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.
Abn	abandoned
Abut	abutment
Ac	acres
Adj	adjusted
Aggr	aggregate
Ahd	ahead
ARV	air release valve
Align	alignment
Al	alley
Alt	alternate
Alum	aluminum
ADA	Americans with Disabilities Act
A	ampere
&	and
Appr	approach
Approx	approximate
ACP	asbestos cement pipe
Asph	asphalt
AC	asphalt cement
Assmd	assumed
@	at
Atten	attenuation
ATR	automatic traffic recorder
Ave	Avenue
Avg	average
ADT	average daily traffic
Az	azimuth
Bk	back
BF	back face
Bs	backsight
Balc	balcony
B Wire	barbed wire
Barr	barricade
Btry	battery
Brg	bearing
BI	beehive inlet
Beg	begin
BG	below grade
BM	bench mark
Bkwy	bikeway
Bit	bituminous
Blk	block
Bd Ft	board feet
BH	bore hole
BS	both sides
Bot	bottom
Blvd	Boulevard
Bndry	boundary
BC	brass cap
Brkwy	breakaway
Br	bridge
Bldg	building
BV	butterfly valve
Byp	bypass
C Gdrl	cable guardrail
Calc	calculate
Cd	candela
CIP	cast iron pipe
CB	catch basin
CRS	cationic rapid setting
C Gd	cattle guard
C To C	center to center
CI or ℄	centerline
Cm	centimeter
Ch	chain
Chnlk	chain-link
Ch Blk	channel block
Ch Ch	channel change
Chk	check
Chsld	chiseled
Cir	circle
Cl	class
Cl	clay
Cl F	clay fill
Cl Hvy	clay heavy
Cl Lm	clay loam
Clnt	clean-out
Clr	clear
Cl&gr	clearing & grubbing
Co S	coal slack
C Gr	coarse gravel
CS	coarse sand
Comb.	combination
Coml	commercial
Compr	compression
CADD	computer aided drafting & design
Conc	concrete
CECB	concrete erosion control blanket
Cond	conductor
Const	construction
Cont	continuous
CSB	continuous split barrel sample
Contr	contraction
Contr	contractor
CP	control point
Coord	coordinate
Cor	corner
Corr	corrected
CAES	corrugated aluminum end section
CAP	corrugated aluminum pipe
CMES	corrugated metal end section
CMP	corrugated metal pipe
CPVCP	corrugated poly-vinyl chloride pipe
CSES	corrugated steel end section
CSFES	corrugated steel flared end section
CSP	corrugated steel pipe
CSTES	corrugated steel traversable end section
C	coulomb
Co	County
Crse	course
Ct	Court
Xarm	cross arm
Xbuck	cross buck
Xsec	cross sections
Xing	crossing
Xrd	Crossroad
Crn	crown
CF	cubic feet
M3	cubic meter
M3/s	cubic meters per second
CY	cubic yard
Cy/mi	cubic yards per mile
Culv	culvert
C&G	curb & gutter
CI	curb inlet
CR	curb ramp
CS	curve to spiral
C	cut
Dd Ld	dead load
Defl	deflection
Defm	deformed
Deg or D	degree
Dlnt	delineate
Dlntr	delineator
Depr	depression
Desc	description
Det	detail
DWP	detectable warning panel
Dtr	detour
Dia or ø	diameter
Dir	direction
Dist	distance
DM	disturbed material
DB	ditch block
DG	ditch grade
Dbl	double
Dn	down
Dwg	drawing
Dr	drive
Drwy	driveway
DI	drop inlet
D	dry density
DSDS	dynamic speed display sign
Ea	each
Esmt	easement
E	East
EB	Eastbound
Elast	elastomeric
EL	electric locker
E Mtr	electric meter
Elec	electric/al
EDM	electronic distance meter
Elev or El	elevation
Ellipt	elliptical
Emb	embankment
Emuls	emulsion/emulsified
ES	end section
Engr	engineer
ESS	environmental sensor station
Eq	equal
Eq	equation
Evgr	evergreen
Exc	excavation
Exst	existing
Exp	expansion
Expy	Expressway
E	external of curve
Extru	extruded
FOS	factor of safety
F	Fahrenheit
FS	far side
F	farad
Fed	Federal
FP	feed point
Ft	feet/foot
Fn	fence
Fn P	fence post
FO	fiber optic
FB	field book
FD	field drive
F	fill
FAA	fine aggregate angularity
FS	fine sand
FH	fire hydrant
Fl	flange
Flrd	flared
FES	flared end section
F Bcn	flashing beacon
FA	flight auger sample
FL	flow line
Ftg	footing
FM	force main
Fs	foresight

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE
04-23-18	General Revisions
09-20-18	General Revisions

This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 09/20/18 and the original document is stored at the North Dakota Department of Transportation

NDDOT ABBREVIATIONS

D-101-2

Fnd	found
Fdn	foundation
Frac	fractional
Frwy	freeway
Frt	front
FF	front face
F Disp	fuel dispenser
FFP	fuel filler pipes
FLS	fuel leak sensor
Furn	furnish/ed
Gal	gallon
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
Geod	geodetic
GIS	Geographical Information System
G	giga
GPS	Global Positioning System
Gov	government
Grd	graded/grade
Gr	gravel
Grnd	ground
GWM	ground water monitor
Gdrl	guardrail
Gtr	gutter
H Plg	H piling
Hdwl	headwall
Ha	hectare
Ht	height
HI	height of instrument
Hel	helical
H	henry
Hz	hertz
HDPE	high density polyethylene
HM	high mast
HP	high pressure
HPS	high pressure sodium
Hwy	highway
Hor	horizontal
HBP	hot bituminous pavement
HMA	hot mix asphalt
Hr	hour(s)
Hyd	hydrant
Ph	hydrogen ion content
Id	identification
In or "	inch
Incl	inclinometer tube
IMH	inlet manhole
ID	inside diameter
Inst	instrument
Intchg	interchange
Intmdt	intermediate
Intscn	intersection
Inv	invert
IM	iron monument
I Pn	Iron Pin
IP	iron Pipe
Jt	joint
J	joule
Jct	junction
K	kelvin
Kn	kilo newton
Kpa	kilo pascal
Kg	kilogram
Kg/m3	kilogram per cubic meter
Km	kilometer
K	Kip(s)
LS	Land Surveyor (licensed)
LSIT	Land Surveyor In Training
Ln	lane
Lg	large
Lat	latitude
Lt	left
L	length of curve
Lens	lenses
Lvl	level
LB	level book
Lvlng	leveling
Lht	light
LP	light pole
Ltg	lighting
Lig Co	lignite coal
Lig Sl	lignite slack
LF	linear foot
Liq	liquid
LL	liquid limit
L	litre
Lm	loam
Loc	location
LC	long chord
Long.	longitude
Lp	loop
LD	loop detector
Lm	lumen
Lum	luminaire
L Sum	lump sum
Lx	lux
Mb	mailbox
ML	main line
M Hr	man hour
MH	manhole
Mkd	marked
Mkr	marker
Mkg	marking
MA	mast arm
Matl	material
Max	maximum
MC	meander corner
Meas	measure
Mdn	median
MD	median drain
MC	medium curing
M	mega
Mer	meridian
M	meter
M/s	meters per second
M	mid ordinate of curve
MGS	Midwest Guardrail System
Mi	mile
MM	mile marker
MP	mile post
Ml	milliliter
Mm	millimeter
Mm/hr	millimeters per hour
Min	minimum
Misc	miscellaneous
Mon	monument
Mnd	mound
Mtbl	mountable
Mtd	mounted
Mtg	mounting
Mk	muck
Mun	municipal
N	nano
NGS	National Geodetic Survey
NS	near side
Neop	neoprene
Ntwk	network
N	newton
N	North
NE	North East
NW	North West
NB	Northbound
No. or #	number
Obsc	obscure(d)
Obsn	observation
Ocpd	occupied
Ocpy	occupy
Off Loc	office location
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
PK	Parker-Kalon nail
Pa	pascal
PSD	passing sight distance
Pvmt	pavement
Ped	pedestal
Ped	pedestrian
PPP	pedestrian pushbutton post
Pen.	penetration
Perf	perforated
Per.	perimeter
PL	pipeline
Pl	place
P&P	plan & profile
PL	plastic limit
P Cap	plastic cap
Pl or ℙ	plate
Pt	point
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
PE	polyethylene
PVC	polyvinyl chloride
PCC	Portland Cement concrete
Lb or #	pounds
PP	power pole
Preempt	preemption
Prefab	prefabricated
Prfmd or Pref	preformed
Prep	preperation
Press.	pressure

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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NDDOT ABBREVIATIONS

D-101-3

PRV	pressure relief valve
Prestr	prestressed
Pvt	private
PD	private drive
Prod.	production/produce
Prog	programmed
Prop.	property
Prop Ln	property line
Ppsd	proposed
PB	pull box
Qty	quantity
Qtr	quarter
Rad or R	radius
RR	railroad
Rlwy	railway
Rsd	raised
RTP	random traverse point
Rge or R	range
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
RCTES	reinforced concrete traversable end section
RCP	reinforced concrete pipe
RCPS	reinforced concrete pipe sewer
Reinf	reinforcement
Res	reservation
Rs	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
Salv	salvage(d)
Sd	sand
Sdy Cl	sandy clay
Sdy Cl Lm	sandy clay loam
Sdy Fl	sandy fill
Sdy Lm	sandy loam
San	sanitary sewer line
Sc	scoria
Sec	seconds
Sec	section
SL	section line
Sep	separation
Seq	sequence
Serv	service
Sh	shale
Sht	sheet
Shtng	sheeting
Shldr	shoulder
Sw or Sdwk	sidewalk
S	siemens
SD	sight distance
SN	sign number
Sig	signal
Si Cl	silt clay
Si Cl Lm	silty clay loam
Si Lm	silty loam
Sgl	single
SRCP	slotted reinforced concrete pipe
SC	slow curing
SS	slow setting
Sm	small
S	South
SE	South East
SW	South West
SB	Southbound
Sp	spaces
Spcl	special
SA	special assembly
SP	special provisions
G	specific gravity
Spk	spike
SC	spiral to curve
ST	spiral to tangent
SB	split barrel sample
SH	sprinkler head
SV	sprinkler valve
Sq	square
SF	square feet
Km2	square kilometer
M2	square meter
SY	square yard
Stk	stake
Std	standard
N	standard penetration test
Std Specs	standard specifications
Sta	station
Sta Yd	station yards
Stm L	steam line
SEC	steel encased concrete
SMA	stone matrix asphalt
SSD	stopping sight distance
SD	storm drain
St	street
SPP	structural plate pipe
SPPA	structural plate pipe arch
Str	structure
Subd	subdivision
Sub	subgrade
Sub Prep	subgrade preperation
Ss	subsoil
SE	superelevation
SS	supplement specification
Supp	supplemental
Surf	surfacing
Surv	survey
Sym	symmetrical
SI	systems international
Tan	tangent
T	tangent (semi)
TS	tangent to spiral
Tel	telephone
Tel B	Telephone Booth
Tel P	telephone pole
Tv	television
Temp	temperature
Temp	temporary
TBM	temporary bench mark
T	tesla
T	thinwall tube sample
T/mi	tons per mile
Ts	topsoil
Twp or T	township
Traf	traffic
TSCB	traffic signal control box
Tr	trail
Transf	transformer
TB	transit book
Trans	transition
TT	transmission tower
TES	traversable end section
Trans	transverse
Trav	traverse
TP	traverse point
Trtd	treated
Trmt	treatment
Qc	triaxial compression
TERO	tribal employment rights ordinance
Tpl	triple
TP	turning point
Typ	typical
Qu	unconfined compressive strength
Ugrnd	underground
USC&G	US Coast & Geodetic Survey
USGS	US Geologic Survey
Util	utility
VG	valley gutter
Vap	vapor
Vert	vertical
VC	vertical curve
VCP	vitrified clay pipe
V	volt
Vol	volume
Wkwy	walkway
W	water content
WGV	water gate valve
WL	water line
WM	water main
WMV	water main valve
W Mtr	water meter
WSV	water service valve
WW	water well
W	watt
Wrng	wearing
Wb	weber
WIM	weigh in motion
W	west
WB	westbound
Wrng	wiring
W/	with
W/o	without
WC	witness corner
WGS	world geodetic system
Z	zenith

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NDDOT UTILITY COMPANY AND ORGANIZATION ABBREVIATIONS

D-101-10

702COM	702 Communications
ACCENT	Accent Communications
AGASSIZ WU	Agassiz Water Users Incorporated
AGC	Assiociated General Contractors of America
All PI	Alliance Pipeline
ALL SEAS WU	All Seasons Water Users Association
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 WU	Burleigh Water Users
Cable One	Cable One
CABLE SERV	Cable Services
CAP ELEC	Capital Electric Cooperative Incorporat
CASS CO ELEC	Cass County Electric Cooperative
CASS RWU	Cass Rural Water Users Incorporated
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
COE	Corps of Engineers
CONS TEL	Consolidated Telephone
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
DICKEY R NET	Dickey Rural Networks
DICKEY RWU	Dickey Rural Water Users Association
DICKEY TEL	Dickey Telephone
DNRR	Dakota Northern Railroad
DOME PL	Dome Pipeline Company
DVELEC	Dakota Valley Electric Cooperative
DVMW	Dakota, Missouri Valley & Western
ENBRDG	Enbridge Pipelines Incorporated
ENVENTIS	Enventis Telephone
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
GRGS CO TEL	Griggs County Telephone
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
LNGDN RWU	Langdon Rural Water Users Incorporated
LWR YELL R ELEC	Lower Yellowstone Rural Electric
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
MDU	Montana-dakota Utilities
MID-CONT CABLE	Mid-Continent Cable
MIDSTATE TEL	Midstate Telephone Company
MINOT CABLE	Minot Cable Television
MINOT TEL	Minot Telephone Company
MISS VALL COMM	Missouri Valley Communications
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
MRE LBTY TEL	Moore & Liberty Telephone
MUNICIPAL	City Water And Sewer
MUNICIPAL	City Of '.....'
N CENT ELEC	North Central Electric Cooperative
N VALL W DIST	North Valley Water District
ND PKS & REC	North Dakota Parks And Recreation
ND TEL	North Dakota Telephone Company
NDDOT	North Dakota Department of Transportation
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
NTH PRAIR RW	Northern Prairie Rural Water Association
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
P L E M	Prairielands Energy Marketing
POLAR COM	Polar Communications
PVT ELEC	Private Electric
QWEST	Qwest Communications
R&T W SUPPLY	R & T Water Supply Association
RED RIV TEL	Red River Rural Telephone
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
S E W U	South East 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 RWU	Stutsman Rural Water Users
SW PL PRJ	Southwest Pipeline Project
T M C	Turtle Mountain Communications
TCI	TCI of North Dakota
TESORO HGH PLNS PL	Tesoro High Plains Pipeline
TRI-CNTY WU	Tri-County Water Users Incorporated
TRL CO RWU	Traill County Rural Water Users
UNTD TEL	United Telephone
UPPR SOUR WUA	Upper Souris Water Users Association
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
WEB	W. E. B. Water Development Association
WILLI RWA	Williams Rural Water Association
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

Proposed Topography

- 3-Cable w Posts
- Flow
- Fence
- Remove Line
- Wall
- Retaining Wall (Plan View)
- W-Beam w 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	
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09-23-16	Added and Revised Items, Organized by Functional Groups

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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) (void — void — void — v)
- 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 (D — D)
- Geogrid (Geo — Geo)
- Geotextile Fabric Type R (R — R)
- Geotextile Fabric Type R1 (R — R)
- Geotextile Fabric Type RR (RR — RR)
- Geotextile Fabric Type S (S — 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

- Hidden Object
- Small Hidden Object
- Large Hidden Object
- Phantom Object
- Centerline Main
- Centerline
- Existing Ground (Details)
- Existing Conditions
- Sheet Piling

Erosion Control

- Limits of Const Transition Line
- Bale Check
- Rock Check
- Floating Silt Curtain (S — S)
- Silt Fence (SF — SF)
- 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	
REVISIONS	
DATE	CHANGE
09-23-16	Added and Revised Items, Organized by Functional Groups

This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930, on 09/23/16 and the original document is stored at the North Dakota Department of Transportation

Symbols

D-101-30

North Arrow (Half Scale)

Truck Mounted Attenuator

Type I Barricade

Type II Barricade

Type III Barricade

Catch Basin

Cairn or Stone Circle

Video Detection Camera

Storm Drain Cap or Stub

Corrugated Metal End Section 18 Inch

Corrugated Metal End Section 24 Inch

Corrugated Metal End Section 30 Inch

Corrugated Metal End Section 36 Inch

Corrugated Metal End Section 42 Inch

Corrugated Metal End Section 48 Inch

Concrete Foundation

Ground Connection Conductor

Neutral Connection Conductor

Phase 1 Connection Conductor

Phase 2 Connection Conductor

Traffic Cone

Signal Controller

Pad Mounted Signal Controller

Alignment Data Point

Emergency Vehicle Detector

Attenuation Device

Diamond Grade Delineator Type A

Diamond Grade Delineator Type B

Diamond Grade Delineator Type C

Diamond Grade Delineator Type D

Diamond Grade Delineator Type E

Flexible Delineator

Flexible Delineator Type A

Flexible Delineator Type B

Flexible Delineator Type C

Flexible Delineator Type D

Flexible Delineator Type E

Delineator Type A

Delineator Type A Reset

Delineator Type B

Delineator Type B Reset

Delineator Type C

Delineator Type D

Delineator Type E

Delineator Drums

Spot Elevation

Existing Access Control Arrow

Existing Artifact

Existing Flashing Beacon

Existing Benchmark

Existing Railroad Battery Box

Existing Bush or Shrub

Existing Gas Cap or Stub

Existing Sanitary Cap or Stub

Existing Storm Drain Cap or Stub

Existing Water Cap or Stub

Existing Sanitary Cleanout

Existing Concrete Foundation

Existing Traffic Signal Controller

Existing Pad Mounted Signal Controller

Existing Sixteenth Section Corner

Existing Quarter Section Corner

Existing Section Corner

Existing Railroad Crossbuck

Existing Satellite Dish

Existing Fuel Dispensers

Existing Flexible Delineator Type A

Existing Flexible Delineator Type B

Existing Flexible Delineator Type C

Existing Flexible Delineator Type D

Existing Flexible Delineator Type E

Existing Delineator Type A

Existing Delineator Type B

Existing Delineator Type C

Existing Delineator Type D

Existing Delineator Type E

Existing EFB Misc

Existing Flashing Beacon

Existing Pipe Mounted Flasher

Existing Pad Mounted Feed Point

Existing Pipe Mounted Feed Point with Pad

Existing Pole Mounted Feed Point

Existing Railroad Frog

Existing Snow Gate 18

Existing Snow Gate 28

Existing Snow Gate 40

Existing Headwall

Existing Pedestrian Head with Number

Existing Signal Head

Existing Sprinkler Head

Existing Fire Hydrant

Existing Catch Basin Drop Inlet

Existing Curb Inlet

Existing Manhole Inlet

Existing Junction Box

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE

This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930 , on 07/01/14 and the original document is stored at the North Dakota Department of Transportation

Symbols

D-101-31

- Existing Light Standard
- Existing High Mast Light Standard 10 Luminaire
- Existing High Mast Light Standard 3 Luminaire
- Existing High Mast Light Standard 4 Luminaire
- Existing High Mast Light Standard 5 Luminaire
- Existing High Mast Light Standard 6 Luminaire
- Existing High Mast Light Standard 7 Luminaire
- Existing High Mast Light Standard 8 Luminaire
- Existing High Mast Light Standard 9 Luminaire
- Existing Overhead Sign Structure Load Center
- Existing Luminaire
- Existing Light Standard Luminaire
- Existing Federal Mailbox
- Existing Private Mailbox
- Existing Meander Section Corner
- Existing Meter
- Existing Electrical Manhole
- Existing Gas Manhole
- Existing Sanitary Manhole
- Existing Sanitary Force Main Manhole
- Existing Sanitary Manhole with Valve
- Existing Storm Drain Manhole
- Existing Force Main Storm Drain Manhole
- Existing Force Main Storm Drain Manhole with Valve
- Existing Telephone Manhole
- Existing Manhole with Valve Water
- Existing Water Manhole
- Existing Mile Post Type A
- Existing Mile Post Type B
- Existing Mile Post Type C
- Existing Reference Marker
- Existing RW Marker
- Existing Utility Marker
- Iron Monument Found
- Iron Pin R/W Monument
- Existing Object Marker Type I
- Existing Object Marker Type II
- Existing Object Marker Type III
- Existing Electrical Pedestal
- Existing Telephone Pedestal
- Existing Fiber Optic Telephone Pedestal
- Existing TV Pedestal
- Existing Fiber Optic TV Pedestal
- Existing Fuel Filler Pipes
- Existing Traverse PI Aerial Panel
- Existing Pole
- Existing Power Pole
- Existing Power Pole with Transformer
- Existing Telephone Pole
- Existing Wood Pole
- Existing Post
- Existing Pedestrian Push Button Post
- Existing Control Point CP
- Existing Control Point GPS-RTK
- Existing Control Point TRI
- Existing Reference Marker Point NGS
- Existing Pull Box
- Existing Intelligent Transportation Pull Box
- Existing Water Pump
- Existing Slotted Reinforced Concrete Pipe
- Existing RR Profile Spot
- Existing Fuel Leak Sensors
- Existing Highway Sign
- Existing Miscellaneous Spot
- Existing Lighting Standard Pole
- Existing Traffic Signal Standard
- Existing Transformer
- Existing Large Evergreen Tree
- Existing Small Evergreen Tree
- Existing Large Tree
- Existing Small Tree
- Existing Tree Trunk
- Existing Pad Mounted Traffic Signal Control Box
- Existing Undefined Manhole
- Existing Undefined Pull Box
- Existing Undefined Pedestal
- Existing Undefined Valve
- Existing Undefined Pipe Vent
- Existing Gas Valve
- Existing Water Valve
- Existing Fuel Pipe Vent
- Existing Gas Pipe Vent
- Existing Sanitary Pipe Vent
- Existing Storm Drain Pipe Vent
- Existing Water Pipe Vent
- Existing Weather Station
- Existing Ground Water Well Bore Hole
- Existing Windmill or Tower
- Existing Witness Corner
- Flashing Beacon
- Flagger
- Pipe Mounted Flasher
- Sanitary Force Main with Valve

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE

This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930 , on 07/01/14 and the original document is stored at the North Dakota Department of Transportation

Symbols

D-101-32

- Pad Mounted Feed Point
- Pipe Mounted Feed Point with Pad
- Pole Mounted Feed Point
- Headwall
- Double Headwall with Vegitation Barrier
- Single Headwall with Vegitation Barrier
- Pole Mounted Head
- Sprinkler Head
- Fire Hydrant
- Inlet Type 1
- Inlet Type 2
- Double Inlet Type 2
- Inlet Grate Type 2
- Junction Box
- High Mast Light Standard 10 Luminaire
- High Mast Light Standard 3 Luminaire
- High Mast Light Standard 4 Luminaire
- High Mast Light Standard 5 Luminaire
- High Mast Light Standard 6 Luminaire
- High Mast Light Standard 7 Luminaire
- High Mast Light Standard 8 Luminaire
- High Mast Light Standard 9 Luminaire
- Relocate Light Standard
- Overhead Sign Structure Load Center
- Light Standard 100 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 1000 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 150 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 175 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 200 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 250 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 310 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 35 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 400 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 50 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 70 Watt High Pressure Sodium Vapor Luminaire
- Light Standard 700 Watt High Pressure Sodium Vapor Luminaire
- Manhole
- Manhole 48 Inch
- Sanitary Force Main Manhole
- Sanitary Sewer Manhole
- Storm Drain Manhole
- Storm Drain Manhole with Inlet
- Reset Mile Post
- Mile Post Type A
- Mile Post Type B
- Mile Post Type C
- Right of Way Marker
- Tubular Marker
- Alignment Monument
- Iron Pin Reference Monument
- Object Marker Type I
- Object Marker Type II
- Object Marker Type III
- Caution Mode Arrow Panel
- Back to Back Vertical Panel Sign
- Double Direction Arrow Panel
- Left Directional Arrow Panel
- Right Directional Arrow Panel
- Sequencing Arrow Panel
- Truck Mounted Arrow Panel
- Power Pole
- Wood Pole
- Pedestrian Push Button Post
- Property Corner
- Pull Box
- Intelligent Transportation Pull Box
- Sanitary Pump
- Storm Drain Pump
- Reinforced Pavement
- Reinforced Concrete End Section 15 Inch
- Reinforced Concrete End Section 18 Inch
- Reinforced Concrete End Section 24 Inch
- Reinforced Concrete End Section 30 Inch
- Reinforced Concrete End Section 36 Inch
- Reinforced Concrete End Section 42 Inch
- Reinforced Concrete End Section 48 Inch
- Reinforced Concrete End Section 54 Inch
- Reset Right of Way Marker
- Reset USGS Marker
- Right of Way Markers
- Riser 30 Inch
- Continuous Split Barrel Sample (CSB)
- Flight Auger Sample (FA)
- Split Barrel Sample (SB)
- Thinwall Tube Sample
- Highway Sign
- SNOW GATE 18 FT
- SNOW GATE 28 FT
- SNOW GATE 40 FT
- Standard Penetration Test (N)
- Transformer
- Inclinometer Tube (Incl)
- Underdrain Cleanout
- Excavation Unit
- Water Valve

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-01-14	
REVISIONS	
DATE	CHANGE

This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930 , on 07/01/14 and the original document is stored at the North Dakota Department of Transportation

Cross Section Legend

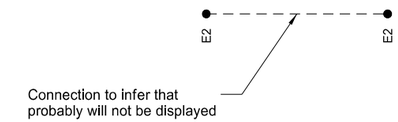
D-101-40

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

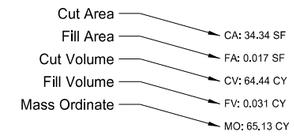
Description	Longitudinal Parallel to Roadway	Transverse Perpendicular to Roadway*
Overhead Power Transmission Line	OHT1	OHT2
Overhead Line	OH1	OH2

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.

* 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.



On the right side of most cross sections there is a earthwork table. The following example (values not related to project) details the earthwork table layout.



NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-20-18	
REVISIONS	
DATE	CHANGE

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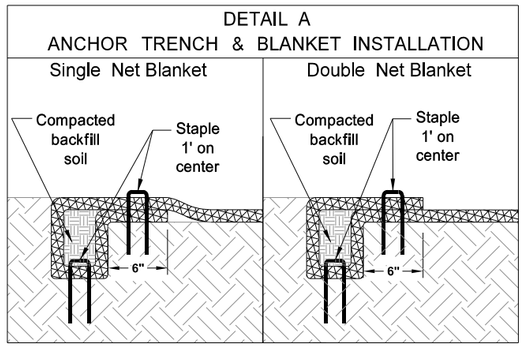
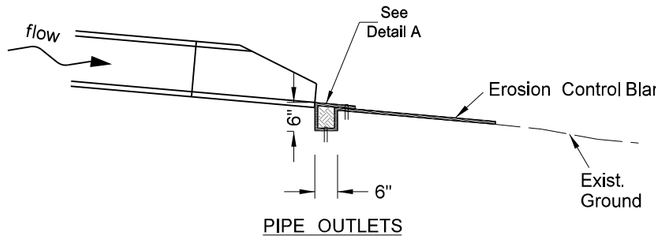
D-255-2

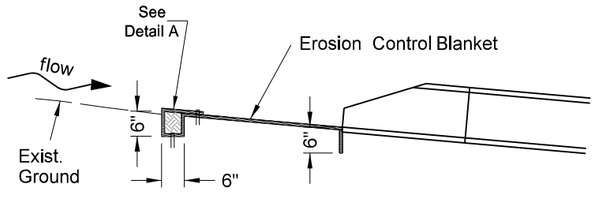
EROSION AND SILTATION CONTROL
EROSION CONTROL BLANKET INSTALLATION



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

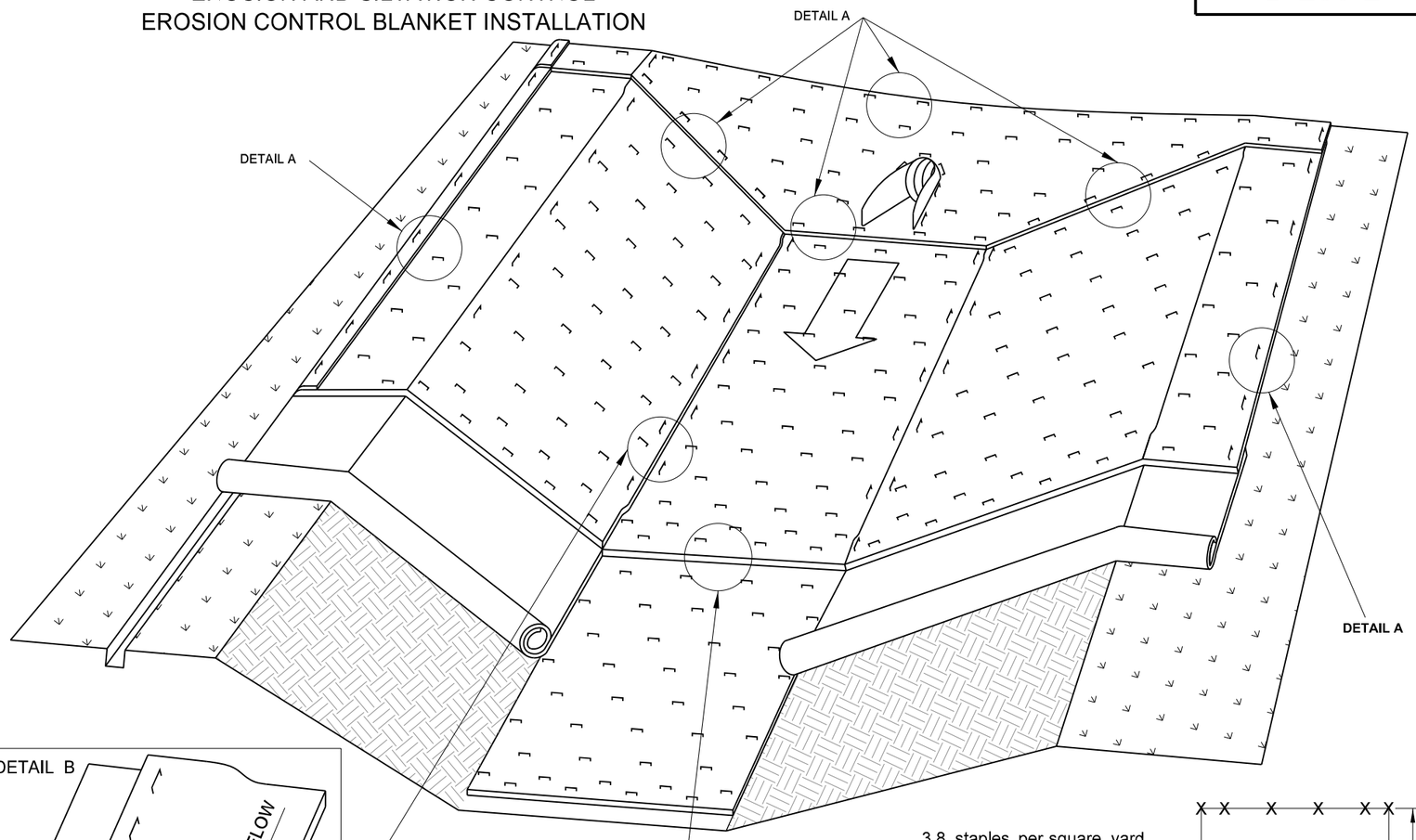


PIPE OUTLETS

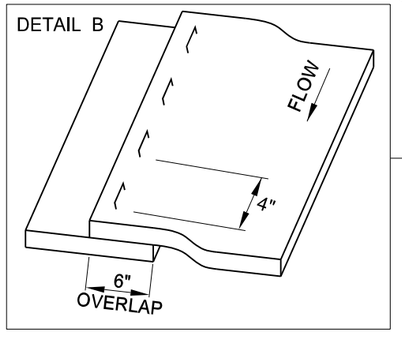


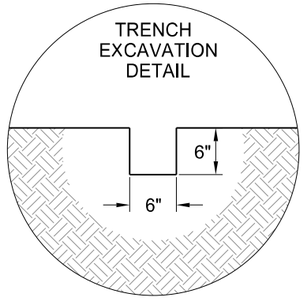
PIPE INLETS

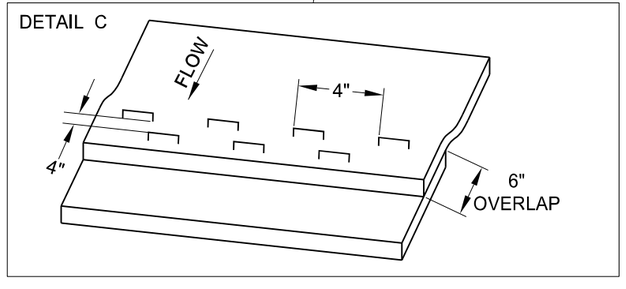
INSTALLATION AT PIPE ENDS



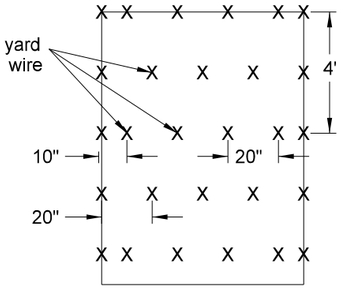
BLANKET LAYOUT
CHANNEL OR SLOPE INSTALLATION







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



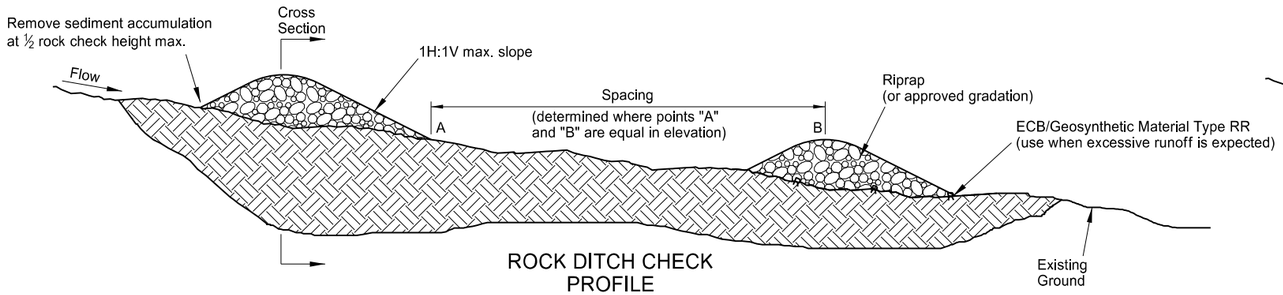
STAPLE PATTERN

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Changed standard drawing number from D-708-5 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.

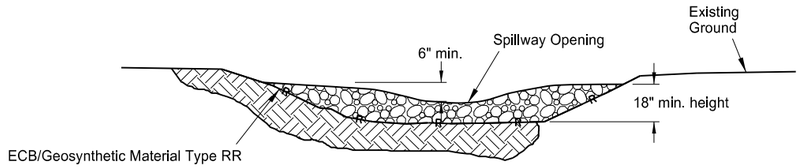
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 08/27/19 and the original document is stored at the North Dakota Department of Transportation

EROSION AND SILTATION CONTROLS

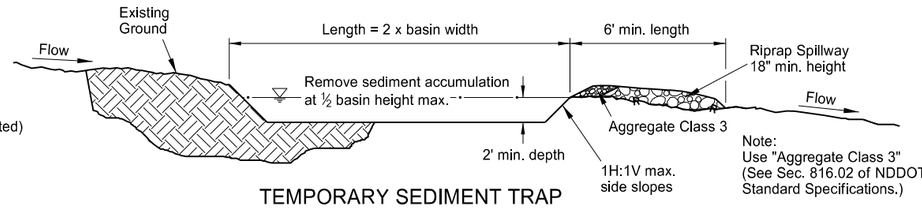
D-256-1



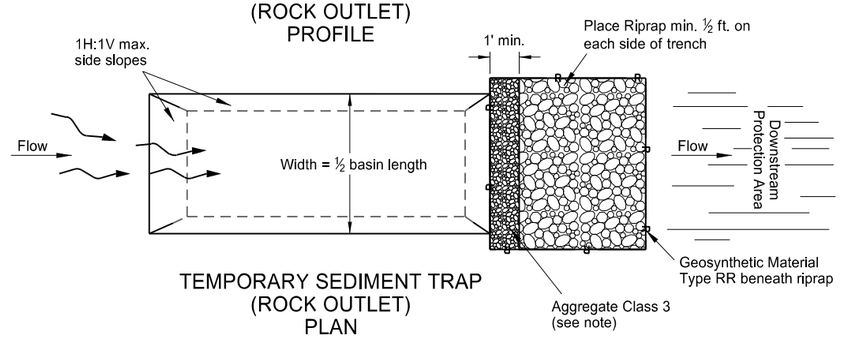
ROCK DITCH CHECK
PROFILE



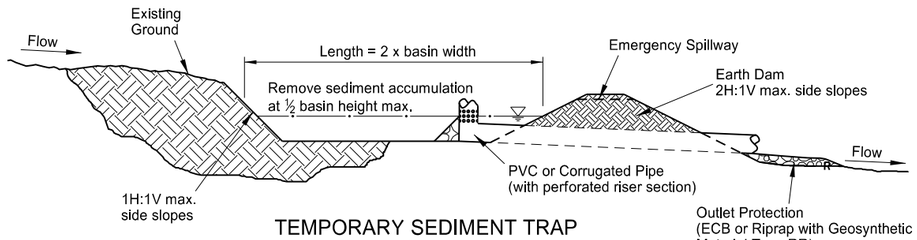
ROCK DITCH CHECK
CROSS SECTION



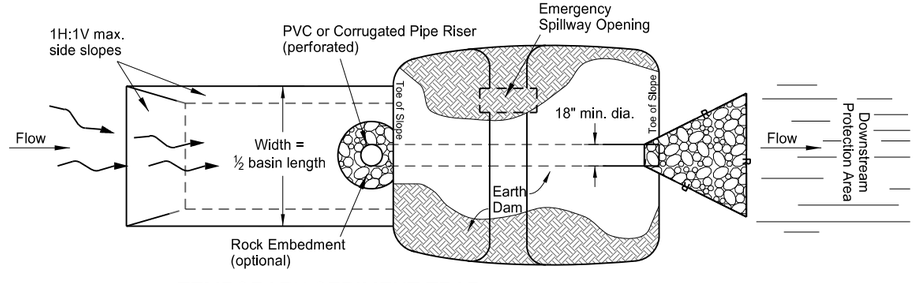
TEMPORARY SEDIMENT TRAP
(ROCK OUTLET)
PROFILE



TEMPORARY SEDIMENT TRAP
(ROCK OUTLET)
PLAN



TEMPORARY SEDIMENT TRAP
(RISER PIPE OUTLET)
PROFILE



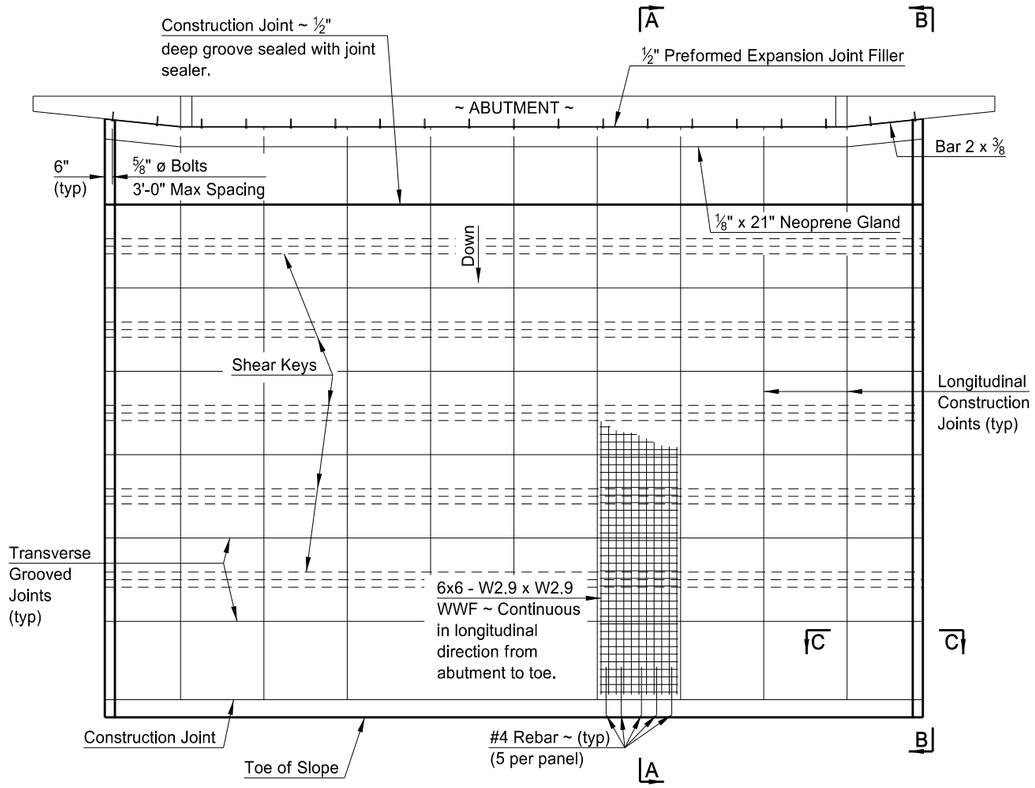
TEMPORARY SEDIMENT TRAP
(RISER PIPE OUTLET)
PLAN

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

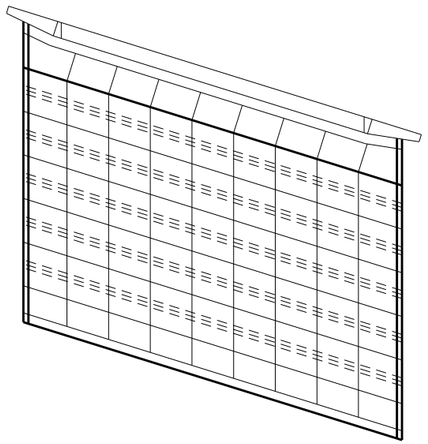
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8-27-2019 and the original document is stored at the North Dakota Department of Transportation

STANDARD SLOPE PROTECTION UNDER BRIDGES

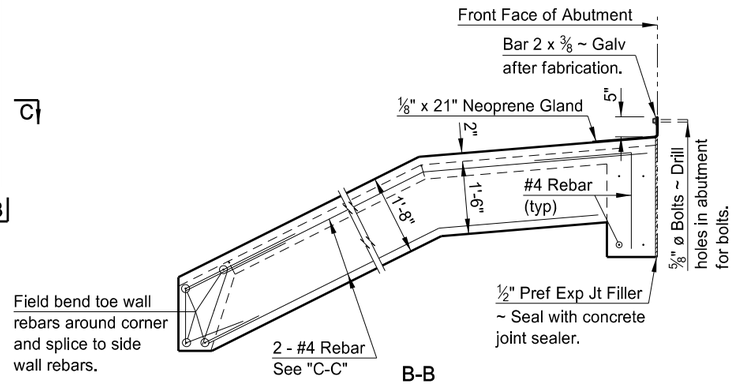
D-258-1



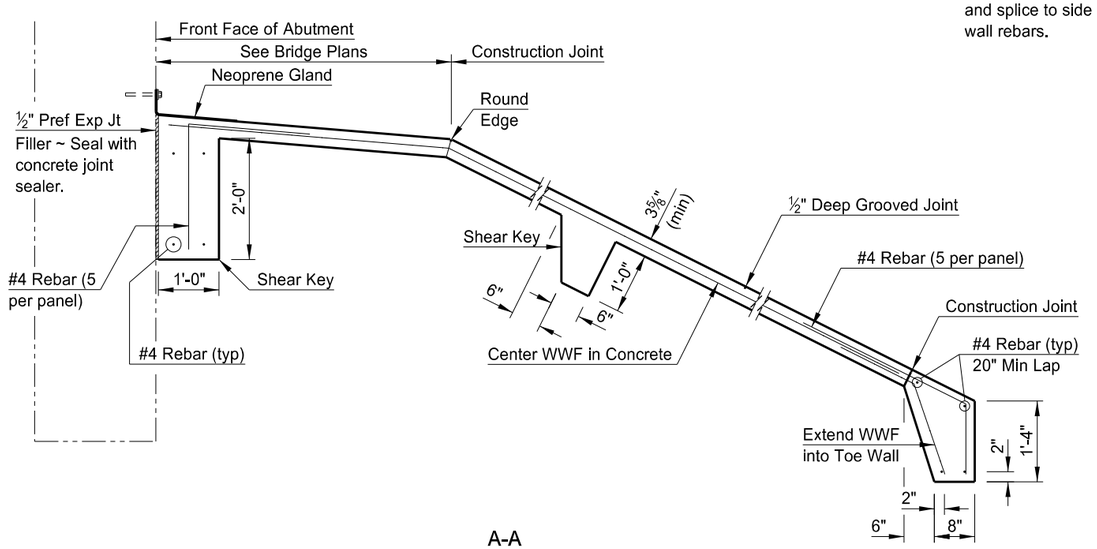
SLOPE PROTECTION LAYOUT



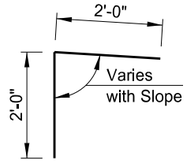
SKEWED SLOPE PROTECTION LAYOUT



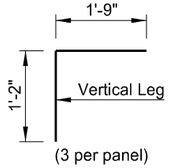
B-B



A-A

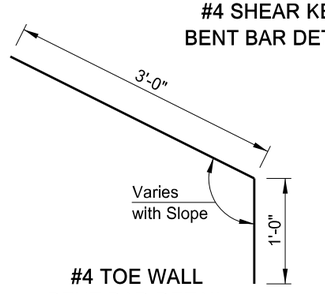


#4 SHEAR KEY BENT BAR DETAIL

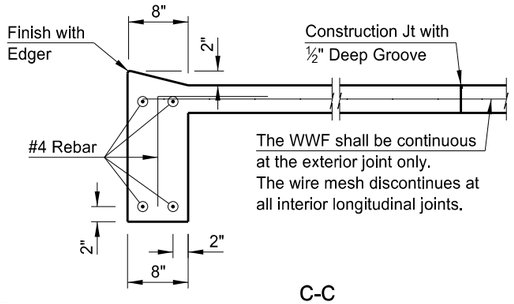


(3 per panel)

#4 SIDE WALL BENT BAR DETAIL



#4 TOE WALL BENT BAR DETAIL



C-C

NOTES:

The toe wall shall be placed before concrete is placed on the slope.

All inside panels shall be 5'-6" square. All outside panels shall be adjustable from 5'-0" minimum to 8'-0" maximum.

All transverse joints shall be ½" deep grooved joints sealed with concrete joint sealer. All longitudinal joints shall be construction joints with ½" deep grooves sealed with concrete joint sealer. All cracks that may have developed before the project has been accepted shall also be sealed with concrete joint sealer. An elastomeric joint sealant which meets ASTM C-920, Cl 25, can be used in lieu of the sealants allowed in 826.02 of the ND Standard Specifications.

Wherever parts of a structure, such as piers, etc. are contacted by the slope protection, preformed expansion joint filler shall be installed between the contact areas as shown.

Shear keys shall be placed in every panel on the slope, as shown.

The welded wire fabric (WWF) shall be supplied in sheets. When it is necessary to make the WWF continuous, a lap splice at least 8" long shall be used.

Several shorter bars may be substituted for the continuous Bar 2 x ⅜. If the substitution is made, the space from the end of the bar to the first hole shall not be more than 6 inches.

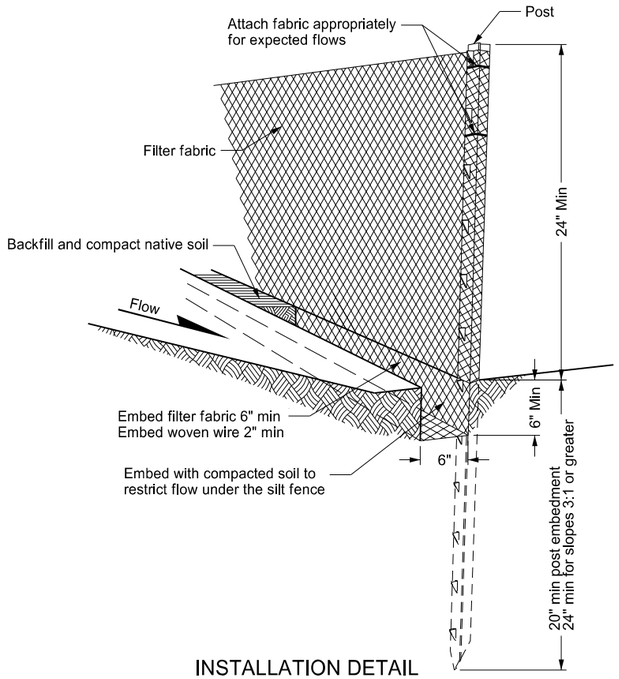
The bolts to hold the neoprene gland in place shall be installed into the abutment by a mechanical or chemically bonded method.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07/10/14	
REVISIONS	
DATE	CHANGE
07/10/14	CHANGED FROM D-708-1
09/03/19	UPDATED SIGNATURES

This document was originally issued and sealed by Jon Ketterling Registration Number PE-4684, on 09/03/19 and the original document is stored at the North Dakota Department of Transportation

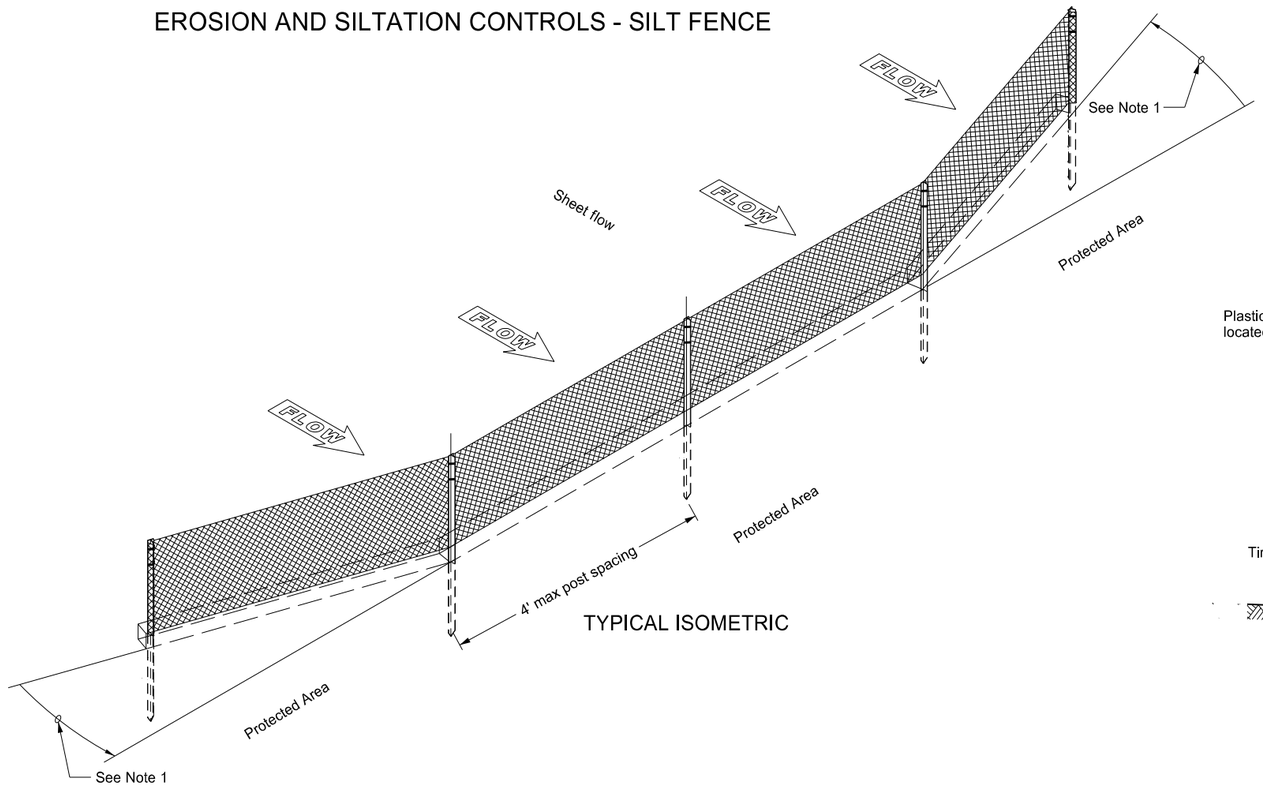
EROSION AND SILTATION CONTROLS - SILT FENCE

D-260-1

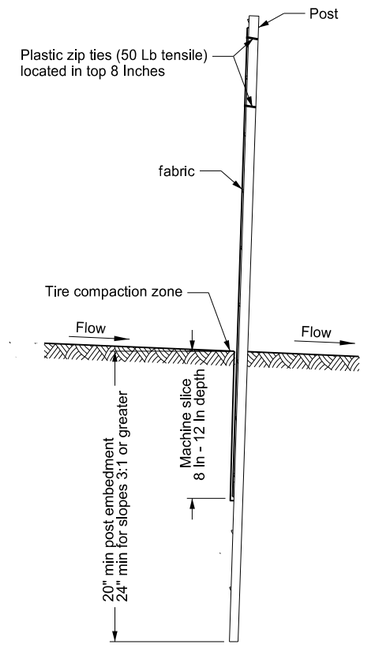


INSTALLATION DETAIL

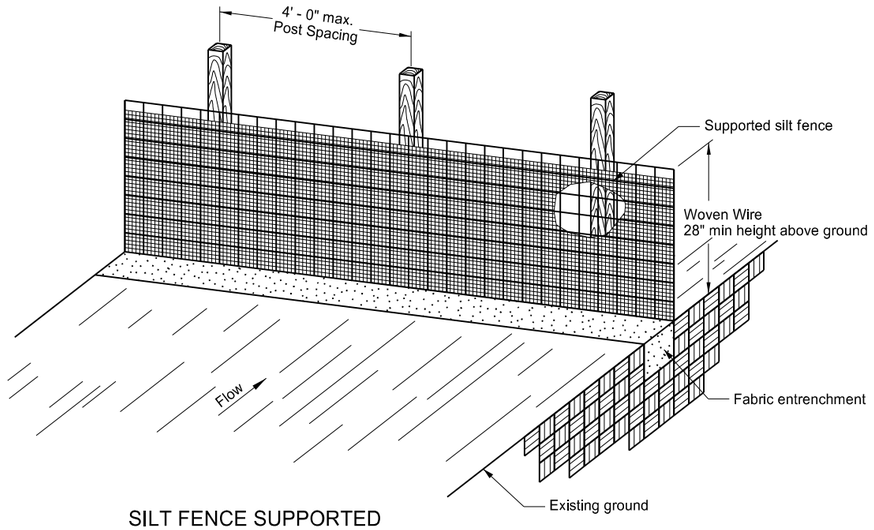
Minimize disturbance of ground around trench and smooth surface after excavation to avoid concentrating flows. Compact to prevent undercutting flows.



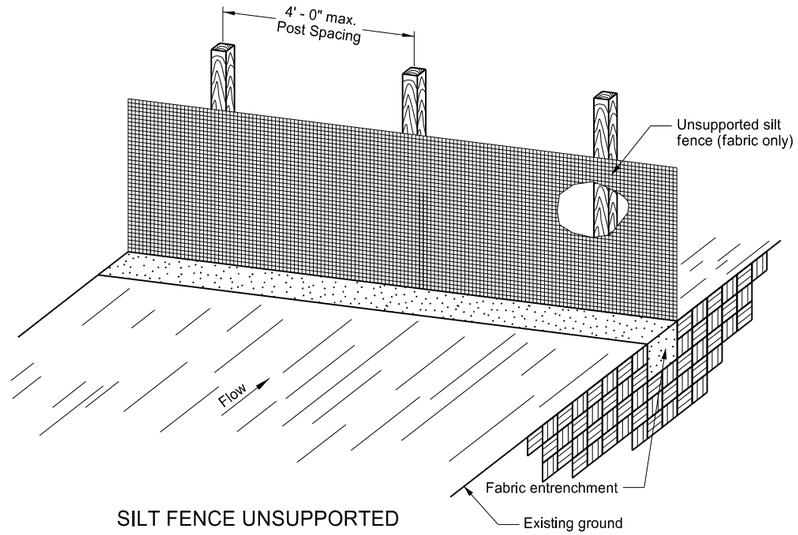
TYPICAL ISOMETRIC



MACHINE SLICED SILT FENCE



SILT FENCE SUPPORTED



SILT FENCE UNSUPPORTED

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. Install silt fencing parallel to contour lines.
4. Do not embed silt fence when placed in standing water.
5. Silt fence material does not need to reach the top of woven wire support.

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 08-27-19	Revised details & added new ones. New Design Engineer PE Stamp.

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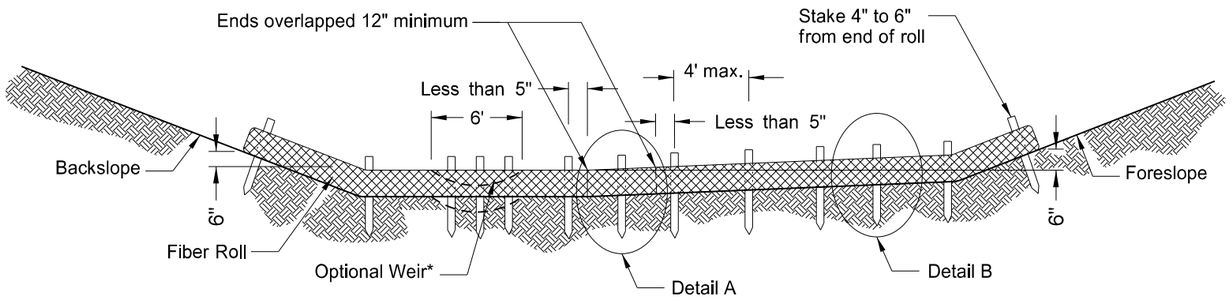
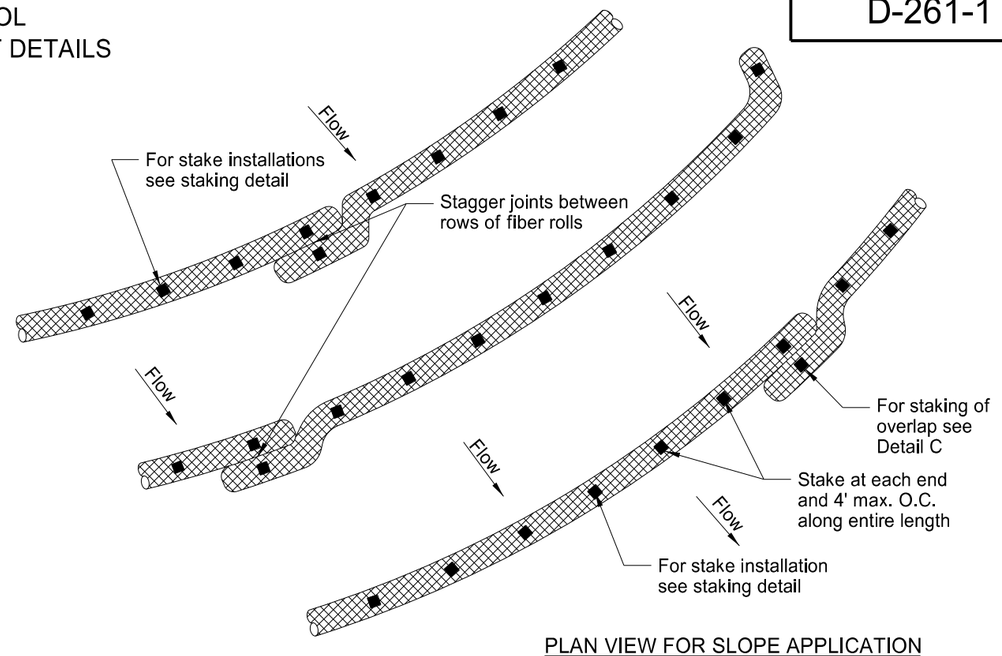
D-261-1

EROSION CONTROL
FIBER ROLL PLACEMENT DETAILS

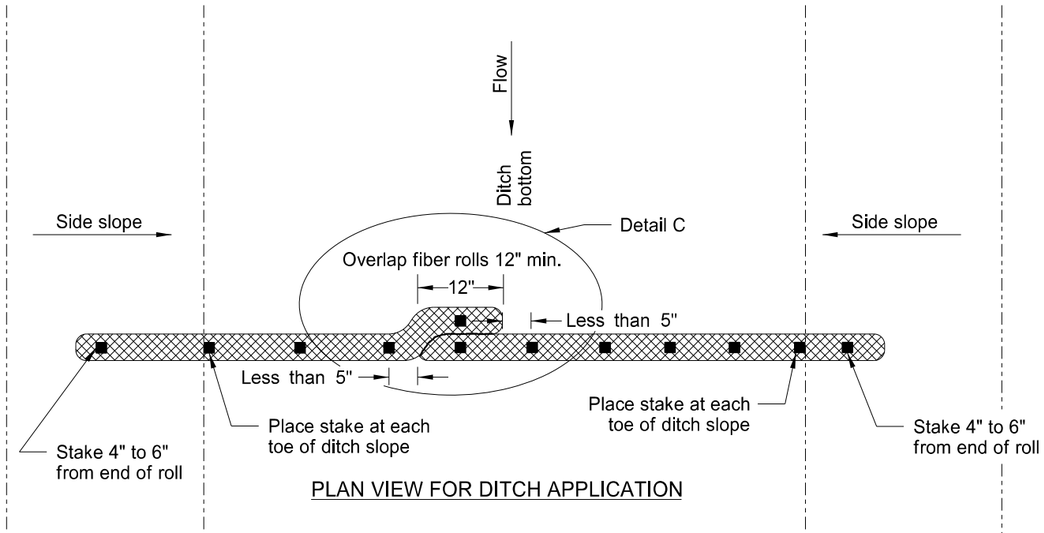


*Optional Weir. Use in flat areas, such as the Red River Valley, where there is potential for water to back up on adjacent property. Lower fiber roll enough to prevent water from backing up on adjacent property. Do not use 20-inch fiber rolls in flat areas where there is potential for water to back up on adjacent property.

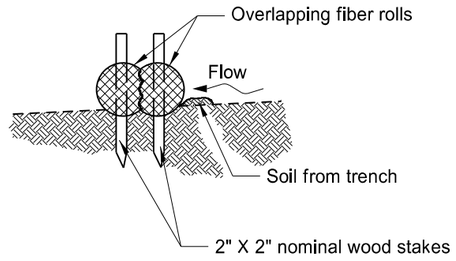
12 OR 20 INCH FIBER ROLL - DITCH BOTTOM



PLAN VIEW FOR SLOPE APPLICATION

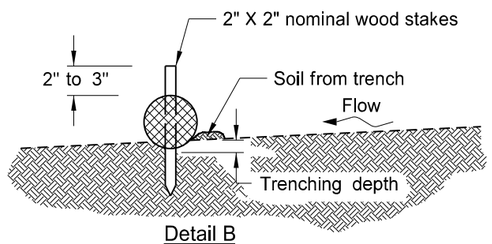


PLAN VIEW FOR DITCH APPLICATION



Detail A

Fiber Roll Overlapping Staking Detail



Detail B

Fiber Roll Staking Detail

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

NOTE: Runoff must not be allowed to run under or around roll.

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

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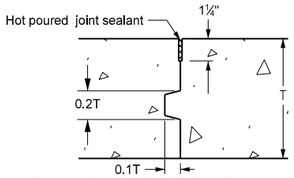
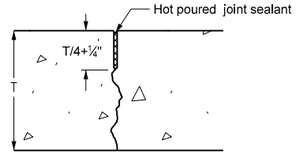
LONGITUDINAL JOINT DETAILS

D-550-2

UNTIED JOINTS

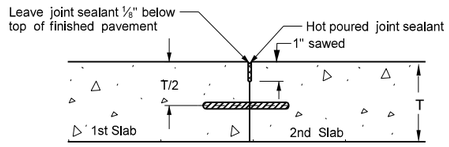


Sawed longitudinal joint with keyway



Sawed longitudinal joint without keyway

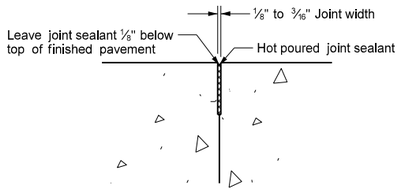
TIED JOINTS



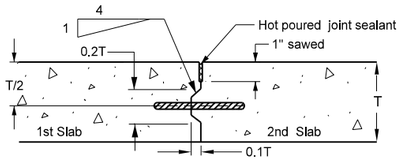
Longitudinal construction joint (tied butt joint)

Notes:

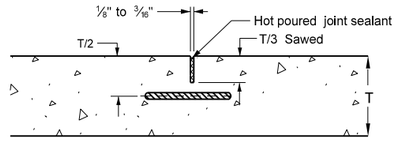
1. Provide hot poured joint sealant meeting the requirements of Section 826.02A.2 of the Standard Specifications.
2. Include all costs of the longitudinal joint and seal in the price bid for the PCC pavement.
3. Do not place tie bars within 18 inches of a transverse skewed joint.
4. Use Grade 40 steel for tie bars installed bent and later straightened.
5. Increase the 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.



