSULATED STEEL WITH SMALL CLEAR GLASS WINDOW. EQUIPPED WITH HORIZONTAL PUSH BAR, HEAVY DUTY DOOR CLOSER, AND PULL HANDLE MOUNTED ABOVE PUSH BAR. EACH DOOR SHALL HAVE A SET OF STEPS WITH DECK, AND HANDRAILS. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **FLOOR:** ADEQUATE INSULATION UNDER THE FLOOR. FLOOR COVERING SHALL BE SKID RESISTANT.
6. **HEATING:** FURNACE, 55,000 BTU, FORCED AIR TYPE.
7. **AIR CONDITIONING:** TWO, 8,300 BTU MINIMUM.
8. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 HZ, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD LABORATORY EQUIPMENT. ALL TRAILERS CONSTRUCTED AFTER JULY 1, 2006 SHALL HAVE AN APPROPRIATELY SIZED CIRCUIT BREAKER TO HANDLE THE LOAD OF ALL LABORATORY AND ENVIRONMENTAL EQUIPMENT OPERATING AT ONE TIME. PROVIDE A SEPARATE ELECTRICAL CIRCUIT TO SUPPLY POWER TO THE ASPHALT CONTENT GAUGE AND THE OUTLET IN THE STORAGE CABINET UNDER THE WORK BENCH.
9. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING DIRECTLY OVER ALL WORK BENCH AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
10. **VENT FAN:** ONE, GENERAL VENTILATION WITH 800 CFM CAPACITY AND 2 SPEED SWITCH. MOUNTED IN THE ROOF OR AT TOP OF WALL NEAR THE RANGE.
11. **FURNITURE:** TWO, TWO–DRAWER, LEGAL SIZE FILE CABINETS BUILT INTO DESK AREA. DESK SHALL BE BUILT–IN WITH ONE CENTER DRAWER. ONE DESK CHAIR WITH ROLLERS, ONE STRAIGHT CHAIR, AND FOUR STOOLS FOR WORK AREA WITH HEIGHT COMPATIBLE WITH WORK BENCHES. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
12. **BOOK SHELVES:** MINIMUM 10 LINEAR FT. LONG, 10 IN. DEEP. BUILT OVER DESK AREA. TOP SHELF SHALL BE AT LEAST 14 IN. BELOW CEILING.
13. **WORK BENCHES:** 30 IN. DEEP x 36 IN. HIGH WITH A DURABLE WORKING SURFACE SUCH AS FORMICA.
14. **STORAGE CABINETS:** TWO, ONE BUILT–IN UNDER THE WORK BENCH WITH A 28 IN. x 28 IN. LOCK EQUIPPED DOOR, WITH ELECTRICAL OUTLET INSIDE. ONE REMOVABLE, WITH OPEN BOTTOM, LOCK EQUIPPED TO SECURE CABINET TO TOP OF WORK BENCH, AND LARGE ENOUGH TO COVER A 22 IN. x 18 IN. x 18 IN. HIGH ASPHALT CONTENT (AC) GAUGE.
15. **SINK:** ONE, SINGLE TUB, STAINLESS STEEL, 25 IN. x 22 IN. x $6\frac{1}{2}$ IN. EQUIPPED WITH SPRAY NOZZLE, ONE COMBINATION (MIXING) HOT AND COLD WATER FAUCET AND ONE SINGLE COLD WATER FAUCET. ALL FAUCETS SHALL BE EQUIPPED WITH STANDARD HOSE THREAD SPIGOTS. DRAIN SHALL HAVE NO TRAP.
16. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
17. **TESTING WATER SUPPLY:** 300 GALLON WATER CAPACITY, IN ONE OR MORE TANKS LOCATED ALONG THE TRAILER END OR ALONG BOTH SIDES OF THE TRAILER END, VENTED WITH MEANS OF DETERMINING WATER LEVEL, WITH ONE PRESSURE PUMP, MINIMUM 30 PSI DELIVERY PRESSURE. TEN GALLON ELECTRIC WATER HEATER. ONE COLD WATER FAUCET WITH BACK FLOW PREVENTER LOCATED ON OUTSIDE OF TRAILER. WATER PIPES SHALL BE LOCATED SO THEY ARE UNEXPOSED AND PROTECTED FROM DAMAGE. WATER SHALL BE SUPPLIED BY THE CONTRACTOR.
18. **TELEPHONES:** TWO TELEPHONES. TWO PRIVATE LINES (1FB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FAX. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ–11 JACKS (TWO WIRE PAIRS PER JACK). TWO AT EACH END OF THE TRAILER. WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE LINE.
19. **FIRE EXTINGUISHER:** ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
20. **RANGE:** 30 IN. KITCHEN RANGE, ELECTRIC OR GAS, HAVING FOUR SURFACE BURNERS AND A 3.5 CU. FT. OVEN WITH REINFORCED OVEN RACKS.
21. **FORCED AIR OVEN:** IF A FORCED AIR OVEN IS REQUIRED, THE LOCATION WHERE THE OVEN IS PLACED SHALL HAVE A MINIMUM 3 IN. DIAMETER PIPE INSTALLED AND VENTED TO THE OUTSIDE.
22. **MICROWAVE OVEN:** ONE, 1.5 CU. FT. WITH AT LEAST FIVE POWER LEVELS AND A REVOLVING FLOOR OR ROTATING POWER SOURCE.
23. **SIEVE SHAKER:** ONE MOTOR DRIVEN STANDARD PORTABLE SHAKER INCLUDING:
    A. A SAFETY SHIELD ON DRIVE BELT.
    B. AN ADJUSTABLE TIMED – ON/OFF SWITCH LOCATED NEAR THE SHAKER.
    C. ADAPTERS TO HANDLE EITHER 8 IN. OR 12 IN. SIEVES.

