

NDDOT ABBREVIATIONS

D-101-1

?	This is a special text character used in the labeling of existing features. It indicates a feature that has an unknown characteristic, potentially based on: lack of description, location accuracy or purpose.	C Gdrl	cable guardrail	Culv	culvert	FOS	factor of safety
Abn	abandoned	Calc	calculate	C&G	curb & gutter	Fed	Federal
Abut	abutment	CIP	cast iron pipe	CI	curb inlet	FP	feed point
Adj	adjusted	CB	catch basin	CR	curb ramp	Fn	fence
Aggr	aggregate	CRS	cationic rapid setting	C	cut	Fn P	fence post
Ahd	ahead	C Gd	cattle guard	Dd Ld	dead load	FO	fiber optic
ARV	air release valve	C To C	center to center	Defl	deflection	FD	field drive
Align	alignment	CL or $\varnothing$	centerline	Defm	deformed	F	fill
Al	alley	Ch	chain	DInt	delineate	FAA	fine aggregate angularity
Alt	alternate	Chnlk	chain-link	DIntr	delineator	FH	fire hydrant
Alum	aluminum	Ch Blk	channel block	Depr	depression	Fl	flange
ADA	Americans with Disabilities Act	Ch Ch	channel change	Desc	description	Flrd	flared
&	and	Chk	check	Det	detail	FES	flared end section
Appr	approach	Chsld	chiseled	DWP	detectable warning panel	F Bcn	flashing beacon
Approx	approximate	Cir	circle	Dtr	detour	FA	flight auger sample
ACP	asbestos cement pipe	Cl	class	Dia or $\varnothing$	diameter	FL	flow line
Asph	asphalt	Clnt	clean-out	Dir	direction	Ftg	footing
AC	asphalt cement	Clr	clear	Dist	distance	FM	force main
Assmd	assumed	Cl&gr	clearing & grubbing	DM	disturbed material	Fnd	found
@	at	Comb.	combination	DB	ditch block	Fdn	foundation
Atten	attenuation	Coml	commercial	DG	ditch grade	Frac	fractional
ATR	automatic traffic recorder	Compr	compression	Dbl	double	Frwy	freeway
Ave	Avenue	CADD	computer aided drafting & design	Dn	down	Frt	front
Avg	average	Conc	concrete	Dwg	drawing	FF	front face
ADT	average daily traffic	CECB	concrete erosion control blanket	Dr	drive	F Disp	fuel dispenser
		Cond	conductor	Drw	driveway	FFP	fuel filler pipes
		Const	construction	DI	drop inlet	FLS	fuel leak sensor
		Cont	continuous	D	dry density	Furn	furnish/ed
		CSB	continuous split barrel sample				
		Contr	contraction				
		Contr	contractor				
Bk	back	CP	control point	Ea	each		
BF	back face	Coord	coordinate	Esmt	easement		
Balc	balcony	Cor	corner	E	East		
B Wire	barbed wire	Corr	corrected	EB	Eastbound		
Barr	barricade	CAES	corrugated aluminum end section	Elast	elastomeric		
Btry	battery	CAP	corrugated aluminum pipe	EL	electric locker		
BI	beehive inlet	CMES	corrugated metal end section	E Mtr	electric meter		
Beg	begin	CMP	corrugated metal pipe	EVSE	electric vehicle supply equipment		
BG	below grade	CPVCP	corrugated poly-vinyl chloride pipe	Elec	electric/al		
BM	bench mark	CSES	corrugated steel end section	EDM	electronic distance meter		
Bkwy	bikeway	CSFES	corrugated steel flared end section	Elev or El	elevation		
Bit	bituminous	CSP	corrugated steel pipe	Ellipt	elliptical		
Blk	block	CSTES	corrugated steel traversable end section	Emb	embankment		
BH	bore hole	Co	County	Emuls	emulsion/emulsified		
Bot	bottom	Crse	course	ES	end section		
Blvd	Boulevard	Ct	Court	Engr	engineer		
Bndry	boundary	Xarm	cross arm	ESS	environmental sensor station		
Brkwy	breakaway	Xbuck	cross buck	Eq	equal		
Br	bridge	Xsec	cross sections	Evgr	evergreen		
Bldg	building	Xing	crossing	Exc	excavation		
Bus.	business	Xrd	crossroad	Exst	existing		
BV	butterfly valve	Crn	crown	Exp	expansion		
Byp	bypass			Expy	Expressway		
				E	external of curve		
				Extru	extruded		

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NDDOT ABBREVIATIONS

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Galv      galvanized  
Gar      garage  
Gs L      gas line  
G Reg    gas line regulator  
GMV      gas main valve  
G Mtr    gas meter  
GSV      gas service valve  
GVP      gas vent pipe  
GV       gate valve  
Ga       gauge  
Gov      government  
Grd      graded/grade  
Grnd     ground  
GWM     ground water monitor  
Gdrl     guardrail  
Gtr      gutter

H Plg     H piling  
Hdwl     headwall  
Ht       height  
Hel      helical  
HDPE    high density polyethylene  
HM       high mast  
HP       high pressure  
HPS      high pressure sodium  
HTCG    high tension cable guardrail  
Hwy      highway  
Hor      horizontal  
HBP      hot bituminous pavement  
HMA      hot mix asphalt  
Hyd      hydrant  
Ph       hydrogen ion content

Id        identification  
Incl      inclinometer tube  
IMH      inlet manhole  
ID        inside diameter  
Inst      instrument  
Intchg   interchange  
Intmdt   intermediate  
Intscn   intersection  
Inv       invert  
IP        iron pipe

Ln        lane  
Lg        large  
Lat       latitude  
Lt        left  
Lens      lenses  
Lvl       level  
Lvng      leveling  
Lht       light  
LP        light pole  
Ltg       lighting  
Liq       liquid  
LL        liquid limit  
Loc       location  
Long.     longitude  
Lp        loop  
LD        loop detector  
Lum       luminaire

Mb       mailbox  
ML       main line  
MH       manhole  
Mkd       marked  
Mkr       marker  
Mkg       marking  
MA       mast arm  
Matl      material  
Max       maximum

Meas      measure  
Mdn       median  
MD       median drain  
MC       medium curing  
MGS      Midwest Guardrail System  
MM       mile marker  
MP       mile post  
Min       minimum  
Misc      miscellaneous  
Mon       monument  
Mnd       mound  
Mtbl      mountable  
Mtd       mounted  
Mtg       mounting  
Mk        muck

Neop      neoprene  
Ntwk      network  
N          North  
NE        Northeast  
NW        Northwest  
NB        Northbound  
No. or #   number

Obsc      obscure(d)  
Ocpd      occupied  
Ocpy      occupy  
O/s       offset  
OC        on center  
C          one dimensional consolidation  
OC        organic content  
Orig      original  
O To O    out to out  
OD        outside diameter  
OH        overhead

PMT       pad mounted transformer  
Pg        pages  
Pntd      painted  
Pr        pair  
Pnl       panel  
Pk        park  
PSD       passing sight distance  
Pvmt      pavement  
Ped       pedestal  
Ped       pedestrian  
PPP       pedestrian pushbutton post  
Pen.      penetration  
Perf       perforated  
Per.       perimeter  
Perm      permanent  
PL        pipeline  
Pl        place  
P&P      plan & profile  
PL        plastic limit  
Pl or P   plate  
Pt        point  
PE        polyethylene  
PVC       polyvinyl chloride  
PCC       Portland Cement concrete  
PP        power pole  
Preempt   preemption  
Prefab    prefabricated  
Prfmd or Pref   preformed  
Prep      preperation  
Press.    pressure  
PRV       pressure relief valve  
Prestr    prestressed  
Pvt       private  
PD        private drive  
Prod.     production/produce  
Prog      programmed  
Prop.     property  
Ppsd      proposed  
PB        pull box

Qty       quantity  
Qtr       quarter

Rad or R   radius  
RR       railroad  
Rlwy      railway  
Rsd       raised  
RC        rapid curing  
Rec       record  
Rcy       recycle  
RAP       recycled asphalt pavement  
RPCC      recycled portland cement concrete  
Ref       reference  
R Mkr     reference marker  
RM        reference monument  
RP        reference point  
Refl       reflectorized  
RCB       reinforced concrete box  
RCES      reinforced concrete end section  
RCFES    reinforced concrete flared end section  
RCP       reinforced concrete pipe  
RCPS      reinforced concrete pipe sewer  
RCTES    reinforced concrete traversable end section  
Reinf      reinforcement  
Res       reservation  
Res       residence  
Ret        retaining  
Rev       reverse  
Rt        right  
R/W       right of way  
Riv        river  
Rd        road  
Rdbd      road bed  
Rdwy      roadway  
RWIS      roadway weather information system  
Rk        rock  
Rt        route

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Salv	salvage(d)	Tel	telephone
San	sanitary sewer line	Tel B	Telephone Booth
Sec	section	Tel P	telephone pole
SL	section line	Tv	television
Sep	separation	Temp	temperature
Seq	sequence	Temp	temporary
Serv	service	TBM	temporary bench mark
Sht	sheet	T	thinwall tube sample
Shtng	sheeting	Ts	topsoil
Shldr	shoulder	Traf	traffic
Sw or Sdwk	sidewalk	TSCB	traffic signal control box
SD	sight distance	Tr	trail
SN	sign number	Transf	transformer
Sig	signal	Trans	transition
Sgl	single	TT	transmission tower
SRCP	slotted reinforced concrete pipe	TES	traversable end section
SC	slow curing	Trans	transverse
SS	slow setting	Trtd	treated
Sm	small	Trmt	treatment
S	South	Qc	triaxial compression
SE	Southeast	TERO	tribal employment rights ordinance
SW	Southwest	Tpl	triple
SB	Southbound	Typ	typical
Sp	spaces		
Spcl	special	Qu	unconfined compressive strength
SA	special assembly	Ugrnd	underground
SP	special provisions	Util	utility
G	specific gravity		
Spk	spike		
SB	split barrel sample	VG	valley gutter
SH	sprinkler head	Vap	vapor
SV	sprinkler valve	Vert	vertical
Sq	square	VCP	vitrified clay pipe
Stk	stake	Vol	volume
Std	standard	VSFS	vehicle speed feedback sign
N	standard penetration test		
Std Specs	standard specifications	Wkwy	walkway
Stm L	steam line	W	water content
SEC	steel encased concrete	WGV	water gate valve
SMA	stone matrix asphalt	WL	water line
SSD	stopping sight distance	WM	water main
SD	storm drain	WMV	water main valve
St	street	W Mtr	water meter
SPP	structural plate pipe	WSV	water service valve
SPPA	structural plate pipe arch	WW	water well
Str	structure	Wrng	wearing
Subd	subdivision	WIM	weigh in motion
Sub	subgrade	W	west
Sub Prep	subgrade preperation	WB	westbound
Ss	subsoil	Wrng	wiring
SS	supplement specification	W/	with
Supp	supplemental	W/o	without
Surf	surfacing		
Surv	survey		
Sym	symmetrical		

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NDDOT ABBREVIATIONS

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MEASUREMENTS

ac	acres
A	ampere
Bd Ft	board feet
Cd	candela
cm	centimeter
C	coulomb
CF	cubic feet
m3	cubic meter
m3/s	cubic meters per second
CY	cubic yard
CY/mi	cubic yards per mile
D or Deg	degree
F	Fahrenheit
F	farad
ft	feet/foot
Gal	gallon
G	giga
Ha	hectare
H	henry
Hz	hertz
hr	hour(s)
in.	inch
J	joule
K	kelvin
kN	kilo newton
kPa	kilo pascal
kg	kilogram
kg/m3	kilogram per cubic meter
km	kilometer
K	Kip(s)
LF	linear foot
L	litre
Lm	lumen
L sum	lump sum
Lx	lux
M Hr	man hour
M	mega
m	meter
m/s	meters per second
mi	mile
mL	milliliter
mm	millimeter
mm/hr	millimeters per hour
n	nano
N	newton
Pa	pascal
lb	pounds
sec	seconds
S	siemens
SF	square feet
km2	square kilometer
m2	square meter
SY	square yard
Sta Yd	station yards
SI	Systems International

T	tesla
T/mi	tons per mile
V	volt
W	watt
Wb	weber

SURVEY DESCRIPTIONS

Az	azimuth
Bs	backsight
Brg	bearing
BP Cap	blue plastic cap
BS	both sides
BC	brass cap
CC	closing corner
CS	curve to spiral
Eq	equation
E	external of curve
FS	far side
FB	field book
Fs	foresight
Geod	geodetic
GIS	Geographical Information System
GPS	Global Positioning System
HI	height of instrument
IM	iron monument
I Pn	iron pin
LS	Land Surveyor (licensed)
LSIT	Land Surveyor In Training
L	length of curve
LC	long chord
LB	level book
MC	meander corner
Mer	meridian
M	mid ordinate of curve
NGS	National Geodetic Survey
NS	near side
Obsn	observation
Off Loc	office location
OP Cap	orange plastic cap
PK	Parker-Kalon nail
P Cap	plastic cap
PP Cap	pink plastic cap
PCC	point of compound curve
PC	point of curve
PI	point of intersection
PRC	point of reverse curvature
PT	point of tangent
POC	point on curve
POT	point on tangent
RTP	random traverse point
Rge	range
RP Cap	red plastic cap
SC	spiral to curve
SC	standard corner
ST	spiral to tangent
Sta	station
SE	superelevation
Tan	tangent
T	tangent (semi)
TS	tangent to spiral
Twp	township
TB	transit book
TP	traverse point
TP	turning point
USC&G	US Coast & Geodetic Survey
USGS	US Geologic Survey
VC	vertical curve
WC	witness corner
WGS	World Geodetic System
YP Cap	yellow plastic cap
Z	zenith

SOIL TYPES

Cl	clay
Cl F	clay fill
Cl Hvy	clay heavy
Cl Lm	clay loam
Co S	coal slack
C Gr	coarse gravel
CS	coarse sand
FS	fine sand
Gr	gravel
Lig Co	lignite coal
Lig Sl	lignite slack
Lm	loam
Rk	rock
Sd	sand
Sdy Cl	sandy clay
Sdy Cl Lm	sandy clay loam
Sdy Fl	sandy fill
Sdy Lm	sandy loam
Sc	scoria
Sh	shale
Si Cl	silt clay
Si Cl Lm	silty clay loam
Si Lm	silty loam

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NDDOT UTILITY COMPANY AND ORGANIZATION ABBREVIATIONS

D-101-10

702COM 702 Communications  
ACCENT Accent Communications  
AGASSIZ WU Agassiz Water Users District  
AGC Associated General Contractors of America  
ALL PL Alliance Pipeline  
ALL SEAS WU All Seasons Water Users District  
AMOCO PI Amoco Pipeline Company  
AMRDA HESS Amerada Hess Corporation  
AT&T AT&T Corporation  
B PAW Bear Paw Energy Incorporated  
BAKER ELEC Baker Electric  
BASIN ELEC Basin Electric Cooperative Incorporated  
BEK TEL Bek Communications Cooperative  
BELLE PL Belle Fourche Pipeline Company  
BLM Bureau of Land Management  
BNSF Burlington Northern Santa Fe Railway  
BOEING Boeing  
BRNS RWD Barnes Rural Water District  
BURK-DIV ELEC Burke-Divide Electric Cooperative  
BURL WRD Burleigh County Water Resource District  
CABLE ONE Cable One  
CABLE SERV Cable Services  
CAP ELEC Capital Electric Cooperative Incorporated  
CASS CO ELEC Cass County Electric Cooperative  
CASS RWU Cass Rural Water Users District  
CAV ELEC Cavalier Rural Electric Cooperative  
CBLCOM Cablecom Of Fargo  
CENEX PL Cenex Pipeline  
CENT PL WATER DIST Central Pipe Line Water District  
CENT PWR ELEC Central Power Electric Cooperative  
CENTURYLINK CenturyLink  
COE Corps of Engineers  
CONS COMM Consolidated Communications  
CONS TELCOM Consolidated Telcom  
CONT RES Continental Resource Inc  
CPR Canadian Pacific Railway  
D O E Department Of Energy  
DAK CARR Dakota Carrier Network  
DAK CENT TEL Dakota Central Telephone  
DAK RWD Dakota Rural Water District  
DGC Dakota Gasification Company  
DICKY R NET Dickey Rural Networks  
DICKY WRD Dickey County Water Resource District  
DICKY TEL Dickey Telephone  
DNRR Dakota Northern Railroad  
DOME PL Dome Pipeline Company  
DVELEC Dakota Valley Electric Cooperative  
DVMW Dakota, Missouri Valley & Western  
E CENT REG WD East Central Water District  
ENBRDG Enbridge Pipelines Incorporated  
ENVENTIS Enventis Telephone  
EQUINOR Equinor Pipeline  
FALK MNG Falkirk Mining Company  
FHWA Federal Highway Administration  
G FKS-TRL WD Grand Forks-traill Water District  
GETTY TRD & TRAN Getty Trading & Transportation  
GLDN W ELEC Golden West Electric Cooperative

GTR RAMSEY WD Greater Ramsey Water District  
GT PLNS NAT GAS Great Plains Natural Gas Company  
HALS TEL Halstad Telephone Company  
IDEA1 Idea1  
INT-COMM TEL Inter-Community Telephone Company  
KANEB PL Kaneb Pipeline Company  
KEM ELEC Kem Electric Cooperative Incorporated  
KOCH GATH SYS Koch Gathering Systems Incorporated  
LKHD PL Lakehead Pipeline Company  
LWR YELL R ELEC Lower Yellowstone Rural Electric  
LUMEN Lumen Technologies Incorporated  
MCKNZ CON McKenzie Consolidated Telcom  
MCKNZ ELEC McKenzie Electric Cooperative  
MCKNZ WRD McKenzie County Water Resource District  
MCLEOD McLeod USA  
MCLN ELEC McLean Electric Cooperative  
MCLN-SHRDN R WAT McLean-Sheridan Rural Water District  
MDU Montana-dakota Utilities  
MIDCO MidContinent Communications  
MIDSTATE TEL Midstate Telephone Company  
MINOT CABLE Minot Cable Television  
MINOT TEL Minot Telephone Company  
MISS VALL COMM Missouri Valley Communications Incorporated  
MISS W W S Missouri West Water System  
MNKOTA PWR Minnkota Power  
MOR-GRAN-SOU ELEC Mor-gran-sou Electric Cooperative  
MOUNT-WILLI ELEC Mountrail-williams Electric Cooperative  
MLGC Moore & Liberty - Griggs County  
MUNICIPAL City Water And Sewer  
MUNICIPAL City Of '.....'  
N CENT ELEC North Central Electric Cooperative  
N PRAIR REG WD North Prairie Regional Water District  
ND PKS & REC North Dakota Parks And Recreation  
ND TEL North Dakota Telephone Company  
NDDOT North Dakota Department of Transportation  
NE REG WD Northeast Regional Water District  
NDSU SOIL SCI DEPT NDSU Soil Science Department  
NEMONT TEL Nemont Telephone  
NODAK R ELEC Nodak Rural Electric Cooperative  
NOON FRMS TEL Noonan Farmers Telephone Company  
NPR Northern Plains Railroad  
NSP Northern States Power  
NTHN BRDR PL Northern Border Pipeline  
NTHN PLNS ELEC Northern Plains Electric Cooperative Incorporated  
NTHWSTRN REF Northwestern Refinery Company  
NW COMM Northwest Communication Cooperation  
NWRWD Northwest Rural Water District  
ONEOK Oneok gas  
OSHA Occupational Safety and Health Administration  
OTTR TL PWR Otter Tail Power Company  
PAAP Plains All American Pipeline  
P L E M Prairielands Energy Marketing  
POLAR COM Polar Communications  
PVT ELEC Private Electric  
QWEST Qwest Communications  
R&T REG WD R & T Water District

RED RIV COMM Red River Communications  
RESVTN TEL Reservation Telephone  
ROBRTS TEL Roberts Company Telephone  
R-RIDER ELEC Roughrider Electric Cooperative  
RRVW Red River Valley & Western Railroad  
S CENT REG WD South Central Regional Water District  
SE W U Southeast Water Users Incorporated  
SCOTT CABLE Scott Cable Television Dickinson  
SHERDN ELEC Sheridan Electric Cooperative  
SHEYN VLY ELEC Sheyenne Valley Electric Cooperative  
SKYTECH Skyland Technologies Incorporated  
SLOPE ELEC Slope Electric Cooperative Incorporated  
SOURIS RIV TELCOM Souris River Telecommunications  
ST WAT COMM State Water Commission  
STATE LN WATER State Line Water Cooperative  
STER ENG Sterling Energy  
STUT RWD Stutsman Rural Water District  
SW PL PRJ Southwest Pipeline Project  
SWWA Southwest Water Authority  
SUNOCO Sunoco LP  
T M C Turtle Mountain Communications  
TCI TCI of North Dakota  
TESORO GHG PLNS PL Tesoro High Plains Pipeline  
TRI-CNTY WU Tri-County Water Users Incorporated  
TRL CO WRD Traill County Water Resource District  
UNTD TEL United Telephone  
UPPR SOUR WD Upper Souris Water District  
US SPRINT U.S. Sprint  
USAF MSL CABLE U.S.A.F. Missile Cable  
USFWS US Fish and Wildlife Service  
USW COMM U.S. West Communications  
VRNDRY ELEC Verendrye Electric Cooperative  
W RIV TEL West River Telephone Incorporated  
WAPA Western Area Power Administration  
WAWSA Western Area Water Supply Authority  
WEB W. E. B. Water Development Association  
WILLI WRD Williams County Water Resource District  
WILSTN BAS PL Williston Basin Interstate Pipeline Company  
WLSH RWD Walsh Water Rural Water District  
WOLVRTN TEL Wolverton Telephone  
XLENER Xcel Energy  
YSVR Yellowstone Valley Railroad

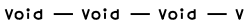
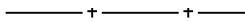
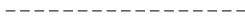



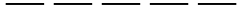
















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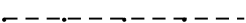
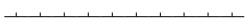


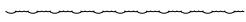
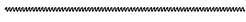
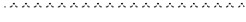

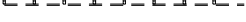

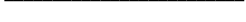





LINE STYLES



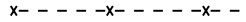


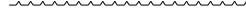


D-101-20

Existing Topography









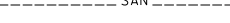













	Existing Ground Void
	Existing Cemetary Boundary
	Existing Box Culvert Bridge
	Existing Concrete Surface
	Existing Drainage Structure
	Existing Gravel Surface
	Existing Riprap
	Existing Dirt Surface
	Existing Asphalt Surface
	Existing Tie Point Line
	Existing Railroad Centerline
	Existing Guardrail Cable
	Existing Guardrail Metal
	Existing Edge of Water
	Existing Fence
	Existing Railroad
	Existing Field Line
	Exst Flow
	Existing Curb
	Existing Valley Gutter
	Existing Driveway Gutter
	Existing Curb and Gutter
	Existing Mountable Curb and Gutter

	Existing 3-Cable w Posts
	Site Boundary
	Existing Berm, Dike, Pit, or Earth Dam
	Existing Ditch Block
	Existing Tree Boundary
	Existing Brush or Shrub Boundary
	Existing Retaining Wall
	Existing Planter or Wall
	Existing W-Beam Guardrail with Posts
	Existing Railroad Switch
	Gravel Pit - Borrow Area
	Existing Wet Area-Vegetation Break
	Existing High Tension Cable Guardrail
	Existing High Tension Cable Guardrail with Posts

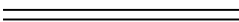


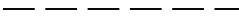
Proposed Topography

	3-Cable w Posts
	Flow
	Fence
	Remove Line
	Wall
	Retaining Wall (Plan View)
	W-Beam w Posts
	High Tension Cable Guardrail with Posts

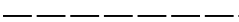
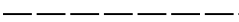



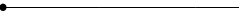
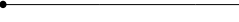

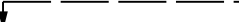
Existing Utilities

	Existing Electrical
	Existing Fiber Optic Line
	Existing TV Fiber Optic
	Existing Gas Pipe
	Existing Overhead Utility Line
	Existing Power
	Existing Fuel Pipeline
	Existing Undefined Above Ground Pipe Line
	Existing Sanitary Sewer
	Existing Sanitary Force Main
	Existing Storm Drain
	Existing Storm Drain Force Main
	Existing Culvert
	Existing Telephone Line
	Existing TV Line
	Existing Water or Steam Line
	Existing Under Drain
	Existing Slotted Drain
	Existing Conduit
	Existing Conductor
	Existing Down Guy Wire Down Guy
	Existing Underground Vault or Lift Station




Proposed Utilities


	24 Inch Pipe
	Reinforced Concrete Pipe
	Under Drain
	Edge Drain

Traffic Utilities

	Conductor
	Fiber Optic
	Existing Loop Detector
	Existing Double Micro Loop Detector
	Micro Loop Detector Double
	Existing Micro Loop Detector
	Micro Loop Detector
	Signal Head with Mast Arm
	Existing Signal Head with Mast Arm

Sign Structures






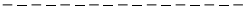







	Existing Overhead Sign Structure
	Existing Overhead Sign Structure Cantilever
	Overhead Sign Structure Cantilever

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION		
07-01-14 REVISIONS		
DATE	CHANGE	
09-23-16 12-18-20	Added and Revised Items, Organized by Functional Groups General Revisions	
		12 18 2020



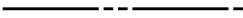
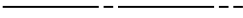
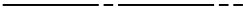




LINE STYLES

D-101-21

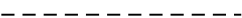
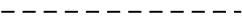
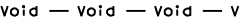





Right Of Way

	Easement
	Existing Easement
	Right of Way
	Existing Right of Way
	Existing Right of Way Railroad
	Existing Right of Way Not State Owned
	Existing Government Lot Line
	Existing Adjacent Block Lines
	Existing Adjacent Lot Lines
	Existing Adjacent Property Line
	Existing Adjacent Subdivision Lines
	Sight Distance Triangle Line
	Dimension Leader







Boundary Control


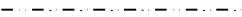
	Existing City Corporate Limits or Reservation Boundary
	Existing State or International Line
	Existing Township
	Existing County
	Existing Section Line
	Existing Quarter Section Line
	Existing Sixteenth Section Line
	Existing Centerline
	Tangent Line

Cross Sections and Typicals



	Existing Ground
	Existing Topsoil (Cross Section View)
	Existing Ground Void (Not Surveyed)
	Existing Concrete
	Existing Aggregate (Cross Section View)
	Existing Curb and Gutter (Cross Section View)
	Existing Asphalt (Cross Section View)
	Existing Reinforcement Rebar

Geotechnical



	Geotextile Fabric Type D
	Geogrid
	Geotextile Fabric Type R
	Geotextile Fabric Type R1
	Geotextile Fabric Type RR
	Geotextile Fabric Type S

	Subgrade Reinforcement
	Failure Line







Countours

	Depression Contours
	Supplemental Contour


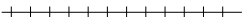

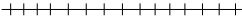
Profile

	Subgrade, Subcut or Ditch Grade
	Topsoil Profile










Striping

	Centerline Pavement Marking
	Barrier with Centerline Pavement Marking
	Barrier Pavement Marking
	Stripe 4 IN Dotted Extension White
	Stripe 8 IN Dotted Extension White
	Stripe 8 IN Lane Drop








Pavement Joints

	Doweled Joint
	Tie Bar 30 Inch 4 Foot Center to Center
	Tie Bar 18 Inch 3 Foot Center to Center
	Tie Bar at Random Spacing




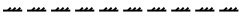
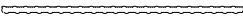
Bridge Details

	Small Hidden Object
	Large Hidden Object
	Phantom Object
	Existing Conditions Object
	Centerline Main
	Centerline Secondary
	Excavation Limits
	Proposed Ground
	Sheet Piling

Erosion Control

	Limits of Const Transition Line
	Bale Check
	Rock Check
	Floating Silt Curtain
	Silt Fence
	Excavation Limits
	Fiber Rolls

Environmental

	Wetland Mitigation
	Existing Wetland Easement USFWS
	Existing Wetland Jurisdictional
	Existing Wetland
	Tree Row

NORTH DAKOTA  
DEPARTMENT OF TRANSPORTATION


07-01-14

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DATE	CHANGE
09-23-16	Added and Revised Items, Organized by Functional Groups General Revisions
12-18-20	

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NORTH DAKOTA

12 18 2020


SYMBOLS

D-101-30


 North Arrow (Half Scale)


 Alignment Data Point

 Alignment Monument

 Spot Elevation

 Existing Miscellaneous Spot

 Existing Access Control Arrow

 Existing Benchmark

 Reset USGS Marker

 Iron Monument Found





 Iron Pin R/W Monument

 Property Corner




 Iron Pin Reference Monument


   Right of Way Marker (Exst, Ppsd, Reset)

 Existing Federal Reference Corner


    Existing Section Corner (Full, Quarter, Sixteenth, Meander)


 Existing Witness Corner


   Existing Control Point (CP, GPS-RTK, TRI)


 Existing Traverse PI Aerial Panel


 Existing Reference Marker Point NGS

 Existing EFB Misc

 Existing Bush or Shrub

 Existing Large Evergreen Tree

 Existing Small Evergreen Tree


 Existing Large Tree

 Existing Small Tree

 Existing Tree Trunk

 Cairn or Stone Circle


 Existing Artifact

 Existing Satellite Dish

 Existing Weather Station


 Existing Windmill or Tower


 Reinforced Pavement


 Continuous Split Barrel Sample


 Flight Auger Sample

 Split Barrel Sample

 Thinwall Tube Sample

 Standard Penetration Test

 Inclinometer Tube

 Excavation Unit

 Existing Ground Water Well Bore Hole

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
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DATE	CHANGE
12-18-20	General Revisions

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NORTH DAKOTA


12 18 2020

SYMBOLS

D-101-31

					Flexible Delineator							Highway Sign (Exst, Ppsd)
					Flexible Delineator Type A (Exst, Ppsd)							Mile Post Type A (Exst-Ppsd-Reset)
					Flexible Delineator Type B (Exst, Ppsd)							Mile Post Type B (Exst, Ppsd)
					Flexible Delineator Type C (Exst, Ppsd)							Mile Post Type C (Exst, Ppsd)
					Flexible Delineator Type D (Exst, Ppsd)							Object Marker Type I (Exst, Ppsd)
					Flexible Delineator Type E (Exst, Ppsd)							Object Marker Type II (Exst, Ppsd)
					Delineator Type A (Exst, Ppsd, Diamond Grade-Reset)							Object Marker Type III (Exst, Ppsd)
					Delineator Type B (Exst, Ppsd, Diamond Grade-Reset)							Existing Reference Marker
					Delineator Type C (Exst, Ppsd, Diamond Grade)							Road Closure Gate 18 Ft (Exst, Ppsd)
					Delineator Type D (Exst, Ppsd, Diamond Grade)							Road Closure Gate 28 Ft (Exst, Ppsd)
					Delineator Type E (Exst, Ppsd, Diamond Grade)							Road Closure Gate 40 Ft (Exst, Ppsd)
					Barricade (Type I, Type II, Type III)							Existing Railroad Battery Box
					Arrow Panel (Caution Mode, Double Direction, Left Directional, Right Directional, Sequencing, Truck Mounted)							Existing RR Profile Spot
					Attenuation Device							Existing Railroad Crossbuck
					Truck Mounted Attenuator							Existing Railroad Frog
					Delineator Drums							Existing Mailbox (Private, Federal)
					Flagger							
					Tubular Marker							
					Traffic Cone							
					Back to Back Vertical Panel Sign							

















































































NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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12 18 2020

SYMBOLS


D-101-32

	Existing Luminaire			High Mast Light Standard 3 Luminaire (Exst, Ppsd)		Existing Traffic Signal Standard			
	Luminaire LED			High Mast Light Standard 4 Luminaire (Exst, Ppsd)				Pull Box (Exst-Ppsd-Undefined)	
	Existing Light Standard Luminaire			High Mast Light Standard 5 Luminaire (Exst, Ppsd)				Intelligent Transportation Pull Box (Exst, Ppsd)	
	Relocate Light Standard			High Mast Light Standard 6 Luminaire (Exst, Ppsd)				Transformer (Exst, Ppsd)	
	Light Standard Light LED Luminaire			High Mast Light Standard 7 Luminaire (Exst, Ppsd)				Power Pole (Exst-Ppsd-with Transformer)	
	Light Standard 35 Watt High Pressure Sodium Vapor Luminaire			High Mast Light Standard 8 Luminaire (Exst, Ppsd)				Wood Pole (Exst, Ppsd)	
	Light Standard 50 Watt High Pressure Sodium Vapor Luminaire			High Mast Light Standard 9 Luminaire (Exst, Ppsd)				Pedestrian Push Button Post (Exst, Ppsd)	
	Light Standard 70 Watt High Pressure Sodium Vapor Luminaire			High Mast Light Standard 10 Luminaire (Exst, Ppsd)				Existing Pole	
	Light Standard 100 Watt High Pressure Sodium Vapor Luminaire			Overhead Sign Structure Load Center (Exst, Ppsd)				Existing Telephone Pole	
	Light Standard 150 Watt High Pressure Sodium Vapor Luminaire			Traffic Signal Controller (Exst, Ppsd)				Existing Post	
	Light Standard 200 Watt High Pressure Sodium Vapor Luminaire			Pad Mounted Traffic Signal Controller (Exst, Ppsd)					Connection Conductor (Ground, Neutral, Phase 1, Phase 2)
	Light Standard 250 Watt High Pressure Sodium Vapor Luminaire			Flashing Beacon (Exst, Ppsd)					
	Light Standard 310 Watt High Pressure Sodium Vapor Luminaire			Concrete Foundation (Exst, Ppsd)					
	Light Standard 400 Watt High Pressure Sodium Vapor Luminaire			Pipe Mounted Flasher (Exst, Ppsd)					
	Light Standard 700 Watt High Pressure Sodium Vapor Luminaire			Pad Mounted Feed Point (Exst, Ppsd)					
	Light Standard 1000 Watt High Pressure Sodium Vapor Luminaire			Pipe Mounted Feed Point with Pad (Exst, Ppsd)					
	Emergency Vehicle Detector			Pole Mounted Feed Point (Exst, Ppsd)					
	Video Detection Camera			Junction Box (Exst, Ppsd)					
				Existing Pedestrian Head with Number					
				Existing Signal Head					
				Pole Mounted Head					
				Existing Lighting Standard Pole					

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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SYMBOLS

D-101-33

			Existing Manhole (Electrical, Gas, Telephone)		Cap or Stub Exst Gas, Exst Sanitary, Exst Storm Drain, Ppsd Storm Drain, Exst Water
			Water Manhole (Exst, Exst with Valve)		Existing Pedestal Electrical, Telephone, Fiber Optic Telephone, TV, Fiber Optic TV, Undefined
			Sanitary Sewer Manhole (Exst, Ppsd, Exst with Valve)		Existing Pipe Vent Gas, Fuel, Sanitary, Storm Drain, Water, Undefined
			Sanitary Force Main Manhole (Exst, Ppsd, Exst with Valve)		Valve Exst Gas, Exst Water, Ppsd Water, Exst Undefined
			Storm Drain Manhole (Exst, Ppsd, Exst with Inlet, Ppsd with Inlet)		Pump Sanitary, Storm Drain, Exst Water
			Force Main Storm Drain Manhole (Exst, Exst with Valve)		Corrugated Metal End Section (18, 24, 30, 36, 42, 48, 54, 60 Inch)
			Manhole (Ppsd, Ppsd 48 Inch, Exst Undefined)		Reinforced Concrete End Section (18, 24, 30, 36, 42, 48, 54, 60 Inch)
			Existing Water Appurtenance		Existing Utility Marker
			Sprinkler Head (Exst, Ppsd)		Existing Meter
			Fire Hydrant (Exst, Ppsd)		Existing Fuel Dispensers
			Cleanout (Exst Sanitary, Underdrain)		Existing Fuel Filler Pipes
			Existing Catch Basin Inlet (Round, Square)		Existing Fuel Leak Sensors
			Existing Curb Inlet (Round, Square)		
			Existing Slotted Reinforced Concrete Pipe		
			Catch Basin (Riser 30 Inch, Beehive, Type A)		
			Inlet Mountable Curb (Type A, Type B)		
			Inlet Saddle Base (Type 1, Type 2)		
			Inlet Special (Catch Basin, Type 1, Type A)		
			Inlet (Tee, Type 1, Type 2, Type 2 Double)		
			Median Drain		
			Headwall (Exst, Ppsd, Ppsd Single with Vegetation Barrier, Ppsd Double with Vegetation Barrier)		

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
12-18-20	General Revisions Sheet added - Continued from D-101-32

12 18 2020

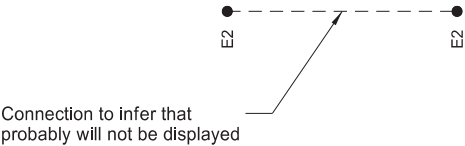
Cross Section Legend

D-101-40

Description	Longitudinal Parallel to Roadway	Transverse Perpendicular to Roadway*
Cable Line	● CBL1	● CBL2
Conduit Line	● CDU1	● CDU2
Electric Line	● E1	● E2
Fiber Optic Line	● F1	● F2
Gas Main Line	● GM1	● GM2
Gas Service Line	● GS1	● GS2
Gas Transmission Line	● GT1	● GT2
Fuel Pipeline	● PL1	● PL2
Sanitary Sewer Force Main	● SSF1	● SSF2
Sanitary Sewer	● SS1	● SS2
Steam Line	● STE1	● STE2
Storm Drain (Assumed Depth)	● SD1	● SD2
Telephone Line	● T1	● T2
TV Line	● TV1	● TV2
Water Main Line	● WM1	● WM2
Water Service Line	● WS1	● WS2

Description	Longitudinal Parallel to Roadway	Transverse Perpendicular to Roadway*
Overhead Power Transmission Line	↑ OHT1	↑ OHT2
Overhead Line	↑ OH1	↑ OH2

\* Usually the transverse utilities are shown on a cross section with 2 or more symbols. The utility runs from one symbol to the other, but the connection may not be shown.



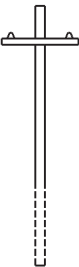
When storm drain invert elevations are NOT used to draw pipe, they will appear as shown to the left. When invert elevations are used to draw pipe, they will be a cross section similar to the graphics shown below.



Light Standard - Multiple Variations  
Concrete  
Steel  
Wood  
with Traffic Signal



Pole - Multiple Variations  
Utility  
Brace  
Feed Point  
Guy  
Power  
Power Structure  
Power with Light  
Power with Transformer



Manhole - Multiple Variations  
Electric  
Fiber Optic  
Gas  
Inlet  
Sanitary Force Main  
Sanitary  
Sanitary with Valve  
Steam  
Storm  
Storm Force Main  
Storm with Valve  
Telephone  
Water  
Water with Meter  
Water with Valve  
Water with Air Release Valve



Anchor



High Tension Cable Guardrail

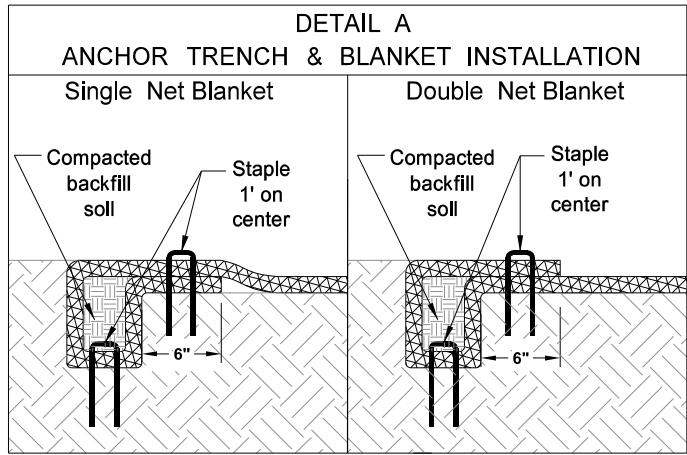


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-20-18	
REVISIONS	
DATE	CHANGE
6/14/2023	CADD Standards Update

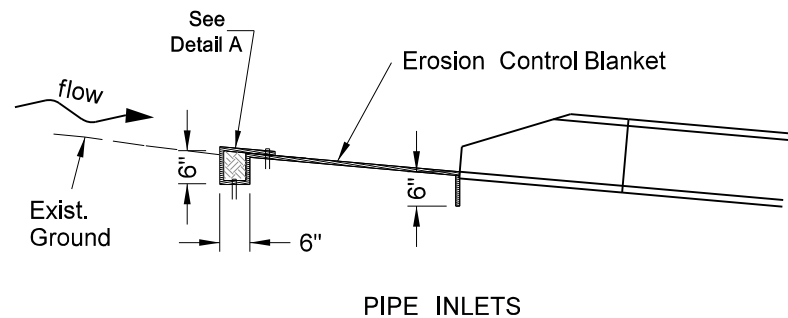
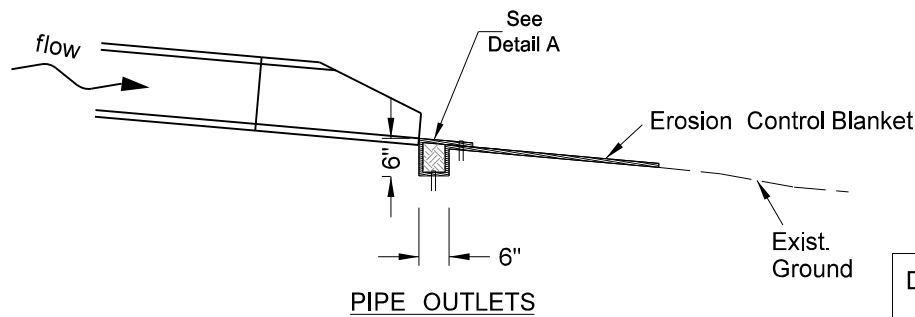


06/14/23

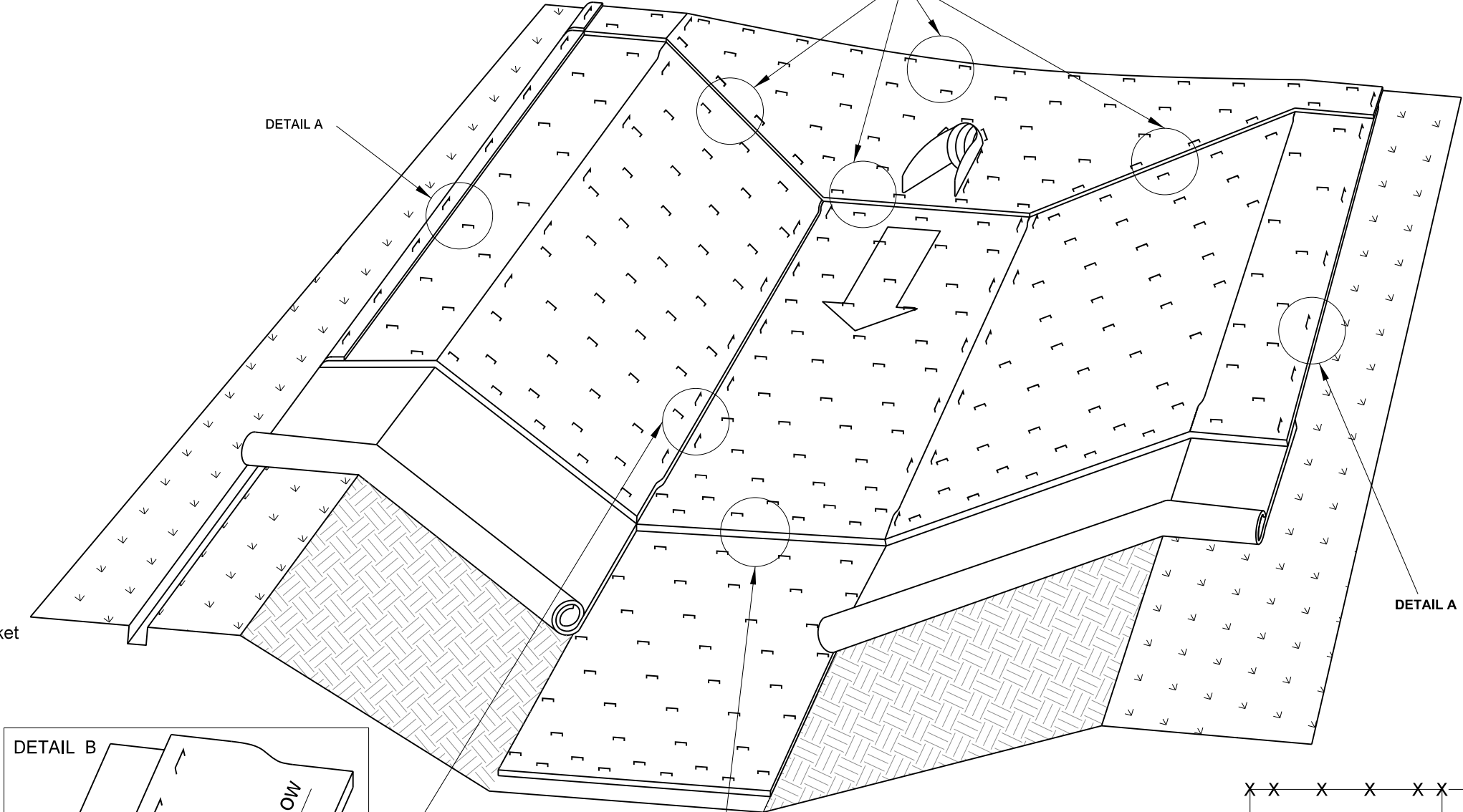
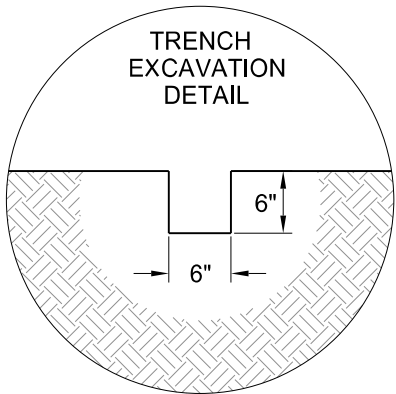
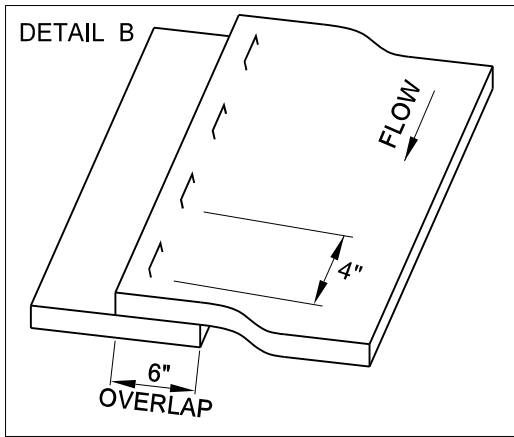
EROSION AND SILTATION CONTROL  
EROSION CONTROL BLANKET INSTALLATION



NOTE:  
If a Single Net Blanket is used the side with the netting should be on the top once the blanket is installed.

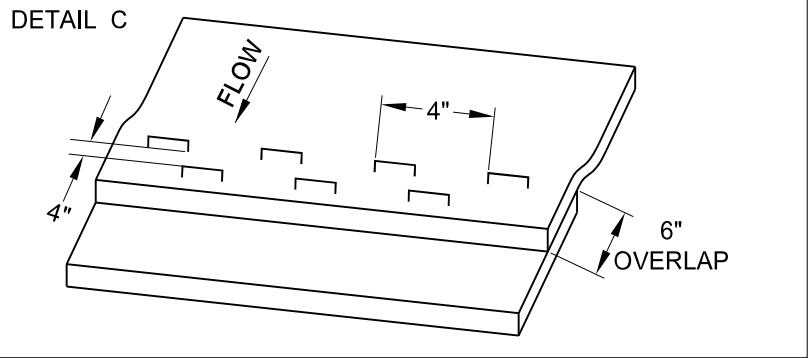
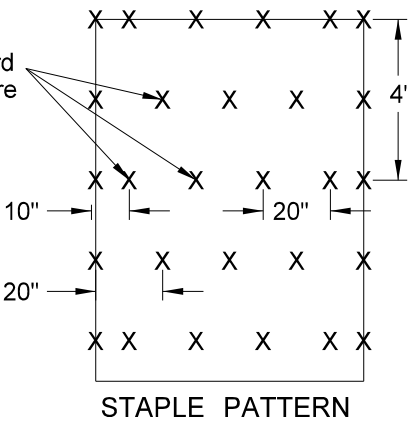


INSTALLATION AT PIPE ENDS



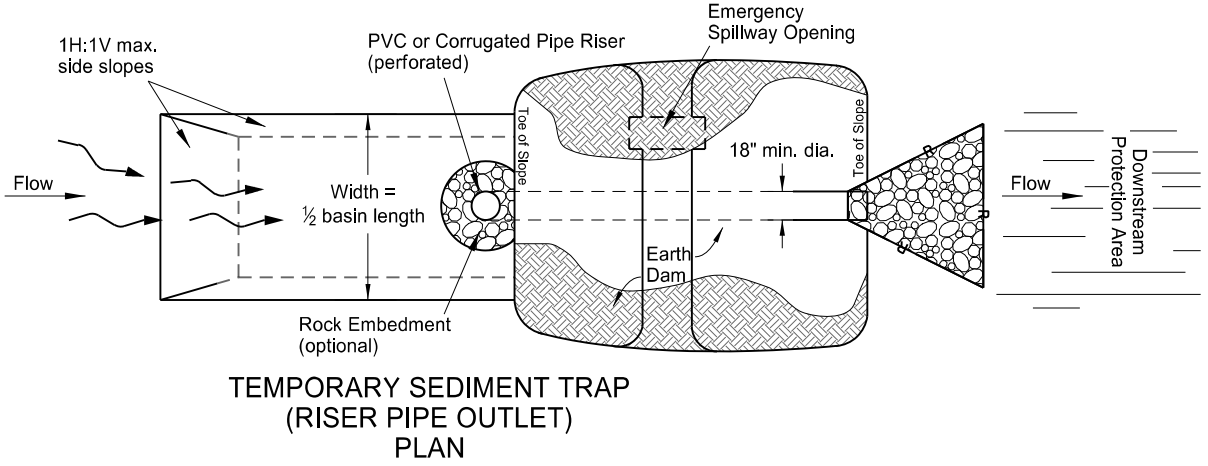
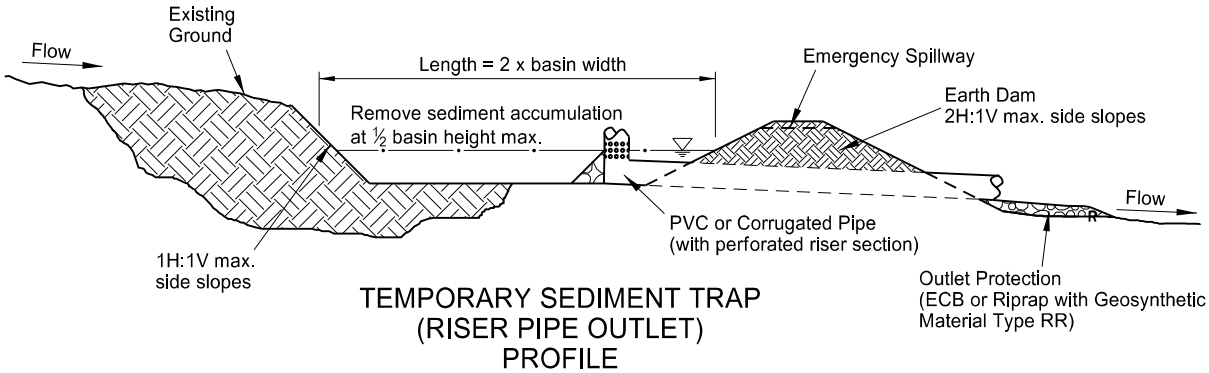
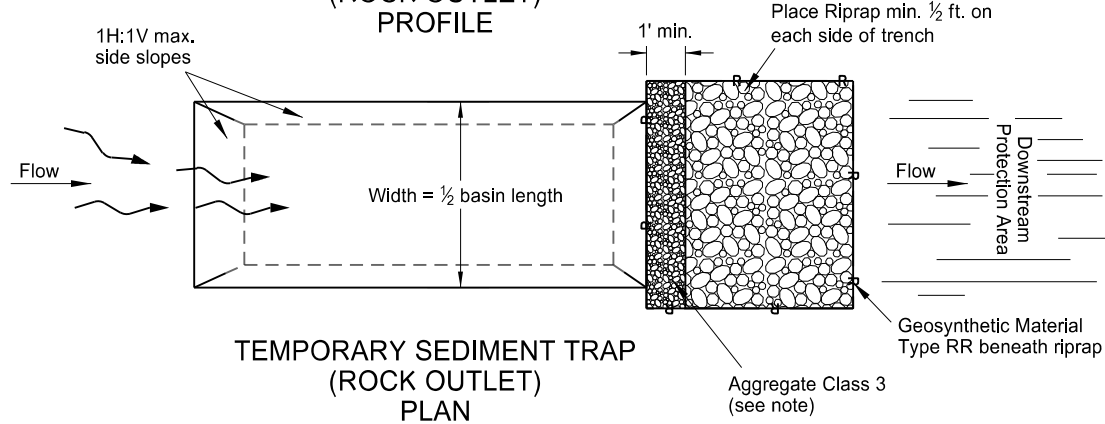
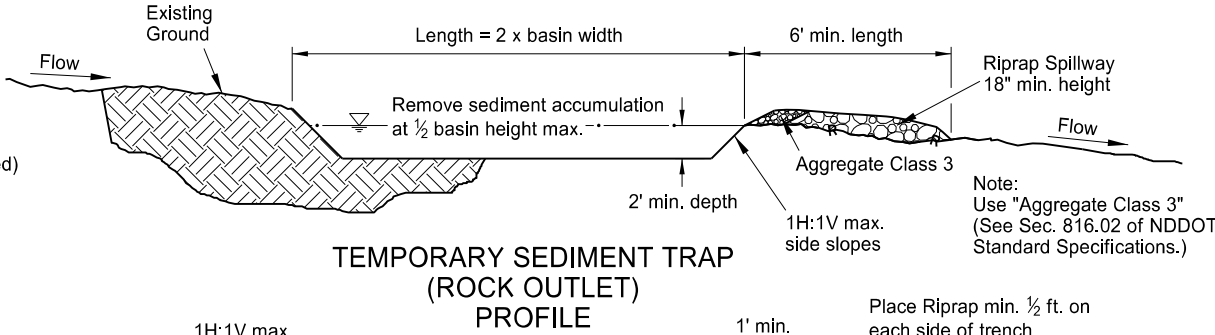
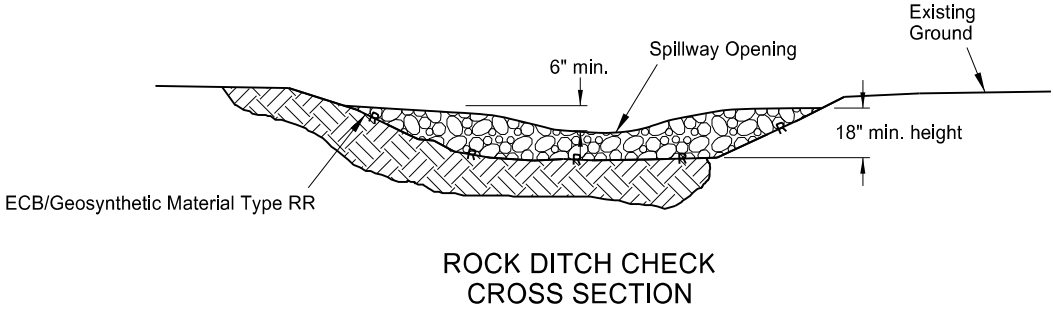
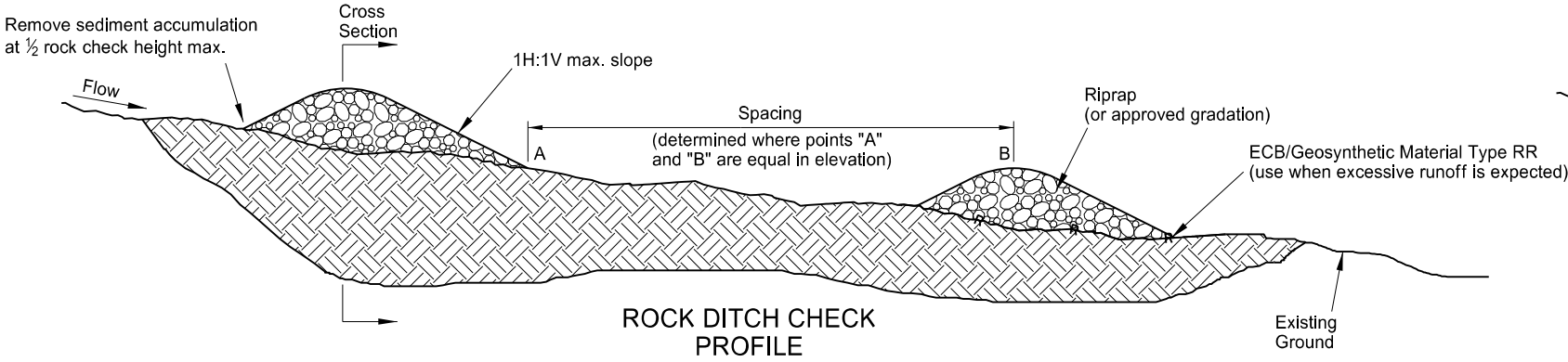
BLANKET LAYOUT  
CHANNEL OR SLOPE INSTALLATION

3.8 staples per square yard  
using 8-inch 11 gauge wire  
"u" staples.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Changed standard drawing number from D-708-S to D-255-2.
07-27-15	Changed installation details such as trench depth and overlap dimensions.
08-27-19	New Design Engineer PE Stamp.

This document was originally issued and sealed by  
Kirk J Hoff,  
Registration Number  
PE- 4683,  
on 08/27/19 and the original document is stored at the  
North Dakota Department  
of Transportation



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Changed standard drawing number from D-708-2 to D-256-1. Deleted silt fence details.
10-17-17	Updated to active voice.
08-27-19	New Design Engineer PE Stamp

This document was originally issued and sealed by  
Kirk J Hoff,  
Registration Number  
PE- 4683,  
on 8-27-2019 and the original document is stored at the  
North Dakota Department  
of Transportation

STANDARD SLOPE PROTECTION UNDER BRIDGES

D-258-1

NOTES:

Construct the toe wall before concrete is placed on the slope.

Construct 5'-6" square interior panels. Vary the width of the outside panels from 5'-0" min to 8'-0" max to achieve the width shown in the plans. Vary the length of the bottom panel from 3'-0" min to 8'-0" max to achieve the length shown in the plans.

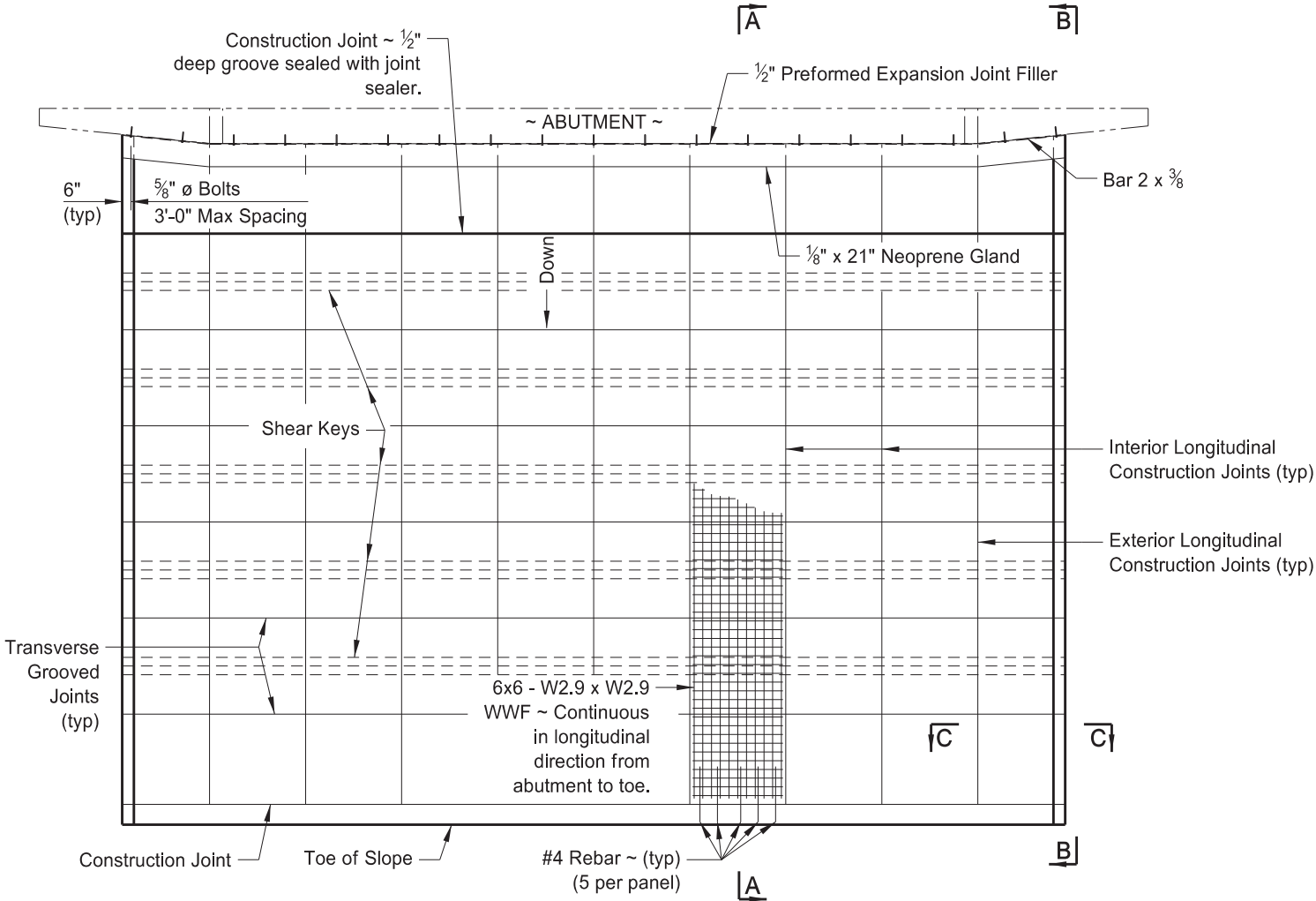
Construct 1/2" deep grooves in transverse and longitudinal joints. Seal the joints with a concrete joint sealant meeting 826.02 or ASTM C-920, Class 25.

Install 1/2" thick preformed expansion joint filler around pier columns or other obstructions projecting through the concrete slope protection.

Place shear keys in every panel on the slope, as shown.

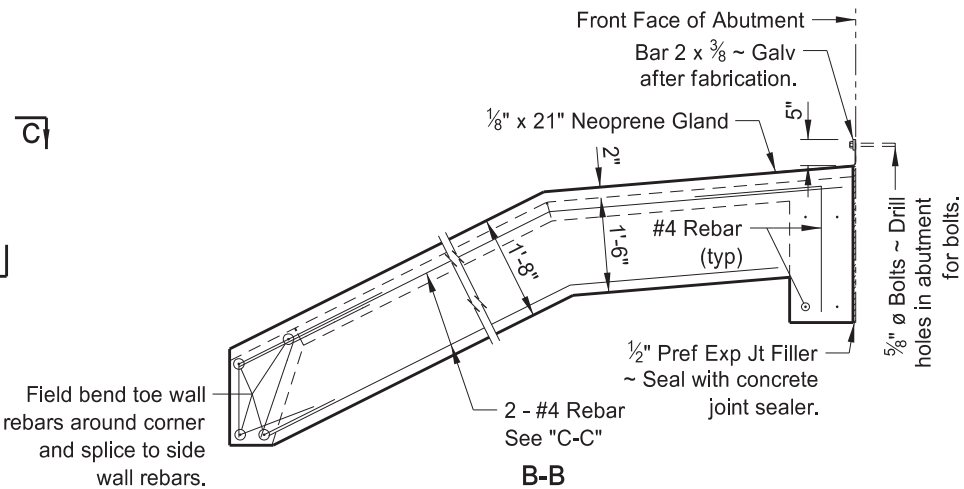
Supply the welded wire fabric (WWF) in sheets. Use a lap splice at least 8" long when it is necessary to make the WWF continuous.

Fasten the neoprene gland to the front face of abutment using 5/8" diameter bolts passing through a 2" wide x 3/8" thick steel bar. Provide a continuous steel bar, or a series of shorter bars, each with a length sufficient to hold a minimum of 3 bolts and extend a minimum distance of 6" past the centerline of outer bolts. Install the bolts into the front face of abutment using chemical or mechanical anchors. Galvanize the bolts and steel bars per Section 854.

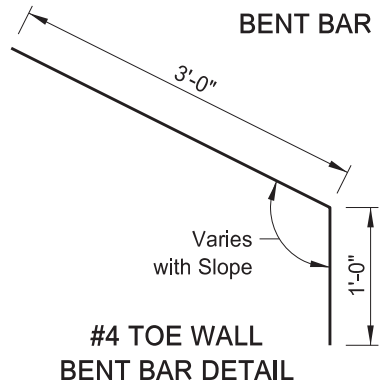
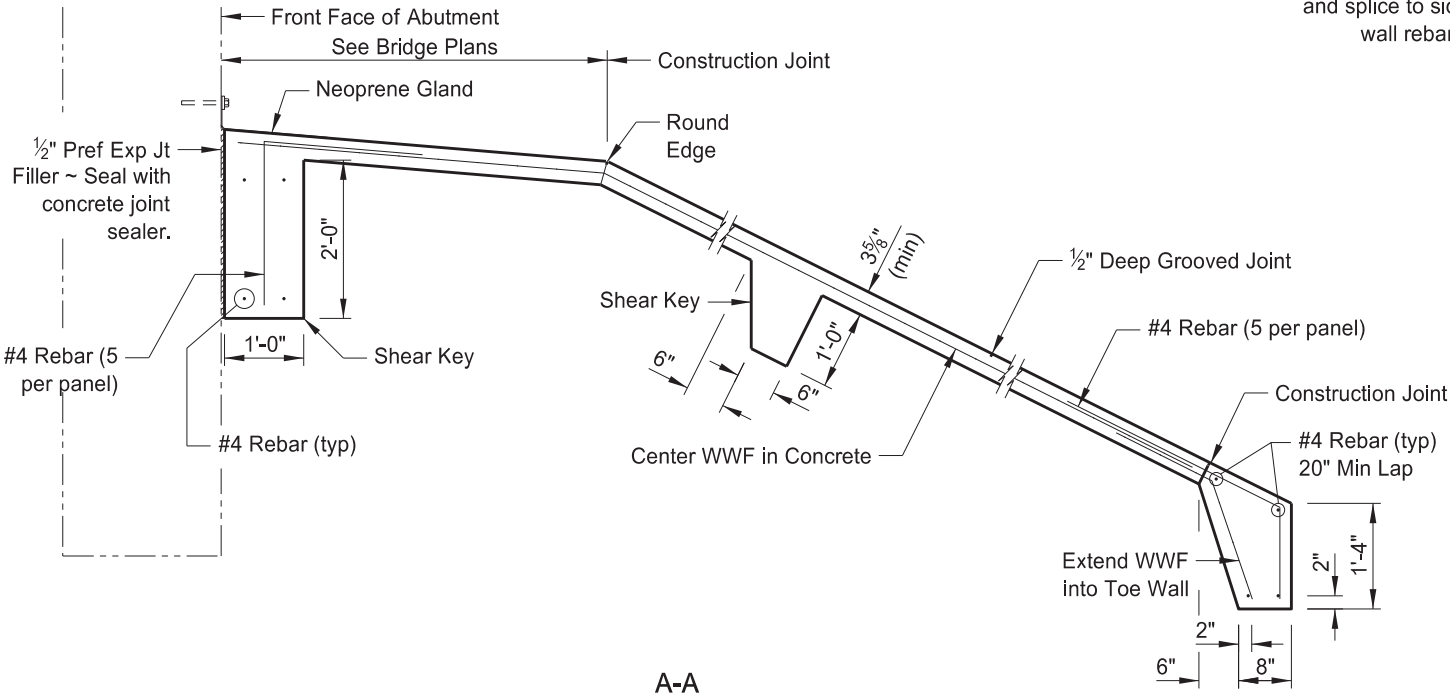
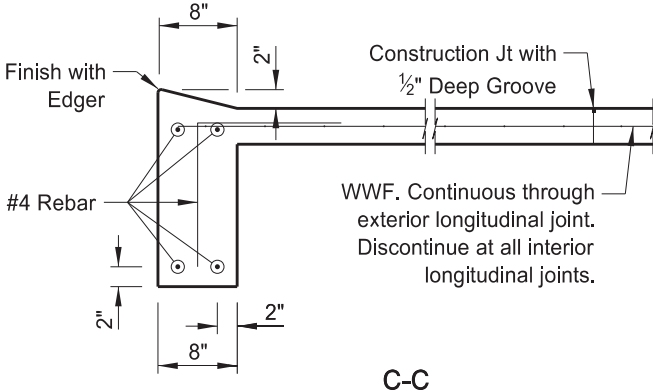
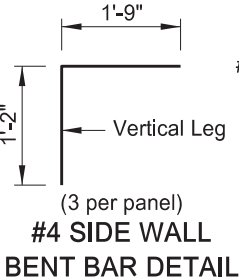
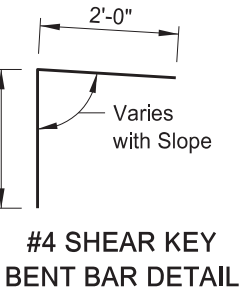


SLOPE PROTECTION LAYOUT

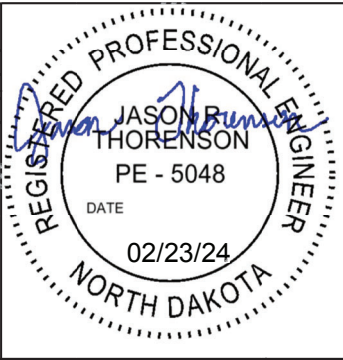
SKEWED SLOPE PROTECTION LAYOUT



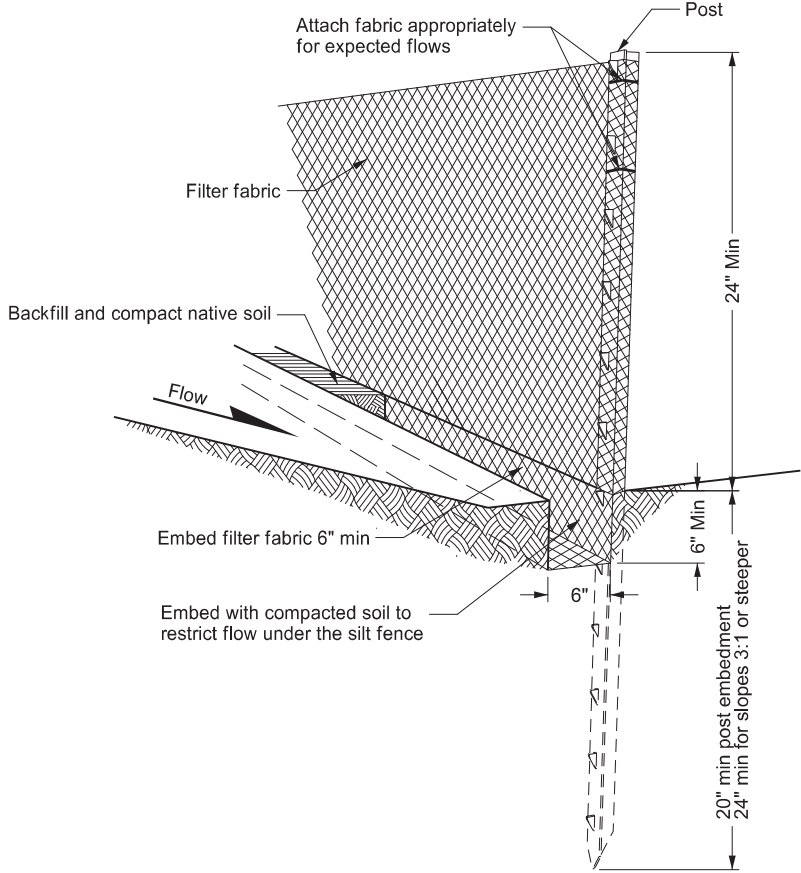
B-B



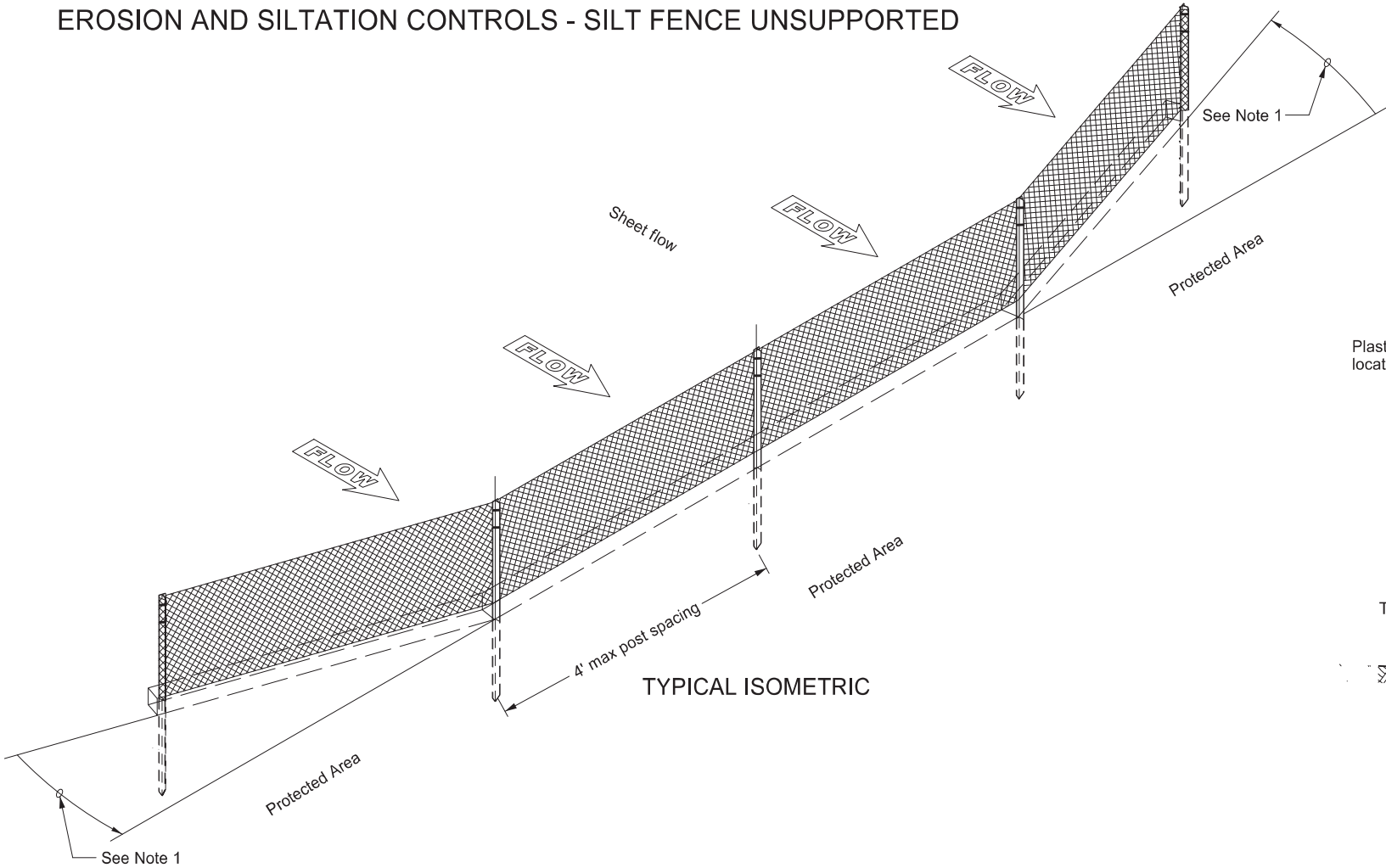
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07/10/14	
REVISIONS	
DATE	CHANGE
07/10/14	CHANGED FROM D-708-1
09/03/19	UPDATED SIGNATURE
02/23/24	Updated Signature Revised notes & updated to active voice



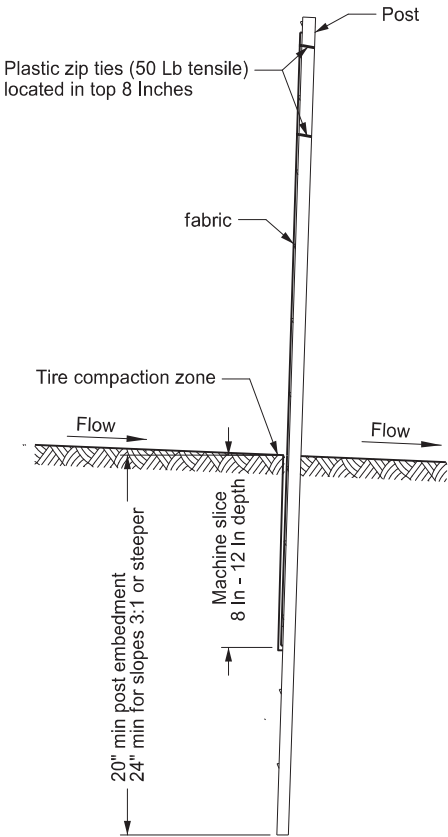
EROSION AND SILTATION CONTROLS - SILT FENCE UNSUPPORTED



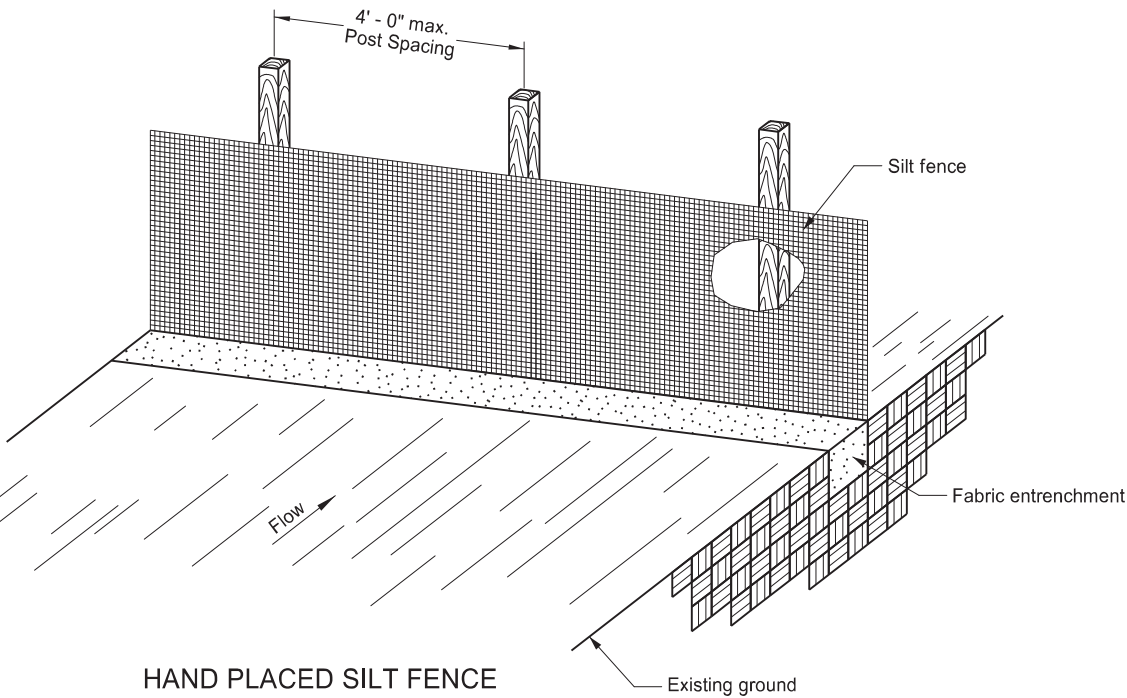
**HAND PLACED INSTALLATION DETAIL**  
Minimize disturbance of ground around trench and smooth surface after excavation to avoid concentrating flows. Compact to prevent undercutting flows.



TYPICAL ISOMETRIC



MACHINE SLICED INSTALLATION DETAIL



HAND PLACED SILT FENCE

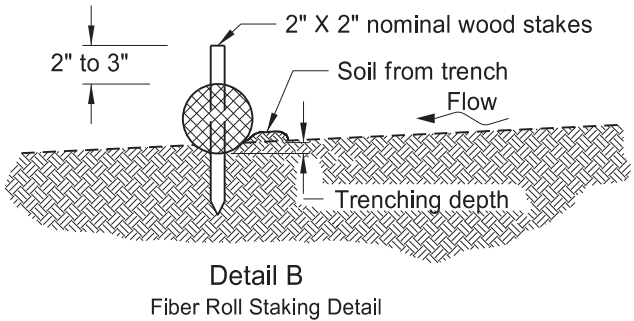
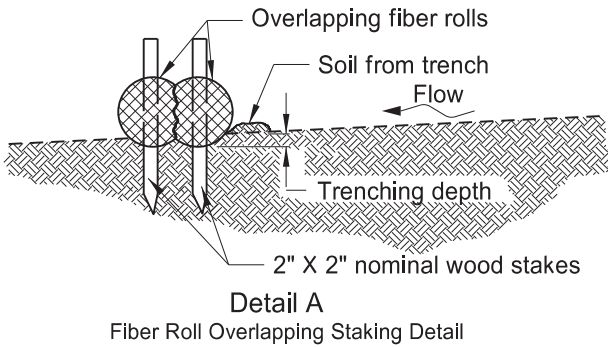
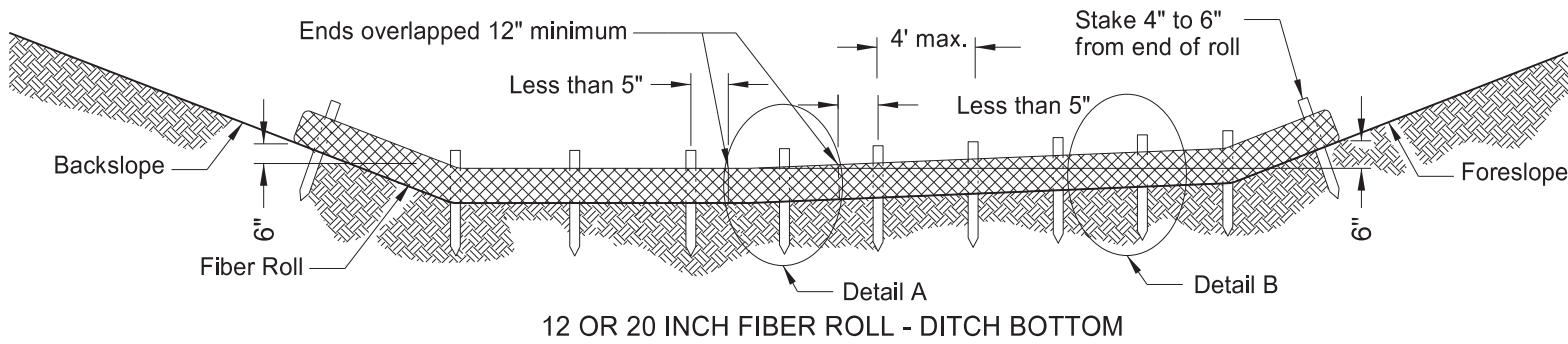
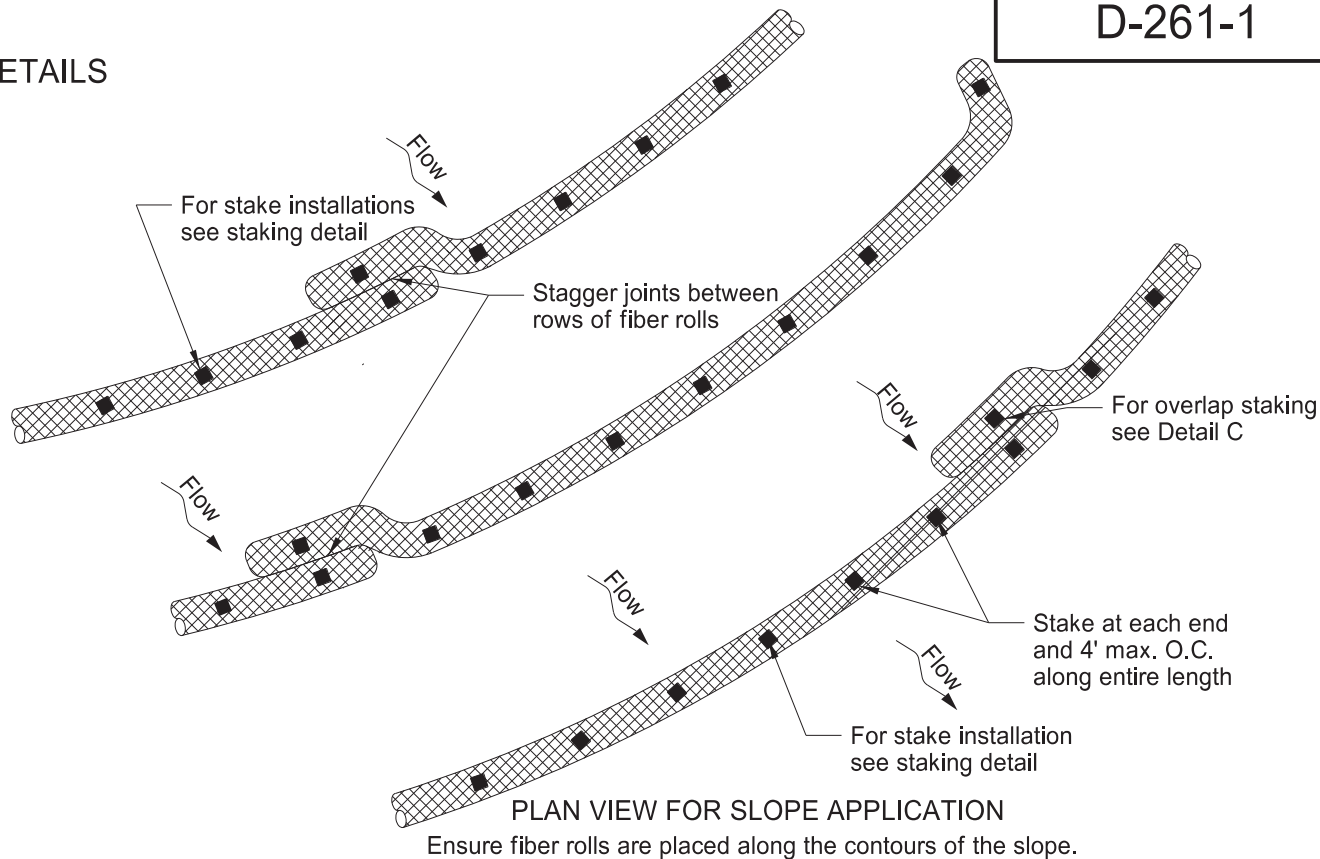
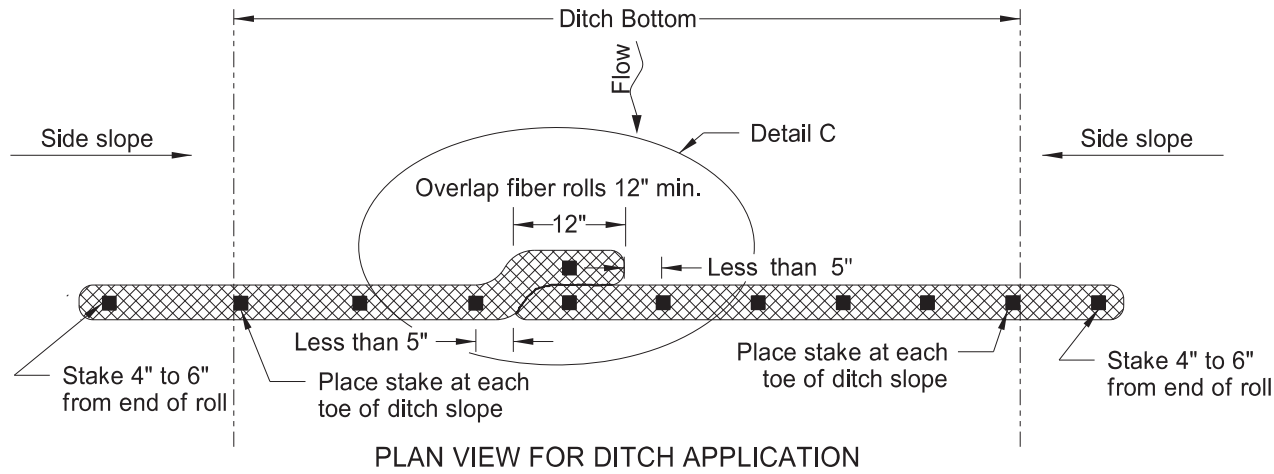
- NOTES:
- 1. Install the ends of the silt fence to point slightly upslope to prevent sediment from flowing around the ends of the fence.
  - 2. Place splices outside low spots.
  - 3. Do not embed silt fence placed in standing water.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Standard drawing resulted from splitting standard D-708-2.
06-27-16	Revised details & added new ones.
08-27-19	New Design Engineer PE Stamp.
07-22-25	Matched Revised Silt Fence Specs.

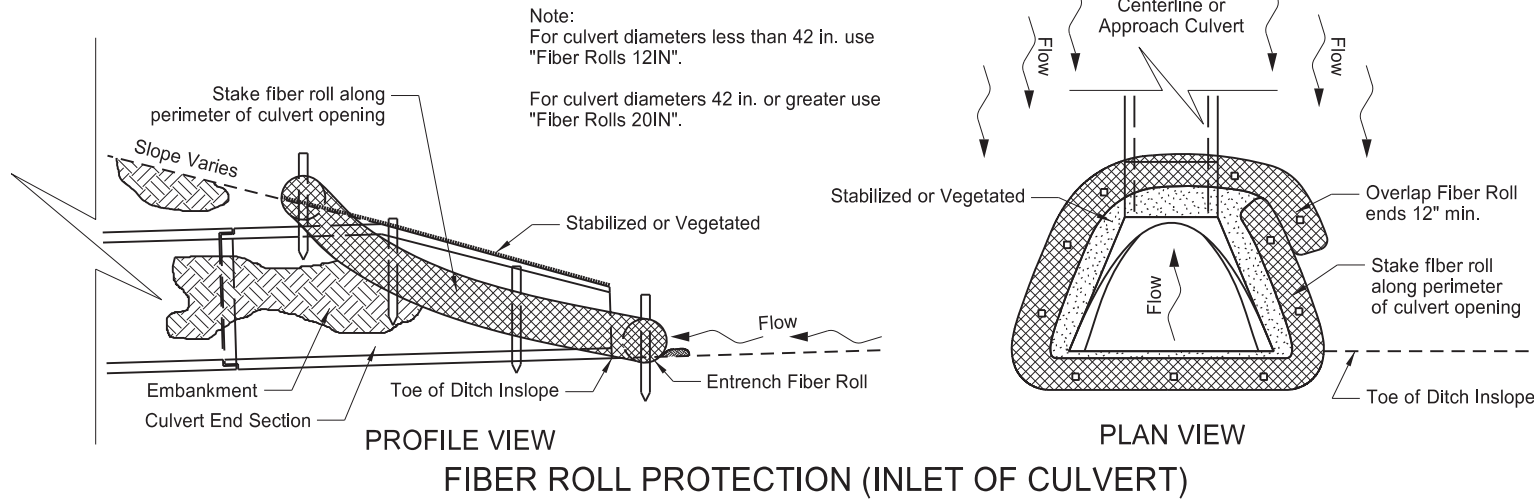


07/22/25

EROSION CONTROL  
FIBER ROLL PLACEMENT DETAILS



NOTE: Do not allow runoff to run under or around roll.



FIBER ROLL DIAMETER	NOMINAL STAKE SIZE	MINIMUM STAKE LENGTH	TRENCH DEPTH	
			MINIMUM	MAXIMUM
6"	2" x 2"	18"	2"	2"
9" or 12"	2" x 2"	24"	2"	3"
20"	2" x 2"	36"	3"	5"

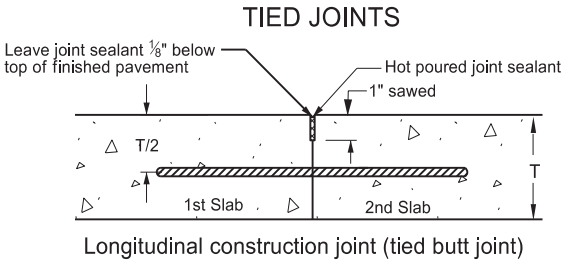
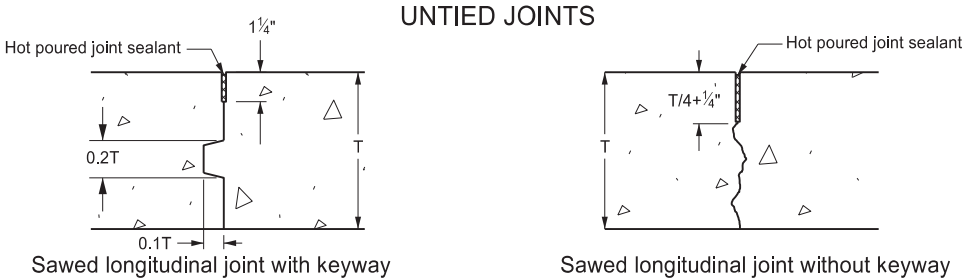
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-18-10	
REVISIONS	
DATE	CHANGE
06-10-13	Added plan view for ditch and slope application. Added table with values for stake and trench dimensions.
10-04-13	Revised fiber roll overlap detail.
06-26-14	Changed standard drawing number from D-708-7 to D-261-1.
08-27-19	New Design Engineer PE Stamp.
04-22-24	Slope Plan View-overlap change.
03-13-25	Added D-708-6 Culvert Inlet detail.



