# 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 |
| 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 |
| Cl 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 |
| Comb. | combination |
| Coml | commercial |
| Compr | compression |
| CADD | computer aided drafting & design |
| Conc | concrete |
| 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 |
| CSP | corrugated steel pipe |
| C | coulomb |
| Co | County |
| Crse | course |
| C Gr | course gravel |
| CS | course sand |
| 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 | 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 |
| 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 |
| Fnd | found |
| Fdn | foundation |
| Frac | fractional |
| Frwy | freeway |
| Frt | front |
| FF | front face |
| F Disp | fuel dispenser |

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# NDDOT ABBREVIATIONS

D-101-2

| | |
|---|---|
| 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 |
| 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 |
| 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 |
| Pl | 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 | preformed |
| Prep | preperation |
| Press. | pressure |
| 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 |

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# NDDOT ABBREVIATIONS

| | |
|---|---|
| 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 |
| Refl | reflectorized |
| RCB | reinforced concrete box |
| RCES | reinforced concrete end section |
| RCP | reinforced concrete pipe |
| RCPS | reinforced concrete pipe sewer |
| Reinf | reinforcement |
| Res | reservation |
| 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 | 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 |
| 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 |
| 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 |
| 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 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 |
| 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 |
| RAMSEY R SEW | Ramsey Rural Sewer Association |
| RAMSEY RW | Ramsey Rural Water Association |
| RAMSEY UTIL | Ramsey County Rural Utilities |
| RED RIV TEL | Red River Rural Telephone |
| RESVTN TEL | Reservation Telephone |
| ROBRTS TEL | Roberts Company Telephone |
| R-RIDER ELEC | Roughrider Electric Coop |
| RRVW | Red River Valley & Western Railroad |
| RSR ELEC | R.S.R. Electric Cooperative |
| 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

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| 07-01-14 | |
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| DATE | CHANGE |
| 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

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| 09-23-16 | Added and Revised Items, Organized by Functional Groups |

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# 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

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# 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

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# 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

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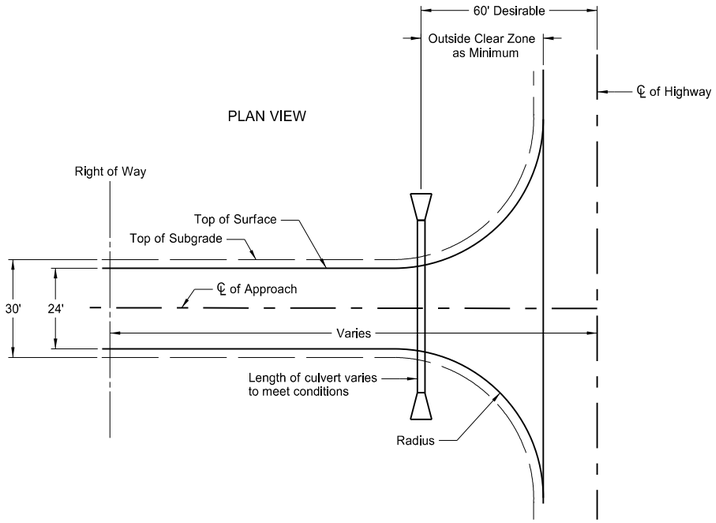
# STANDARD RURAL APPROACHES

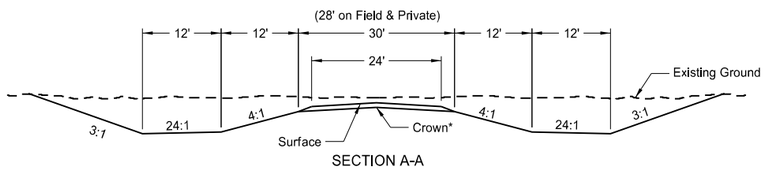
D-203-8

PLAN VIEW



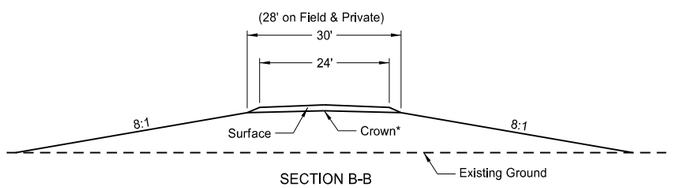

CRITERIA FOR RURAL APPROACH TYPES

| | Field Drives | Private Drives | Low Volume Public Roads |
|---|---|---|---|
| Radius | R=24 ft | R=30 ft | R=40 ft |
| Maximum Grade | 10% | 7% | 7% |
| Storage Platform | 20 ft | 24 ft | 30 ft |
| Vertical Curve Length | 10 ft | 10 ft | Varies (Min. 20 mph) |

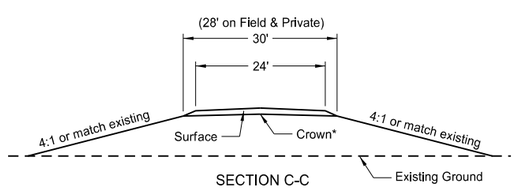



SECTION A-A

*2.1% crown for paved surface
*3.0% crown for gravel surface

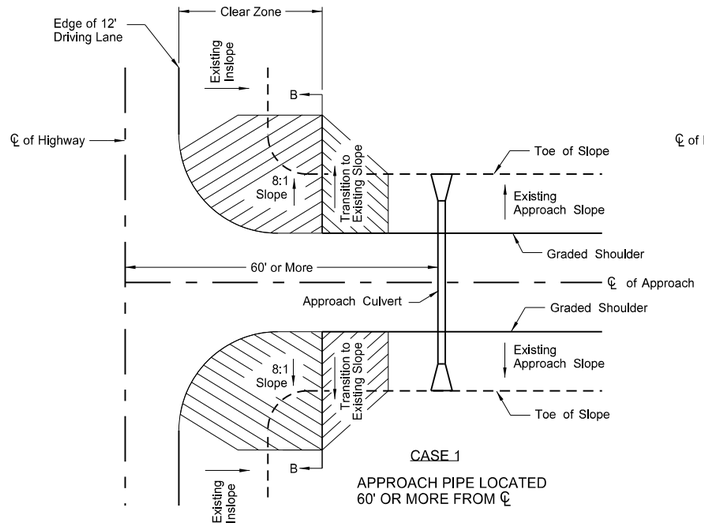



SECTION B-B



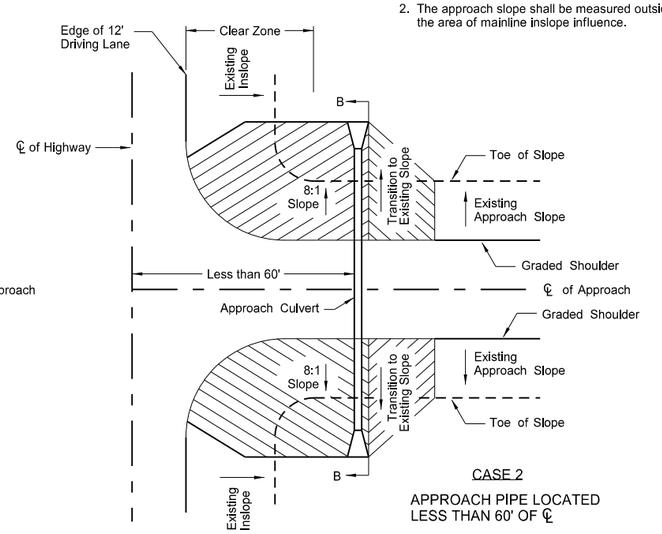

SECTION C-C

APPROACH INSLOPES




CASE 1

APPROACH PIPE LOCATED 60' OR MORE FROM ℄

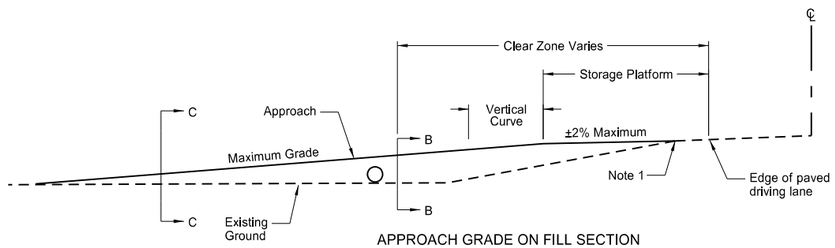



CASE 2

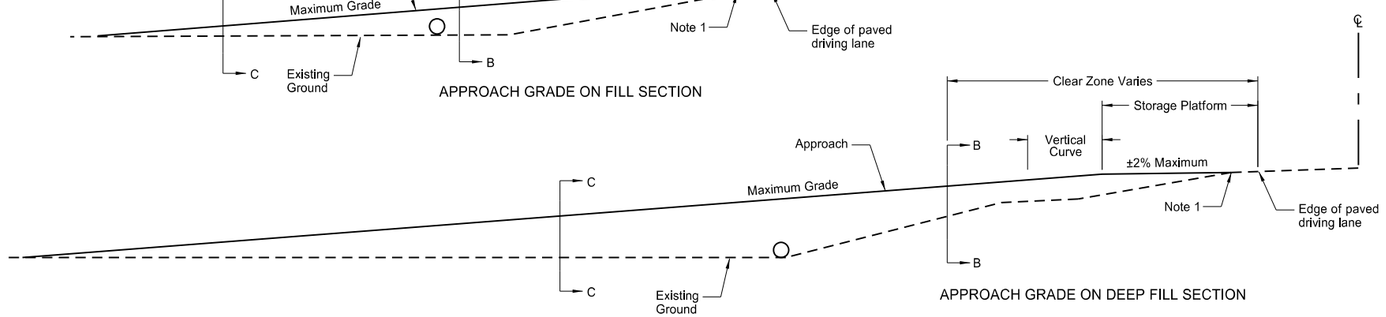
APPROACH PIPE LOCATED LESS THAN 60' OF ℄

NOTES:

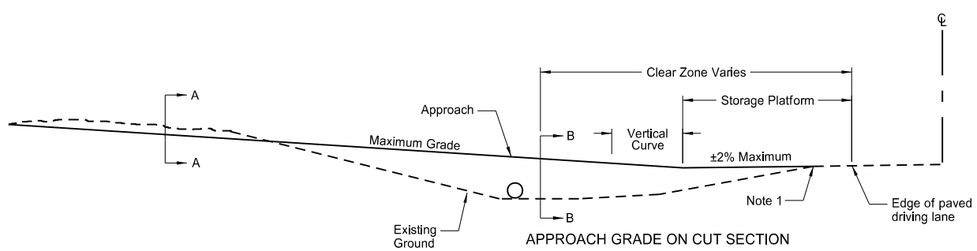
1. Max breakover between approach storage platform and highway shall not exceed 5%.
2. The approach slope shall be measured outside the area of mainline inslope influence.




APPROACH GRADE ON FILL SECTION




APPROACH GRADE ON DEEP FILL SECTION




APPROACH GRADE ON CUT SECTION

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|---|---|
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| | |

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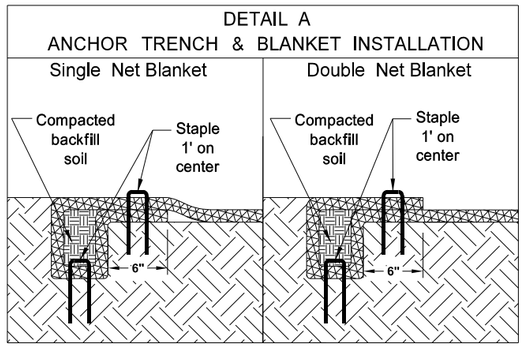
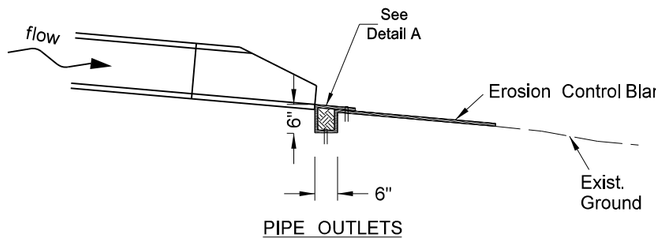
D-255-2

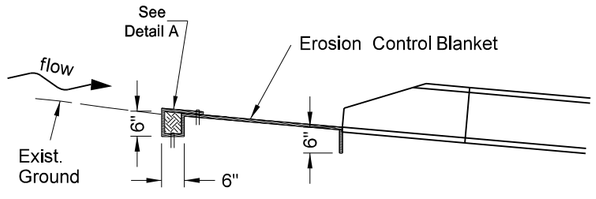
# EROSION AND SILTATION CONTROL
# EROSION CONTROL BLANKET INSTALLATION




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

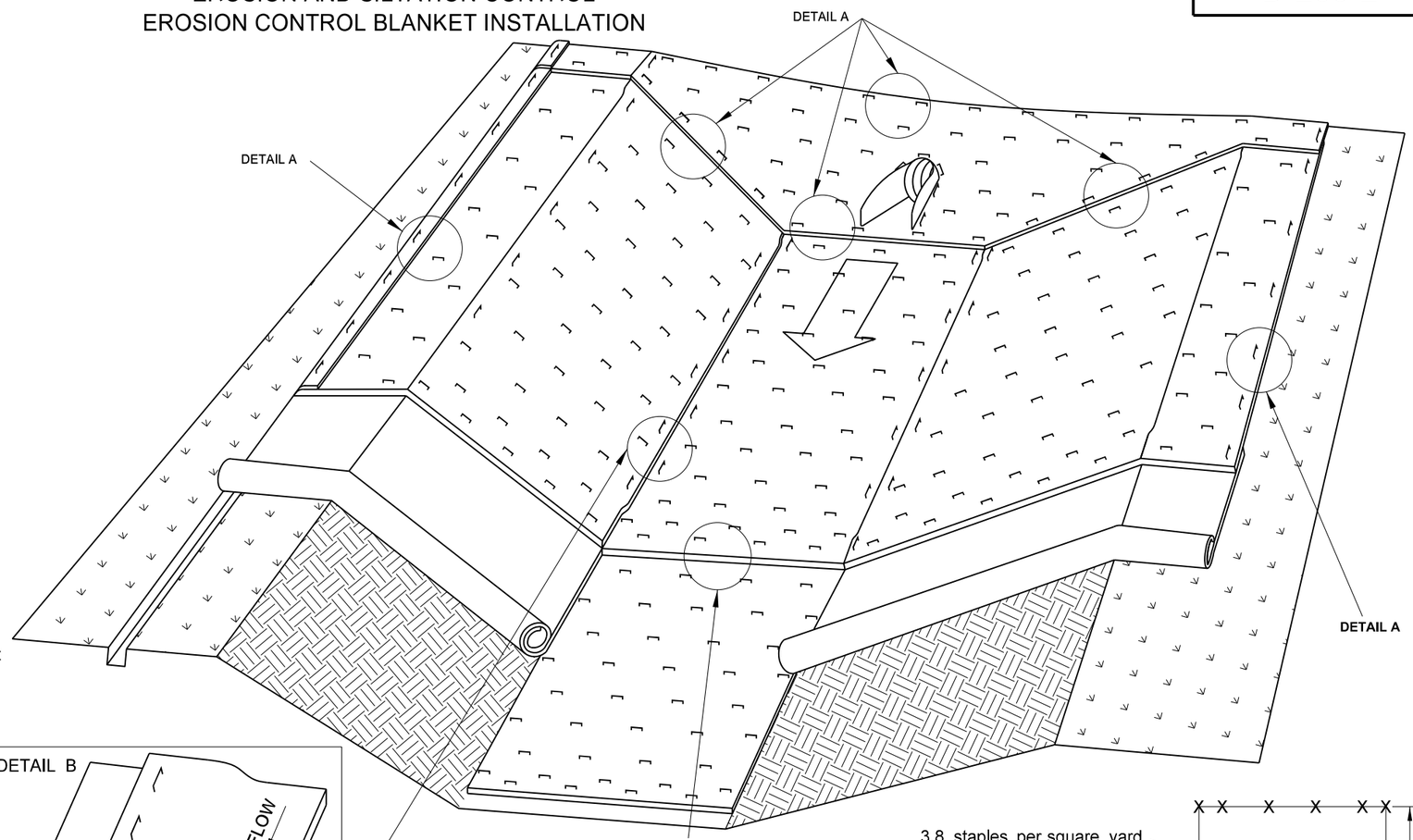



PIPE OUTLETS

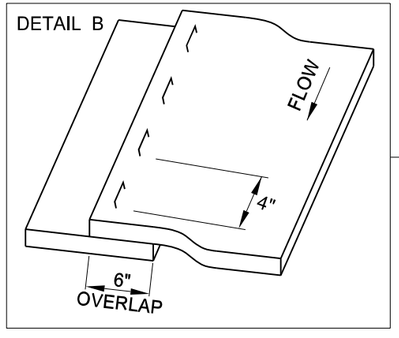


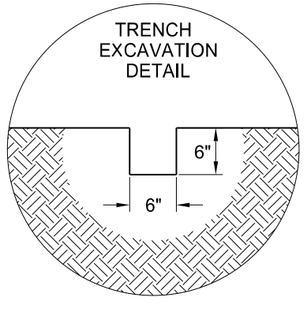

PIPE INLETS

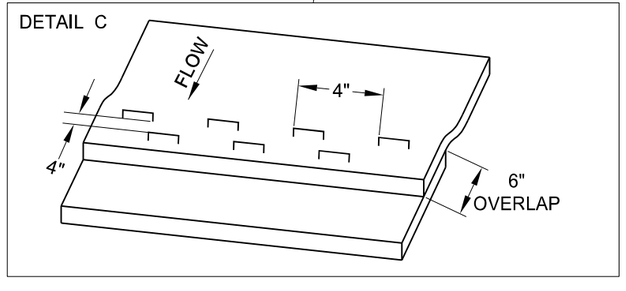
## INSTALLATION AT PIPE ENDS



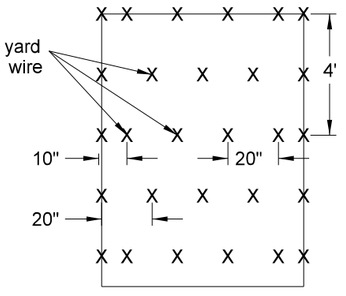

## BLANKET LAYOUT
## CHANNEL OR SLOPE INSTALLATION




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-709-5 to D-255-2. |
| 07-27-15 | Changed installation details such as trench depth and overlap dimensions. |

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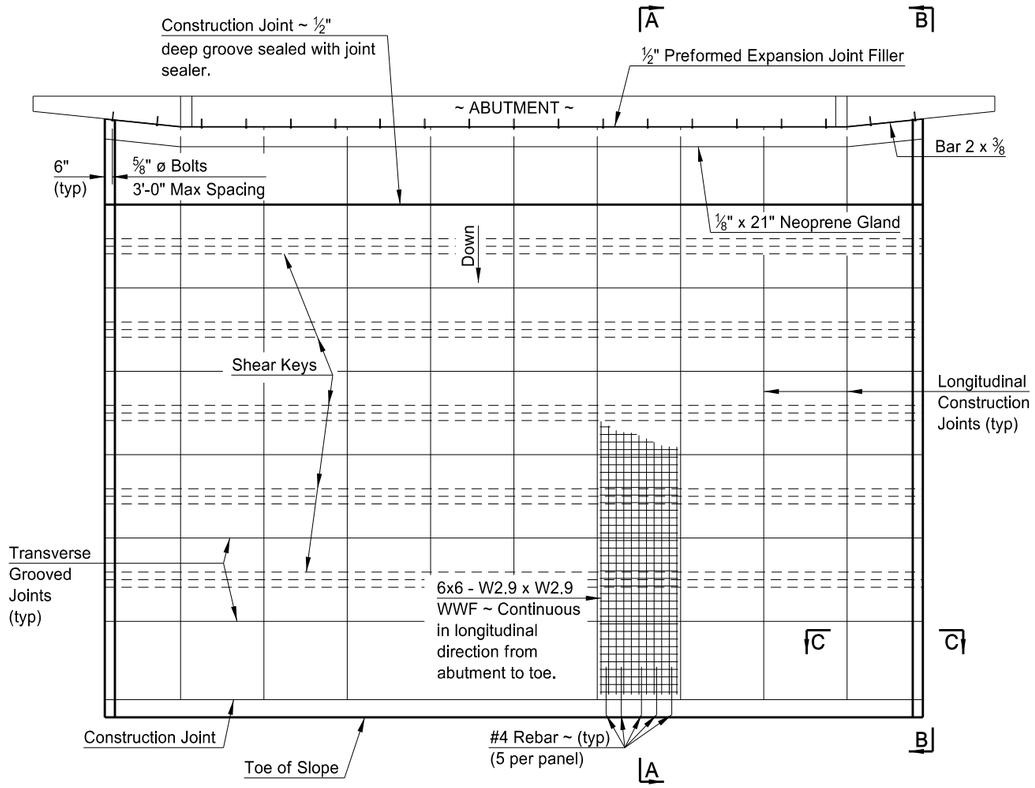
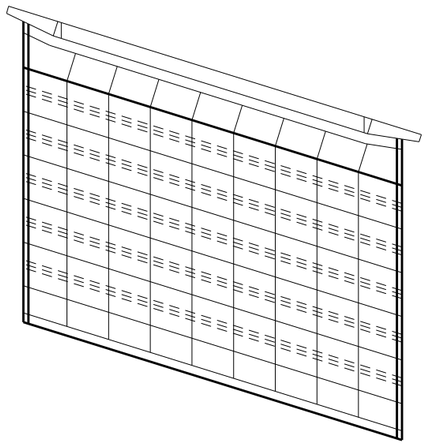
# STANDARD SLOPE PROTECTION UNDER BRIDGES

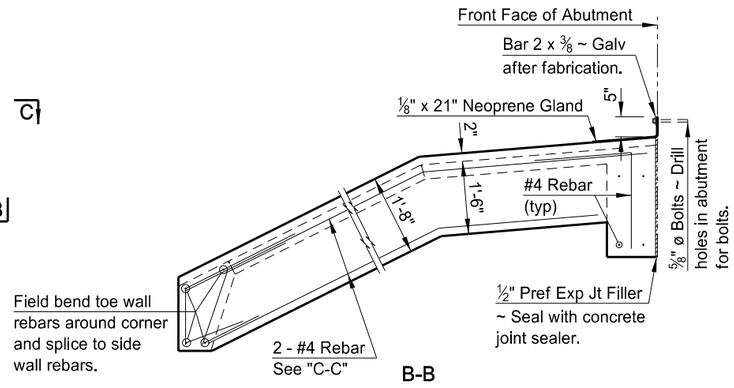
D-258-1



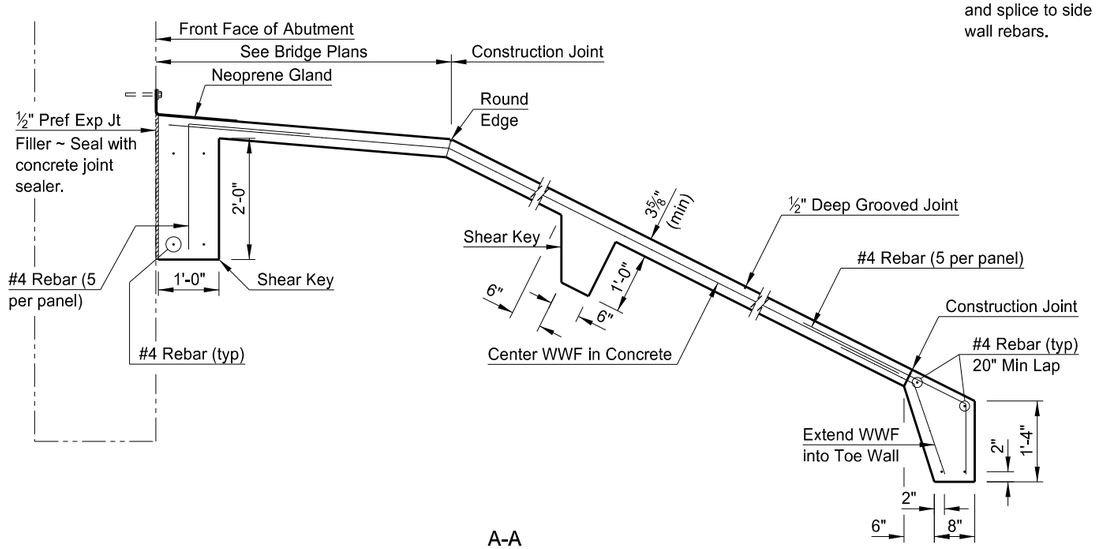

SLOPE PROTECTION LAYOUT



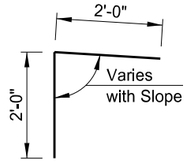
SKEWED SLOPE PROTECTION LAYOUT



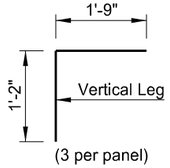

B-B




A-A

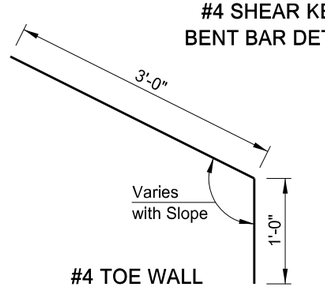



#4 SHEAR KEY BENT BAR DETAIL

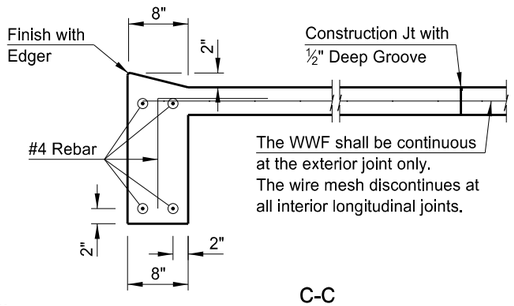



(3 per panel)

#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.

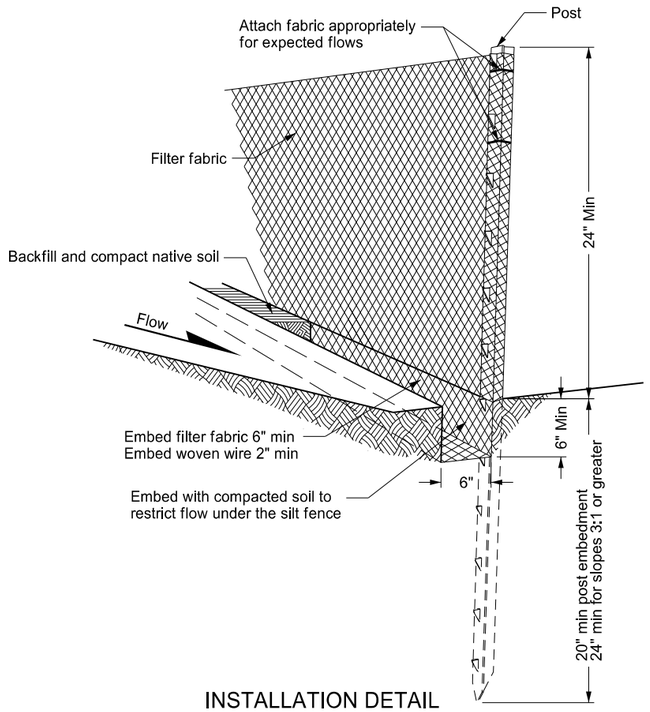
The bolts to hold the neoprene gland in place shall be installed into the abutment by a mechanical or chemically bonded method.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 07/10/14 | |
| REVISIONS | |
| DATE | CHANGE |
| 07/10/14 | CHANGED FROM D-708-1 |

This document was originally issued and sealed by Terrence R. Udland, Registration Number PE-2674, on 07/10/14 and the original document is stored at the North Dakota Department of Transportation

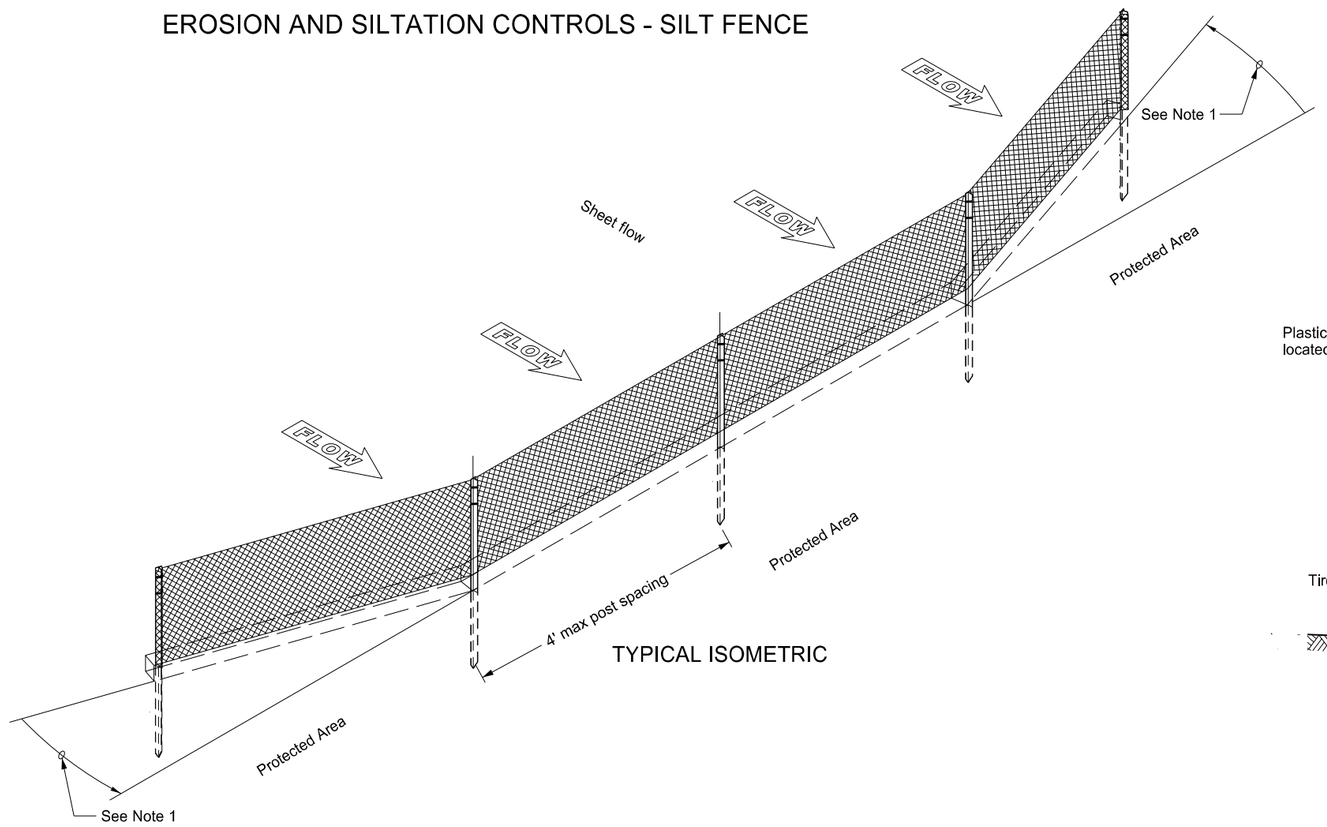
# EROSION AND SILTATION CONTROLS - SILT FENCE

D-260-1

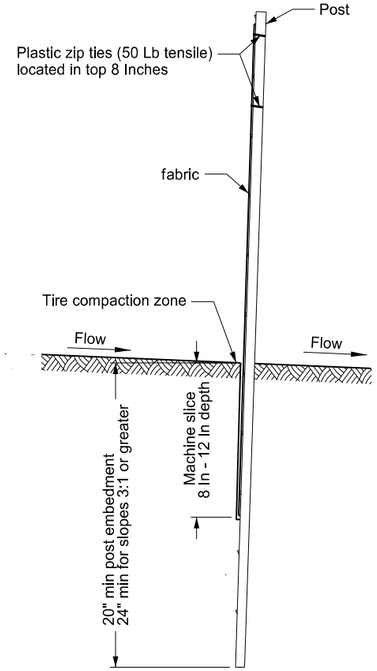



## INSTALLATION DETAIL

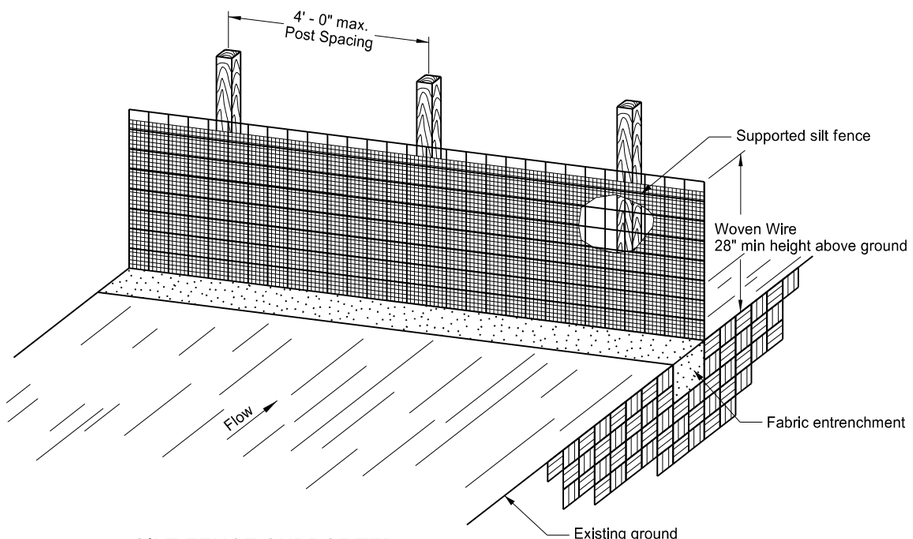
Minimize disturbance of ground around trench and smooth surface after excavation to avoid concentrating flows. Compact to prevent undercutting flows.



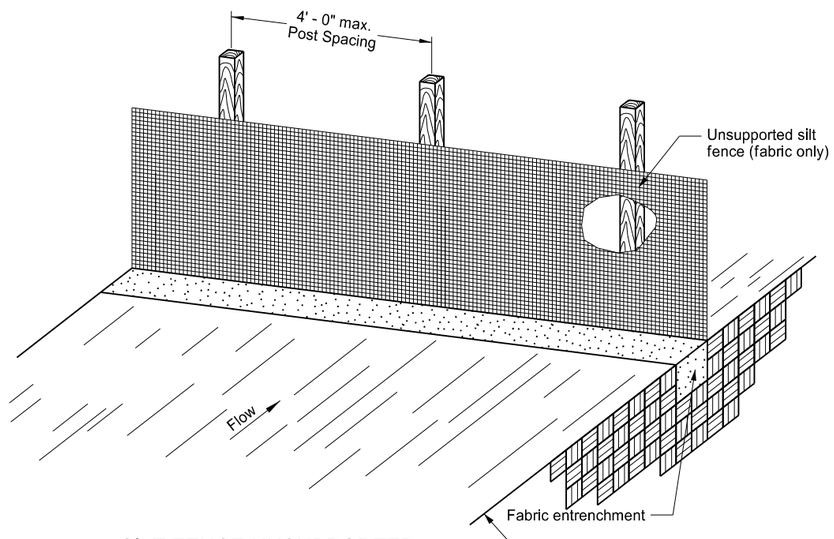

## TYPICAL ISOMETRIC




## MACHINE SLICED SILT FENCE




## SILT FENCE SUPPORTED




## SILT FENCE UNSUPPORTED

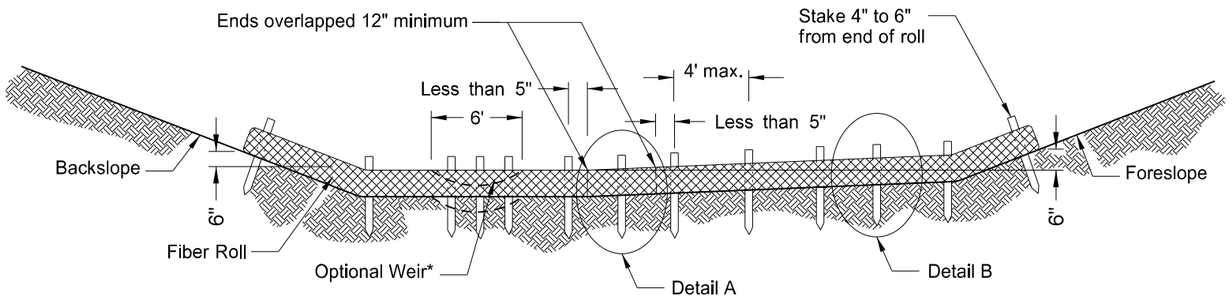
NOTES:
1. Install the ends of the silt fence to point slightly upslope to prevent sediment from flowing around the ends of the fence.
2. Place splices outside low spots.
3. Install silt fencing parallel to contour lines.
4. Do not embed silt fence when placed in standing water.
5. Silt fence material 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 | Revised details & added new ones. |

This document was originally issued and sealed by Roger Weigel Registration Number PE-2930, on 06/27/16 and the original document is stored at the North Dakota Department of Transportation

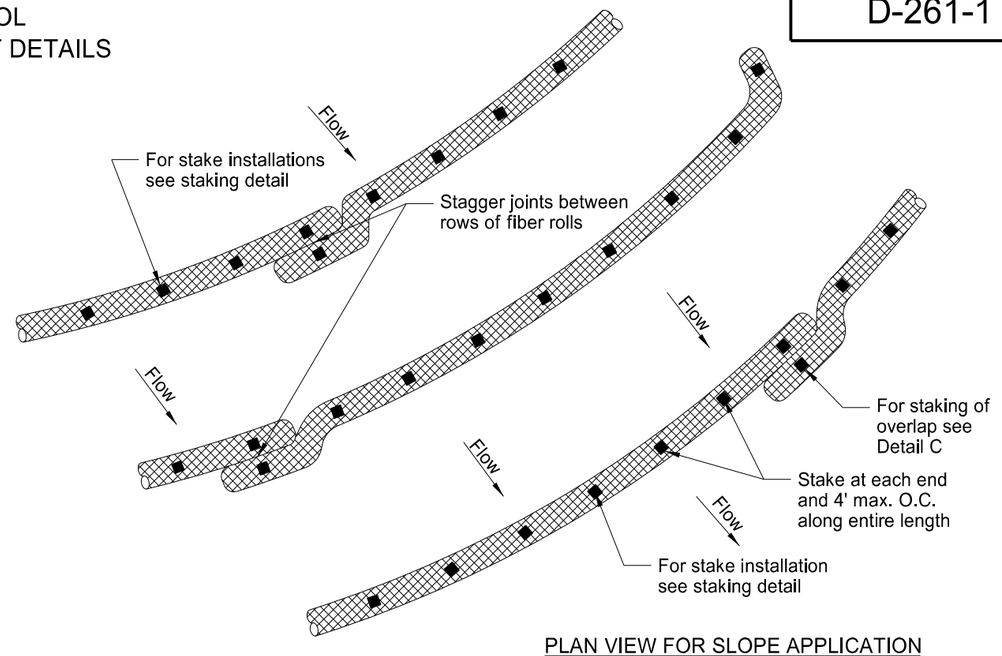
D-261-1

# EROSION CONTROL
# FIBER ROLL PLACEMENT DETAILS

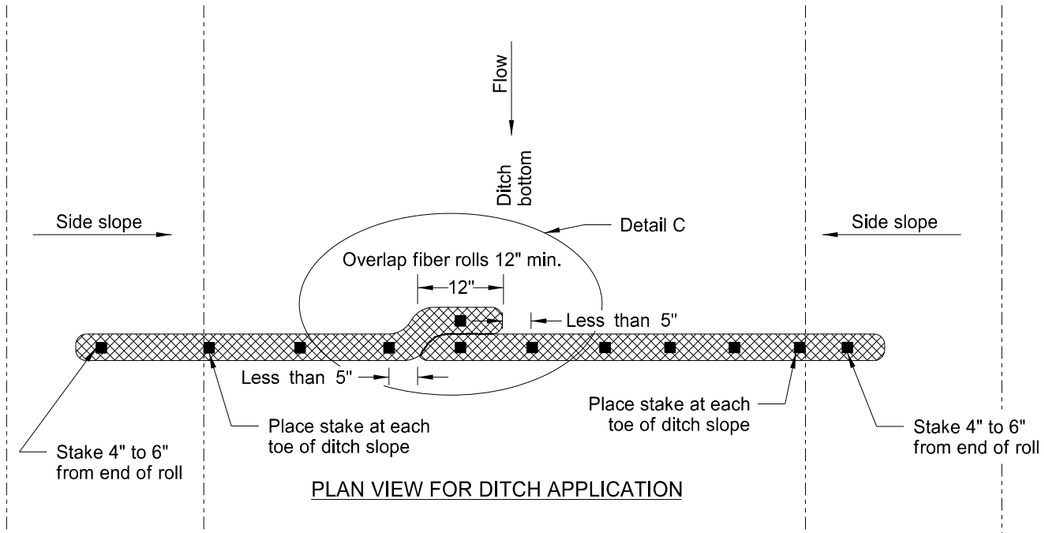



*Optional Weir. Use in flat areas, such as the Red River Valley, where there is potential for water to back up on adjacent property. Lower fiber roll enough to prevent water from backing up on adjacent property. Do not use 20-inch fiber rolls in flat areas where there is potential for water to back up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