    THE SHAKER SHALL BE CAPABLE OF SHAKING A FULL SET OF 8 IN. SIEVES AS WELL AS 12 IN. SIEVES, AND SHALL BE MOUNTED 24 IN. ABOVE THE FLOOR IN A SOUND PROOF, INSULATED ENCLOSURE HAVING HINGED OPENINGS.

    THE SIEVE SHAKER SHALL BE A RO–TAP, ENDOCOTT FROM SOILTEST, SS–12R FROM GILSON OR APPROVED EQUAL.
24. **ELECTRONIC BALANCE:** THE BALANCE SHALL COMPLY WITH ASSHTO M 231 FOR GENERAL PURPOSE, CLASS G2 BALANCES, AND THE FOLLOWING:
    A. POWER: 115 VAC
    B. MODEL: TOP LOADING
    C. CAPACITY: MINIMUM OF 35 LBS.
    D. READABILITY AND SENSITIVITY: 0.0005 LB.
    E. ACCURACY: 0.001 LB. OR 0.1%
    F. DISPLAY PANEL: SHALL BE EQUIPPED WITH THE FOLLOWING: LED DISPLAY, ON/OFF KEY, PRINT KEY, RE–ZERO KEY, WEIGHING MODE KEY, SAMPLE % KEY, SERIAL RS– 232C PORT, AND A CALIBRATION SWITCH.
    G. WEIGHING MODES: GRAMS, POUNDS, AND PERCENT OF TARGET MASS (WEIGHT).
    H. WEIGHING SURFACE DIMENSION: MINIMUM OF 9 IN. WIDE BY 12 IN. DEEP.
    I. BASE: SHALL HAVE ADJUSTABLE LEVELING FEET AND A LEVEL VIAL ATTACHED.

    THE BALANCE SHALL BE EQUIPPED WITH AN UNDERHOOK WEIGHING DEVICE AND ONE COPY OF THE OWNER'S MANUAL.
25. **RECORDING THERMOMETER:** RECORDING THERMOMETER FOR CURING TANKS SHALL BE EITHER ELECTRICAL OR MECHANICAL TYPE.
    A. THE ELECTRICAL RECORDING THERMOMETER SHALL BE EQUIPPED WITH THE FOLLOWING:
        (1) 120 VAC/60 Hz WITH A MINIMUM 3 FT. LONG POWER CORD.
        (2) MINIMUM 6 IN. DIAMETER CIRCULAR PAPER CHART WITH A BOX OF BLANK CHARTS.
        (3) A SELECTABLE TEMPERATURE SCALE WITH ONE SCALE THAT HAS A RANGE FROM 50° F. TO 120° F.
        (4) A SELECTABLE CHART SPEED WITH ONE SPEED OF 24 HOURS AND ONE SPEED OF 7 DAYS. THE SPEED ACCURACY SHALL BE ±1.5%.
        (5) THE DISPLAY SHALL BE A MINIMUM 3 DIGIT LED WITH A MINIMUM DIGIT SIZE OF 0.5 IN.
        (6) THE TEMPERATURE ACCURACY OF THE MONITOR SHALL BE $\pm 1^{\circ}$ F
        (7) THE MONITOR SHALL HAVE A CHART ADVANCE BUTTON, A TIME POINTER, A PEN ADJUST BUTTON, AND A TEMPERATURE ADJUST KNOB.

    THE RECORDING PEN SHALL BE AN INK TYPE WITH A SPARE PEN INCLUDED.

    THE TEMPERATURE PROBE SHALL BE SUBMERSIBLE TYPE J THERMOCOUPLE WITH A 15 FT. MINIMUM CORD LENGTH.

    B. THE MECHANICAL RECORDING THERMOMETER SHALL BE EQUIPPED WITH THE FOLLOWING:
        (1) MINIMUM 3 IN. DIAMETER PRESSURE SENSITIVE PAPER CHART WITH A BOX OF BLANK CHARTS.
        (2) THE STEM OF THE THERMOMETER SHALL BE A MINIMUM OF 12 IN. LONG.
        (3) THE THERMOMETER SHALL BE A KEY TYPE, WINDING MODEL CAPABLE OF 7 DAY, 24 HOUR RECORDING.
        (4) THE DRIVE MECHANISM SHALL BE CAPABLE OF OPERATING BEYOND ITS FULL RECORDING RANGE BY A MINIMUM OF 20%.
        (5) THE THERMOMETER SHALL BE CAPABLE OF OPERATING FROM 0° F TO 200° F.
        (6) THE CLOCK MECHANISM ACCURACY SHALL BE A MINIMUM OF 2% OF THE FULL–SCALE RANGE BEING USED.
        (7) THE RECORDING RANGE SHALL BE A MINIMUM OF 20° F TO 220° F.

    THE RECORDING THERMOMETER SHALL BE MOUNTED IN SUCH A WAY THAT A MINIMUM 8 IN. OF THE STEM IS IMMERSED IN THE CURING TANKS AND IS EASILY ACCESSIBLE TO CHANGE THE RECORDING TEMPERATURE CHARTS.
26. **SECURITY:** THIS SYMBOL ✛ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.
27. THE REQUIREMENTS LISTED HEREIN ARE INTENDED TO MEET THE NEEDS OF THE CDOT TESTING PERSONNEL CONCERNING TESTING FACILITIES. THERE IS NO INTENT TO SPECIFY ANY STRUCTURAL PORTIONS OF THE SUBJECT LABORATORY EXCEPT AS NEEDED TO SATISFACTORILY PERFORM THE REQUIRED TESTING OF MATERIALS.