03/13/25

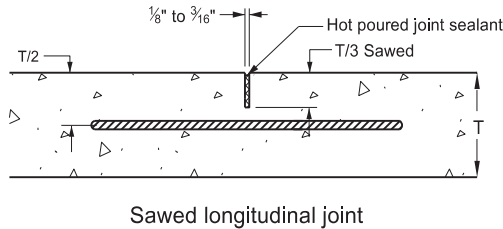
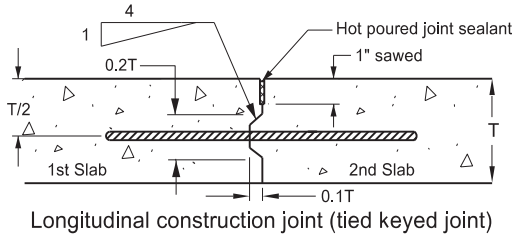
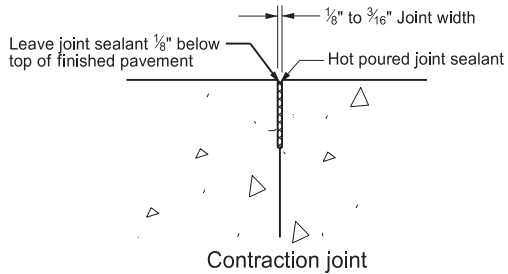
LONGITUDINAL JOINT DETAILS

D-550-2



Notes:

1. Provide hot poured joint sealant meeting the requirements of Section 826.02A.2 of the Standard Specifications.
2. Include all costs of the longitudinal joint and seal in the price bid for the PCC pavement.
3. Do not place tie bars within 18 inches of a transverse joint.
4. Use Grade 40 steel for tie bars installed bent and later straightened.
5. Increase the maximum tie bar spacing up to 10%, when necessary to facilitate construction.
6. Place tie Bars at a 48 inch maximum spacing.
7. A "Warp" joint is a sawed joint or a construction joint with a keyway.
8. A "Butt joint" is a construction joint with no keyway.

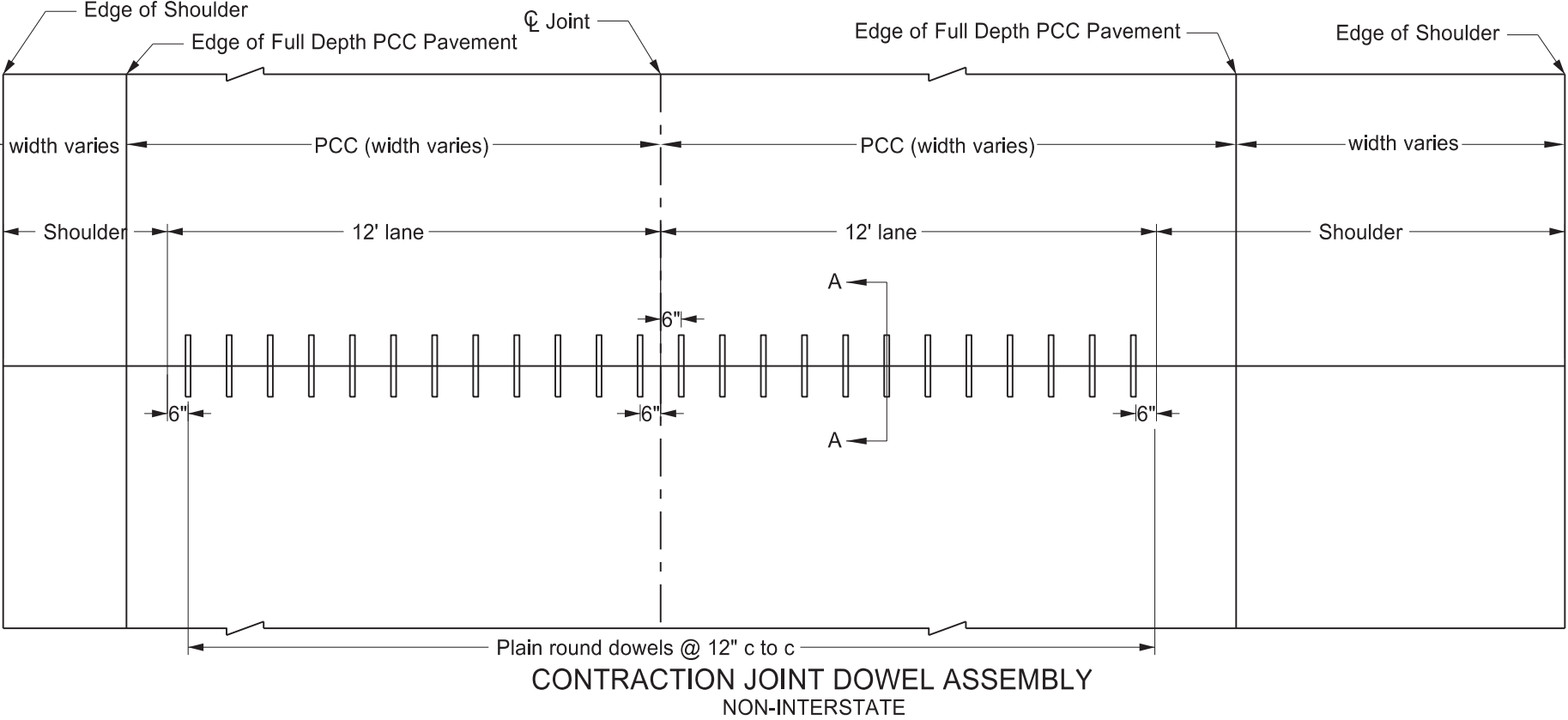
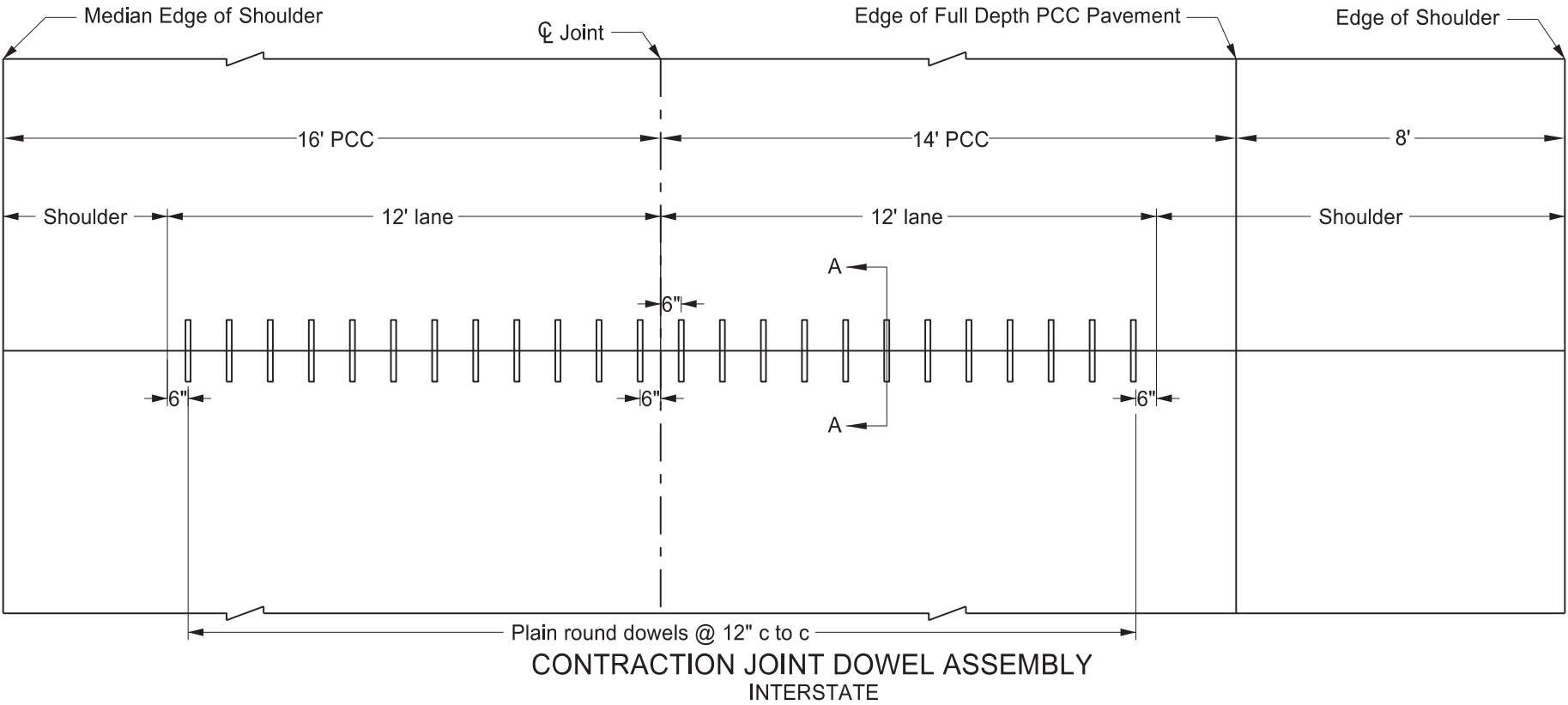
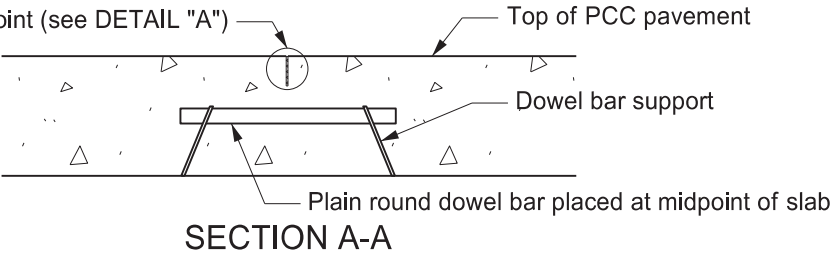
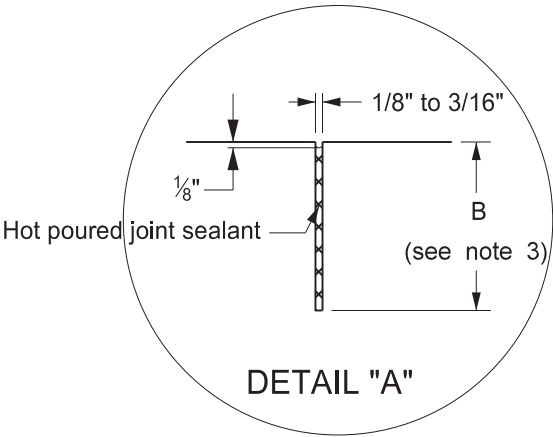


		TIEBAR SPACINGS (In)*																																															
TIE BARS	STEEL GRADE	40				60				40				60				40				60				40				60																			
	SIZE & LENGTH	#3x24" BARS				#3x30" BARS				#4x24" BARS				#4x36" BARS				#5x30" BARS				#5x42" BARS				#6x36" BARS				#6x48" BARS																			
DIST TO NEAREST FREE EDGE		4	6	8	10	4	6	8	10	12	14	8	10	12	14	16	8	10	12	14	16	22	24	10	12	14	16	22	24	10	12	14	16	22	24	10	12	14	16	19	22	24	10	12	14	16	19	22	24
PCC PVMT DEPTH JOINT TYPE																																																	
6"	WARP		48	39			48	48				48					48																																
	BUTT		37	27			48	42				48					48																																
8"	WARP	48	39	29	24	48	48	44	35	29	25	48	42	35	30	26	48	48	48	45	39	28	26	48	48	47	41	30	27	48	48	48	48	45	41	48	48	48	48	43	39	48	48	48	48	48	48	48	48
	BUTT	42	27			48	42	31	25			37	29	24			48	44	37	32	27			46	39	33	29		48	48	48	43	32	29	48	48	48	48	35	30	27	48	48	48	48	48	45	41	
8½"	WARP	48	37	28		48	48	42	33	28	24	48	39	33	28	24	48	48	48	42	37	27	24	48	48	44	38	28	25	48	48	48	48	42	38	48	48	48	48	47	40	37	48	48	48	48	48	48	48
	BUTT	39	26			44	39	29				35	27				48	42	35	29	26			44	36	31	27		48	48	47	41	30	27	48	48	45	39	33	28	26	48	48	48	48	48	42	39	
9"	WARP	48	35	26		48	48	39	31	26		47	37	31	26		48	48	47	40	35	25		48	48	42	36	26	24	48	48	48	48	40	36	48	48	48	48	44	38	35	48	48	48	48	48	48	48
	BUTT	37	24			48	37	27				33	26				48	40	33	28	25			41	34	29	25		48	48	44	39	28	25	48	48	42	37	31	26	24	48	48	48	48	47	40	37	
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	BUTT	35				48	35	26				31	25				47	37	31	27				39	32	27	25		48	48	42	37	27	24	48	47	40	35	29	25		48	48	48	48	44	38	35	
10"	WARP	47	31			48	47	35	28			42	34	28	24		48	48	42	36	31			48	44	37	33	24		48	48	48	48	36	33	48	48	48	48	40	34	31	48	48	48	48	48	48	47
	BUTT	33				48	33	25				29	24				45	36	29	25				37	31	26	24		48	46	40	35	25		48	45	38	33	28	24		48	48	48	48	42	36	33	
10½"	WARP	45	30			48	45	34	27			40	32	26			48	48	40	34	30			48	42	36	31		48	48	48	47	34	31	48	48	48	45	38	33	30	48	48	48	48	48	48	45	
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11"	WARP	43	28			48	43	32	26			38	31	25			48	46	38	33	28			48	40	34	30		48	48	48	45	32	30	48	48	48	43	36	31	28	48	48	48	48	48	47	43	
	BUTT	30				46	30					27					40	32	27				34	28	24			48	42	36	32			48	40	35	30	25		48	48	48	46	38	33	30			
11½"	WARP	41	27			48	41	31	24			36	29	24			48	44	36	31	27			46	38	32	28		48	48	48	43	31	28	48	48	47	41	34	30	27	48	48	48	48	48	45	41	
	BUTT	29				44	29					25					39	31	25				32	27				48	40	35	30			46	39	33	29	24		48	48	48	44	37	31	29			
12"	WARP	39	26			48	39	29				35	28				48	42	35	30	26			44	36	31	28		48	48	47	41	30	27	48	48	45	40	33	28	26	48	48	48	48	48	43	39	
	BUTT	27				42	27					25					37	30	25				31	25				48	46	39	33	29			45	37	32	28		48	48	48	42	35	30	27			
12½"	WARP	38	25			48	38	28				33	27				48	40	33	29	25			42	35	30	26		48	48	45	39	28	26	48	48	43	38	32	27	25	48	48	48	48	48	41	38	
	BUTT	27				40	27					35	28				35	28					29	25				44	37	32	27			42	35	30	27		48	48	45	40	34	29	26				
13"	WARP	36	24			48	36	27				32	26				48	39	32	27	24			40	33	29	25		48	48	43	38	27	25	48	48	41	36	30	26	24	48	48	48	48	46	40	36	
	BUTT	25				38	25					34	27				34	27					28					42	35	30	27			41	34	29	25		48	48	44	38	32	28	25				
13½"	WARP	35				48	35	26				31	25				47	37	31	26			39	32	28	24		48	48	42	36	26	24	48	47	40	35	29	25		48	48	48	48	44	38	35		
	BUTT	25				37	25					33	26				33	26					27					41	34	29	25			39	33	28	25		48	48	42	37	31	27	24				
14"	WARP	34				48	34	25				30	24				45	36	30	25			37	31	27			48	47	40	35	25		48	45	38	34	28	24		48	48	48	48	43	37	34		
	BUTT	24				35	24					32	25				32	25					26					39	33	28	25			38	32	27	24		48	47	40	35	30	26					
14½"	WARP	32				48	32	24				29					43	35	29	25			36	30	26			48	45	39	34	24		48	43	37	32	27		48	48	48	48	41	35	32			
	BUTT					34						30	25				30	25					25					38	32	27	24			36	30	26		48	46	39	34	29	25						
15"	WARP	31				47	31					28					42	33	28	24			35	29	25			48	44	37	33	24		48	42	36	31	26		48	48	48	47	40	34	31			
	BUTT					33						29					29						25					37	31	26			35	29	25		48	44	38	33	28	24							

TRANSVERSE CONTRACTION JOINT DETAILS

Notes

1. The joint seal details apply to both doweled and non-doweled (plain) transverse joints.
2. T = Thickness of pavement.
3.  $B = T/4 + \frac{1}{4}"$  for AE or non-doweled concrete pavement or  
 $B = T/3$  for AAE or doweled concrete pavement



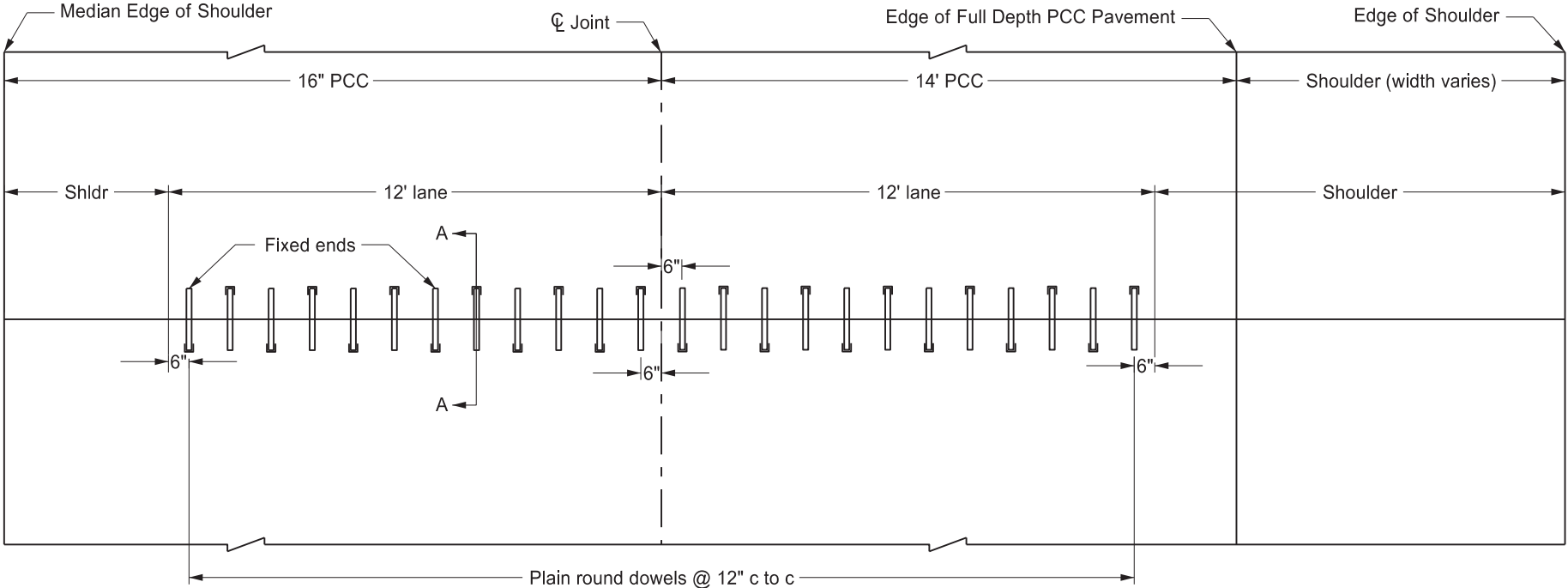
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-15-10	
REVISIONS	
DATE	CHANGE
6/23/2014	Removed dowel size reference
3/16/2016	Revised Joint Details and notes
10/25/2019	Expanded Details for clarity
03/13/2025	Revised # of Dowels & Note 3.

KIRK J. HOFF  
REGISTERED  
PE-4683  
ENGINEER  
NORTH DAKOTA

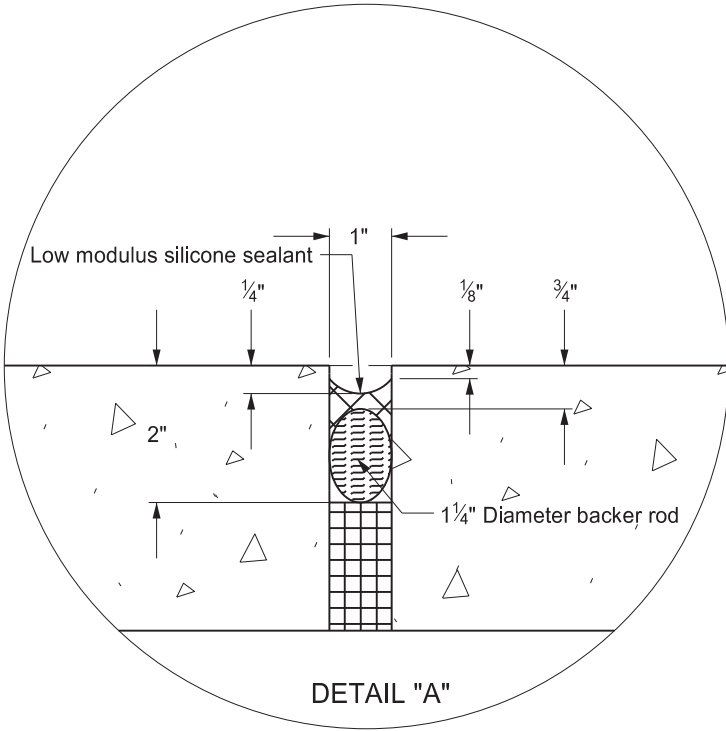
03/13/25

TRANSVERSE EXPANSION JOINT DETAIL

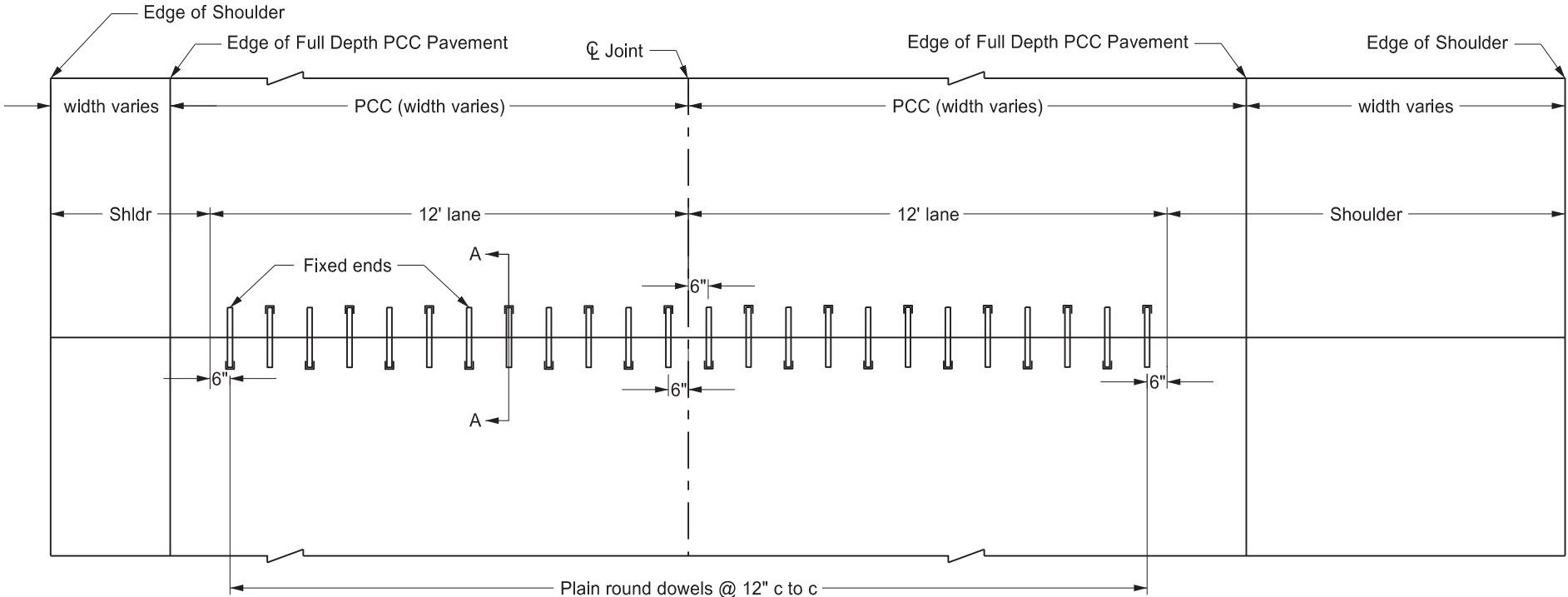
D-550-4



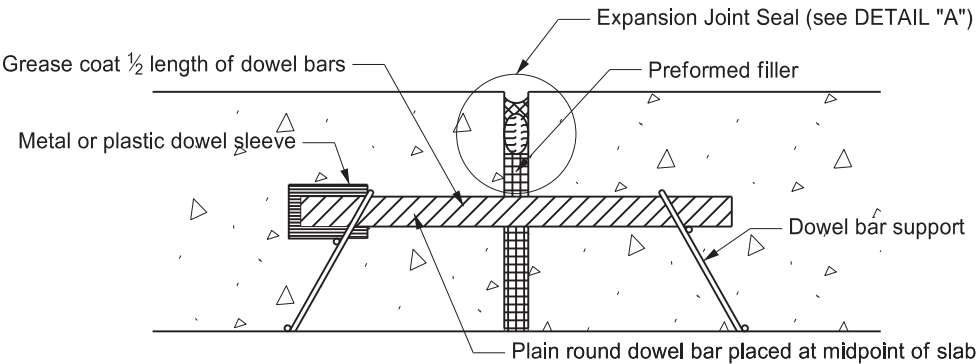
DOWELED EXPANSION JOINT ASSEMBLY  
INTERSTATE



DETAIL "A"



DOWELED EXPANSION JOINT ASSEMBLY  
NON-INTERSTATE



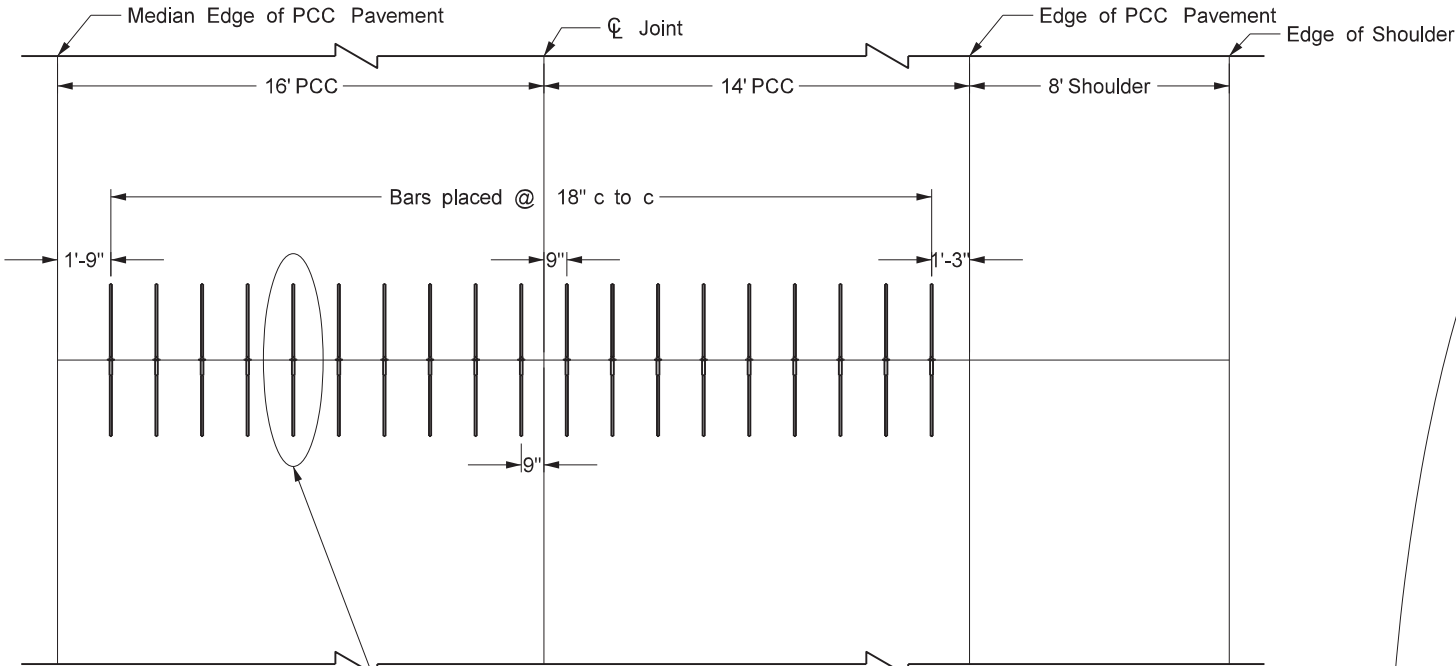
SECTION A-A

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-15-2010	
REVISIONS	
DATE	CHANGE
6/23/2014	Removed dowel bar sizes
10/25/2019	Expanded details for clarity
3/13/2025	Revised # of dowels.



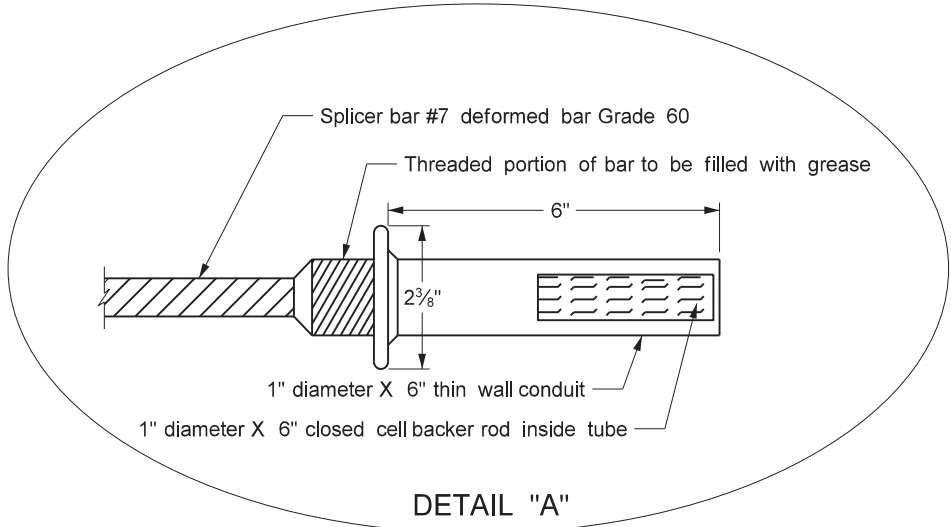
03/13/25

TRANSVERSE CONSTRUCTION JOINT

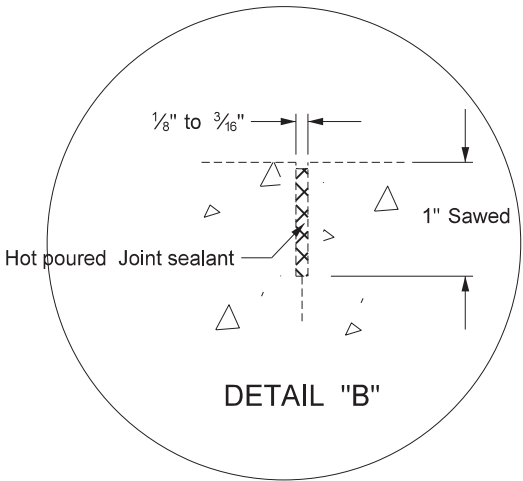


See "DEFORMED SPLICER BAR", "DETAIL A", "DETAIL B" and "STAGES OF CONSTRUCTION" drawings, this standard

PLAN VIEW

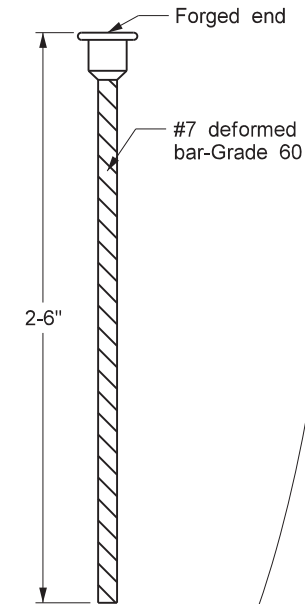
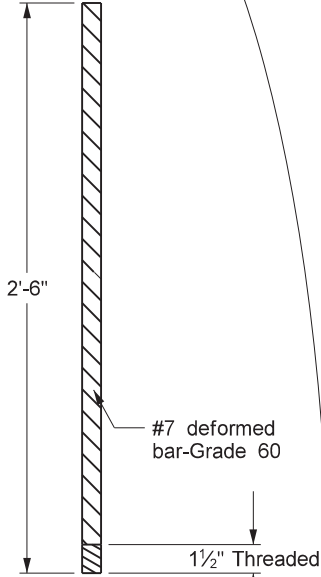


DETAIL "A"



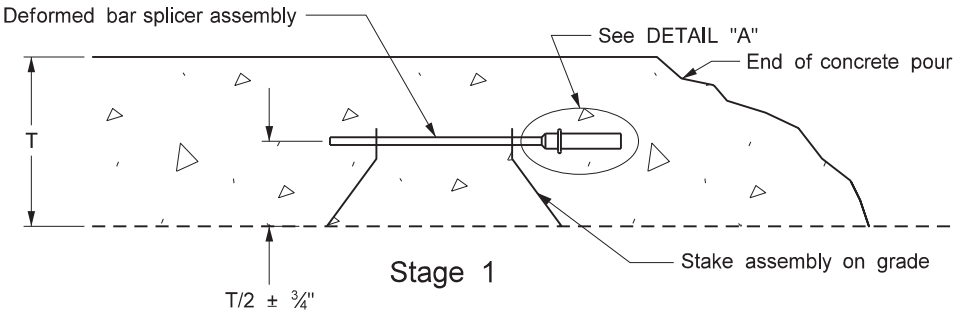
DETAIL "B"

DEFORMED INSERT

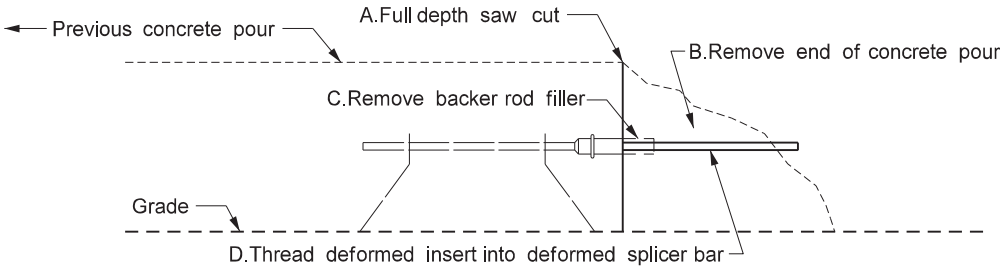


DEFORMED SPLICER BAR

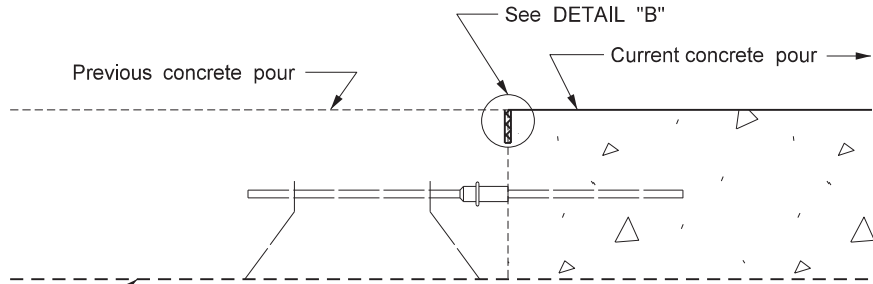
STAGES OF CONSTRUCTION



Stage 1



Stage 2



Stage 3

Notes

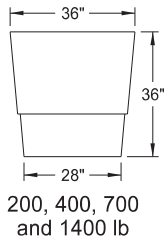
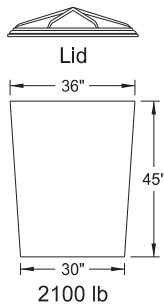
1. Saw and seal all construction joints.
2. Include all costs for transverse construction joints in the price bid for PCC pavement.
3. Do not saturate the subgrade during the sawing operation.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-15-2010	
REVISIONS	
DATE	CHANGE
3-16-16	Revised Joint Details & notes.
8-27-19	New Design Engr PE Stamp.
8-09-24	Electronic Stamp/Signature.



08/09/24

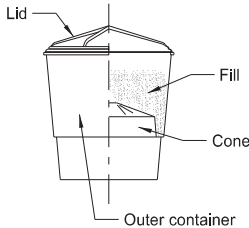
ATTENUATION DEVICE



Outer Containers

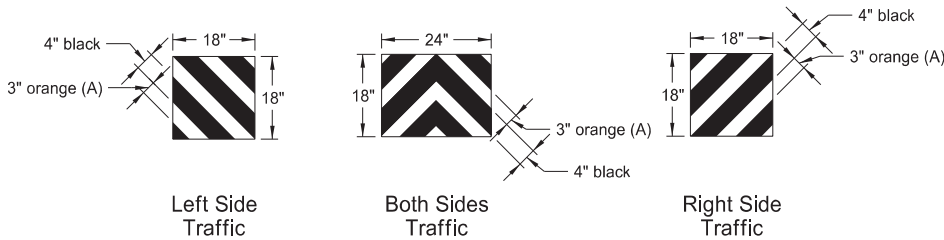


Cones



Typical Assembly

Typical Module Construction Detail

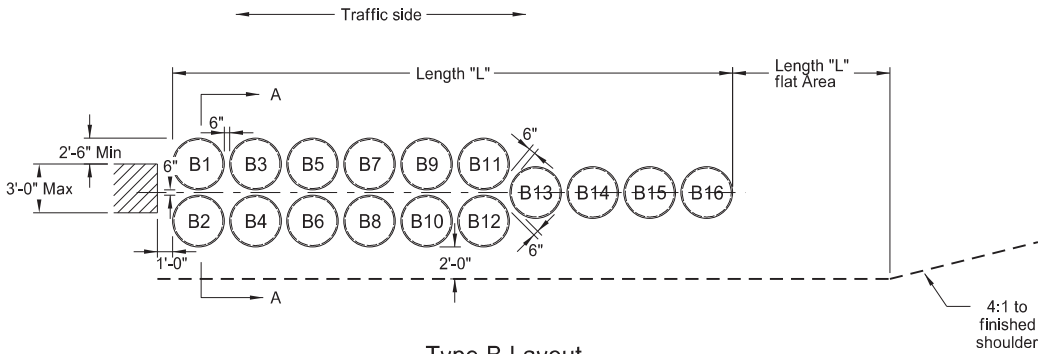


Reflective Sheet Detail

Note:  
Apply Type IV reflective sheeting (as specified in the NDDOT Standard Specifications) directly to the outer container of the last attenuation device facing traffic, following the details above.  
Or apply the sheet to a metallic sheet and attach it to the container with approved fasteners.

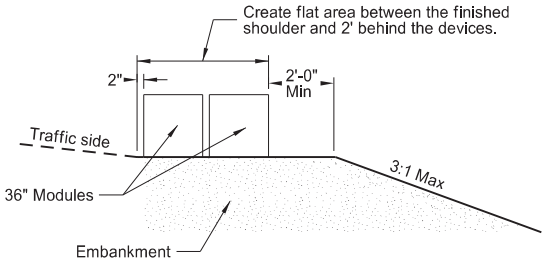
(A) Use 3" orange sheeting for temporary installations, and 3" yellow sheeting for permanent installations.

Fill Chart					
	Module Weights (LBS)				
	200	400	700	1400	2100
Distance from top edge	8½"	5"	4"	3"	0"



Type B Layout

Note:  
Angle attenuation devices 10 degrees towards traffic when placed at piers offset from roadway.



Section A-A  
(Type B Layout)

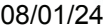
Type B Attenuation Device												
Module Number	Dash Number											
	80	75	70	65	60	55	50	45	40	35	30	25
	Module Weights (LBS)											
B1	2100	2100										
B2	2100	2100										
B3	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B4	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
B5	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B6	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B7	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B8	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400
B9	700	700	700	700	700	700	700	700	700	700	700	700
B10	700	700	700	700	700	700	700	700	700	700	700	700
B11	700	700	700	700	700	700	700	700	700	700	700	700
B12	700	700	700	700	700	700	700	700	700	700	700	700
B13	700	700	700	700	700	700	700	700	700	700	700	700
B14	400	400	400	400	400	400	400	400	400	400	400	400
B15	400	400	400	400	400	400	400	400	400	400	400	400
B16	200	200	200	200	200	200	200	200	200	200	200	200
Length (L)	34.2'	34.2'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	30.7'	27.2'	27.2'
Module Weights (LBS)	Replacement Module											
	1	1	1	1	1	1	1	1	1	1		
2100	1	1	1	1	1	1	1	1	1	1		1
1400	1	1	1	1	1	1	1	1	1	1	1	1
700	2	2	2	2	2	2	2	2	2	2	2	2
400	1	1	1	1	1	1	1	1	1	1	1	1
200	2	2	2	2	1	1	1	1	1	1	1	1

Notes:

- Materials
  - Use modules manufactured from frangible polyethylene material which shatters upon impact.
  - Fill modules with class 43 aggregate meeting NDDOT Standard Specifications aggregate requirements. Use fill with a unit weight of at least 100 pounds per cubic foot. Use fill with a moisture content of 2% or less when left over winter.
- Modules
  - Provide three components in two sizes containing volumes of either 2, 4, 7, 14, or 21 cubic feet minimum.
  - Provide three components for 2, 4, or 7 cubic foot module containers:
    - A 14 C.F., yellow outer container.
    - A black lid securely locking over the top lip of the container.
    - A variable cone-shaped supporting insert capable of supporting 200, 400, or 700 pounds of sand mass to allow for three sizes of modules. Place cone inserts inside the 14 cubic foot container.
  - Provide two components for the 14 cubic foot module container:
    - A 14 C.F., yellow outer container.
    - A black lid securely locking over the top lip of the container.
  - Provide two components for the 21 cubic foot module container:
    - A 36" height X 36" width yellow outer container.
    - A black lid which locks securely over the top of the container.
- For temporary installations use Energite or Fitch attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or approved equal modules. As an option, place attenuation devices on 3½" maximum thickness pallets to facilitate maintenance.
- For permanent installations use Barrel Attenuation Device consisting of one-piece outer sand container modules with separate detachable lid. Energite attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or approved equal meet these requirements.
- The Typical Module Construction Detail and Type B Layout are based on the Energite Crash Cushion manufactured by Energy Absorption. Provide any required layouts and details from other sand filled attenuation module manufacturers which differ from those shown here.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
07-18-14	Revised sheeting in reflective sheet detail
09-27-17	Update to active voice
10-03-19	New Design Engr PE Stamp
08-01-24	Electronic Stamp/Signature
06-30-25	Legislative Changes

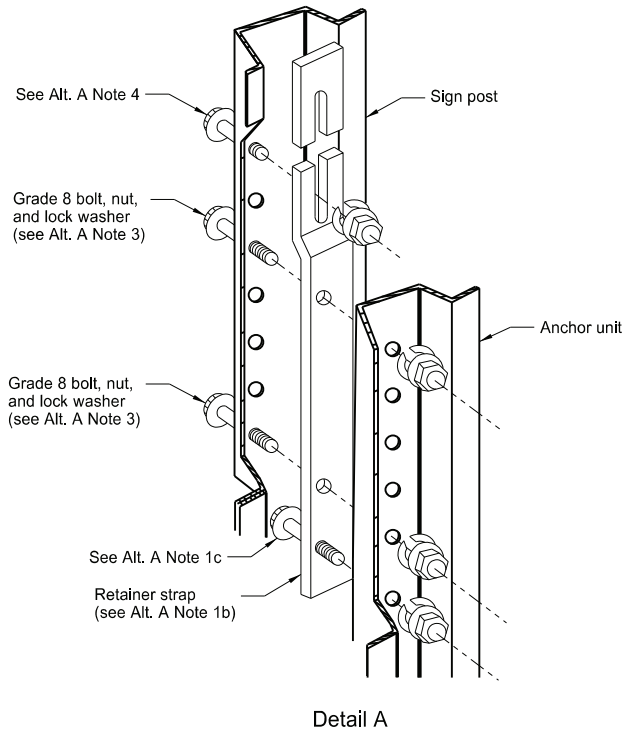




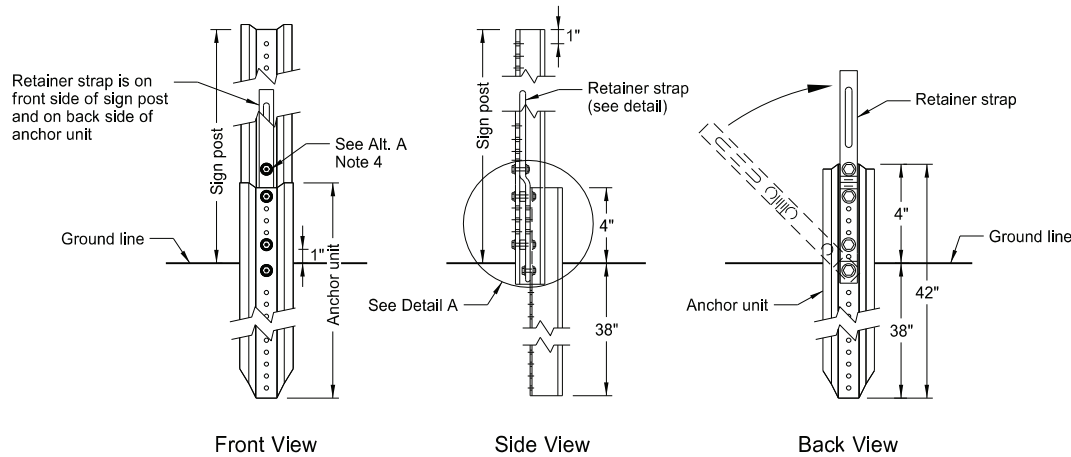
BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-8

U-Channel Post



Detail A



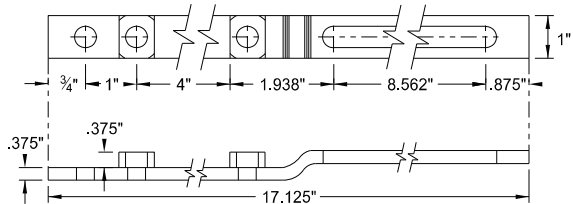
Front View

Side View

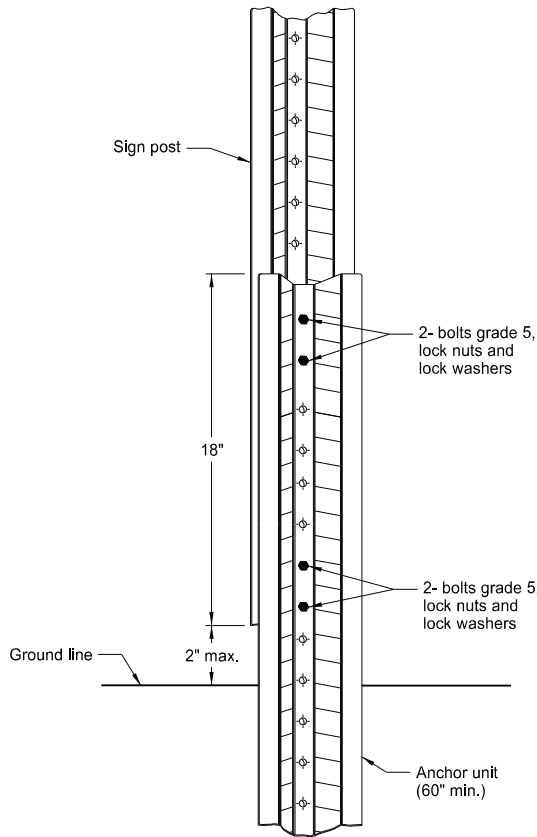
Back View

Breakaway U-Channel Detail Alternate A

Install a maximum of 2 posts within 7'.

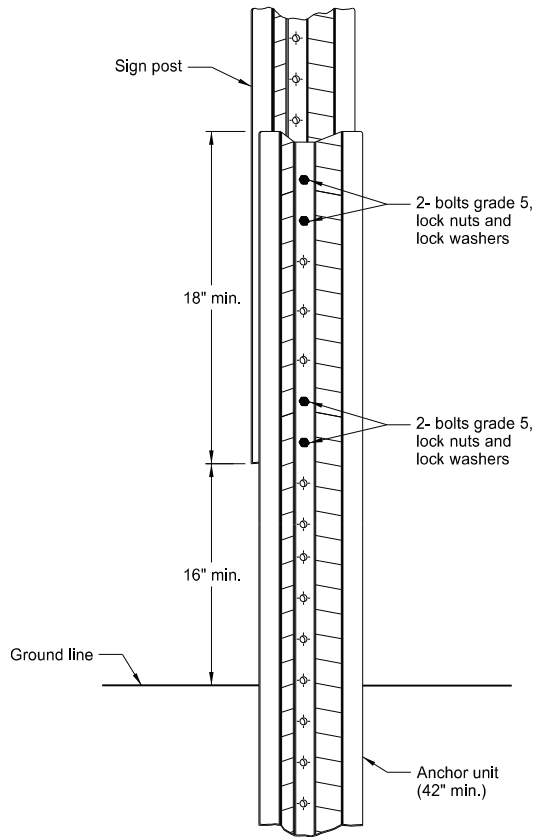


Retainer Strap Detail



Breakaway U-Channel Splice Detail Alternate B (2.5 and 3 lb/ft)

Install a maximum of 3 posts within 7'.



Breakaway U-Channel Splice Detail Alternate C (2.5 and 3 lb/ft)

Install a maximum of 3 posts within 7'.

Alternate A Steps of Installation:

- a) Drive anchor unit to within 12" of ground level.  
b) Establish proper assembly by lining up bottom hole of retainer strap with 6th hole from the top of the anchor unit.  
c) Assemble strap to back of anchor unit using 5/16"x2" bolt, lock washer and nut.  
d) Rotate strap 90° to left.
- a) Drive anchor unit to 4" above ground.  
b) Rotate strap to vertical position.
- a) Place 5/16"x2" bolt, lock washer and nut in bottom of sign post to facilitate alignment of sign post with proper hole in anchor unit.  
b) Alternately tighten two connector bolts.
- Complete assembly by tightening 5/16"x2" bolt (this fastens sign post to retainer strap).
- Properly nest base post, strap, and sign post. Proper nesting occurs when all flat surfaces of the base post, strap, and sign post at the bolts have full contact across the entire width.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
10-03-19	New Design Engr PE Stamp
8-01-24	Electronic Stamp/Signature

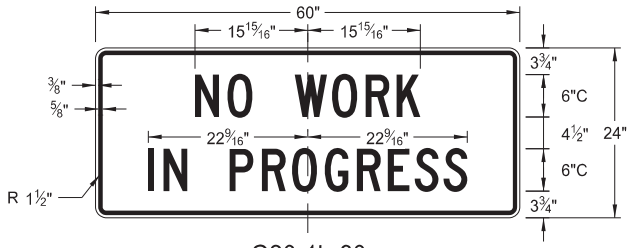


08/01/24

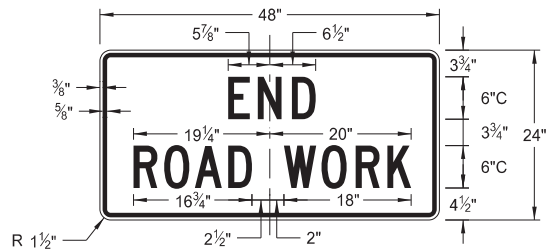
CONSTRUCTION SIGN DETAILS  
TERMINAL AND GUIDE SIGNS



G20-1-60  
Legend: black (non-refl)  
Background: orange



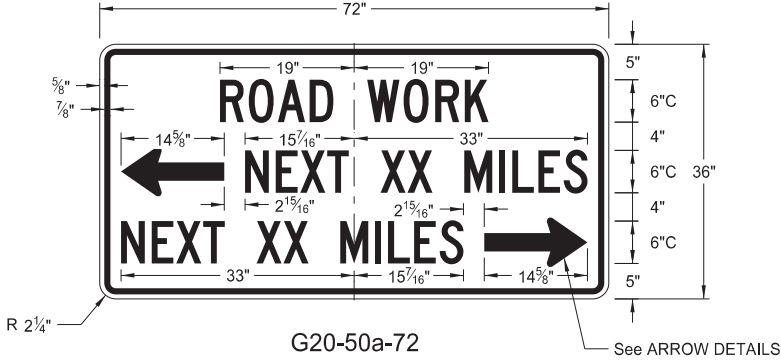
G20-1b-60  
Legend: black (non-refl)  
Background: orange



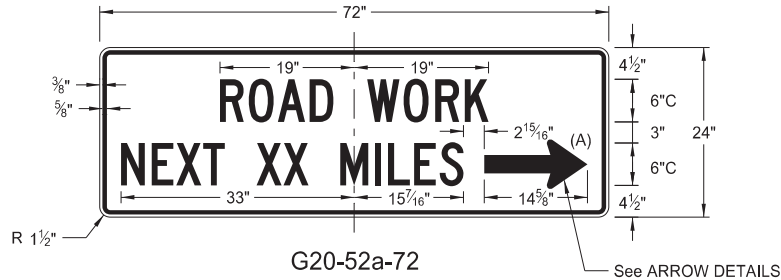
G20-2-48  
Legend: black (non-refl)  
Background: orange



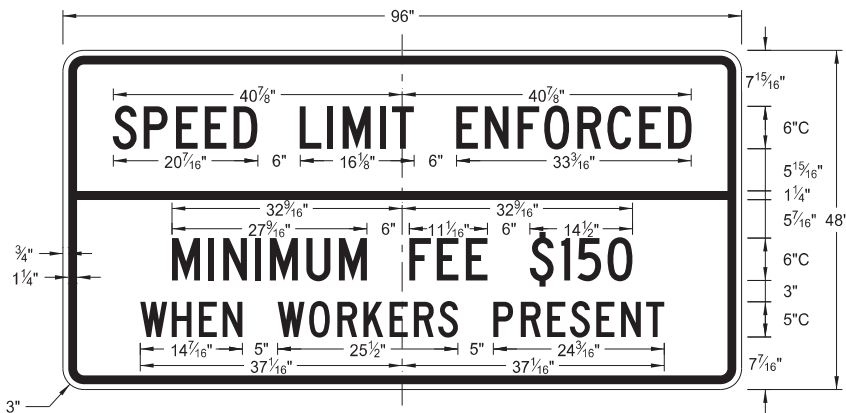
G20-4b-36  
Legend: black (non-refl)  
Background: orange



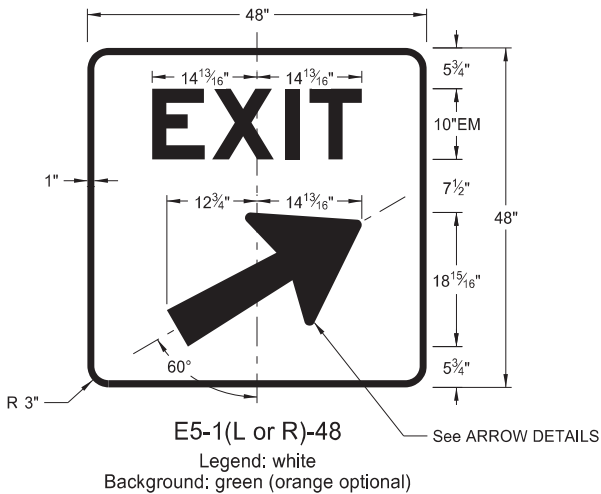
G20-50a-72  
Legend: black (non-refl)  
Background: orange



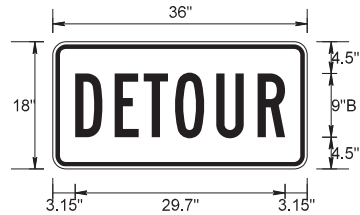
G20-52a-72  
Legend: black (non-refl)  
Background: orange



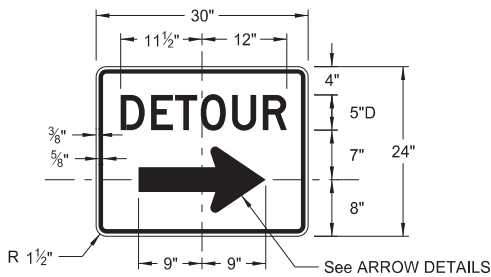
G20-55-96  
Legend: black (non-refl)  
Background: orange



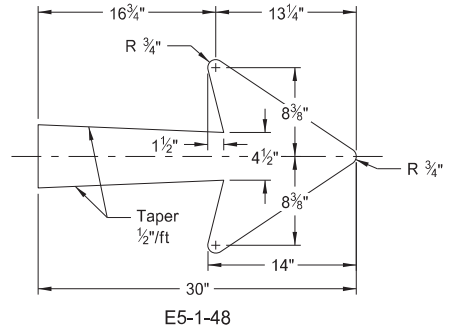
E5-1(L or R)-48  
Legend: white  
Background: green (orange optional)



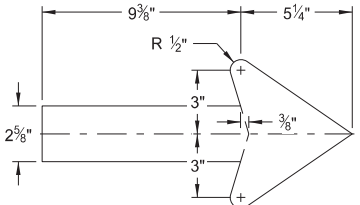
M4-8-36  
Legend: black (non-refl)  
Background: orange



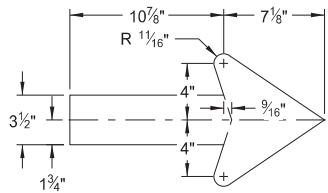
M4-9(L or R)-30 &  
M4-9-30  
Legend: black (non-refl)  
Background: orange



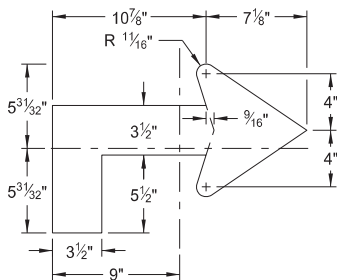
E5-1-48



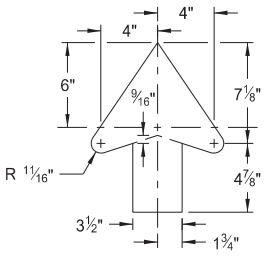
G20-50a-72  
G20-52a-72



M4-9(L or R)-30  
Right or Left



M4-9(L or R)-30  
Advanced Right or Left



M4-9-30  
Straight

ARROW DETAILS

NOTES:

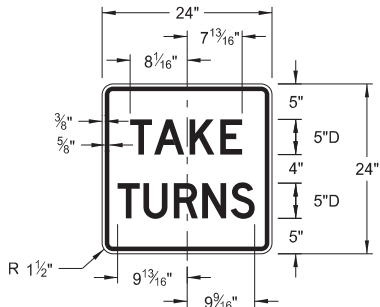
(A) Arrow may be right or left of the legend to indicate construction to the right or left.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
08-17-17	Added sign & background color
10-03-19	New Design Engineer PE Stamp
08-01-24	Electronic Stamp/Signature
06-30-25	Legislative Changes

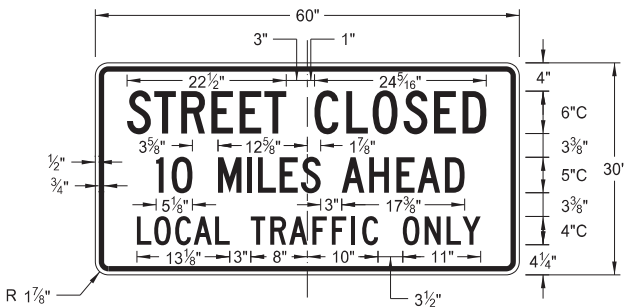


CONSTRUCTION SIGN DETAILS  
REGULATORY SIGNS

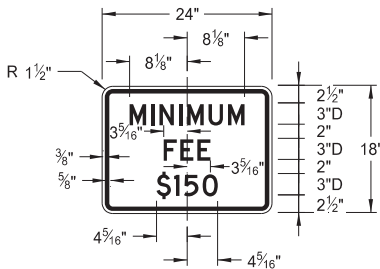
D-704-10



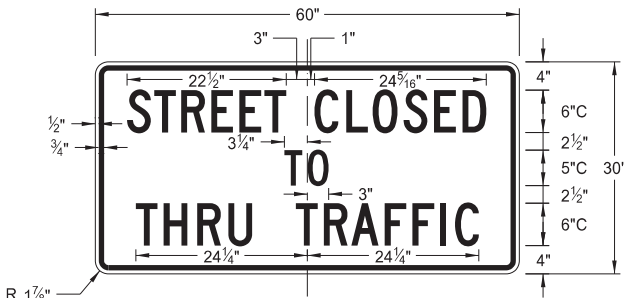
R1-50P-24  
Legend: black (non-refl)  
Background: white



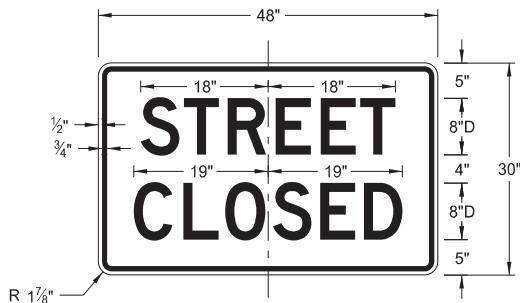
R11-3c-60  
Legend: black (non-refl)  
Background: white



R2-1aP-24  
Legend: black (non-refl)  
Background: white



R11-4a-60  
Legend: black (non-refl)  
Background: white



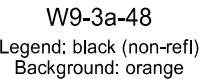
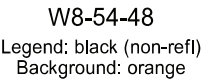
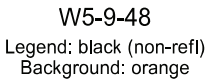
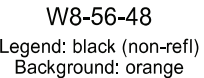
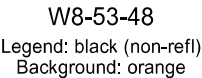
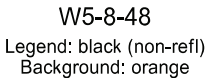
R11-2a-48  
Legend: black (non-refl)  
Background: white

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
08-17-17	Revised sign number
10-03-19	New Design Engineer PE Stamp
08-01-24	Electronic Stamp/Signature
06-30-25	Legislative Changes



WORD	LETTER SPACING
AHEAD	Standard
200 FT	Standard
350 FT	Standard
500 FT	Standard
1000 FT	Reduce 40%
1500 FT	Reduce 40%
½ MILE	Reduce 50%
1 MILE	Standard

## \* DISTANCE MESSAGES



## ARROW DETAILS

NORTH DAKOTA	
DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17	Updated sign number
5-31-18	Revised sign and arrow details
10-03-19	New Design Engineer PE Stamp
8-01-24	Electronic Stamp/Signature

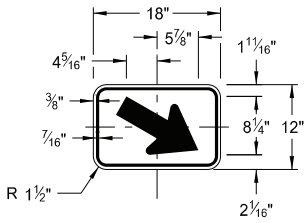


08/01/24

CONSTRUCTION SIGN DETAILS  
WARNING SIGNS

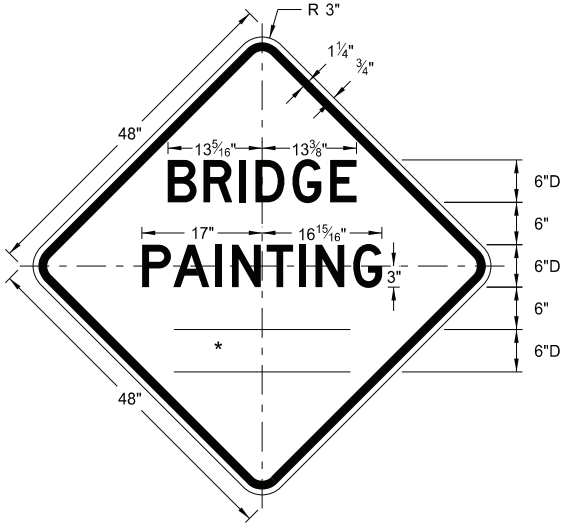
WORD	LETTER SPACING
AHEAD	Standard
200 FT	Standard
350 FT	Standard
500 FT	Standard
1000 FT	Reduce 40%
1500 FT	Reduce 40%
½ MILE	Reduce 50%
1 MILE	Standard

\* DISTANCE MESSAGES



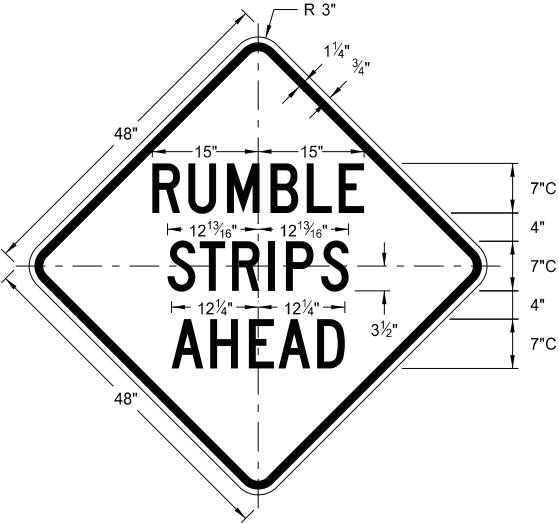
W16-7aP-18

Legend: black (non-refl)  
Background: orange



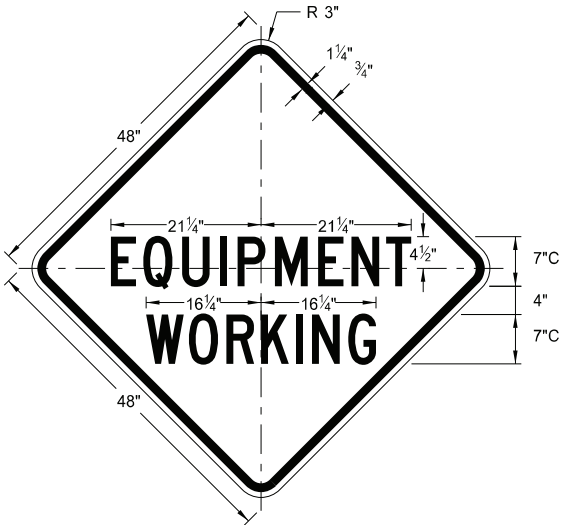
W21-50-48

Legend: black (non-refl)  
Background: orange



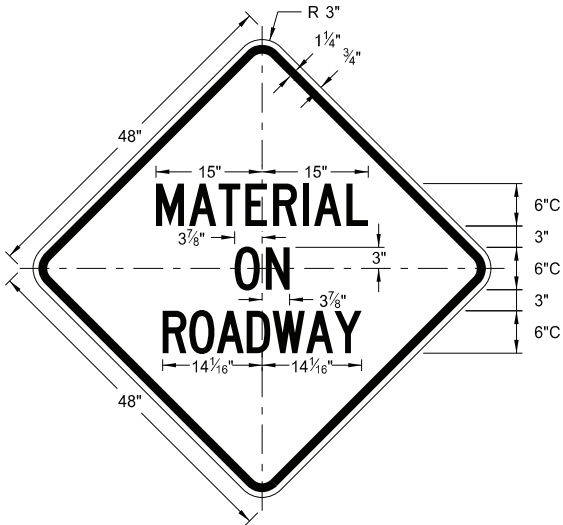
W21-53-48

Legend: black (non-refl)  
Background: orange



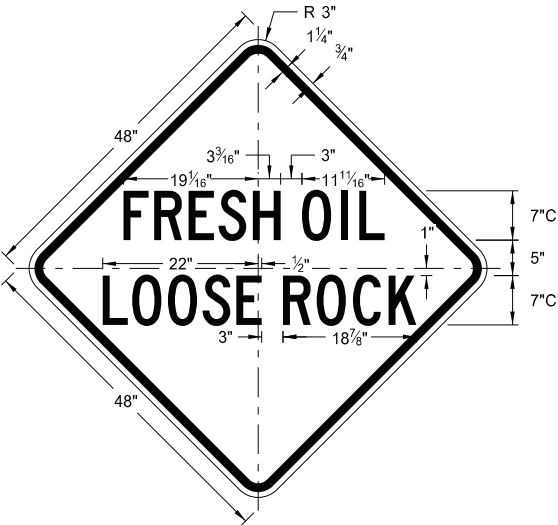
W20-51-48

Legend: black (non-refl)  
Background: orange



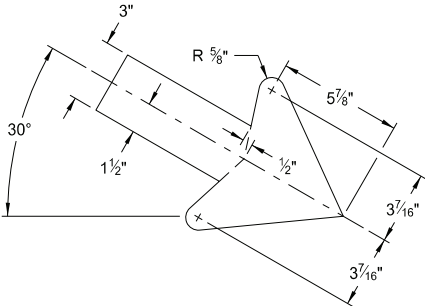
W21-51-48

Legend: black (non-refl)  
Background: orange

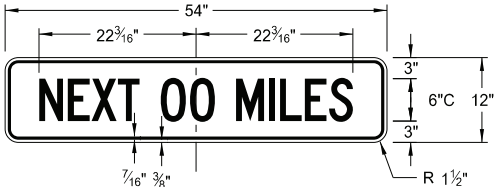


W22-8-48

Legend: black (non-refl)  
Background: orange

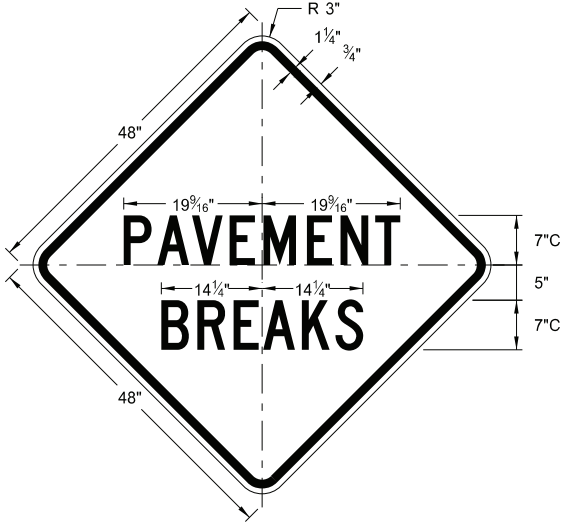


W16-7aP-18



W20-52P-54

Legend: black (non-refl)  
Background: orange



W21-52-48

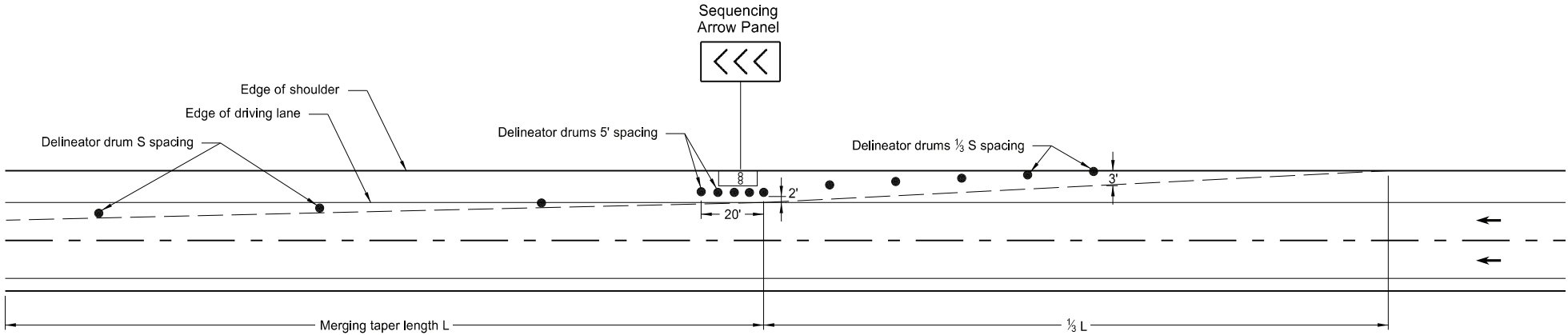
Legend: black (non-refl)  
Background: orange

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
5-31-18	
REVISIONS	
DATE	CHANGE
11-01-19	Added details for sign W16-7aP-18.
8-01-24	Electronic Stamp/Signature.

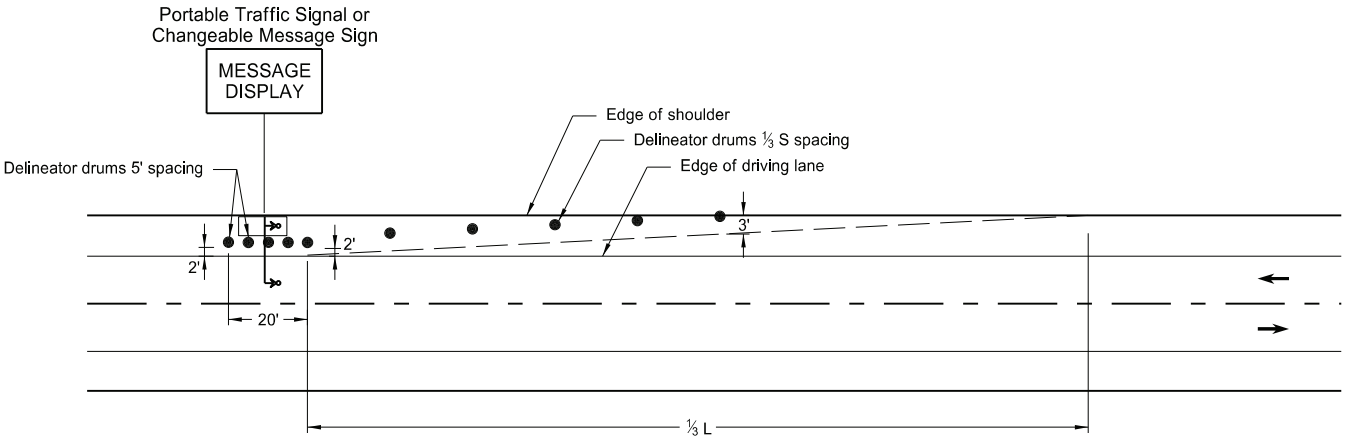
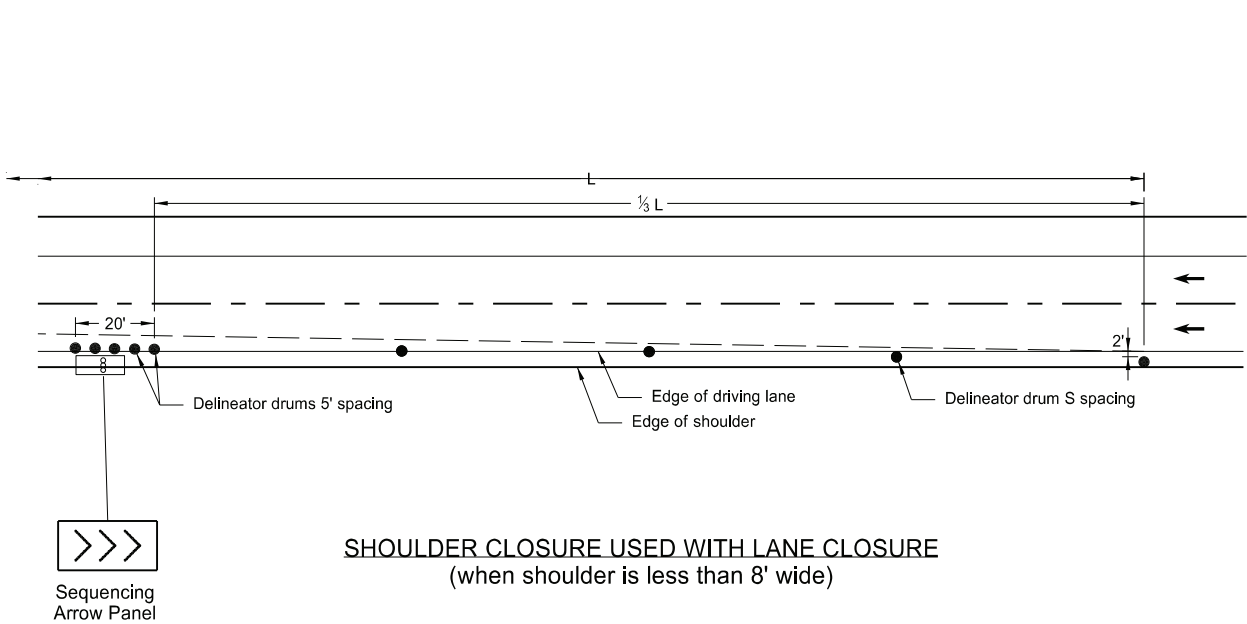
08/01/24

SHOULDER CLOSURE TAPERS

D-704-12



SHOULDER CLOSURE WITH LANE CLOSURE  
(when shoulder is 8' or wider)



PORTABLE TRAFFIC SIGNAL OR CHANGEABLE MESSAGE SIGN ON SHOULDER

SHOULDER CLOSURE USED WITH LANE CLOSURE  
(when shoulder is less than 8' wide)

KEY			
●	Delineator Drum	∞	Sequencing Arrow Panel
•	Message Display	↳	Portable Traffic Signal

Notes:

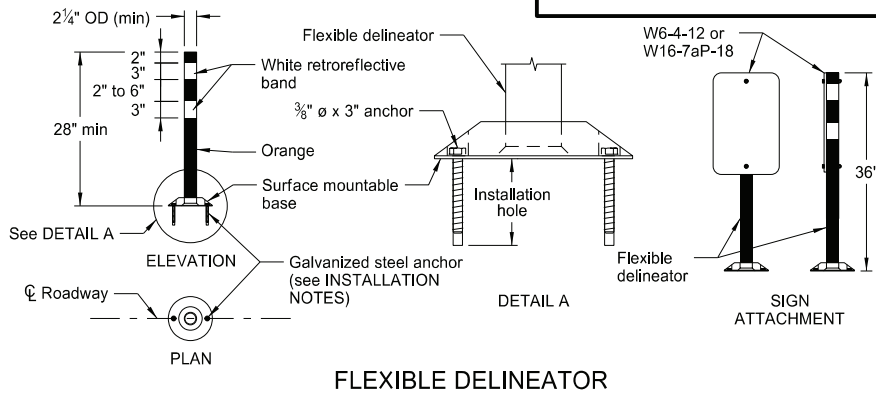
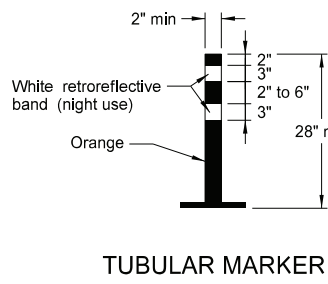
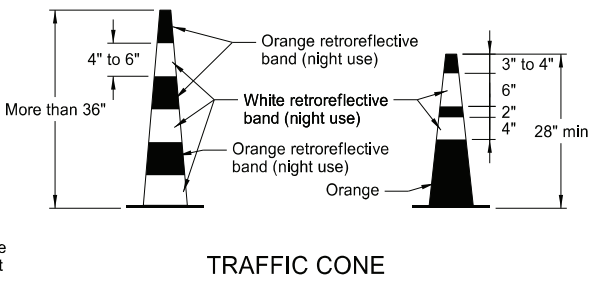
- S = Posted Speed Limit in mph  
W = Width of offset in feet  
L = Taper length in feet  
L = WS<sup>2</sup>/60 (40mph or less)  
L = WS (45mph or more)
- If a shoulder taper is used, use a length of approximately 1/3L. If a shoulder is used as a travel lane, use a normal merging or shifting taper.
- When paved shoulders of 8 foot width or more are closed, use channelizing devices to close shoulder in advance, to delineate beginning of work space, and to direct vehicular traffic to remain within the traveled way.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
10-25-19	Added L dimension to detail
8-01-24	Electronic Stamp/Signature



08/01/24

D-704-13



### INSTALLATION NOTES:

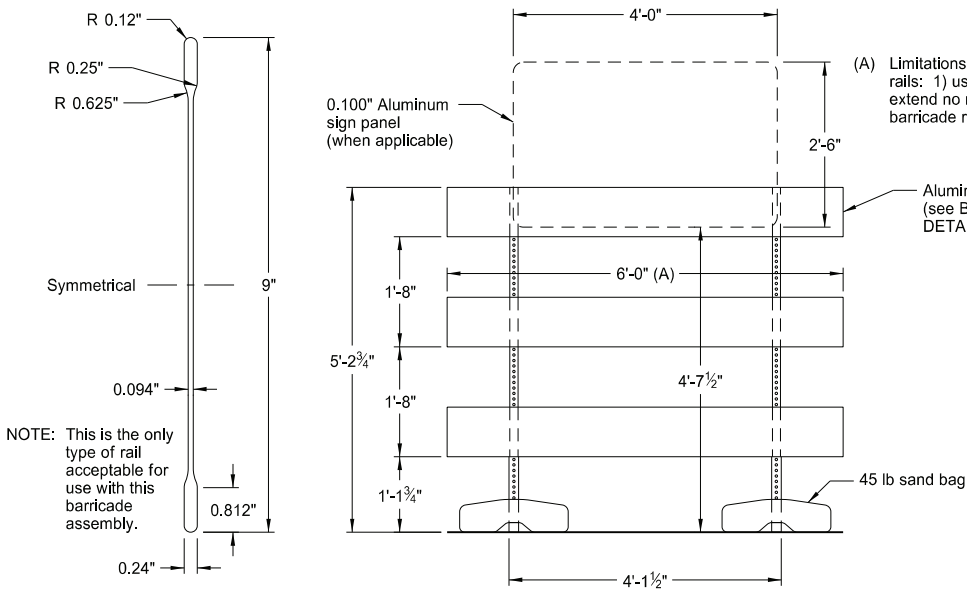
1. Drill installation holes to diameter and depth required by manufacturer's specifications.
2. For removal, remove anchors and fill installation hole with an epoxy designed to bond to pavement surface.
3. In lieu of bolted down base, use an 8" x 8" butyl pad or hot melt butyl. Remove butyl as close as possible to pavement surface.

Provide horizontal, circumferential, alternating orange and white retroreflective stripes 4" to 6" wide for drum markings. Use a minimum of two orange and two white stripes with the top stripe being orange for each drum. Do not exceed 3" nonretroreflectORIZED spaces between the horizontal orange and white stripes. Avoid placement of stripes on drum ribs or indentations. Use closed top drums that will not allow collection of debris. Do not place ballast on the top of drum.

Provide alternating orange and white retroreflective stripes, sloping downward in direction vehicular traffic is to pass. Place retroreflective sheeting on both sides of panel with a minimum of 270 square inches of retroreflective area facing vehicular traffic. Where the height of the retroreflective material on the vertical panel is 36 inches or more, use a stripe width of 6 inches.

Provide retroreflectorization of cones more than 36" in height by alternating orange and white retroreflective stripes. Use a minimum of two orange and two white stripes for each cone with the top stripe being orange. Use maximum 3" nonretroreflectorized space between the orange and white stripes.

Provide retroreflectorization of tubular markers more than 42" in height by alternating four 4" to 6" wide orange and white stripes with the top stripe being orange.



(A) Limitations when using 8'-0" barricade rails: 1) use no sign panel, and 2) extend no more than 1'-0" of the barricade rail past the uprights.

Aluminum barricade rail  
(see BARRICADE BLADE  
DETAIL)

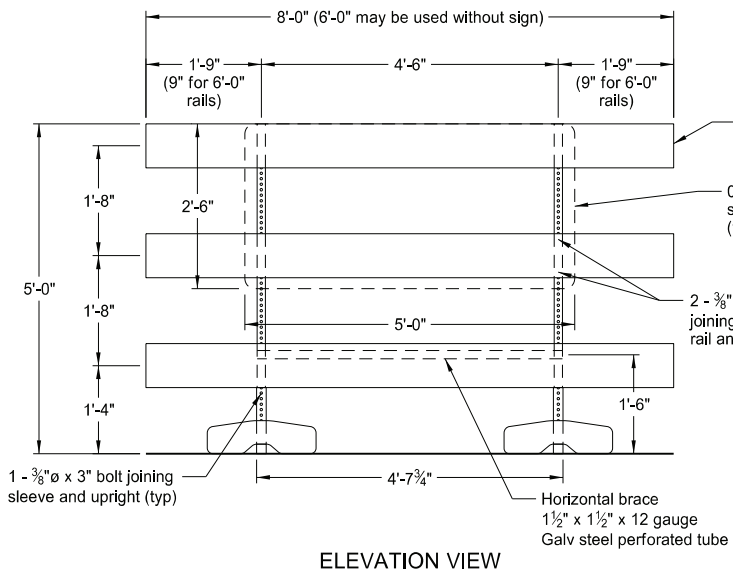
Uprights slide inside sleeves - use no bolt or fastening device

Attach sign panel to top barricade rail with  $\frac{5}{16}$ " x 1" hex head bolts with a square washer on back side of barricade rail.

right  
" x 1½" x ⅛" x 5'-0"  
lv steel perforated tube

1" x 1 3/4" x 14 gauge x 12' galv steel perforated tube

— Skid  
1 3/4" x 1 3/4" x 14 gauge x 5'-0"  
Galv steel perforated tube



- Barricade rails  
1" x 8" wood slats or  
hollow-profile plastic rails  
0.080" Aluminum  
sign panel  
(when applicable)

- 2 -  $\frac{3}{8}$ "  $\varnothing$  x 4" bolts  
joining sign panel,  
rail and upright (typ)

Upright  
1½" x 1½" x 12 gauge  
Galv steel perforated tube

Horizontal brace  
Attach to upright and  
rail with  $\frac{3}{8}$ "  $\varnothing$  x 5" bolt

Sleeve  
1 3/4" x 1 3/4" X 12 gauge  
Galv steel perforated tube

6 1/4" Ballast (see Table)

**SIDE VIEW**

Skid  
1 3/4" x 1 3/4" x 12 gauge  
Galv steel perforated tube

## BARRICADE BLADE DETAIL

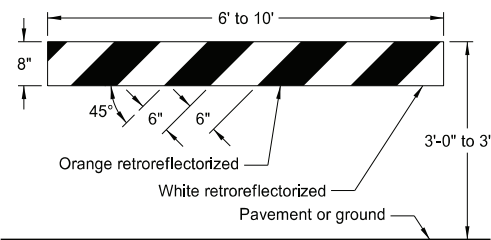
ELEVATION VIEW

## BARRICADE ASSEMBLY DETAIL (Aluminum Barricade Rails)

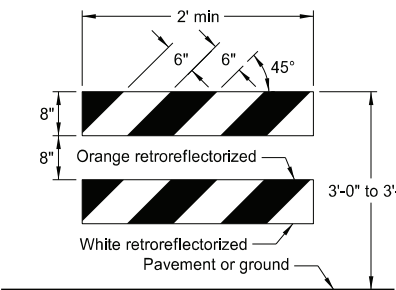
### SIDE VIEW

## BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

**NOTE:** For barricade markings use alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Place retroreflective sheeting on both sides of the rails with a minimum of 270 square inches of visible retroreflective area facing vehicular traffic. When the barricade length is less than 36", use a rail stripe width of 4".

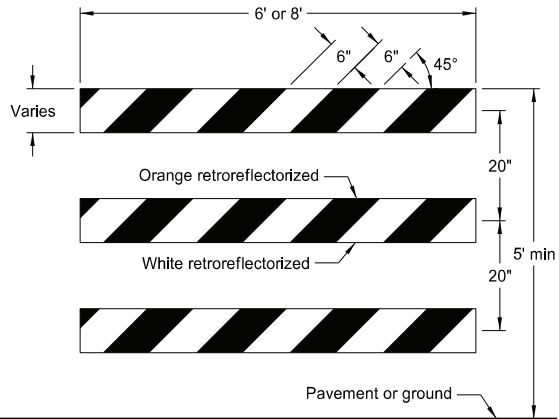


## TYPE I BARRICADE

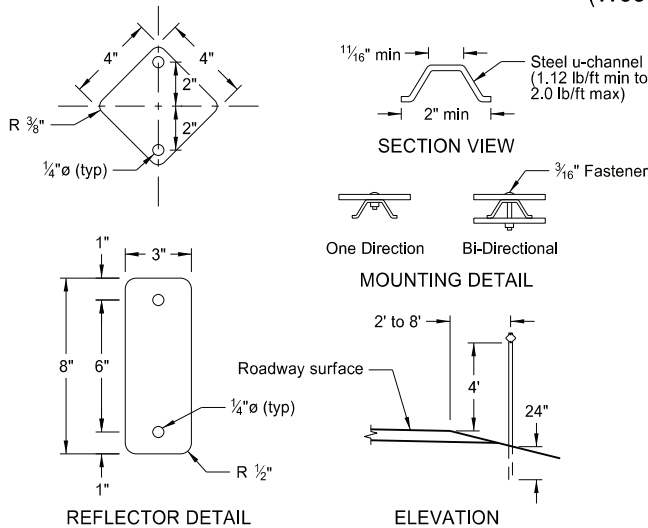


## TYPE II BARRICADE

## BARRICADE RAIL DETAILS



## TYPE III BARRICADE



## DELINEATORS

MINIMUM BALLAST  
(For each side of barricade support)

Without Sign	4 - 25 lb sandbags
With Sign	6 - 25 lb sandbags

Note: Number of sandbags based on a wind speed of 55 MPH. Sandbags assumed to be placed at or near the ends of the skids.

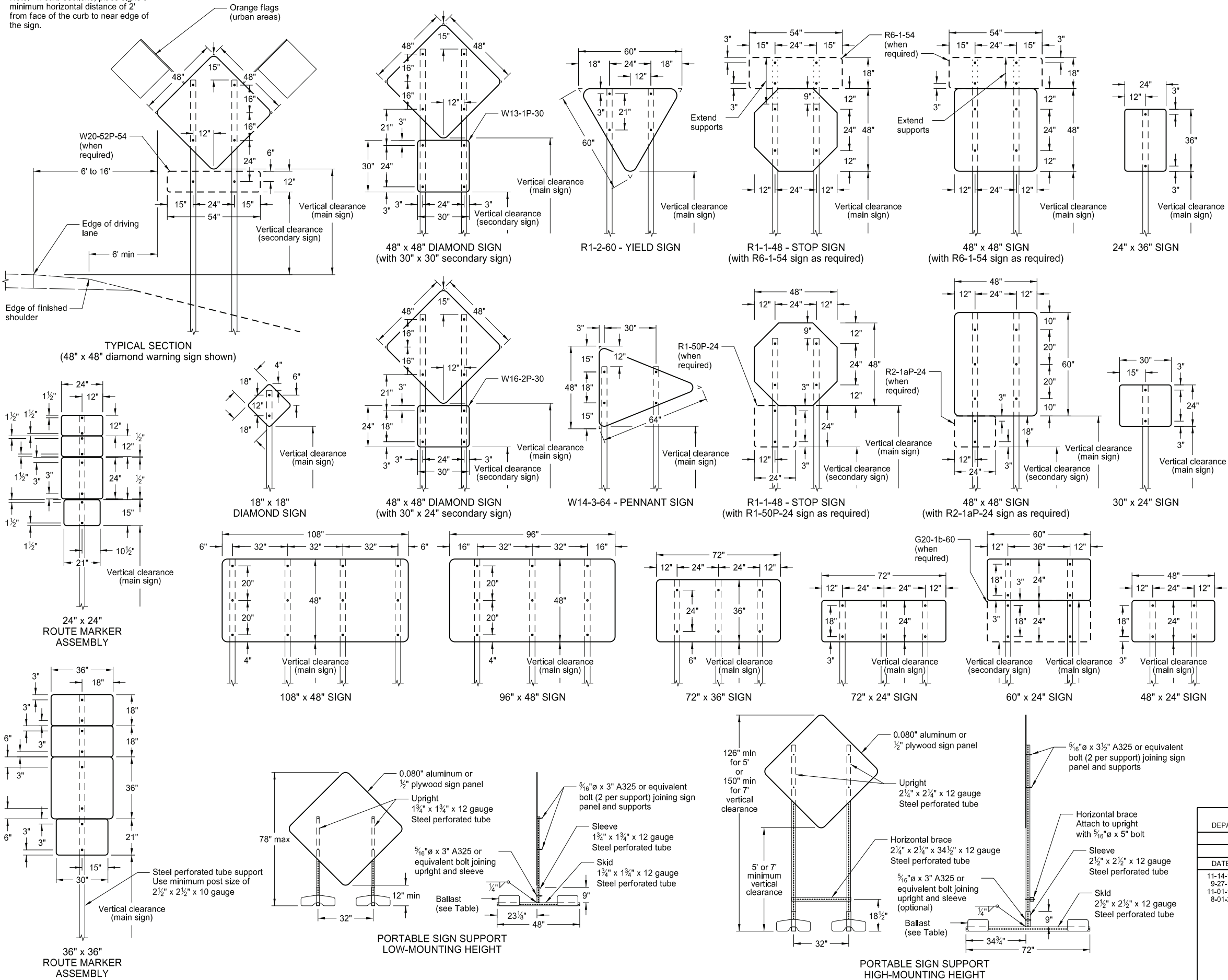
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
9-27-17 11-01-19 8-01-24	Updated to active voice Revised details for Flexible Delineator Electronic Stamp/Signature



08/01/24

CONSTRUCTION SIGN PUNCHING AND MOUNTING DETAILS

Note: In curb sections, place signs a minimum horizontal distance of 2' from face of the curb to near edge of the sign.



NOTES:

1. Sign Supports: Galvanize or paint supports. Minimum post sizes are 2.5 lb/ft u-channel or 2" x 2" x 12 gauge steel perforated tube, except where noted. When installing signs on u-channel, minimum post size for assemblies containing a secondary sign is 3.0 lb/ft. Post sizes based on a wind speed of 55 MPH.  
  
Place signs over 50 square feet on 2½" x 2½" perforated tube supports as a minimum.  
  
Do not attach guy wires to sign supports. Attach wind beams behind sign panels when used with u-posts.
2. Sign Panels: Provide sign panels made of 0.100" aluminum, ½" plywood, or other approved material, except where noted. Punch all holes round for ⅜" bolts.
3. Alternate Messages: Install and remove alternate message signs on reflectorized plate (without borders) as required. (i.e. "Left" and "Right" message on lane closure sign)
4. Route Marker Auxiliary Signs: Provide route marker auxiliary signs, such as the cardinal direction and directional arrows, with a background and legend that match the route marker they are used with:

Interstate - white legend on blue background  
Interstate Business Loop - white legend on green background  
US and State - black legend on white background  
County - yellow legend on blue background

5. Vertical Clearance: Install signs with a vertical clearance of 5'-0" (see TYPICAL SECTION.) In areas where parking or pedestrian movements are likely or the view of the sign may be obstructed, install signs with a vertical clearance of 7'-0" from the top of the curb or from the near edge of the driving lane in absence of a curb.

The vertical clearance to secondary signs is 1'-0" less than the vertical clearance stated above.

Provide a minimum clearance of 7'-0" from the ground at the post for signs with an area exceeding 50 square feet.

6. Portable Signs: Provide portable signs that meet the vertical clearance stated above when it is necessary to place signs within the pavement surface.

Use of low-mounting height (minimum 12" vertical clearance) portable signs for 5 days or less, is allowed as long as the view of the sign is not obstructed. Time delays caused by unforeseen circumstances, such as equipment breakdown, rain, subgrade failures, etc., will not accrue towards the 5 day period. Use of R9-8 through R9-11a series, W1-6 through W1-8 series, M4-10, and E5-1 is allowed for longer than 5 days.

Restrict signs mounted on portable sign supports shown in the LOW-MOUNTING HEIGHT and HIGH-MOUNTING HEIGHT details to a maximum surface area of 16 square feet.