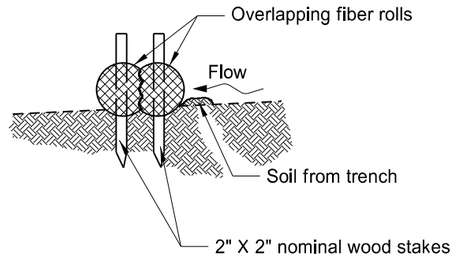
12 OR 20 INCH FIBER ROLL - DITCH BOTTOM




PLAN VIEW FOR SLOPE APPLICATION

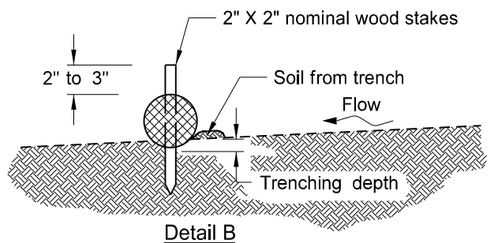



PLAN VIEW FOR DITCH APPLICATION




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 |

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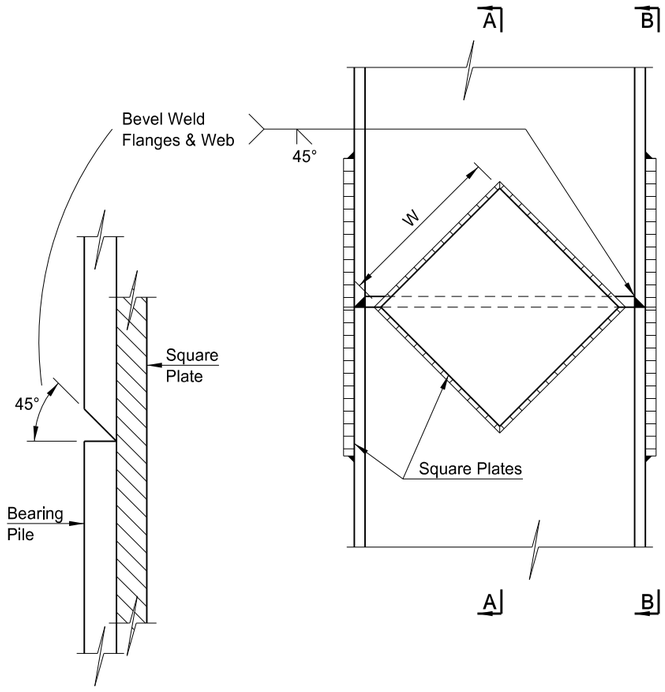
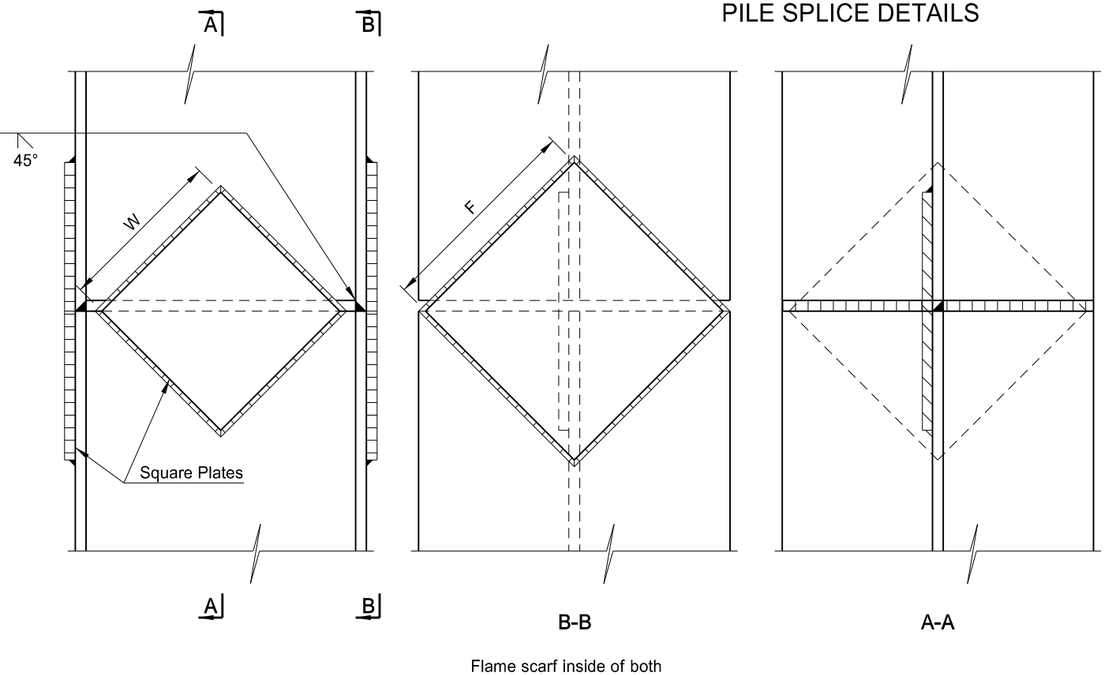
# PILE SPLICE DETAILS

D-622-1



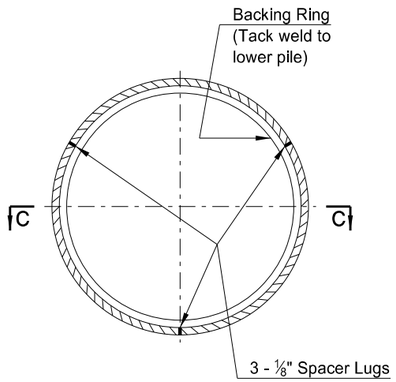

ENLARGED VIEW



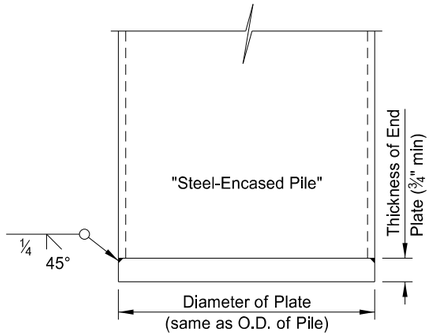

B-B

A-A

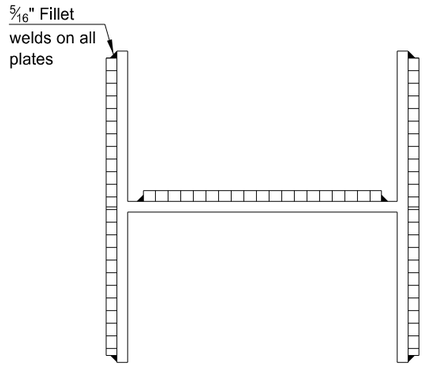
Flame scarf inside of both flanges and one side of web of upper section.




Backing Ring may be made from pile cut-offs or other material of a like quality.

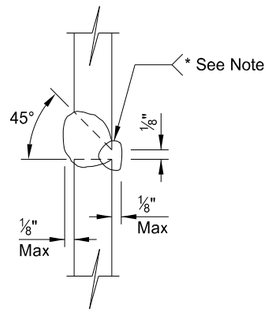



END PLATE DETAIL

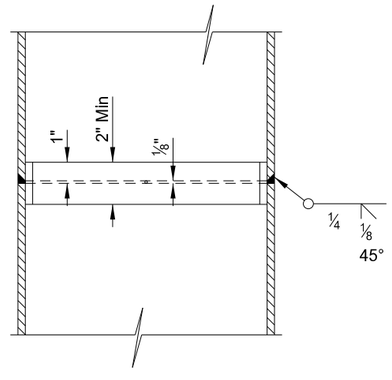



| PILE | 8" | 10" | 12" | 14" |
|---|---|---|---|---|
| "F" FLANGE | 5" | 6½" | 8" | 10" |
| "W" WEB | 4" | 5½" | 6½" | 8" |

H-PILE SPLICE DETAIL

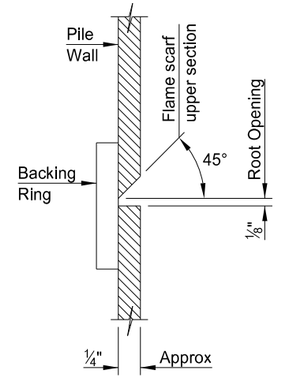



ALTERNATE H-PILE SPLICE DETAIL




C-C

STEEL-ENCASED CONCRETE PILE SPLICE DETAIL




ENLARGED VIEW

## NOTES:

Steel H-Pile may be spliced with complete penetration groove welds in both flanges and web in lieu of using the reinforcing plates.

AWS classification E7OXX Low Hydrogen Electrodes shall be used.

* Welds made without the use of backing material shall have the root gouged to sound metal and welded from the second side.

All welding shall conform to the current AASHTO/AWS D1.5 Bridge Welding Code.

The thickness of the steel square plates shall at a minimum be as thick as the flanges and web of the pile being spliced.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 09/14/11 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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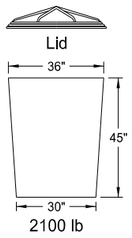
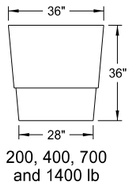
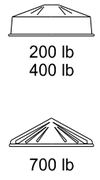
# ATTENUATION DEVICE

D-704-1

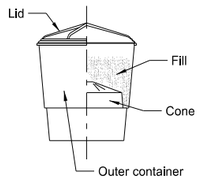



Outer Containers

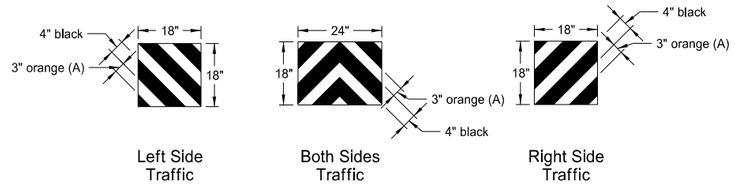



Cones




Typical Assembly

Typical Module
Construction Detail



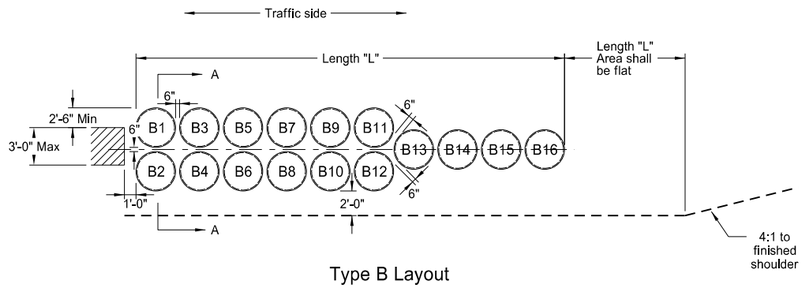

Left Side Traffic | Both Sides Traffic | Right Side Traffic

Reflective Sheet Detail

Note:
The last attenuation device facing traffic shall have a reflective sheet, following the details above, directly applied to the outer container. The sheet may also be applied to a metallic sheet and attached to the container with approved fasteners. The reflective sheeting shall be Type IV as specified in NDDOT Standard Specifications.

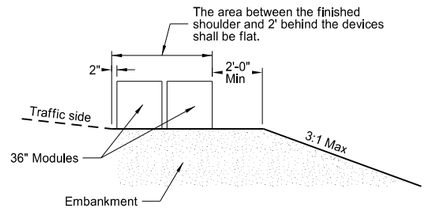
(A) 3" orange sheeting shall be used for temporary installations, and 3" yellow sheeting shall be used for permanent installations.

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




Type B Layout

Note:
When attenuation devices are placed at piers offset from roadway, they shall be angled 10 degrees towards traffic.




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) Modules shall be manufactured from a frangible polyethylene material which will shatter upon impact.
   B) Modules shall be filled with class 43 aggregate meeting the requirements for aggregate according to NDDOT Standard Specifications. The fill unit weight shall be at least 100 pounds per cubic foot. Fill left over winter shall have a moisture content of 2% or less.

2. Modules
   The modules shall be provided in two sizes to contain volumes of either 2, 4, 7, 14, or 21 cubic feet as a minimum.
   A) The module for the 2, 4 or 7 cubic foot container shall consist of three components:
      1) A 14 C.F., yellow outer container.
      2) A black lid which locks securely over the top lip of the container.
      3) A cone-shaped supporting insert. The insert shall be varied to allow for the three sizes of modules and capable of supporting 200, 400, or 700 pounds of sand mass. The cone inserts shall be placed inside the 14 cubic foot container.
   B) The module for the 21 cubic foot container shall consist of two components:
      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 use: The modules shall be 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 an approved equal. The attenuation devices may be placed on pallets to facilitate maintenance. Pallets shall have a maximum thickness of 3½".

4. For permanent use: Barrel Attenuation Device installations, the outer sand container portion of the modules shall consist of a one-piece container with separate detachable lid. The modules which meet these requirements are Energite attenuation barrels manufactured by Energy Absorption Systems of Chicago, IL, TrafFix barrels manufactured by TrafFix Devices, Inc. of San Clemente, CA, or an approved equal. Modules having outer sand containers assembled from multiple pieces shall not be accepted for permanent installations.

5. The Typical Module Construction Detail and Type B Layout are based on the Energite Crash Cushion manufactured by Energy Absorption. The manufacturer of other sand filled attenuation modules shall provide any necessary layouts and details required which differ from those shown here.

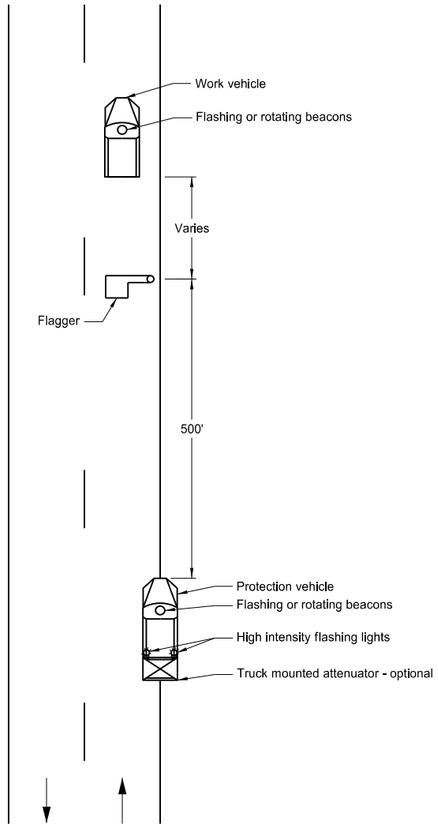
| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 9-25-12 | |
| REVISIONS | |
| DATE | CHANGE |
| 7-18-14 | Revised sheeting in reflective sheet detail |

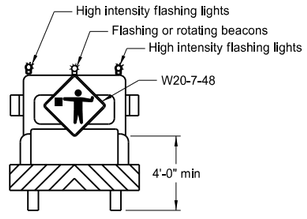
This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 7/18/14 and the original document is stored at the North Dakota Department of Transportation

# TRAFFIC CONTROL FOR CORING OF HOT BITUMINOUS PAVEMENT

D-704-2

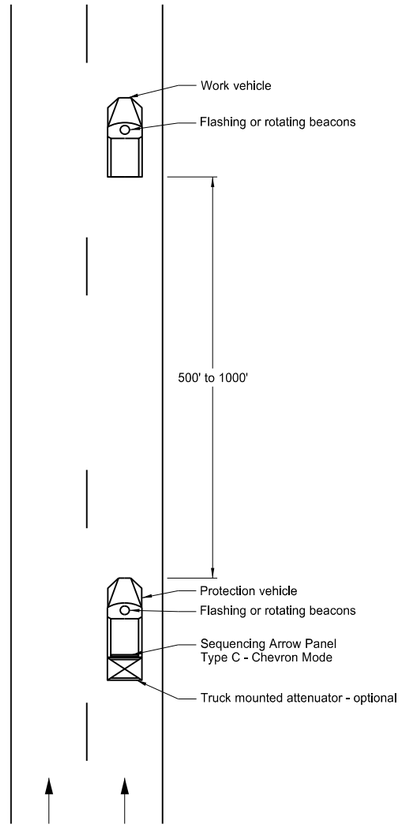
## Two Lane, Two Way Roadways

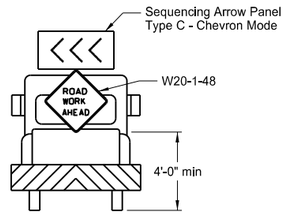



Typical Protection Vehicle

## Multilane Roadways




Typical Protection Vehicle

Notes:

1. The working vehicle shall display a 360 degree rotating, flashing, oscillating or strobe light.
2. The shadow vehicle shall display a 360 degree rotating, flashing, oscillating or strobe light. The shadow vehicle for Multilane Roadway shall also have a sequencing arrow panel Type C operated in the chevron mode.
3. This application is for use during daylight hours and in areas of good visibility only.
4. Two lane, two way roadway, a flagger shall be used to protect the work area and warn oncoming traffic.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 9-25-12 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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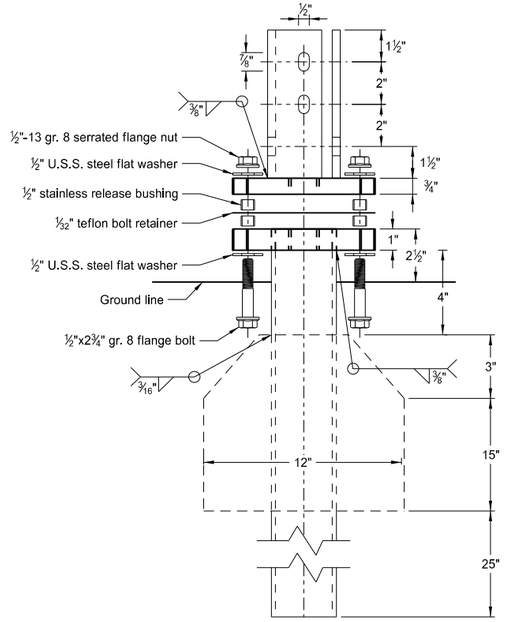
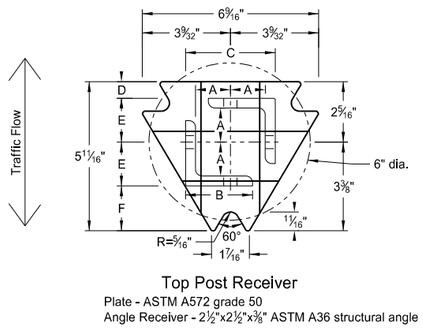
# BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-7

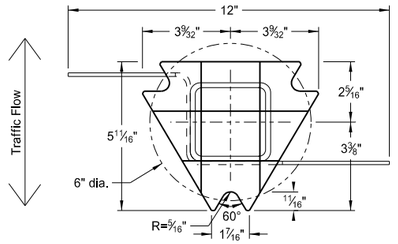



Multi-Directional
Slip Base Assembly

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. Slip base bolts shall be torqued as specified by the manufacturer.
2. Anchor shall have a yield strength of 43.9 KSI and tensile strength of 59.3 KSI.
3. The 4" vertical clearance is required for the anchor or breakaway base. The 4"x60" measurement shall be made above and below post location and also back and ahead of the post.
4. When used in concrete sidewalk, anchor shall be same except without the wings.
5. Four post signs shall have over 7' between the first and the fourth posts.

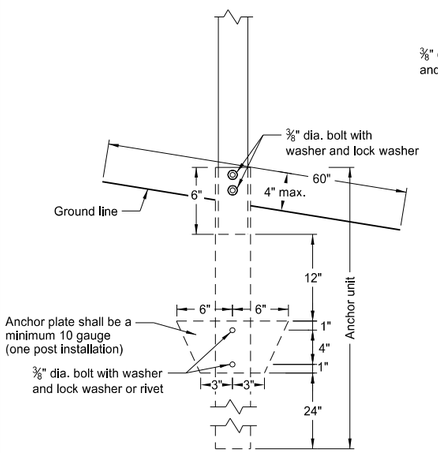
| Telescoping Perforated Tube | | | | | | |
|---|---|---|---|---|---|---|
| Number of Posts | Post Size in. | Wall Thick-ness Gauge | Sleeve Size in. | Wall Thick-ness Gauge | Slip Base | Anchor Size without Slip Base in. |
| 1 | 2 | 12 | | | No | 2¼ |
| 1 | 2¼ | 12 | | | No | 2½ |
| 1 | 2½ | 12 | | | (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 |

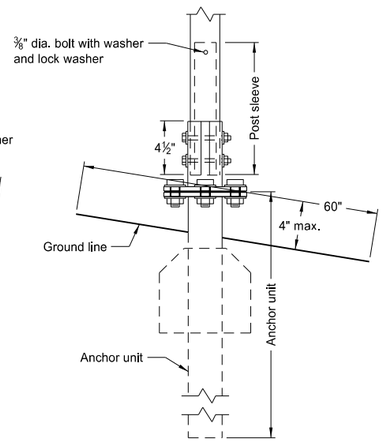
| Top Post Receiver Data Table | | | | | | |
|---|---|---|---|---|---|---|
| Square Post Sizes (B) | A | B | C | D | E | F |
| 2³⁄₁₆"x10 ga. | 1⁹⁄₆₄" | 2½" | 3¹⁄₃₂" | 25⁄₃₂" | 1³³⁄₆₄" | 1⅞" |
| 2½"x10 ga. | 1⁹⁄₃₂" | 2½" | 3⁵⁄₁₆" | ⅝" | 1²¹⁄₃₂" | 1¾" |

(A) The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak.

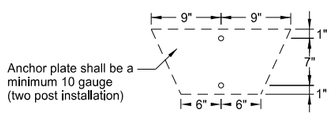
(B) The 2³⁄₁₆"x10 ga. may be inserted into 2½"x10 ga. for additional wind load.

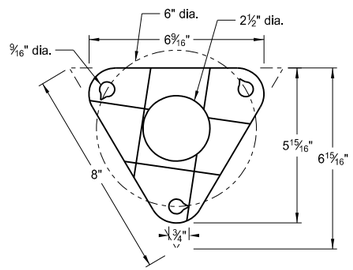



Anchor Unit and Post Assembly




Multi-Directional
Slip Base Anchor Unit
and Post Sleeve Assembly




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

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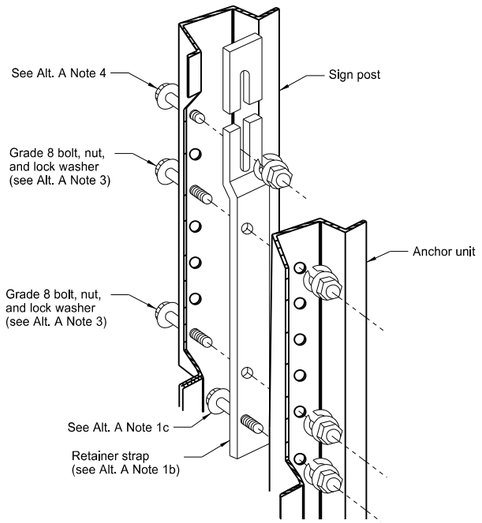
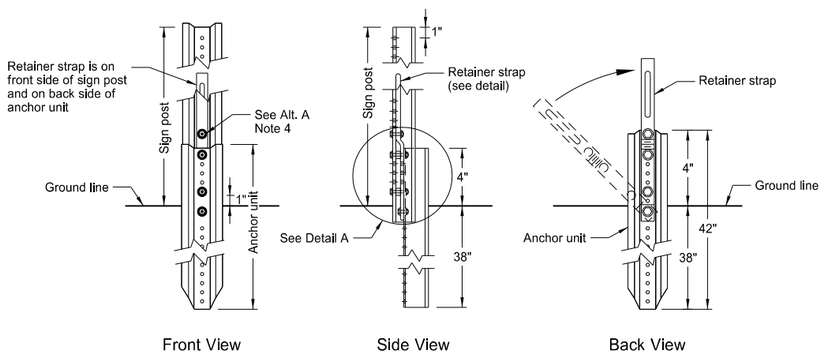
# BREAKAWAY SYSTEMS FOR CONSTRUCTION ZONE SIGNS

D-704-8

## U-Channel Post



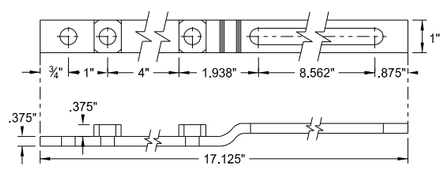

Detail A



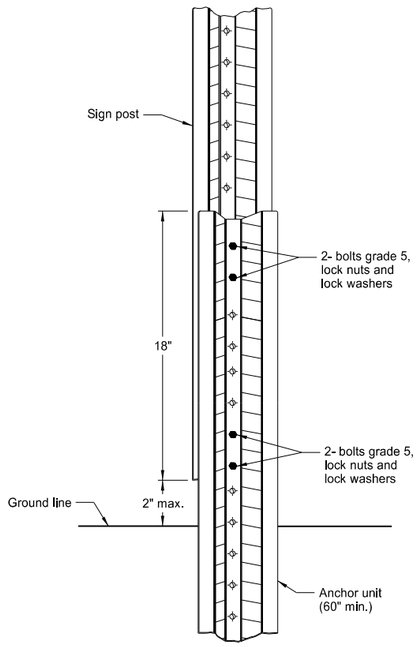

Front View Side View Back View

Breakaway U-Channel Detail
Alternate A

A maximum of 2 posts shall be installed within 7'.

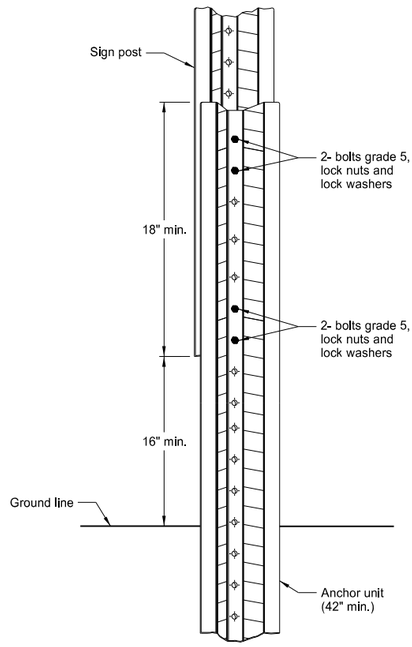



Retainer Strap Detail




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

A maximum of 3 posts shall be installed within 7'.




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

A maximum of 3 posts shall be installed within 7'.

Alternate A Steps of Installation:

1. a) Drive anchor unit to within 12" of ground level.
   b) Proper assembly established by lining up the bottom hole of retainer strap with the 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. The base post, strap and sign post shall be properly nested. 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.

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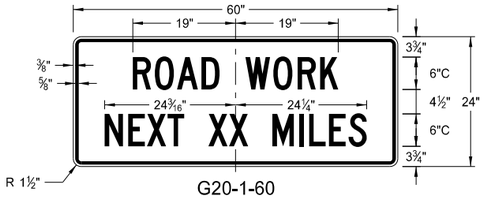
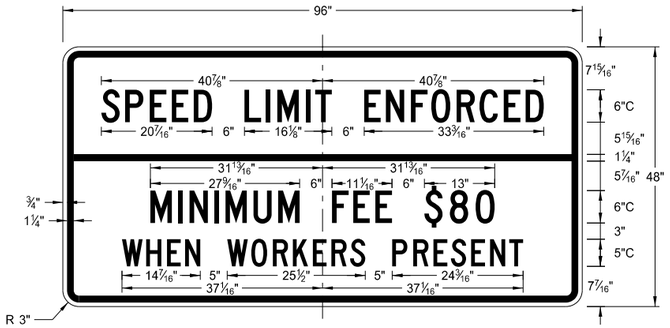
# CONSTRUCTION SIGN DETAILS
# TERMINAL AND GUIDE SIGNS




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


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




G20-55-96
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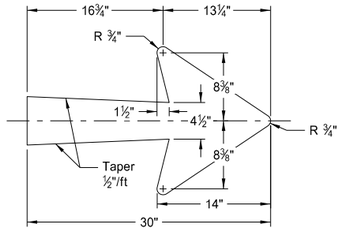
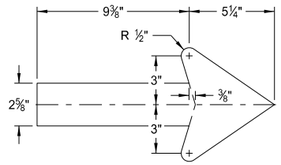
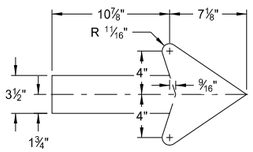
Background: orange



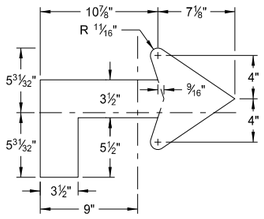

E5-1-48



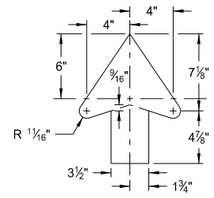
G20-50a-72
G20-52a-72



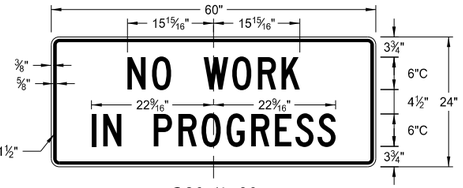
M4-9(L or R)-30
Right or Left



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



M4-9-30
Straight




G20-1b-60
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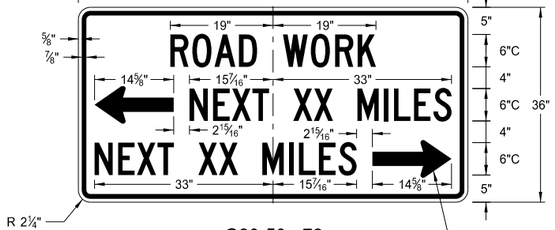
Background: orange




G20-50a-72
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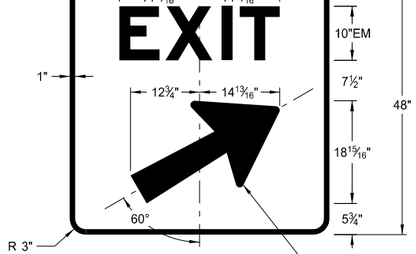
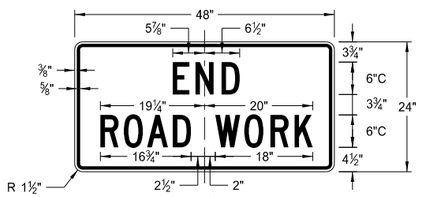
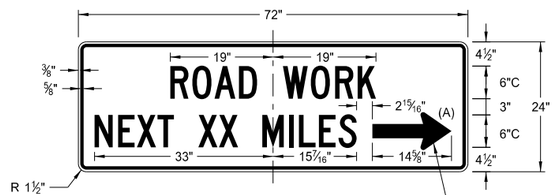
Background: orange




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




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

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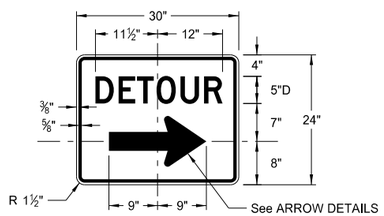
Background: orange




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.

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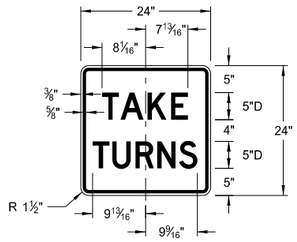
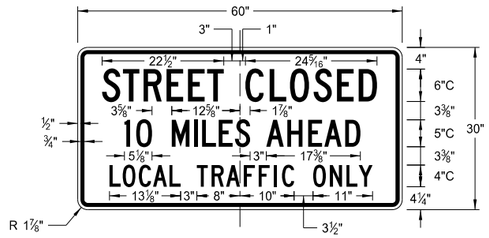
# CONSTRUCTION SIGN DETAILS
## REGULATORY SIGNS




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




R11-3c-60
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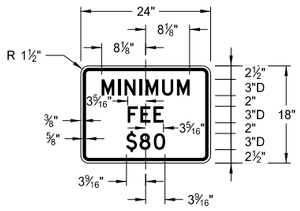


R2-1a-24
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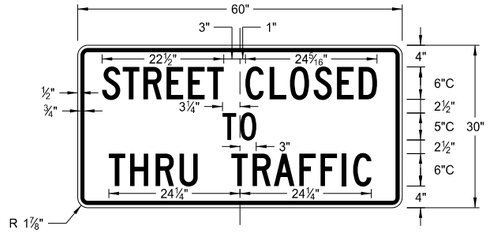


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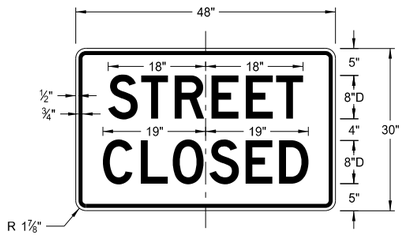


R11-2a-48
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Background: white

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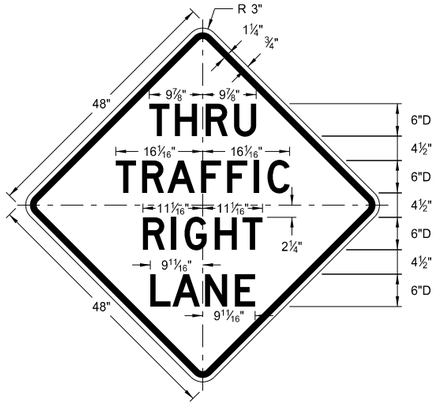
# CONSTRUCTION SIGN DETAILS
## WARNING SIGNS




W5-8-48
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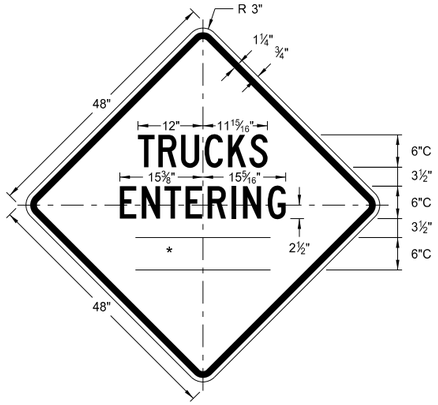
Background: orange




W8-54-48
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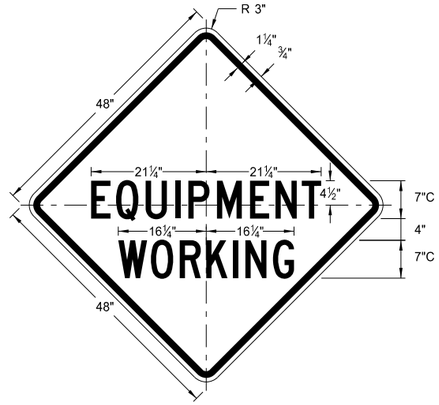


W20-51-48
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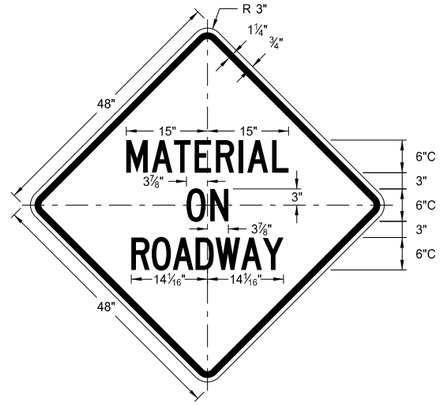
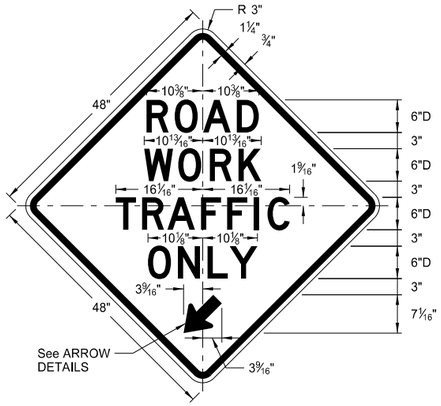
Background: orange




W21-51-48
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
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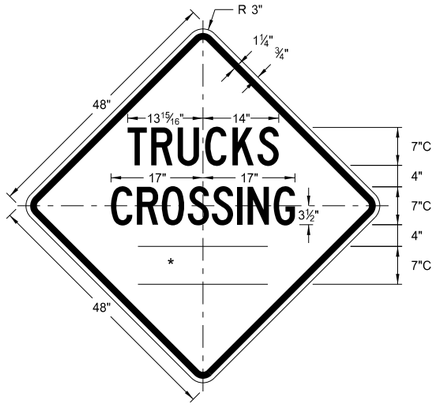


W8-55-48
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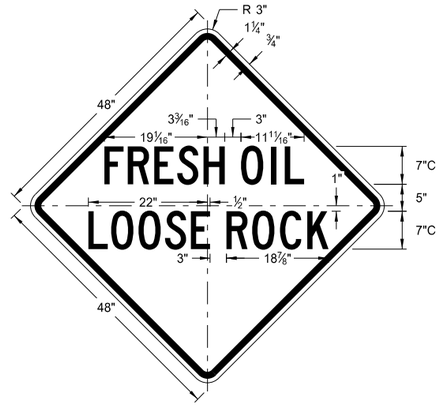
Background: orange




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

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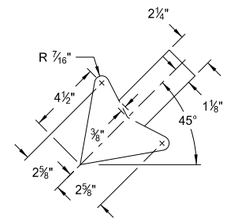
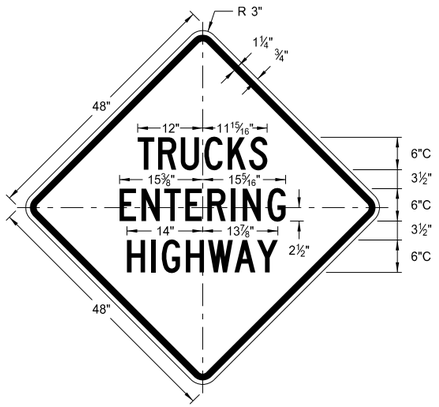



W5-9-48

ARROW DETAILS

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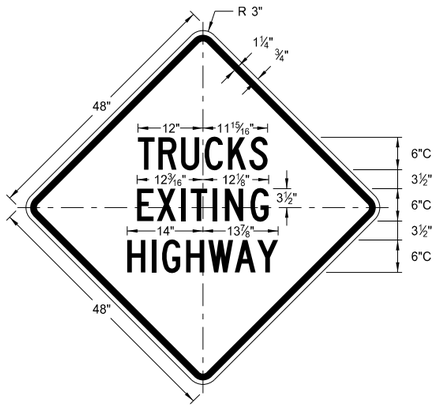


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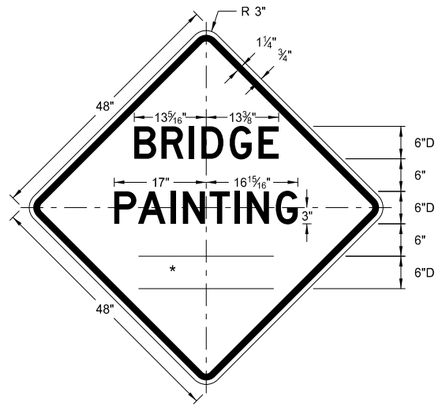


W21-50-48
Legend: black (non-refl)
Background: orange

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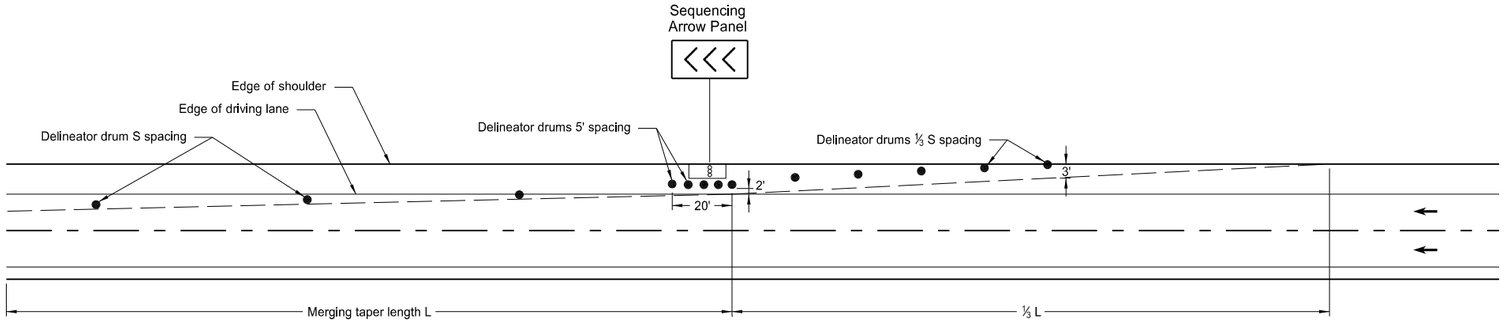
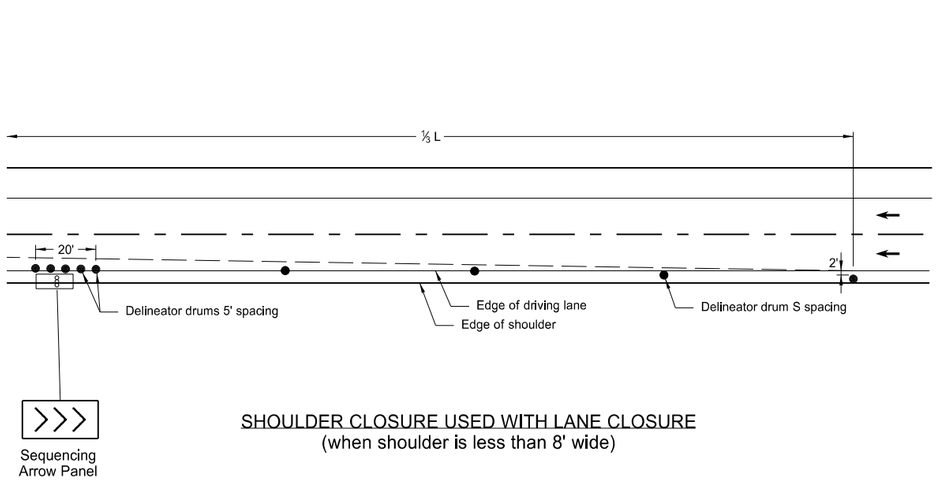
# SHOULDER CLOSURE TAPERS

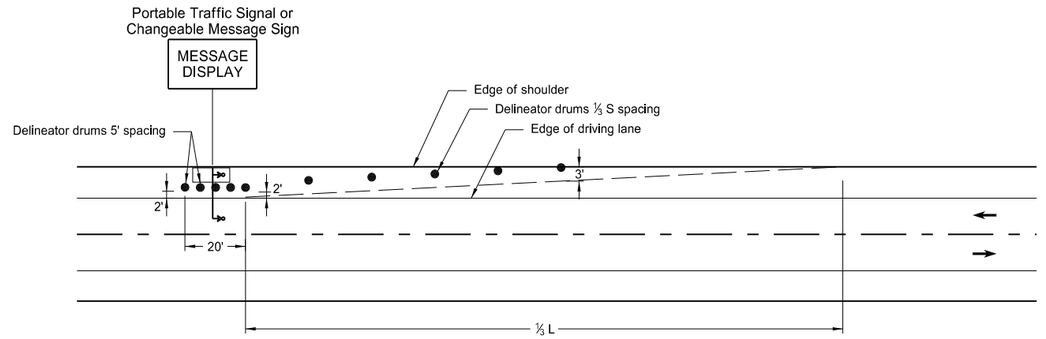
D-704-12




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, it should have a length of approximately ⅓L. If a shoulder is used as a travel lane, a normal merging or shifting taper should be used.
3. When paved shoulders of 8 foot width or more are closed, channelizing devices shall be used to close the shoulder in advance to delineate the beginning of the work space and direct vehicular traffic to remain within the traveled way.