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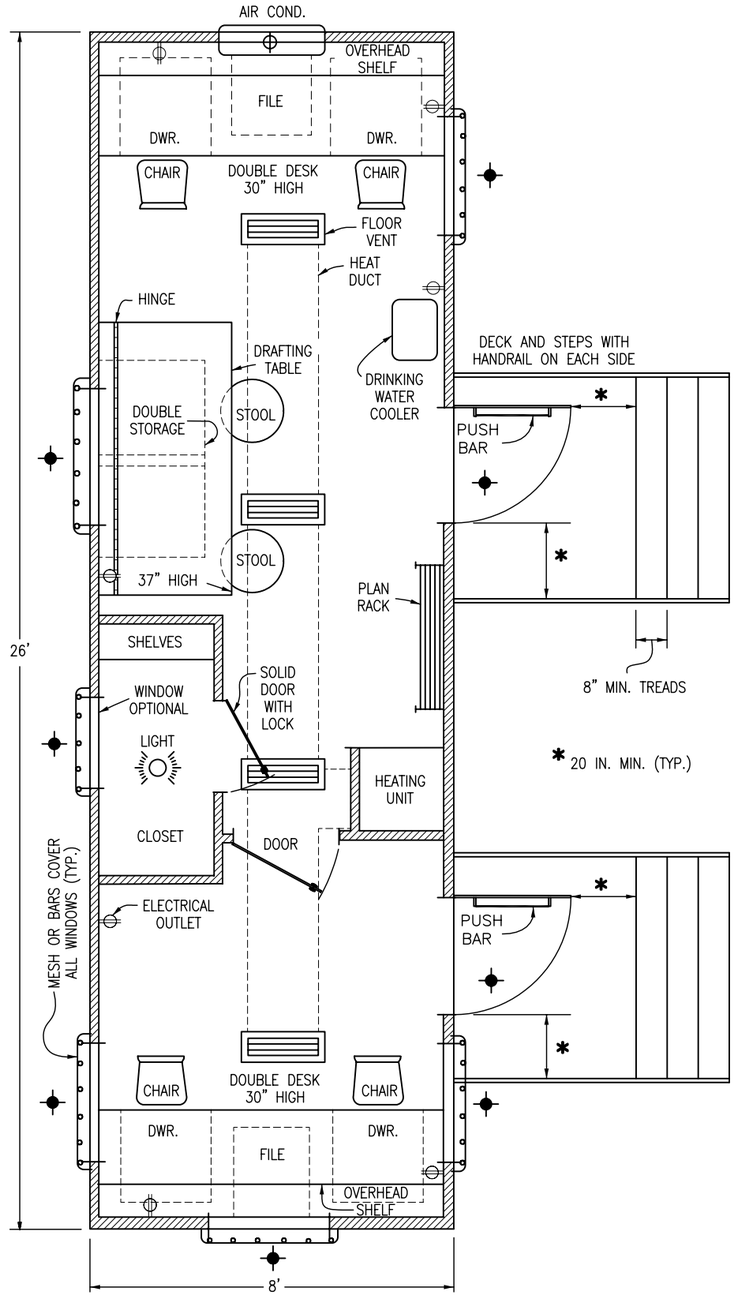
FIELD LABORATORY CLASS 2

Issued By: Project Development Branch on July 04, 2006

STANDARD PLAN NO.
M-620-2
Sheet No. 1 of 1



FLOOR PLAN

GENERAL NOTES

1. CLASS 1 FIELD OFFICES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, CONSTRUCTED TO THE UNIFORM BUILDING CODE SERIES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 26 FT. LONG x 8 FT. WIDE OUTSIDE, 7 FT.–6 IN. HEIGHT INSIDE.
3. **WINDOWS:** A MINIMUM OF 4, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.
4. **OUTSIDE DOORS:** TWO, REINFORCED WITH DEADBOLT LOCKS. DECK, STEPS, AND HANDRAILS AT EACH DOOR. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **HEATING:** A THERMOSTAT CONTROLLED FORCED AIR UNIT WITH A MINIMUM INPUT CAPACITY OF 200 BTU PER SQUARE FT. OF FLOOR AREA.
6. **AIR CONDITIONING:** ONE, 8,300 BTU MINIMUM.
7. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.
8. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING OVER ALL DRAFTING TABLES AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
9. **DESKS:** ONE 30 IN. x FULL INSIDE WIDTH x 30 IN. HIGH, AT EACH END OF THE TRAILER, SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER PEDESTAL. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.
10. **DRAFTING TABLES:** ONE 26 IN. x 72 IN. HINGED BOARD WITH DOUBLE STORAGE BELOW. SLOPE BOARD 12:1 DOWN TO 37 IN. HEIGHT AT FRONT EDGE.
11. **FURNITURE:** FOUR CHAIRS WITH ROLLERS AND TWO DRAFTING STOOLS. EACH OF APPROPRIATE HEIGHT. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
12. **PLAN STORAGE:** A PLAN RACK OR FILE FOR FULL SIZE PLANS.
13. **CLOSET:** A LOCKED STORAGE AREA OF 15 SQ. FT.
14. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
15. **TELEPHONES:** TWO TELEPHONES. TWO PRIVATE LINES (1FB) WITH TOUCH TONE SERVICE (IF AVAILABLE) FROM THE LOCAL CARRIER. ONE LINE SHALL BE SHARED BY THE TWO TELEPHONES. THE SECOND LINE SHALL BE SHARED BY A COMPUTER AND A FACSIMILE MACHINE. THE CONTRACTOR SHALL PROVIDE AN EXCLUSION SWITCH (AB SWITCH) FOR THE COMPUTER AND FACSIMILE MACHINE. TRAILER WIRING SHALL INCLUDE FOUR BOXES EQUIPPED WITH RJ–11 JACKS (TWO WIRE PAIRS PER JACK), TWO AT EACH END OF THE TRAILER. WHERE PRIVATE LINE SERVICE IS NOT AVAILABLE, PROVIDE ONLY ONE TELEPHONE LINE.
16. **FIRE EXTINGUISHER:** ONE, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
17. **SECURITY:** THIS SYMBOL ⌖ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.