Contraction joint



Longitudinal construction joint (tied keyed joint)



Sawed longitudinal joint

TIEBAR SPACINGS (In)

BAR SIZE / GRADE STEEL / BAR LENGTH / DIST TO FREE EDGE (FT) / JOINT TYPE / PVMT THICKNESS		# 3 BAR										# 4 BAR												# 5 BAR												# 6 BAR											
		GRADE 40				GRADE 60						GRADE 40					GRADE 60							GRADE 40						GRADE 60							GRADE 40						GRADE 60					
		24"				30"						24"					36"							30"						42"							36"						48"					
		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	22	24
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	48	43	39	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
	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
9½"	WARP	48	33	25		48	48	37	30	25		44	35	29	25		48	48	44	38	33	24		48	46	39	34	25		48	48	48	48	38	34	48	48	48	48	42	36	33	48	48	48	48	48	48	48
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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
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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
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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
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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					22	25				32	25						26						39	33	28	25			38	32	27	24				48	47	40	35	30	26	
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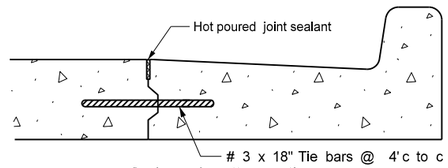
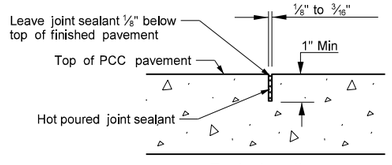


Curb and gutter sections

JOINT SEALER DETAILS



Typical section

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

9-15-2010

REVISIONS

DATE	CHANGE
10/23/2012	Expanded Tie Bar Table
03/16/2016	Updated Jt Details & notes
10/25/2019	Corrected "Typo" in Note 3

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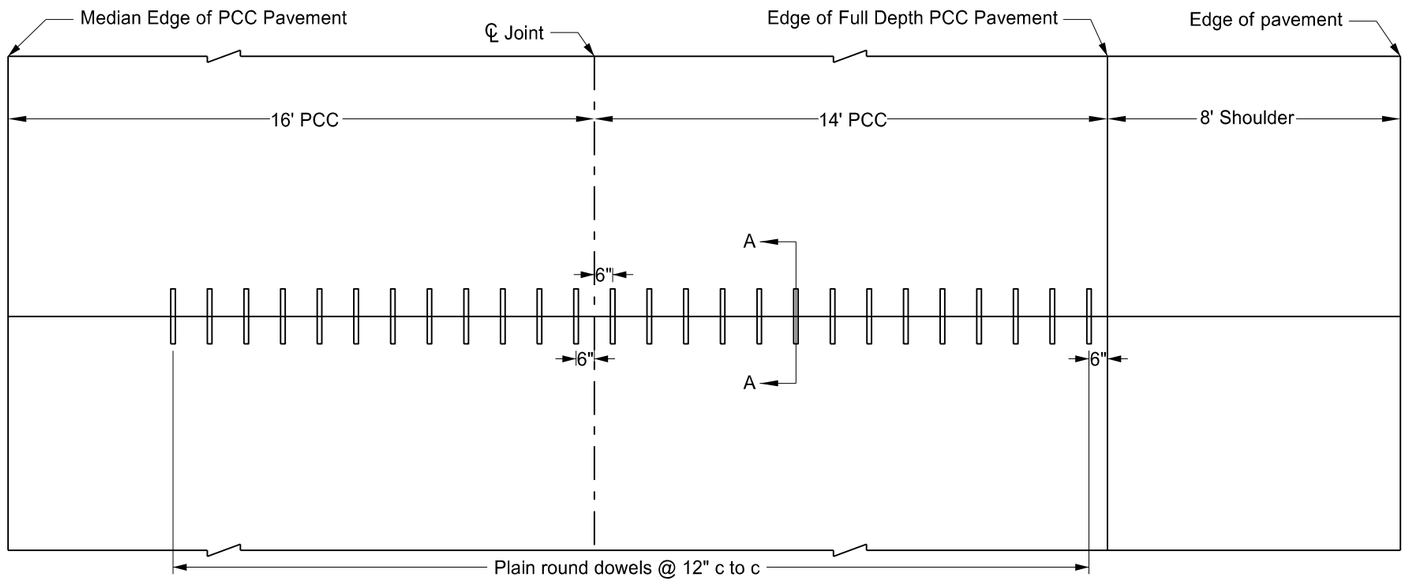
TRANSVERSE CONTRACTION JOINT DETAILS

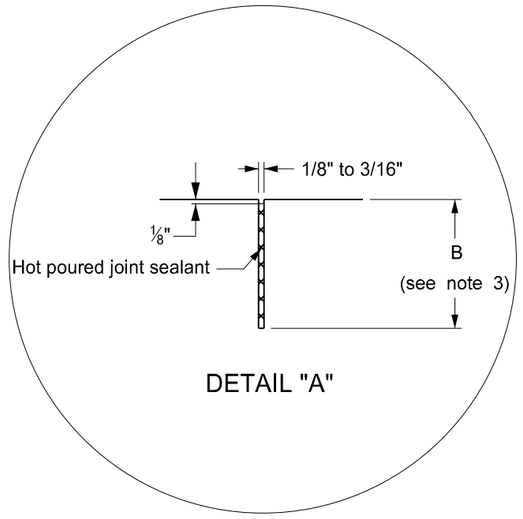
D-550-3



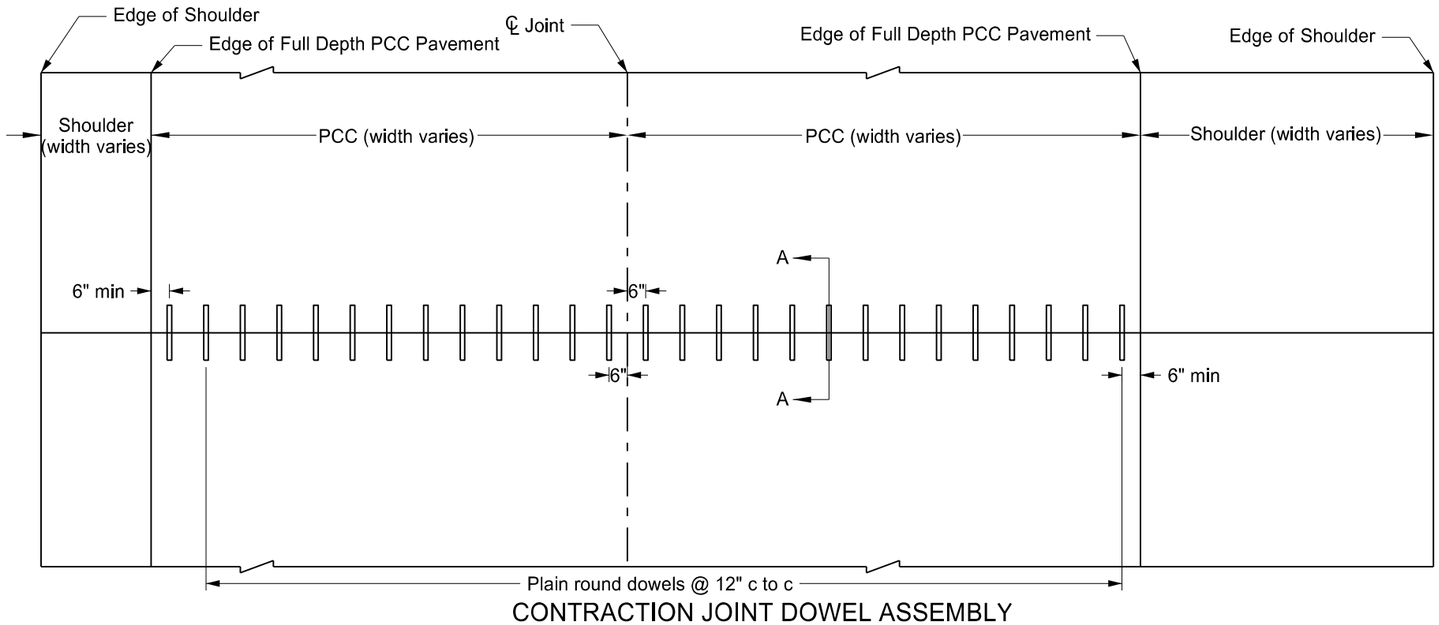
CONTRACTION JOINT DOWEL ASSEMBLY
INTERSTATE

Notes

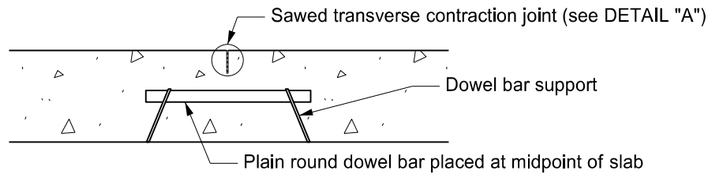
1. The joint seal details apply to both doweled and non-doweled (plain) transverse joints.
2. T = Thickness of pavement.
3. B = T/4 + ¼" for AE or YE for non-dowelled concrete pavement or
   B = T/3 for AAE or dowelled concrete pavement



DETAIL "A"



CONTRACTION JOINT DOWEL ASSEMBLY
NON-INTERSTATE



SECTION A-A

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

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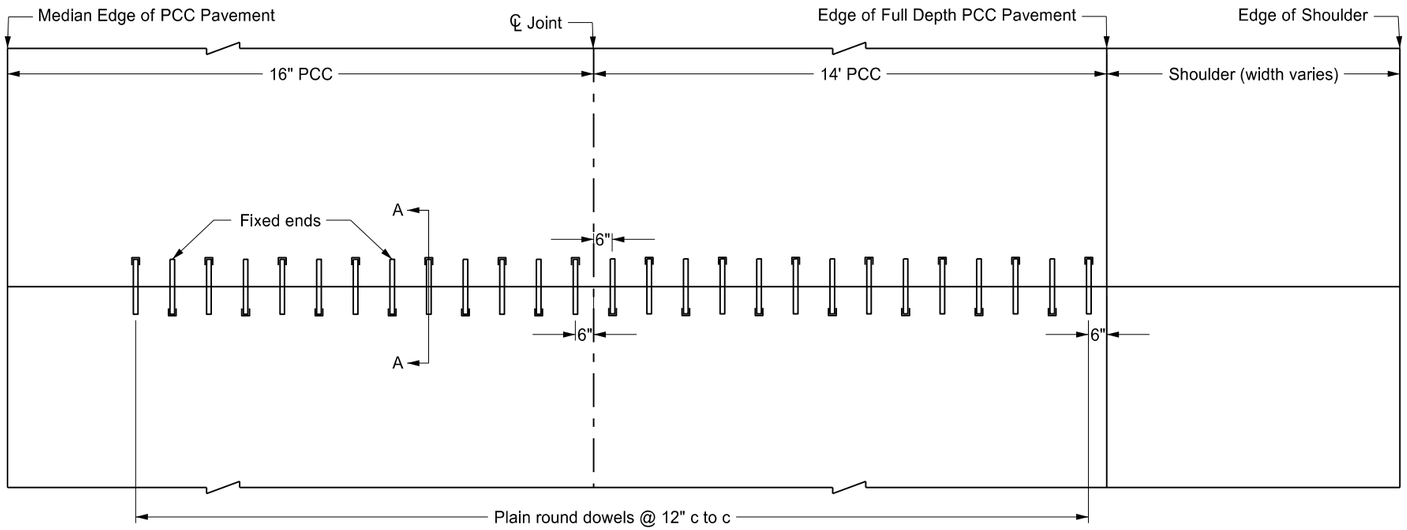
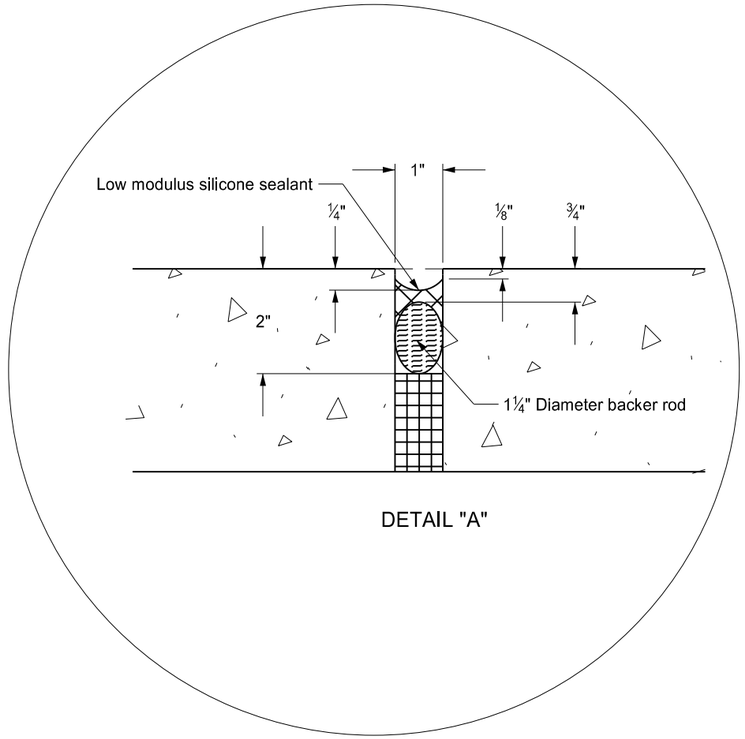
TRANSVERSE EXPANSION JOINT DETAIL

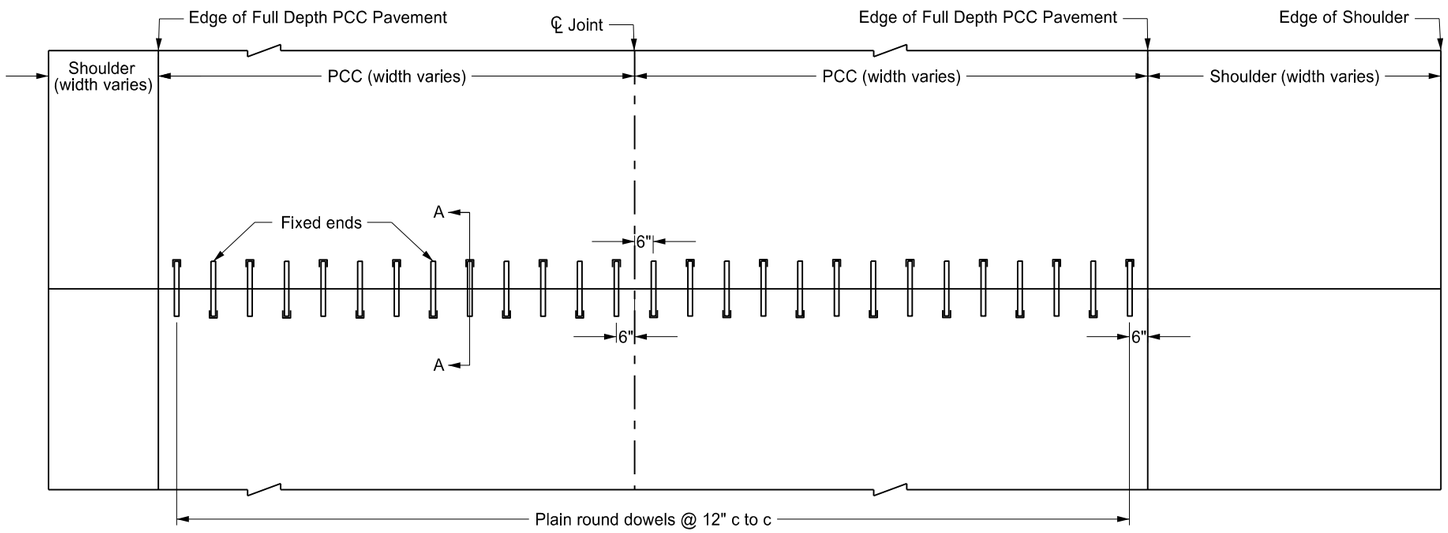
D-550-4



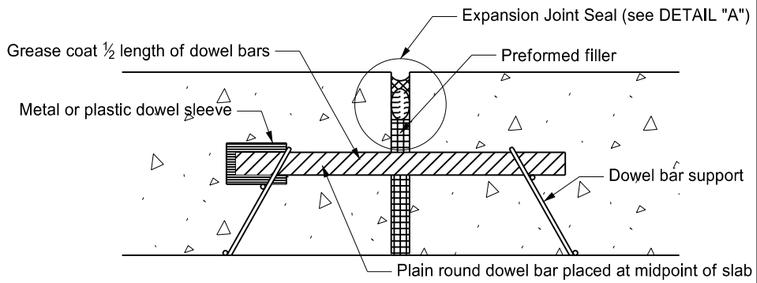
DOWELED EXPANSION JOINT ASSEMBLY
INTERSTATE



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 10/25/2019	Removed dowel bar sizes Expanded details for clarity

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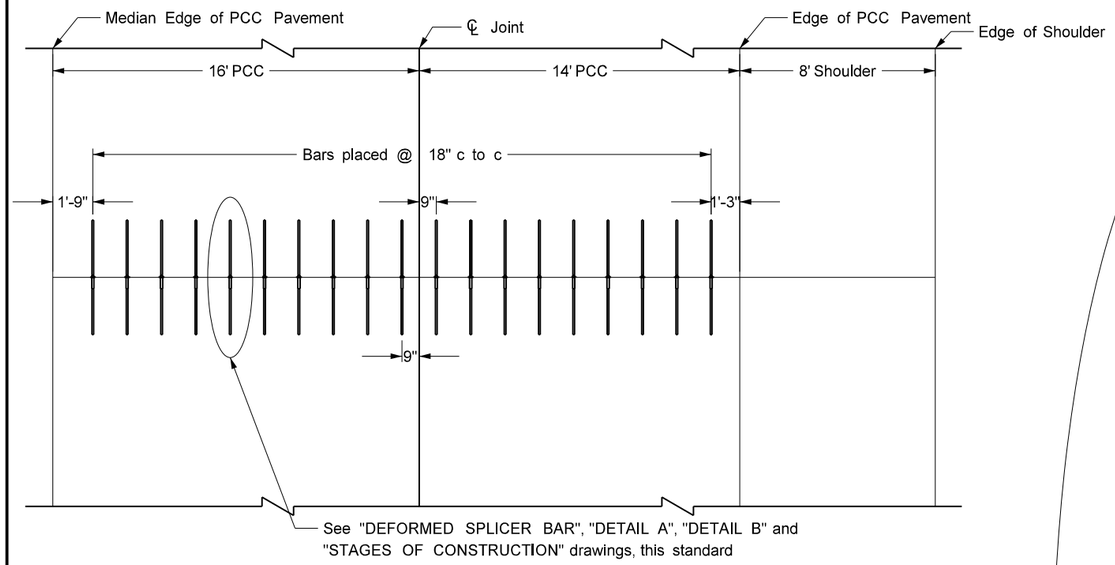
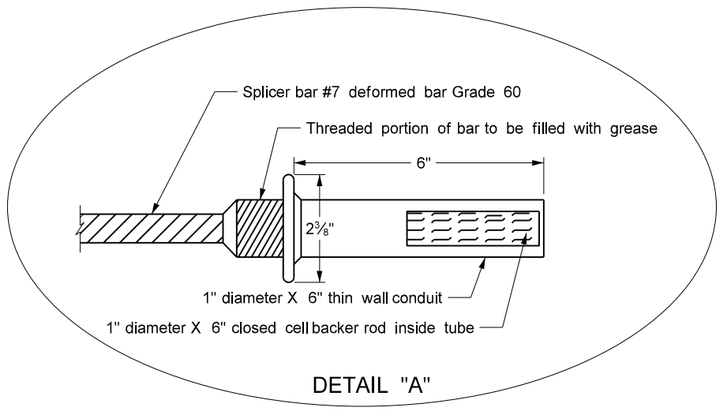
TRANSVERSE CONSTRUCTION JOINT

D-550-5



PLAN VIEW



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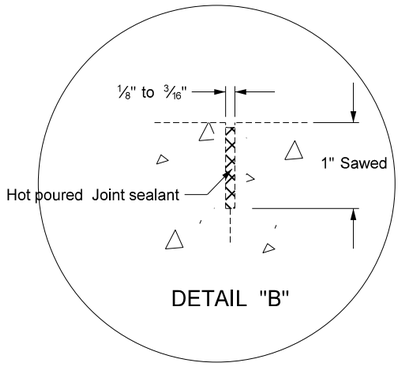
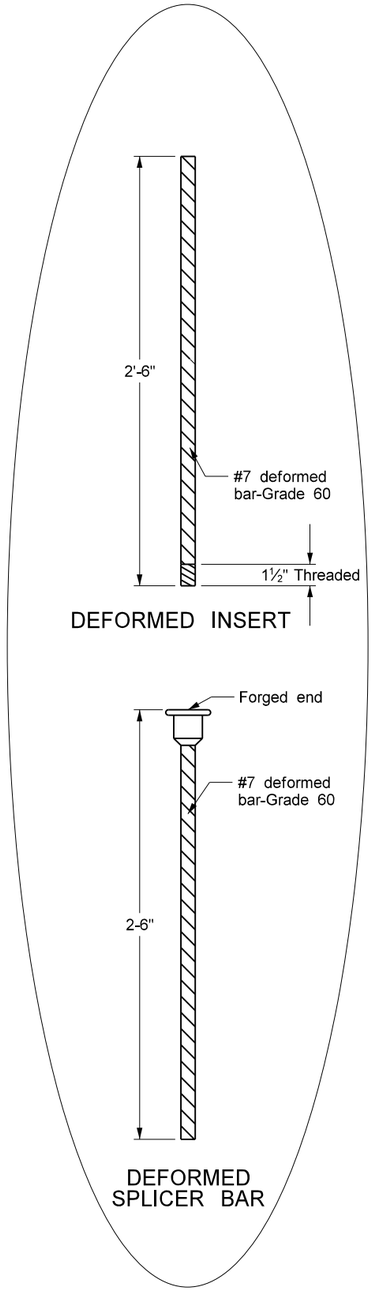


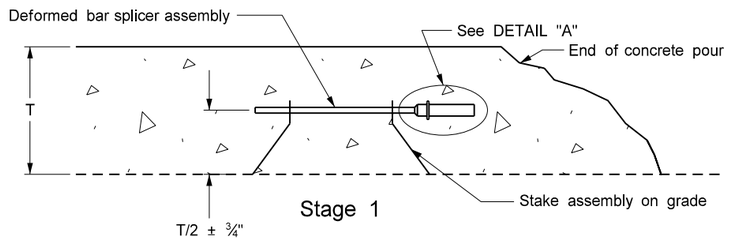
DETAIL "B"



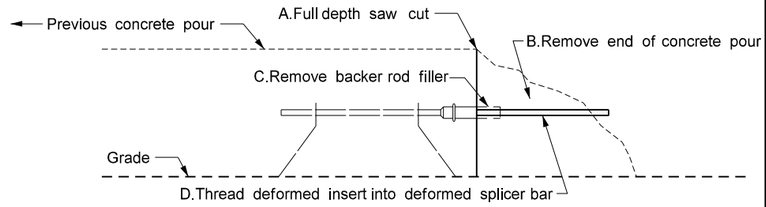
DEFORMED INSERT

DEFORMED SPLICER BAR

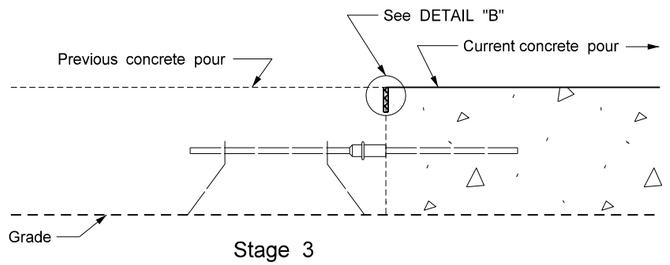
STAGES OF CONSTRUCTION



Stage 1



Stage 2



Stage 3

Notes

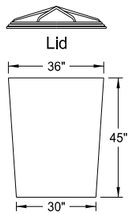
1. Saw and seal all construction joints.
2. Include all costs for transverse construction joints in the price bid for PCC pavement.
3. Do not saturate the subgrade during the sawing operation.

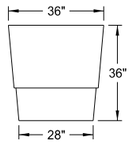
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-15-2010	
REVISIONS	
DATE	CHANGE
3-16-16 8-27-19	Revised Joint Details & notes. New Design Engr PE Stamp.

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

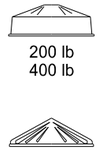
ATTENUATION DEVICE

D-704-1

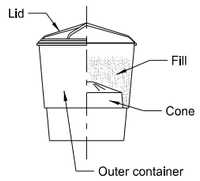




Outer Containers

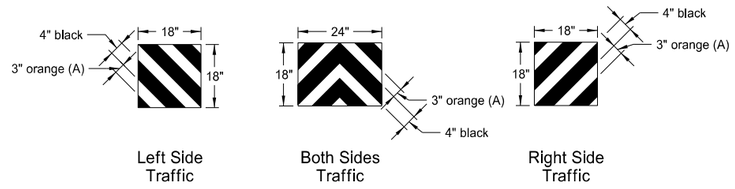


Cones



Typical Assembly

Typical Module
Construction Detail

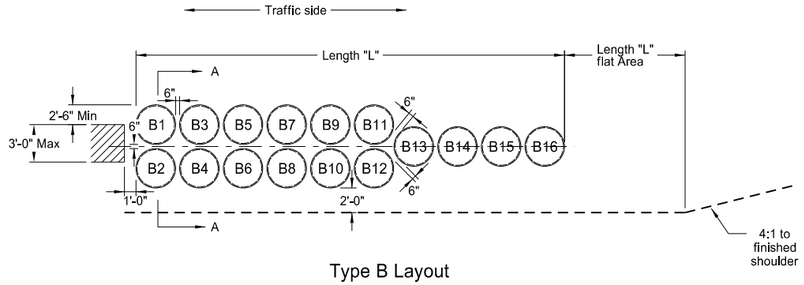


Left Side Traffic | Both Sides Traffic | Right Side Traffic

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.

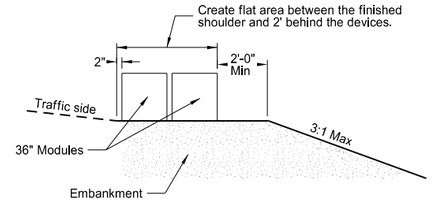
(A) Use 3" orange sheeting for temporary installations, and 3" yellow sheeting for permanent installations.



Type B Layout

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

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



Section A-A
(Type B Layout)

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

Notes:

1. Materials
   A) Use modules manufactured from frangible polyethylene material which shatters upon impact.
   B) 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.

2. Modules
   Provide modules in two sizes containing volumes of either 2, 4, 7, 14, or 21 cubic feet minimum.
   A) Provide three components for 2, 4, or 7 cubic foot module containers:
      1) A 14 C.F., yellow outer container.
      2) A black lid securely locking over the top lip of the container.
      3) 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.
   B) Provide two components for the 14 cubic foot module container:
      1) A 14 C.F., yellow outer container.
      2) A black lid securely locking over the top lip of the container.
   C) Provide two components for the 21 cubic foot module container:
      1) A 36" height X 36" width yellow outer container.
      2) A black lid which locks securely over the top of the container.

3. 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.

4. 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.

5. 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.

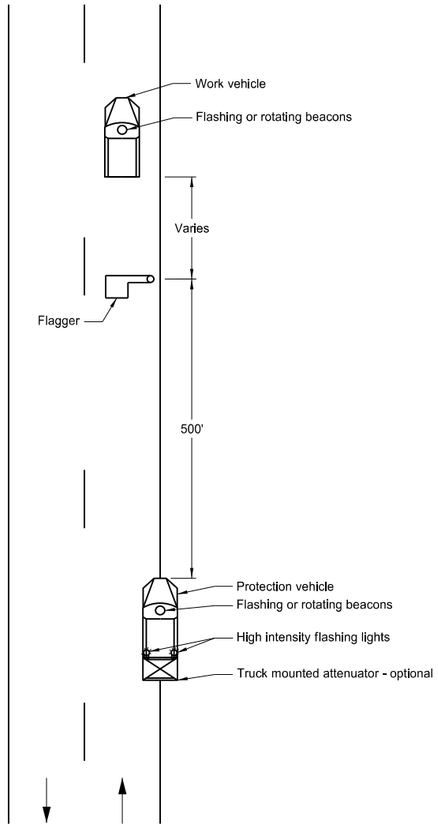
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
7-18-14	Revised sheeting in reflective sheet detail
9-27-17	Update to active voice
10-03-19	New Design Engr PE Stamp

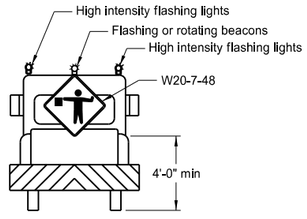
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

TRAFFIC CONTROL FOR CORING OF HOT BITUMINOUS PAVEMENT

D-704-2

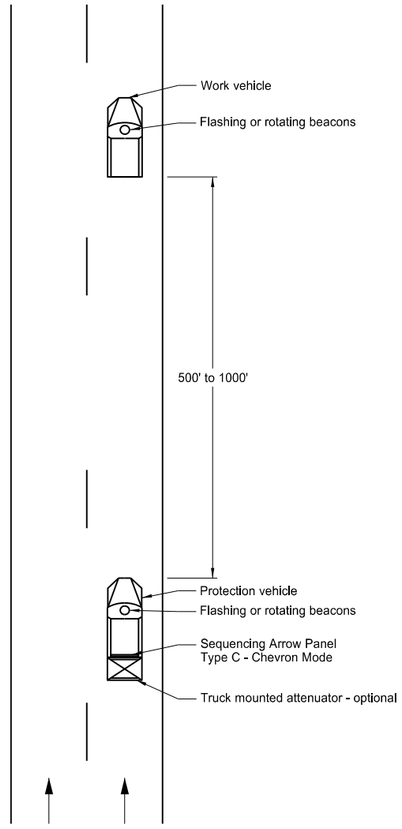
Two Lane, Two Way Roadways

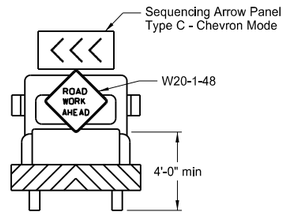




Typical Protection Vehicle

Multilane Roadways





Typical Protection Vehicle

Notes:

1. Display a 360 degree rotating, flashing, oscillating or strobe light on the working vehicle.

2. Display a 360 degree rotating, flashing, oscillating or strobe light on the shadow vehicle. Operate a sequencing arrow panel Type C in chevron mode on the shadow vehicle for Multilane Roadway.

3. Use these layouts during daylight hours and in areas of good visibility only.

4. Use flagger to protect the work area and warn oncoming traffic for two lane, two way roadway.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
10-03-19	New Design Engr PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

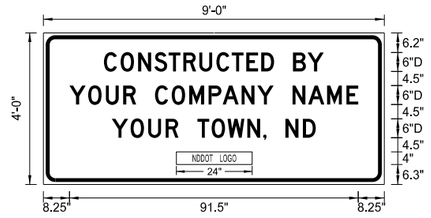
CONSTRUCTION SIGN DETAIL

D-704-5

SIGN NUMBER	G20-10-108
WIDTH x HEIGHT	9'-0" x 4'-0"
BORDER WIDTH	1.25" (inset 0.75")
CORNER RADIUS	3"
MOUNTING	Ground
BACKGROUND	TYPE: IV Reflective
	COLOR: Fluorescent Orange
LEGEND/BORDER	TYPE: Non-Refl
	COLOR: Black

SYMBOL	X	Y	WID	HT	ANGLE
	42.1	6.2	24	4	0

STATION(S): AREA: 36.0 Sq.Ft.



Dimensions are in inches.tenths

Letter locations are panel edge to lower left corner

LETTER POSITION (X)																			LENGTH	SIZE	SERIES
C	O	N	S	T	R	U	C	T	E	D		B	Y						69.7	6	D 2000
19.2	24.5	30	35.1	39.7	44.3	49.4	54.8	59.7	64.3	69	73.1	79.1	83.7								
Y	O	U	R		C	O	M	P	A	N	Y		N	A	M	E			91.5	6	D 2000
8.3	14.2	19.8	25.3	29.4	35.4	40.7	46.2	52.4	56.8	62.8	67.8	72.9	78.9	83.9	89.9	96					
Y	O	U	R		T	O	W	N	,		N	D							64.6	6	D 2000
21.7	27.6	33.2	38.7	42.8	48.8	53.3	58.4	64.6	69.6	70.7	76.7	82.2									

Notes:

1. Post mount sign a distance of ½A following the End Road Work (G20-2-48) sign (maximum 2 signs per project.)

2. Use sign on rural projects with a 30 day or longer duration (not required on seal coats or other short duration projects.)

3. Do not place sign in urban areas or within city limits.

Advance Warning Sign Spacing (A)			
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

8-22-12

REVISIONS

DATE	CHANGE
7-18-14	Revise sheeting to type IV.
9-27-17	Updated to active voice.
8-30-18	Updated sign number in note 1.
10-03-19	New Design Engineer PE Stamp.

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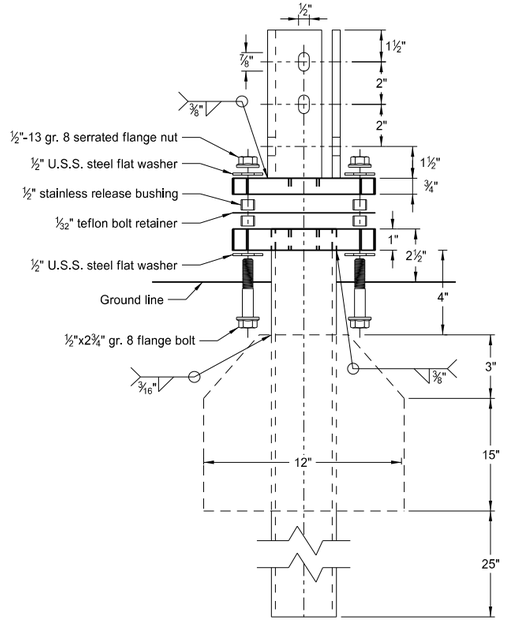
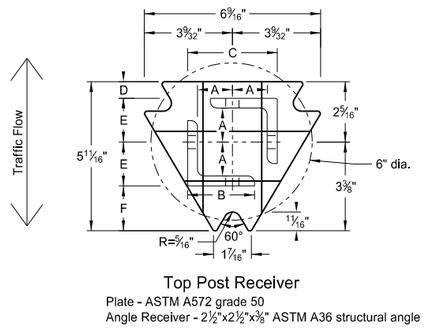
BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-7

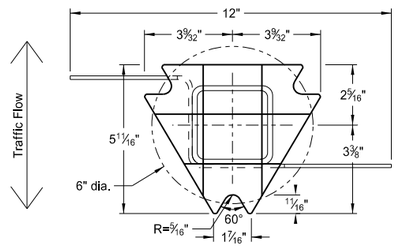


Multi-Directional
Slip Base Assembly

Perforated Tube



Top Post Receiver
Plate - ASTM A572 grade 50
Angle Receiver - 2½"x2½"x⅜" ASTM A36 structural angle



Bottom Soil Stub
Tube - 3"x3"x7 gauge ASTM A500 grade B tube
Stabilizing Wing - 7 gauge H.R.P.O. ASTM A1011
Plate - ASTM A572 grade 50

Notes:

1. Torque slip base bolts as specified by manufacturer.
2. Use anchor with 43.9 KSI yield strength and 59.3 KSI tensile strength.
3. Provide 4" vertical clearance for anchor or breakaway base. Measure the 4"x60" measurement above and below post location and back and ahead of post.
4. In concrete sidewalk, use same anchor without wings.
5. Provide more than 7' between the first and fourth posts of a four post sign.

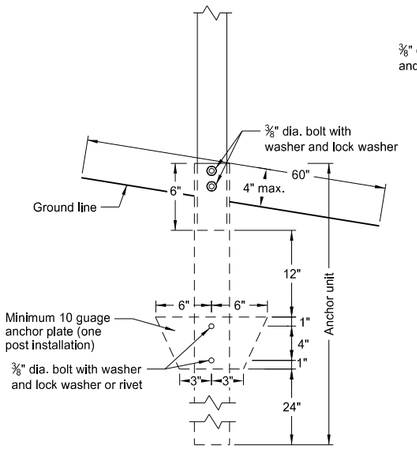
Telescoping Perforated Tube						
Number of Posts	Post Size in.	Wall Thick-ness Gauge	Sleeve Size in.	Wall Thick-ness Gauge	Slip Base	Anchor Size without Slip Base in.
1	2	12			No	2¼
1	2¼	12			No	2½
1	2½	12			(A)	3
1	2½	10			Yes	
1	2¼	12	2	12	Yes	
1	2½	12	2¼	12	Yes	
2	2	12			No	2¼
2	2¼	12			No	2½
2	2½	12			Yes	
2	2½	12			Yes	
2	2¼	10	2	12	Yes	
2	2½	12	2¼	12	Yes	
3 & 4	2½	12			Yes	
3 & 4	2½	10			Yes	
3 & 4	2½	12	2¼	12	Yes	
3 & 4	2¼	12	2	12	Yes	
3 & 4	2½	10	2³⁄₁₆	10	Yes	

Properties of Telescoping Perforated Tube						
Tube Size in.	Wall Thickness in.	U.S. Standard Gauge	Weight per Foot lbs.	Moment of Inertia $in.^4$	Cross Sec. Area $in.^2$	Section Modulus $in.^3$
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
2³⁄₁₆ x 2³⁄₁₆	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	0.785

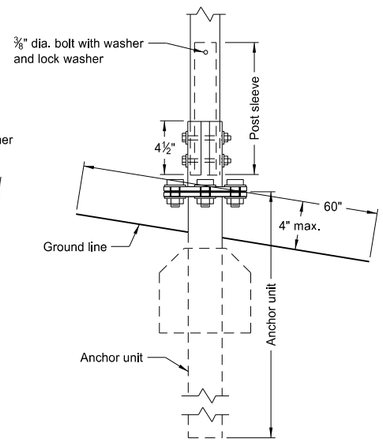
Top Post Receiver Data Table						
Square Post Sizes (B)	A	B	C	D	E	F
2³⁄₁₆"x10 ga.	1⁹⁄₆₄"	2½"	3¹⁄₃₂"	25⁄₃₂"	1³³⁄₆₄"	1⅞"
2½"x10 ga.	1⁹⁄₃₂"	2½"	3⁵⁄₁₆"	⅝"	1²¹⁄₃₂"	1¾"

(A) Use breakaway base when support is placed in weak soils. Engineer determines if soils are weak.

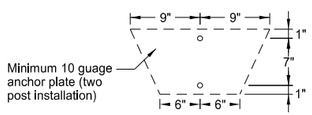
(B) For additional wind load, insert the 2³⁄₁₆"x10 ga. into 2½"x10 ga.

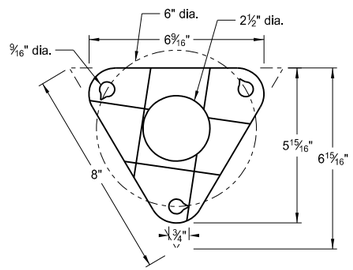


Anchor Unit and Post Assembly



Multi-Directional
Slip Base Anchor Unit
and Post Sleeve Assembly





Bolt Retainer for Base Connection
Bolt Retainer- 1⁄32" Reprocessed Teflon

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

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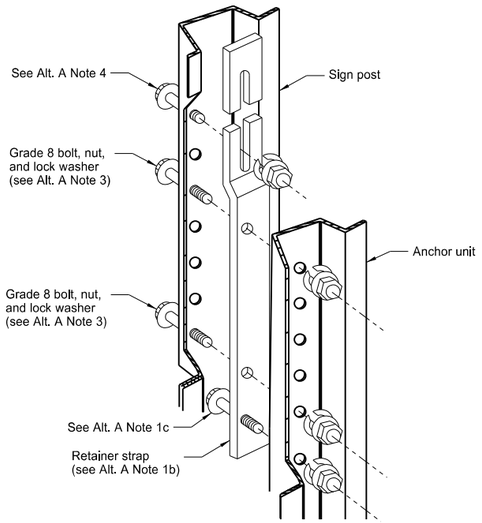
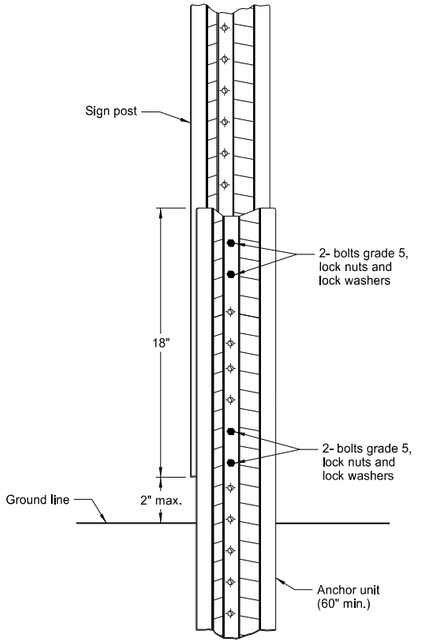
BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-8

U-Channel Post

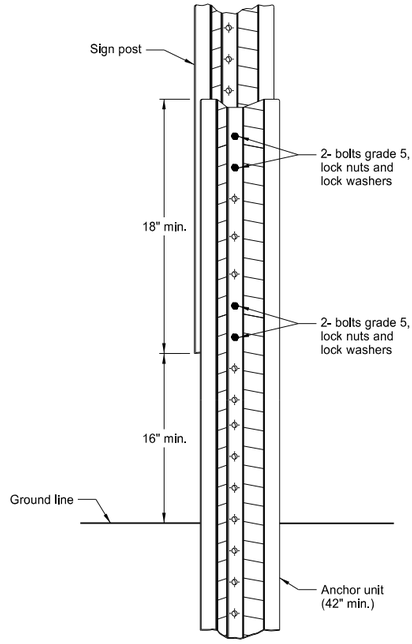


Detail A



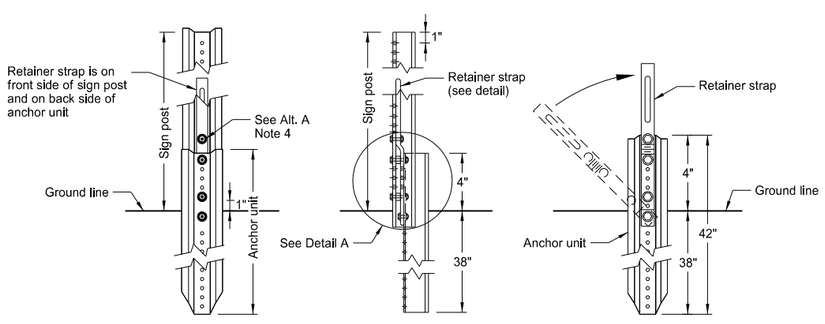
Breakaway U-Channel Splice Detail
Alternate B
(2.5 and 3 lb/ft)

Install a maximum of 3 posts within 7'.



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

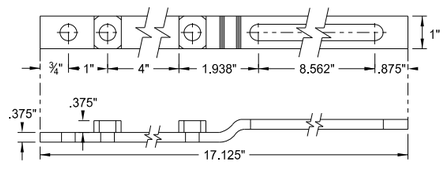
Install a maximum of 3 posts within 7'.



Front View Side View Back View

Breakaway U-Channel Detail
Alternate A

Install a maximum of 2 posts within 7'.



Retainer Strap Detail

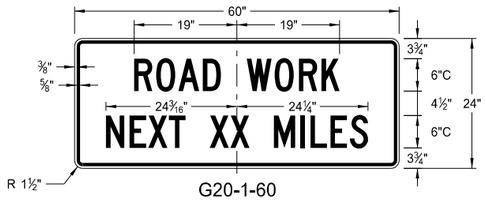
Alternate A Steps of Installation:

1. 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.
2. a) Drive anchor unit to 4" above ground.
   b) Rotate strap to vertical position.
3. 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.
4. Complete assembly by tightening 5/16"x2" bolt (this fastens sign post to retainer strap).
5. 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.

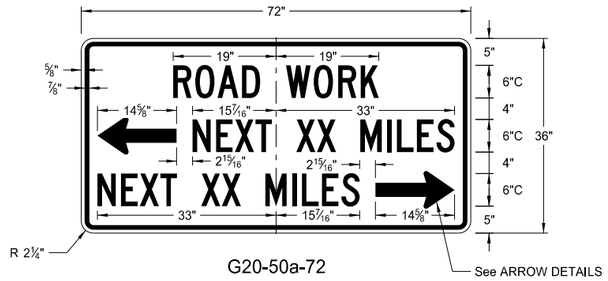
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
10-03-19	New Design Engr PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

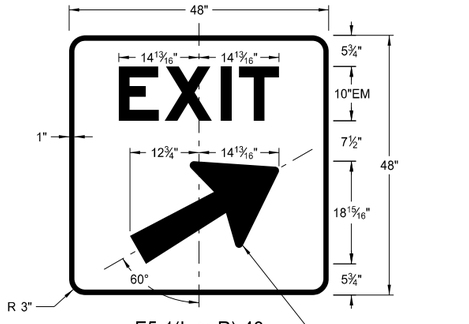
CONSTRUCTION SIGN DETAILS
TERMINAL AND GUIDE SIGNS



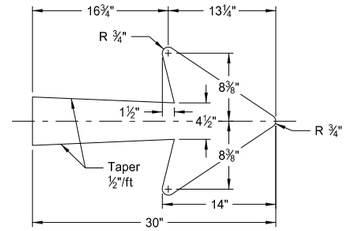
G20-1-60
Legend: black (non-refl)
Background: orange



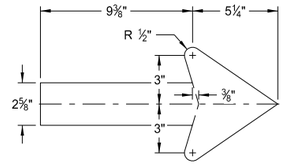
G20-50a-72
Legend: black (non-refl)
Background: orange



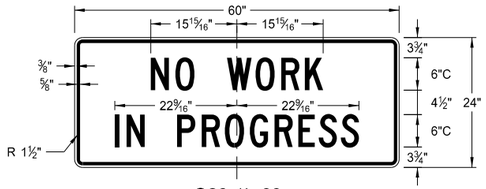
E5-1(L or R)-48
Legend: white
Background: green (orange optional)



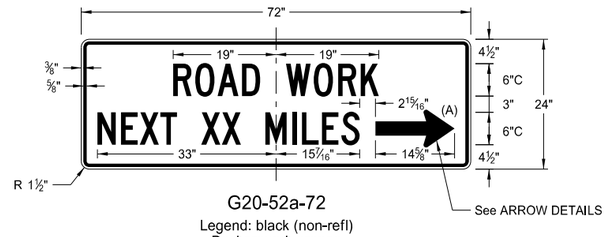
E5-1-48



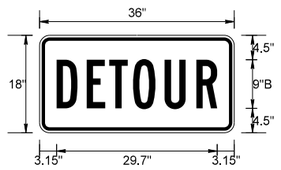
G20-50a-72
G20-52a-72



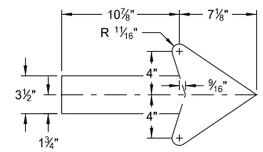
G20-1b-60
Legend: black (non-refl)
Background: orange



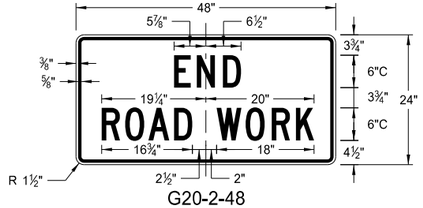
G20-52a-72
Legend: black (non-refl)
Background: orange



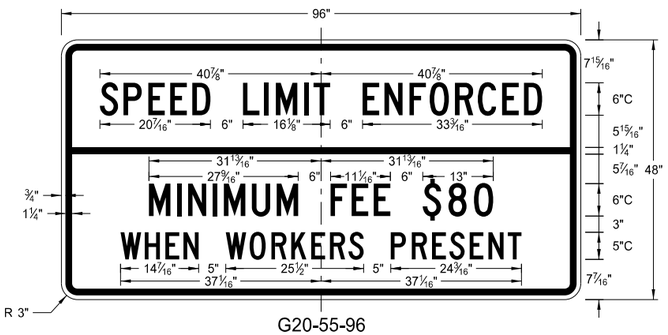
M4-8-36
Legend: black (non-refl)
Background: orange



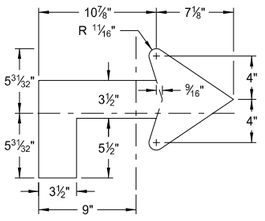
M4-9(L or R)-30
Right or Left



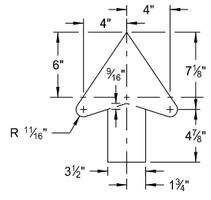
G20-2-48
Legend: black (non-refl)
Background: orange



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

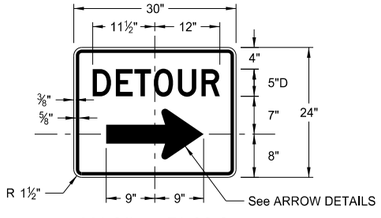


M4-9(L or R)-30
Advanced Right or Left



M4-9-30
Straight

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



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

ARROW DETAILS

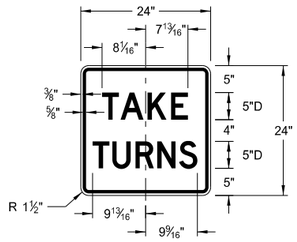
NOTES:

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

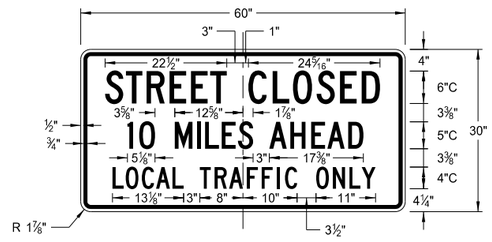
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17 10-03-19	Added sign & background color New Design Engineer PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

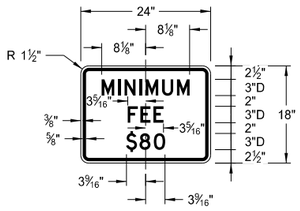
CONSTRUCTION SIGN DETAILS
REGULATORY SIGNS



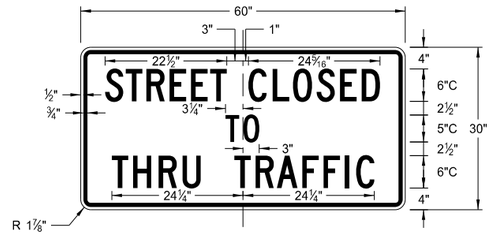
R1-50P-24
Legend: black (non-refl)
Background: white



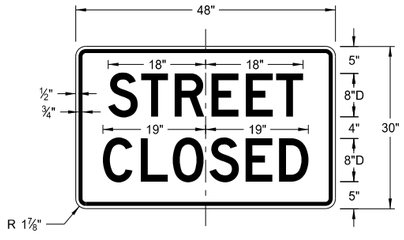
R11-3c-60
Legend: black (non-refl)
Background: white



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



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

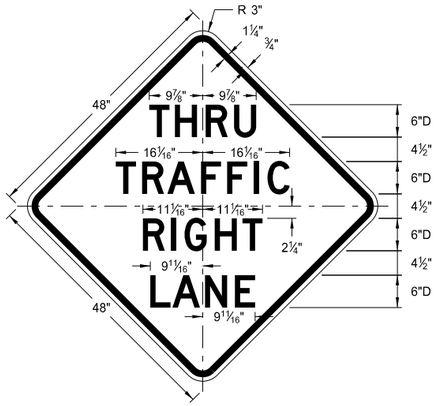


R11-2a-48
Legend: black (non-refl)
Background: white

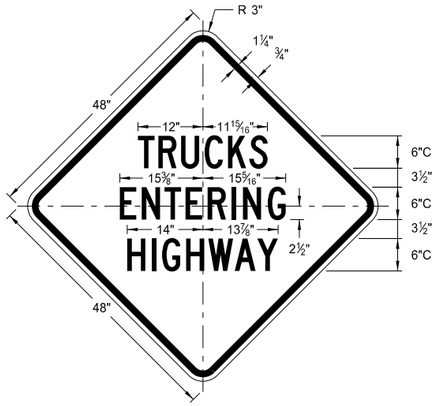
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17	Revised sign number
10-03-19	New Design Engineer PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

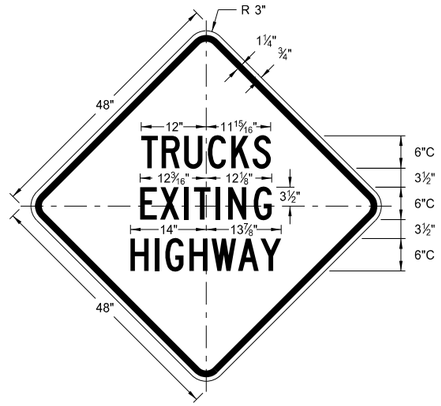
CONSTRUCTION SIGN DETAILS
WARNING SIGNS



W5-8-48
Legend: black (non-refl)
Background: orange



W8-53-48
Legend: black (non-refl)
Background: orange



W8-56-48
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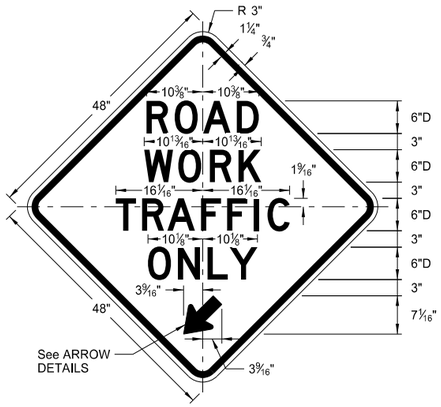
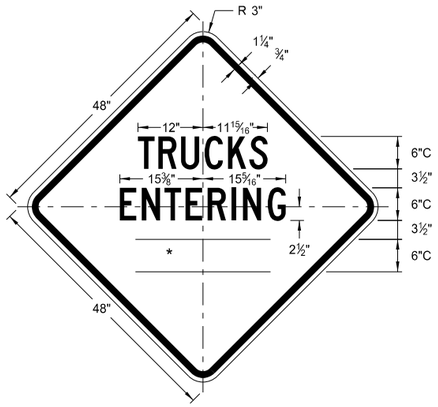
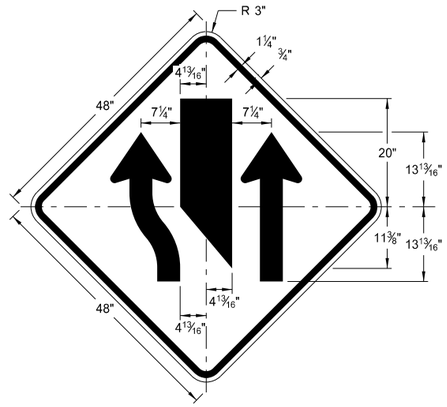
Background: orange



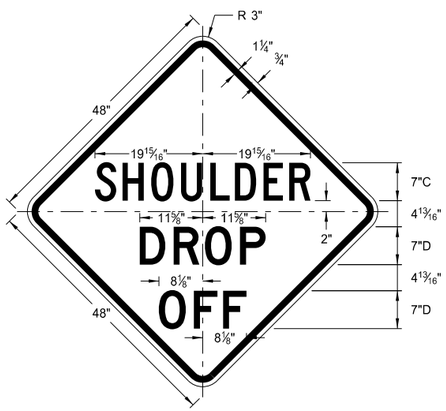
W5-9-48
Legend: black (non-refl)
Background: orange



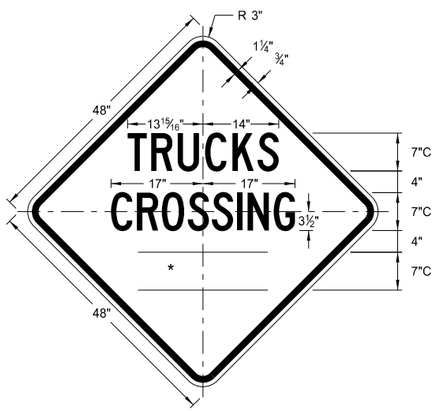
W8-54-48
Legend: black (non-refl)
Background: orange



W9-3a-48
Legend: black (non-refl)
Background: orange



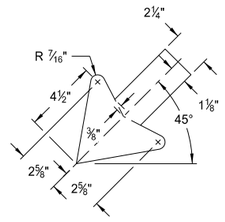
W8-9a-48
Legend: black (non-refl)
Background: orange



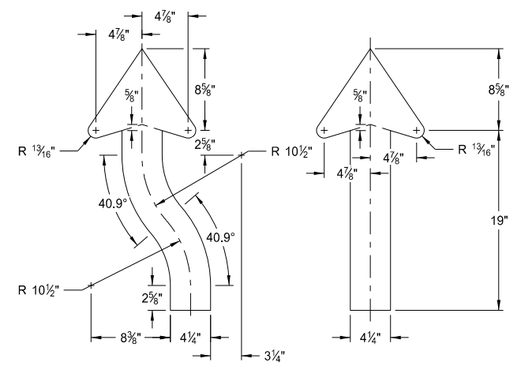
W8-55-48
Legend: black (non-refl)
Background: orange

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



W5-9-48



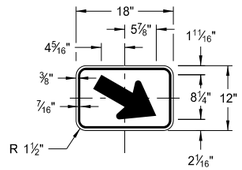
W9-3a-48

ARROW DETAILS

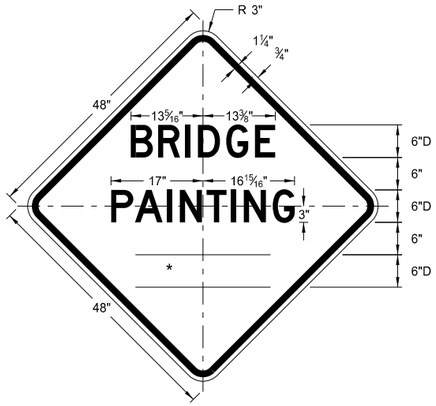
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-13-13	
REVISIONS	
DATE	CHANGE
8-17-17 5-31-18 10-03-19	Updated sign number Revised sign and arrow details New Design Engineer PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/03/19 and the original document is stored at the North Dakota Department of Transportation

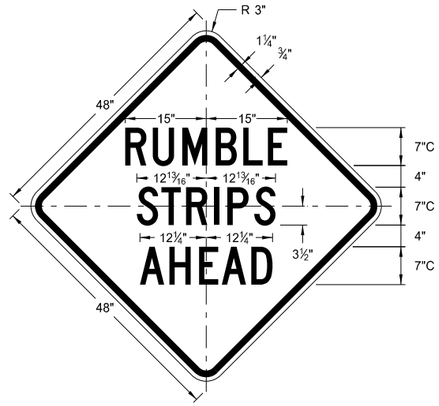
CONSTRUCTION SIGN DETAILS
WARNING SIGNS



W16-7aP-18
Legend: black (non-refl)
Background: orange



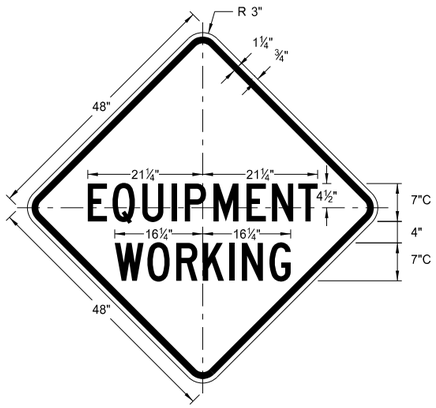
W21-50-48
Legend: black (non-refl)
Background: orange



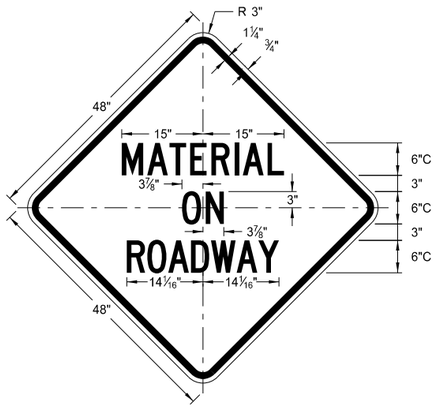
W21-53-48
Legend: black (non-refl)
Background: orange

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

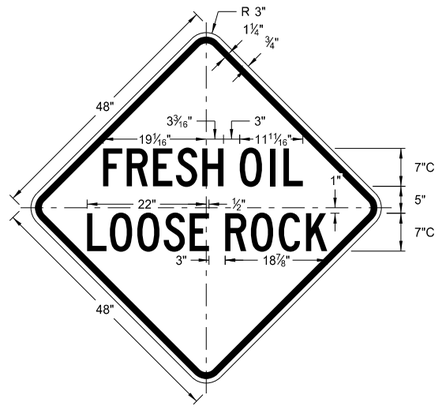
* DISTANCE MESSAGES



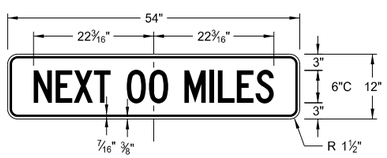
W20-51-48
Legend: black (non-refl)
Background: orange



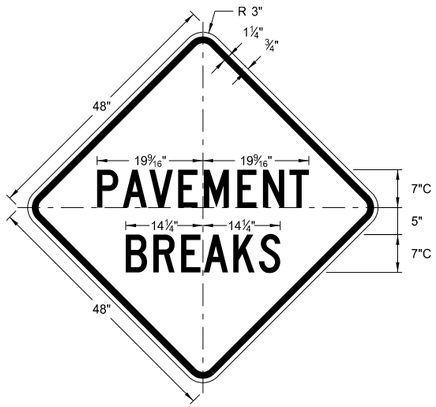
W21-51-48
Legend: black (non-refl)
Background: orange



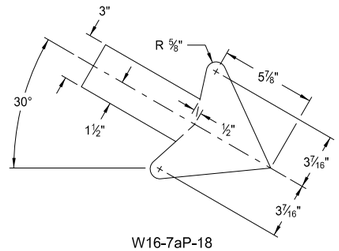
W22-8-48
Legend: black (non-refl)
Background: orange



W20-52P-54
Legend: black (non-refl)
Background: orange



W21-52-48
Legend: black (non-refl)
Background: orange



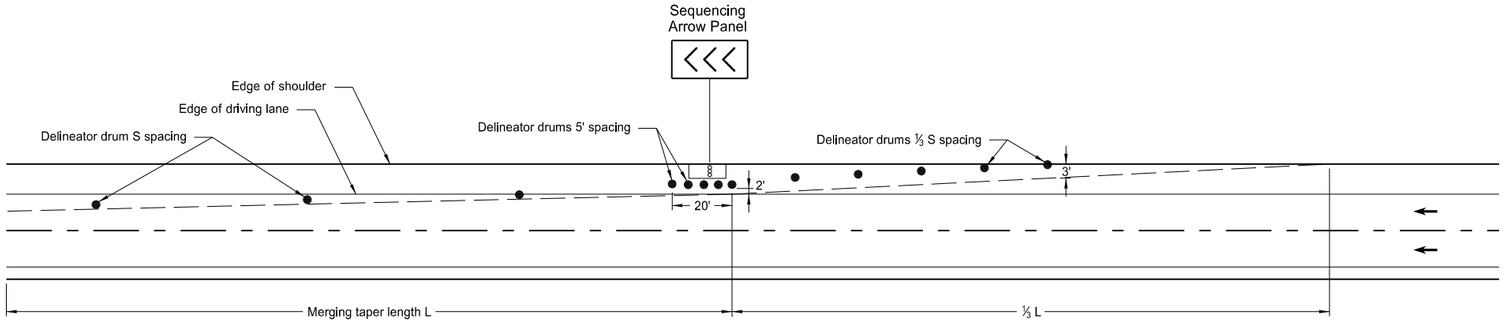
W16-7aP-18

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
5-31-18	
REVISIONS	
DATE	CHANGE
11-01-19	Added details for sign W16-7aP-18.

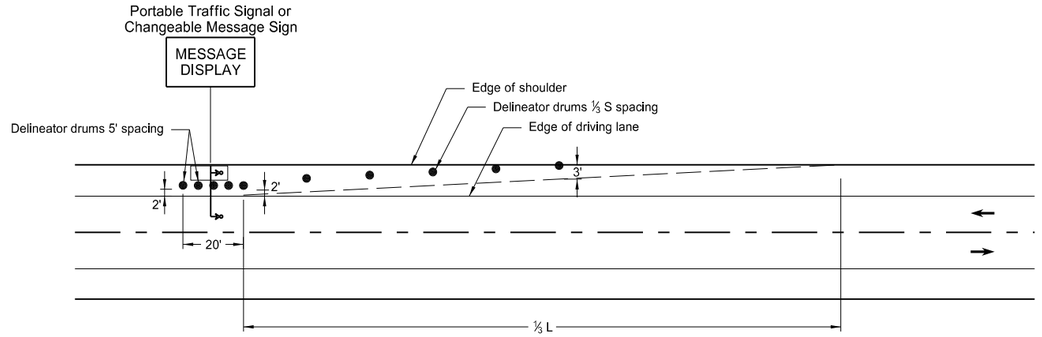
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

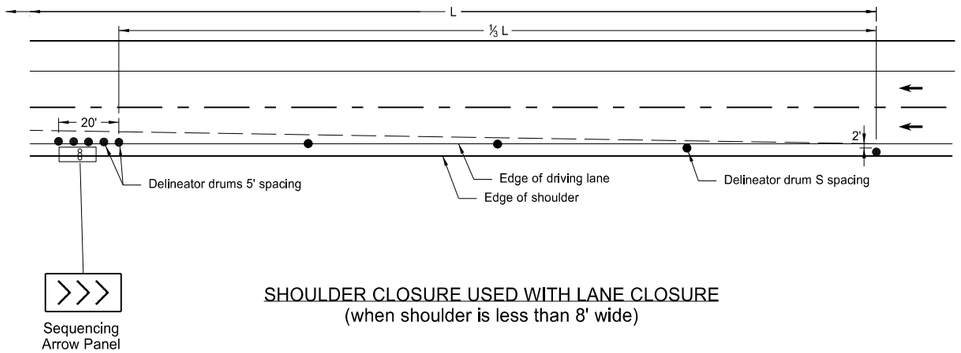
SHOULDER CLOSURE TAPERS

D-704-12



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





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

PORTABLE TRAFFIC SIGNAL OR CHANGEABLE MESSAGE SIGN ON SHOULDER

KEY

● Delineator Drum	∞ Sequencing Arrow Panel
° Message Display	Portable Traffic Signal

Notes:

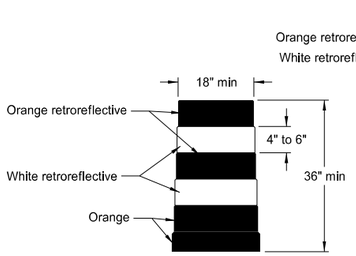
1. S = Posted Speed Limit in mph
   W = Width of offset in feet
   L = Taper length in feet
   L = $WS^2/60$ (40mph or less)
   L = WS (45mph or more)
2. If a shoulder taper is used, use a length of approximately ⅓L. If a shoulder is used as a travel lane, use a normal merging or shifting taper.
3. When 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

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/25/19 and the original document is stored at the North Dakota Department of Transportation

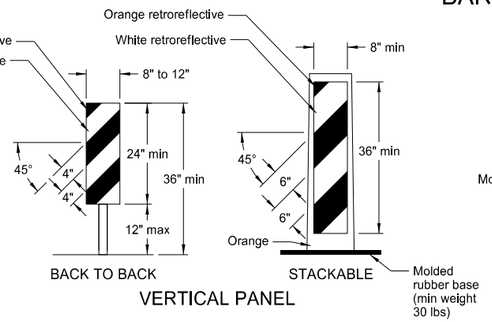
BARRICADE AND CHANNELIZING DEVICE DETAILS

D-704-13



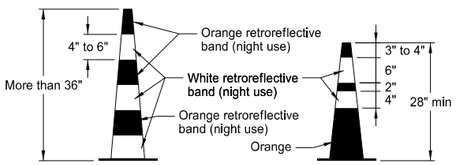
DELINEATOR DRUM

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.



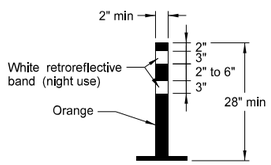
VERTICAL PANEL

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.



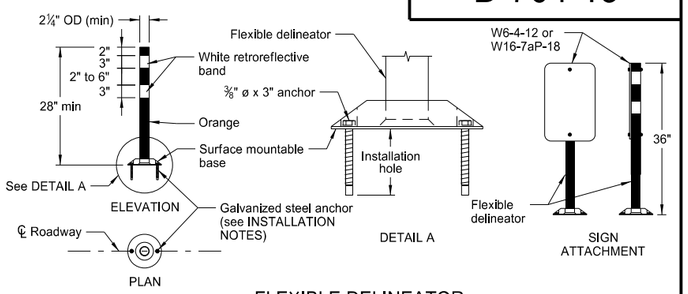
TRAFFIC CONE

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.



TUBULAR MARKER

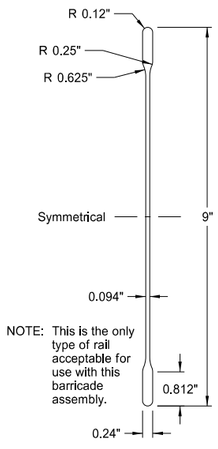
Provide retroreflectorization of tubular markers more than 42" in height by alternating four 4" to 6" wide orange and white stripes with the top stripe being orange.



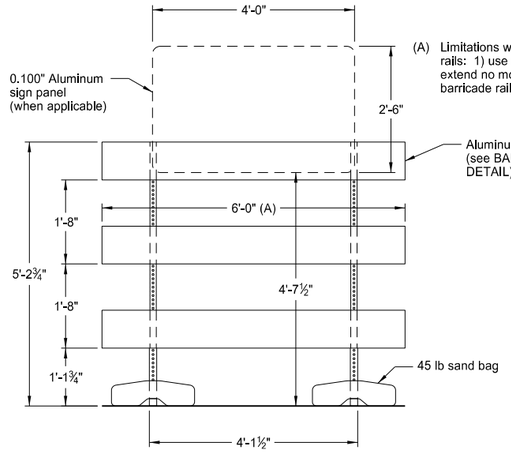
FLEXIBLE DELINEATOR

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.

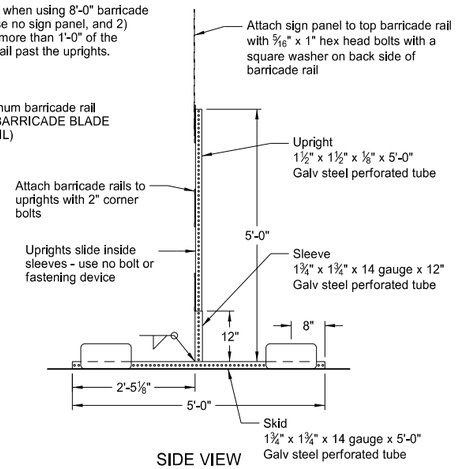


BARRICADE BLADE DETAIL



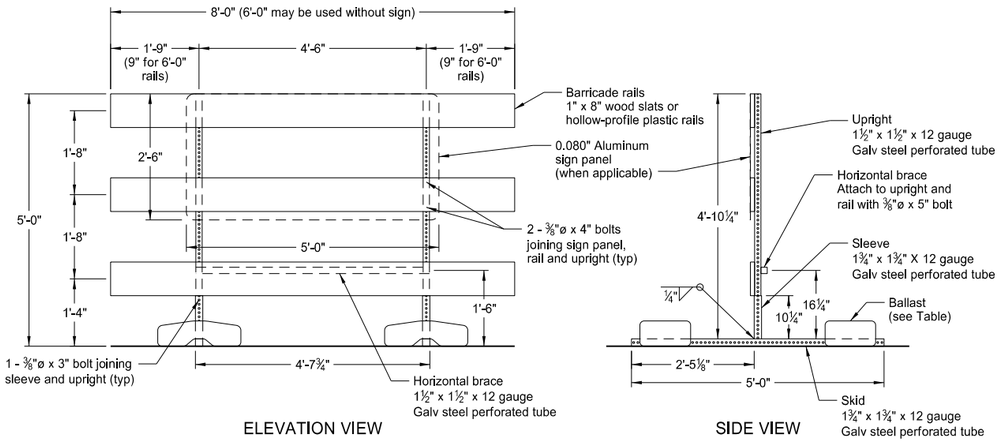
ELEVATION VIEW

(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.