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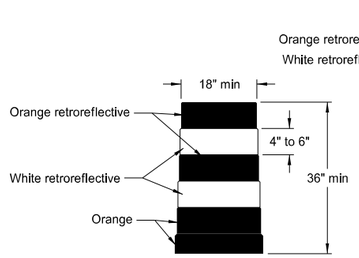
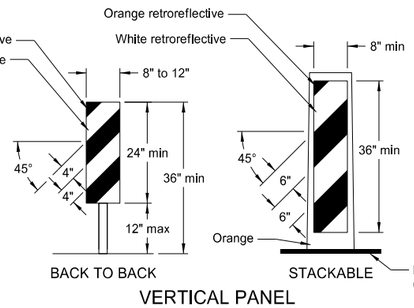
# BARRICADE AND CHANNELIZING DEVICE DETAILS

D-704-13



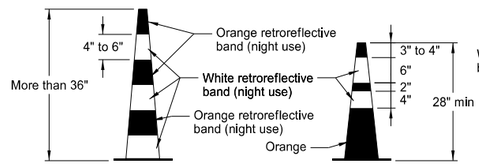

DELINEATOR DRUM

The markings on drums shall be horizontal, circumferential, alternating orange and white retroreflective stripes 4" to 6" wide. Each drum shall have a minimum of two orange and two white stripes with the top stripe being orange. Any nonretroreflectorized spaces between the horizontal orange and white stripes shall not exceed 3" wide. Stripes shall not be placed on ribs or indentations in the drum. Drums shall have closed tops that will not allow collection of construction debris or other debris. Ballast shall not be placed on the top of a drum.



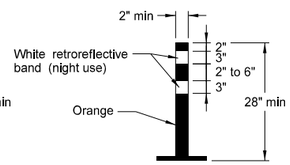

VERTICAL PANEL

Markings for vertical panels shall be alternating orange and white retroreflective stripes, sloping downward in the direction vehicular traffic is to pass. Retroreflective sheeting shall be placed on both sides of panel and shall have 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, a stripe width of 6 inches shall be used.



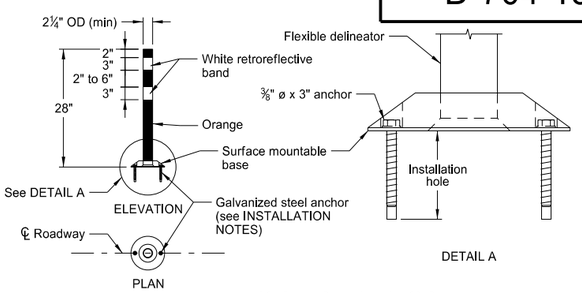

TRAFFIC CONE

Retroreflectorization of cones more than 36" in height shall be provided by alternating orange and white retroreflective stripes. Each cone shall have a minimum of two orange and two white stripes with the top stripe being orange. Any nonretroreflectorized space between the orange and white stripes shall not exceed 3" wide.




TUBULAR MARKER

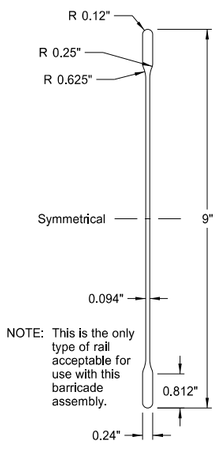
Retroreflectorization of tubular markers more than 42" in height shall be provided by alternating four 4" to 6" wide orange and white stripes with the top stripe being orange.



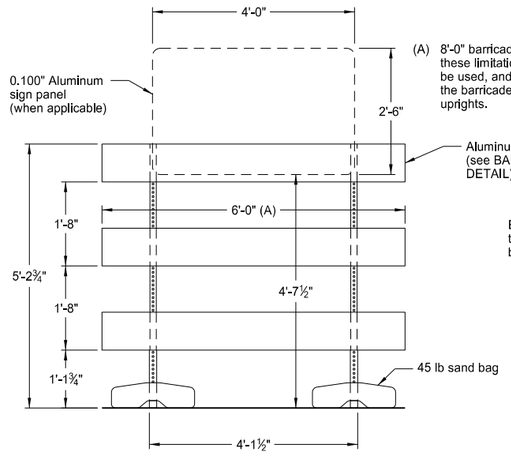

FLEXIBLE DELINEATOR

INSTALLATION NOTES:

1. Drill installation holes to diameter and depth as 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, the contractor may use an 8" x 8" butyl pad or hot melt butyl. Butyl shall be removed as close as possible to pavement surface.

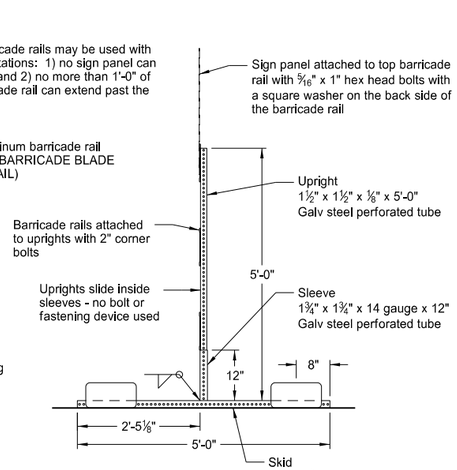



BARRICADE BLADE DETAIL



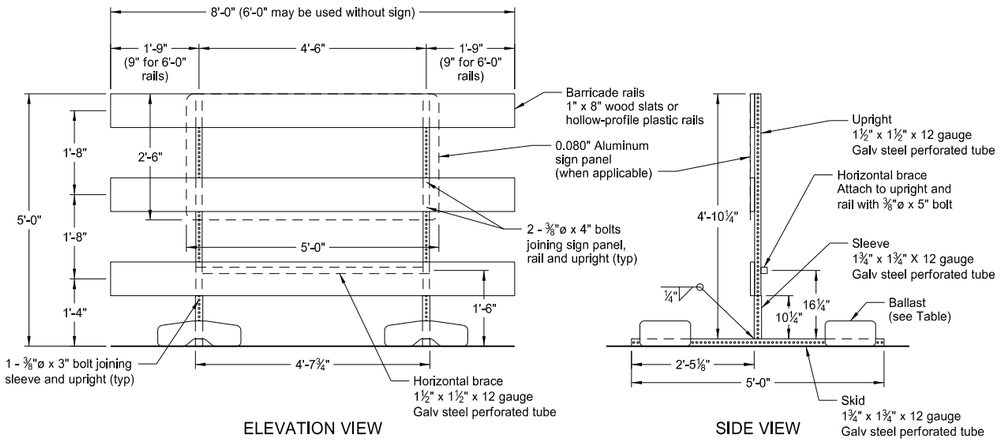

ELEVATION VIEW

(A) 8'-0" barricade rails may be used with these limitations: 1) no sign panel can be used, and 2) no more than 1'-0" of the barricade rail can extend past the uprights.




SIDE VIEW

BARRICADE ASSEMBLY DETAIL
(Aluminum Barricade Rails)

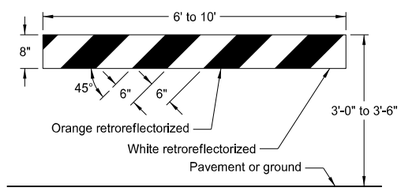



ELEVATION VIEW

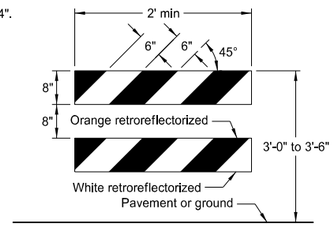
SIDE VIEW

BARRICADE ASSEMBLY DETAIL
(Wood or Plastic Rails)

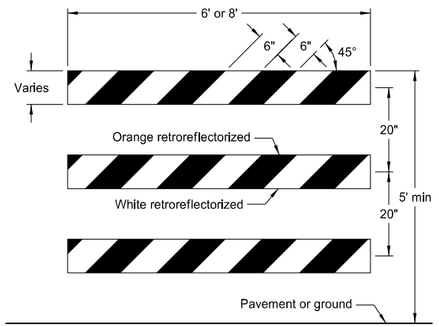
NOTE: Markings for barricades shall be alternating orange and white retroreflective stripes, sloping downward in the direction traffic is to pass. Retroreflective sheeting shall be placed on both sides of the rails and shall have a minimum of 270 square inches of visible retroreflective area facing vehicular traffic. When the barricade length is less than 36", the rail stripe width shall be 4".




TYPE I BARRICADE

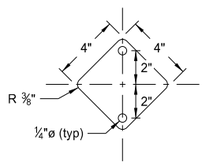


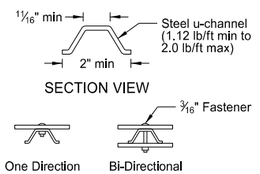

TYPE II BARRICADE

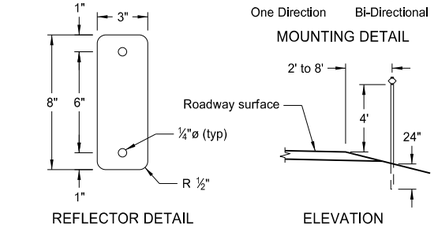



TYPE III BARRICADE

BARRICADE RAIL DETAILS




DELINEATORS

MINIMUM BALLAST
(For each side of barricade support)

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

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

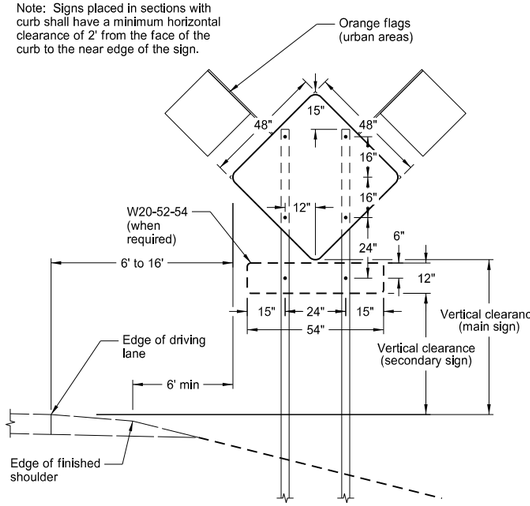
| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 10-3-13 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

This document was originally issued and sealed by Roger Weigel, Registration Number PE- 2930, on 10/3/13 and the original document is stored at the North Dakota Department of Transportation

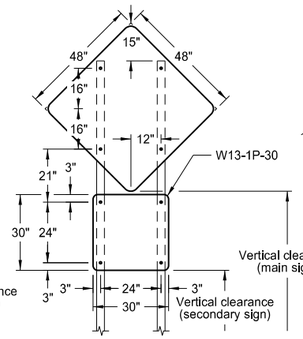
# CONSTRUCTION SIGN PUNCHING AND MOUNTING DETAILS

D-704-14

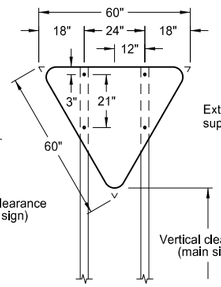
Note: Signs placed in sections with curb shall have a minimum horizontal clearance of 2' from the face of the curb to the near edge of the sign.



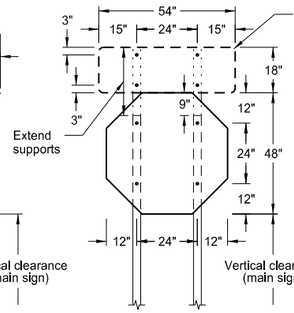

TYPICAL SECTION
(48" x 48" diamond warning sign shown)



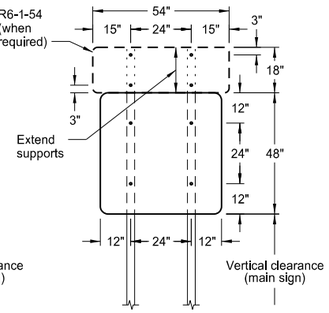

48" x 48" DIAMOND SIGN
(with 30" x 30" secondary sign)



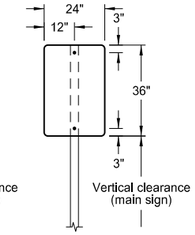

R1-2-60 - YIELD SIGN



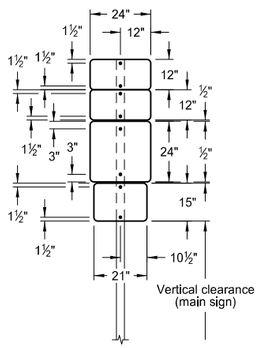

R1-1-48 - STOP SIGN
(with R6-1-54 sign as required)



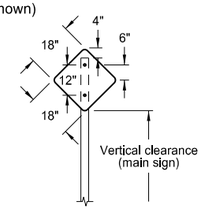

48" x 48" SIGN
(with R6-1-54 sign as required)



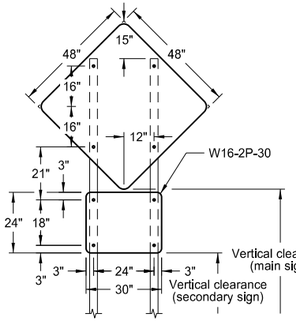

24" x 36" SIGN



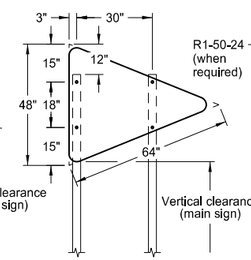

24" x 24"
ROUTE MARKER
ASSEMBLY



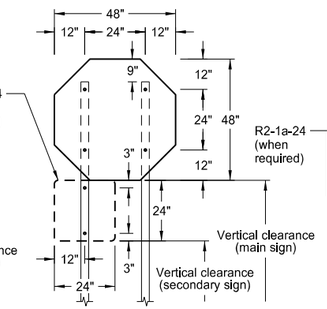

18" x 18"
DIAMOND SIGN



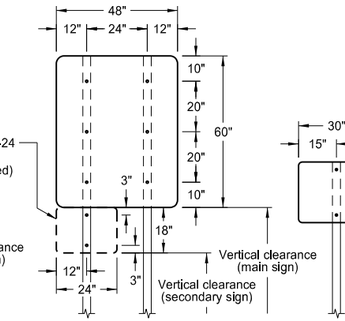

48" x 48" DIAMOND SIGN
(with 30" x 24" secondary sign)



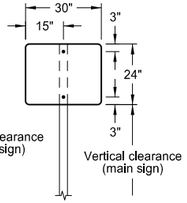

W14-3-64 - PENNANT SIGN



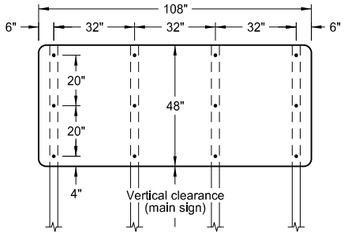

R1-1-48 - STOP SIGN
(with R1-50-24 sign as required)



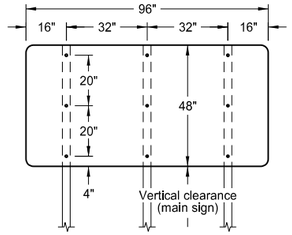

48" x 48" SIGN
(with R2-1a-24 sign as required)



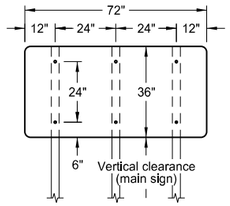

30" x 24" SIGN



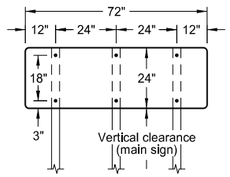

108" x 48" SIGN



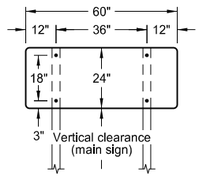

96" x 48" SIGN



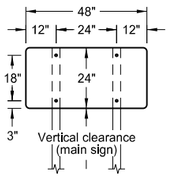

72" x 36" SIGN



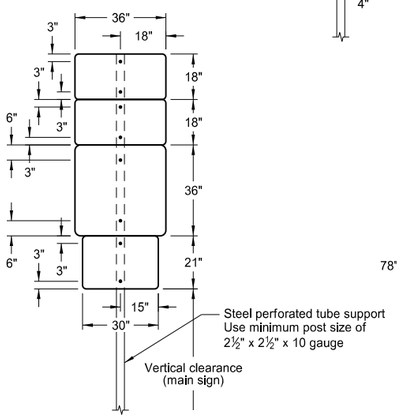

72" x 24" SIGN



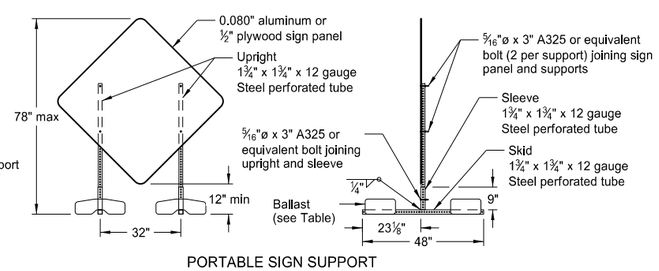

60" x 24" SIGN



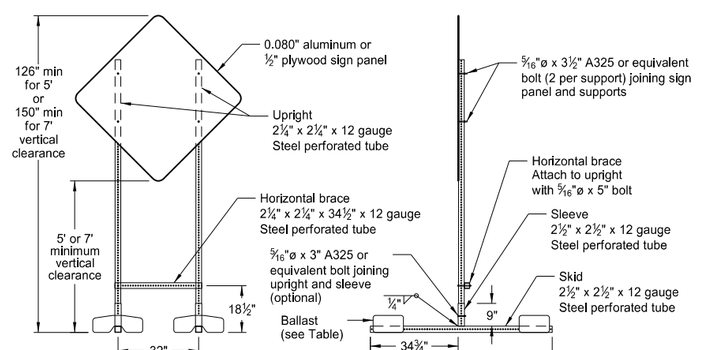

48" x 24" SIGN




36" x 36"
ROUTE MARKER
ASSEMBLY




PORTABLE SIGN SUPPORT
LOW-MOUNTING HEIGHT




PORTABLE SIGN SUPPORT
HIGH-MOUNTING HEIGHT

NOTES:

1. Sign Supports: Supports shall be galvanized or painted. 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, the minimum post size for assemblies containing a secondary sign is 3.0 lb/ft. Post sizes are based on a wind speed of 55 MPH.

   Signs over 50 square feet should be installed on 2½" x 2½" perforated tube supports as a minimum.

   Guy wires shall not be attached to sign supports. Wind beams may be attached to u-posts behind the sign panels.

2. Sign Panels: Provide sign panels made of 0.100" aluminum, ½" plywood, or other approved material, except where noted. All holes to be punched round for ⅜" bolts.

3. Alternate Messages: The signs that have alternate messages may have these alternate messages placed on a reflectorized plate (without a border) and installed and removed as required. (i.e. "Left" and "Right" message on a 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 as stated above.

   Large signs having an area exceeding 50 square feet shall have a minimum clearance of 7'-0" from the ground at the post.

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

   When portable signs are used for 5 days or less, low-mounting height (minimum 12" vertical clearance) sign supports may be used 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. The R9-8 through R9-11a series, W1-6 through W1-8 series, M4-10, and E5-1 may be used for longer than 5 days.

   Signs mounted to the portable sign supports shown in the LOW-MOUNTING HEIGHT and HIGH-MOUNTING HEIGHT Details shall have 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 |

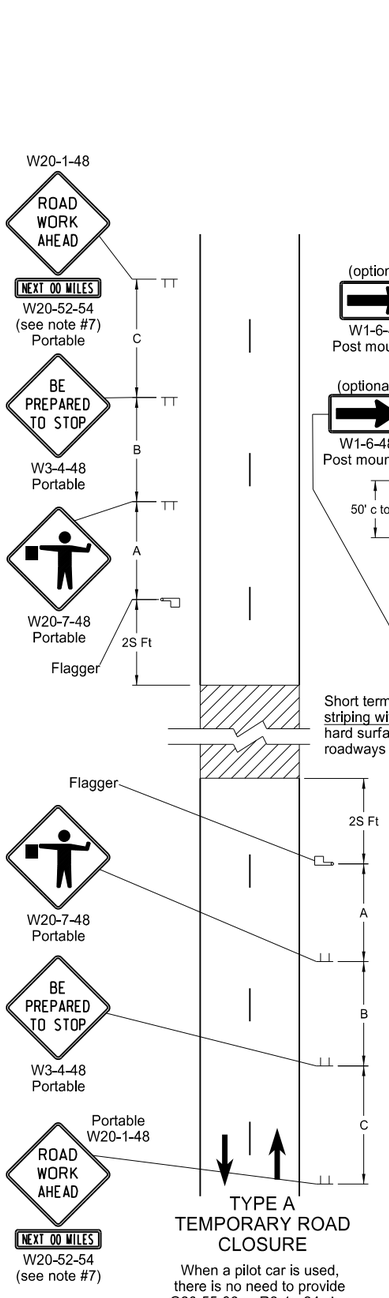
Note: The number of sandbags are based on a wind speed of 55 MPH. The sandbags are assumed to be placed at or near the ends of the skids.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 10-4-13 | |
| REVISIONS | |
| DATE | CHANGE |
| 11-14-13 | Revised Note 6. |

This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 11/14/13 and the original document is stored at the North Dakota Department of Transportation

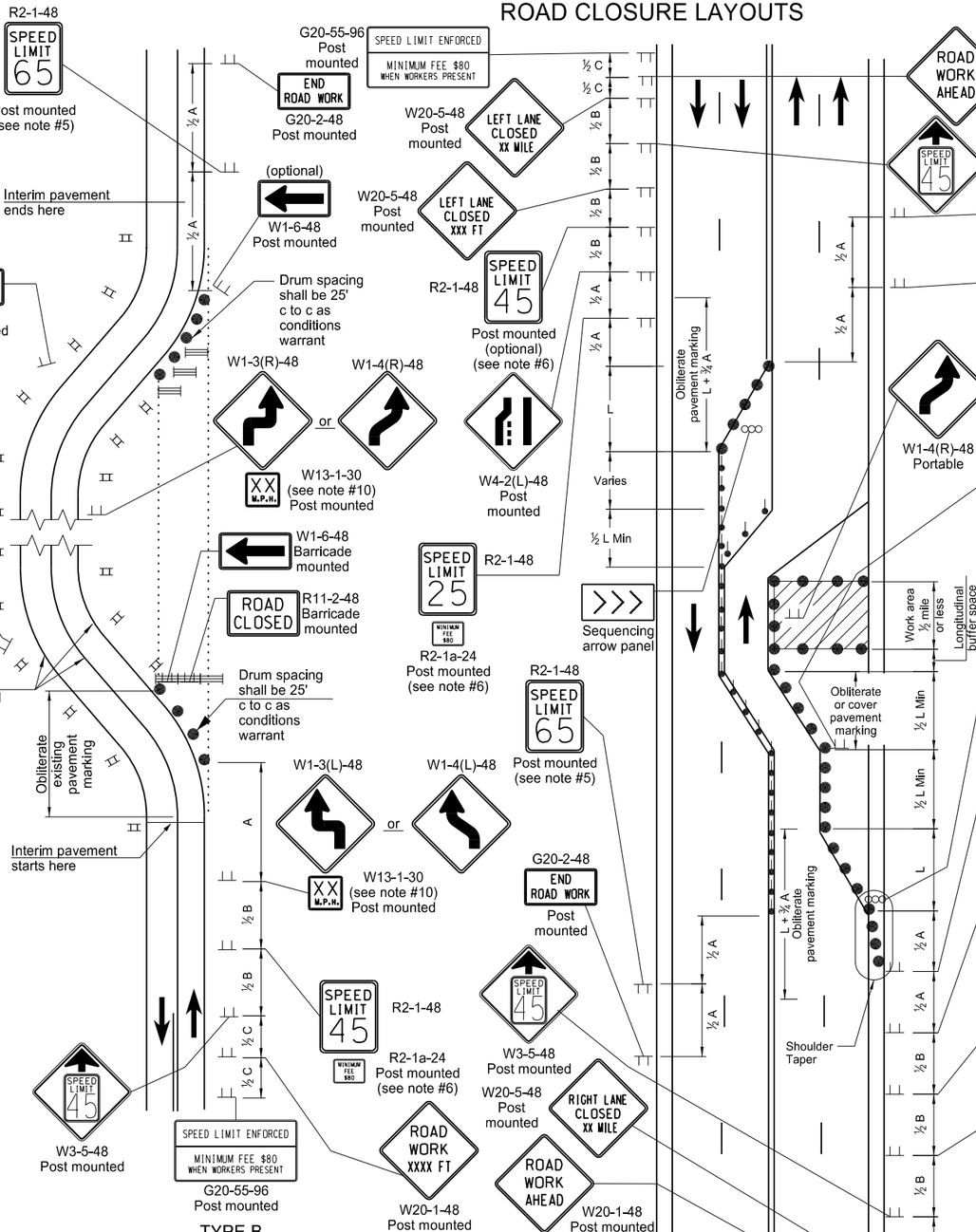
# ROAD CLOSURE LAYOUTS

D-704-15



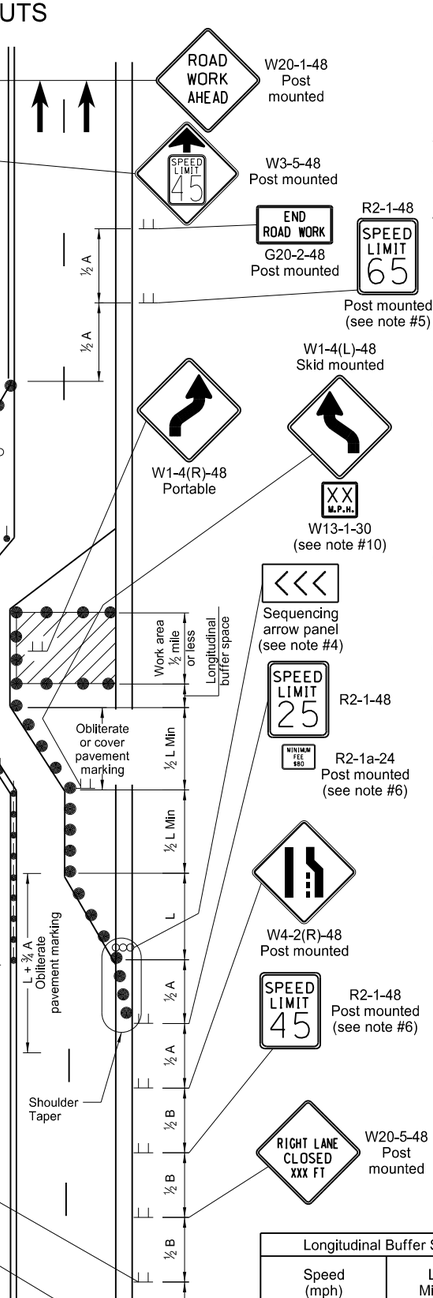

TYPE A
TEMPORARY ROAD CLOSURE

When a pilot car is used, there is no need to provide G20-55-96 or R2-1a-24 sign on the project as the pilot car will control the speed.




TYPE B
ROAD CLOSURE WITH A DIVERSION

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




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.
   L = Minimum length of taper, or 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. Barricades placed on roadway shall be on a moveable assembly. Signs placed on roadway shall be placed on skid mounted assemblies.
3. Delineator drums, barricades or cones used for tapering traffic shall be spaced at the dimension "S". Delineator drums or cones used for tangents shall be spaced at 2 times 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. See Shoulder Closure Standard Drawing.
   Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).
   Type B shall be used on roadways with moderate traffic speeds and volumes (40 mph or less and 5000 ADT or less).
   Type C shall be used on roadways with high traffic speeds and volumes (over 40 mph or over 5000 ADT).
5. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
6. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at ½ B.
7. Use when work area is 1 mile or longer.
8. When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
9. Existing speed limit signs within a reduced speed zone shall be covered.
10. Where necessary, safe speed to be determined by the Engineer.
11. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.
12. G20-55-96 sign is not required if this standard is part of other traffic control layouts, or the work is less than 15 days.

| 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

| 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

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| | |

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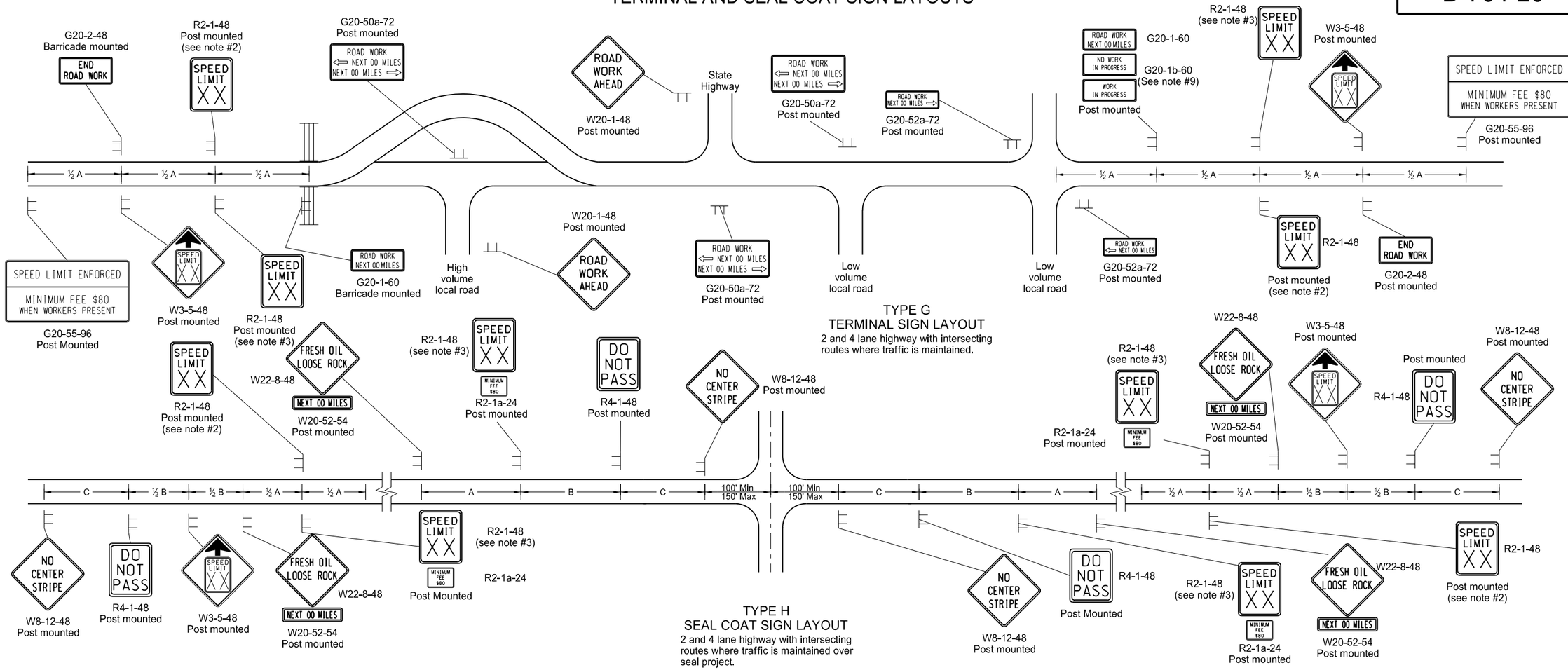
# TERMINAL AND SEAL COAT SIGN LAYOUTS

D-704-20




1. Barricades placed on roadway shall be on a moveable assembly. Signs placed on the roadway shall be placed on skid mounted assemblies.
2. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
3. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 MPH below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 MPH. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at ½ B.
4. When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
5. Existing speed limit signs within a reduced speed zone shall be covered.
6. On seal projects, signs R2-1-48, R2-1a-24, R4-1-48, W22-8-48 and W20-52-54 shall be placed just after all important intersections and at five mile intervals thereafter. Sign W8-12-48 shall be placed just after all important intersections and at 2 mile intervals thereafter until the short term center line pavement marking is in place. No short term pavement markings are placed when traffic volumes are 750 ADT or less.
7. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.
8. Type H construction sign traffic control shall have the speed limit signs covered or removed once the loose aggregate has been removed.
9. The contractor shall install the G20-1b-60 sign when work is suspended for winter.
10. Other traffic control layouts will be required in the immediate work areas. If the speed limit is reduced in the work area, speed limit signs shall have the R2-1a-24 sign placed below.
11. G20-55-96 sign is not required if work is less than 15 days.

| 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

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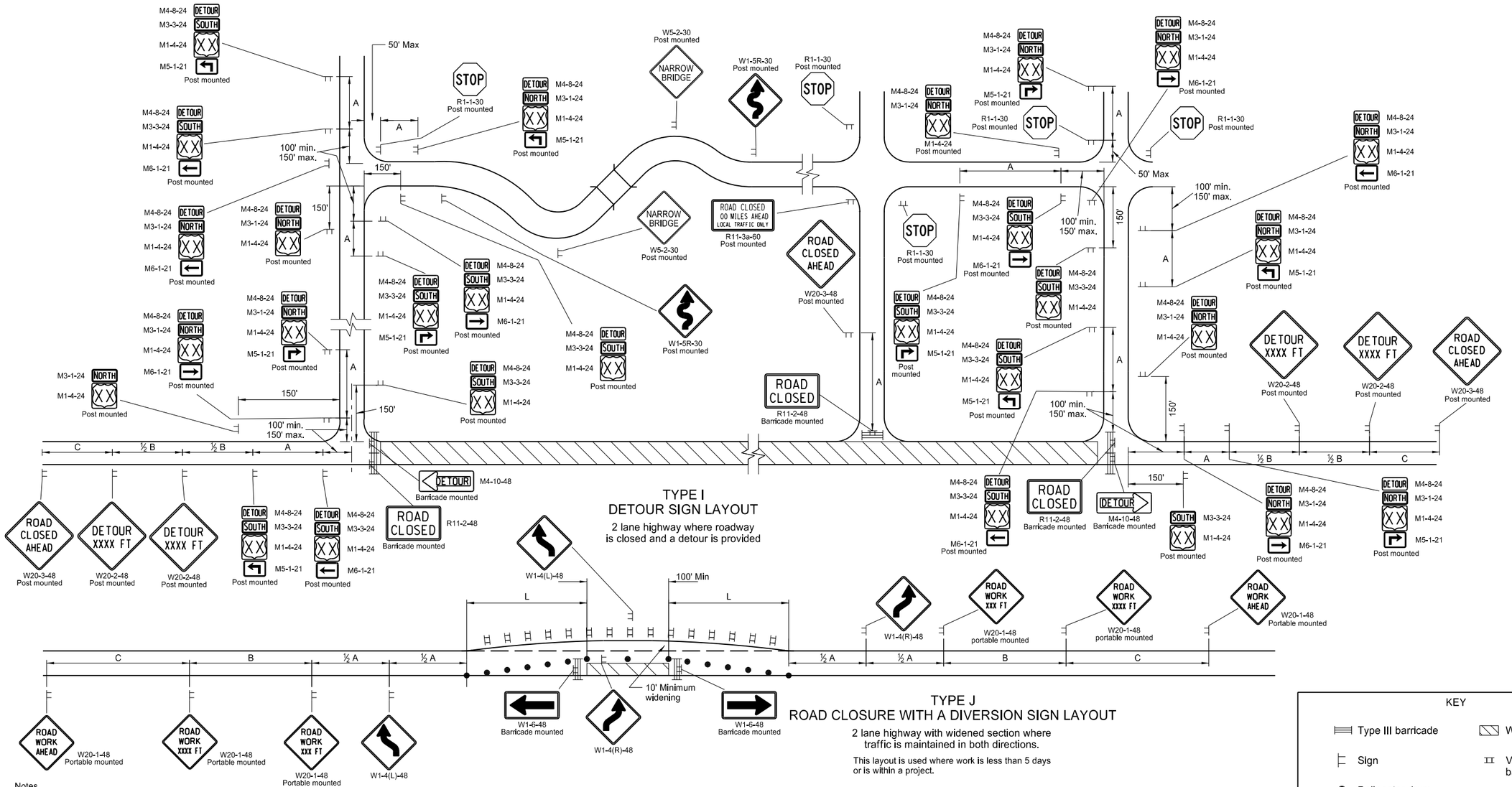
# DETOUR AND ROADWAY DIVERSION SIGN LAYOUTS

D-704-21




KEY

- Type III barricade
- Work area
- Sign
- Vertical panels back to back
- Delineator drum

Notes

1. Variables
   S=Numerical value of speed limit or 85th percentile. W=The width of taper.
   L=Minimum length of taper, or 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. Barricades placed on roadway shall be on a moveable assembly. Signs placed on roadway shall be placed on skid mounted assemblies.
3. Delineator drums and vertical panels used for tapering traffic shall be spaced at dimension "S". Delineator drums, tubular markers and vertical panels used for tangents shall be spaced at 2 times "S".
4. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 MPH. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit shall be placed at ½ B.
5. When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
6. Existing speed limit signs within a reduced speed zone shall be covered.
7. Obliterated or covered payment marking shall be paid for as Obliteration of Pavement Marking. The covering shall be approved by the engineer.
8. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.
9. A W24-1-48 sign may be used in place of the double reverse curve signs if the tangent between tapers is less than 600'.

| 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 |

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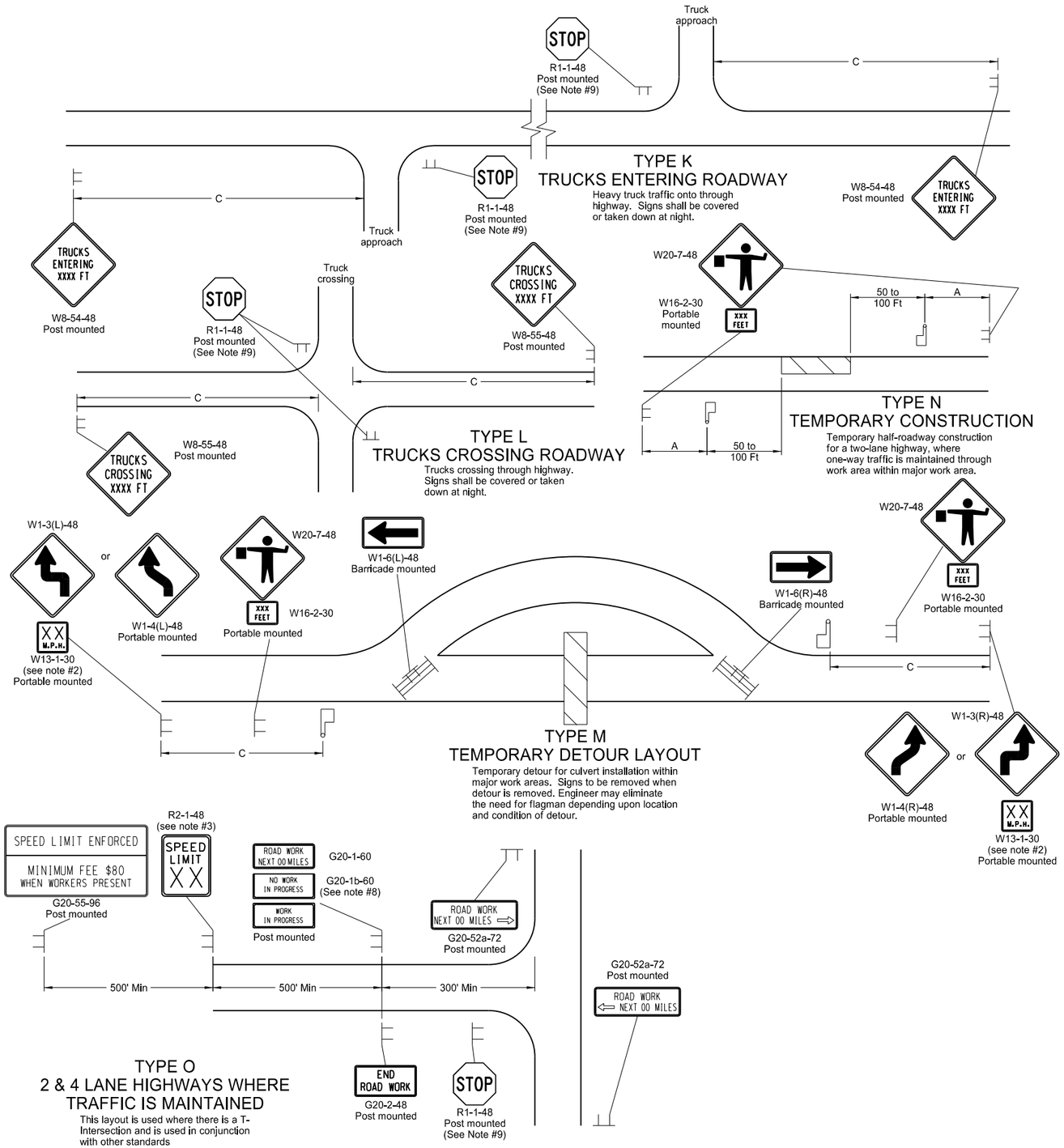
# CONSTRUCTION TRUCK AND TEMPORARY DETOUR LAYOUTS

D-704-22




Notes

1. Barricades placed on roadway shall be on a moveable assembly. Signs placed on the roadway shall be placed on skid mounted assemblies.
2. Where necessary, safe speed to be determined by the Engineer.
3. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at ½ B.
4. When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
5. Existing speed limit signs within a reduced speed zone shall be covered.
6. Obliterated or covered pavement marking shall be paid for as Obliteration of Pavement Marking. The covering shall be approved by the engineer.
7. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.
8. The contractor shall install the G20-1b-60 sign when work is suspended for winter.
9. If existing stop sign is in place, a 48" stop sign is not required.
10. G20-55-96 sign is not required if this standard is part of other traffic control layouts with this sign or the work is less than 15 days.