MINIMUM BALLAST  
(For each side of sign support base)

Sign Panel Mounting Height (ft)	Number of 25 lb sandbags for 4' x 4' sign panel
1'	6
5'	8
7'	10

Note: The number of sandbags are based on a wind speed of 55 MPH. Place sandbags at or near the ends of skids.

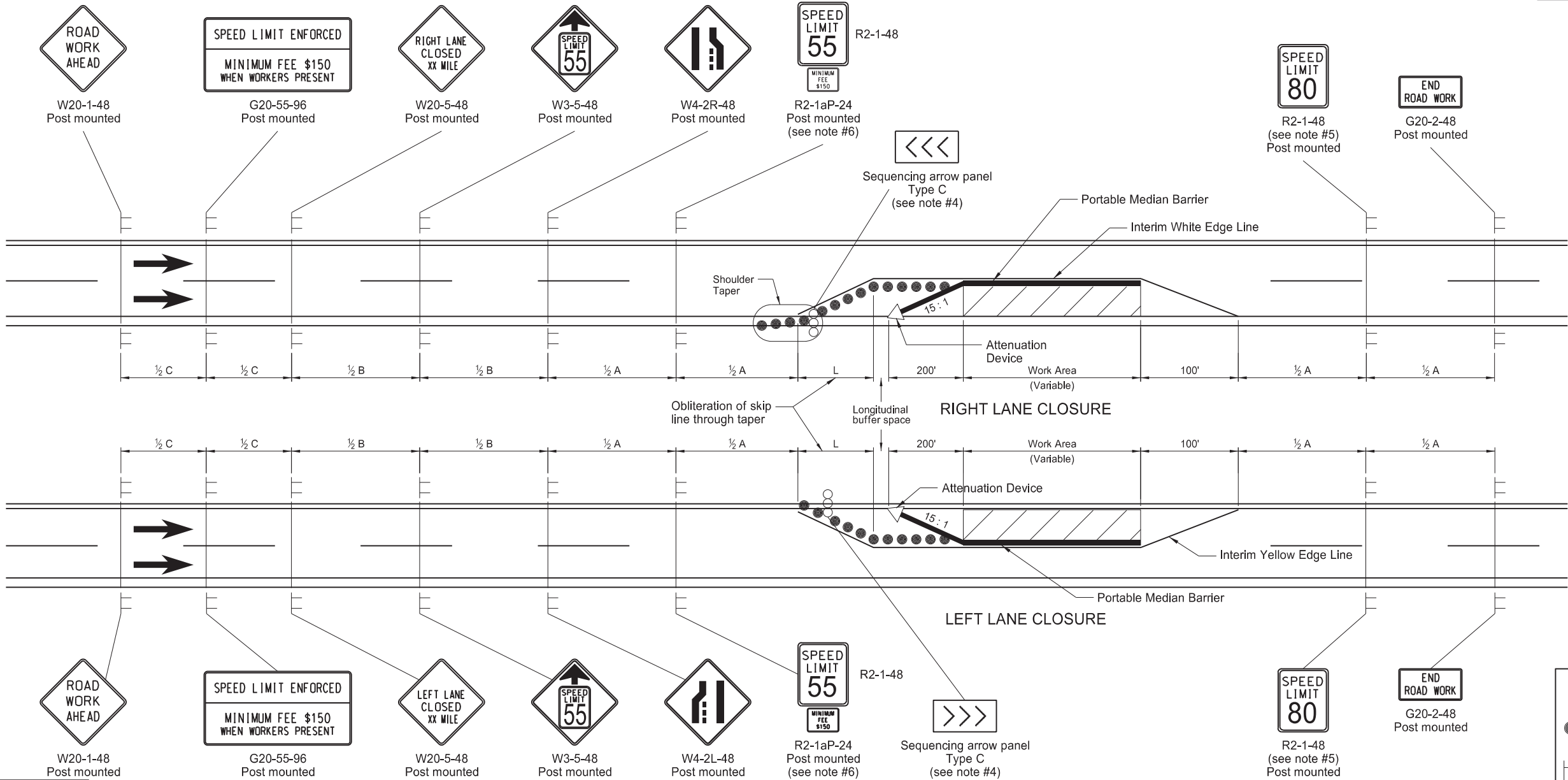
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-4-13	
REVISIONS	
DATE	CHANGE
11-14-13	Revised Note 6
9-27-17	Updated to active voice
11-01-19	Revised 60"x24" sign detail
8-01-24	Electronic Stamp/Signature



08/01/24

SIGN LAYOUT FOR INTERSTATE SYSTEM ONE LANE CLOSURE

D-704-18



Longitudinal Buffer Space	
*Speed (mph)	Length Min (feet)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820
80	910

\* Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 80 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

- Notes:
- Variables  
S = Numerical value of posted speed limit, off-peak 85th percentile speed prior to work starting, or anticipated operating speed in MPH.  
W = The width of offset in feet.  
L = Minimum taper length in feet.  $S \times W$  for freeways, expressways, and roads with speeds of 45 mph or greater, or  $W \times S^2 / 60$  for urban, residential, and streets with speeds of 40 mph or less.
  - Place barricades on moveable assemblies and signs on portable assemblies when located on the roadway.
  - Space delineator drums used for tapering traffic and on tangent at dimension "S".
  - Place Sequencing Arrow Panels at the beginning of the taper when possible. Where shoulder width does not provide sufficient room, move the panel closer to the work area and place on the roadway surface. See Shoulder Closure Standard Drawing. Use Type C on roadways with high traffic speeds and volumes (over 40 mph or 5000 ADT or greater).
  - Re-establish speed limit. Determine exact speed limit in the field, dependent on location and conditions.
  - Determine the reduced speed limit based on the in place speed limit before construction. Where speed reductions exceed 30 MPH, install a second speed limit sign with the desired speed reduction (not to exceed 30 MPH.) Place the second speed limit sign at  $\frac{1}{2}$  B.
  - Install flags on warning signs in urban areas when signs are not portable. Mount 24 inch square flags perpendicular to the edges of the sign, and at such a distance above the edge that the flag does not touch the sign when limp.
  - Cover existing speed limit signs within a reduced speed zone.
  - As an option, use portable sign supports in lieu of post mounted signs in accordance with the Standard D-704-14.
  - Sign G20-55-96 is not required if this layout is part of other traffic control that contains this sign, or if work is less than 15 days.
  - Reduce speed limit further, if location and conditions dictate.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE
01-13-16	Changed to Interim yellow edge line
03-15-16	Removed Do Not Pass signs & updated notes
08-17-17	Updated notes & sign numbers
11-01-19	Note, sign #, & pvmt oblit change
12-08-21	Switched order of Road Work Ahead and Spd Limit Enforced & added Dollars At Work
11-29-22	Removed Dollars At Work
08-21-24	Portable Median Barriers
06-30-25	Legislative Changes

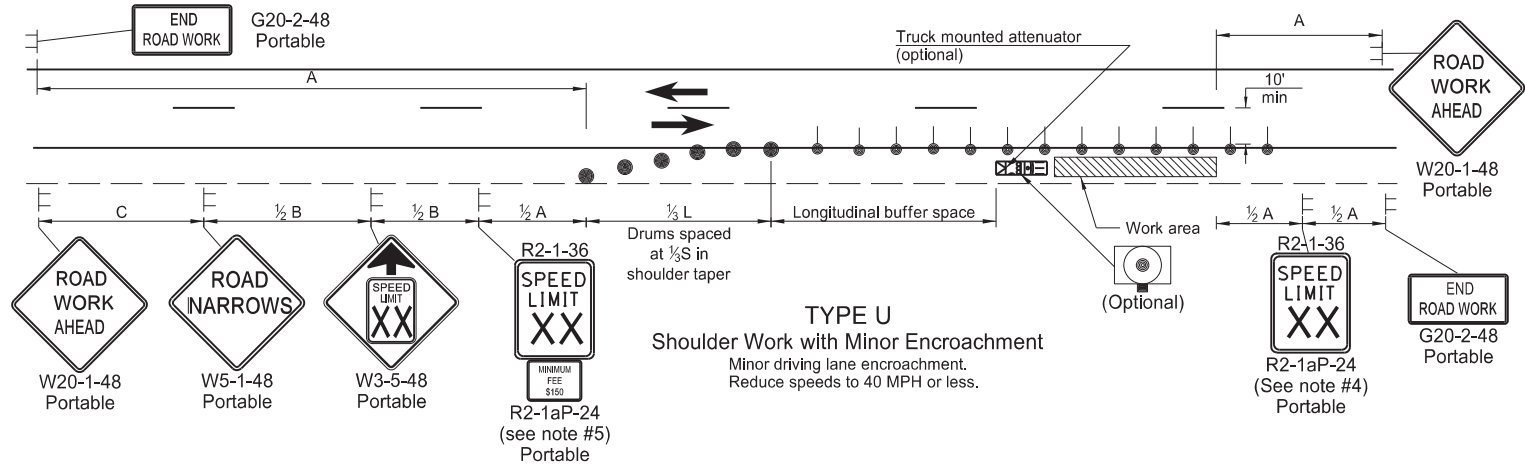
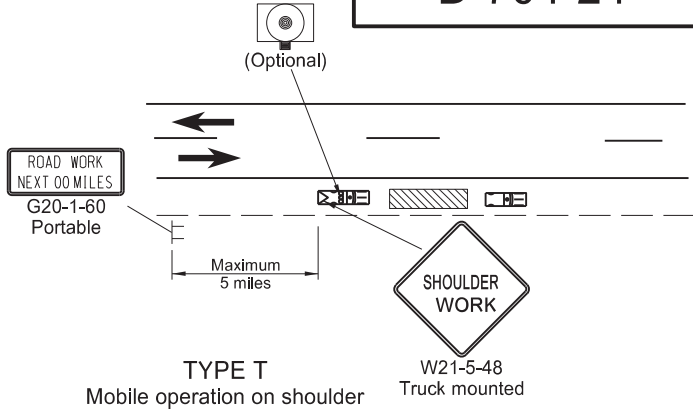
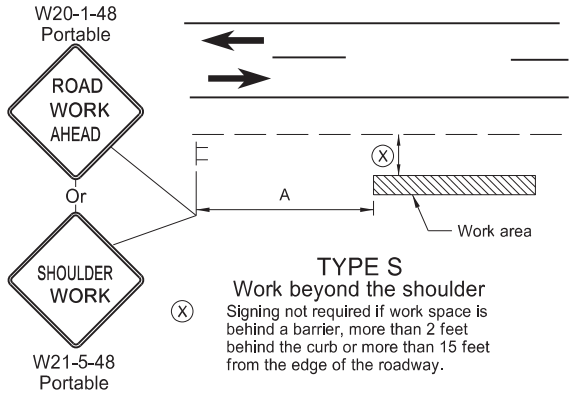
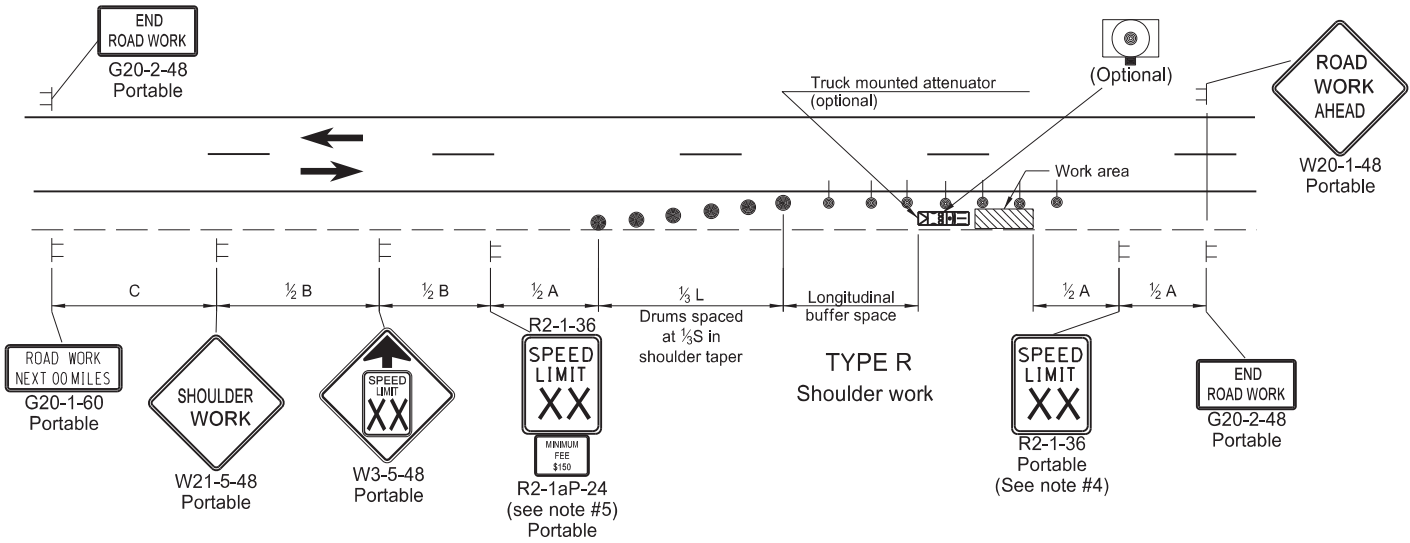
KEY

- Delineator Drum
- Sign
- Attenuation Device
- Sequencing Arrow Panel
- Work Area

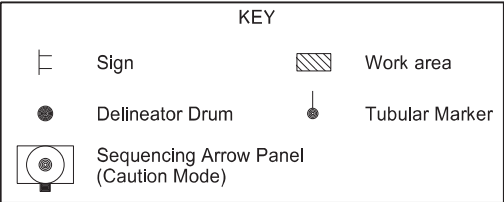
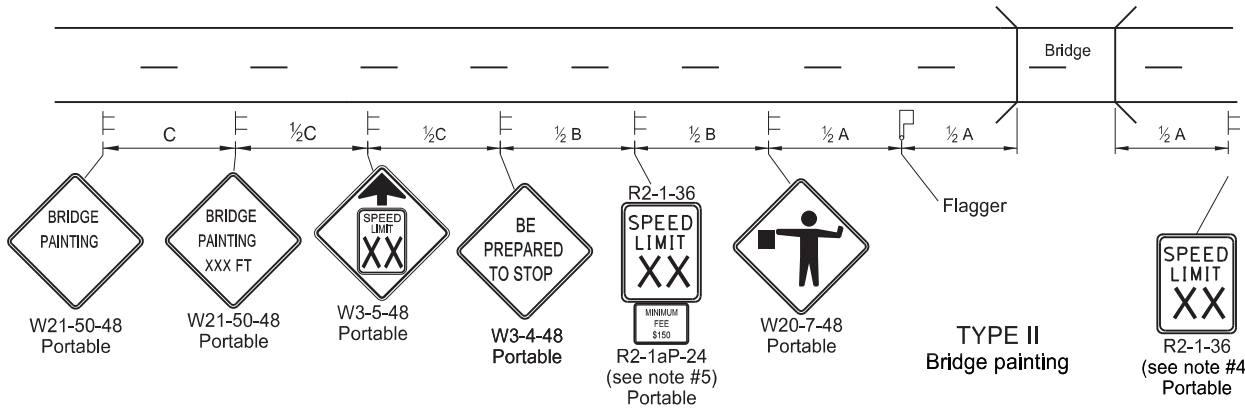
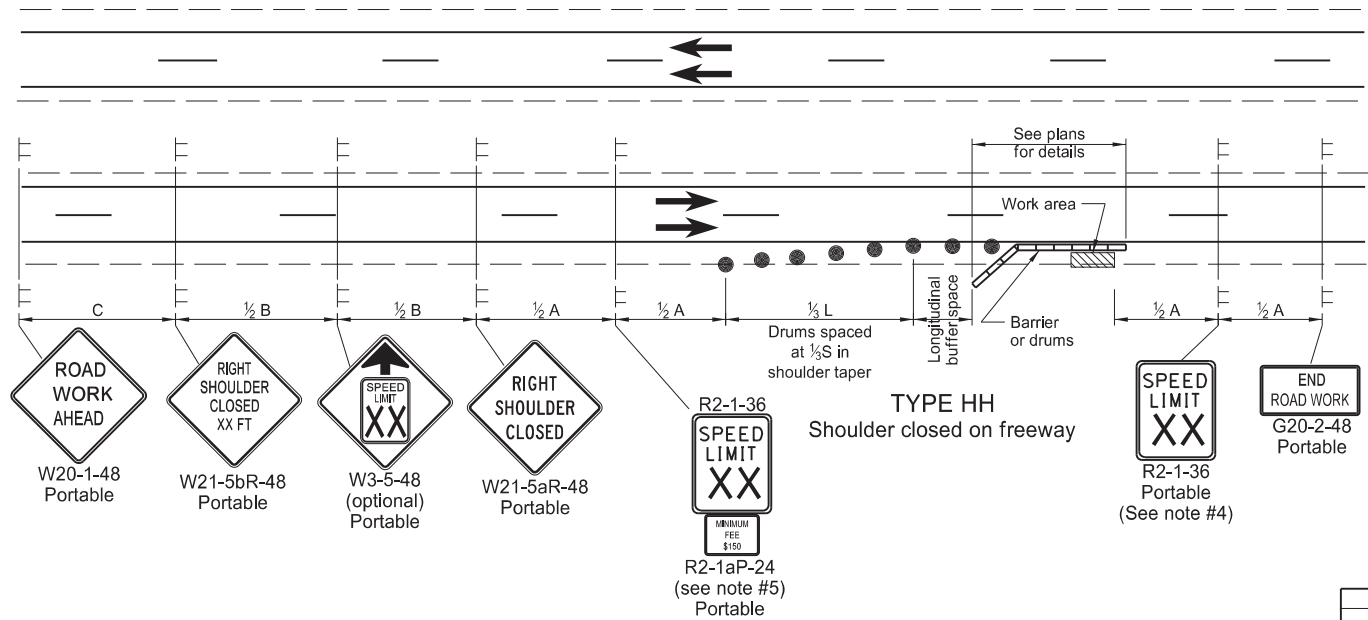


SHOULDER CLOSURES AND BRIDGE PAINTING LAYOUTS

D-704-24



- Notes
- Variables
    - S = Numerical value of speed limit or 85th percentile.
    - W = The width of the taper in feet.
    - L = Minimum length of taper,  $S \times W$  for freeways, expressways, and all other roads with speeds of 45 mph or greater, or  $W \times S^2 / 60$  for urban, residential, and other streets with speeds of 40 mph or less.
  - Space delineator drums for tapering traffic at dimension "S". Space delineator drums or tubular markers for tangents at 2 times "S".
  - Sequencing Arrow Panels
    - Use Type A on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).
    - Use Type B on roadways with moderate traffic speeds and volumes (40 mph or less and 5000 ADT or less).
    - Use Type C on roadways with high traffic speeds and volumes (over 40 mph or over 5000 ADT).
  - Re-establish speed limit. Determine exact speed limit in the field, dependent on location and conditions.
  - Determine the reduced speed limit based on the in-place speed limit before construction. Where speed reductions exceed 30 MPH, install a second speed limit sign with the desired speed reduction (not to exceed 30 mph.) Place the second speed limit sign at 1/2 B.
  - Install flags on warning signs in urban areas when signs are not portable. Mount 24 inch square flags perpendicular to the edges of the sign, and at such a distance above the edge that the flag does not touch the sign when limp.
  - Cover existing speed limit signs within a reduced speed zone.
  - As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
  - Recommend 40 mph speed limit in vicinity of workers, unless location and conditions dictate otherwise.



ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 80 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

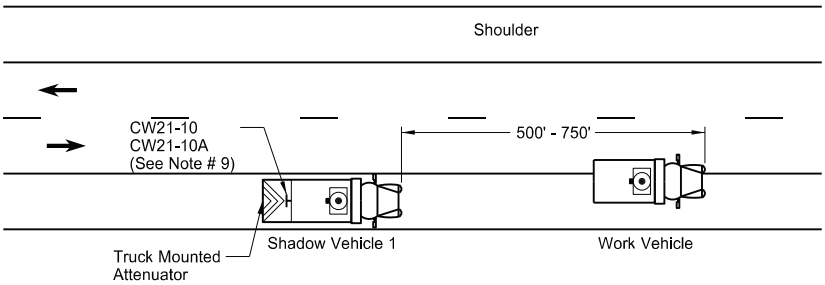
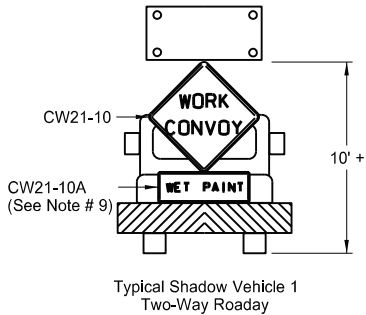
Longitudinal Buffer Space	
Speed (mph)	Length Min (feet)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570
65	645
70	730
75	820
80	910

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE
08-17-17	Updated notes & revised signs
11-01-19	Revised drum spacing & signs nos
08-01-24	Electronic Stamp/Signature
06-30-25	Legislative Changes

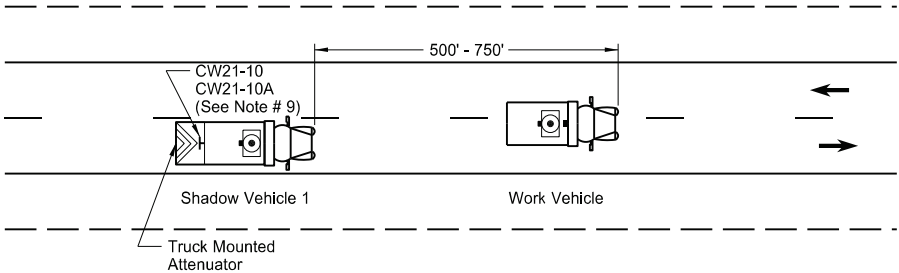


MOBILE OPERATION  
(PAVEMENT MARKING)

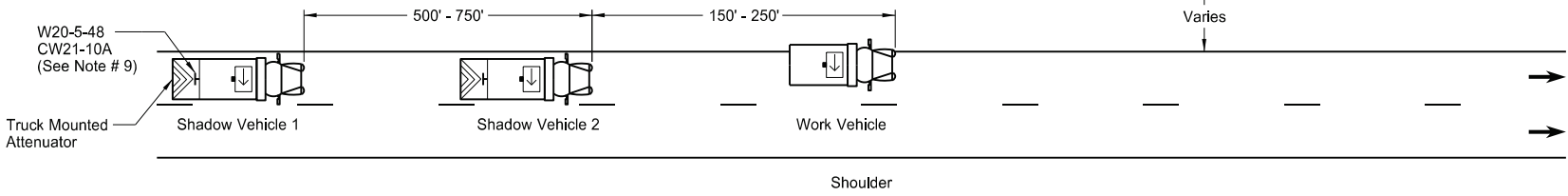
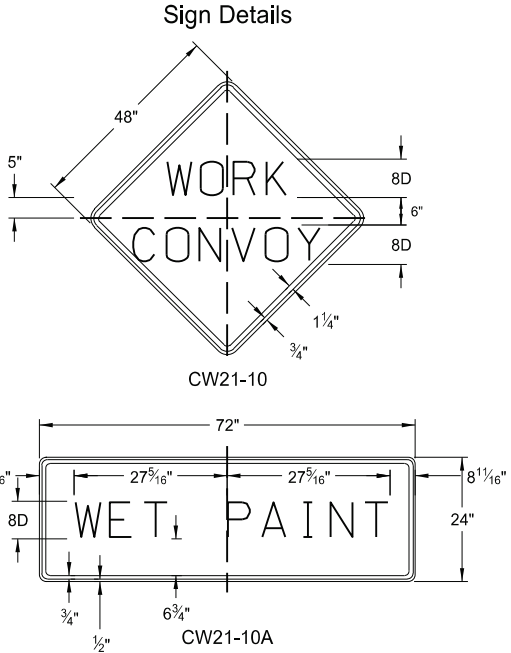
D-704-27



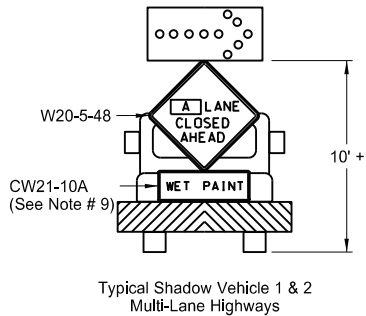
Two-Way Roadway with Paved Shoulders



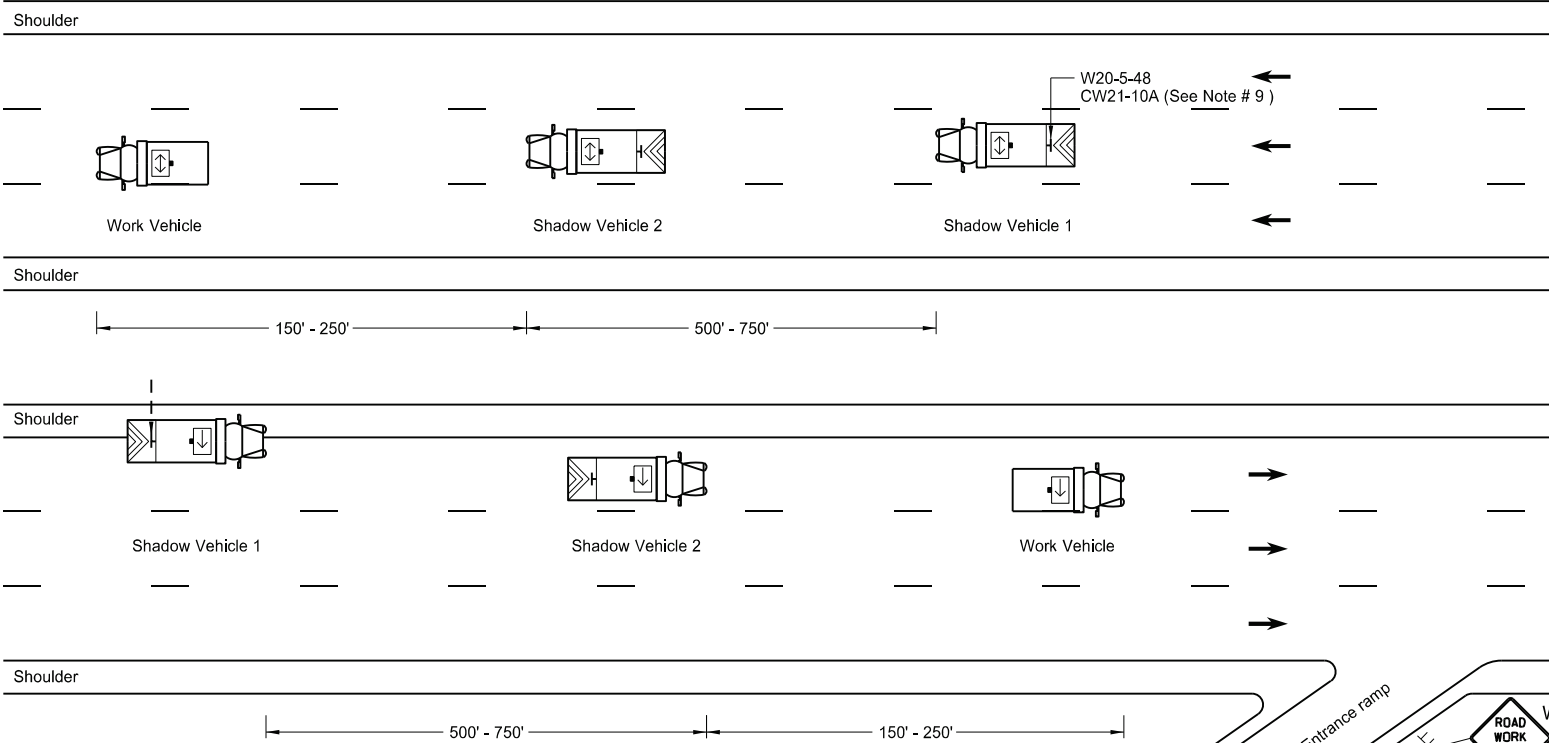
Two-Way Roadway without Paved Shoulders



Undivided Multi-Lane Roadway

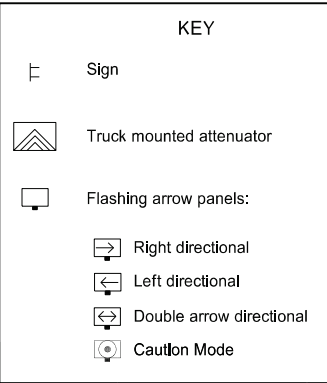


A = ☐ Left ☐ Right ☐ Center



Divided Multi-Lane Highway

- Notes
1. Use additional vehicles you choose to be in the convoy with truck mounted attenuators, at your own expense.
  2. Display yellow rotating beacons or strobe lights on shadow and work vehicles, unless otherwise stated in the plans.
  3. Use Type B or Type C flashing arrow panels controlled from inside the vehicle.
  4. Provide each vehicle with two-way electronic communication capability.
  5. Move shadow vehicle 1 first to shadow other convoy vehicles when convoy changes lane.
  6. Vary vehicle spacing between shadow vehicle 1 and shadow vehicle 2 based on sight distance restrictions. Motorists approaching the work convoy need to see trail vehicle in time to slow down and/or change lanes as they approach shadow vehicle.
  7. Sign Colors  
Letters = Black  
Border = Black  
Background = Orange
  8. As an option, use shadow vehicle 2 the paint tender vehicle.
  9. Use sign CW21-10A only during painting operation.
  10. Pull over work and shadow vehicles periodically to allow motor vehicle traffic to pass on two lane - two way roadways.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE
6-18-14	Removed shadow vehicle 2 on two lane roadways
9-27-17	Updated to active voice
11-08-19	Changed Standard Heading
6-02-24	Electronic Stamp/Signature.



08/02/24

Two-Lane Roadway Portable Rumble Strips

D-704-33

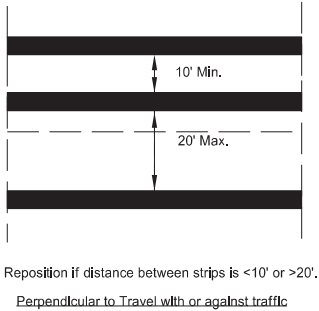
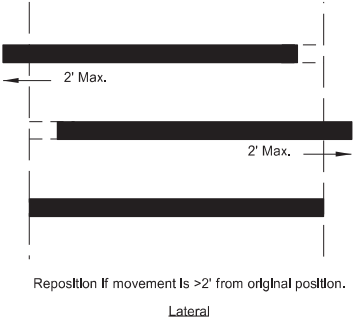
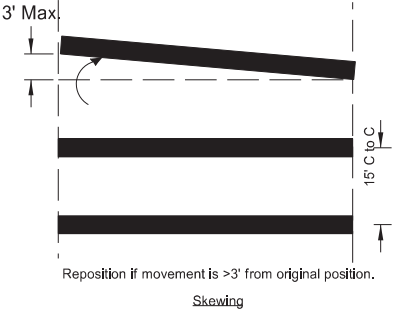
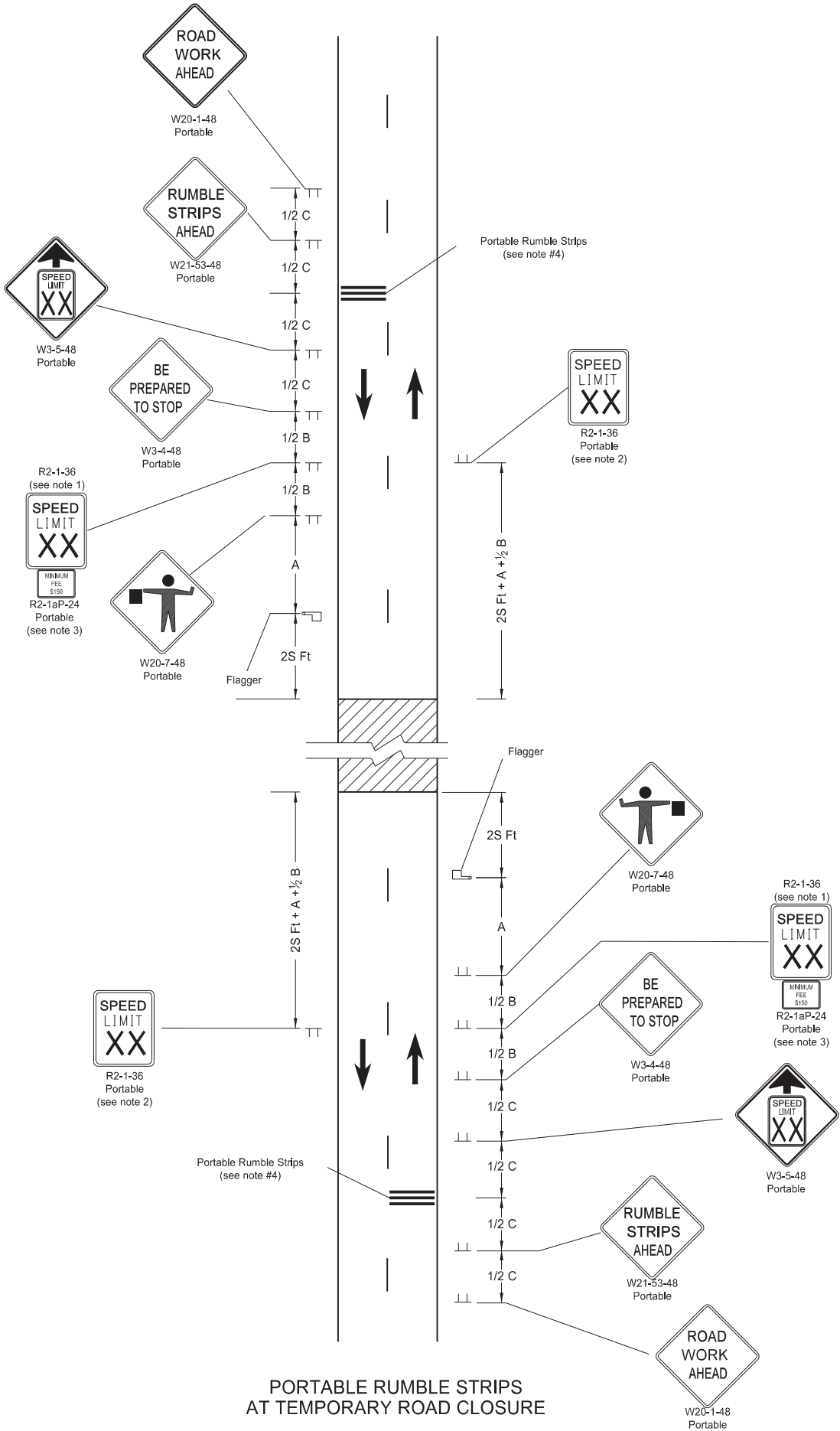
Work area

Flagger

Sign

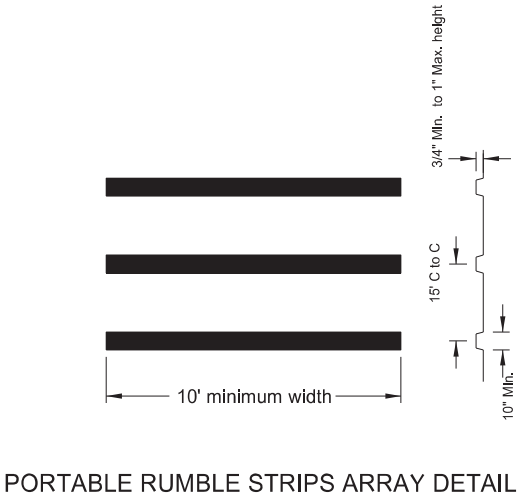
S = Numerical value of speed limit or 85th percentile.

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - High Speed (over 45 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720



PORTABLE RUMBLE STRIPS ARRAY  
TYPES OF MOVEMENT AND MAXIMUM ALLOWANCES

- Notes:
- Determine speed in the field based on location and conditions.
  - Re-establish the speed limit. Determine the exact speed limit in the field, dependent on location and conditions.
  - Sign R2-1aP-24 is not required when pilot car operation is used.
  - Do not use rumble strips on a non paved surface or in a pre-construction speed zone of 45 mph or less.



PORTABLE RUMBLE STRIPS  
AT TEMPORARY ROAD CLOSURE

NORTH DAKOTA  
DEPARTMENT OF TRANSPORTATION

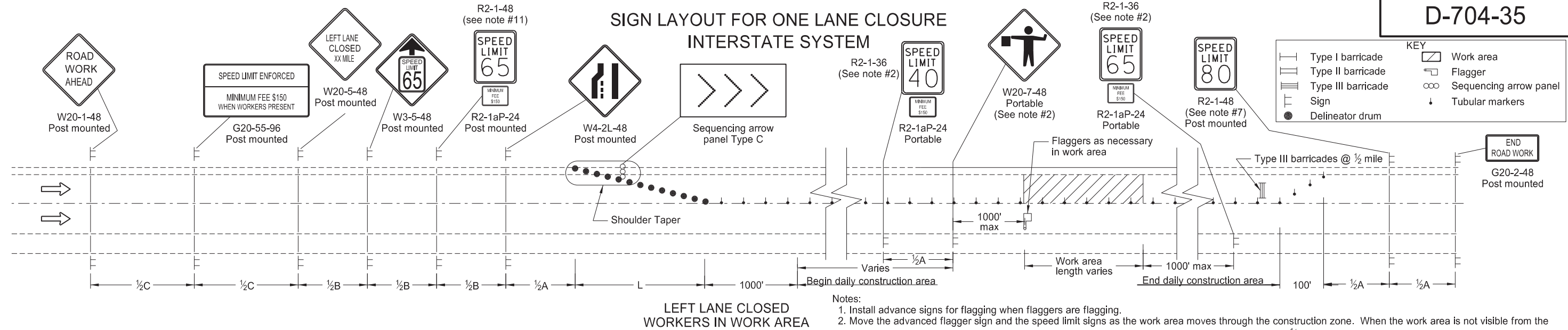
02-22-22

REVISIONS

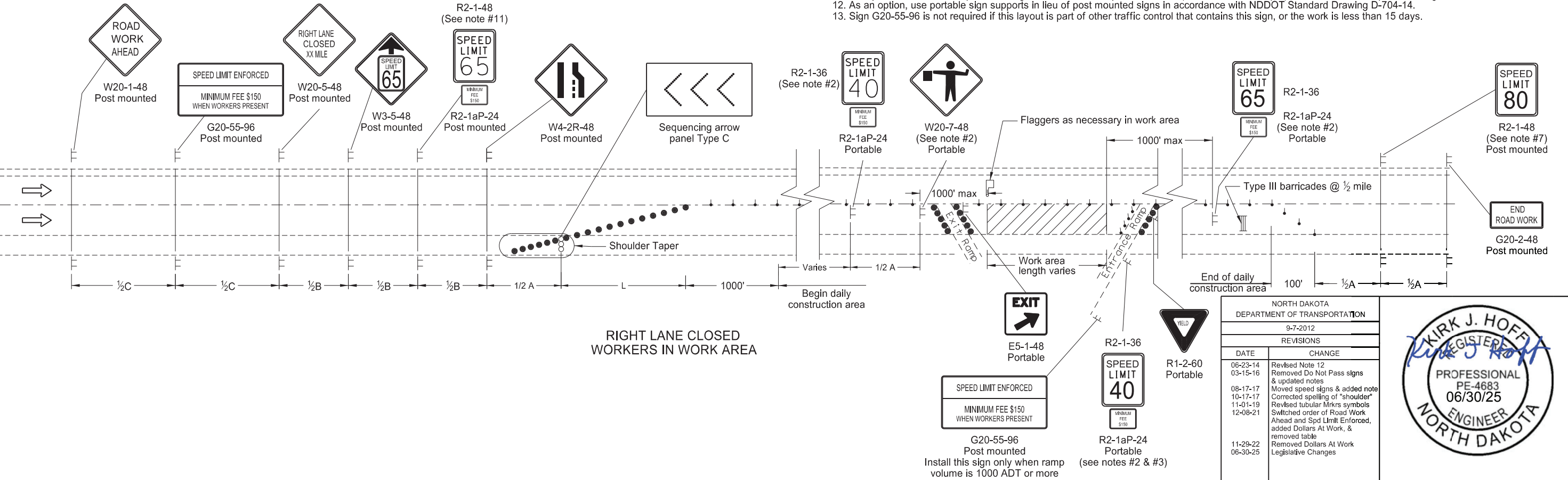
DATE	CHANGE
03-07-23	Use changed to min 45 mph
06-30-25	Legislative Changes

SIGN LAYOUT FOR ONE LANE CLOSURE  
INTERSTATE SYSTEM

D-704-35



ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min (ft)		
	A	B	C
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 80 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

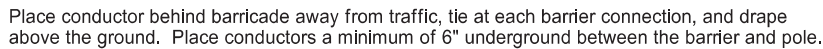


- Notes:
1. Install advance signs for flagging when flaggers are flagging.
  2. Move the advanced flagger sign and the speed limit signs as the work area moves through the construction zone. When the work area is not visible from the flagger, move the flagger station so the work area is visible. Space the 40 mph speed limit sign at 1/2A in advance of the flagger sign and move the 65 mph speed limit sign. Cover or remove the 40 mph speed limit and Minimum Fee \$150 signs and the 65 mph speed limit sign upon completion of the work day or when workers are not present.
  3. RAMPs: When the work area encompasses an entrance ramp, install a 40 mph speed limit sign on the ramp and cover any existing yield sign. Install new yield sign as necessary. Remove the ramp speed limit sign when the main line 40 mph speed zone is moved past the ramp.
  4. Variables:
    - S=Numerical value of speed limit or 85th percentile
    - W=The width of taper.
    - L=Minimum length of taper, or SxW for freeways, expressways, and all other roads with speeds of 45 mph or greater, or WxSxS/60 for urban, residential, and other streets with speeds of 40 mph or less.
  5. Space delineator drums for tapering traffic at the dimension "S". Space tubular markers used for tangents at 2 times dimension "S".
  6. Place sequencing arrow panels at the beginning of the taper when possible. Where shoulder width does not provide sufficient room, move the panel closer to the work area and place on the roadway surface.
    - Use Type C on roadways with high traffic speeds and volumes (over 40 mph or 5000 ADT or greater).
  7. Re-establish the speed limit. Determine the exact speed limit in the field, dependent on location and conditions.
  8. Cover existing speed limit signs within a reduced speed zone.
  9. Upon approval, the Engineer will measure obliterated or covered pavement marking as Obliteration of Pavement Marking.
  10. Install flags on warning signs in urban areas when signs are not portable. Mount 24 inch square flags perpendicular to the edges of the diamond sign, and at such a distance above the edge that the flag does not touch the sign when limp.
  11. Determine the reduced speed limit dependent on the in place speed limit before construction. When speed limits are to be reduced more than 30 mph, install a second speed limit sign with the desired speed reduction (not to exceed 30 mph.) Place the second speed limit sign at 1/2B.
  12. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
  13. Sign G20-55-96 is not required if this layout is part of other traffic control that contains this sign, or the work is less than 15 days.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-7-2012	
REVISIONS	
DATE	CHANGE
06-23-14	Revised Note 12
03-15-16	Removed Do Not Pass signs & updated notes
08-17-17	Moved speed signs & added note
10-17-17	Corrected spelling of "shoulder"
11-01-19	Revised tubular Mkrs symbols
12-08-21	Switched order of Road Work Ahead and Spd Limit Enforced, added Dollars At Work, & removed table
11-29-22	Removed Dollars At Work
06-30-25	Legislative Changes



D-704-38



Notes:

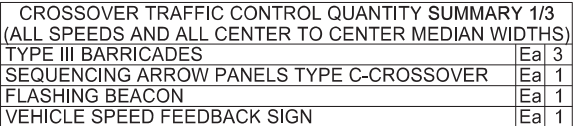
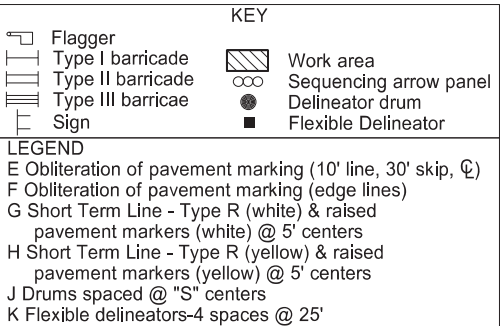
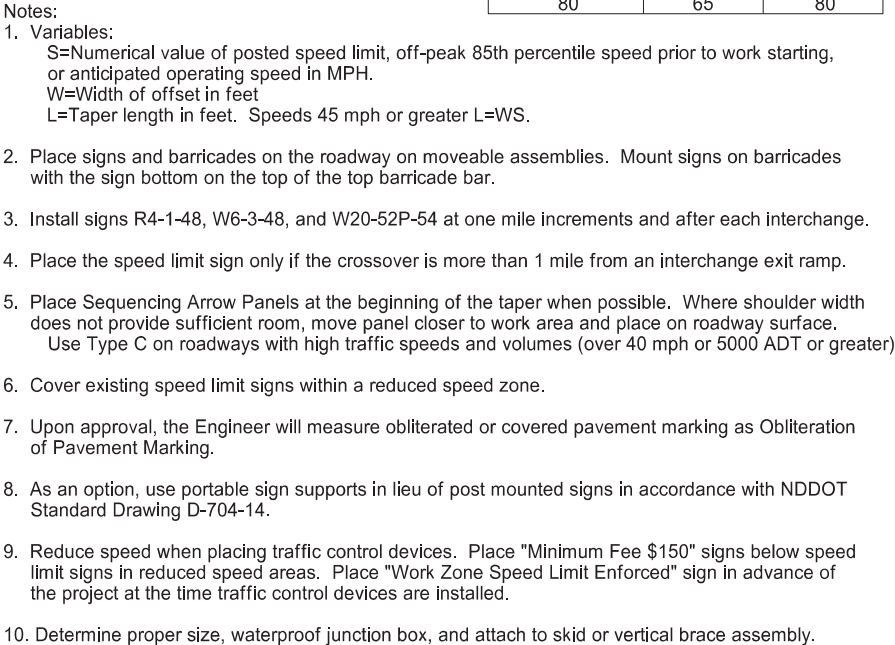
1. Variables:  
S=Numerical value of posted speed limit, off-peak 85th percentile speed prior to work starting, or anticipated operating speed in MPH.  
W=Width of offset in feet  
L=Taper length in feet. Speeds 45 mph or greater L=WS.
2. Place signs and barricades on the roadway on moveable assemblies.  
Mount signs on barricades with the sign bottom on the top of the top barricade bar.
3. Install signs R4-1-48, W6-3-48, and W20-52P-54 at one mile increments and after each interchange.
4. Place the speed limit sign only if the crossover is more than 1 mile from an interchange exit ramp.
5. Place Sequencing Arrow Panels at the beginning of the taper when possible. Where shoulder width does not provide sufficient room, move panel closer to work area and place on roadway surface.  
Use Type C on roadways with high traffic speeds and volumes (over 40 mph or 5000 ADT or greater)
6. Cover existing speed limit signs within a reduced speed zone.
7. Upon approval, the Engineer will measure obliterated or covered pavement marking as Obliteration of Pavement Marking.
8. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
9. Reduce speed when placing traffic control devices. Place "Minimum Fee \$150" signs below speed limit signs in reduced speed areas. Place "Work Zone Speed Limit Enforced" sign in advance of the project at the time traffic control devices are installed.
10. Determine proper size, waterproof junction box, and attach to skid or vertical brace assembly.

CROSSOVER TRAFFIC CONTROL QUANTITY SUMMARY 3/3																			
		75' C-C Median						84' C-C Median						104' C-C Median					
		Pre-Construction Speed Limit						Pre-Construction Speed Limit						Pre-Construction Speed Limit					
		55 mph	60 mph	65 mph	70 mph	75 mph	80 mph	55 mph	60 mph	65 mph	70 mph	75 mph	80 mph	55 mph	60 mph	65 mph	70 mph	75 mph	80 mph
DELINEATOR DRUMS	Ea	48	48	48	52	52	52	49	49	49	52	53	53	50	50	50	54	55	55
FLEXIBLE DELINEATORS	Ea	20	21	21	21	22	22	21	22	22	22	23	23	23	24	24	24	25	25
OBLITERATION OF PAVEMENT MARKING**	SF	409	420	432	448	459	470	414	425	436	452	463	475	423	434	446	462	473	484
RAISED PAVEMENT MARKERS (YELLOW)	Ea	217	220	223	226	229	232	225	228	231	234	237	240	240	243	246	249	252	255
RAISED PAVEMENT MARKERS (WHITE)	Ea	341	359	377	395	413	431	349	367	385	403	421	439	364	382	400	418	436	454
SHORT TERM LINE-TYPE R (YELLOW)	LF	881	896	911	926	941	956	920	935	950	965	980	995	996	1,011	1,026	1,041	1,056	1,071
SHORT TERM LINE-TYPE R (WHITE)	LF	1,706	1,796	1,886	1,976	2,066	2,156	1,745	1,835	1,925	2,015	2,105	2,195	1,821	1,912	2,002	2,092	2,182	2,271

\*\*Quantity based on 6 inch wide existing pavement marking - adjust SF when existing lines are 4 inch wide.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-7-2012	
REVISIONS	
DATE	CHANGE
06-23-14	Revised Note 8
03-15-16	Removed Do Not Pass sign & updated notes
11-14-16	Revised attenuation width, termination area, & quantities
08-17-17	Updated note & quantities
11-01-19	Note, sign #s, Del Drums updated
12-08-21	Switched out of Road Work Ahead and Spd Limit Enforced and added Dollars At Work
12-20-23	Removed Dollars At Work sign, shortened x-over, revised tables
06-12-24	Pvmt Mkg Type/Quantity Update
06-30-25	Legislative Changes





CROSSOVER TRAFFIC CONTROL QUANTITY SUMMARY 2/3							
		PRE-CONSTRUCTION SPEED LIMIT					
		55 MPH	60 MPH	65 MPH	70 MPH	75 MPH	80 MPH
		15	16	16	16	16	16
DELINEATOR DRUMS	Ea						
FLEXIBLE DELINEATORS	Ea	111' (75' C-C Median), 112' (84' C-C Median), and 114' (104' C-C Median)					
ATTENUATION DEVICES	Ea	1 Type B-55	1 Type B-60	1 Type B-65	1 Type B-70	1 Type B-75	1 Type B-80
PORTABLE MEDIAN BARRIER	Lf	222' (75' C-C Median), 216' (84' C-C Median), and 212' (104' C-C Median)					

CROSSOVER TRAFFIC CONTROL QUANTITY SUMMARY 3/3																			
		75' C-C Median						84' C-C Median						104' C-C Median					
		Pre-Construction Speed Limit						Pre-Construction Speed Limit						Pre-Construction Speed Limit					
		55 mph	60 mph	65 mph	70 mph	75 mph	80 mph	55 mph	60 mph	65 mph	70 mph	75 mph	80 mph	55 mph	60 mph	65 mph	70 mph	75 mph	80 mph
OBLITERATION OF PAVEMENT MARKING**	SF	424	435	446	467	478	490	435	446	457	478	489	500	434	446	457	478	489	500
RAISED PAVEMENT MARKERS (YELLOW)	Ea	432	450	468	486	504	522	440	458	476	494	512	530	455	473	491	509	527	545
RAISED PAVEMENT MARKERS (WHITE)	Ea	163	163	163	163	163	163	171	171	171	171	171	171	186	186	186	186	186	186
SHORT TERM LINE-TYPE R (YELLOW)	LF	1,957	2,047	2,137	2,227	2,317	2,407	1,995	2,085	2,175	2,265	2,355	2,445	2,070	2,160	2,250	2,340	2,430	2,520
SHORT TERM LINE-TYPE R (WHITE)	LF	817	817	817	817	817	817	855	855	855	855	855	855	930	930	930	930	930	930

\*\*Quantity based on 6 inch wide existing pavement marking - adjust SF when existing lines are 4 inch wide.

Place conductor behind barricade away from traffic, tie at each barrier connection, and drape above the ground. Place conductors a minimum of 6" underground between the barrier and pole.

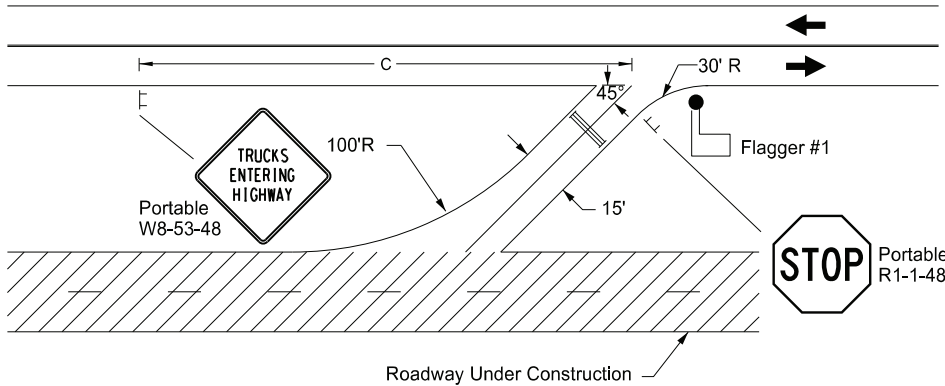
### DETAIL "B"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
5-31-12	
REVISIONS	
DATE	CHANGE
06-23-14	Revised Note 8
03-15-16	Removed Do Not Pass sign & updated notes
11-14-16	Revised attenuation width, termination area, & quantities updated
08-17-17	Updated sign & quantity
11-01-19	Note, sign #, & Del Drum update
12-08-21	Switched order of Road Work Ahead and Spd Limit Enforced & added Dollars At Work
12-20-23	Removed Dollars at Work sign, shortened Xover, revised tables
06-12-24	Pvmt Mkg Type/Quantity update
06-30-25	Legislative Changes

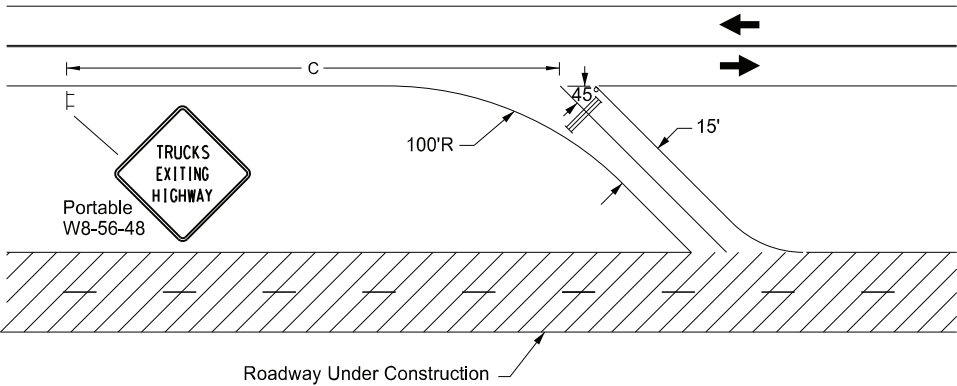


CONSTRUCTION SIGNING MEDIAN CROSSOVER

D-704-45

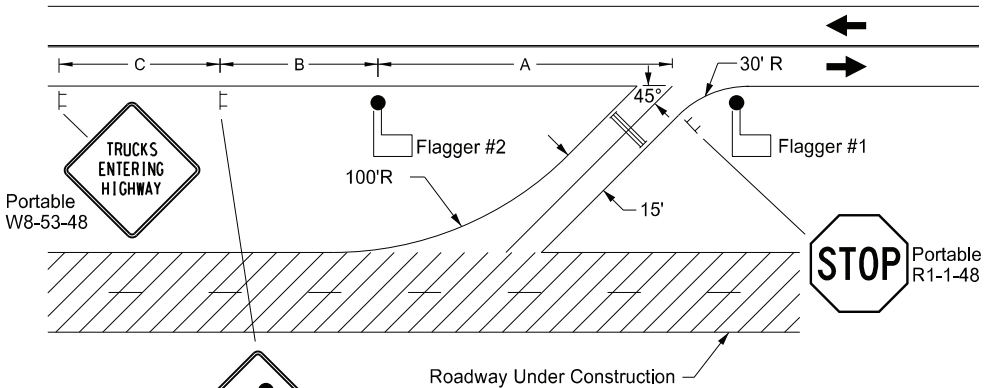


TRUCKS ENTERING ROADWAY  
(ADT 2000 or Less)



TRUCKS EXITING ROADWAY

- NOTES:
- 1. Do not use Flagger #1 to slow interstate traffic. Flagger #1 is intended to assist truck driver in viewing oncoming traffic for truck's safe entry into traffic.
  - 2. For ADT over 2000, use Flagger #2 to slow, but not stop, interstate traffic for trucks entering traffic.
  - 3. Install barricades on median access when not in use. Place barricades at 45 degrees away from approaching traffic.
  - 4. Do not stop exiting vehicles on roadway carrying traffic.



TRUCKS ENTERING ROADWAY  
(ADT Over 2000 )

KEY

- Type III Barricade
- Sign
- Work Area
- Flagger

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (FT)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (Over 30 mph to 40 mph)	280	280	280
Urban - High Speed (Over 40 mph to 50 mph)	360	360	360
Rural - High Speed (Over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

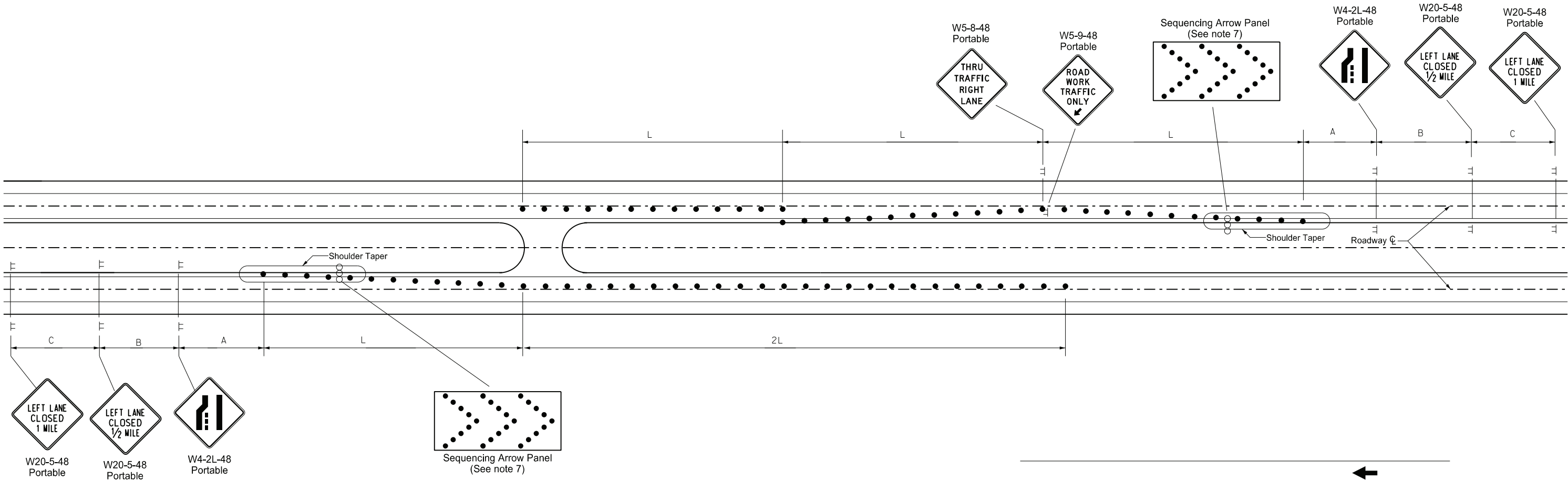
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-19-12	
REVISIONS	
DATE	CHANGE
08-19-14	Deleted sign W16-2-24.
09-27-17	Updated to active voice.
11-01-19	New Design Engineer PE Stamp
08-02-24	Electronic Stamp/Signature



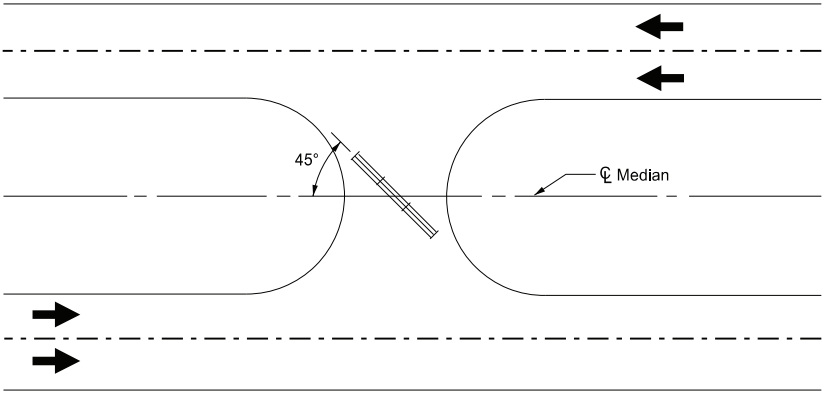
08/02/24

CONSTRUCTION SIGN AND BARRICADE LOCATION DETAILS  
CONSTRUCTION TRAFFIC MEDIAN CROSSING

D-704-49



- Notes:
1. Include all costs for construction signing and devices in other items.
  2. Remove construction signs and channelizing devices daily and barricade median access during nonworking hours.
  3. Provide a minimum distance of one mile between the work area and the crossover. Use interchange access when the distance between work area and interchange is less than two miles.
  4. Do not allow construction traffic to decelerate until they are well into crossover lane.
  5. Variables:
    - S = Numerical value of speed limit or 85th percentile.
    - W = The width of taper
    - L = Minimum length of taper, or  $S \times W$  for freeways, expressways, and all other roads with speeds of 45 mph or greater, or  $W \times S \times 60$  for urban, residential, and other streets with speed of 40 mph or less
  6. Space delineator drums, barricades or cones used for tapering traffic at dimension "S".
  7. Sequencing Arrow Panels:
    - Place sequencing arrow panels at the beginning of the taper when possible. Where shoulder width does not provide sufficient room, move the panel closer to the work area and place on the roadway surface.
    - Use Type A on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).
    - Use Type B on roadways with moderate traffic speeds and volumes (40 mph or less and 5000 ADT or less).
    - Use Type C on roadways with high traffic speeds and volumes (over 40 mph and over 5000 ADT).



BARRICADE LOCATION DETAIL

Install barricades at 45 degrees away from approaching traffic when median access is not in use.

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

KEY	
	Sign
	Delineator Drum
	Sequencing Arrow Panel
	Type III Barricade

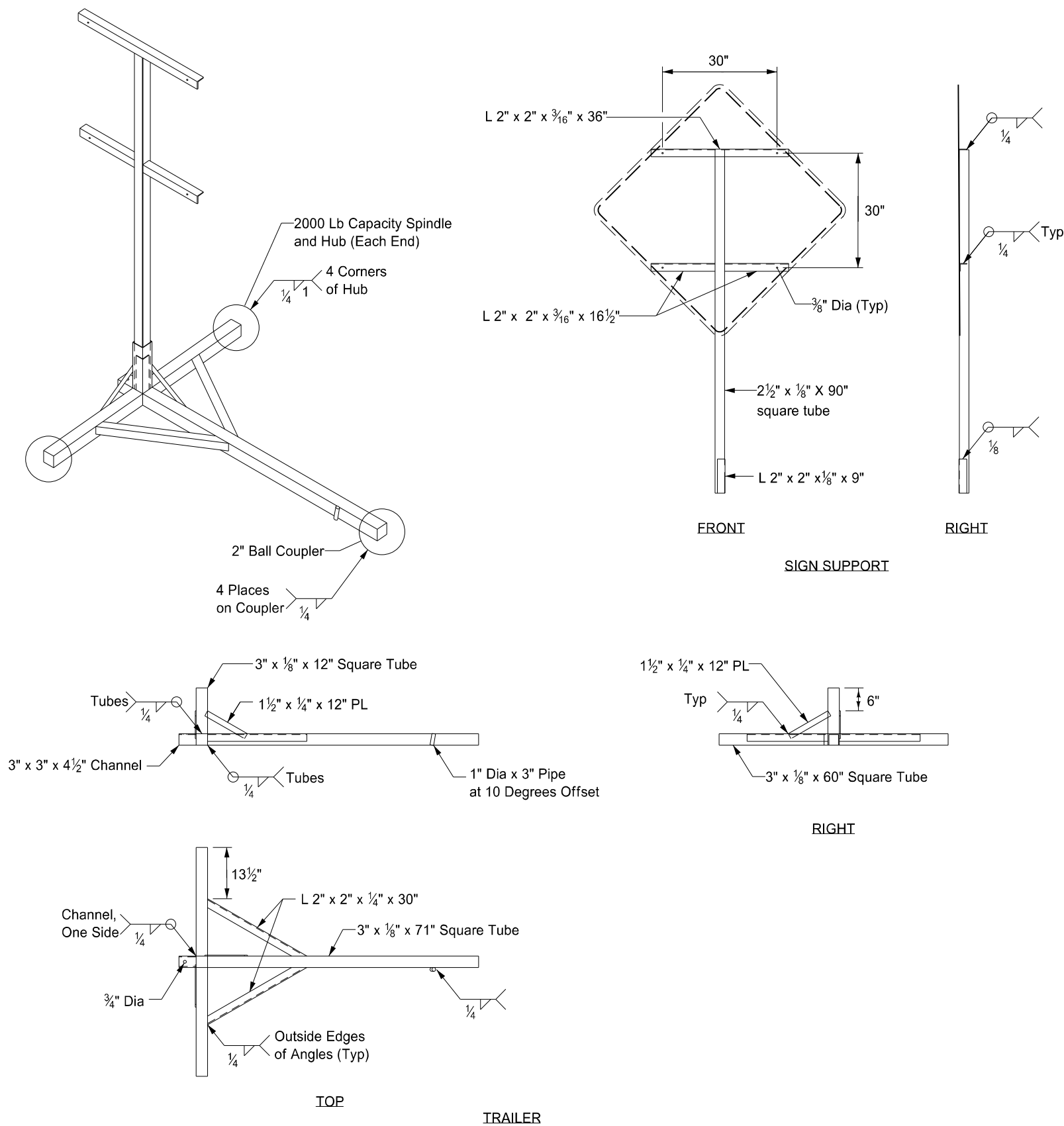
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-19-12	
REVISIONS	
DATE	CHANGE
06-24-14	Changed W5-9-48 to portable mounted.
09-06-19	Update Notes to active voice & New Design Engr PE Stamp.
11-01-19	Identified Shoulder Taper.
08-02-24	Electronic Stamp/Signature.



08/02/24

PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



- Notes:
- 1. Maximum 250 pound weight of assembly.
  - 2. Use a 14" wheel and tire.
  - 3. Use no automotive and equipment axle assemblies for trailer-mounted sign supports.
  - 4. Other NCHRP 350 or MASH crash tested assemblies are acceptable.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-23-10	
REVISIONS	
DATE	CHANGE
12/02/2020	Updated Note to active voice.

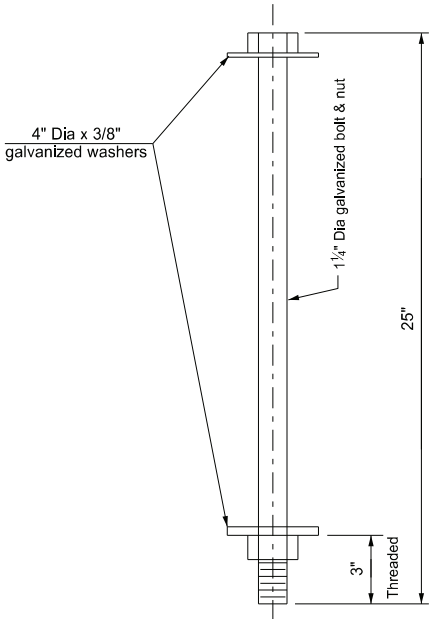
KIRK J. HOFF  
REGISTERED  
PROFESSIONAL  
PE-4683  
ENGINEER  
NORTH DAKOTA  
12 02 2020

CONCRETE MEDIAN BARRIER  
(TEMPORARY USAGE)

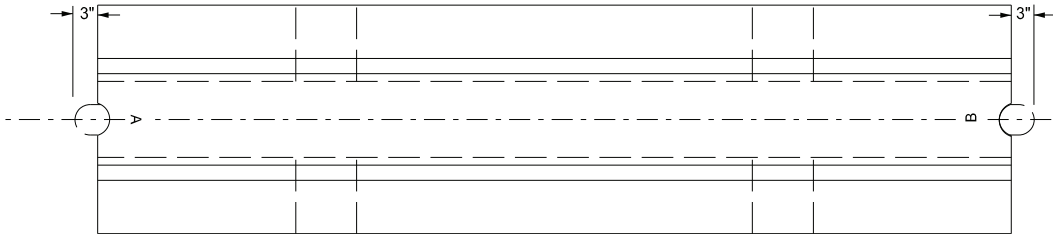
D-704-51

Notes:

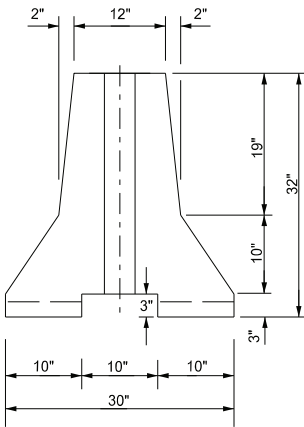
- Barrier ends imprinted with 4 inch letters A and B. Field match A end with B end.
- Place barrier markers at the center of the barrier at 20' centers.
- Connect barrier sections with 1 ¼" Dia A-307 double hex connecting bolt. Maintain bottom nut and washer connection for duration of barrier installation.
- Place barrier to minimize openings between individual sections.



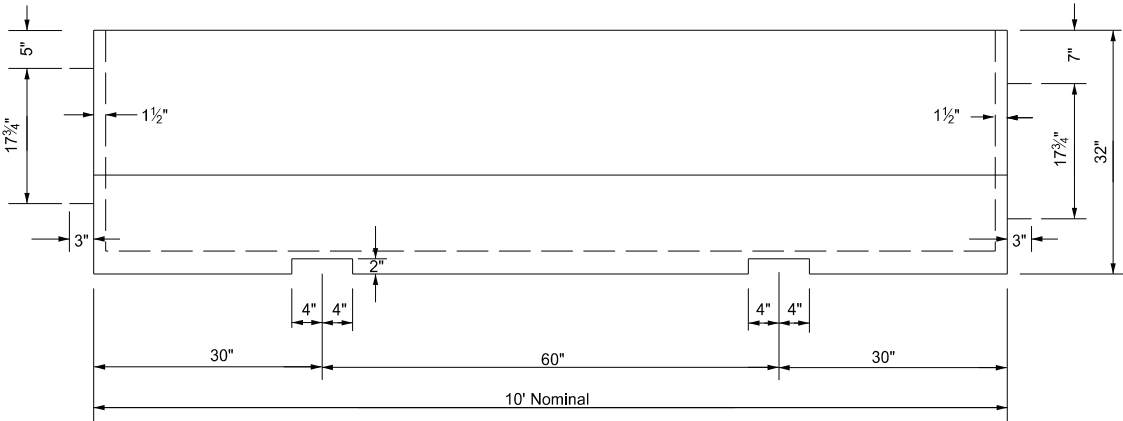
Connecting Bolt Detail  
(One per 10 Ft section)



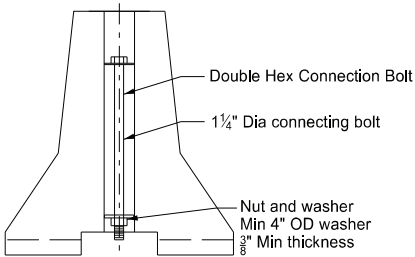
Plan View



End View



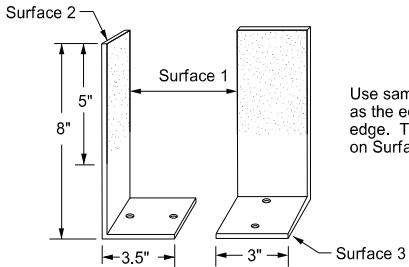
Side View



Bolt Connection Detail

Marker Body  
Use high impact,weatherable engineering thermo-plastic material conforming to the following:

Property	Result	ASTM Test Method
Thickness (min)	.090"	—
Tensile strength (min psi) @ yield	5,500	D638
Impact strength @ -20°F (ft-lbs/in of notch)	3.2	D256 Method A
Impact strength @ 73°F (ft-lbs/in of notch)	14.0	D256 Method A
Flexural strength, PSI ¼" @ 73°F	8,000	D790
Flexural modulus, PSI ¼" @ 73°F	300,000	D790
Elongation @ yield	30%	D638



Barrier Marker Detail

Use same color reflective faces as the edge line along barrier edge. Two way reflective on Surface 1 & 2.

Reflective Tape  
Use retroreflective, acrylic microprism material with acrylic backing, 3" wide, providing the following minimum optical performance with an observation angle of 0.1° measured in candlepower for the reflector:

Entrance Angle	Specific Intensity
Yellow - 4"	136
White - 4"	200

Adhesive  
Use factory applied solid butyl rubber ⅛" thick, 2" wide on 2 ¼" wide release paper on surface 3 to temporarily mount markers to portable concrete barrier.

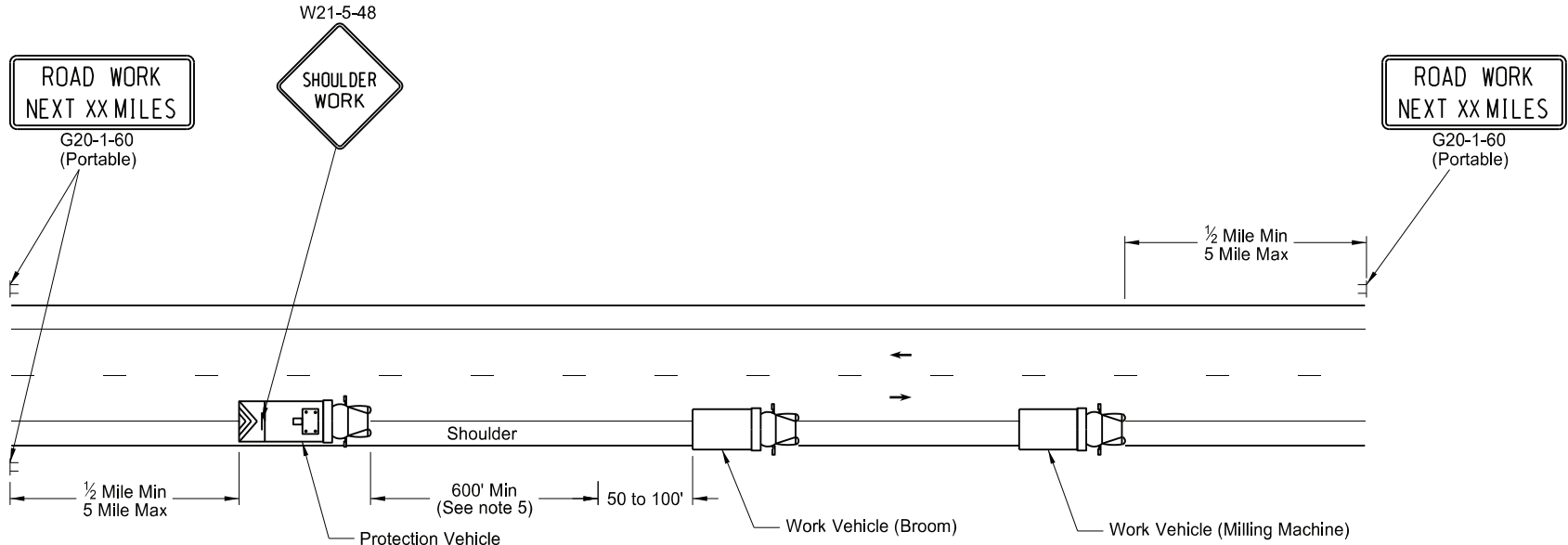
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-20-12	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
11-01-19	New Design Engr PE Stamp
8-21-24	Removed Fabrication Info



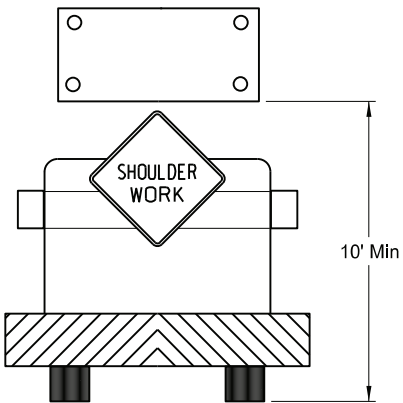
08/21/24

MOBILE OPERATION  
Grinding Shoulder Rumble Strips

D-704-56



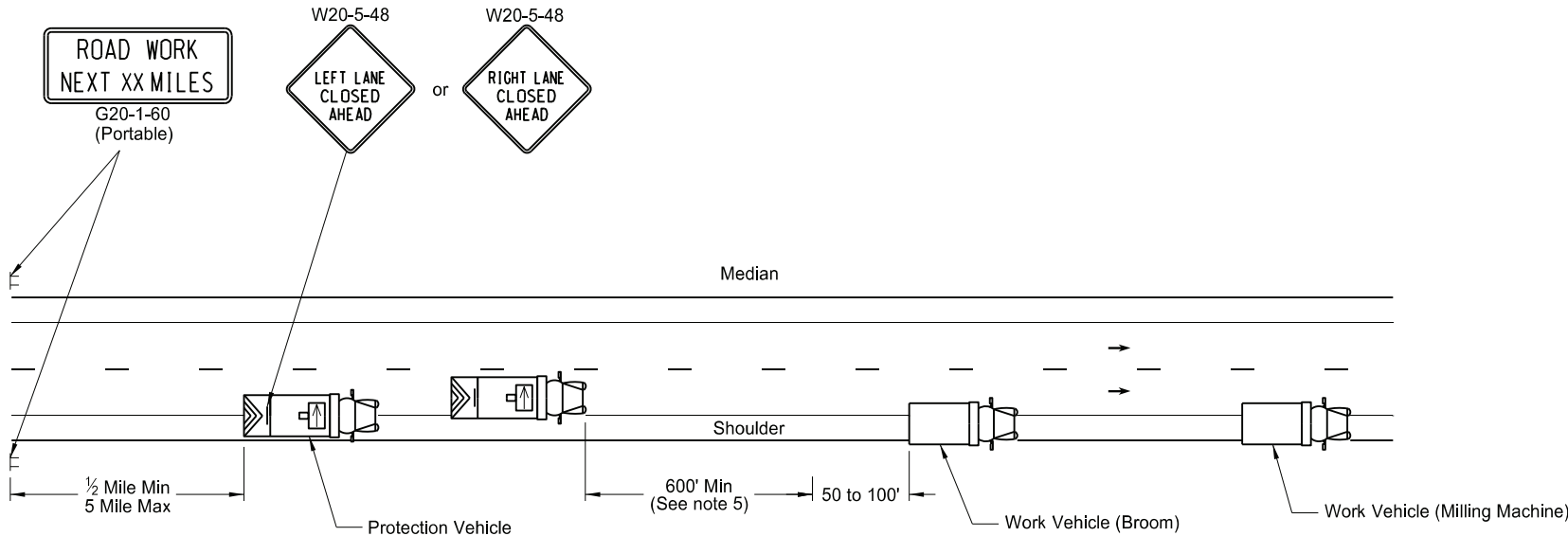
TWO LANE - TWO WAY ROADWAY



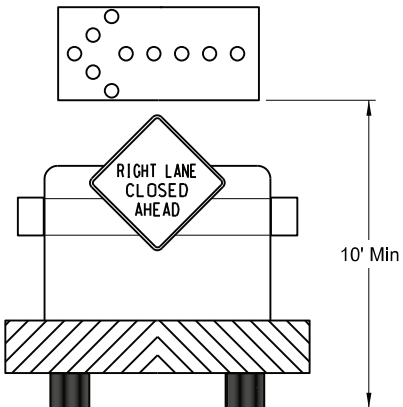
TWO LANE - TWO WAY ROADWAY

Typical Protection Vehicle with  
Flashing Arrow Panel In Caution Mode

- Notes:
1. Provide truck mounted attenuators on additional vehicles in the convoy, at no additional cost.
  2. Provide rotating, flashing, oscillating, or strobe lights on vehicles.
  3. Provide Type B or Type C flashing arrow panels that are controlled from inside the vehicle.
  4. Provide two - way electronic communication capability in each vehicle.
  5. Vary vehicle spacing between the protection vehicle and work vehicle depending on sight distance restrictions. Keep the spacing of the convoy vehicles such that motorists approaching the work convoy can see the protection vehicle in time to slow down and safely pass the work vehicles.
  6. Move advance Road Work Ahead signs as the work area moves through the construction zone.

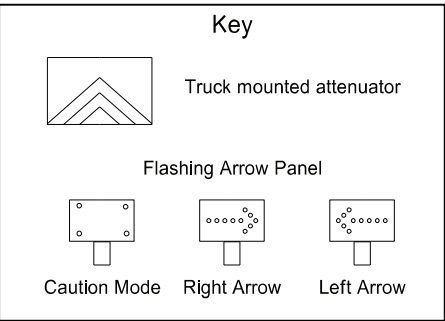


INTERSTATE & 4 LANE DIVIDED HIGHWAY



INTERSTATE & 4 LANE DIVIDED HIGHWAY

Typical Protection Vehicle with Flashing Arrow  
Panel In Flashing Arrow Mode



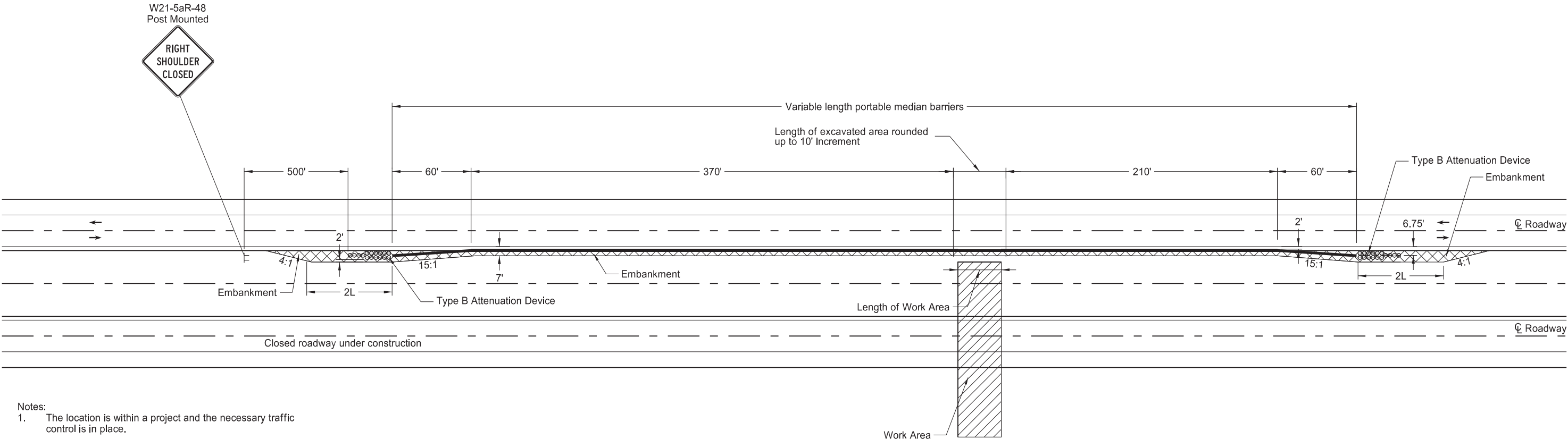
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-15-12	
REVISIONS	
DATE	CHANGE
8-17-17	Updated notes & signs
10-03-19	New Design Engineer PE Stamp
8-02-24	Electronic Stamp/Signature



08/02/24

Two-way, Two-lane Operation on Divided Highway With Excavation in the Median


D-704-57





- Notes:
- 1. The location is within a project and the necessary traffic control is in place.
  - 2. Install Portable Median Barriers when excavation is within clear zone and 1 foot or more in depth.


L = length of attenuation device


KEY


 Flagger

 Sign

 Embankment

 Work Area

 Attenuation Device

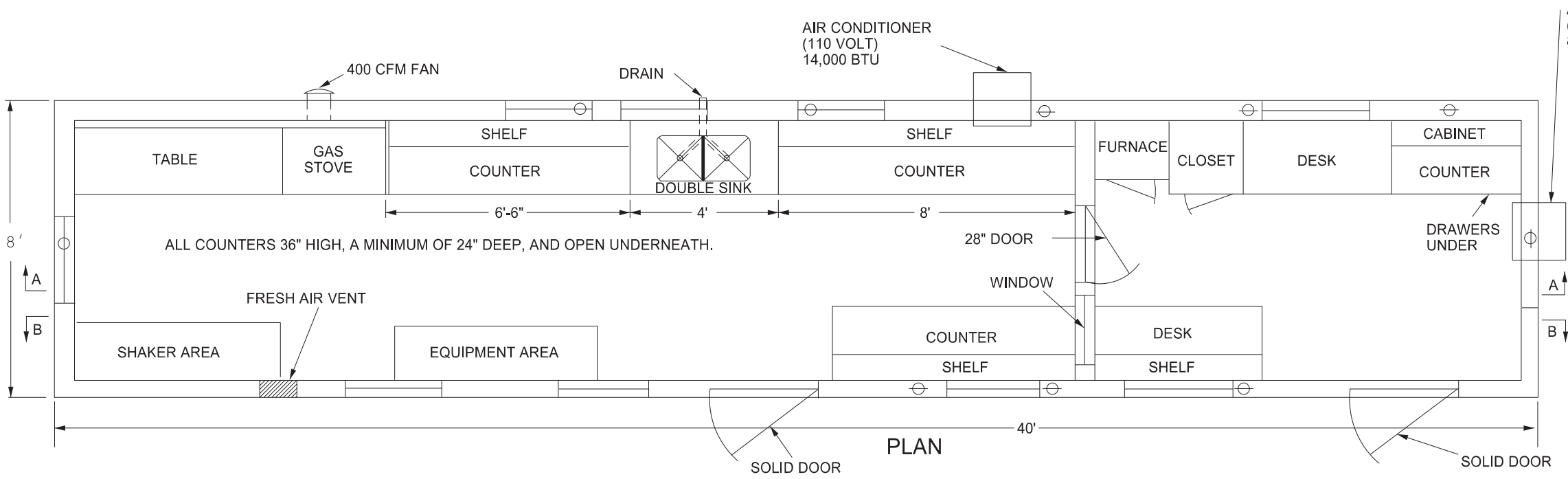
 Portable Median Barriers

ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 80 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-18-15	
REVISIONS	
DATE	CHANGE
9-18-15	Revised Standard Description
9-27-17	Updated to active voice
10-09-19	New Design Engineer PE Stamp
8-21-24	Renamed Portable Median Barrier
07-22-25	Legislative Changes

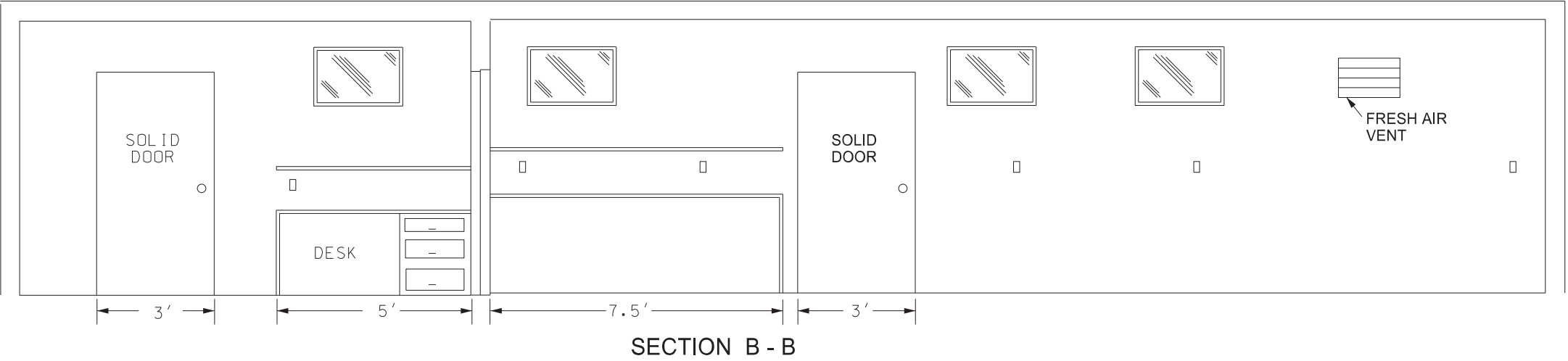
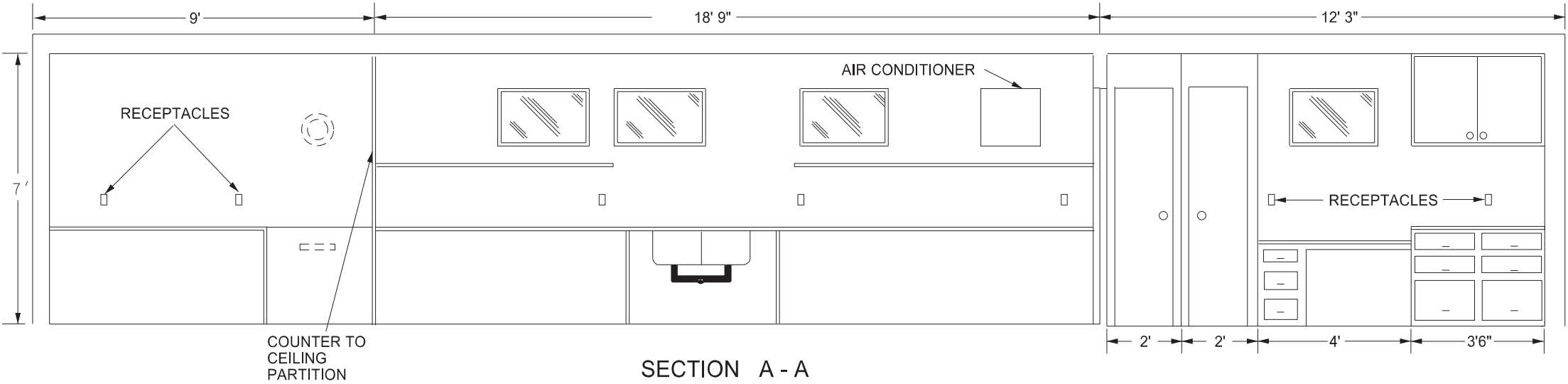


D-706-1



Provide a laboratory with the following:

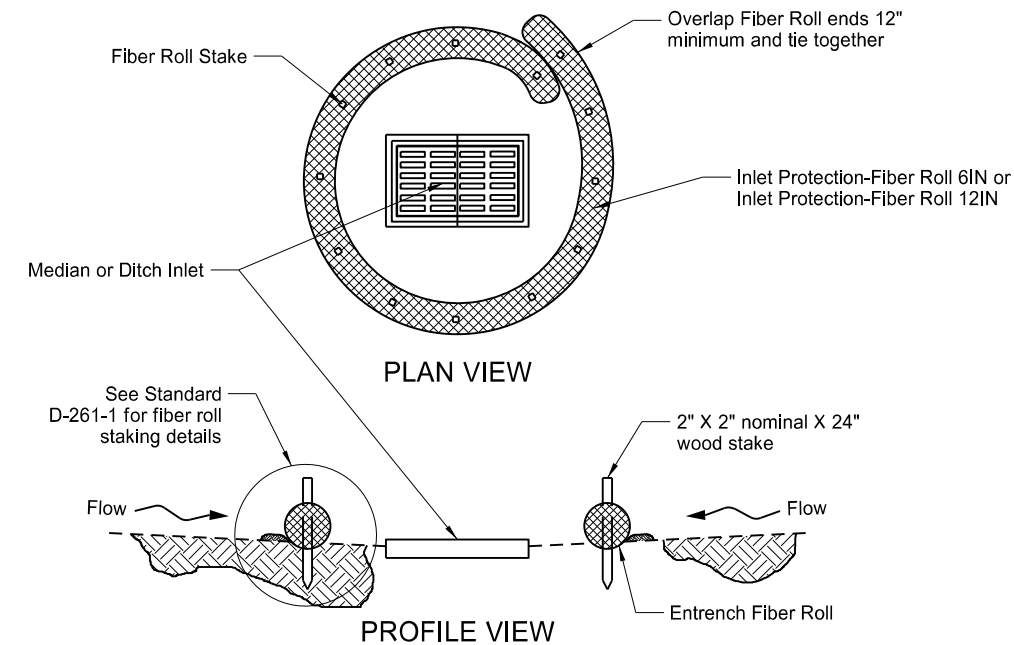
1. A 1'x1' shelf at 36" above the regular countertop.
2. Double compartment stainless steel sink, with each compartment a minimum of 16"x14"x10" deep. Provide water service lines made of copper or plastic and a diameter of ½ inch.
3. An exhaust fan capable of removing inside air at a rate of 400 CFM.
4. Fresh air vent hinged to open or close manually.
5. 24" x 48" table capable of holding a 200 lb masonry saw with a minimum clearance of 36" above the table.
6. A water supply tank with a capacity of 500 gallons and a 20 gallon capacity pressure tank on the pump.
7. Heavy duty type locks, latches, and hinges for doors made to withstand the intense use in service.
8. A wall between the office and the work area properly insulated to prevent the transmission of heat and noise.
9. The steel cable tie downs and ground anchors at each corner of the lab.
10. Electrical service entrance wired for 100 amps and separate circuits for air conditioners. Space convenience outlets in counter areas a minimum of four feet apart.



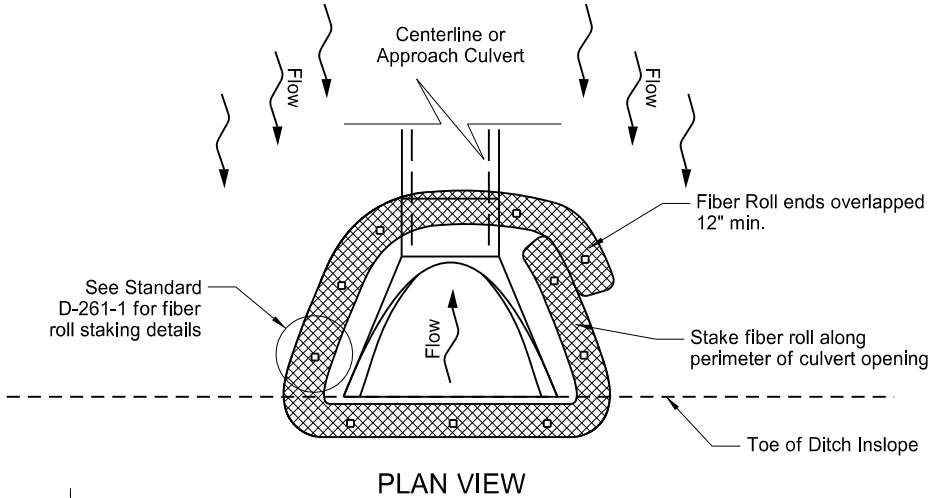
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
07-30-14	Changed standard's title and revised notes.
01-11-16	Revised notes.
08-27-19	New Design Engineer PE Stamp
08-09-24	Electronic Stamp/Signature.