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FIELD OFFICE CLASS 1

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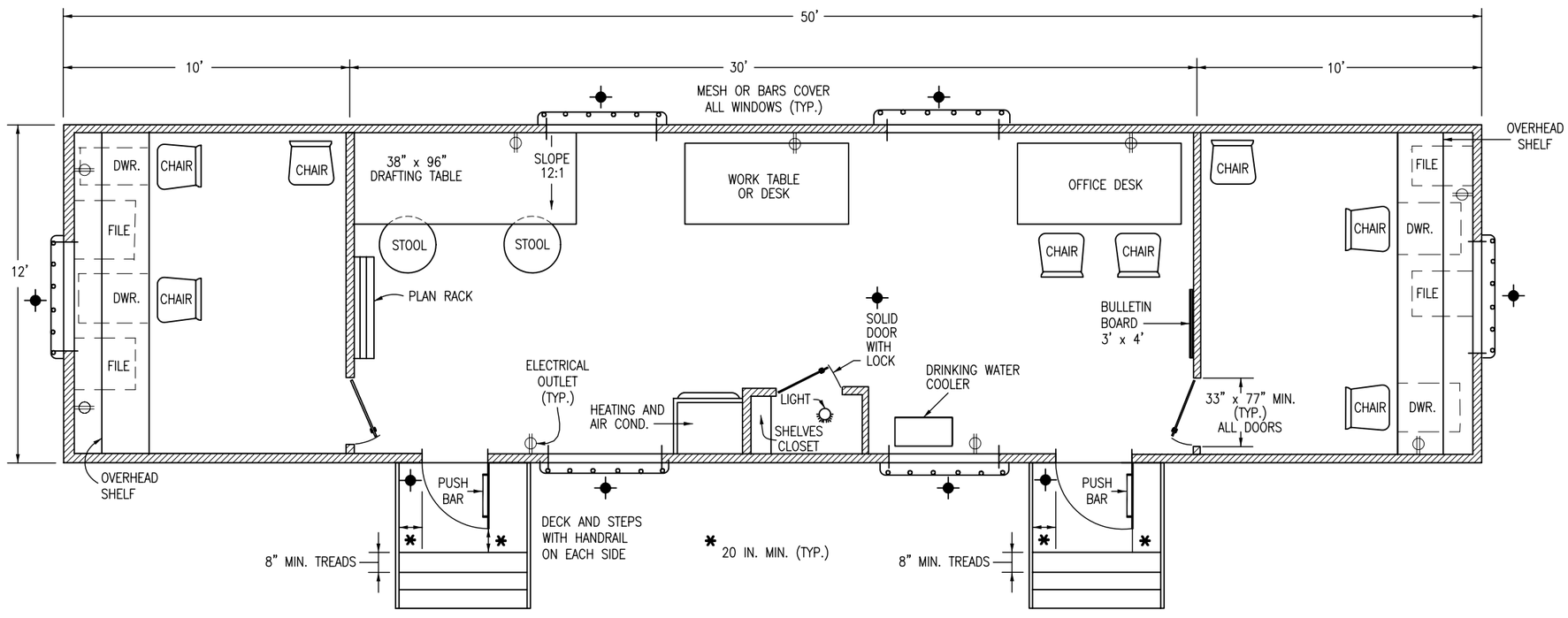
Sheet No. 1 of 1

GENERAL NOTES

1. CLASS 2 FIELD OFFICES SHALL CONSIST OF A WEATHERPROOF, INSULATED, TEMPORARY OFFICE TYPE TRAILER, BUILT TO THE UNIFORM BUILDING CODE SERIES OF CODES, WITH FLOOR PLAN AND EQUIPMENT LAYOUT SIMILAR TO THE DRAWING ON THIS SHEET. IT SHALL MEET OR EXCEED THE FOLLOWING REQUIREMENTS.
2. **DIMENSIONS:** 50 FT. LONG x 12 FT. WIDE OUTSIDE, 7 FT.–6 IN. HEIGHT INSIDE.
3. **WINDOWS:** A MINIMUM OF 6, WITH PROVISION FOR CROSS VENTILATION AND LOCKING.
4. **DOORS:** TWO INSIDE DOORS, MAY BE LOCATED EITHER TO ONE SIDE OR AT CENTER OF PARTITION. ONE CLOSET DOOR. TWO OUTSIDE DOORS SHALL BE REINFORCED AND HAVE DEADBOLT LOCKS. DECK, STEPS, AND HANDRAILS AT EACH OUTER DOOR. THE STEPS SHALL BE PLACED SO THE DECK CAN BE ACCESSED EITHER FROM THE SIDE OR FROM THE FRONT. THE DECK, RAILS, AND STEPS SHALL MEET OSHA REQUIREMENTS.
5. **HEATING & AIR CONDITIONING:** THREE TON CAPACITY AIR CONDITIONING AND 80,000 BTU CAPACITY HEATING, CONNECTED TO DUCTING & THERMOSTAT CONTROLLED.
6. **ELECTRICAL:** WORK SHALL CONFORM TO THE NATIONAL ELECTRICAL CODE FOR 110/220 VOLTS, 60 Hz, APPLICATIONS AND PROVIDE RELIABLE UNIFORM POWER TO PROPERLY OPERATE ALL FIELD OFFICE EQUIPMENT.
7. **LIGHTING:** ADEQUATE FLUORESCENT LIGHTING OVER ALL DRAFTING TABLES AND DESK AREAS. THERE SHALL BE ONE 110 VOLT EXTERIOR PORCH LIGHT FIXTURE WITHIN 2 FT. OF EACH EXTERIOR DOOR.
8. **DESKS:** ONE 30 IN. x FULL INSIDE WIDTH x 30 IN. HIGH AT EACH END OF THE TRAILER, SUPPORTED BY A LEGAL SIZE 2 DRAWER METAL FILE CENTER PEDESTAL. EACH DESK TOP SHALL HAVE AN OVERHEAD SHELF AND TWO PEN DRAWERS.
9. **DRAFTING TABLE:** ONE 38 IN. x 96 IN. TABLE, SLOPED 12:1 TO 37 IN. HEIGHT AT FRONT EDGE OR WITH PROVISION FOR ADJUSTING THE SLOPE.
10. **WORK TABLE:** ONE 72 IN. x 36 IN. TABLE. THE TOP OF THE TABLE SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.
11. **OFFICE DESK:** ONE 72 IN. x 36 IN. DESK WITH SIX DRAWERS AND ONE CENTER PEN DRAWER. THE TOP OF THE DESK SHALL BE FREE OF ALL SCRATCHES, CHIPS, AND DENTS.
12. **FURNITURE:** EIGHT CHAIRS WITH ROLLERS AND TWO DRAFTING STOOLS. EACH OF APPROPRIATE HEIGHT. ONE WORK TABLE OR DESK. ALL CHAIRS SHALL BE ERGONOMICALLY BUILT.
13. **PLAN STORAGE:** A PLAN RACK OR FILE FOR FULL SIZE PLANS.
14. **CLOSET:** A LOCKED STORAGE AREA OF 15 SQ. FT.
15. **DRINKING WATER SUPPLY:** DRINKING WATER DISPENSED FROM AN ACCEPTABLE WATER COOLING DEVICE.
16. **TELEPHONES:** THREE, 2–LINE TELEPHONES. FOUR PRIVATE LINES (1FB) WITH TOUCH TONE SERVICE. TWO LINES ARE FOR TELEPHONE SERVICES, WITH ROLL–OVER CAPABILITY FOR THE THREE TELEPHONES. ONE LINE SHALL BE USED FOR THE COMPUTER, AND ONE LINE SHALL BE USED FOR THE FACSIMILE MACHINE. TRAILER WIRING SHALL INCLUDE 9 RJ–11 JACKS, ONE JACK EACH FOR A TWO–LINE TELEPHONE, A COMPUTER LINE, AND A FACSIMILE MACHINE LINE AT EACH END OF THE OFFICE, AND IN THE CENTER AREA OF THE OFFICE.
17. **FIRE EXTINGUISHER:** TWO, DRY CHEMICAL, 10 LBS. CLASS ABC, UNDERWRITERS LABORATORIES, INC. APPROVED.
18. **SECURITY:** THIS SYMBOL ⌖ ON THE FLOOR PLAN DENOTES AREAS ON THE TRAILER WHERE ADEQUATE PROTECTION AGAINST ILLEGAL ENTRY, VANDALISM AND THEFT SHALL BE PROVIDED.