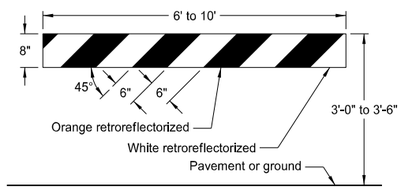
SIDE VIEW

BARRICADE ASSEMBLY DETAIL (Aluminum Barricade Rails)

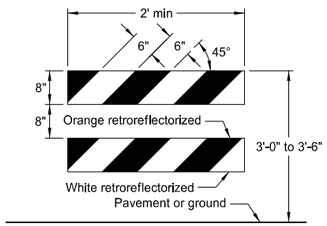


BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

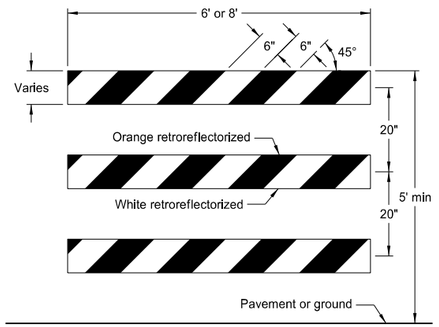
NOTE: For barricade markings use alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Place retroreflective sheeting on both sides of the rails with a minimum of 270 square inches of visible retroreflective area facing vehicular traffic. When the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



TYPE I BARRICADE

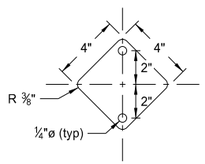


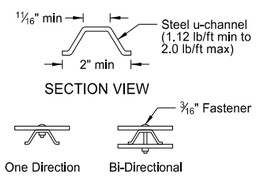
TYPE II BARRICADE

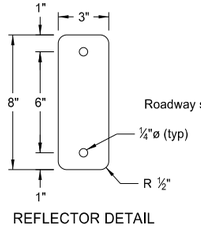


TYPE III BARRICADE

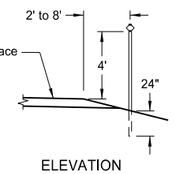
BARRICADE RAIL DETAILS







REFLECTOR DETAIL



ELEVATION

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.

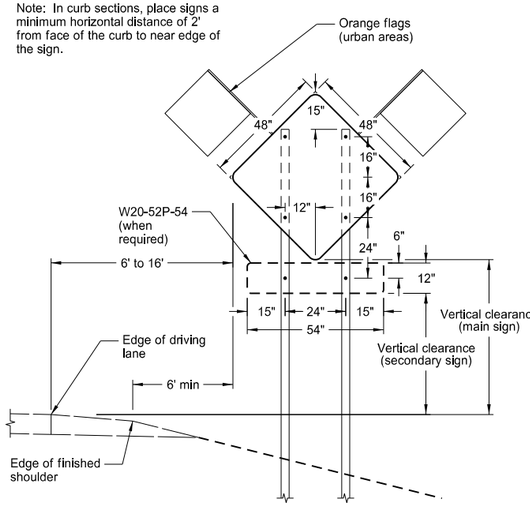
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-13	
REVISIONS	
DATE	CHANGE
9-27-17 11-01-19	Updated to active voice Revised details for Flexible Delineator

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

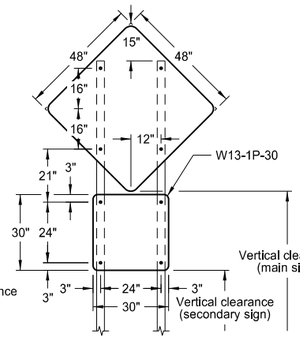
CONSTRUCTION SIGN PUNCHING AND MOUNTING DETAILS

D-704-14

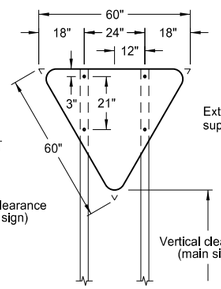
Note: In curb sections, place signs a minimum horizontal distance of 2' from face of the curb to near edge of the sign.



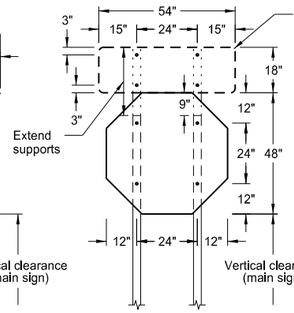
TYPICAL SECTION
(48" x 48" diamond warning sign shown)



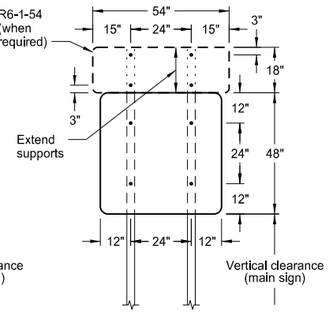
48" x 48" DIAMOND SIGN
(with 30" x 30" secondary sign)



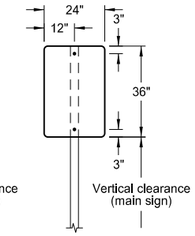
R1-2-60 - YIELD SIGN



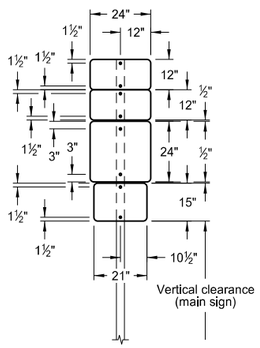
R1-1-48 - STOP SIGN
(with R6-1-54 sign as required)



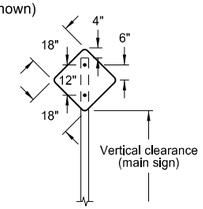
48" x 48" SIGN
(with R6-1-54 sign as required)



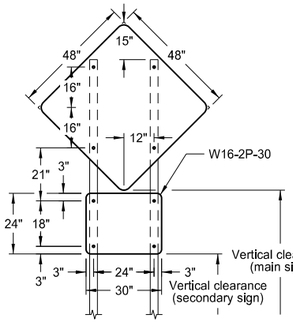
24" x 36" SIGN



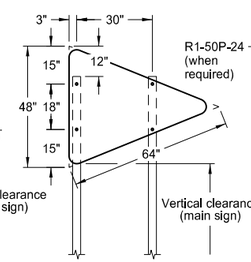
24" x 24"
ROUTE MARKER
ASSEMBLY



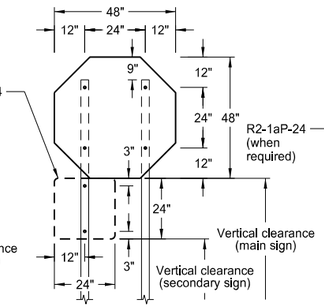
18" x 18"
DIAMOND SIGN



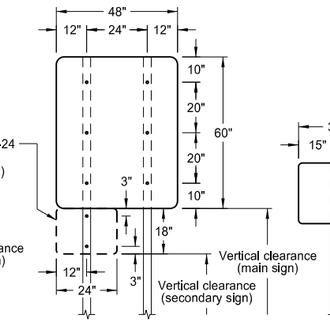
48" x 48" DIAMOND SIGN
(with 30" x 24" secondary sign)



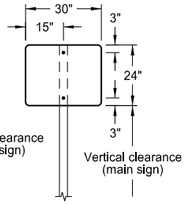
W14-3-64 - PENNANT SIGN



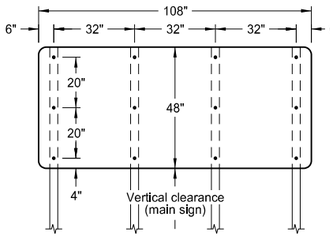
R1-1-48 - STOP SIGN
(with R1-50P-24 sign as required)



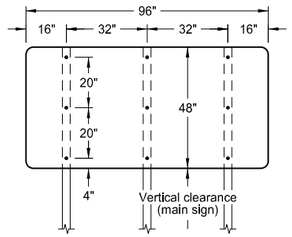
48" x 48" SIGN
(with R2-1aP-24 sign as required)



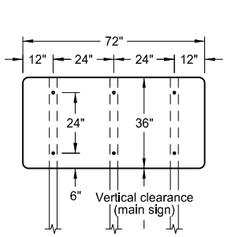
30" x 24" SIGN



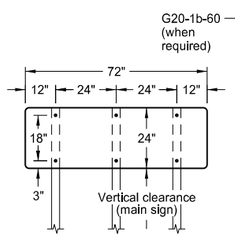
108" x 48" SIGN



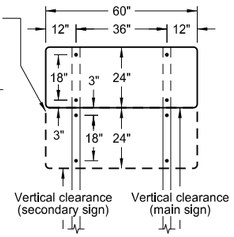
96" x 48" SIGN



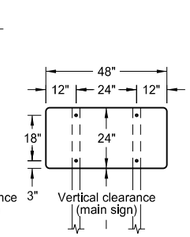
72" x 36" SIGN



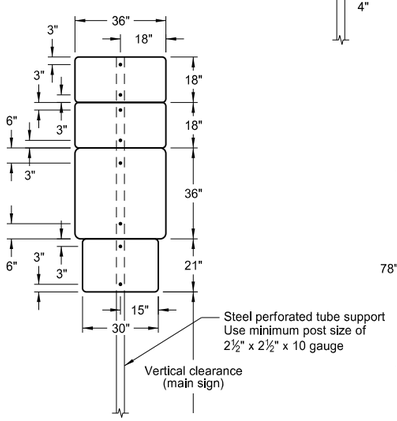
72" x 24" SIGN



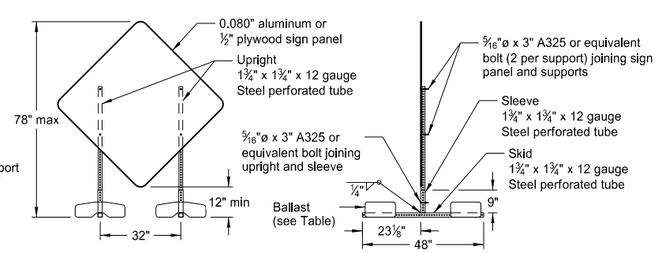
60" x 24" SIGN



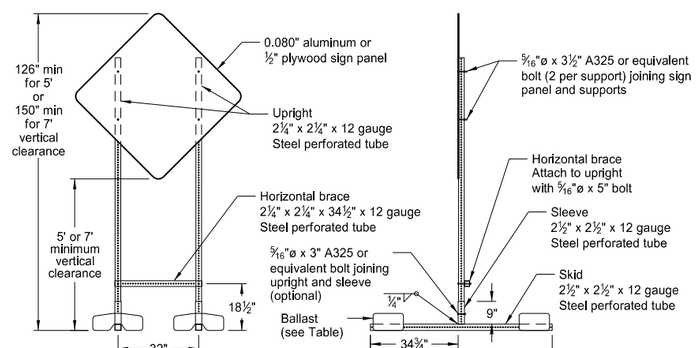
48" x 24" SIGN



36" x 36"
ROUTE MARKER
ASSEMBLY



PORTABLE SIGN SUPPORT
LOW-MOUNTING HEIGHT



PORTABLE SIGN SUPPORT
HIGH-MOUNTING HEIGHT

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 unforseen 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

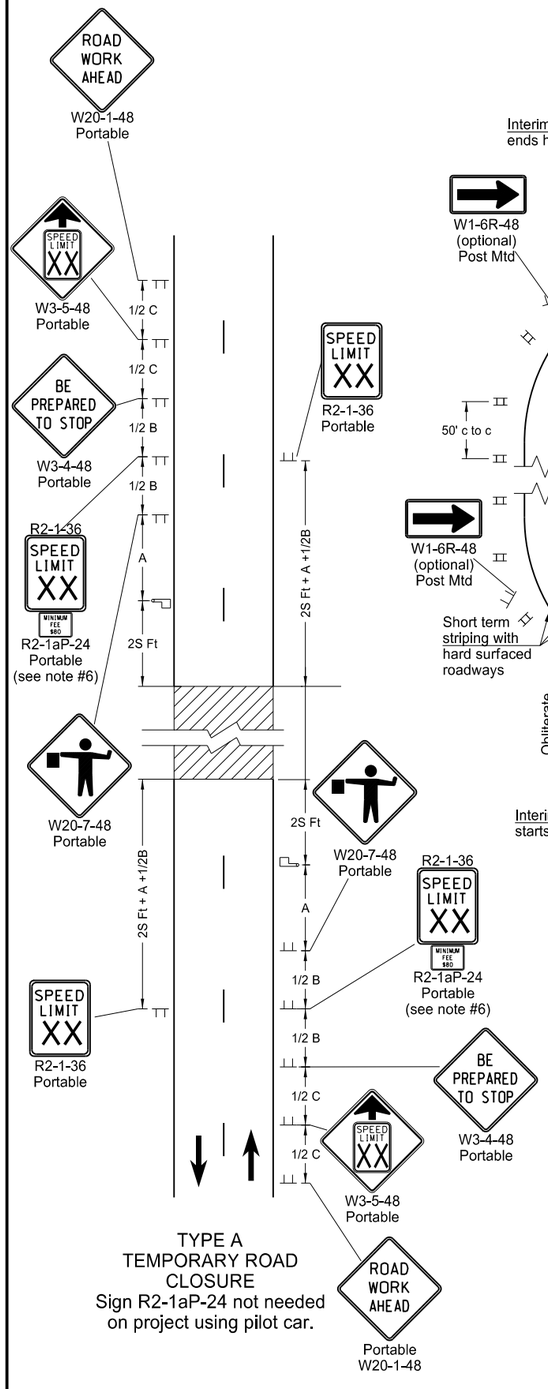
10-4-13

REVISIONS

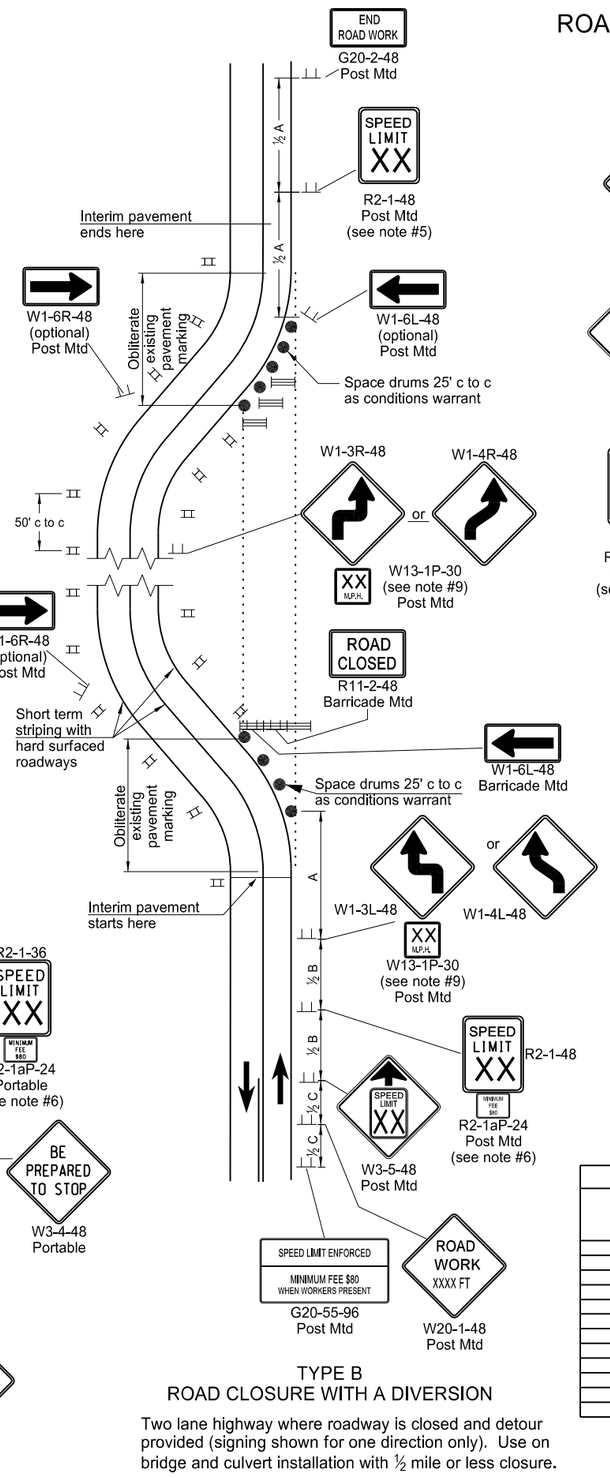
DATE	CHANGE
11-14-13	Revised Note 6
9-27-17	Updated to active voice
11-01-19	Revised 60"x24" sign detail

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

ROAD CLOSURE LAYOUTS



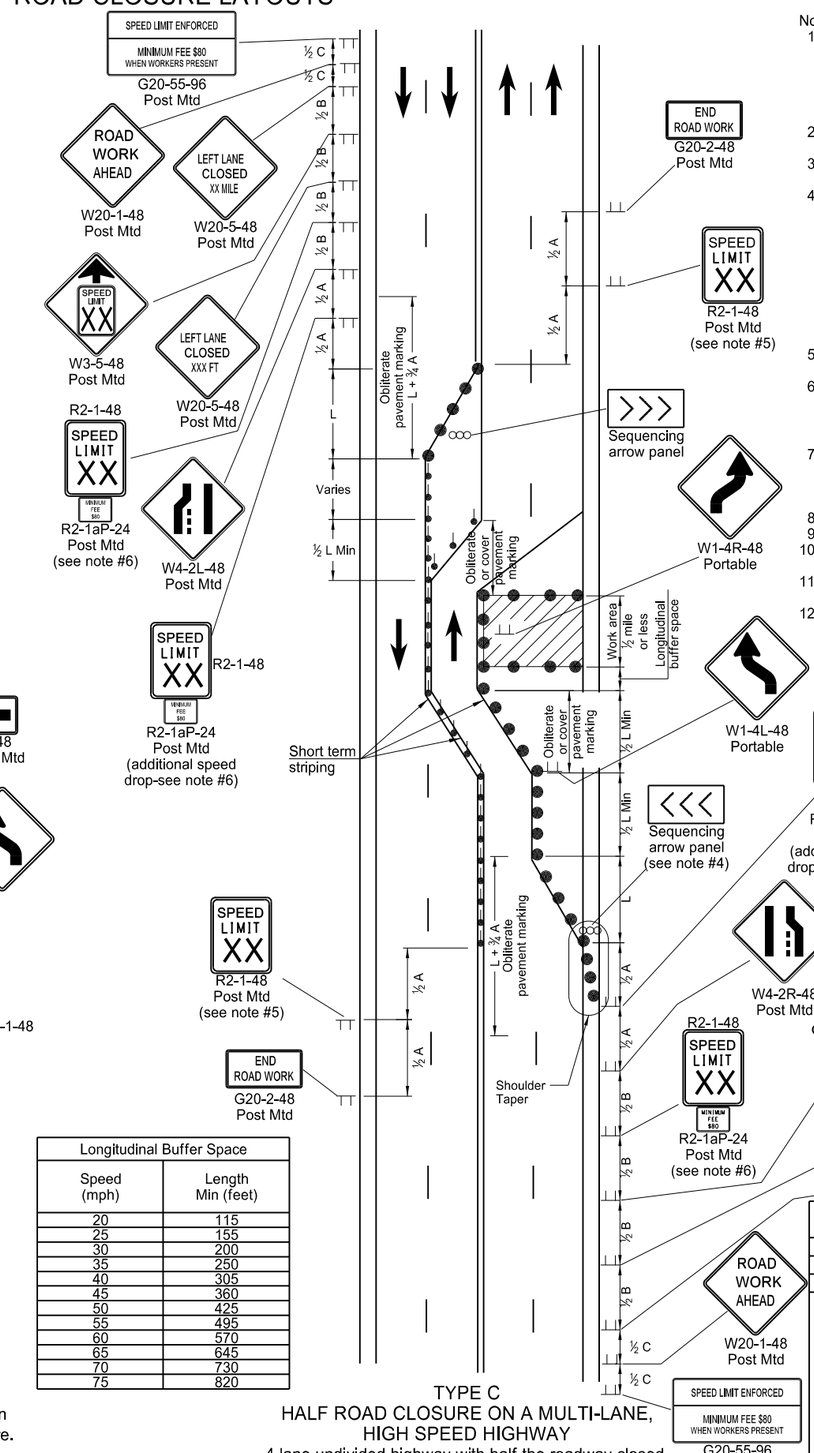
TYPE A
TEMPORARY ROAD CLOSURE
Sign R2-1aP-24 not needed on project using pilot car.

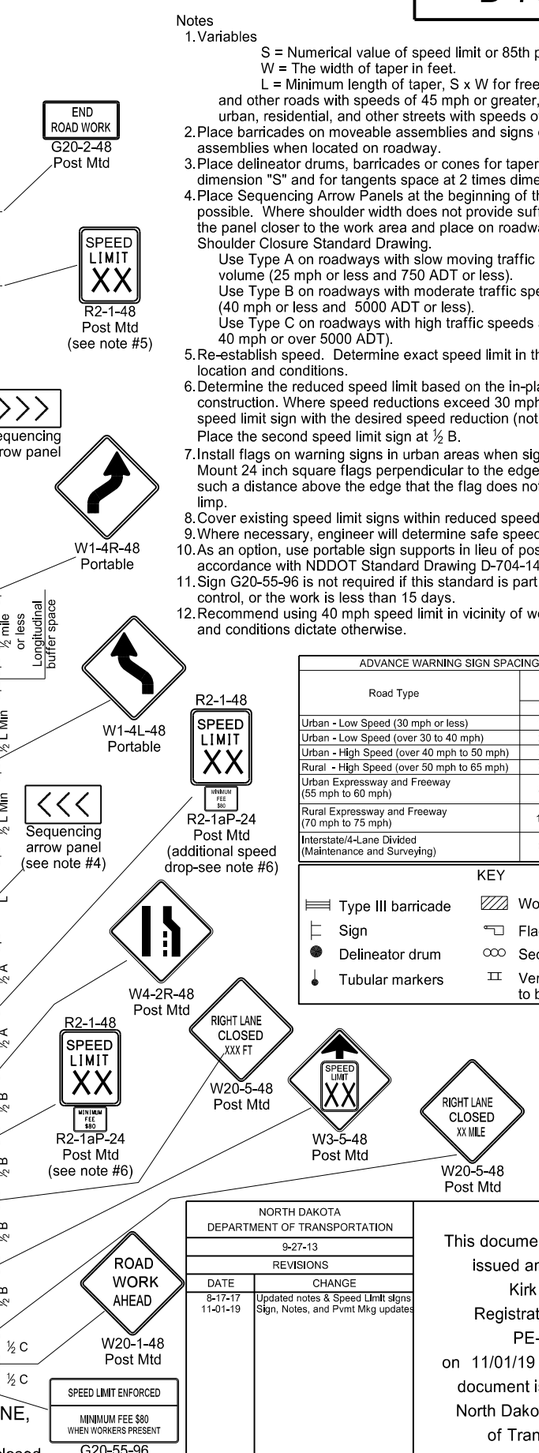


TYPE B
ROAD CLOSURE WITH A DIVERSION

Two lane highway where roadway is closed and detour provided (signing shown for one direction only). Use on bridge and culvert installation with ½ mile or less closure.

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





TYPE C
HALF ROAD CLOSURE ON A MULTI-LANE, HIGH SPEED HIGHWAY
4 lane undivided highway with half the roadway closed.

Notes

1. Variables
   S = Numerical value of speed limit or 85th percentile.
   W = The width of taper in feet.
   L = Minimum length of taper, S x W for freeways, expressways, and other roads with speeds of 45 mph or greater, or W x $S^2/60$ for urban, residential, and other streets with speeds of 40 mph or less.
2. Place barricades on moveable assemblies and signs on portable assemblies when located on roadway.
3. Place delineator drums, barricades or cones for tapering traffic at dimension "S" and for tangents space at 2 times dimension "S".
4. 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 roadway surface. See Shoulder Closure Standard Drawing.
   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).
5. Re-establish speed. Determine exact speed limit in the field, dependent on location and conditions.
6. 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 ½ B.
7. 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.
8. Cover existing speed limit signs within reduced speed zones.
9. Where necessary, engineer will determine safe speed.
10. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
11. Sign G20-55-96 is not required if this standard is part of other traffic control, or the work is less than 15 days.
12. Recommend using 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 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

KEY

- Type III barricade
- Sign
- Delineator drum
- Tubular markers
- Work area
- Flagger
- Sequencing arrow panel
- Vertical panels back to back

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

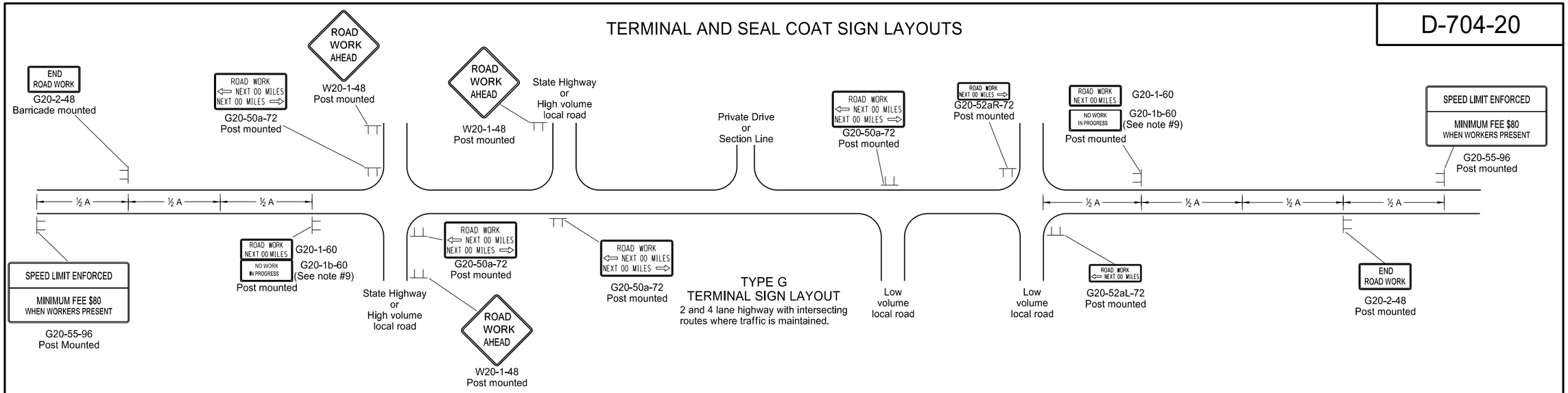
9-27-13

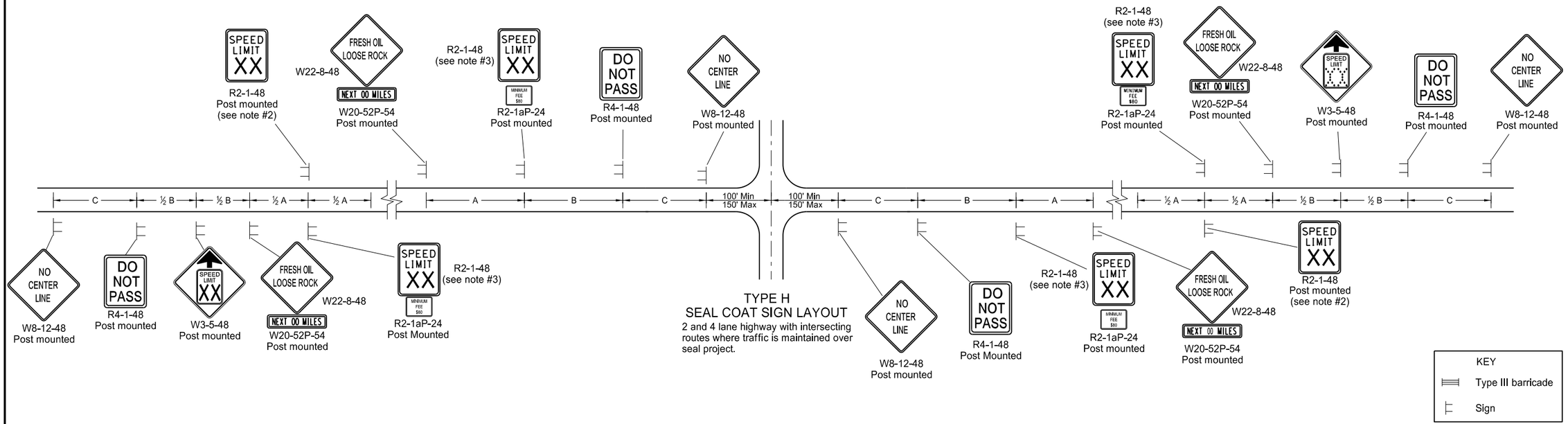
REVISIONS

DATE	CHANGE
8-17-17	Updated notes & Speed Limit signs
11-01-19	Sign, Notes, and Pvmt Mkg updates

TERMINAL AND SEAL COAT SIGN LAYOUTS

D-704-20





1. Place barricades on moveable assemblies and signs on portable assemblies when located on roadway.
2. Determine the exact speed limit in the field, based on location and conditions.
3. Determine the reduced speed limit based on the in place speed limit before construction. Where speed limit 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 ½ B.
4. 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.
5. Cover existing speed limit signs within a reduced speed zone.
6. On seal coat projects, place signs R2-1-48, R2-1aP-24, R4-1-48, W22-8-48 and W20-52P-54 after all important intersections and at five mile intervals. Place sign W8-12-48 after all important intersections and at 2 mile intervals until short term center line pavement marking is placed.
7. As an option, use portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Drawing D-704-14.
8. Cover or remove speed limit signs from layout Type H when loose aggregate is removed.
9. Install sign G20-1b-60 when work is suspended for winter.
10. Use other traffic control layouts in immediate work areas. Place sign R2-1aP-24 below speed limit signs in reduced speed limit work areas.
11. Sign G20-55-96 is not required if work is less than 15 days.
12. Recommend using 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 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
8-17-17	Updated notes & sign numbers.
11-01-19	Note & sign updates.

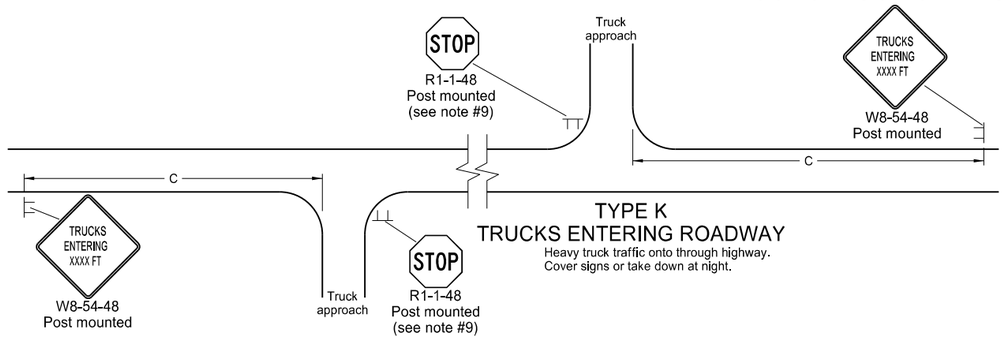
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

CONSTRUCTION TRUCK AND TEMPORARY DETOUR LAYOUTS

D-704-22

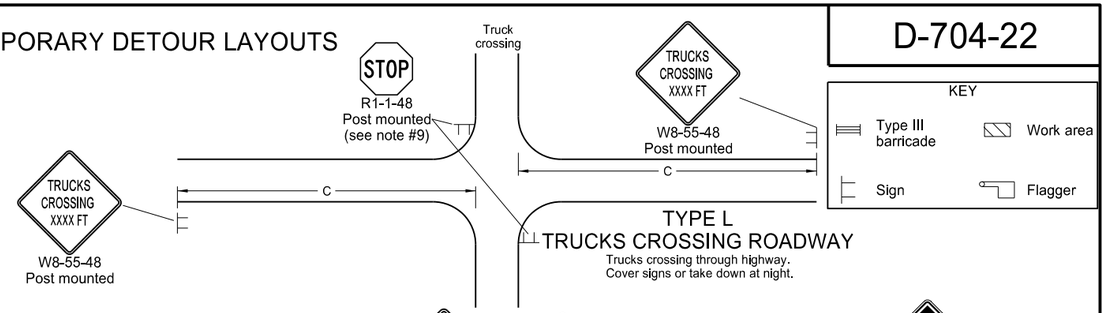
KEY

Type III barricade | Work area | Sign | Flagger



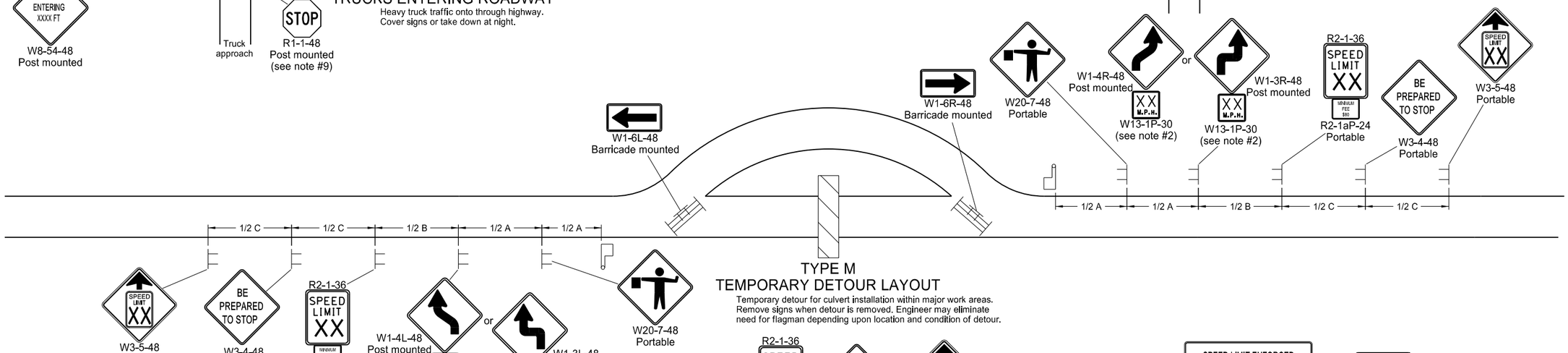
TYPE K
TRUCKS ENTERING ROADWAY

Heavy truck traffic onto through highway.
Cover signs or take down at night.



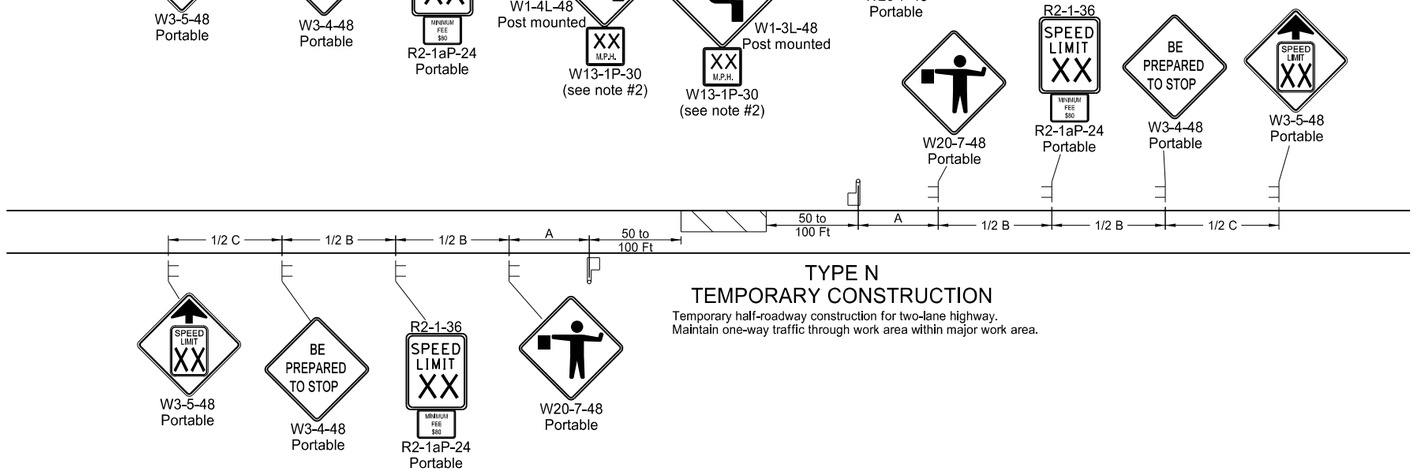
TYPE L
TRUCKS CROSSING ROADWAY

Trucks crossing through highway.
Cover signs or take down at night.



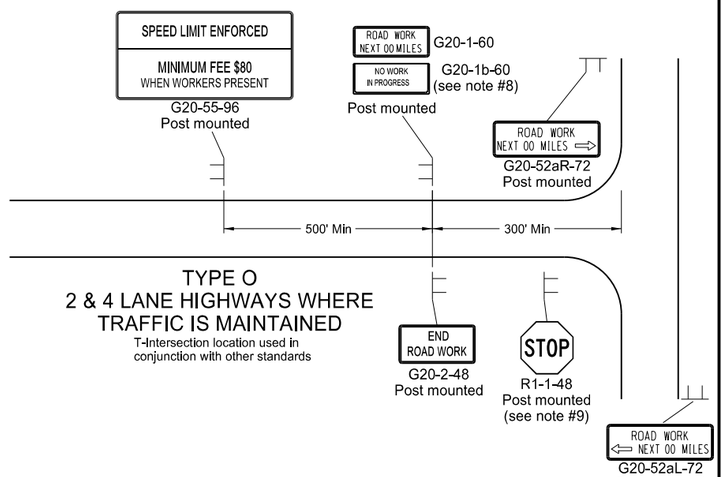
TYPE M
TEMPORARY DETOUR LAYOUT

Temporary detour for culvert installation within major work areas.
Remove signs when detour is removed. Engineer may eliminate need for flagman depending upon location and condition of detour.



TYPE N
TEMPORARY CONSTRUCTION

Temporary half-roadway construction for two-lane highway.
Maintain one-way traffic through work area within major work area.



TYPE O
2 & 4 LANE HIGHWAYS WHERE TRAFFIC IS MAINTAINED

T-Intersection location used in conjunction with other standards

Notes

1. Place barricades on a moveable assemblies and signs on portable assemblies when located on roadway.
2. Where necessary, safe speed to be determined by the Engineer.
3. 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 ½ B.
4. 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.
5. Cover existing speed limit signs within a reduced speed zone.
6. Covered (when approved by engineer) or obliterated pavement marking measured as Obliteration of Pavement Marking.
7. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
8. Install sign G20-1b-60 when work is suspended for winter.
9. If existing stop sign is in place, a 48" stop sign is not required.
10. Sign G20-55-96 is not required if layout is part of other traffic control or if work is less than 15 days.
11. Recommend using 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 40mph)	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

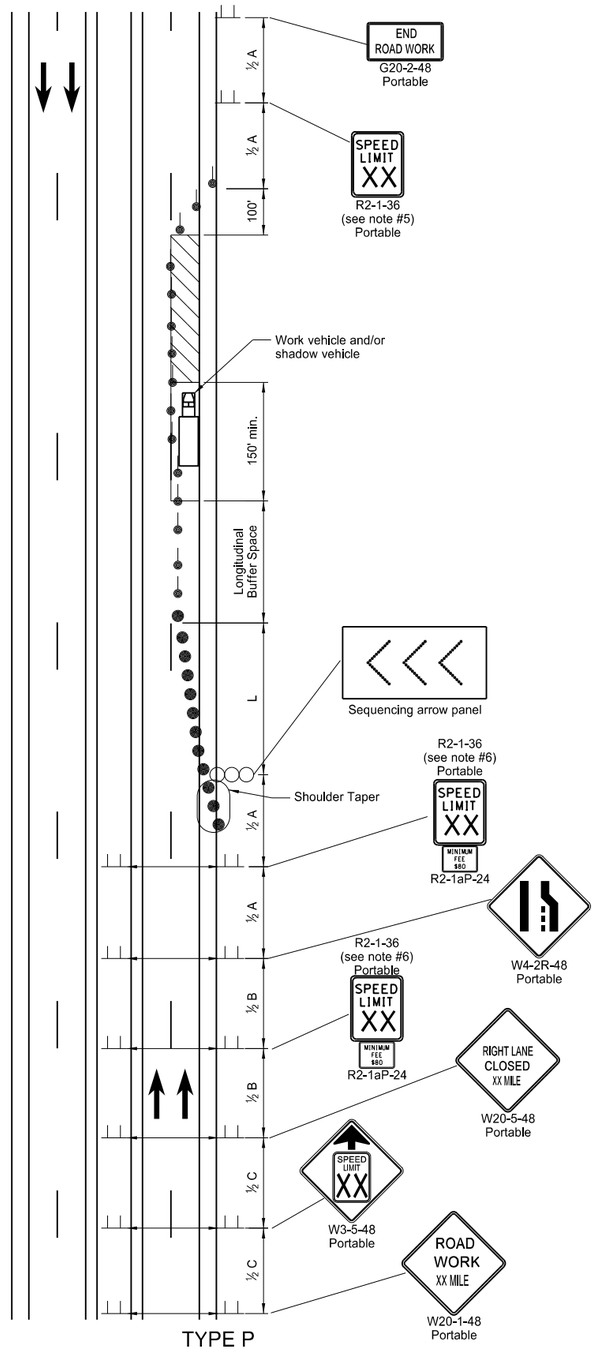
REVISIONS

DATE	CHANGE
8-17-17	Update notes & sign numbers
11-01-19	Revised sign numbers & note 7

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

SHORT TERM URBAN DETOUR AND LANE CLOSURE ON A DIVIDED HIGHWAY LAYOUTS

D-704-23

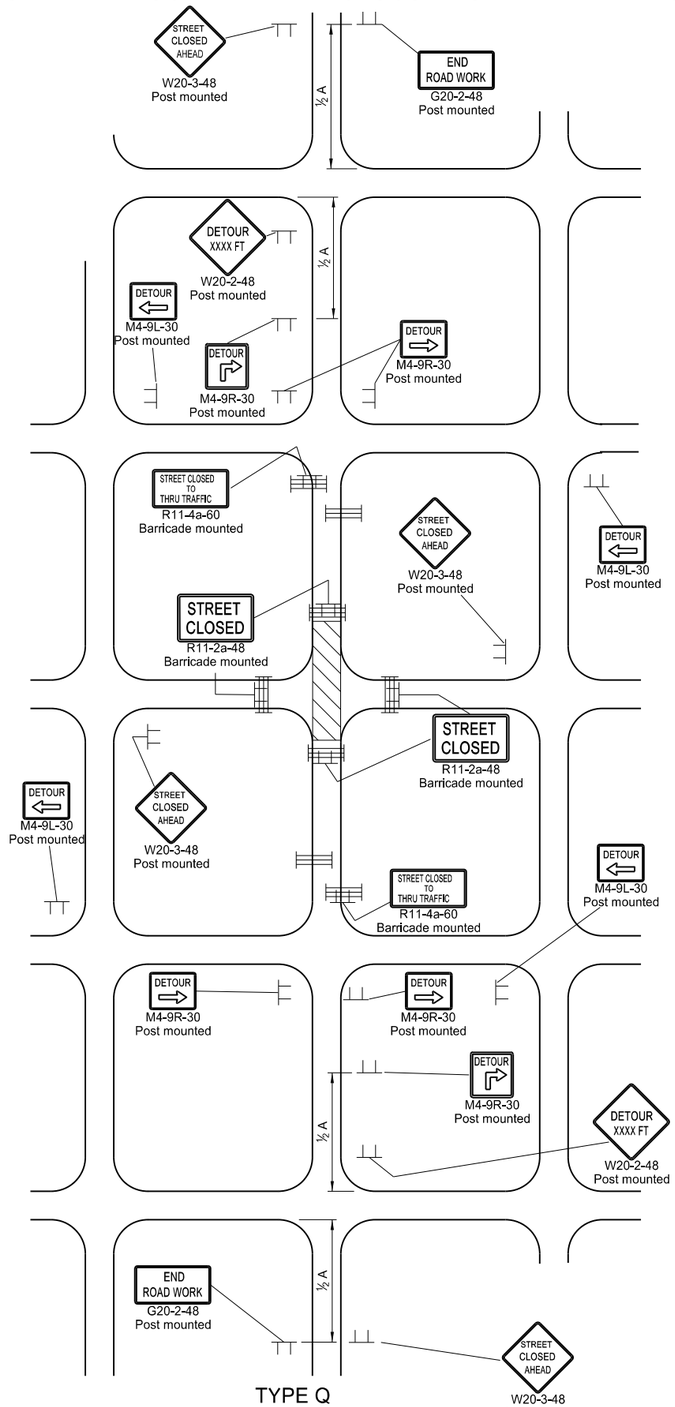


TYPE P

STATIONARY LANE CLOSURE ON A DIVIDED HIGHWAY

4 lane divided roadway where ½ of roadway is closed.

Short-term (more than 1 hour within a single daylight period.)



TYPE Q

DETOUR FOR A CLOSED STREET

Where city streets are used for detouring traffic.

Urban projects do not require the G20-55-96 and R2-1aP-24 signs.

Notes

1. Variables
   - S = Numerical value of speed limit or 85th percentile.
   - W = The width of taper in feet
   - L = Minimum length of taper, S x W for freeways, expressways, and all other roads with speeds of 45 mph or greater, or W x S^2 /60 for urban, residential, and other streets with speeds of 40 mph or less.
2. Place barricades on moveable assemblies and signs on portable assemblies when located on roadway.
3. Space delineator drums for tapering traffic at dimension "S". Space delineator drums or tubular markers for tangents at 2 times "S".
4. Place Sequencing Arrow Panels at the beginning of taper. Where shoulder width does not provide sufficient room, move panel closer to the work area and place on 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 or over 5000 ADT).
5. Re-established speed limit. Determine exact speed limit in the field, dependent on location and conditions.
6. 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 ½ B.
7. 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.
8. Cover existing speed limit signs within a reduced speed zone.
9. Covered (when approved by engineer) or obliterated payment marking measured as as Obliteration of Pavement Marking.
10. Change intersection control on detour for Type Q when determined necessary by the engineer.
11. Engineer to determine safe speed where necessary. When parking is present, place signs so they are entirely visible above parked vehicles or at the edge of the parking area so they are visible to oncoming traffic.
12. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
13. Recommend using 40 mph speed limit in vicinity of workers for Layout Type P, unless location and conditions dictate otherwise.

KEY

Type III barricade	Work area
Sign	Sequencing arrow panel
Delineator Drum	Tubular Markers

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

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

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

9-27-13

REVISIONS

DATE	CHANGE
8-17-17	Removed Speed limit signs, & updated notes & sign numbers.
11-01-19	Revised sign numbers & note.

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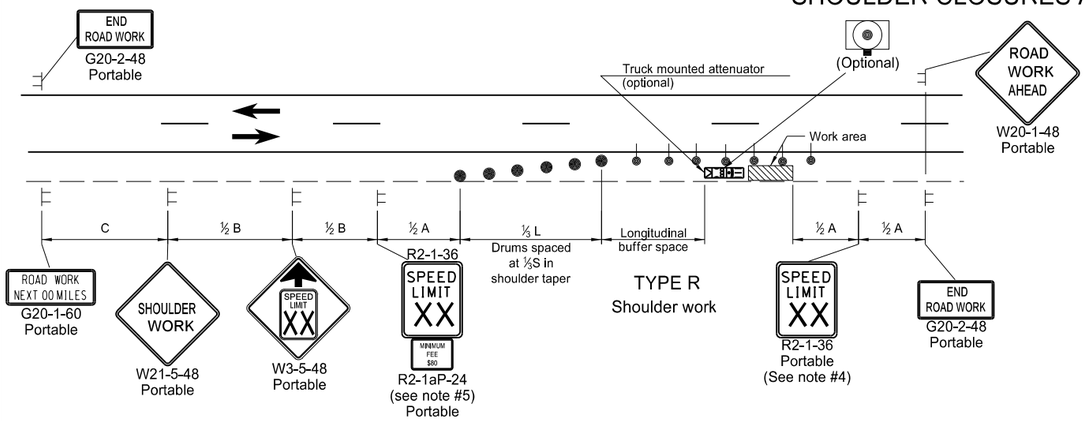
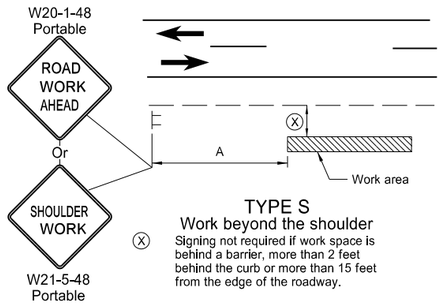
SHOULDER CLOSURES AND BRIDGE PAINTING LAYOUTS

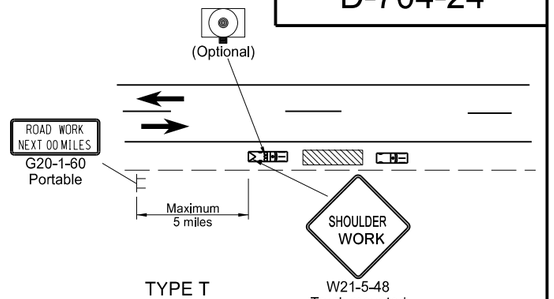
D-704-24



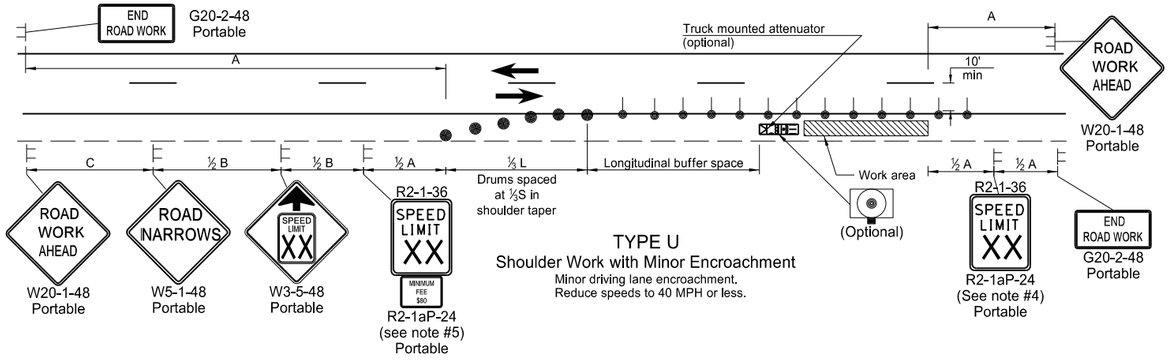
TYPE R
Shoulder work



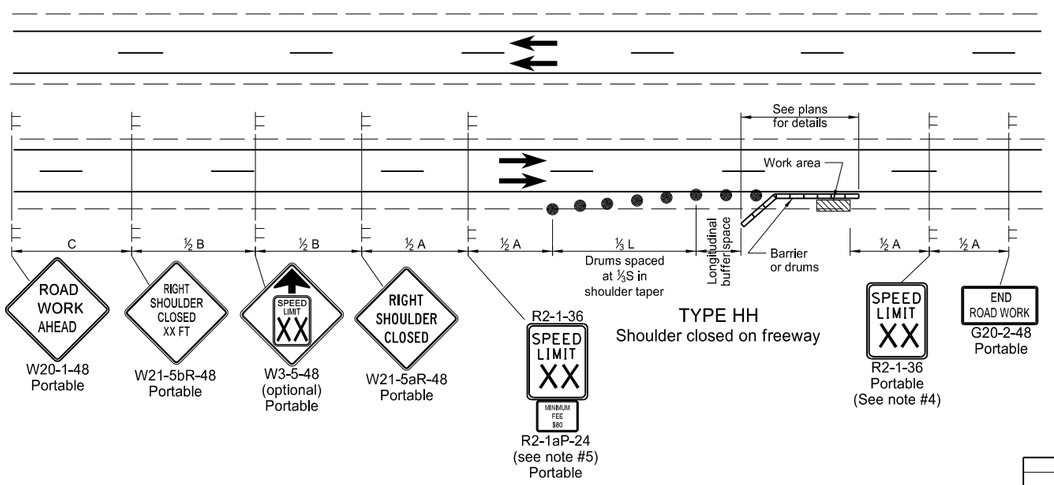
TYPE S
Work beyond the shoulder
Signing not required if work space is behind a barrier, more than 2 feet behind the curb or more than 15 feet from the edge of the roadway.



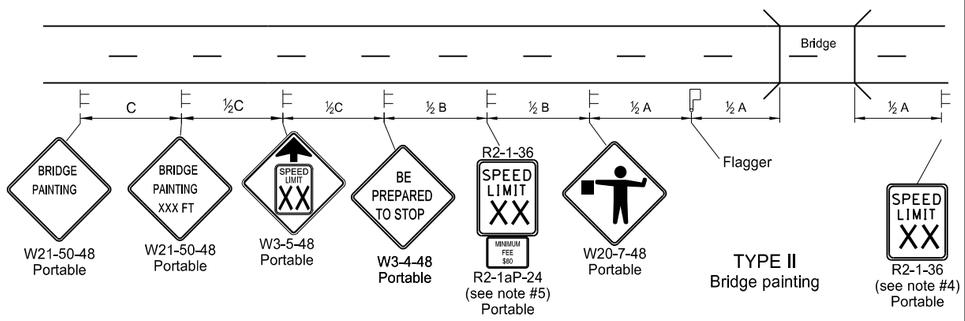
TYPE T
Mobile operation on shoulder



TYPE U
Shoulder Work with Minor Encroachment
Minor driving lane encroachment.
Reduce speeds to 40 MPH or less.



TYPE HH
Shoulder closed on freeway



TYPE II
Bridge painting

Notes
1. Variables
   S = Numerical value of speed limit or 85th percentile.
   W = The width of the taper in feet.
   L = Minimum length of taper, S x W for freeways, expressways, and all other roads with speeds of 45 mph or greater, or W x S^2 /60 for urban, residential, and other streets with speeds of 40 mph or less.
2. Space delineator drums for tapering traffic at dimension "S". Space delineator drums or tubular markers for tangents at 2 times "S".
3. 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).
   UseType 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).
4. Re-establish speed limit. Determine exact speed limit in the field, dependent on location and conditions.
5. 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 ½B.
6. 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.
7. Cover existing speed limit signs within a reduced speed zone.
8. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
9. Recommend 40 mph speed limit in vicinity of workers, unless location and conditions dictate otherwise.

KEY

Sign	Work area
Delineator Drum	Tubular Marker
Sequencing Arrow Panel (Caution Mode)	

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

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

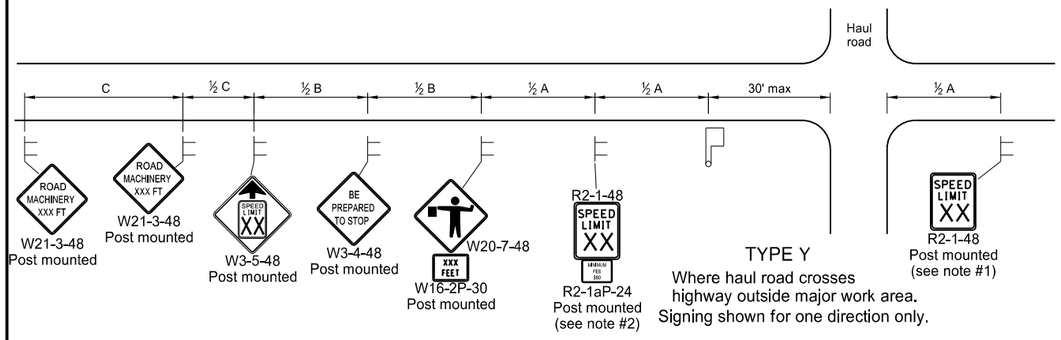
9-27-13

REVISIONS

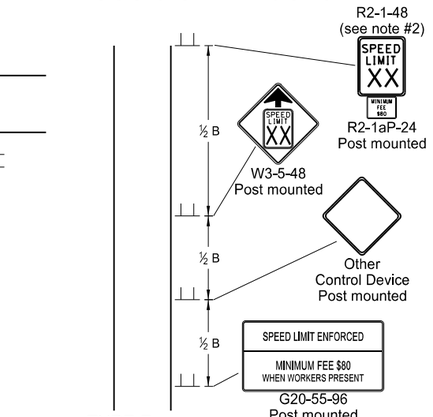
DATE	CHANGE
8-17-17	Updated notes & revised signs
11-01-19	Revised drum spacing & signs nos.

MISCELLANEOUS SIGN LAYOUTS

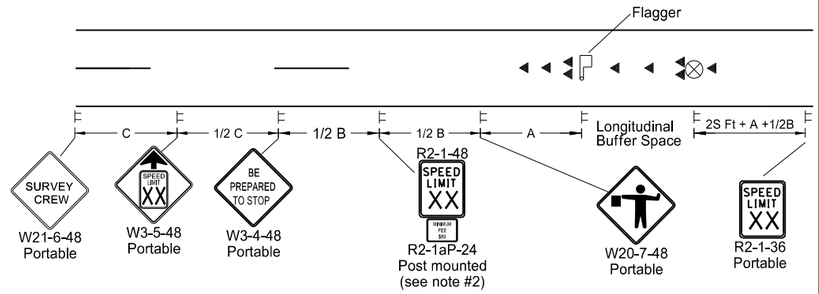
D-704-26



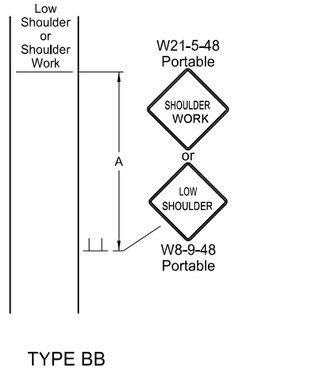
TYPE Y
Where haul road crosses highway outside major work area.
Signing shown for one direction only.



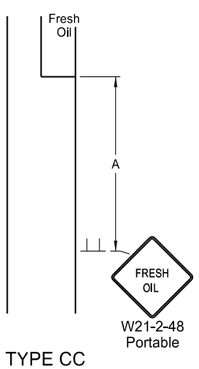
TYPE Z
Where speed zone is needed
Signing shown for one direction only.



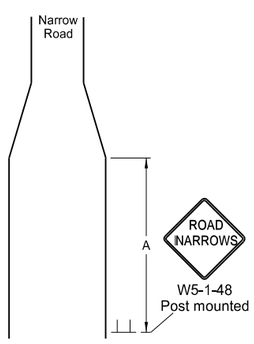
TYPE AA
Where survey crew is used
Signing shown for one direction only.



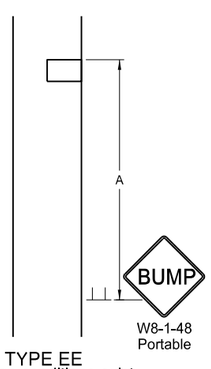
TYPE BB
Within major work area where sign conditions exist



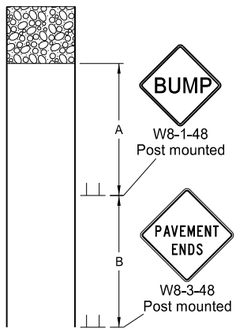
TYPE CC
Where sign conditions exist



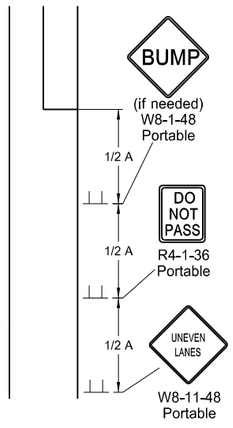
TYPE DD
Where sign conditions exist



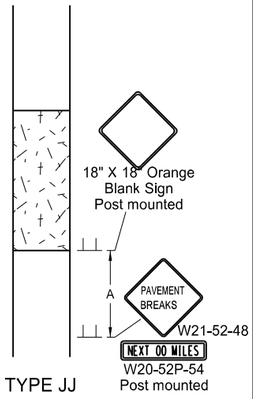
TYPE EE
Where sign conditions exist



TYPE FF
Where sign conditions exist
Signing shown for one direction only.



TYPE GG
Where elevation difference exists between lanes

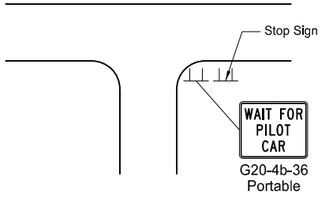


TYPE JJ
For break in pavement.
Install signs when conditions exist and remove when not applicable.
Signing shown for one direction only.

KEY

Flagger	Sign
Cones	Survey Equipment

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



TYPE KK
At major intersections within pilot car control area

Notes
1. Re-establish speed limit. Determine exact speed limit in the field, dependent on location and conditions.
2. Determine reduced speed limit based on 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 ½B.
3. 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.
4. Cover existing speed limit signs within reduced speed zones.
5. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
6. Sign G20-55-96 is not required if this standard is part of other traffic control layouts, or work is less than 15 days.
7. When pilot car operation is used, place sign G20-4b-36 "Wait For Pilot Car" at major intersections within pilot car control area.
8. Recommend 40 mph speed limit in vicinity of workers, unless location and conditions dictate otherwise.
9. Layouts shown for one direction only.

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

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

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
9-27-13
REVISIONS

DATE	CHANGE
8-17-17	Added speed limit signs. Updated notes & sign numbers
11-01-19	Revised note 5 & sign numbers

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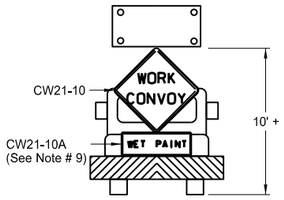
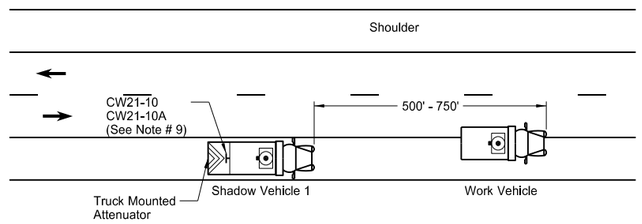
MOBILE OPERATION
(PAVEMENT MARKING)

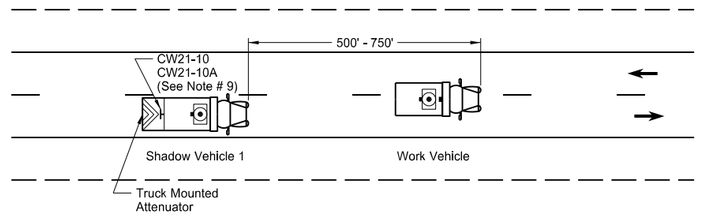
D-704-27



Typical Shadow Vehicle 1
Two-Way Roaday

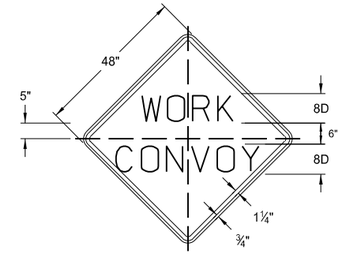


Two-Way Roadway with Paved Shoulders

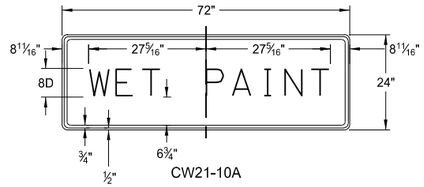


Two-Way Roadway without Paved Shoulders

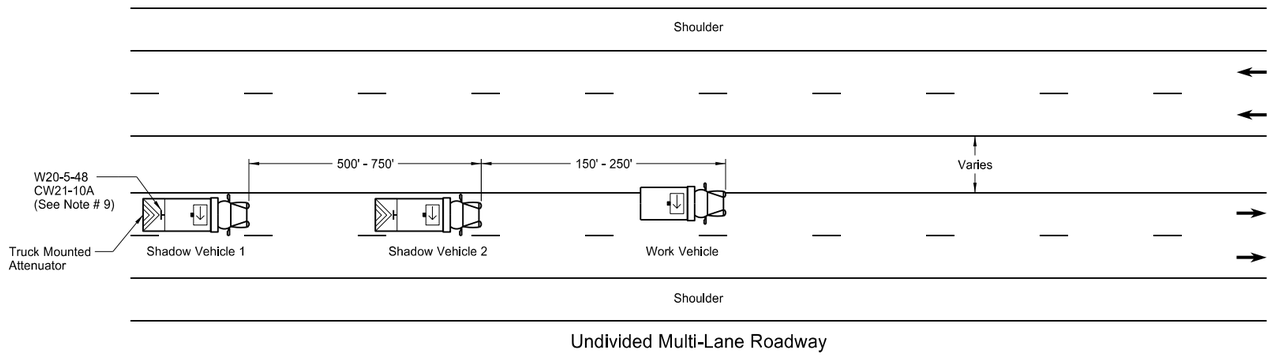
Sign Details



CW21-10

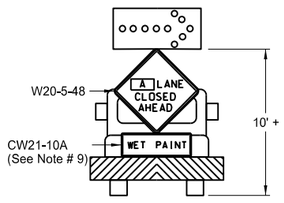


CW21-10A



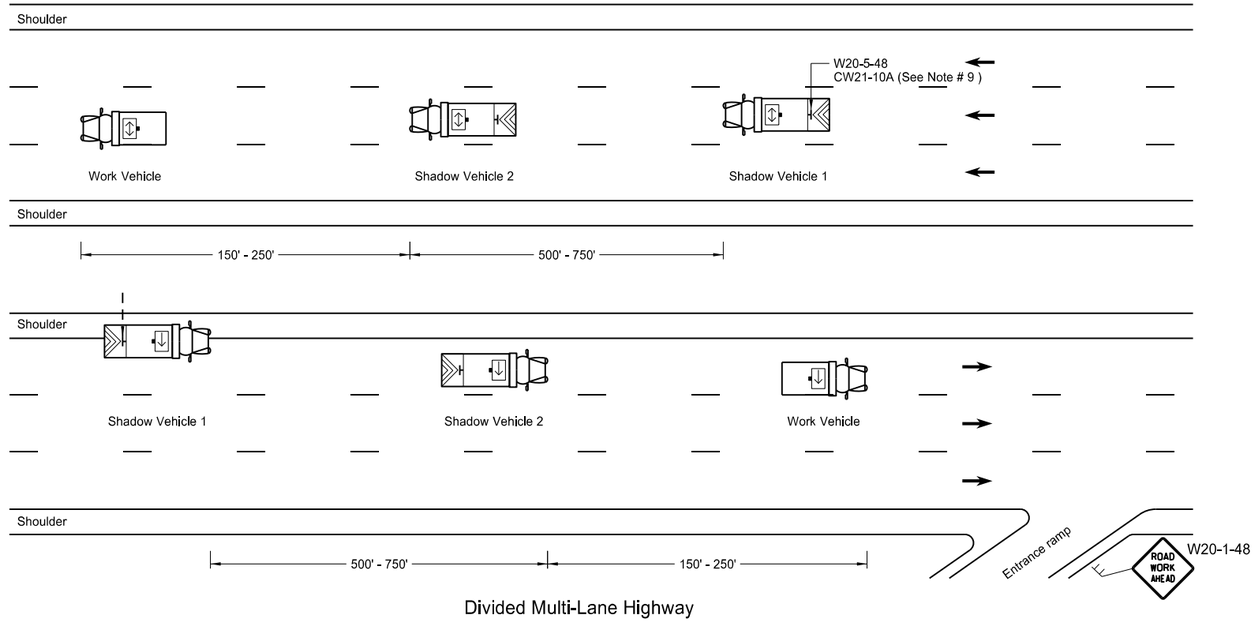
Undivided Multi-Lane Roadway

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 stobe 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.