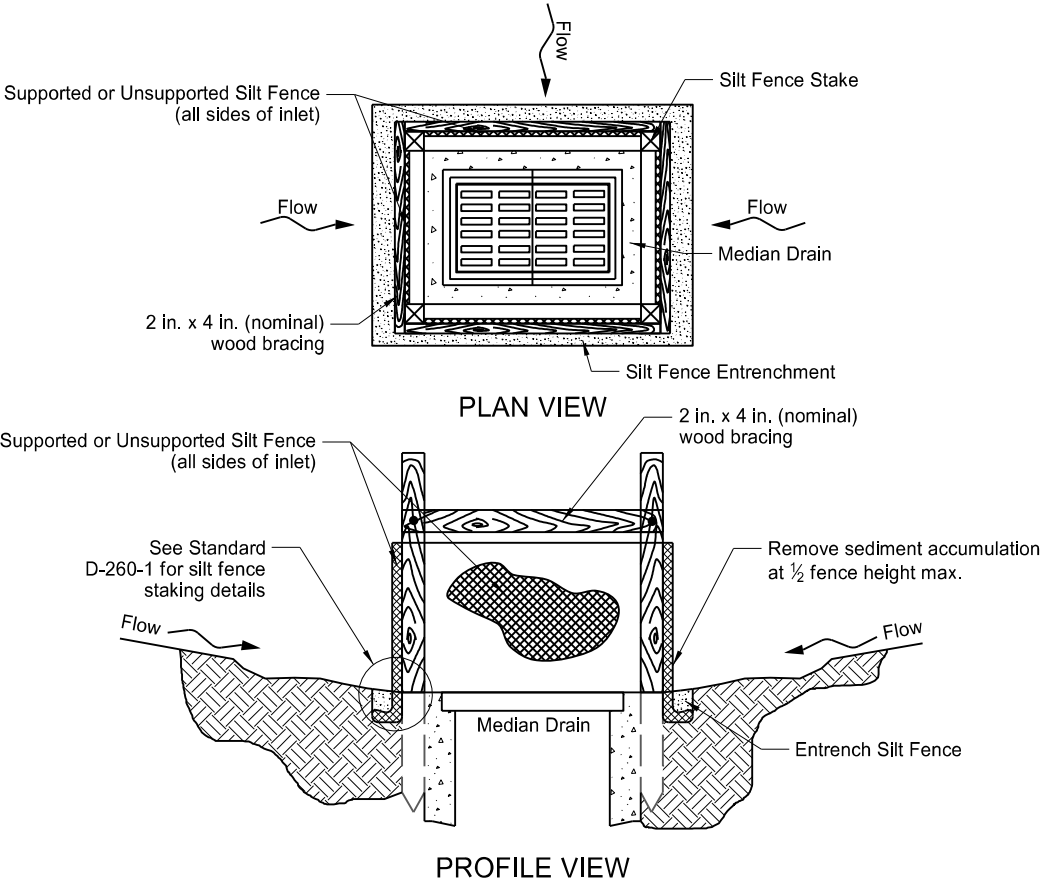
EROSION AND SILTATION CONTROLS  
MEDIAN OR DITCH INLET PROTECTION



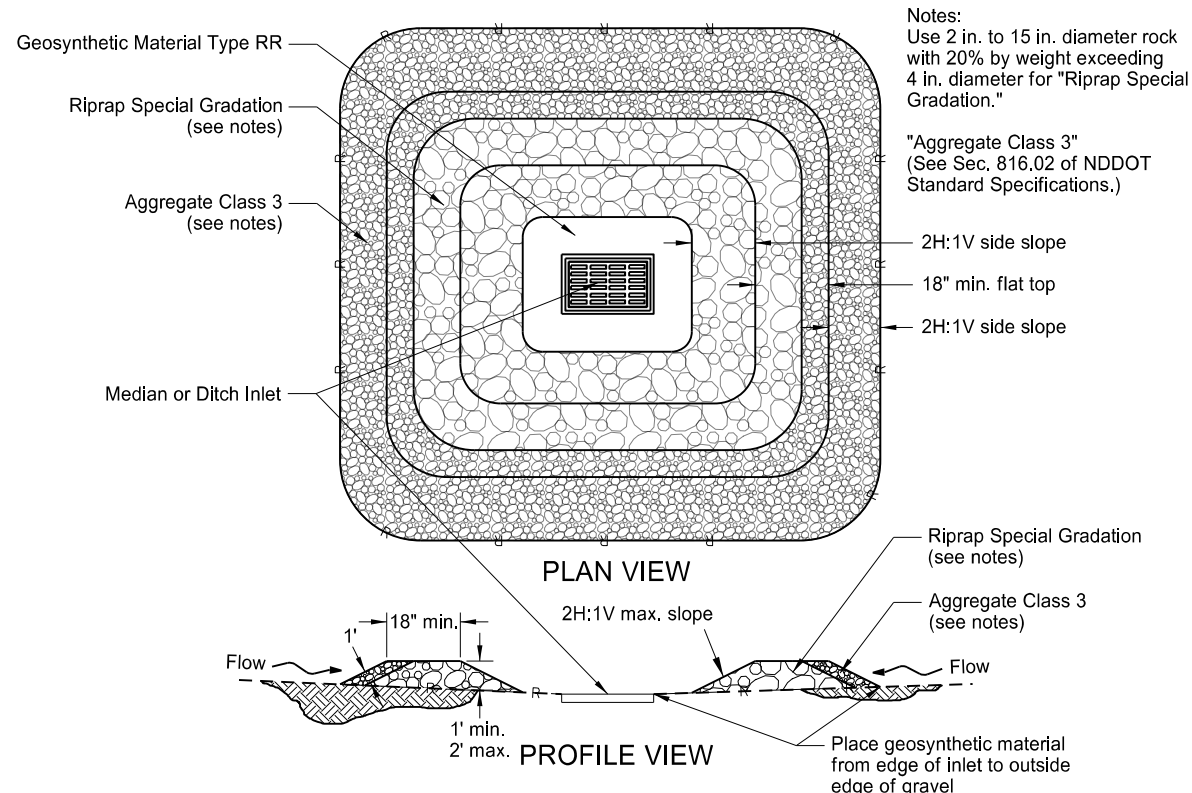
FIBER ROLL PROTECTION  
(MEDIAN OR DITCH INLET)



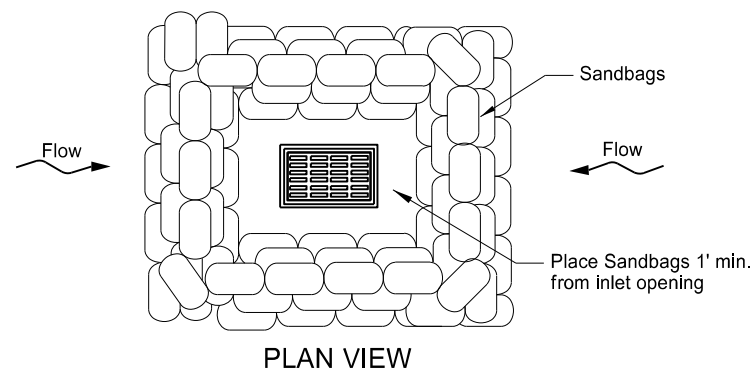
FIBER ROLL PROTECTION  
(INLET OF CULVERT)



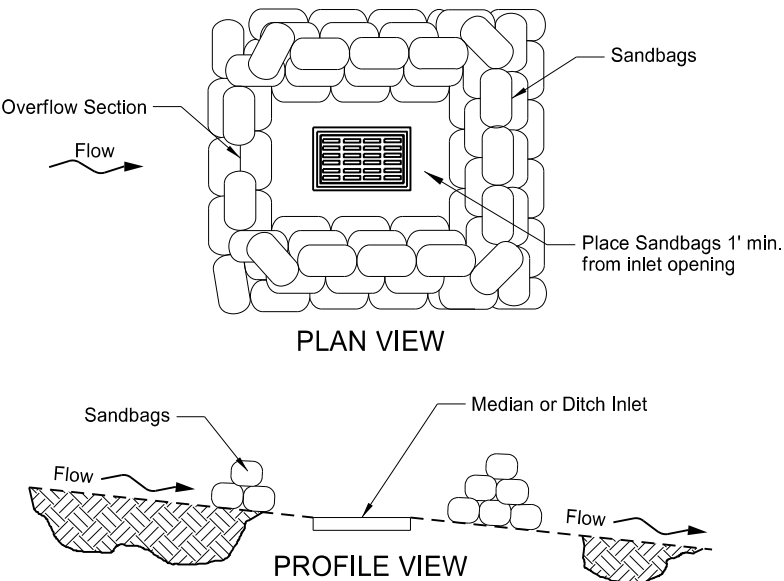
SILT FENCE PROTECTION  
(MEDIAN OR DITCH INLET)



GRAVEL INLET PROTECTION  
(MEDIAN OR DITCH INLET)



SANDBAG PROTECTION  
(LOW POINT)

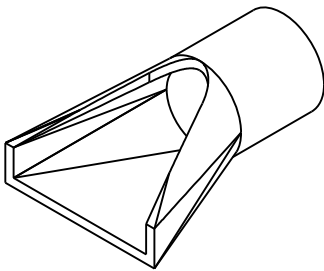


SANDBAG PROTECTION  
(ON SLOPE)

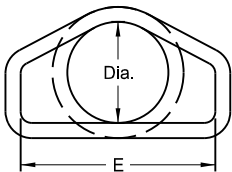
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Updated reference to standard drawing number for fiber roll staking details.
10-01-14	Updated reference to standard drawing number for silt fence.
10-17-17	Updated to active voice.
08-27-19	New Design Engineer PE Stamp.

This document was originally issued and sealed by  
Kirk J Hoff,  
Registration Number  
PE- 4683,  
on 8-27-19 and the original document is stored at the  
North Dakota Department  
of Transportation

FLARED END SECTION						
TERMINAL DIMENSIONS						
DIA	A	B	C	D	E	U
12	0'-4"	2'-0"	4'-0 <sup>7</sup> / <sub>8</sub> "	6'-0 <sup>7</sup> / <sub>8</sub> "	2'-0"	2"
15	0'-6"	2'-3"	3'-10"	6'-1"	2'-6"	2 <sup>1</sup> / <sub>4</sub> "
18	0'-9"	2'-3"	3'-10"	6'-1"	3'-0"	2 <sup>1</sup> / <sub>2</sub> "
21	0'-9"	3'-0"	3'-1"	6'-1"	3'-6"	2 <sup>3</sup> / <sub>4</sub> "
24	0'-9 <sup>1</sup> / <sub>2</sub> "	3'-7 <sup>1</sup> / <sub>2</sub> "	2'-6"	6'-1 <sup>1</sup> / <sub>2</sub> "	4'-0"	3"
27	0'-10 <sup>1</sup> / <sub>2</sub> "	4'-0"	2'-1 <sup>1</sup> / <sub>2</sub> "	6'-1 <sup>1</sup> / <sub>2</sub> "	4'-6"	3 <sup>1</sup> / <sub>2</sub> "
30	1'-0"	4'-6"	1'-7 <sup>3</sup> / <sub>4</sub> "	6'-1 <sup>3</sup> / <sub>4</sub> "	5'-0"	3 <sup>1</sup> / <sub>2</sub> "
36	1'-3"	5'-3"	2'-9"	8'-0"	6'-0"	4"
42	1'-9"	5'-3"	2'-9"	8'-0"	6'-6"	4 <sup>1</sup> / <sub>2</sub> "
48	2'-0"	6'-0"	2'-0"	8'-0"	7'-0"	5"
54	2'-3"	5'-5"	2'-9 <sup>1</sup> / <sub>2</sub> "	8'-2 <sup>1</sup> / <sub>4</sub> "	7'-6"	5 <sup>1</sup> / <sub>2</sub> "
60	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"	5"
66	2'-6"	6'-0"	2'-3"	8'-3"	8'-6"	5 <sup>1</sup> / <sub>2</sub> "
72	3'-0"	6'-6"	1'-9"	8'-3"	9'-0"	6"
78	3'-0"	7'-6"	1'-9"	9'-3"	9'-6"	6 <sup>1</sup> / <sub>2</sub> "
84	3'-0"	7'-6 <sup>1</sup> / <sub>2</sub> "	1'-9"	9'-3 <sup>1</sup> / <sub>2</sub> "	10'-0"	6 <sup>1</sup> / <sub>2</sub> "
90	3'-5"	7'-3 <sup>1</sup> / <sub>2</sub> "	2'-0"	9'-3 <sup>1</sup> / <sub>4</sub> "	11'-0"	6 <sup>1</sup> / <sub>2</sub> "

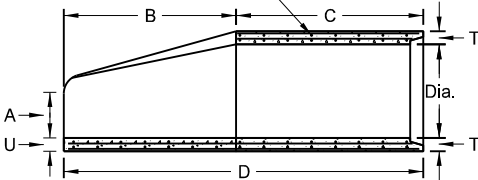


PERSPECTIVE

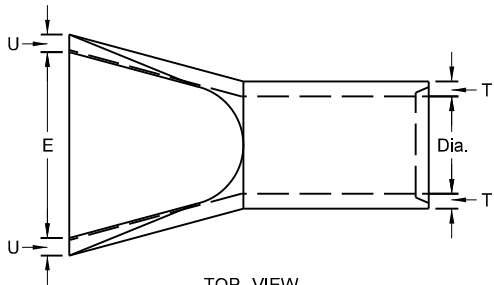


END VIEW

Standard Reinforcement for Class III pipe reinforced as per AASHTO M170



SIDE VIEW



TOP VIEW

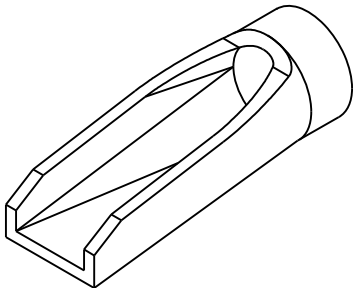
NOTES:

1. All reinforcing steel shall meet AASHTO M170 requirements.
2. All circular, longitudinal, and elliptical reinforcement shall be assembled and securely fastened in cage fashion so as to maintain reinforcement in exact shape and correct positions within the forms.
3. Laying length of pipe: 12" to 66" (incl.) = not less than 4 feet  
66" to 108" (incl.) = not less than 6 feet
4. Joints shall be sealed with rubber gaskets or with sealer approved by the engineer whenever pipe are specified for storm drain or sanitary sewers.
5. For Class IV and Class V reinforced concrete pipe and end section sizes which do not have reinforcement specified by AASHTO M170, shop drawings and design calculations shall be prepared and sealed by a Professional Engineer and submitted for the Engineer's review.

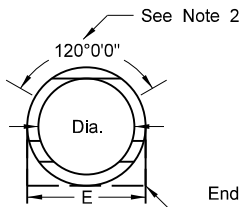
REINFORCED CONCRETE PIPE - FLARED END SECTION

Reinforcement to be equivalent to Class III RCP

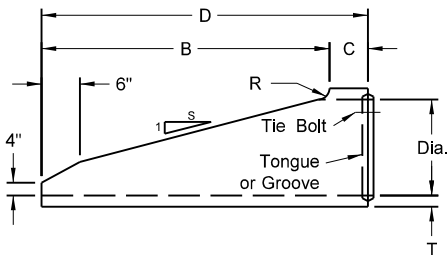
TRAVERSABLE END SECTION						
DIA	B	C	D	E	R	S
15"	4'	9"	4'-9"	1'-7 <sup>1</sup> / <sub>2</sub> "	3"	6
18"	5'-9"	9"	6'-6"	1'-11"	3"	6
24"	6'	1'	7'	2'-6"	3"	4
30"	7'-6"	1'	8'-6"	3'-1"	3 <sup>1</sup> / <sub>2</sub> "	4
36"	7'-3"	15"	8'-6"	3'-8"	3"	4



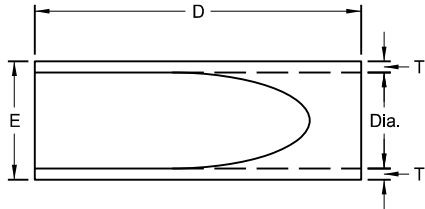
PERSPECTIVE



END VIEW



SIDE VIEW



TOP VIEW

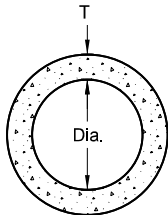
NOTES (Traversable End Section):

1. Manufactured in accordance with applicable portions of ASTM C76/AASHTO M170.
2. Reinforcement per Class III RCP with double reinforcement in the upper 120° of the full barrel portion.

REINFORCED CONCRETE PIPE - TRAVERSABLE END SECTION

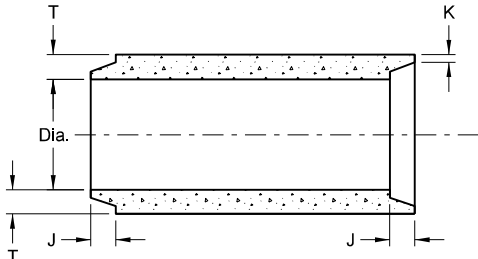
Reinforcement to be equivalent to Class III RCP

All Classifications of Round Concrete Pipe						
Internal Dia. of pipe in Inches	Cross-Sectional Water Area	Weight per Lin. Foot of pipe Std. Wall	Joint J Groove End Min./Max.	Joint K Tongue Min.	Minimum Wall Thickness (T)	
Dia	Sq. ft.	Lbs.	In.	In.	In.	
12	0.79	92	1 <sup>5</sup> / <sub>8</sub> -2 <sup>3</sup> / <sub>8</sub>	3/4	2	
15	1.23	127	1 <sup>3</sup> / <sub>4</sub> -2 <sup>1</sup> / <sub>4</sub>	7/8	2 <sup>1</sup> / <sub>4</sub>	
18	1.77	168	1 <sup>1</sup> / <sub>2</sub> -2 <sup>1</sup> / <sub>2</sub>	1	2 <sup>1</sup> / <sub>2</sub>	
21	2.40	214	1 <sup>1</sup> / <sub>2</sub> -3 <sup>1</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>8</sub>	2 <sup>3</sup> / <sub>4</sub>	
24	3.14	265	2 <sup>3</sup> / <sub>4</sub> -3 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>8</sub>	3	
27	3.98	322	2 <sup>3</sup> / <sub>4</sub> -4	1 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>4</sub>	
30	4.91	384	3 <sup>1</sup> / <sub>4</sub> -4 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>2</sub>	
33	5.94	452	3 <sup>1</sup> / <sub>4</sub> -4 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>4</sub>	
36	7.07	524	3 <sup>1</sup> / <sub>4</sub> -4 <sup>1</sup> / <sub>4</sub>	1 <sup>1</sup> / <sub>2</sub>	4	
42	9.62	685	3 <sup>3</sup> / <sub>4</sub> -4 <sup>3</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>4</sub>	4 <sup>1</sup> / <sub>2</sub>	
48	12.57	685	3 <sup>3</sup> / <sub>4</sub> -4 <sup>3</sup> / <sub>4</sub>	1 <sup>3</sup> / <sub>4</sub>	5	
54	15.90	1070	4 <sup>1</sup> / <sub>2</sub> -5 <sup>1</sup> / <sub>4</sub>	2	5 <sup>1</sup> / <sub>2</sub>	
60	19.63	1296	4 <sup>1</sup> / <sub>2</sub> -5 <sup>1</sup> / <sub>2</sub>	2 <sup>1</sup> / <sub>4</sub>	6	
66	23.76	1542	5-6	2 <sup>3</sup> / <sub>8</sub>	6 <sup>1</sup> / <sub>2</sub>	
72	28.27	1810	5 <sup>5</sup> / <sub>8</sub> -6 <sup>3</sup> / <sub>4</sub>	2 <sup>3</sup> / <sub>8</sub>	7	
78	33.18	2098	6 <sup>1</sup> / <sub>4</sub> -7 <sup>1</sup> / <sub>4</sub>	2 <sup>3</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>2</sub>	
84	38.48	2410	5 <sup>5</sup> / <sub>8</sub> -7 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>8</sub>	8	
90	44.18	2793	6 <sup>3</sup> / <sub>4</sub> -8 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>2</sub>	
96	50.27	3092	7-8 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>2</sub>	9	
102	56.75	3466	7-8 <sup>1</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>2</sub>	9 <sup>1</sup> / <sub>2</sub>	
108	63.62	3864	7 <sup>1</sup> / <sub>4</sub> -8 <sup>1</sup> / <sub>2</sub>	3 <sup>3</sup> / <sub>4</sub>	10	

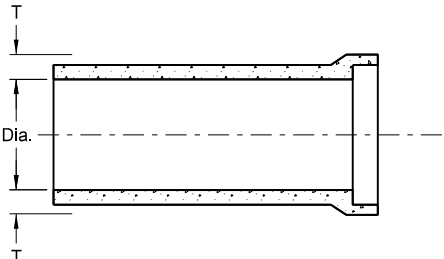


END VIEW

CIRCULAR PIPE

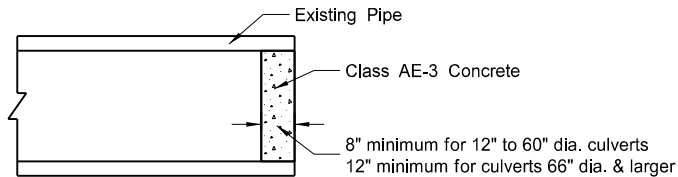


TONGUE & GROOVE JOINT



BELL & SPIGOT JOINT

JOINTS FOR REINFORCED CONCRETE PIPE



CONCRETE PIPE PLUG

SEE STANDARD DRAWING D-714-22 FOR DETAILS OF CONCRETE PIPE TIES (TIE BOLTS).

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
05-12-14	
REVISIONS	
DATE	CHANGE
01-21-15	Revised Note 5
11-21-16	Revised End Section Dimensions
09-18-19	Updated Perspective View Details

This document was originally issued and sealed by  
Jon Ketterling  
Registration Number  
PE- 4684,  
on 9/18/19 and the original document is stored at the  
North Dakota Department  
of Transportation

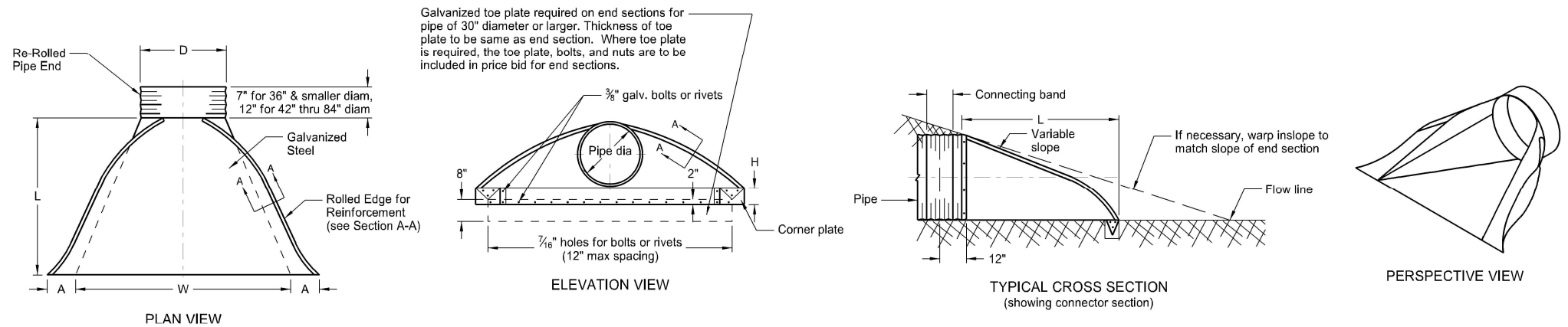
## D-714-2

This document was originally issued and sealed by Jon Ketterling, Registration Number PE- 4684, on 9/18/19 and the original document is stored at the North Dakota Department of Transportation



ROUND CORRUGATED STEEL PIPE CULVERTS AND END SECTIONS

D-714-4



PIPE DIA.	GALVANIZED THICKNESS	END SECTION DIMENSIONS					APPROX. SLOPE	BODY
		A	B	H	L	W		
IN	IN	IN	IN	IN	IN	IN	RATE	PIECE
15	0.064 - 0.079	7	8	6	26	30	2½:1	1
18	0.064 - 0.109	8	10	6	31	36	2½:1	1
24	0.064 - 0.109	10	13	6	41	48	2½:1	1
30	0.064 - 0.109	12	16	8	51	60	2½:1	1 or 2
36	0.064 - 0.109	14	19	9	60	72	2½:1	2
42	0.064 - 0.138	16	22	11	69	84	2½:1	2
48	0.064 - 0.168	18	27	12	78	90	2½:1	2
54	0.064 - 0.168	18	30	12	84	102	2:1	2
* 60	0.064 - 0.168	18	33	12	87	114	1½:1	3
* 66	0.064 - 0.168	18	36	12	87	120	1½:1	3
* 72	0.064 - 0.168	18	39	12	87	126	1½:1	3
* 78	0.064 - 0.168	18	42	12	87	132	1½:1	3
* 84	0.064 - 0.168	18	45	12	87	138	1½:1	3

\* These sizes have 0.109" sides and 0.138" center panels.

\* \* Pipe diameter is equal to dimension "D" of end section.

Manufacturers tolerances of above dimensions will be allowed.

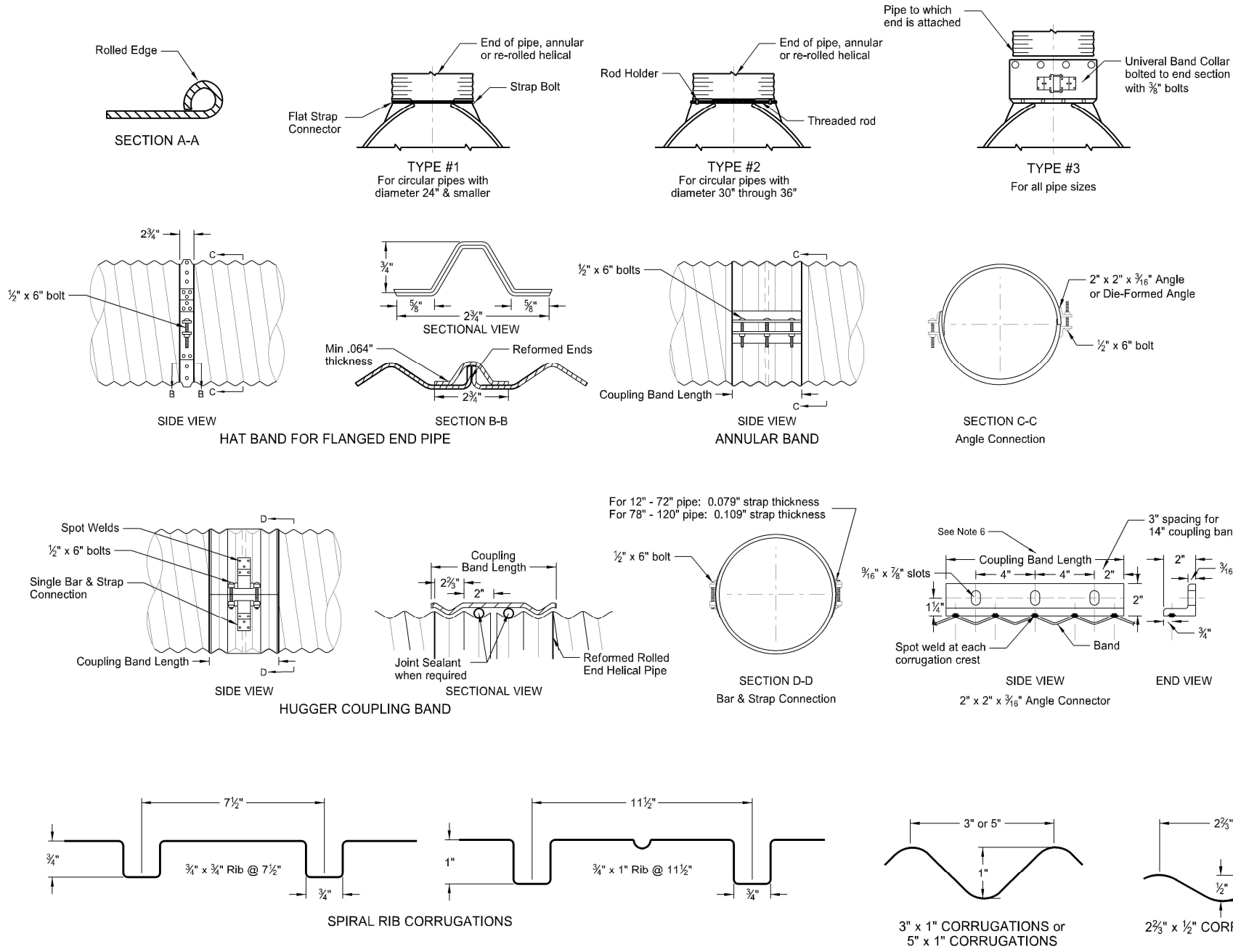
Splices to be the lap riveted type.

Multiple panel bodies shall have lap seams which are to be tightly joined with 3/8" dia. galv. bolts or rivets. Nuts to be torqued to 25 foot-lbs ±.

NOTES:

- Pipes and connecting bands shall conform to applicable sections of NDDOT Standard Specifications and to AASHTO M-36.
- Top edge of all end sections to have rolled edges for reinforcement (see Section A-A). The reinforced edges are to be supplemented with 2" x 2" x 1/8" galv. angle for 60" through 72" dia. and 2 1/2" x 2 1/2" x 1/4" galv. angle for 78" and 84" dia.. Angles to be attached by galv. 3/8" dia. bolts and nuts. Angles are to extend from pipe to the corner wing bend.
- Elongated pipes shall be factory preformed so that the vertical diameter shall be 5% greater and the horizontal diameter 5% less than a circular pipe.
- Coupling bands shall be two-piece for pipes larger than 36" as shown in Section C-C & D-D details. For pipes 36" and smaller, a one-piece band is acceptable.
- 1/2" x 8" bolts may be used as a substitute for the 1/2" x 6" bolts shown in the details.
- Coupling bands wider than 14" may be used if a minimum of four 1/2" bolts with maximum spacing of 5 1/2" are used for the connection.
- Length of spot welds shall be minimum 1/2".

COUPLING BAND DIMENSIONS				
COUPLING TYPE	CORRUGATION PITCH x DEPTH	PIPE SIZE	COUPLING BAND LENGTH	MIN. BAND THICKNESS
Hat Band	2 3/8" x 1/2"	12" - 48"	2 3/4"	.064"
Annular Band	2 3/8" x 1/2"	12" - 72"	12"	.052"
		78" - 84"	12"	.079"
Hugger Band	2 3/8" x 1/2" Rerolled End	12" - 72"	10 1/2"	.052"
		78" - 84"	10 1/2"	.079"
	3" x 1" Rerolled End	48" - 120"	10 1/2"	.052"
		48" - 120"	12"	.064"

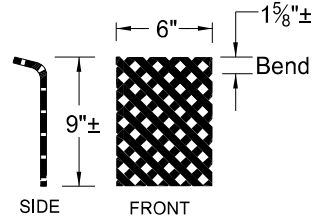
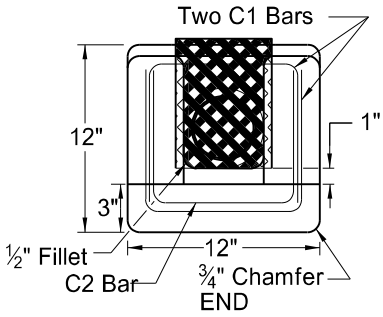
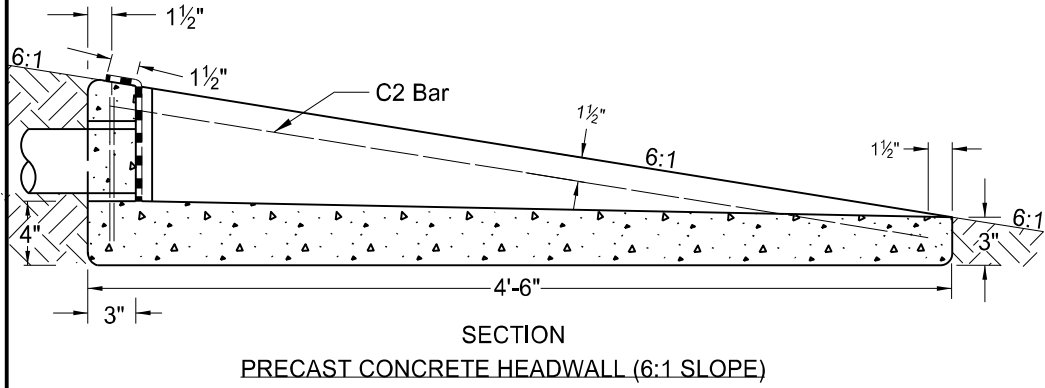
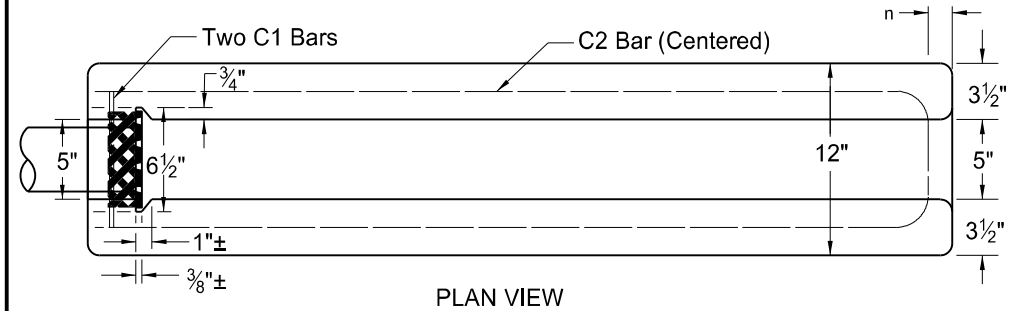


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
08-16-13	
REVISIONS	
DATE	CHANGE
01-07-14	End Section Plan View
02-27-14	3" x 1" Corrugation Detail
09-18-19	Added Perspective View Detail
09-23-22	Galvanized Thickness Table

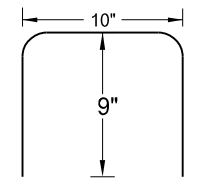
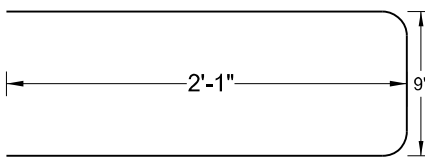
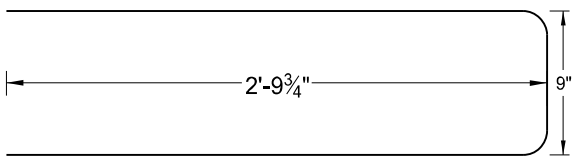
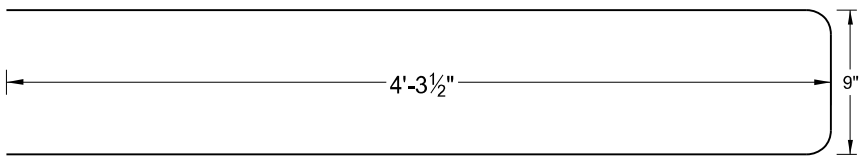
THAN D KETTER  
PROFESSIONAL  
PE-4684  
ENGINEER  
NORTH DAKOTA  
09/23/22

PRECAST CONCRETE HEADWALL DETAILS

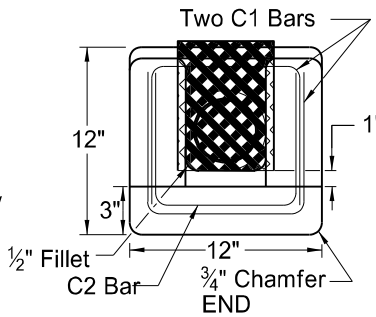
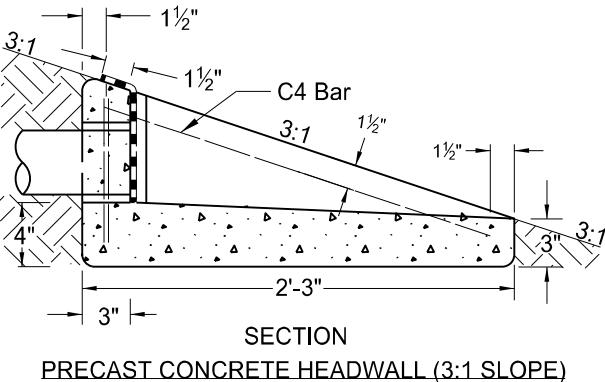
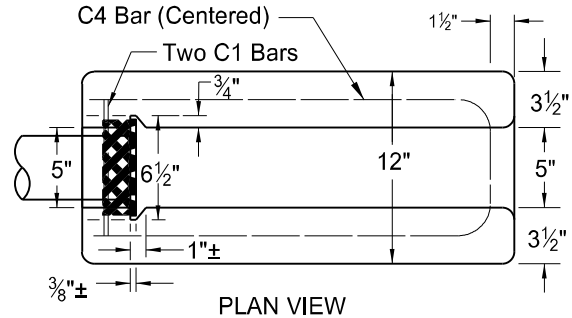
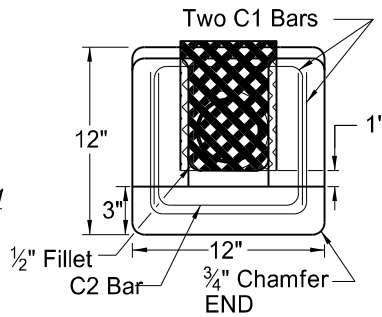
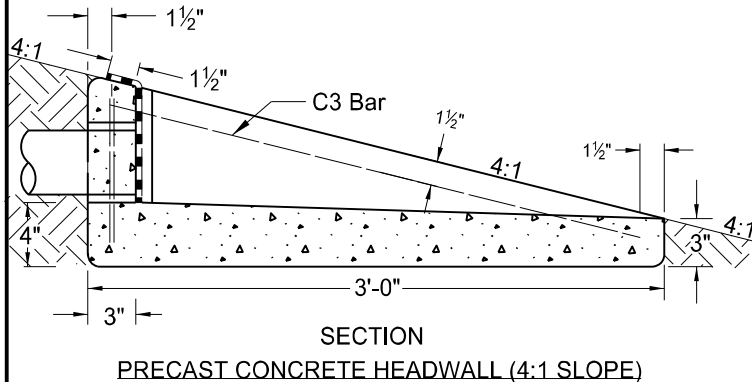
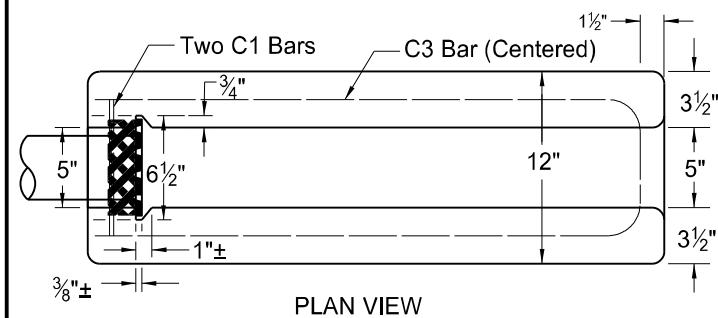
D-714-18



RODENT SCREEN  
Dimensions are approximate to allow bend and a snug fit in headwall slot



BENT BAR DETAILS



NOTES:

RODENT SCREEN: Fabricate rodent screen from flattened expanded metal with screen openings of approximately 0.25 square inches. Use 16 ga metal, hot dip galvanized after fabrication, for the screen.

REINFORCING BARS: Use No. 4 deformed steel reinforcing bars.

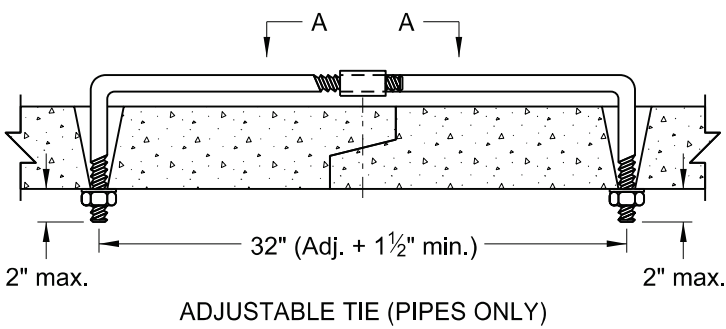
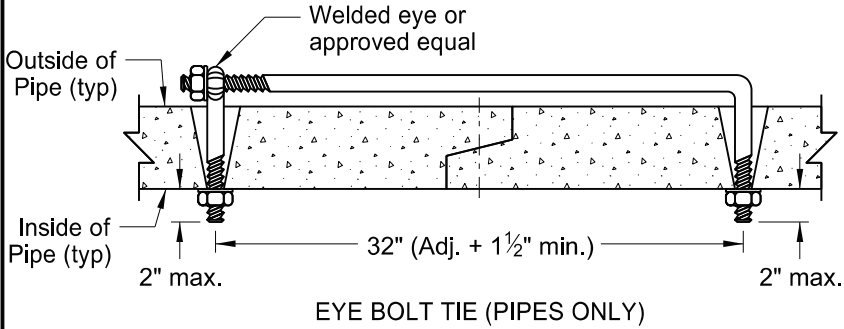
BENT BARS: Bent bar dimensions given out to out.

SLOPE: Match headwall slope to foreslope.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-27-2010	
REVISIONS	
DATE	CHANGE
12/02/2020	Removed drainable base details Added 4:1 and 3:1 Headwalls



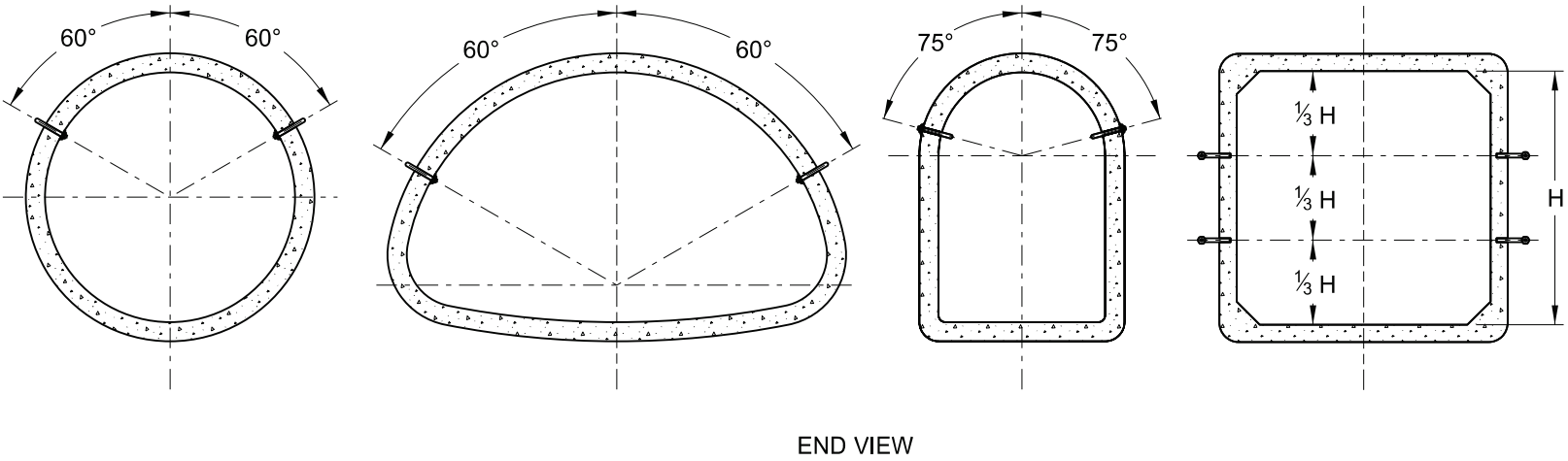
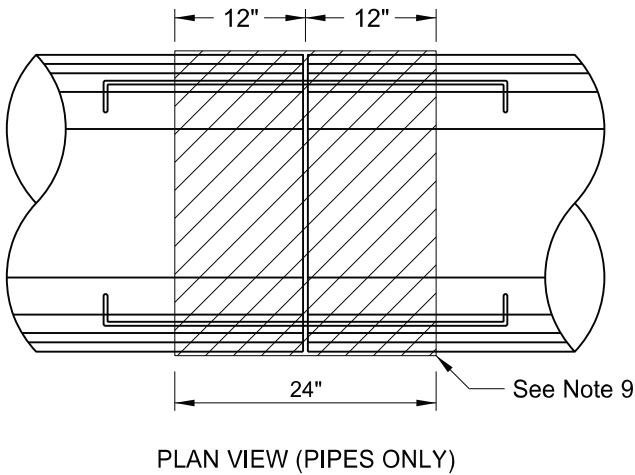
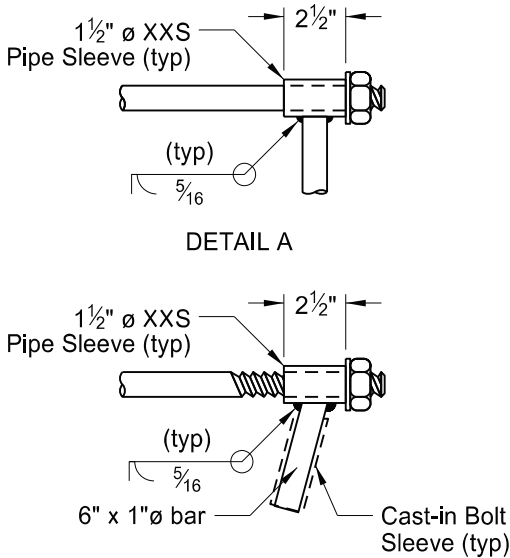
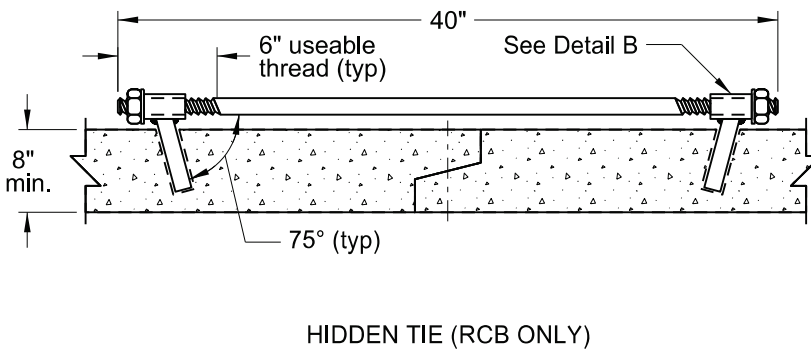
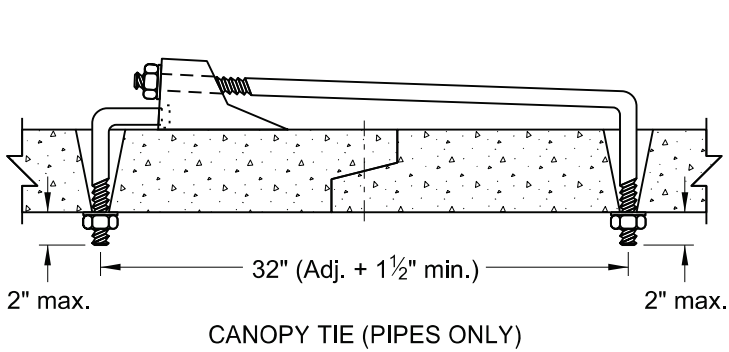
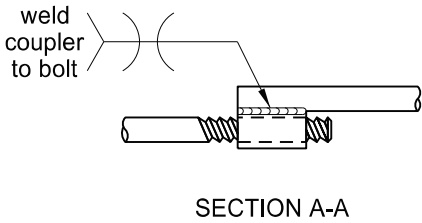
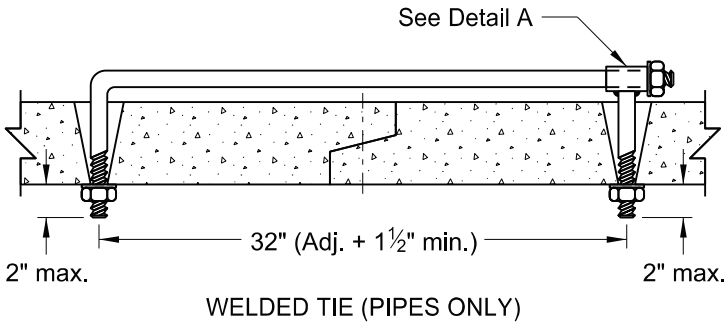
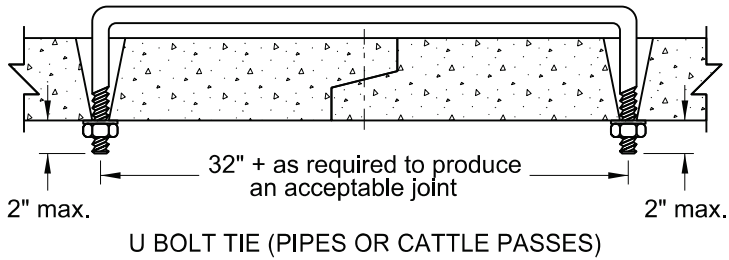
CONCRETE PIPE, CATTLE PASS, OR  
PRECAST CONCRETE BOX CULVERT TIES



REQUIRED SIZE OF TIE BOLTS		
PIPE SIZE	THREAD Ø	XXS PIPE SLEEVE INNER Ø
18" - 24"	5/8"	3/4"
30" - 66"	3/4"	1"
72" - 120"	1"	1 1/4"
RCB/CATTLE PASS	1"	1 1/4"

NOTES:

1. The pipe size listed is the inside diameter of round pipe or the equivalent diameter of pipe arch.
2. Insert pipe ties from the inside of the pipes and grout into place for Cattle Pass and Jacked and Bored pipes. Jacked and bored pipes with a diameter of 24" or less do not require pipe ties.
3. Nuts and washers are not required on Jacked and Bored pipes or pipes with a 24" diameter or less. Insert and grout tie bars into place where nuts and washers are not used.
4. Do not use pipe ties to pull the pipe or RCB sections tight. The ties are only for holding sections together.
5. Use only tie bolt assemblies that have been hot dip galvanized in accordance with ASTM A 153.
6. Holes in pipes to accommodate tie bolts will be precast. Tapered holes are permitted. Use holes that have a diameter 1/4" larger than the diameter of the thread. In precast RCB's, use holes that contain cast-in bolt sleeves with an inside diameter of 1 1/4".
7. Include the cost of precasting the required holes and furnishing and installing the tie bolts in the price bid for the appropriate conduit or RCB pay item.
8. Tie all centerline and approach RCP culvert joints. Tie all joints including the end sections of all free ends of storm drain systems. Free ends are defined as any storm drain end which does not terminate at an inlet or manhole. Outfall culverts with end sections which drain adjacent ditches are examples of free ends.
9. Place joint wrap prior to installing ties. Firmly secure the wrap around the full perimeter. For concrete pipes, use Type S2 geotextile fabric and overlap the joint by 12" in both directions. For box culverts, use a waterproof membrane that meets ASTM C990. Provide a membrane that is a minimum of 12" wide and center it at the joint. Provide a minimum overlap of 2.5" at the seams.
10. Use tie bolts that conform to ASTM A 36. Use heavy hex nuts that conform to ASTM A 563. Use washers that conform to ASTM F 436, Type 1. Use welded pipe sleeves and cast-in bolt sleeves that conform to ASTM A 53, Grade B.
11. Provide lock washers or burr threads of concrete box ties after installation and tightening to prevent nut rotation.
12. Tie RCB's as noted in the plans.

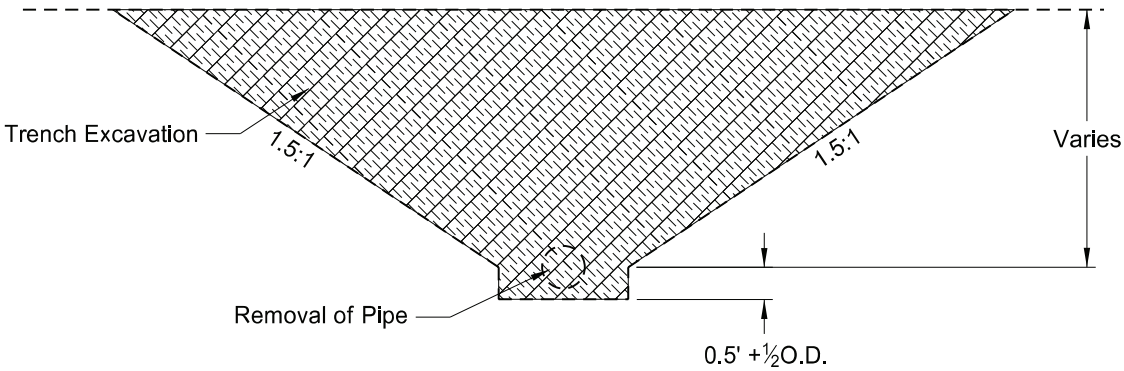


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
3-18-14	
REVISIONS	
DATE	CHANGE
7-21-15	Note 8
6-6-17	Notes 2-11 Table, Title, Labels
8-11-21	Notes 2-12 Table, Label
01-17-25	Notes 9-13 Table, Labels Section A-A, End View

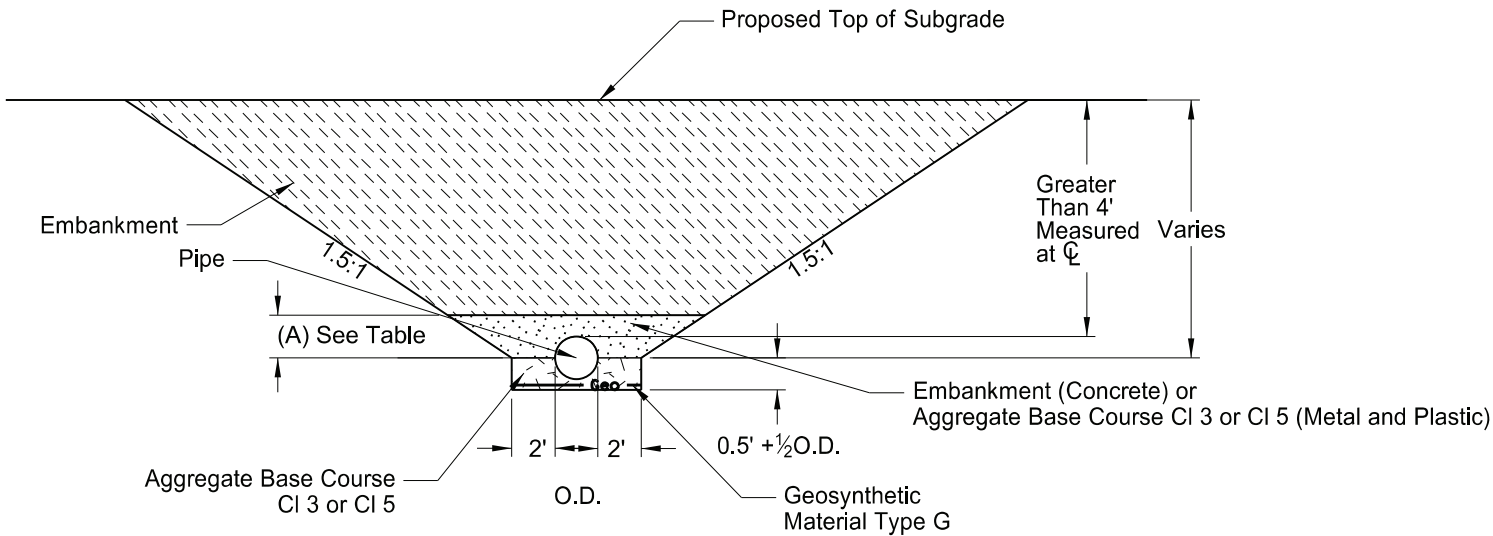


TRANSVERSE MAINLINE PIPE INSTALLATION DETAIL  
PIPES MORE THAN 4 FEET BELOW TOP OF SUBGRADE

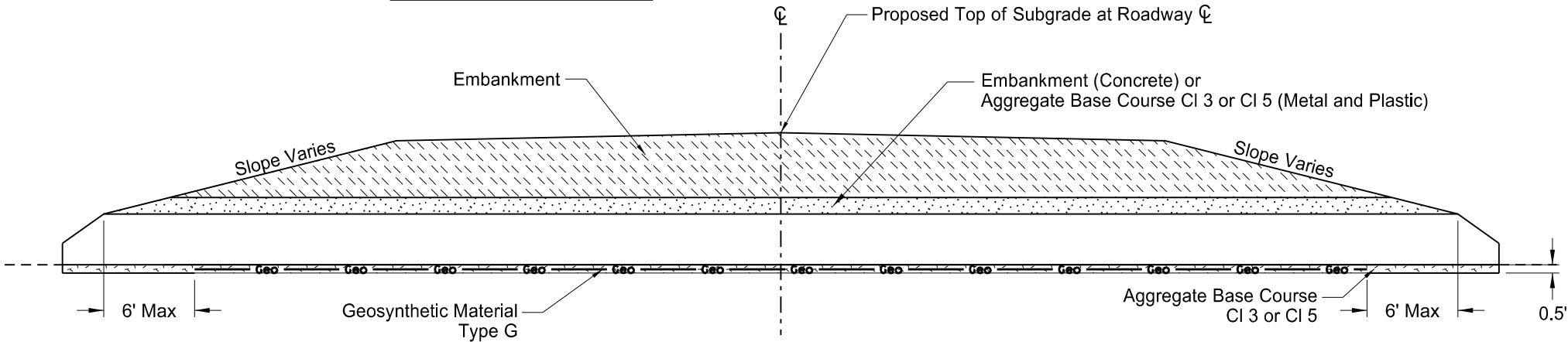
D-714-25



EXCAVATION DETAIL



INSTALLATION DETAIL



CROSS SECTION

Pay Items

- 1) Pipe\*
- 2) Geosynthetic Material Type G
- 3) Removal of Pipe (if required)

\*Included in Pipe Pay Item

- 1) Pipe
- 2) Trench excavation
- 3) Aggregate Base Course CI 3 or CI 5
- 4) Embankment

NOTES:

- 1) This drawing applies to new/replaced mainline and paved intersection roadways (including ramps). It does not include pipes in approaches.
- 2) Embankment may be either Borrow Excavation or Common Excavation - Type A.

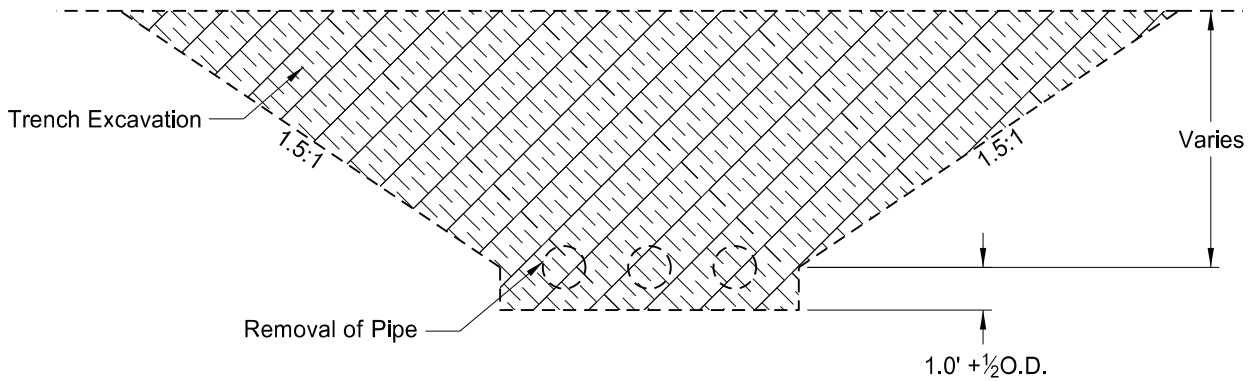
Backfill Dimensions	
Pipe Materials	Dimension (A)
Concrete	0.5 O.D.
Metal and Plastic	0.5 O.D. + 1 Foot

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
7-26-13	
REVISIONS	
DATE	CHANGE
10-15-13	Label Formatting
1-21-14	Nomenclature
9-18-15	Title Rewording
12-10-15	Added Plastic Pipe
5-27-20	Replaced R1 Fabric with Geogrid Changed bedding depth

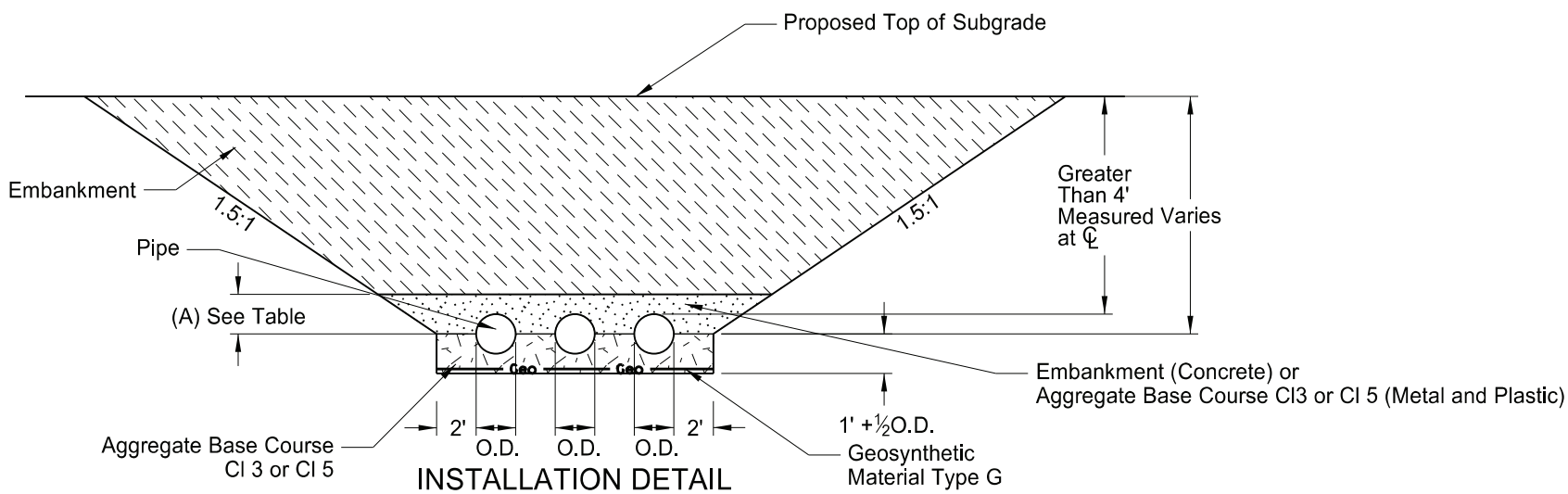


TRANSVERSE MAINLINE PIPE INSTALLATION DETAIL  
MULTIPLE PIPES MORE THAN 4 FEET BELOW TOP OF SUBGRADE

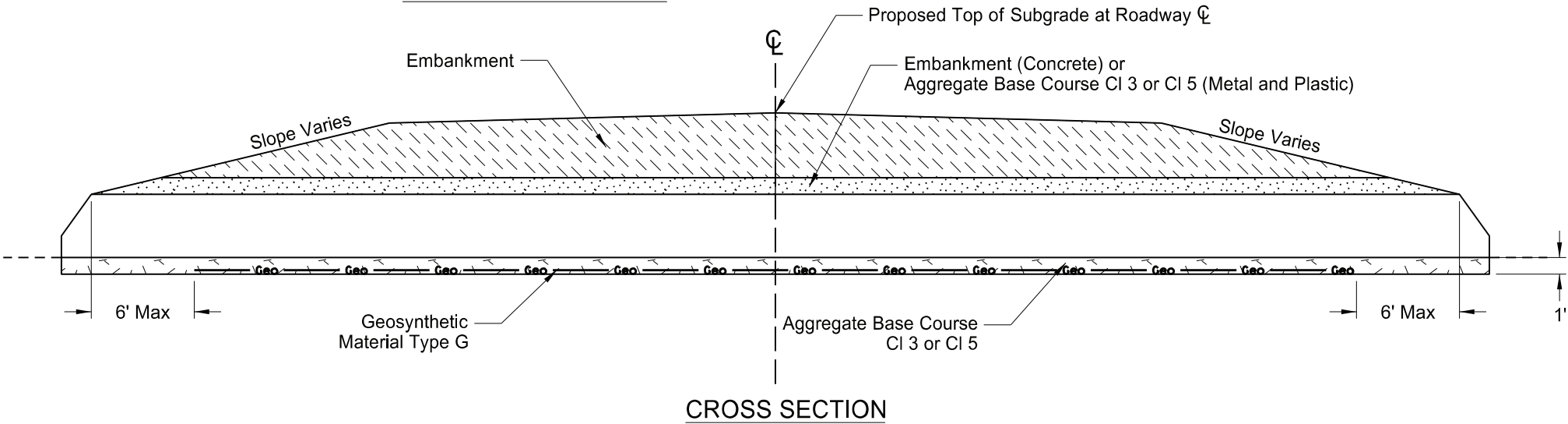
D-714-25M



EXCAVATION DETAIL



INSTALLATION DETAIL



CROSS SECTION

Pay Items

- 1) Pipe\*
- 2) Geosynthetic Material Type G
- 3) Removal of Pipe (if required)

\*Included in Pipe Pay Items

- 1) Pipe
- 2) Trench Excavation
- 3) Aggregate Base Course CI 3 or CI 5
- 4) Embankment

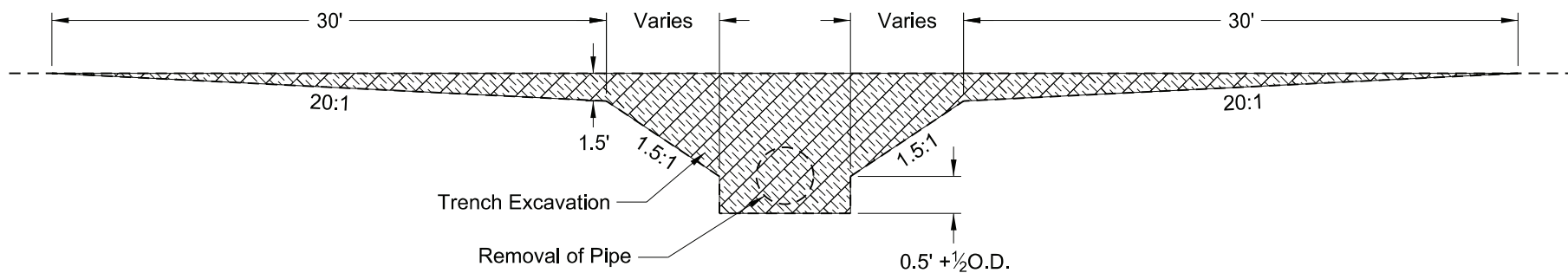
NOTES:

- 1) This drawing applies to new/replaced mainline and paved intersection roadways (including ramps). It does not include pipes in approaches.
- 2) Embankment may be either Borrow Excavation or Common Excavation - Type A.

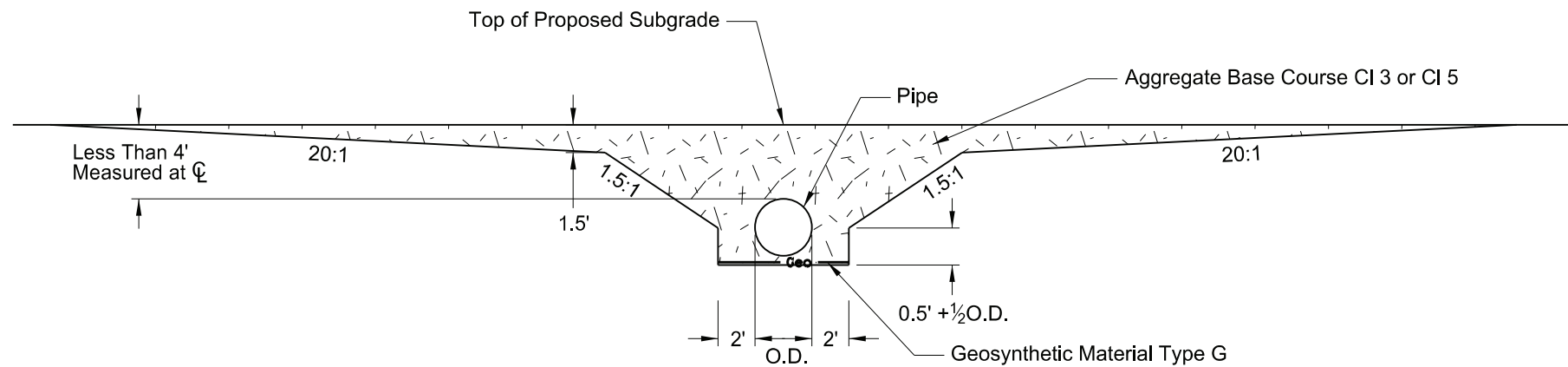
Backfill Dimensions	
Pipe Materials	Dimension (A)
Concrete	0.5 O.D.
Metal and Plastic	0.5 O.D. + 1 Foot

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-4-14	
REVISIONS	
DATE	CHANGE
3-3-14	Spelling
1-21-14	Nomenclature
9-16-15	Title Rewording
12-10-15	Added Plastic Pipe
5-27-20	Replaced R1 Fabric with Geogrid Changed bedding depth and embankment requirements

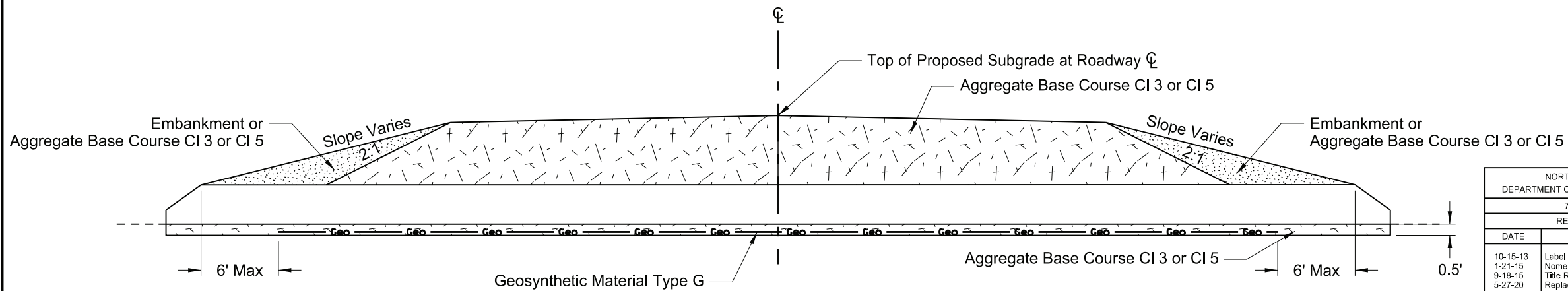


TRANSVERSE MAINLINE PIPE INSTALLATION DETAIL  
PIPES 4 FEET OR LESS BELOW TOP OF SUBGRADE

EXCAVATION DETAIL



INSTALLATION DETAIL



CROSS SECTION

## Pay Items

- 1) Pipe\*
- 2) Geosynthetic Material Type G
- 3) Removal of Pipe (if required)

## \*Included in Pipe Pay Item

- 1) Pipe
- 2) Trench Excavation
- 3) Aggregate Base Course CI 3 or CI 5
- 4) Embankment

## NOTES:

- 1) This drawing applies to new/replaced mainline and paved intersection roadway pipes only (including ramps). It does not include pipes in approaches.
- 2) Embankment may be either borrow Excavation or Common Excavation - Type A

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
7-26-13	
REVISIONS	
DATE	CHANGE
10-15-13	Label Formatting
1-21-15	Nomenclature
9-18-15	Title Rewording
5-27-20	Replaced R1 Fabric with Geogrid Changed bedding depth





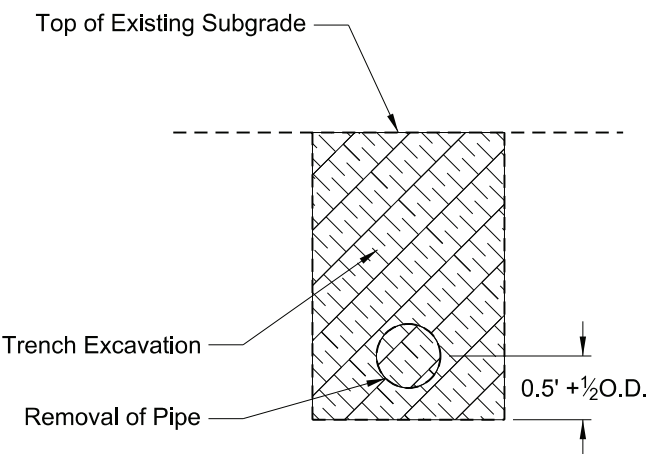
- 1) This drawing applies to new/replaced mainline and paved intersection roadway pipes only (including ramps). It does not include pipes in approaches.
- 2) Embankment may be either Borrow Excavation or Common Excavation - Type A



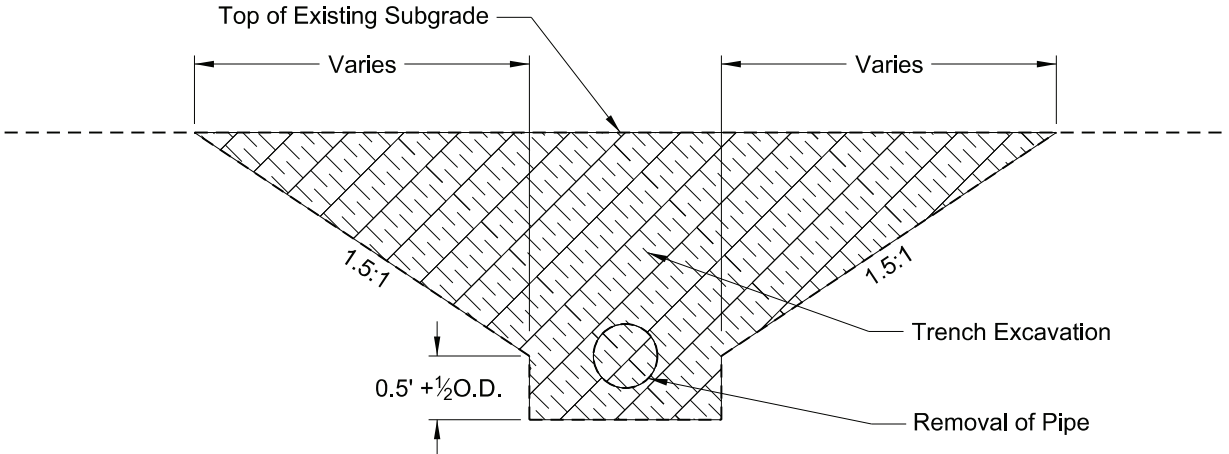
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-4-14	
REVISIONS	
DATE	CHANGE
1-21-15	Nomenclature
9-18-15	Title Rewording
5-27-20	Replaced R1 Fabric with Geogrid Changed bedding depth



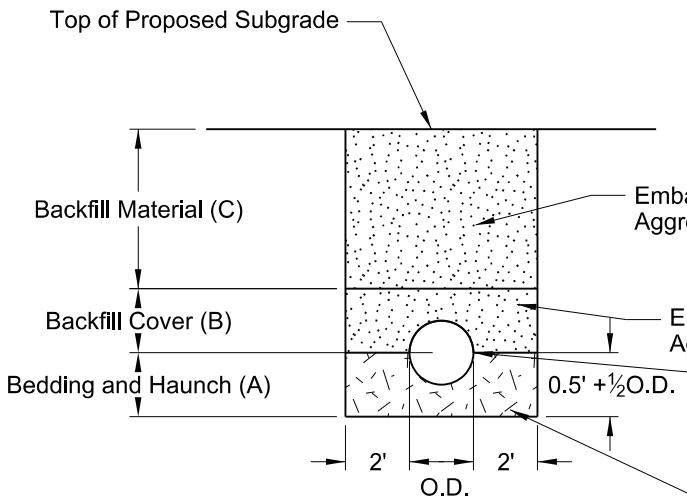
# PIPE INSTALLATION DETAIL FOR LONGITUDINAL MAINLINE PIPE OR PIPE NOT UNDER THE ROADWAY



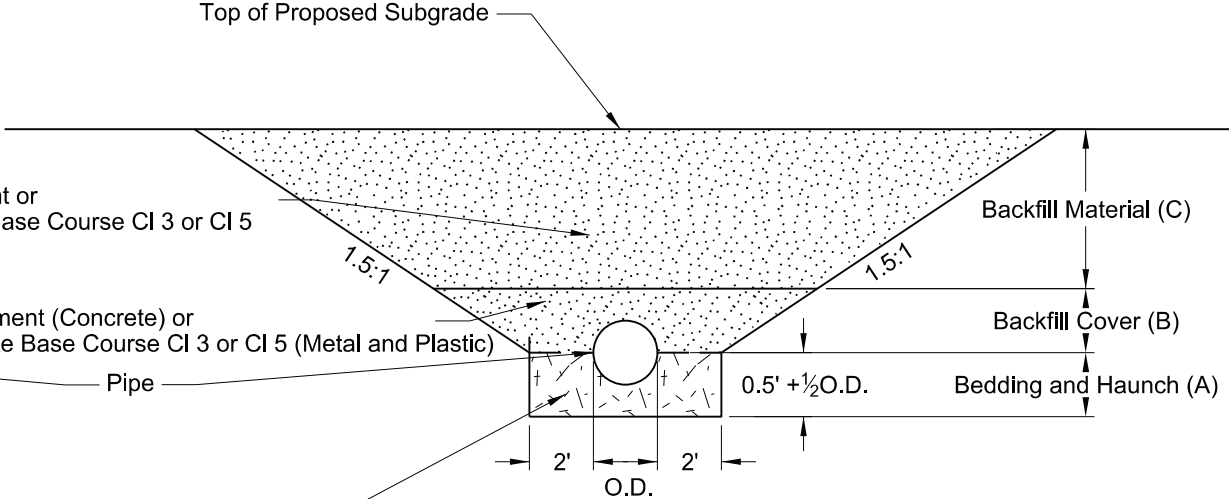
EXCAVATION DETAIL A



EXCAVATION DETAIL B



BACKFILL DETAIL A



BACKFILL DETAIL B

Pay Items  
1) Pipe\*  
2) Removal of Pipe (if required)

\*Included in Pipe Pay Item  
1) Pipe  
2) Trench excavation  
3) Aggregate base course CI 3 or CI 5  
4) Embankment

NOTES:  
1) This drawing does not apply to pipes in approaches.  
2) It is the contractor's option to select Detail A or B.  
3) Embankment may be either Borrow Excavation or Common Excavation - Type A

Bedding and Haunch (A)
Pipes Not Under Roadway = 0.5 O.D. + 0.5 Feet
Pipes Under the Roadway = 0.5 O.D. + 0.5 Feet
Backfill Cover (B)
Concrete Pipe = 0.5 O.D.
Metal and Plastic = 0.5 O.D. + 1 Foot
Backfill Material (C)
Top of Pipe 4 Feet or Less Below the Top of Proposed Subgrade = Aggregate Base Course CI3 or CI 5
Top of Pipe Greater than 4 Feet Below the Top of Proposed Subgrade = Common Excavation - Type A
Pipe Not Under Roadway = Common Excavation - Type B

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
7-26-13	
REVISIONS	
DATE	CHANGE
10-15-13	Label Formatting
1-21-15	Nomenclature
12-10-15	Added Plastic Pipe
5-27-20	Changed bedding depth and updated table



STANDARD MONUMENTS AND RIGHT OF WAY MARKERS

D-720-1

NOTES:

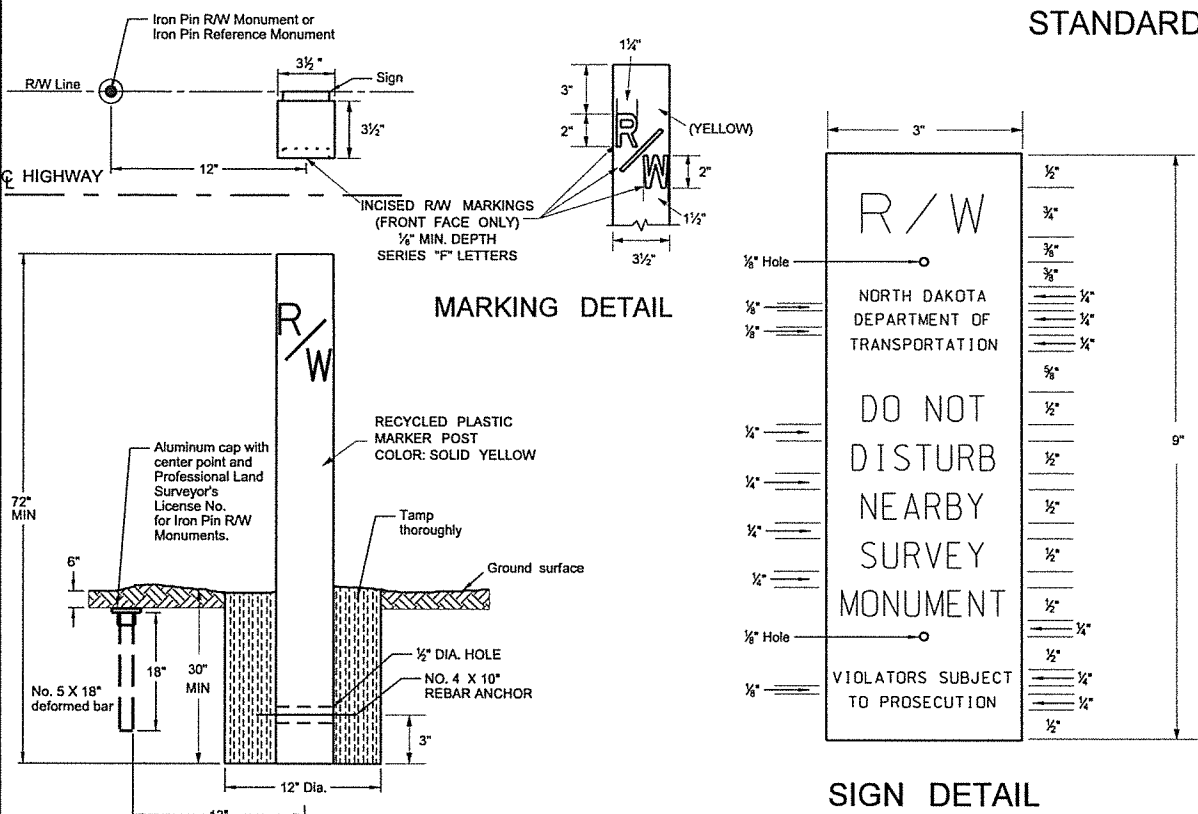
Construct and install Alignment Monuments, Iron Pin Reference Monuments, Iron Pin R/W Monuments, and Right of Way Markers (witness posts) according to Section 720 of the Standard Specifications.

ALIGNMENT MONUMENTS: Place Iron Pin or Precast Concrete Alignment Monuments with aluminum caps on the centerline alignment PI's, section corners, quarter corners, section line crossings, quarter line crossings, and at curve points (PC's, PT's, TS's, and ST's) on the centerline.

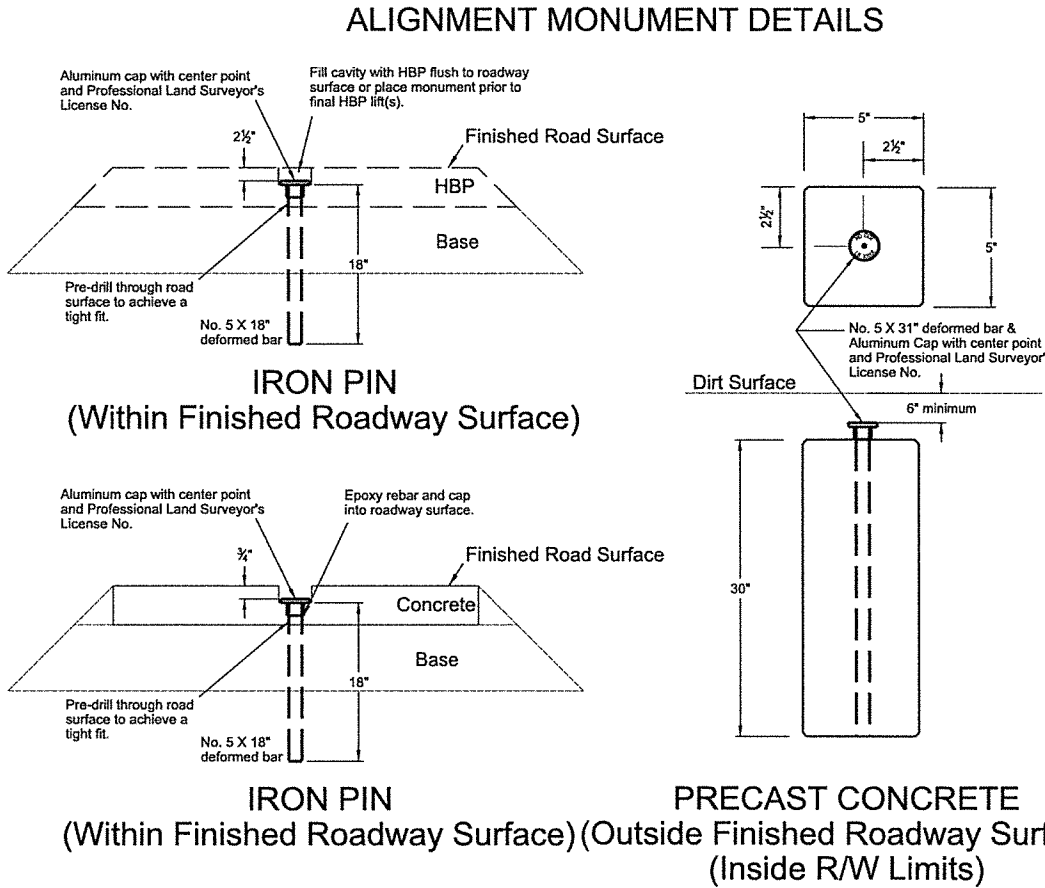
IRON PIN R/W MONUMENT: Place Iron Pins with aluminum caps (No. 5 X 18") at breaks on the Right of Way line, and at curve points (PC's, PT's, TS's and ST's) on the Right of Way line.

IRON PIN REFERENCE MONUMENT: Place Iron Pins without aluminum caps (No. 5 X 18") as reference monuments on the Right of Way line at section corners, quarter corners, section line crossings, and quarter line crossings.

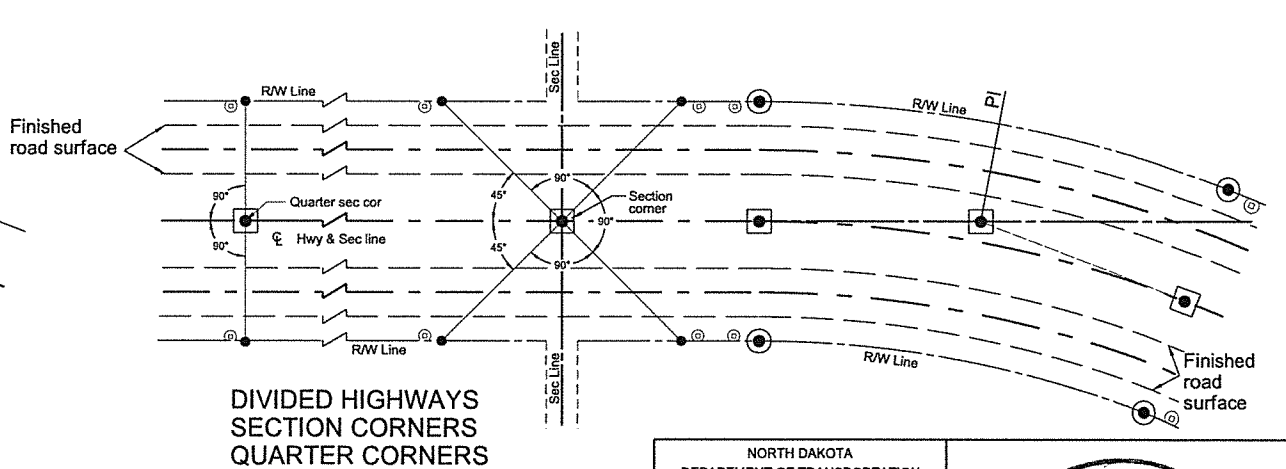
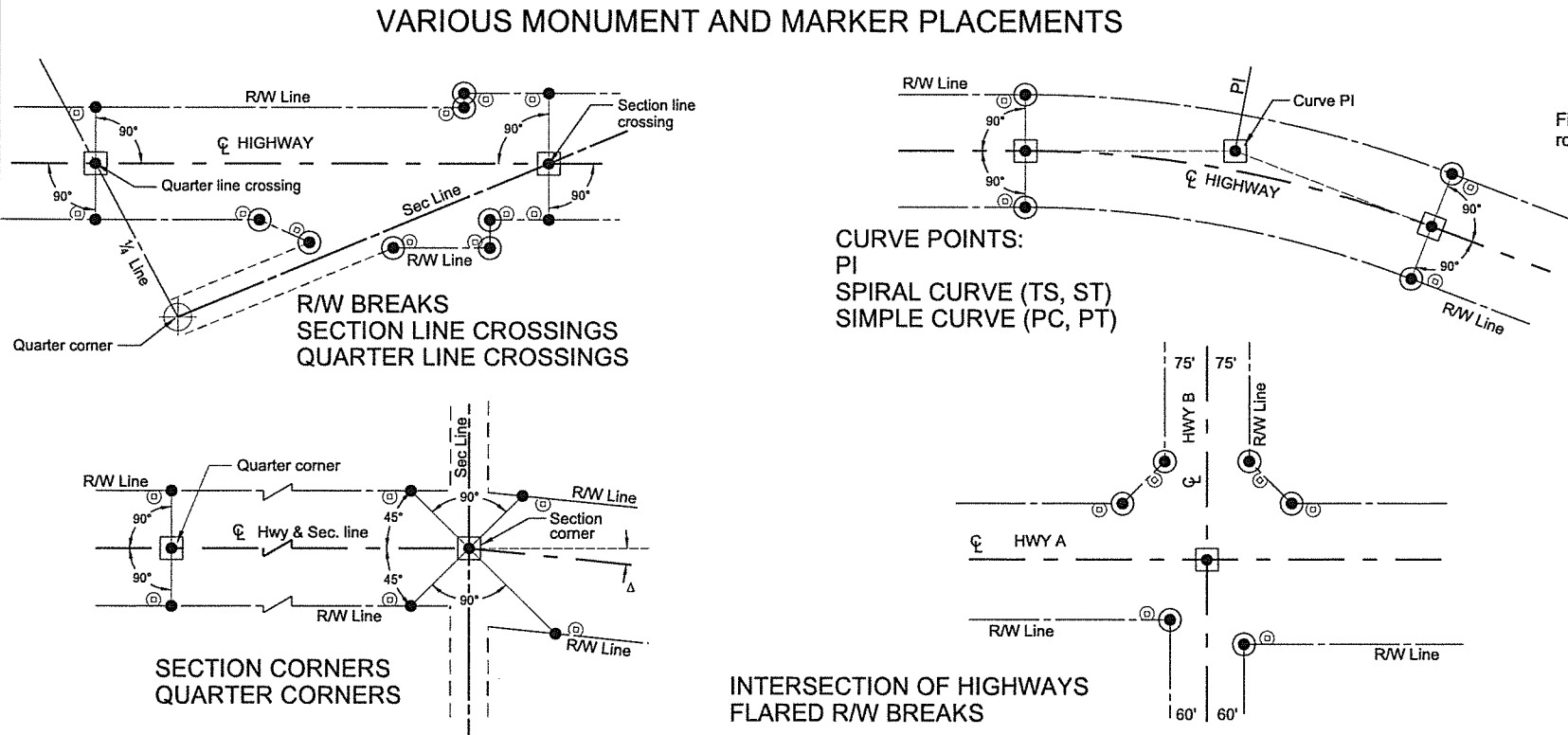
R/W MARKERS (WITNESS POST) WITHIN DRIVEWAYS: If a single iron Pin R/W or Reference Monument is within a driveway, place right of way marker (witness post) 50 feet back, in stationing, from the Iron Pin Monument along the R/W line. If R/W break is within a driveway, place right of way markers (witness posts) 50 feet back, or ahead from respective Iron Pin R/W Monuments along the R/W lines. Maintain Iron Pin R/W or Reference Monument original position within driveway.