FLOOR PLAN

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FIELD OFFICE CLASS 2

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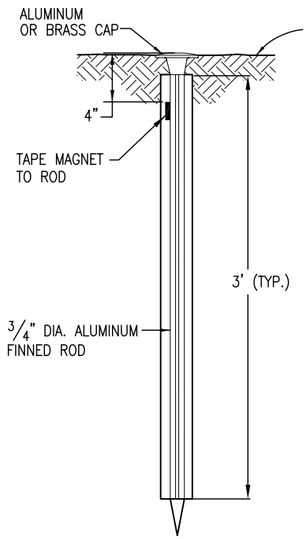
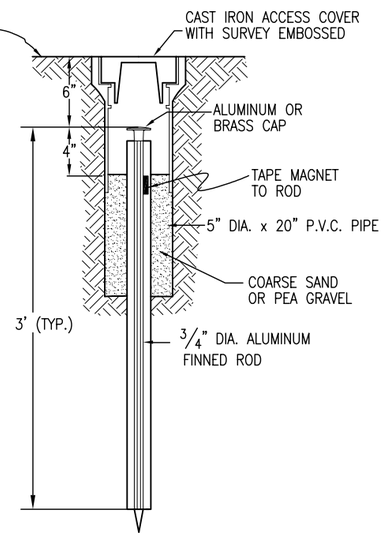
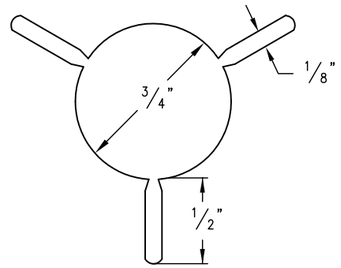