Typical Shadow Vehicle 1 & 2
Multi-Lane Highways

A = Left Right Center



Divided Multi-Lane Highway

KEY

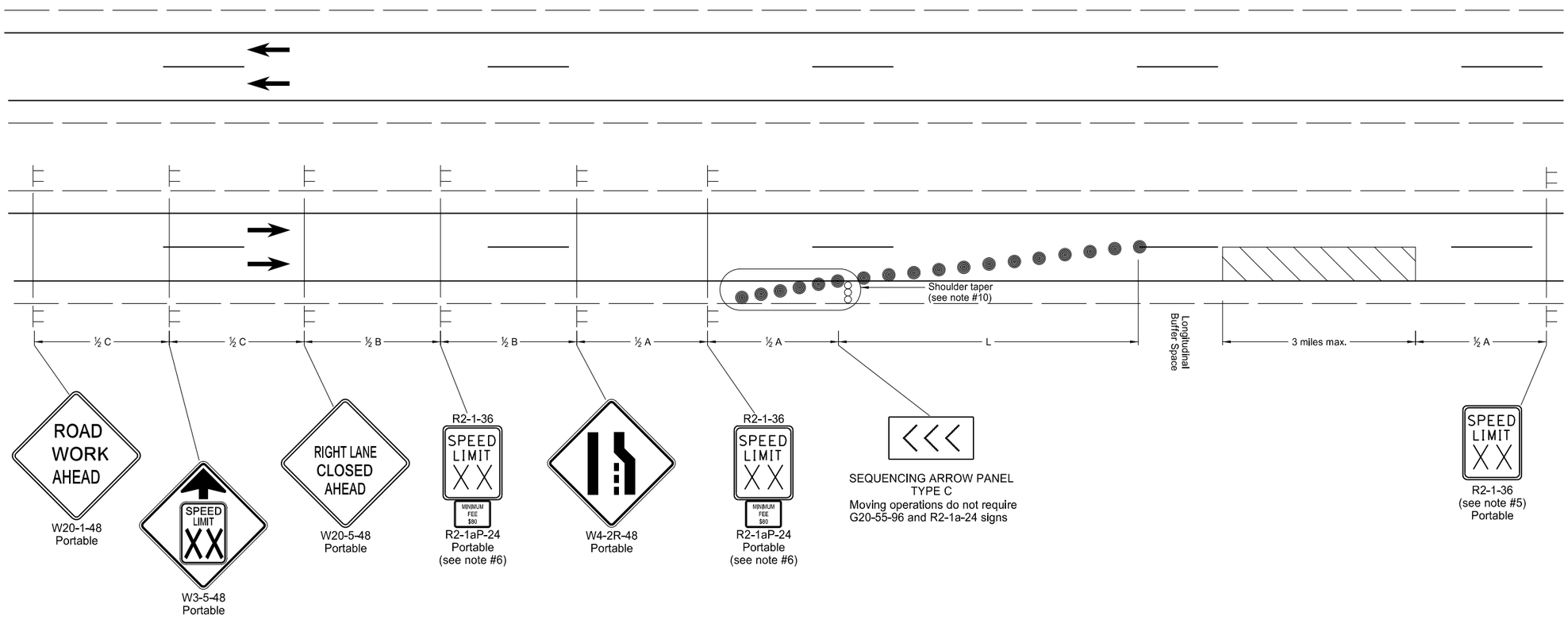
- Sign
- Truck mounted attenuator
- Flashing arrow panels:
  - Right directional
  - Left directional
  - Double arrow directional
  - Caution Mode

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

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/08/19 and the original document is stored at the North Dakota Department of Transportation

SIGN LAYOUT FOR ONE LANE CLOSURE DIVIDED HIGHWAY MOVING OPERATION

D-704-32



Notes
1. Provide an additional sequencing arrow panel in the closed lane, near the work area, if the moving operation is not visible to the motorist from the end of the taper.
2. Variables
   S = Numerical value of speed limit or 85th percentile.
   W = The width of the taper.
   L = Minimum length of taper, S x W for freeways, expressways, and all other roads with speeds of 45 mph or greater, or W x S^2 /60 for urban, residential, and other streets with speeds of 40 mph or less.
3. Space delineator drums for tapering traffic at dimension "S".
4. Sequencing Arrow Panels
   Panels should normally be placed at the beginning of the taper. Where shoulder width does not provide sufficient room, the panel should be moved closer to the work area so that it can be placed on the roadway surface.
   Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph & 750 ADT or less).
   Type B shall be used on roadways with moderate traffic speeds and volumes (40 mph and 5000 ADT or less).
   Type C shall be used on roadways with high traffic speeds and volumes (over 40 mph and 5000 ADT).
5. Re-establish speed limit. Determine the exact speed limit in the field, dependent on location and conditions.
6. Determine the reduced speed limit 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 ½ B.
7. 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.
8. Cover existing speed limit signs within a reduced speed zone.
9. As an option, use portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Drawing D-704-14.
10. Provide shoulder taper when shoulder is 8' or wider.
11. Recommend using 40 mph speed limit in vicinity of workers, unless location and conditions dictate otherwise.

KEY

Sign		Work area	
Delineator Drums		Sequencing arrow panel	

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

* Posted speed, off-peak 85th percentile speed prior to work starting, or 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 75 mph)	1000	1500	2640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1000	1500

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

9-27-13

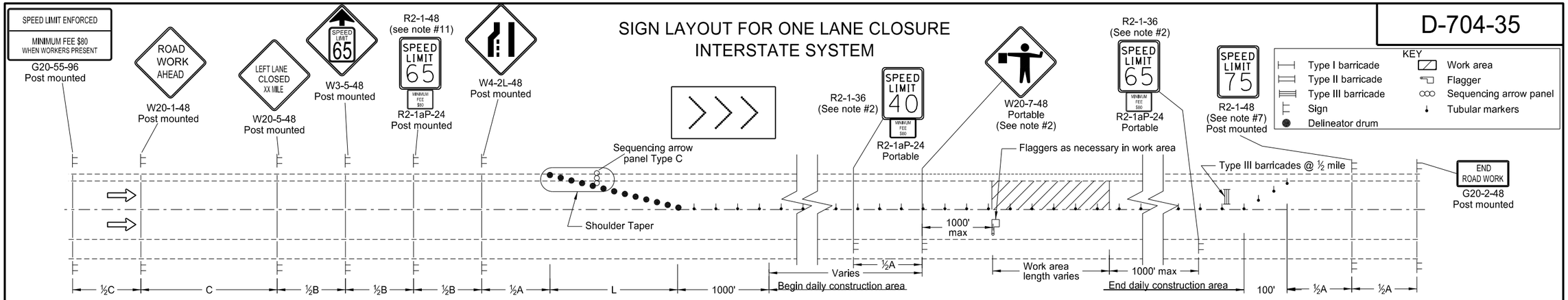
REVISIONS

DATE	CHANGE
6-24-14	Revised Note 9
8-17-17	Updated notes & sign numbers
11-01-19	Added sign, revised note & sign #

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

D-704-35

SIGN LAYOUT FOR ONE LANE CLOSURE INTERSTATE SYSTEM



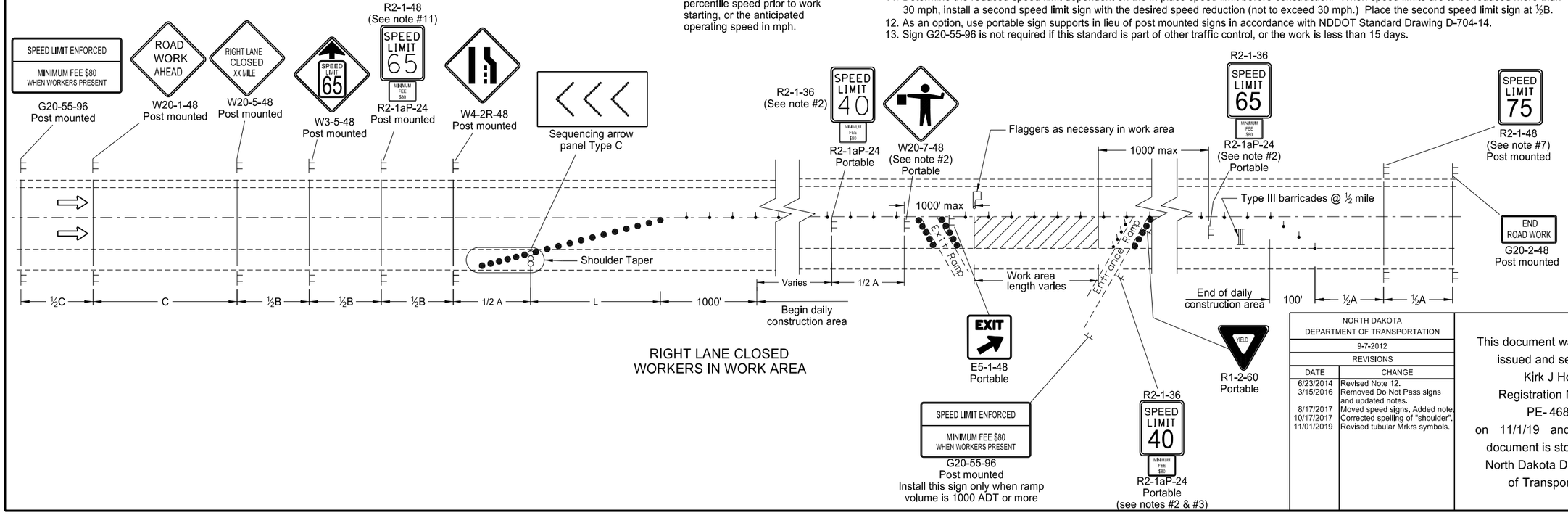
LEFT LANE CLOSED WORKERS IN WORK AREA

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 75 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

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

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 ½A 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 $80 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 ½B.
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 standard is part of other traffic control, or the work is less than 15 days.

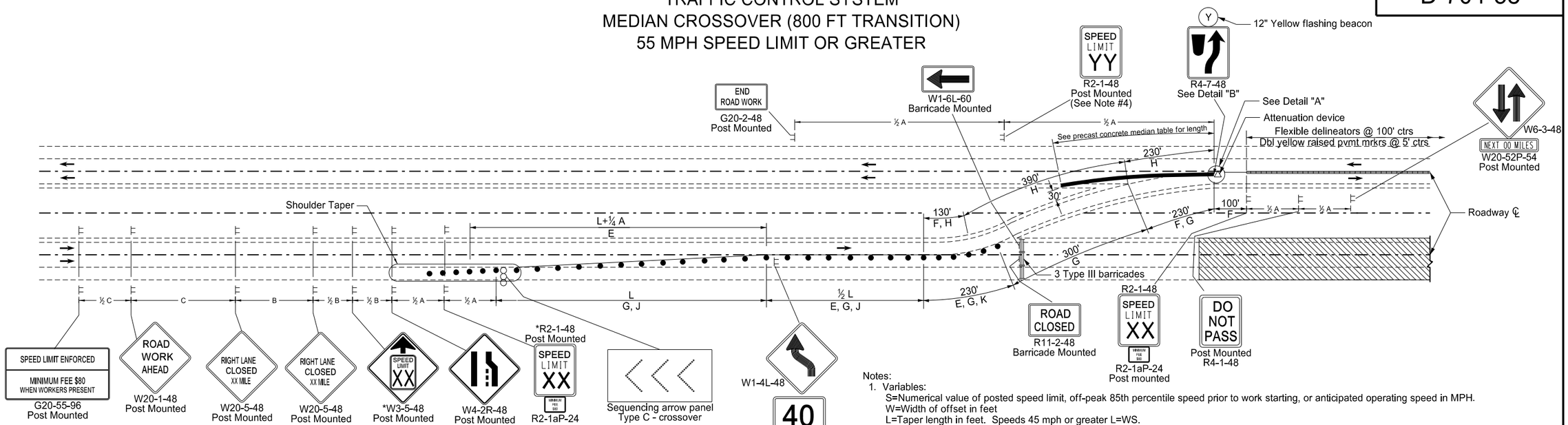


RIGHT LANE CLOSED WORKERS IN WORK AREA

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-7-2012	
REVISIONS	
DATE	CHANGE
6/23/2014	Revised Note 12.
3/15/2016	Removed Do Not Pass signs and updated notes.
8/17/2017	Moved speed signs. Added note.
10/17/2017	Corrected spelling of "shoulder".
11/01/2019	Revised tubular Mrkrs symbols.

TRAFFIC CONTROL SYSTEM
MEDIAN CROSSOVER (800 FT TRANSITION)
55 MPH SPEED LIMIT OR GREATER

D-704-38



*Not required for projects on roadways with 55 mph existing speed limit.

Notes:

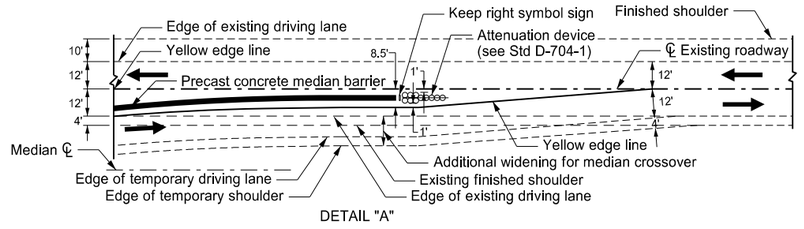
1. Variables:
   S=Numerical value of posted speed limit, off-peak 85th percentile speed prior to work starting, or anticipated operating speed in MPH.
   W=Width of offset in feet
   L=Taper length in feet. Speeds 45 mph or greater L=WS.
2. Place signs and barricades on the roadway on moveable assemblies. 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 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)
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 $80" 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 QUANTITY SUMMARY					
	ROADWAY EXISTING SPEED LIMIT				
	55 MPH	60 MPH	65 MPH	70 MPH	75 MPH
TYPE III BARRICADES	3 Each	3 Each	3 Each	3 Each	3 Each
FLASHING BEACON	1 Each	1 Each	1 Each	1 Each	1 Each
DELINEATOR DRUMS	31 Each	31 Each	31 Each	31 Each	31 Each
SEQUENCING ARROW PANEL TYPE C-CROSSOVER	1 Each	1 Each	1 Each	1 Each	1 Each
PORTABLE PRECAST CONCRETE MEDIAN BARRIER	See "PRECAST CONCRETE MEDIAN BARRIER TABLE"				
ATTENUATION DEVICES	1-Type B-55	1-Type B-60	1-Type B-65	1-Type B-70	1-Type B-75
RAISED PAVEMENT MARKERS (YELLOW)	151 Each	151 Each	151 Each	151 Each	151 Each
RAISED PAVEMENT MARKERS (WHITE)	351 Each	369 Each	387 Each	405 Each	423 Each
OBLITERATION OF PAVEMENT MARKING	310 SF	318 SF	325 SF	338 SF	346 SF

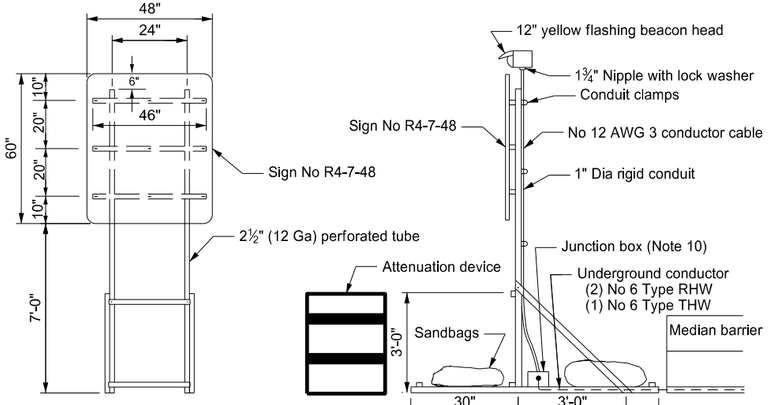
ADVANCE WARNING SIGN SPACING			
Road Type	Minimum Distance Between Signs (ft)		
	A	B	C
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1,350	2,200
Rural Expressway and Freeway (70 mph to 75 mph)	1,000	1,500	2,640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1,000	1,500

SPEED LIMIT SIGNING		
ROADWAY EXISTING SPEED LIMIT	SPEED LIMIT TO BE USED	
	XX	YY
55	50	55
60	50	60
65	55	65
70	60	70
75	65	75

PRECAST CONCRETE MEDIAN BARRIER TABLE	
Roadway ℄ to roadway ℄	Number-median barrier length
75'	48 - 480'
84'	44 - 440'
104'	43 - 430'



DETAIL "A"



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"

KEY

Type I barricade	Work area
Type II barricade	Flagger
Type III barricade	Sequencing arrow panel
Sign	Delineator drum

LEGEND

E Obliteration of pavement marking (10' line, 30' skip, centerline)
F Obliteration of pavement marking (edge lines)
G Raised pavement markers (white) @ 5' centers
H Raised pavement markers (yellow) @ 5' centers
J Drums spaced @ "S" centers
K Drums spaced @ 40' centers

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

9-7-2012

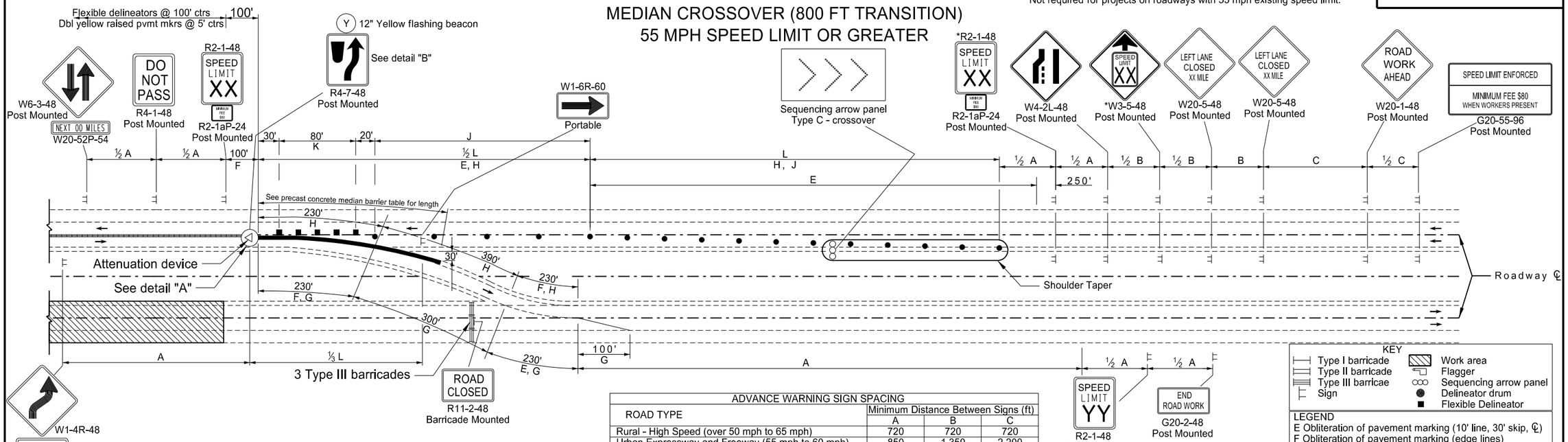
REVISIONS

DATE	CHANGE
6/23/2014	Revised Note 8
3/15/2016	Removed Do Not Pass sign and updated notes
11/14/2016	Revised Attenuation width Termination area and quantities
8/17/2017	Updated note & quantities
11/01/2019	Note, sign #s, Del Drums update

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

TRAFFIC CONTROL SYSTEM
MEDIAN CROSSOVER (800 FT TRANSITION)
55 MPH SPEED LIMIT OR GREATER

*Not required for projects on roadways with 55 mph existing speed limit.

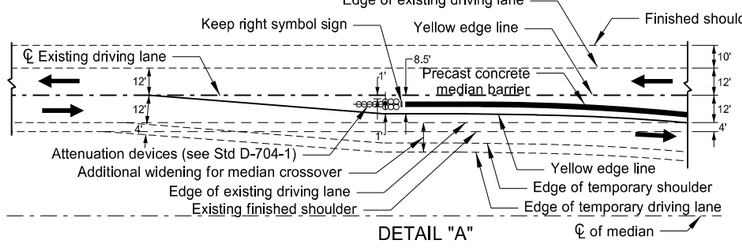


ADVANCE WARNING SIGN SPACING			
ROAD TYPE	Minimum Distance Between Signs (ft)		
	A	B	C
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway and Freeway (55 mph to 60 mph)	850	1,350	2,200
Rural Expressway and Freeway (70 mph to 75 mph)	1,000	1,500	2,640
Interstate/4-Lane Divided (Maintenance and Surveying)	750	1,000	1,500

KEY

Type I barricade	Work area
Type II barricade	Flagger
Type III barricae	Sequencing arrow panel
Sign	Delineator drum
	Flexible Delineator

LEGEND
E Obliteration of pavement marking (10' line, 30' skip, ℄)
F Obliteration of pavement marking (edge lines)
G Raised pavement markers (white) 5' centers
H Raised pavement markers (yellow) 5' centers
J Drums spaced @ "S" centers
K Flexible delineators-4 spaces @ 20'

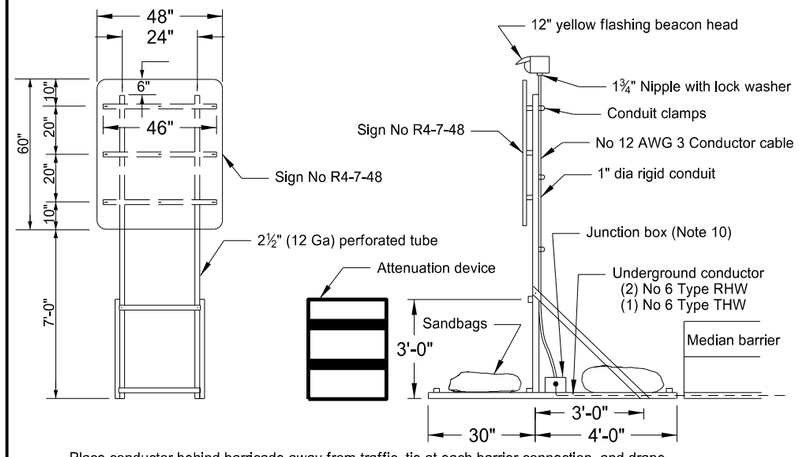


DETAIL "A"

PRECAST CONCRETE MEDIAN BARRIER TABLE	
Roadway ℄ to roadway ℄	Number-median barrier length
75'	37 - 370'
84'	36 - 360'
104'	36 - 360'

ROADWAY EXISTING SPEED LIMIT	SPEED LIMIT TO BE USED	
	XX	YY
55	50	55
60	50	60
65	55	65
70	60	70
75	65	75

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 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)
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 $80" 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.



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"

CROSSOVER QUANTITY SUMMARY					
	ROADWAY EXISTING SPEED LIMIT				
	55 MPH	60 MPH	65 MPH	70 MPH	75 MPH
TYPE III BARRICADES	3 Each	3 Each	3 Each	3 Each	3 Each
FLASHING BEACON	1 Each	1 Each	1 Each	1 Each	1 Each
FLEXIBLE DELINEATORS	5 Each	5 Each	5 Each	5 Each	5 Each
DELINEATOR DRUMS	22 Each	22 Each	22 Each	22 Each	22 Each
SEQUENCING ARROW PANELS TYPE C-CROSSOVER	1 Each	1 Each	1 Each	1 Each	1 Each
PORTABLE PRECAST CONCRETE MEDIAN BARRIERS	See "PRECAST CONCRETE MEDIAN BARRIER TABLE"				
ATTENUATION DEVICES	1-Type B-55	1-Type B-60	1-Type B-65	1-Type B-70	1-Type B-75
RAISED PAVEMENT MARKERS (Yellow)	370 Each	388 Each	406 Each	424 Each	442 Each
RAISED PAVEMENT MARKERS (White)	173 Each	173 Each	173 Each	173 Each	173 Each
OBLITERATION OF PAVEMENT MARKING	298 SF	305 SF	313 SF	332 SF	339 SF

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

5-31-12

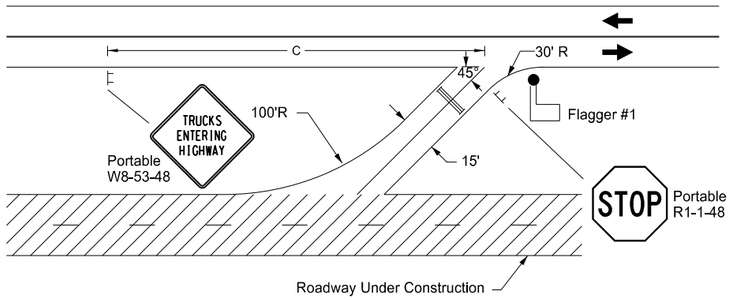
REVISIONS

DATE	CHANGE
6/23/2014	Revised Note 8
3/15/2016	Removed Do Not Pass sign and updated notes
11/14/2016	Revised attenuation width Termination area and quantities
8/17/2017	Updated note and quantity
11/01/2019	Note, sign #, & Del Drum update

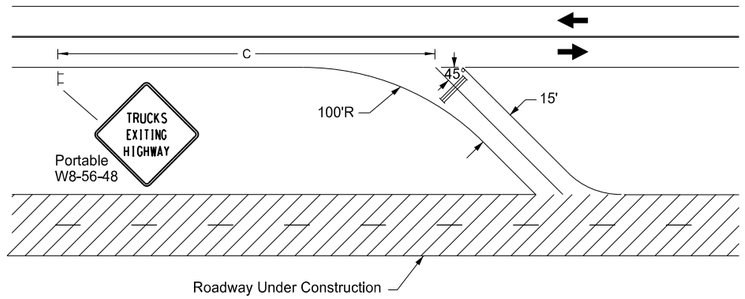
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

CONSTRUCTION SIGNING MEDIAN CROSSOVER

D-704-45



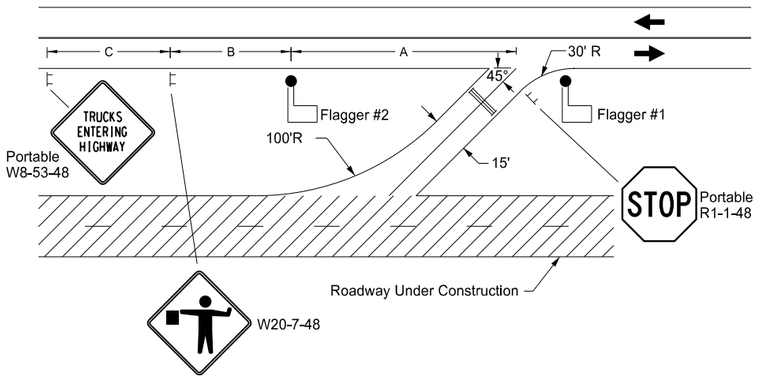
TRUCKS ENTERING ROADWAY
(ADT 2000 or Less)



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 (0ver 30 mph to 40 mph)	280	280	280
Urban - High Speed (0ver 40 mph to 50 mph)	360	360	360
Rural - High Speed (0ver 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

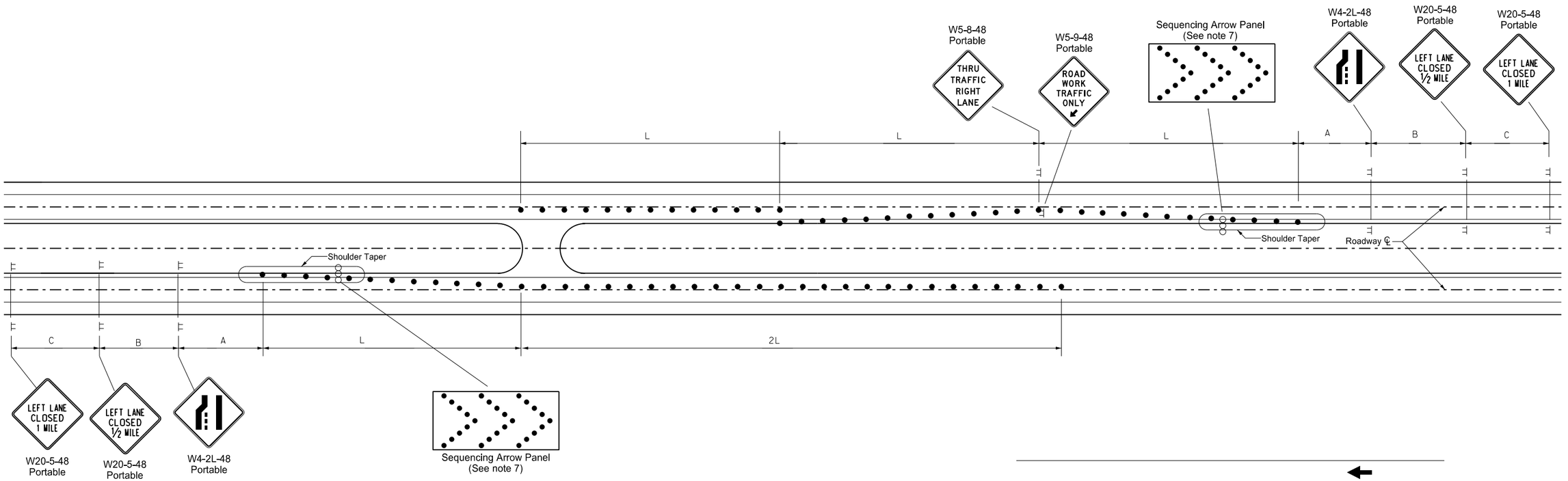
REVISIONS

DATE	CHANGE
06-19-14	Deleted sign W16-2-24.
09-27-17	Updated to active voice.
11-01-19	New Design Engineer PE Stamp.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

CONSTRUCTION SIGN AND BARRICADE LOCATION DETAILS
CONSTRUCTION TRAFFIC MEDIAN CROSSING

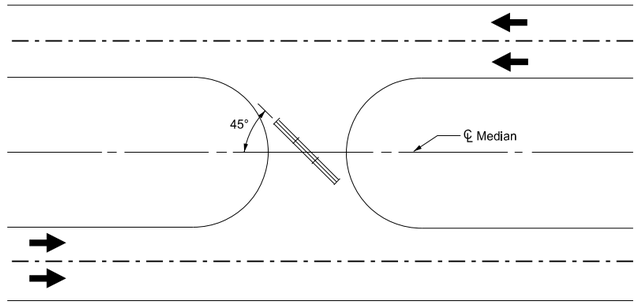
D-704-49



Notes:
1. Include all costs for construction signing and devices in other items.
2. Remove construction signs and channelizing devices daily and barriecade 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 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 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).

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



BARRICADE LOCATION DETAIL

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

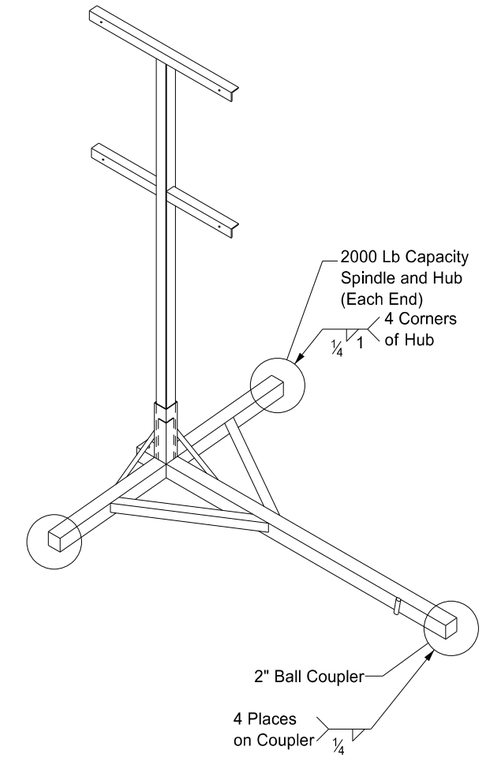
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
11-19-12

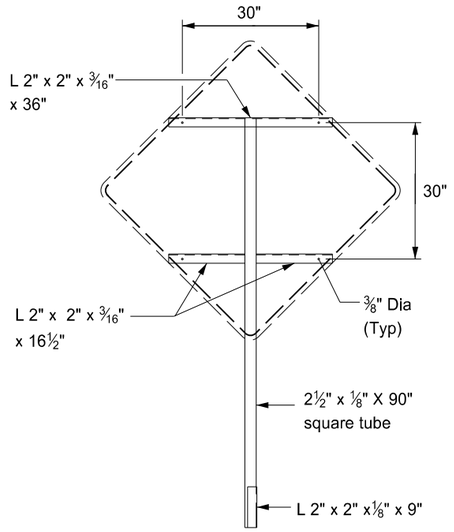
REVISIONS

DATE	CHANGE
06-24-14	Changed W5-9-48 to portable mounted.
09-06-19	Update Notes to active voice &
11-01-19	New Design Engr PE Stamp. Identified Shoulder Taper.

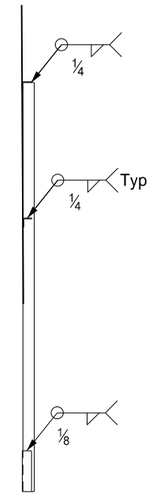
PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



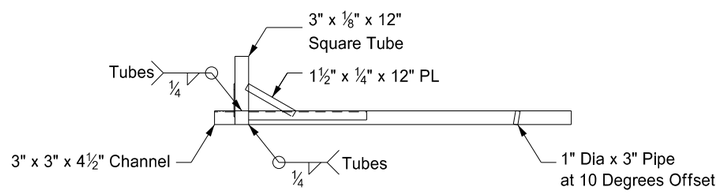


FRONT

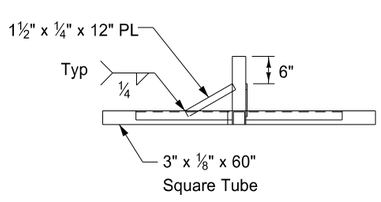


RIGHT

SIGN SUPPORT



FRONT



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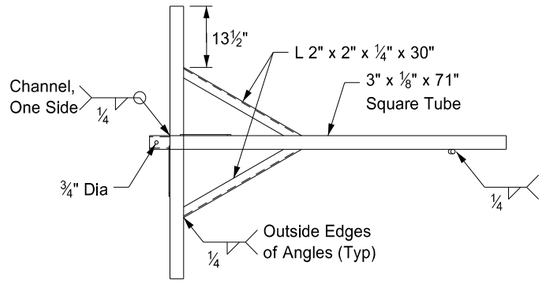


TOP

TRAILER

Notes:

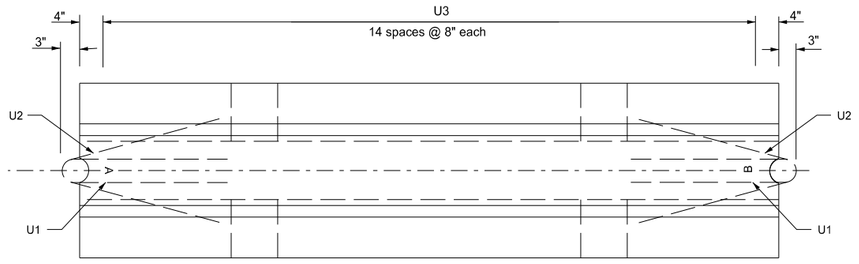
1. The maximum weight of the assembly is 250 pounds.
2. Use a 14" wheel and tire.
3. Automotive and equipment axle assemblies may not be used for trailer-mounted sign supports.
4. Other NCHRP 350 crash tested assemblies are acceptable.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-23-10	
REVISIONS	
DATE	CHANGE

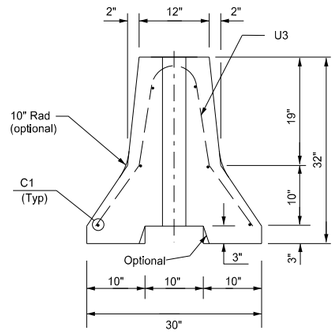
This document was originally issued and sealed by Roger Weigel Registration Number PE-2930, on 11/23/10 and the original document is stored at the North Dakota Department of Transportation

PORTABLE PRECAST CONCRETE MEDIAN BARRIER
(TEMPORARY USAGE)

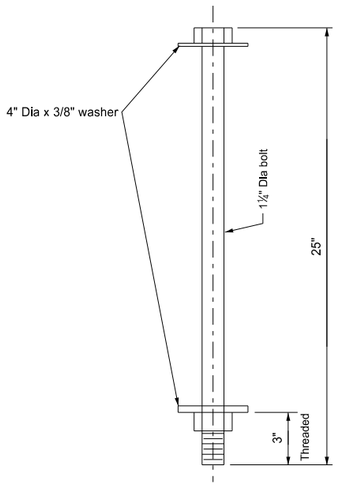
D-704-51



Plan View



End View

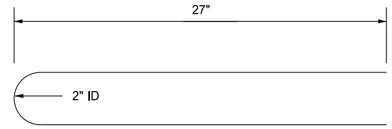


Connecting Bolt Detail

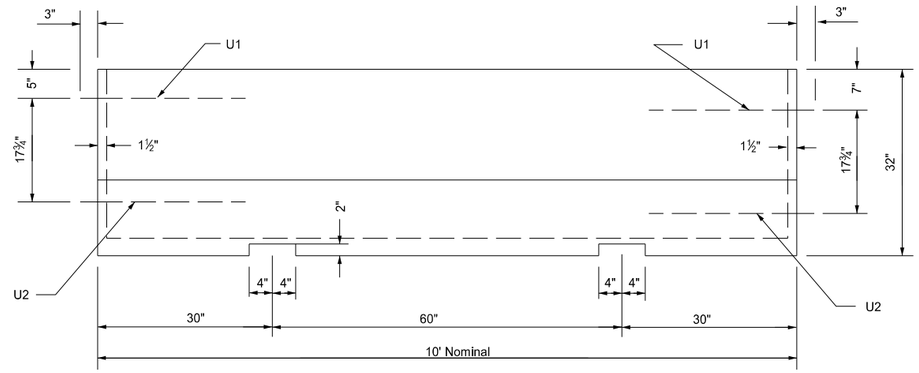
(One per 10 Ft section)

Notes:

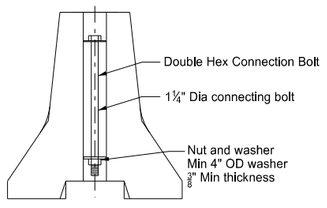
1. Galvanize all exposed hardware as per ASTM A153, except for the loop inserts.
2. Use AAE-3 Concrete.
3. Provide steel in accordance with Section 612 of NDDOT Standard Specifications.
4. Imprint barrier ends A and B as shown with 4 inch letters. Field match A end with B end.
5. Place barrier markers at the center of the barrier at 20' centers.
6. Connect barrier sections with 1 $\frac{1}{4}$" Dia A-307 double hex connecting bolt. Maintain bottom nut and washer connection for duration of barrier installation.
7. Place barrier to minimize openings between individual sections.



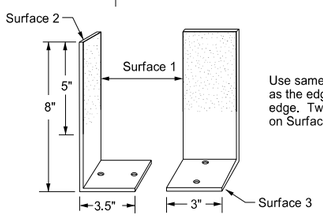
U1 Bar Detail



Side View

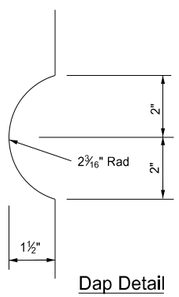


Bolt Connection Detail

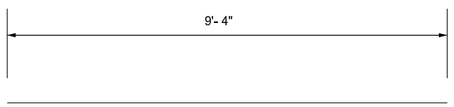


Use same color reflective faces as the edge line along barrier edge. Two way reflective on Surface 1 & 2.

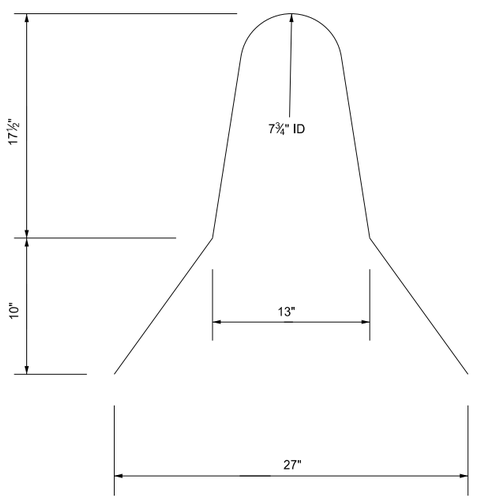
Barrier Marker Detail



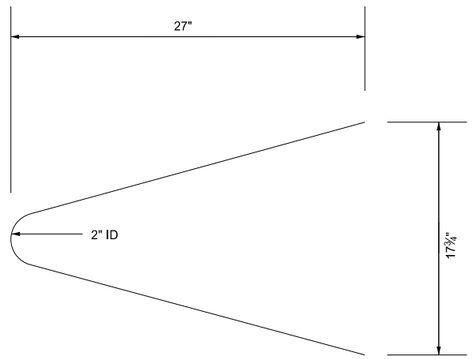
Dap Detail



C1 Bar Detail



U3 Bar Detail



U2 Bar 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

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

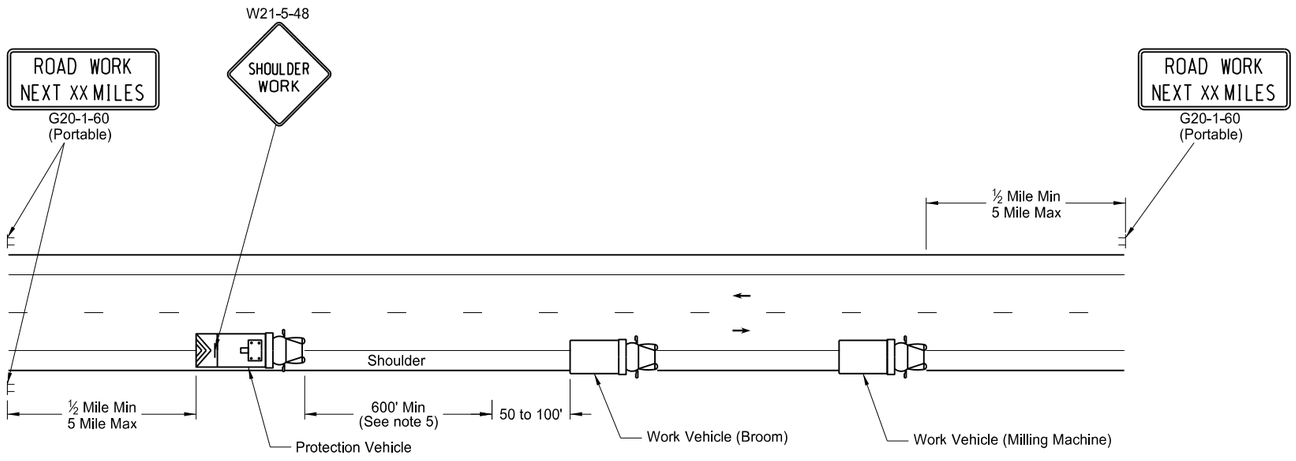
Adhesive
Use factory applied solid butyl rubber ⅛" thick, 2" wide on 2¼" wide release paper on surface 3 to temporarily mount markers to portable concrete barrier.

Bar List				
Mark	Size	No.	Length	Shape
C1	4	6	9'- 4"	Straight
U1	4	2	4'- 8"	Bent
U2	4	2	4'- 10¼"	Bent
U3	4	15	5'- 4"	Bent

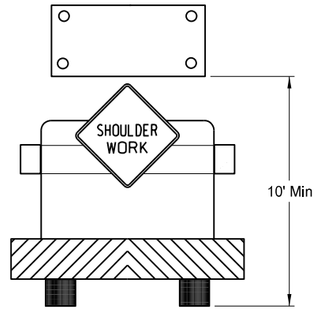
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
07-20-12	
REVISIONS	
DATE	CHANGE
9-27-17	Updated to active voice
11-01-19	New Design Engr PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 11/1/19 and the original document is stored at the North Dakota Department of Transportation

MOBILE OPERATION
Grinding Shoulder Rumble Strips



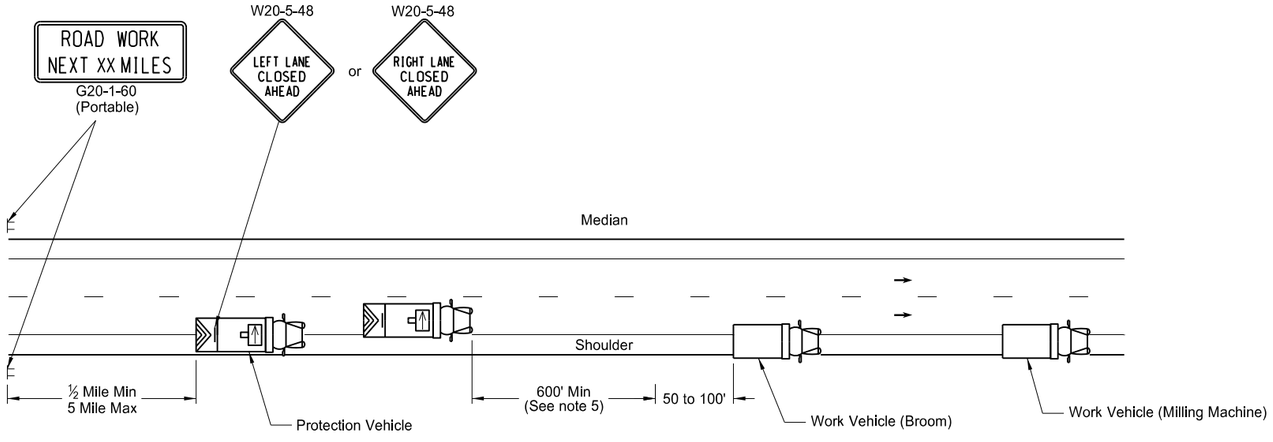
TWO LANE - TWO WAY ROADWAY



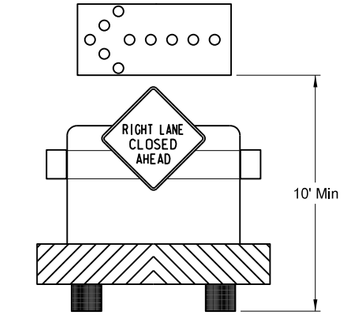
TWO LANE - TWO WAY ROADWAY

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.

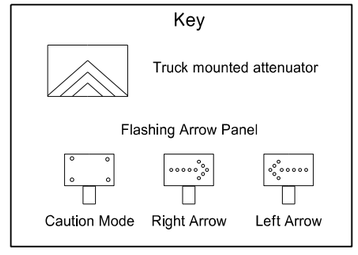


INTERSTATE & 4 LANE DIVIDED HIGHWAY



INTERSTATE & 4 LANE DIVIDED HIGHWAY

Typical Protection Vehicle with Flashing Arrow Panel In Flashing Arrow Mode

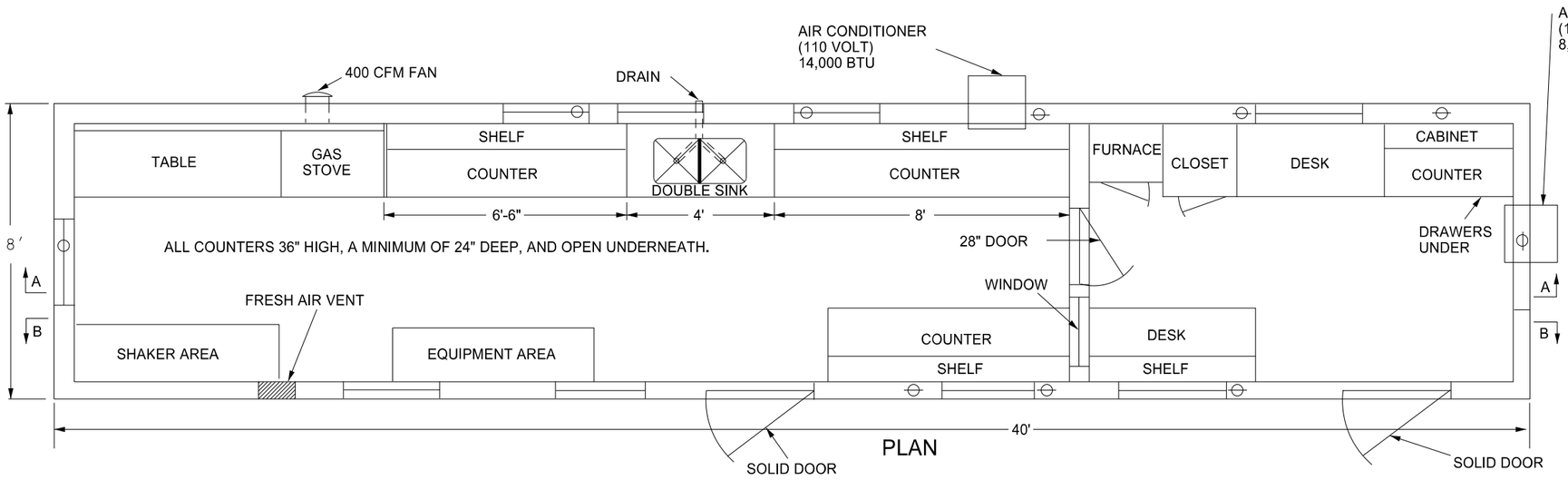


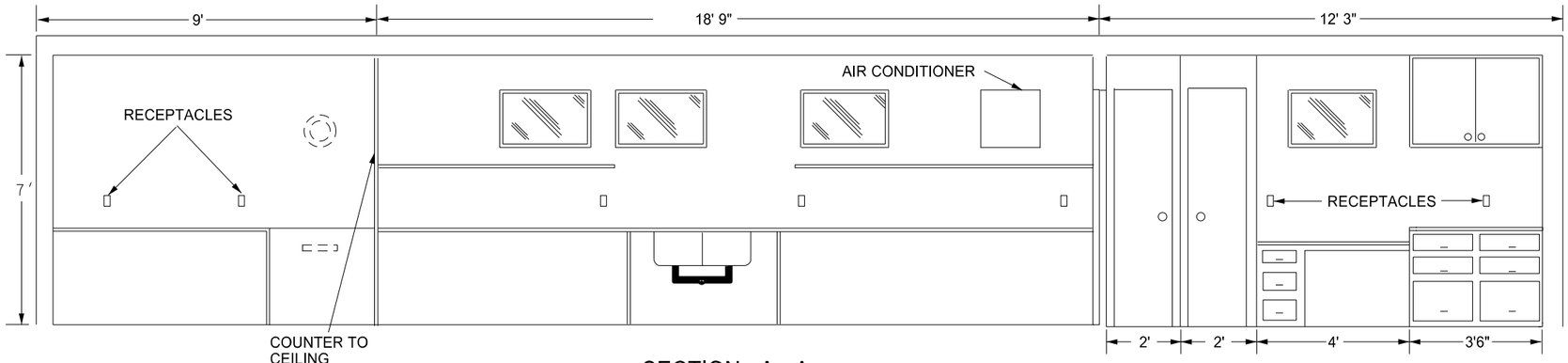
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-15-12	
REVISIONS	
DATE	CHANGE
8-17-17	Updated notes & signs
10-03-19	New Design Engineer PE Stamp

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683, on 10/3/19 and the original document is stored at the North Dakota Department of Transportation

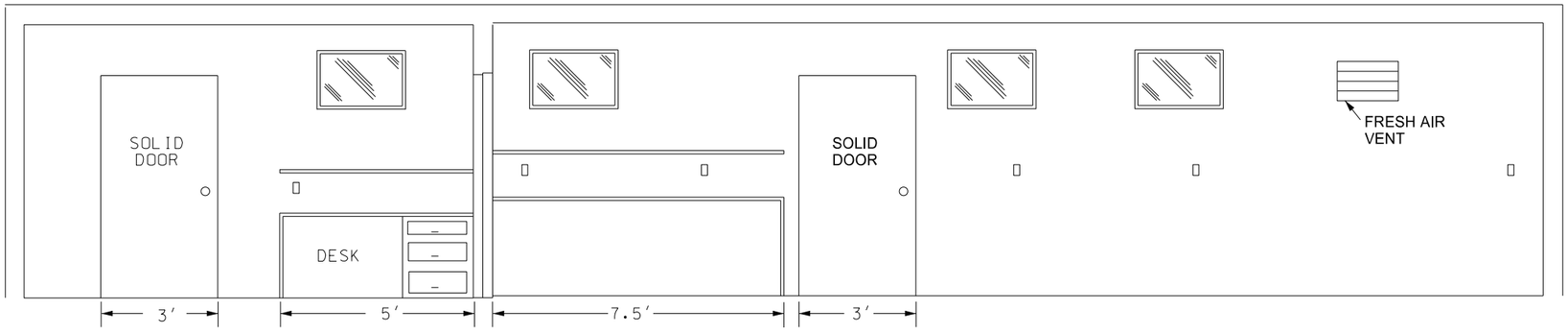
BITUMINOUS LABORATORY

D-706-1





SECTION A - A



SECTION B - B

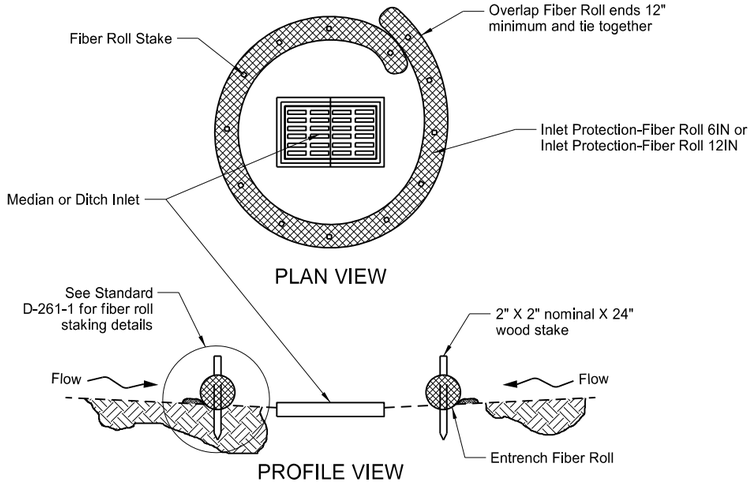
Provide a laboratory with the following:

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.

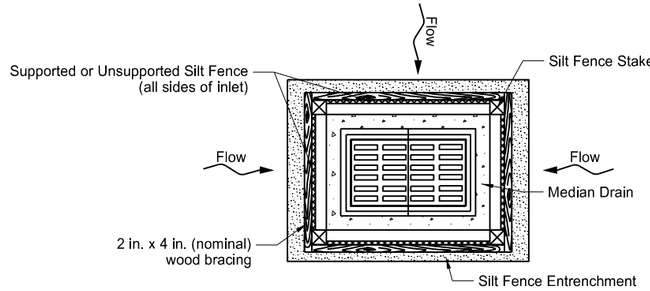
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
07-30-14	Changed standard's title and revised notes.
01-11-16	Revised notes.
08-27-19	New Design Engineer PE Stamp

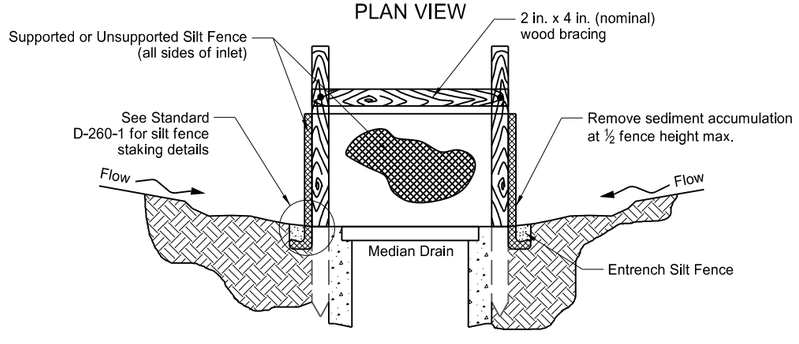
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 08/27/19 and the original document is stored at the North Dakota Department of Transportation

EROSION AND SILTATION CONTROLS
MEDIAN OR DITCH INLET PROTECTION

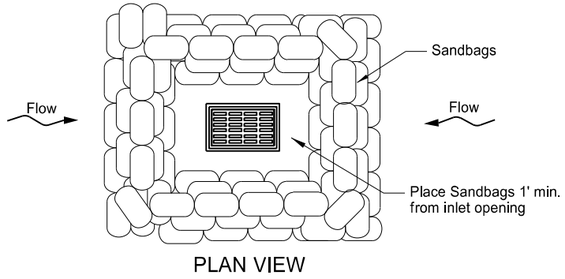


FIBER ROLL PROTECTION (MEDIAN OR DITCH INLET)

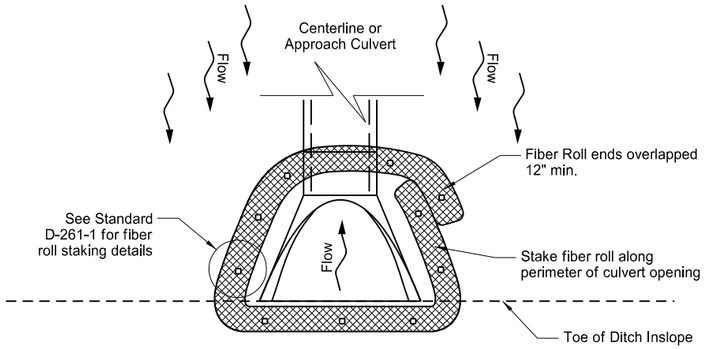




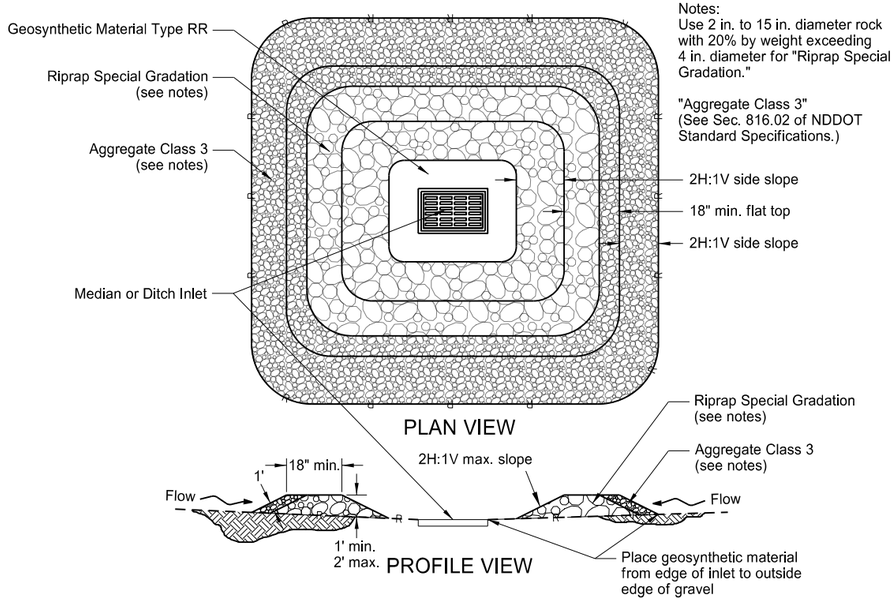
SILT FENCE PROTECTION (MEDIAN OR DITCH INLET)



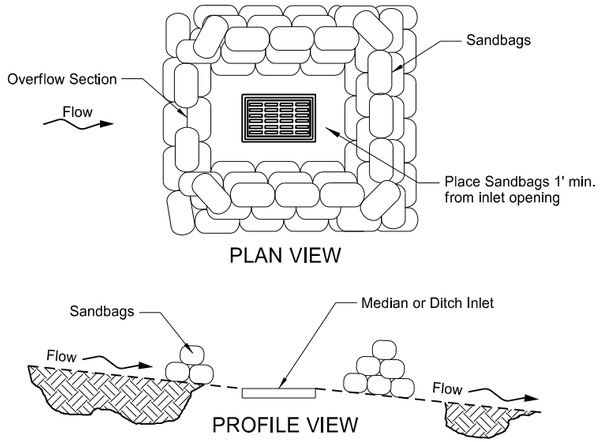
SANDBAG PROTECTION (LOW POINT)



FIBER ROLL PROTECTION (INLET OF CULVERT)



GRAVEL INLET PROTECTION (MEDIAN OR DITCH INLET)

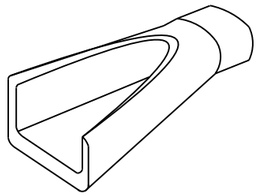


SANDBAG PROTECTION (ON SLOPE)

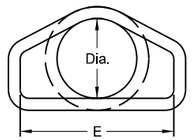
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-03-13	
REVISIONS	
DATE	CHANGE
06-26-14	Updated reference to standard drawing number for fiber roll staking details.
10-01-14	Updated reference to standard drawing number for silt fence.
10-17-17	Updated to active voice.
08-27-19	New Design Engineer PE Stamp.

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

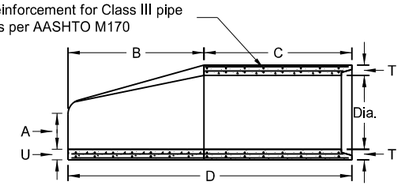
REINFORCED CONCRETE PIPE CULVERTS AND END SECTIONS
(Round Pipe)



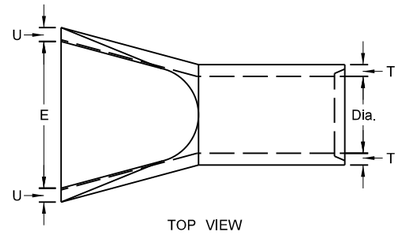
PERSPECTIVE



END VIEW



SIDE VIEW



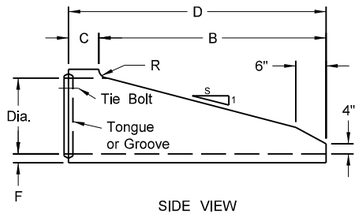
TOP VIEW

REINFORCED CONCRETE PIPE - FLARED END SECTION

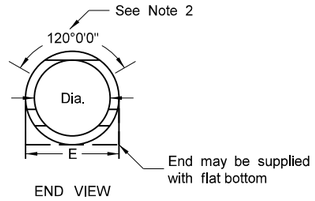
Reinforcement to be equivalent to Class III RCP

FLARED END SECTION						
TERMINAL DIMENSIONS						
DIA	A	B	C	D	E	U
12	0'-4"	2'-0"	4'-0⅞"	6'-0⅞"	2'-0"	2"
15	0'-6"	2'-3"	3'-10"	6'-1"	2'-6"	2¼"
18	0'-9"	2'-3"	3'-10"	6'-1"	3'-0"	2½"
21	0'-9"	3'-0"	3'-1"	6'-1"	3'-6"	2¾"
24	0'-9½"	3'-7½"	2'-6"	6'-1½"	4'-0"	3"
27	0'-10½"	4'-0"	2'-1½"	6'-1½"	4'-6"	3¼"
30	1'-0"	4'-6"	1'-7¾"	6'-1¾"	5'-0"	3½"
36	1'-3"	5'-3"	2'-9"	8'-0"	6'-0"	4"
42	1'-9"	5'-3"	2'-9"	8'-0"	6'-6"	4½"
48	2'-0"	6'-0"	2'-0"	8'-0"	7'-0"	5"
54	2'-3"	5'-5"	2'-9¼"	8'-2¼"	7'-6"	5½"
60	2'-11"	5'-0"	3'-3"	8'-3"	8'-0"	5"
66	2'-6"	6'-0"	2'-3"	8'-3"	8'-6"	5½"
72	3'-0"	6'-6"	1'-9"	8'-3"	9'-0"	6"
78	3'-0"	7'-6"	1'-9"	9'-3"	9'-6"	6½"
84	3'-0"	7'-6½"	1'-9"	9'-3½"	10'-0"	6½"
90	3'-5"	7'-3½"	2'-0"	9'-3½"	11'-0"	6½"

TRAVERSABLE END SECTION							
DIA	B	C	D	E	F	R	S
15"	4'	9"	4'-9"	1'-7½"	2¼"	3"	6
18"	5'-9"	9"	6'-6"	1'-11"	2½"	3"	6
24"	6'	1'	7'	2'-6"	3"	3"	4
30"	7'-6"	1'	8'-6"	3'-1"	3½"	3½"	4
36"	7'-3"	15"	8'-6"	3'-8"	4"	3"	4



SIDE VIEW



END VIEW

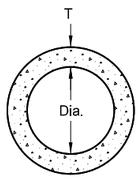
NOTES (Traversable End Section):

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.

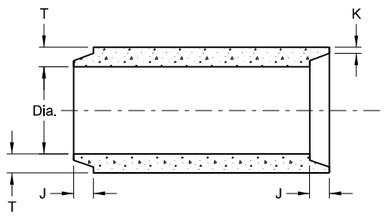
REINFORCED CONCRETE PIPE - TRAVERSABLE END SECTION

Reinforcement to be equivalent to Class III RCP

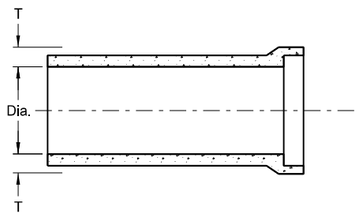
All Classifications of Round Concrete Pipe					
Internal Dia of pipe in Inches	Cross-Sectional Water Area	Weight per lin. foot of Pipe Std. Wall	Joint J Groove End Min./Max.	Joint K Tongue End Min.	Minimum Wall Thickness (T)
Dia	Sq. ft.	Lbs.	In.	In.	In.
12	0.79	92	1⅛-2⅛	¾	2
15	1.23	127	1¾-2¾	⅞	2¼
18	1.77	168	1⅞-2⅛	1	2½
21	2.40	214	1⅞-3⅛	1⅛	2¾
24	3.14	265	2⅛-3¼	1⅛	3
27	3.98	322	2¾-4	1¼	3¼
30	4.91	384	3¼-4¼	1¼	3½
33	5.94	452	3¼-4¼	1½	3¾
36	7.07	524	3½-4¼	1½	4
42	9.62	685	3¾-4¾	1¾	4½
48	12.57	685	3⅞-4¾	1⅞	5
54	15.90	1070	4⅛-5¼	2	5½
60	19.63	1296	4½-5½	2¼	6
66	23.76	1542	5-6	2⅝	6½
72	28.27	1810	5⅝-6¾	2⅝	7
78	33.18	2098	6¼-7¼	2⅝	7½
84	38.48	2410	5⅝-7¾	3⅜	8
90	44.18	2793	6¾-8½	3⅛	8½
96	50.27	3092	7-8¾	3½	9
102	56.75	3466	7-8¾	3½	9½
108	63.62	3864	7¼-8½	3¾	10



END VIEW



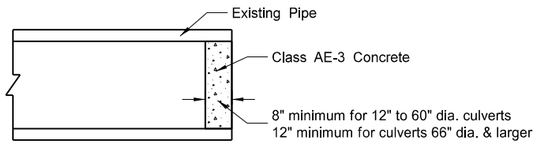
TONGUE & GROOVE JOINT



BELL & SPIGOT JOINT

CIRCULAR PIPE

JOINTS FOR REINFORCED CONCRETE PIPE



CONCRETE PIPE PLUG

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.