KEY

Type III barricade — Work area

Sign — Flagger

| ADVANCE WARNING SIGN SPACING | | | |
|---|---|---|---|
| Road Type | Distance Between Signs Min. (ft) | | |
| | A | B | C |
| Urban - Low Speed (30 mph or less) | 150 | 150 | 150 |
| Urban - Low Speed (over 30 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 |

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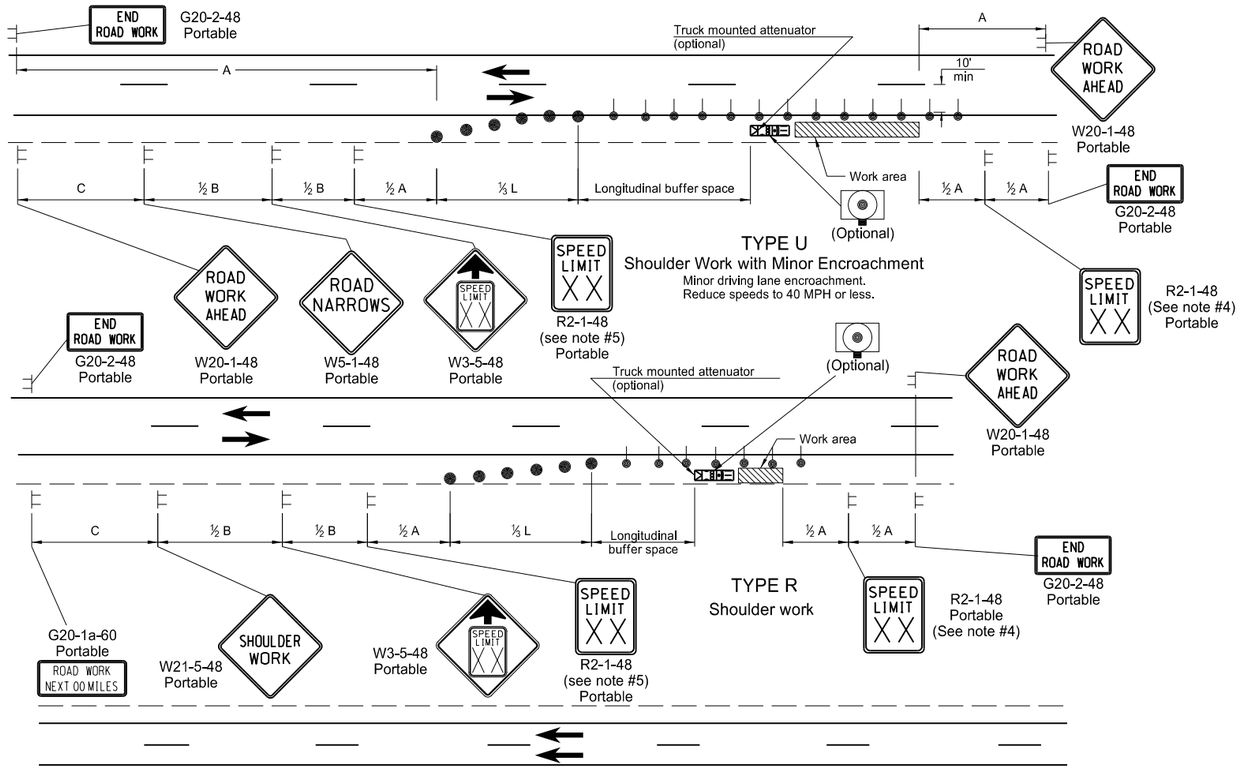
# SHOULDER CLOSURES AND BRIDGE PAINTING LAYOUTS

D-704-24




Notes

1. Variables
   S = Numerical value of speed limit or 85th percentile.
   W = The width of the taper.
   L = Minimum length of taper, or 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. Delineator drums used for tapering traffic shall be spaced at dimension "S".
   Delineator drums or tubular markers used for tangents shall be spaced at 2 times "S".
3. Sequencing Arrow Panels
   Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph or less and 750 ADT or less).
   Type B shall be used on roadways with moderate traffic speeds and volumes (40 mph or less and 5000 ADT or less).
   Type C shall be used on roadways with high traffic speeds and volumes (over 40 mph or over 5000 ADT).
4. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
5. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at ½B.
6. When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
7. Existing speed limit signs within a reduced speed zone shall be covered.
8. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.

| 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 |

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

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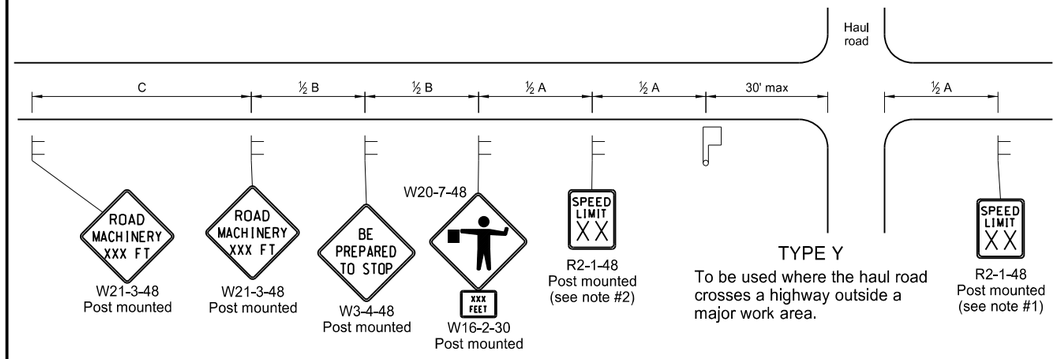
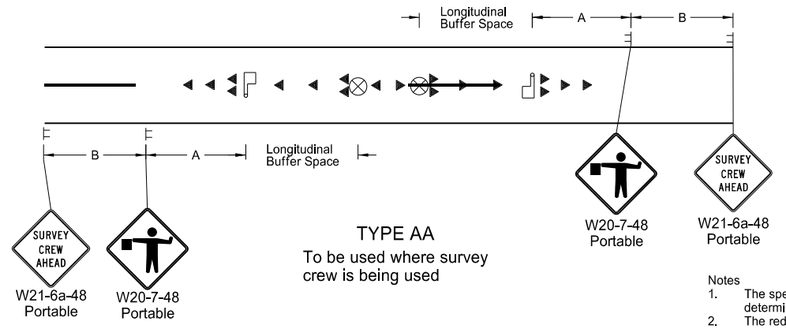
# MISCELLANEOUS SIGN LAYOUTS

D-704-26



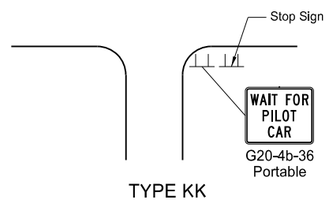

## TYPE Y

To be used where the haul road crosses a highway outside a major work area.




## TYPE AA

To be used where survey crew is being used

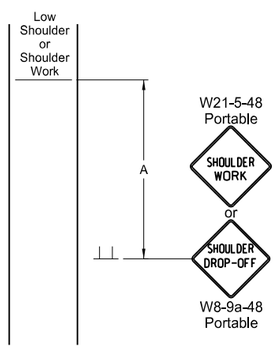



## TYPE KK

To be used at major intersections within pilot car control area

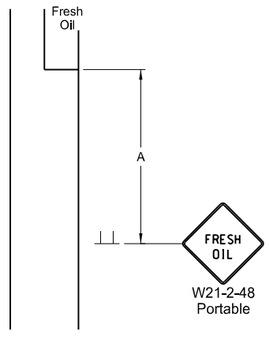
Notes

1. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
2. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 MPH. Where speed limits are to be reduced more than 30 MPH, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 MPH. The second speed limit sign shall be placed at ½ B.
3. When warning signs are used in urban areas and the signs are not portable, flags shall be installed. The flags shall be 24 inches square, mounted perpendicular to the edges of the diamond sign, and at such a distance above the edge so that when the flag is limp it will not touch the sign. Rural areas will not require flags.
4. Existing speed limit signs within a reduced speed zone shall be covered.
5. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.
6. G20-55-96 signs are not required if this standard is part of other traffic control layouts, or the work is less than 15 days.
7. When a pilot car operation is used, place a G20-4b-36 "Wait For Pilot Car" sign at major intersections within pilot car control area.



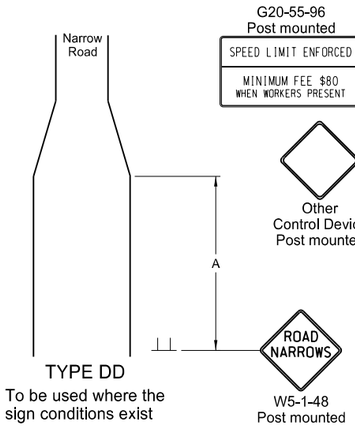

## TYPE BB

To be used within a major work area where the sign conditions exist



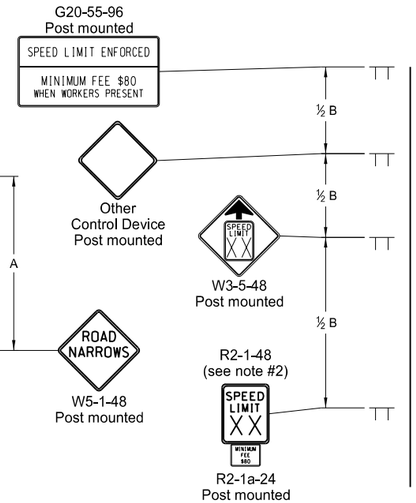

## TYPE CC

To be used where the sign conditions exist



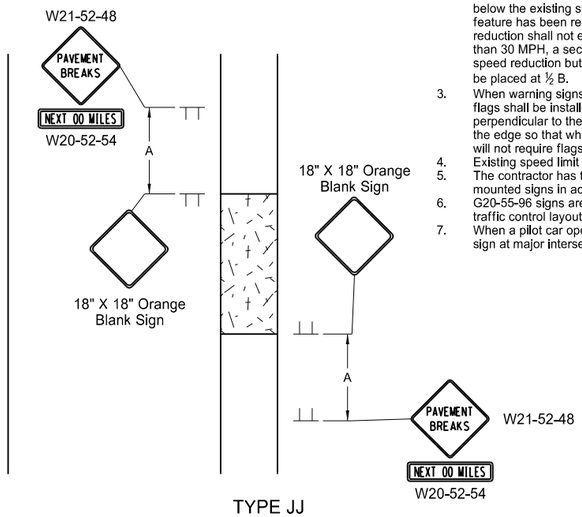

## TYPE DD

To be used where the sign conditions exist




## TYPE Z

To be used where speed zone is needed

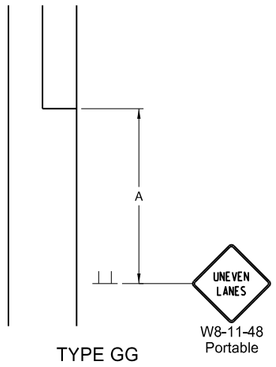



## TYPE JJ

To be used where there is a break in the pavement. These signs may be skid mounted or post mounted and shall be installed when conditions exist and removed when not applicable.

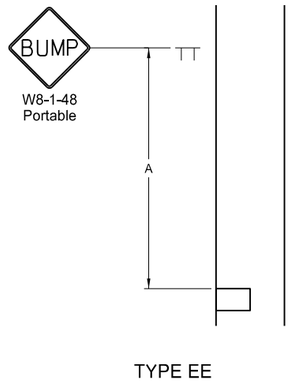
| Longitudinal Buffer Space | |
|---|---|
| *Speed (mph) | Length Min (feet) |
| 20 | 115 |
| 25 | 155 |
| 30 | 200 |
| 35 | 250 |
| 40 | 305 |
| 45 | 360 |
| 50 | 425 |
| 55 | 495 |
| 60 | 570 |
| 65 | 645 |
| 70 | 730 |
| 75 | 820 |

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



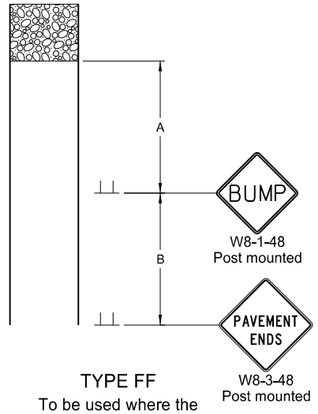

## TYPE GG

To be used where a difference of elevation between lanes exist




## TYPE EE

To be used where the sign conditions exist




## TYPE FF

To be used where the sign conditions exist

| 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 — Flagger

Cones

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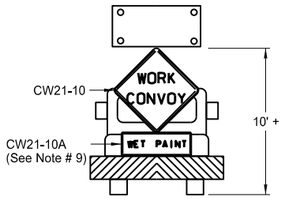
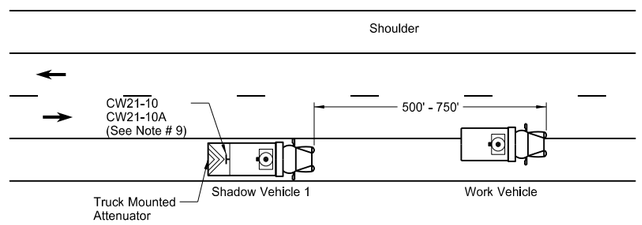
# TRAFFIC CONTROL PLAN FOR MOVING OPERATIONS

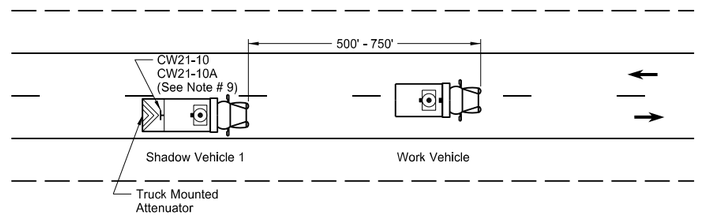
D-704-27




Typical Shadow Vehicle 1
Two-Way Roaday



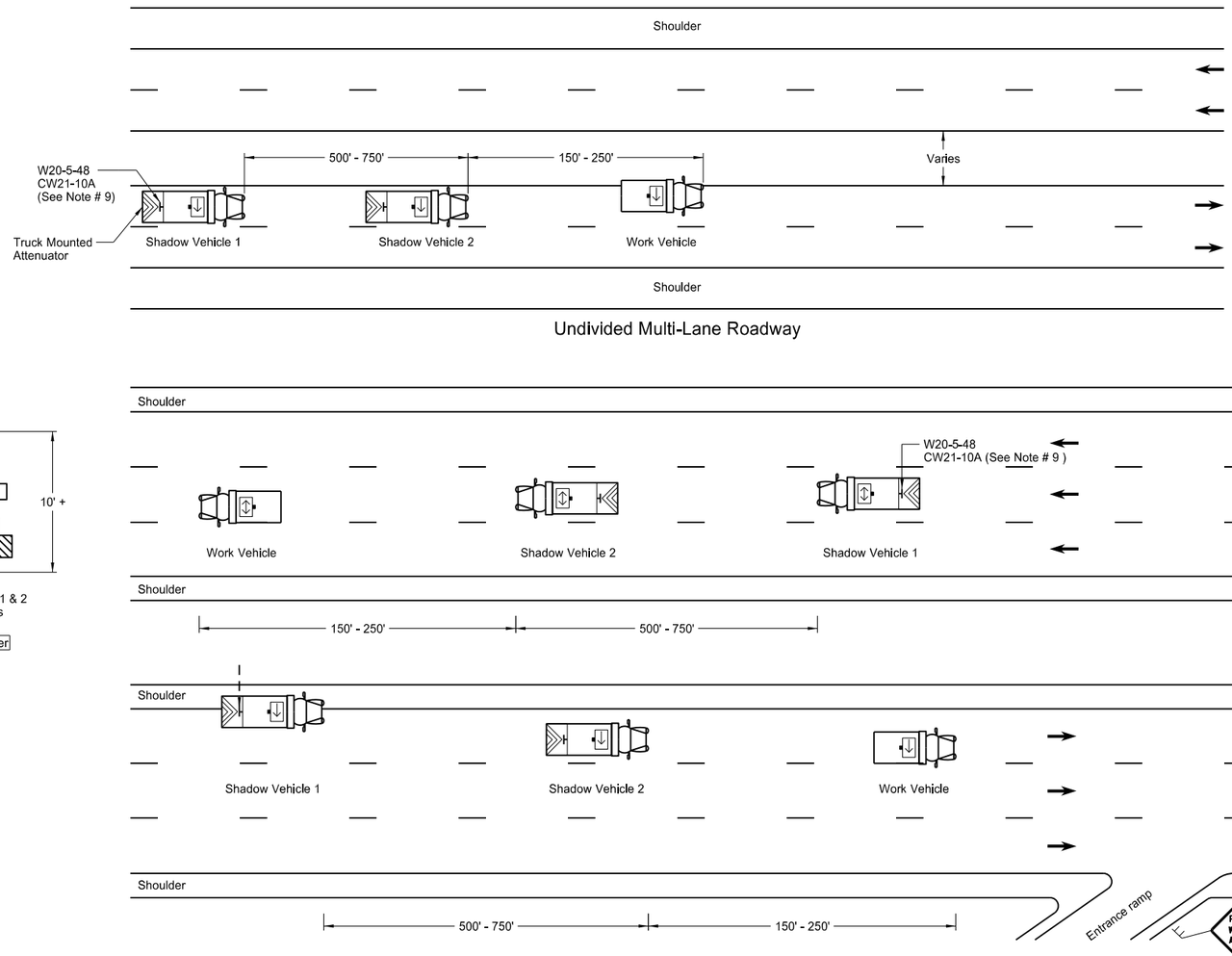

Two-Way Roadway with Paved Shoulders



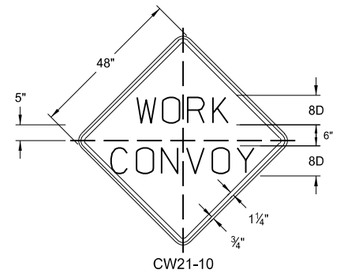

Two-Way Roadway without Paved Shoulders

Notes

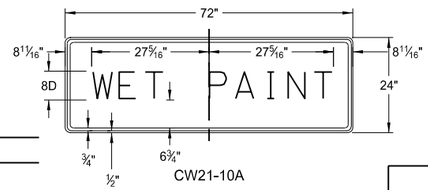
1. If the contractor chooses to place more vehicles in the convoy than are shown, these vehicles shall have the truck mounted attenuator and shall be at the contractor's expense.
2. Shadow and work vehicles shall display yellow rotating beacons or strobe lights unless otherwise stated elsewhere in the plans.
3. Flashing arrow panels shall be Type B or Type C. The panel operation shall be controlled from inside the vehicle.
4. Each vehicle shall have two-way electronic communication capability.
5. When work convoys must change lanes, shadow vehicle 1 should change lanes first to shadow other convoy vehicles.
6. Vehicle spacing between the shadow vehicle 1 and shadow vehicle 2 will vary depending on sight distance restrictions. Motorists approaching the work convoy should be able to see the trail vehicle in time to slow down and/or change lanes as they approach the shadow vehicle.
7. Sign Colors
   Letters = Black
   Border = Black
   Background = Orange
8. Shadow vehicle 2 may be used as the paint tender vehicle.
9. Sign CW21-10A shall only be used during a painting operation.
10. On two lane - two way roadways, the work and shadow vehicles should pull over periodically to allow motor vehicle traffic to pass.



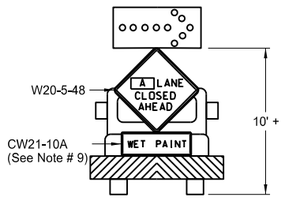

Sign Details




CW21-10




CW21-10A




Typical Shadow Vehicle 1 & 2
Multi-Lane Highways

A = Left Right Center

KEY

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

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
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| 9-27-13 | |
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| 6-18-14 | Removed shadow vehicle 2 on two lane roadways |

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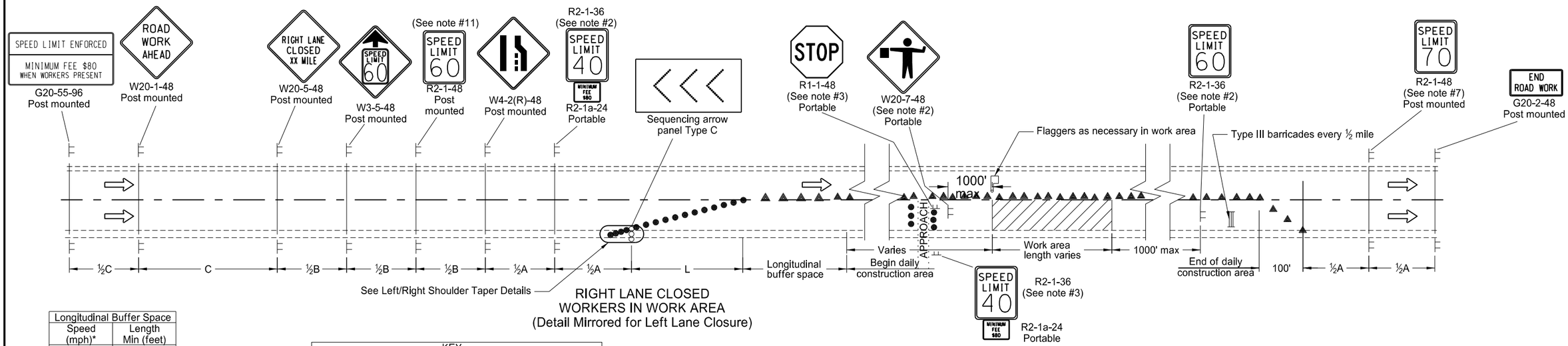
# SIGN LAYOUT FOR ONE LANE CLOSURE

D-704-34



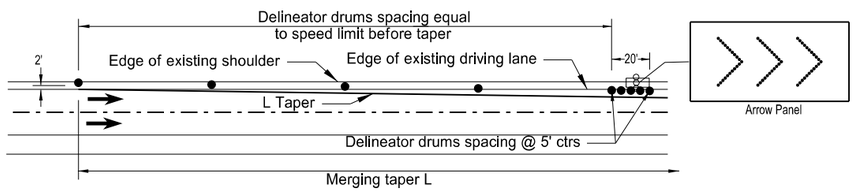

RIGHT LANE CLOSED
WORKERS IN WORK AREA
(Detail Mirrored for Left Lane Closure)

| 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 |

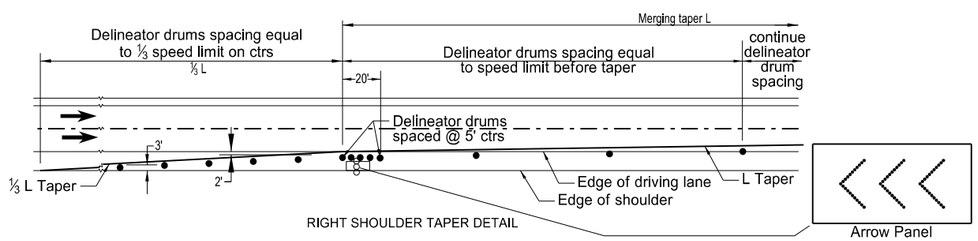
*Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.

KEY

| | |
|---|---|
| Type I barricade | Work area |
| Type II barricade | Flagger |
| Type III barricade | Sequencing arrow panel |
| Sign | Tubular markers |
| Delineator drum | |




LEFT SHOULDER TAPER DETAIL




RIGHT SHOULDER TAPER DETAIL

Notes:

1. Install advance signs for flagging when flaggers are flagging.

2. Move the advanced flagger sign and 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. Place the 40 mph speed limit sign at ½A in advance of the flagger sign and move the 60 mph speed limit sign. Cover or remove the 40 mph speed limit and the Minimum Fee $80 signs upon completion of the work day or when workers are not present. Determine the exact speed limit in the field, dependent on location and conditions.

3. Approaches: When the work area encompasses an approach, install a 40 mph speed limit sign to control the approach. Cover the existing stop sign and install a new portable stop sign when the approach is on the side of the lane closure. Remove the approach speed limit sign once the main line 40 mph speed zone is moved past the approach.

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 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).

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. Install flags when warning signs are used in urban areas and the 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. Rural areas will not require flags.

10. Determine the reduced speed limit dependent on the in place speed limit before construction. Do not exceed a speed limit reduction of 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. Where speed limits are to be reduced more than 30 mph, install a second speed limit sign so no single speed reduction exceeds 30 mph. Place the second speed limit sign at ½B.

11. The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with NDDOT Standard Specifications.

12. Sign G20-55-96 is not required if this standard is part of other traffic control layouts or the work is less than 15 days.

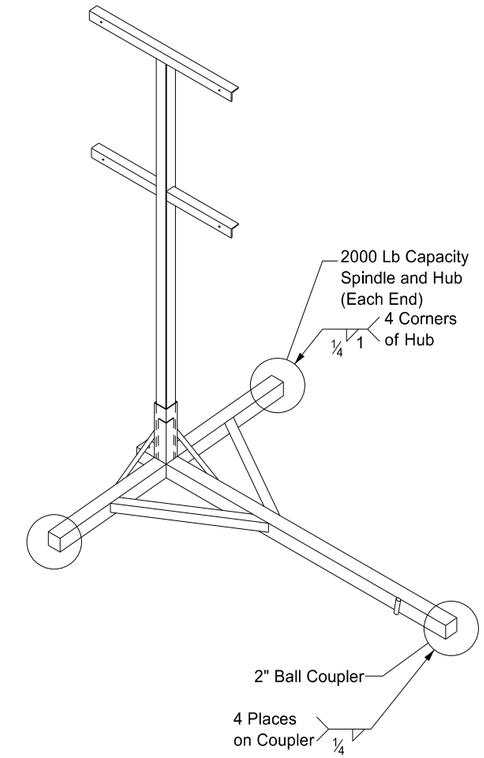
| ADVANCE WARNING SIGN SPACING | | | |
|---|---|---|---|
| Road Type | Distance Between Signs Min (ft) | | |
| | A | B | C |
| Urban - Low Speed (30 mph or less) | 150 | 150 | 150 |
| Urban - Low Speed (over 30 to 40 mph) | 280 | 280 | 280 |
| Urban - High Speed (over 40 mph to 50 mph) | 360 | 360 | 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 |

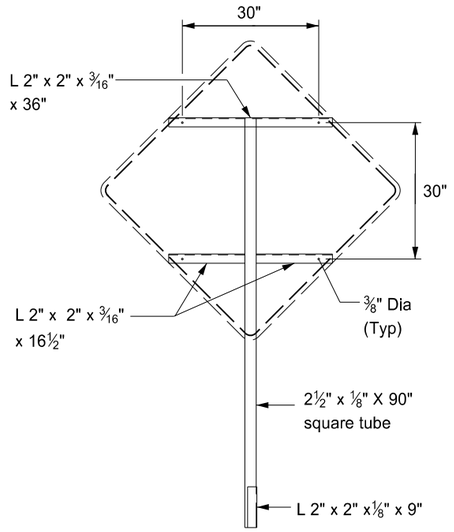
| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 9-26-2012 | |
| REVISIONS | |
| DATE | CHANGE |
| 3-15-16 | Removed Do Not Pass signs and updated notes |

This document was originally issued and sealed by Roger Weigel, Registration Number PE-2930, on 03/15/2016 and the original document is stored at the North Dakota Department of Transportation

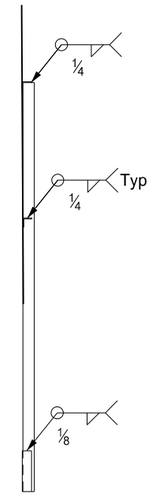
# PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



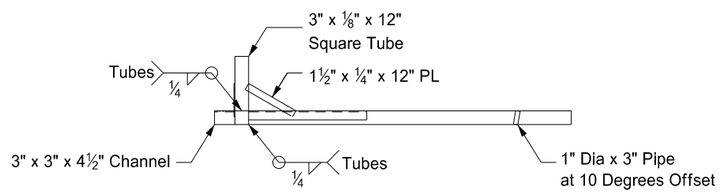




FRONT




RIGHT

SIGN SUPPORT

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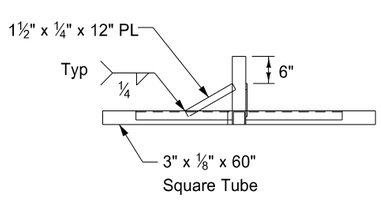
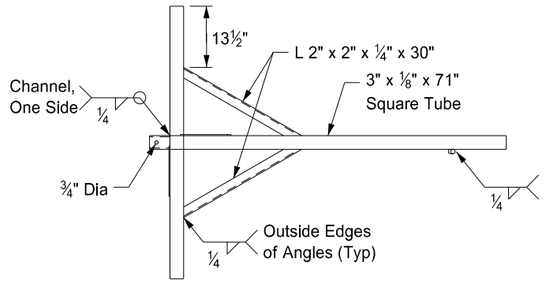



RIGHT




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 |
| | |

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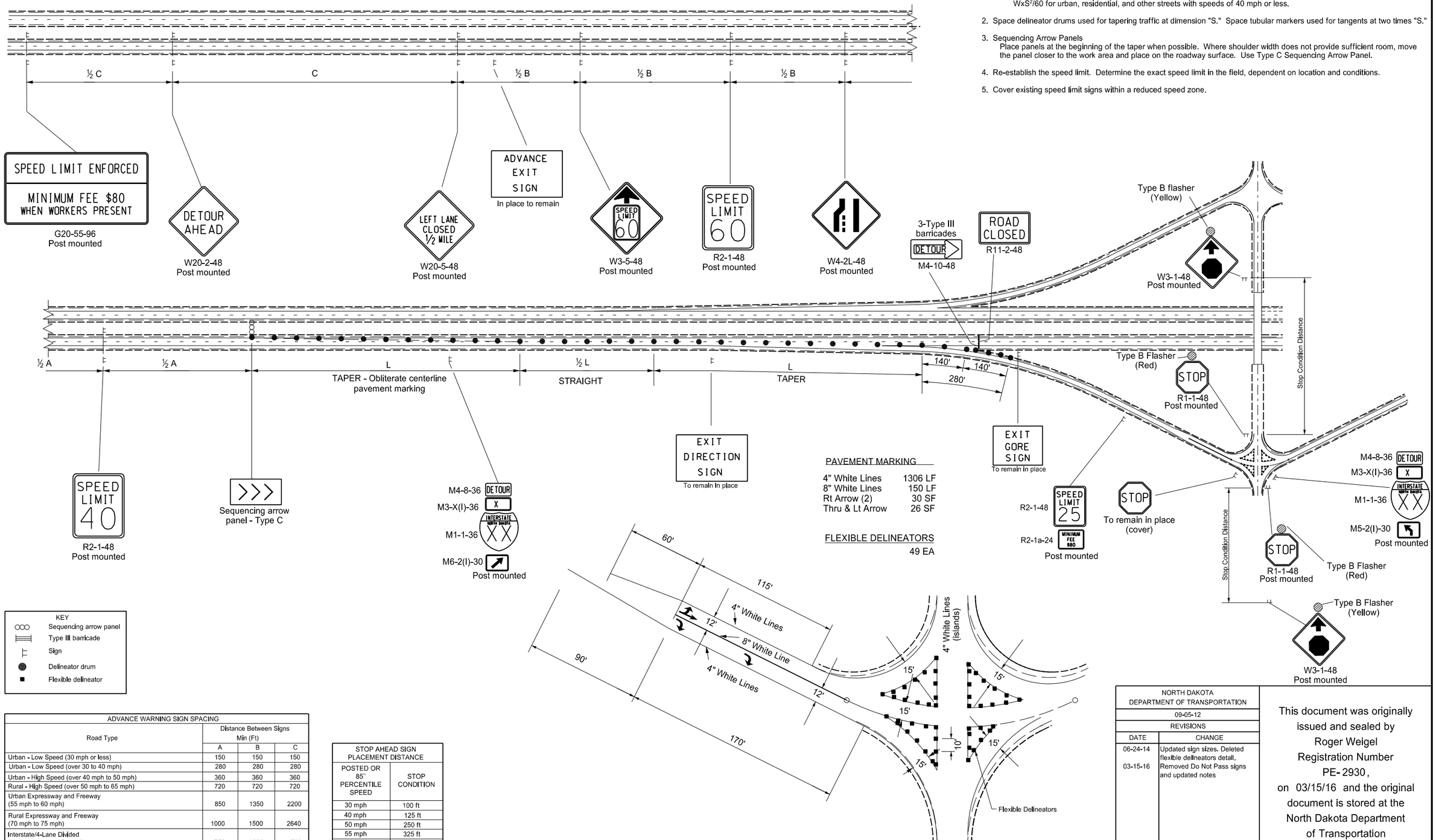
# INTERSTATE ROAD CLOSURE USING RAMPS
# CLOSURE FOR MORE THAN FIVE DAYS
# and Crossroad is not Closed

D-704-52A

Notes:
1. Variables
   S = Numerical value of speed limit or 85th percentile prior to work starting.
   W = The width of the taper.
   L = Minimum length of taper, or SxW for freeways, expressways, and all other roads with speeds of 45 mph or greater, or $WxS^2/60$ for urban, residential, and other streets with speeds of 40 mph or less.
2. Space delineator drums used for tapering traffic at dimension "S." Space tubular markers used for tangents at two times "S."
3. Sequencing Arrow Panels
   Place 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 Sequencing Arrow Panel.
4. Re-establish the speed limit. Determine the exact speed limit in the field, dependent on location and conditions.
5. Cover existing speed limit signs within a reduced speed zone.