TYPE 1 MONUMENT

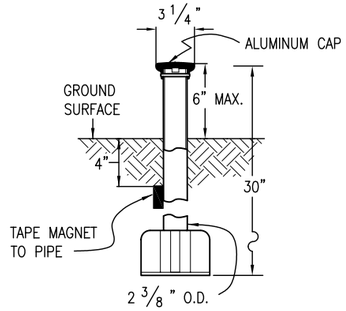


TYPE 1A MONUMENT

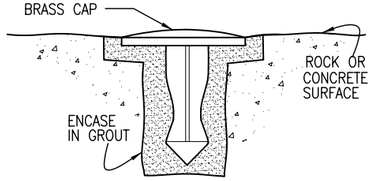
INCLUDES MONUMENT BOX



SECTION A–A

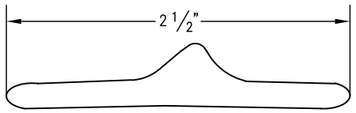


TYPE 3 MONUMENT

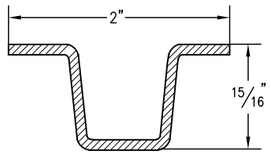


TYPE 5 MONUMENT

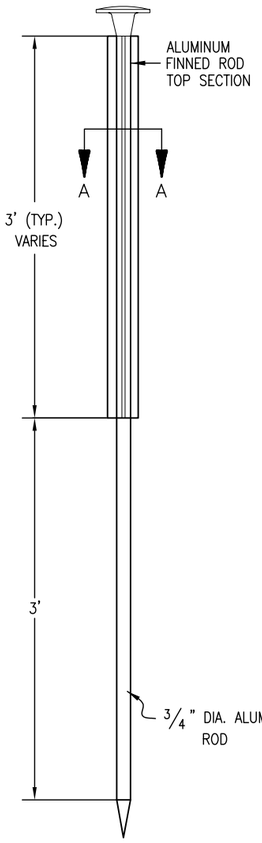
ALUMINUM CAP AND TYPE 5(S)
DETAILS SHOWN ON SHEET 2

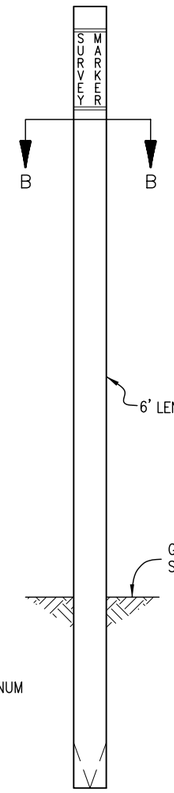


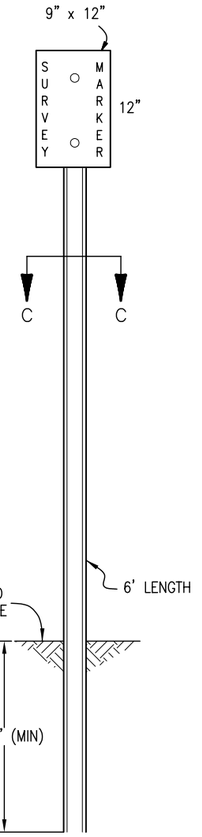
SECTION B–B



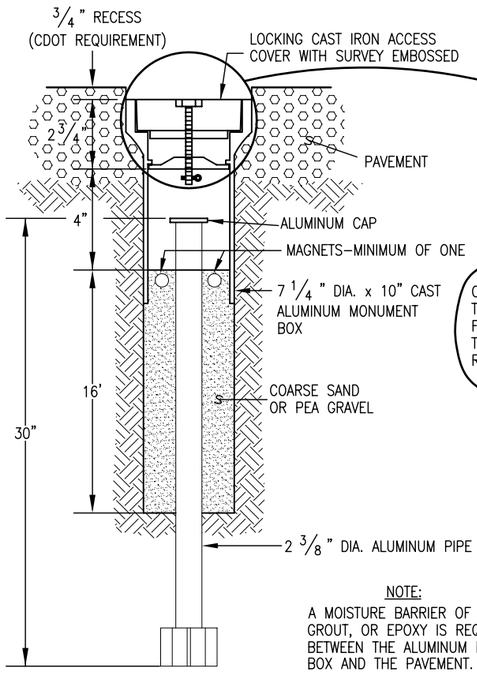
DELINEATOR POST
SECTION C–C







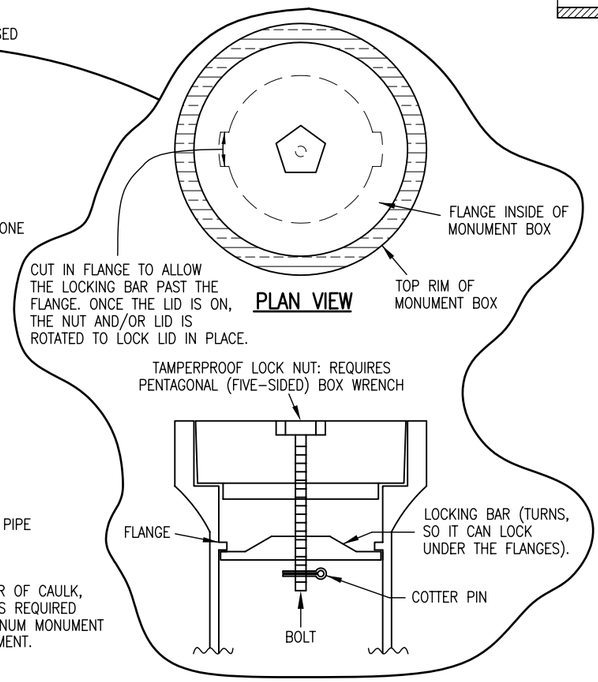
WITNESS POSTS



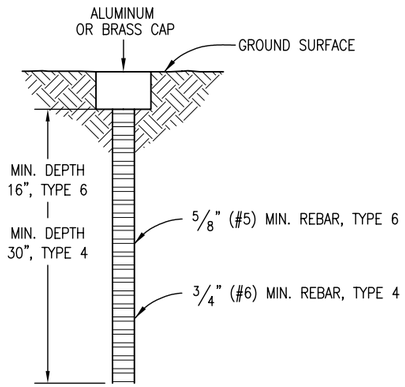
NOTE:
A MOISTURE BARRIER OF CAULK, GROUT, OR EPOXY IS REQUIRED BETWEEN THE ALUMINUM MONUMENT BOX AND THE PAVEMENT.

TYPE 3A MONUMENT

ROADWAY INSTALLATION
INCLUDES MONUMENT BOX



LOCKING CAST IRON ACCESS COVER



TYPE 4 AND TYPE 6 MONUMENT

TYPE 2 MONUMENT

TYPE 2A INCLUDES MONUMENT BOX

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Last Modification Date: 07/04/06 Initials: LTA	R–X		
Full Path: www.dot.state.co.us/DesignSupport/	R–X		
Drawing File Name: 629010102.dwg	R–X		
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English			

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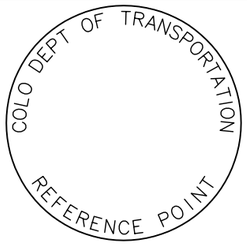
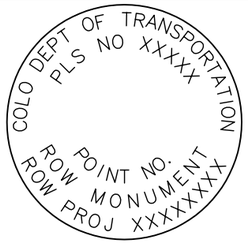
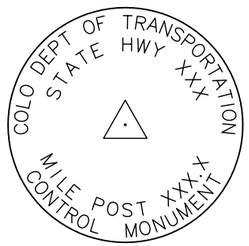
STANDARD PLAN NO.
M-629-1
Sheet No. 1 of 2