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

This document was originally issued and sealed by Jon Ketterling Registration Number PE-4684, on 11/21/16 and the original document is stored at the North Dakota Department of Transportation

REINFORCED CONCRETE PIPE ARCH CULVERTS AND END SECTIONS

D-714-2

NOMINAL DIMENSIONS OF RCP ARCH CULVERTS						DIMENSIONS OF END SECTIONS											DIMENSIONS OF INTERMEDIATE SECTIONS														STIRRUP REQUIREMENTS						f_c (KSI)		WT. PER FOOT	DOUBLE LINE REINFORCEMENT												SINGLE LINE REINFORCEMENT		
																														CLASS III			CLASS IV							A_s CONTINUOUS BASIC REINFORCEMENT						A_s ADDITIONAL REINFORCEMENT								
SPAN-RISE	EQUIV. SIZE	T	RISE	SPAN	WATER AREA	A	B	C	D	E	F	G	R	SLOPE	WEIGHT IN LBS.		H	I	J	K	L	M	N	P	Q	R1	R2	R3	U	V	Y	As_y	X	Y	As_x	As_y	CLASS				INNER CAGE			OUTER CAGE			"U" INNER CAGE			"V" OUTER CAGE					
IN.	IN.	IN.	IN.	IN.	S.F.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.		SEC. 1	SEC. 2	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.							II	III	IV	LBS.	CL.II	CL.III	CL.IV	CL.II	CL.III	CL.IV	CL.II	CL.III	CL.IV	CL.II	CL.III	CL.IV	CL.II	CL.III	CL.IV
22x13	18	2½	13½	22	1.65	7	27	45	72	36			2	3:1			2	1⅜	⅜	¾	1⅛	1	¼	6	5¾	27½	13¾	5¼									4	4	4	170												0.11	0.14	0.26
29x18	24	3	18	28½	2.8	8½	39	33	72	48			3	3:1			3	1⅝	½	1⅞	1⅞	1⅝	3/16	5 29/32	9 21/32	40 1/16	14 5/16	4 9/32									4	4	4	315												0.16	0.22	0.32
36x23	30	3½	22½	36¼	4.4	9½	50	46	96	60			3	3:1			3½	1 13/16	⅝	1 5/16	1 5/16	1 13/16	3¾	7 1/16	12 3/32	51	18¾	6 1/32	26	29							4	4	4	445	0.09	0.12	0.18	0.07	0.09	0.14	0.09	0.12	0.18	0.07	0.09	0.13	0.18	0.24	0.36
44x27	36	4	26⅝	43¾	6.4	11⅛	60	36	96	72			6	3:1			4	2	¾	1¾	1¾	2	4⅛	8 5/16	15½	62	22½	6⅜	30	34							4	4	4	597	0.11	0.15	0.22	0.09	0.12	0.17	0.11	0.15	0.22	0.09	0.12	0.16	0.22	0.30	0.44
51x31	42	4½	31 5/16	51⅛	8.8	15 13/16	60	36	96	78			6	3:1			4	2	¾	1¾	1¾	2	5 1/16	10 1/16	18	73	26¼	7 9/16	34	39							4	4	4	739	0.13	0.18	0.27	0.10	0.14	0.21	0.13	0.18	0.27	0.10	0.14	0.22	0.26	0.36	0.54
58x36	48	5	36	58½	11.4	21	60	36	96	84			6	3:1			5	2¼	¾	2	2	2¼	6	11 15/32	20½	84	30	8¾	42	43							4	4	4	882	0.15	0.22	0.40	0.12	0.17	0.26	0.15	0.22	0.33	0.12	0.17	0.27	0.30	0.44	
65x40	54	5½	40	65	14.3	25½	60	36	96	90			6	3:1			5	3	¾	1¾	2½	2¼	6⅝	13	22 13/16	92½	33⅜	9 13/16	48	49							4	4	4	1090	0.18	0.24	0.44	0.14	0.19	0.28	0.18	0.24	0.33	0.14	0.19	0.28	0.36	0.48	
73x45	60	6	45	73	17.7	31	60	36	96	96			6	3:1			5	3 5/16	¾	1 5/16	2¾	2½	7½	14 11/16	25 9/32	105	37½	11 1/32	52	55	48	0.55	36	48	0.44	0.98	4	4	5	1320	0.21	0.28	0.52	0.17	0.22	0.33	0.21	0.28	0.36	0.17	0.22	0.33	0.42	0.56	
88x54	72	7	54	88	25.6	31	60	39	99	120			6	2:1			6	3 13/16	1	2 5/16	3¼	2¾	9	17	31 1/16	126	45	12 9/16	60	67	60	0.66	48	60	0.55	1.18	4	5	5	1840	0.26	0.36	0.60	0.20	0.28	0.38	0.26	0.36	0.44	0.20	0.28	0.38	0.52	0.72	
102x62	84	8	62	102	34.6	28½	84	18	102	144			6	2:1			6	4⅛	1	2⅞	3½	3½	10	18 23/32	37 1/32	162½	52	13 31/32	68	77	72	0.77	60	72	0.66	1.37	4	5	5	2412	0.32	0.44	0.70	0.24	0.34	0.48	0.32	0.44	0.49	0.24	0.34	0.44	0.64	0.88	
115x72	90	8½	72	115	44.5	29⅜			133¼		30¼	48		2:1	19100	3950	7	4¼	1	3¼	3¾	3¼	13	23 13/16	38 3/32	183	59	19 9/32	40	87	84	0.88	72	84	0.77	1.57	4	5	5	2894	0.40	0.53	0.75	0.28	0.36	0.51	0.40	0.53	0.75	0.28	0.36	0.51			
122x78	96	9	77¼	122	51.7	30			143¾		40½	54		2:1	22000	6050	7	4½	1	3½	4	4	15¼	24 11/32	40 5/16	218	62	20 1/16	41	96	84	0.88	72	84	0.77	1.57	4	5	5	3285	0.42	0.54	0.77	0.30	0.39	0.56	0.42	0.54	0.77	0.30	0.39	0.56			
138x88	108	10	87⅛	138	66.0	32⅜			160½		81½	66		2:1	23000	15800	7	5	1	4	4½	4½	17⅛	26 27/32	46⅝	269	70	22⅝	48	105	96	0.99	84	96	0.88	1.77	5	5	5	4126	0.50	0.64	0.91	0.34	0.45	0.63	0.50	0.64	0.91	0.34	0.45	0.63			
154x97	120	11	96⅞	154	81.8	35⅞			175		96	78		2:1	27000	24600	7	5½	1	4½	5	5	18⅛	29 32	53	301⅜	78	24	70	125	108	1.10	96	108	0.99	1.96	5	5	5	5048	0.59	0.76	1.07	0.41	0.53	0.76	0.59	0.76	1.07	0.41	0.53	0.76			

Equiv. Size = Dia. of Circular Pipe with approximately equivalent cross section area.

As = Minimum Circumferential Steel Area (in square inches) per lineal foot of pipe barrel in each continuous basic cage and additional cages in area denoted "U" and "V".

As_x and As_y = Minimum Stirrup Reinforcement Steel Area in square inches per lineal feet of Pipe Arch.

Maximum spacing of Stirrups = 12"

Tolerance in radial dimensions at Joints = + ⅛ for 54" or smaller & + ¼" for 60" or larger.

Tolerance in length of Joints (H) + ¼".

Laying length underruns shall not be more than ½".

f_c (KSI) = Minimum compressive strength of concrete in thousands of lbs. per square inch.

Laying length of pipe shall not be less than 6 feet for size 84" and larger.

¾" Minimum Reinforcement cover.

Reinforced Concrete Pipe Arch & End Sections shall conform to Sec. 714 of the Std. Specs.

Design of End Sections shall conform to Class III Reinforced Concrete Pipe Arch. For Class IV and Class V reinforced concrete pipe arches and end sections, shop drawings and design calculations shall be sealed by a Professional Engineer and submitted for Engineer's review.

Tolerance in Rise and Span = + 2% of Tabular values.

Tolerance in Wall thickness (T) = Not less than Design T by more than 7% or ¼".

Dimension "U" and "V" is measured on the ℄ of the Culvert wall.

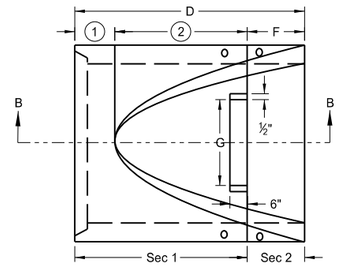
NOTE:

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

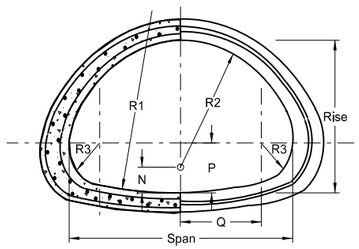
Joints shall be sealed with rubber gaskets or with sealer approved by the engineer whenever pipe are specified for storm drains or sanitary sewers.

① 2' 0" for groove end and 2' 7" for tongue end.

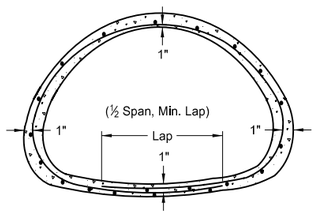
② 72" for 90" and 96". 48" for 108" and 120".



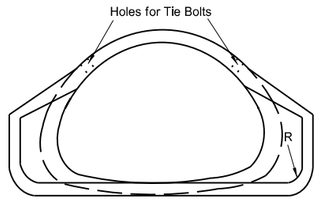
PLAN VIEW
TWO-PIECE END SECTION



TRANSVERSE SECTION
END VIEW



SINGLE-LINE
REINFORCEMENT



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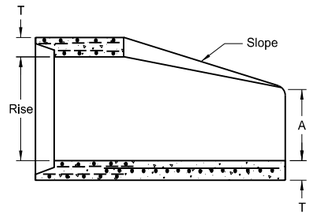
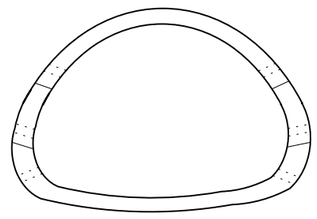
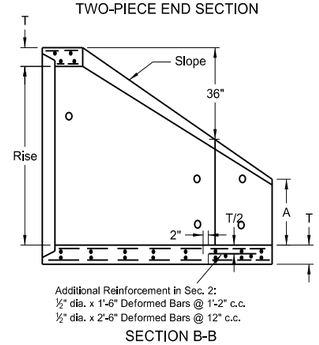


SECTION A-A

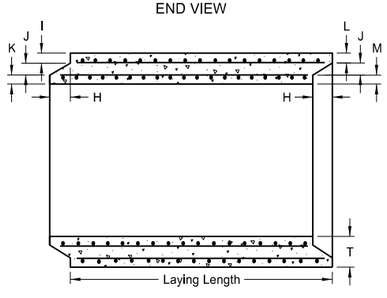


END VIEW

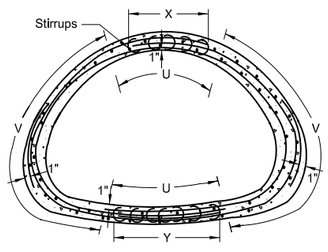


SECTION B-B

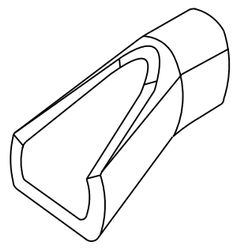
END SECTION
FOR ARCHES 90" AND LARGER



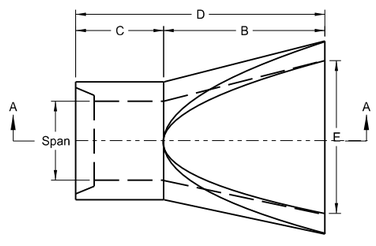
LONGITUDINAL SECTION



DOUBLE-LINE
REINFORCEMENT



PERSPECTIVE VIEW



PLAN VIEW

END SECTION
FOR ARCHES SMALLER THAN 90"

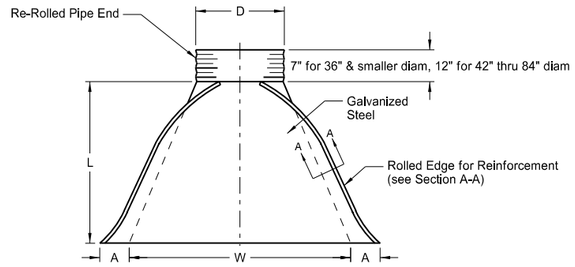
REINFORCED CONCRETE PIPE ARCH CULVERT

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
05-12-14	
REVISIONS	
DATE	CHANGE

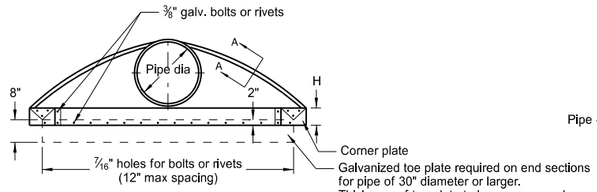
This document was originally issued and sealed by Terrence R. Udland, Registration Number PE-2674, on 05/12/14 and the original document is stored at the North Dakota Department of Transportation

ROUND CORRUGATED STEEL PIPE CULVERTS AND END SECTIONS

D-714-4

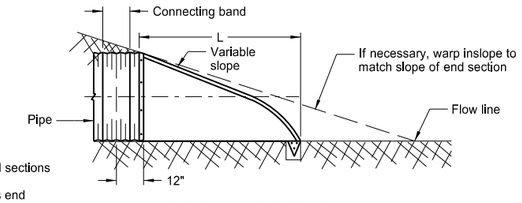


PLAN VIEW



ELEVATION VIEW

Galvanized toe plate required on end sections for pipe of 30" diameter or larger. Thickness of toe plate to be same as end section. Where toe plate is required, the toe plate, bolts, and nuts are to be included in price bid for end sections.



TYPICAL CROSS SECTION
(showing connector section)

* * PIPE DIA.	GALV. THICK.	END SECTION DIMENSIONS A	B	H	L	W	APPROX. SLOPE	BODY PIECE
IN	IN	IN	IN	IN	IN	IN	RATE	
15	0.064	7	8	6	26	30	2½:1	1
18	0.064	8	10	6	31	36	2½:1	1
24	0.064	10	13	6	41	48	2½:1	1
30	0.079	12	16	8	51	60	2½:1	1 or 2
36	0.079	14	19	9	60	72	2½:1	2
42	0.109	16	22	11	69	84	2½:1	2
48	0.109	18	27	12	78	90	2¼:1	2
54	0.109	18	30	12	84	102	2:1	2
* 60	0.109	18	33	12	87	114	1¾:1	3
* 66	0.109	18	36	12	87	120	1½:1	3
* 72	0.109	18	39	12	87	126	1 1/3 :1	3
* 78	0.109	18	42	12	87	132	1¼:1	3
* 84	0.109	18	45	12	87	138	1 1/6 :1	3

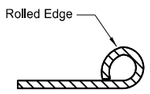
* These sizes have 0.109" sides and 0.138" center panels.

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

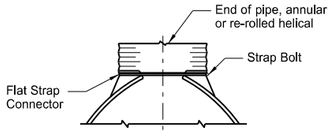
Manufacturers tolerances of above dimensions will be allowed.

Splices to be the lap riveted type.

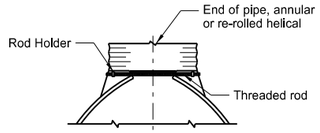
Multiple panel bodies shall have lap seams which are to be tightly joined with ⅜" dia. galv. bolts or rivets. Nuts to be torqued to 25 foot-lbs ±.



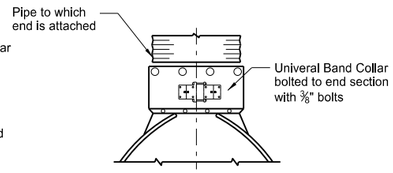
SECTION A-A



TYPE #1
For circular pipes with diameter 24" & smaller



TYPE #2
For circular pipes with diameter 30" through 36"

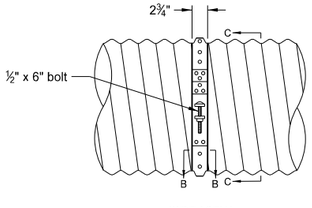


TYPE #3
For all pipe sizes

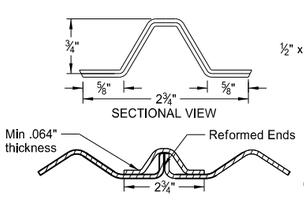
COUPLING BAND DIMENSIONS				
COUPLING TYPE	CORRUGATION PITCH x DEPTH	PIPE SIZE	COUPLING BAND LENGTH	MIN. BAND THICKNESS
Hat Band	2⅔" x ½"	12" - 48"	2¾"	.064"
Annular Band	2⅔" x ½"	12" - 72"	12"	.052"
		78" - 84"	12"	.079"
	3" x 1"	48" - 120"	14"	.052"
Hugger Band	2⅔" x ½" Rerolled End	12" - 72"	10½"	.052"
		78" - 84"	10½"	.079"
	3" x 1" Rerolled End	48" - 120"	10½"	.052"
	5" x 1" Rerolled End	48" - 120"	12"	.064"

NOTES:

1. Pipes and connecting bands shall conform to applicable sections of NDDOT Standard Specifications and to AASHTO M-36.
2. 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 ¼" galv. angle for 60" through 72" dia. and 2½" x 2½" x ¼" galv. angle for 78" and 84" dia.. Angles to be attached by galv. ⅜" dia. bolts and nuts. Angles are to extend from pipe to the corner wing bend.
3. 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.
4. 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.
5. ½" x 8" bolts may be used as a substitute for the ½" x 6" bolts shown in the details.
6. Coupling bands wider than 14" may be used if a minimum of four ½" bolts with maximum spacing of 5½" are used for the connection.
7. Length of spot welds shall be minimum ½".

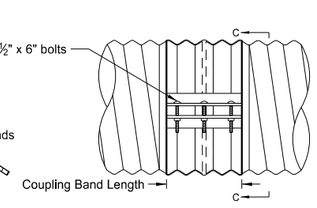


SIDE VIEW

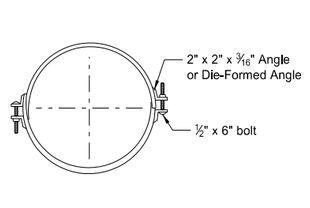


SECTION B-B

HAT BAND FOR FLANGED END PIPE

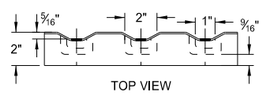


SIDE VIEW

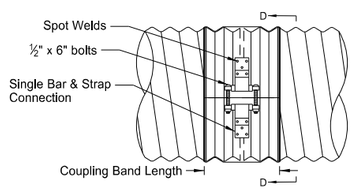


SECTION C-C
Angle Connection

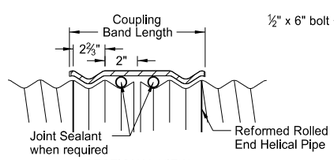
ANNULAR BAND



TOP VIEW
Die-Formed Angle Connector

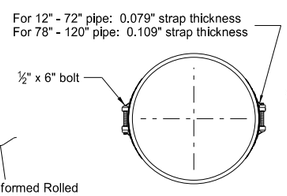


SIDE VIEW

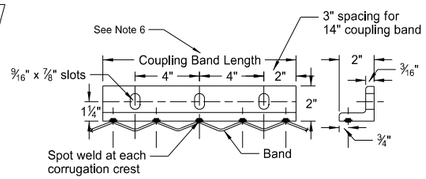


SECTIONAL VIEW

HUGGER COUPLING BAND



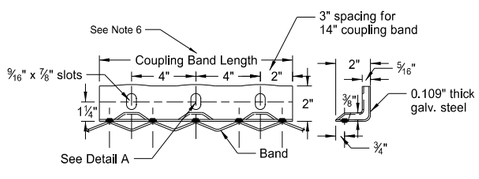
SECTION D-D
Bar & Strap Connection



SIDE VIEW

END VIEW

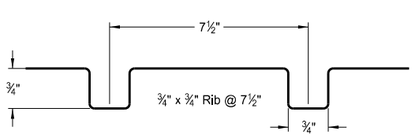
2" x 2" x 3/16" Angle Connector

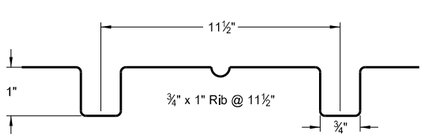


SIDE VIEW

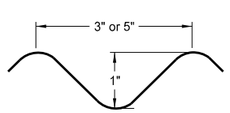
END VIEW

Die-Formed Angle Connector

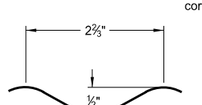




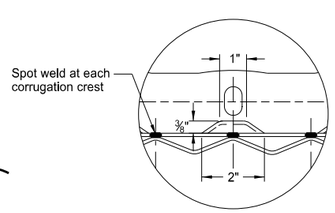
SPIRAL RIB CORRUGATIONS



3" x 1" CORRUGATIONS or
5" x 1" CORRUGATIONS



2⅔" x ½" CORRUGATIONS



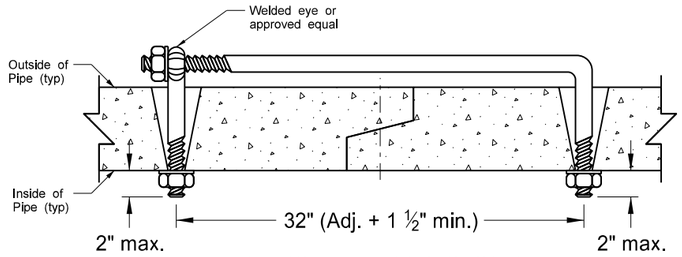
Detail A

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
08-06-13	
REVISIONS	
DATE	CHANGE
01-07-14	End Section Plan View
02-27-14	3" x 1" Corrugation Detail

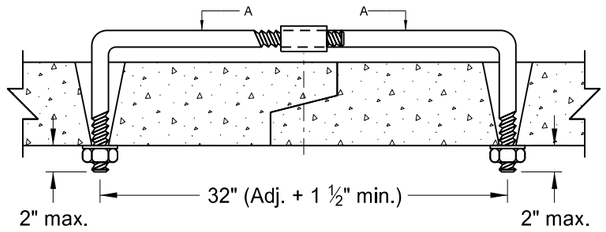
This document was originally issued and sealed by Terrence R. Udland, Registration Number PE- 2674 , on 02/27/2014 and the original document is stored at the North Dakota Department of Transportation

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

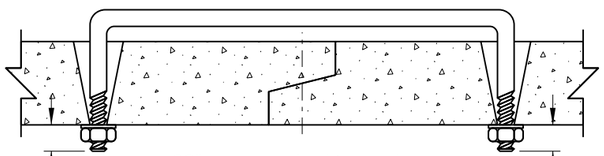
D-714-22



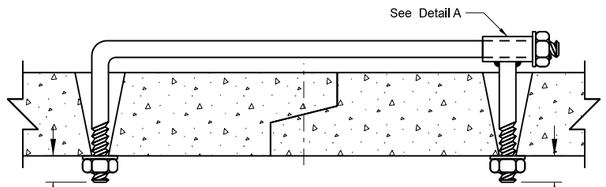
EYE BOLT TIE (PIPES ONLY)



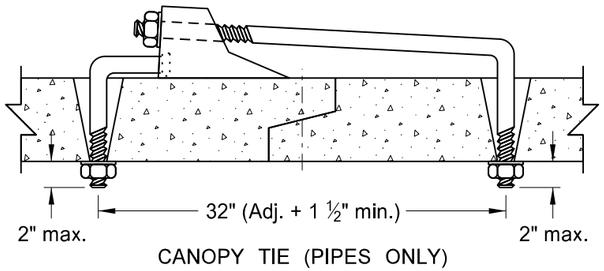
ADJUSTABLE TIE (RCB AND PIPES ONLY)



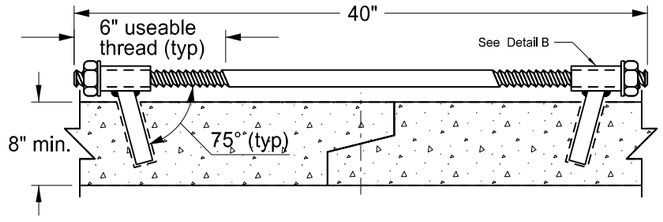
U BOLT TIE (RCB, PIPES, OR CATTLE PASSES)



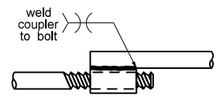
WELDED TIE (RCB AND PIPES ONLY)



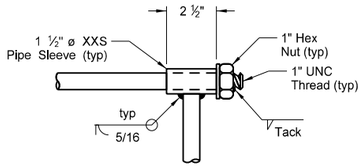
CANOPY TIE (PIPES ONLY)



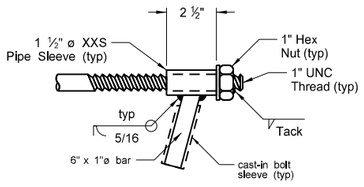
HIDDEN TIE (RCB ONLY)



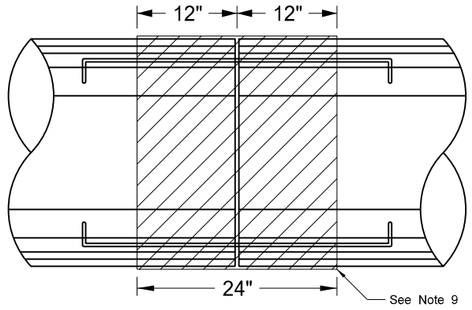
SECTION A-A



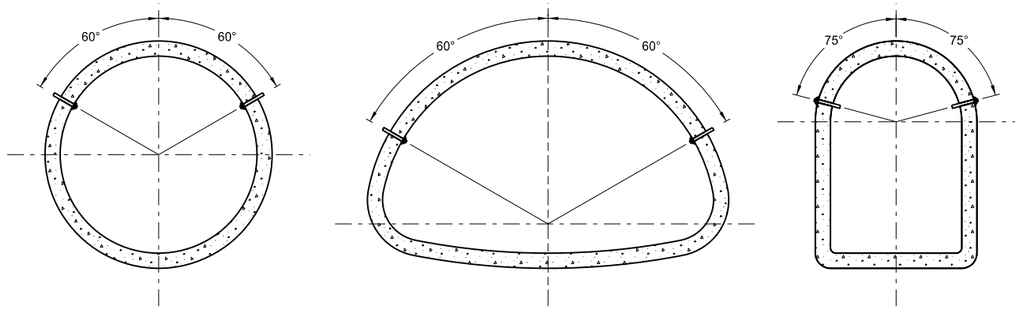
DETAIL A



DETAIL B



PLAN VIEW



END VIEW

REQUIRED SIZE OF TIE BOLTS		
Pipe Size	Thread ø	XXS Pipe Sleeve Inner ø
18" - 24"	⅝" See note 2	¾"
30" - 66"	¾"	1"
72" - 78"	1"	1 ¼"
RCB/Cattle Pass		

NOTES:

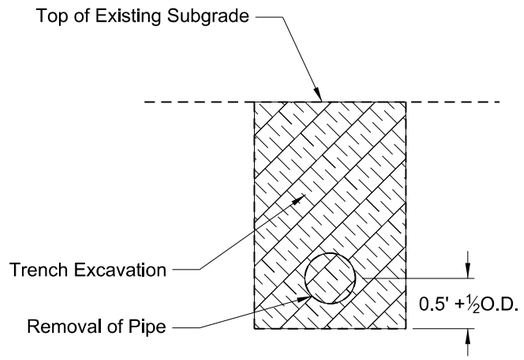
1. The pipe size listed is the inside diameter of round pipe or the equivalent diameter of pipe arch.
2. Cattle Pass and Jacked and Bored pipes shall have pipe ties inserted from the inside of the pipes and grouted into place. Jacked and bored pipes with a diameter of 24" or less do not require pipe ties.
3. Nuts and washers are not required on Jacked and Bored pipes or pipes with a 24" diameter or less. Where nuts and washers are not used, the tie bars shall be inserted and grouted into place.
4. Ties are only for holding pipe or RCB sections together, not for pulling sections tight.
5. Tie bolt assembly shall be hot dip galvanized in accordance with AASHTO M232.
6. Holes in pipes to accommodate tie bolts can be precast or drilled. Tapered holes are permitted when precast. Holes shall have a diameter ¼" larger than the diameter of the thread. Holes in precast RCB's shall contain cast-in bolt sleeves with an inside diameter of 1 ¼".
7. The contractor has the option of selecting the type of tie bolt used from those shown.
8. The cost of precasting or drilling the required holes and furnishing and installing the tie bolts shall be included in the price bid for the appropriate conduit or RCB pay item.
9. All centerline and approach RCP culvert joints shall be tied. Storm drain systems shall have the first three joints including the end section of all free ends tied. 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.
10. Place joint wrap prior to installing ties. Overlap the joint by 12" in both directions.
11. Tie bolts shall conform to ASTM A 36. Nuts shall be be heavy hex and conform to ASTM A 563. Washers shall conform to ASTM F 436, Type 1. Welded pipe sleeves and cast-in bolt sleeves shall conform to ASTM A 53, Grade B.
12. RCB tie locations shall be as shown on 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, Lables

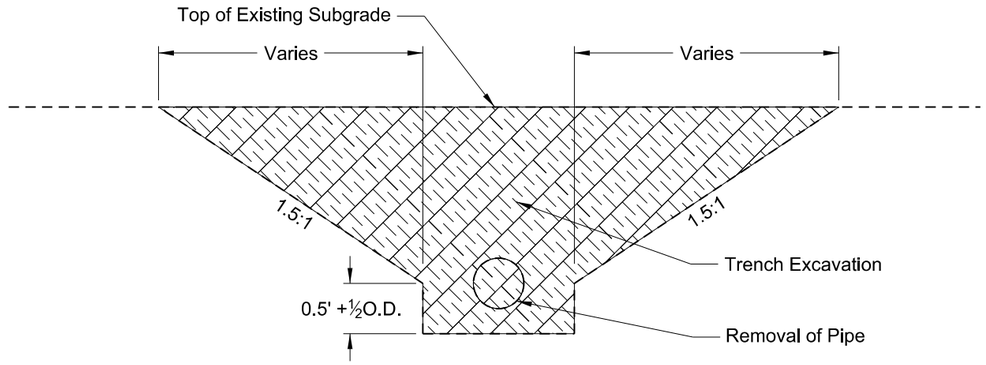
This document was originally issued and sealed by Jonathan David Ketterling, Registration Number PE-4684, on 6/6/2017 and the original document is stored at the North Dakota Department of Transportation

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

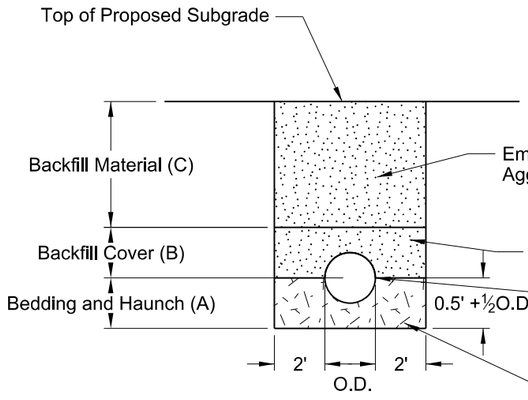
D-714-27



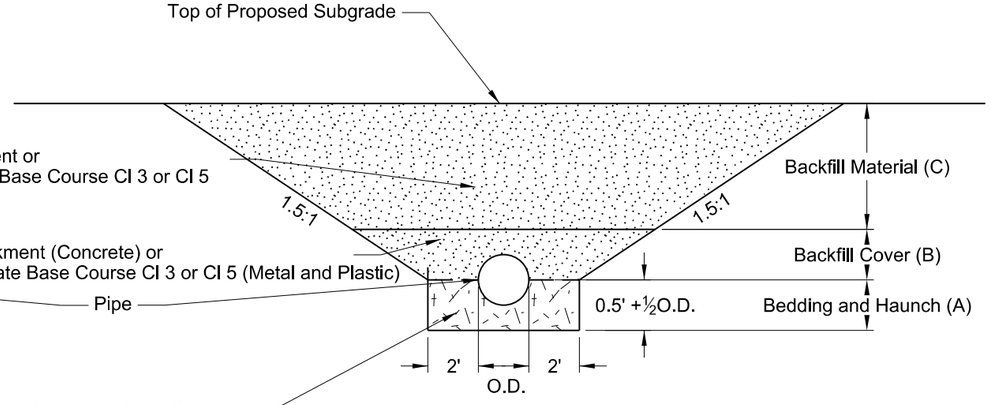
EXCAVATION DETAIL A



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 contactor'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

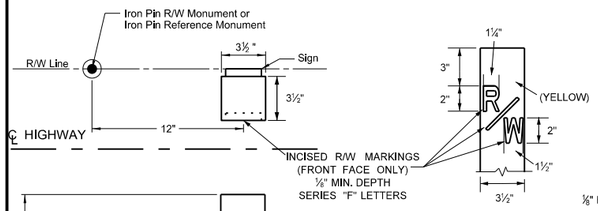
REVISIONS

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

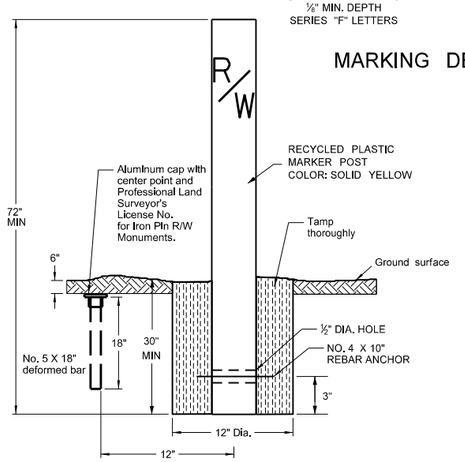
This document was originally issued and sealed by Matthew C. Kurle, Registration Number PE- 8777, on 5/27/2020 and the original document is stored at the North Dakota Department of Transportation

STANDARD MONUMENTS AND RIGHT OF WAY MARKERS

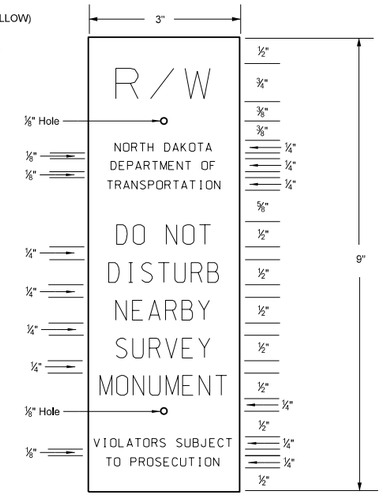
D-720-1



MARKING DETAIL



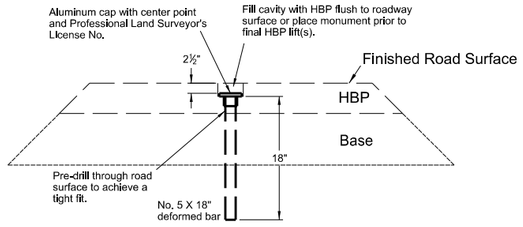
RECYCLED PLASTIC
RIGHT OF WAY MARKER
(WITNESS POST) DETAILS
&
IRON PIN REFERENCE AND R/W
MONUMENT DETAILS



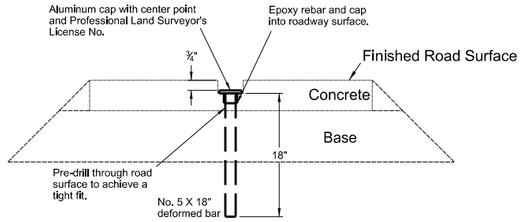
SIGN DETAIL

Black letters on orange high intensity background sheeting meeting ASTM D-4956 Type III or higher on 80 gauge 5052-H38 aluminum. Silk screen graphics. One color print. Attach sign by drilling two holes in the face of the post (side facing the private owner, away from the Department of Transportation right of way). Put inserts into the holes and mount the sign with #4 vandal proof screws. Install sign 2" from top of post.

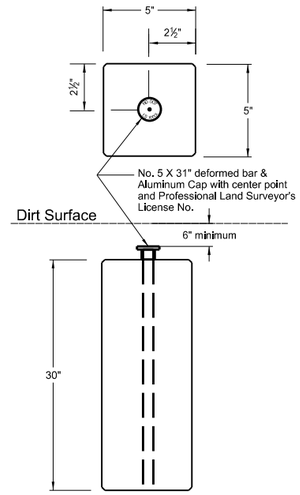
ALIGNMENT MONUMENT DETAILS



IRON PIN
(Within Finished Roadway Surface)



IRON PIN
(Within Finished Roadway Surface)



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

NOTES:

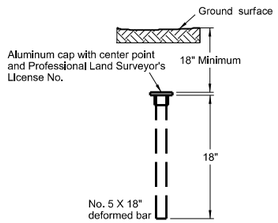
Construct and install Alignment Monuments, Iron Pin Reference Monuments, Iron Pin R/W Monuments, and Right of Way Markers (witness posts) according to Section 720 of the Standard Specifications.

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 Pns 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.

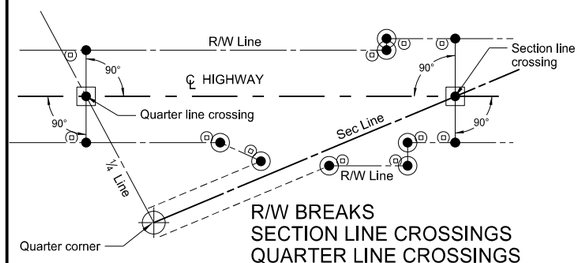
IRON PIN REFERENCE MONUMENT: Place Iron Pins without aluminum caps (No. 5 X 18") as reference monuments on the Right of Way line at section corners, quarter corners, section line crossings, and quarter line crossings.

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.

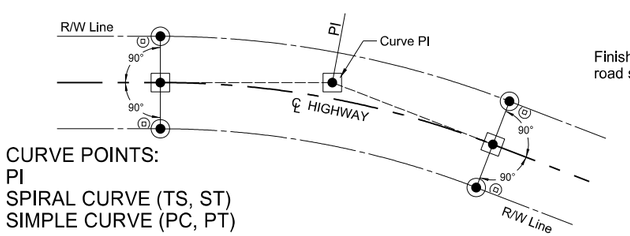


IRON PIN
(Outside Finished Roadway Surface)
(Outside R/W Limits)

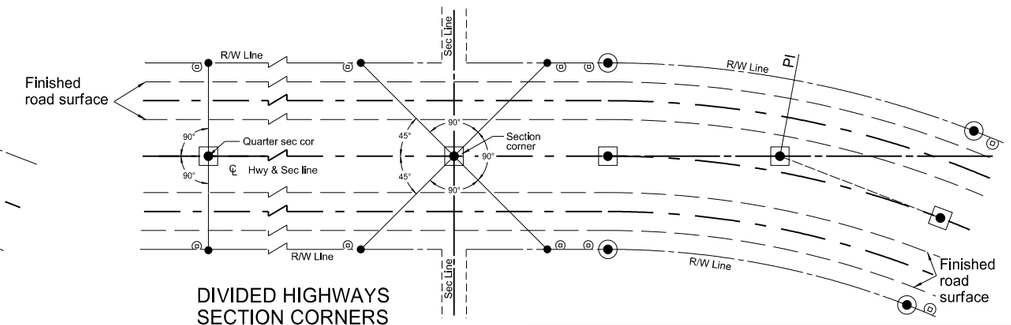
VARIOUS MONUMENT AND MARKER PLACEMENTS



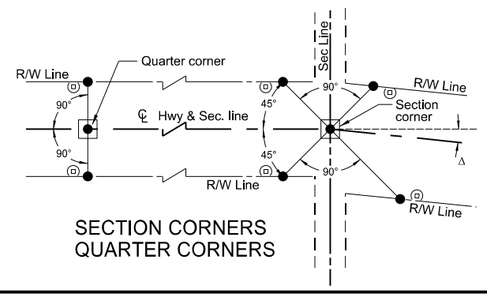
R/W BREAKS
SECTION LINE CROSSINGS
QUARTER LINE CROSSINGS



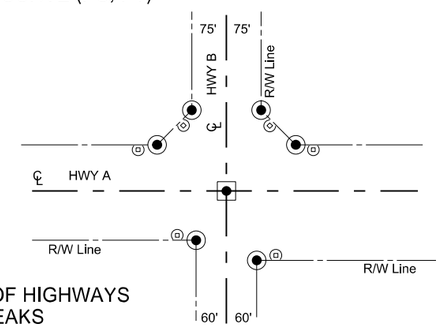
CURVE POINTS:
PI
SPIRAL CURVE (TS, ST)
SIMPLE CURVE (PC, PT)



DIVIDED HIGHWAYS
SECTION CORNERS
QUARTER CORNERS



SECTION CORNERS
QUARTER CORNERS



INTERSECTION OF HIGHWAYS
FLARED R/W BREAKS

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

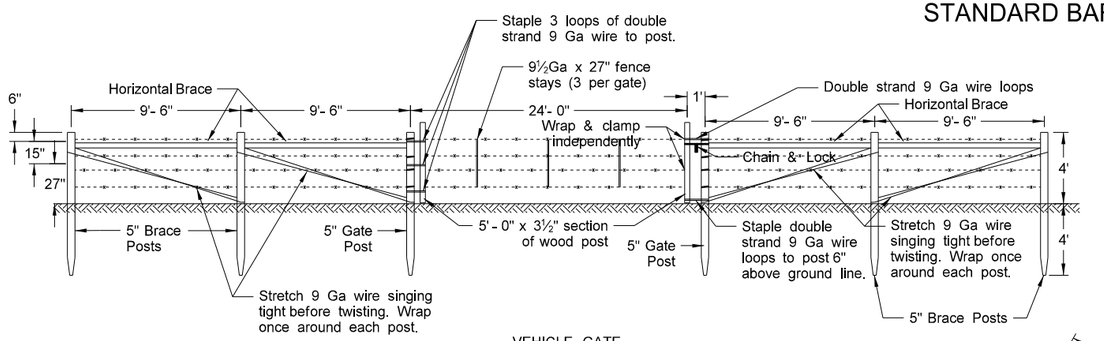
REVISIONS

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.

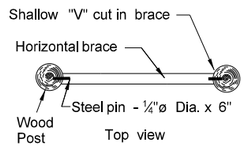
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/27/19 and the original document is stored at the North Dakota Department of Transportation

STANDARD BARBED WIRE FENCE

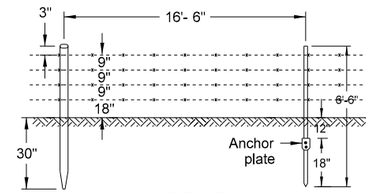
D-752-1



VEHICLE GATE



HORIZONTAL BRACE DETAIL



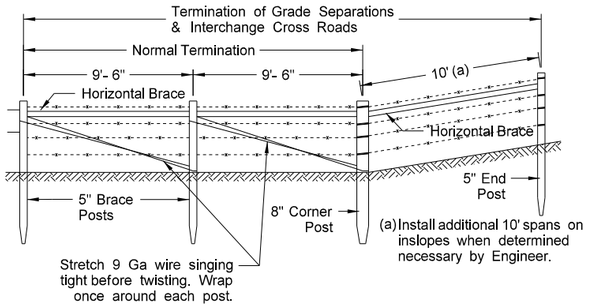
NOTES

1. No deduction in measured pay length of cable 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.

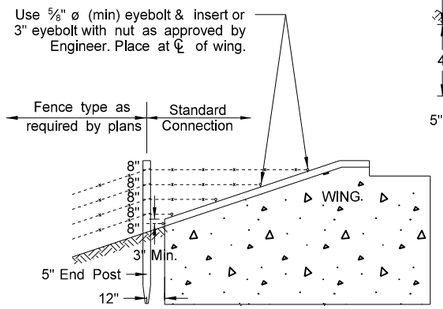
2. Install double brace assemblies at locations shown on the plans or established by the Engineer. Place adjacent fence terminals, corner assemblies, or double brace assemblies at a maximum spacing of 1,320 feet.

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 ⅝" diameter threaded eyebolt, when installed in concrete.

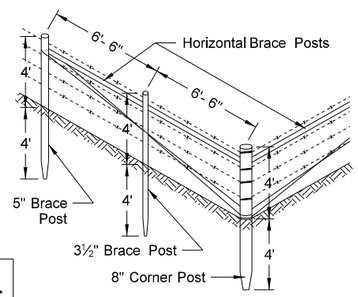
4. Determine post type used, either wood or steel, unless otherwise specified in the plans.



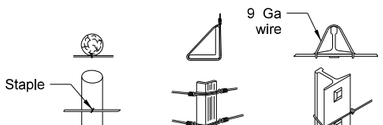
FENCE TERMINAL



DETAIL FOR TYING FENCE TO WINGS OF ABUTMENTS

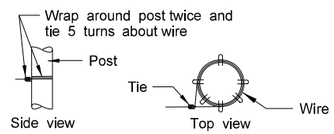


SHORT SPAN DETAIL
(FENCE LINE 100' OR LESS)

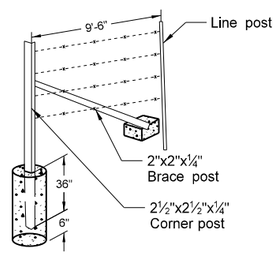


FASTENING TO POSTS

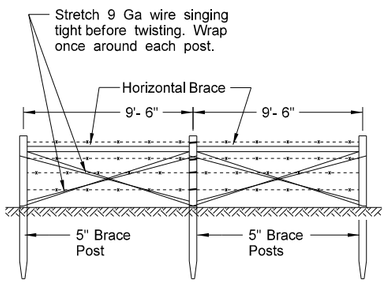
POST SIZES					
	TREATED WOOD		STEEL		
USE OF POST	Post dia.	Post length	Post length	Post wt. Lbs/Ft	Anchor wt. Lbs.
Line post	3½"	6'-6"	6'-6"	1.33	0.67
Corner post	8"	8'	7'	4.10	(Conc.)
End post	5"	8'			
Brace post	5" / 3½"	8'	7'	3.19	(Conc.)
Gate post	5"	8'			
Horizontal brace	3½"	Var.	As appoved by the Engineer		



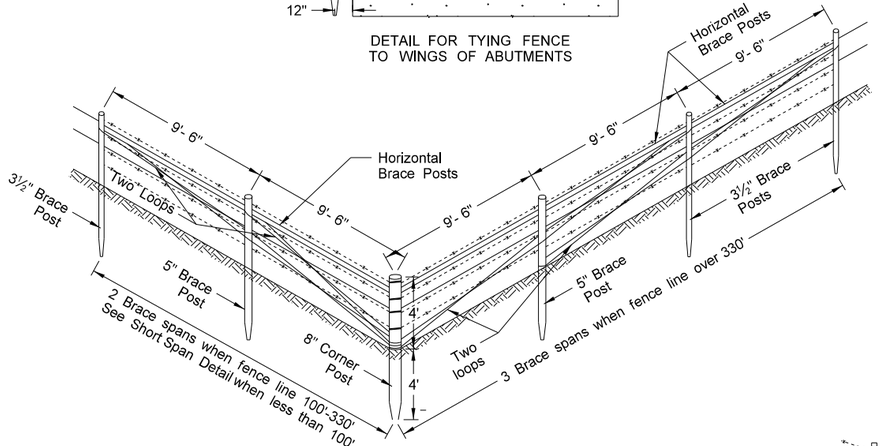
WRAP-AROUND DETAIL



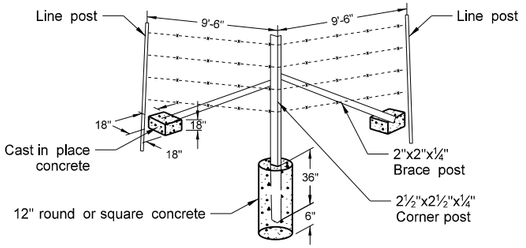
FENCE TERMINAL
STEEL POSTS



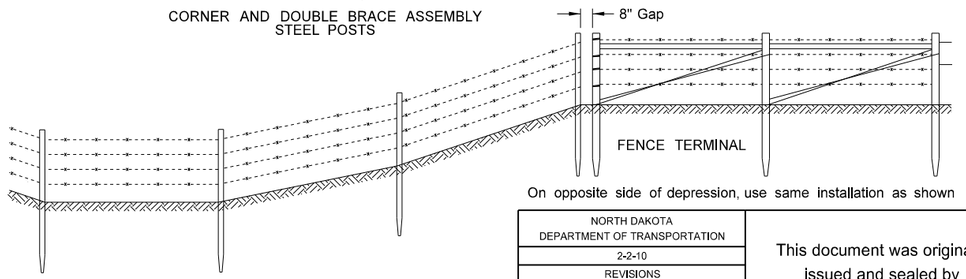
DOUBLE BRACE ASSEMBLY



CORNER ASSEMBLY

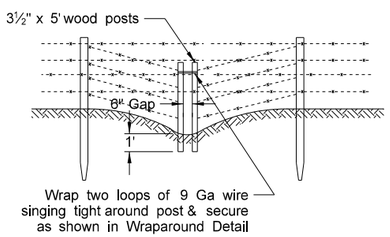


CORNER AND DOUBLE BRACE ASSEMBLY
STEEL POSTS

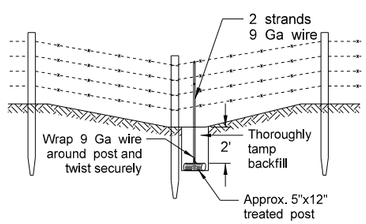


On opposite side of depression, use same installation as shown

FENCING FOR WIDE DEPRESSIONS



BREAK-AWAY FENCE FOR NARROW
DEPRESSIONS SUBJECT TO FLOODING



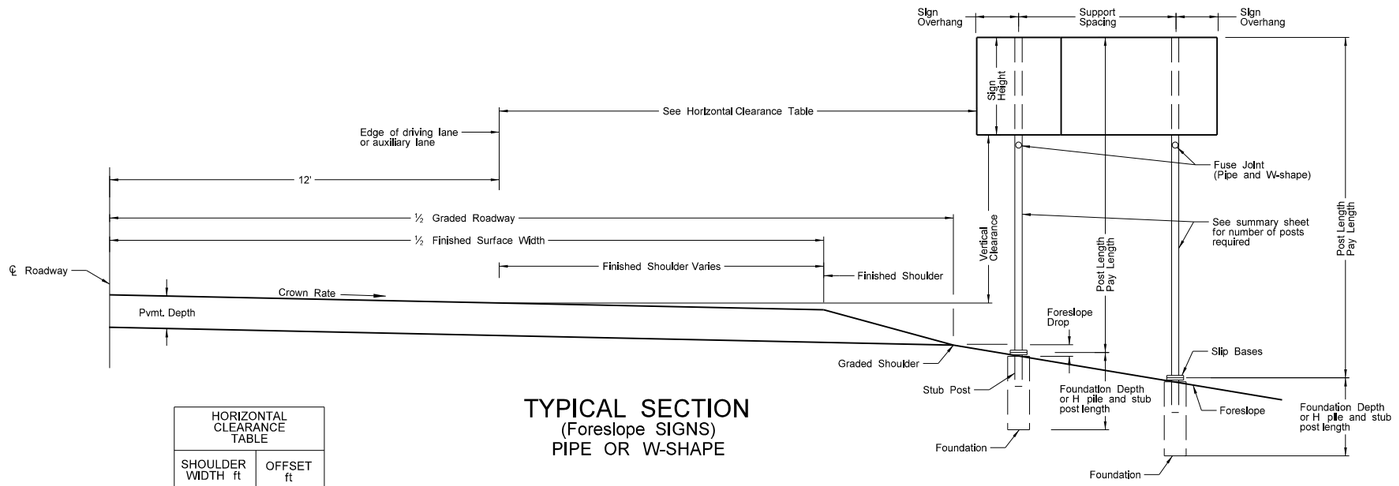
DETAIL FOR ANCHORING FENCES IN DEPRESSIONS*
*Determine locations in the field and include in price bid for fencing. Use other methods of anchoring fence if approved by the Engineer.

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.

This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 10-17-2017 and the original document is stored at the North Dakota Department of Transportation

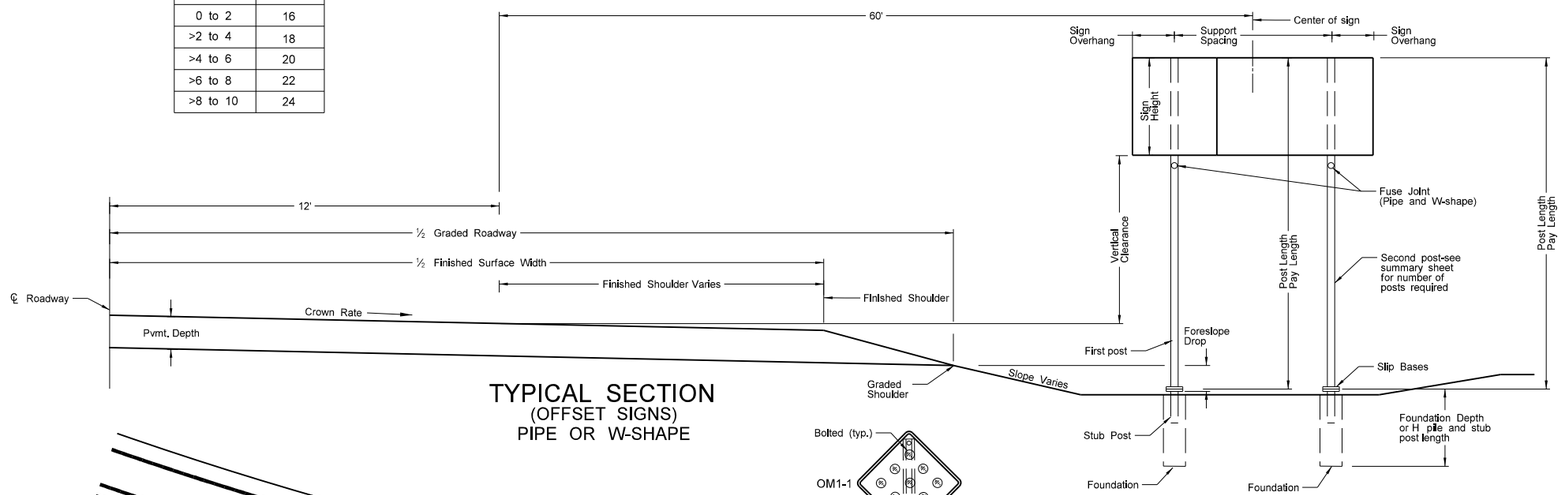
PIPE OR W-SHAPE ASSEMBLY DETAILS

D-754-1



TYPICAL SECTION
(Foreslope SIGNS)
PIPE OR W-SHAPE

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
(OFFSET SIGNS)
PIPE OR W-SHAPE

OBJECT MARKER
(Optional)

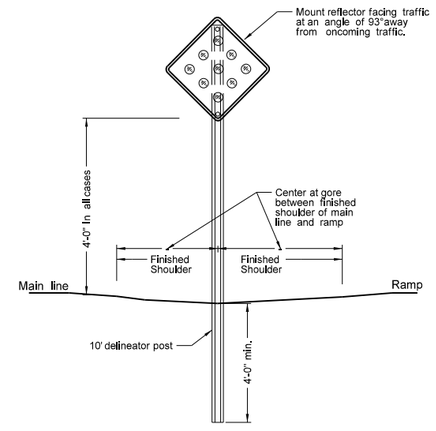
EXIT RAMP
GORE SIGN PLACEMENT

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.

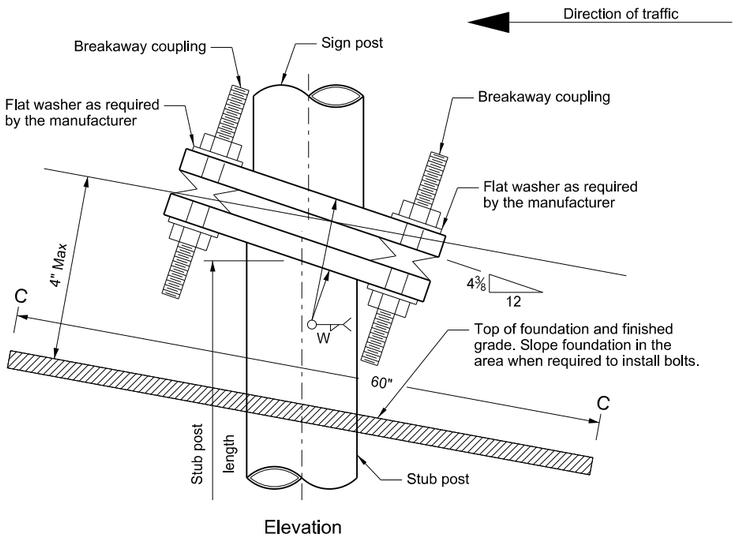


OBJECT MARKER INSTALLATION

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.

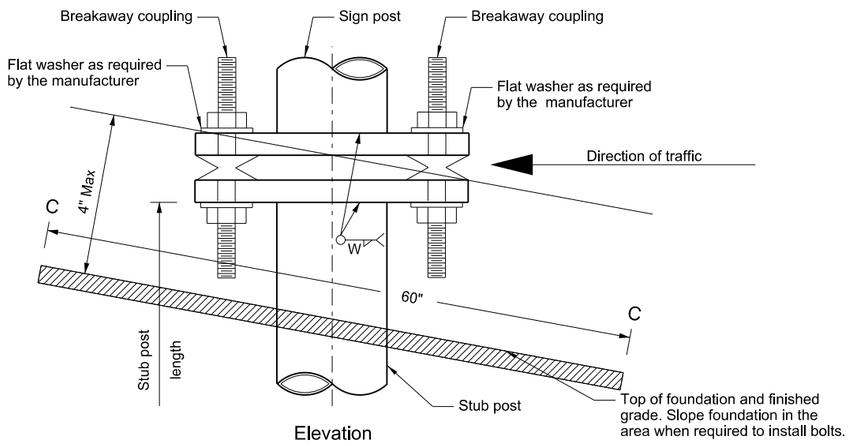
This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 8-30-2018 and the original document is stored at the North Dakota Department of Transportation

Breakaway Coupler System for Standard Pipe Stub Post



Elevation

Single Post Sign and Stub Post
Type A

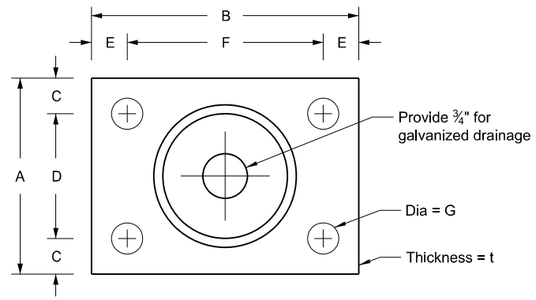


Elevation

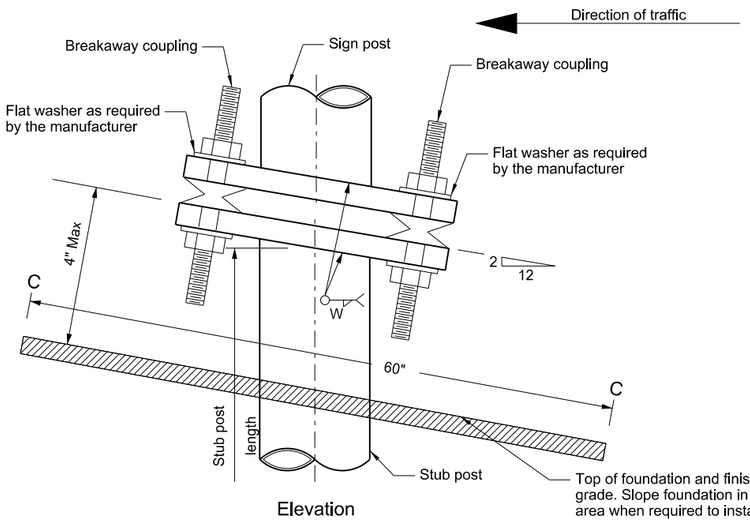
Two or More Post Sign and Stub Post
For two post signs with 8' or more post spacing and all three or more post signs
Type C

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.

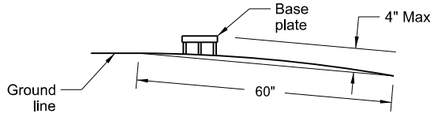


Plan Base Plate



Elevation

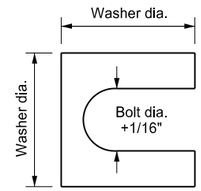
Two Post Sign and Stub Post
For signs with less than 8' post spacing
Type B



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.

Dimension / Nom. Pipe Size	Breakaway Coupling	A	B	C	D	E	F	G	t	W	Stub Post Length
Steel											
3½"	½" x 4½"	5½"	8⅜"	13/16"	3⅞"	13/16"	6¾"	9/16"	¾"	⅜"	1'-6"
4"	⅝" x 4½"	5½"	8¾"	1"	3½"	1"	6¾"	11/16"	¾"	⅜"	1'-6"
5"	¾" x 5¼"	6½"	10"	1⅛"	4¼"	1⅛"	7¾"	13/16"	1"	7/16"	2'-0"
6"	1" x 5¼"	7½"	11¾"	1⅜"	4¾"	1⅜"	9"	1 1/16"	1¼"	7/16"	2'-0"
8"	1" x 5¼"	9½"	13¼"	1⅜"	6¾"	1⅜"	10½"	1 1/16"	1¼"	7/16"	2'-6"
10"	1" x 5¼"	11¾"	15¼"	1⅜"	9"	1⅜"	12½"	1 1/16"	1¼"	½"	3'-0"
12"	1" x 7"	13¾"	18"	1⅝"	10 ½"	1⅝"	14¾"	1 1/16"	1½"	½"	3'-0"
Aluminum											
3½"	½" x 4½"	5½"	8⅜"	13/16"	3⅞"	13/16"	6¾"	9/16"	¾"	⅜"	1'-6"
4"	⅝" x 4½"	5½"	8¾"	1"	3½"	1"	6¾"	11/16"	1"	7/16"	1'-6"
5"	¾" x 5¼"	6½"	10"	1⅛"	4¼"	1⅛"	7¾"	13/16"	1"	½"	2'-0"
6"	1" x 5¼"	7½"	11¾"	1⅜"	4¾"	1⅜"	9"	1 1/16"	1¼"	½"	2'-0"
8"	1" x 5¼"	9½"	13¼"	1⅜"	6¾"	1⅜"	10½"	1 1/16"	1¼"	½"	2'-6"
10"	1" x 5¼"	11¾"	15¼"	1⅜"	9"	1⅜"	12½"	1 1/16"	1½"	7/16"	3'-0"
12"	1" x 7"	13¾"	18"	1⅝"	10¼"	1⅝"	14¾"	1 1/16"	1¾"	11/16"	3'-0"



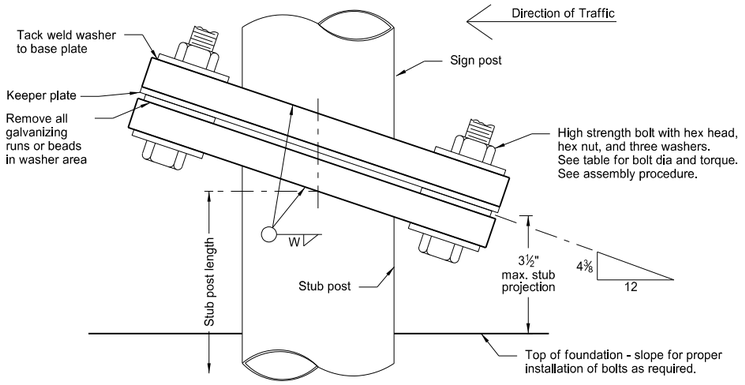
Shim Detail

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

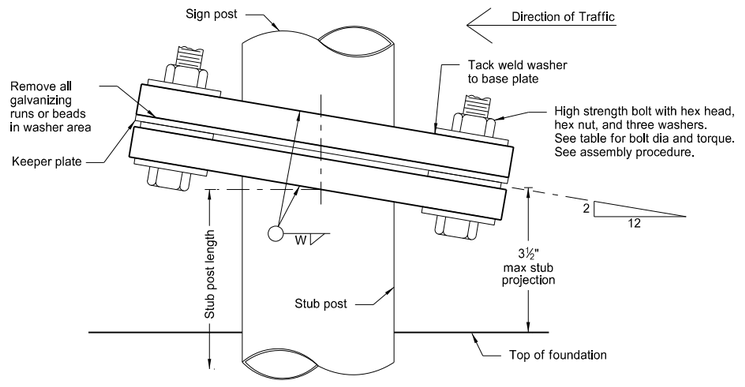
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-2013	
REVISIONS	
DATE	CHANGE
8-30-2018 8-29-2019	Updated notes to active voice. New Design Engineer PE Stamp.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

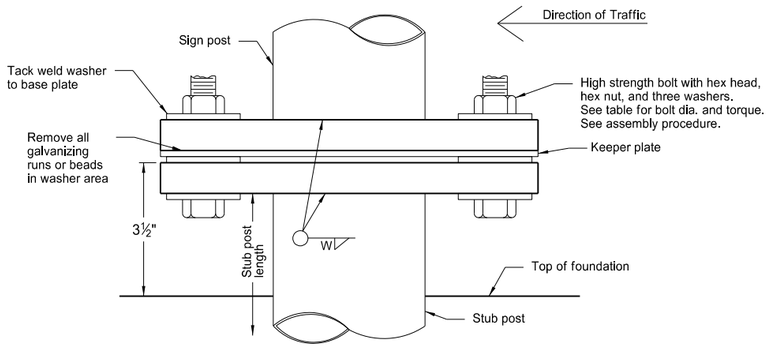
Breakaway System for Standard Pipe Stub Post



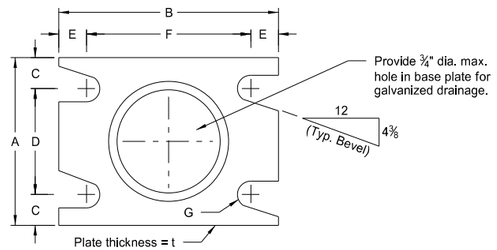
Stub Post Connection - Type A
Elevation View
(Single Post)



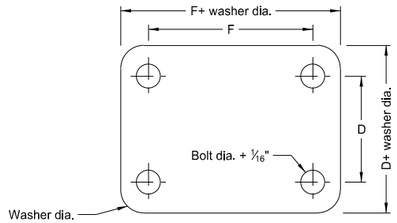
Stub Post Connection - Type B
Elevation View
(Two Posts)



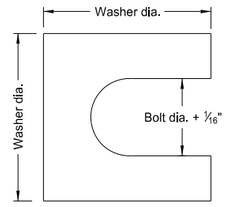
Stub Post Connection - Type C
Elevation View
(Two Posts)



Base Plate Plan View
Place bevel toward roadway on approach side and away on the other side.



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.

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:
1. Assemble post to stub with bolts and one flat washer between base plate and keeper plate.
2. Shim as required.
3. Tighten all bolts the maximum possible with 12" to 15" wrench to bed washers and shims and to clean bolt threads, then loosen.
4. Retighten bolts in a systematic order to prescribed torque. (see table)
5. 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.
6. Retighten each bolt to prescribed torque in the same order as initial retightening.

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												
3½"	½"x2½"	12	5½"	8⅜"	13/16"	3⅞"	13/16"	6¾"	9/32"	¾"	⅜"	1'-6"
4"	⅝"x2¾"	29	5½"	8¾"	1"	3½"	1"	6¾"	11/32"	¾"	⅜"	1'-6"
5"	¾"x3½"	46	6½"	10"	1⅛"	4¼"	1⅛"	7¾"	13/32"	1"	7/16"	2'-0"
6"	1"x4¼"	61	7½"	11¾"	1⅜"	4¾"	1⅜"	9"	17/32"	1¼"	7/16"	2'-0"
Aluminum												
3½"	½"x2½"	12	5½"	8⅜"	13/16"	3⅞"	13/16"	6¾"	9/32"	¾"	⅜"	1'-6"
4"	⅝"x2¾"	29	5½"	8¾"	1"	3½"	1"	6¾"	11/32"	1"	7/16"	1'-6"
5"	¾"x3½"	46	6½"	10"	1⅛"	4¼"	1⅛"	7¾"	13/32"	1"	½"	2'-0"
6"	1"x4¼"	61	7½"	11¾"	1⅜"	4¾"	1⅜"	9"	17/32"	1¼"	½"	2'-0"

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

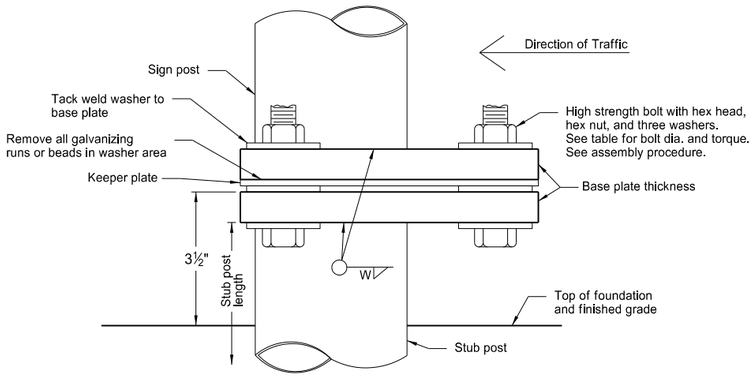
11-21-11

REVISIONS

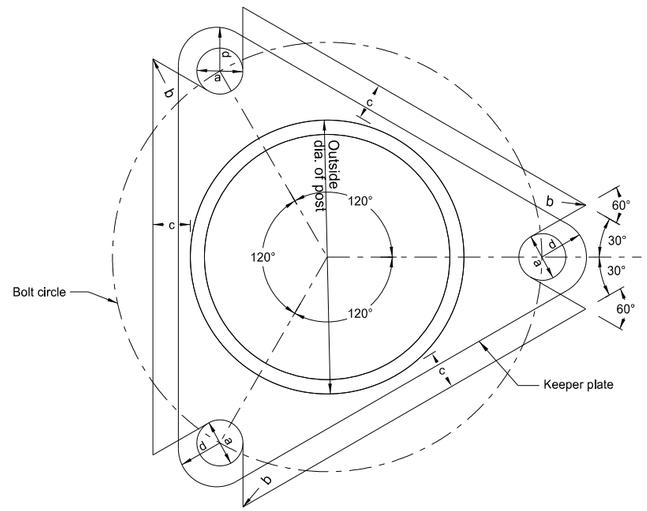
DATE	CHANGE
2-28-14	Removed lower post and foundation details.
8-30-18	Updated notes to active voice.
8-29-19	New Design Engineer PE Stamp.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

Multi-Directional Breakaway System for Standard Pipe Stub Post



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

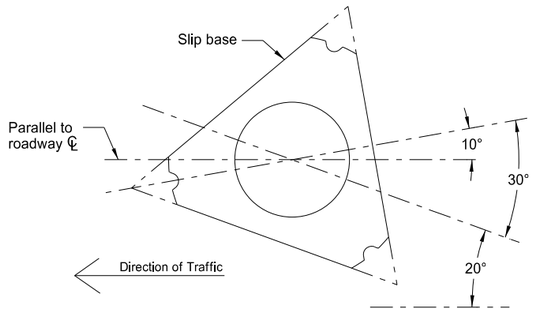


Stub Post Detail
Top View

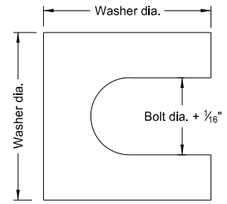
Notes:
Tack weld aluminum base plate washers to the base, when the base plate is fabricated from aluminum.

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.