RECYCLED PLASTIC RIGHT OF WAY MARKER (WITNESS POST) DETAILS & IRON PIN REFERENCE AND R/W MONUMENT DETAILS



IRON PIN (Within Finished Roadway Surface) PRECAST CONCRETE (Outside Finished Roadway Surface) (Inside R/W Limits) IRON PIN (Outside Finished Roadway Surface) (Outside R/W Limits)



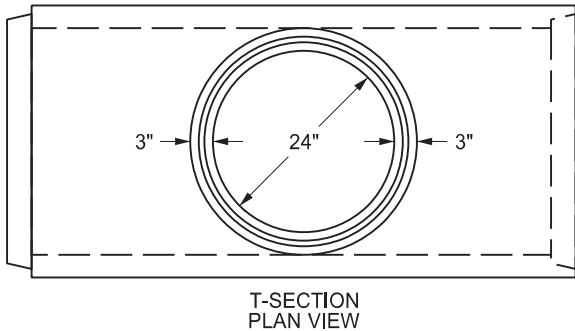
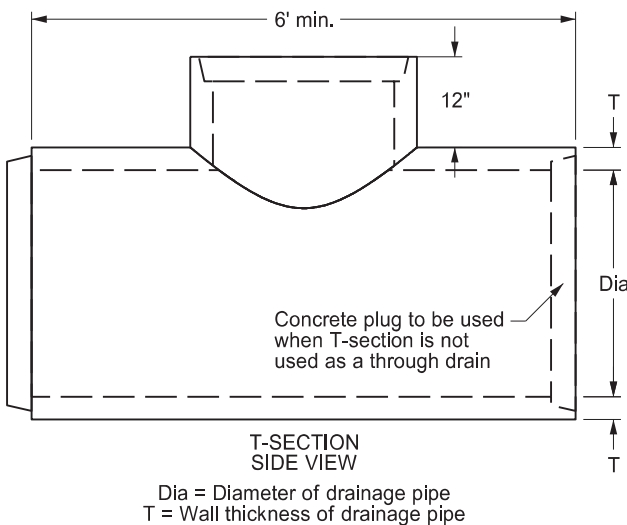
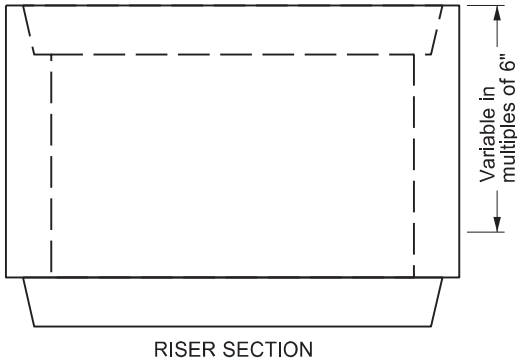
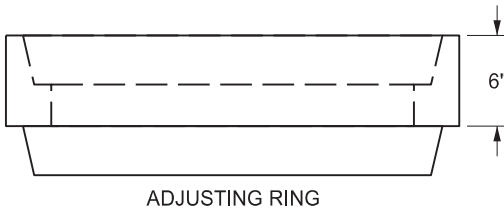
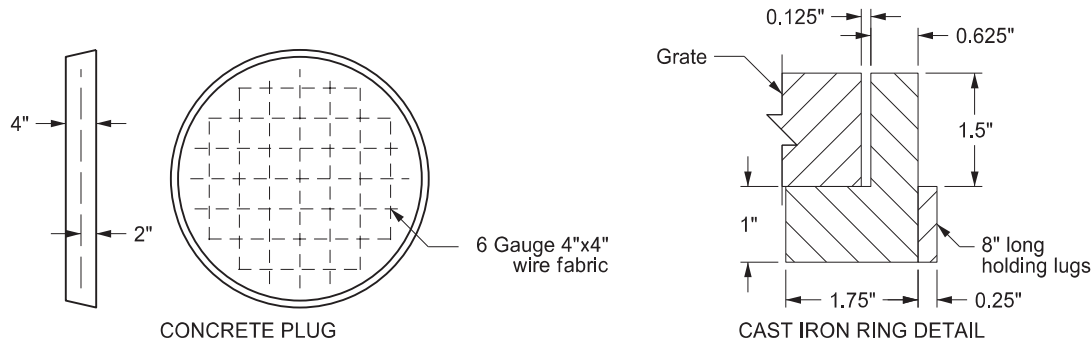
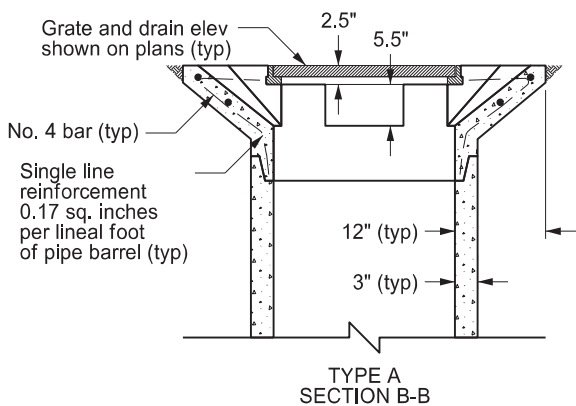
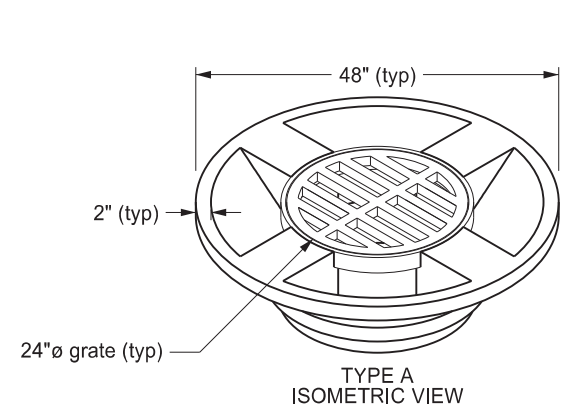
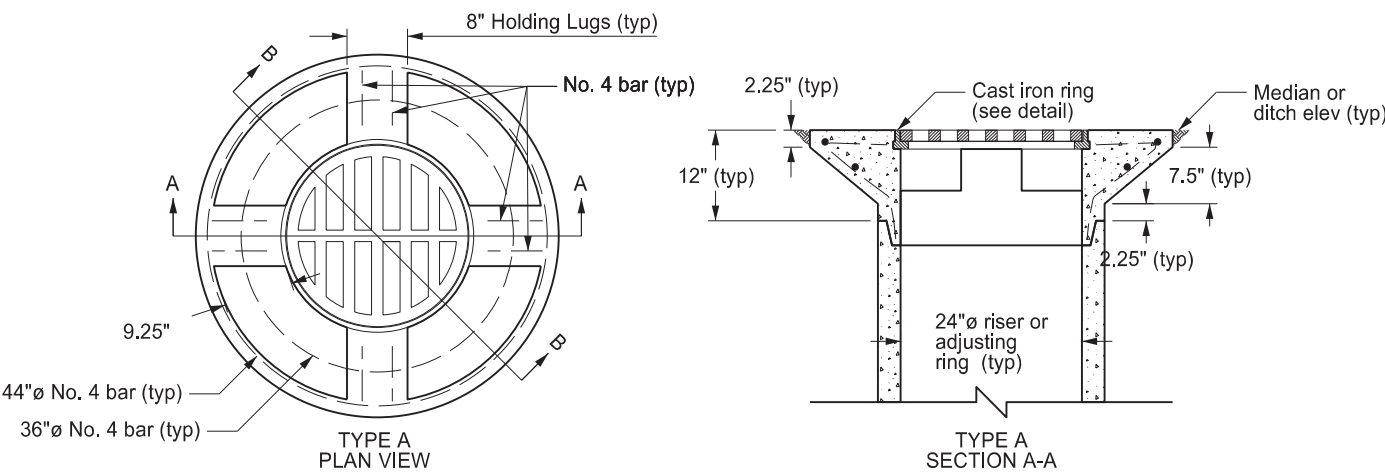
- LEGEND**
- Iron Pin Reference Monument
  - ⊙ R/W Marker (witness post)
  - Alignment Monument
  - Iron Pin R/W Monument

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-2013	
REVISIONS	
DATE	CHANGE
11/12/13	Note for SIGN DETAIL modified to meet ASTM D-4956 Type III or higher on 80 gauge 5052-H38
10/17/17	Updated to active voice.
08/27/19	New Design Engr PE Stamp.



PRECAST CONCRETE MEDIAN DRAIN

D-722-7

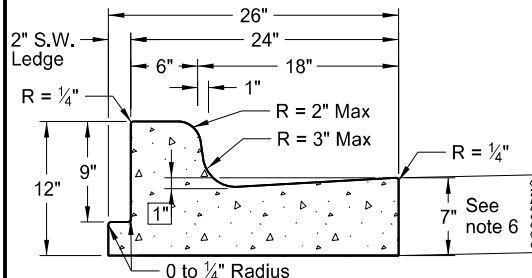
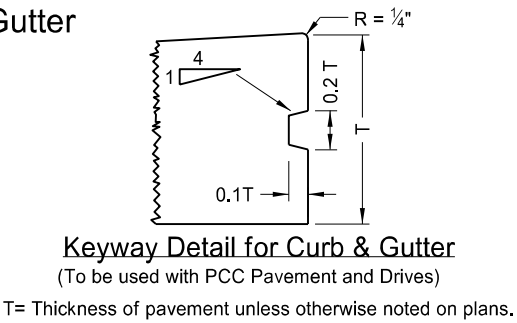
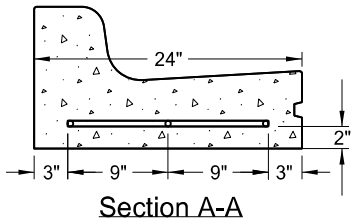
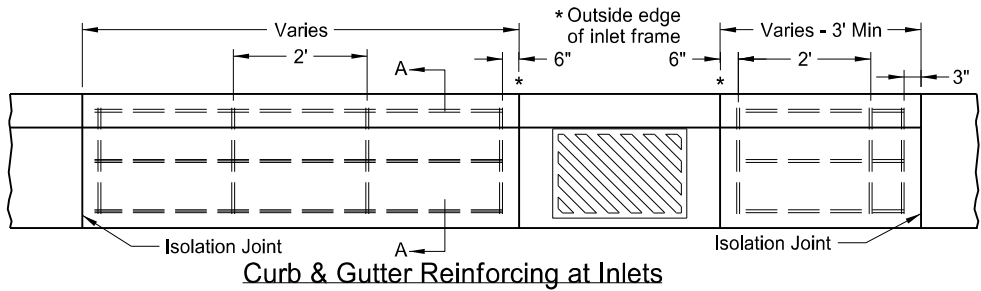


- Notes:
1. Use Neenah R-4370-23G, East Jordan 1117 grate, or equal with a minimum waterway of 0.85 SF. If modifications to the drain are required to facilitate similar castings, obtain written approval from the Engineer.
  2. Use castings manufactured in accordance with AASHTO M 306. Use castings comprised of metal that conforms to AASHTO M 105, Class 35B.
  3. Use precast concrete median drains, adjusting rings, and riser sections that have been constructed in accordance with AASHTO M 199. Use T-sections constructed in accordance with AASHTO M 170.
  4. Use only Grade 60 reinforcing steel. For adjusting rings, riser sections, and T-sections, use reinforcing that meets AASHTO M 170.
  5. Include the cost of furnishing and installing the castings and drains in the price bid for "Median Drain Precast Concrete-Type A". Include the cost of furnishing and installing the adjusting rings and riser sections shall in the price bid for "Pipe Conc Reinf 24IN (CL \_)". Include the cost of furnishing and installing the T-sections and concrete plugs in the price bid for "Pipe Conc Reinf ( \_ IN) (CL \_)".
  6. Seal all joints with rubber gaskets or with sealer approved by the engineer.

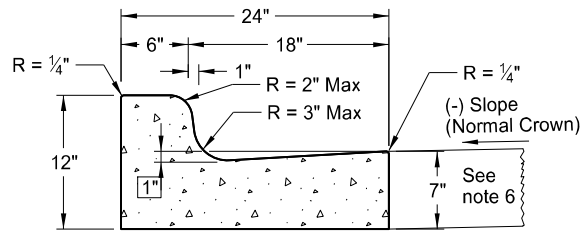
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
6-30-14	
REVISIONS	
DATE	CHANGE
8-6-21	Notes 1-5



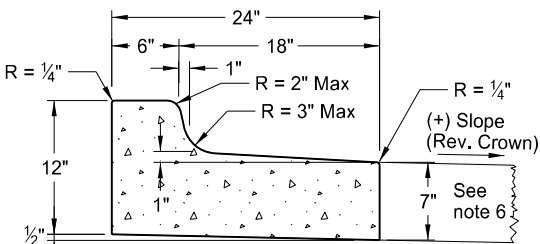
Curb & Gutter and Valley Gutter



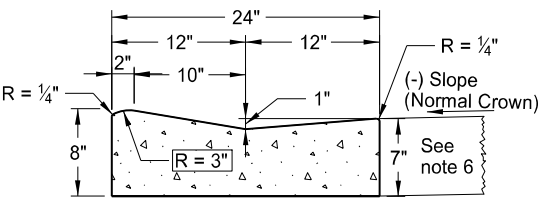
Curb & Gutter Type 1 (Sec. A & B)  
Adjacent to Concrete Sidewalk, Median,  
or Parking Lot. (Sec. A shown. See  
Sec B for additional details.)



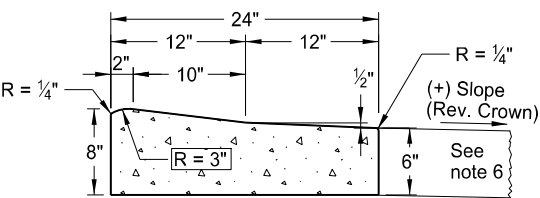
Curb & Gutter Type 1 (Sec. A)



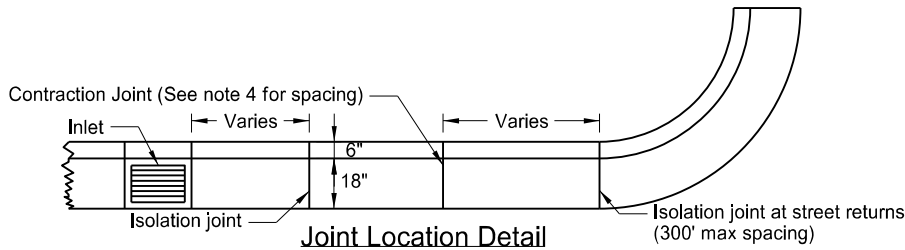
Curb & Gutter Type 1 (Sec. B)



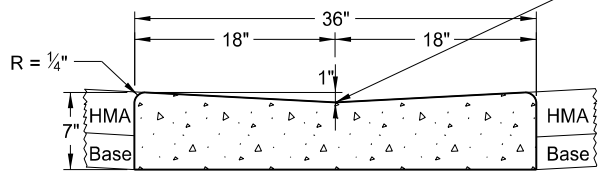
Mountable Curb & Gutter Type 1 (Sec. A)



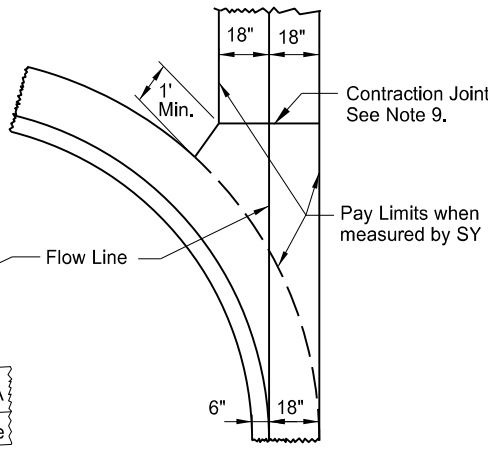
Mountable Curb & Gutter Type 1 (Sec. B)



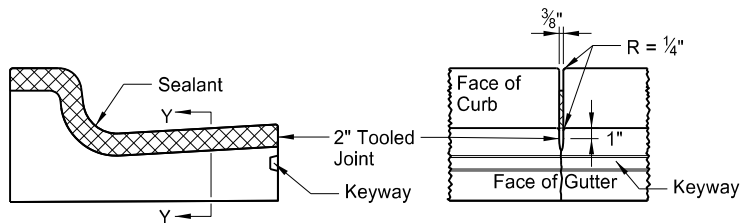
Joint Location Detail



36" Concrete Valley Gutter Detail



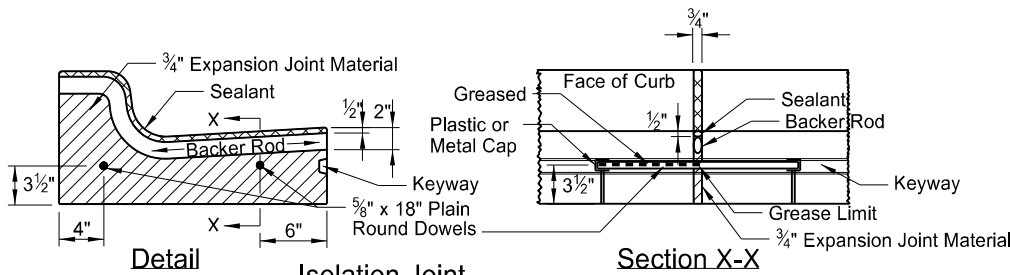
36" Concrete Valley Gutter Plan



Detail

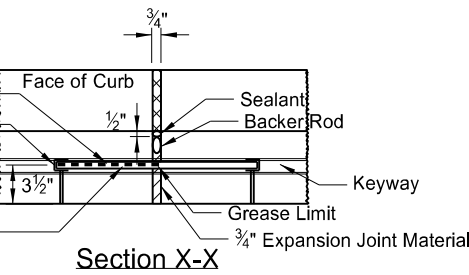
(10' Max Spacing)

Contraction Joint

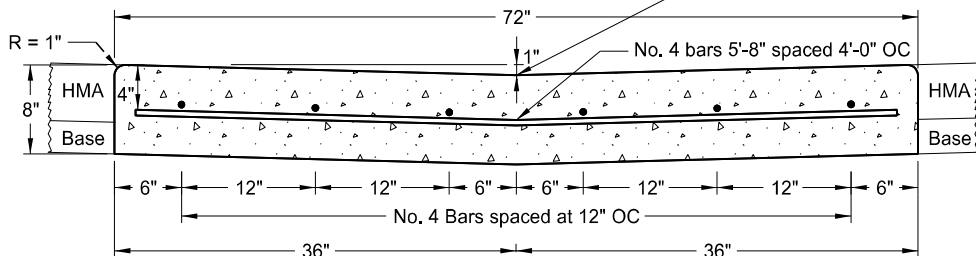


Detail

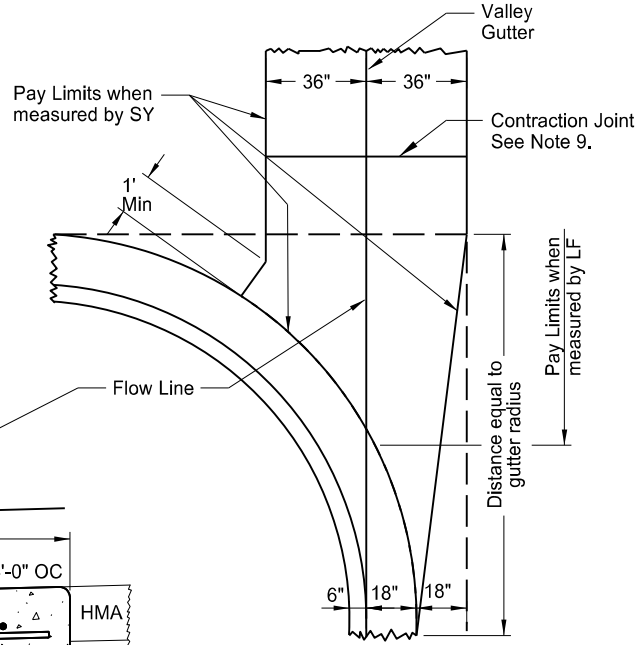
Isolation Joint



Section X-X



72" Concrete Valley Gutter Detail



72" Concrete Valley Gutter Plan

NOTES:

1. Use Curb and Gutter Type 1 (Sec. A & B). Use section "A" with (-) pavement slopes and section "B" with (+) pavement slopes.
2. Contraction Joints: Tool the Curb & Gutter 2" as shown on the contraction joint details.
3. Isolation Joints: Use  $\frac{3}{4}$ " expansion joint material for isolation joints. Form the backer rod and joint sealant opening with a pre-cut piece of wood or other material approved by the engineer. Dowel supports are not required on the second pour at a cold joint. Install plastic or metal caps and greased dowels in the cold joint for the second pour.
4. Joint Spacing: For hot mix asphalt pavements use a 10' max joint spacing for the curb and gutter with panels on each side of the inlets. For concrete pavements match the joint spacing for the curb and gutter to the pavement joint on PCC Pavements (approximately 15' spacing.)
5. Joint sealing: For contraction joint, use joint sealant that conforms to section 826.02B. Use sealant for expansion joints specified in note 3 above. Tool and install sealant in accordance with the manufacturer's recommendations.
6. Curb & Gutter-Pavement Interface: For hot mix asphalt pavement use gutter depth shown. For PCC pavements, either match gutter depth to adjacent pavement depth or construct gutter depth shown.
7. Tie curb and gutter to abutting PCC pavement with No. 4 bars, 2'-0" in length, spaced at 3'-9" centers for 15' joint spacing (maximum spacing of 4' centers).
8. On street returns and other locations where new curb and gutter ends and does not abut existing curb and gutter, taper the last two (2) feet of the curb from 6" in height to 0". Install a 1/2" premolded full depth isolation joint (the same shape as the curb and gutter just ahead of the taper) with an 18" plain round bar across the joint.
9. Valley Gutter Joints: Form, saw, or score  $\frac{1}{8}$ " min. to  $\frac{3}{8}$ " max. width contraction joints (a minimum 2" depth) at approx 10' intervals. Seal the joints with hot poured elastic type joint sealer (Section 826.02A.2 of the Standard Specifications.) Include all costs for the joint and sealant in the price bid for Valley Gutter.
10. Reinforcing at Inlets: Use #4 deformed reinforcing bars without splices. Include all costs for reinforcing bars at inlets (even inlets located on radii) in the price bid for "Curb & Gutter - Type 1" or "Curb & Gutter Mountable - Type 1." Extend reinforcement to the second joint (with rebar placed through the first joint) in cases where the 3' minimum panel length can't be obtained.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-7-2013	
REVISIONS	
DATE	CHANGE
10-17-17	Updated to active voice.
08-27-19	New Design Engr PE Stamp.
10-30-24	Revised bar size & notes.



10/30/24

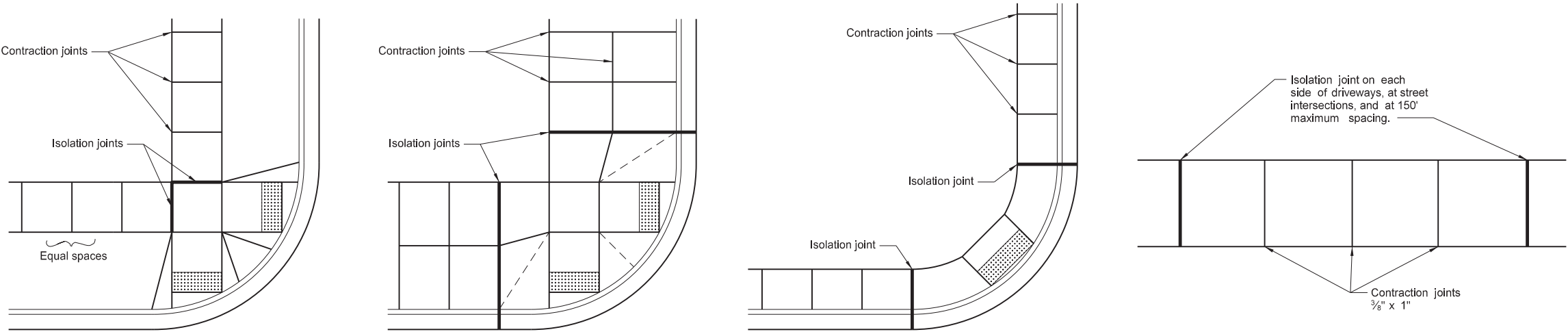
SIDEWALK

D-750-2

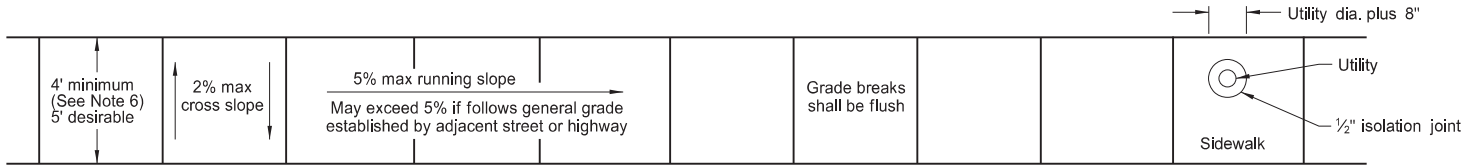
NOTES:

1. Curb ramp and detectable warning panel layouts for informational purposes only. See Standard Drawing D-750-3 for curb ramp and detectable warning panel details.
2. Joint Spacing: Vary transverse contraction joint spacing from 4' to 6' to create approximate square panels.  
  
Use longitudinal contraction joints when sidewalk width is 8' or greater, and space at half the sidewalk width.  
  
Saw or groove contraction joints to a minimum depth of 1/3 the depth of the concrete.  
  
When sidewalk is adjacent to curb & gutter, vary the sidewalk joint spacing to match curb & gutter joints.  
  
Use isolation joints between separate concrete pours, or between old and new concrete.
3. Include all costs for labor, equipment, and material necessary to construct contraction and isolation joints in the price bid for sidewalk concrete.
4. Use 4" sidewalk concrete thickness unless otherwise specified.
5. Use 4" base material thickness unless otherwise specified. Include all costs for labor and materials necessary to place the base material in the price bid for "Salvage Base Course" or "Aggregate Base Course CL 5."  
  
Modify existing ground slope with landscaping as needed. If not possible, such as adjacent buildings, use a vertical curb as shown in the detail below. The Engineer will measure curb at the unit price bid for "Curb - Type I" per lineal foot.
6. Sidewalk Width & Grade: Provide a continuous 4' min clear width pedestrian access route with max 2% concrete cross slope, excluding flares. The width of the curb cannot be counted as part of the pedestrian access route.

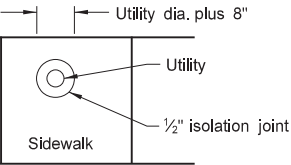
When clear width of pedestrian access routes is less than 5.0', provide passing spaces at a maximum of 200' with a minimum size of 5.0' by 5.0'.



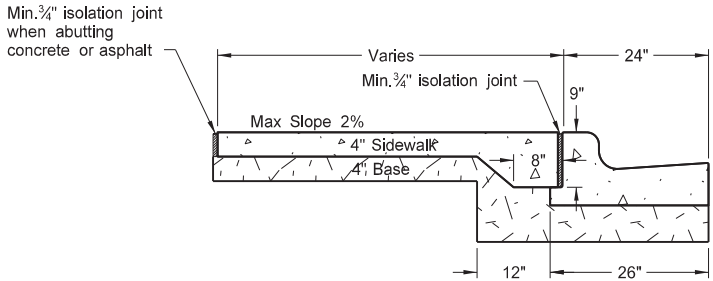
Typical Joint Layouts



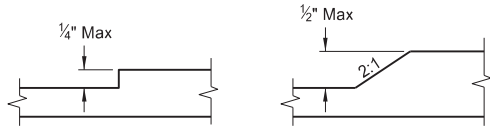
Sidewalk Width and Grade



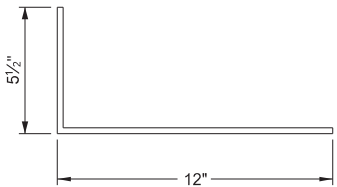
Utility Blockout



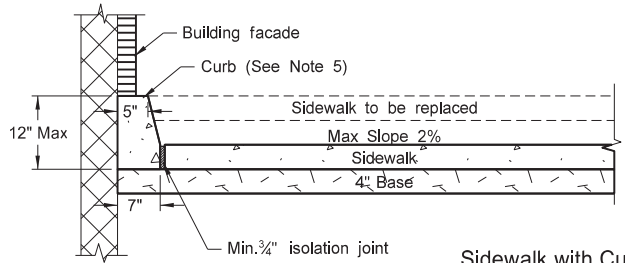
Sidewalk Detail  
(Installed adjacent to curb and gutter)



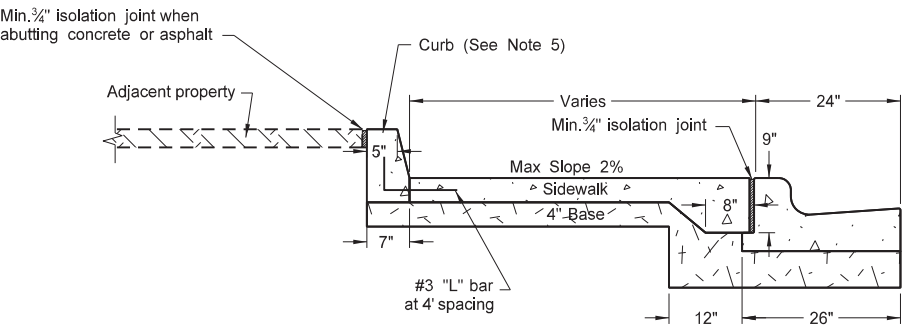
Vertical Discontinuities  
(As needed for utility covers, vaults, grating, etc..)



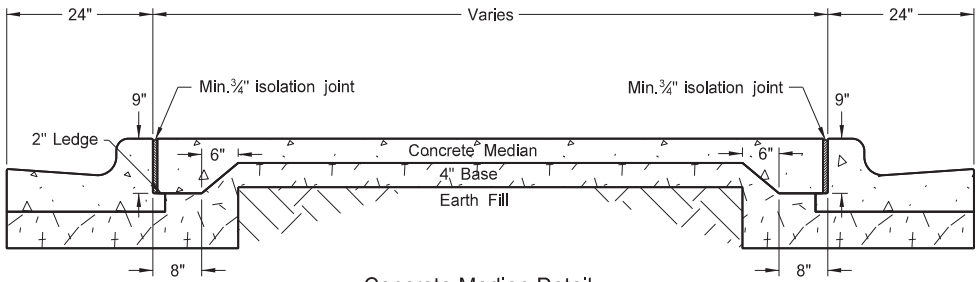
"L" Bar Detail  
#3 Bar



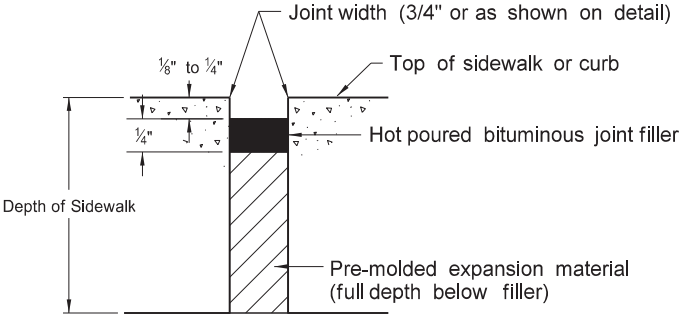
Sidewalk with Curb Detail  
(Building face application)



Sidewalk with Curb Detail  
(Adjacent property application)



Concrete Median Detail



Typical Isolation Joint Seal  
(longitudinal and transverse)

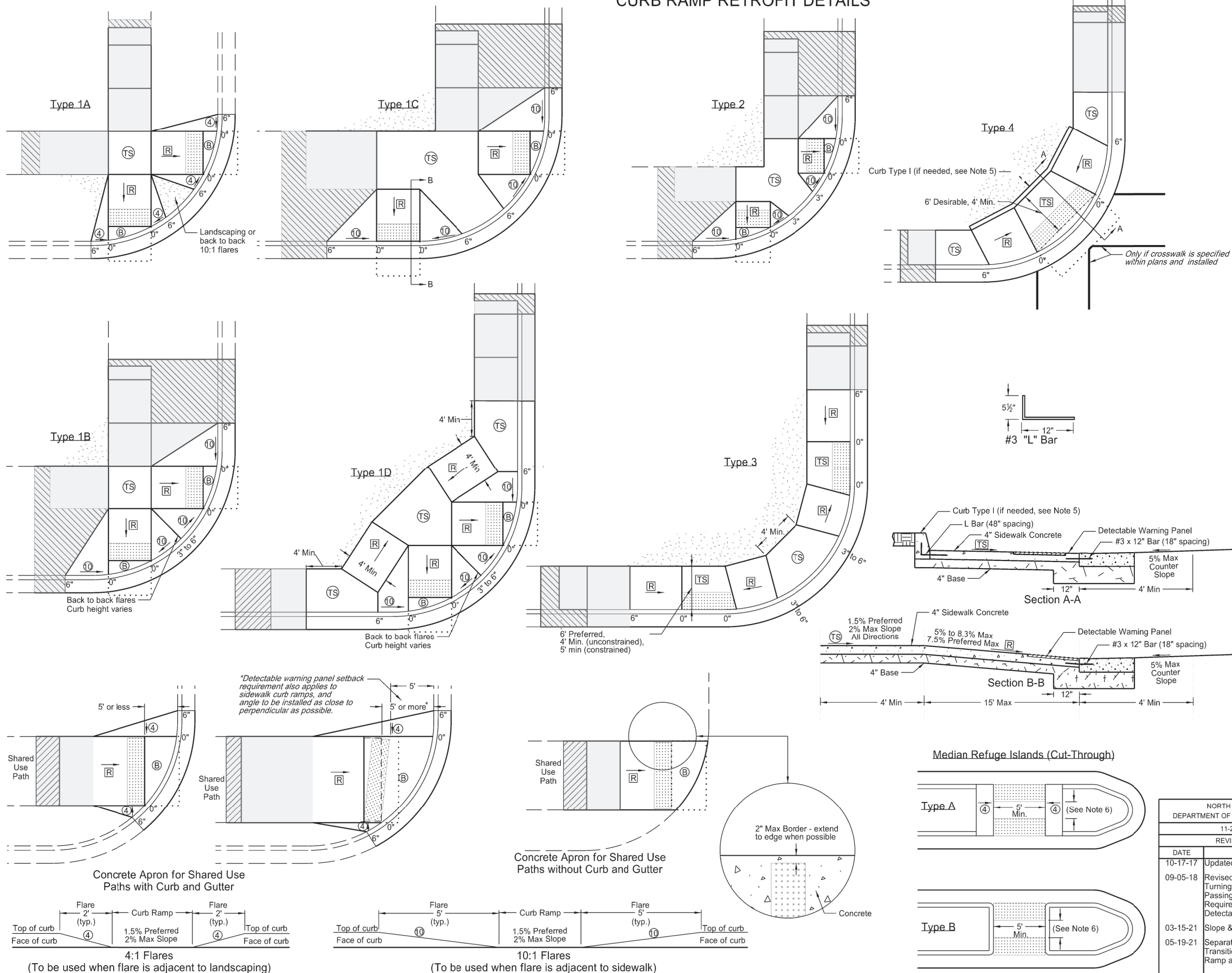
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-26-13	
REVISIONS	
DATE	CHANGE
10-17-17	Updated to active voice.
09-05-18	Added sidewalk details for width & grade & passing lane requirements.
08-27-19	New Design Engineer PE Stamp.
08-09-24	Electronic Stamp/Signature.



08/09/24

CURB RAMP RETROFIT DETAILS

D-750-3



- NOTES:
- Ramp width is the useable portion of the ramp, excluding flares. Match curb ramp width to Existing Pedestrian Facility (EPF) width (4' minimum or 5' for island ramps.) Match ramp width to existing shared use path width. Maximum ramp length is 15'.
  - Provide turning space with desirable 5' x 5' size or larger and minimum 4' x 4' unconstrained size, for any change of direction. Provide landing 5' long x width of path at the bottom and top of parallel ramps and at the top of perpendicular ramps. Turning spaces and Landings may overlap.
  - Match detectable warning panel width to ramp width. Radial panels are allowed. Place detectable warning panel within the lower turning space.
  - Provide a continuous 4' minimum width EPF with 1.5% preferred cross slope and max 2% constructed cross slope.
  - Modify existing ground slope with landscaping, as needed. If not possible, use a vertical curb as detailed on Standard D-750-2. The Engineer will measure curb at the unit price bid for "Curb - Type 1" per lineal foot.
  - Islands: If the profile of the island curb ramp is 2% or less, provide a minimum distance of 2' between warning panels. If the profile of the island curb ramp is steeper than 2%, provide a turning space between the ramps.
  - Provide generally planar vertical alignments. Provide grade breaks, perpendicular to the direction of the pedestrian travel, at the top and bottom of curb ramps (1.5% preferred, 2% max constructed cross slope).
  - See Curb Ramp Retrofit Transition Details Standard D-750-4 for additional information. Also See PROWAG for full compliance in the curb ramp area.
  - Grade transitions shall be flush.

LEGEND:

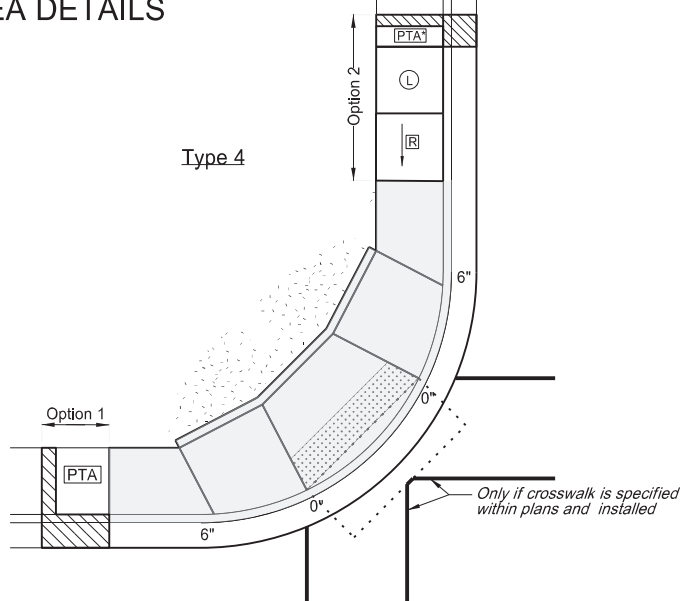
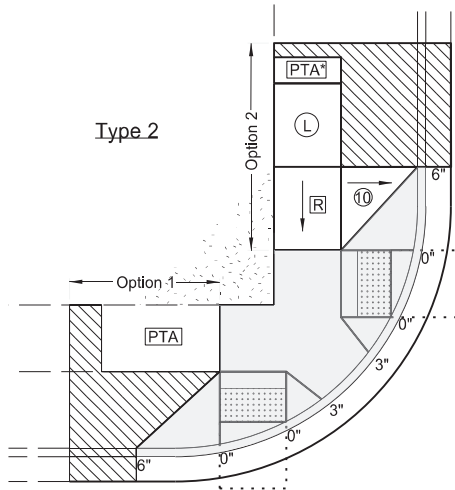
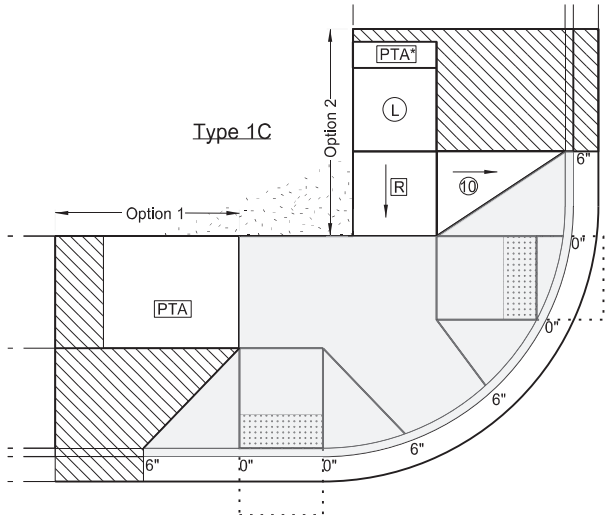
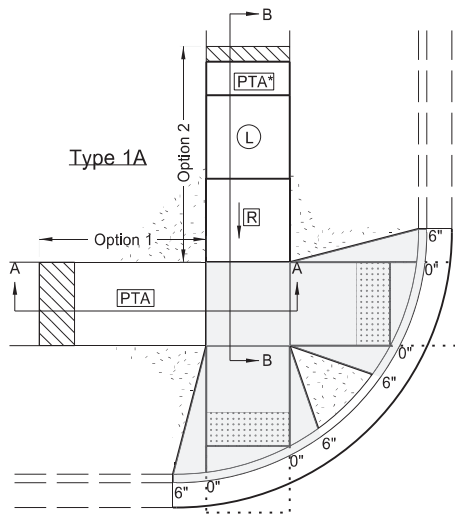
- Detachable Warning Panel.
- Landscaping.
- Transitional tie-in to nearest joint, if needed.
- Curb Ramp Retrofit Transitional Area (See Standard Drawing D750-4)
- 4' long x width of EPF or 4' minimum Clear space outside traffic lanes of travel. 1.5% preferred cross slope 2% maximum cross slope 4.7% preferred running and counter slope 5% maximum running and counter slope
- TS : Turning Space Use at top of ramp or when changing directions. 1.5% preferred slope (2% maximum) all directions.
- R : Preferred Ramp Grade = 5% to 7.5%. Maximum Constructed Grade = 8.3%. Preferred Cross Slope = 1.5%. Maximum Constructed Cross Slope = 2%.
- B : 1.5% preferred cross slope 2% maximum constructed cross slope running slope consistent with the EPF 4.7% preferred max counter slope 5.0% max constructed counter slope
- 10 : 10:1 maximum constructed slope.
- 4 : 4:1 maximum constructed slope.
- 0", 3", or 6" : Curb Height.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-26-13 REVISIONS	
DATE	CHANGE
10-17-17	Updated to active voice.
09-05-18	Revised Notes, Revision for Turning Space, Added Passing Space Requirements, Turned Detectable Warning Panel
03-15-21	Slope & other clarifications.
05-19-21	Separate Curb Ramp Transition Area from Curb Ramp area

KIRK J. HOFF  
REGISTERED  
PROFESSIONAL  
PE-4683  
ENGINEER  
NORTH DAKOTA  
05 19 2021

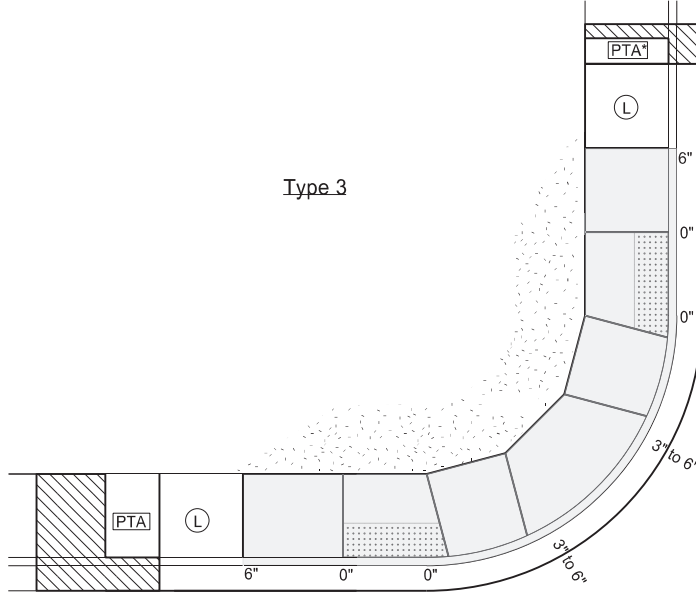
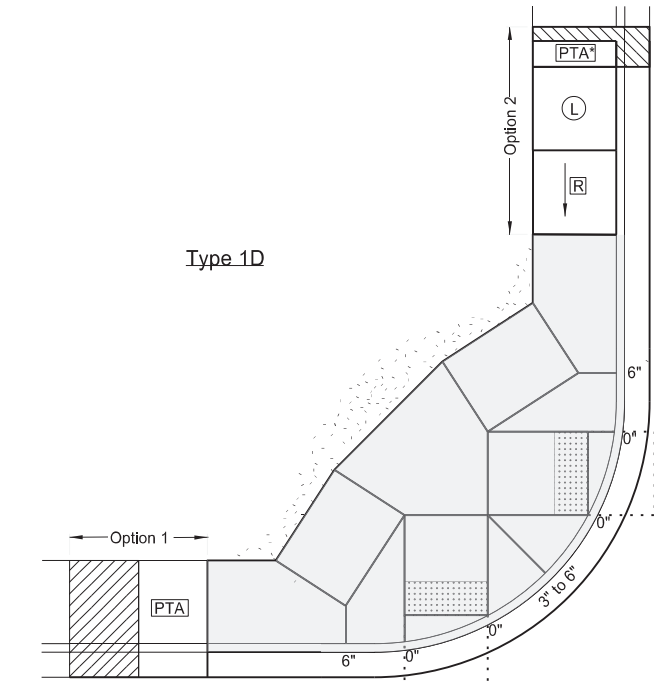
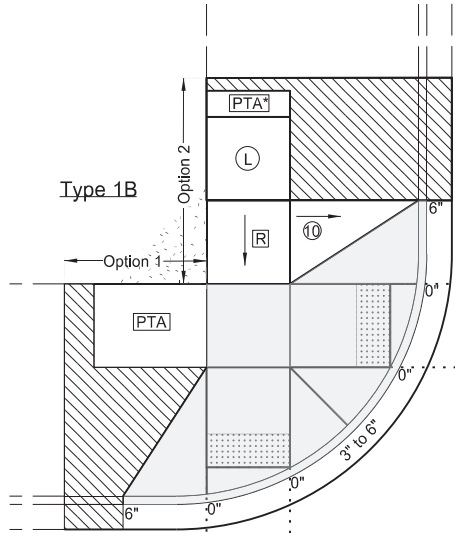
CURB RAMP RETROFIT TRANSITIONAL AREA DETAILS

D-750-4



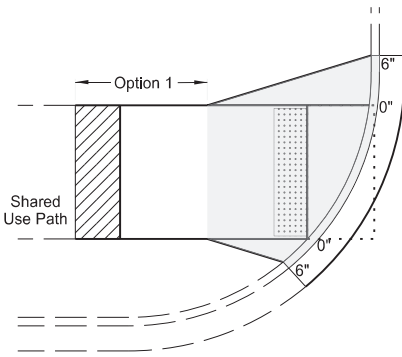
NOTES:

1. Curb Ramp Transitional Areas are to transition from the Curb Ramp area into the Existing Pedestrian Facility (EPF). Each layout shows example transitions. Use any combination for transitions from the Ramp Area into the EPF that allows for similar or gentler slopes to that of the existing condition, yet transitions in the shortest distance possible. In some cases, if grades allow, the Ramp area can immediately transition into the EPF and no transitional area is needed.
  2. Option 1: Use this transition when existing running slope grades are less than 5%. Transition from the ramp area to the EPF using the Pedestrian Access Transition Area (PTA) transition rates and in less than 20 feet.
  3. Option 2: Use this transition when existing running slopes are greater than 5% and option 1 is not able to be met.
- Add a ramp and a landing immediately after the ramp area. Then transition from the compliant landing into the EPF using the PTA rates (preferred), or in less than 15 feet (which ever is shorter).
4. Transitional Areas for Shared Use Paths can be concrete or asphalt.
  5. See Curb Ramp Retrofit Details Standard D-750-3 for additional information.

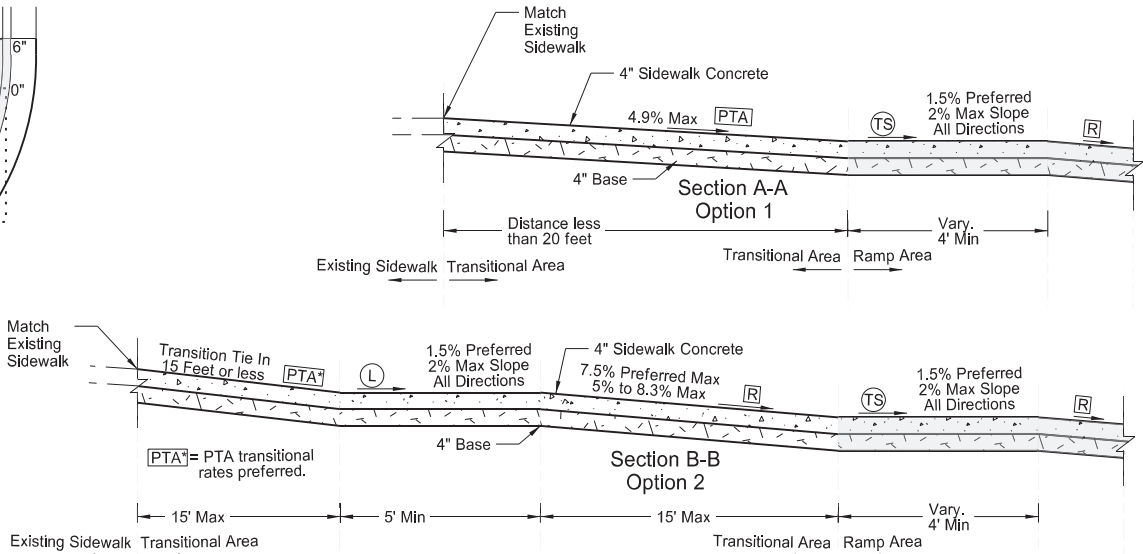
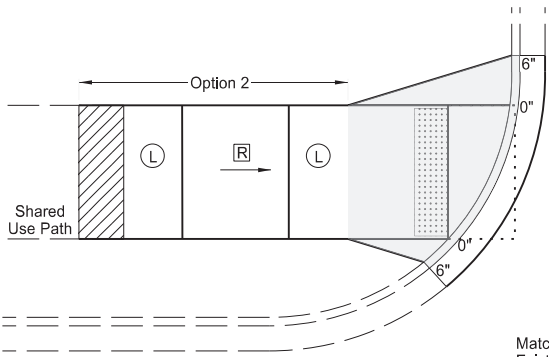


LEGEND:

- : Detectable Warning Panel.
- : Landscaping.
- : Transitional tie-in to nearest joint, if needed.
- : Curb Ramp Retrofit Area (See Standard Drawing D750-3)
- : 4' long x width of EPF or 4' minimum Clear space outside traffic lanes of travel. 1.5% preferred cross slope 2% maximum cross slope 4.7% preferred running slope 5% maximum running slope
- : Pedestrian Access Transition Area Running Slope less than 4.9%. Transition Cross Section at 1/2 percent per foot from the from Ramp Area to EPF.
- : Turning Space/Landing Use at top of ramp or when changing directions. 1.5% preferred slope (2% maximum) all directions.
- : Preferred Ramp Grade = 5% to 7.5%. Maximum Constructed Grade = 8.3%. Preferred Cross Slope = 1.5%. Maximum Constructed Cross Slope = 2% Maximum Length = 15 feet
- : 10:1 maximum constructed slope.
- : 4:1 maximum constructed slope.
- 0", 3", or 6" : Curb Height.



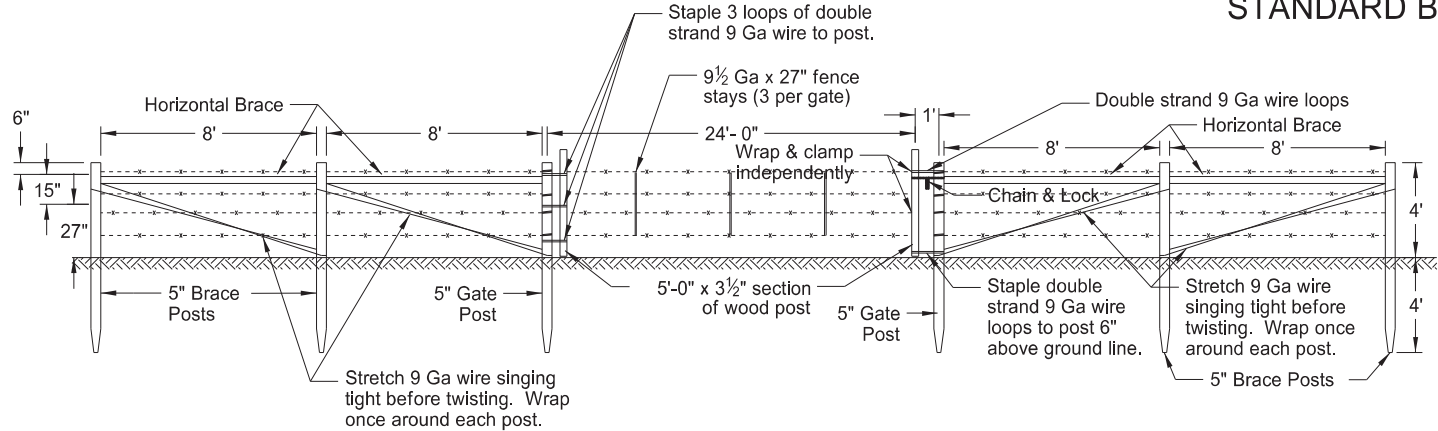
Transition Areas for Shared Use Paths



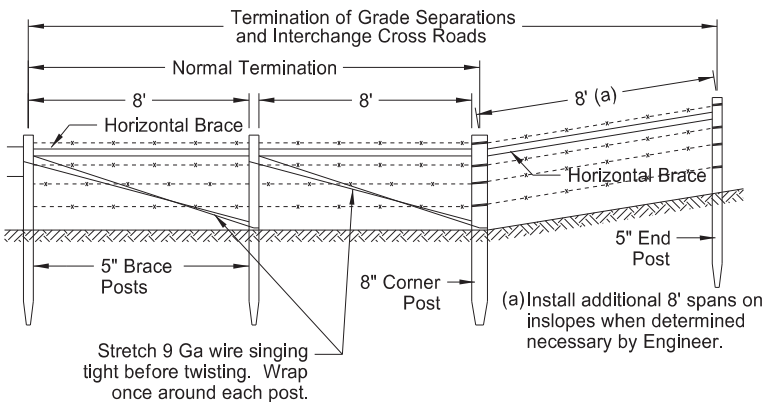
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
05-19-21	
REVISIONS	
DATE	CHANGE



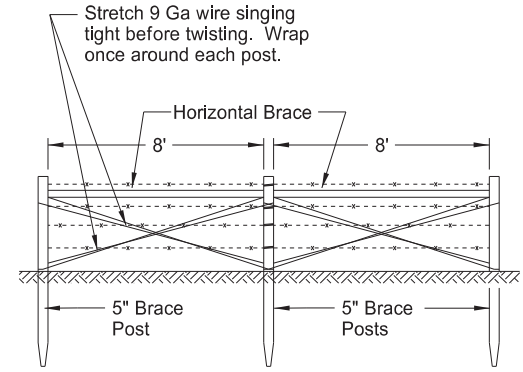
STANDARD BARBED WIRE FENCE



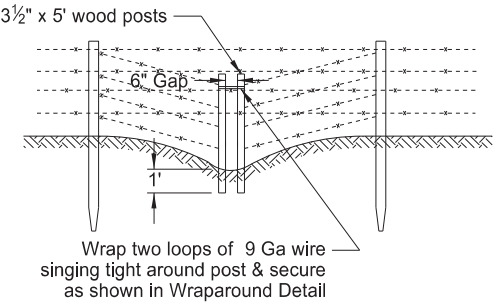
VEHICLE GATE



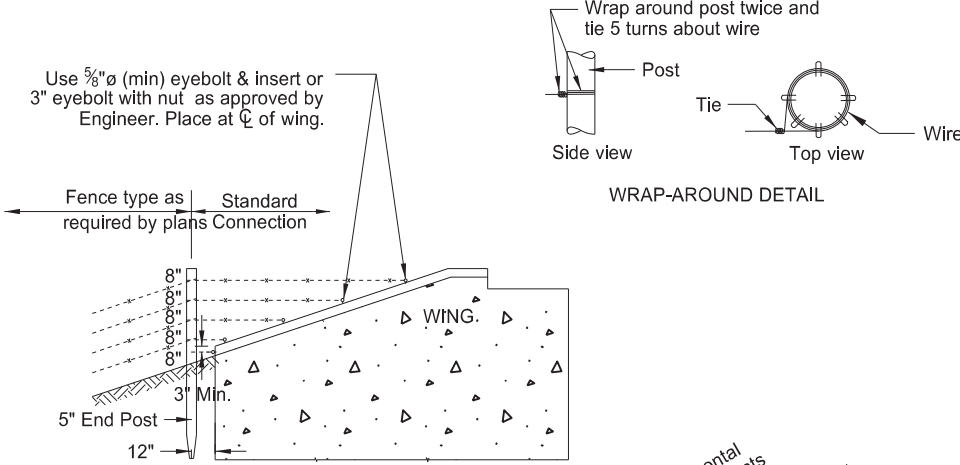
FENCE TERMINAL



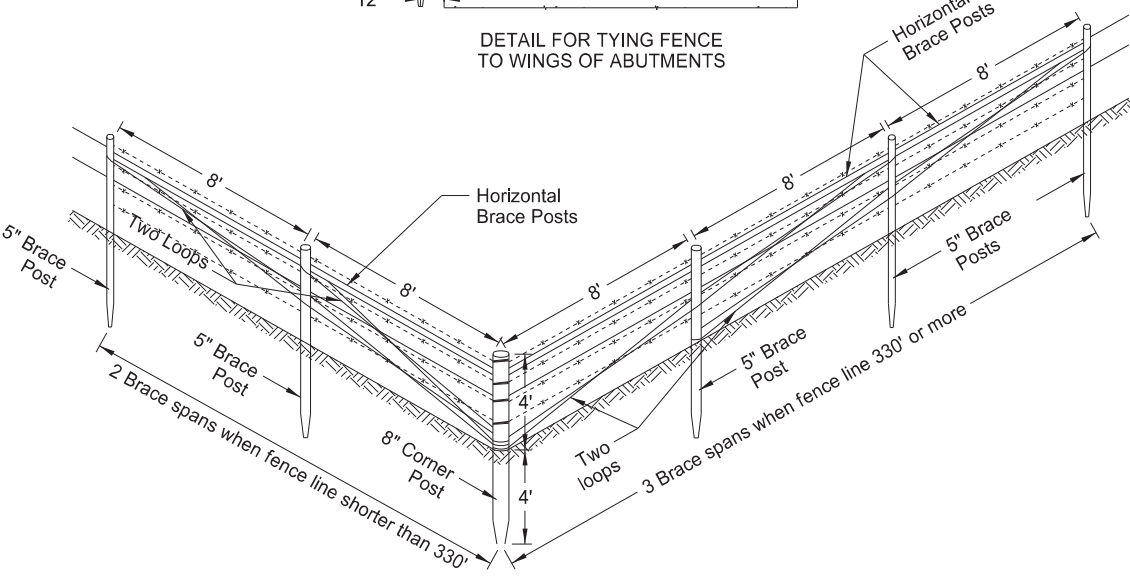
DOUBLE BRACE ASSEMBLY



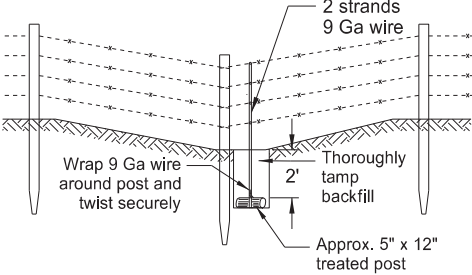
BREAK-AWAY FENCE FOR NARROW DEPRESSIONS SUBJECT TO FLOODING



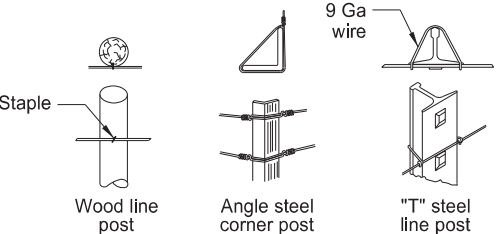
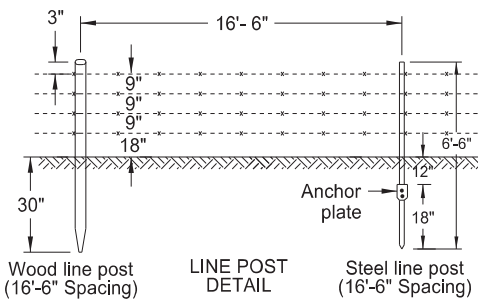
DETAIL FOR TYING FENCE TO WINGS OF ABUTMENTS



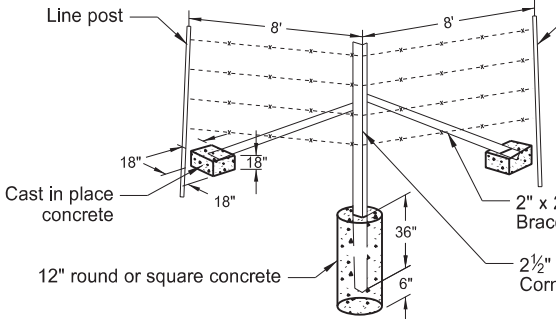
CORNER ASSEMBLY



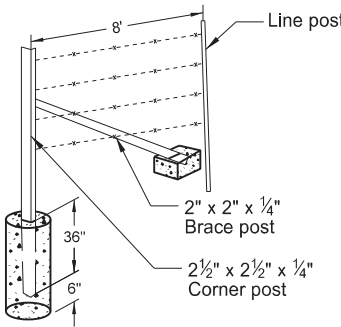
DETAIL FOR ANCHORING FENCES IN DEPRESSIONS\*  
\*Determine locations in the field and include in price bid for fencing. Use other methods of anchoring fence if approved by the Engineer.



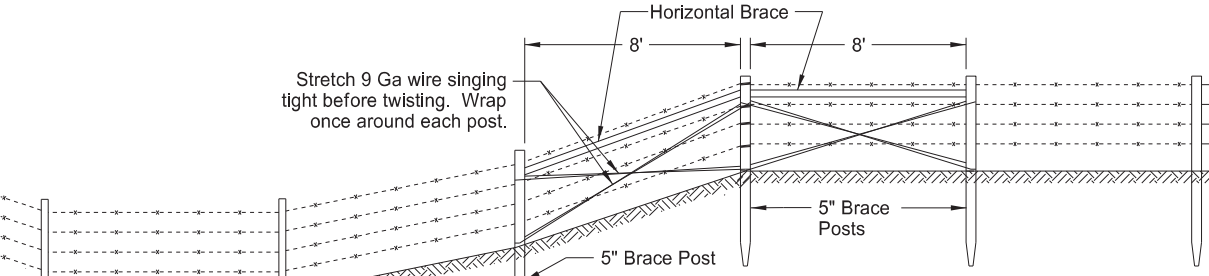
FASTENING TO POSTS



CORNER AND DOUBLE BRACE ASSEMBLY STEEL POSTS



FENCE TERMINAL STEEL POSTS



FENCING FOR WIDE DEPRESSIONS  
Use double brace installation, as shown, on opposite side of depression.  
Decrease line post spacing as needed due to terrain.

NOTES

1. No deduction in measured pay length of fence made for gates, corner assemblies, double brace assemblies, fence terminals, or depression fencing. Include all costs for abutment fencing in the price bid for fencing bid items.
2. Install double brace assemblies at locations shown on the plans or established by the Engineer. Place adjacent fence terminals, corner assemblies, or double brace assemblies at a maximum spacing of 1,320 feet.
3. Include all costs of furnishing and installing inserts and eyebolts in the unit price bid for fencing bid items. Use eyebolts galvanized according to AASHTO designation M-30; inserts of corrosion resistant material do not require galvanization. Use concrete inserts capable of developing the full strength of the 5/8" diameter threaded eyebolt, when installed in concrete.
4. Determine post type used, either wood or steel, unless otherwise specified in the plans.
5. Include the cost of bracing at vehicle gates in the price bid for "Vehicle Gate."

POST SIZES					
USE OF POST	TREATED WOOD		STEEL		
	Post dia.	Post length	Post length	Post wt. Lbs./Ft.	Anchor wt. Lbs.
Line post	3 1/2"	6'-6"	6'-6"	1.33	0.67
Corner post	8"	8'	7'	4.10	(Conc.)
End post	5"	8'			
Brace post	5"	8'	7'	3.19	(Conc.)
Gate post	5"	8'			
Horizontal brace	4"	8'	As approved by the Engineer		

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-2-10	
REVISIONS	
DATE	CHANGE
10-02-12	Notes, steel assemblies/posts.
11-25-13	Revised Vehicle Gate.
10-17-17	Updated to active voice.
02-23-23	Revised post spacing/brace size.



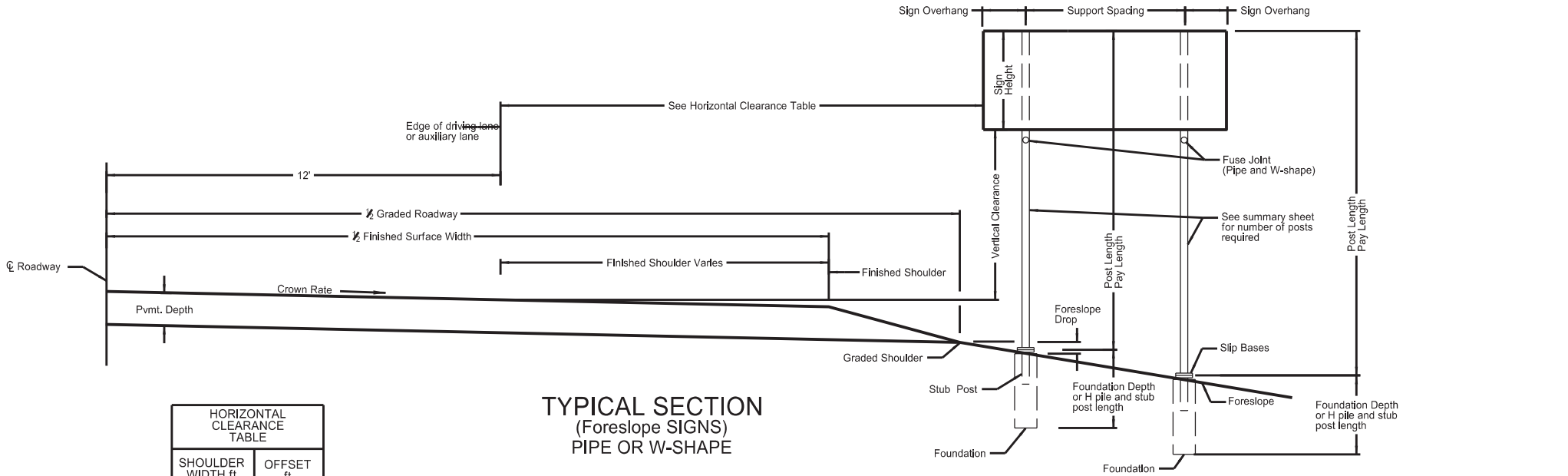
PIPE OR W-SHAPE ASSEMBLY DETAILS

D-754-1

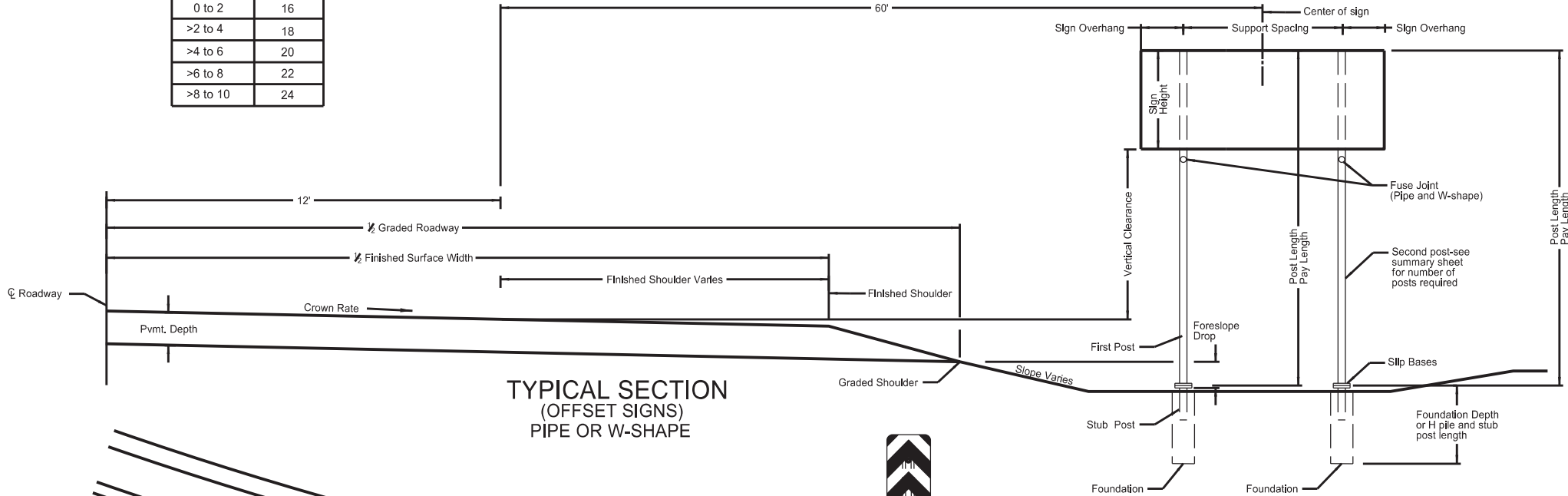
NOTES:  
MINIMUM VERTICAL CLEARANCE:  
Install signs with a minimum 5 foot vertical clearance from bottom of sign to top edge of the driving lane or auxiliary lane in rural locations. Provide a minimum 7 foot vertical clearance where parking or pedestrian movements occur. Install signs with a minimum 7 foot vertical clearance on freeways, expressways, and multi-lane conventional roadways.

A vertical clearance of 5 feet is acceptable where signs are placed a minimum of 30 feet from the edge of the traveled way.

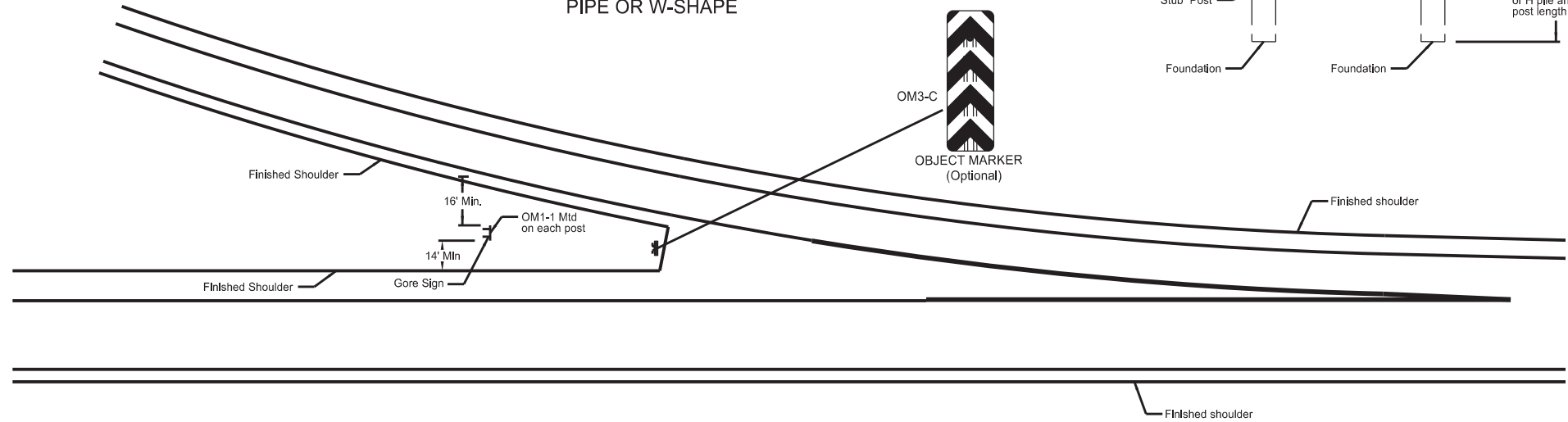
Place signs a maximum of 6" above the vertical clearance specified above.



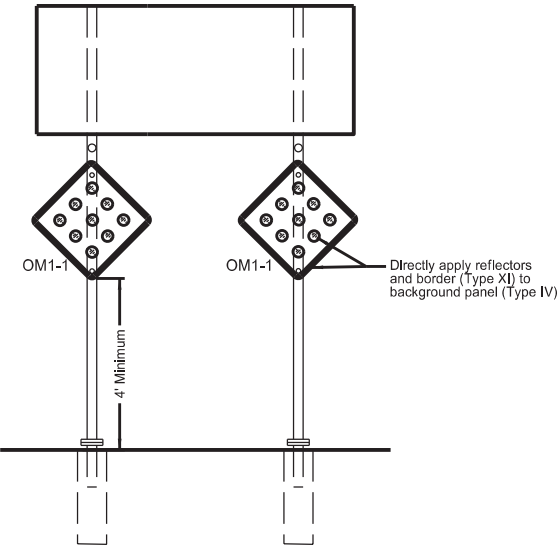
TYPICAL SECTION  
(FORESLOPE SIGNS)  
PIPE OR W-SHAPE



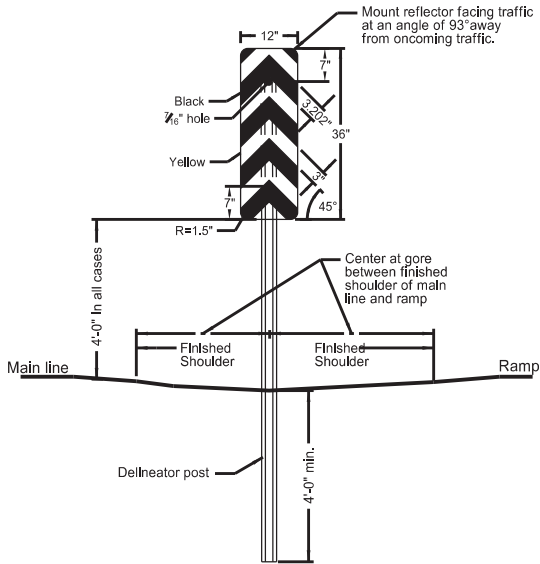
TYPICAL SECTION  
(OFFSET SIGNS)  
PIPE OR W-SHAPE



EXIT RAMP  
GORE SIGN PLACEMENT



GORE SIGN OBJECT MARKER INSTALLATION



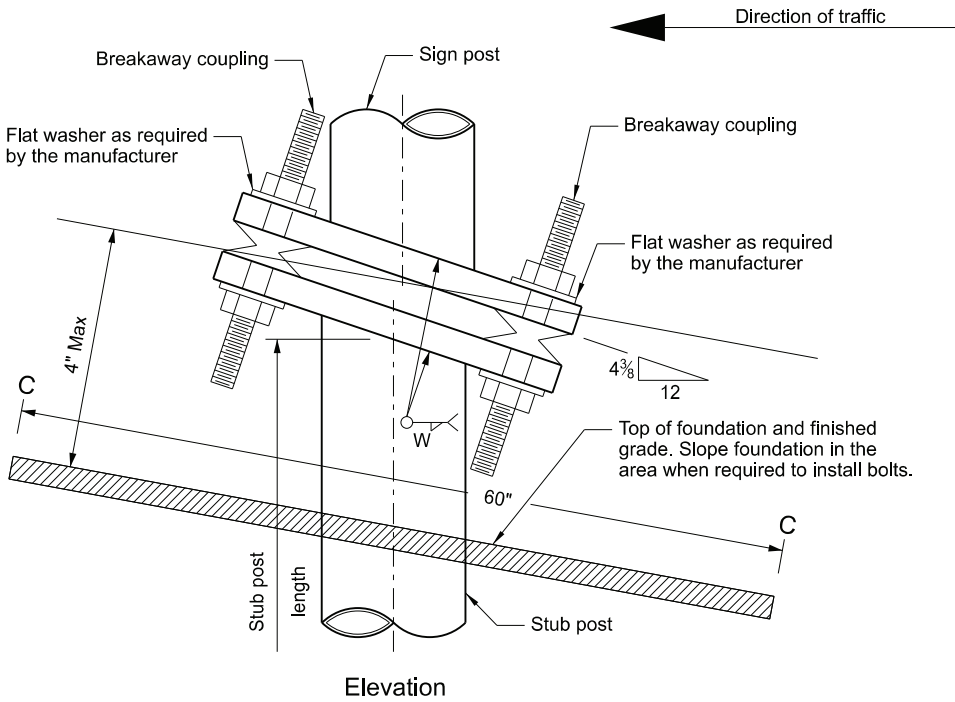
OBJECT MARKER INSTALLATION

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
7-18-14	Modify notes and update reflective sheeting for object marker. Add correct section number for object marker post.
8-30-18	Updated notes to active voice.
11-26-21	Revised Object Marker signs.

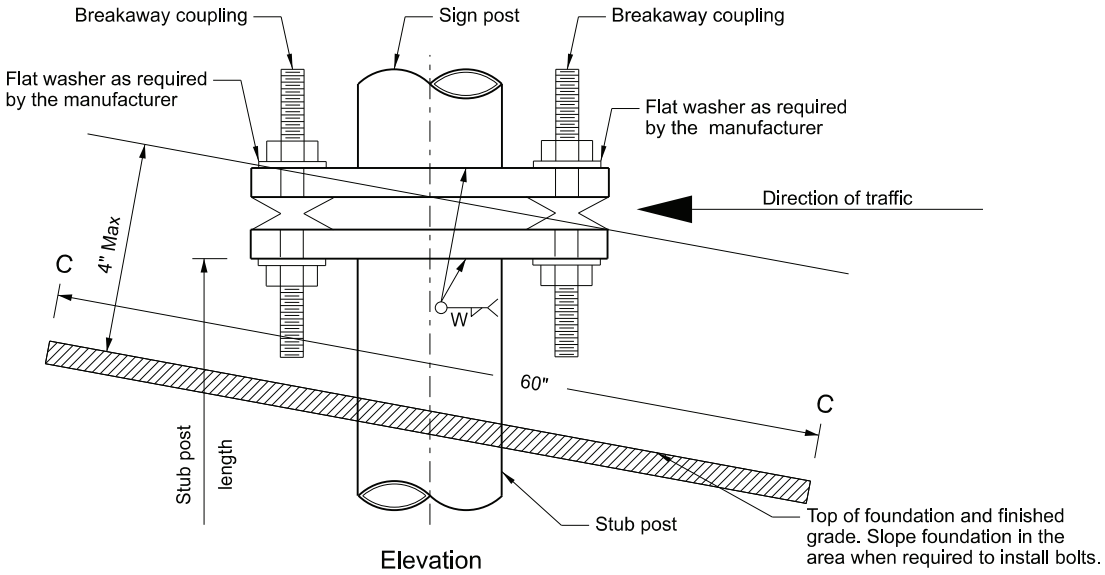


11/26/21

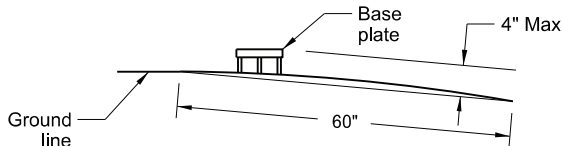
Breakaway Coupler System  
for Standard Pipe  
Stub Post



Single Post Sign and Stub Post  
Type A

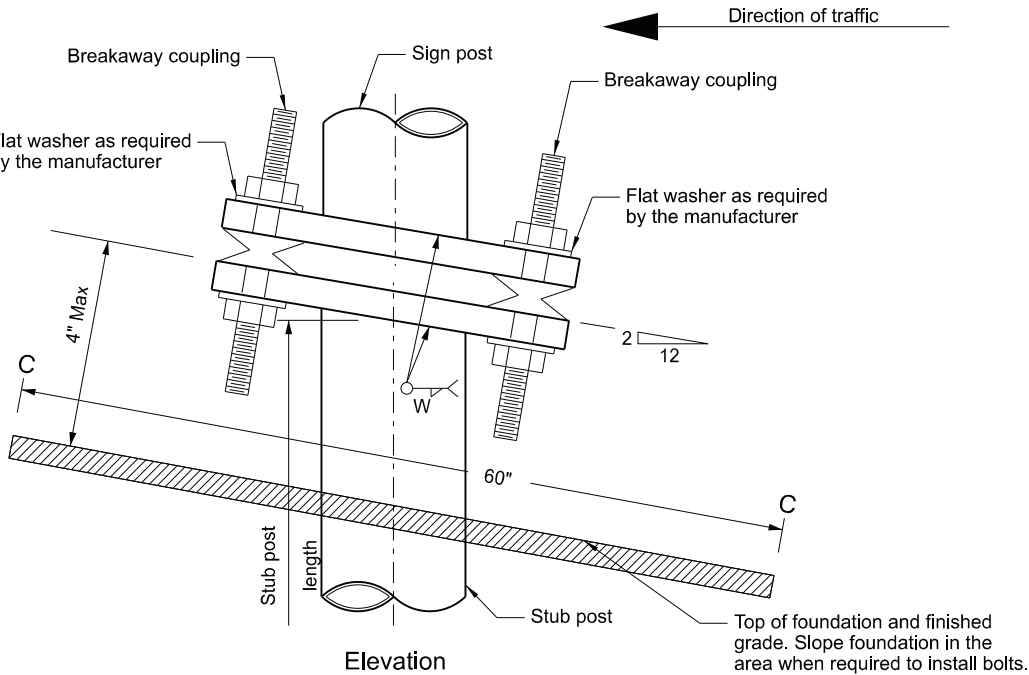


Two or More Post Sign and Stub Post  
For two post signs with 8' or more post spacing  
and all three or more post signs  
Type C



Section C - C

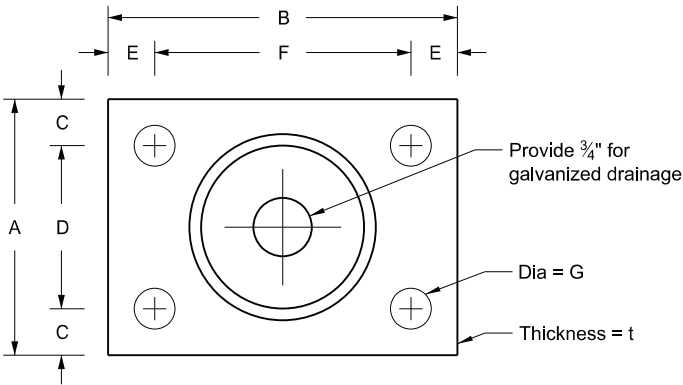
Max. protection of the stub post is 4" above a 60" chord aligned radially to the center line of the highway and connecting any point, within the length of the chord, on the ground surface on one side of the support to a point in the ground surface on the other side.



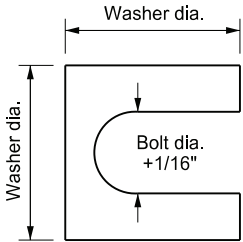
Two Post Sign and Stub Post  
For signs with less than 8' post spacing  
Type B

Notes:

1. In lieu of the breakaway base system on standards D-754-3 and D-754-4, use a breakaway coupler system. Manufacture the breakaway coupler system from material meeting the requirements of ASTM A325 fasteners with the special requirements as specified by DENT BREAKAWAY IND., INC. which meets the requirements of NCHRP Report 350.
2. Fuse Joint Cuts - For steel posts cut after galvanizing, either galvanize cut after fabrication, or treat cut surface in accordance with ASTM A780. Aluminum posts need no treatment.
3. Shim as required to plumb post.
4. Tighten all bolts the maximum possible with 12" to 15" wrench.



Plan Base Plate



Shim Detail

Furnish 2 - .012"± thick and 2 - .032"± thick shims per post. Fabricate shims from brass shim stock or strip conforming to ASTM B36.

Dimension  Nom. Pipe Size	Base Table Data										
	Breakaway Coupling	A	B	C	D	E	F	G	t	W	Stub Post Length
Steel											
3½"	½" x 4 ½"	5½"	8⅜"	1⅜"	3⅞"	1⅜"	6¾"	9⅛"	¾"	⅜"	1'-6"
4"	⅝" x 4 ½"	5½"	8¾"	1"	3½"	1"	6¾"	1⅛"	¾"	⅝"	1'-6"
5"	¾" x 5¼"	6½"	10"	1⅞"	4¼"	1⅞"	7¾"	1⅜"	1"	⅞"	2'-0"
6"	1" x 5¼"	7½"	11¾"	1⅜"	4¾"	1⅜"	9"	1⅛"	1¼"	⅞"	2'-0"
8"	1" x 5¼"	9½"	13¼"	1⅜"	6¾"	1⅜"	10½"	1⅛"	1¼"	⅞"	2'-6"
10"	1" x 5½"	11¾"	15¼"	1⅝"	9"	1⅝"	12½"	1⅛"	1¼"	½"	3'-0"
12"	1" x 7"	13¾"	18"	1⅝"	10 ½"	1⅝"	14¾"	1⅛"	1½"	½"	3'-0"
Aluminum											
3½"	½" x 4 ½"	5½"	8⅜"	1⅜"	3⅞"	1⅜"	6¾"	9⅛"	¾"	⅜"	1'-6"
4"	⅝" x 4 ½"	5½"	8¾"	1"	3½"	1"	6¾"	1⅛"	1"	⅞"	1'-6"
5"	¾" x 5¼"	6½"	10"	1⅞"	4¼"	1⅞"	7¾"	1⅜"	1"	½"	2'-0"
6"	1" x 5¼"	7½"	11¾"	1⅜"	4¾"	1⅜"	9"	1⅛"	1¼"	½"	2'-0"
8"	1" x 5¼"	9½"	13¼"	1⅜"	6¾"	1⅜"	10½"	1⅛"	1¼"	½"	2'-6"
10"	1" x 5¼"	11¾"	15¼"	1⅝"	9"	1⅝"	12½"	1⅛"	1½"	⅞"	3'-0"
12"	1" x 7"	13¾"	18"	1⅝"	10¼"	1⅝"	14¾"	1⅛"	1¾"	1⅛"	3'-0"

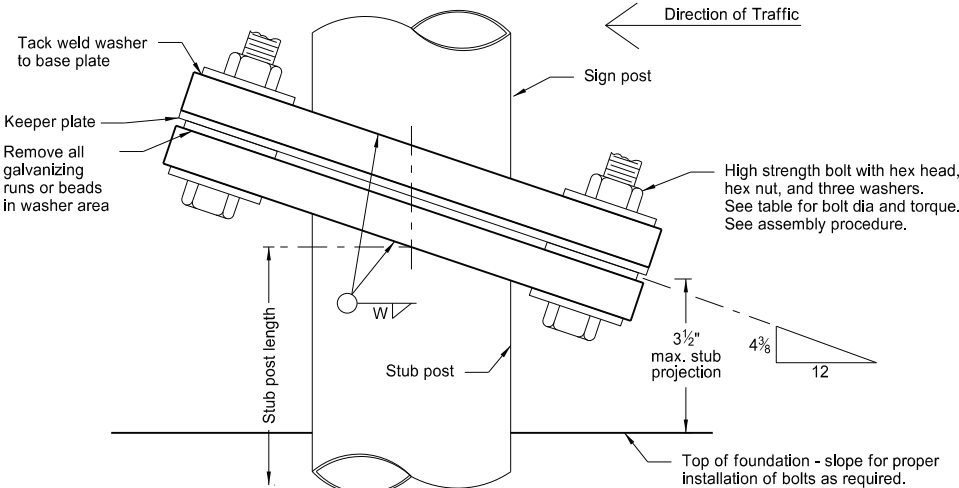
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-2013	
REVISIONS	
DATE	CHANGE
8-30-2018	Updated notes to active voice.
8-29-2019	New Design Engineer PE Stamp.
8-05-2024	Electronic Stamp/Signature.

08/05/24

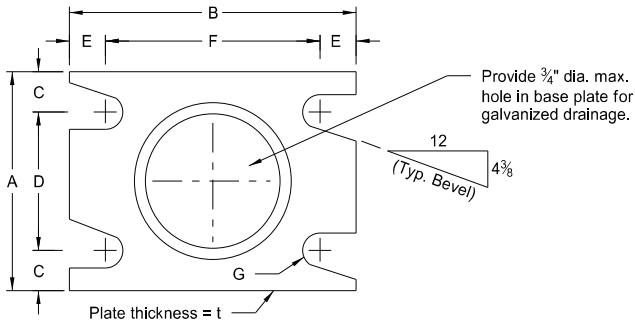
Breakaway System  
for Standard Pipe  
Stub Post

Notes:  
Tack weld aluminum base plate washers to the base, when the base plate is aluminum.  
Use standard drawing D-754-6 for fuse plate, hinge plate, and foundation details.

- Assembly Procedure:
- Assemble post to stub with bolts and one flat washer between base plate and keeper plate.
  - Shim as required.
  - Tighten all bolts the maximum possible with 12" to 15" wrench to bed washers and shims and to clean bolt threads, then loosen.
  - Retighten bolts in a systematic order to prescribed torque. (see table)
  - Loosen each bolt and fill the gaps between the thread and mating surface with thread locking liquid resin, conforming to ASTM D5363-03 (2008), forming solid, one part assemblies secure from vibration, pressure, and corrosion.
  - Retighten each bolt to prescribed torque in the same order as initial retightening.

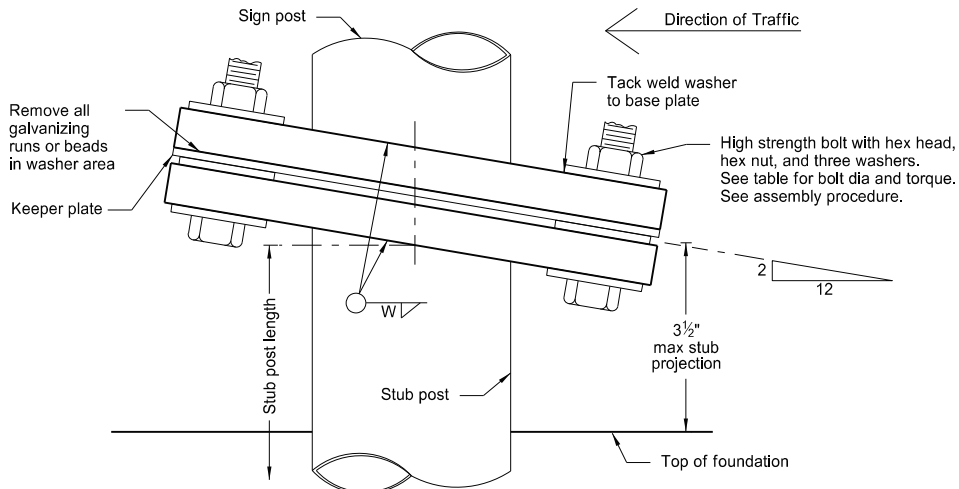


Stub Post Connection - Type A  
Elevation View  
(Single Post)

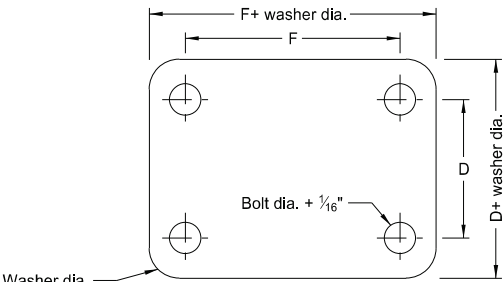


Base Plate Plan View

Place bevel toward roadway on approach side and away on the other side.

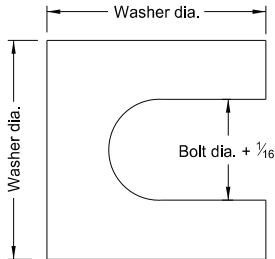


Stub Post Connection - Type B  
Elevation View  
(Two Posts)



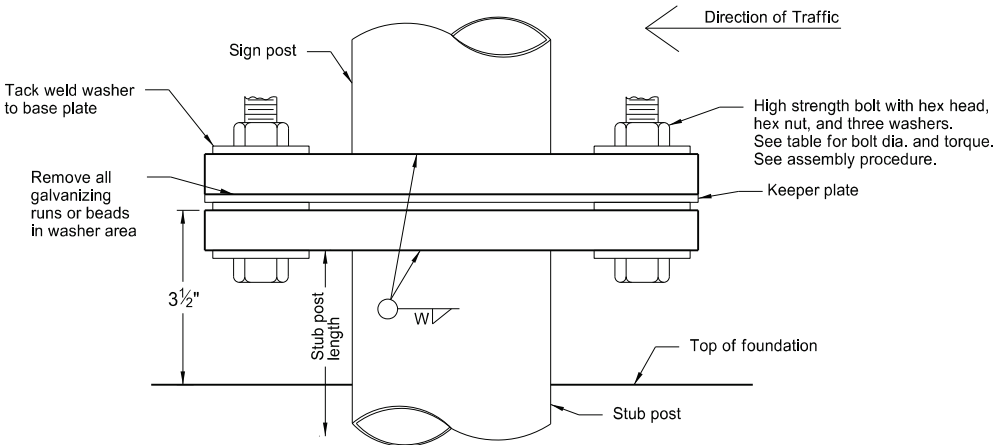
Keeper Plate Detail

Place keeper plate above center washer between top and bottom slip bases. Fabricate keeper plate from 28 gauge material and galvanize after fabrication in conformance with ASTM A653 G60 coating.



Shim Detail

Furnish 2 each ±.012" thick and 2 each ±.032" thick shims per post. Fabricate shims from brass shim stock or strip in conformance with ASTM B36.