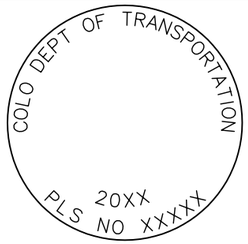
REFERENCE
MONUMENT CAP



ROW
MONUMENT CAP



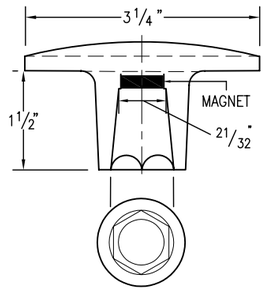
CONTROL
MONUMENT CAP



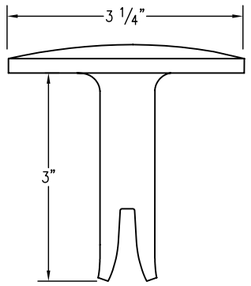
ALIQUOT CORNER
MONUMENT CAP

ALUMINUM CAP

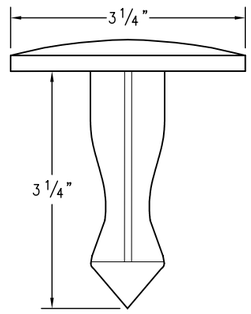
NOTE: A BLANK CAP MAY BE SUBSTITUTED IF THE APPROPRIATE CAP SHOWN ABOVE IS NOT AVAILABLE. IF A BLANK CAP IS USED, ALL INFORMATION NORMALLY INCLUDED ON THE APPROPRIATE STANDARD CAP, SHALL BE STAMPED ON THE BLANK CAP ALONG WITH SPECIFIC PROJECT INFORMATION SUCH AS PROJECT NO., DATE, POINT NO., ETC..



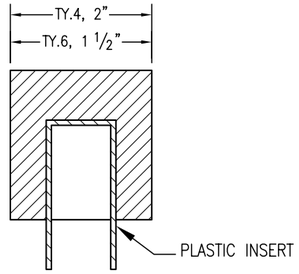
ALUMINUM CAP
USED WITH ALUMINUM ROD



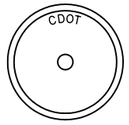
ALUMINUM CAP
TYPE 5
FOR PLACING IN EXISTING CONCRETE OR ROCK

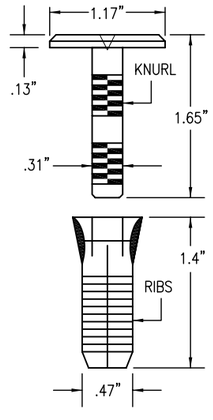


BRASS CAP
TYPE 5
FOR PLACING IN EXISTING CONCRETE OR ROCK



ALUMINUM CAP





COPPER ALLOY CAP
TYPE 5(S)
FOR PLACING IN EXISTING SIDEWALK, CURB, OR GUTTER

MONUMENT APPLICATION

CAP TYPE	MONUMENT TYPE									
	1	1A	2	2A	3	3A	4	5	5(S)	6
REFERENCE	X	X						X	X	X
ROW	X	X						X	X	
CONTROL			X	X				X	X	
ALIQUOT CORNER	X	X			X	X	X	X		
PERMANENT EASEMENT								X	X	X
PROJECT POINTS								X	X	X
WITNESS POST * (REQUIRED)	X		X	X	X			X		

ALL MONUMENTATION MATERIALS WILL BE FURNISHED BY CDOT

THE MONUMENT TYPE SHALL MEET THE MINIMUM STANDARDS AS DETERMINED BY THE COLORADO STATE BOARD OF REGISTRATION FOR PROFESSIONAL LAND SURVEYORS RULES (STATE BOARD RULES).

THE CDOT SURVEY COORDINATOR SHALL APPROVE ALL EXCEPTIONS FOR STAMPING MONUMENTS DIFFERING FROM THE STANDARDS.

TYPE 1 AND TYPE 1A ALUMINUM FINNED ROD MONUMENTS

THIS MONUMENT SHALL BE USED FOR ROW OR REFERENCE MONUMENTS OR MAY BE USED FOR AN ALIQUOT CORNER MONUMENT. WHEN USED AS AN ALIQUOT CORNER MONUMENT, INSTALLATION AND RECORD FILING REQUIREMENTS SHALL BE AS STATED FOR TYPE 3 AND TYPE 3A MONUMENTS.

MONUMENTS SHALL BE INSTALLED BY ATTACHING THE PROPER SIZE TIP TO ONE END OF A SECTION OF FINNED ROD, AND A 3 IN. LONG X 3/4 IN. DIA. STAINLESS STEEL ADAPTER TO THE OTHER END. THE DRIVER IS THEN PLACED OVER THE STAINLESS STEEL ADAPTER FOR THE HAMMER TO CONTACT. TYPE 1 MONUMENTS SHALL USE A MINIMUM 3 FT. SECTION OF FINNED ROD.

WHEN SUBSURFACE ROCK OR CONCRETE IS ENCOUNTERED LESS THAN 3 FT. BELOW THE GROUND SURFACE, THE ROD SHALL BE EMBEDDED IN THE ROCK OR IN CONCRETE AT LEAST 6 IN. AND GROUTED IN PLACE. THE ROD MAY BE SHORTENED TO ACCOMMODATE THE CONDITIONS.

WHEN UNSTABLE SOIL CONDITIONS ARE ENCOUNTERED, ADDITIONAL SECTIONS OF ROD SHALL BE ADDED TO ACHIEVE STABILITY. HORIZONTAL AND VERTICAL STABILITY ARE REQUIRED.

TYPE 1A MONUMENT INCLUDES MONUMENT BOX. A LOCKING CAST IRON ACCESS COVER SHALL BE INSTALLED WHEN THE MONUMENT IS LOCATED IN THE ROADWAY PAVEMENT.