Slip Base Orientation
Top View



Shim Detail

Furnish 2 each ±.012" thick and 2 each ±.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											
3½"	4"	7"	1 1/16"	⅛"	1⅛"	1"x4"	1¼"	5/16"	55	1⅛"	1'-6"
4"	4.5"	7½"	1 1/16"	⅛"	1⅛"	1"x4½"	1½"	⅜"	98	1⅛"	1'-6"
5"	5.563"	9½"	1 5/16"	⅛"	1⅛"	1¼"x5"	1½"	⅜"	167	1⅜"	2'-0"
Aluminum											
3½"	4"	7"	13/16"	⅛"	⅞"	¾"x3½"	1"	5/16"	43	⅞"	1'-6"
4"	4.5"	7½"	13/16"	⅛"	¾"	¾"x4"	1¼"	5/16"	76	⅞"	1'-6"
5"	5.563"	9½"	1 1/16"	⅛"	1⅛"	1"x4"	1¼"	5/16"	98	1⅛"	2'-0"
6"	6.625"	10¼"	1 1/16"	⅛"	¾"	1"x4½"	1½"	⅜"	134	1⅛"	2'-0"

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

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

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:

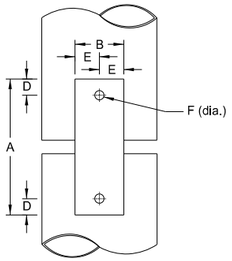
1. Use Grade 60 reinforcing steel.

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

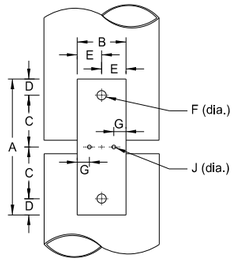
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

Hinge Plate, Fuse Plate and Foundation Details for Standard Pipe

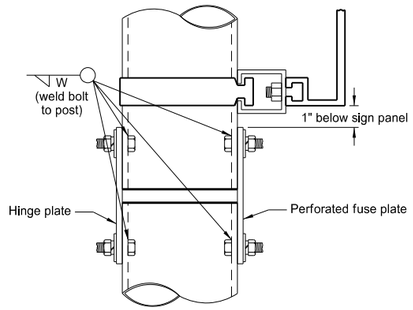
D-754-6



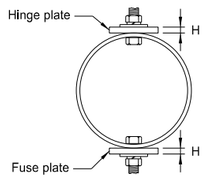
Hinge Plate



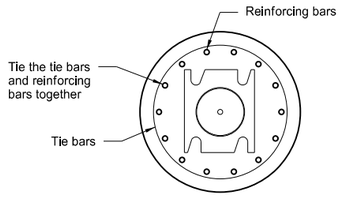
Perforated Fuse Plate



Side View

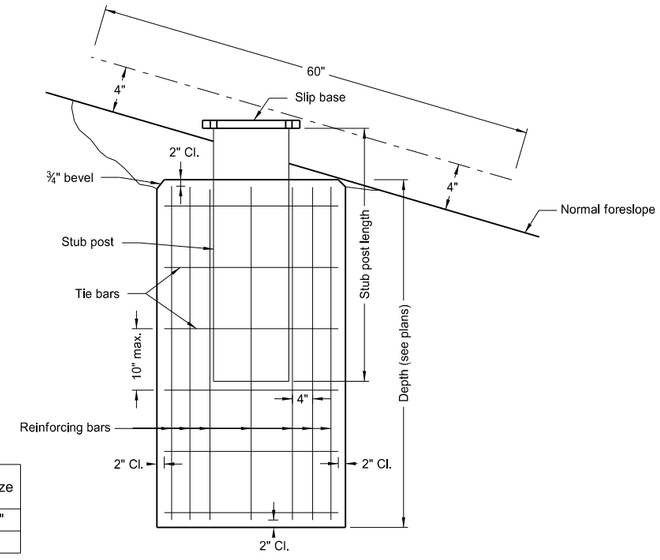


Top View



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"	3½"-4"
1'-9"	5"-6"

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.

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.^{4}	Cross Sec. Area in.^{2}	Section Diameter in.^{2}
Steel							
3½	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							
3½	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
3½"	½"ø x 1½"	5"	1¾"	1 11/16"	13/16"	⅞"	9/16"	15/32"	¼"	13/32"	7/16"
4"	⅝"ø x 1½"	5¾"	2"	1⅞"	1"	1"	11/16"	17/32"	⅜"	15/32"	9/16"
5"	⅝"ø x 1¾"	5¾"	2"	1⅞"	1"	1"	11/16"	9/16"	½"	7/16"	⅝"
6"	¾"ø x 2¼"	6¼"	2¼"	2"	1⅛"	1⅛"	13/16"	⅝"	½"	½"	⅝"

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.

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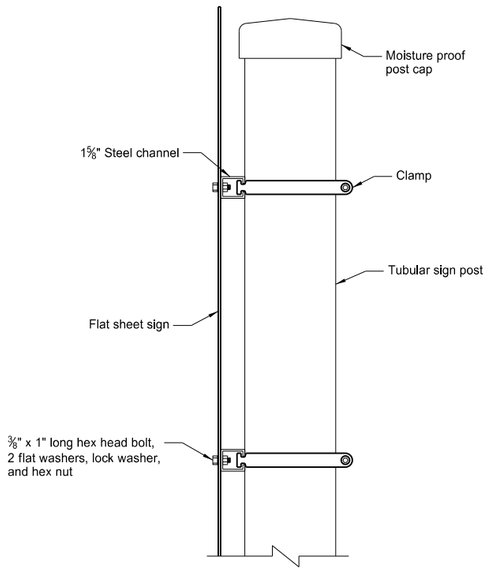
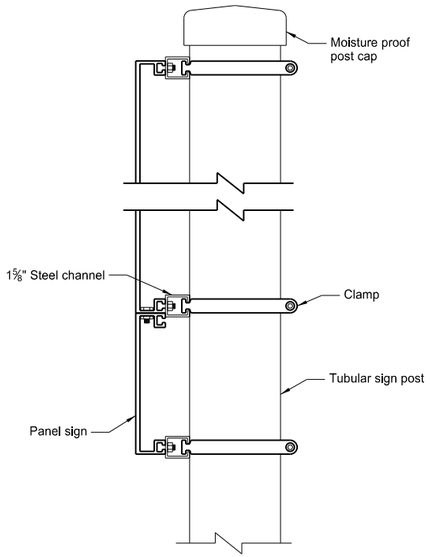
PIPE SUPPORT AND SIGN MOUNTING DETAILS

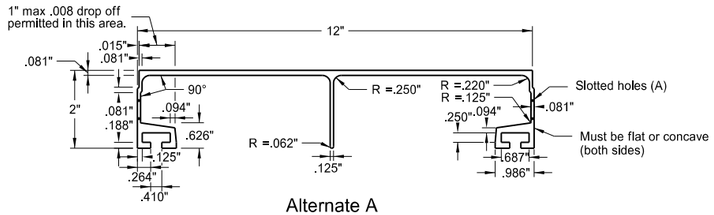
D-754-7



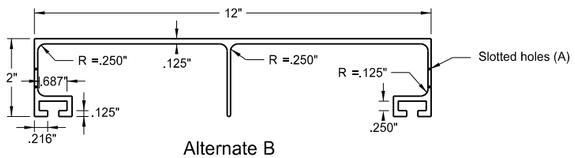
Side View



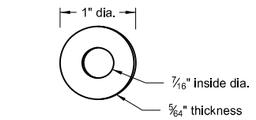
Side View



Alternate A
12" Extruded Panel



Alternate B
12" Extruded Panel



Flat Washer Detail

Slotted Hole Detail

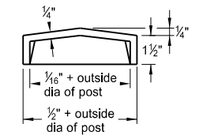
6" Extruded Panel

Aluminum Panel Details

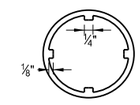
(A) Punch slotted holes in aluminum panels at 1'-0" on center, space from end as listed below:

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.



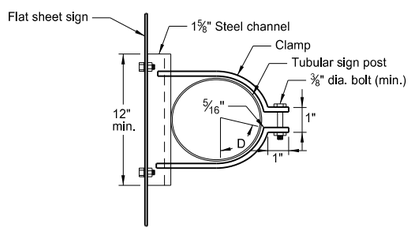
Side View



Top View

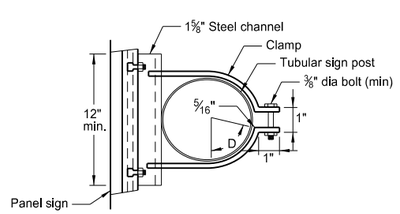
Post Cap Detail

Furnish post caps for all steel or aluminum posts or weld a ⅛" plate all around.



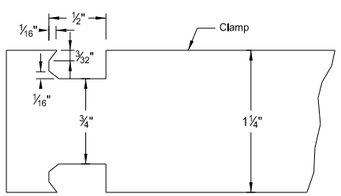
Top View

Flat Sheet Sign Clamp Mounting Details

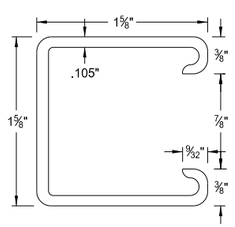


Top View

Panel Sign Clamp Mounting Details



Clamp Detail



Steel Channel Detail

Post Size dia	Clamp Gauge min
3½" to 5"	11
6" to 12"	10

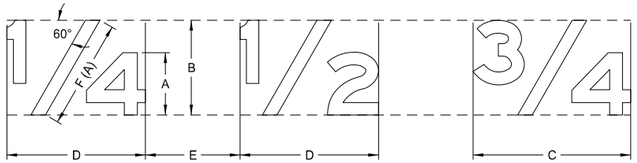
Post Size dia (in)	D (in)
3½	3
4	3 3⁄16
5	5⅛
6	7 7⁄16
8	13 1⁄16
10	20¾
12	29⅜

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-21-14	
REVISIONS	
DATE	CHANGE
8-30-18	Updated to active voice, defined bolt & washers for fastening sign.
8-29-19	New Design Engineer PE Stamp.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

LETTER AND ARROW DETAILS

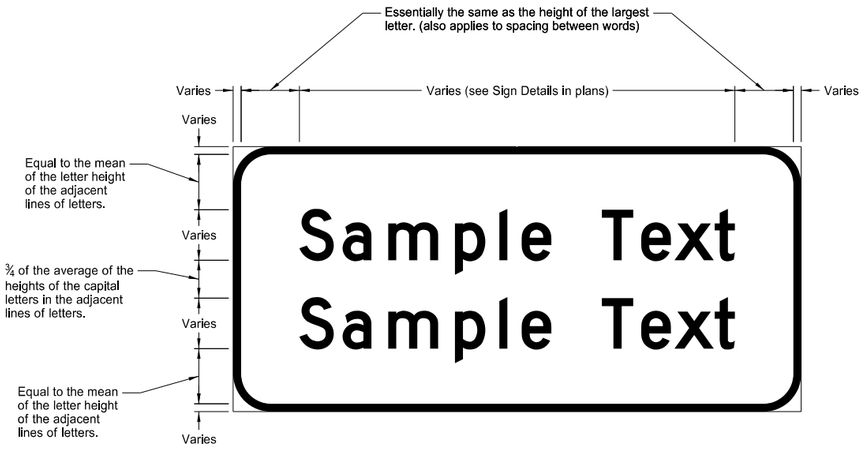
D-754-9



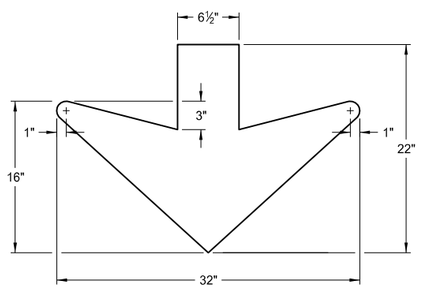
DETERMINE SIZE OF THE FRACTION AS FOLLOWS:

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

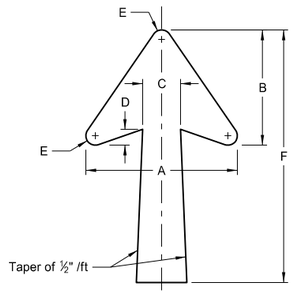
(A) Center diagonal stroke of fraction optically.



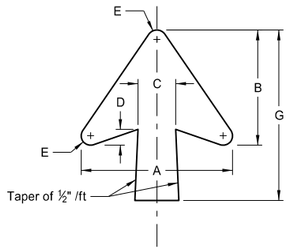
TYPICAL SPACING



DOWN ARROW



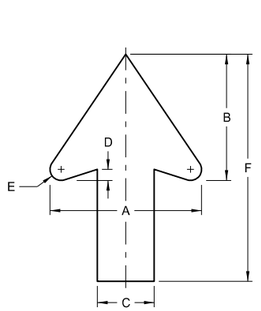
TYPE A



TYPE B

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"							

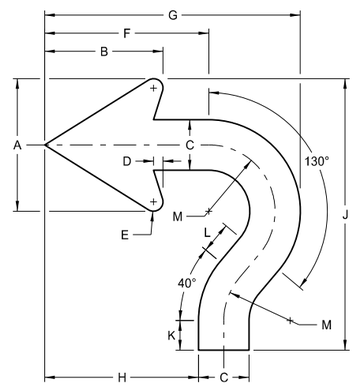
NOTE: Arrow size on gore signs is based on the letter size of "EXIT".



TYPE D

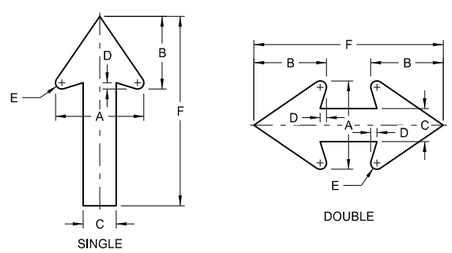
NOTE: Measure rotation angle of arrows counterclockwise from positions shown in details.

DESIGNATION	LETTER SIZE (Upper Case)	A	B	C	D	E	F
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"



ROUNDABOUT

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"



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

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.

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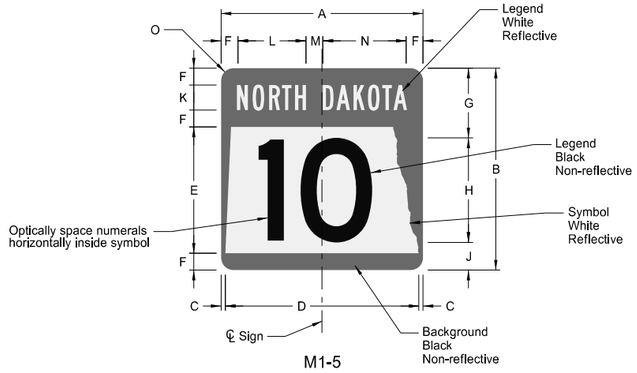
STATE HIGHWAY ROUTE SHIELD DETAIL

D-754-11

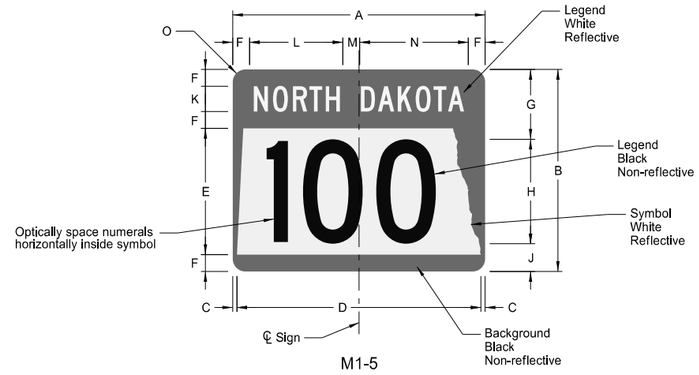


M1-5

STATE ROUTE MARKER

SIGN	DIMENSION (INCHES)													
	A	B	C	D	E	F	G	H	J	K	L	M	N	O
1, 2 digits	18*	18*	0.38	17.25	11.25	1.5	6.38	9 D**	2.63	2.25 B	6.1	1.5	7.4	1.5
1, 2 digits	24	24	0.5	23	15	2	8.5	12 D**	3.5	3 B	8.1	2	9.9	1.5
1, 2 digits	36	36	0.75	34.5	22.5	3	12.75	18 D**	5.25	4.5 B	12.1	3	14.9	2.25
1, 2 digits	48*	48*	1	46	30	4	17	24 D**	7	6 B	16.2	4	19.8	3

* Size not for independent use (only for use within a guide sign)
** Reduce numeral spacing by 25%

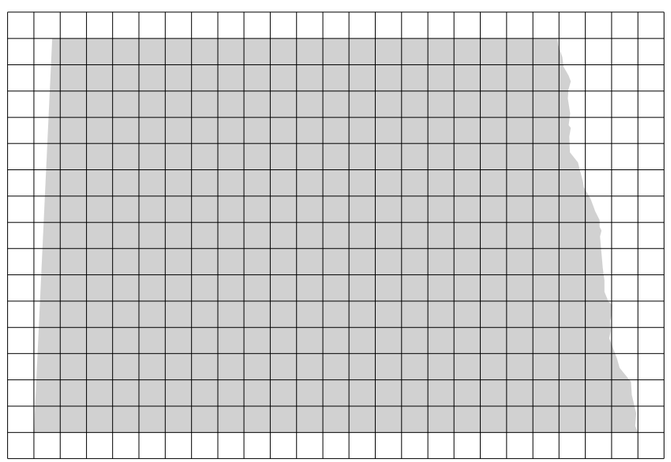


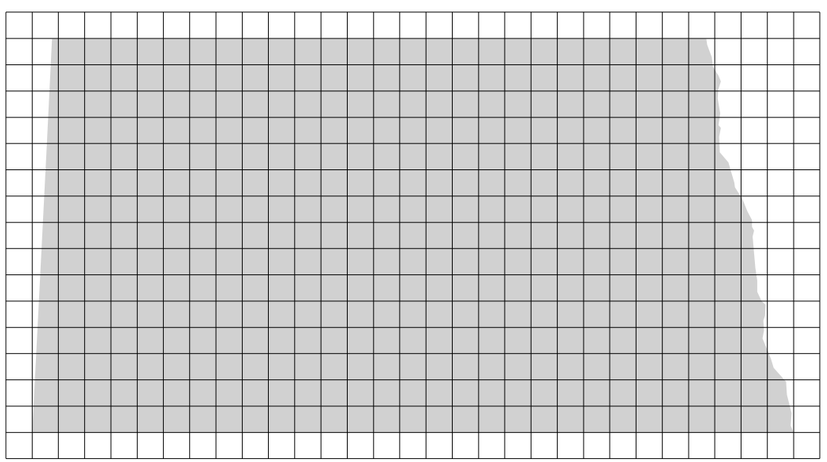
M1-5

STATE ROUTE MARKER

SIGN	DIMENSION (INCHES)													
	A	B	C	D	E	F	G	H	J	K	L	M	N	O
3 digits	24*	18*	1.13	21.75	11.25	1.5	6.38	9 C**	2.63	2.25 C	8.8	2	10.2	1.5
3 digits	30	24	0.5	29	15	2	8.5	12 C**	3.5	3 C	10.7	2.5	12.8	1.5
3 digits	45	36	0.75	43.5	22.5	3	12.75	18 C**	5.25	4.5 C	16.1	3.8	19.1	2.25
3 digits	60*	48*	1	58	30	4	17	24 C**	7	6 C	21.5	5	25.5	3
4 digits	24*	18*	1.13	21.75	11.25	1.5	6.38	9 B***	2.63	2.25 C	8.8	2	10.2	1.5
4 digits	30	24	0.5	29	15	2	8.5	12 B***	3.5	3 C	10.7	2.5	12.8	1.5
4 digits	45	36	0.75	43.5	22.5	3	12.75	18 B***	5.25	4.5 C	16.1	3.8	19.1	2.25
4 digits	60*	48*	1	58	30	4	17	24 B***	7	6 C	21.5	5	25.5	3

* Size not for independent use (only for use within a guide sign)
** Reduce numeral spacing by 25%
*** Reduce numeral spacing by 50%





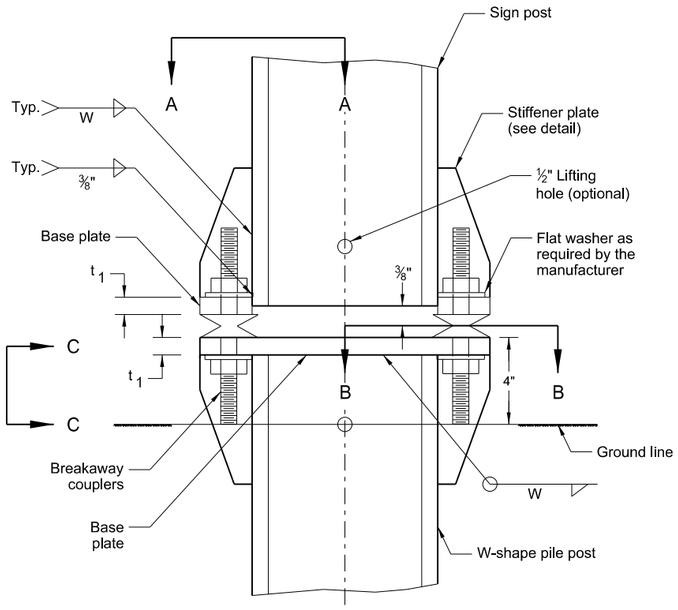
Note: North Dakota symbol graphics file may be obtained from the Design Division of North Dakota Department of Transportation.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
4-23-18	
REVISIONS	
DATE	CHANGE
8-29-19	New Design Engineer PE Stamp.

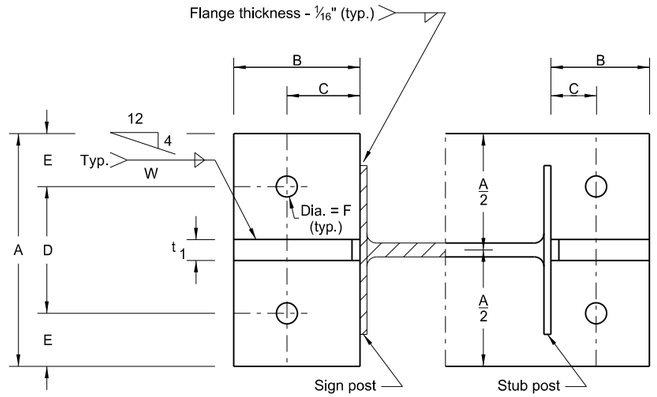
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

Breakaway Coupler System
Structural Details
for W-Shape Supports

D-754-12



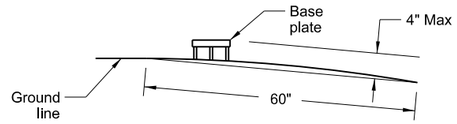
Sign Post and Stub Post
Elevation



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

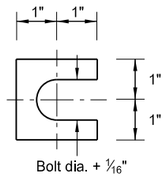
Notes:

1. 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.
2. 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.
3. Use manufacturer's recommendations for assembly procedures.

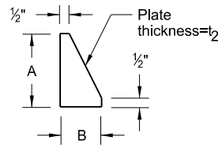


Section C - C

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.



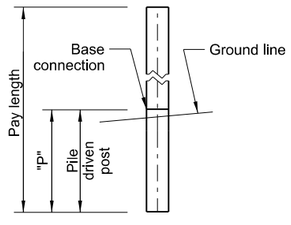
Shim Detail



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

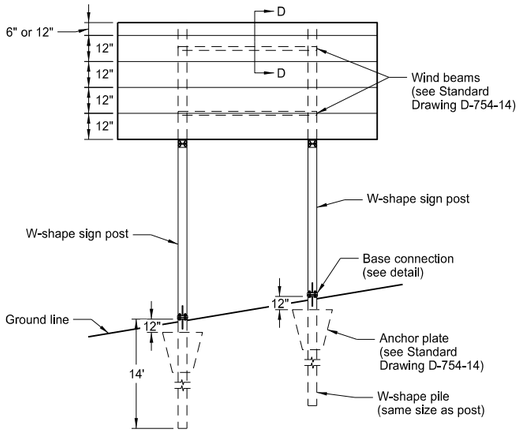
W-Shape Post & Pile Size	Base Connection Data										Footing Data
	Bolt Size	A	B	C	D	E	t_1	t_2	W	F	W-Shape Pile Post "P"
W4X13	3/4" x 5 1/4"	6"	2 1/2"	1 1/2"	3 1/2"	1 1/4"	1"	1/2"	1/4"	13/16"	14'
W5X16											14'
W6X20	7/8" x 5 1/4"	8"	3"	1 3/4"	4"	2"	1 1/4"	1/2"	1/4"	15/16"	14'
W8X24											14'
W8X28	1" x 5 1/4"	8"	3"	2"	4"	2"	1 1/2"	3/4"	5/16"	1 1/16"	14'

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.

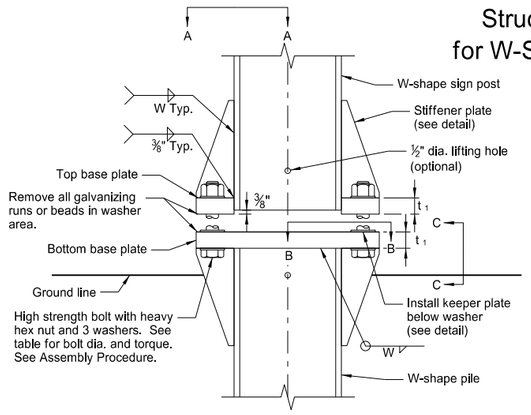
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

Breakaway System Structural Details for W-Shape Supports

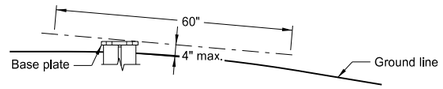
D-754-13



Typical Panel Mounting on W-shape Sign Posts

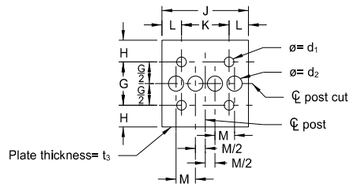


Base Connection Detail

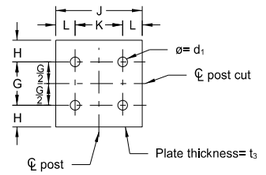


Section C-C
Stub Height Requirements

Maximum projection of base plate limits are defined as a line 4" parallel to any chord, which is perpendicular to, or aligned radially to, the center line of the highway and has the chord's end points on the ground surface on opposite sides of the stub post.



Perforated Fuse Plate



Hinge Plate

Notes:

Use structural steel conforming to Section 894.03 B.6 of the Standard Specifications and high strength bolts conforming to ASTM A325.

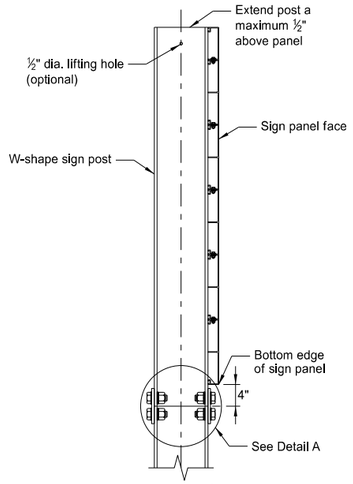
Refer to Sign Summary sheet for specific data on individual sign installation.

Install perforated fuse plate on side of post facing traffic.

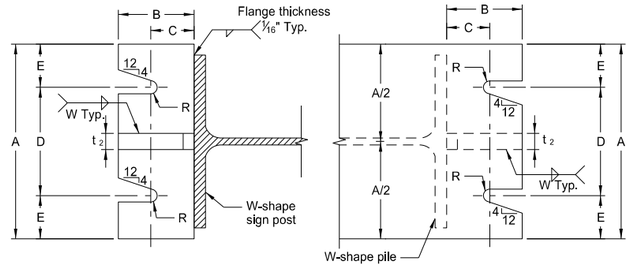
Saw cut posts. Shear or flame cut plates using a mechanically guided cutting torch in accordance with Section 754.04 D.4.b of the Standard Specifications. Prepare edge in accordance with Section 754.04 D.4.c of the Standard Specifications.

Assembly Procedure:

1. Assemble base plates with bolts and one flat washer between top base plate and keeper plate.
2. Shim as required to plumb post.
3. Tighten all base connection bolts the maximum possible with 12" to 15" wrench to bed washers and shims and clean bolt threads.
4. Loosen each bolt in turn and retighten in systematic order to the prescribed torque (see table).
5. Assemble perforated fuse and hinge plates to post with bolts and one flat washer and lock washer under nut.

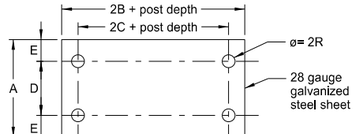


Fuse Joint
(Side View)

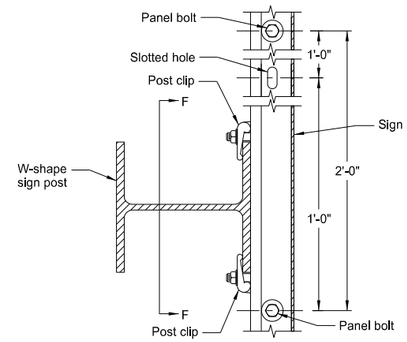


Section A-A Section B-B

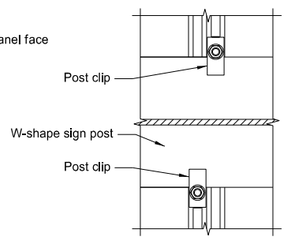
Sections shown for installations on right shoulder. Reverse plate slot bevels for installations on left shoulder.



Keeper Plate

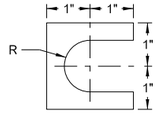


Section E-E



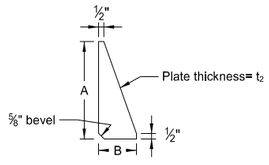
Section F-F

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

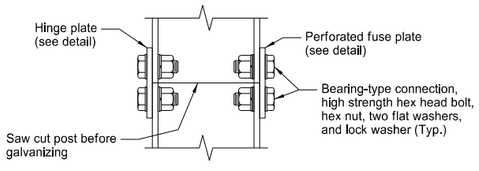


Shim Detail

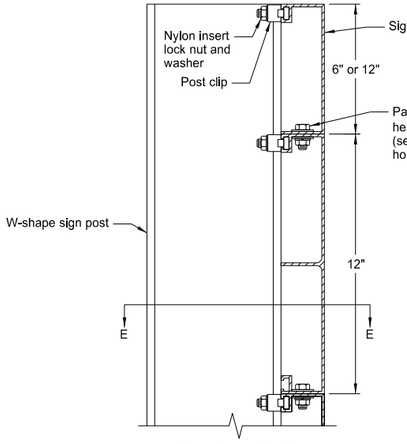
Furnish 2 each .012"± thick and 2 each .032"± thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.



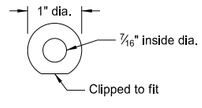
Stiffener Plate



Detail A



Section D-D



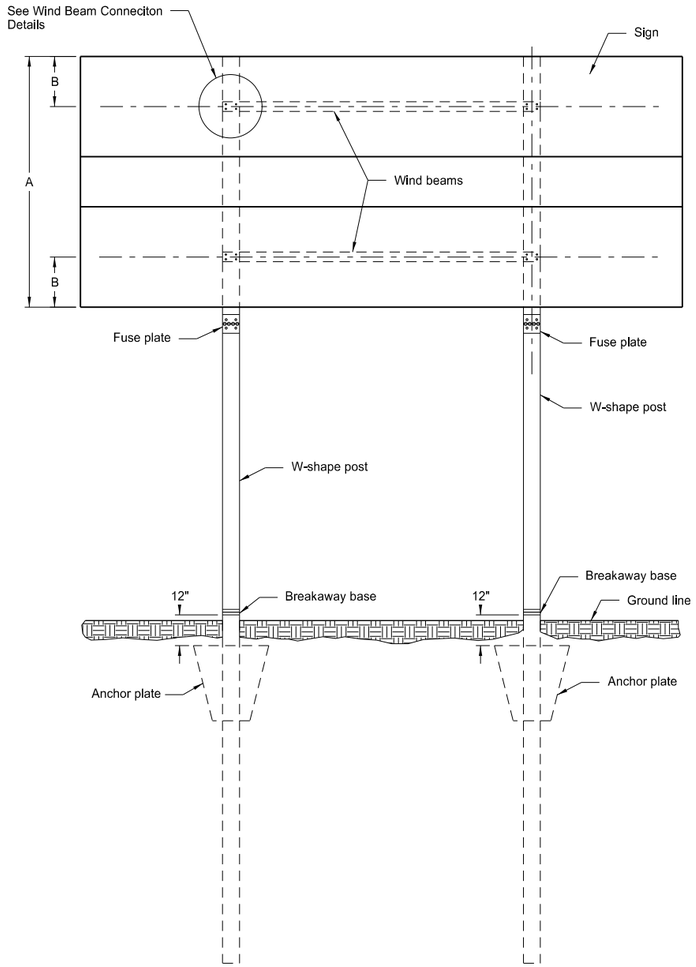
Flat Washer Detail
Thickness = 5/64"

W-Shape Post and Pile Size	Base Connection Dimensions										Fuse and Hinge Plate Dimensions									
	Bolt Size and Torque	A	B	C	D	E	t_1	t_2	W	R	G	H	J	K	L	M	d_1	d_2	t_3	Bolt dia.
W4x13	¾" ø x 3½" Torque = 600 in-lb	6"	2½"	1½"	3½"	1¼"	1"	½"	¼"	13/32"	2"	1¼"	4"	2¼"	⅞"	1"	11/16"	¾"	⅜"	⅝"
W5x16	¾" ø x 3½" Torque = 600 in-lb	6"	2½"	1½"	3½"	1¼"	1"	½"	¼"	13/32"	2½"	1¼"	5"	2¾"	1⅛"	1⅛"	13/16"	⅞"	⅜"	¾"
W6x20	⅞" ø x 4¼" Torque = 800 in-lb	8"	3"	1¾"	4"	2"	1¼"	½"	¼"	15/32"	2½"	1¼"	6"	3½"	1¼"	1⅜"	13/16"	1⅛"	⅜"	¾"
W8x24	⅞" ø x 4¼" Torque = 800 in-lb	8"	3"	1¾"	4"	2"	1¼"	½"	¼"	15/32"	2½"	1½"	6½"	3½"	1½"	1½"	15/16"	1¼"	½"	⅞"
W8x28	1" ø x 5" Torque = 1000 in-lb	8"	3"	2"	4"	2"	1½"	¾"	5/16"	17/32"	2½"	1½"	6½"	3½"	1½"	1⅝"	1 1/16"	1⅛"	½"	1"
W8x31	1⅛" ø x 5" Torque = 1200 in-lb	9"	3½"	2"	5"	2"	1½"	¾"	5/16"	19/32"	3"	1¾"	8"	5½"	1¼"	2"	1 1/16"	1½"	½"	1"
W10x39	1⅛" ø x 5" Torque = 1200 in-lb	9"	3½"	2"	5"	2"	1½"	¾"	5/16"	19/32"	3"	1¾"	8"	5½"	1¼"	1⅞"	1 3/16"	1⅜"	½"	1⅛"

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.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

WIND BEAMS AND ANCHOR PLATES FOR W-SHAPE SUPPORTS



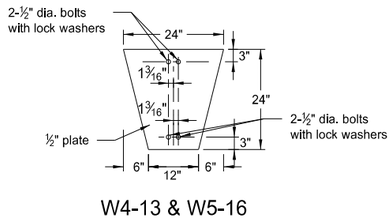
ASSEMBLY DETAIL FOR WIND BEAMS AND ANCHOR PLATES

Notes:

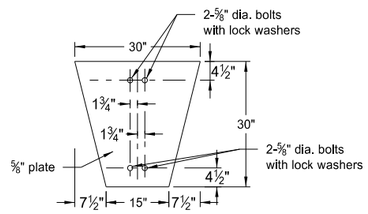
Calculate the B distance using the formula, B=A/4.

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

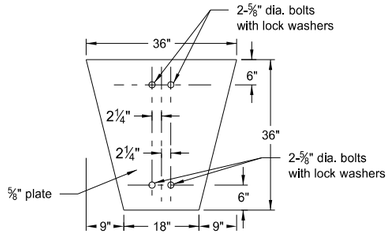
Use bolts conforming to ASTM A307 and galvanized according to ASTM A153.



W4-13 & W5-16

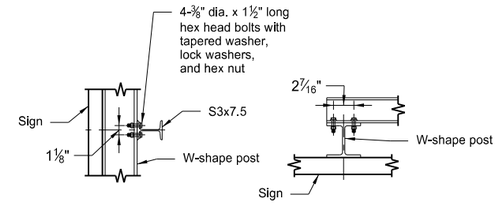


W6-20, W8-24 & W8-28



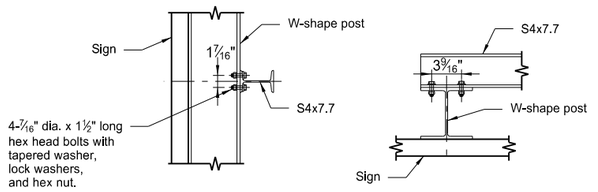
W8-31 & W10-39

ANCHOR PLATE DETAILS



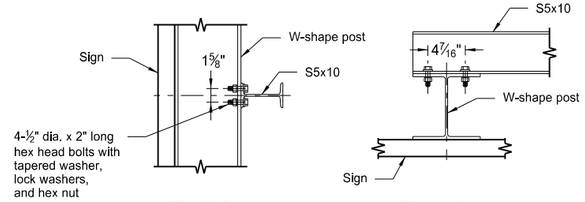
End View Top View

W4-13 & W5-16



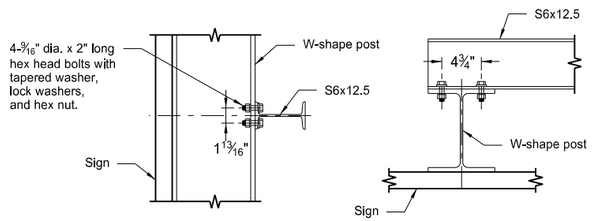
End View Top View

W6-20, W8-24 and W8-28



End View Top View

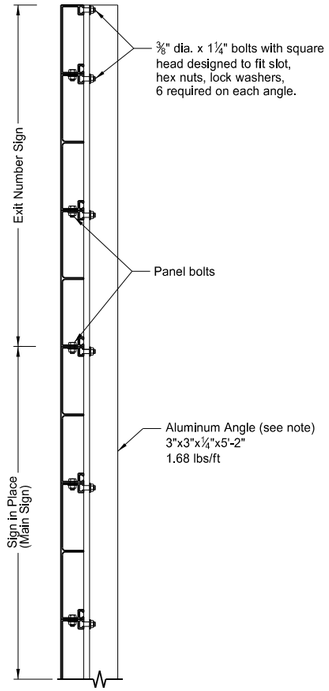
W8-31



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.

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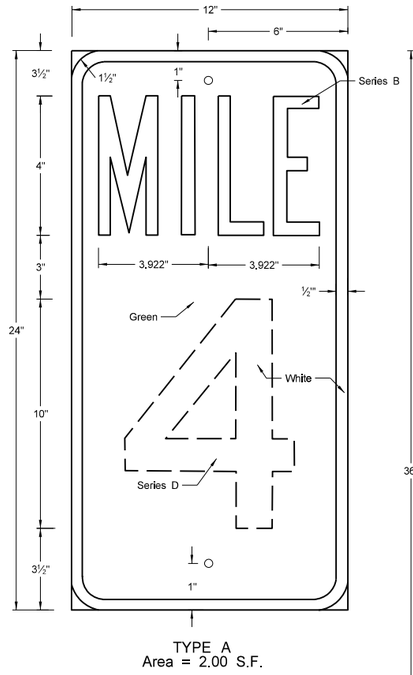
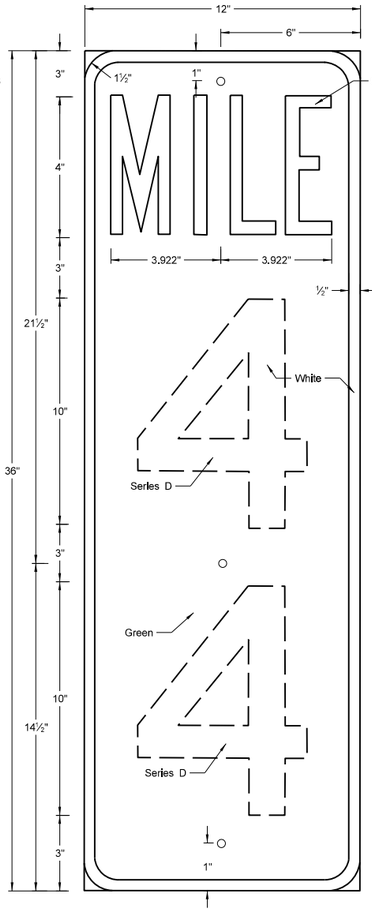
(EXPRESSWAY-FREEWAY USE) MILE POSTS

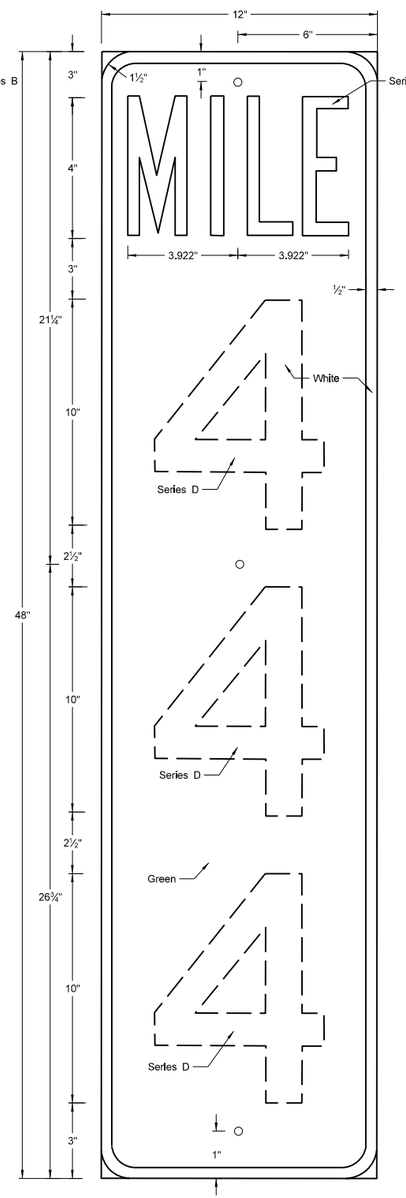
D-754-20



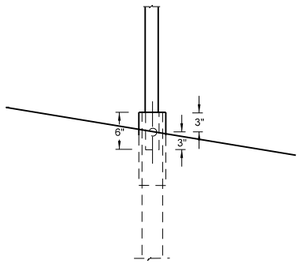
TYPE A
Area = 2.00 S.F.



TYPE B
Area = 3.00 S.F.

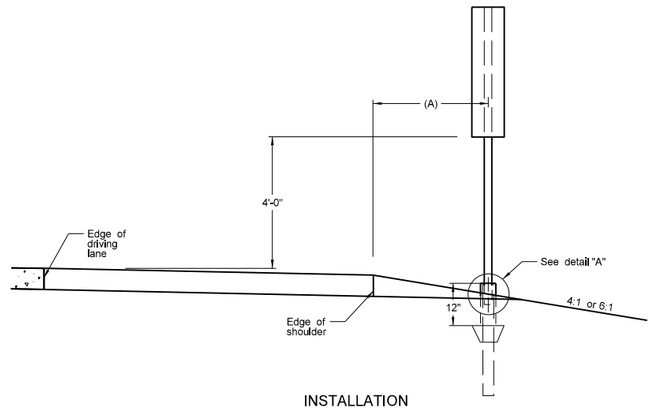


TYPE C
Area = 4.00 S.F.

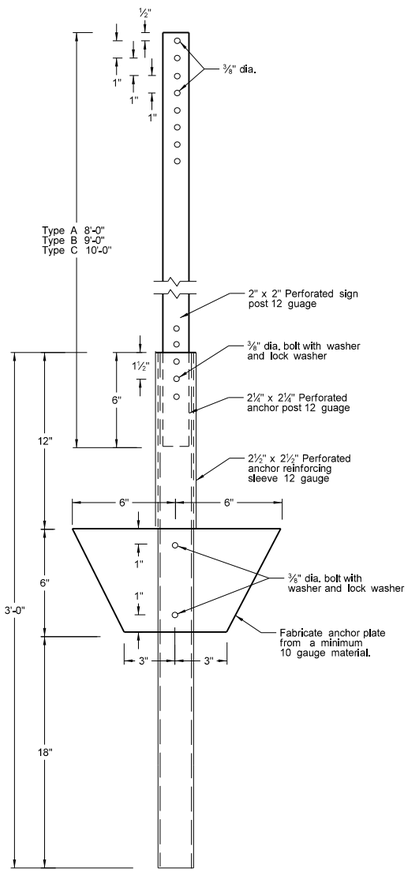


DETAIL "A"

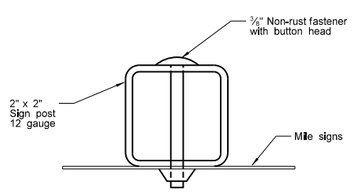
(A) 8' Clearance to finished shoulder or in line with existing delineator posts.



INSTALLATION



POST AND ANCHOR PLATE DETAIL



ASSEMBLY 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.

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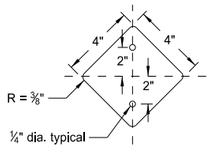
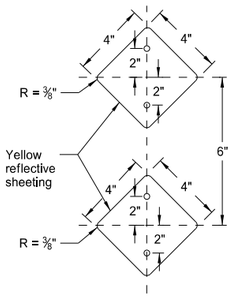
REFLECTORIZED DELINEATORS

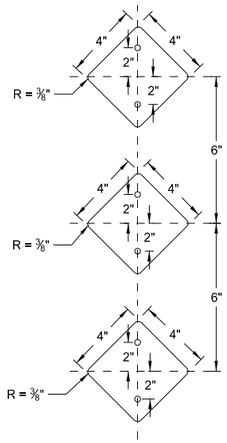
D-754-21



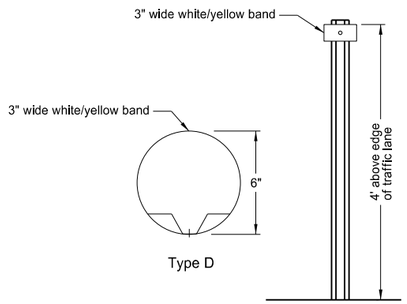
Main line
One reflector
(Type A delineator)



Ramps
Two reflectors
(Type B delineator)

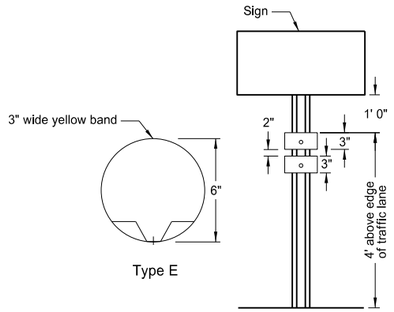


Narrow Bridges
Three reflectors
(Type C delineator)



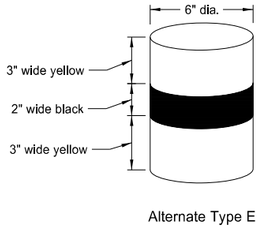
Type D

Median
One reflector
(Type D delineator)

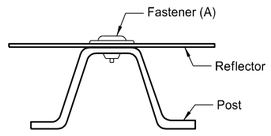


Type E

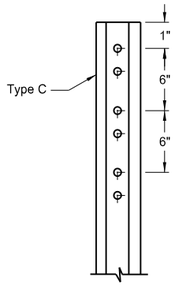
Median
Two reflectors
(Type E delineator)

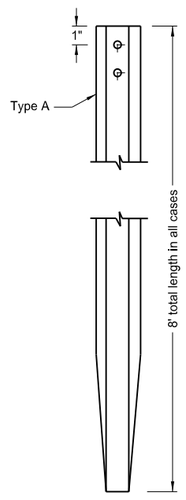


Alternate Type E

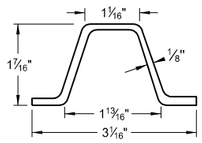


Delineator Attachment Detail

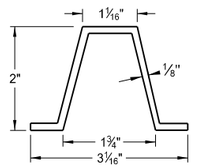




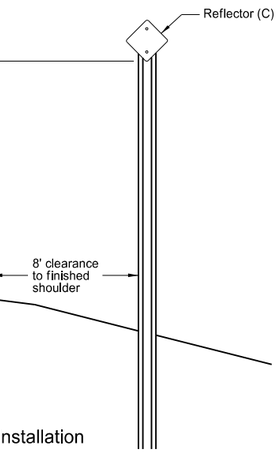
U-type Post



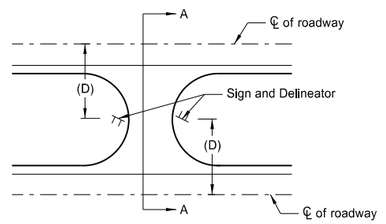
Steel Post Detail
Approx. 2.0 lbs/ft

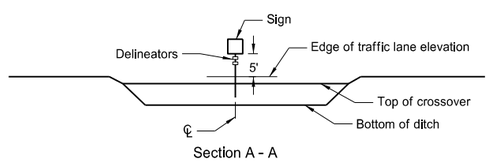


Aluminum Post Detail
Approx. 0.88 lbs/ft



Installation





Section A - A

Median Crossovers
Signing and Delineation system

Delineator Details

Type A, B, and C

Installation: Install posts along the right shoulder line unless shown otherwise on the plans.

Reflectors: Use reflector of the same color as the adjacent pavement marking.

Spacing: For delineator spacing along main line tangents and curves with radius greater than 11500' (less than 0° 30') use 528' centers. For curves with a radius less than 11500', but greater than 1200', use 264' centers. With curves less than 1200' use spacing (S) = 3*(Square Root(R))-50

Type E

Alternate: As an alternate, use one unit band consisting of two yellow stripes separated by a 2" black stripe in place of two 3" yellow bands.

(A) Use a ⅜" dia tension pin type or other non-rust vandal resistant fastener with min $1\frac{3}{16}$" outside dia flat washer.

(B) 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.

(C) Mount reflector facing traffic at an angle of 93° away from oncoming traffic.

(D) The median width may vary. Place sign and delineator assembly in the median crossover an equal distance from each roadway.

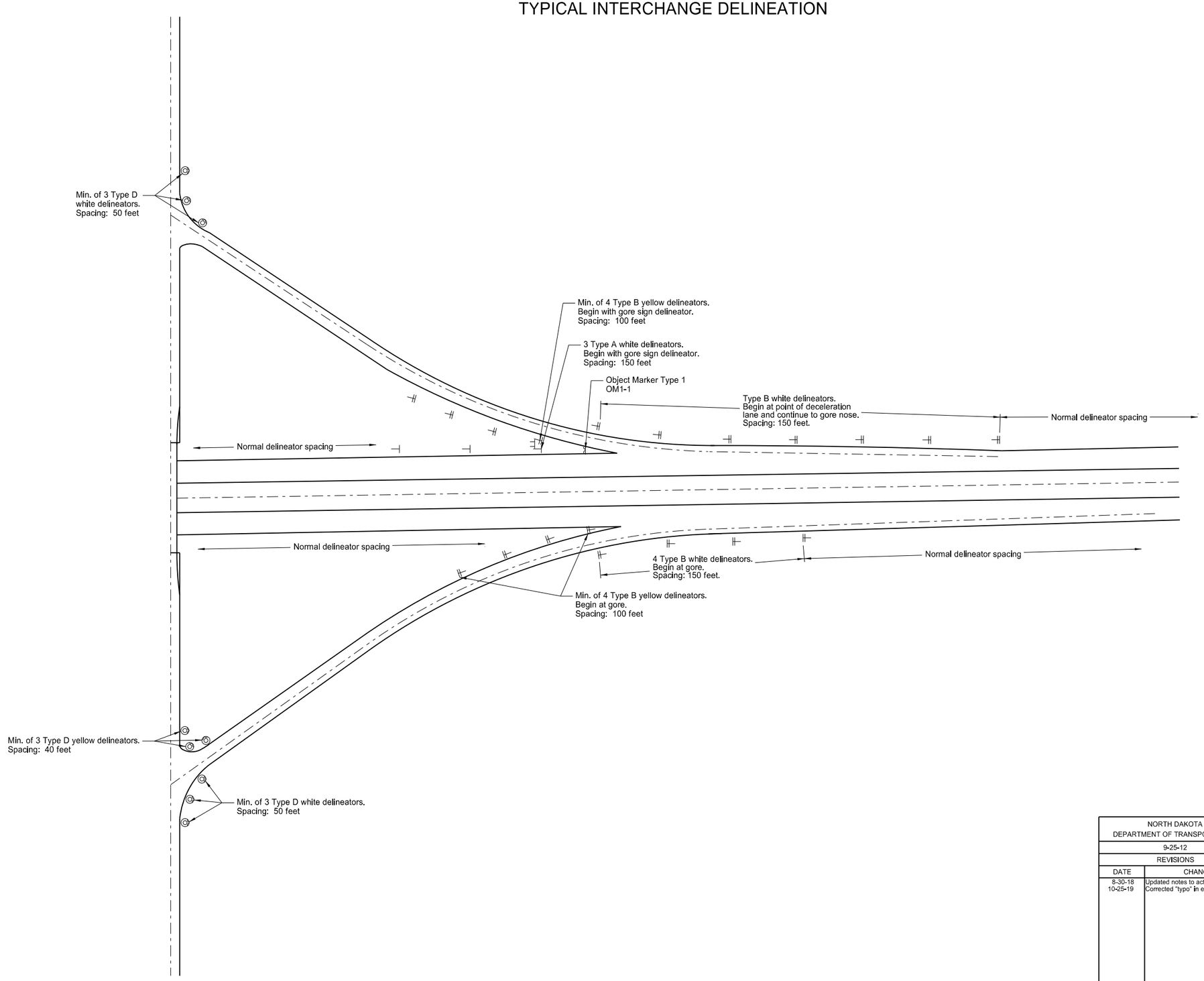
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
7-18-14	Revised reflective sheeting.
10-25-19	Updated notes to active voice and revised Median detail.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/25/19 and the original document is stored at the North Dakota Department of Transportation

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 10-25-19	Updated notes to active voice. Corrected "typo" in exit ramp layout.

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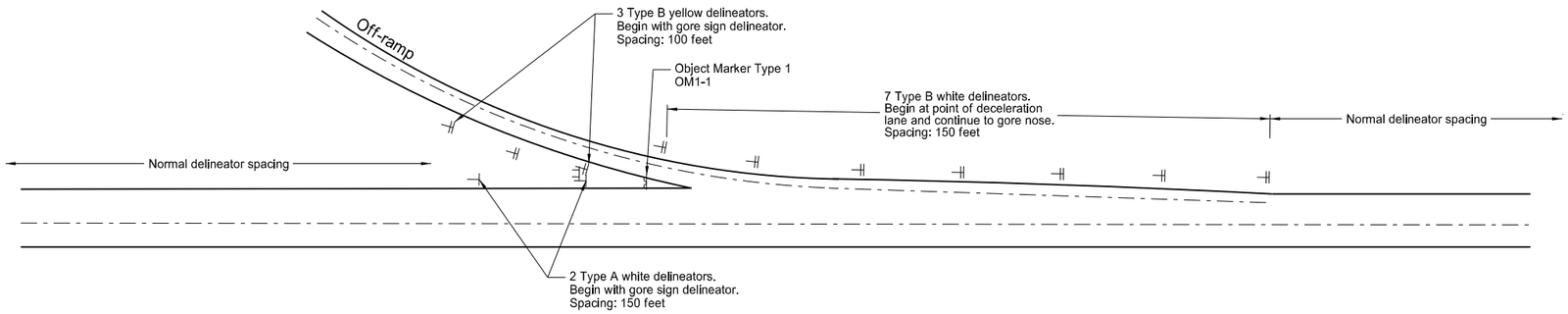
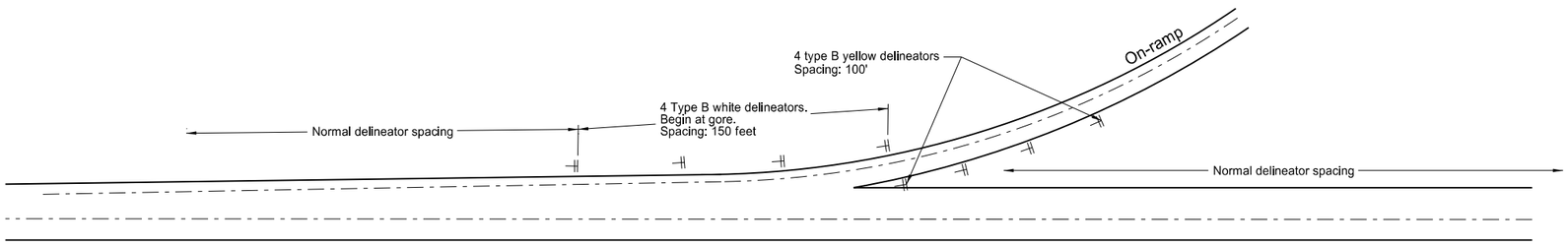
TYPICAL REST AREA DELINEATION

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 8-29-19	Updated notes to active voice. New Design Engineer PE Stamp.

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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.

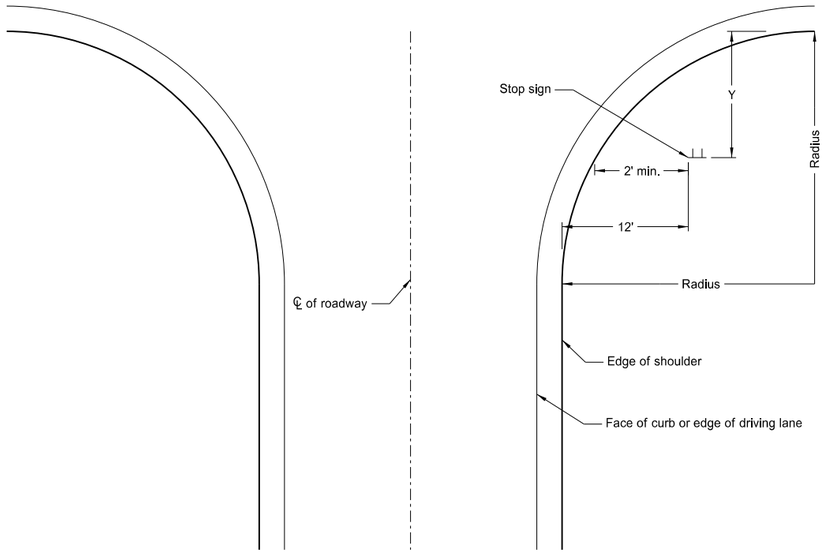
   Install signs on expressways a minimum height of 7'.

   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.

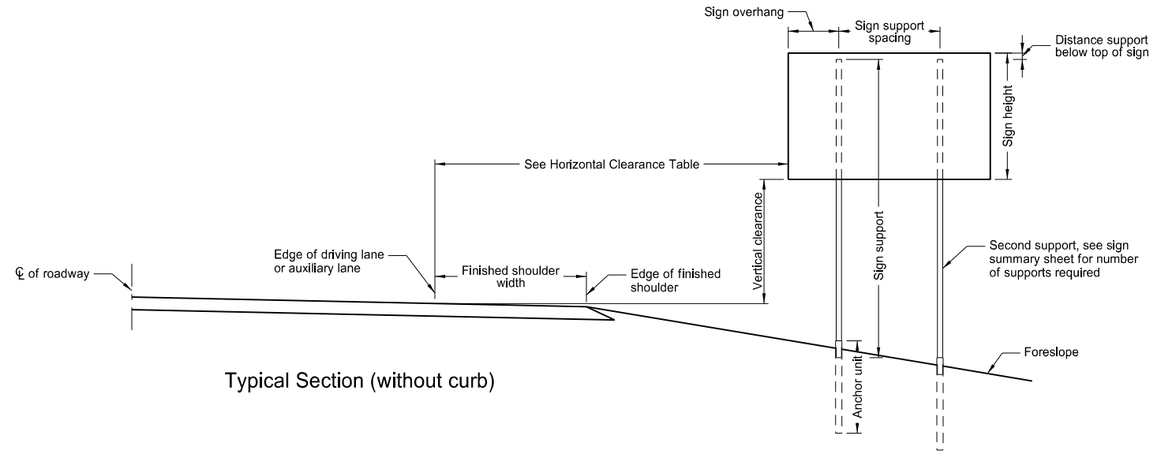
4. Provide a horizontal clearance from edge of shared use path to edge of sign of 3', except where width is limited. Provide a minimum clearance of 2'.



Stop Sign Location
Wide Throat Intersection

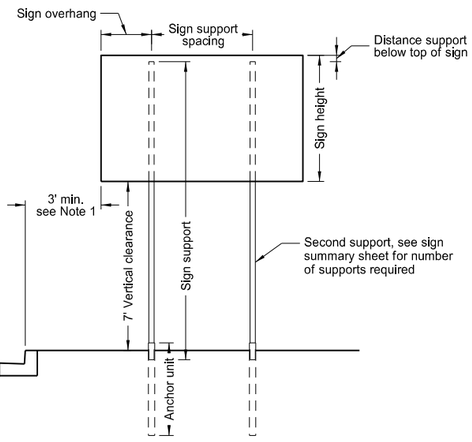
Use layout for the placement of "Stop" signs.

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



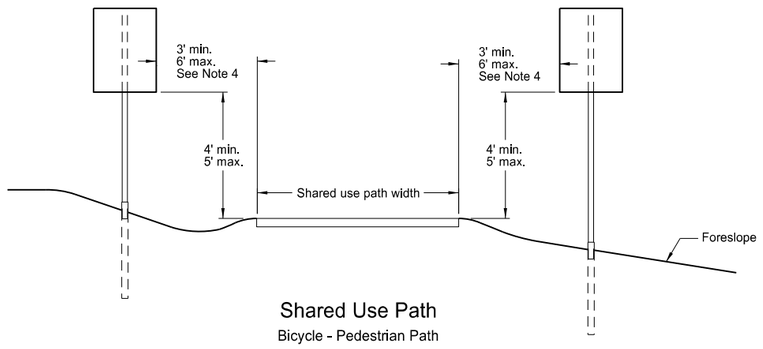
Typical Section (without curb)

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



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.

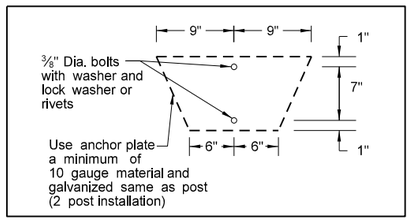
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

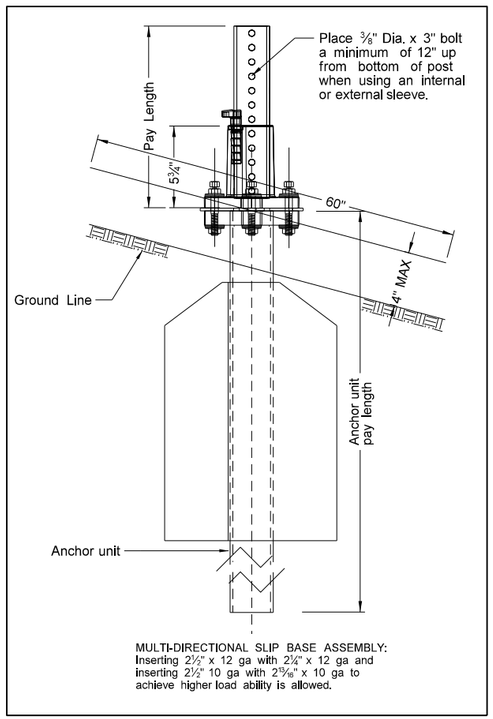
Mounting Details Perforated Tube

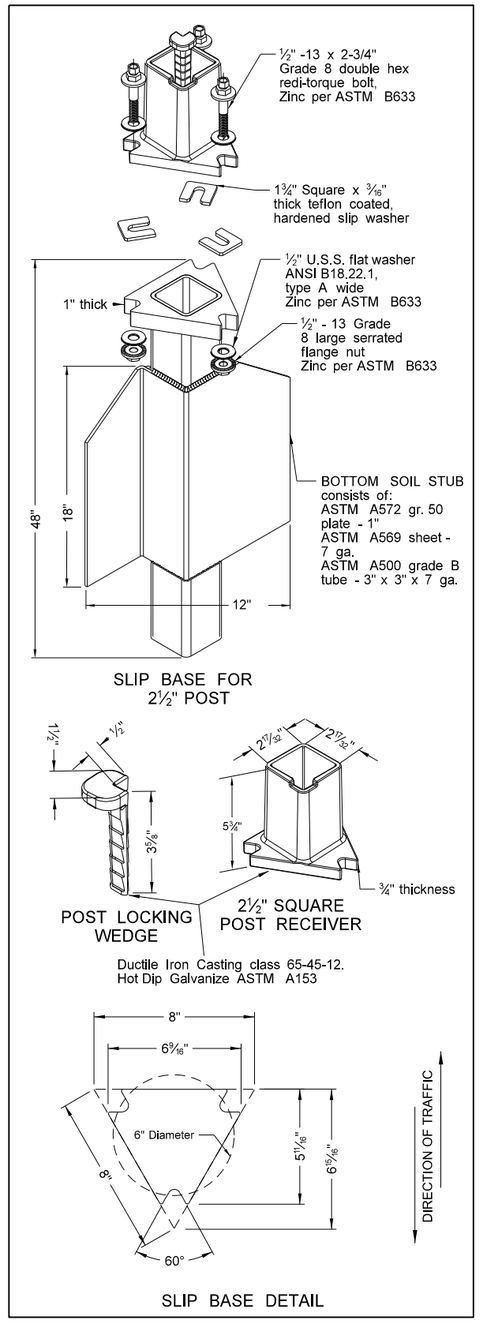
D-754-24

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 Thick-ness 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	2⅜	10	Yes		7

(B) - Provide a shim as specified by the manufacturer when placing 2½", 12 gauge posts in standard soils without breakaway bases. Provide breakaway base when placing the support in weak soils. The Engineer will determine if the 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.





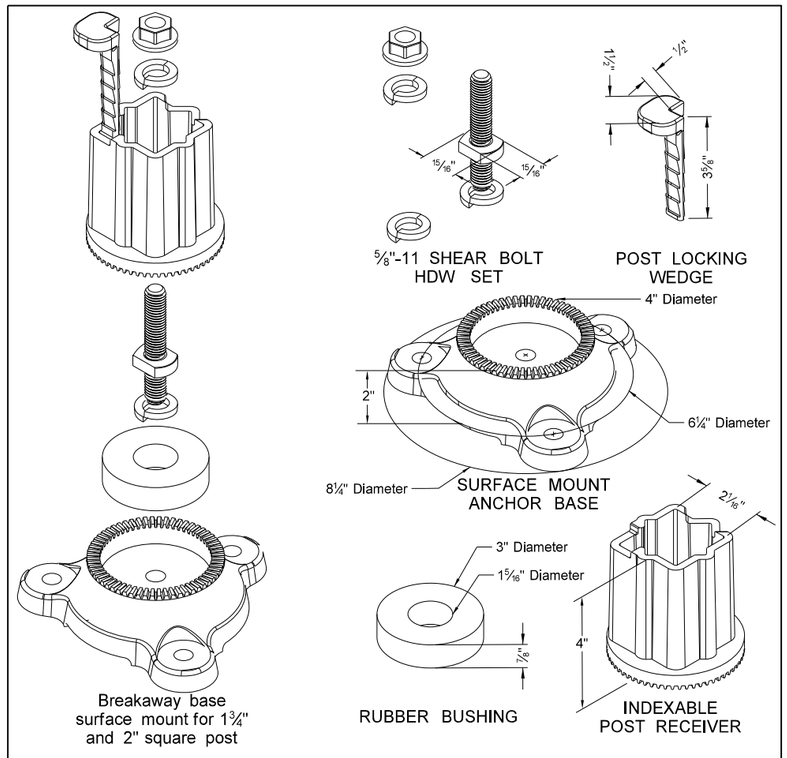


Properties of Telescoping Perforated Tubes						
Tube Size In.	Wall Thickness in.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In.⁴	Cross Sect. Area In.²	Section Modulus In.³
1½ x 1½	0.105	12	1.702	0.129	0.380	0.172
2 x 2	0.105	12	2.416	0.372	0.590	0.372
2¼ x 2¼	0.105	12	2.773	0.561	0.695	0.499
2⅜ x 2⅜	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 ¾" size 10 gauge is shown as 2.19" size on the plans; The 2½" size is shown as 2.51" size on the plans.