Stub Post Connection - Type C  
Elevation View  
(Two Posts)

Base Data Table												
Nominal Post Size dia.	Bolt Size (dia. x length)	Base Bolt Torque ft. lb.	A	B	C	D	E	F	G	t	W	Stub Post Length
Steel												
3 1/2"	1/2"x2 1/2"	12	5 1/2"	8 3/8"	1 3/16"	3 7/8"	1 3/16"	6 3/4"	9/32"	3/4"	3/8"	1'-6"
4"	5/8"x2 3/4"	29	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	1 1/32"	3/4"	3/8"	1'-6"
5"	3/4"x3 1/2"	46	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	1 3/32"	1"	7/16"	2'-0"
6"	1"x4 1/4"	61	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	1 7/32"	1 1/4"	7/16"	2'-0"
Aluminum												
3 1/2"	1/2"x2 1/2"	12	5 1/2"	8 3/8"	1 3/16"	3 7/8"	1 3/16"	6 3/4"	9/32"	3/4"	3/8"	1'-6"
4"	5/8"x2 3/4"	29	5 1/2"	8 3/4"	1"	3 1/2"	1"	6 3/4"	1 1/32"	1"	7/16"	1'-6"
5"	3/4"x3 1/2"	46	6 1/2"	10"	1 1/8"	4 1/4"	1 1/8"	7 3/4"	1 3/32"	1"	1/2"	2'-0"
6"	1"x4 1/4"	61	7 1/2"	11 3/4"	1 3/8"	4 3/4"	1 3/8"	9"	1 7/32"	1 1/4"	1/2"	2'-0"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-21-11	
REVISIONS	
DATE	CHANGE
2-28-14	Removed lower post and foundation details.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



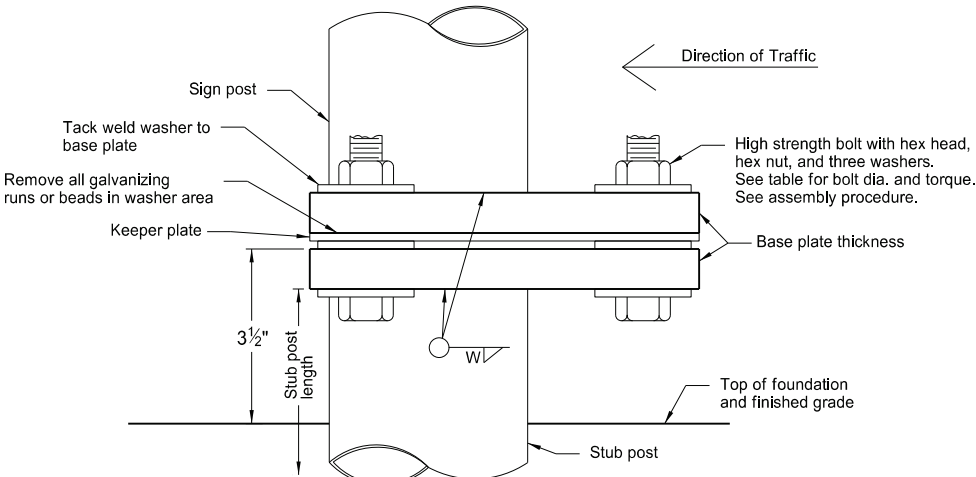
08/05/24

Multi-Directional Breakaway System  
for Standard Pipe  
Stub Post

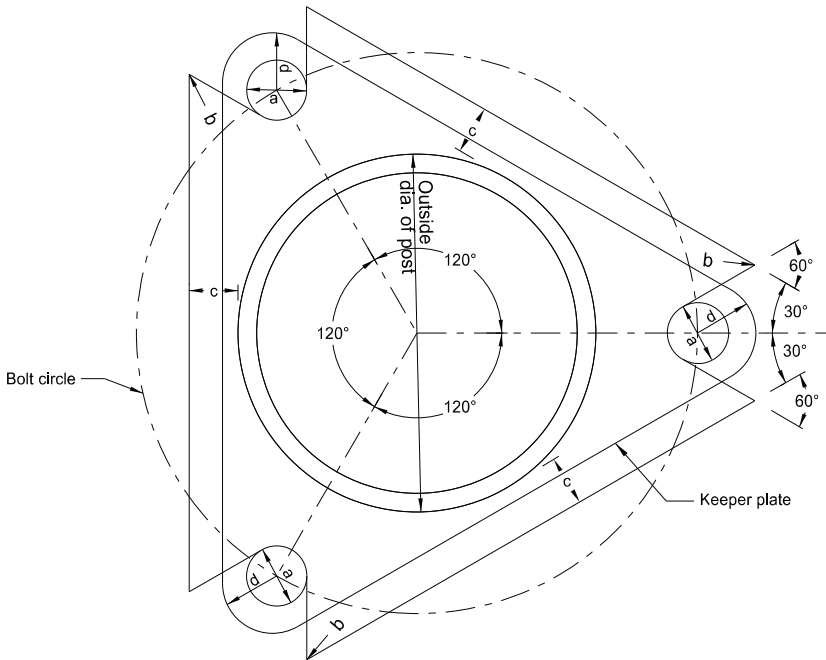
Notes:  
Tack weld aluminum base plate washers to the base, when the base plate is fabricated from aluminum.

Use standard drawing D-754-6 for fuse plate, hinge plate, and foundation details.

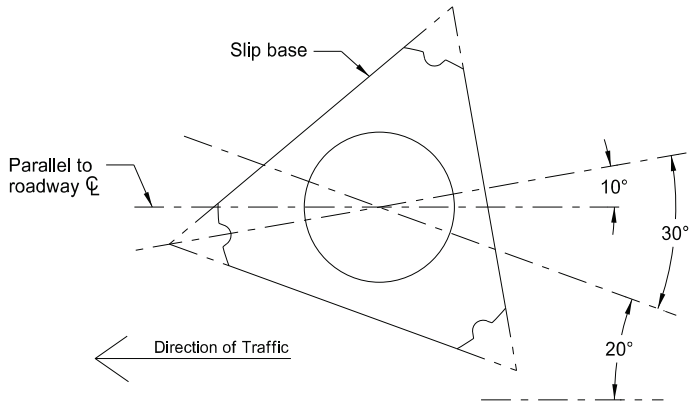
- Assembly Procedure:
1. Assemble post to stub with bolts and one flat washer between base plates and keeper plate.
  2. Shim as required.
  3. Tighten all bolts the maximum possible with 12" to 15" wrench to bed washers and shims to clean bolt threads, then loosen.
  4. Retighten bolts in a systematic order to prescribed torque. (see table)
  5. Loosen each bolt and apply thread locking liquid resin conforming to ASTM D5363-03 (2008). Fill gaps between thread and mating surface with thread locker to form solid, one part assemblies secure from vibration, pressure, and corrosion.
  6. Retighten each bolt to prescribed torque in the same order as initial retightening.



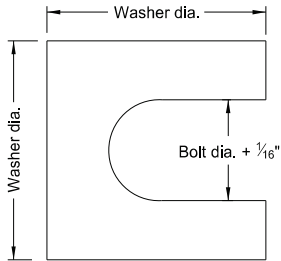
Stub Post Connection - Type D  
Elevation View  
(Single Post)



Stub Post Detail  
Top View



Slip Base Orientation  
Top View



Shim Detail

Furnish 2 each  $\pm 0.012$ " thick and 2 each  $\pm 0.032$ " thick shims per post. Fabricate shims from brass shim stock or strip conforming to ASTM B36.

Base Data Table											
Nominal Post Size dia.	Outside Post dia.	Bolt Circle	a rad.	b rad.	c rad.	Bolt Size (dia. x length)	Base Plate Thickness	W	Base Bolt Torque ft. lb.	d rad.	Stub Post Length
Steel											
3 1/2"	4"	7"	1 1/16"	1/8"	1 1/8"	1"x4"	1 1/4"	5/16"	55	1 1/8"	1'-6"
4"	4.5"	7 1/2"	1 1/16"	1/8"	1 1/8"	1"x4 1/2"	1 1/2"	3/8"	98	1 1/8"	1'-6"
5"	5.563"	9 1/2"	1 5/16"	1/8"	1 1/8"	1 1/4"x5"	1 1/2"	3/8"	167	1 3/8"	2'-0"
Aluminum											
3 1/2"	4"	7"	1 3/16"	1/8"	7/8"	3/4"x3 1/2"	1"	5/16"	43	7/8"	1'-6"
4"	4.5"	7 1/2"	1 3/16"	1/8"	3/4"	3/4"x4"	1 1/4"	5/16"	76	7/8"	1'-6"
5"	5.563"	9 1/2"	1 1/16"	1/8"	1 1/8"	1"x4"	1 1/4"	5/16"	98	1 1/8"	2'-0"
6"	6.625"	10 1/4"	1 1/16"	1/8"	3/4"	1"x4 1/2"	1 1/2"	3/8"	134	1 1/8"	2'-0"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



08/05/24

FOUNDATION DATA FOR STEEL SUPPORTS

D-754-5

Foundation Diameter	Foundation			Vertical Reinforcing Steel				Horizontal Tie Bars		
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
1' - 4"	4' - 6"	0.23	0.47	4' - 2"	5	6	12	3	6	12
1' - 4"	5' - 0"	0.26	0.52	4' - 8"	5	6	12	3	7	14
1' - 4"	5' - 6"	0.28	0.57	5' - 2"	5	6	12	3	8	16
1' - 4"	6' - 0"	0.31	0.62	5' - 8"	5	6	12	3	8	16
1' - 4"	6' - 6"	0.34	0.67	6' - 2"	5	6	12	3	9	18
1' - 4"	7' - 0"	0.36	0.72	6' - 8"	5	6	12	3	9	18
1' - 4"	7' - 6"	0.39	0.78	7' - 2"	5	6	12	3	10	20
1' - 4"	8' - 0"	0.41	0.83	7' - 8"	5	6	12	3	11	22
1' - 4"	8' - 6"	0.44	0.88	8' - 2"	5	6	12	3	11	22
1' - 4"	9' - 0"	0.47	0.93	8' - 8"	5	6	12	3	12	24
1' - 4"	9' - 6"	0.49	0.98	9' - 2"	5	6	12	3	12	24
1' - 4"	10' - 0"	0.52	1.03	9' - 8"	5	6	12	3	13	26
1' - 4"	10' - 6"	0.54	1.09	10' - 2"	5	6	12	3	14	28
1' - 4"	11' - 0"	0.57	1.14	10' - 8"	5	6	12	3	14	28
1' - 4"	11' - 6"	0.59	1.19	11' - 2"	5	6	12	3	15	30
1' - 4"	12' - 0"	0.62	1.24	11' - 8"	5	6	12	3	15	30

Foundation Diameter	Foundation			Vertical Reinforcing Steel				Horizontal Tie Bars		
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
1' - 9"	4' - 6"	0.40	0.80	4' - 2"	5	10	20	3	6	12
1' - 9"	5' - 0"	0.45	0.89	4' - 8"	5	10	20	3	7	14
1' - 9"	5' - 6"	0.49	0.98	5' - 2"	5	10	20	3	8	16
1' - 9"	6' - 0"	0.53	1.07	5' - 8"	5	10	20	3	8	16
1' - 9"	6' - 6"	0.58	1.16	6' - 2"	5	10	20	3	9	18
1' - 9"	7' - 0"	0.62	1.25	6' - 8"	5	10	20	3	9	18
1' - 9"	7' - 6"	0.67	1.34	7' - 2"	5	10	20	3	10	20
1' - 9"	8' - 0"	0.71	1.43	7' - 8"	5	10	20	3	11	22
1' - 9"	8' - 6"	0.76	1.51	8' - 2"	5	10	20	3	11	22
1' - 9"	9' - 0"	0.80	1.60	8' - 8"	5	10	20	3	12	24
1' - 9"	9' - 6"	0.85	1.69	9' - 2"	5	10	20	3	12	24
1' - 9"	10' - 0"	0.89	1.78	9' - 8"	5	10	20	3	13	26
1' - 9"	10' - 6"	0.94	1.87	10' - 2"	5	10	20	3	14	28
1' - 9"	11' - 0"	0.98	1.96	10' - 8"	5	10	20	3	14	28
1' - 9"	11' - 6"	1.02	2.05	11' - 2"	5	10	20	3	15	30
1' - 9"	12' - 0"	1.07	2.14	11' - 8"	5	10	20	3	15	30

Foundation Diameter	Foundation			Vertical Reinforcing Steel				Horizontal Tie Bars		
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
2' - 0"	4' - 6"	0.52	1.05	4' - 2"	6	10	20	3	6	12
2' - 0"	5' - 0"	0.58	1.16	4' - 8"	6	10	20	3	7	14
2' - 0"	5' - 6"	0.64	1.28	5' - 2"	6	10	20	3	8	16
2' - 0"	6' - 0"	0.70	1.40	5' - 8"	6	10	20	3	8	16
2' - 0"	6' - 6"	0.76	1.51	6' - 2"	6	10	20	3	9	18
2' - 0"	7' - 0"	0.81	1.63	6' - 8"	6	10	20	3	9	18
2' - 0"	7' - 6"	0.87	1.75	7' - 2"	6	10	20	3	10	20
2' - 0"	8' - 0"	0.93	1.86	7' - 8"	6	10	20	3	11	22
2' - 0"	8' - 6"	0.99	1.98	8' - 2"	6	10	20	3	11	22
2' - 0"	9' - 0"	1.05	2.09	8' - 8"	6	10	20	3	12	24
2' - 0"	9' - 6"	1.11	2.21	9' - 2"	6	10	20	3	12	24
2' - 0"	10' - 0"	1.16	2.33	9' - 8"	6	10	20	3	13	26
2' - 0"	10' - 6"	1.22	2.44	10' - 2"	6	10	20	3	14	28
2' - 0"	11' - 0"	1.28	2.56	10' - 8"	6	10	20	3	14	28
2' - 0"	11' - 6"	1.34	2.68	11' - 2"	6	10	20	3	15	30
2' - 0"	12' - 0"	1.40	2.79	11' - 8"	6	10	20	3	15	30
2' - 0"	12' - 6"	1.45	2.91	12' - 2"	6	10	20	3	16	32
2' - 0"	13' - 0"	1.51	3.03	12' - 8"	6	10	20	3	17	34
2' - 0"	13' - 6"	1.57	3.14	13' - 2"	6	10	20	3	17	34
2' - 0"	14' - 0"	1.63	3.26	13' - 8"	6	10	20	3	18	36
2' - 0"	14' - 6"	1.69	3.37	14' - 2"	6	10	20	3	18	36
2' - 0"	15' - 0"	1.75	3.49	14' - 8"	6	10	20	3	19	38

Foundation Diameter	Foundation			Vertical Reinforcing Steel				Horizontal Tie Bars		
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
2' - 4"	4' - 6"	0.71	1.43	4' - 2"	6	14	28	3	6	12
2' - 4"	5' - 0"	0.79	1.58	4' - 8"	6	14	28	3	7	14
2' - 4"	5' - 6"	0.87	1.74	5' - 2"	6	14	28	3	8	16
2' - 4"	6' - 0"	0.95	1.90	5' - 8"	6	14	28	3	8	16
2' - 4"	6' - 6"	1.03	2.06	6' - 2"	6	14	28	3	9	18
2' - 4"	7' - 0"	1.11	2.22	6' - 8"	6	14	28	3	9	18
2' - 4"	7' - 6"	1.19	2.38	7' - 2"	6	14	28	3	10	20
2' - 4"	8' - 0"	1.27	2.53	7' - 8"	6	14	28	3	11	22
2' - 4"	8' - 6"	1.35	2.69	8' - 2"	6	14	28	3	11	22
2' - 4"	9' - 0"	1.43	2.85	8' - 8"	6	14	28	3	12	24
2' - 4"	9' - 6"	1.50	3.01	9' - 2"	6	14	28	3	12	24
2' - 4"	10' - 0"	1.58	3.17	9' - 8"	6	14	28	3	13	26
2' - 4"	10' - 6"	1.66	3.33	10' - 2"	6	14	28	3	14	28
2' - 4"	11' - 0"	1.74	3.48	10' - 8"	6	14	28	3	14	28
2' - 4"	11' - 6"	1.82	3.64	11' - 2"	6	14	28	3	15	30
2' - 4"	12' - 0"	1.90	3.80	11' - 8"	6	14	28	3	15	30
2' - 4"	12' - 6"	1.98	3.96	12' - 2"	6	14	28	3	16	32
2' - 4"	13' - 0"	2.06	4.12	12' - 8"	6	14	28	3	17	34
2' - 4"	13' - 6"	2.14	4.28	13' - 2"	6	14	28	3	17	34
2' - 4"	14' - 0"	2.22	4.43	13' - 8"	6	14	28	3	18	36
2' - 4"	14' - 6"	2.30	4.59	14' - 2"	6	14	28	3	18	36
2' - 4"	15' - 0"	2.38	4.75	14' - 8"	6	14	28	3	19	38
2' - 4"	15' - 6"	2.45	4.91	15' - 2"	6	14	28	3	20	40
2' - 4"	16' - 0"	2.53	5.07	15' - 8"	6	14	28	3	20	40
2' - 4"	16' - 6"	2.61	5.23	16' - 2"	6	14	28	3	21	42
2' - 4"	17' - 0"	2.69	5.38	16' - 8"	6	14	28	3	21	42
2' - 4"	17' - 6"	2.77	5.54	17' - 2"	6	14	28	3	22	44
2' - 4"	18' - 0"	2.85	5.70	17' - 8"	6	14	28	3	23	46

Foundation Diameter	Foundation			Vertical Reinforcing Steel				Horizontal Tie Bars		
	Depth	Conc. Vol. for 1 Post (CU YDS)	Conc. Vol. for 2 Posts (CU YDS)	Length of Each Bar	Size	No. Bars for 1 Post	No. Bars for 2 Posts	Size	No. Bars for 1 Post	No. Bars for 2 Posts
2' - 6"	4' - 6"	0.82	1.64	4' - 2"	6	16	32	3	6	12
2' - 6"	5' - 0"	0.91	1.82	4' - 8"	6	16	32	3	7	14
2' - 6"	5' - 6"	1.00	2.00	5' - 2"	6	16	32	3	8	16
2' - 6"	6' - 0"	1.09	2.18	5' - 8"	6	16	32	3	8	16
2' - 6"	6' - 6"	1.18	2.36	6' - 2"	6	16	32	3	9	18
2' - 6"	7' - 0"	1.27	2.55	6' - 8"	6	16	32	3	9	18
2' - 6"	7' - 6"	1.36	2.73	7' - 2"	6	16	32	3	10	20
2' - 6"	8' - 0"	1.45	2.91	7' - 8"	6	16	32	3	11	22
2' - 6"	8' - 6"	1.55	3.09	8' - 2"	6	16	32	3	11	22
2' - 6"	9' - 0"	1.64	3.27	8' - 8"	6	16	32	3	12	24
2' - 6"	9' - 6"	1.73	3.45	9' - 2"	6	16	32	3	12	24
2' - 6"	10' - 0"	1.82	3.64	9' - 8"	6	16	32	3	13	26
2' - 6"	10' - 6"	1.91	3.82	10' - 2"	6	16	32	3	14	28
2' - 6"	11' - 0"	2.00	4.00	10' - 8"	6	16	32	3	14	28
2' - 6"	11' - 6"	2.09	4.18	11' - 2"	6	16	32	3	15	30
2' - 6"	12' - 0"	2.18	4.36	11' - 8"	6	16	32	3	15	30
2' - 6"	12' - 6"	2.27	4.55	12' - 2"	6	16	32	3	16	32
2' - 6"	13' - 0"	2.36	4.73	12' - 8"	6	16	32	3	17	34
2' - 6"	13' - 6"	2.45	4.91	13' - 2"	6	16	32	3	17	34
2' - 6"	14' - 0"	2.55	5.09	13' - 8"	6	16	32	3	18	36
2' - 6"	14' - 6"	2.64	5.27	14' - 2"	6	16	32	3	18	36
2' - 6"	15' - 0"	2.73	5.45	14' - 8"	6	16	32	3	19	38
2' - 6"	15' - 6"	2.82	5.64	15' - 2"	6	16	32	3	20	40
2' - 6"	16' - 0"	2.91	5.82	15' - 8"	6	16	32	3	20	40
2' - 6"	16' - 6"	3.00	6.00	16' - 2"	6	16	32	3	21	42
2' - 6"	17' - 0"	3.09	6.18	16' - 8"	6	16	32	3	21	42
2' - 6"	17' - 6"	3.18	6.36	17' - 2"	6	16	32	3	22	44
2' - 6"	18' - 0"	3.27	6.54	17' - 8"	6	16	32	3	23	46
2' - 6"	18' - 6"	3.36	6.73	18' - 2"	6	16	32	3	23	46
2' - 6"	19' - 0"	3.45	6.91	18' - 8"	6	16	32	3	24	48
2' - 6"	19' - 6"	3.55	7.09	19' - 2"	6	16	32	3	24	48
2' - 6"	20' - 0"	3.64	7.27	19' - 8"	6	16	32	3	25	50

NOTES:

1. Use Grade 60 reinforcing steel.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
8-30-18 8-29-19 8-05-24	Updated notes to active voice. New Design Engineer PE Stamp. Electronic Stamp/Signature.



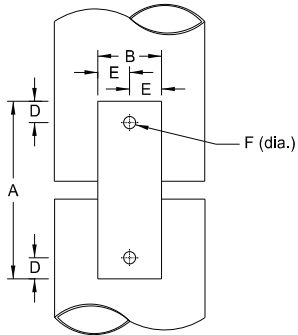
Hinge Plate, Fuse Plate  
and Foundation Details  
for Standard Pipe

Notes:  
Fuse Joint Cuts - For steel posts cut after galvanizing, either galvanize cut after fabrication, or treat cut surface in accordance with ASTM A780. Aluminum posts need no treatment.

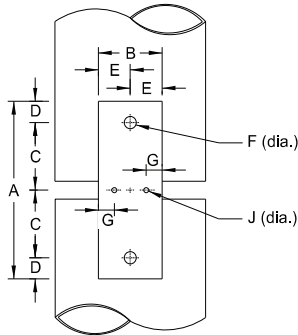
Use standard drawings D-754-2, D-754-3 and D-754-4 for information on breakaway base details.

Maintain the 4" vertical height and 60" diameter horizontal clearance of the break-away base at each post location.

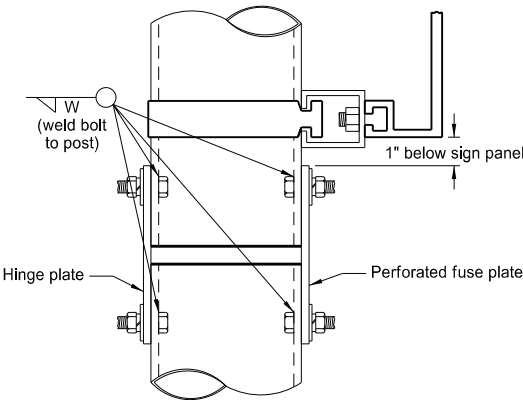
- Assembly Procedure:
1. Assemble hinge plate to post with bolts and one flat washer and lock washer under nut.
  2. Tighten all bolts the maximum possible with 12" to 15" wrench.



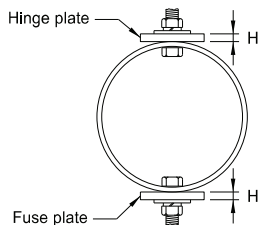
Hinge Plate



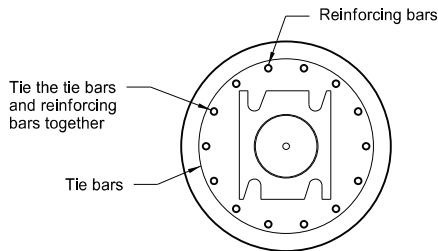
Perforated Fuse Plate



Side View

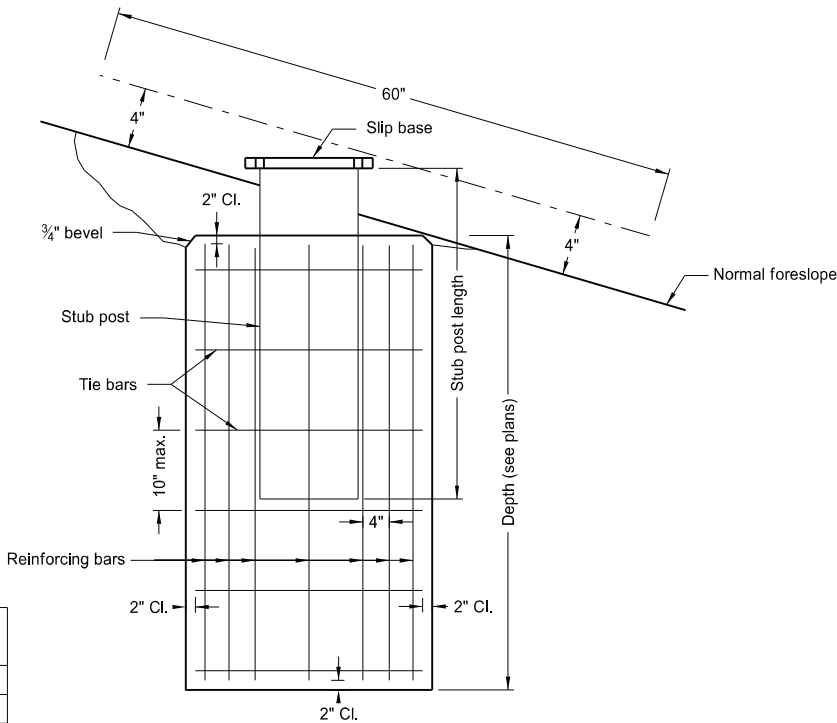


Top View



Top View

See standard drawing D-754-5 for size, number, and length of rebar. Use 3 bolt base plate for Type D.



Foundation  
Front View

Foundation detail for breakaway base with stub post connection.

Foundation diameter	Post Size
1'-4"	3 1/2"-4"
1'-9"	5"-6"

Round Metal Posts							
Dimensions				Properties			
Nominal dia. in.	Outside dia. in.	Inside dia. in.	Wall Thickness in.	Weight per Foot Pound	Moment of Inertia in. <sup>4</sup>	Cross Sec. Area in. <sup>2</sup>	Section Diameter in. <sup>2</sup>
Steel							
3 1/2	4.000	3.548	.226	9.11	4.788	2.680	2.394
4	4.500	4.026	.237	10.79	7.233	3.174	3.215
5	5.563	5.047	.258	14.62	15.16	4.300	5.449
6	6.625	6.065	.280	18.97	28.14	5.581	8.495
Aluminum							
3 1/2	4.000	3.548	.226	3.151	4.788	2.680	2.394
4	4.500	4.026	.237	3.733	7.232	3.174	3.214
5	5.563	5.047	.258	5.057	15.16	4.300	5.451
6	6.625	6.065	.280	6.564	28.14	5.581	8.496

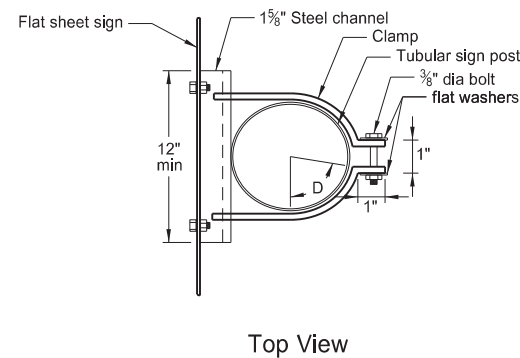
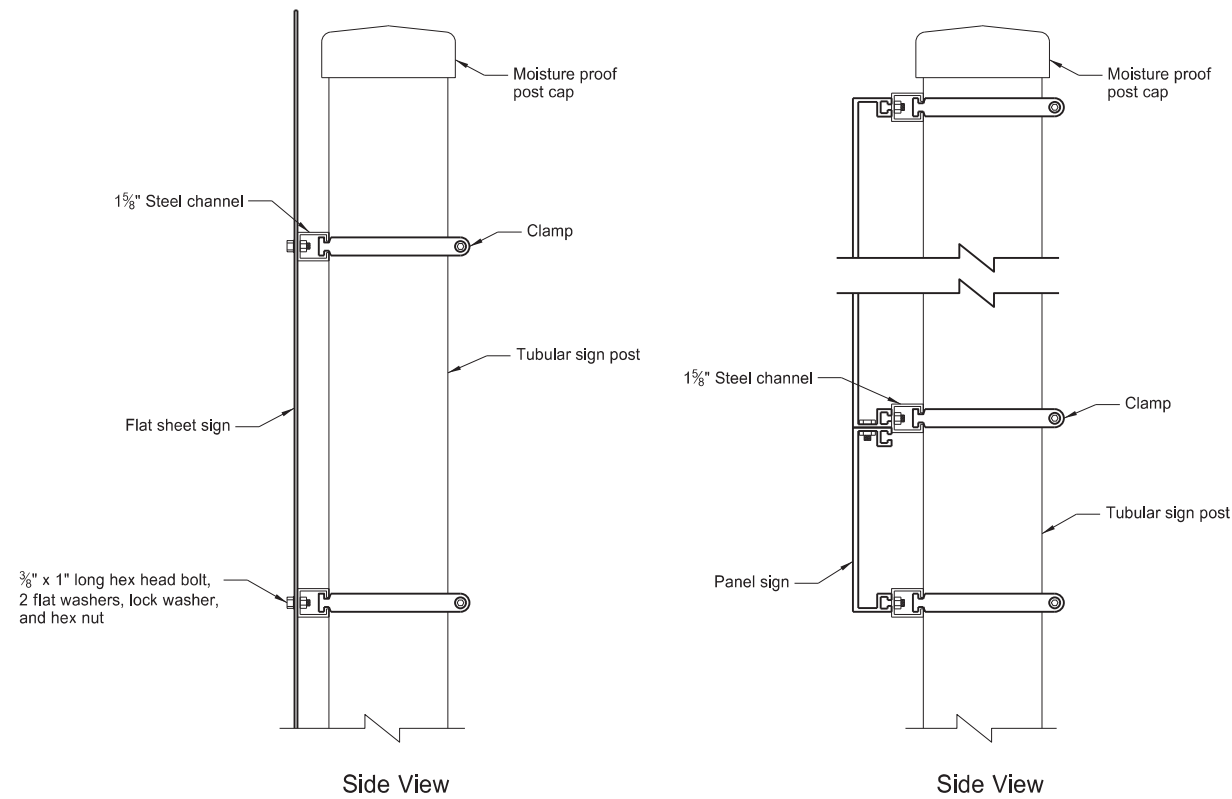
Nominal Pipe Size dia.	Fuse and Hinge Plate Data										
	Bolt Size	A	B	C	D	E	F	G	H	I	J
3 1/2"	1/2" Ø x 1 1/2"	5"	1 3/4"	1 1/16"	1 3/16"	7/8"	9/16"	15/32"	1/4"	13/32"	7/16"
4"	5/8" Ø x 1 1/2"	5 3/4"	2"	1 7/8"	1"	1"	1 1/16"	17/32"	3/8"	15/32"	9/16"
5"	5/8" Ø x 1 3/4"	5 3/4"	2"	1 7/8"	1"	1"	1 1/16"	9/16"	1/2"	7/16"	5/8"
6"	3/4" Ø x 2 1/4"	6 1/4"	2 1/4"	2"	1 1/8"	1 1/8"	13/16"	5/8"	1/2"	1/2"	5/8"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.

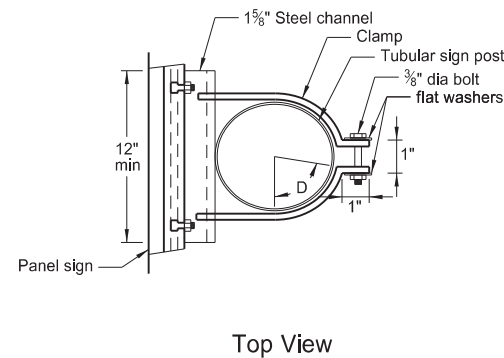


PIPE SUPPORT AND SIGN MOUNTING DETAILS

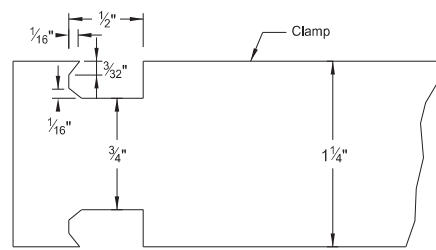
D-754-7



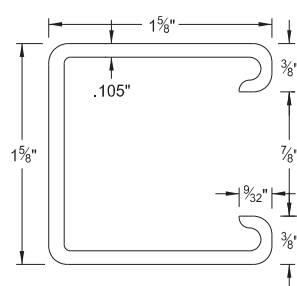
Flat Sheet Sign Clamp Mounting Details



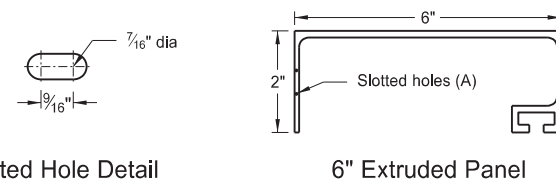
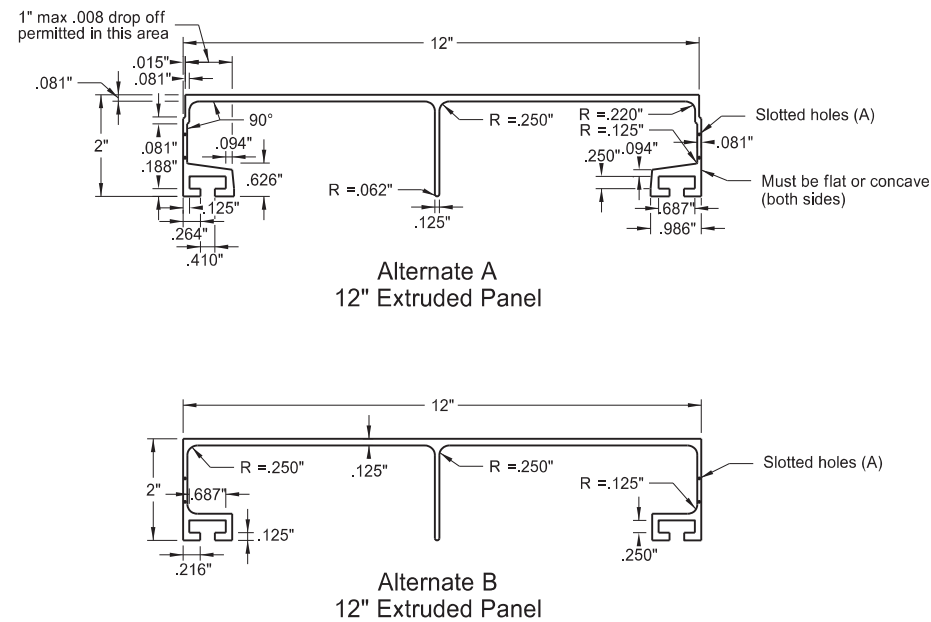
Panel Sign Clamp Mounting Details



Clamp Detail



Steel Channel Detail

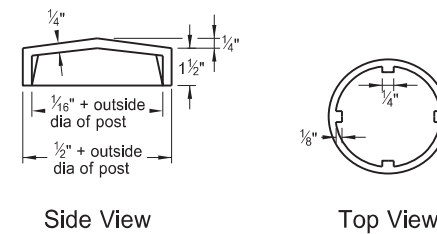
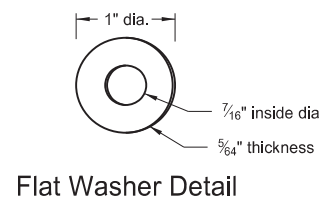


Aluminum Panel Details

(A) Punch slotted holes in aluminum panels at 1'-0" on center, space from end as listed below:

12" even length panels	4'-0" etc.
9" odd + 6" length panels	5'-6" etc.
6" odd length panels	5'-0" etc.
3" even + 6" length panels	4'-6" etc.

Wall thickness = .078" unless specified otherwise.  
All inside and outside corners = .031" radius unless specified otherwise.



Furnish post caps for all steel or aluminum posts or weld a 1/8" plate all around.

Post Size dia	Clamp Gauge min
3 1/2" to 5"	11
6" to 12"	10

Post Size dia (in)	D (in)
3 1/2	3
4	3 3/16
5	5 1/8
6	7 1/16
8	13 1/16
10	20 3/4
12	29 5/8

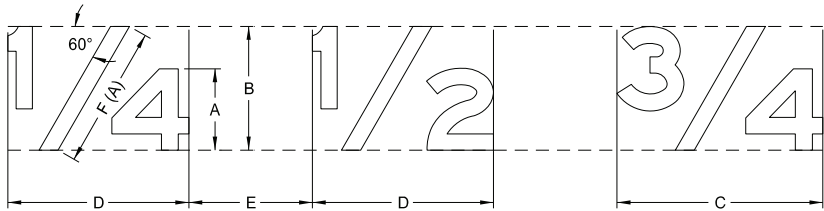
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-21-14	
REVISIONS	
DATE	CHANGE
08-30-18	Updated to active voice, defined bolt & washer for fastening sign.
08-29-19	New Design Engineer PE Stamp.
10-19-22	Added washers to clamp.



10/20/22

LETTER AND ARROW DETAILS

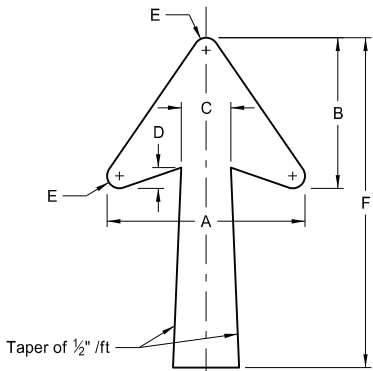
D-754-9



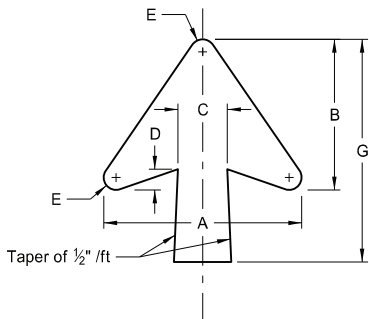
DETERMINE SIZE OF THE FRACTION AS FOLLOWS:

SYMBOL	TITLE	RATIO TO HEIGHT OF CAPITAL OR UPPER CASE
A	Letter height	1.0 of capital or upper case
B	Fraction height	1.5 X A
C	Fraction width	2.5 X A
D	Fraction width	2 X A
E	Space to next character	1 to 1.5 X A
F(A)	Length of diagonal	1.75 X A

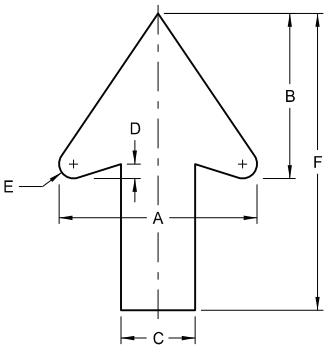
(A) Center diagonal stroke of fraction optically.



TYPE A



TYPE B



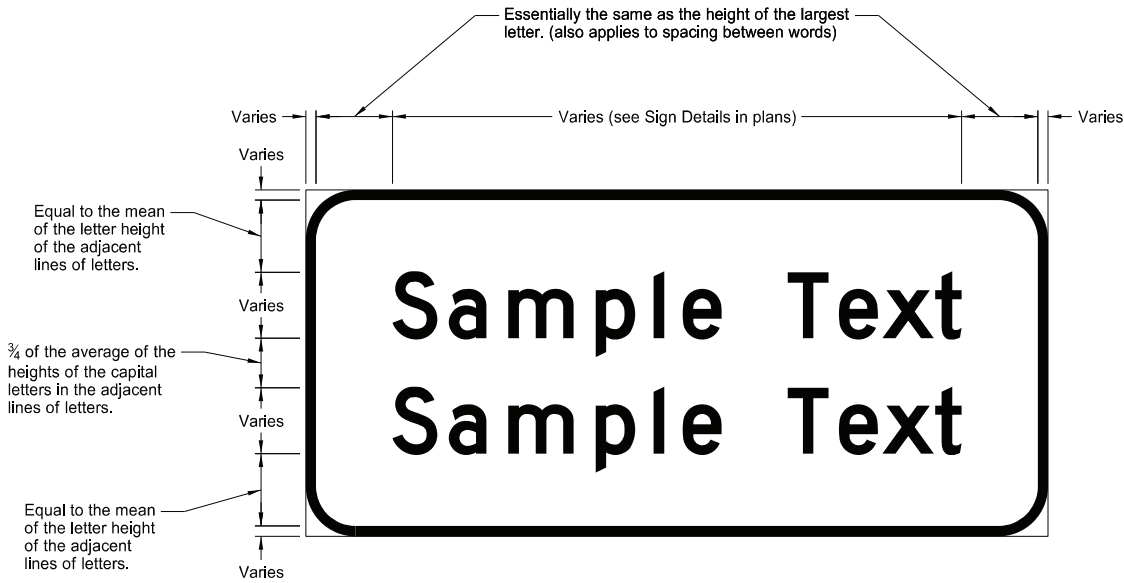
TYPE D

NOTE: Measure rotation angle of arrows counterclockwise from positions shown in details.

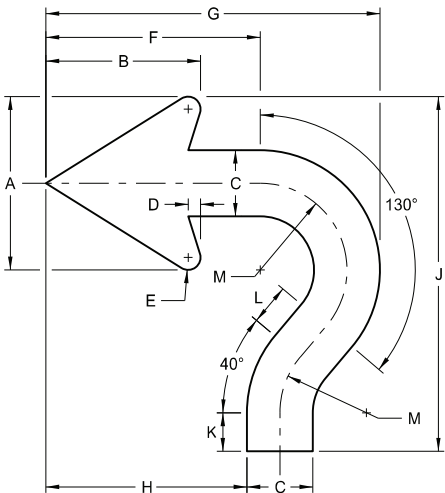
DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F	G
ND_6IN	6"	12"	9.125"	3"	1"	0.625"	20"	13.5"
ND_8IN	8"	15.125"	11.563"	3.75"	1.313"	0.813"	25"	17"
ND_10IN	10"	18.25"	14"	4.5"	1.5"	0.75"	30"	20"
ND_12IN	12"							
ND_13IN	13.3"							
ND_16IN	16"	22.25"	17"	5.375"	1.75"	1"	35"	25"
ND_20IN	20"							

NOTE: Arrow size on gore signs is based on the letter size of "EXIT".

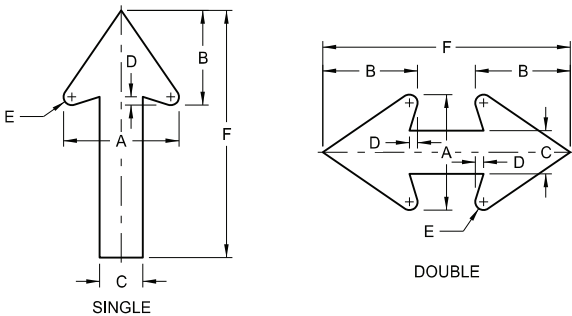
DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F
ND_2IN	2"	2"	1.625"	0.75"	0.125"	0.125"	3"
ND_4IN	4"	4"	3.313"	1.5"	0.25"	0.25"	6"
ND_6IN	6"	6"	4.875"	2.25"	0.375"	0.375"	9"
ND_8IN	8"	8"	6.625"	3"	0.5"	0.5"	12"
ND_10IN	10"	10"	8.375"	3.75"	0.75"	0.75"	15"
ND_12IN	12"	12"	10"	4.5"	0.875"	0.875"	18"



TYPICAL SPACING

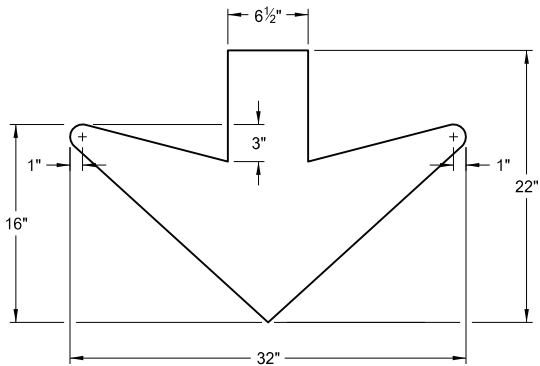


ROUNDBOUT



SPECIAL

DESIGNATION	A	B	C	D	E	F	USES
ND_0.75IN	2"	1.625"	0.75"	0.125"	0.125"	7.75"	Parking Signs (Regulatory)
ND_2.625IN	7"	5.75"	2.625"	0.5"	0.5"	15"	Frontage Road Signs



DOWN ARROW

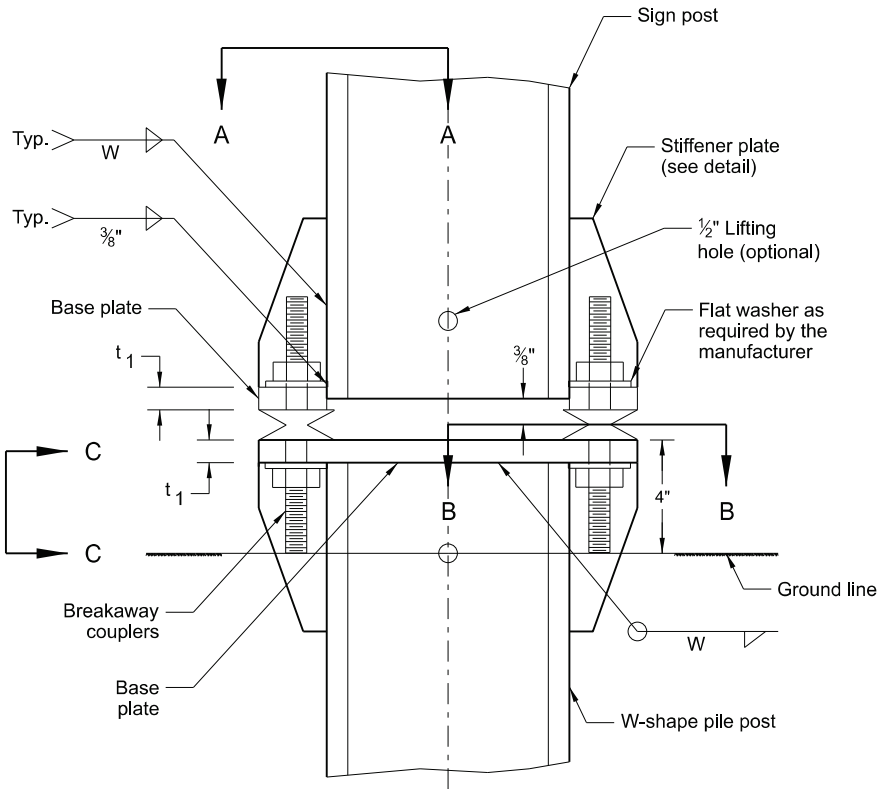
DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F	G	H	J	K	L	M
ND_6IN	6"	5.25"	4.688"	2"	0.375"	0.375"	6.5"	10.125"	6.094"	10.75"	1.168"	1.25"	2.625"
ND_8IN	8"	7"	5.75"	2.625"	0.5"	0.5"	8.688"	13.5"	8.166"	14.333"	1.557"	1.667"	3.5"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-3-11	
REVISIONS	
DATE	CHANGE
7-8-14	Revised gore sign and added 4" D & D arrow
5-4-16	Revised Distance & Destination and Typical Spacing details
4-23-18	Revised arrow details
8-30-18	Updated notes to active voice.
8-29-19	New Design Engr PE Stamp.
8-05-24	Electronic Stamp/Signature.

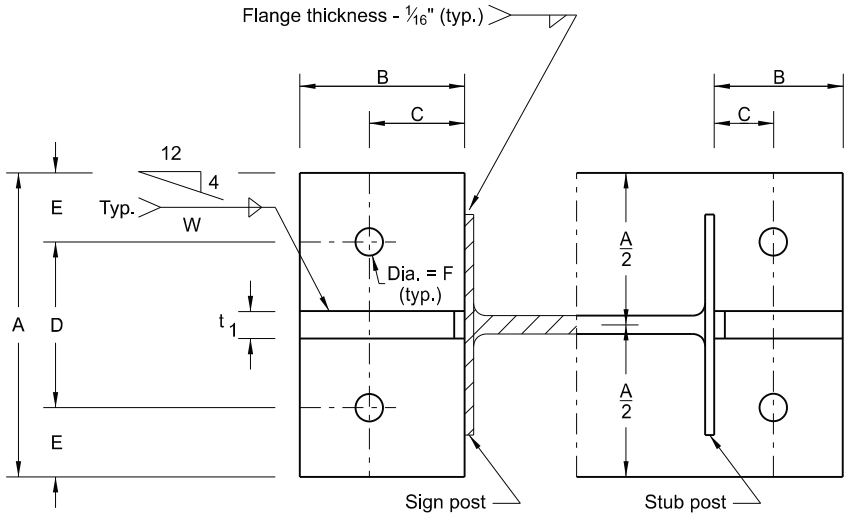


08/05/24

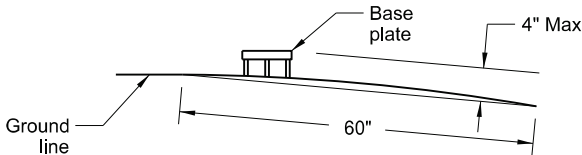
Breakaway Coupler System  
Structural Details  
for W-Shape Supports



Sign Post and Stub Post  
Elevation

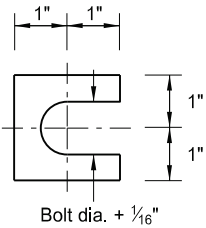


Section A - A      Section B - B  
(See Table for Dimensions)

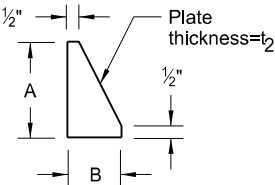


Section C - C

Max. protection of the stub post is 4" above a 60" chord aligned radially to the center line of the highway and connecting any point, within the length of the chord, on the ground surface on one side of the support to a point in the ground surface on the other side.



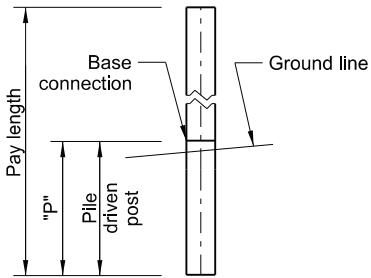
Shim Detail



Stiffener Plate Detail  
(See Table for Dimensions)

Furnish 2 - .012"± thick and 2 - .032"± thick shims per post. Fabricate shims from brass shim stock or strip conforming to ASTM B36.

Sections shown are for installations on right shoulder and in gore. Plate slot bevels are opposite hand from that shown for installations on left shoulder.



W-Shape - Pile Footing

W-Shape Post & Pile Size	Base Connection Data										Footing Data
	Bolt Size	A	B	C	D	E	t <sub>1</sub>	t <sub>2</sub>	W	F	W-Shape Pile Post "P"
W4X13	3/4" x 5 1/4"	6"	2 1/2"	1 1/2"	3 1/2"	1 1/4"	1"	1/2"	1/4"	13/16"	14'
W5X16											14'
W6X20	7/8" x 5 1/4"	8"	3"	1 3/4"	4"	2"	1 1/4"	1/2"	1/4"	15/16"	14'
W8X24											14'
W8X28	1" x 5 1/4"	8"	3"	2"	4"	2"	1 1/2"	3/4"	5/16"	1 1/16"	14'

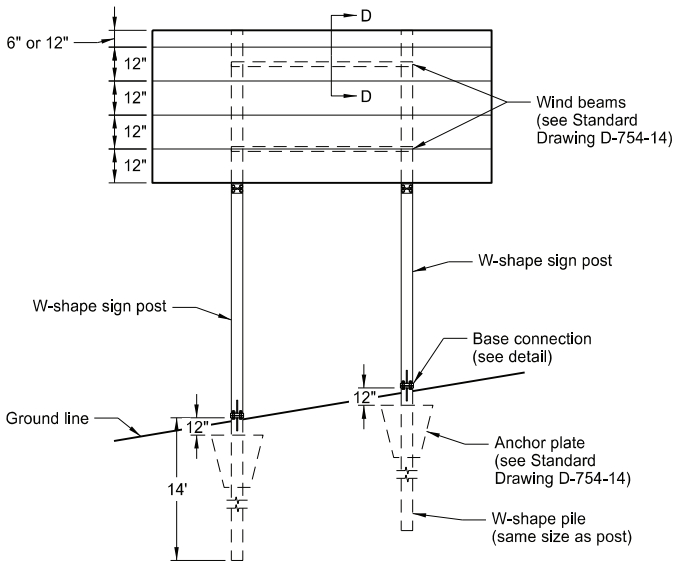
Notes:

- Use either the breakaway base system shown on standard D-754-13 or a breakaway coupling system manufactured from material meeting the requirements of ASTM A325 fasteners with the special requirements as specified by DENT BREAKAWAY IND., INC. which meets the requirements of NCHRP Report 350.
- Use structural steel conforming to Sec. 894.03 B.6 and high strength bolts conforming to ASTM - A325. Refer to "Sign Summary" sheet for specific data on each individual sign installation.
- Use manufacturer's recommendations for assembly procedures.

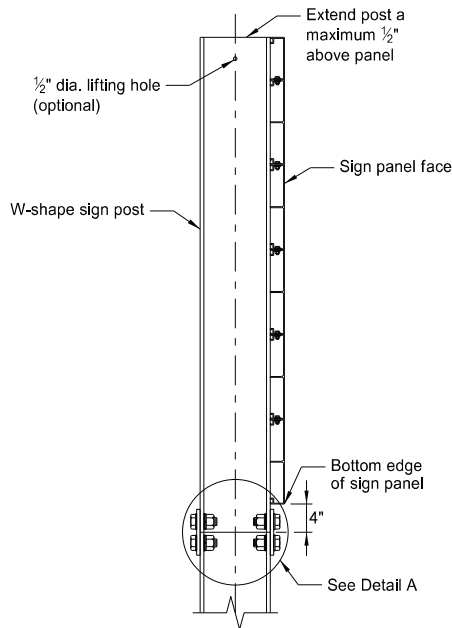
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-4-2013	
REVISIONS	
DATE	CHANGE
7-8-14	Revised notes 2 and 3.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.

08/05/24

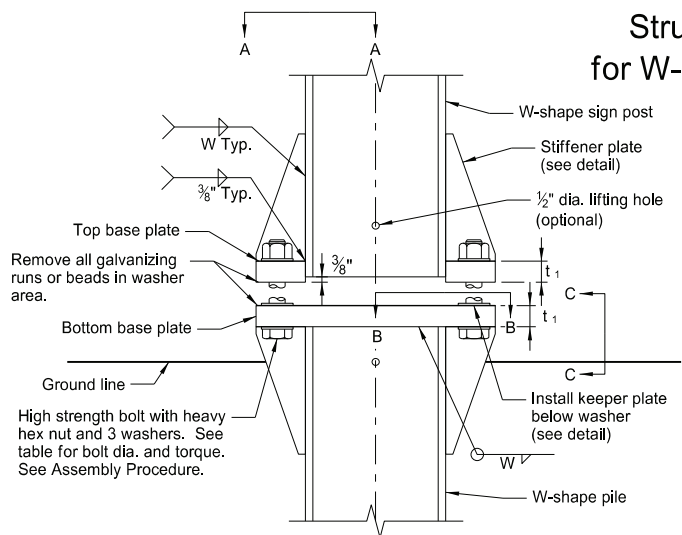
Breakaway System  
Structural Details  
for W-Shape Supports



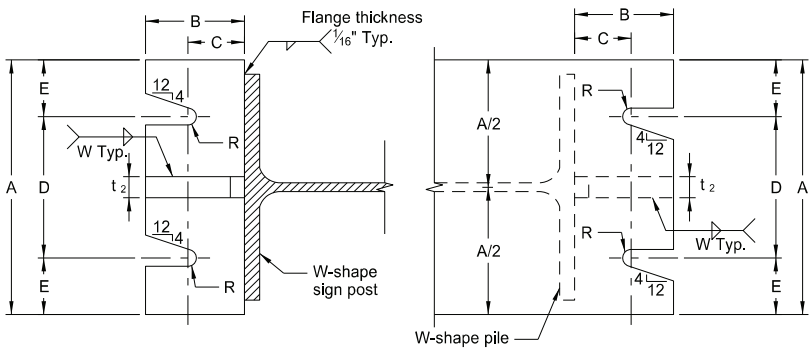
Typical Panel Mounting  
on W-shape Sign Posts



Fuse Joint  
(Side View)



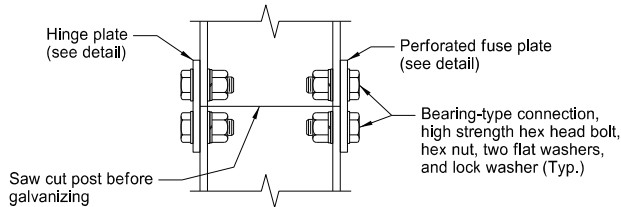
Base Connection Detail



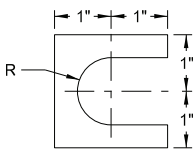
Section A-A

Section B-B

Sections shown for installations on right shoulder. Reverse plate slot  
bevels for installations on left shoulder.

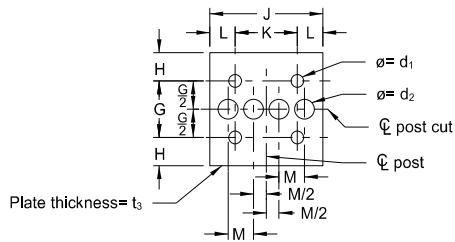
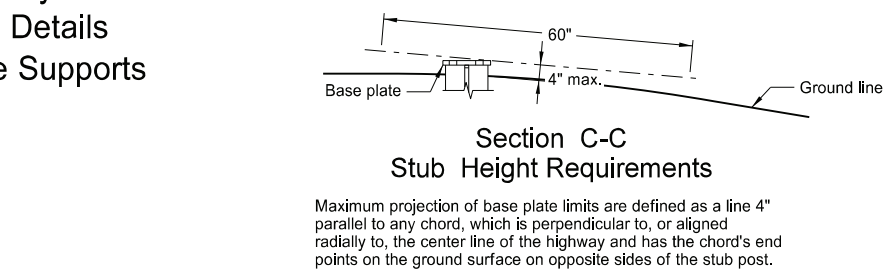


Detail A

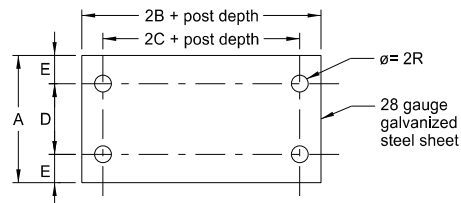


Shim Detail

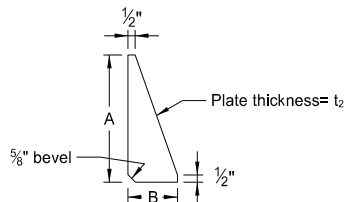
Furnish 2 each .012"± thick and 2 each .032"± thick shims per post. Shims shall  
be fabricated from brass shim stock or  
strip conforming to ASTM B36.



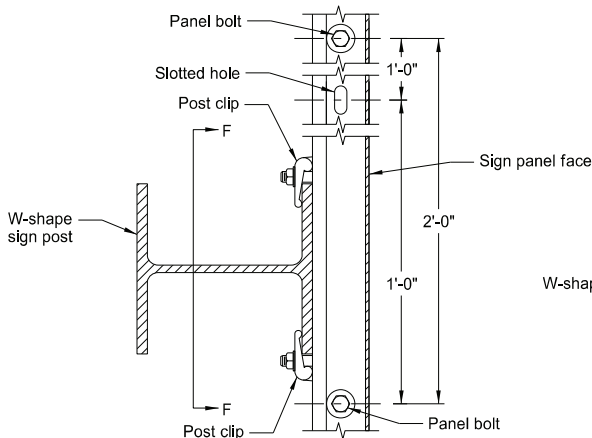
Perforated Fuse Plate



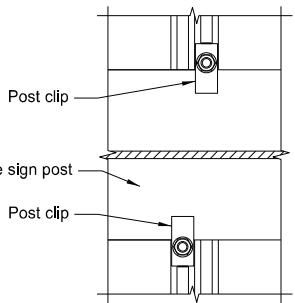
Keeper Plate



Stiffener Plate

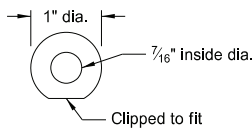


Section E-E



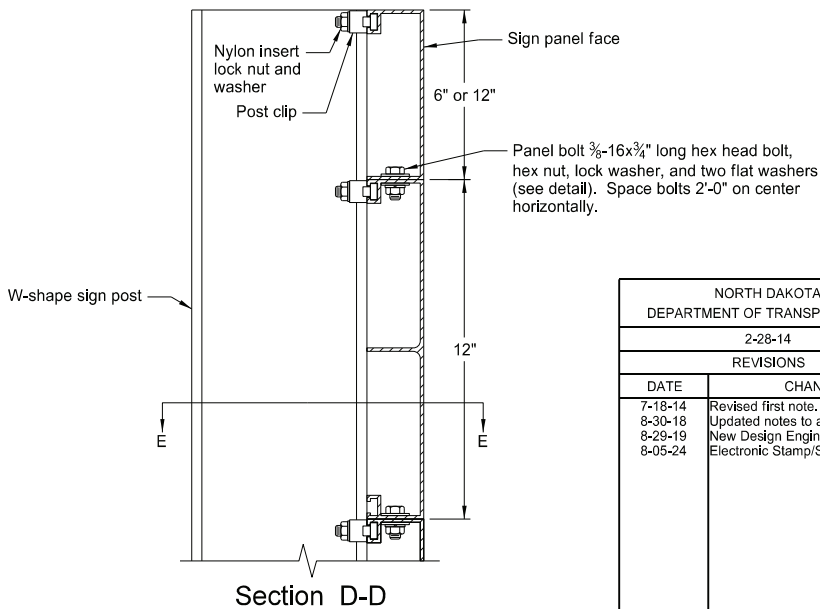
Section F-F

Install post clips on both sides of each post at  
each panel joint indicated.



Flat Washer Detail  
Thickness = 5/64"

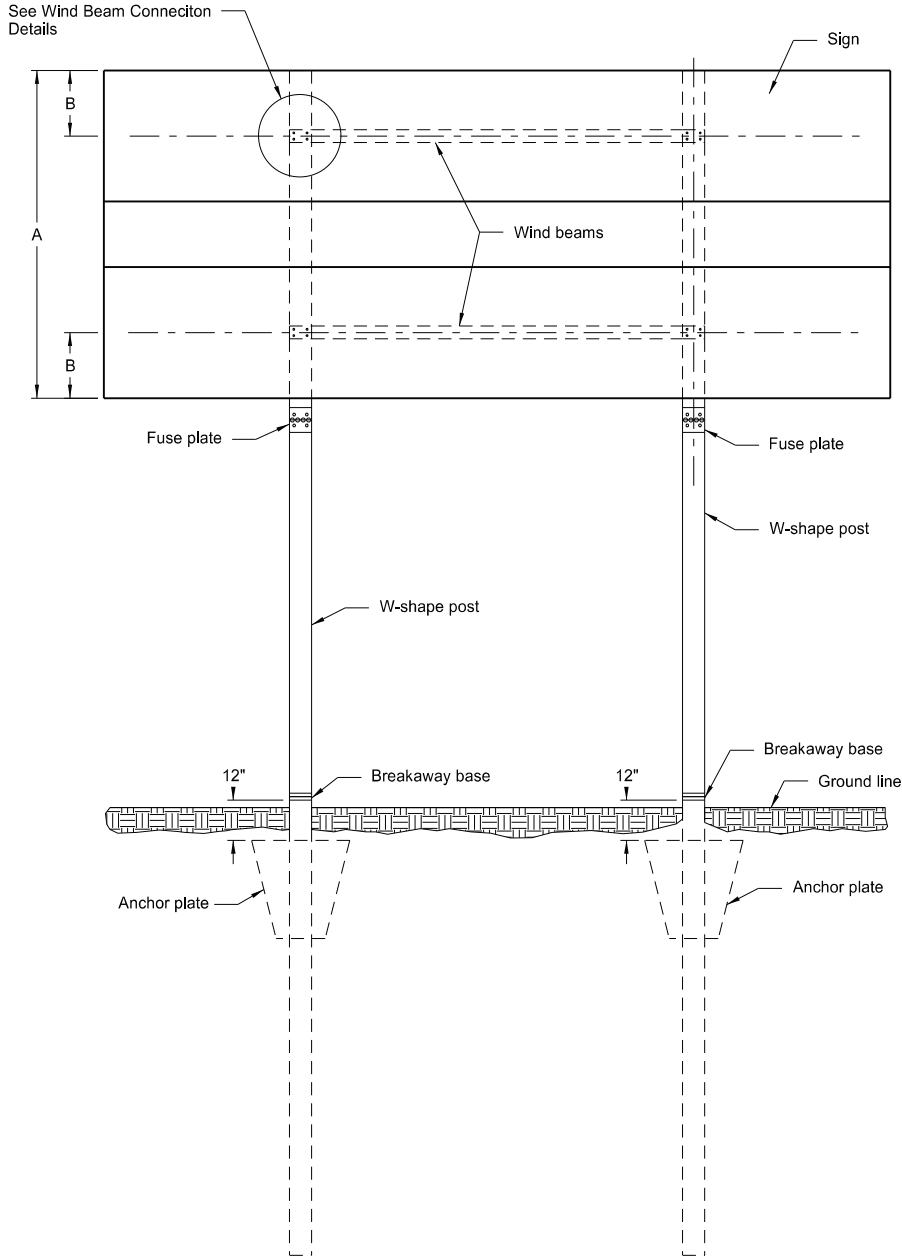
W-Shape Post and Pile Size	Base Connection Dimensions										Fuse and Hinge Plate Dimensions									
	Bolt Size and Torque	A	B	C	D	E	t <sub>1</sub>	t <sub>2</sub>	W	R	G	H	J	K	L	M	d <sub>1</sub>	d <sub>2</sub>	t <sub>3</sub>	Bolt dia.
W4x13	$\frac{3}{4}$ " $\varnothing$ x $3\frac{1}{2}$ " Torque = 600 in-lb	6"	2½"	1½"	3½"	1¼"	1"	½"	¼"	$\frac{13}{32}$ "	2"	1¼"	4"	2¼"	⅞"	1"	$\frac{11}{16}$ "	¾"	⅜"	⅝"
W5x16	$\frac{3}{4}$ " $\varnothing$ x $3\frac{1}{2}$ " Torque = 600 in-lb	6"	2½"	1½"	3½"	1¼"	1"	½"	¼"	$\frac{13}{32}$ "	2½"	1¼"	5"	2¾"	1⅝"	1⅝"	$\frac{13}{16}$ "	⅞"	⅜"	¾"
W6x20	$\frac{7}{8}$ " $\varnothing$ x $4\frac{1}{4}$ " Torque = 800 in-lb	8"	3"	1¾"	4"	2"	1¼"	½"	¼"	$\frac{15}{32}$ "	2½"	1¼"	6"	3½"	1¼"	1⅜"	$\frac{13}{16}$ "	1⅝"	⅜"	¾"
W8x24	$\frac{7}{8}$ " $\varnothing$ x $4\frac{1}{4}$ " Torque = 800 in-lb	8"	3"	1¾"	4"	2"	1¼"	½"	¼"	$\frac{15}{32}$ "	2½"	1½"	6½"	3½"	1½"	1½"	$\frac{15}{16}$ "	1¼"	½"	⅞"
W8x28	1" $\varnothing$ x 5" Torque = 1000 in-lb	8"	3"	2"	4"	2"	1½"	¾"	$\frac{5}{16}$ "	$\frac{17}{32}$ "	2½"	1½"	6½"	3½"	1½"	1⅝"	1⅝"	1⅝"	½"	1"
W8x31	1⅝" $\varnothing$ x 5" Torque = 1200 in-lb	9"	3½"	2"	5"	2"	1½"	¾"	$\frac{5}{16}$ "	$\frac{19}{32}$ "	3"	1¾"	8"	5½"	1¼"	2"	1⅝"	1½"	½"	1"
W10x39	1⅝" $\varnothing$ x 5" Torque = 1200 in-lb	9"	3½"	2"	5"	2"	1½"	¾"	$\frac{5}{16}$ "	$\frac{19}{32}$ "	3"	1¾"	8"	5½"	1¼"	1⅞"	1⅜"	1⅜"	½"	1⅝"



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
7-18-14	Revised first note.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



08/05/24



ASSEMBLY DETAIL  
FOR WIND BEAMS  
AND ANCHOR PLATES

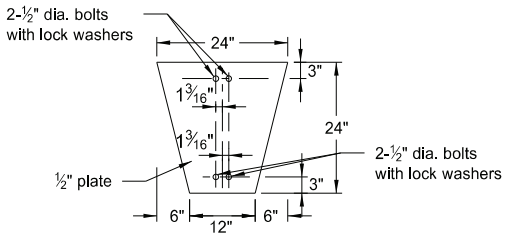
Notes:

Calculate the B distance using the formula,  $B=A/4$ .

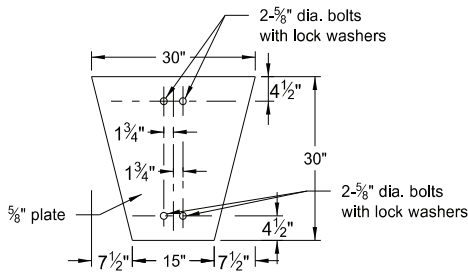
Use wind beam conforming to Section 894.03 B.6 of the Standard Specifications.

Use bolts conforming to ASTM A307 and galvanized according to ASTM A153.

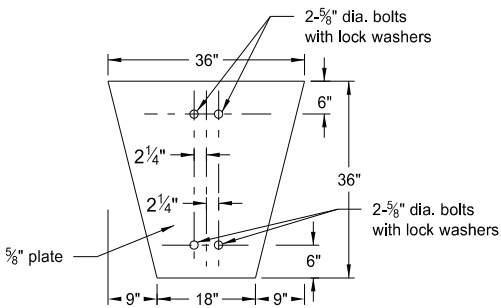
WIND BEAMS AND ANCHOR PLATES  
FOR W-SHAPE SUPPORTS



W4-13 & W5-16

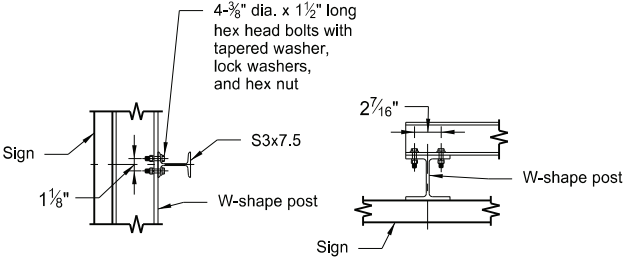


W6-20, W8-24 & W8-28

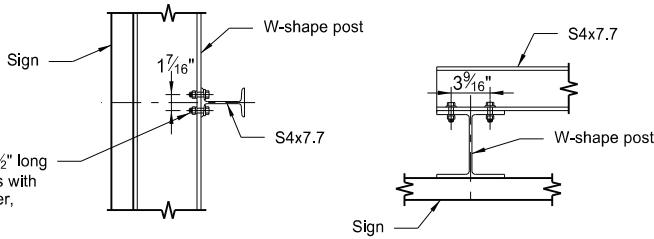


W8-31 & W10-39

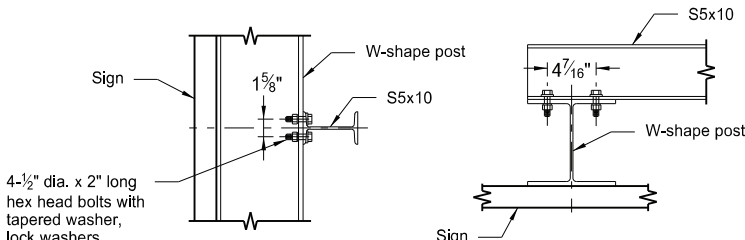
ANCHOR PLATE DETAILS



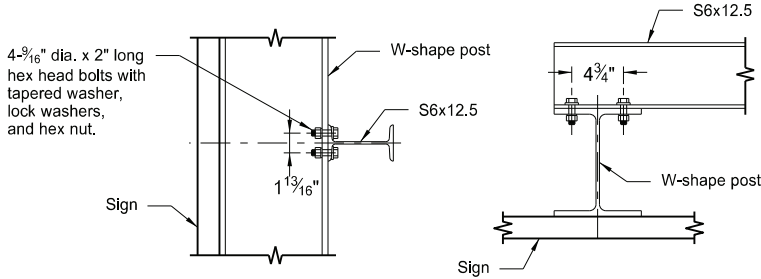
End View  
Top View  
W4-13 & W5-16



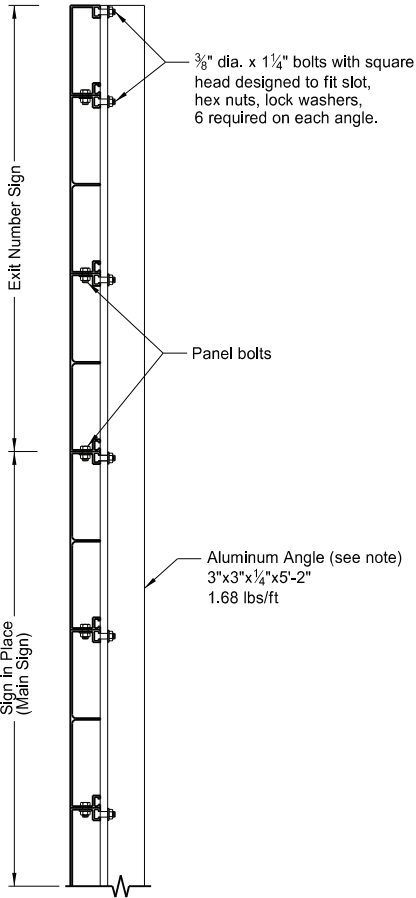
End View  
Top View  
W6-20, W8-24 and W8-28



End View  
Top View  
W8-31



End View  
Top View  
W10-39  
WIND BEAM CONNECTION DETAILS



ASSEMBLY DETAIL FOR  
EXIT NUMBER SIGNS

Note: Use two aluminum angles on each sign. Vary distance between angles dependent on post spacing of sign in place. Place angles as near as possible to posts. The Engineer will determine exact location.

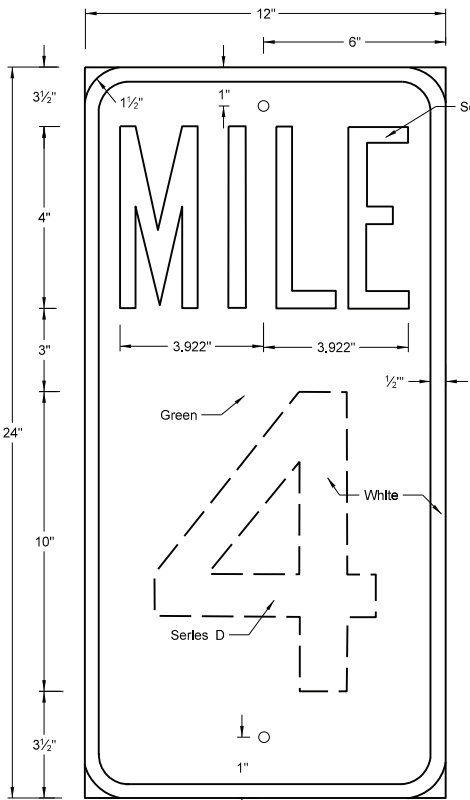
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
7-8-14	Revised second note.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



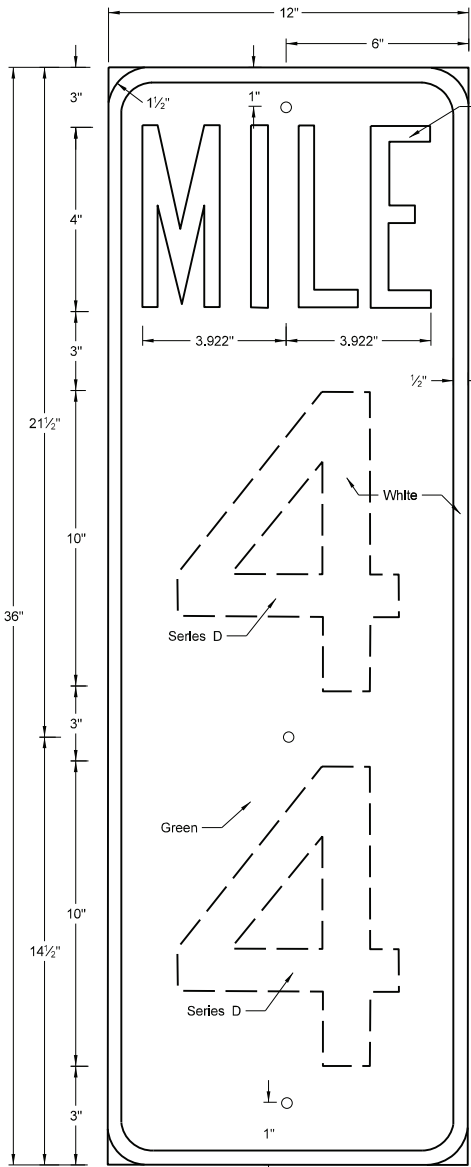
08/05/24

(EXPRESSWAY-FREEWAY USE) MILE POSTS

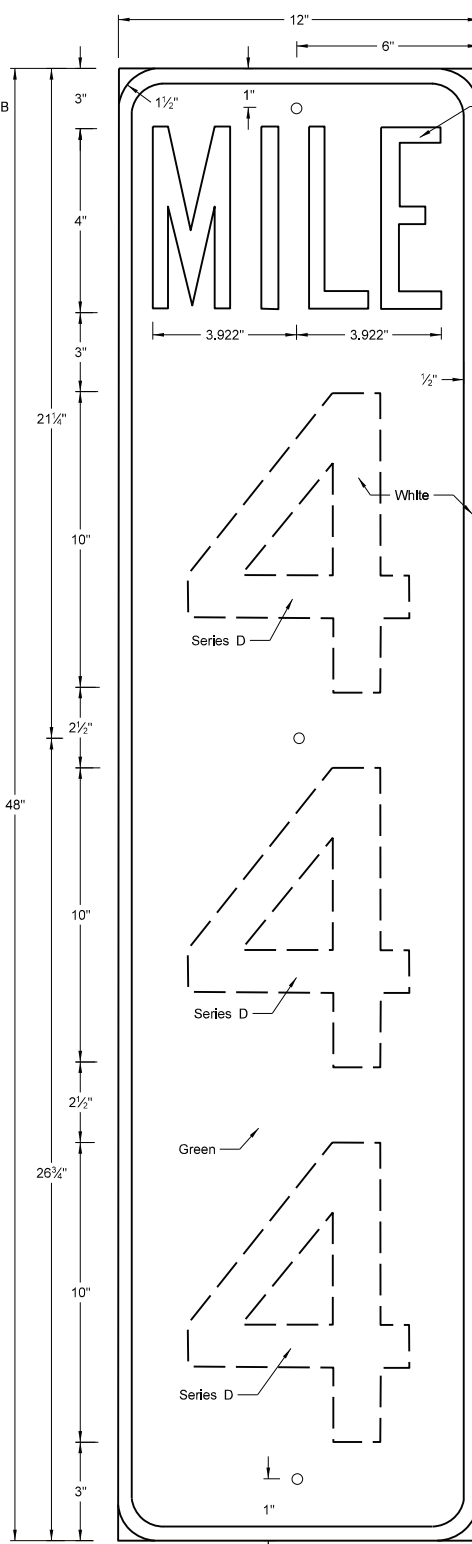
D-754-20



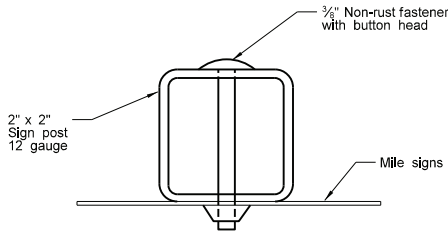
TYPE A  
Area = 2.00 S.F.



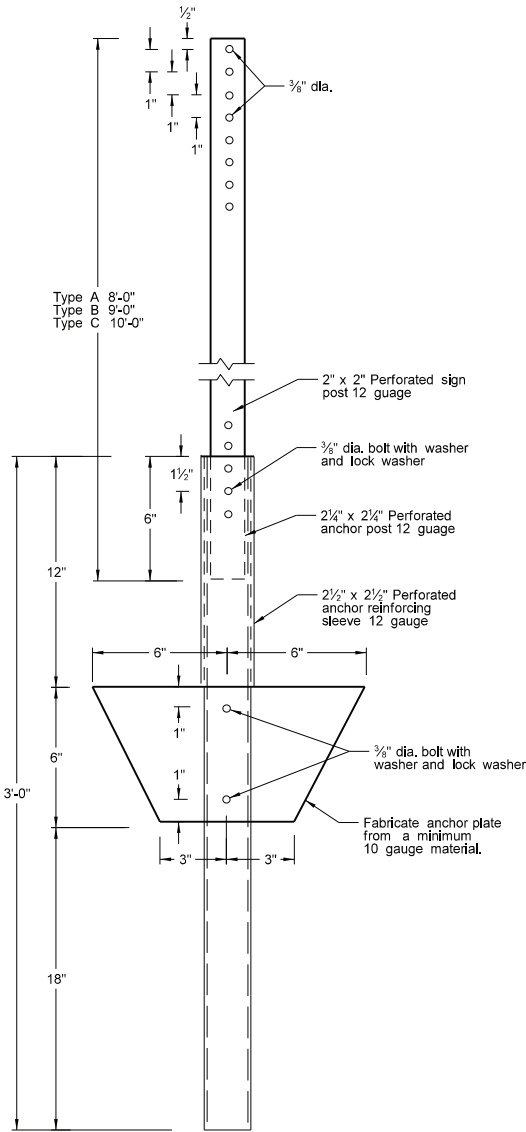
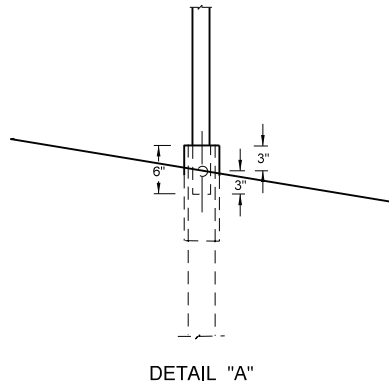
TYPE B  
Area = 3.00 S.F.



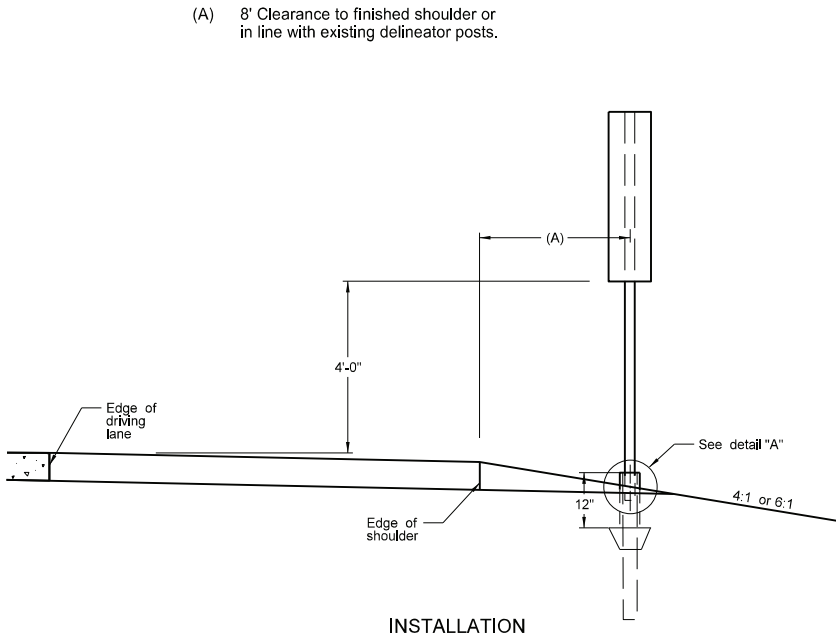
TYPE C  
Area = 4.00 S.F.



ASSEMBLY DETAIL



POST AND ANCHOR PLATE DETAIL



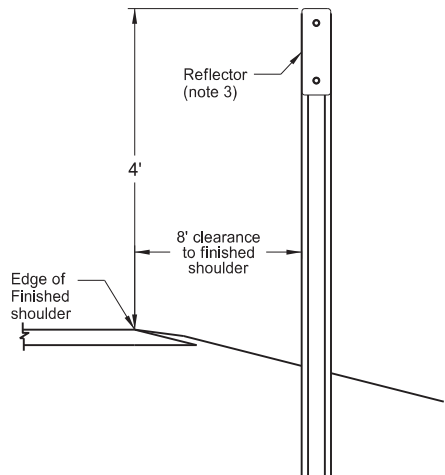
- NOTES:
- Installation: Install posts along right shoulder in line with delineators.
  - Mile Sign Backing: Fabricate backing of 0.080 aluminum.
  - Fasteners: Attach signs to post with tension pin type fastener or other suitable vandal resistant non-rust fastener.
  - Reflective Sheeting: Use Type IV sheeting.
  - Numbers: Use screened or applied copy numbers of the series shown.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
7-8-14	Revised post and reflective sheeting notes.
8-30-18	Updated to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.

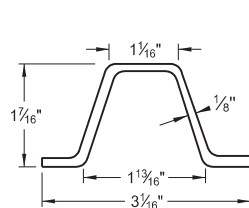


08/05/24

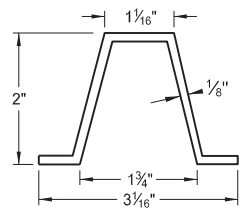
REFLECTORIZED DELINEATORS - DIVIDED HIGHWAY



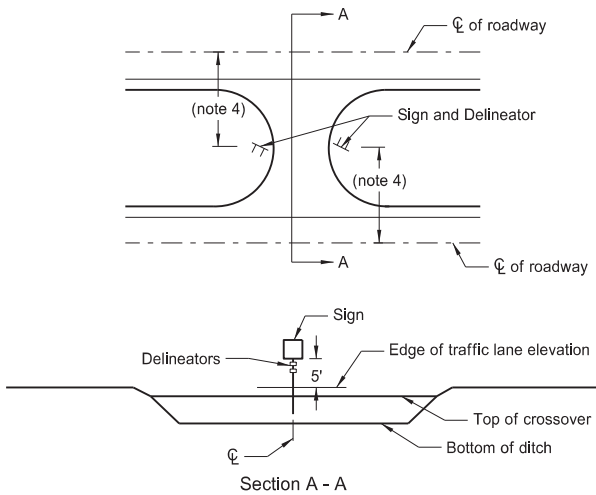
Installation  
(Type A, B, and C)



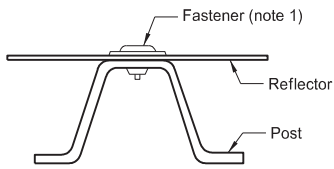
Steel Post Detail  
Approx. 2.0 lbs/ft



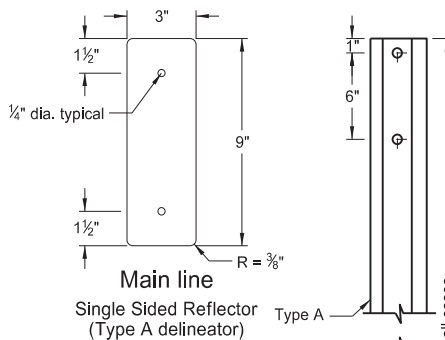
Aluminum Post Detail  
Approx. 0.88 lbs/ft



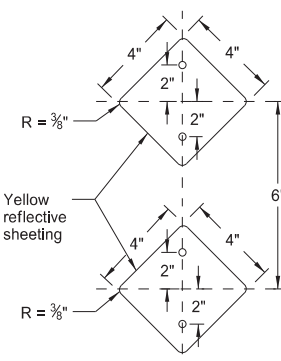
Median Crossovers  
Signing and Delineation system



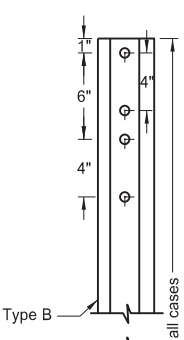
Type A, Type B, and Type C  
Delineator Attachment Detail



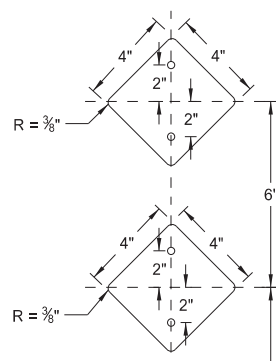
Type A



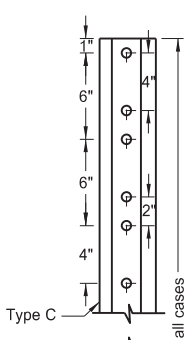
Ramps  
Two reflectors  
(Type B delineator)



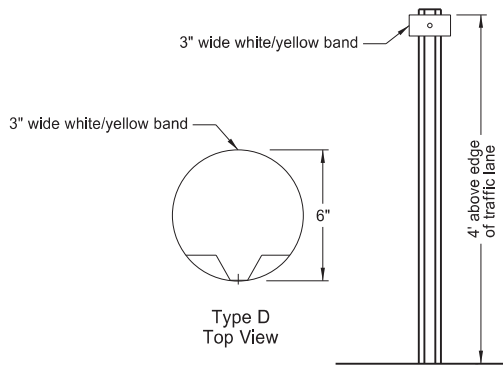
Type B



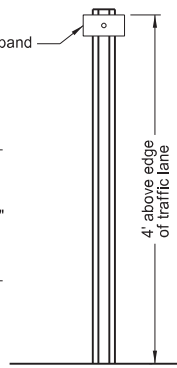
Narrow Bridges  
Three reflectors  
(Type C delineator)



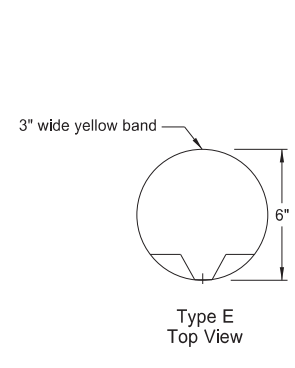
Type C



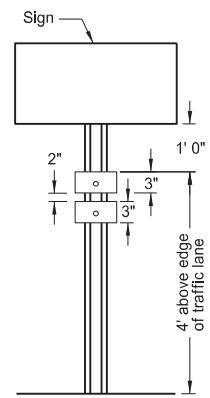
Type D  
Top View



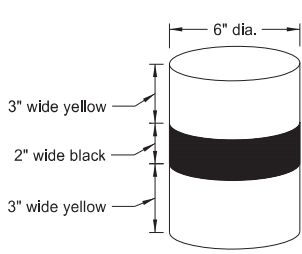
Median  
One reflector  
(Delineators-Type D)



Type E  
Top View



Median  
Two reflectors  
(Delineators-Type E)



Alternate Type E delineator

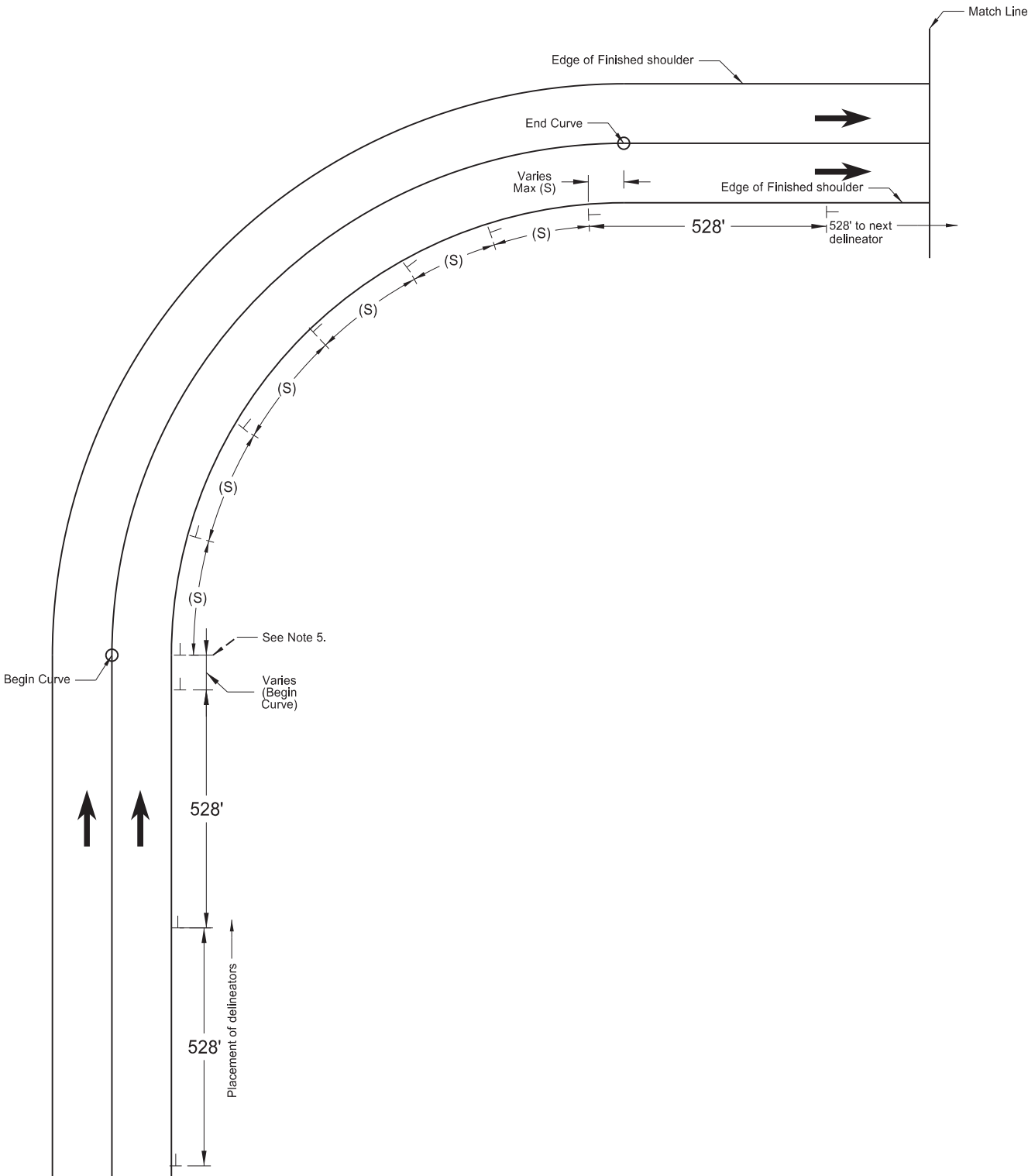
- Delineator Details  
Type A, B, and C
- Installation: Install posts along the right shoulder line, in the direction of travel, unless shown otherwise on the plans.
- Reflectors: Use reflector of the same color as the adjacent pavement marking with a 0.080 inch minimum thickness sign backing material.
- Type E
- Alternate: As an alternate, use one unit consisting of two yellow stripes separated by a 2" black stripe in place of two 3" yellow bands.
- (1) Use fasteners that are a minimum 1/4" diameter. Use double headed rivet or other non-rust vandal resistant fastener.
- (2) Drill only those holes required to attach the number of reflectors on that post, or drill all the posts the same so that any number of reflectors may be added.
- (3) Mount reflector facing traffic at an angle of 90° away from oncoming traffic.
- (4) Median width may vary. Place sign and delineator assembly in the median crossover an equal distance from each roadway.
- (5) Include all costs for materials, labor, and equipment to install single sided type A delineators in the unit price bid for "Delineators-Type A-Single Sided." Include all costs for materials, labor, and equipment to install single sided type B, type C, type D, and type E delineators in the unit price bid for "Delineators-Type B", "Delineators-Type C", "Delineators-Type D", and "Delineators-Type E."