KEY
- Sequencing arrow panel
- Type III barricade
- Sign
- Delineator drum
- Flexible delineator

| 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 |

| STOP AHEAD SIGN PLACEMENT DISTANCE | |
|---|---|
| POSTED OR 85th PERCENTILE SPEED | STOP CONDITION |
| 30 mph | 100 ft |
| 40 mph | 125 ft |
| 50 mph | 250 ft |
| 55 mph | 325 ft |
| 65 mph | 475 ft |

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

09-05-12

REVISIONS

| DATE | CHANGE |
|---|---|
| 06-24-14 | Updated sign sizes. Deleted flexible delineators detail. |
| 03-15-16 | Removed Do Not Pass signs and updated notes |

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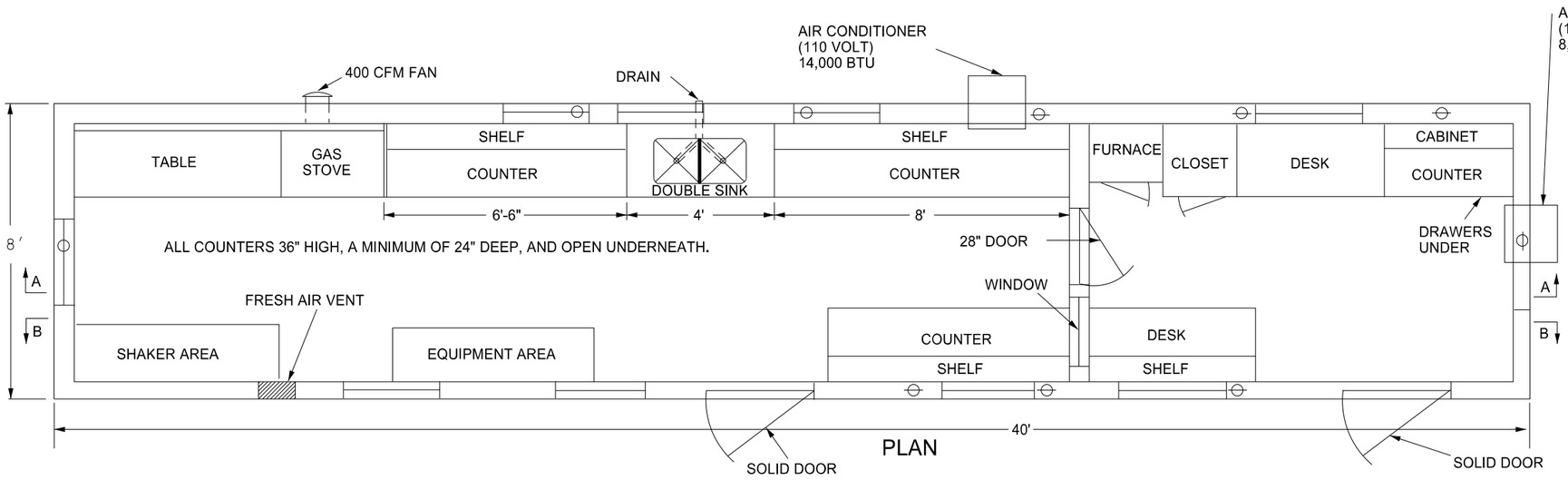
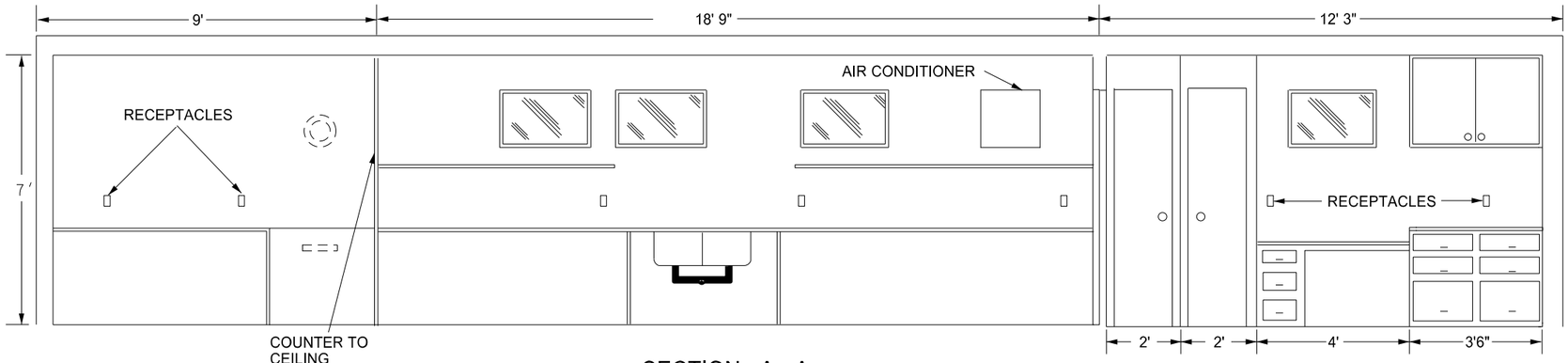
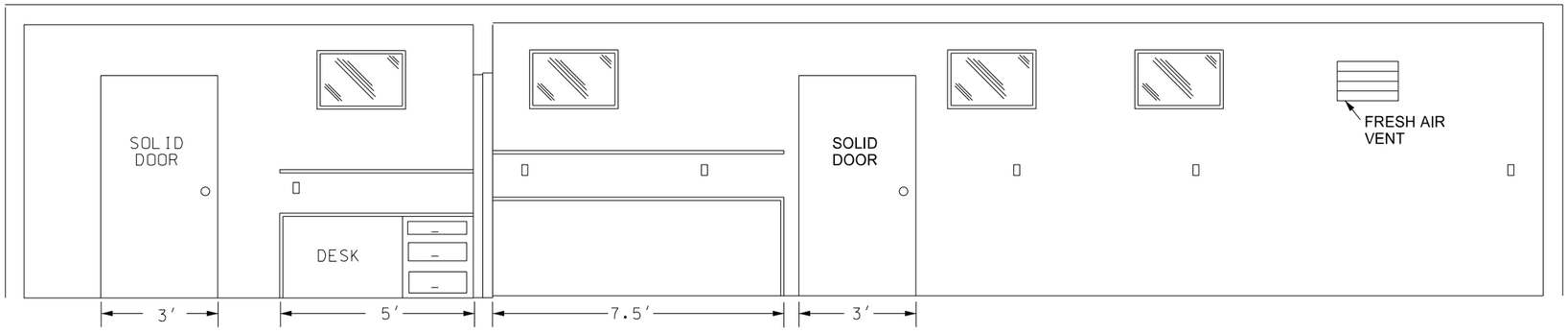
# BITUMINOUS LABORATORY

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. |

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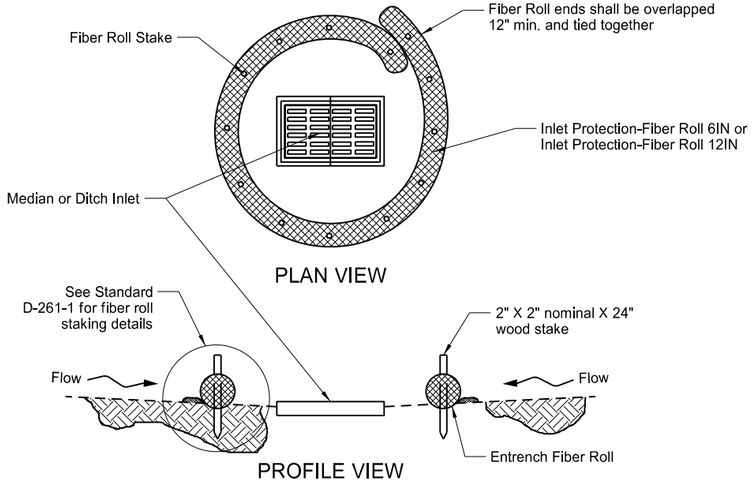
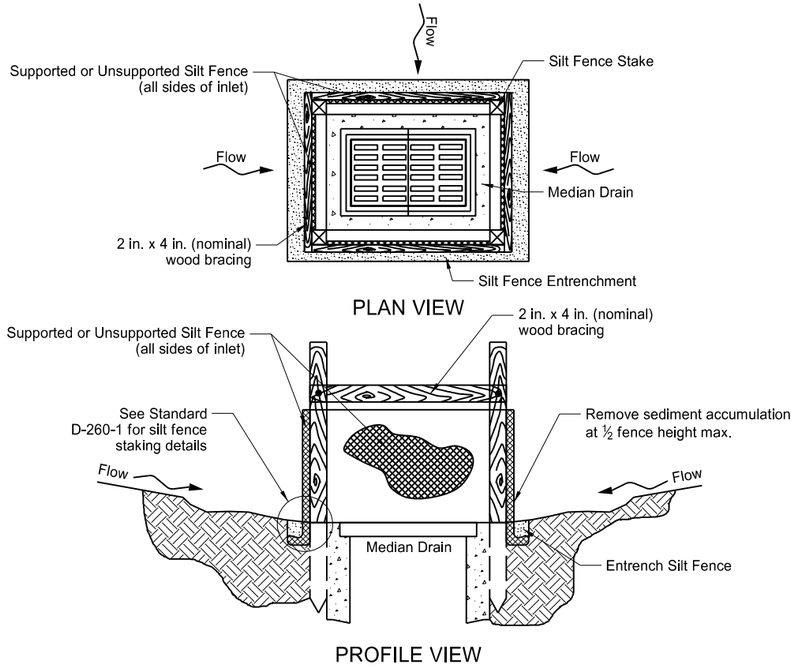
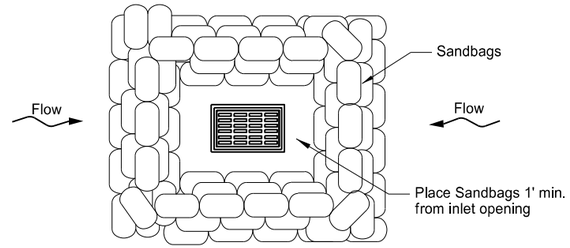
# EROSION AND SILTATION CONTROLS
# MEDIAN OR DITCH INLET PROTECTION



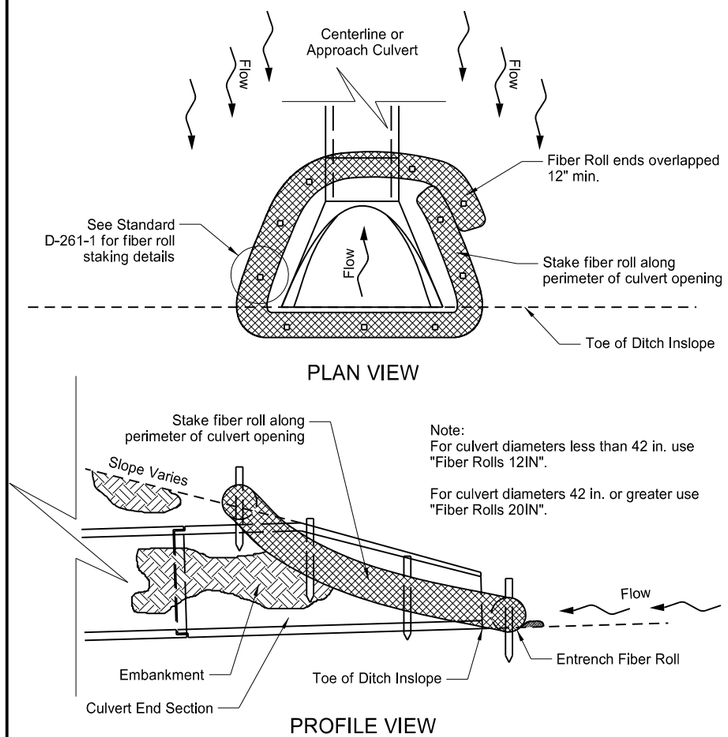

## FIBER ROLL PROTECTION (MEDIAN OR DITCH INLET)



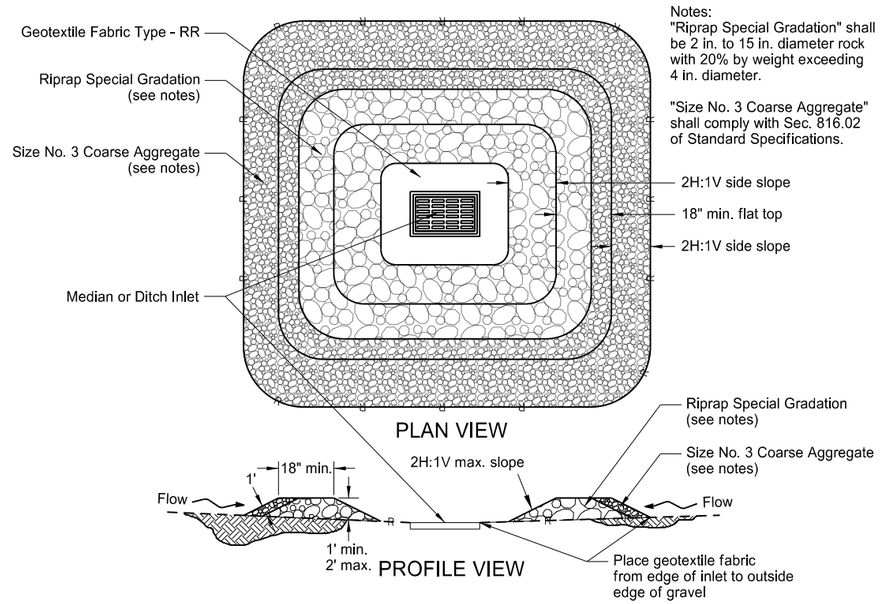

## SILT FENCE PROTECTION (MEDIAN OR DITCH INLET)



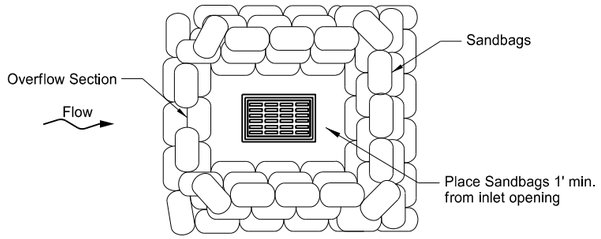

## SANDBAG PROTECTION (LOW POINT)




## 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. |

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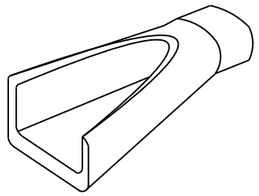
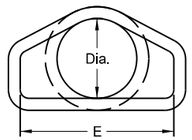
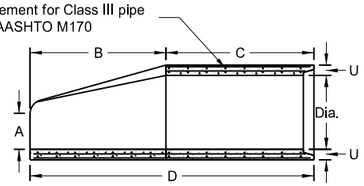
# REINFORCED CONCRETE PIPE CULVERTS AND END SECTIONS
## (Round Pipe)



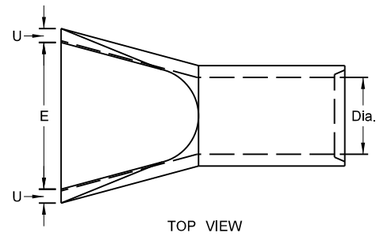
PERSPECTIVE




END VIEW




SIDE VIEW



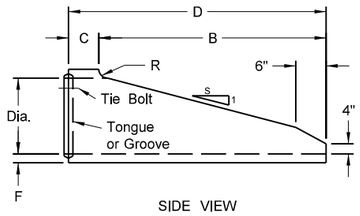

TOP VIEW

REINFORCED CONCRETE PIPE - FLARED END SECTION

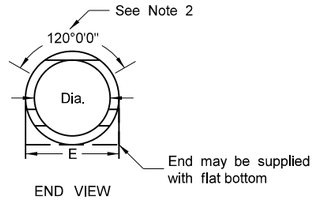
Reinforcement to be equivalent to Class III RCP

| 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



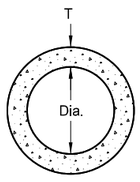

END VIEW

NOTES (Traversable End Section):

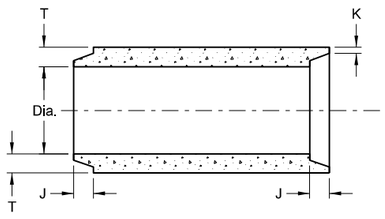
1. Manufactured in accordance with applicable portions of ASTM C76/AASHTO M170.
2. Reinforcement per Class III RCP with double reinforcement in the upper 120° of the full barrel portion.

REINFORCED CONCRETE PIPE - TRAVERSABLE END SECTION

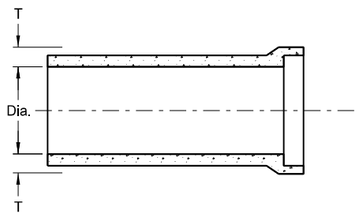
Reinforcement to be equivalent to Class III RCP



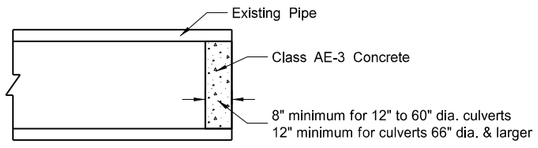

END VIEW




TONGUE & GROOVE JOINT




BELL & SPIGOT JOINT




CONCRETE PIPE PLUG

CIRCULAR PIPE

JOINTS FOR REINFORCED CONCRETE PIPE

| 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 | 1⅞-2⅞ | 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 | 3⅛-4¼ | 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 | 4⅛-5½ | 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 | 7-8¼ | 3½ | 9 |
| 102 | 56.75 | 3466 | 7-8¼ | 3½ | 9½ |
| 108 | 63.62 | 3864 | 7¼-8½ | 3¾ | 10 |

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

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.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 05-12-14 | |
| REVISIONS | |
| DATE | CHANGE |
| 01-21-15 | Revised Note 5 |

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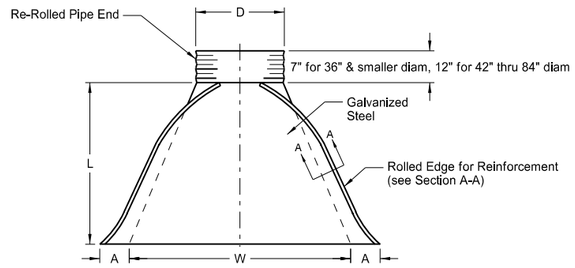
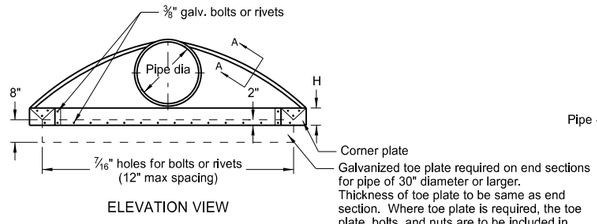
# ROUND CORRUGATED STEEL PIPE CULVERTS AND END SECTIONS

D-714-4

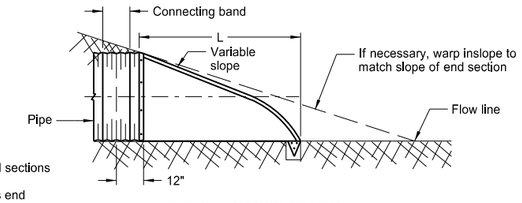



PLAN VIEW




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. IN | GALV. THICK. IN | END SECTION DIMENSIONS A IN | B IN | H IN | L IN | W IN | APPROX. SLOPE RATE | BODY PIECE |
|---|---|---|---|---|---|---|---|---|
| 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 | 2½:1 | 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 |

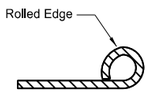
* These sizes have 0.109" sides and 0.138" center panels.

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

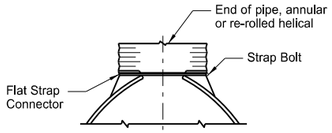
Manufacturers tolerances of above dimensions will be allowed.

Splices to be the lap riveted type.

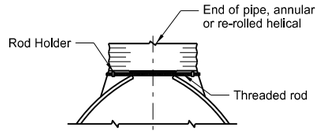
Multiple panel bodies shall have lap seams which are to be tightly joined with ⅜" dia. galv. bolts or rivets. Nuts to be torqued to 25 foot-lbs ±.



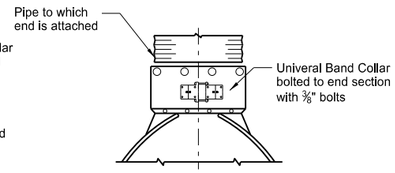

SECTION A-A




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




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

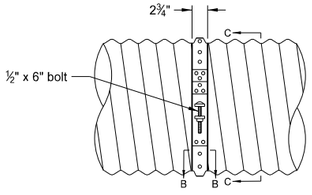



TYPE #3
For all pipe sizes

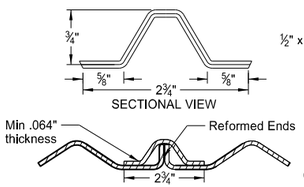
| COUPLING BAND DIMENSIONS | | | | |
|---|---|---|---|---|
| COUPLING TYPE | CORRUGATION PITCH x DEPTH | PIPE SIZE | COUPLING BAND LENGTH | MIN. BAND THICKNESS |
| Hat Band | 2⅔" x ½" | 12" - 48" | 2¾" | .064" |
| Annular Band | 2⅔" x ½" | 12" - 72" | 12" | .052" |
| | | 78" - 84" | 12" | .079" |
| | 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".

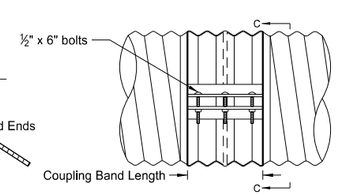



SIDE VIEW

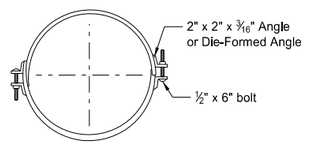



SECTION B-B

HAT BAND FOR FLANGED END PIPE

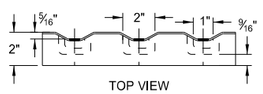



SIDE VIEW



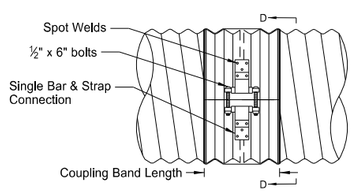

SECTION C-C
Angle Connection

ANNULAR BAND

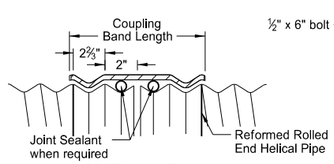



TOP VIEW

Die-Formed Angle Connector

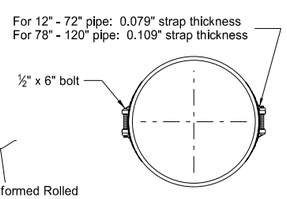



SIDE VIEW

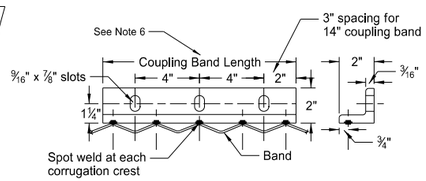



SECTIONAL VIEW

HUGGER COUPLING BAND



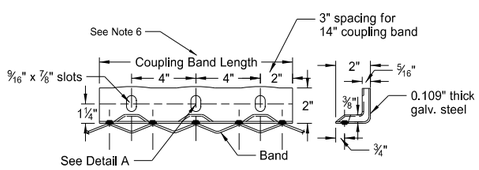

SECTION D-D
Bar & Strap Connection




SIDE VIEW

END VIEW

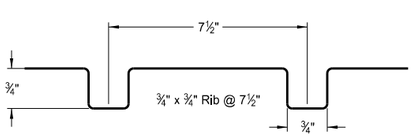
2" x 2" x 3/16" Angle Connector

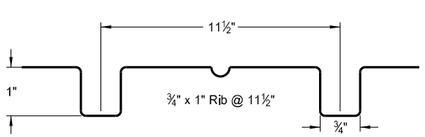



SIDE VIEW

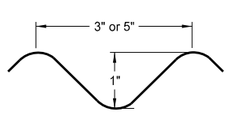
END VIEW

Die-Formed Angle Connector

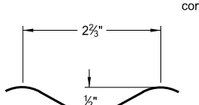


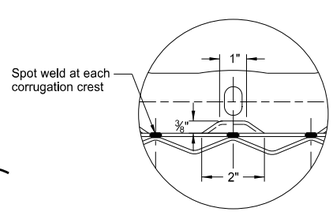

SPIRAL RIB CORRUGATIONS




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




2⅔" x ½" CORRUGATIONS



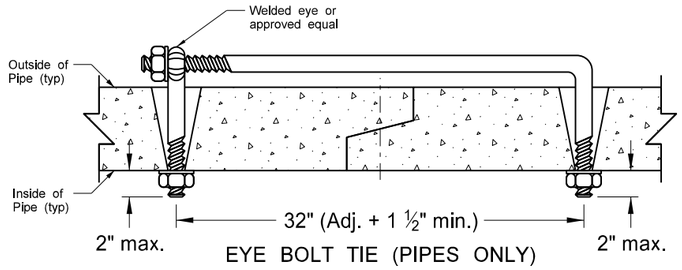

Detail A

| 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 |

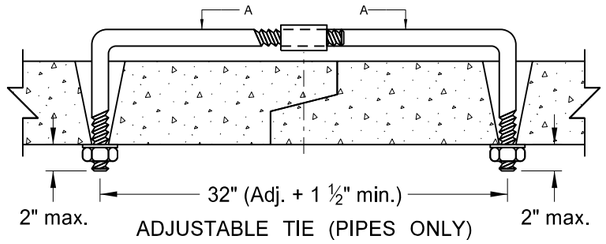
This document was originally issued and sealed by Terrence R. Udland, Registration Number PE- 2674 , on 02/27/2014 and the original document is stored at the North Dakota Department of Transportation

# CONCRETE PIPE OR PRECAST CONCRETE BOX CULVERT TIES

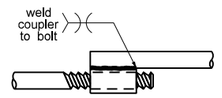
D-714-22



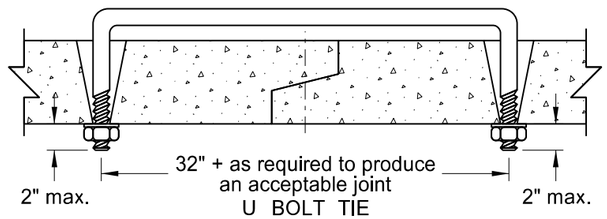

EYE BOLT TIE (PIPES ONLY)



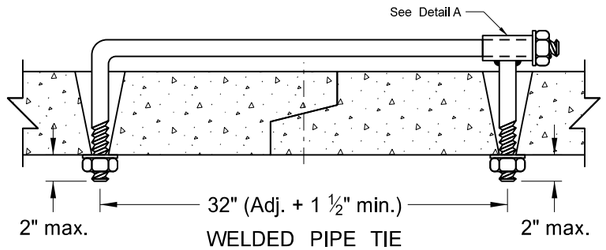

ADJUSTABLE TIE (PIPES ONLY)



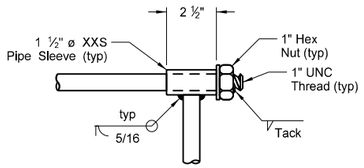

SECTION A-A



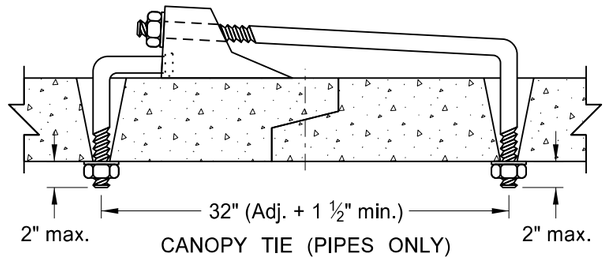

U BOLT TIE



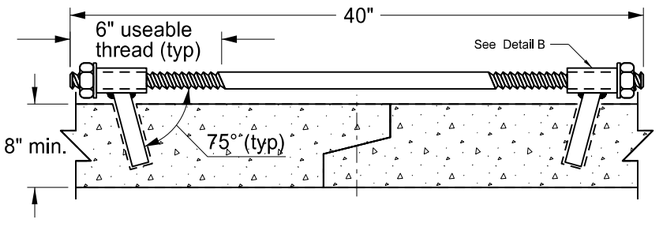

WELDED PIPE TIE



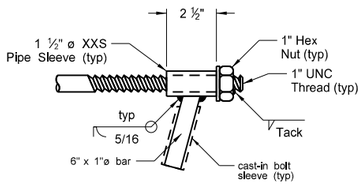

DETAIL A



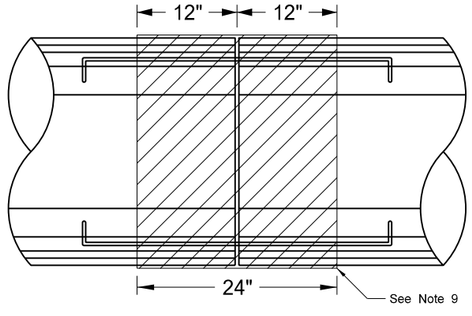

CANOPY TIE (PIPES ONLY)



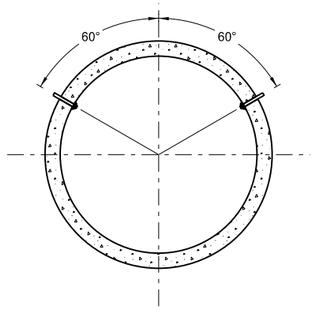

HIDDEN TIE (RCB ONLY)

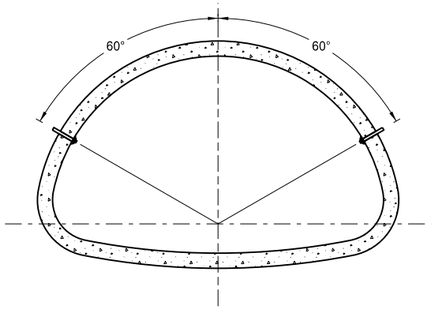


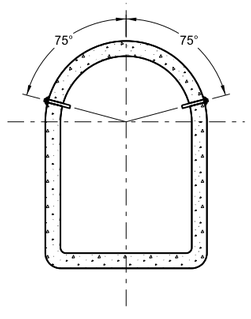

DETAIL B




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 | | |

NOTES:

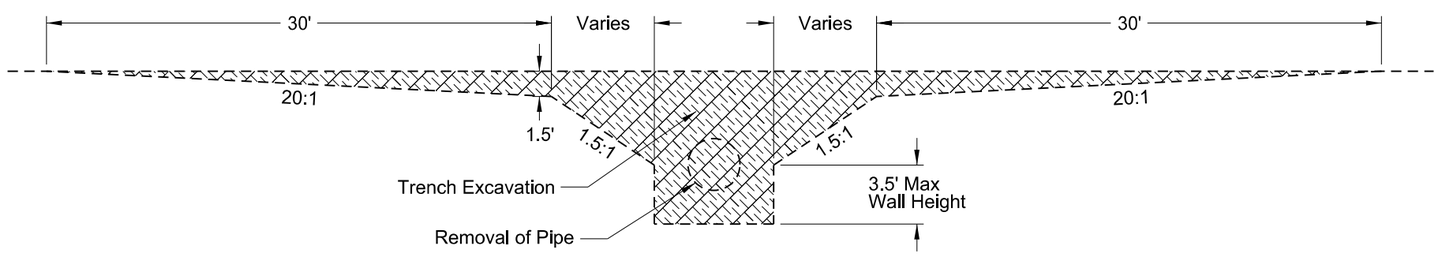
1. The pipe size listed is the inside diameter of round pipe or the equivalent diameter of pipe arch.
2. Nuts and washers are not required on Jacked and Bored pipes or pipes with a 24" diameter or less. Where nuts and washers are not used, the tie bars shall be inserted and grouted into place.
3. Ties are only for holding pipe or RCB sections together, not for pulling sections tight.
4. Tie bolt assembly shall be hot dip galvanized in accordance with AASHTO M232.
5. 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".
6. The contractor has the option of selecting the type of tie bolt used from those shown.
7. 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.
8. 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.
9. When joint wrap is specified in the plans, place wrap beneath ties. Overlap the joint by 12" in both directions.
10. 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.
11. 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.
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 |

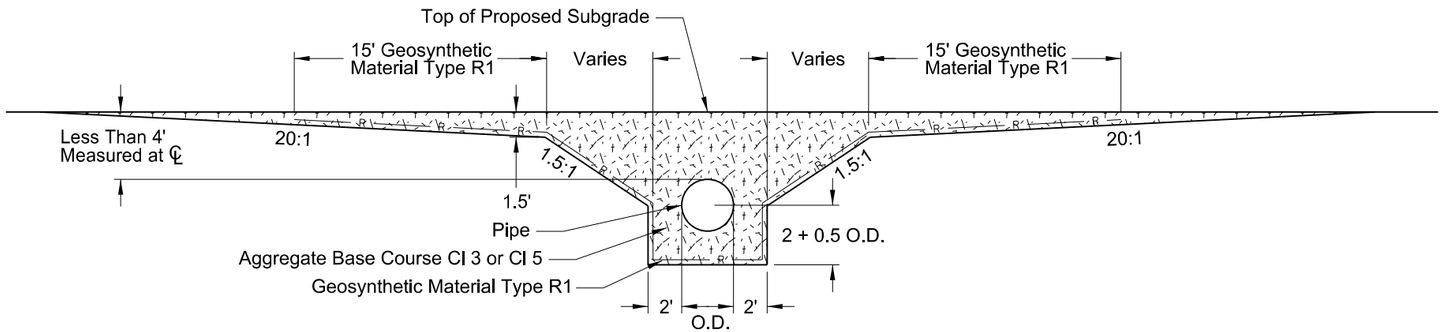
This document was originally issued and sealed by Terrence R. Udland, Registration Number PE-2674, on 07/21/15 and the original document is stored at the North Dakota Department of Transportation

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

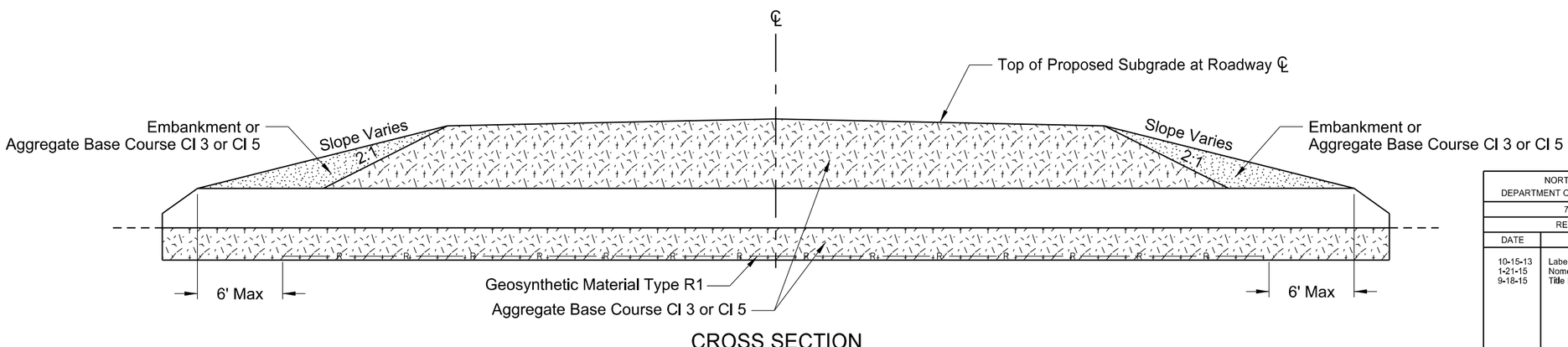
D-714-26




## EXCAVATION DETAIL




## INSTALLATION DETAIL




## CROSS SECTION

Pay Items
1) Pipe*
2) Geosynthetic Material Type R1
3) Removal of Pipe (if required)

*Included in Pipe Pay Item
1) Pipe
2) Trench Excavation
3) Aggregate Base Course CI 3 or CI 5
4) Embankment

NOTES:

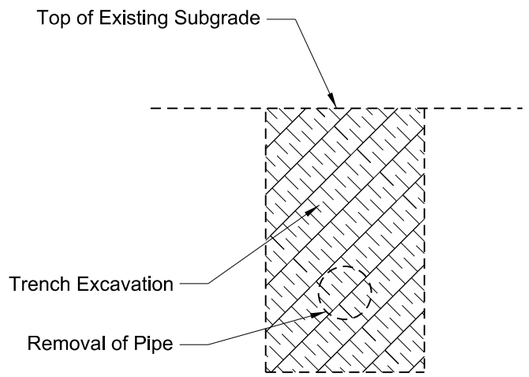
1) This drawing applies to new/replaced mainline and paved intersection roadway pipes only (including ramps). It does not include pipes in approaches.
2) Embankment may be either Borrow Excavation or Common Excavation - Type A

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 7-26-13 | |
| REVISIONS | |
| DATE | CHANGE |
| 10-15-13 | Label Formatting |
| 1-21-15 | Nomenclature |
| 9-18-15 | Title Rewording |

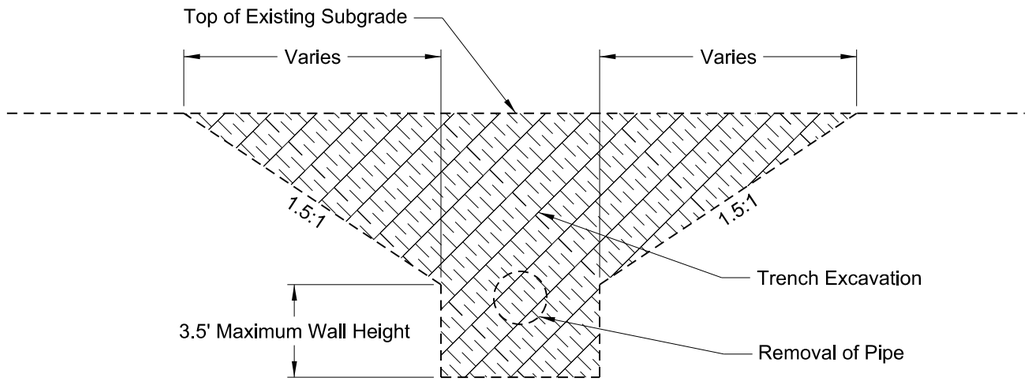
This document was originally issued and sealed by Ron Horner, Registration Number PE-2087, on 9/18/2015 and the original document is stored at the North Dakota Department of Transportation

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

D-714-27




EXCAVATION DETAIL A



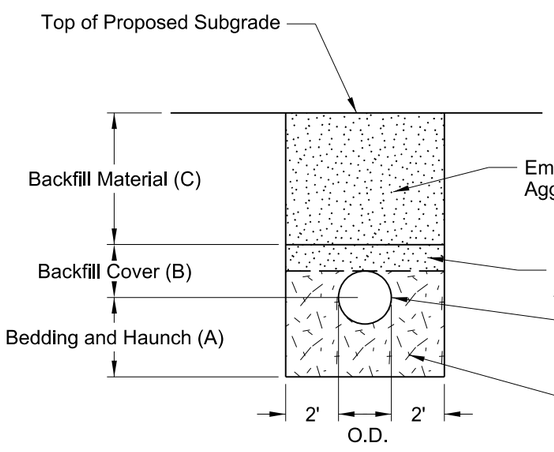

EXCAVATION DETAIL B

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

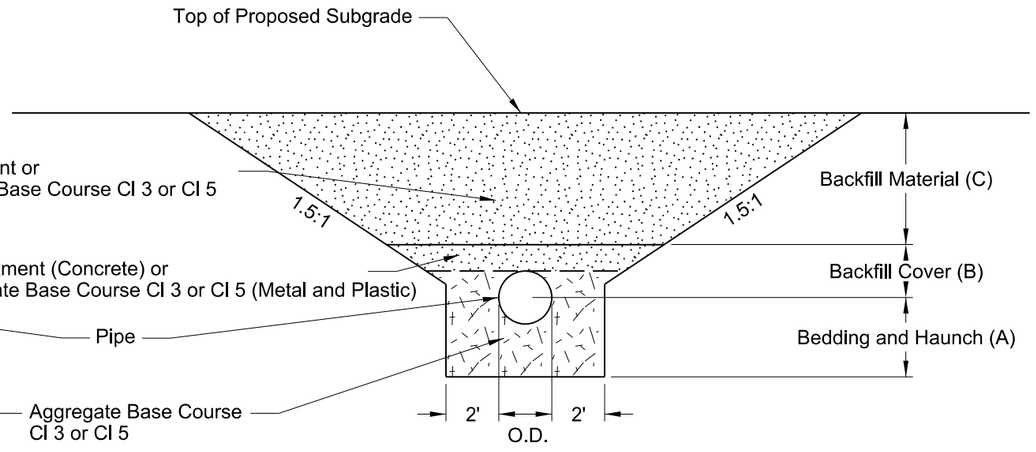
*Included in Pipe Pay Item
1) Pipe
2) Trench excavation
3) Aggregate base course Cl 3 or Cl 5
4) Embankment

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. + 4 Inches |
| Pipes Under the Roadway = 0.5 O.D. + 2 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 Cl3 or Cl 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 |