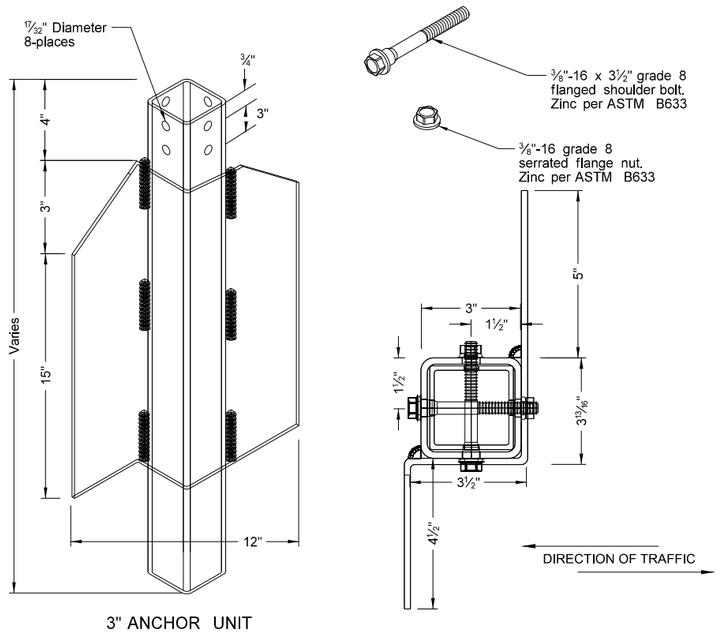
NOTE:

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. Provide 7 guage HRPO commmercial quality ASTM A569 and 3" x 3" x 7" guage ASTM A500 grade B anchor material with 43.9 KSI yield strength and 59.3 KSI tensile strength. Hot dip galvanize anchor per ASTM A123/153. Tolerances on anchor unit and slip base bottom assembly are +/- 0.005" unless ortherwise noted.
3. Eliminate wings when anchor is used in concrete sidewalk.
4. Provide a minimum 8' distance between the first and fourth post on four post signs.
5. Install in accordance with manufacturers recommendation.
6. Use a minimum ½" diameter x 4" grade 8 concrete fastener for surface mount breakaway base.



SHOULDER BOLT

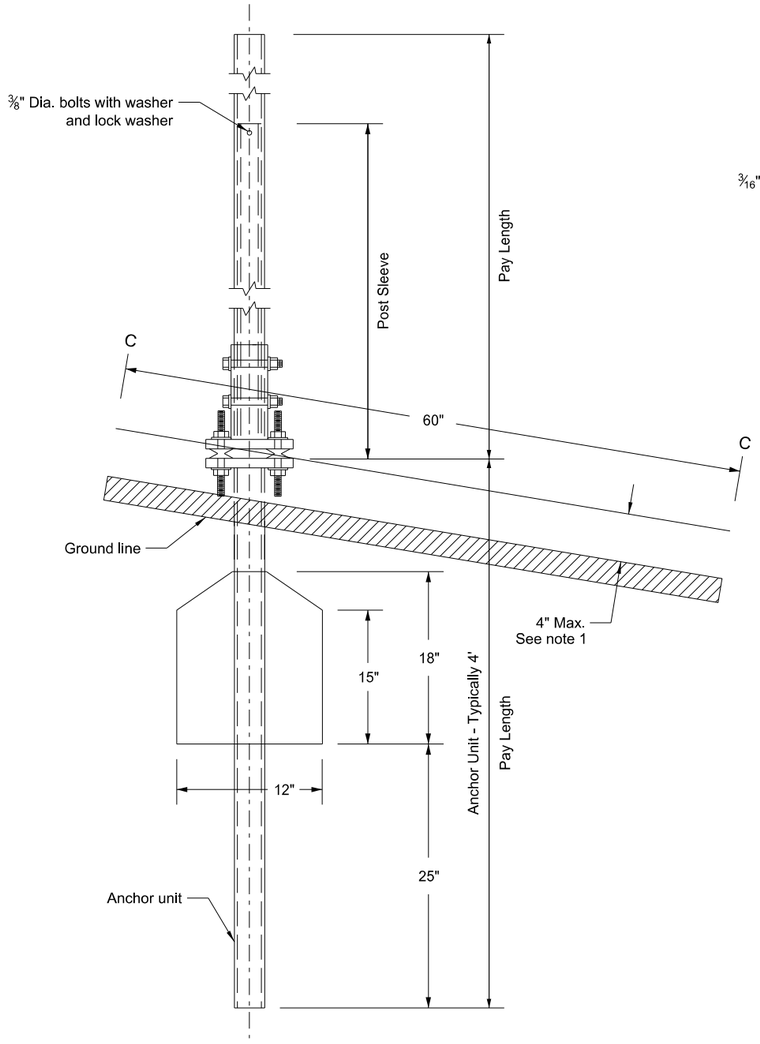
Shimming agent to reduce tolerance between 3" anchor unit and 2½" post.
(use standard ⅜" diameter grade 8 bolt with proper shim)

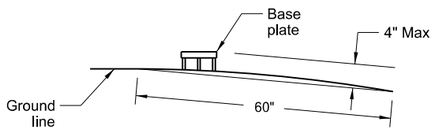


3" ANCHOR UNIT

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
8-6-09	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice & corrected max height of base.
8-29-19	New Design Engineer PE Stamp.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683 on 8/29/19 and the original document is stored at the North Dakota Department of Transportation

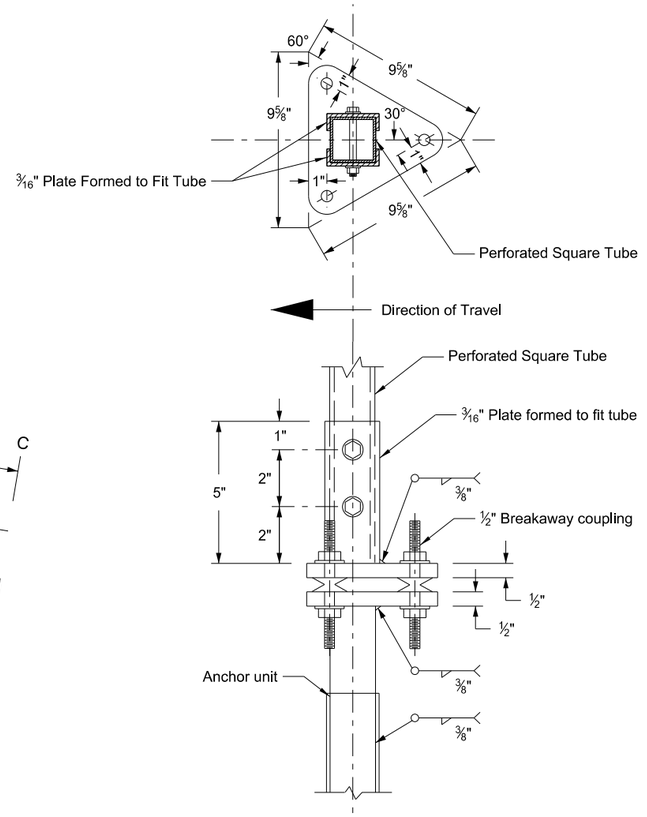




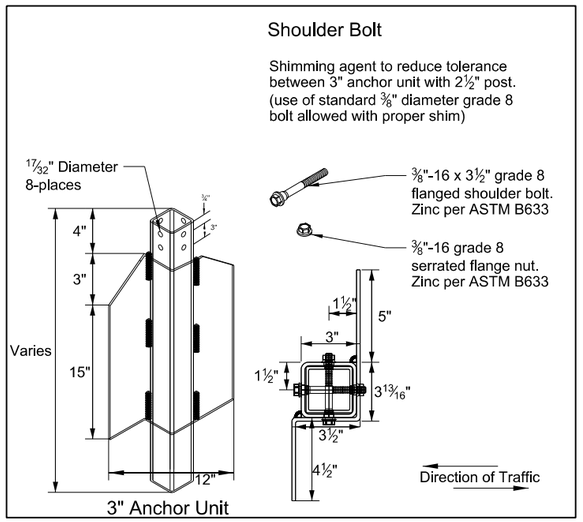
Section C-C

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.

Breakaway Coupler System for Perforated Tubes



Base Plate with Breakaway Coupler



3" Anchor Unit

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 Guage
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	2 3/16	10	Yes		7

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

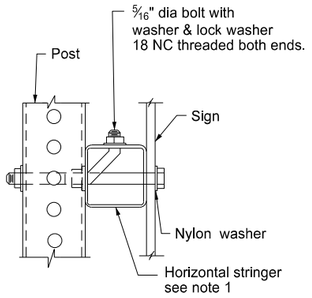
(C) - 3" anchor unit

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-3-2013	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
8-30-19	New Design Engr PE Stamp.

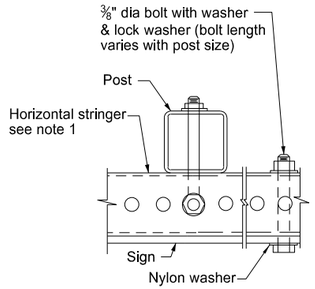
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/30/19 and the original document is stored at the North Dakota Department of Transportation

Mounting Details Perforated Tube

D-754-25

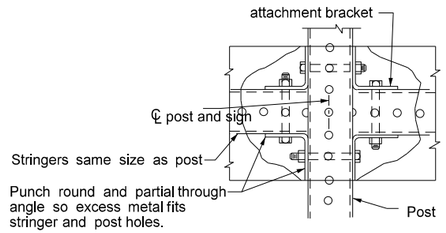


Side View



Top View

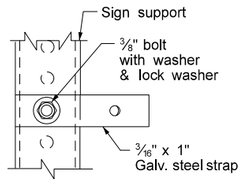
STRINGER MOUNTING
(WITH STRINGER IN FRONT OF POST)



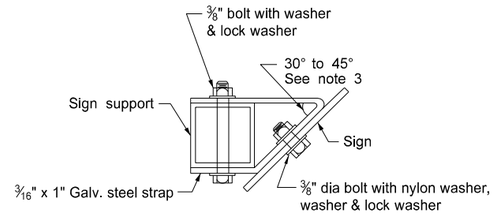
STREET NAME SIGNS AND ONE WAY SIGNS
SINGLE POST ASSEMBLY
ONE STRINGER OR BACK TO BACK MOUNTING

Note:

1. Horizontal stringers - Use perforated tubes or 1¾" x 3/16" thick, 1.08 lbs./ft aluminum or 3.16 lbs./ft steel z bar stringers.
2. Use minimum outside diameter 15/16" ±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.

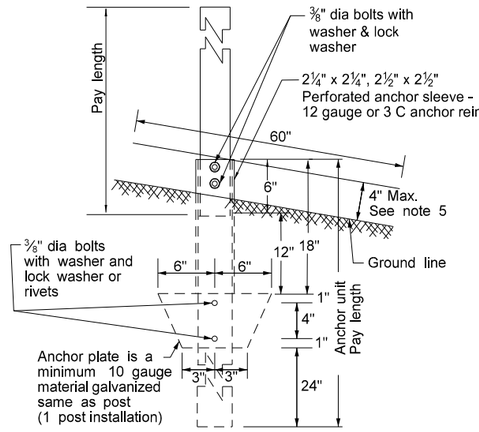


Side View



Top View

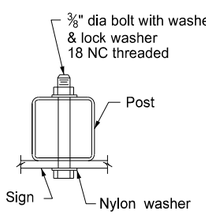
STRAP DETAIL



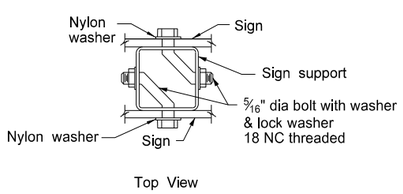
ANCHOR UNIT AND POST ASSEMBLY

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 Thick-ness 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	2 3/16	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.

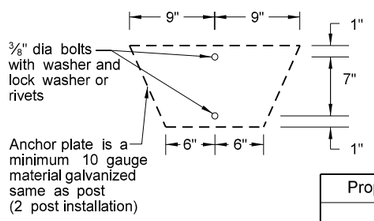


BOLT MOUNTING



Top View

BACK TO BACK MOUNTING



Properties of Telescoping Perforated Tubes

Tube Size In.	Wall Thickness In.	U.S. Standard Gauge	Weight Per Foot Lbs.	Moment of Inertia In.4	Cross Sect. area In.2	Section Modulus In.3
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
2 3/16 x 2 3/16	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

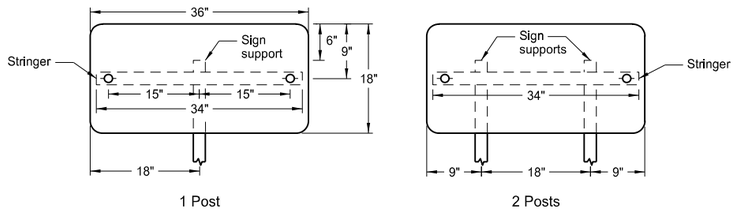
The 2 3/16" size 10 gauge is shown as 2.19" size on the plans.
The 2½" size is shown as 2.51" size on the plans.

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.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683 , on 8/30/19 and the original document is stored at the North Dakota Department of Transportation

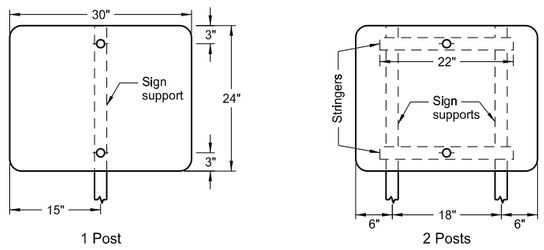
SIGN PUNCHING, STRINGER AND SUPPORT LOCATION
DETAILS REGULATORY, WARNING AND GUIDE SIGNS

D-754-32



1 Post 2 Posts

Assembly No. 31

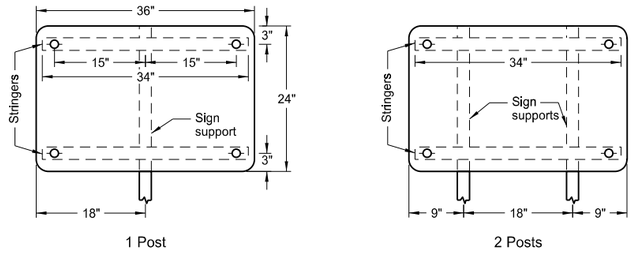


1 Post 2 Posts

Assembly No. 32

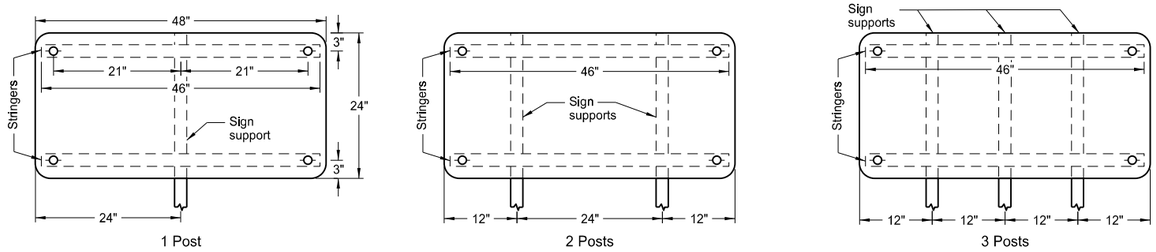
Notes:

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.



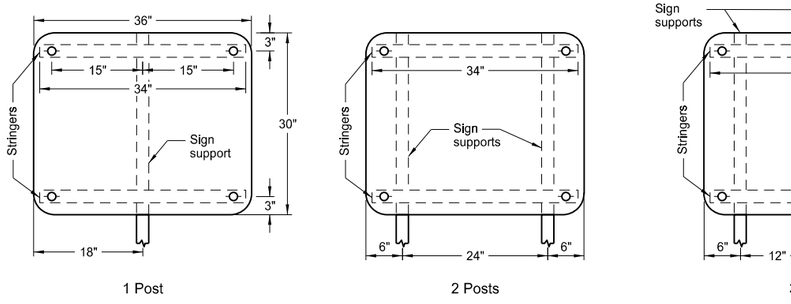
1 Post 2 Posts

Assembly No. 33



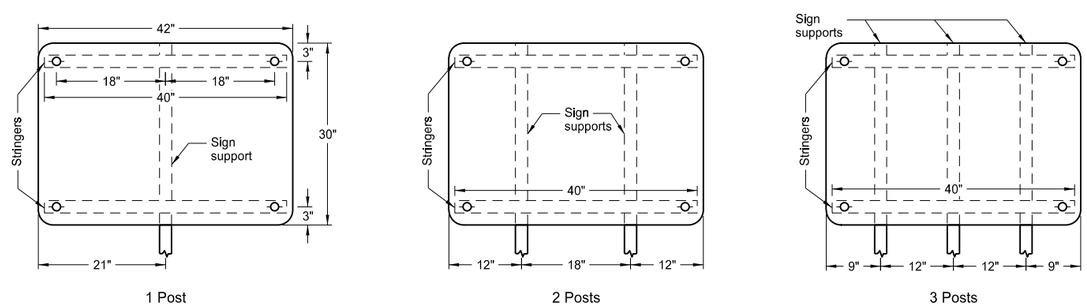
1 Post 2 Posts 3 Posts

Assembly No. 34



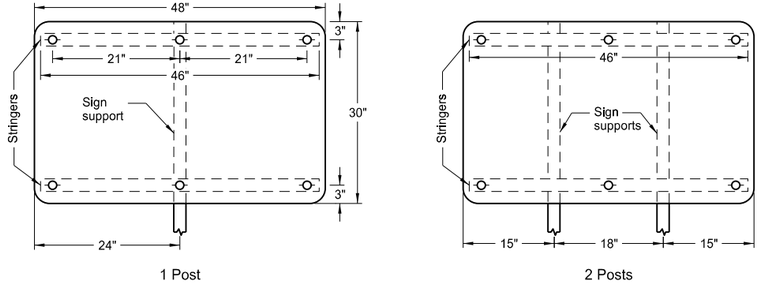
1 Post 2 Posts 3 Posts

Assembly No. 35



1 Post 2 Posts 3 Posts

Assembly No. 36



1 Post 2 Posts 3 Posts

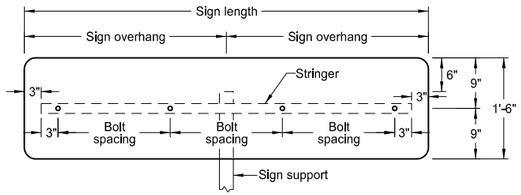
Assembly No. 37

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

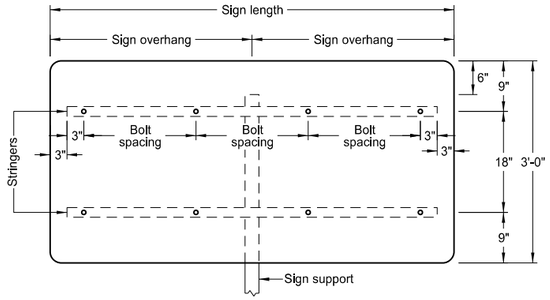
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/30/19 and the original document is stored at the North Dakota Department of Transportation

SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR VARIABLE LENGTH SIGNS

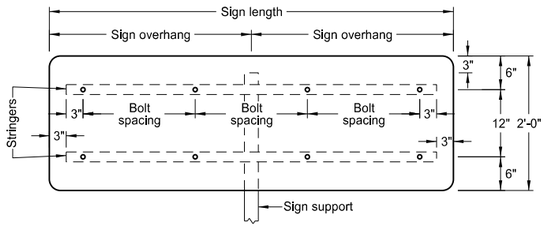
D-754-47



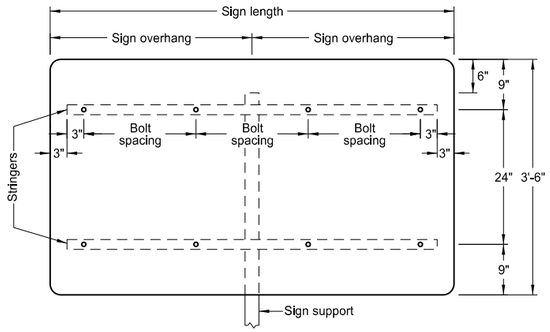
VARIES X 1'-6"



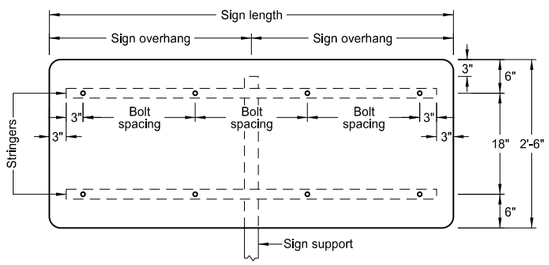
VARIES X 3'-0"



VARIES X 2'-0"



VARIES X 3'-6"



VARIES X 2'-6"

1 POST		
Sign Length	Sign Overhang	Bolt Spacing
4'-0"	2'-0"	18"
4'-6"	2'-3"	21"
5'-0"	2'-6"	24"
5'-6"	2'-9"	18"
6'-0"	3'-0"	20"
6'-6"	3'-3"	22"
7'-0"	3'-6"	24"
7'-6"	3'-9"	2-20" & 2-19"
8'-0"	4'-0"	21"
8'-6"	4'-3"	2-22" & 2-23"
9'-0"	4'-6"	24"
9'-6"	4'-9"	4-20" & 1-22"
10'-0"	5'-0"	2-21" & 3-22"
10'-6"	5'-3"	4-23" & 1-22"
11'-0"	5'-6"	24"
11'-6"	5'-9"	21"
12'-0'	6'-0"	22"

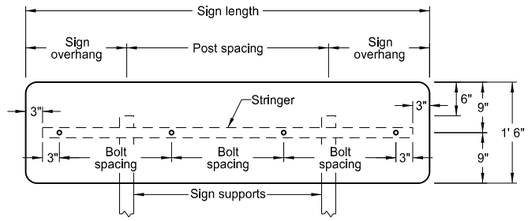
Notes:

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.
4. Attach single stringer to single post signs with special stringer angle, shown on "Mounting Details Perforated Tube" standard drawing.

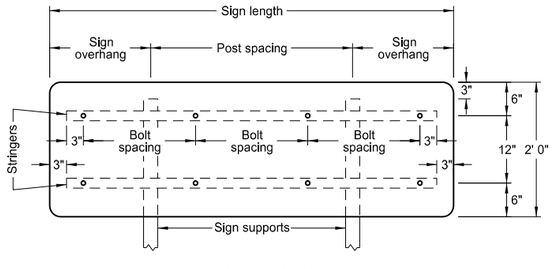
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-25-12	
REVISIONS	
DATE	CHANGE
8-30-18	Updated notes to active voice.
9-04-19	New Design Engr PE Stamp.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 9/04/19 and the original document is stored at the North Dakota Department of Transportation

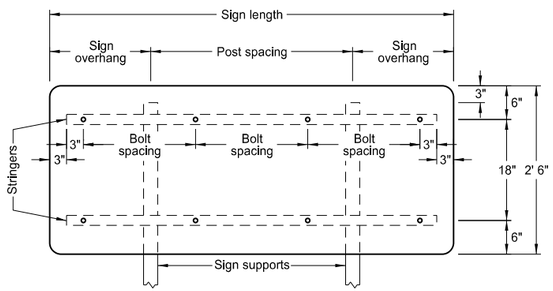
SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR VARIABLE LENGTH SIGNS



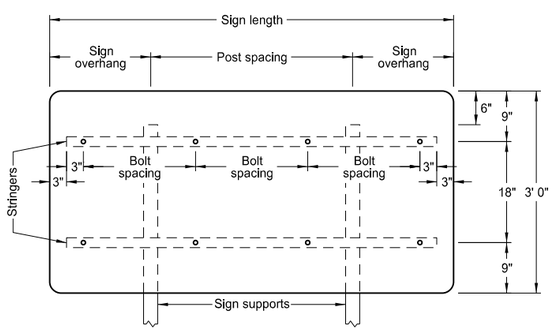
VARIES X 1'-6"



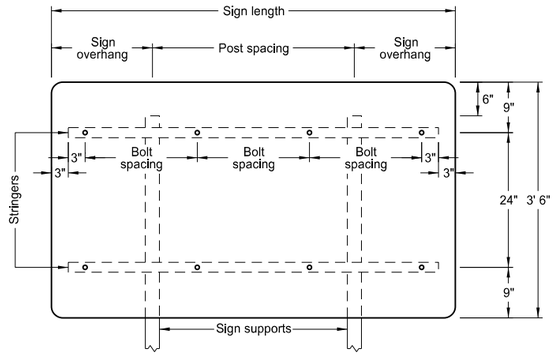
VARIES X 2'-0"



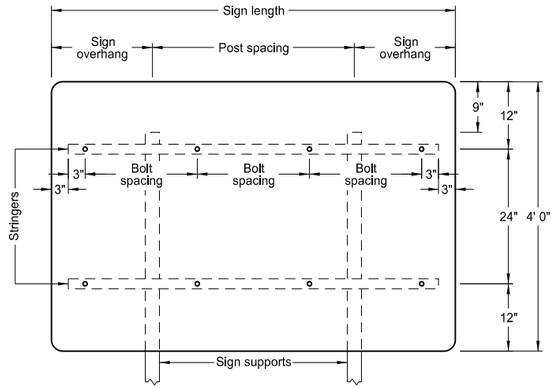
VARIES X 2'-6"



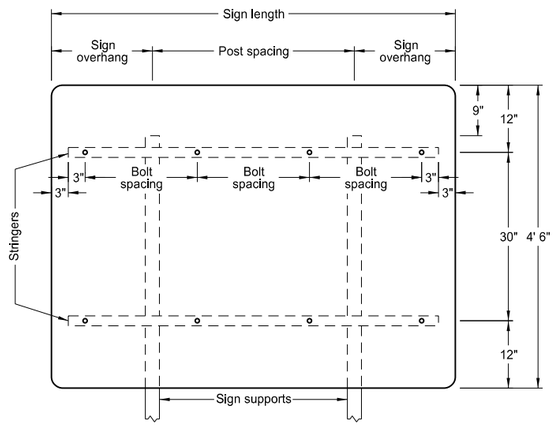
VARIES X 3'-0"



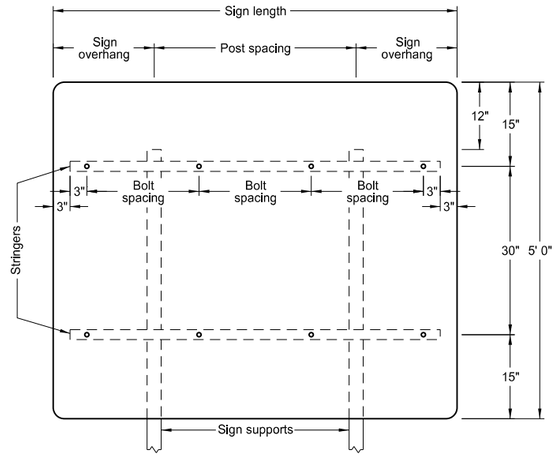
VARIES X 3'-6"



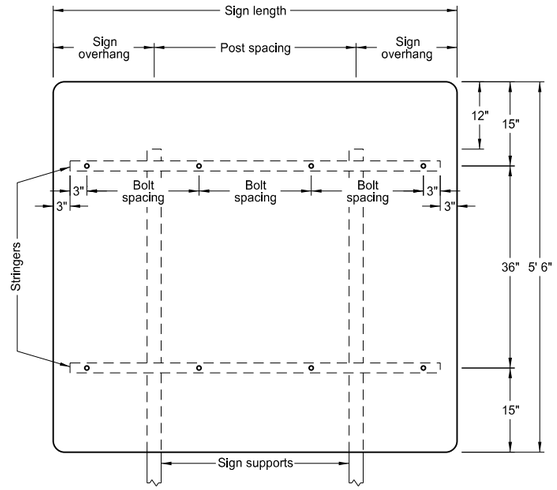
VARIES X 4'-0"



VARIES X 4'-6"



VARIES X 5'-0"



VARIES X 5'-6"

2 POSTS			
Sign Length	Sign Overhang	Post Spacing	Bolt Spacing
4'-0"	1'-0"	2'-0"	18"
4'-6"	1'-3"	2'-0"	21"
5'-0"	1'-0"	3'-0"	24"
5'-6"	1'-3"	3'-0"	18"
6'-0"	1'-6"	3'-0"	20"
6'-6"	1'-3"	4'-0"	22"
7'-0"	1'-6"	4'-0"	24"
7'-6"	1'-9"	4'-0"	2-20" & 2-19"
8'-0"	2'-0"	4'-0"	21"
8'-6"	1'-9"	5'-0"	2-22" & 2-23"
9'-0"	2'-0"	5'-0"	24"
9'-6"	1'-9"	6'-0"	4-20" & 1-22"
10'-0"	2'-0"	6'-0"	2-21" & 3-22"
10'-6"	2'-3"	6'-0"	4-23" & 1-22"
11'-0"	2'-6"	6'-0"	24"
11'-6"	2'-9"	6'-0"	21"
12'-0"	2'-0"	8'-0"	22"
12'-6"	2'-3"	8'-0"	23"
13'-0"	2'-6"	8'-0"	24"
13'-6"	2'-9"	8'-0"	3-22" & 4-21"
14'-0'	3'-0"	8'-0"	2-23" & 5-22"
14'-6"	3'-3"	8'-0"	6-23" & 1-24"
15'-0"	3'-6"	8'-0"	24"
15'-6"	2'-9"	10'-0"	6-22" & 2-21"
16'-0"	3'-0"	10'-0"	4-23" & 4-22"
16'-6"	3'-3"	10'-0"	6-23" & 2-24"
17'-0"	3'-6"	10'-0"	24"
17'-6"	3'-9"	10'-0"	22"
18'-0"	3'-0"	12'-0"	6-23" & 3-22"
18'-6"	3'-3"	12'-0"	6-23" & 3-24"
19'-0"	3'-6"	12'-0"	24"
19'-6"	3'-9"	12'-0"	8-22" & 2-23"
20'-0"	4'-0"	12'-0"	8-23" & 2-22"

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

9-25-12

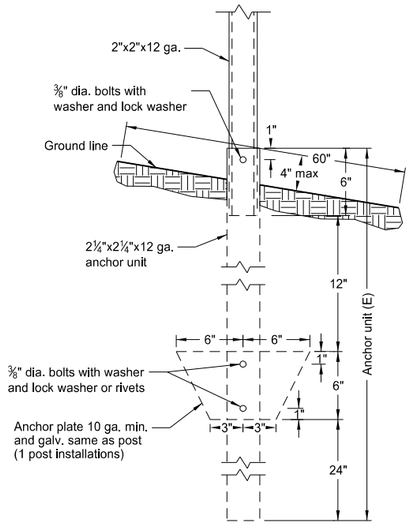
REVISIONS

DATE	CHANGE
8-30-18	Updated notes to active voice.
9-04-19	New Design Engineer PE Stamp.

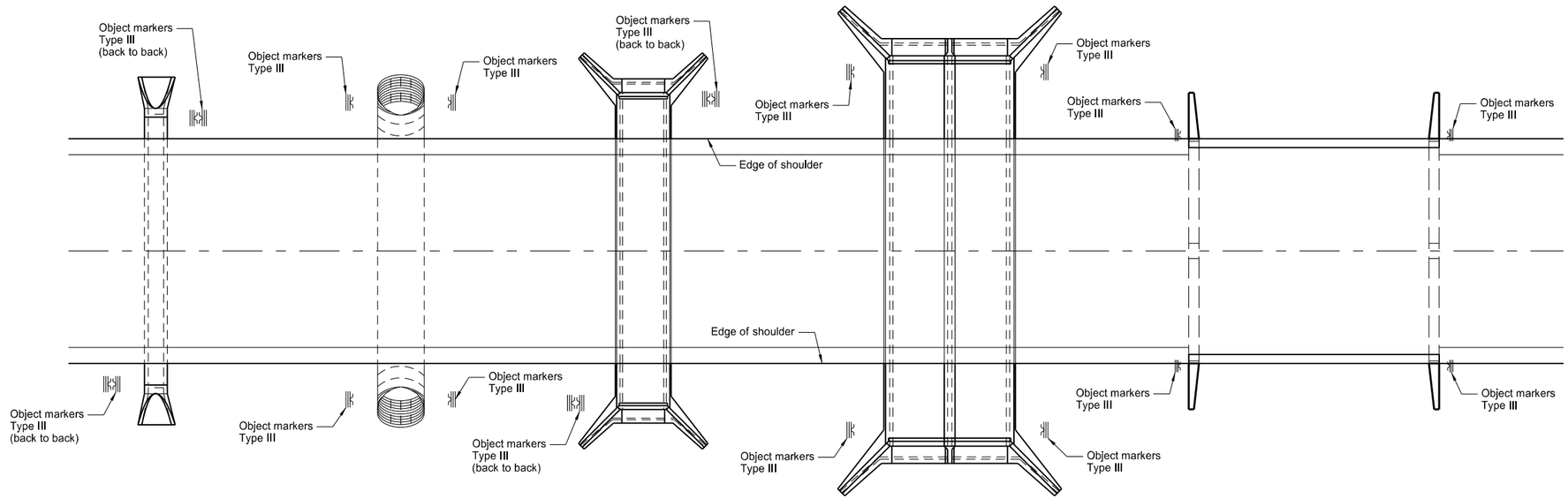
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683 , on 9/04/19 and the original document is stored at the North Dakota Department of Transportation

OBJECT MARKERS

D-754-82



Perforated Tube Anchor Unit Assembly



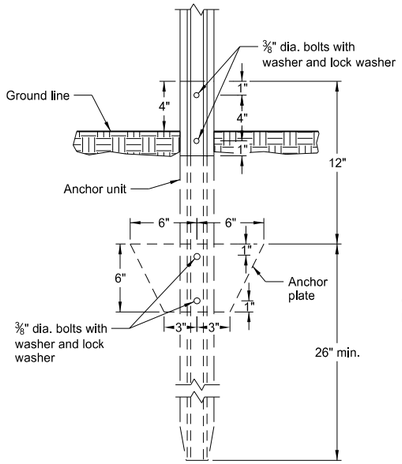
Pipe Culverts 10' max

Pipe Culverts greater than 10'

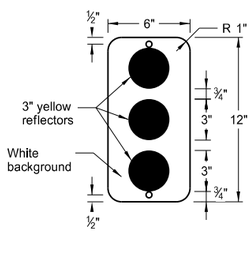
Box Culverts 10' max

Box Culverts greater than 10'

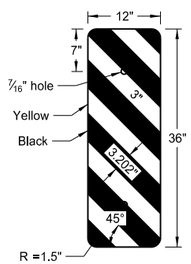
Bridges (B)



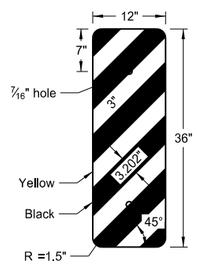
U-Channel Anchor Unit Assembly



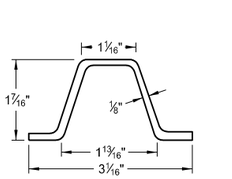
Object Marker
OM2-1V (C)
Type II



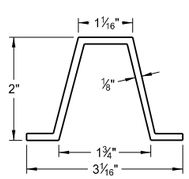
Object Marker Left
OM-3L (C)
Type III



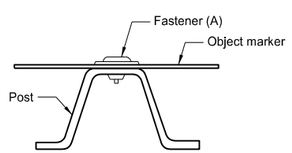
Object Marker Right
OM-3R (C)
Type III



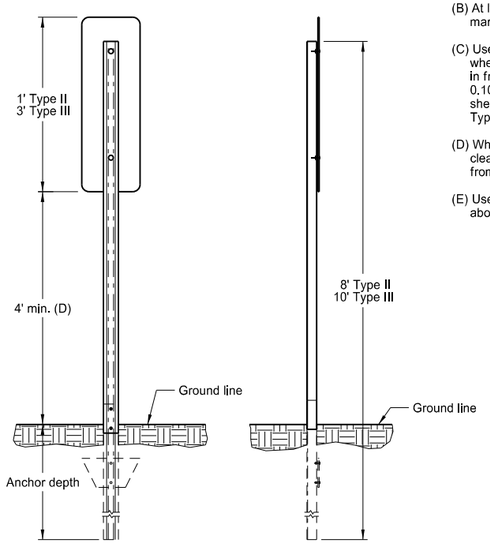
Steel Post Detail
Approx. 2 lb/ft



Aluminum Post Detail
Approx. 0.88 lb/ft



Fastener Detail



Object Marker
Installation Detail

Notes:

(A) Use ⅜" dia. tension pin type or other non-rust vandal resistant fastener with min. outside dia. 13/16" 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.

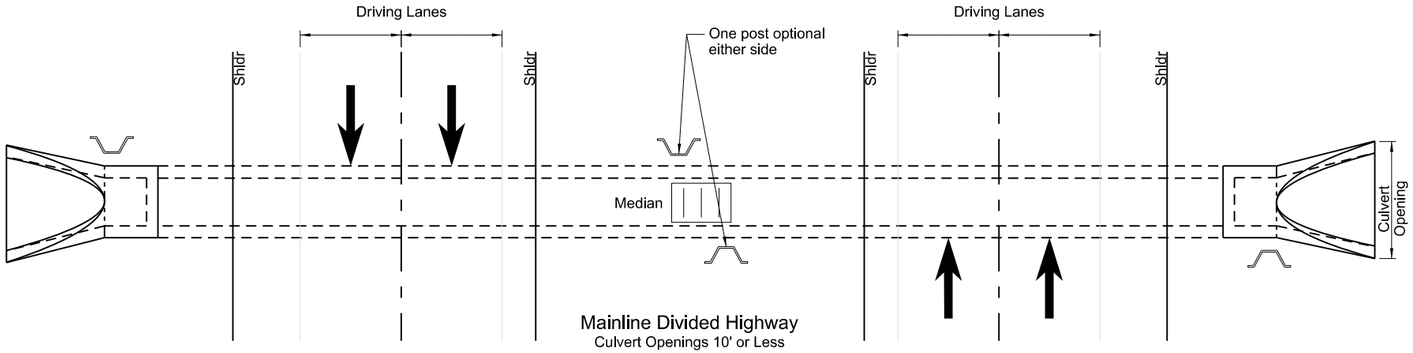
(E) Use 4" vertical clearance for anchor or breakaway base. Provide 4"x60" measurement above and below post location and back and ahead of post.

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

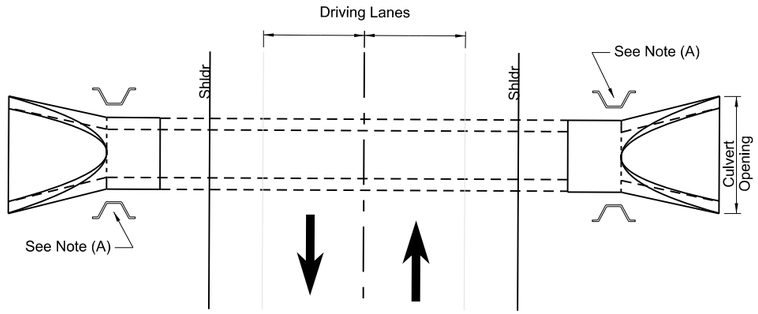
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 9/05/19 and the original document is stored at the North Dakota Department of Transportation

OBJECT MARKERS - CULVERTS

D-754-83

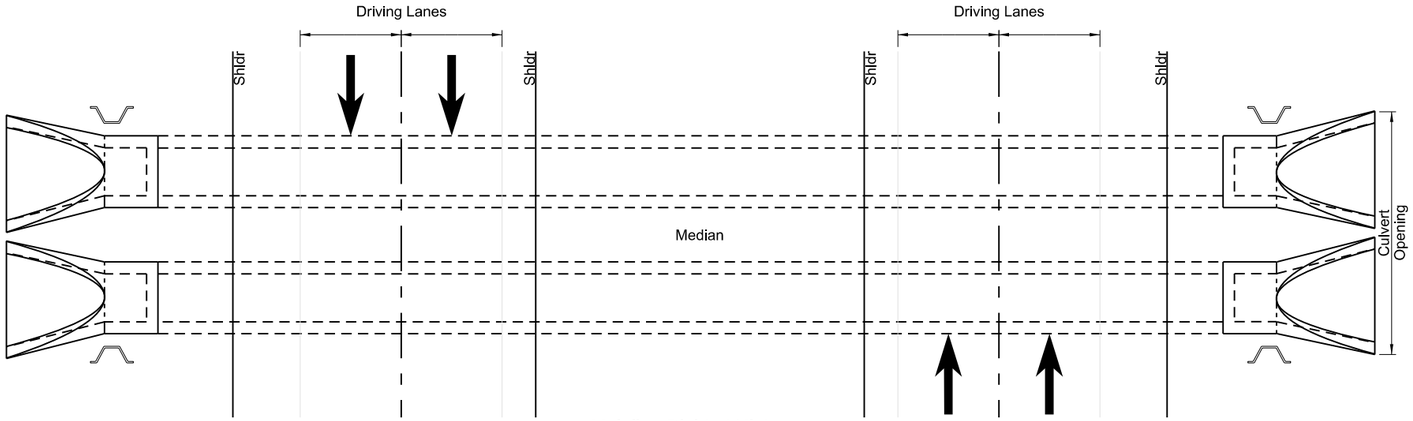


Mainline Divided Highway
Culvert Openings 10' or Less

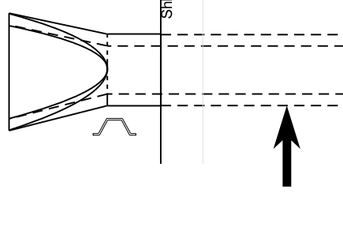


Two-Lane Highway

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

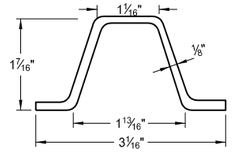


Mainline Divided Highway
Culvert Openings Greater than 10'
Multiple Installations

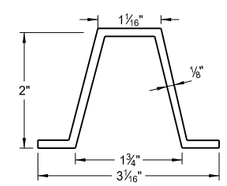


Ramp

Post Location



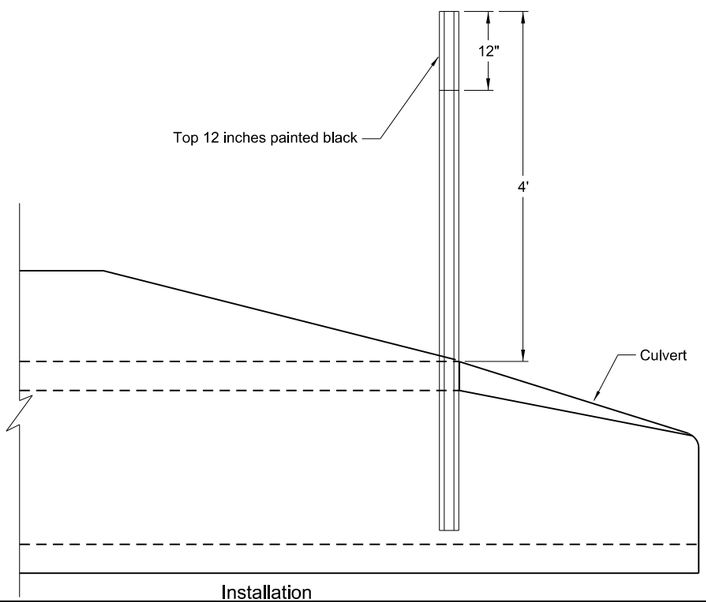
Steel Post Detail
Approx. 2.0 lbs/ft



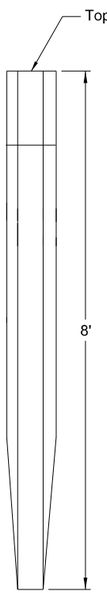
Aluminum Post Detail
Approx. 0.88 lbs/ft

Notes:

Mark each end of culverts crossing the roadway 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.



Installation



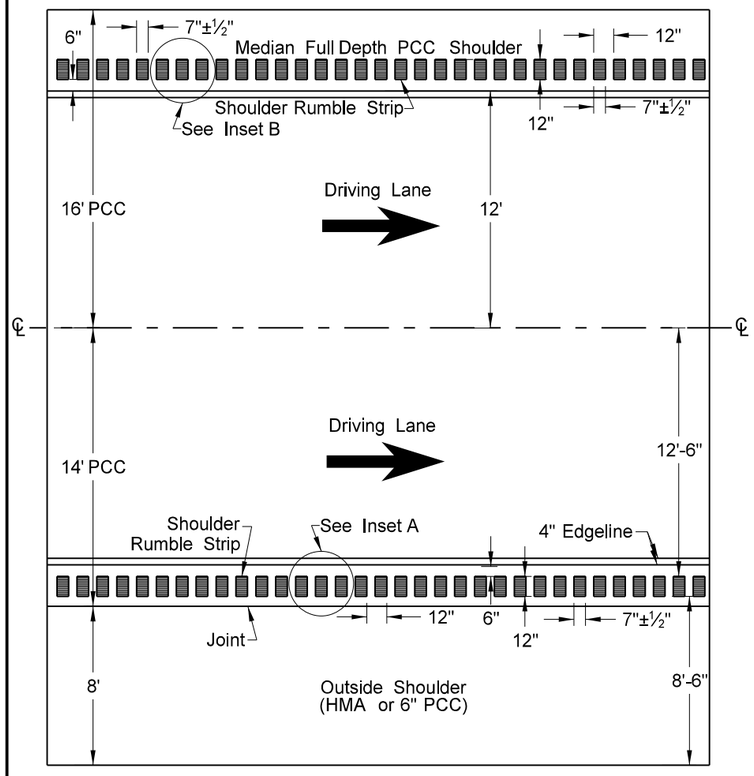
U-Type Post

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.

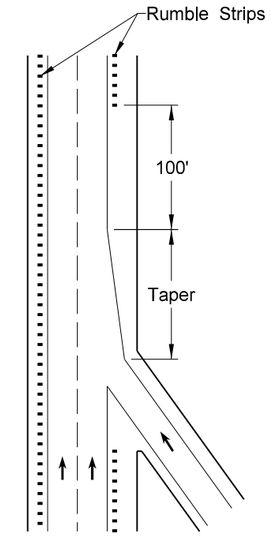
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 9/05/19 and the original document is stored at the North Dakota Department of Transportation

RUMBLE STRIPS
INTERSTATE HIGHWAYS

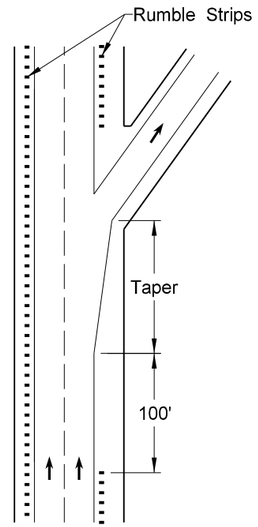
D-760-1



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



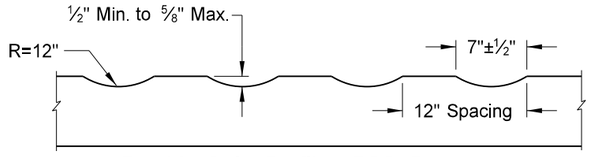
Entrance Ramp



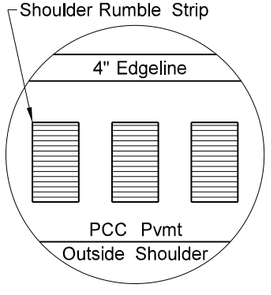
Exit Ramp

NOTES:

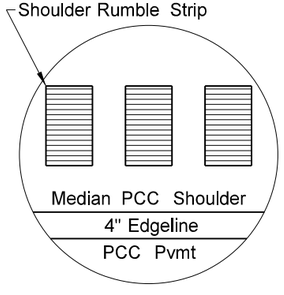
1) Discontinue rumble strips through ramps and 100' before and after ramp tapers as shown below.



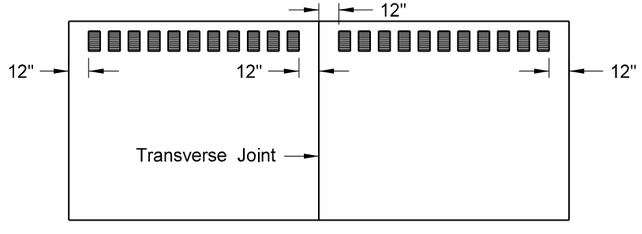
Rumble Strip Profile - PCC Pavements



Inset A - Shoulder Rumble Strip



Inset B - Shoulder Rumble Strip



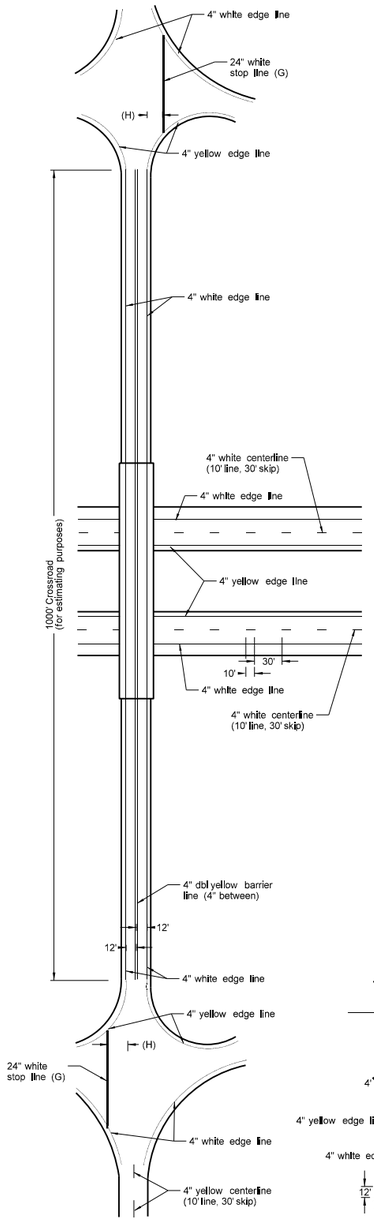
Discontinue rumble strip approx 12" each side of PCC transverse joint

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-29-09	
REVISIONS	
DATE	CHANGE
2-25-10	Note 4 was added.
9-8-11	Revised Notes and D-760-1.
8-30-18	Revised drawings for clarity.
10-25-19	Added missing dimensions.

This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/25/19 and the original document is stored at the North Dakota Department of Transportation

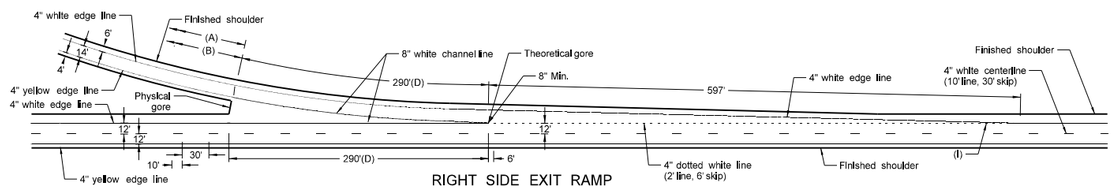
INTERSTATE PAVEMENT MARKING
4 LANE DIVIDED HIGHWAY

D-762-2

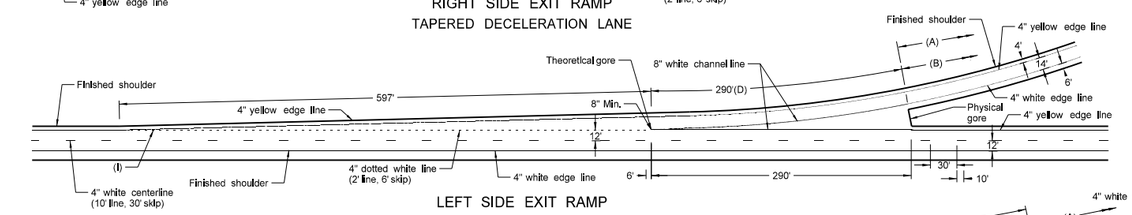


CROSS-ROAD & STRUCTURE

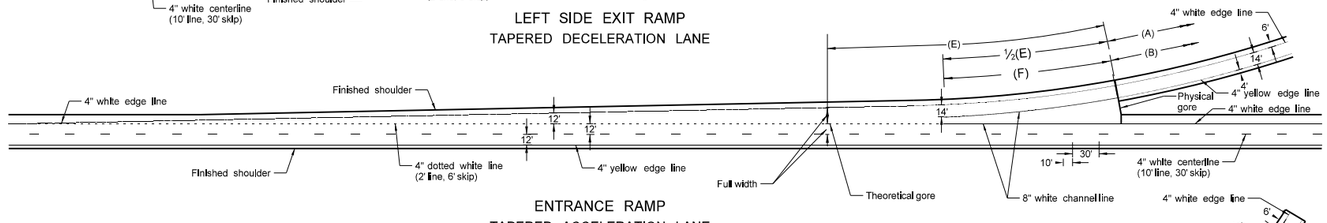
Engineer will determine length striped.



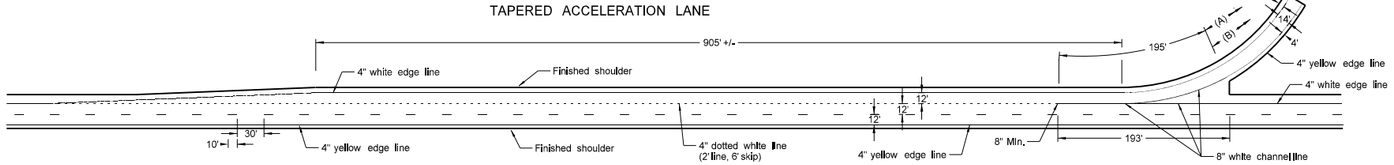
RIGHT SIDE EXIT RAMP
TAPERED DECELERATION LANE



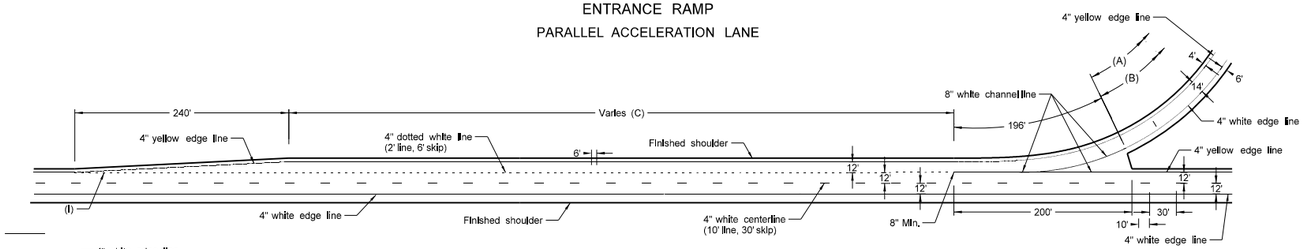
LEFT SIDE EXIT RAMP
TAPERED DECELERATION LANE



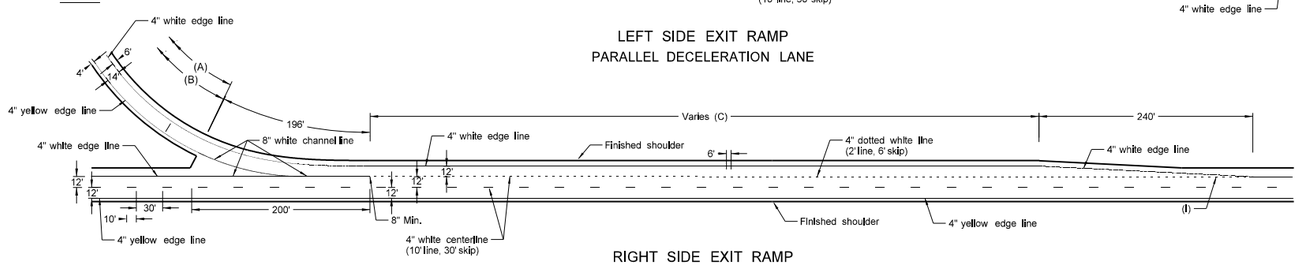
ENTRANCE RAMP
TAPERED ACCELERATION LANE



ENTRANCE RAMP
PARALLEL ACCELERATION LANE



LEFT SIDE EXIT RAMP
PARALLEL DECELERATION LANE



RIGHT SIDE EXIT RAMP
PARALLEL DECELERATION LANE

NOTE:

(A) 4" White edge line
(B) 4" Yellow edge line
(C) Assume "varies" equals 790' for purpose of estimate. Place pavement marking from beginning of taper to the 8" line.
(D) Beginning of physical gore to theoretical gore.
(E) If the distace is less than 350' extend the 8" channel line to the theoretical gore, otherwise use 195'.
(F) Use 195' for estimating purposes.
(G) Not required for gravel surface crossroad approaches.
(H) 4' minimum, 15' maximum from nearest edge of intersection traveled way.
(I) Extend dotted line until it touches the edgeline.

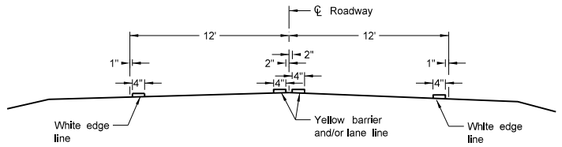
BASIS OF ESTIMATE		
LOCATION	ITEM	
Right or Left Side Exit Ramp TAPERED	8" White channel line	580 LF
	24" White stop line	60 LF
	4" White dotted line	148 LF
	4" White edge line	1115 LF
	4" Yellow edge line	1075 LF
Entrance Ramp TAPERED	8" White channel line	390 LF
	4" White dotted line	258 LF
	4" White edge line	1270 LF
	4" Yellow edge line	1075 LF
Right or Left Side Exit Ramp PARALLEL	8" White channel line	396 LF
	24" White stop line	60 LF
	4" White dotted line (C)	258 LF
	4" White edge line	1115 LF
	4" Yellow edge line	1075 LF
Entrance Ramp PARALLEL	8" White channel line	388 LF
	4" White dotted line	283 LF
	4" White edge line	1275 LF
	4" Yellow edge line	1075 LF
Main Line (Both Roadways)	4" White lane line, 10' line, 30' skip	2640 LF/MI
	4" White edge line	10,560 LF/MI
	4" Yellow edge line	10,560 LF/MI
Cross Road	4" White edge line	2000 LF
	4" Dbl 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 (I)

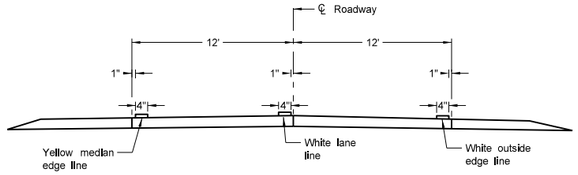
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 10/25/19 and the original document is stored at the North Dakota Department of Transportation

PAVEMENT MARKING

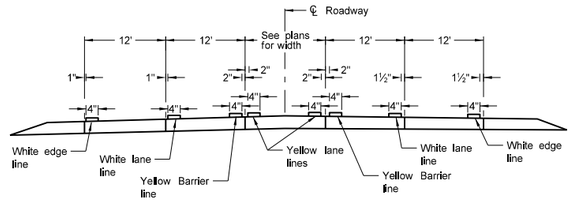
D-762-4



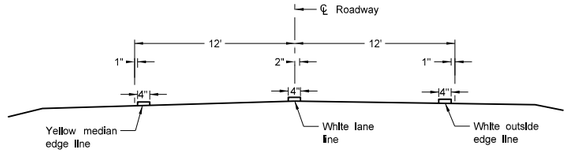
Two Lane Two Way
RURAL ROADWAY



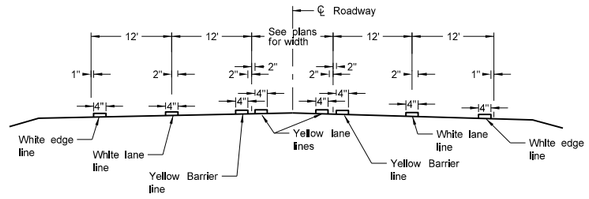
Two Lane Roadway
INTERSTATE HIGHWAY
Concrete Section



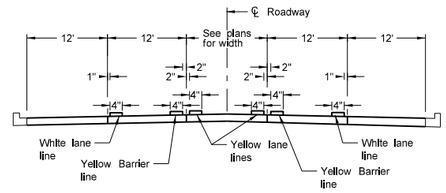
RURAL FIVE LANE ROADWAY
Concrete Section



Two Lane Divided
Rural Roadway
PRIMARY HIGHWAY
Asphalt Section



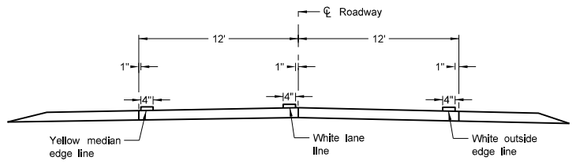
RURAL FIVE LANE ROADWAY
Asphalt Section



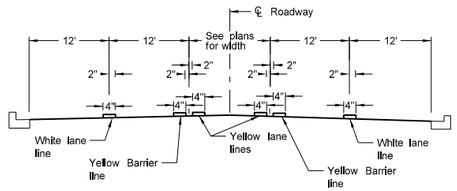
URBAN FIVE LANE SECTION
Concrete Section

NOTES:

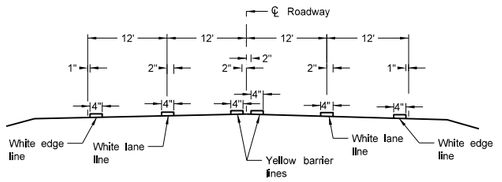
1. Continue edge lines through private drives and field drives. Break edge lines for intersections.



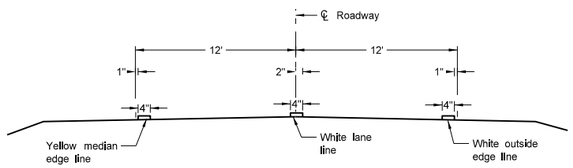
Two Lane Roadway
PRIMARY HIGHWAY
Concrete Section



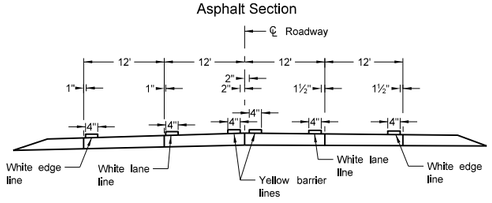
URBAN FIVE LANE SECTION
Asphalt Section



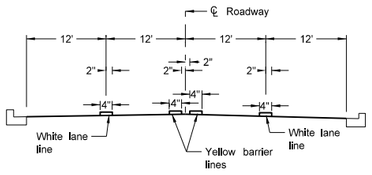
RURAL FOUR LANE ROADWAY
Asphalt Section



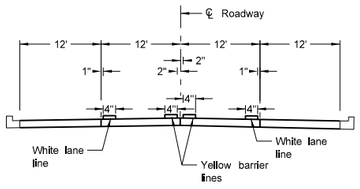
Two Lane Roadway
INTERSTATE HIGHWAY
Asphalt Section



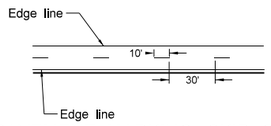
RURAL FOUR LANE ROADWAY
Concrete Section



URBAN FOUR LANE SECTION
Asphalt Section



URBAN FOUR LANE SECTION
Concrete Section



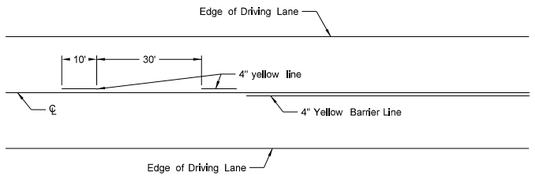
CENTERLINE PAVEMENT MARKING SKIP SPACING DETAIL

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
10-17-17 08-27-19	Updated to active voice. New Design Engineer PE Stamp.

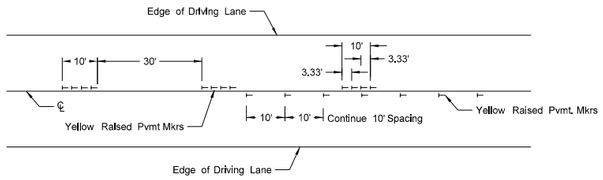
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE-4683, on 8/27/19 and the original document is stored at the North Dakota Department of Transportation

SHORT-TERM PAVEMENT MARKING

D-762-11

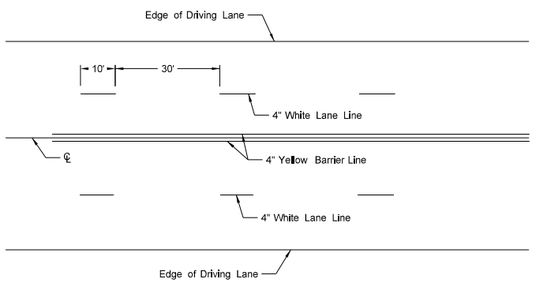


Painted or Tape Lines

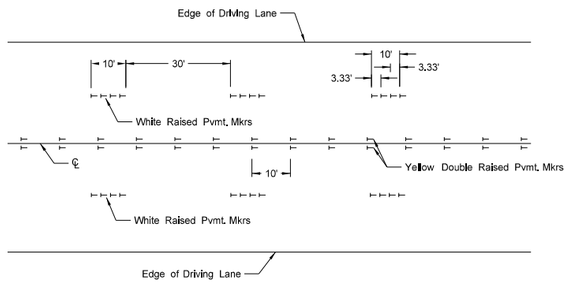


Raised Pavement Markers

TWO-LANE TWO-WAY ROADWAY

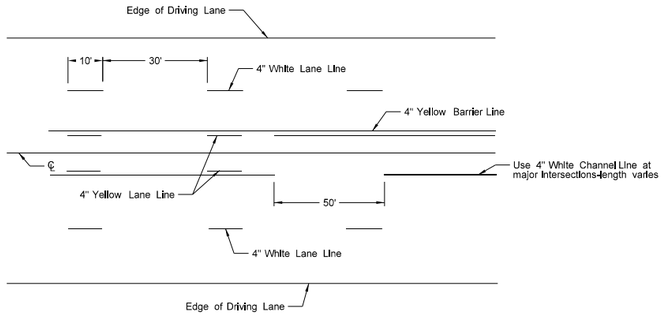


Painted or Tape Lines



Raised Pavement Markers

FOUR LANE ROADWAY



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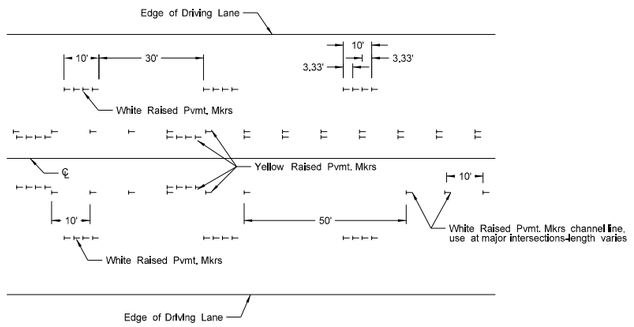
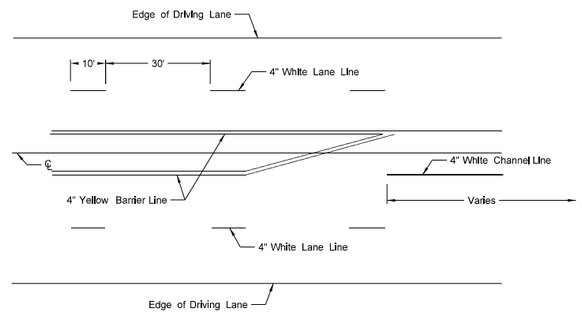


Raised Pavement Markers

FIVE LANE ROADWAY TWO WAY LEFT TURN



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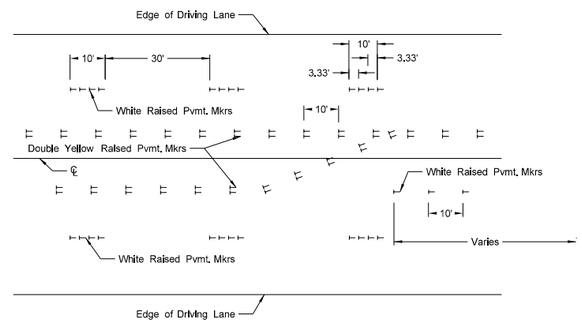

Raised Pavement Markers

FIVE LANE ROADWAY WITH MARKED ISLANDS

NOTES:

1. Place no passing zones on two-lane two-way roadways as shown. In lieu of short term no passing zone pavement markings, place no passing zone signs. Replace no passing zone signs with short term no passing zone pavement marking within three days.
2. Place short term center line stripe (paint) on top lift to match exact placement of permanent stripe.
3. Remove raised markers and tape markings after permanent pavement marking is installed.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
12-1-10	
REVISIONS	
DATE	CHANGE
3-29-16	Re-numbered to be D-762-11 (previously was D-762-6)
10-17-17	Updated to active voice.
8-27-19	New Design Engineer PE Stamp.