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12/16/22	
REVISIONS	
DATE	CHANGE

KIRK J. HOFF  
REGISTERED  
PROFESSIONAL  
PE-4683  
ENGINEER  
NORTH DAKOTA  
12/16/22

TYPE A REFLECTORIZED DELINEATOR SPACING - DIVIDED HIGHWAY

D-754-21A



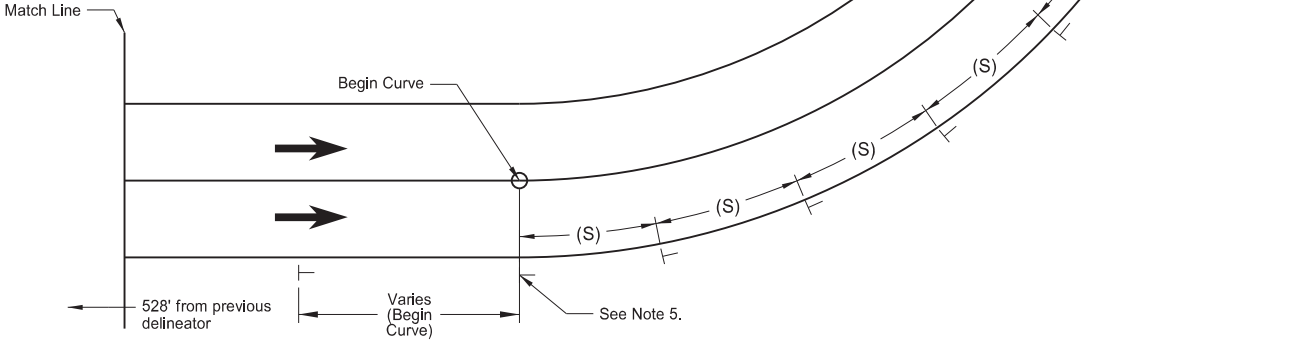
Spacing:

Curve Radius	Spacing (S) on Center
$R > 11,500'$	528'
$11,500' \geq R > 1,200'$	264'
$1,200' \geq R$	See table below

Radius (R) of Curve	Approx. Spacing (S) on Curve
$1,200' \geq R > 1,000'$	90'
$1,000' \geq R > 800'$	80'
$800' \geq R > 500'$	65'
$500' \geq R > 300'$	50'
$300' \geq R > 180'$	35'
$180' \geq R > 50'$	20'

Notes:

- Do not place delineators within 100' of a railroad crossing. Shift delineators in either direction to minimize impact to uniform spacing. Reestablish uniform spacing based on the last delineator location.
- For Type A delineators that land within approaches or ramps, shift delineators in either direction a distance not exceeding  $\frac{1}{4}$  of the uniform spacing. Eliminate delineators that still fall within approaches or ramps.
- Eliminate delineators landing within guardrail. Reestablish uniform spacing based on last delineator.
- Do not place delineators within  $\frac{1}{4}$  of the uniform spacing of a reference point marker.
- Install Type A delineators along the right shoulder line at the start of each curve.
- Only one roadway is shown. When installation is required for both roadways, install Type A delineators on each roadway as shown (Independent of the other roadway).
- Discontinue delineators on outside of curve where chevrons exist.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-16-22	
REVISIONS	
DATE	CHANGE

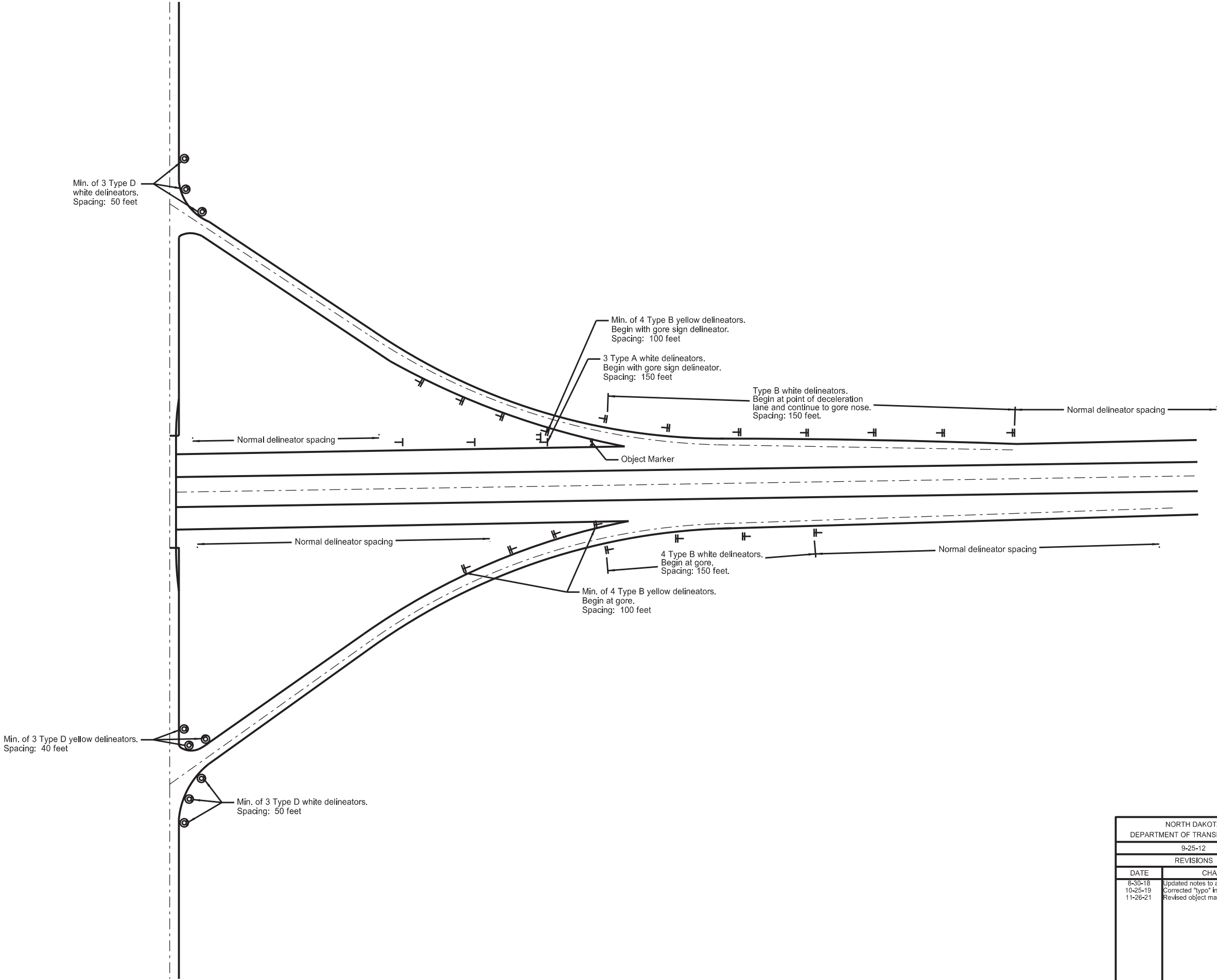


12/16/22

TYPICAL INTERCHANGE DELINEATION

D-754-22A

Interstate mainline delineator spacing:  
528' on tangent and curves less than 0°30'  
264' on curves 0°30' and greater.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
10-25-19	Corrected "typo" in exit ramp layout.
11-26-21	Revised object marker designation.

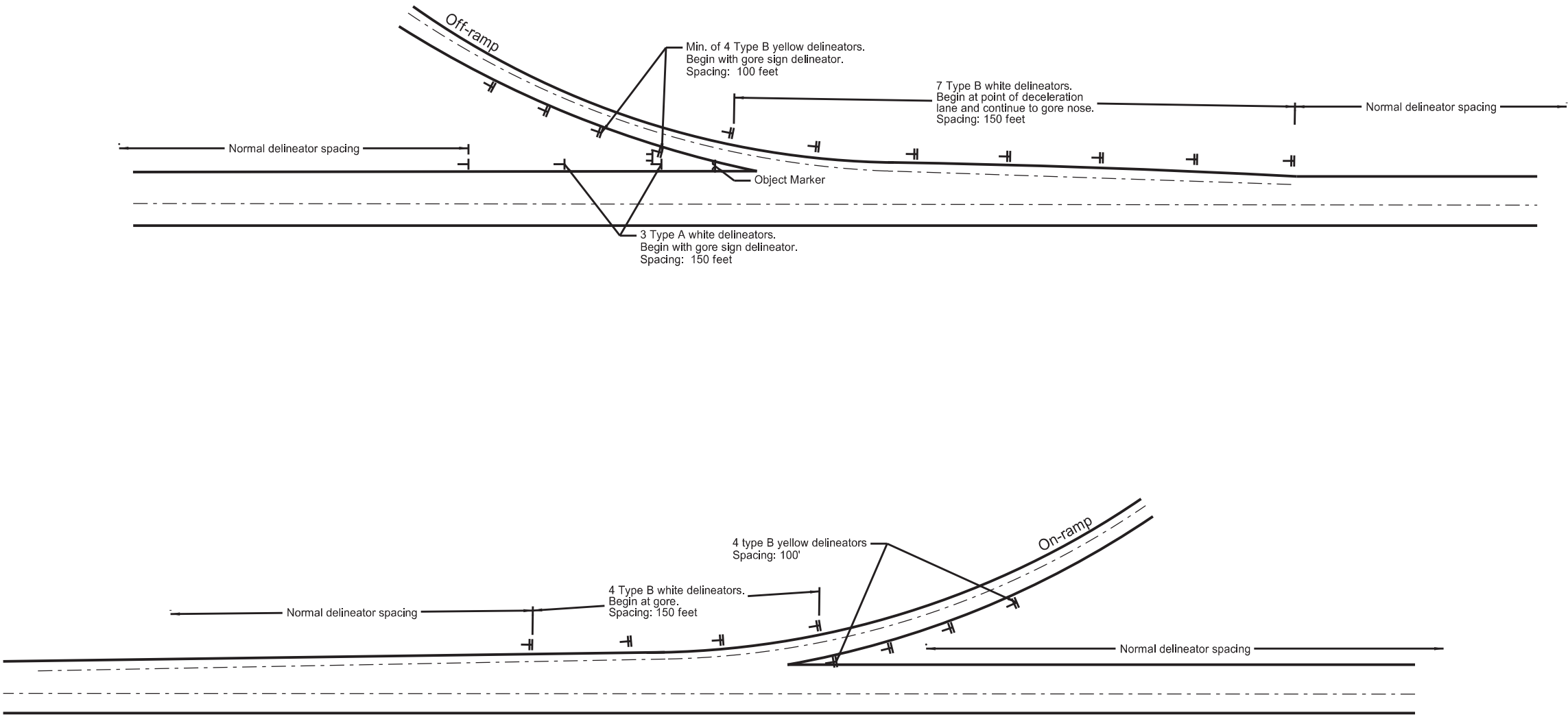


11/26/21

TYPICAL REST AREA DELINEATION

D-754-22B

Interstate mainline delineator spacing:  
528' on tangent and curves less than 0°30'  
264' on curves 0°30' and greater.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
11-26-21	Revised Object Marker designation.



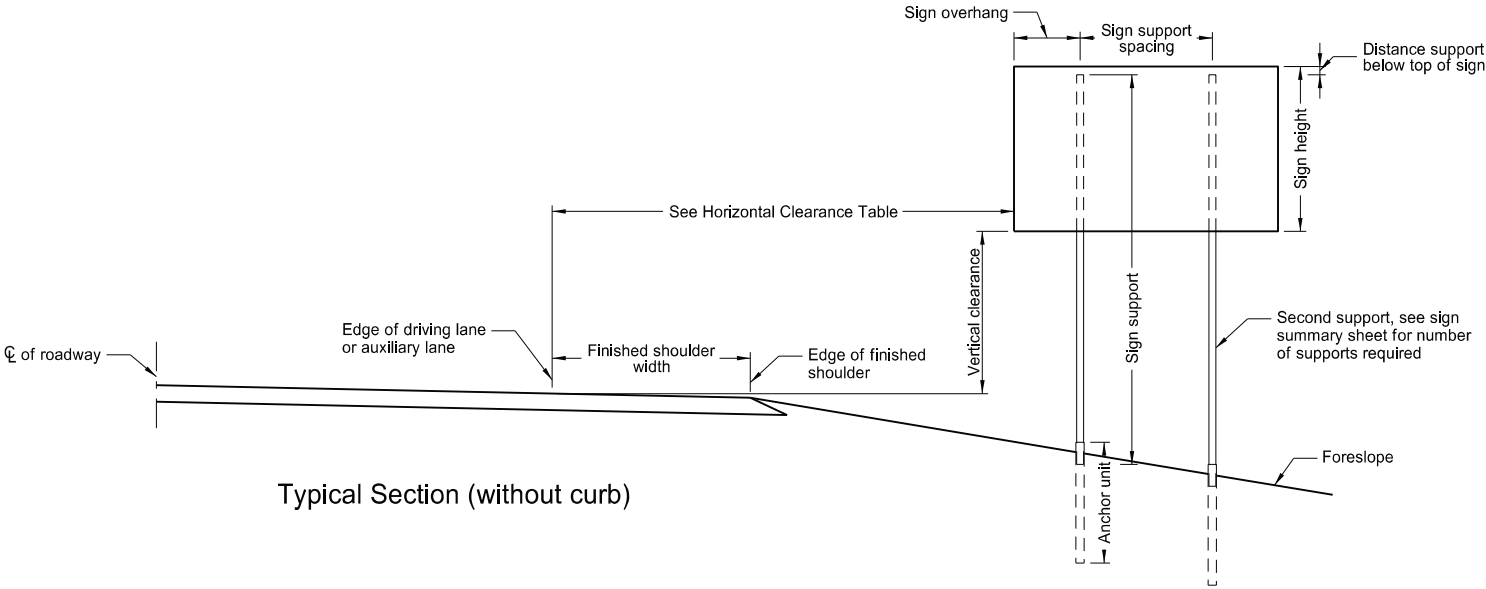
11/26/21

PERFORATED TUBE ASSEMBLY DETAILS

D-754-23

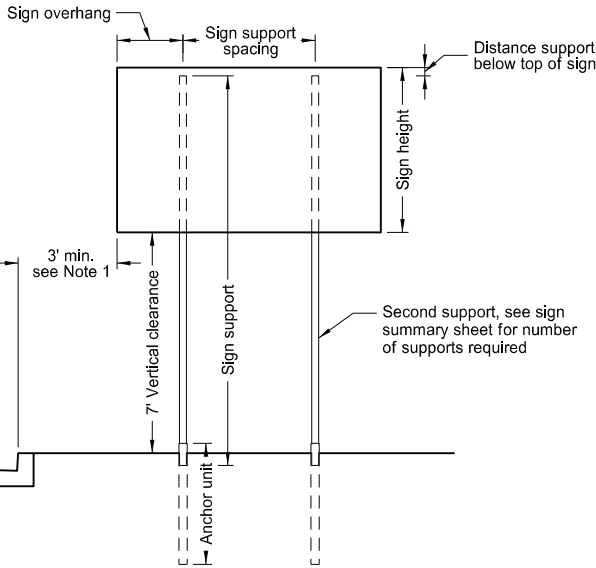
Notes:

1. Curbed Roadways: Use a 3' clearance from face of the curb except where right of way or sidewalk width is limited; Use a minimum 2' clearance. Increase the horizontal clearance if required to maintain a minimum sidewalk clear width of 4' from the sign support, not including any attached curb.
2. Minimum vertical clearance: Provide at least 5' measured from the bottom of the sign to the edge of the driving lane or auxiliary lane at the side of the road in rural districts. Provide at least 7' clearance to the bottom of the sign, where parking or pedestrian movements occur.
- Install signs on expressways a minimum height of 7'.
- Install adopt-a-highway signs on Freeways at least 7' above the edge of the driving lane.
- Maximum vertical clearance is 6" greater than the minimum vertical clearance.
3. Offset signs: Use a vertical clearance of 5' above the edge of the driving lane for signs placed 30 feet or more from the edge of the traveled way.
4. Provide a horizontal clearance from edge of shared use path to edge of sign of 3', except where width is limited. Provide a minimum clearance of 2'.

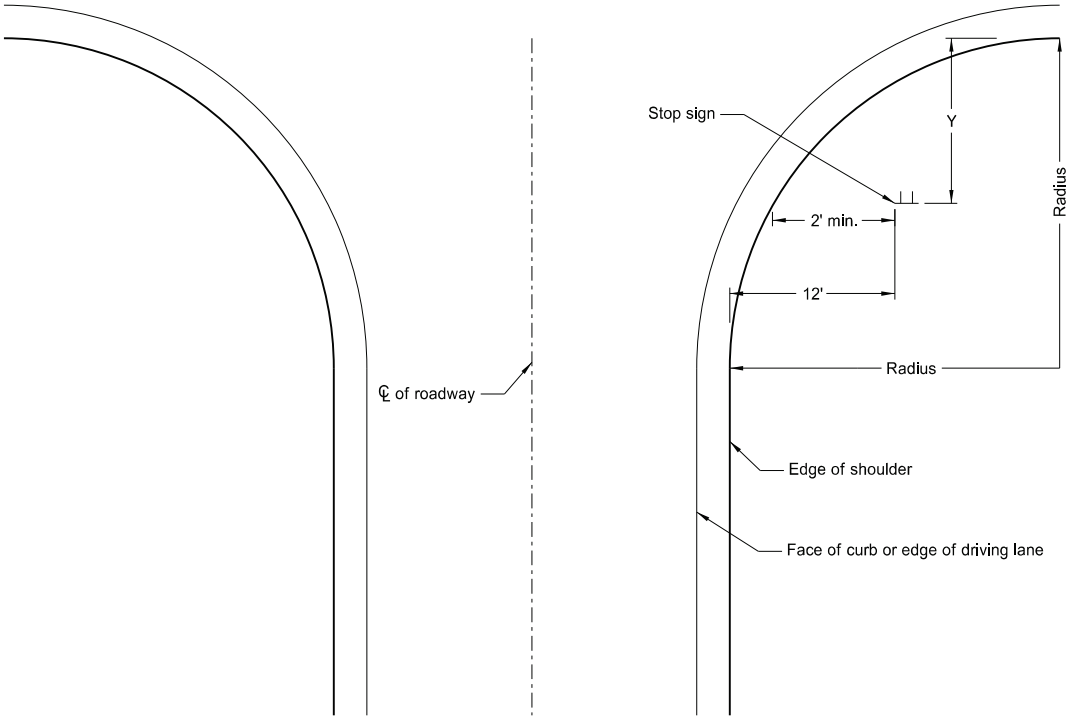


Typical Section (without curb)

Horizontal Clearance Table	
Shoulder Width ft	Offset ft
0 to 2	16
>2 to 4	18
>4 to 6	20
>6 to 8	22
>8 to 10	24



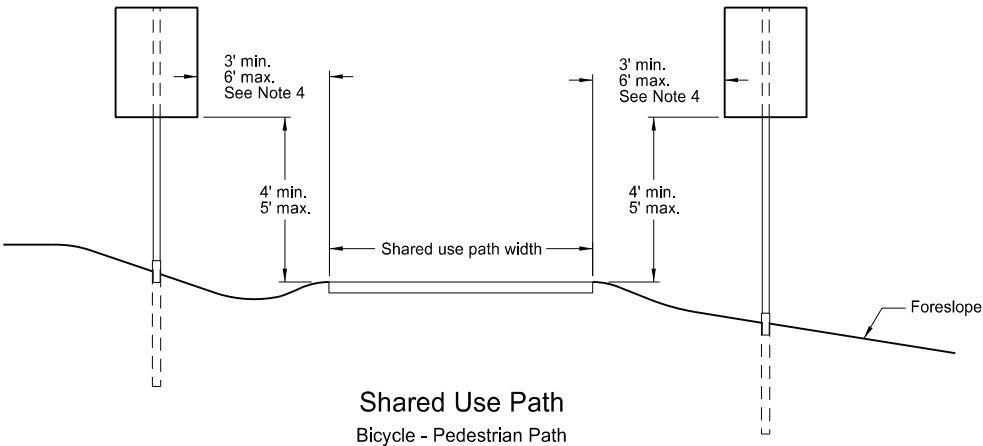
Typical Section (with curb)  
Residential or Business District



Stop Sign Location  
Wide Throat Intersection

Use layout for the placement of "Stop" signs.

Radius ft.	Y-max. ft.	Y-min. ft.
40	50	15
45	50	18
50	50	21
55	50	25
60	50	28
65	50	32
70	50	35
75	50	39
80	50	43



Shared Use Path  
Bicycle - Pedestrian Path

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
7-8-14	Revised note 2, added note 4.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



08/05/24



Notes:

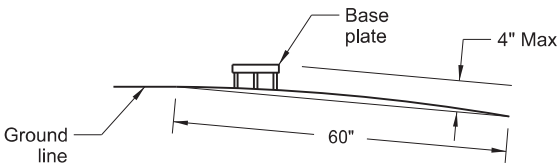
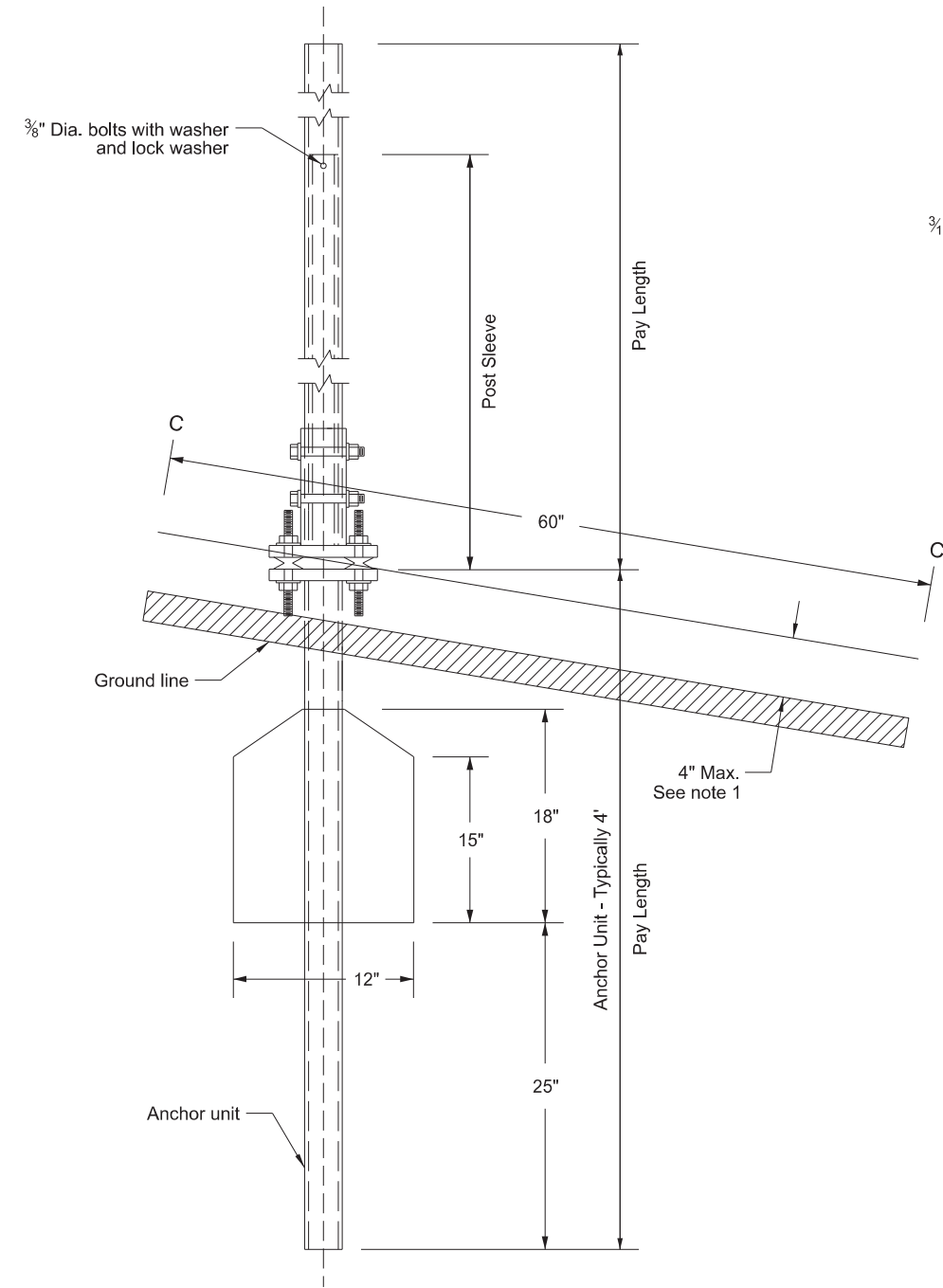
1. 4" Vertical clearance of anchor or breakaway base. The 4" x 60" measurement is above and below post location and also back and ahead of post.
2. Use anchor unit of the same size and specification as the post.
3. Provide a minimum 8' distance between the first and fourth post on four post signs.
4. Use the breakaway base system on standard D-754-24 or the breakaway coupling system manufactured from material meeting the requirements of ASTM A325 fasteners with the special requirements specified by DENT BREAKAWAY IND., INC. which meets the test requirements of NCHRP Report 350.

Number of Posts	Telescoping Perforated Tube						
	Post Size In.	Wall Thick-ness Gauge	Sleeve Size In.	Wall Thick-ness Gauge	Slip Base	Anchor Size Without Slip Base In.	Anchor Wall Thickness Gauge
1	2	12			No	2¼	12
1	2¼	12			No	2½	12
1	2½	12			(B)	3(C)	7
1	2½	10			Yes		7
1	2¼	12	2	12	Yes		7
1	2½	12	2¼	12	Yes		7
2	2½	10			Yes		7
2	2¼	12	2	12	Yes		7
2	2½	12	2¼	12	Yes		7
3 & 4	2½	12			Yes		7
3 & 4	2½	10			Yes		7
3 & 4	2½	12	2¼	12	Yes		7
3 & 4	2¼	12	2	12	Yes		7
3 & 4	2½	10	2¾	10	Yes		7

(B) - 2½" 12 gauge posts do not need breakaway bases unless support is placed in boggy, wet, or loose soil areas.

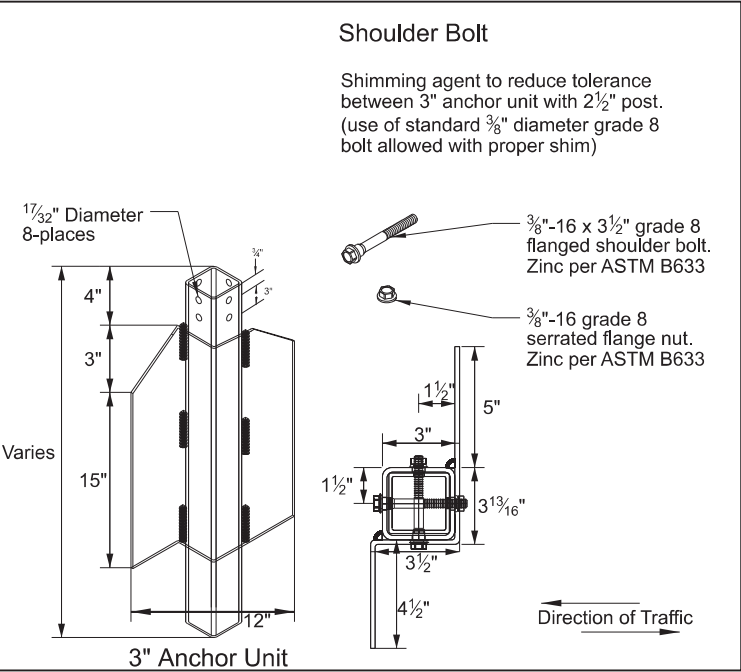
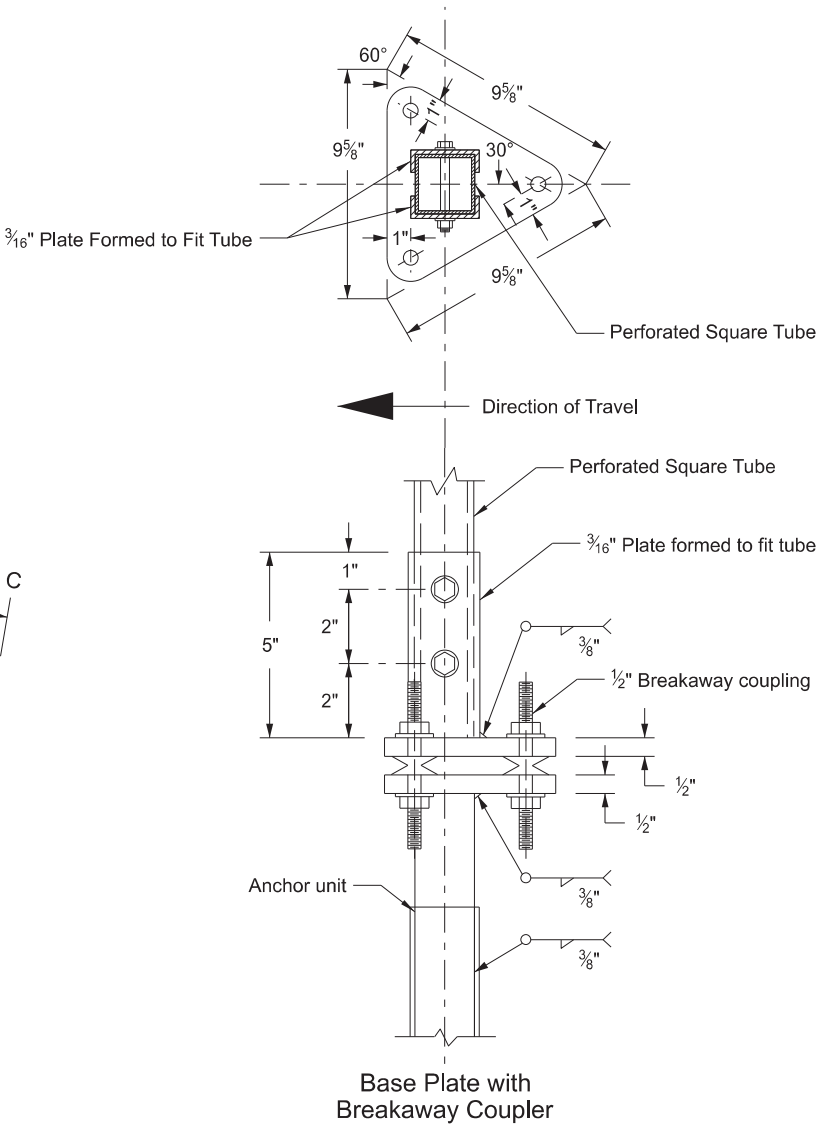
(C) - 3" anchor unit

Breakaway Coupler System for Perforated Tubes



Section C-C

Max projection of the stub post is 4" above a 60" chord aligned radially to the center line of the highway and connecting any point, within the length of the chord, on the ground surface on one side of the support to a point in the ground surface on the other side.



NORTH DAKOTA  
DEPARTMENT OF TRANSPORTATION

10-3-2013

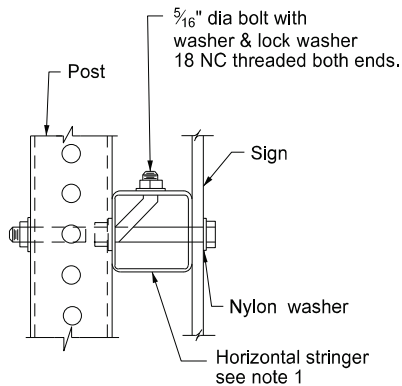
REVISIONS

DATE	CHANGE
08-30-18	Updated notes to active voice.
08-30-19	New Design Engr PE Stamp.
08-05-24	Electronic Stamp/Signature.
07-22-25	Corrected "typo" in C-C note.

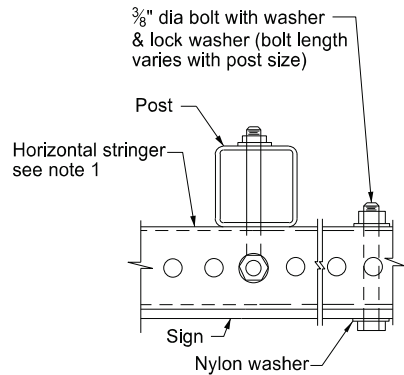
KIRK J. HOFF  
REGISTERED  
PROFESSIONAL  
PE-4683  
ENGINEER  
NORTH DAKOTA

07/22/25

## Mounting Details Perforated Tube

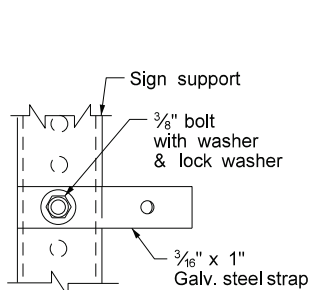


Side View

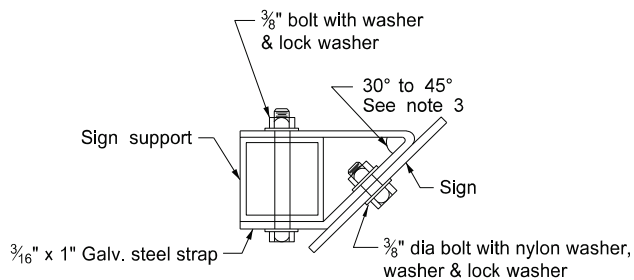


Top View

### STRINGER MOUNTING (WITH STRINGER IN FRONT OF POST)

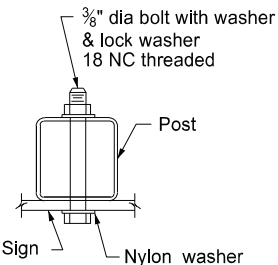


Side View

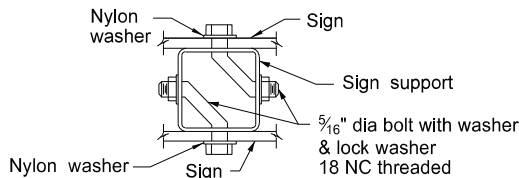


Top View

## STRAP DETAIL

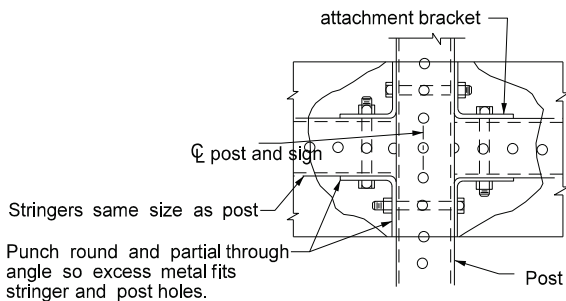


## BOLT MOUNTING



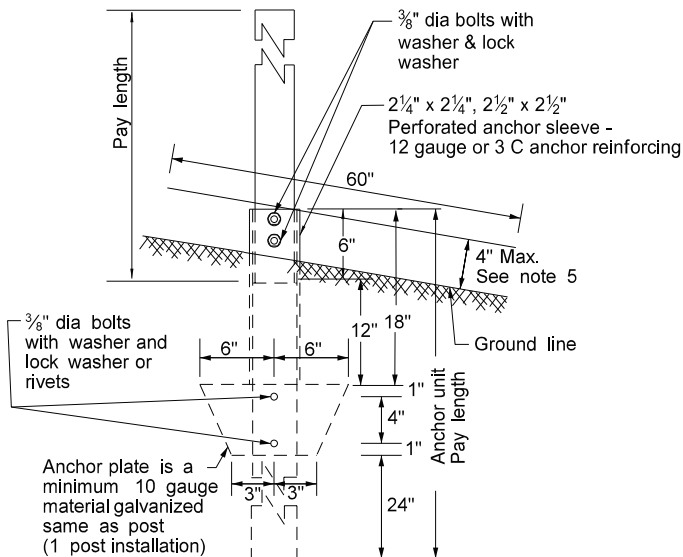
Top View

## BACK TO BACK MOUNTING

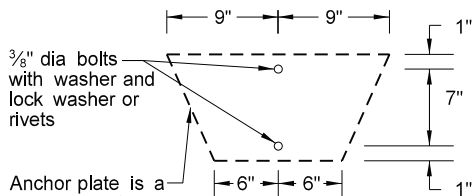


Stringers same size as post—  
Punch round and partial through  
angle so excess metal fits  
stringer and post holes.

STREET NAME SIGNS AND ONE WAY SIGNS  
SINGLE POST ASSEMBLY  
ONE STRINGER OR BACK TO BACK MOUNTING



## ANCHOR UNIT AND POST ASSEMBLY



Anchor plate is a minimum 10 gauge material galvanized same as post (2 post installation)

Properties of Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In. <sup>4</sup>	Cross Sect. area In. <sup>2</sup>	Section Modulus In. <sup>3</sup>
1½ x 1½	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.416	0.372	0.590	0.372
2¼ x 2¼	0.105	12	2.773	0.561	0.695	0.499
2⅝ x 2⅝	0.135	10	3.432	0.605	0.841	0.590
2½ x 2½	0.105	12	3.141	0.804	0.803	0.643
2½ x 2½	0.135	10	4.006	0.979	1.010	0.783

The 2<sup>3</sup>/<sub>16</sub>" size 10 gauge is shown as 2.19" size on the plans.  
The 2<sup>1</sup>/<sub>2</sub>" size is shown as 2.51" size on the plans.

**Note:**

1. Horizontal stringers - Use perforated tubes or  $1\frac{3}{4}$ " x  $\frac{3}{16}$ " thick, 1.08 lbs./ft aluminum or 3.16 lbs./ft steel z bar stringers.
2. Use minimum outside diameter  $\frac{1}{16}$ "  $\pm \frac{1}{16}$ " and 10 gauge thick metal washers on sign face.
3. Place No Parking signs with directional arrows at a 30 to 45 degree angle with the line of traffic flow. Turning the support to the correct angle for No Parking signs requiring the above angles is allowed. If the No Parking sign is placed with another sign that requires placement at a 90 degree angle with the line of traffic flow, use the detailed angle strap to mount the No Parking sign. Use flat washers and lock washers with all nylon washers.
4. Punching the sign backing and placing the bolt through the sign, the stringer and the post is allowed in lieu of using the bent bolt to attach the post to the stringer.
5. 4" vertical clearance of anchor or breakaway base. The 4" x 60" measurement is above and below post location and also back and ahead of post.

Number of Posts	Telescoping Perforated Tube						
	Post Size In.	Wall Thickness Gauge	Sleeve Size In.	Wall Thickness Gauge	Slip Base	Anchor Size Without Slip Base In.	Anchor Wall Thickness Gauge
1	2	12			No	2¼	12
1	2¼	12			No	2½	12
1	2½	12			(B)	3(C)	7
1	2½	10			Yes		7
1	2¼	12	2½(D)	12	Yes		7
1	2½	12	2¼	12	Yes		7
2	2½	10			Yes		7
2	2¼	12	2½(D)	12	Yes		7
2	2½	12	2¼	12	Yes		7
3 & 4	2½	12			Yes		7
3 & 4	2½	10			Yes		7
3 & 4	2½	12	2¼	12	Yes		7
3 & 4	2¼	12	2½(D)	12	Yes		7
3 & 4	2½	10	2¾/16	10	Yes		7

(B) - When placing 2½", 12 gauge posts in standard soils without breakaway bases, provide a shim as specified by the manufacturer. Provide breakaway base when placing the support in weak soils. Engineer will determine if soils are weak. Weak soils are classified as boggy, wet, or loose soil areas.

(C) - 3" anchor unit

(D) - 2½" x 12 ga. x 18" minimum length external sleeve required.

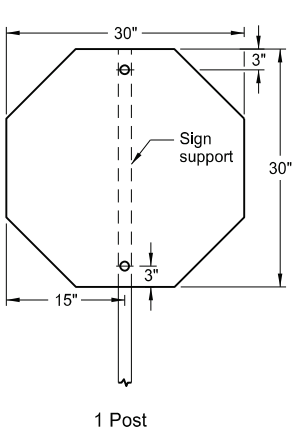
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-6-09	
REVISIONS	
DATE	CHANGE
7-8-14	Revised Note 3.
8-30-18	Updated notes to active voice.
8-30-19	New Design Engr PE Stamp.
8-05-24	Electronic Stamp/Signature.



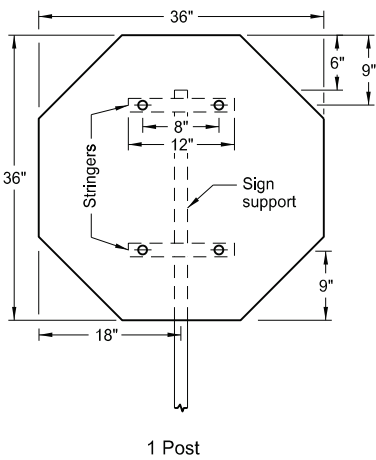
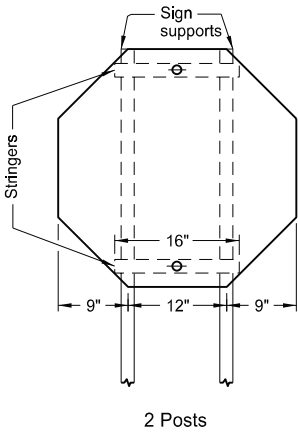
08/05/24

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION  
DETAILS REGULATORY, WARNING AND GUIDE SIGNS

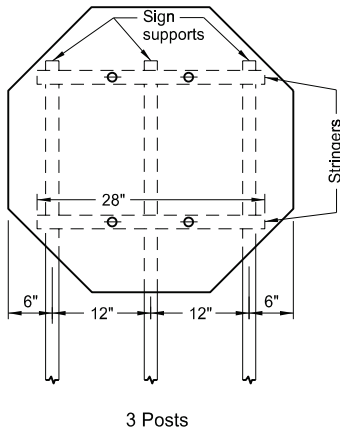
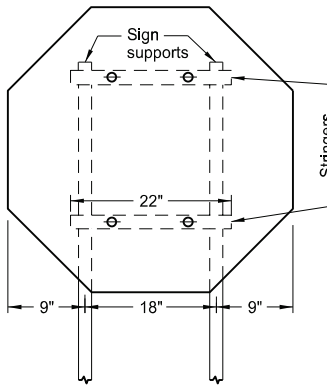
D-754-26



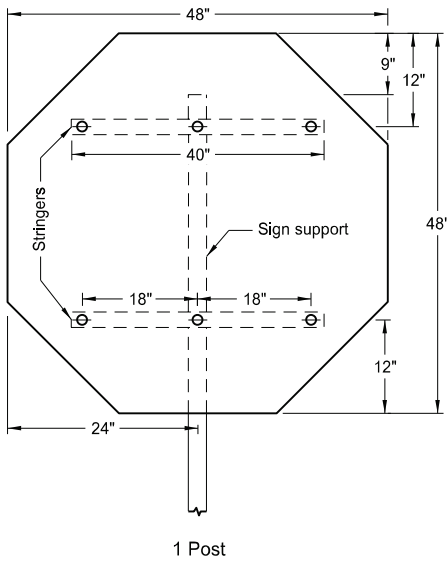
Assembly No. 1



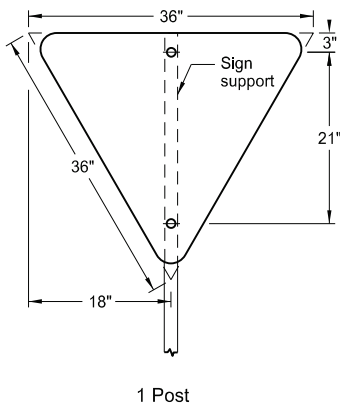
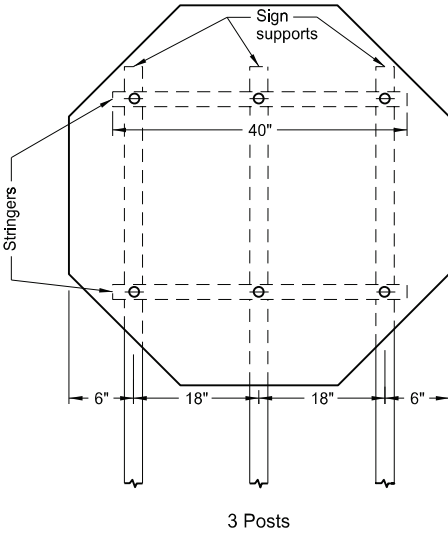
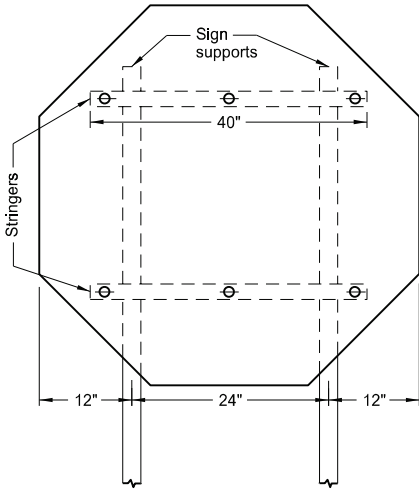
Assembly No. 2



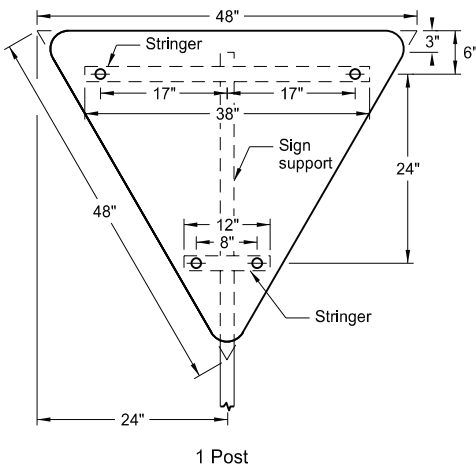
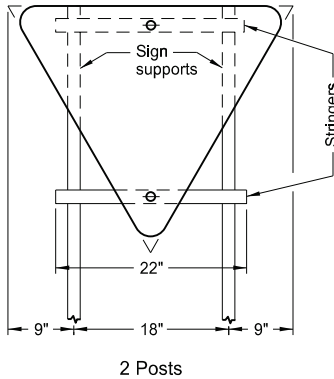
- Notes:
1. Use 0.100 inch minimum thickness sign backing material.
  2. Use 1½" x 1½" perforated square tube stringers.
  3. Punch holes round for ¾" bolt.



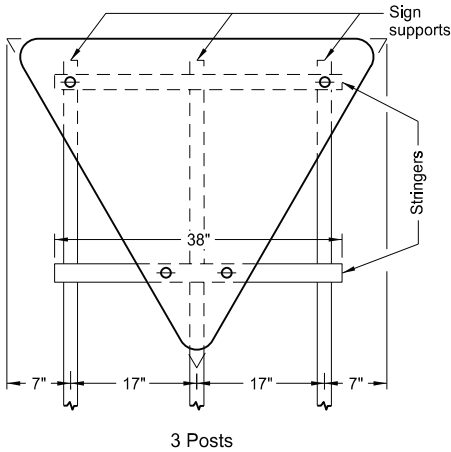
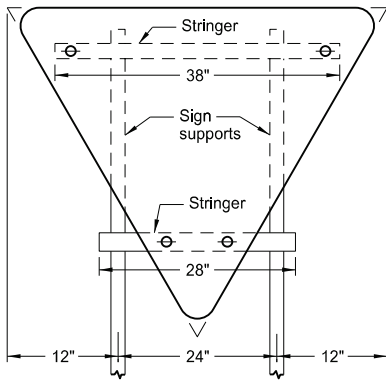
Assembly No. 3



Assembly No. 4



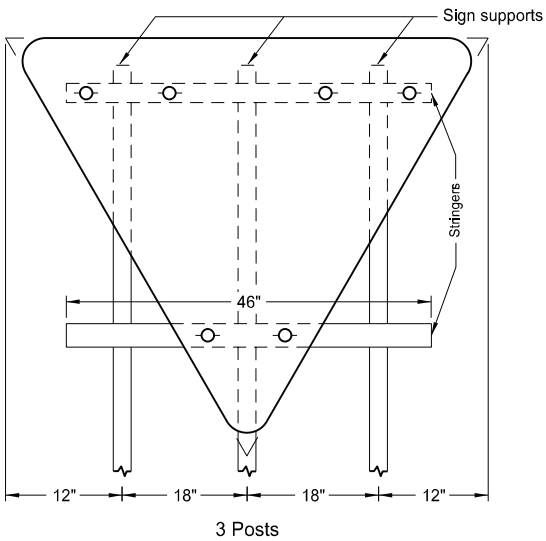
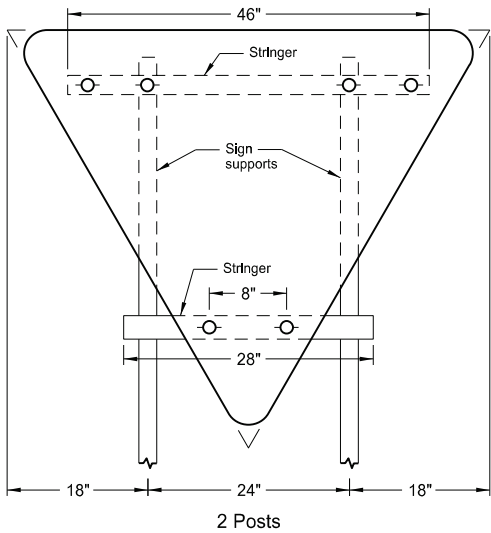
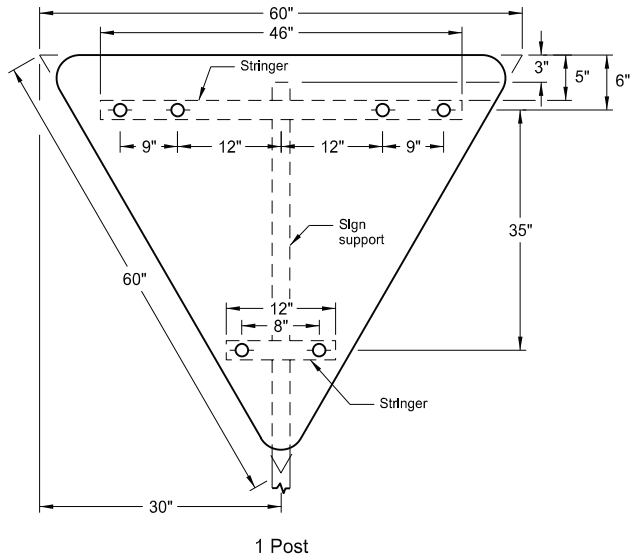
Assembly No. 5



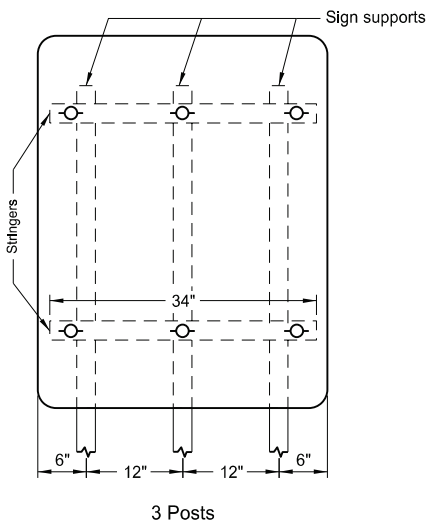
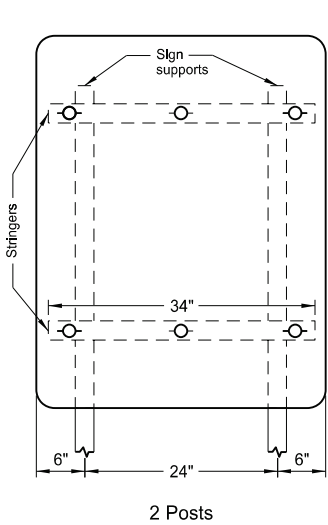
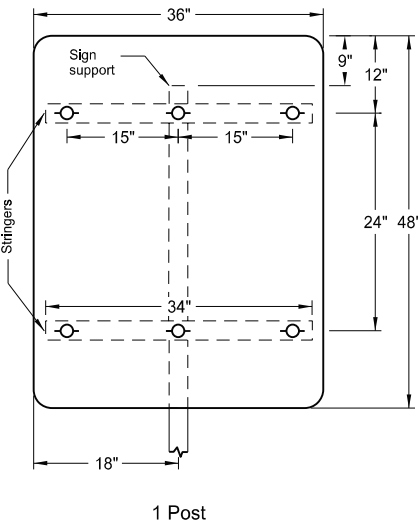
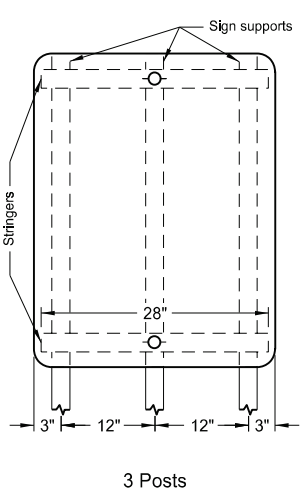
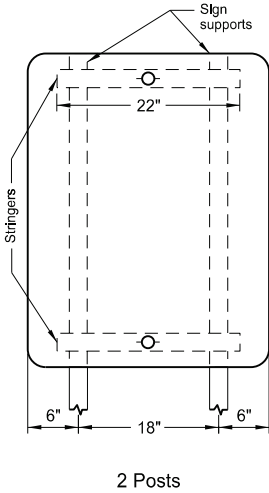
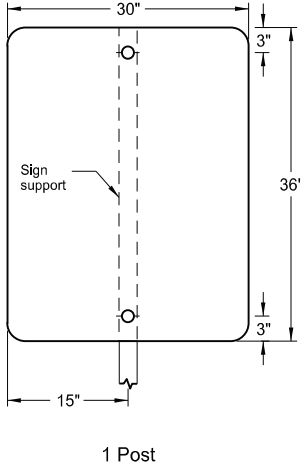
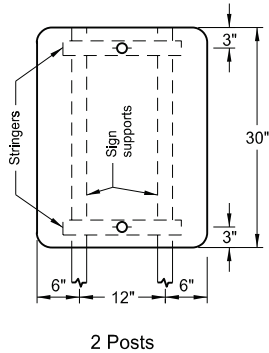
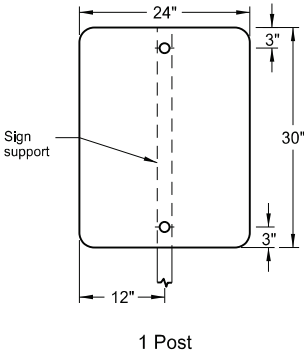
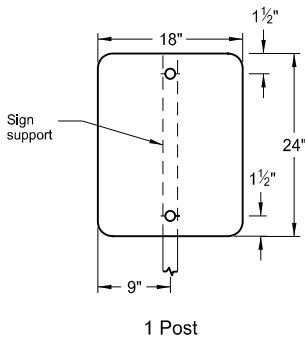
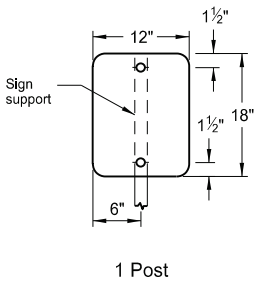
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-30-19	New Design Engineer PE Stamp.
8-05-24	Electronic Stamp/Signature.



SIGN PUNCHING, STRINGER AND SUPPORT LOCATION  
DETAILS REGULATORY, WARNING AND GUIDE SIGNS



- Notes:
1. Use 0.100 inch minimum thickness sign backing material.
  2. Use 1½" x 1½" perforated square tube stringers.
  3. Punch holes round for ⅜" bolt.

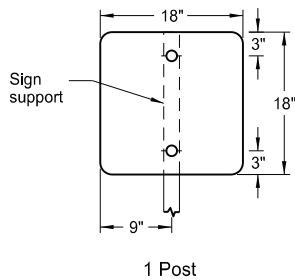
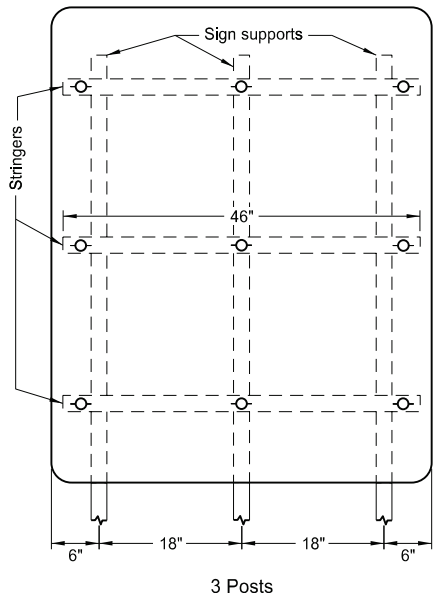
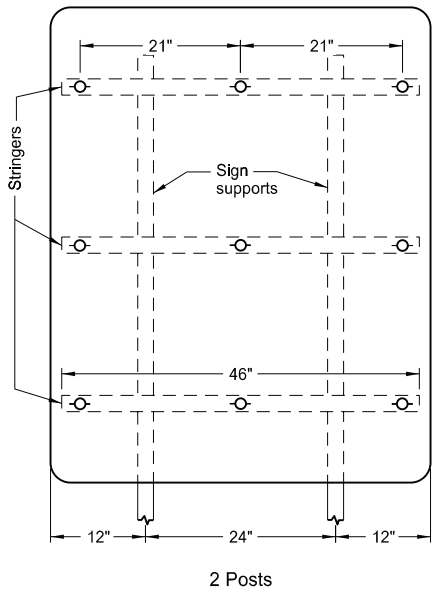
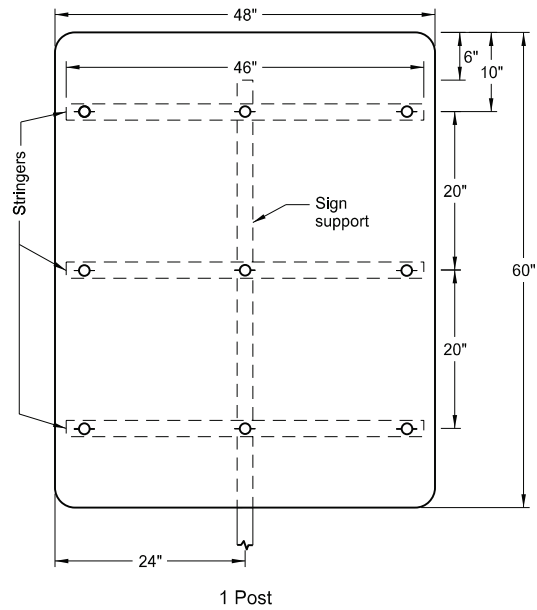


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-30-19	New Design Engineer PE Stamp.
8-06-24	Electronic Stamp/Signature.

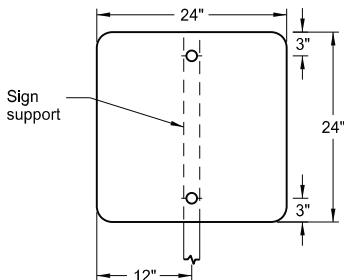


08/06/24

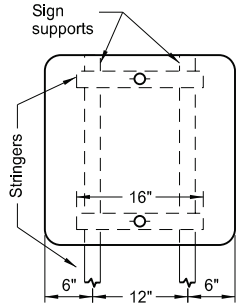
SIGN PUNCHING, STRINGER AND SUPPORT LOCATION  
DETAILS REGULATORY, WARNING AND GUIDE SIGNS



Assembly No. 13

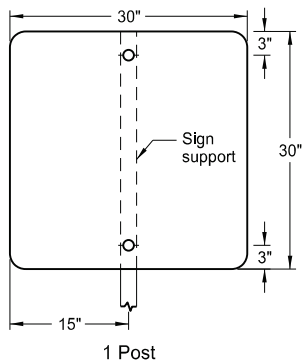


1 Post

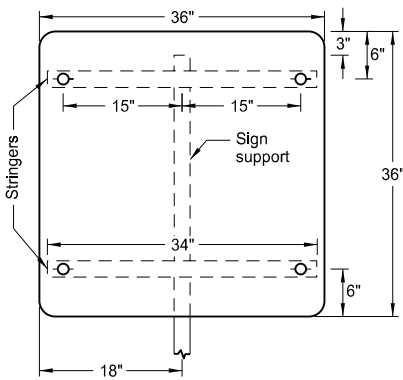
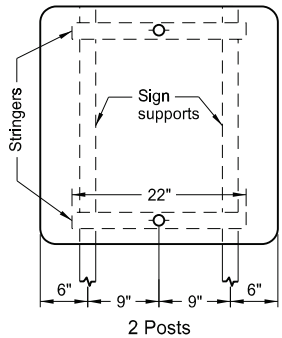


2 Posts

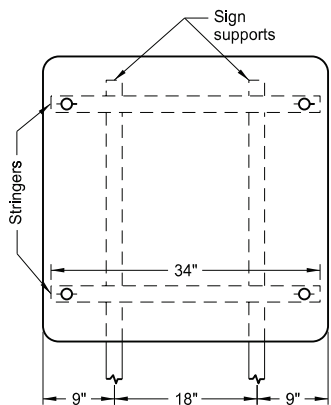
Assembly No. 14



Assembly No. 15

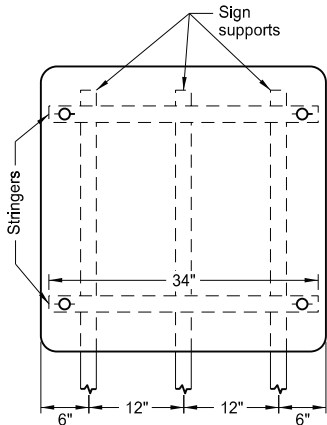


1 Post

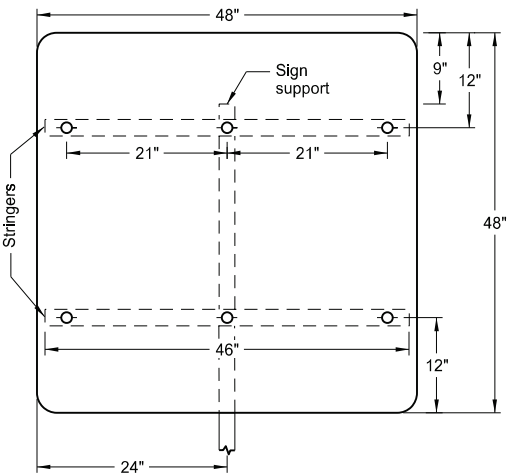


2 Posts

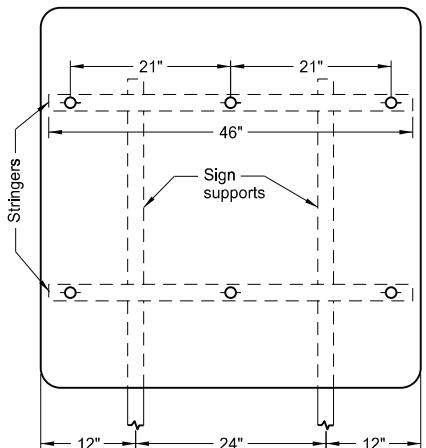
Assembly No. 16



3 Posts

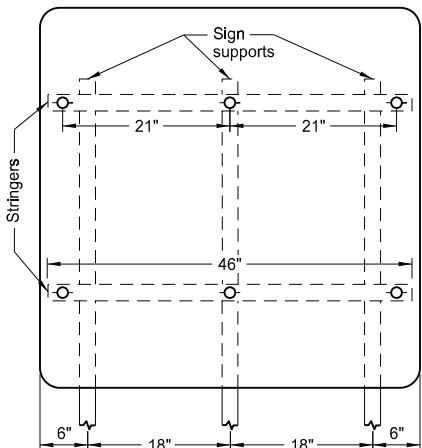


1 Post



2 Posts

Assembly No. 17



3 Posts

Notes:

1. Use 0.100 inch minimum thickness sign backing material.
2. Use 1½" x 1½" perforated square tube stringers.
3. Punch holes round for ⅜" bolt.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
8-30-18	Updated to active voice & changed Assembly 16 post spacing.
8-30-19	New Design Engineer PE Stamp.
8-06-24	Electronic Stamp/Signature.

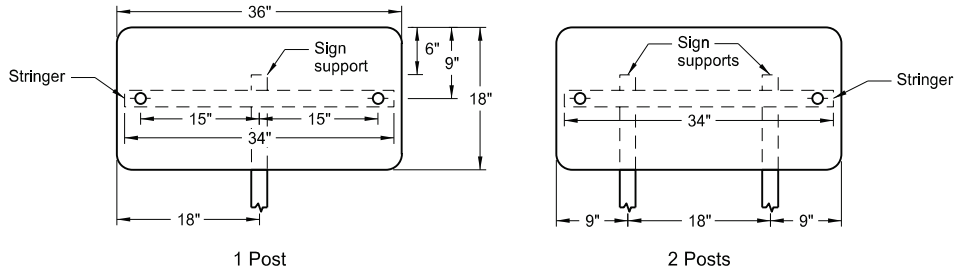


08/06/24

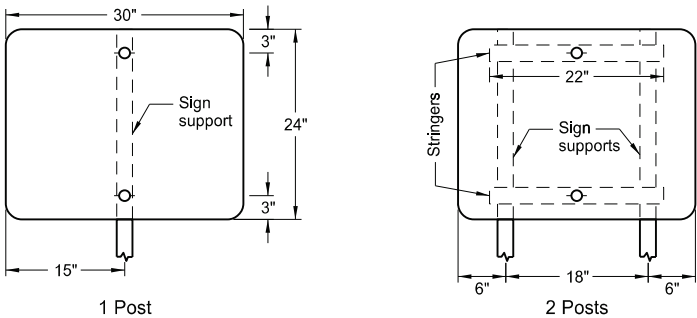
SIGN PUNCHING, STRINGER AND SUPPORT LOCATION  
DETAILS REGULATORY, WARNING AND GUIDE SIGNS

D-754-32

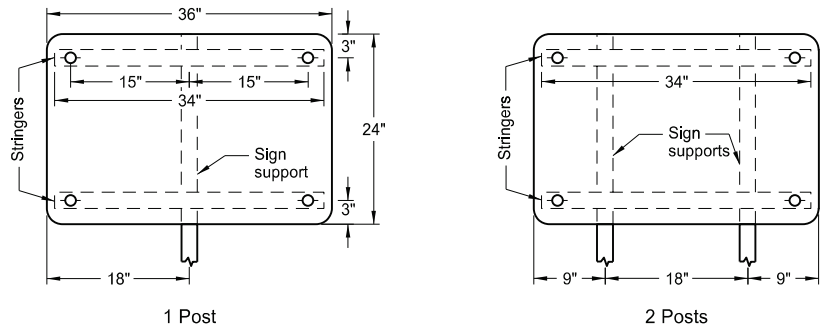
- Notes:
- 1. Use 0.100 inch minimum thickness sign backing material.
  - 2. Use 1½" x 1½" perforated square tube stringers.
  - 3. Punch holes round for ⅜" bolt.



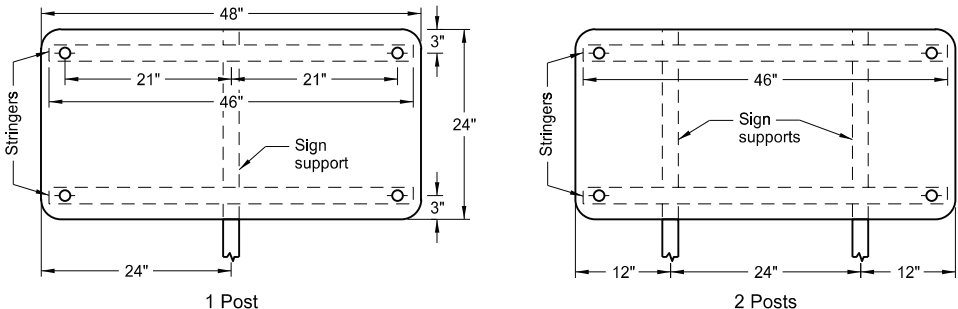
Assembly No. 31



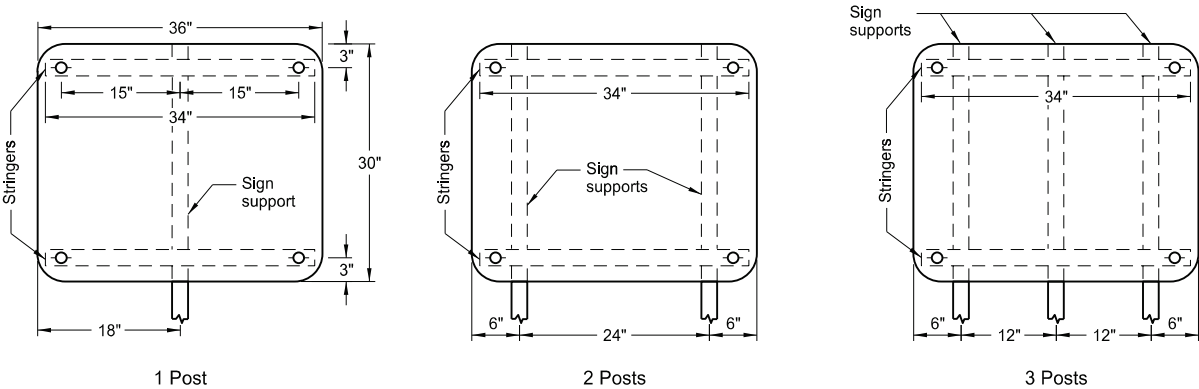
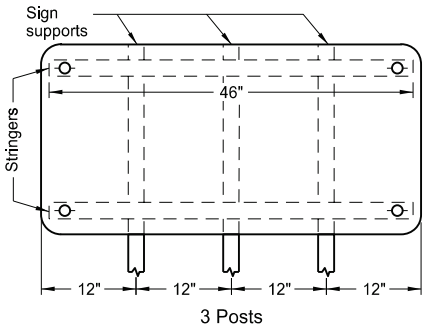
Assembly No. 32



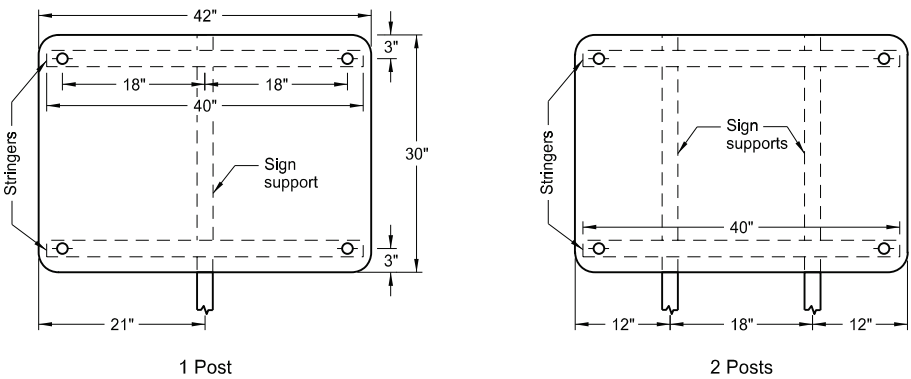
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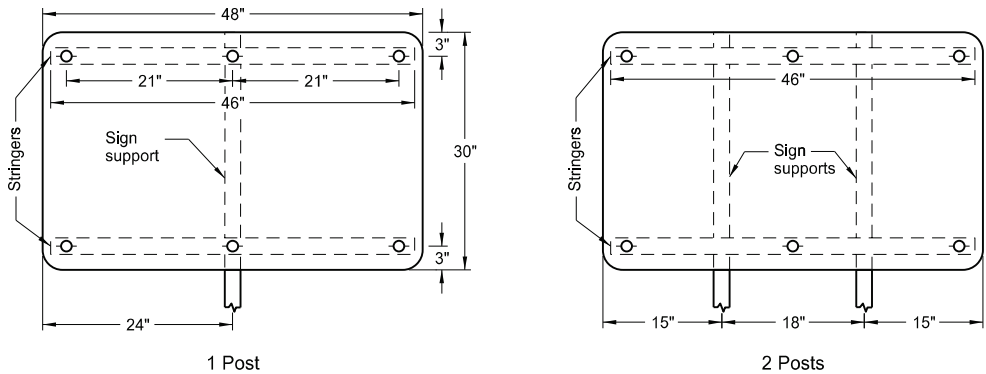
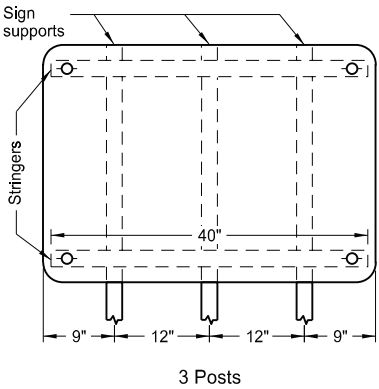
Assembly No. 34



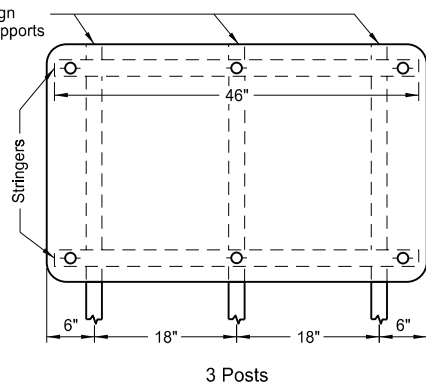
Assembly No. 35



Assembly No. 36



Assembly No. 37

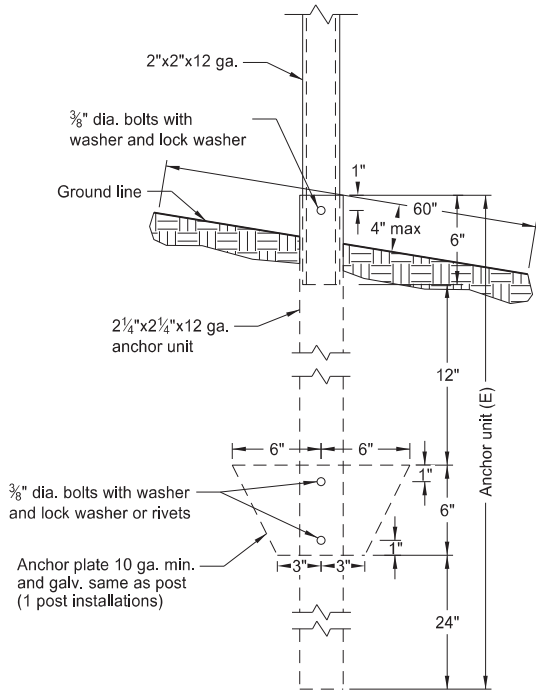


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-30-19	New Design Engineer PE Stamp.
8-06-24	Electronic Stamp/Signature.

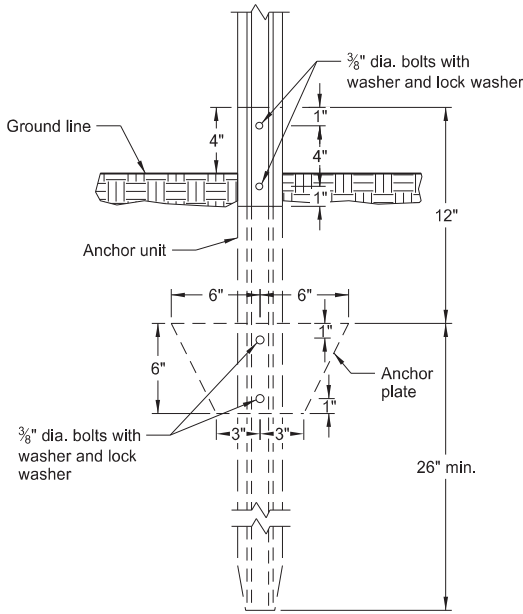


08/06/24

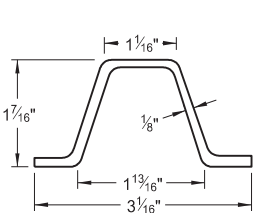
OBJECT MARKERS



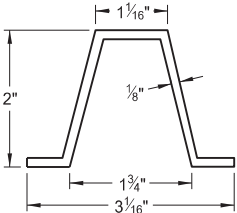
Perforated Tube Anchor Unit Assembly



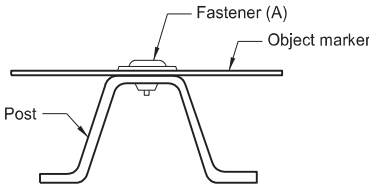
U-Channel Anchor Unit Assembly



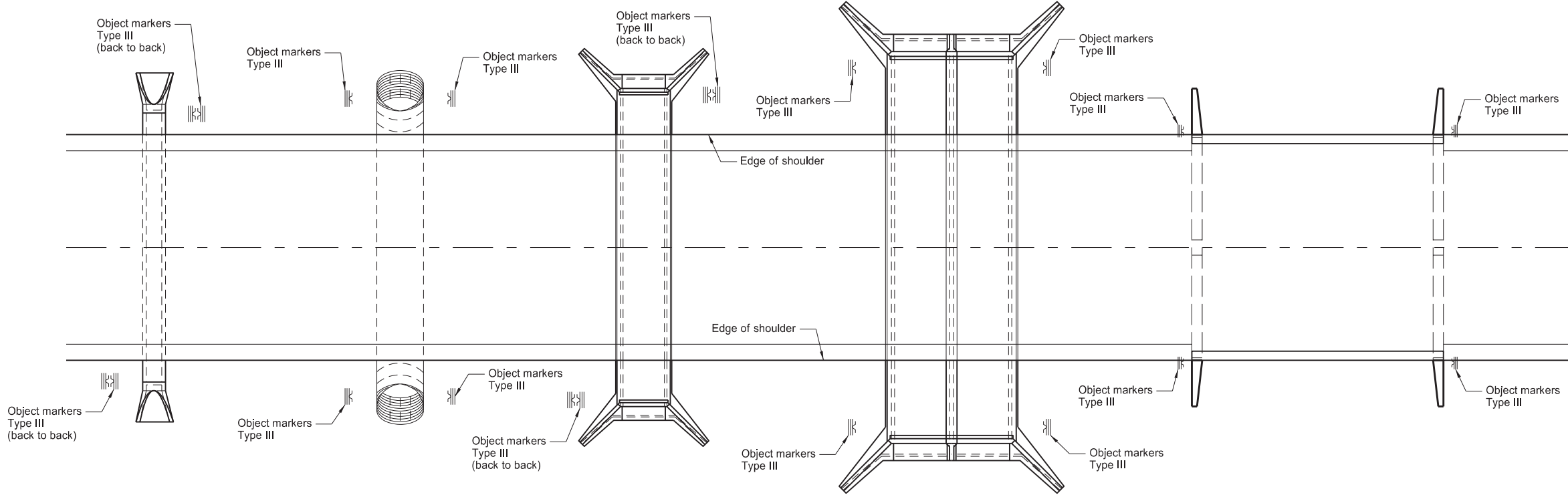
Steel Post Detail  
Approx. 2 lb/ft



Aluminum Post Detail  
Approx. 0.88 lb/ft



Fastener Detail



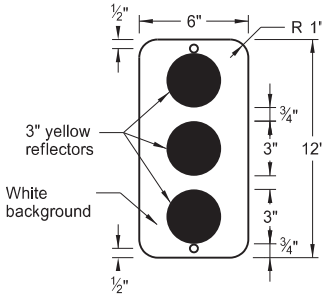
Pipe Culverts  
10' max

Pipe Culverts  
greater than 10'

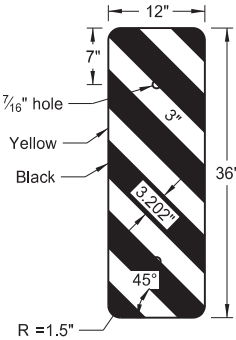
Box Culverts  
10' max

Box Culverts  
greater than 10'

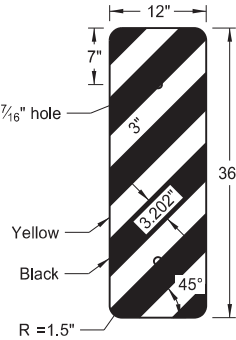
Bridges (B)



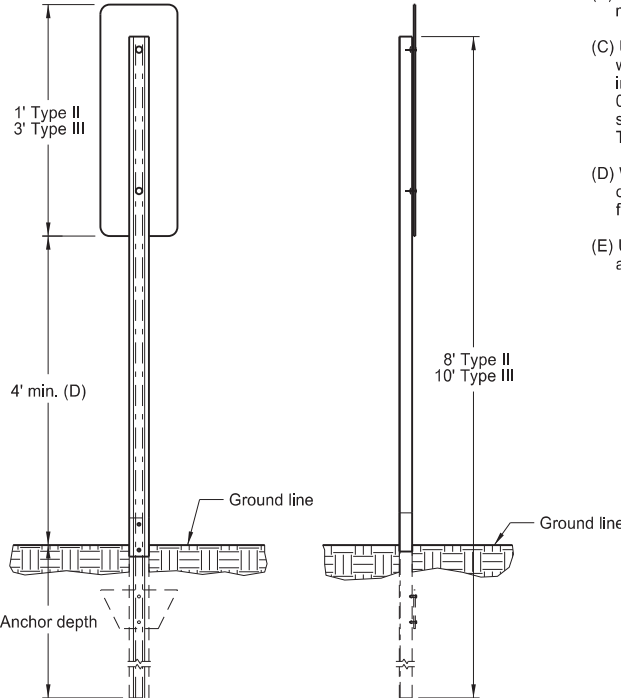
Object Marker  
OM2-1V (C)  
Type II



Object Marker Left  
OM-3L (C)  
Type III



Object Marker Right  
OM-3R (C)  
Type III



Object Marker  
Installation Detail

- Notes:
- (A) Use 3/8" dia. tension pin type or other non-rust vandal resistant fastener with min. outside dia. 1 3/16" flat washer.
  - (B) At locations of approach guardrail with reflectors and end terminal with impact head object markers, do not install object markers.
  - (C) Use two object markers for back to back mountings. On bridges where the distance between wheel guards is less than the approach width, mount object markers vertically on steel posts in front of the bridge railing on each side of highway to mark the horizontal clearance. Use 0.100" minimum thickness sheet aluminum for sign backing material. Use ASTM Type XI sheeting for Type III object markers and ASTM Type IV background sheeting with ASTM Type XI reflectors for Type II object markers.
  - (D) When object marker is located 8' or less from shoulder or curb, provide 4' minimum vertical clearance from near edge of traveled way to bottom of sign. When located more than 8' from shoulder or curb provide 4' minimum vertical clearance from ground to bottom of sign.
  - (E) Use 4" vertical clearance for anchor or breakaway base. Provide 4"x60" measurement above and below post location and back and ahead of post.

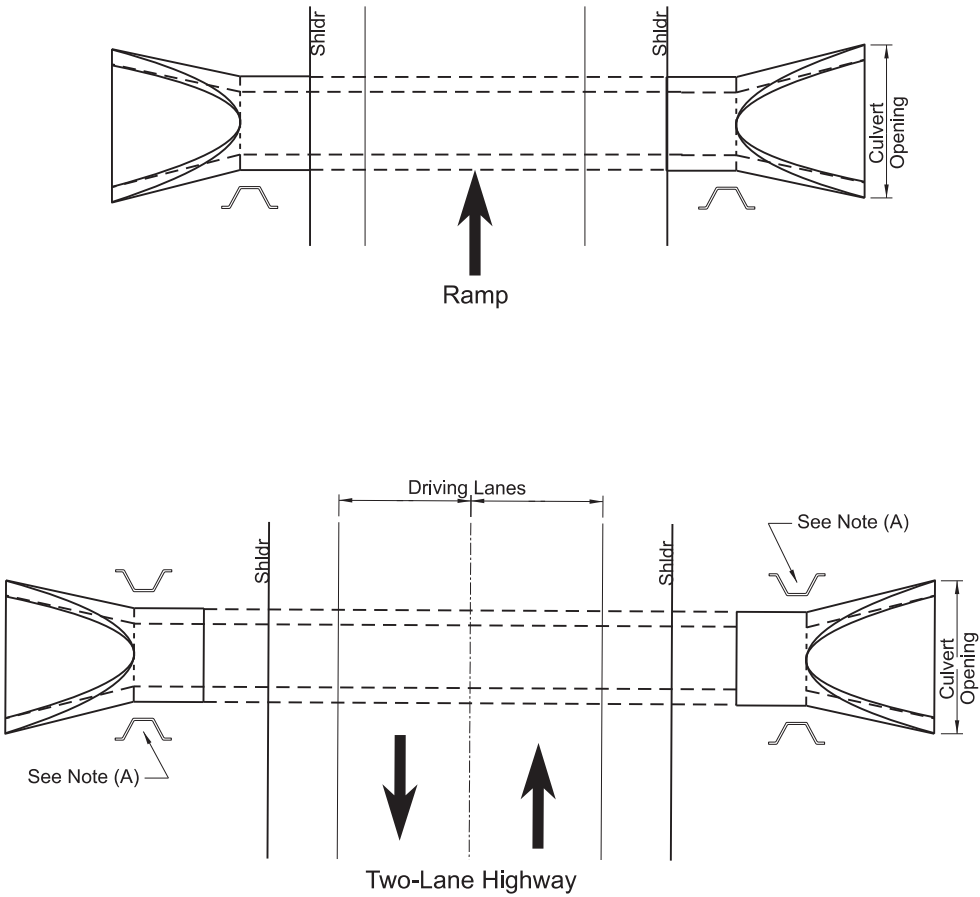
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
7-18-14	Revised Note C
8-30-18	Updated notes to active voice and removed note.
9-05-19	New Design Engineer PE Stamp.
8-08-24	Electronic Stamp/Signature.



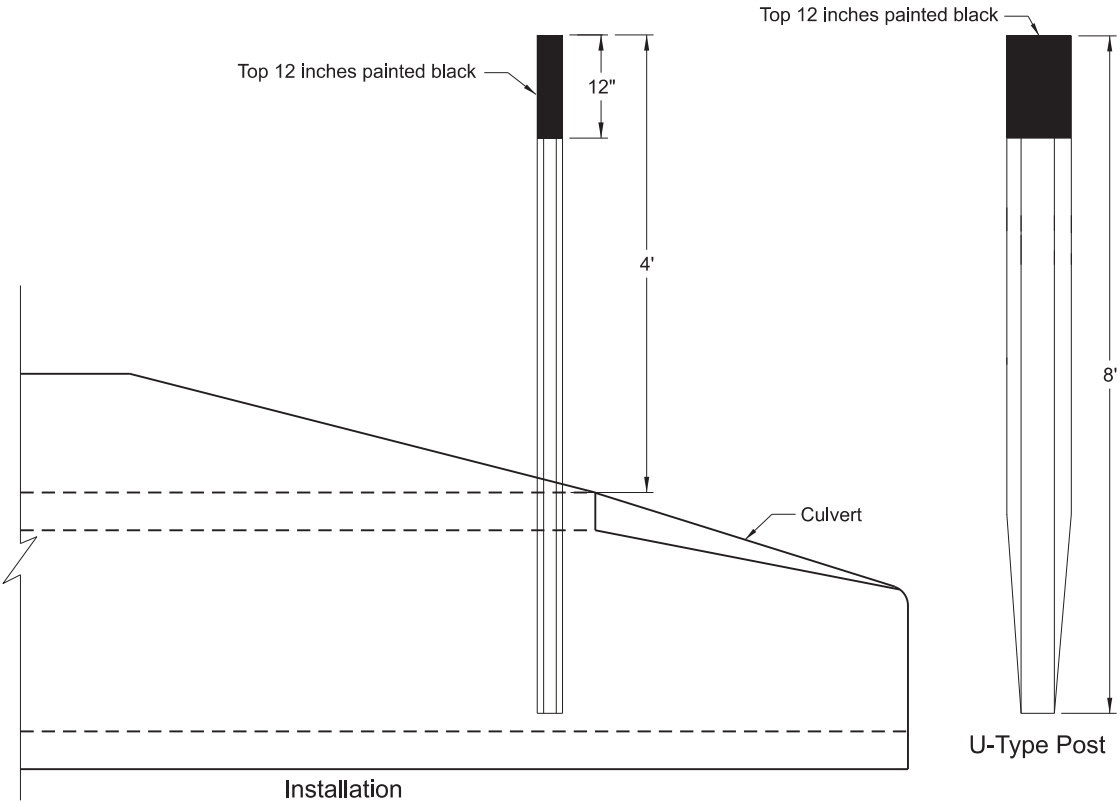
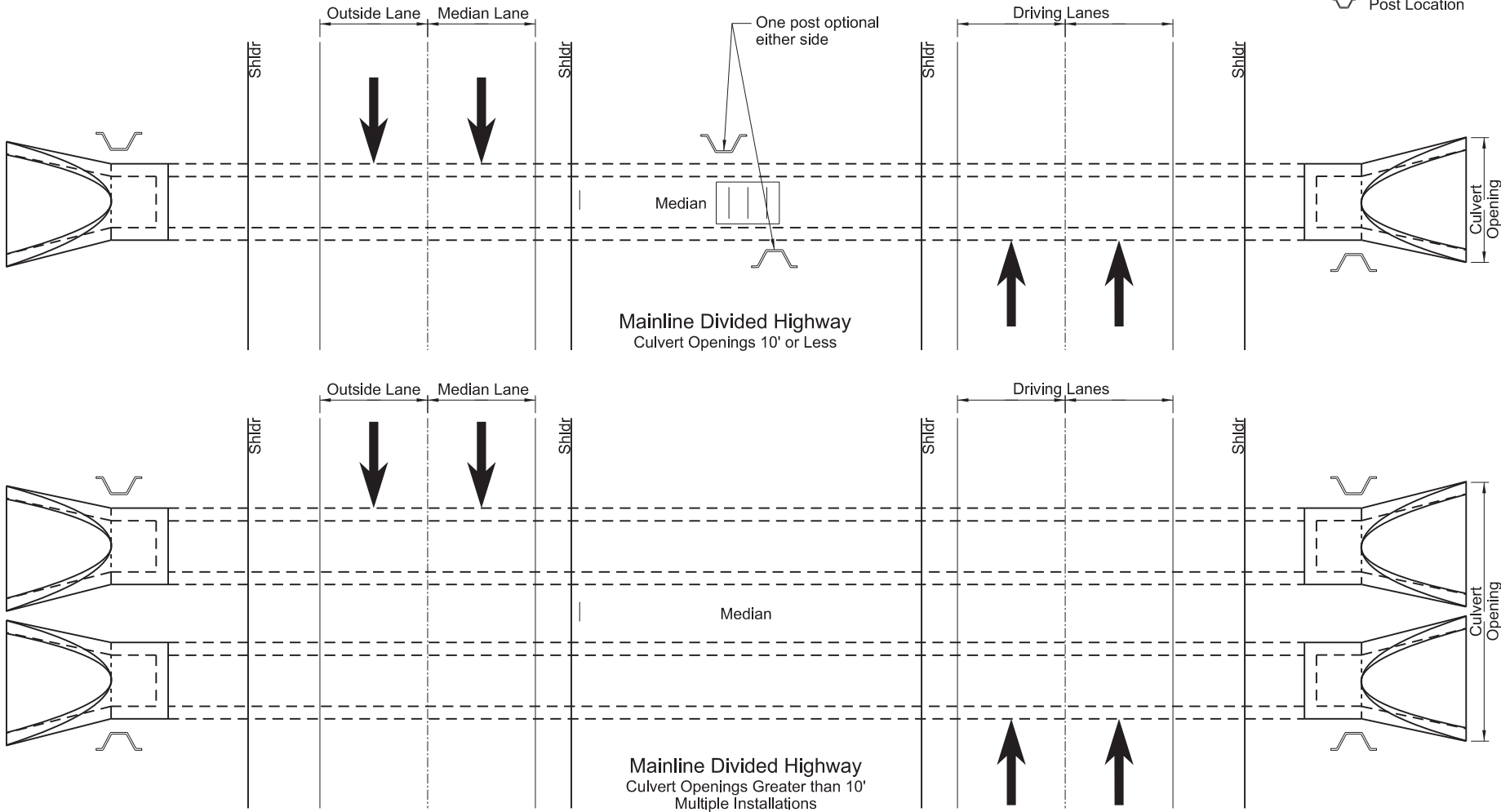
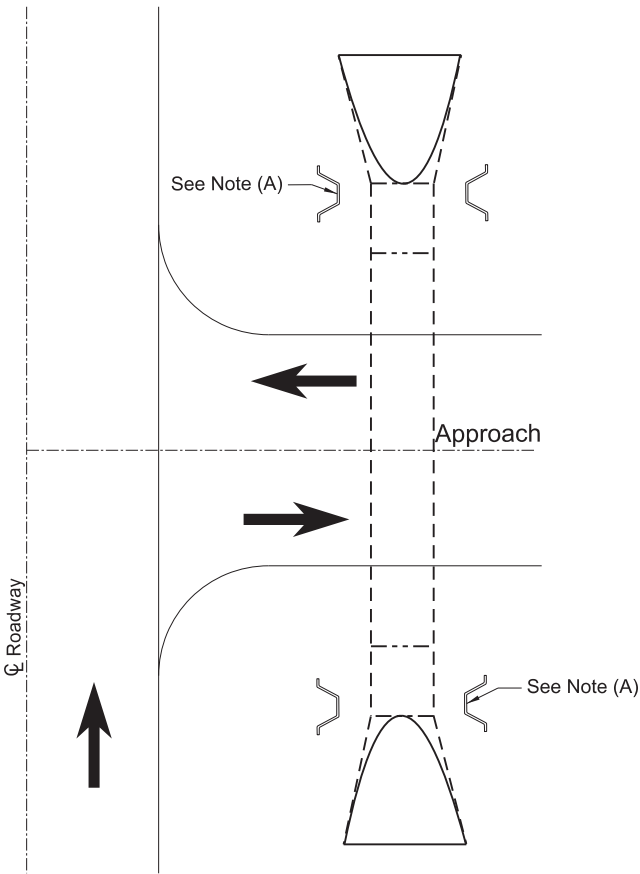
08/08/24

OBJECT MARKERS - CULVERTS

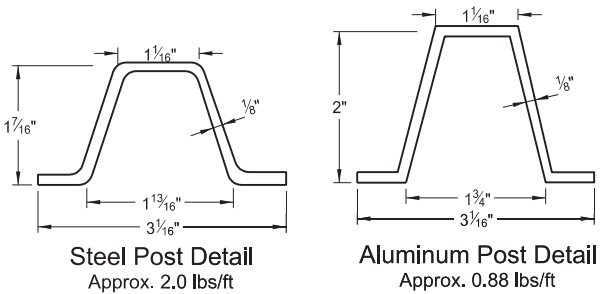
D-754-83



(A) Install additional marker where multiple pipe installations have a width greater than 10'.



**Note:**  
Mark each end of culverts within the right-of-way with a post. Install posts in front of culvert in direction of travel along the side of culvert and one foot from culvert opening unless shown otherwise in plans.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-05-13	
REVISIONS	
DATE	CHANGE
7-7-14	Revised Notes
8-30-18	Updated notes to active voice.
9-05-19	New Design Engineer PE Stamp.
3-13-25	Added Approach Pipe Detail.