BACKFILL DETAIL A

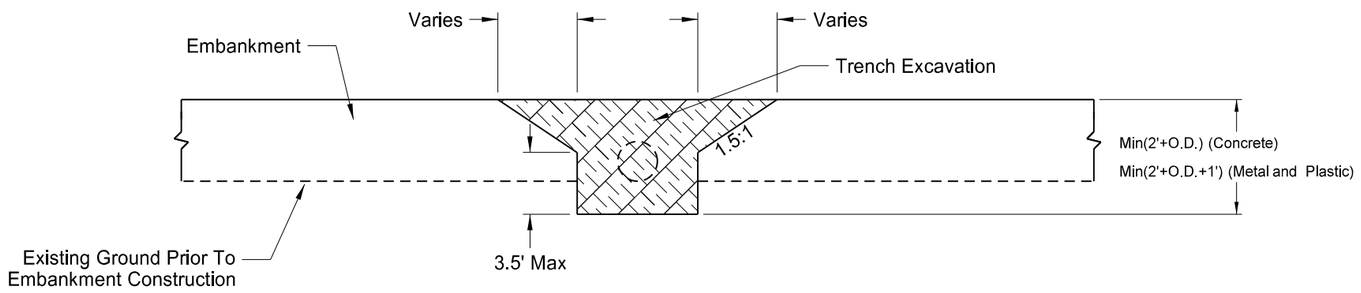



BACKFILL DETAIL B

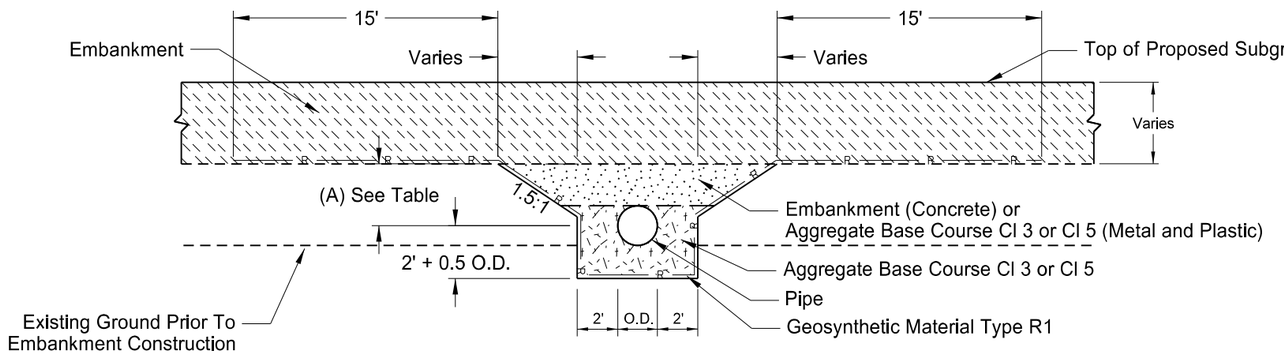
| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 7-26-13 | |
| REVISIONS | |
| DATE | CHANGE |
| 10-15-13<br>1-21-15<br>12-10-15 | Label Formatting<br>Nomenclature<br>Added Plastic Pipe |

This document was originally issued and sealed by Ron Horner, Registration Number PE-2087, on 12/10/2015 and the original document is stored at the North Dakota Department of Transportation

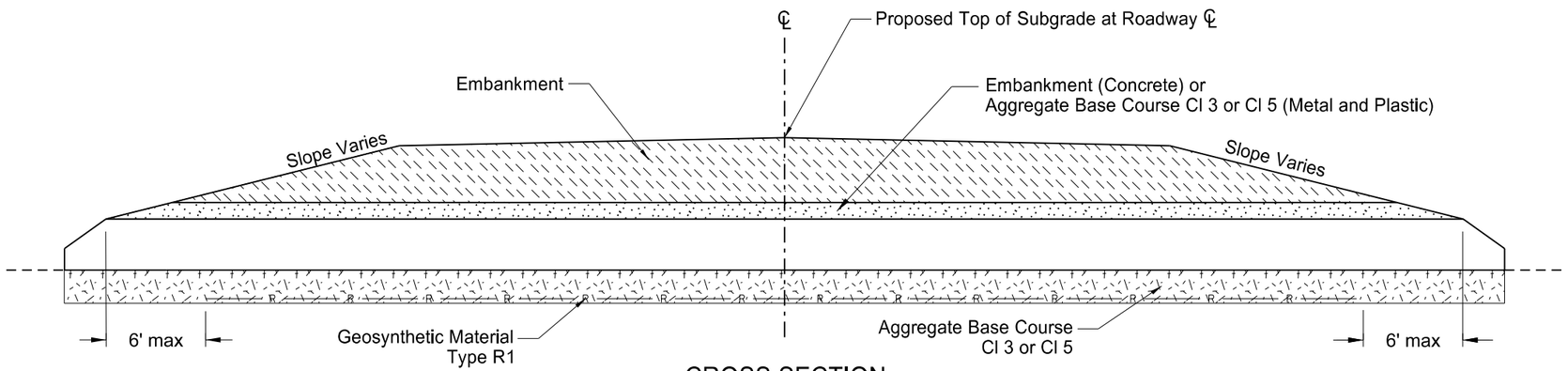
# TRANSVERSE MAINLINE PIPE INSTALLATION DETAIL FOR PIPES INSTALLED IN NEW EMBANKMENT AREAS




EXCAVATION DETAIL




INSTALLATION DETAIL




CROSS SECTION

Pay Items
1) Pipe*
2) Geosynthetic Material Type R1

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

NOTES:

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

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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

7-26-13

REVISIONS

| DATE | CHANGE |
|---|---|
| 10-15-13 | Label Formatting |
| 1-21-15 | Nomenclature |
| 12-10-15 | Added Plastic Pipe |

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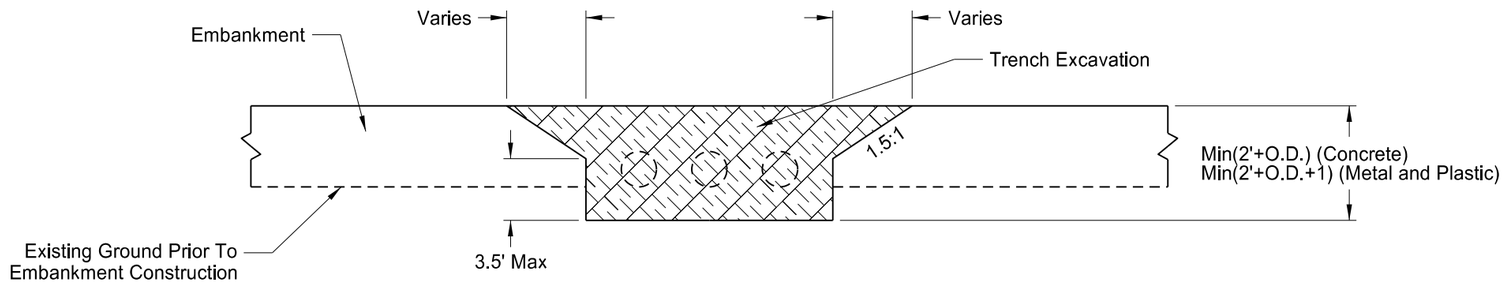
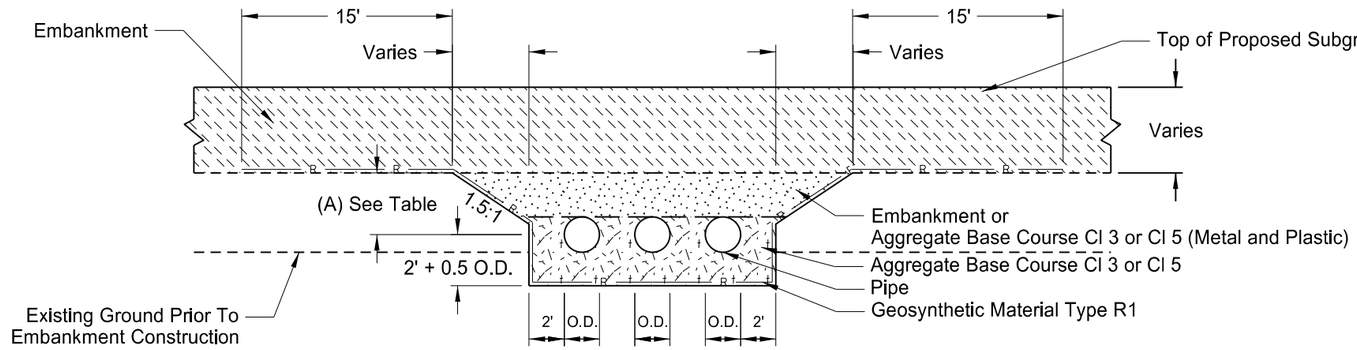
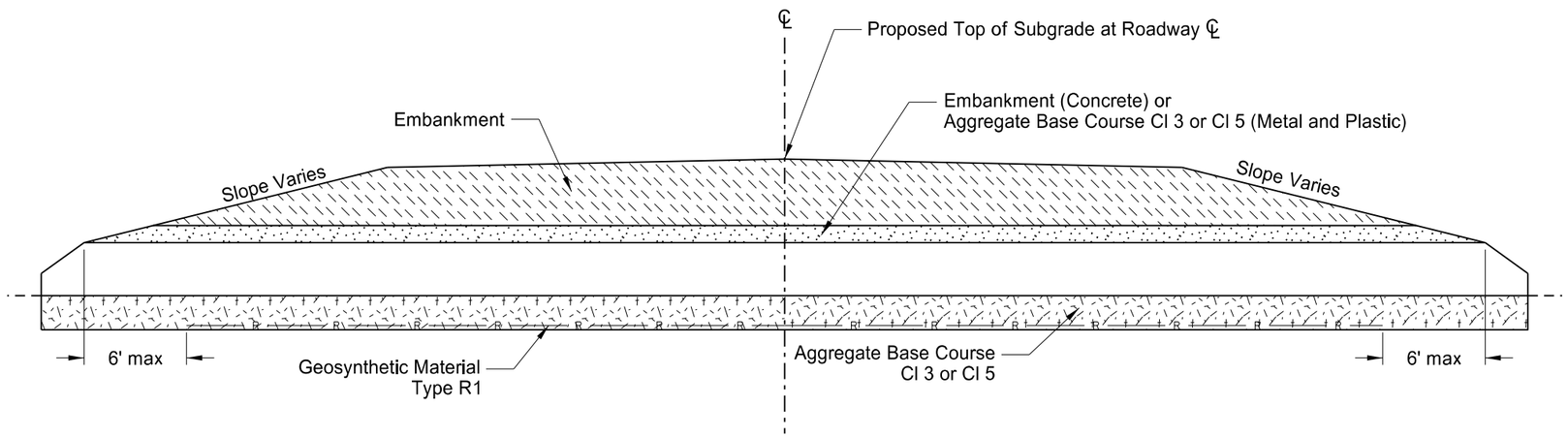
# TRANSVERSE MAINLINE PIPE INSTALLATION DETAIL FOR MULTIPLE PIPES INSTALLED IN NEW EMBANKMENT AREAS




EXCAVATION DETAIL




INSTALLATION DETAIL




CROSS SECTION

Pay Items
1) Pipe*
2) Geosynthetic Material Type R1

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

NOTES:

1) This drawing applies to new/extended mainline and paved intersection roadway pipes only (including ramps). It does not include pipes in approaches
2) The exact location of the pipes will be shown in the plans.
3) Embankment may be either Borrow Excavation or Common Excavation - Type A

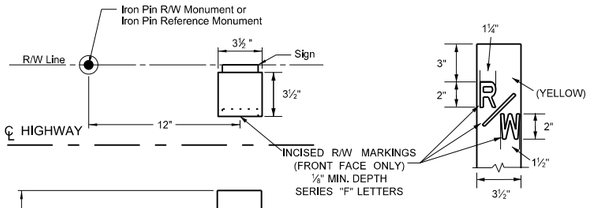
| Backfill Dimensions | |
|---|---|
| Pipe Materials | Dimension (A) |
| Concrete | 0.5 O.D. |
| Metal and Plastic | 0.5 O.D. + 1 Foot |

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 2-4-14 | |
| REVISIONS | |
| DATE | CHANGE |
| 1-21-15<br>12-10-15 | Nomenclature<br>Added Plastic Pipe |

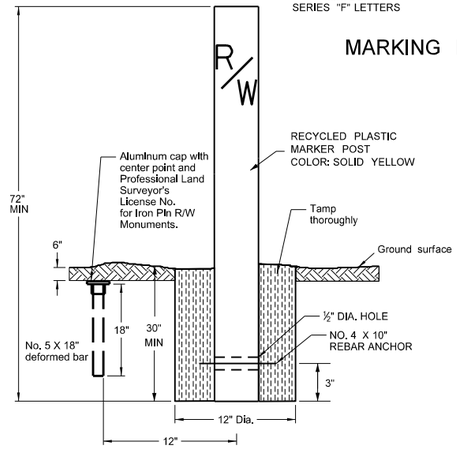
This document was originally issued and sealed by Ron Horner, Registration Number PE-2087, on 12/10/2015 and the original document is stored at the North Dakota Department of Transportation

# STANDARD MONUMENTS AND RIGHT OF WAY MARKERS

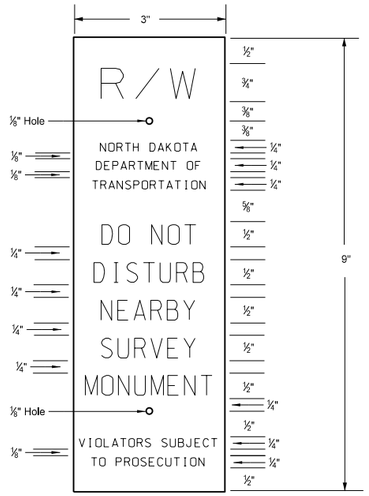
D-720-1




MARKING DETAIL



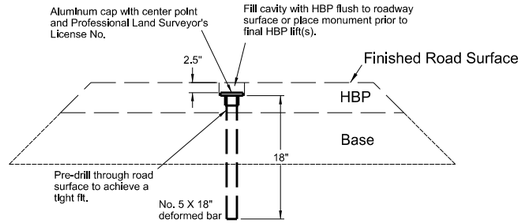

## RECYCLED PLASTIC RIGHT OF WAY MARKER (WITNESS POST) DETAILS & IRON PIN REFERENCE AND R/W MONUMENT DETAILS



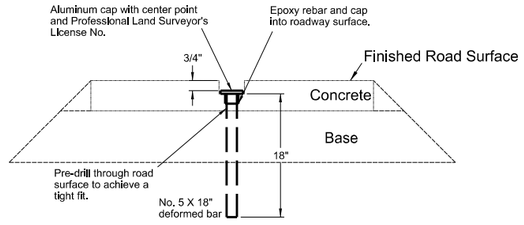

## SIGN DETAIL

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. Sign shall be attached 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. Sign shall be installed 2" from top of post.

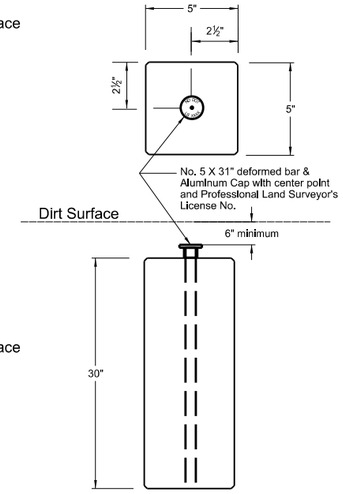
## ALIGNMENT MONUMENT DETAILS



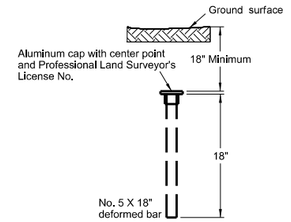

IRON PIN
(Within Finished Roadway Surface)




IRON PIN
(Within Finished Roadway Surface)




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




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

## NOTES:

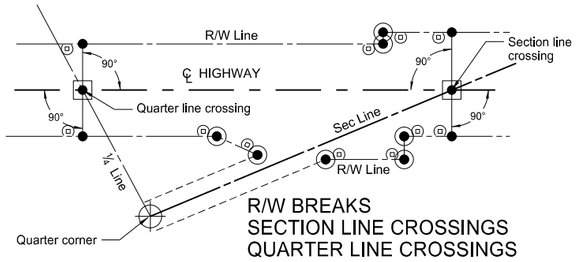
The construction and installation of Alignment Monuments, Iron Pin Reference Monuments, Iron Pin R/W Monuments, and Right of Way Markers (witness posts) shall conform to Section 720 of the Standard Specifications.

ALIGNMENT MONUMENTS:
Iron Pin or Precast Concrete Alignment Monuments with aluminum caps will be placed 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.

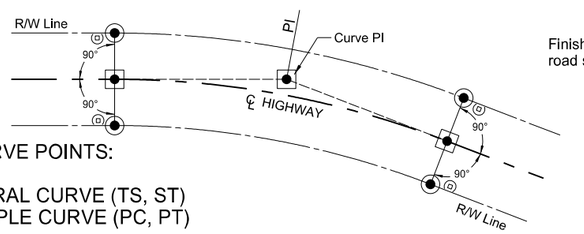
IRON PIN R/W MONUMENT:
Iron pins with aluminum caps (No. 5 X 18") will be placed at breaks on the Right of Way line, and at curve points (PC's, PT's, TS's and ST's) on the Right of Way line.

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

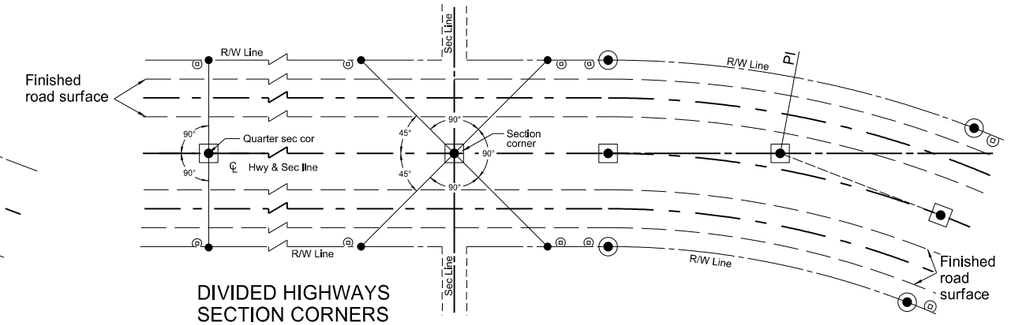
## VARIOUS MONUMENT AND MARKER PLACEMENTS



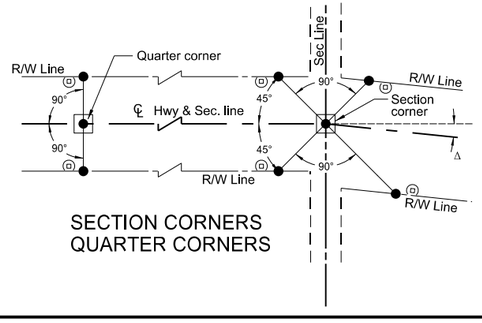

R/W BREAKS
SECTION LINE CROSSINGS
QUARTER LINE CROSSINGS



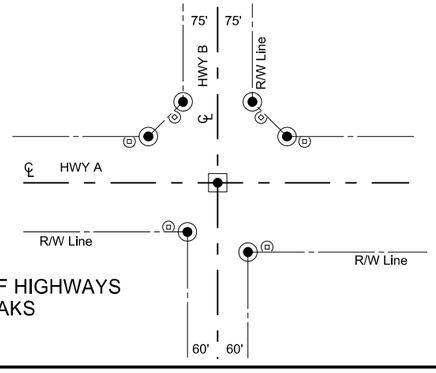

CURVE POINTS:
PI
SPIRAL CURVE (TS, ST)
SIMPLE CURVE (PC, PT)




DIVIDED HIGHWAYS
SECTION CORNERS
QUARTER CORNERS




SECTION CORNERS
QUARTER CORNERS




INTERSECTION OF HIGHWAYS
FLARED R/W BREAKS

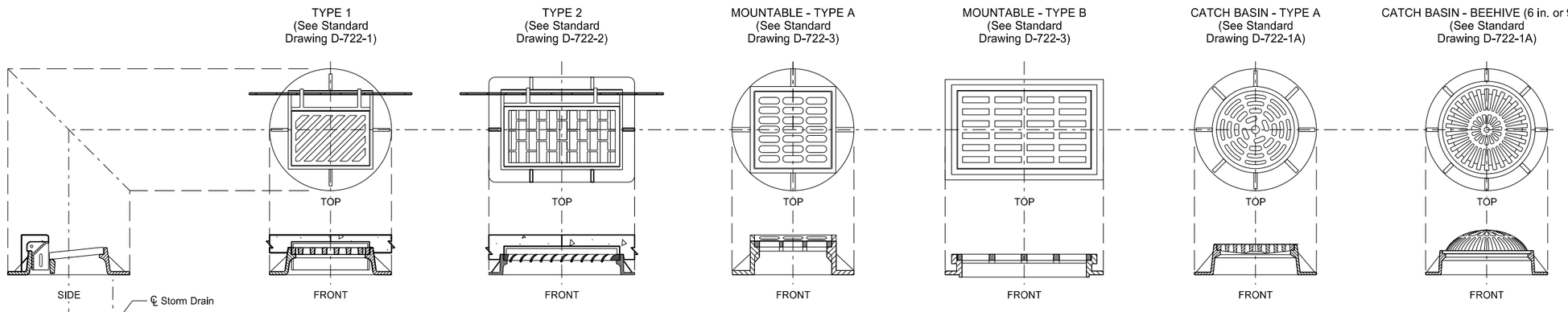
| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 10-3-2013 | |
| REVISIONS | |
| DATE | CHANGE |
| 11/12/13 | Note for SIGN DETAIL modified to meet ASTM D-4956 Type III or higher on 80 gauge 5052-H38 |

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

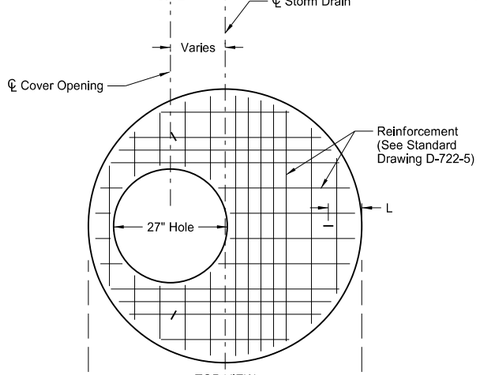
This document was originally issued and sealed by Roger Weigel Registration Number PE- 2930 , on 11/12/13 and the original document is stored at the North Dakota Department of Transportation

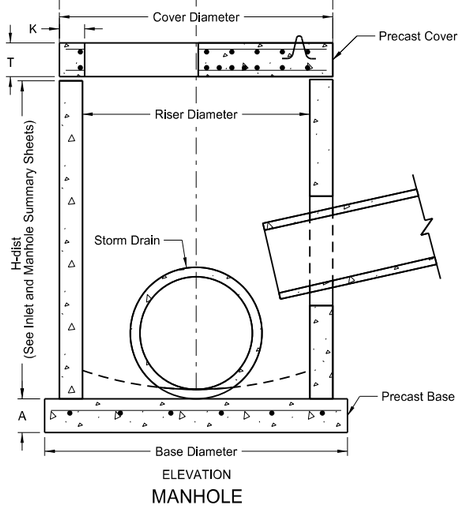
# INLET - SPECIAL

D-722-1B




See Note 1.




MANHOLE
(See Standard Drawing D-722-5)

| RISER DIAMETER | COVER DIAMETER | BASE DIAMETER |
|---|---|---|
| 48" | 58" | 66" |
| 60" | 72" | 78" |
| 72" | 86" | 92" |

See Note 4.

PAY ITEMS

48 in. Riser
- Inlet Special - Type 1 48 in. . . . . Ea.
- Inlet Special - Type 2 48 in. . . . . Ea.
- Inlet Special Mountable - Type A 48 in. . . . . Ea.
- Inlet Special Mountable - Type B 48 in. . . . . Ea.
- Inlet Special Catch basin 6 in. beehive 48 in. . . . Ea.
- Inlet Special Catch basin 9 in. beehive 48 in. . . . Ea.
- Inlet Special Catch basin - Type A 48 in. . . . . Ea.

60 in. Riser
- Inlet Special - Type 1 60 in. . . . . Ea.
- Inlet Special - Type 2 60 in. . . . . Ea.
- Inlet Special Mountable - Type A 60 in. . . . . Ea.
- Inlet Special Mountable - Type B 60 in. . . . . Ea.
- Inlet Special Catch basin 6 in. beehive 60 in. . . . Ea.
- Inlet Special Catch basin 9 in. beehive 60 in. . . . Ea.
- Inlet Special Catch basin - Type A 60 in. . . . . Ea.

72 in. Riser
- Inlet Special - Type 1 72 in. . . . . Ea.
- Inlet Special - Type 2 72 in. . . . . Ea.
- Inlet Special Mountable - Type A 72 in. . . . . Ea.
- Inlet Special Mountable - Type B 72 in. . . . . Ea.
- Inlet Special Catch basin 6 in. beehive 72 in. . . . Ea.
- Inlet Special Catch basin 9 in. beehive 72 in. . . . Ea.
- Inlet Special Catch basin - Type A 72 in. . . . . Ea.

NOTES:

1. For inlet casting details, see Standard Drawings D-722-1, D-722-21A, D-722-2, and D-722-3. Other castings, similar in dimension, may be used provided the casting meets the requirements set forth in the referenced Standard Drawings. The grate style shall be as specified on the plans and included in the price bid for "Inlet Special - (casting type & riser size)".
2. Metal used in the manufacture of castings shall conform to AASHTO M-105, Class 35B.
3. The Class of concrete, aggregate size, and methods of construction for the manhole riser, cover, and base shall be as detailed in Standard Drawing D-722-5.
4. See Standard Drawing D-722-5 for manhole riser, cover, and base details, dimensions, and reinforcement requirements.
5. The distance between the ℄ of the cover opening and the ℄ of the storm drain shall be noted on the Plan & Profile sheets.
6. Manhole steps, if noted on the Plan and Profile sheets, shall be constructed per Standard Drawing D-722-5.
7. On projects with P.C.C pavement, all risers shall be constructed 4 to 5 inches below final elevation and adjusted to final elevation after paving. Adjustments may be made with adjusting rings or cast-in-place concrete. All costs for this adjustment shall be included in the price bid for "Inlet - Special, (casting type & riser size)".

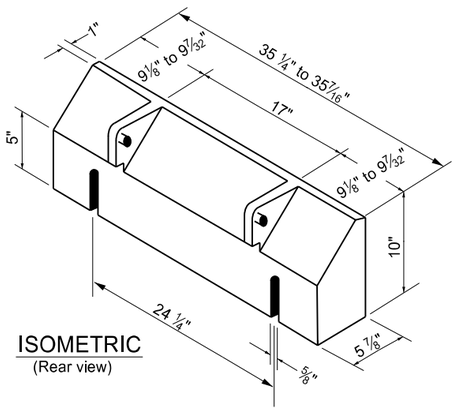
| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 03-18-14 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

This document was originally issued and sealed by Terrence R. Udland Registration Number PE-2674 , on 03-18-14 and the original document is stored at the North Dakota Department of Transportation

# INLET - TYPE 2

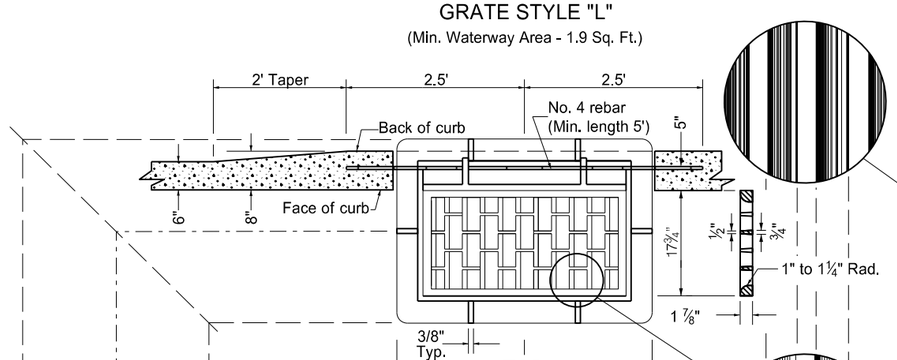
D-722-2

Pay Items
Inlet - Type 2 .....Ea.
Inlet - Type 2, Double.....Ea.

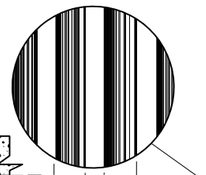


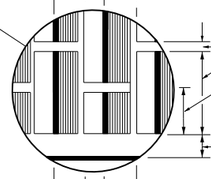

ISOMETRIC
(Rear view)

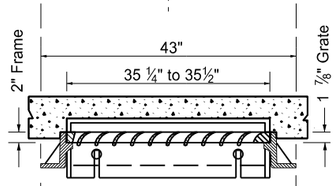
GRATE STYLE "L"
(Min. Waterway Area - 1.9 Sq. Ft.)




TOP

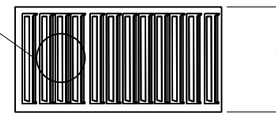




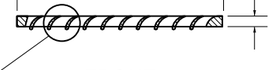




FRONT

GRATE STYLE "V"
(Min. Waterway Area - 2.4 Sq. Ft.)

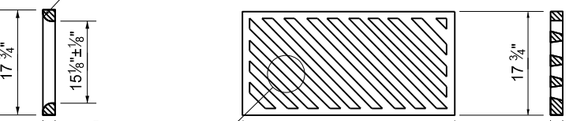



TOP

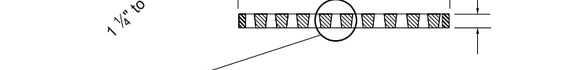



FRONT

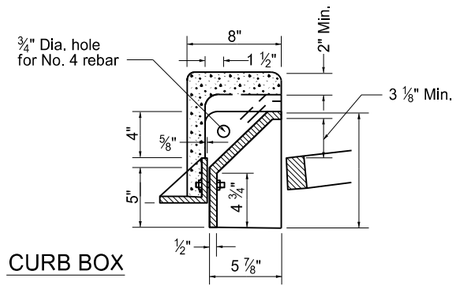
GRATE STYLE "D"
(Min. Waterway area - 1.6 Sq. Ft.)



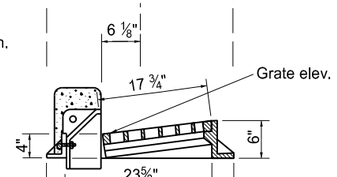

TOP




FRONT

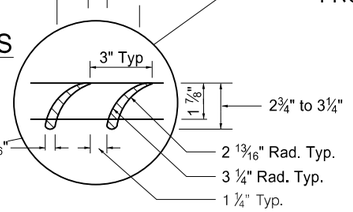


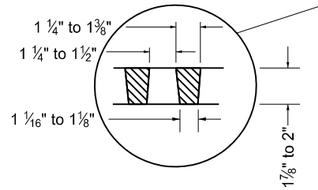

CURB BOX




SIDE

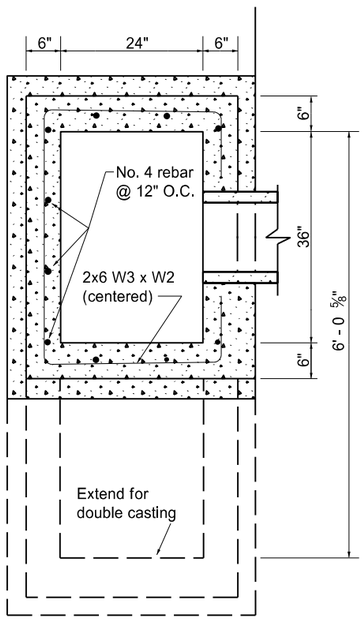
CASTING DETAILS



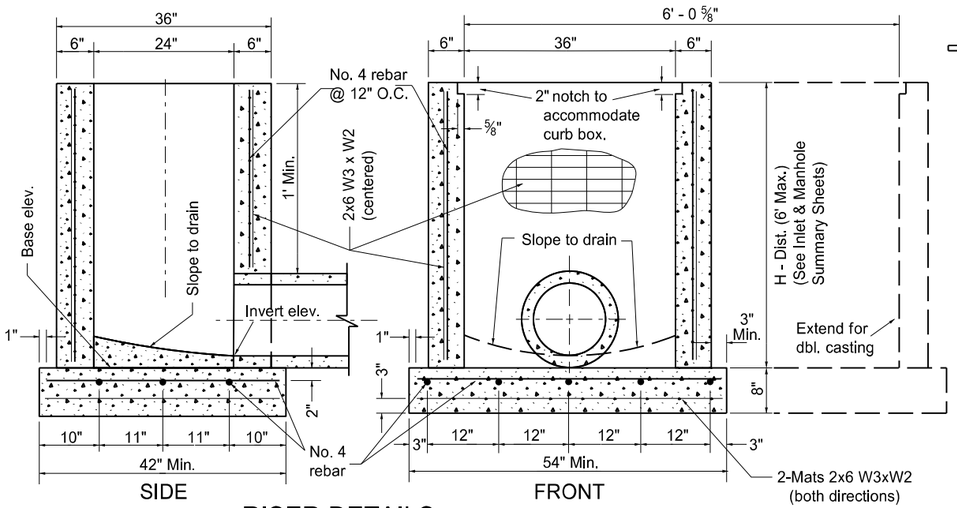




Notes:

1. Drainage structure castings shall be manufactured in accordance with AASHTO M306. Metal used in the manufacture of castings shall conform to AASHTO M105 Class 35B.
2. Other castings, similar in dimension, may be used if the casting conforms to the riser section and has the grate style as specified in the plans. If modifications to the inlet riser are required to accomodate similar castings, the contractor must receive written approval from the engineer.
3. Precast risers shall be constructed in accordance with ASTM C858.
4. The contractor shall have the option of using precast or poured in place bases. Cast in place concrete shall be Class AE-3. Construction shall be in accordance with section 722 of the Standard Specifications.
5. On projects with P.C.C. pavement, all inlet risers or barrels shall be constructed 4 to 5 inches below final elevation and adjusted to final grade after paving. Adjustment may be done with adjusting rings or cast-in-place concrete. All costs for this adjustment shall be included in the price bid for the inlet.
6. Welded wire reinforcing fabric shall conform to AASHTO M55 Grade 65.
7. The deformed reinforcing steel shall conform to AASHTO M31.




TOP

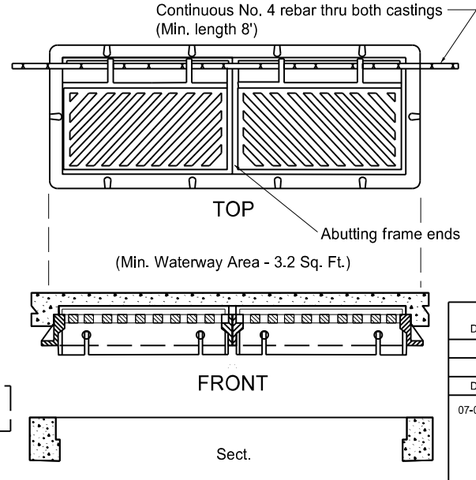



SIDE




FRONT

RISER DETAILS




TOP

FRONT

INLET - TYPE 2 - DOUBLE

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 05-12-14 | |
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| DATE | CHANGE |
| 07-07-14 | Revised Note 4 |

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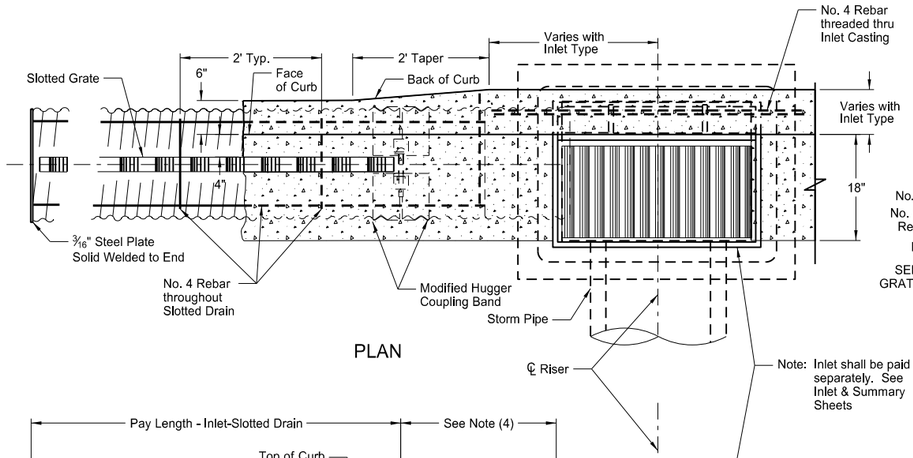
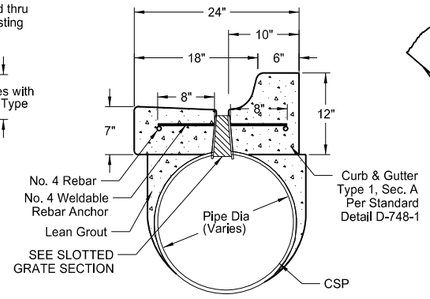
# INLET - SLOTTED DRAIN

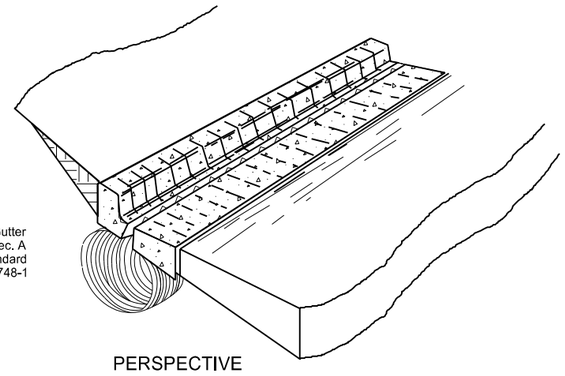
D-722-3A




PLAN



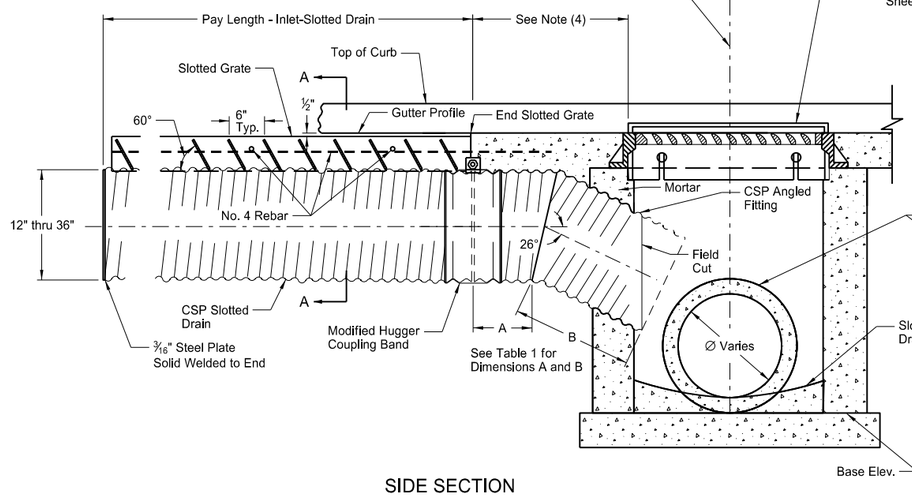

SECTION A-A



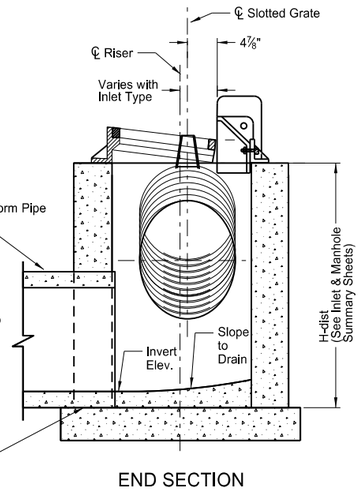
PERSPECTIVE

NOTES:

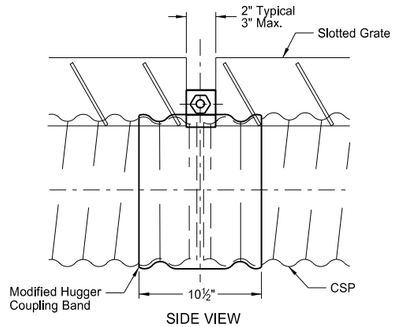
1. Corrugated steel pipe shall conform with applicable sections of NDDOT Standard Specifications and AASHTO M 36.
2. Slotted grate assembly, including rebar and steel plate end, shall be a weldable grade of steel complying with the mechanical requirements of AASHTO M 183 and shall be hot dip galvanized in accordance with AASHTO M 111.
3. All labor, equipment and materials necessary to complete the work, except for the concrete curb and gutter and the inlets, shall be included in the price bid for "Inlet - Slotted Drain (Size)".
4. The non-slotted corrugated pipe angled fitting (see Table 1) shall not be paid for separately but shall be included in the price bid for the Inlet - Slotted Drain.
5. Construction shall be in accordance with Sections 714 and 722 of the Standard Specifications.