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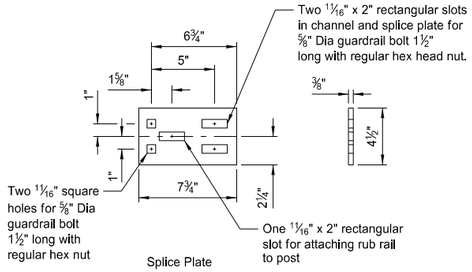
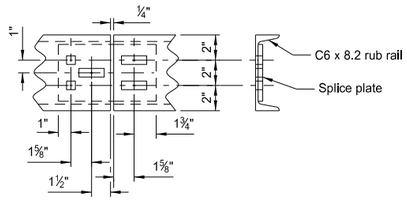
W-BEAM GUARDRAIL GENERAL DETAILS

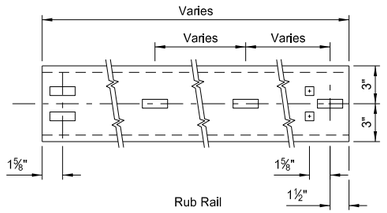
D-764-1



Splice Plate

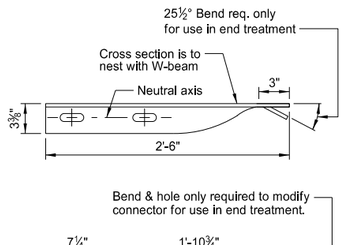


Splice Detail

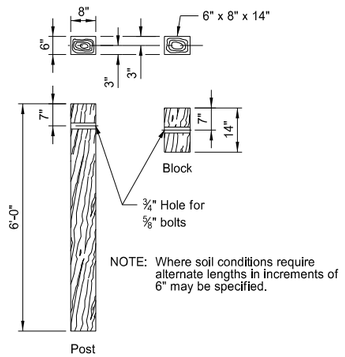


Rub Rail

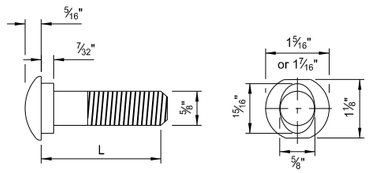
C6x8 RUB RAIL AND SPLICE PLATE



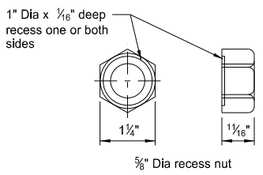
W BEAM TERMINAL CONNECTOR



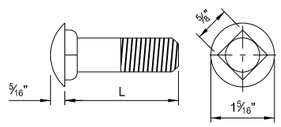
6"x8" TIMBER POST & BLOCK



5/8" Diameter Guardrail Bolt	
L	Thread Length
1 1/4"	Full length thread
2"	1 3/4" Min thread length
9 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

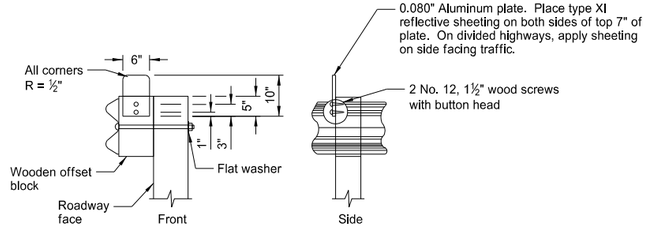


5/8" GUARDRAIL BOLT & RECESS NUT



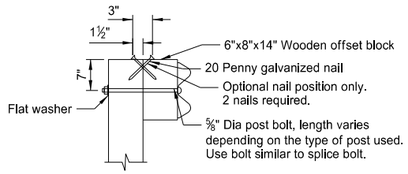
5/8" Diameter Carriage Bolt	
L	Thread Length
1 1/2"	Full length thread
3"	1 1/2" Min thread length
11"	1 3/4" Min thread length
13"	1 3/4" Min thread length

5/8" CARRIAGE BOLT & NUT

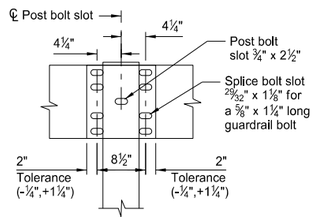


REFLECTORIZED PLATE DETAIL

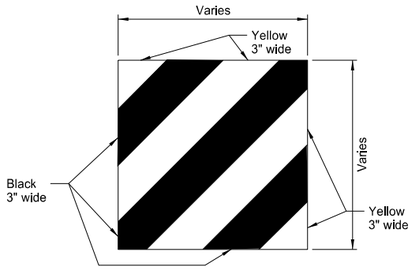
Additional reflectors are added to the W-beam guardrail quantities for placement on end treatment.



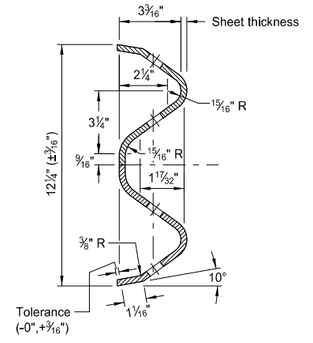
TYPICAL POST ATTACHMENT DETAIL



SPLICE DETAIL



IMPACT HEAD OBJECT MARKER



W-BEAM CROSS SECTION

NOTES:

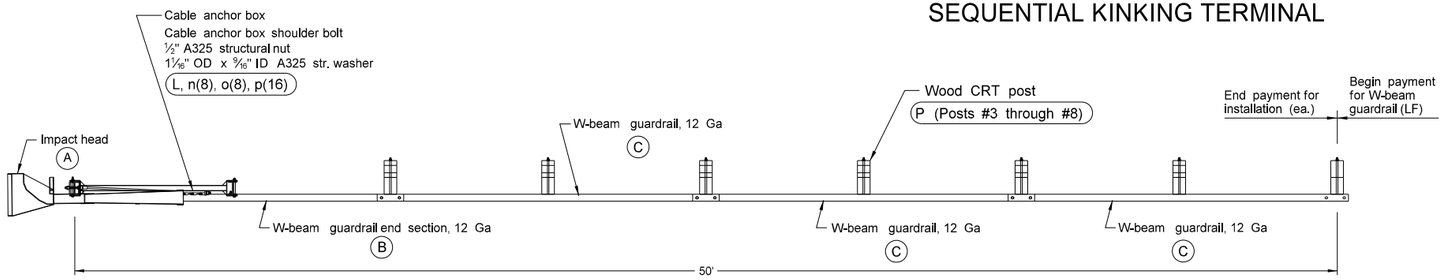
1. Place reflector plates at the first post and spaced at 25' centers on guardrail less than 250' in length and at 50' centers for guardrail over 250' in length. Use reflector the same color as the pavement marking adjacent to that reflector unless noted otherwise on the plans.
2. Dispose of excess earth from excavations for guard posts as directed by the engineer. Replace bituminous material where guardrail is installed after mat is placed. Include cost of excavation and replacing of bituminous material in the price bid for other items.
3. Place Object Marker within the vertical edges of the Impact Plate. Use type XI retroreflective sheeting meeting the requirements of Section 894.02.B of the standard specifications. Apply sheeting to 0.100 Aluminum sheeting meeting the requirements Section 894.01.A. Attach the Object Marker to the Impact Head Plate with non-rust rivets or some other non-rust attachment device. Slope stripes downward toward the roadway side.
4. Guardrail installation height tolerance = - 1/4" , + 1".
5. Standard W-Beam rail post bolt slot spacing is 6'-3". Post bolt slot spacing of 3'-1 1/2" is acceptable.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
REVISIONS	
DATE	CHANGE
10-25-19	Updated notes to active voice and added Note 5.

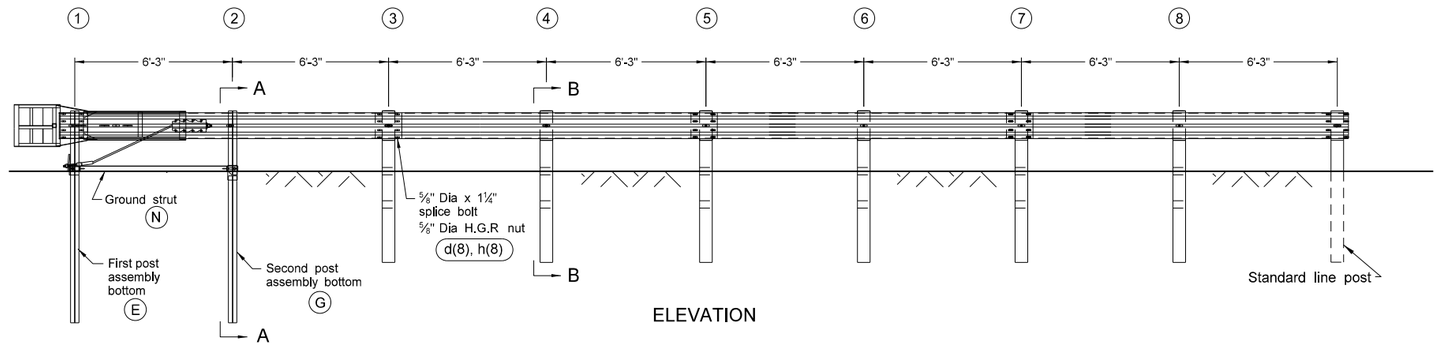
This document was originally issued and sealed by Kirk J Hoff, Registration Number PE- 4683, on 10/25/19 and the original document is stored at the North Dakota Department of Transportation

SEQUENTIAL KINKING TERMINAL

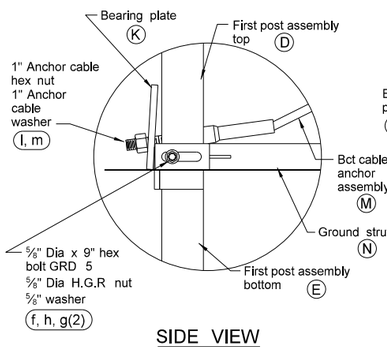
D-764-5



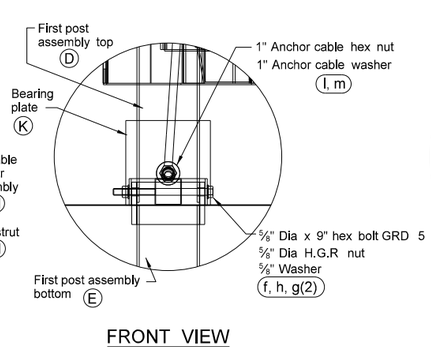
PLAN



ELEVATION

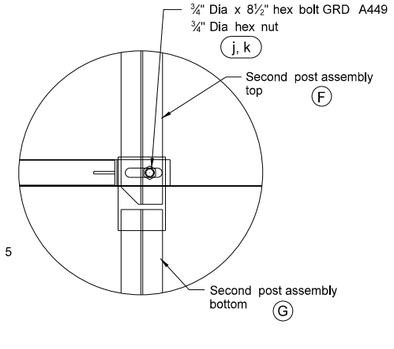


SIDE VIEW

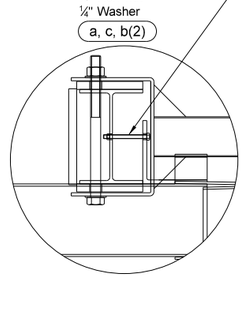


FRONT VIEW

POST #1 CONNECTION DETAILS



SIDE VIEW DETAIL OF POST #2

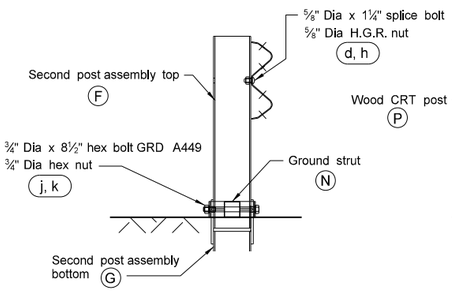


IMPACT HEAD CONNECTION DETAIL

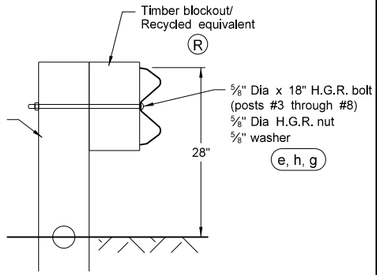
GENERAL NOTES:

1. Breakaway posts are required with the SKT.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The SKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
4. The lower sections of the posts shall not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
5. The lower section of the hinged posts should not be driven with the upper post attached. If the post is placed in a drilled hole, the backfill material must be satisfactorily compacted to prevent settlement.
6. When rock is encountered, a 10" diameter post hole, 20" into the rock surface may be used if approved by the engineer. Granular material will be placed in the bottom of the hole, approximately 2 1/2" deep to provide drainage. Posts 1 & 2 can be field cut to length, placed in the hole and backfilled with adequately compacted material excavated from the hole.
7. The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent the cable from twisting when tightening nuts.
8. The wood blockouts on post #3 through post #8 should be "toe nailed" with two 20 penny galvanized nails into each rectangular post, to prevent them from turning when the wood shrinks.

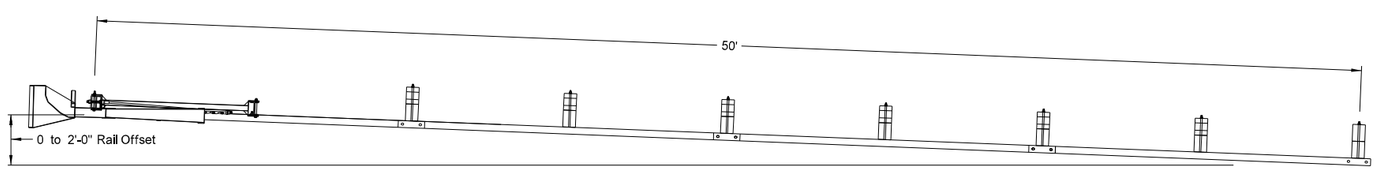
ITEM	QTY	BILL OF MATERIALS
A	1	IMPACT HEAD
B	1	W-BEAM GUARDRAIL END SECTION, 12 Ga
C	3	W-BEAM GUARDRAIL, 12 Ga
D	1	FIRST POST ASSEMBLY TOP
E	1	FIRST POST ASSEMBLY BOTTOM
F	1	SECOND POST ASSEMBLY TOP
G	1	SECOND POST ASSEMBLY BOTTOM
K	1	BEARING PLATE
L	1	CABLE ANCHOR BOX
M	1	BCT CABLE ANCHOR ASSEMBLY
N	1	GROUND STRUT HINGED POST
P	6	WOOD CRT POST
R	6	TIMBER BLOCKOUT/RCY EQUIVALENT
		HARDWARE
a	2	¼" x 4" HEX BOLT Grade 5
b	4	¼" WASHER
c	2	¼" HEX NUT
d	25	⅝" Dia x 1¼" SPLICE BOLT, POST #2
e	6	⅝" Dia x 18" H.G.R. BOLT (POSTS 3 THRU 8)
f	1	⅝" Dia x 9" HEX BOLT GRD 5
g	8	⅝" WASHER
h	32	⅝" Dia H.G.R NUT
j	1	¾" Dia x 8½" HEX BOLT GRD A449
k	1	¾" Dia HEX NUT
l	2	1" ANCHOR CABLE HEX NUT
m	2	1" ANCHOR CABLE WASHER
n	8	CABLE ANCHOR BOX SHOULDER BOLT
o	8	½" A325 STRUCTURAL NUT
p	16	1⅛" OD x ⅝" ID A325 STR. WASHER



SECTION A-A
Post #2



SECTION B-B
Posts #3 through #8



FLARED INSTALLATION
25:1 maximum flare rate

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
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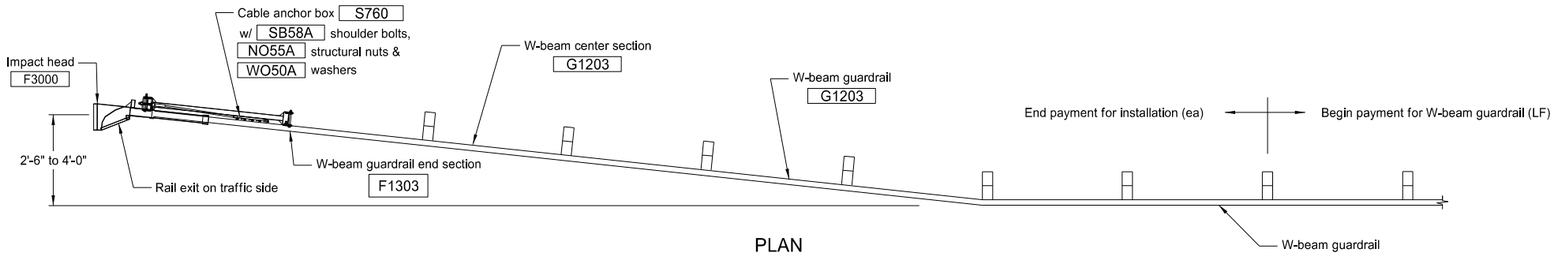
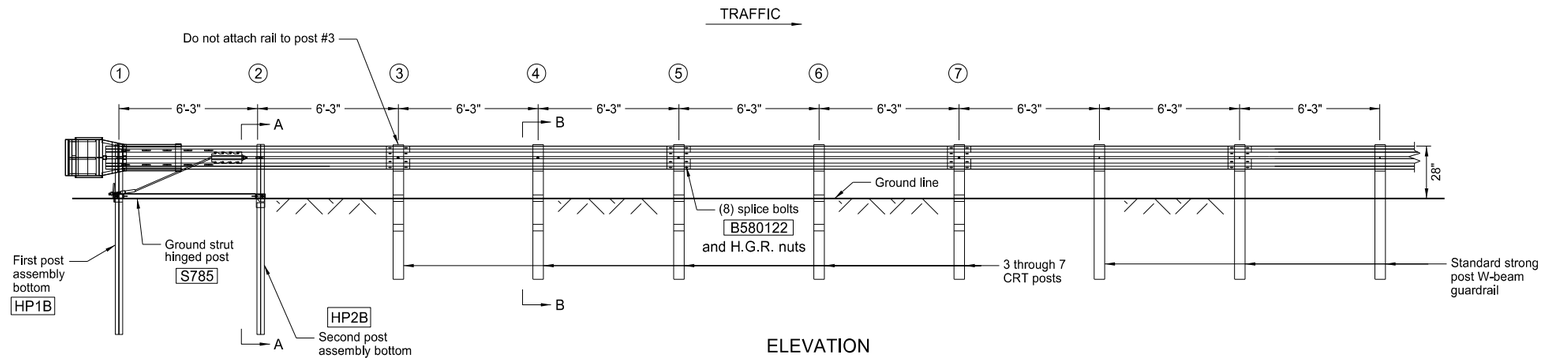
FLARED ENERGY ABSORBING TERMINAL

D-764-6



PLAN

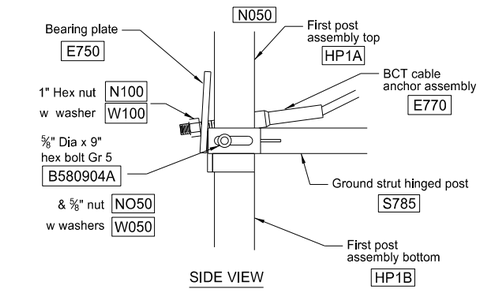


ELEVATION

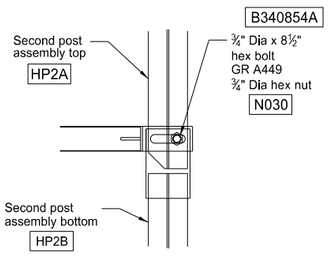
ITEM #	QTY	BILL OF MATERIALS
F3000	1	IMPACT HEAD
F1303	1	W-BEAM GUARDRAIL END SECTION, 12 GA
G1203	2	W-BEAM GUARDRAIL, 12 GA
HP1A	1	FIRST POST ASSEMBLY TOP
HP1B	1	FIRST POST ASSEMBLY BOTTOM
HP2A	1	SECOND POST ASSEMBLY TOP
HP2B	1	SECOND POST ASSEMBLY BOTTOM
P671	5	WOOD CRT POST
P675	5	TIMBER BLOCKOUT OR RECYCLED EQUIVALENT
E750	1	BEARING PLATE
S760	1	CABLE ANCHOR BOX
E770	1	BCT CABLE ANCHOR ASSEMBLY
S785	1	GROUND STRUT HINGED POST
		HARDWARE (ALL DIMENSIONS IN INCHES)
B140404	2	¼ Dia x 4 HEX BOLT
WO14	4	¼ WASHER
N014	2	¼ HEX NUT
B580122	17	⅝ Dia x 1¼ SPLICE BOLT
B581802	4	⅝ Dia x 10 H.G.R. BOLT (POSTS 3 THRU 6)
B580904A	1	⅝ Dia x 9 HEX BOLT GR 5
W050	5	⅝ WASHER
N050	22	⅝ Dia H.G.R. NUT
B340854A	1	¾ Dia x 8½ HEX BOLT GR A449
NO30	1	¾ Dia HEX NUT
N100	2	1 ANCHOR CABLE HEX NUT
W100	2	1 ANCHOR CABLE WASHER
SB58A	8	CABLE ANCHOR BOX SHOULDER BOLT
N055A	8	½ A325 STRUCTURAL NUT
W050A	16	1 1/16 OD x 9/16 ID A325 STR. WASHER

GENERAL NOTES

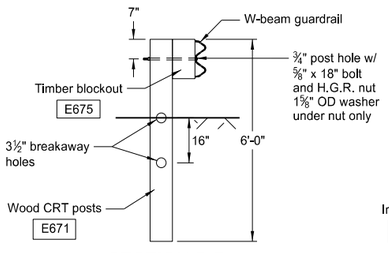
1. Wood posts are required with the Flared Energy Absorbing Terminal except posts #1 and #2.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The lower sections of the posts shall not protrude more than 4 inches above the ground (measured along a 60 inch cord). Site grading may be necessary to meet this requirement.
4. Lower post sections shall not be driven with the upper post attached. If the the post is placed in a drilled hole, the backfill material must be satisfactory compacted to prevent settlement.
5. When rock is encountered during excavation, a 12" diameter post hole 20" deep may be used if approved by the Engineer. Granular material will be placed in the bottom of the hole approximately 2½" deep to provide drainage. The soil tubes shall be field cut to length, placed in the hole and back filled with adequately compacted material excavated from the hole.
6. The breakaway cable assembly shall be taut. A locking device (vice grips or channel lock pliers) should be used to prevent cable from twisting when tightening nuts.
7. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when wood shrinks. The nail shall be 20 penny and galvanized.
8. The Flared Energy Absorbing Terminal shall be flared only when the approach guardrail is parallel with the roadway. When the approach guardrail is flared at 16:1 to 10:1, the Flared Energy Absorbing Terminal shall have only the flare rate of the guardrail. When the guardrail flare is between 10:1 and 7:1, the Flared Energy Absorbing Terminal shall be turned parallel to the roadway.



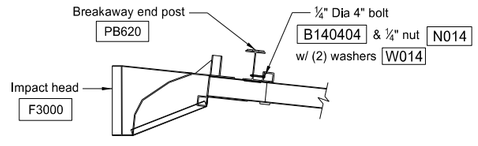
SIDE VIEW



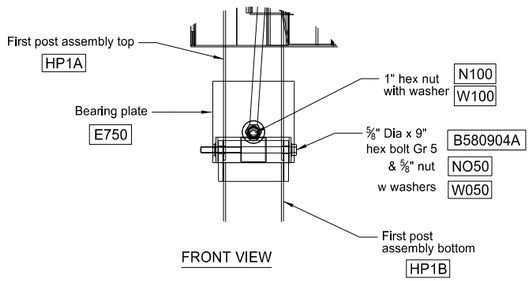
SIDE VIEW DETAIL OF POST #2



SECTION B-B
POST 3 THRU 7

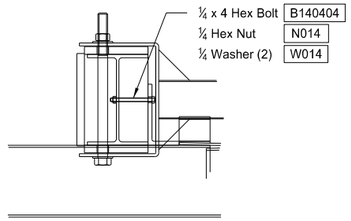


IMPACT HEAD CONNECTING DETAIL

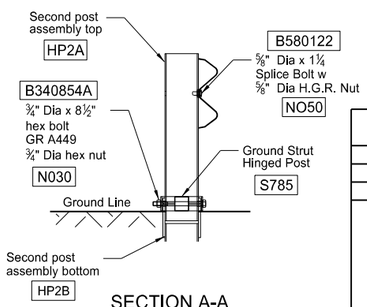


FRONT VIEW

POST #1 CONNECTION DETAILS



IMPACT HEAD CONNECTION DETAIL



SECTION A-A
at Post #2

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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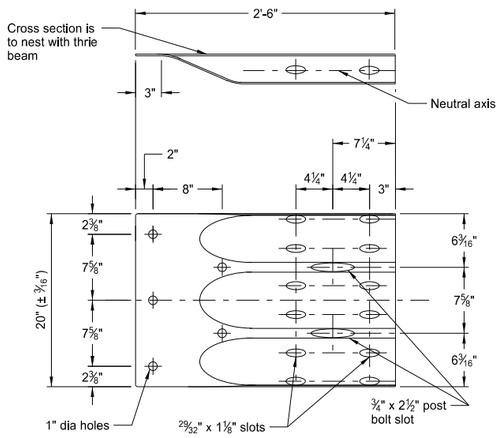
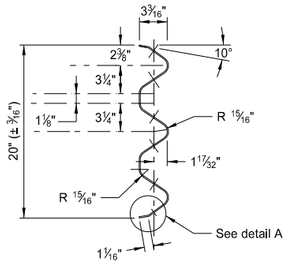
THRIE BEAM TRANSITION TO DOUBLE BOX BEAM RETROFIT

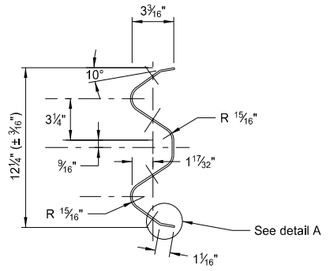
D-764-10



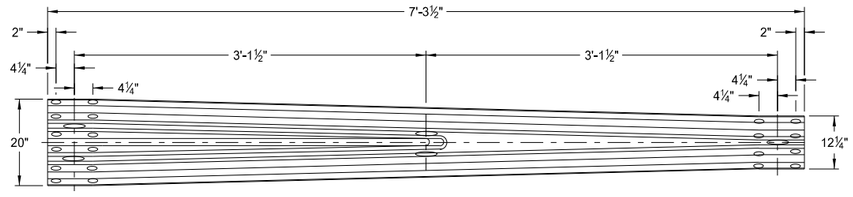
THRIE BEAM TERMINAL CONNECTOR



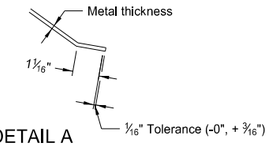
THRIE BEAM END VIEW



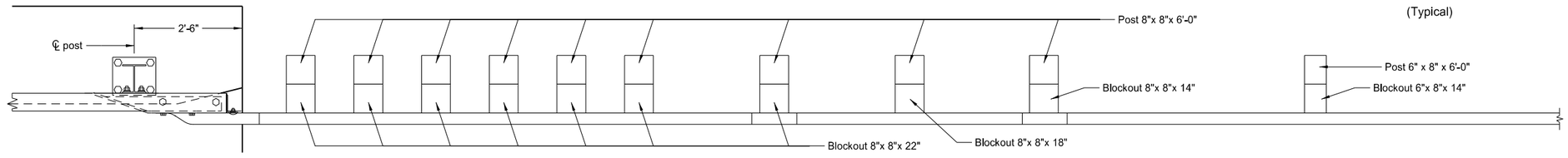
W-BEAM END VIEW



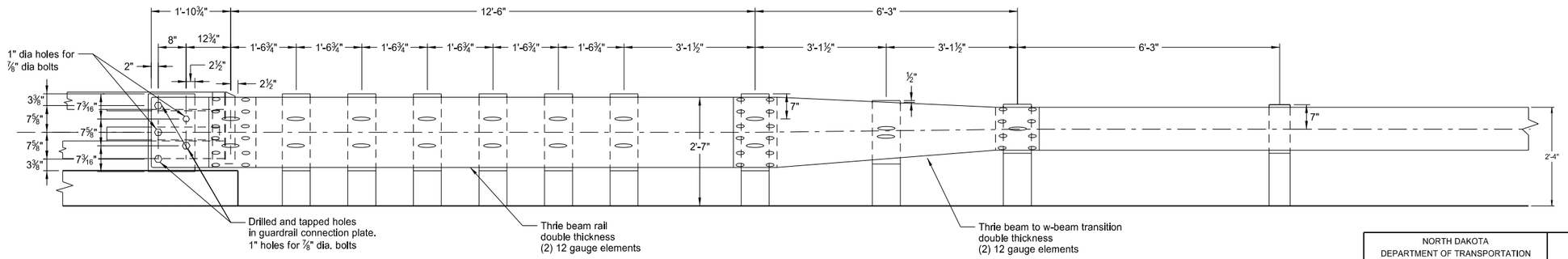
THRIE BEAM TO W-BEAM TRANSITION SECTION



DETAIL A
(Typical)



PLAN



ELEVATION

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
10-11-13	
REVISIONS	
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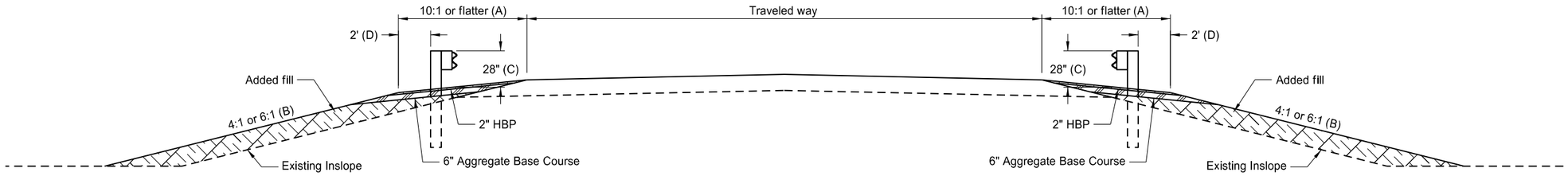
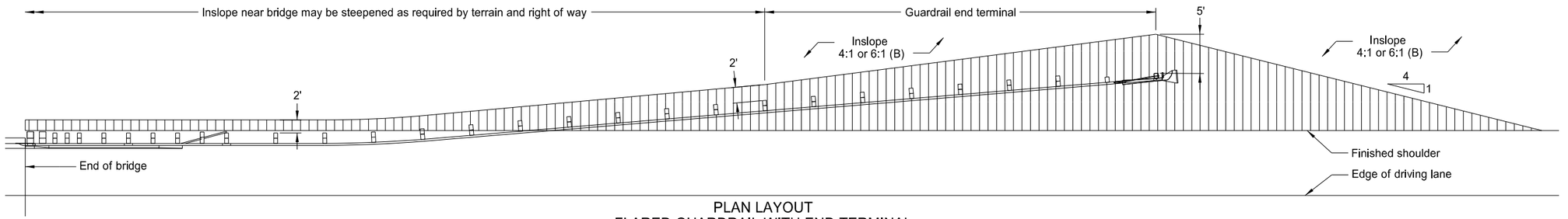
TYPICAL GRADING AT BRIDGE ENDS WITH W-BEAM GUARDRAIL

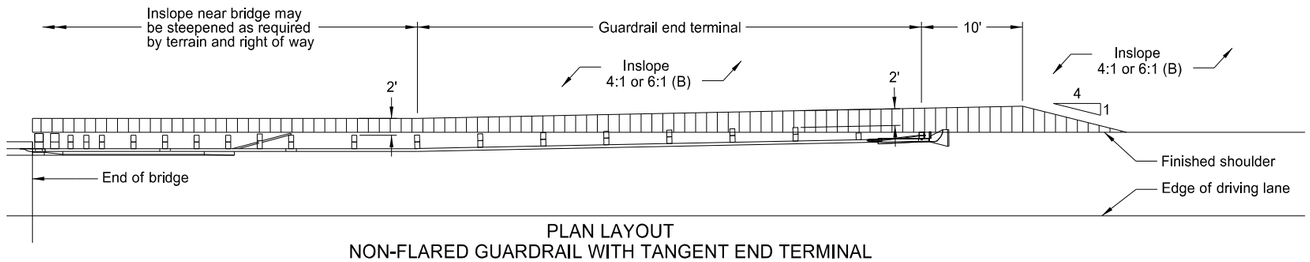
D-764-22



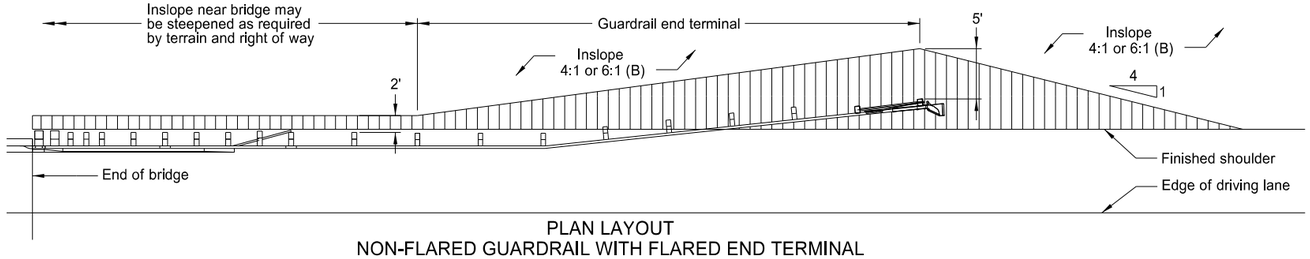
TYPICAL SECTION



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) Slope flatter than 10:1 may be required to provide proper guardrail height.

(B) Where normal inslope is 4:1 the added fill shall be 4:1. Where normal inslope is 6:1 the added fill shall be 6:1.

(C) Measured from top of guardrail to top of surfacing at front face of guardrail.

(D) Dimension at end terminals may vary per Plan Layouts shown on this sheet.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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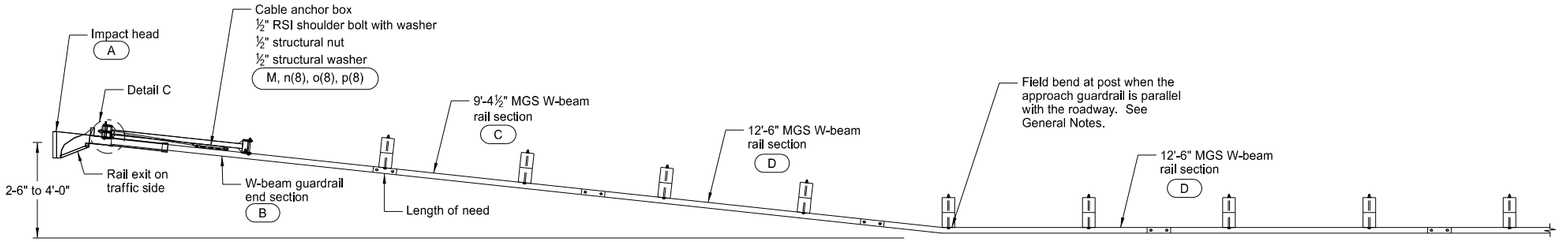
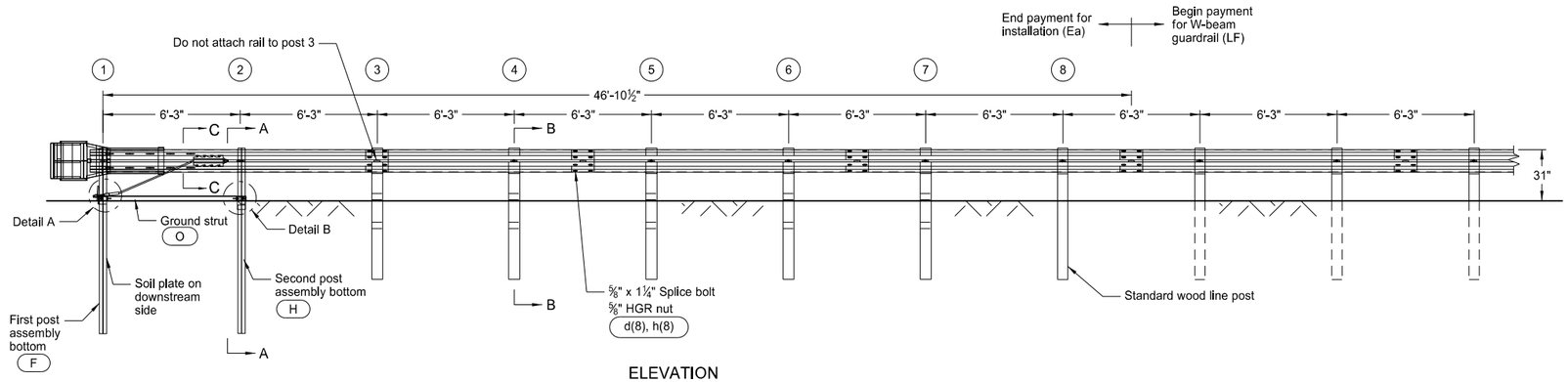
MGS FLARED ENERGY ABSORBING TERMINAL - WOOD POST

D-764-38



PLAN



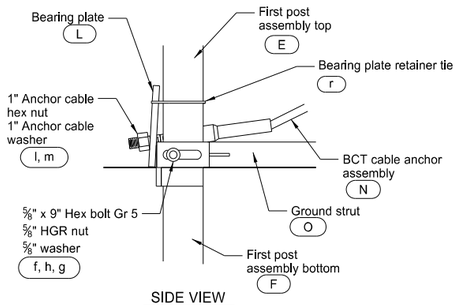
ELEVATION

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

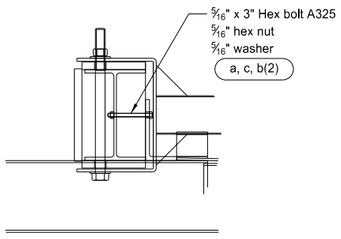
NOTE: Standard wood line post, block, and associated hardware not included in Bill of Materials Table.

GENERAL NOTES:

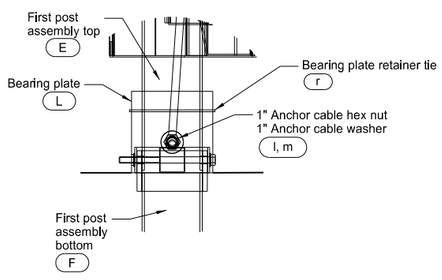
1. Wood posts are required with the Flared Energy Absorbing Terminal except posts 1 and 2.
2. Galvanize all bolts, nuts, cable assemblies, cable anchors, and bearing plates.
3. Flare the Flared Energy Absorbing Terminal when the approach guardrail is parallel with the roadway. When the approach guardrail 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.
4. Ensure the lower sections of the posts do not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
5. Install the lower section of the hinged posts without the upper post attached. If the post is placed in a drilled hole, the backfill material must be compacted to prevent settlement.
6. The breakaway cable assembly must be taut. Use a locking device (vice grips or channel lock pliers) to prevent cable from twisting when tightening nuts.
7. "Toe nail" the wood blockouts to the rectangular wood posts. Use two 20 penny galvanized nails.



SIDE VIEW

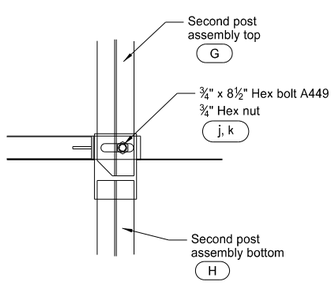


DETAIL C
Post 1 (Impact Head connection)

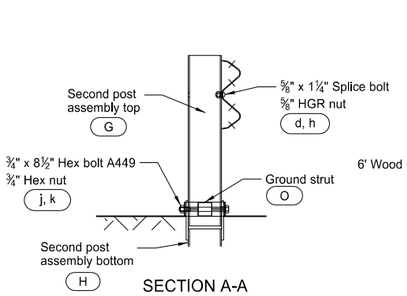


FRONT VIEW

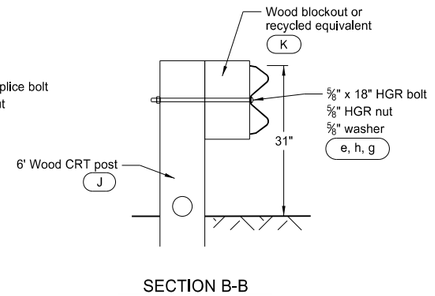
DETAIL A
Post 1



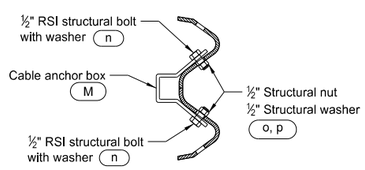
DETAIL B
Post 2



SECTION A-A
Post 2



SECTION B-B
Posts 3 through 7



SECTION C-C

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
7-14-17	
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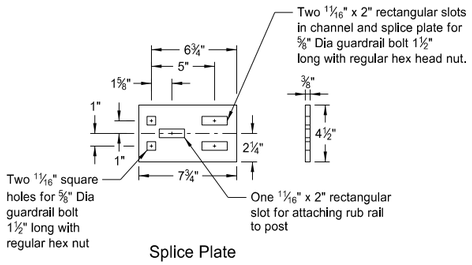
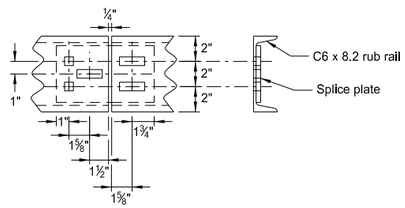
MGS W-BEAM GUARDRAIL GENERAL DETAILS

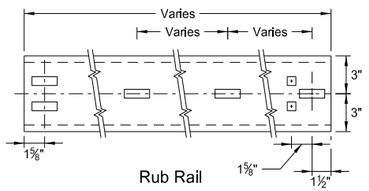
D-764-40



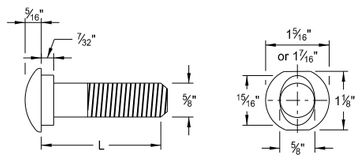
Splice Plate



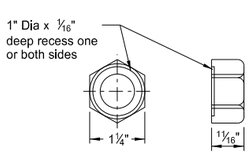
Splice Detail



C6x8.2 RUB RAIL AND SPLICE PLATE

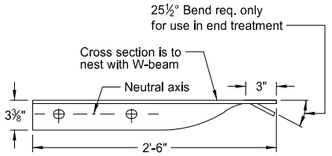


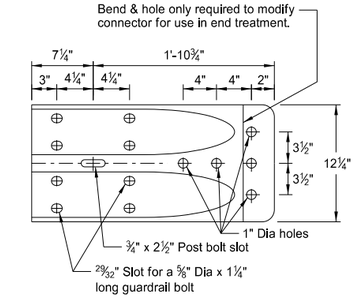
5/8" Diameter Guardrail Bolt	
L	Thread Length
1¼"	Full length thread
2"	1¾" Min thread length
9½"	4" Min thread length
18"	4" Min thread length
20"	4" Min thread length
22"	4" Min thread length
25"	4" Min thread length



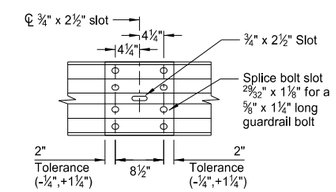
5/8" Dia recess nut

5/8" GUARDRAIL BOLT & RECESS NUT



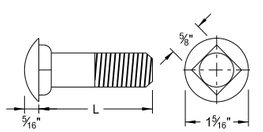


W BEAM TERMINAL CONNECTOR



SPLICE DETAIL

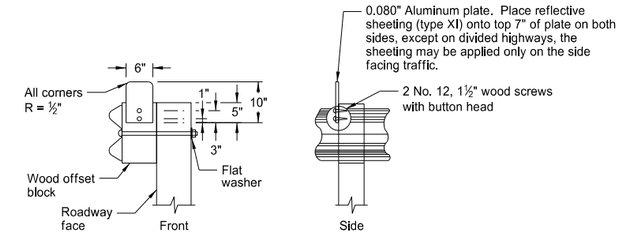
NOTE: Do not install center bolt in the ¾" x 2½" slot at mid span splices.



5/8" Diameter Carriage Bolt	
L	Thread Length
1½"	Full length thread
3"	1½" Min thread length
11"	1¾" Min thread length
13"	1¾" Min thread length

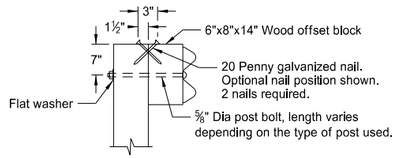
5/8" Dia hex nut

5/8" CARRIAGE BOLT & NUT

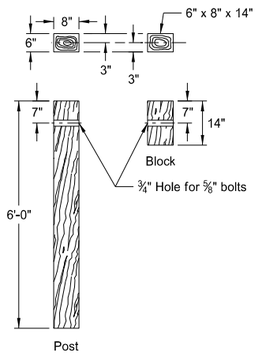


REFLECTORIZED PLATE DETAIL

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

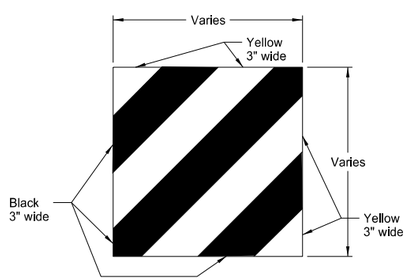


TYPICAL WOOD POST ATTACHMENT DETAIL

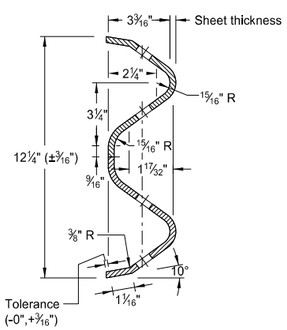


6" x 8" WOOD POST & BLOCK

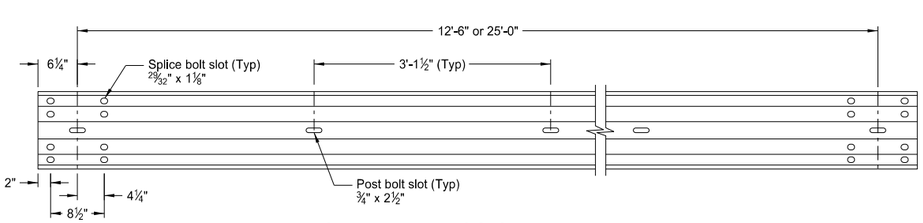
NOTE: Where soil conditions require, alternate lengths may be specified, in 6" increments.



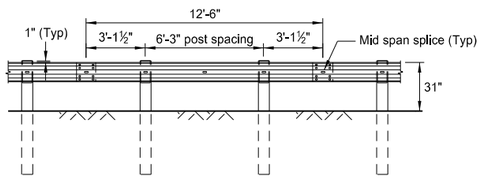
IMPACT HEAD OBJECT MARKER



W-BEAM CROSS SECTION



STANDARD MGS GUARDRAIL PANEL



STANDARD MGS GUARDRAIL SYSTEM

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 = ±1".

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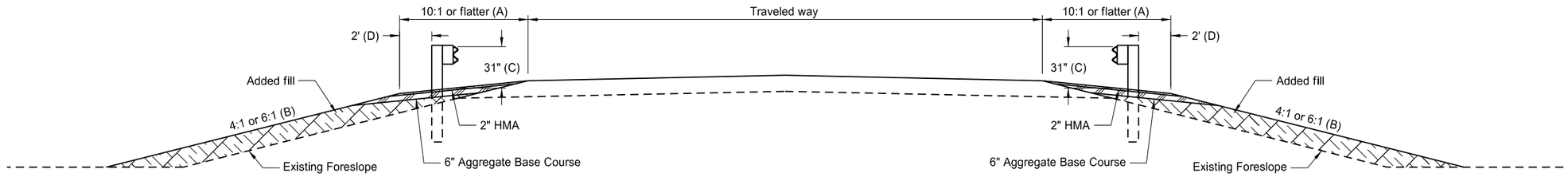
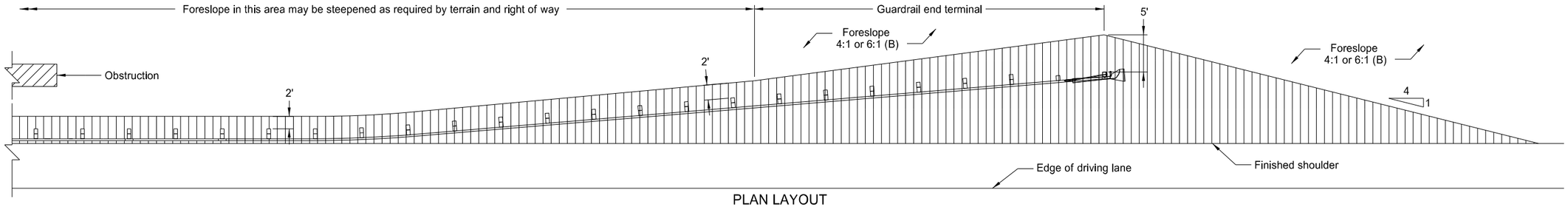
D-764-49

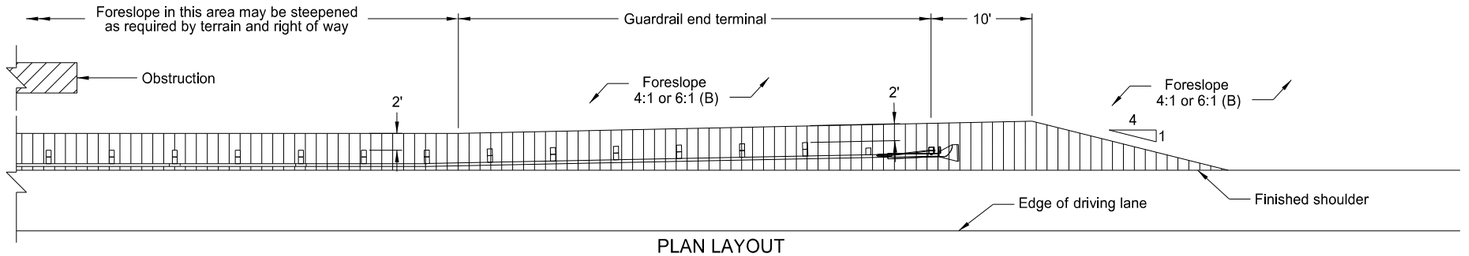
TYPICAL GRADING AT OBSTRUCTIONS WITH MGS W-BEAM GUARDRAIL



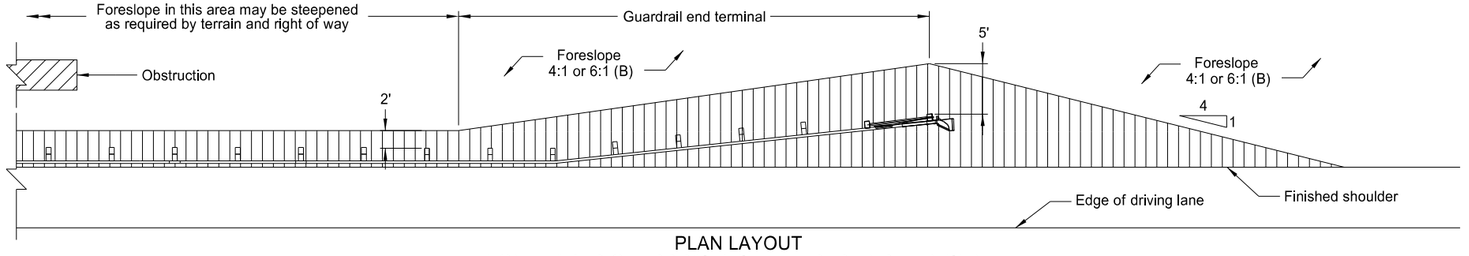
TYPICAL SECTION



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) Slope flatter than 10:1 may be required to provide proper guardrail height.

(B) Where normal foreslope is 4:1 the added fill shall be 4:1. Where normal foreslope is 6:1 the added fill shall be 6:1.

(C) Measured from top of guardrail to top of surfacing at front face of guardrail.

(D) Dimension at end terminals may vary per Plan Layouts shown on this sheet.

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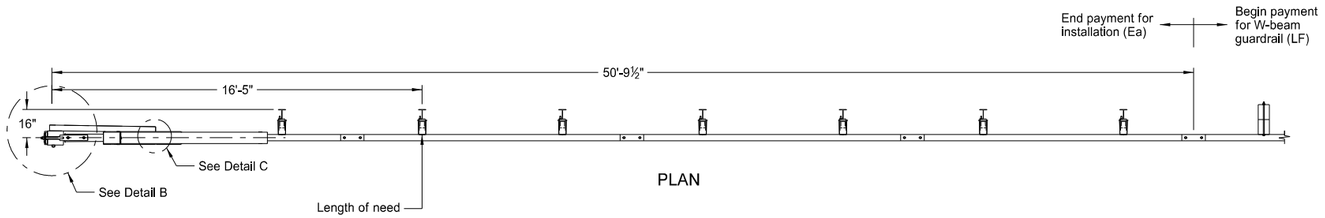
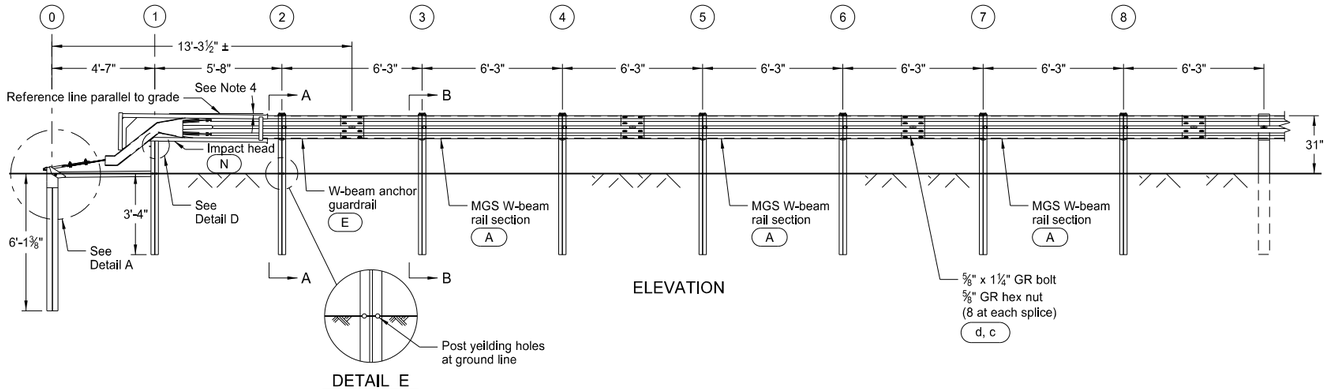
MASH SOFTSTOP END TERMINAL - STEEL POST

D-764-50



PLAN

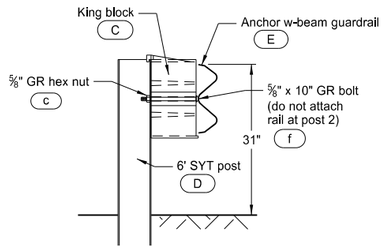


ELEVATION

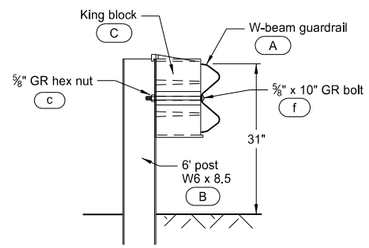
DETAIL E
Posts 1 & 2

GENERAL NOTES:

1. Galvanize all bolts, nuts, cable assemblies, cable anchors, and bearing plates.
2. The SoftStop can be flared at a rate of 25:1 or flatter.
3. Do not curve the guardrail within the SoftStop under any circumstances.
4 It is acceptable to install the SoftStop impact head parallel to the grade line or with an upward tilt. See softstop assembly manual for specific details.

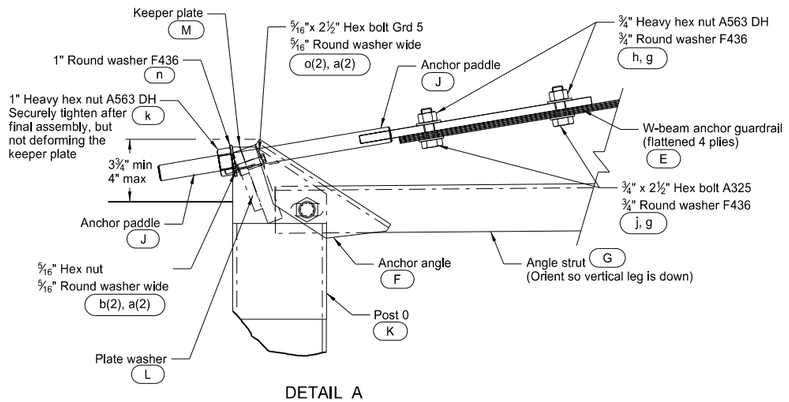


SECTION A-A
Post 2

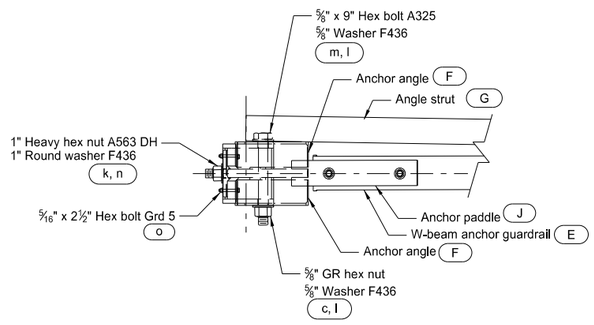


SECTION B-B
Posts 3 through 8

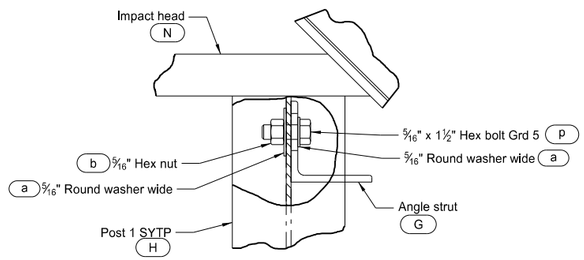
ITEM	ITEM NO.	BILL OF MATERIALS	QTY
A	000011	12 / 12'-6" / 3'-1½" / S MGS W-BEAM RAIL SECTION	3
B	000533	6'-0" STEEL POST W6 x 8.5	6
C	006777	KING BLOCK 4" X 7½" X 1'-2"	7
D	015000	6'-0" SYT POST / 8.5 / 31" GR HT	1
E	015200	SFST - ANCHOR GUARDRAIL 12'-6"	1
F	015201	SFST - ANCHOR ANGLE	2
G	015202	SFST - ANGLE STRUT	1
H	015203	SFST - POST #1 SYTP	1
J	015204	SFST - ANCHOR PADDLE	1
K	015205	SFST - POST #0	1
L	015206	SFST - PLATE WASHER	1
M	015207	SFST - KEEPER PLATE	1
N	015208	SFST - IMPACT HEAD	1
		HARDWARE	
a	003240	5/16" ROUND WASHER WIDE	6
b	003245	5/16" HEX NUT	3
c	003340	⅝" GR HEX NUT	41
d	003360	⅝" x 1¼" GR BOLT	32
e	003391	⅝" x 1¾" HEX BOLT A325	1
f	003500	⅝" x 10" GR BOLT A307	7
g	003701	¾" ROUND WASHER F436	4
h	003704	¾" HVY HEX NUT A563 DH	2
j	003717	¾" x 2½" HEX BOLT A325	2
k	003908	1" HVY HEX NUT A563 DH	1
l	004372	⅝" WASHER F436	4
m	004489	⅝" x 9" HEX BOLT A325	1
n	004902	1" ROUND WASHER F436	1
o	105285	5/16" x 2½" HEX BOLT GRD 5	2
p	105286	5/16" x 1½" HEX BOLT GRD 5	1



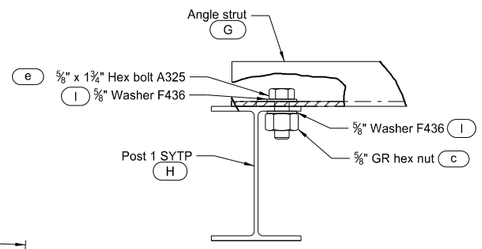
DETAIL A
Post 0



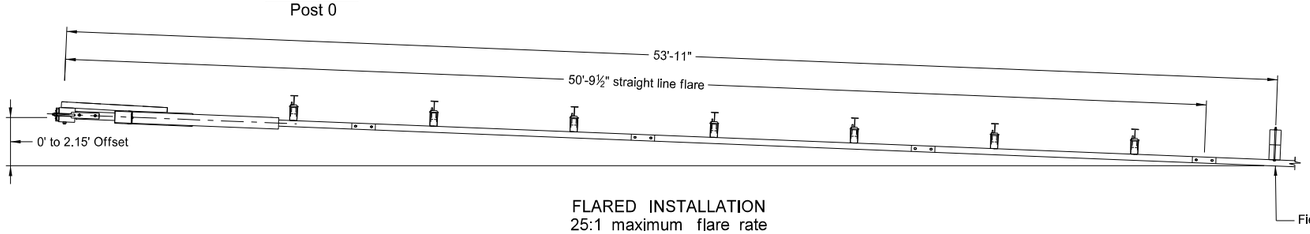
DETAIL B
Post 0



DETAIL D
Post 1



DETAIL C
Post 1
(shown near ground)



FLARED INSTALLATION
25:1 maximum flare rate

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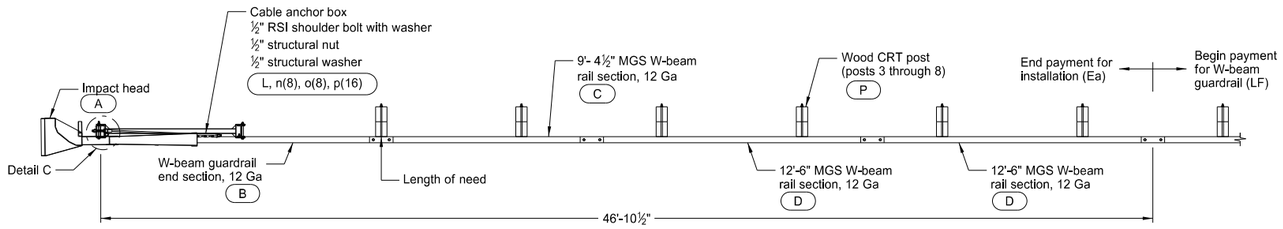
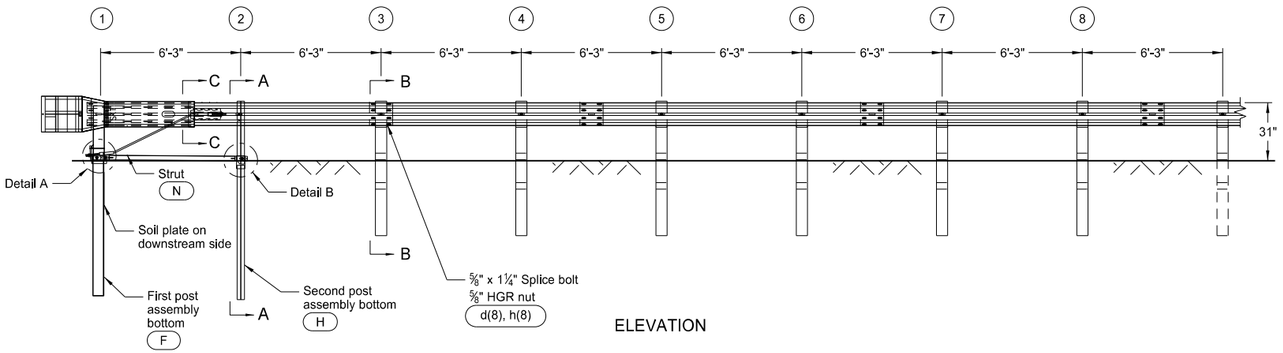
MASH SEQUENTIAL KINKING TERMINAL - WOOD POST

D-764-51



PLAN

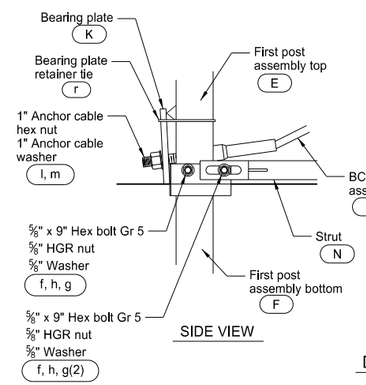


ELEVATION

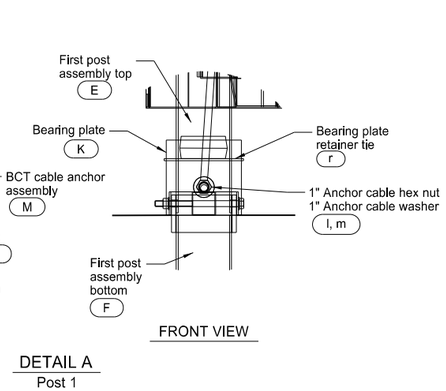
GENERAL NOTES:

1. Galvanize all bolts, nuts, cable assemblies, cable anchors, and bearing plates.
2. The MSKT can be flared at a rate of up to 25:1 to prevent the impact head from encroaching on the shoulder.
3. Ensure the lower sections of the posts do not protrude more than 4" above the ground (measured along a 5' cord). Site grading may be necessary to meet this requirement.
4. Install the lower section of the hinged posts without the upper post attached. If the post is placed in a drilled hole, the backfill material must be compacted to prevent settlement.
5. The breakaway cable assembly must be taut. Use a locking device (vice grips or channel lock pliers) to prevent the cable from twisting when tightening nuts.
6. "Toe nail" the wood blockouts to the rectangular wood posts at post 3 through post 8. Use two 20 penny galvanized nails.

ITEM	ITEM NO.	BILL OF MATERIALS	QTY
A	MS3000	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	MTPHP1A	FIRST POST ASSEMBLY TOP (6" X 6" X⅛" Tube)	1
F	MTPHP1B	FIRST POST ASSEMBLY BOTTOM (6' W6X15)	1
G	UHP2A	SECOND POST ASSEMBLY TOP	1
H	HP2B	SECOND POST ASSEMBLY BOTTOM	1
K	E750	BEARING PLATE	1
L	S760	CABLE ANCHOR BOX	1
M	E770	BCT CABLE ANCHOR ASSEMBLY	1
N	MS785	STRUT	1
P	UP671	6' WOOD CRT POST	6
R	P675	WOOD BLOCKOUT OR RECYCLED EQUIVALENT	6
HARDWARE			
a	B5160104A	5/16" x 1" HEX BOLT GR 5	2
b	W0516	5/16" WASHER	4
c	N0516	5/16" HEX NUT	2
d	B580122	⅝" Dia x 1¼" SPLICE BOLT	33
e	B581802	⅝" Dia x 18" HGR BOLT (POSTS 3 THRU 8)	6
f	B580904A	⅝" x 9" HEX BOLT GR 5	2
g	W050	⅝" WASHER	9
h	N050	⅝" Dia HGR NUT	35
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

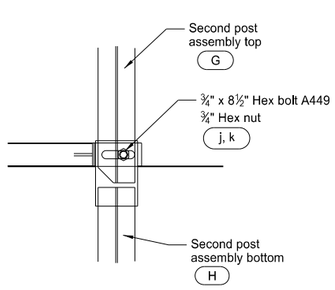


SIDE VIEW



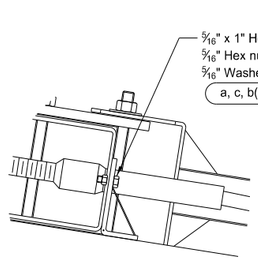
FRONT VIEW

DETAIL A
Post 1

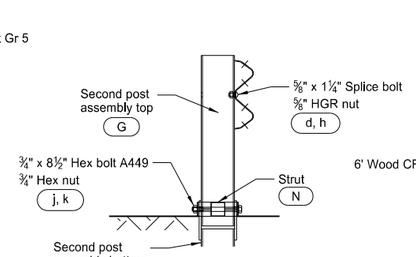


SIDE VIEW

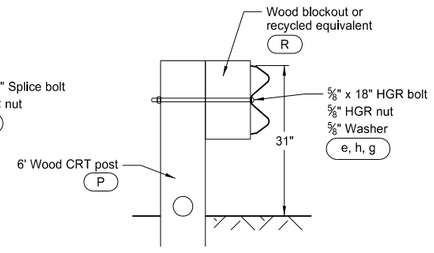
DETAIL B
Post 2



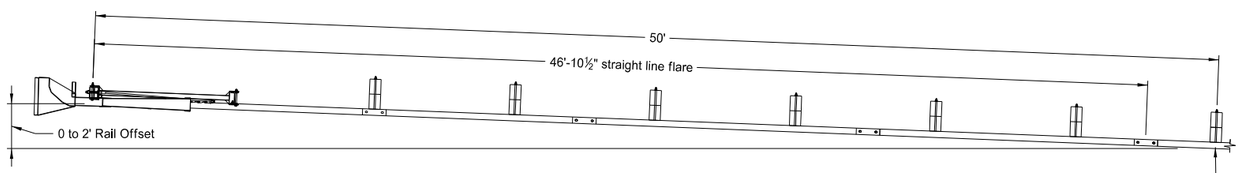
DETAIL C
Post 1 (Impact Head connection)



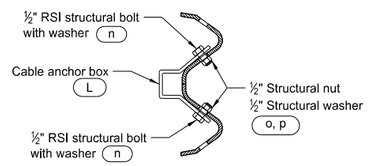
SECTION A-A
Post 2



SECTION B-B
Posts 3 through 8



FLARED INSTALLATION
25:1 maximum flare rate



SECTION C-C

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