TYPE 2 AND TYPE 2A ALUMINUM FINNED ROD MONUMENTS

THIS MONUMENT SHALL BE USED FOR HORIZONTAL AND VERTICAL CONTROL MONUMENTS. WHEN UNSTABLE SOIL CONDITIONS ARE ENCOUNTERED, ADDITIONAL SECTIONS OF ROD SHALL BE ADDED TO ACHIEVE STABILITY. HORIZONTAL AND VERTICAL STABILITY ARE REQUIRED. IN MOST SOIL CONDITIONS THE TYPE 2 MONUMENT IS EMBEDDED 6 FT. INTO THE GROUND.

THE MONUMENT SHALL BE INSTALLED BY FIRST ATTACHING THE PROPER SIZE TIP TO A 3 FT. LONG X 3/4 IN. DIA. ROD, THEN DRIVING THE ROD AT LEAST 30 IN. INTO THE GROUND. ADDITIONAL 3 FT. LONG X 3/4 IN. FINNED ROD SECTIONS SHALL BE ADDED AND DRIVEN FLUSH WITH THE GROUND UNTIL THE MONUMENT IS IN A STABLE POSITION. THE FINS ARE BENT OVER USING PLIERS TO ACCOMMODATE INSTALLING THE CAP. THE CAP IS FIRMLY SEATED ONTO THE LAST FINNED SECTION OF ROD USING A DEAD BLOW SLEDGE HAMMER.

TYPE 2A MONUMENT INCLUDES MONUMENT BOX. A LOCKING CAST IRON ACCESS COVER SHALL BE INSTALLED WHEN THE MONUMENT IS LOCATED IN THE ROADWAY PAVEMENT.

TYPE 3 AND TYPE 3A ALUMINUM PIPE MONUMENTS

THIS MONUMENT SHALL BE USED FOR AN ALIQUOT CORNER MONUMENT. THE INSTALLATION OF THIS MONUMENT AND RECORD FILING SHALL BE DONE IN ACCORDANCE WITH THE STATE BOARD RULES. ALSO REFER TO THE CDOT SURVEY MANUAL AND THE BUREAU OF LAND MANAGEMENT REQUIREMENTS FOR MONUMENT INSTALLATION. THE LAND SURVEYOR'S LICENSE NUMBER AND THE YEAR SHALL BE STAMPED ON THE CAP.

TYPE 3A MONUMENT INCLUDES MONUMENT BOX. A LOCKING CAST IRON ACCESS COVER SHALL BE INSTALLED WHEN THE MONUMENT IS LOCATED IN THE ROADWAY PAVMENT.

TYPE 4 ALUMINUM MONUMENT

THIS MONUMENT MAY BE INSTALLED IN LIEU OF REPLACING THE ENTIRE MONUMENT WHEN REBAR IS IN PLACE AT AN ALIQUOT CORNER LOCATION. REFER TO THE STATE BOARD RULES. A MINIMUM 2 IN. DIA. CAP SHALL BE USED ON 3/4 IN. (#6) REBAR.

TYPE 5 BRASS/ALUMINUM CAP MONUMENT

THIS MONUMENT MAY BE INSTALLED IN LIEU OF ALL OTHER CDOT MONUMENTS, WHEN THE POSITION IS LOCATED IN CONCRETE OR STABLE ROCK FORMATION.

TYPE 5(S) COPPER ALLOY CAP MONUMENT – SMALL

THIS MONUMENT MAY BE INSTALLED IN LIEU OF A TYPE 5 MONUMENT, WHEN THE POSITION IS LOCATED IN A CONCRETE SIDEWALK, CURB OR GUTTER, OR WHEN SETTING A TYPE 5 WOULD COMPROMISE THE INTEGRITY OF THE RECEIVING STRUCTURE.

STAMPING REQUIREMENTS:

- "RP", WHEN THE APPLICATION IS A REFERENCE POINT.
- "ROW", POINT NUMBER, "LS", AND REGISTRATION NUMBER WHEN THE APPLICATION IS A ROW POINT.
- "CP" AND A UNIQUE IDENTIFIER PROVIDED BY THE REGION SURVEY COORDINATOR, WHEN THE APPLICATION IS A CONTROL POINT.
- "PE", POINT NUMBER, "LS", AND REGISTRATION NUMBER, WHEN THE APPLICATION IS A PERMANENT EASEMENT POINT.
- "PP" AND POINT NUMBER, WHEN THE APPLICATION IS A PROJECT POINT.

TYPE 6 ALUMINUM MONUMENT

THIS MONUMENT SHALL BE USED FOR PERMANENT EASEMENTS, PROJECT BENCH MARKS, PROJECT POINTS, AND REFERENCES. AN ALUMINUM CAP WITH A MINIMUM DIAMETER OF 1 1/2 IN., SHALL BE USED ON 5/8 IN. (#5) MINIMUM REBAR.

* WITNESS POSTS

THE WITNESS POST WILL BE SUPPLIED BY CDOT AND INSTALLATION SHALL BE INCLUDED IN THE WORK. IT SHALL BE DRIVEN WITHIN 1 FT. OF THE MONUMENT WHEN POSSIBLE. A DELINEATOR POST WITH A 9 IN. X 12 IN.METAL SIGN PANEL MAY BE USED IN LIEU OF THE PLASTIC POST. THIS POST SHALL CONFORM TO STANDARD PLAN S-612-1. A REQUIRED WITNESS POST MAY BE OMITTED WITH THE APPROVAL OF THE ENGINEER IF THE WITNESS POST LOCATION IS WITHIN A TRAVELED WAY, DRIVEWAY, OR ACCESS OPENING.

Computer File Information	
Creation Date: 07/04/06	Initials: SJR
Last Modification Date: 07/04/06	Initials: LTA
Full Path: www.dot.state.co.us/DesignSupport/	
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CAD Ver.: MicroStation V8 Scale: Not to Scale	Units: English

Sheet Revisions	
Date:	Comments

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

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STANDARD PLAN NO.
M-629-1
Sheet No. 2 of 2

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