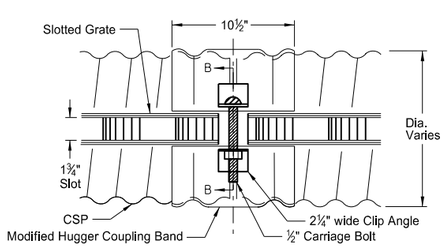

SIDE SECTION



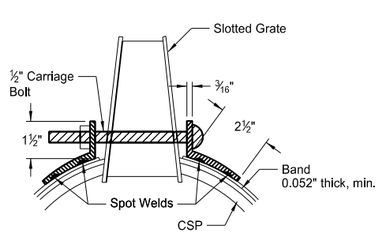

END SECTION




SIDE VIEW




TOP VIEW




SECTION B-B

MODIFIED HUGGER COUPLING BAND

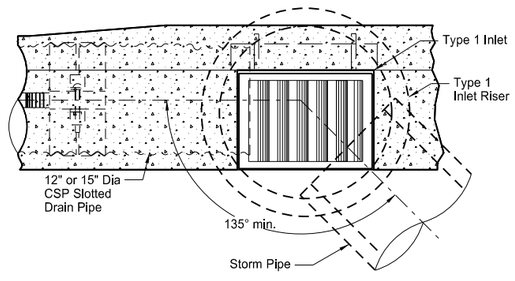
PAY ITEMS

Inlet - Slotted Drain, 12 In . . . . . L.F.
Inlet - Slotted Drain, 15 In . . . . . L.F.
Inlet - Slotted Drain, 18 In . . . . . L.F.
Inlet - Slotted Drain, 24 In . . . . . L.F.
Inlet - Slotted Drain, 30 In . . . . . L.F.
Inlet - Slotted Drain, 36 In . . . . . L.F.

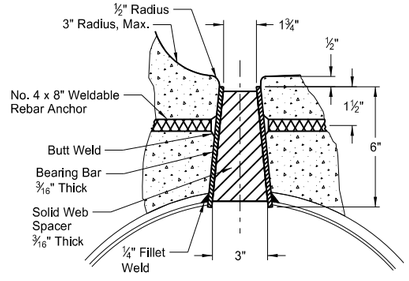
TABLE 1
CSP Angled Fitting Dimensions

| Slotted Drain Pipe Dia (in.) | A (in.) | B (in.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Inlet | | Inlet - Special | | | | | |
| | | Type 1 | Type 2 | Type 1 48" | Type 1 60" | Type 1 72" | Type 2 48" | Type 2 60" | Type 2 72" |
| 12 | 12 | 18(A) | 18 | 35 | 41 | 42 | 31 | 36 | 37 |
| 15 | 12 | 18(A) | 18 | 36 | 42 | 43 | 31 | 37 | 38 |
| 18 | 12 | | 18 | 37 | 42 | 43 | 32 | 38 | 39 |
| 24 | 24 | | | | 44 | 45 | | 39 | 41 |
| 30 | 24 | | | | 45 | 46 | | 41 | 42 |
| 36 | 24 | | | | | 48 | | | 44 |

(A) 135° min. angle required between CSP and Storm Pipe for Type 1 Inlet - see Type 1 Inlet Connection Detail)




TYPE 1 INLET CONNECTION DETAIL
For 12" and 15" Slotted Drain Installation




SLOTTED GRATE SECTION

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 03-17-2014 | |
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| DATE | CHANGE |
| | |

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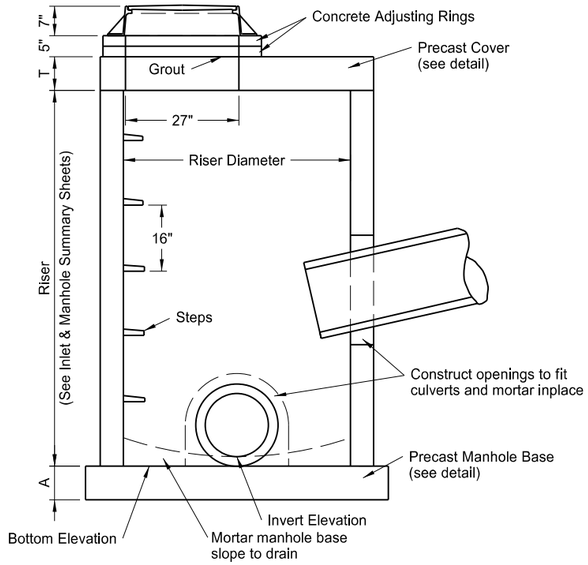
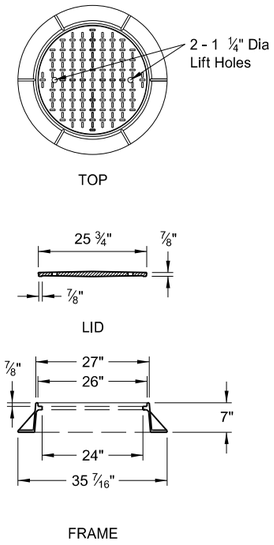
# MANHOLE DETAILS

D-722-5




ELEVATION




MANHOLE CAST IRON RING & COVER

## PRECAST MANHOLE COVERS

| RISER DIAMETER | COVER DIAMETER | WEIGHT OF SECTION | T | K | L | BOTTOM * BARS | TOP * BARS |
|---|---|---|---|---|---|---|---|
| 48" | 58" | 1,080 Lb | 6" | 6" | 8" | #4 at 6" | — |
| 54" | 65" | 1,910 Lb | 8" | 6" | 8" | #4 at 6" | — |
| 60" | 72" | 2,430 Lb | 8" | 7" | 9" | #4 at 6" | #4 at 11" |
| 66" | 79" | 3,010 Lb | 8" | 7" | 9" | #4 at 6" | #4 at 11" |
| 72" | 86" | 3,640 Lb | 8" | 8" | 10" | #4 at 6" | #4 at 11" |
| 84" | 100" | 5,060 Lb | 8" | 9" | 11" | #5 at 6" | #5 at 11" |
| 96" | 114" | 6,695 Lb | 8" | 9" | 11" | #5 at 6" | #5 at 11" |
| 108" | 128" | 12,810 Lb | 12" | 10" | 12" | #5 at 6" | #5 at 11" |
| 120" | 142" | 15,900 Lb | 12" | 11" | 13" | #5 at 6" | #5 at 11" |

* - Reinforcement listed shall be placed in each direction.

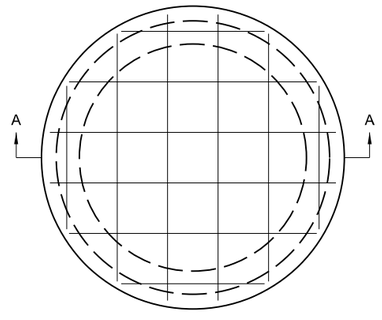
## MANHOLE BASES

| RISER DIAMETER | BASE DIAMETER | WEIGHT OF SECTION | A | BARS * |
|---|---|---|---|---|
| 48" | 66" | 1,785 Lb | 6" | #4 at 12" |
| 54" | 72" | 2,830 Lb | 8" | #4 at 12" |
| 60" | 78" | 3,320 Lb | 8" | #4 at 12" |
| 66" | 86" | 4,035 Lb | 8" | #4 at 12" |
| 72" | 92" | 4,620 Lb | 8" | #4 at 12" |
| 84" | 107" | 6,245 Lb | 8" | #4 at 12" |
| 96" | 120" | 7,855 Lb | 8" | #4 at 12" |
| 108" | 132" | 14,255 Lb | 12" | #4 at 8" |
| 120" | 148" | 17,925 Lb | 12" | #4 at 8" |

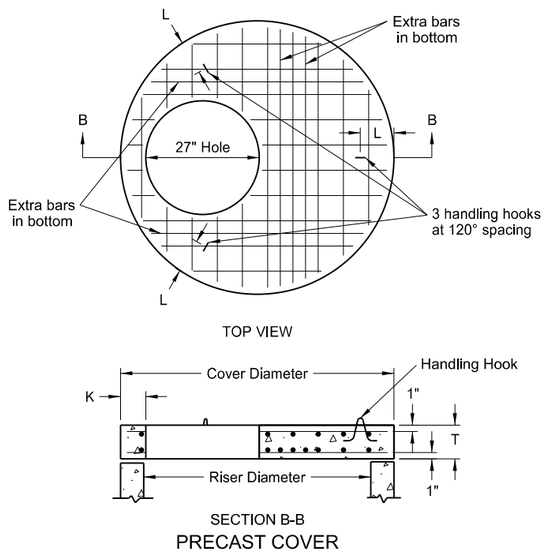
* - Reinforcement listed shall be placed in each direction.

NOTES:

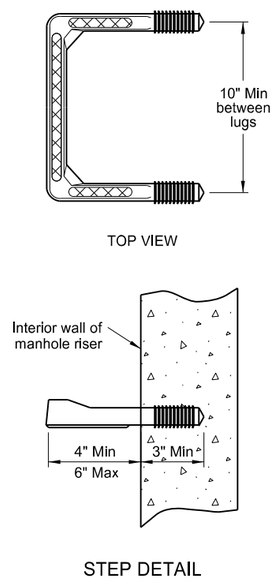
1. The contractor shall have the option of using precast or cast-in-place bases. Class of concrete shall be AE. The aggregate size shall be approved by the engineer in the field. Construction shall be in accordance with the NDDOT Standard Specifications.
2. Precast concrete manholes, risers and steps shall conform to AASHTO M199.
3. Precast concrete bases and covers shall be reinforced as shown in the table for the corresponding riser diameter.
4. All reinforcing steel shall be Grade 60 steel.
5. Bottoms of manhole risers shall be cut or precast square to fit the manhole base. Grout joint between base and riser with cement mortar.
6. The manhole riser length listed in the plans has been determined assuming the use of the 7" manhole casting plus 2 concrete adjusting rings (5") plus the "T" dimension shown in the Precast Manhole Covers table.
7. Manhole steps shall be corrosion resistant and shall have a minimum vertical load resistance of 800 pounds and a minimum horizontal pull-out resistance of 400 pounds. Configuration of the steps shall be approved by the Engineer.
8. Precast concrete manhole covers shown are designed for an HS-20 wheel load and a maximum fill height of 15'-0". Special design required for heavier wheel loads and/or greater fill heights.
9. Other castings, similar in dimension, may be used if the casting conforms to the manhole cover and has a lid style as specified. If modifications to the manhole cover are required to facilitate similar castings the contractor must receive written approval from the engineer.
10. Castings shall be manufactured in accordance with AASHTO M306-09. Metal used in the manufacture of castings shall conform to AASHTO M105 Class 35B.




PRECAST MANHOLE BASE




PRECAST COVER




STEP DETAIL

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 05-14-2013 | |
| REVISIONS | |
| DATE | CHANGE |
| 6-24-14 | Revised notes 1 & 6, added dimensions to Elev. drawing |

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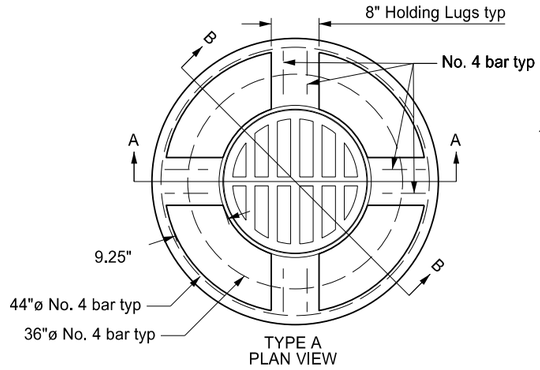
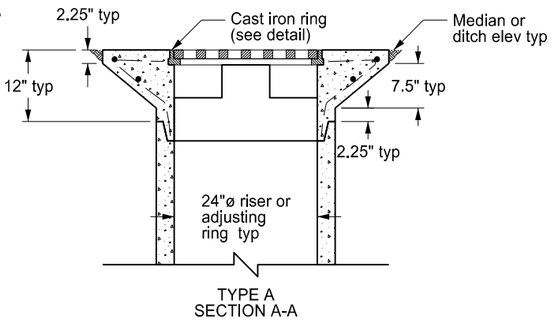
# PRECAST CONCRETE MEDIAN DRAIN

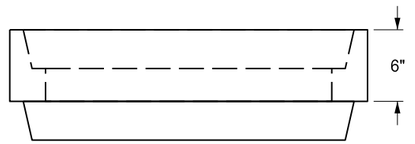
D-722-7



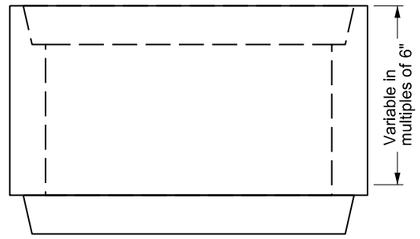

TYPE A
PLAN VIEW



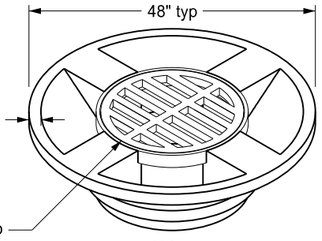

TYPE A
SECTION A-A



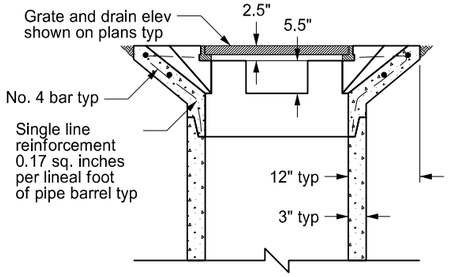

ADJUSTING RING



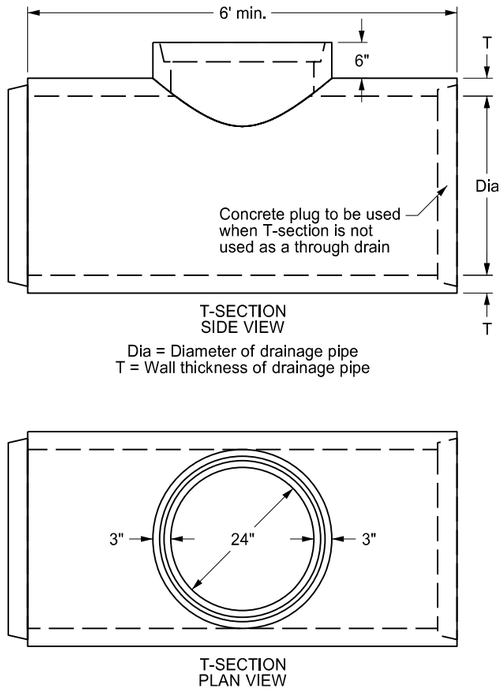

RISER SECTION




TYPE A
ISOMETRIC VIEW

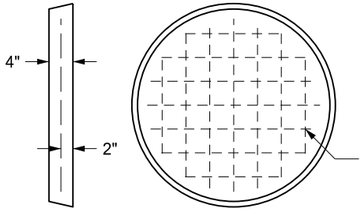



TYPE A
SECTION B-B

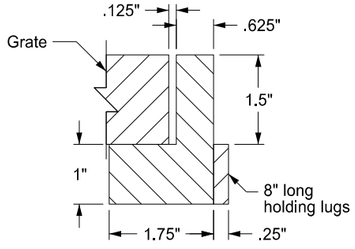



T-SECTION
SIDE VIEW

Dia = Diameter of drainage pipe
T = Wall thickness of drainage pipe




CONCRETE PLUG




CAST IRON RING DETAIL




T-SECTION
PLAN VIEW

Notes:

1. Use Neenah R-4370-23G, East Jordan 1310 grate, or equal with a minimum waterway of 1.2 SF. If modifications to the drain are required to facilitate similar castings, the contractor must receive written approval from the Engineer.
2. Castings shall be manufactured in accordance with AASHTO M 306. Metal used in the manufacture of castings shall conform to AASHTO M 105, Class 35B.
3. Precast concrete median drains, adjusting rings, and riser sections shall be constructed in accordance with AASHTO M 199. T-sections shall be constructed in accordance with AASHTO M 170.
4. All reinforcing steel shall be Grade 60 steel. Reinforcing for adjusting rings, riser sections, and T-sections shall be in accordance with AASHTO M170.
5. The cost of furnishing and installing the castings and drains shall be included in the price bid for "Median Drain Precast Concrete-Type A". The cost of furnishing and installing the adjusting rings and riser sections shall be included in the price bid for "Pipe Conc Reinf 24IN (CL _ )". The cost of furnishing and installing the T-sections and concrete plugs shall be included in the price bid for "Pipe Conc Reinf ( _ IN) (CL _ )".
6. Seal all joints with rubber gaskets or with sealer approved by the engineer.

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|---|---|
| 6-30-14 | |
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| DATE | CHANGE |
| | |

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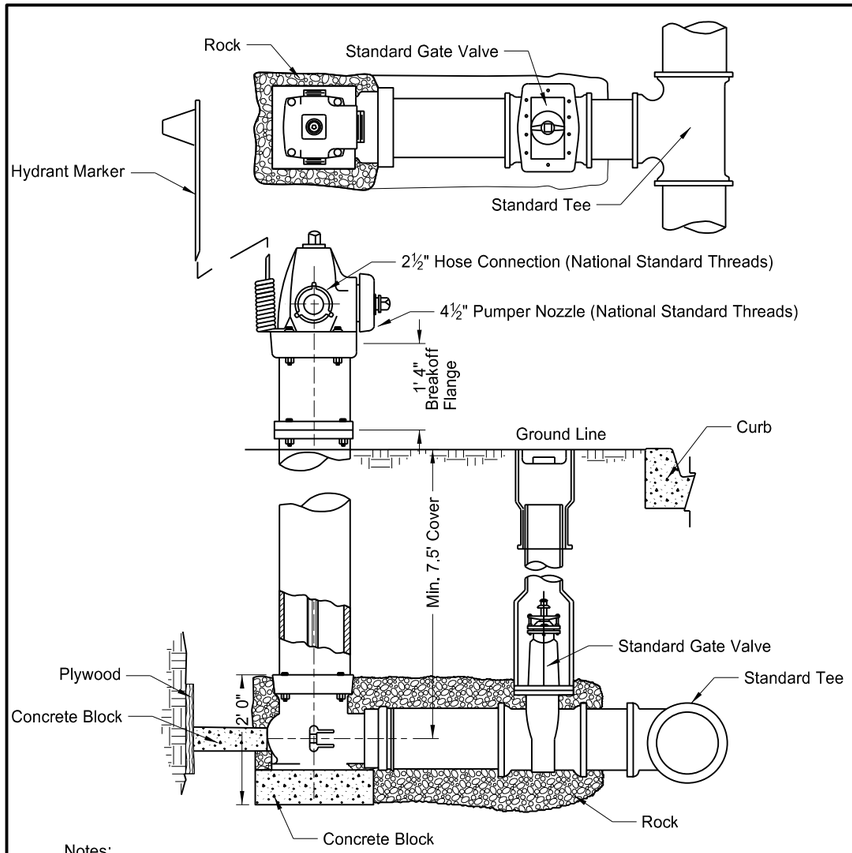
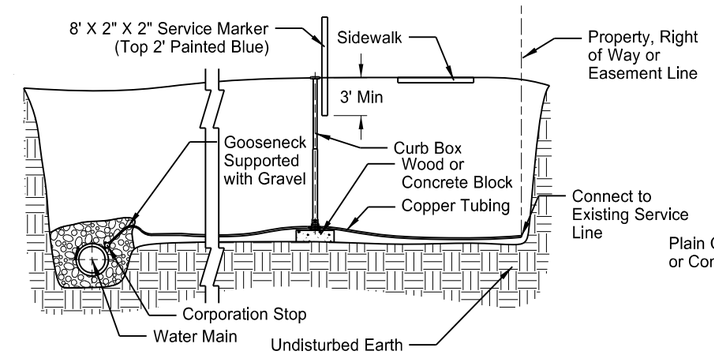
# WATERWORKS

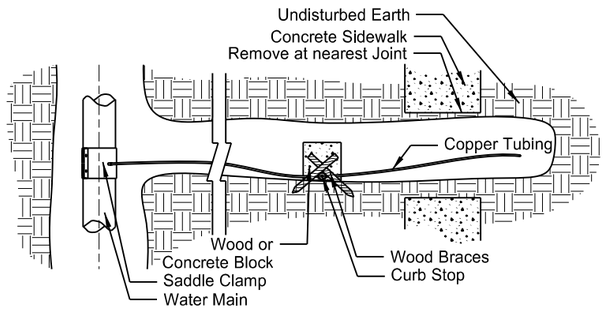



Notes:
1. Operating & Cap Nuts: City Standards

2. Supply and furnish and install hydrant marker. Cost will be included with the unit bid price for the hydrant. The hydrant marker shall be current with city standards or as approved by the engineer in the field.

## STANDARD FIRE HYDRANT & CONNECTION

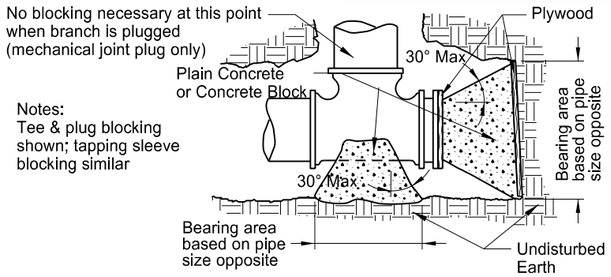


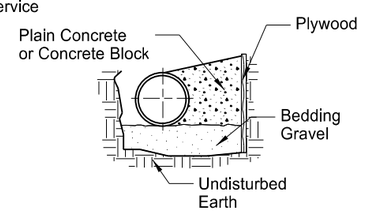

Notes:
1. Service clamp are not required where small size service lines are connected to large cast iron or ductile iron pipe and three threads of the corporation stop make contact with the wall.

2. Trench shall be gravel backfill from water main to back of curb line and under sidewalk areas or standard compaction of earth backfill where specified.

## WATER CURB CONNECTION




Notes:
Tee & plug blocking shown; tapping sleeve blocking similar

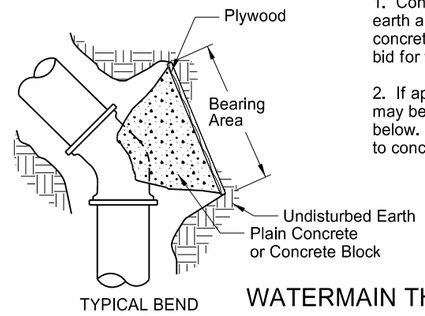



TYPICAL SECTION

| Table of Required Bearing Areas | | | | | |
|---|---|---|---|---|---|
| Size of Pipe | 90° Bend | 45° Bend | 22.5° Bend | 11.25° Bend | Tees, Plugs & Tapping Sleeves |
| 4" | 2' Sq | 2' Sq | 2' Sq | 2' Sq | 2' Sq |
| 6" | 3' Sq | 2' Sq | 2' Sq | 2' Sq | 3' Sq |
| 8" | 5' Sq | 3' Sq | 2' Sq | 2' Sq | 4' Sq |
| 10" | 8' Sq | 4' Sq | 3' Sq | 2' Sq | 6' Sq |
| 12" | 11' Sq | 6' Sq | 3' Sq | 2' Sq | 8' Sq |
| 16" | 20' Sq | 11' Sq | 6' Sq | 4' Sq | 15' Sq |
| 18" | 25' Sq | 14' Sq | 7' Sq | 4' Sq | 18' Sq |

Notes:
1. Concrete blocking to be poured against undisturbed earth and plywood. Keep bells and bolts free of concrete. Concrete in place to be included in price bid for water main.

2. If approved by the engineer, solid concrete blocks may be used for blocking on 8" Dia. pipe and below. 10" Dia. pipe and above will conform to concrete poured in place areas as shown above.

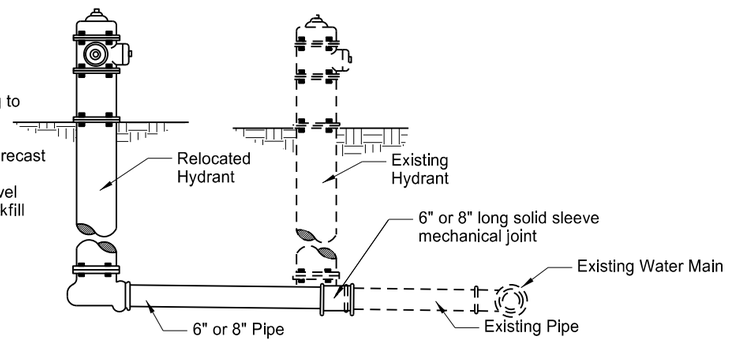



TYPICAL BEND

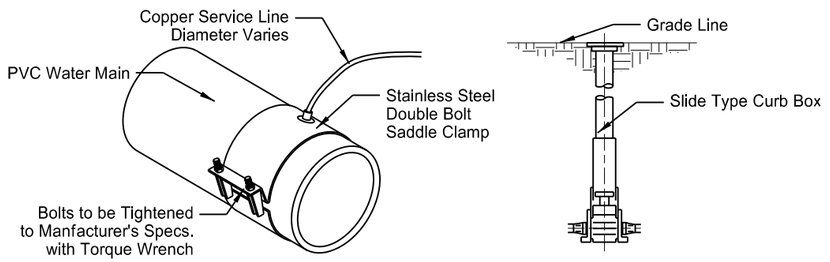
## WATERMAIN THRUST BLOCK DETAILS

Notes:
1. Concrete thrust blocking to be placed as directed.

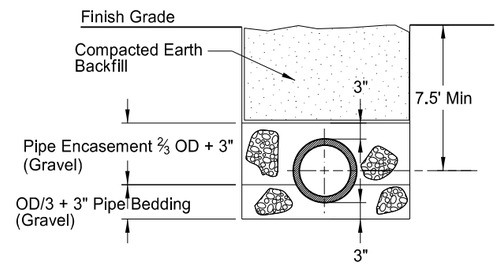
2. Hydrant to be set on a precast concrete pad. The hydrant shall be surrounded by gravel according to the trench backfill detail.




## LAYOUT FOR RELOCATION OF HYDRANTS




## TYPICAL CORPORATION STOP AND CURB STOP




## TRENCH BACKFILL

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 9-22-10 | |
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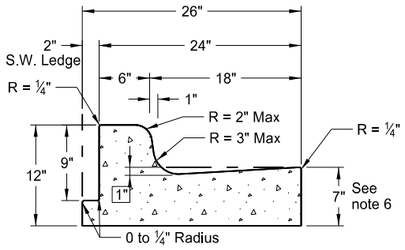
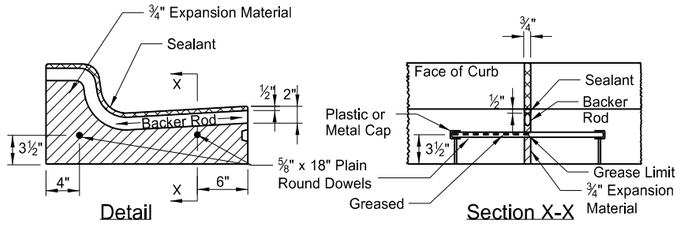
# Curb & Gutter and Valley Gutter

D-748-1

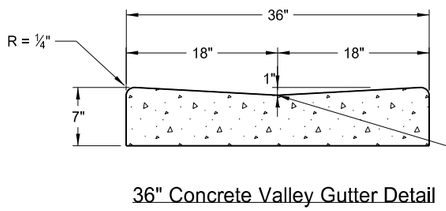



Curb & Gutter Type 1 (Sec. A & B)
Adjacent to Concrete Sidewalk, Median, or Parking Lot.
(Sec. A shown. See Sec B for additional details.)

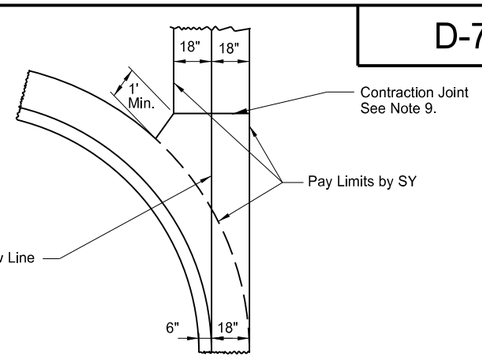



Detail — Section X-X

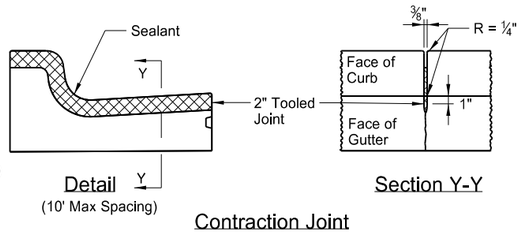
Isolation Joint




36" Concrete Valley Gutter Detail

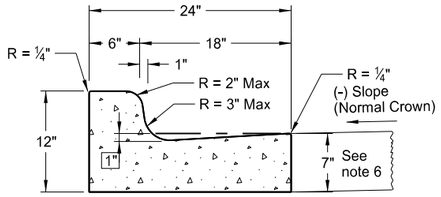



36" Concrete Valley Gutter Plan

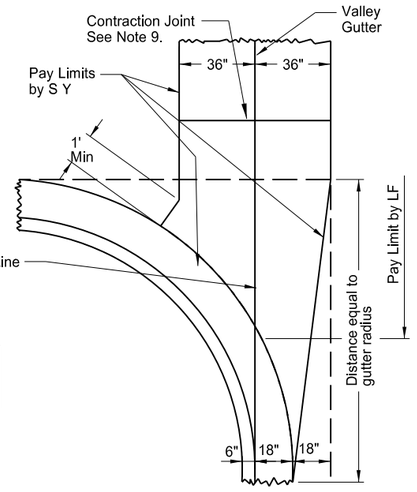



Detail (10' Max Spacing) — Section Y-Y

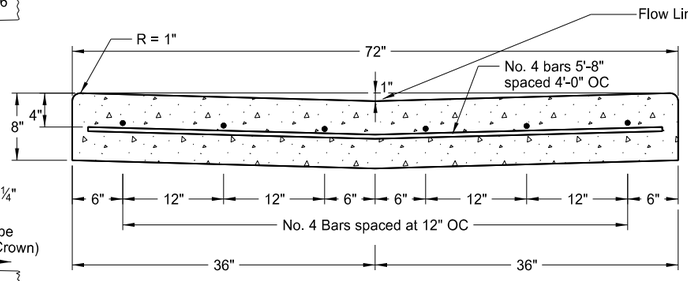
Contraction Joint



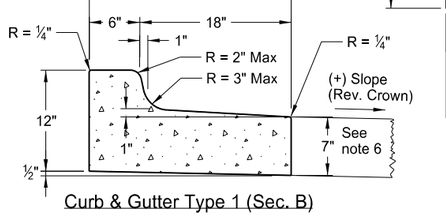

Curb & Gutter Type 1 (Sec. A)



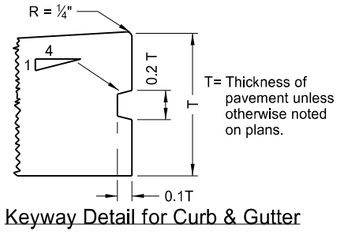

72" Concrete Valley Gutter Plan



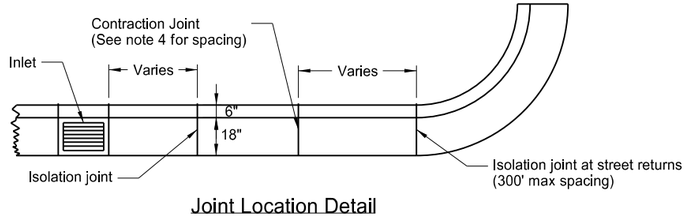

72" Concrete Valley Gutter Detail



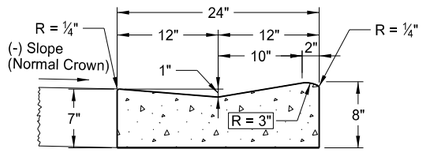

Curb & Gutter Type 1 (Sec. B)



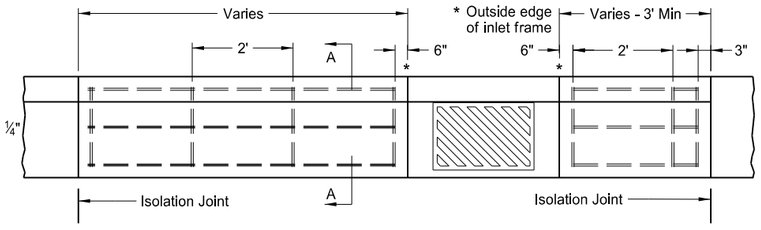

Keyway Detail for Curb & Gutter
(To be used with PCC Pavement and Drives)



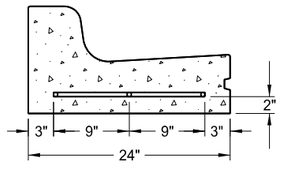

Joint Location Detail



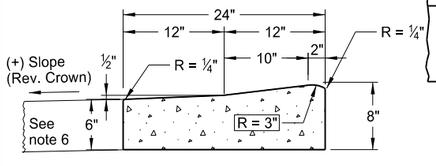

Mountable Curb & Gutter Type 1 (Sec. A)




Curb & Gutter Reinforcing at Inlets




Section A-A




Mountable Curb & Gutter Type 1 (Sec. B)

NOTES:

1. Curb and Gutter Type 1 (Sec. A & B) to be used. Section "A" to be used with (-) pavement slopes and section "B" to be used with (+) pavement slopes.
2. Contraction Joints: Tool the Curb & Gutter 2" as shown on the contraction joint details.
3. Isolation Joints: Isolation joint material shall be 3/4" preformed expansion joint filler conforming to the standard specifications. The opening for the backer rod and joint sealant shall be formed by a pre-cut piece of wood or other material approved by the engineer. Dowel supports are not required on the second pour at a cold joint, plastic or metal caps and greased dowels shall be installed in the cold joint for the second pour.
4. Joint Spacing: For hot bituminous pavements the joint spacing for the curb and gutter shall be 10' max. with the panels on each side of the inlets. For concrete pavements the joint spacing for the curb and gutter shall match the pavement joint on PCC Pavements of approximately 15' spacing.
5. Joint sealing: All contraction and isolation joints shall be sealed as shown in the details. The joint sealant for contraction joints shall conform to section 826.02B.The sealant for expansion joints shall be as specified in note 3 above. The sealant shall be tooled and installed in accordance with the manufacturer's recommendations.
6. Depth of Face of Gutter: For hot bituminous pavement the depth of gutter shall be 7" as shown. For PCC pavements, the Contractor has the option to match the depth of gutter to the depth of the adjacent PCC pavement or to construct a 7" depth as shown.
7. When the curb and gutter abuts PCC pavement, it shall be tied to the PCC pavement. The tie bar shall consist of a No. 3 bar, 1'-6" in length spaced 4' center to center.
8. On street returns and other locations where the new curb and gutter ends and does not abut existing curb and gutter, the end two (2) feet of the curb shall be tapered from 6" in height to 0". A 1/2" premolded isolation joint which is full depth and the same shape as the curb and gutter shall be installed just ahead of the taper. An 18" tie bar shall be installed across the joint.
9. Valley Gutter Joints: Contraction joints are required at approx. 10' intervals. The contraction joints shall be ⅛" min. to ⅜" max. in width. The joints shall be formed by sawing or scoring to a minimum depth of 2". The joint sealant shall be a hot poured elastic type joint sealer in accordance with Section 826.02A.2 of the Standard Specifications. The joint and sealant shall be included in the price bid for Valley Gutter.

NOTE: All bars shall be #4 deformed reinforcing bars. Splices will not be permitted. Reinforcing bars at inlet locations will not be paid for separately, but shall be included in the price bid for "Curb and Gutter - Type 1." This includes inlets located on radii. The reinforcement shall be extended to the second joint (rebar placed through the first joint) in cases where the 3' min. panel length cannot be obtained.

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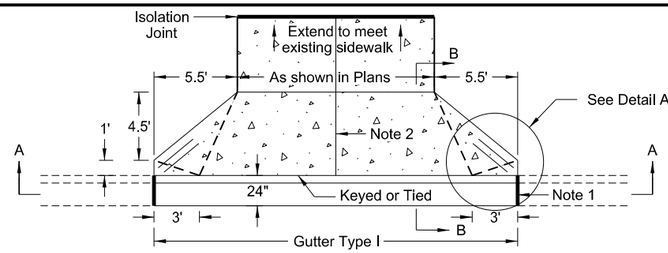
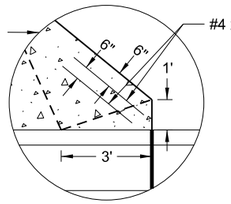
# CONCRETE DRIVEWAY - URBAN

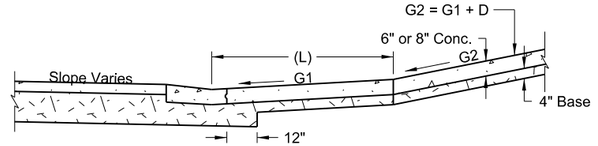
D-750-1



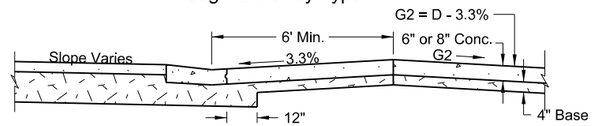

Driveway Type 1



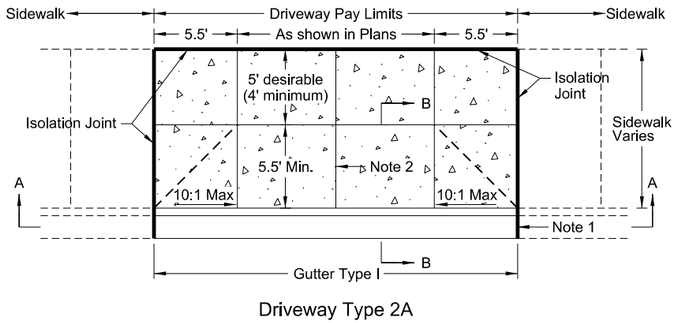

Detail A



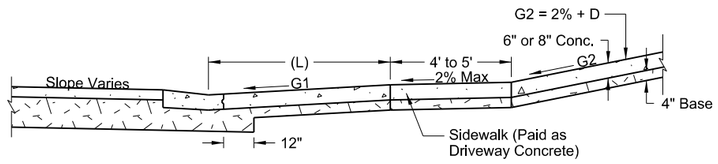

Sag - Driveway Type 1



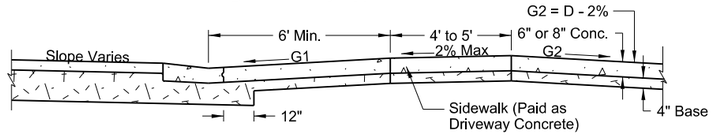

Summit - Driveway Type 1



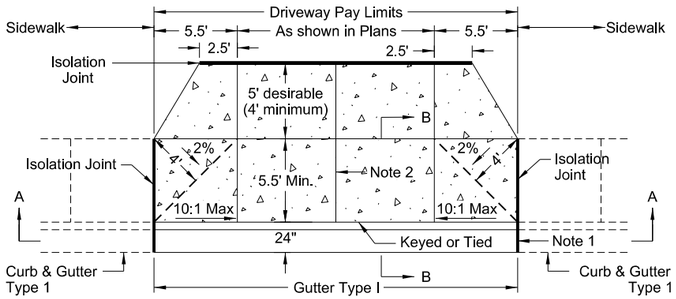

Driveway Type 2A



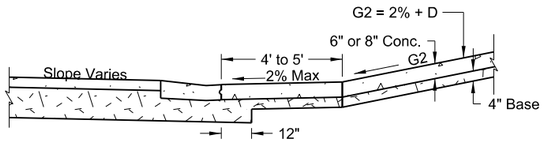

Sag - Driveway Types 2A & 2B



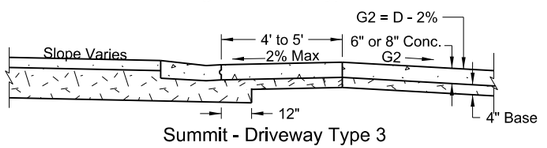

Summit - Driveway Types 2A & 2B



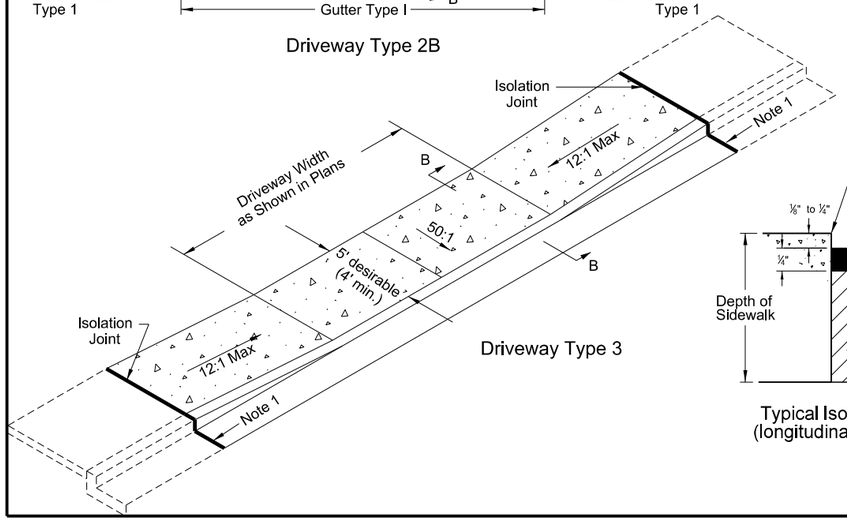

Driveway Type 2B



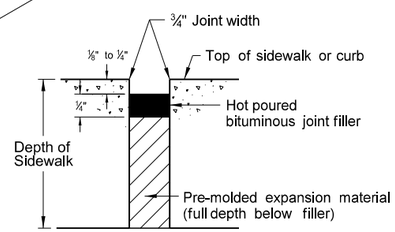

Sag - Driveway Type 3




Summit - Driveway Type 3




Driveway Type 3




Typical Isolation Joint Seal
(longitudinal and transverse)

| Driveway ADT | Grade G1 | | Dimension (L) ft. | | Grade Changes (D) | |
|---|---|---|---|---|---|---|
| | Desirable | Maximum | Desirable | Maximum | Desirable | Maximum |
| (0-500) | 5% | 12% or controlled by vehicle clearance | 12 | 6 | 6% | 15% or controlled by vehicle clearance |
| (500-1500) | 3% | 8% | 20 | 20 | 3% | 6% |
| (> 1500) | 2% | 5% | 40 | 40 | 0% | 3% |

NOTES:

1. See Standard D-748-1 for curb and gutter isolation joint detail. On PCC roadways, the curb and gutter joints should match those of the pavement as much as practical.
2. Joint Spacing: 1 Center contraction joint to be used on all driveways 20' width or less, 2 center contraction joints for driveways > 20' to 30' width, and 3 center contraction joints for driveways greater than 30' width.