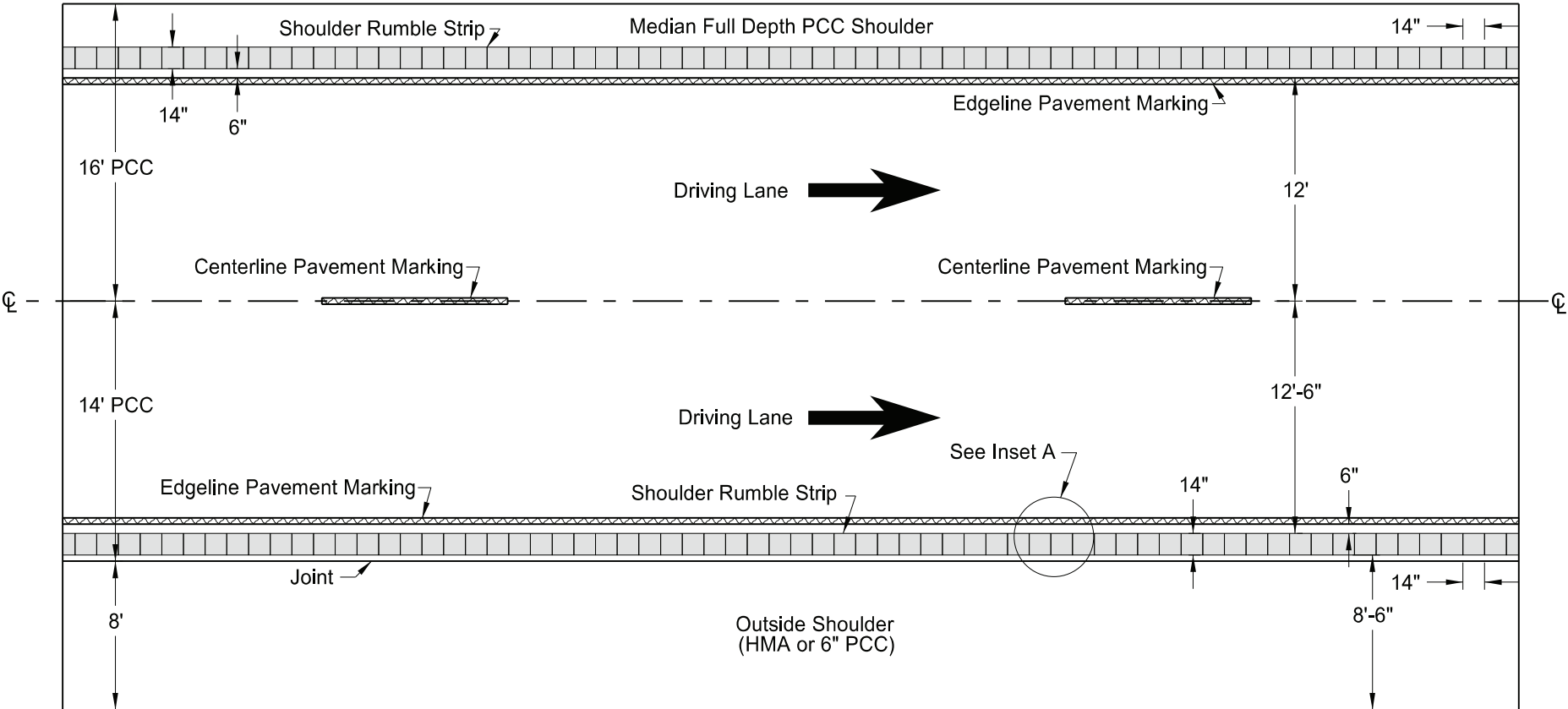


RUMBLE STRIPS  
INTERSTATE HIGHWAYS

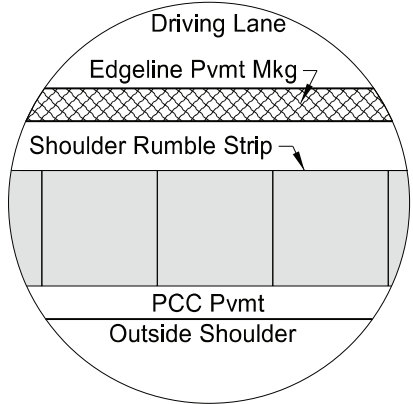
D-760-1

NOTES:

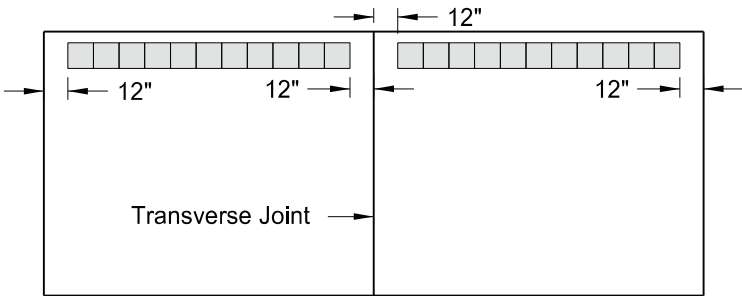
- 1) Discontinue rumble strips through ramps and tapers.



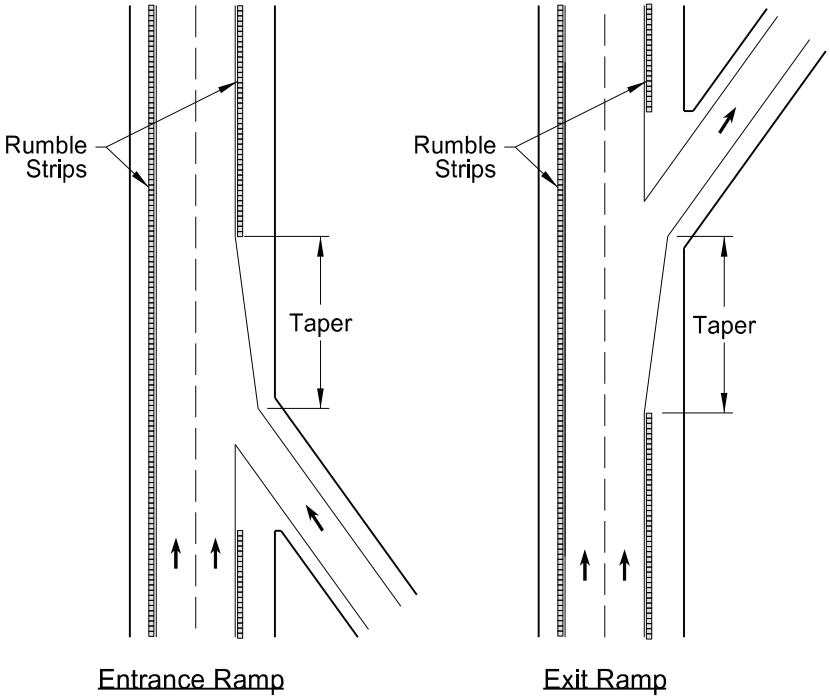
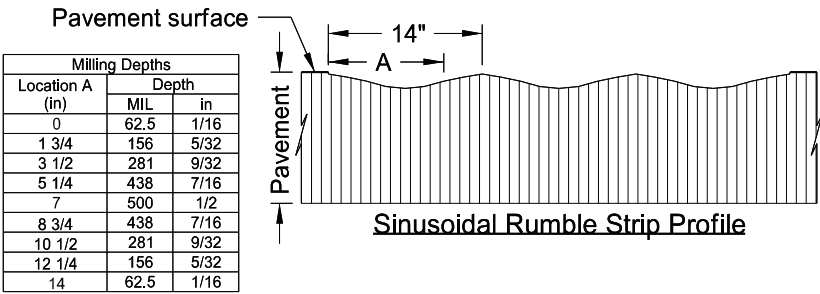
30' Wide Full Depth PCC with 8' Wide HMA Outside Shoulder



Inset A - Shoulder Rumble Strip  
(Layout for opposite shoulder reversed)



Discontinue rumble strip approx. 12" on both sides of PCC transverse joint

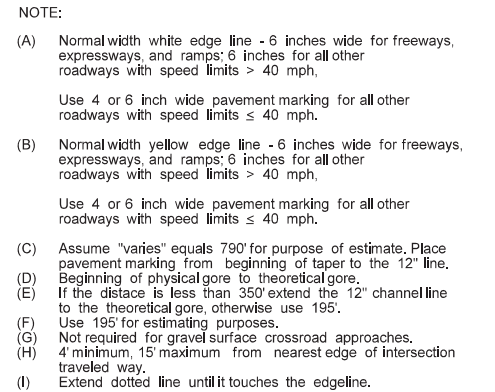


NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-29-09	
REVISIONS	
DATE	CHANGE
2-25-10	Note 4 was added.
9-08-11	Revised Notes and D-760-1.
8-30-18	Revised drawings for clarity.
10-25-19	Added missing dimensions.
11-16-21	Added rumble strips to end of taper.
5-26-23	Rumble strips made sinusoidal.



05/26/23

D-762-2



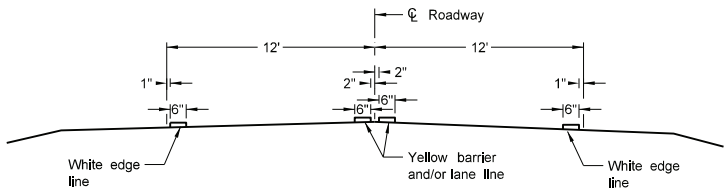
BASIS OF ESTIMATE		
LOCATION	ITEM	
Right or Left Side Exit Ramp TAPERED	12" White channel line	580 LF
	24" White stop line	60 LF
	6" White dotted line	148 LF
	6" White edge line	1115 LF
	6" Yellow edge line	1075 LF
Entrance Ramp TAPERED	12" White channel line	390 LF
	6" White dotted line	258 LF
	6" White edge line	1270 LF
	6" Yellow edge line	1075 LF
Right or Left Side Exit Ramp PARALLEL	12" White channel line	396 LF
	24" White stop line	60 LF
	6" White dotted line (C)	258 LF
	6" White edge line	1115 LF
	6" Yellow edge line	1075 LF
Entrance Ramp PARALLEL	12" White channel line	388 LF
	6" White dotted line	283 LF
	6" White edge line	1275 LF
	6" Yellow edge line	1075 LF
Main Line (Both Roadways)	6" White lane line, 10' line, 30' skip	2640 LF/MI
	6" White edge line	10,560 LF/MI
	6" Yellow edge line	10,560 LF/MI
Cross Road	6" White edge line	2000 LF
	6" Double yellow barrier line (4" between)	2000 LF

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-3-11	
REVISIONS	
DATE	CHANGE
10-17-17	Updated to active voice
10-25-19	Replaced 2' Max dim with Note (1)
11-05-21	Revised labels
11-22-23	Revised print marking widths
1-17-24	Revised wide print marking width

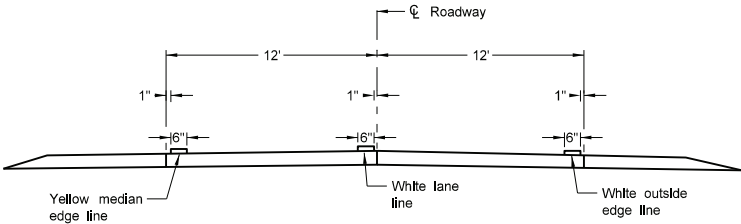


PAVEMENT MARKING

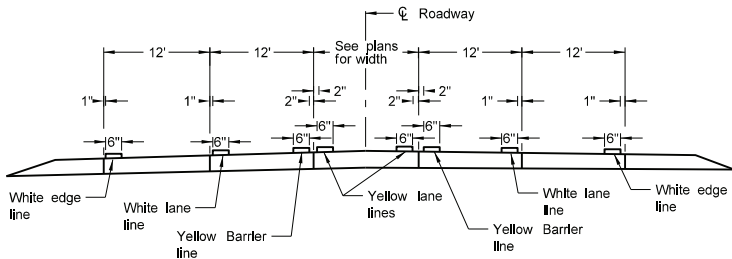
D-762-4



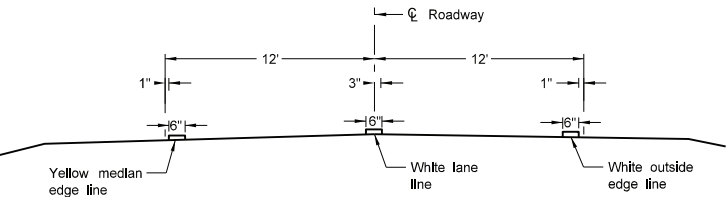
Two Lane Two Way  
RURAL ROADWAY



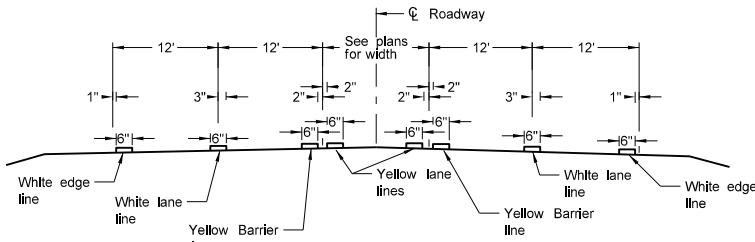
Two Lane Roadway  
INTERSTATE HIGHWAY  
Concrete Section



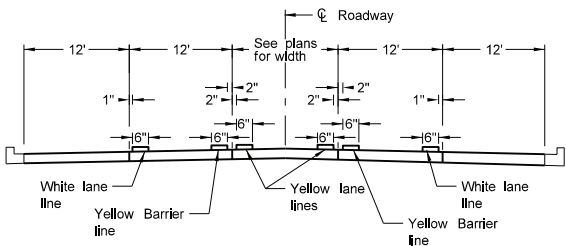
RURAL FIVE LANE ROADWAY  
Concrete Section



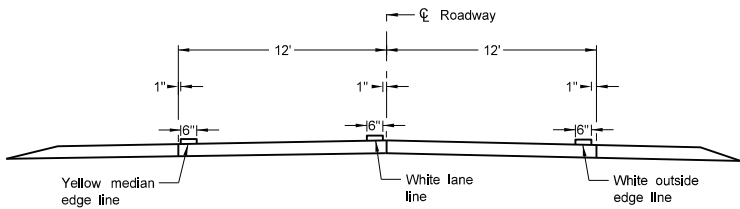
Two Lane Divided  
Rural Roadway  
PRIMARY HIGHWAY  
Asphalt Section



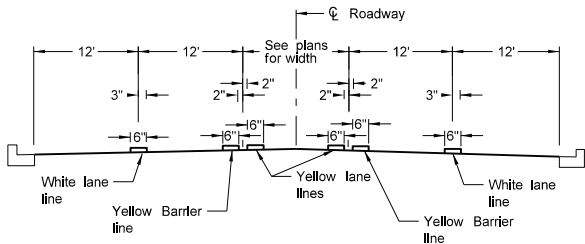
RURAL FIVE LANE ROADWAY  
Asphalt Section



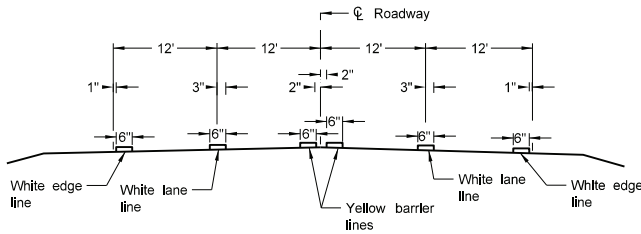
URBAN FIVE LANE SECTION  
Concrete Section



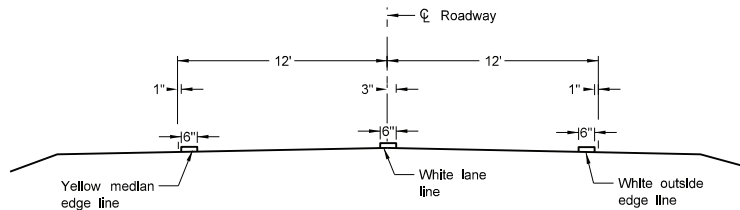
Two Lane Divided  
Rural Roadway  
PRIMARY HIGHWAY  
Concrete Section



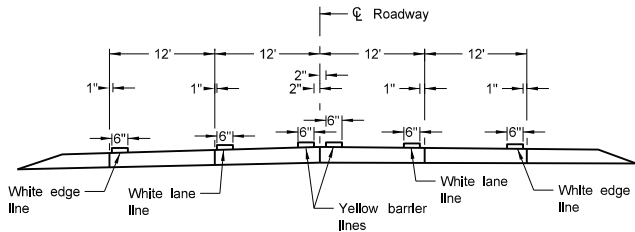
URBAN FIVE LANE SECTION  
Asphalt Section



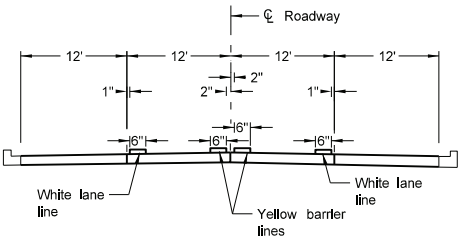
RURAL FOUR LANE ROADWAY  
Asphalt Section



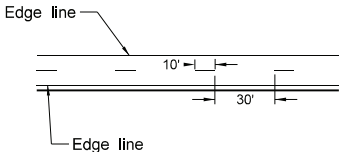
Two Lane Roadway  
INTERSTATE HIGHWAY  
Asphalt Section



RURAL FOUR LANE ROADWAY  
Concrete Section



URBAN FOUR LANE SECTION  
Concrete Section



CENTERLINE PAVEMENT MARKING SKIP SPACING DETAIL

- NOTES:
1. Continue edge lines through private drives and field drives. Break edge lines for intersections.
  2. For section lines, county roads, and street approaches, stripe the radii and edge lines of the paved surface within the right of way except where curb and gutter is present.
  3. Normal width line - 6 inches wide for freeways, expressways, and ramps; 6 inches for all other roadways with speed limits > 40 mph.
  3. Use 4 or 6 inch wide pavement marking for all other roadways with speed limits < 40 mph.

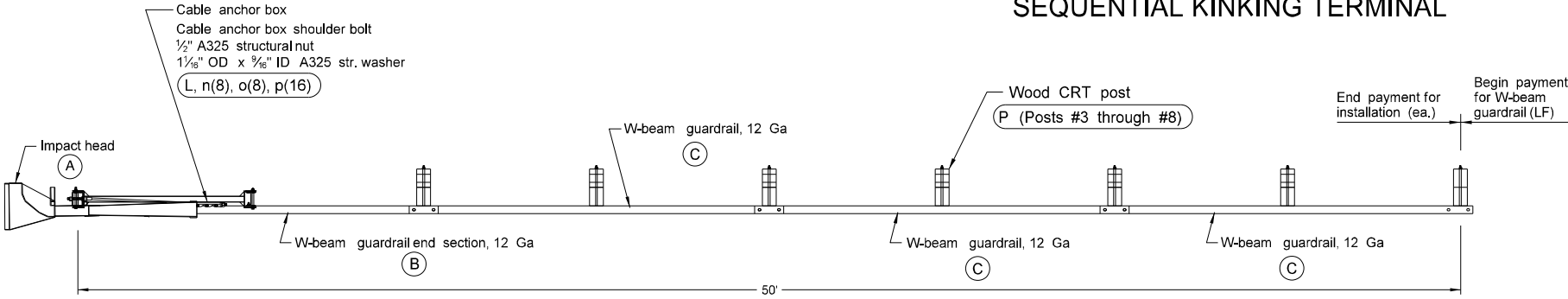
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
10-17-17	Updated to active voice.
08-27-19	New Design Engineer PE Stamp.
11-22-23	Revised pavement marking widths.
07-09-24	Modified Note 1.



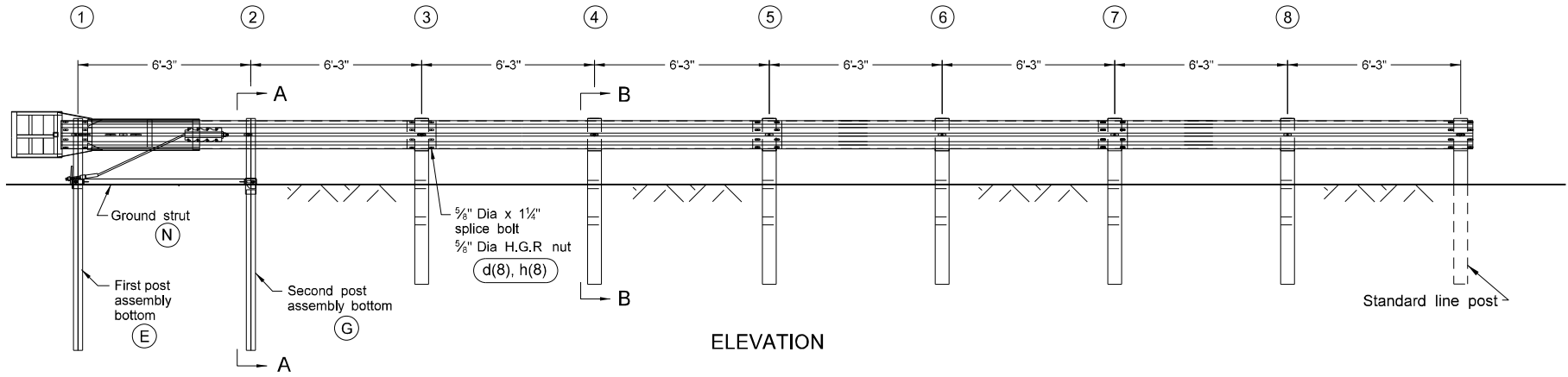


SEQUENTIAL KINKING TERMINAL

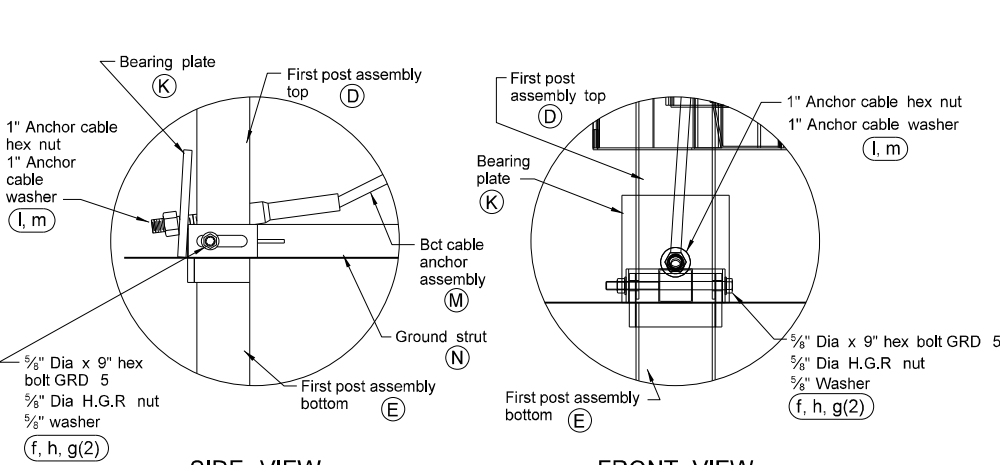
D-764-5



PLAN



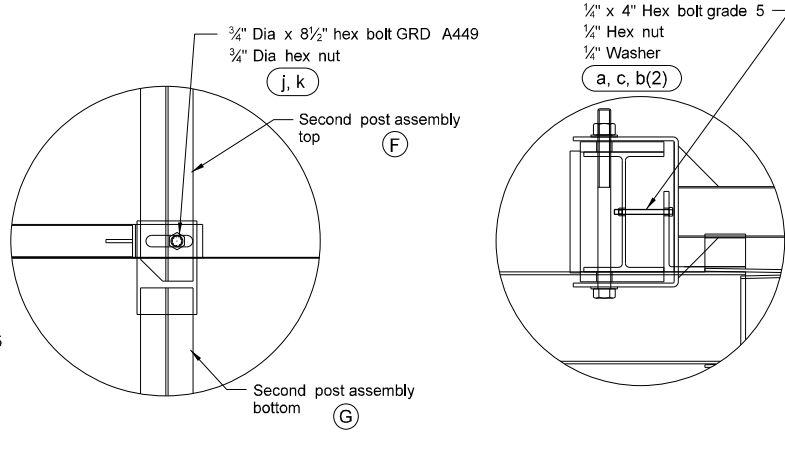
ELEVATION



SIDE VIEW

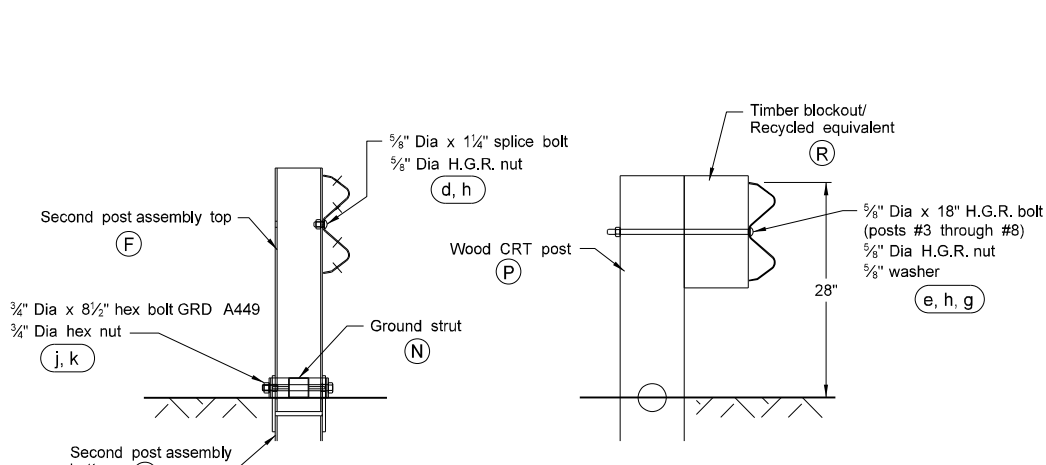
FRONT VIEW

POST #1 CONNECTION DETAILS



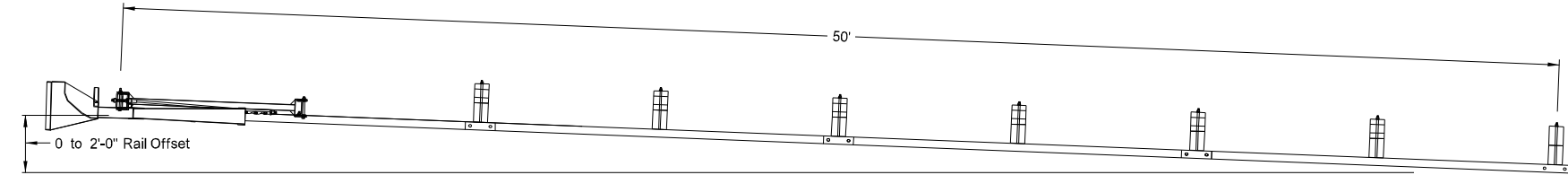
SIDE VIEW DETAIL OF POST #2

IMPACT HEAD CONNECTION DETAIL



SECTION A-A  
Post #2

SECTION B-B  
Posts #3 through #8



FLARED INSTALLATION  
25:1 maximum flare rate

GENERAL NOTES:

1. Use breakaway posts with the SKT.
2. Use galvanized bolts, nuts, cable assemblies, cable anchors, and bearing plates.
3. Flare the SKT at a rate of up to 25:1 to prevent shoulder encroachment by the impact head.
4. Grade site as needed to prevent lower sections of the posts from protruding more than 4" above ground (measured along a 5' cord).
5. Drive the lower section of the hinged posts without the upper post attached. If the post is placed in a drilled hole, compact the backfill material satisfactorily to prevent settlement.
6. When rock is encountered during excavation, use a 10" diameter post hole, 20" into the rock surface, if approved by the engineer. Place granular material in the bottom of the hole, approximately 2 1/2" deep to provide drainage. Field cut posts 1 & 2 to length, place in the hole, and backfill with adequately compacted material excavated from the hole.
7. Place the breakaway cable assembly taut. Use a locking device (vice grips or channel lock pliers) to prevent the cable from twisting when tightening nuts.
8. "Toe nail" the wood blockouts on post #3 through post #8 with two 20 penny galvanized nails in each rectangular post, to prevent them from turning when the wood shrinks.

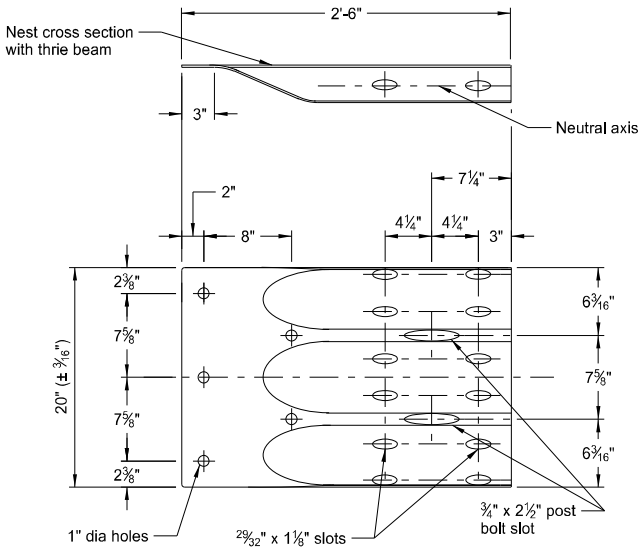
BILL OF MATERIALS		
ITEM	QTY	
A	1	IMPACT HEAD
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga
C	3	W-BEAM GUARDRAIL, 12 Ga
D	1	FIRST POST ASSEMBLY TOP
E	1	FIRST POST ASSEMBLY BOTTOM
F	1	SECOND POST ASSEMBLY TOP
G	1	SECOND POST ASSEMBLY BOTTOM
K	1	BEARING PLATE
L	1	CABLE ANCHOR BOX
M	1	BCT CABLE ANCHOR ASSEMBLY
N	1	GROUND STRUT HINGED POST
P	6	WOOD CRT POST
R	6	TIMBER BLOCKOUT/RCY EQUIVALENT
HARDWARE		
a	2	1/4 " x 4" HEX BOLT Grade 5
b	4	1/2" WASHER
c	2	1/2" HEX NUT
d	25	5/8" Dia X 1 1/4" SPLICE BOLT, POST #2
e	6	5/8" Dia X 18" H.G.R. BOLT (POSTS 3 THRU 8)
f	1	5/8" Dia X 9" HEX BOLT GRD 5
g	8	5/8" WASHER
h	32	5/8" Dia H.G.R. NUT
j	1	3/4" Dia X 8 1/2" HEX BOLT GRD A449
k	1	3/4" Dia HEX NUT
l	2	1" ANCHOR CABLE HEX NUT
m	2	1" ANCHOR CABLE WASHER
n	8	GROUND STRUT HINGED POST
o	8	1/2" A325 STRUCTURAL NUT
p	16	1 1/8" OD X 5/16" ID A325 STR. WASHER

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
REVISIONS	
DATE	CHANGE
12-02-20	Updated notes to active voice.

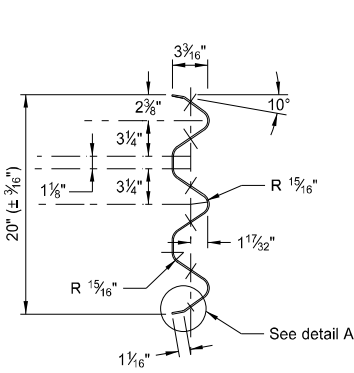


THRIE BEAM TRANSITION TO DOUBLE BOX BEAM RETROFIT

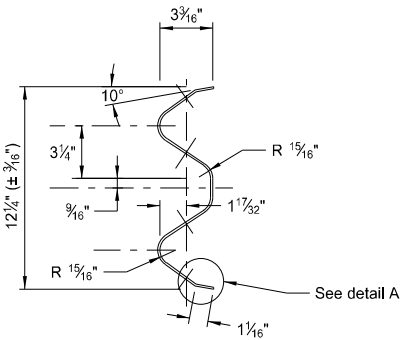
D-764-10



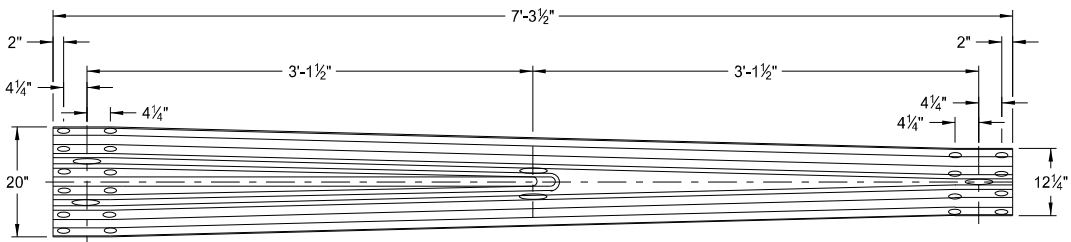
THRIE BEAM TERMINAL CONNECTOR



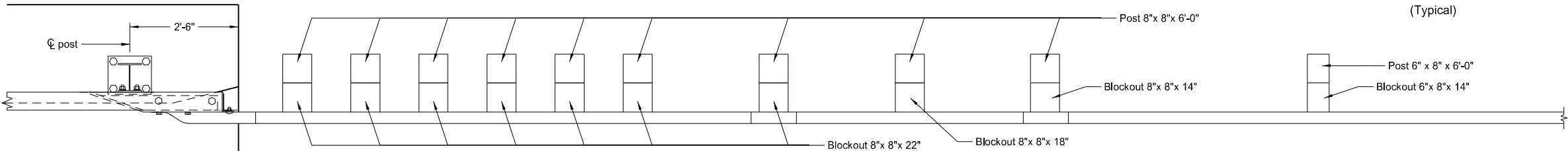
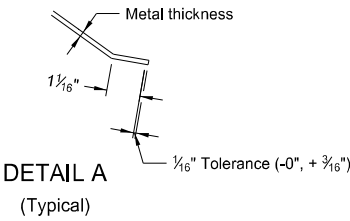
THRIE BEAM END VIEW



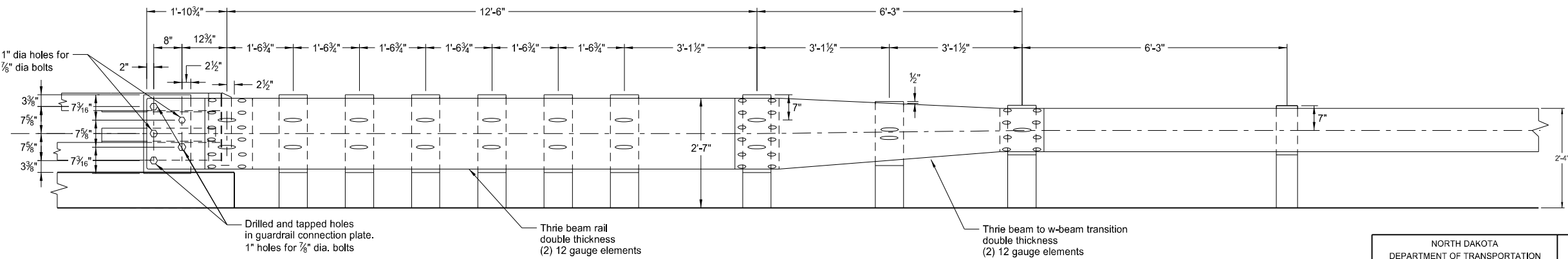
W-BEAM END VIEW



THRIE BEAM TO W-BEAM TRANSITION SECTION



PLAN

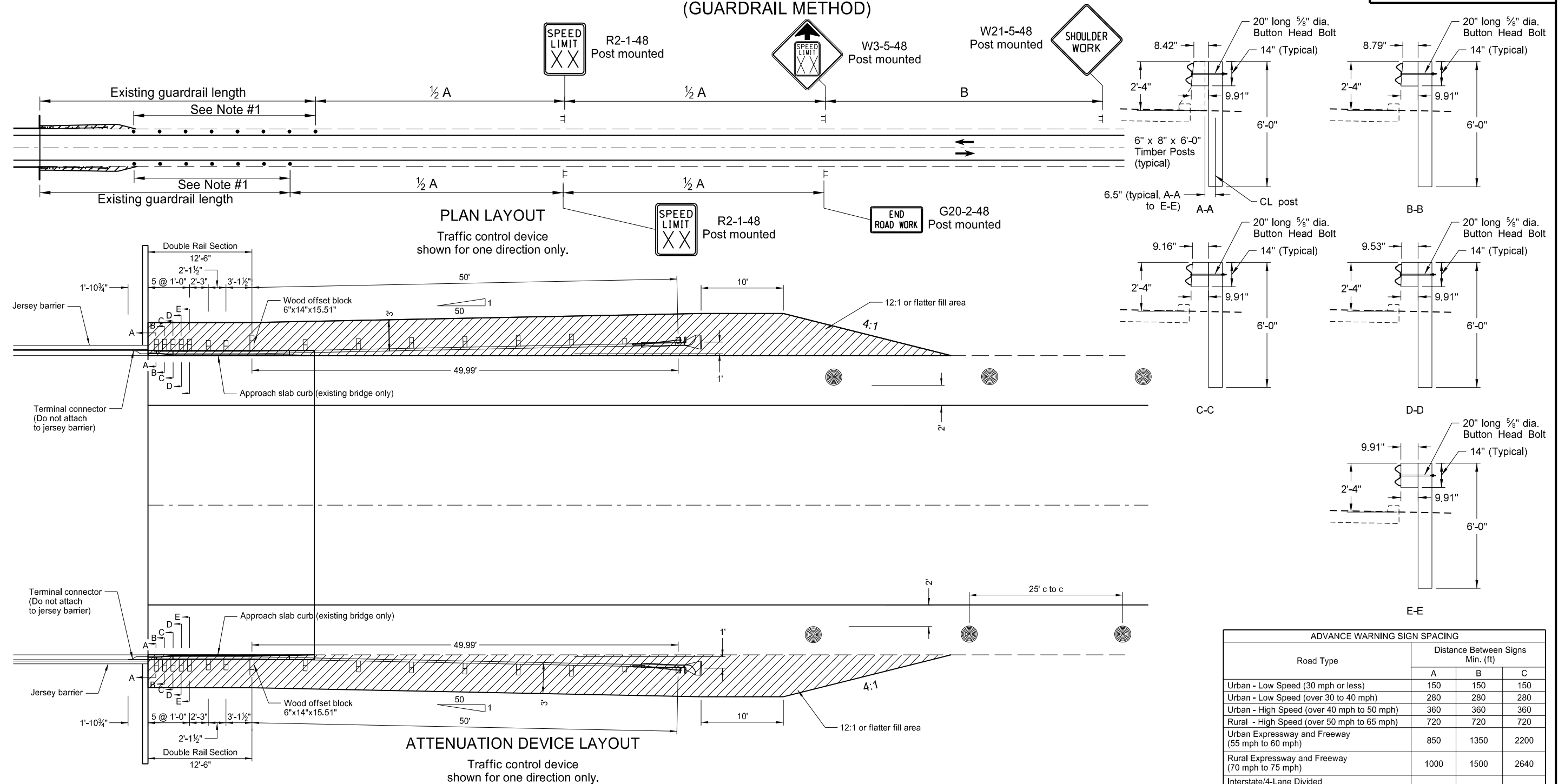


ELEVATION

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
REVISIONS	
DATE	CHANGE
12/02/20	Updated text to active voice.

KIRK J. HOFF  
REGISTERED  
PROFESSIONAL  
PE-4683  
ENGINEER  
NORTH DAKOTA  
12 02 2020

# SHORT TERM END TREATMENT FOR BRIDGES (GUARDRAIL METHOD)



## Notes

- If the shoulder width is less than 3', use vertical panels placed as far from the driving lane as possible and still be on the finished shoulder. When there is no shoulder, place vertical panels as near as possible to the driving lane on the foreslope of the shoulder.
- If the bridge is within construction zone signing, eliminate the reduced speed ahead sign.
- Determine the reduced speed limit dependent on the in place speed limit before construction. Where total speed reduction exceed 30 mph, reduce the speed limit in two stages with each reduction not exceeding 30 mph. Place the second speed limit sign at 1/2 B.
- Re-establish speed limit. Determine exact speed limit in the field, dependent on location and conditions.
- Cover existing speed limit signs within a reduced speed zone.

KEY	
	Sign
	Delineator drum

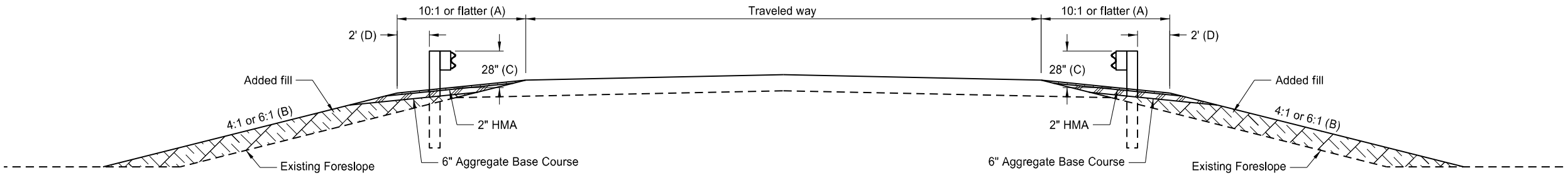
ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1350	2200
Rural Expressway and Freeway (70 mph to 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE
12-02-20	Updated notes to active voice.

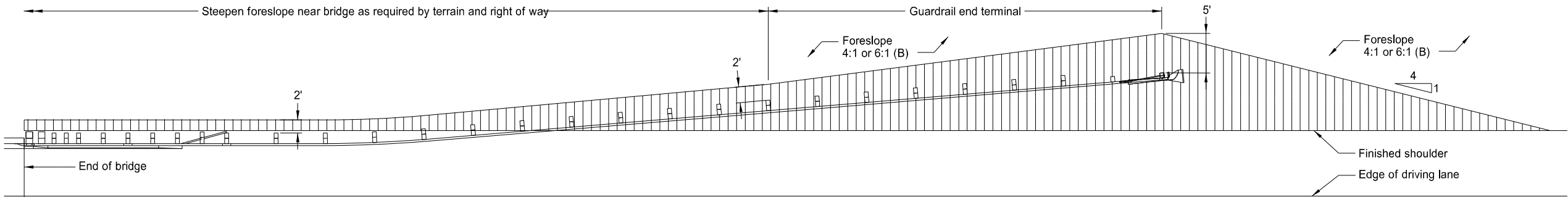


TYPICAL GRADING AT BRIDGE ENDS  
WITH W-BEAM GUARDRAIL

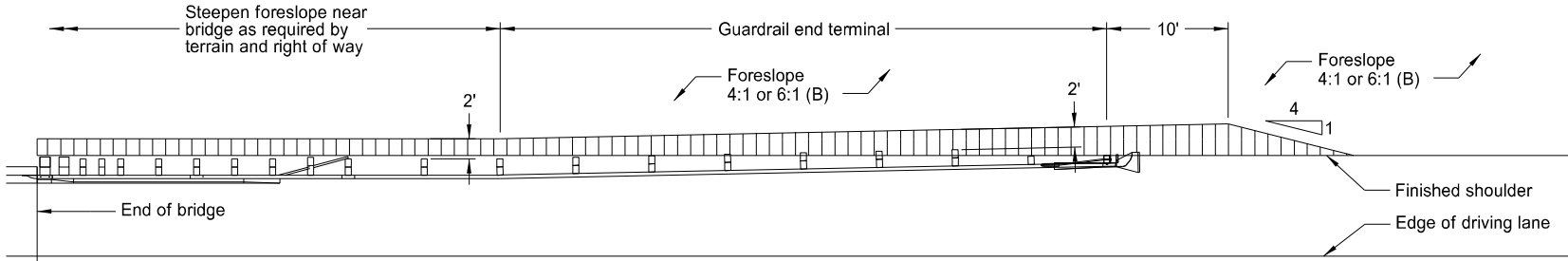
D-764-22



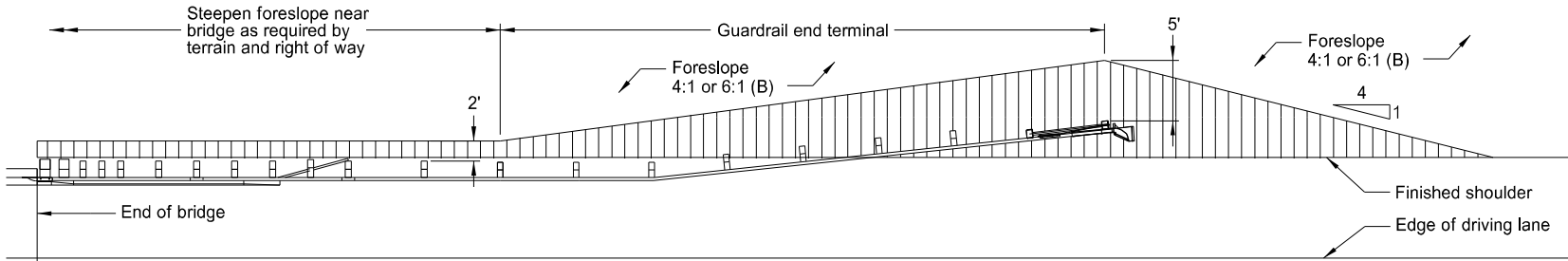
TYPICAL SECTION



PLAN LAYOUT  
FLARED GUARDRAIL WITH END TERMINAL



PLAN LAYOUT  
NON-FLARED GUARDRAIL WITH TANGENT END TERMINAL



PLAN LAYOUT  
NON-FLARED GUARDRAIL WITH FLARED END TERMINAL

- NOTES:
- (A) Use slope flatter than 10:1 when necessary to provide proper guardrail height.
  - (B) When normal foreslope is 4:1, use added fill slope of 4:1. When normal foreslope is 6:1, use added fill slope of 6:1.
  - (C) Measure from top of guardrail to top of surfacing at front face of guardrail.
  - (D) Dimension at end terminals vary per Plan Layouts shown on this sheet.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
12-02-20	Updated notes to active voice.

KIRK J. HOFF

REGISTERED

PROFESSIONAL

PE-4683

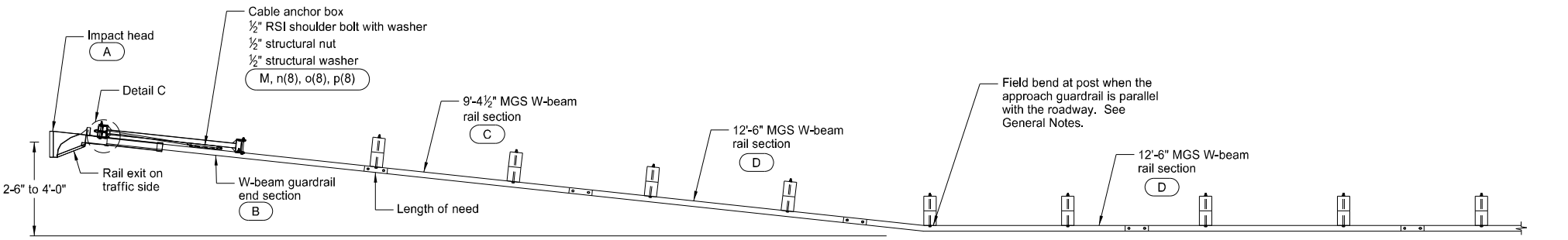
ENGINEER

NORTH DAKOTA

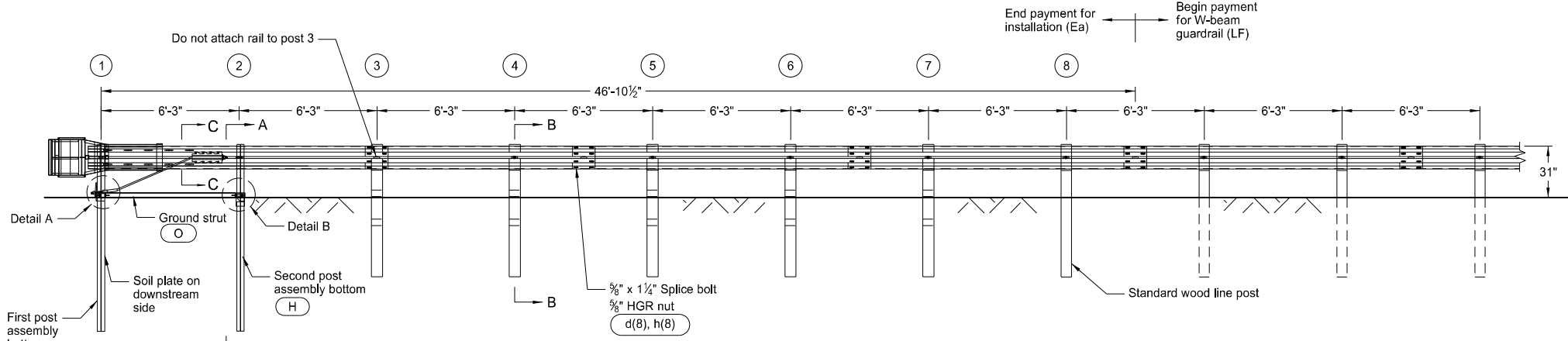
12 02 2020

MGS FLARED ENERGY ABSORBING TERMINAL - WOOD POST

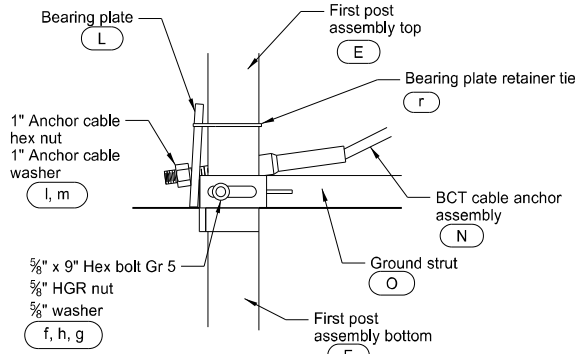
D-764-38



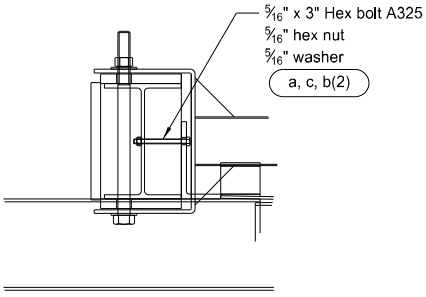
PLAN



ELEVATION

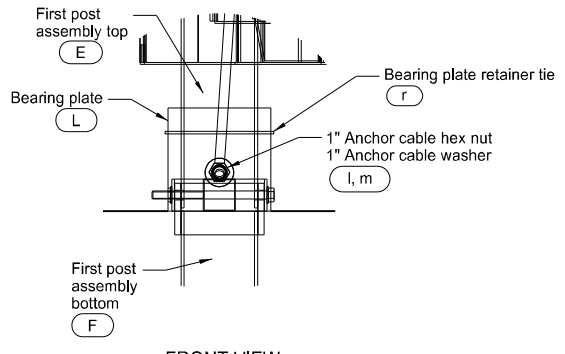


SIDE VIEW



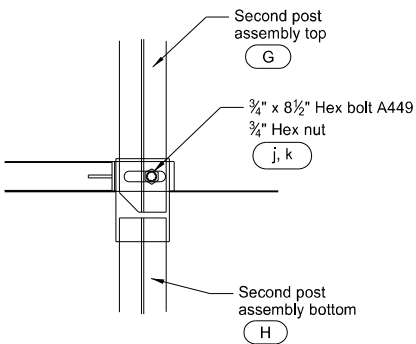
DETAIL C

Post 1 (Impact Head connection)

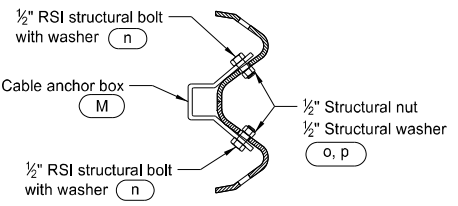


FRONT VIEW

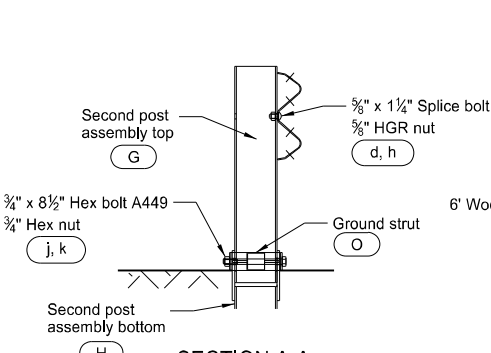
DETAIL A  
Post 1



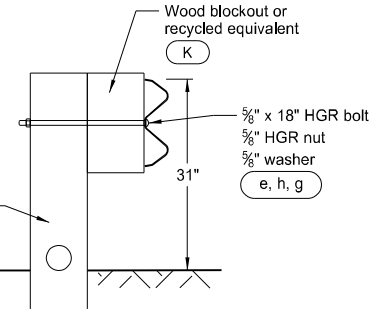
DETAIL B  
Post 2



SECTION C-C



SECTION A-A  
Post 2



SECTION B-B  
Posts 3 through 7

ITEM	ITEM NO.	BILL OF MATERIALS	QTY
A	F3000	IMPACT HEAD	1
B	SF1303	W-BEAM GUARDRAIL END SECTION, 12 Ga	1
C	G12025	9'-4½" MGS W-BEAM RAIL SECTION, 12 Ga	1
D	G1203A	12'-6" MGS W-BEAM RAIL SECTION, 12 Ga	2
E	UHP1A	FIRST POST ASSEMBLY TOP	1
F	HP1B	FIRST POST ASSEMBLY BOTTOM	1
G	UHP2A	SECOND POST ASSEMBLY TOP	1
H	HP2B	SECOND POST ASSEMBLY BOTTOM	1
J	UP671	WOOD CRT POST	5
K	P675	WOOD BLOCKOUT OR RECYCLE EQUIVALENT	5
L	E750	BEARING PLATE	1
M	S760	CABLE ANCHOR BOX	1
N	E770	BCT CABLE ANCHOR ASSEMBLY	1
O	S785	GROUND STRUT HINGED POST	1
HARDWARE			
a	B5160304A	5/16" x 3" HEX BOLT A325	2
b	W0516	5/16" WASHER	4
c	N0516	5/16" HEX NUT	2
d	B580122	5/8" Dia x 1¼" SPLICE BOLT	33
e	B581802	5/8" Dia X 18" HGR BOLT	5
f	B580904A	5/8" Dia x 9" HEX BOLT GRD 5	1
g	W050	5/8" WASHER	7
h	N050	5/8" Dia HGR NUT	39
j	B340854A	¾" Dia x 8½" HEX BOLT GRD A449	1
k	N030	¾" Dia HEX NUT	1
l	N100	1" ANCHOR CABLE HEX NUT	2
m	W100	1" ANCHOR CABLE WASHER	2
n	SB12A	½" RSI SHOULDER BOLT WITH WASHER	8
o	N012A	½" STRUCTURAL NUT	8
p	W012A	½" STRUCTURAL WASHER	8
r	CT-100ST	BEARING PLATE RETAINER TIE	1

NOTE: Standard wood line post, block, and associated hardware not included in Bill of Materials Table.

GENERAL NOTES:

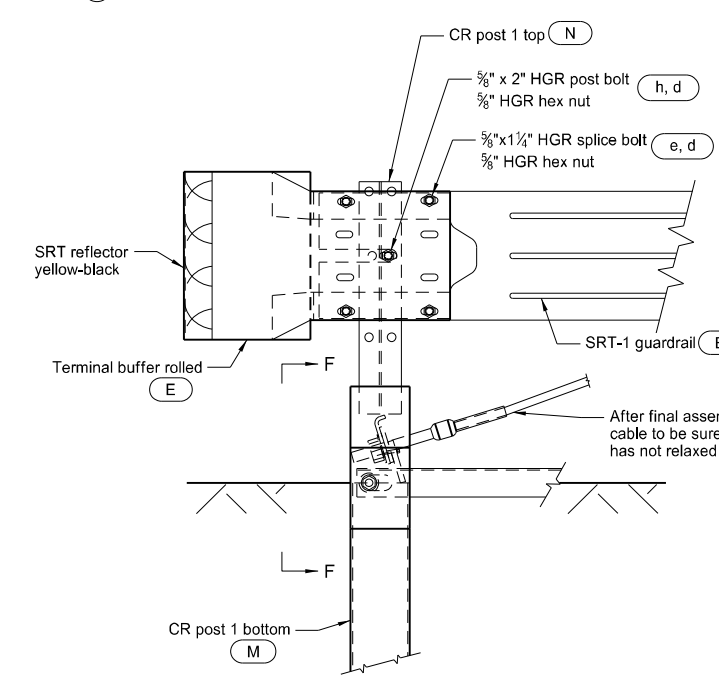
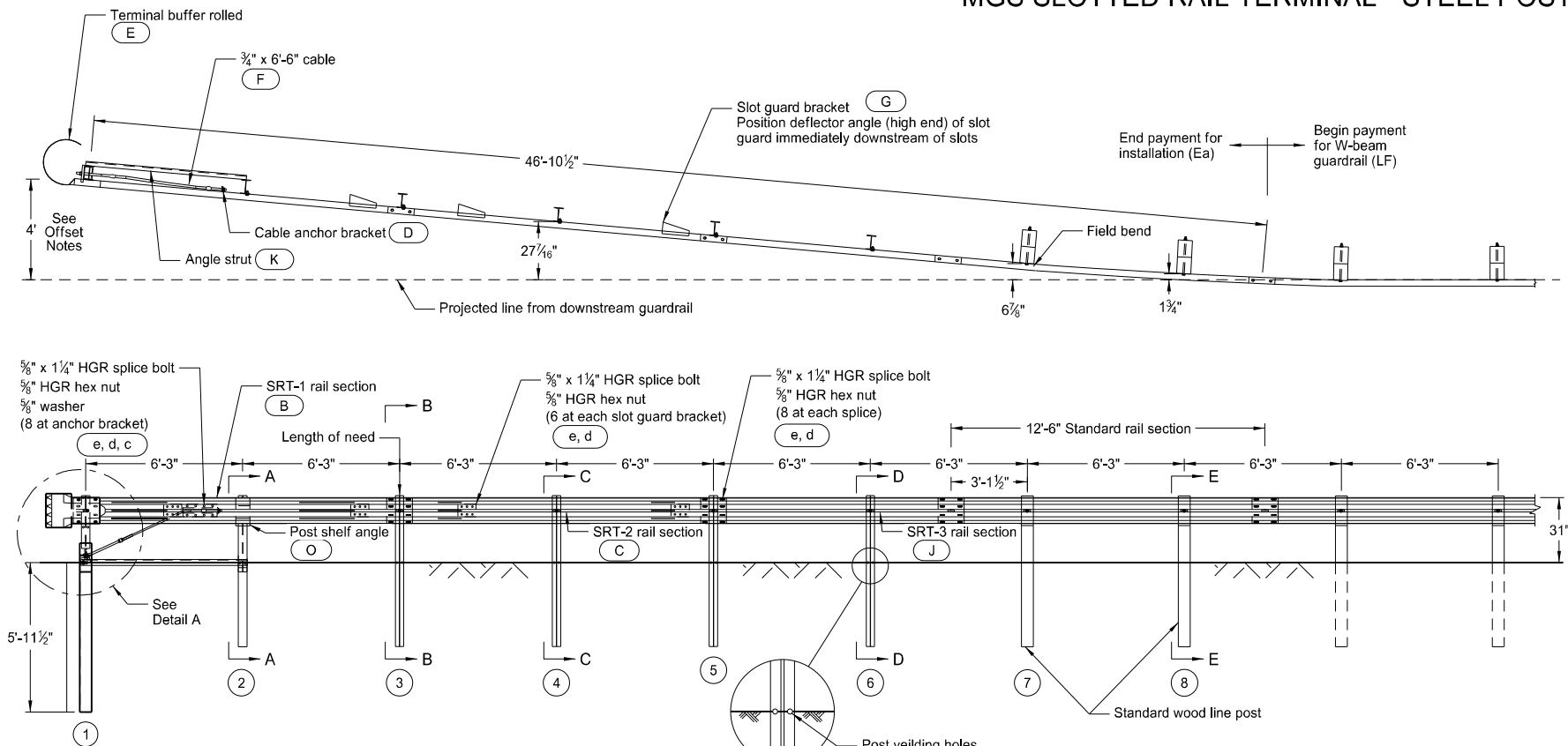
- Wood posts are required with the Flared Energy Absorbing Terminal except posts 1 and 2.
- Galvanize all bolts, nuts, cable assemblies, cable anchors, and bearing plates.
- Flare the Flared Energy Absorbing Terminal when the approach guardrail is parallel with the roadway. When the approach guardrail is flared at 16:1 to 10:1, ensure the Flared Energy Absorbing Terminal has only the flare rate of the guardrail. When the guardrail flare is between 10:1 and 7:1, ensure the Flared Energy Absorbing Terminal is turned parallel to the roadway.
- Site grade as necessary to ensure the lower sections of the posts do not protrude more than 4" above the ground (measured along a 5' cord).
- Install the lower section of the hinged posts without the upper post attached. If the post is placed in a drilled hole, compact the backfill material to prevent settlement.
- Install the breakaway cable assembly taut. Use a locking device (vice grips or channel lock pliers) to prevent cable from twisting when tightening nuts.
- "Toe nail" the wood blockouts to the rectangular wood posts with two 20 penny galvanized nails to prevent them from turning when the wood shrinks.

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12-02-20	Updated notes to active voice.

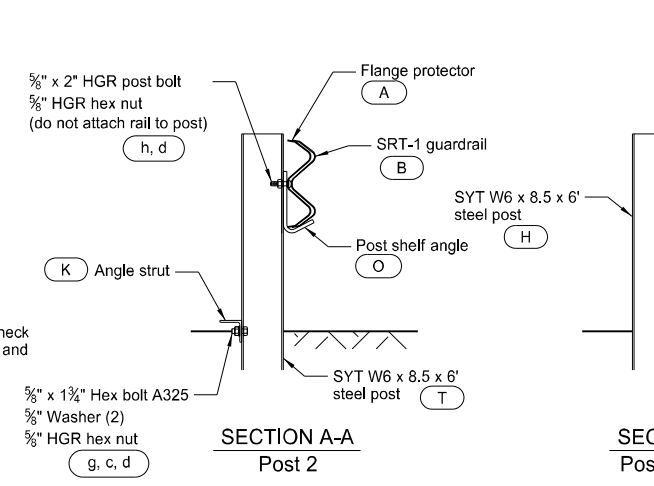


MGS SLOTTED RAIL TERMINAL - STEEL POST

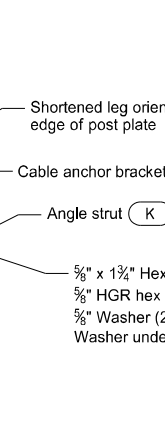
D-764-39



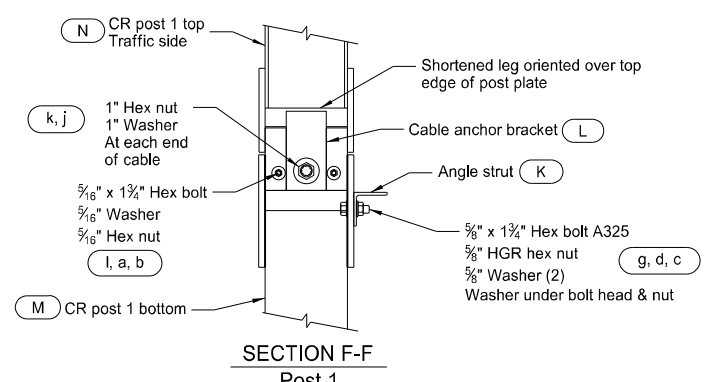
DETAIL B  
Posts 3 through 6



SECTION B-B  
Posts 3 and 5



SECTION D-D  
Post 6



- GENERAL NOTES:
- Galvanize all bolts, nuts, cable assemblies, cable anchors, bearing plates, slot guards, struts, nails, pipes, soil tubes and soil plates.
  - Install breakaway cable assembly taut. Use a locking device (vice grips or channel lock pliers) to prevent cable from twisting when tightening nuts.
  - For curb installation, end curb prior to post 7. Where curb extends beyond post 7, do not use the flared Slotted Rail Terminal. Use a straight end treatment at the end of straight guardrail placed at the face of the curb.
  - For details not shown, see the manufacturer's installation manual.
  - Only use the Slotted Rail Terminal as an end terminal when a minimum length of 175 feet, including the length of the end terminal, is provided in advance of fixed objects.

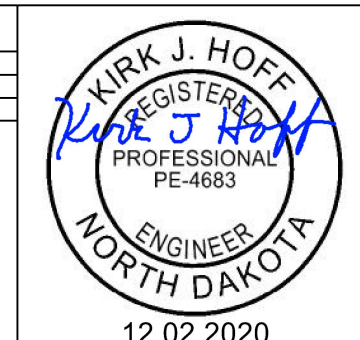
- OFFSET NOTES:
- Post offset dimensions are given to the center of the traffic face of posts, except at posts 7 and 8 where dimensions are to the center of the traffic face of the blockouts.
  - Guardrail between posts 1-7 is on a straight line flare.
  - Install the Slotted Rail Terminal with a 4' flare for either a straight or flared guardrail installation.

ITEM	ITEM NO.	BILL OF MATERIALS	QTY
A	7G	12/6"/FLANGE PROTECTOR (POSTS 2, 4, 6)	3
B	30G	12/12'-6"/S SRT-1 RAIL SECTION	1
C	39G	12/12'-6"/S SRT-2 RAIL SECTION	1
D	700A	CABLE ANCHOR BRACKET	1
E	907G	TERMINAL BUFFER ROLLED	1
F	3000G	3/4" x 6'-6" CABLE	1
G	9960G	SLOT GUARD BRACKET	4
H	15000G	SYT W6x8.5 6' STEEL POST	5
J	10967G	12/9'-4 1/2"/3'-1 1/2"/S SRT-3 RAIL SECTION	1
K	33875G	ANGLE STRUT 3" x 3" x 1/2"	1
L	33909G	CABLE ANCHOR BRACKET (POST 1)	1
M	34052A	CR POST 1 BOTTOM W6x15	1
N	34053A	CR POST 1 TOP W6x8.5	1
O	34054G	POST SHELF ANGLE (POST 2)	1

HARDWARE			
a	3240G	5/16" WASHER	2
b	3245G	5/16" HEX NUT	2
c	3300G	5/8" WASHER	12
d	3340G	5/8" HGR HEX NUT	75
e	3360G	5/8" Dia x 1 1/4" HGR SPLICE BOLT	60
f	3380G	5/8" Dia x 1 1/2" HEX HD BOLT	8
g	3391G	5/8" Dia x 1 3/4" HEX BOLT A325 (AT STRUT)	2
h	3400G	5/8" Dia x 2" HGR POST BOLT (POSTS 1, 2, 4)	4
j	3900G	1" WASHER (AT CABLE)	2
k	3910G	1" HEX NUT (AT CABLE)	2
l	4211G	5/16" Dia x 1 3/4" HEX BOLT (POST 1)	2
m	4419G	5/8" Dia x 1 3/4" COUNTERSUNK HD BOLT (POST 6)	1

NOTE: Standard rail section and standard wood line posts (including the blocks, and associated hardware) not included in Bill of Materials Table. All splice bolts (including associated nuts) are included in the Bill of Materials Table.

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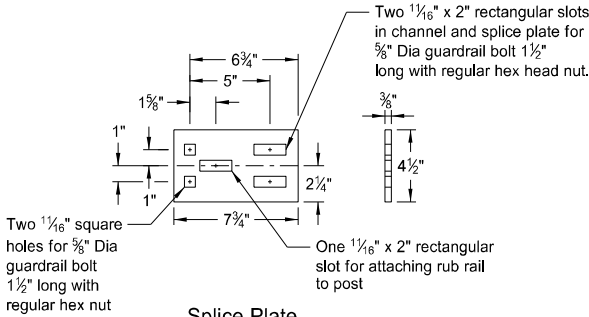


MGS W-BEAM GUARDRAIL GENERAL DETAILS

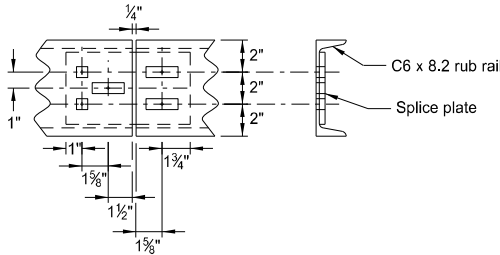
D-764-40

NOTES:

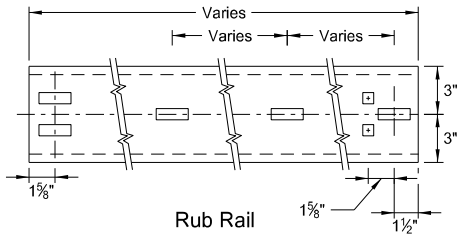
1. Begin reflector plates at the first post and space at 25' centers on guardrail less than 250' length and at 50' centers for guardrail over 250' length. Provide the reflector the same color as the pavement marking adjacent to it unless noted otherwise on the plans.
2. Replacing bituminous material at guardrail post: Dispose all excess earth from excavations for guard posts as directed by the engineer. Replace bituminous material wherever guardrail is installed after mat has been laid. Cost of excavation and replacing of bituminous material to be included in the price bid for other items.
3. Fit the Object Marker within the vertical edges of the Impact Plate. Provide type XI retroreflective sheeting meeting the requirements of Section 894.02.E of the standard specifications. Apply the sheeting to 0.100 Aluminum sheeting meeting the requirements of Section 894.01.A. Attach the Object Marker to the Impact Head Plate with rivets or other attachment device. Ensure the rivets or attachment device are non-rust. Slope the stripes downward toward the roadway side.
4. Guardrail installation height tolerance =  $\pm 1"$ .



Splice Plate

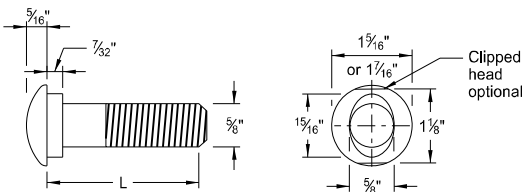


Splice Detail

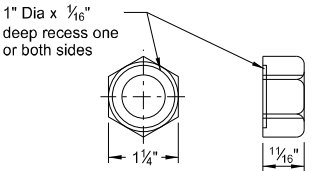


Rub Rail

C6x8.2 RUB RAIL AND SPLICE PLATE

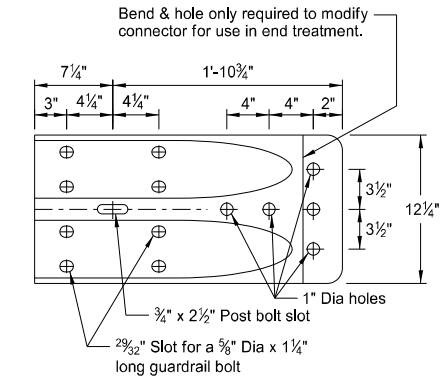
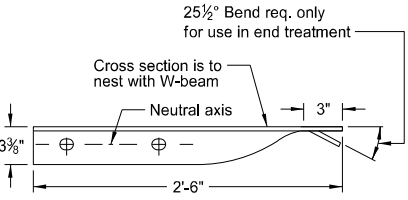


$\frac{5}{8}"$ Diameter Guardrail Bolt	
L	Thread Length
1 $\frac{1}{4}"$	Full length thread
2"	1 $\frac{3}{4}"$ Min thread length
9 $\frac{1}{2}"$	4" Min thread length
18"	4" Min thread length
20"	4" Min thread length
22"	4" Min thread length
25"	4" Min thread length

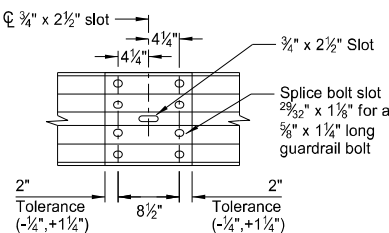


$\frac{5}{8}"$  Dia recess nut

$\frac{5}{8}"$  GUARDRAIL BOLT & RECESS NUT

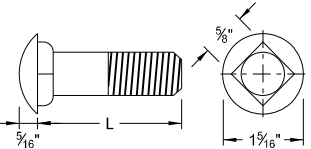


W BEAM TERMINAL CONNECTOR

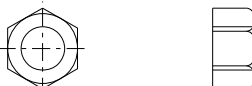


SPLICE DETAIL

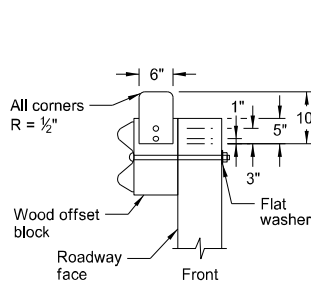
NOTE: Do not install center bolt in the  $\frac{3}{4}" \times 2\frac{1}{2}"$  slot at mid span splices.



$\frac{5}{8}"$ Diameter Carriage Bolt	
L	Thread Length
1 $\frac{1}{2}"$	Full length thread
3"	1 $\frac{1}{2}"$ Min thread length
11"	1 $\frac{3}{4}"$ Min thread length
13"	1 $\frac{3}{4}"$ Min thread length

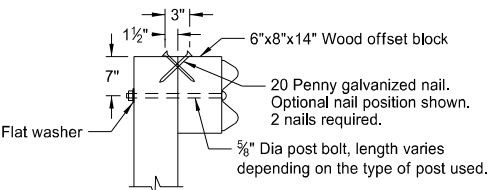


$\frac{5}{8}"$  CARRIAGE BOLT & NUT

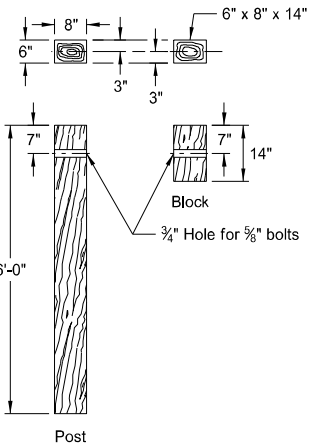


REFLECTORIZED PLATE DETAIL

NOTE: Additional reflectors are added to the W-beam guardrail quantities for placement on end treatment.

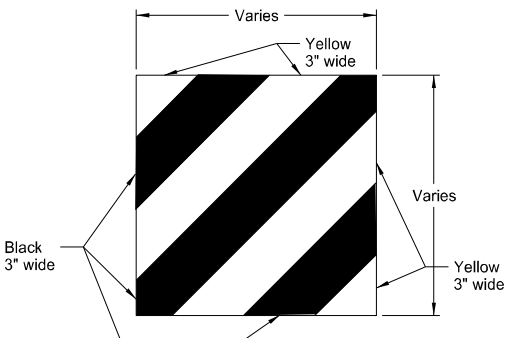


TYPICAL WOOD POST ATTACHMENT DETAIL

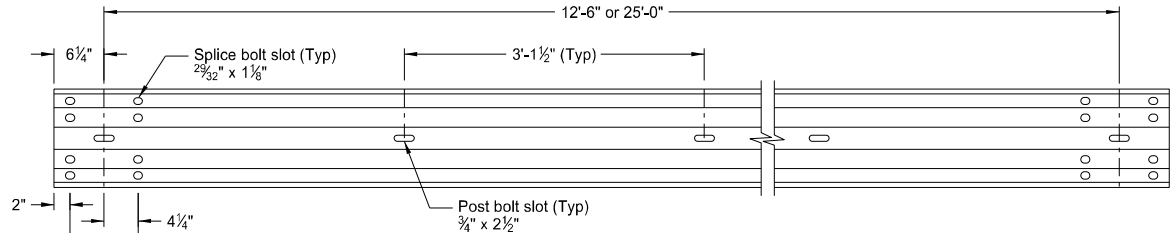


6" x 8" WOOD POST & BLOCK

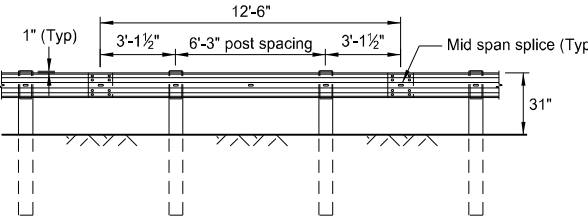
NOTE: Where soil conditions require, alternate lengths may be specified, in 6" increments.



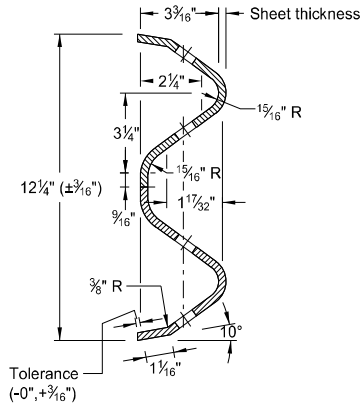
IMPACT HEAD OBJECT MARKER



STANDARD MGS GUARDRAIL PANEL



STANDARD MGS GUARDRAIL SYSTEM



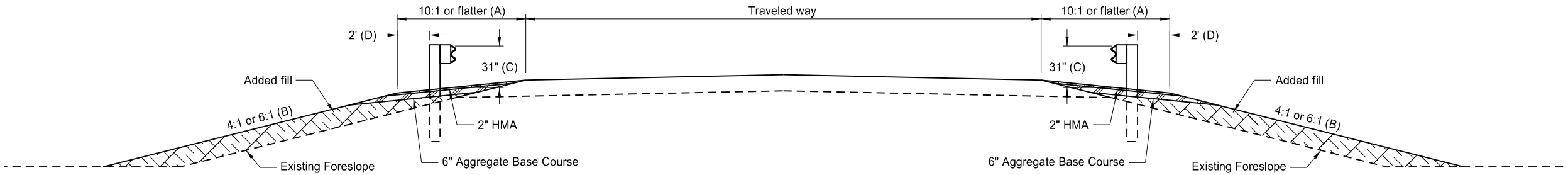
W-BEAM CROSS SECTION

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12-02-20	Updated clipped head to optional

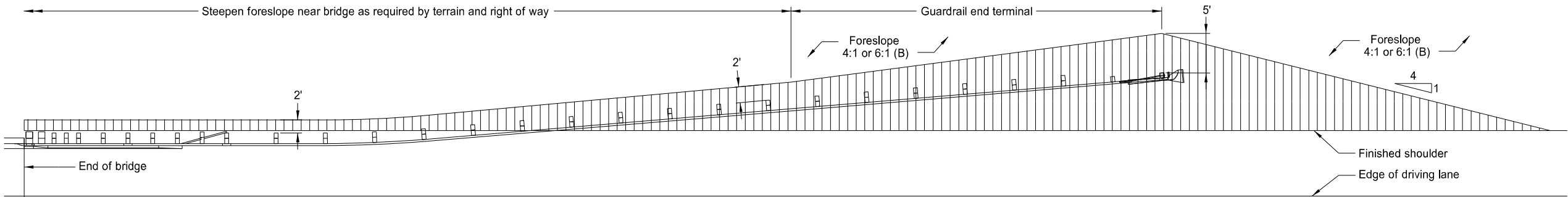


TYPICAL GRADING AT BRIDGE ENDS  
WITH MGS W-BEAM GUARDRAIL

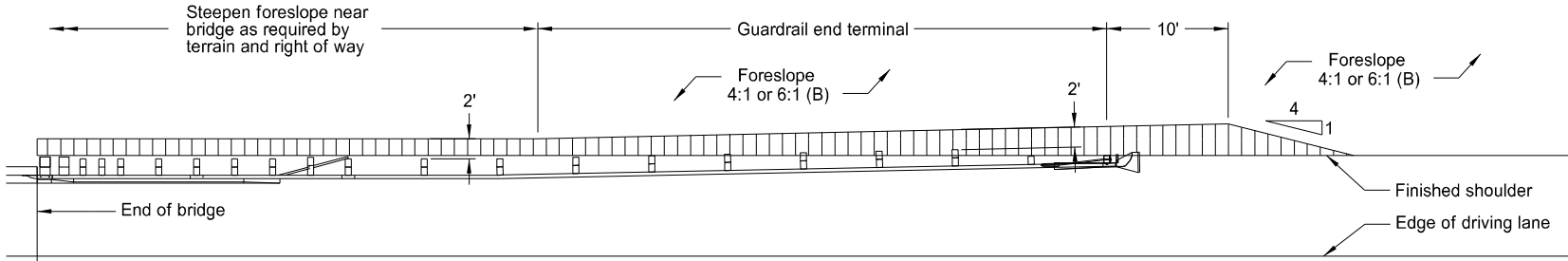
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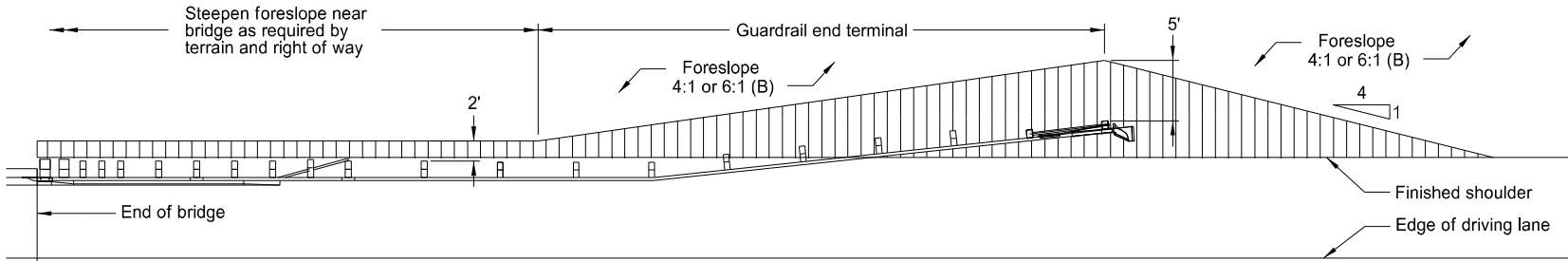
TYPICAL SECTION



PLAN LAYOUT  
FLARED GUARDRAIL WITH END TERMINAL



PLAN LAYOUT  
NON-FLARED GUARDRAIL WITH TANGENT END TERMINAL



PLAN LAYOUT  
NON-FLARED GUARDRAIL WITH FLARED END TERMINAL

NOTES:

- (A) Use slope flatter than 10:1 when required to provide proper guardrail height.
- (B) When normal foreslope is 4:1, use added fill slope of 4:1. When normal foreslope is 6:1, use added fill slope of 6:1.
- (C) Measure from top of guardrail to top of surfacing at front face of guardrail.
- (D) Vary dimension at end terminals per Plan Layouts shown on this sheet.

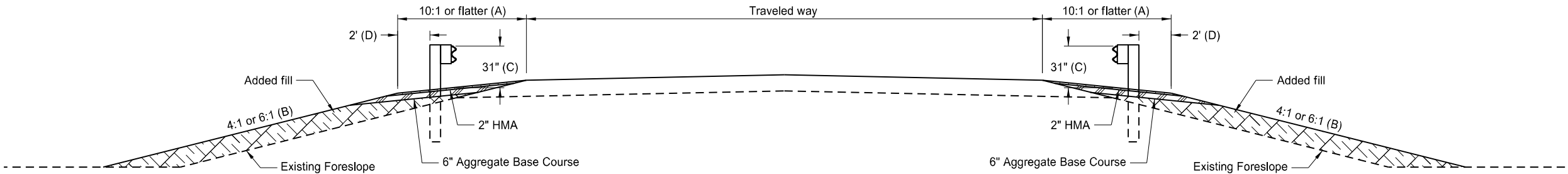
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DATE	CHANGE
12/02/20	Updated notes to active voice.



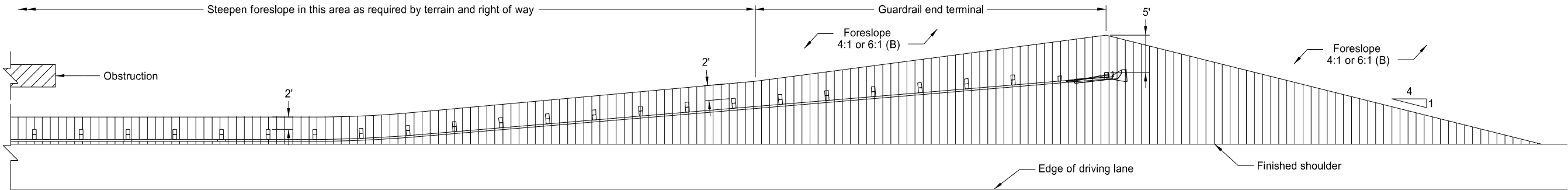
12 02 2020

TYPICAL GRADING AT OBSTRUCTIONS  
WITH MGS W-BEAM GUARDRAIL

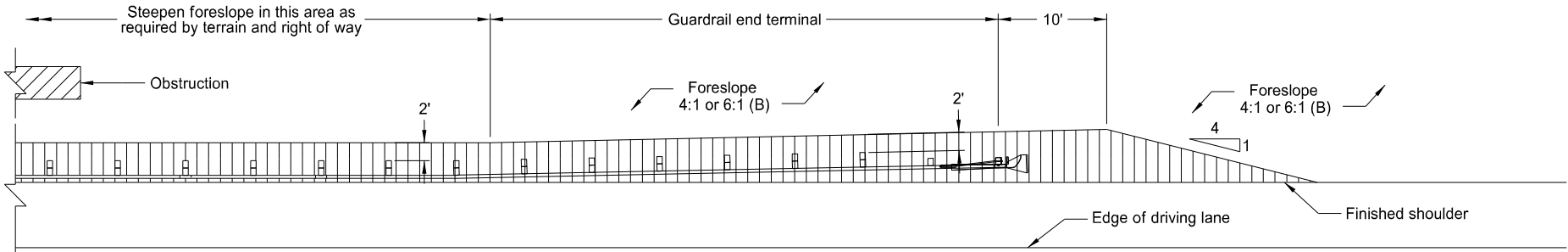
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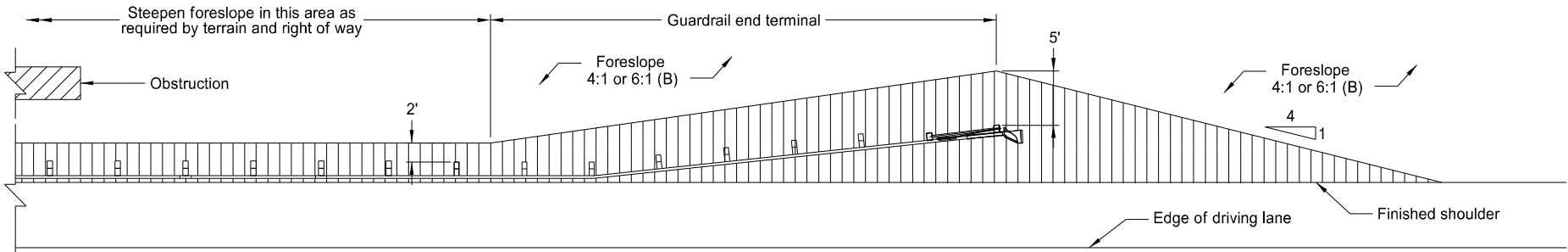
TYPICAL SECTION



PLAN LAYOUT  
FLARED GUARDRAIL WITH END TERMINAL



PLAN LAYOUT  
NON-FLARED GUARDRAIL TANGENT END TERMINAL



PLAN LAYOUT  
NON-FLARED GUARDRAIL WITH FLARED END TERMINAL

NOTES:

- (A) Use slope flatter than 10:1 when required to provide proper guardrail height.
- (B) When normal foreslope is 4:1, use added fill slope of 4:1. When normal foreslope is 6:1, use added fill slope of 6:1.
- (C) Measure from top of guardrail to top of surfacing at front face of guardrail.
- (D) Dimension at end terminals vary per Plan Layouts shown on this sheet.

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12/02/20	Updated notes to active voice.

KIRK J. HOFF

REGISTERED

PROFESSIONAL

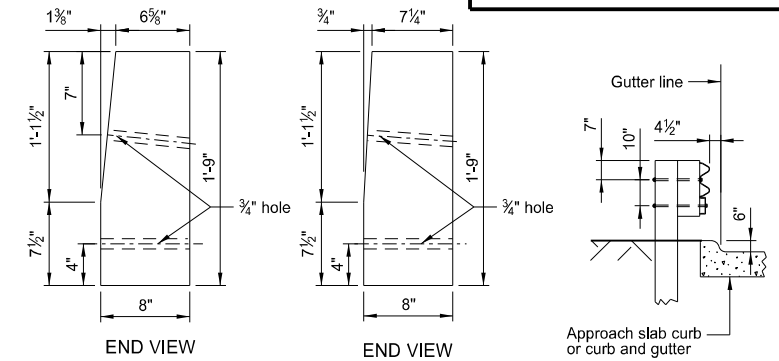
PE-4683

ENGINEER

NORTH DAKOTA

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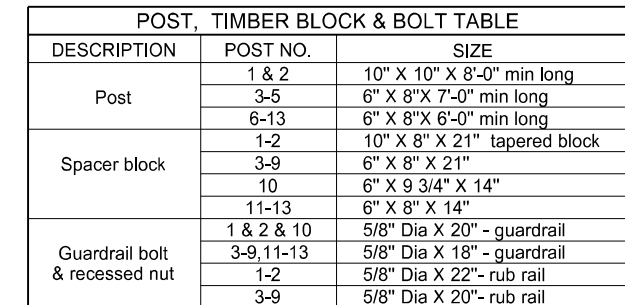
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END VIEW  
Block No. 1  
(width = 10")

END VIEW  
Block No. 2  
(Width = 10")

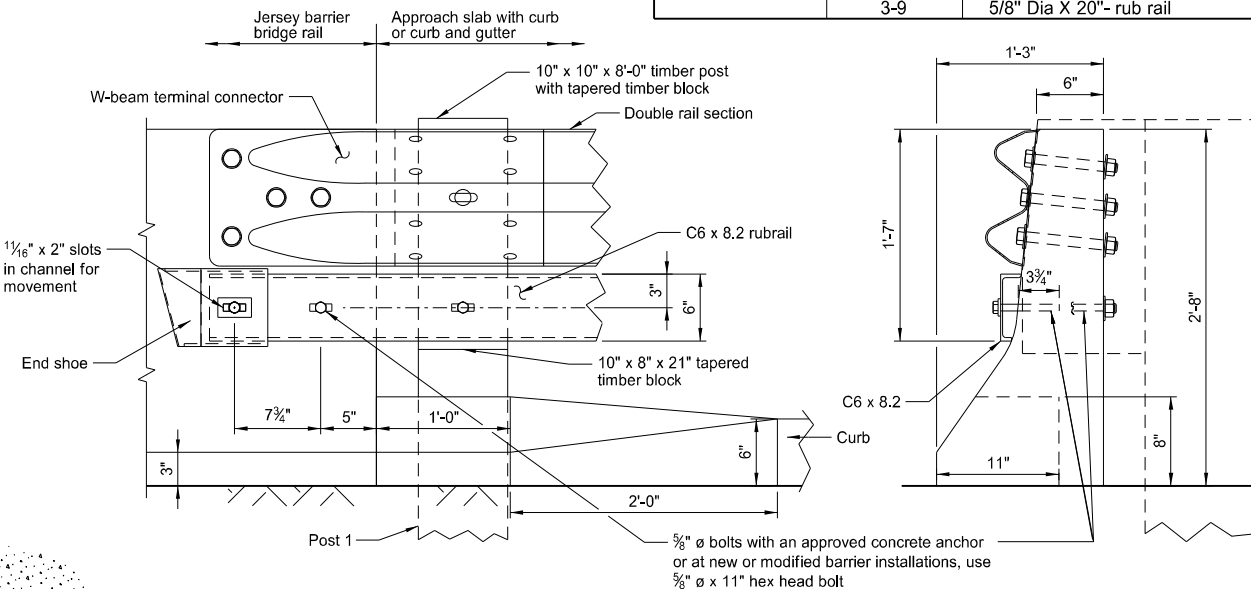
TAPERED TIMBER BLOCK DETAILS



POST, TIMBER BLOCK &amp; BOLT TABLE

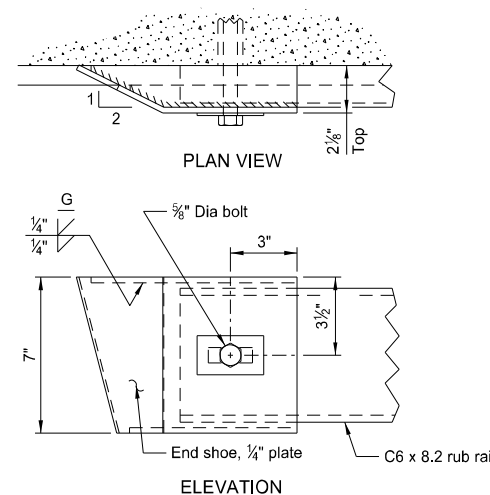
DESCRIPTION	POST NO.	SIZE
Post	1 & 2	10" X 10" X 8'-0" min long
	3-5	6" X 8" X 7'-0" min long
	6-13	6" X 8" X 6'-0" min long
Spacer block	1-2	10" X 8" X 21" tapered block
	3-9	6" X 8" X 21"
	10	6" X 9 3/4" X 14"
	11-13	6" X 8" X 14"
Guardrail bolt & recessed nut	1 & 2 & 10	5/8" Dia X 20" - guardrail
	3-9, 11-13	5/8" Dia X 18" - guardrail
	1-2	5/8" Dia X 22" - rub rail
	3-9	5/8" Dia X 20" - rub rail

## GENERAL ASSEMBLY DETAILS

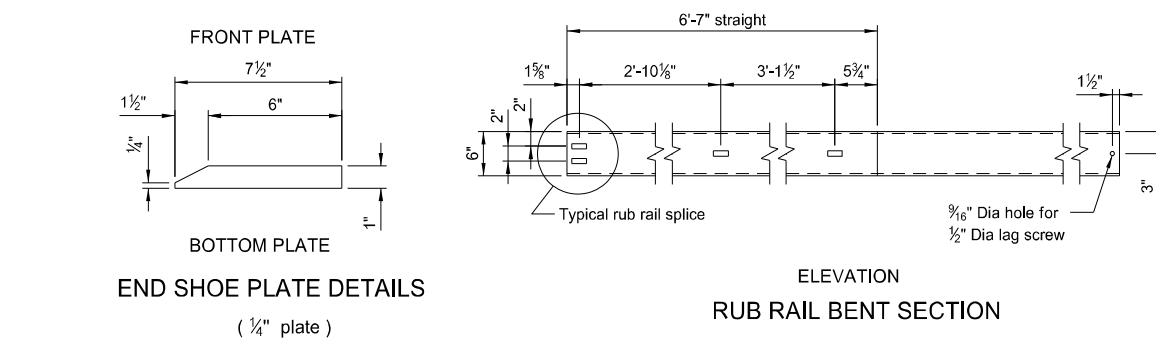


TRAFFIC SIDE ELEVATION

RAIL ATTACHMENT AND CURB DETAIL



## RUB RAIL END SHOE ASSEMBLY



RUB RAIL BENT SECTION

Use timber posts and blocks for W-beam guardrail.

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12-02-20	Updated notes to active voice.