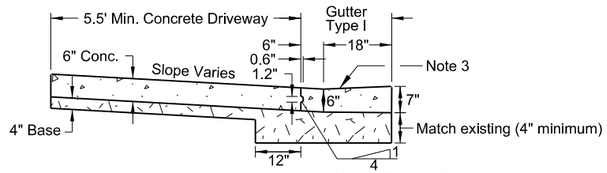
   The contraction joints may be sawed or a grooved joint, and shall be a minimum of 1/3 the depth of the concrete.

   Isolatoin joints should also be used between seperately poured cocretes, or between old and new concrete.

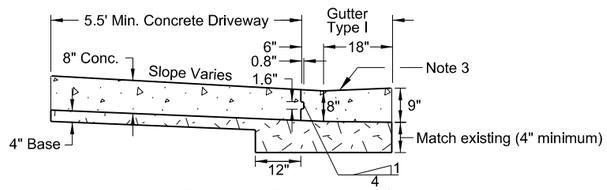
   All joints shall be sealed with hot pour bituminous filler or low modulus silicone. The sealant shall be installed and tooled in accordance with the manufacturer's recommendations.

   All costs for labor, equipment, and material necessary to construct and seal joints shall be included in the price bid for the driveway.
3. Gutter-Type 1 shall be paid for at the unit price bid for "Curb and Gutter-Type 1".
4. 6" Driveway to be used unless otherwise specified.
5. 4" base material shall be placed under the concrete driveway. All labor and materials necessary to place the base material shall be included in the price bid for Salvage Base Course or Aggregate Base Course CL 5.
6. Sidewalk that falls behind a driveway shall be constructed to the same thickness as the driveway and shall be paid for as driveway concrete.


Section A-A




6" Section B-B




8" Section B-B

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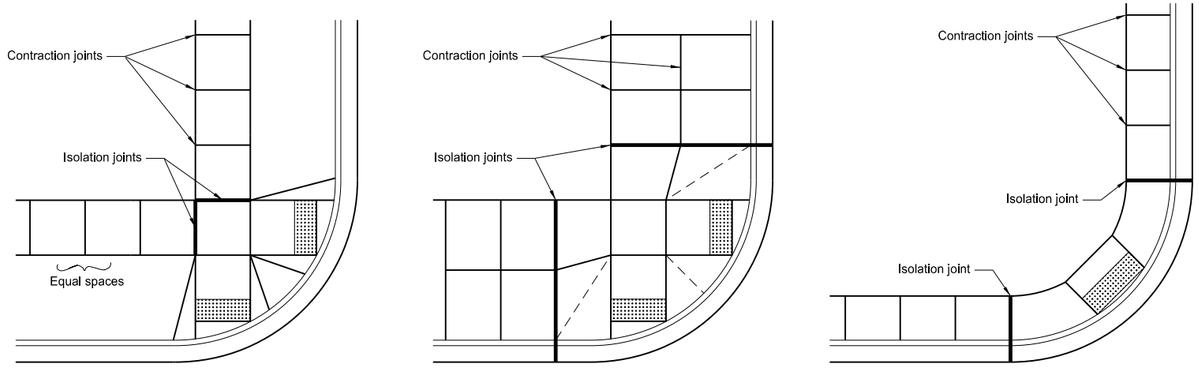
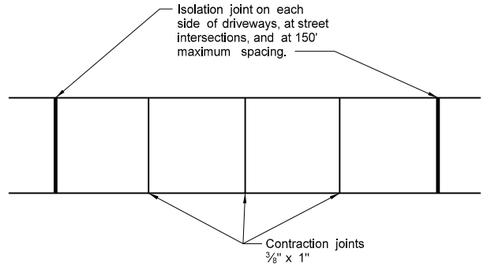
# SIDEWALK

D-750-2




Typical Joint Layouts




NOTES:

1. Curb ramp and detectable warning panel layouts are for informational purposes only. See Standard Drawing D-750-3 for curb ramp and detectable warning panel details.
2. Joint Spacing: Transverse contraction joint spacing shall vary from 4' to 6' to create approximate square panels.

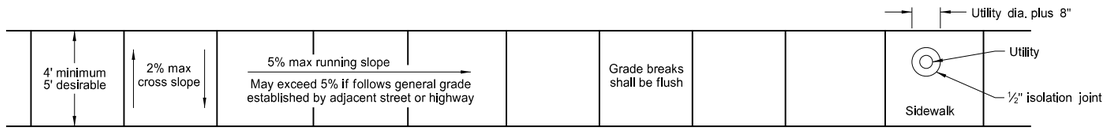
   Longitudinal contraction joints shall be used where the sidewalk width is 8' or greater, and shall be spaced at half the sidewalk width.

   The contraction joints may be sawed or a grooved joint, and shall be a minimum of 1/3 the depth of the concrete.

   When the sidewalk is adjacent to the curb & gutter, the sidewalk joint spacing shall be varied to match up with the curb & gutter joints.

   Isolation joints should also be used between seperately poured concretes, or between old and new concrete.

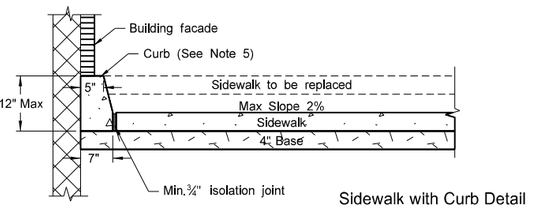
   The cost for all labor, equipment, and material necessary to construct contraction and isolation joints shall be included in the price bid for sidewalk concrete.
3. 4" sidewalk concrete thickness to be used unless otherwise specified in the plans.
4. 4" base material thickness to be used unless otherwise specified in the plans. All labor and materials necessary to place the base material shall be included in the price bid for "Salvage Base Course" or "Aggregate Base Course CL 5."
5. Landscaping is preferred to modify existing ground slope changes as needed. If not possible, such as adjacent buildings, a vertical curb may be used as shown in the detail below. The curb will be paid for at the unit price bid for the item "Curb - Type I" per lineal foot.



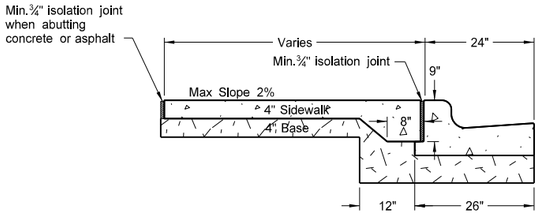

Sidewalk Width and Grade



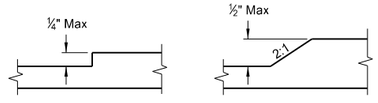

Utility Blockout



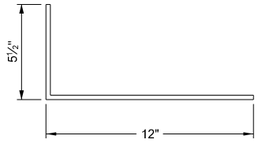

Sidewalk with Curb Detail
(Building face application)



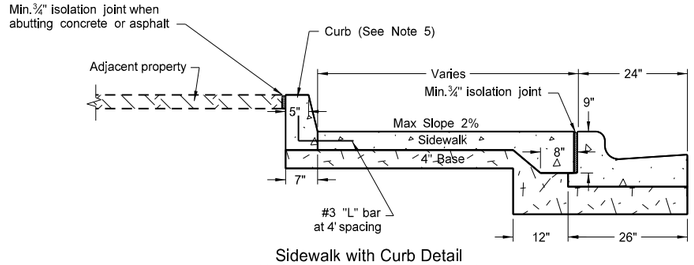

Sidewalk Detail
(Installed adjacent to curb and gutter)



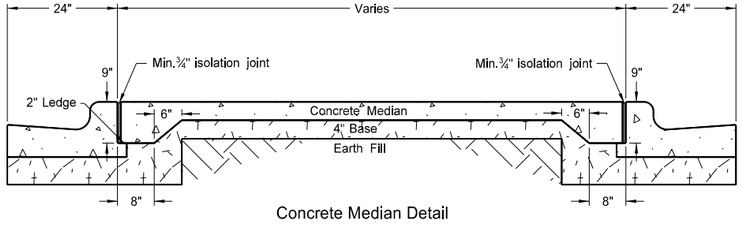

Vertical Discontinuities
(As needed for utility covers, vaults, grating, etc..)



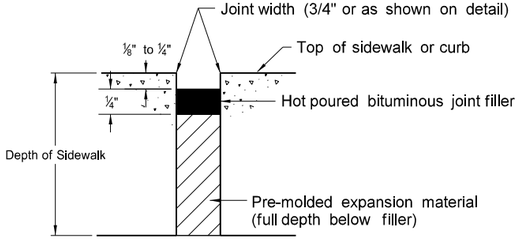

"L"Bar Detail
#3 Bar




Sidewalk with Curb Detail
(Adjacent property application)




Concrete Median Detail




Typical Isolation Joint Seal
(longitudinal and transverse)

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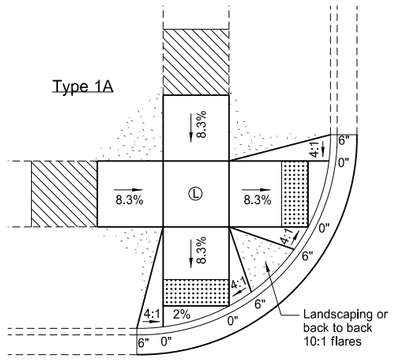
# CURB RAMP DETAILS

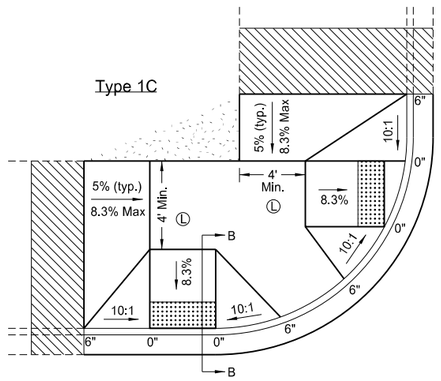
D-750-3

+More Right of Way — Less Right of Way-

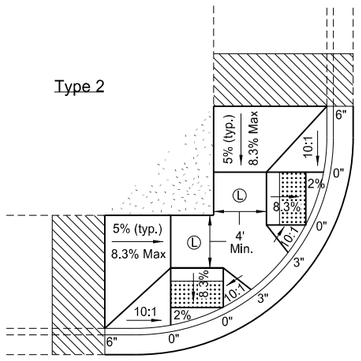
Type 1A



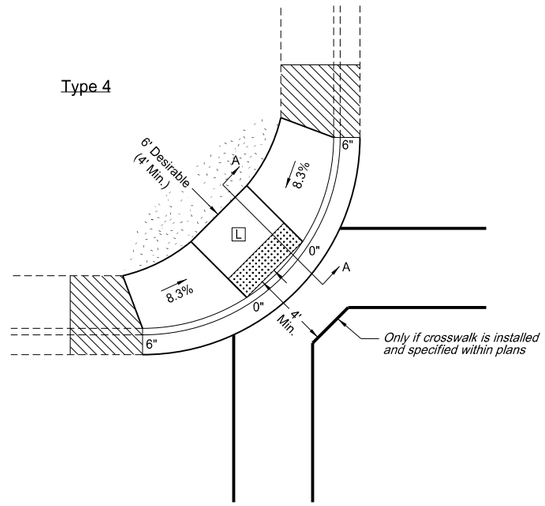

Type 1C




Type 2




Type 4




NOTES:

1. Ramp width is defined as the useable portion of the ramp, excluding flares if used.

   Curb ramp width should match the existing sidewalk width. 4' width minimum.

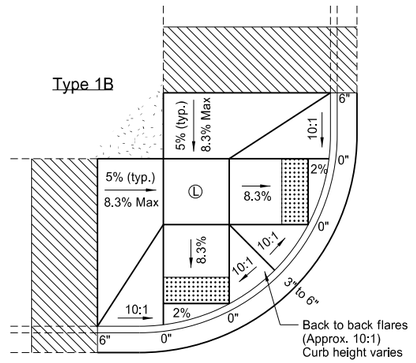
   Ramp width for shared-use paths should match the existing shared use path width.

   Ramp length shall be maximum of 15'.
2. Landings shall be a minimum of 4' x 4' and shall have a max 2% slope in any direction. Landings are desirably 5' x 5' or larger.
3. Detectable warning panels shall match the ramp width. Radial panels may also be used. The detectable warning panel may be located within the lower landing.
4. The pedestrian access route shall be continuous 4' min. width. Max 2% cross slope applies to all concrete, excluding flares.
5. Landscaping is preferred to modify existing ground slope changes as needed. If not possible, such as adjacent buildings, a vertical curb may be used as shown in the detail below. The curb will be paid for at the unit price bid for the item "Curb - Type I" per lineal foot.

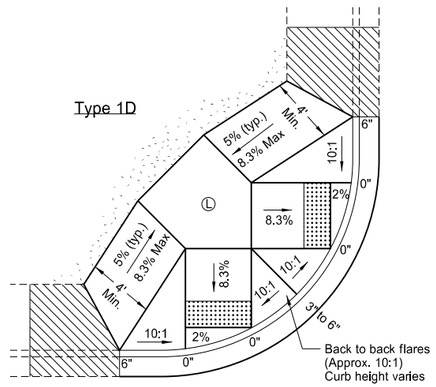
LEGEND:

- : Detectable Warning Panel
- : Landscaping
- : Transitional tie-in segment if needed for retrofits. Max grade slope 8.3%.
- Ⓛ : Upper Landing
- L : Lower Landing
- 0", 3", or 6" : Curb Height
- 8.3% : All slopes shown are max grades. Flatter slopes may be used.

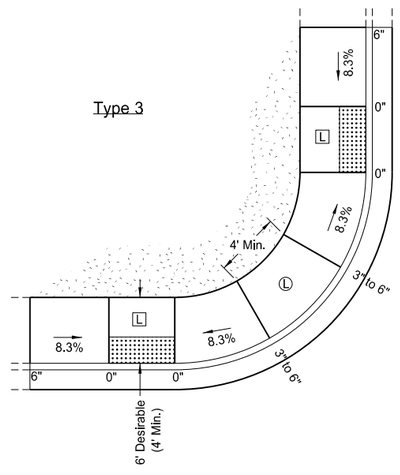
Type 1B




Type 1D

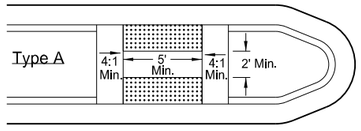



Type 3

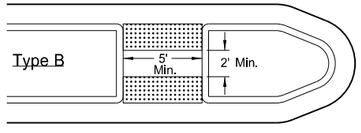


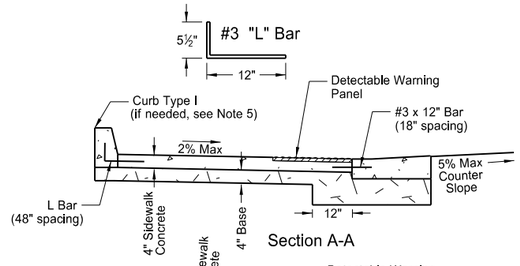

Median Refuge Islands (Cut-Through)

Type A

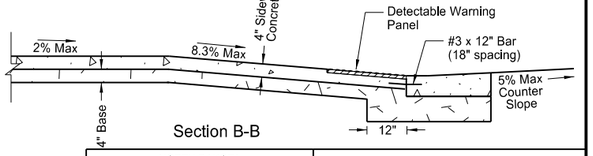



Type B

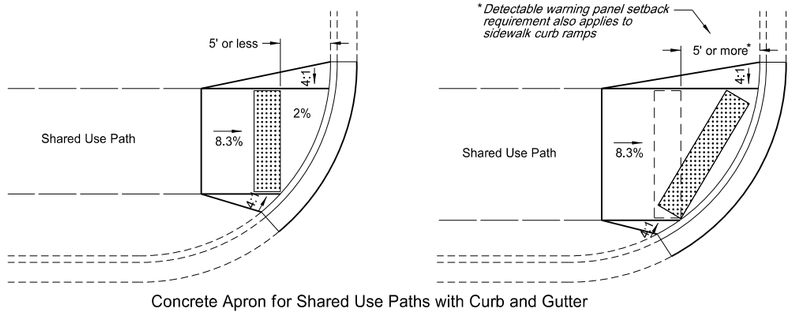


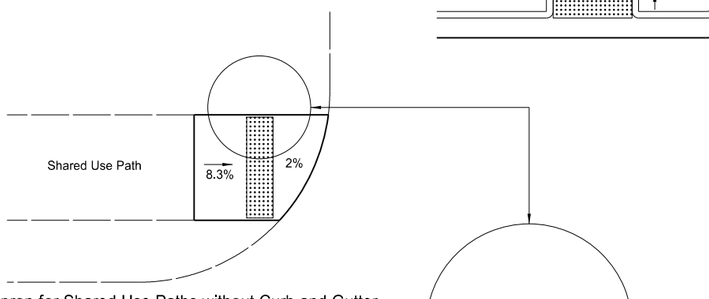

Section A-A



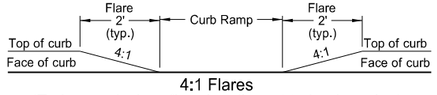

Section B-B



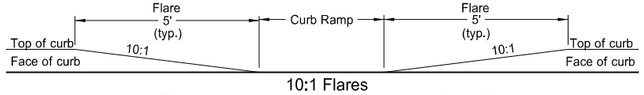

Concrete Apron for Shared Use Paths with Curb and Gutter




Concrete Apron for Shared Use Paths without Curb and Gutter




4:1 Flares
(To be used when flare is adjacent to landscaping)




10:1 Flares
(To be used when flare is adjacent to sidewalk)

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 11-26-13 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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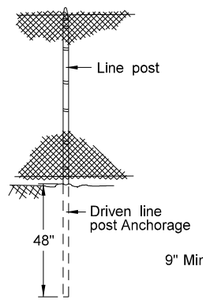
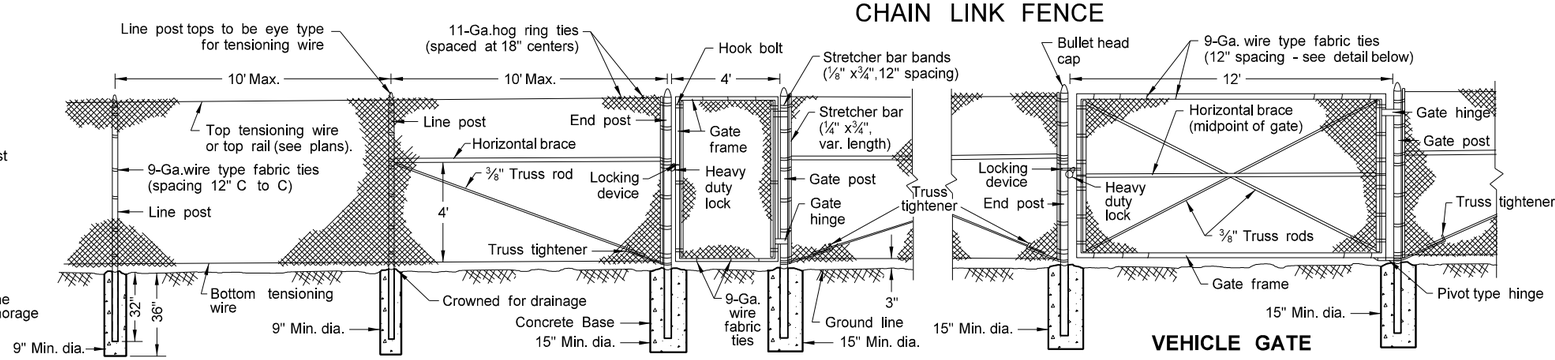
# CHAIN LINK FENCE

D-752-2

## ALTERNATE LINE POST ANCHORAGE




LINE POST

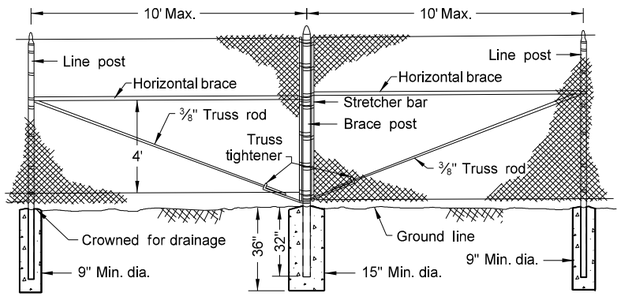



LINE POST

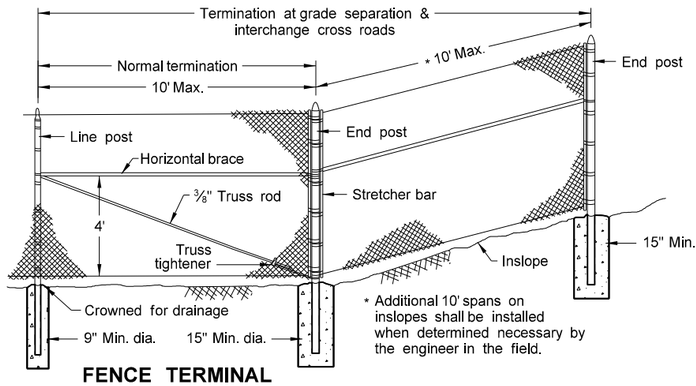
PEDESTRIAN GATE




VEHICLE GATE

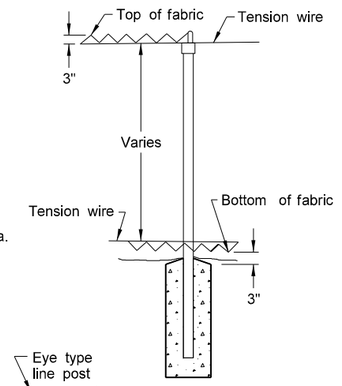


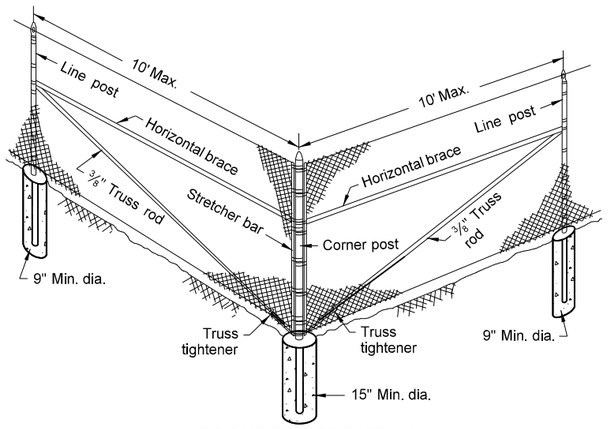

DOUBLE BRACE ASSEMBLY



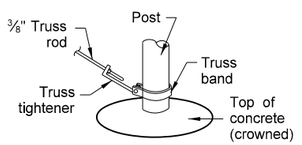

* Additional 10' spans on inslopes shall be installed when determined necessary by the engineer in the field.

FENCE TERMINAL

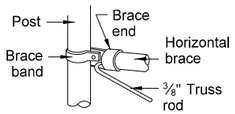


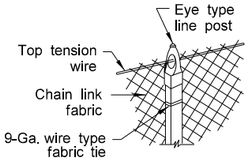

CORNER ASSEMBLY



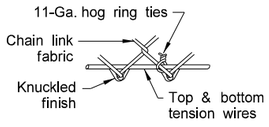

TRUSS ATTACHMENT AT TERMINAL POSTS



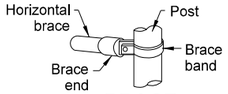

BRACE & TRUSS ATTACHMENT



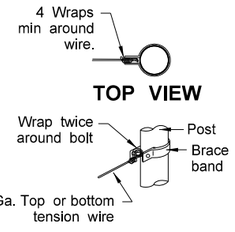

LINE POST TOP DETAIL



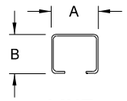

HOG RING FASTENER DETAIL



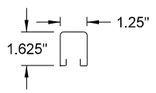

BRACE ATTACHMENT




TENSION WIRE ANCHORAGE

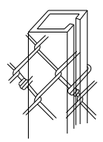



LINE POST

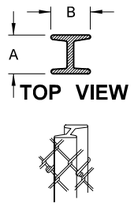



TOP & BRACE RAIL

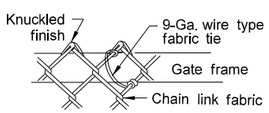
ROLL FORMED POST



ROLL FORMED POST




"H" COLUMN POST




WIRE TYPE FABRIC TIE DETAIL

STRETCHER BAR BAND

NOTES:

1. Double brace assemblies shall be installed at locations shown on the plans or established by the engineer. The distance between adjacent fence terminals, corner assemblies, or double brace assemblies shall not exceed 1000 feet. No deduction in measured pay length of chain link fence will be made for gates, corner assemblies, double brace assemblies, or fence terminals.
2. All miscellaneous fittings shall be of the type and size recommended by the manufacturer of the fence and approved by the engineer.
3. Height of fabric shall be 6' unless otherwise shown on the plans.
4. Concrete for the post bases shall be Class YE in accordance with Sec. 802 of the Standard Specifications. Course aggregate for concrete mix shall be size No. 4 or 5 at the option of the contractor but shall not be changed during the work except by written permission of the engineer.
5. The contractor shall have the option of using any of the types of posts shown in the table of equivalent post sizes and weights for the specified use.
6. Private fences shall not be connected to the highway right-of-way fence, but may be abutted next to the right-of-way fence.
7. A concrete anchorage shall be used for all end, corner, and brace posts, and for the first line post(s) adjacent to the terminal posts.

EQUIVALENT POST SIZES AND WEIGHTS

| USE OF POST | FABRIC HEIGHT | ROUND STEEL | | | ROLL FORMED | | | "H" COLUMN STEEL | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Size | Weight - Lbs./Ft. | | Size | | Weight | Size | | Weight |
| | | Out. Dia. | Grade 1 | Grade 2 | A | B | Lbs./Ft. | A | B | Lbs./Ft. |
| LINE POST | 6' or less | 1.900" | 2.72 | 2.28 | 1.875" | 1.625" | 2.40 | 2.25" | 1.70" | 3.26 |
| | Over 6' | 2.375" | 3.65 | 3.12 | 2.25" | 1.70" | 2.78 | 2.25" | 1.70" | 3.26 |
| END or CORNER | 6' or less | 2.375" | 3.65 | 3.12 | ROLL FORMED STEEL POSTS NOT PERMITTED | | | "H" COLUMN STEEL POSTS NOT PERMITTED | | |
| | Over 6' | 2.875" | 5.79 | 4.64 | | | | | | |
| BRACE POST | 6' or less | 2.375" | 3.65 | 3.12 | | | | | | |
| | Over 6' | 2.875" | 5.79 | 4.64 | | | | | | |
| GATE POST | 6' or less | 3.500" | 7.58 | 5.71 | | | | | | |
| | Over 6' | 4.000" | 9.11 | 6.56 | | | | | | |
| EXTERIOR FRAME FOR GATE | Gate width 6' or less | 1.660" | 2.27 | 1.84 | | | | | | |
| | Gate width over 6' | 1.900" | 2.72 | 2.28 | | | | | | |
| HORIZONTAL BRACE | All | 1.660" | 2.27 | 1.84 | 1.625" x 1.25" | | 1.35 | | | |

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

8-5-09

REVISIONS

| DATE | CHANGE |
|---|---|
| 9-28-10 | Revised Equivalent Post Sizes and Weights, details, & notes |

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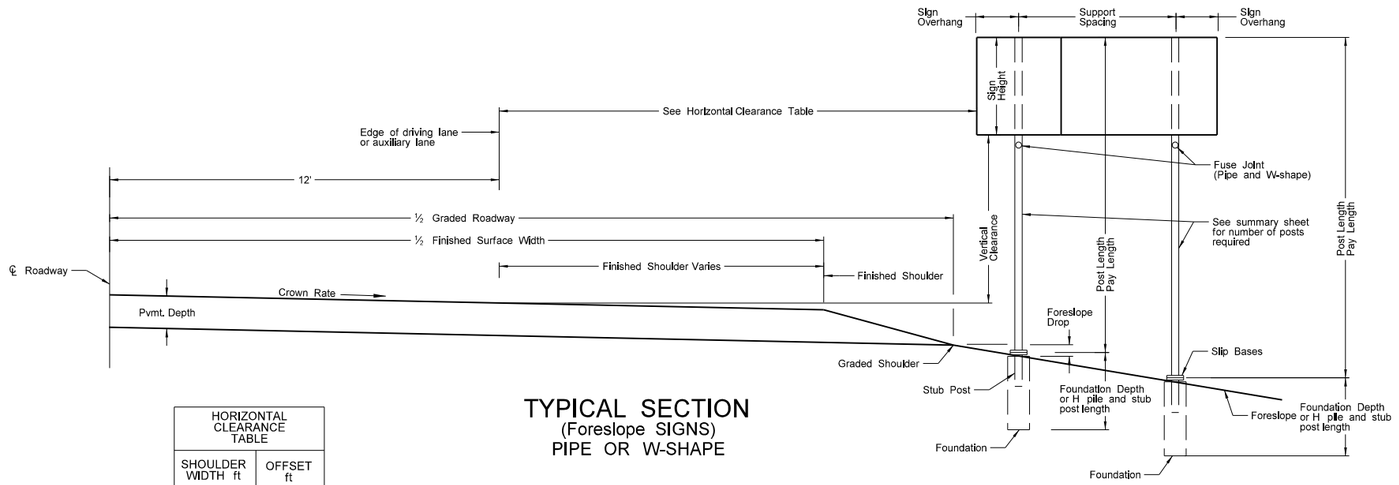
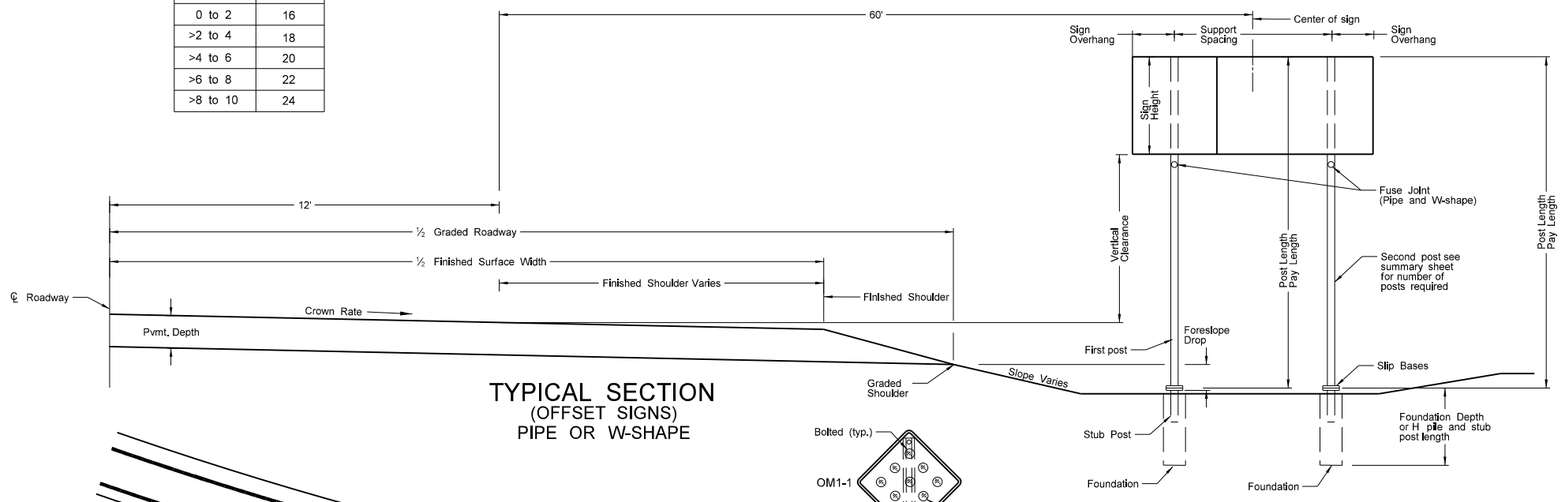
# PIPE OR W-SHAPE ASSEMBLY DETAILS

D-754-1

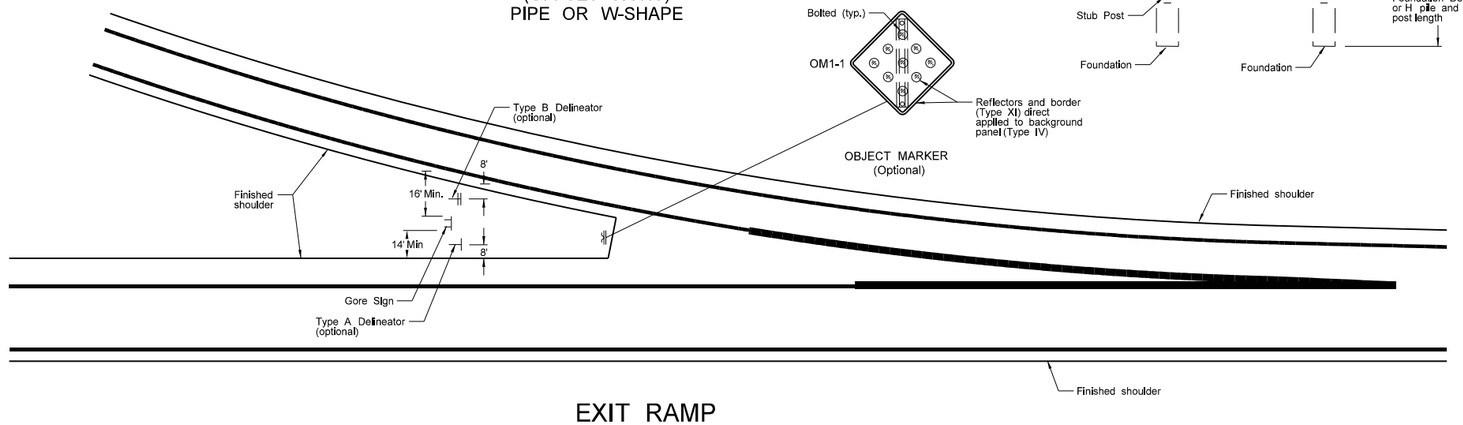



TYPICAL SECTION
(Foreslope SIGNS)
PIPE OR W-SHAPE

| 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

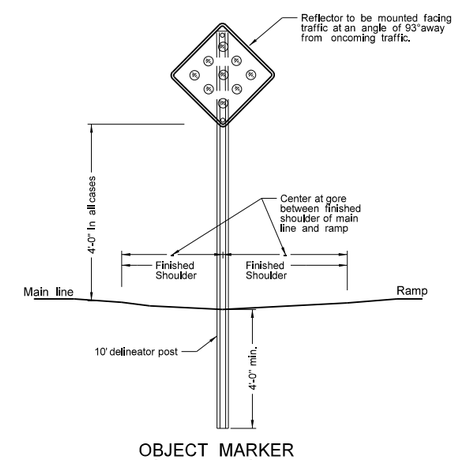
NOTES:

MINIMUM VERTICAL CLEARANCE:
Signs installed at the side of the road in rural districts shall be at least 5 feet measured from the bottom of the sign to the edge of driving lane, or Auxiliary Lane. Where parking or pedestrian movements occur, the clearance to the bottom of the sign shall be at least 7 feet.

Signs on freeways, expressways, and multi-lane conventional roadways shall be installed with a minimum height of 7 feet.

Where signs are placed at least 30 feet or more from the edge of the traveled way, the height to the bottom of such sign shall be 5 feet above the edge of driving lane.

Signs may be placed a maximum of 6" above the vertical clearance specified above.




OBJECT MARKER
INSTALLATION
(Posts shall conform to section 894.04 A of Standard Specifications.)

| 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. |

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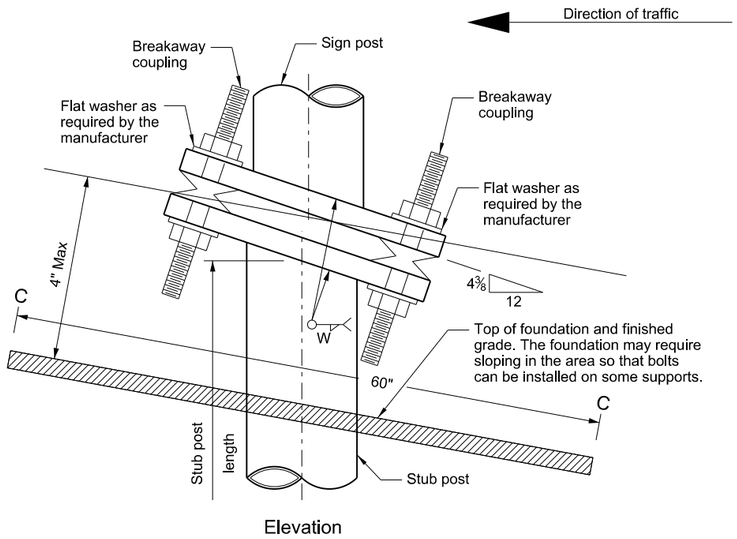
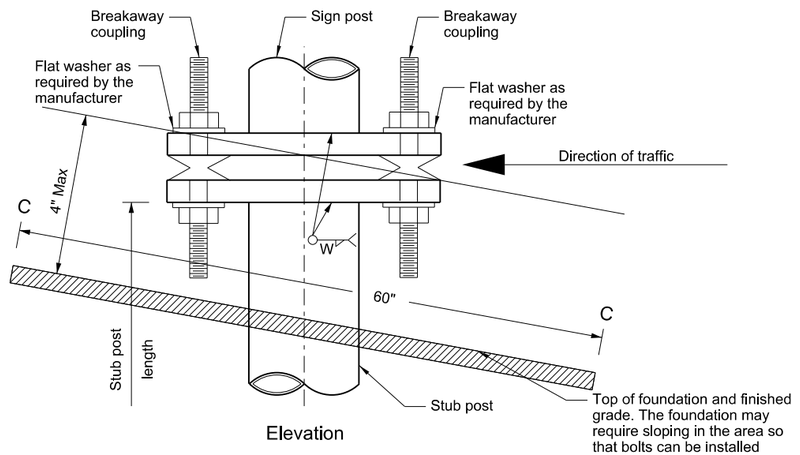
# D-754-2




Elevation

Single Post Sign and Stub Post
Type A

## Breakaway Coupler System for Standard Pipe Stub Post

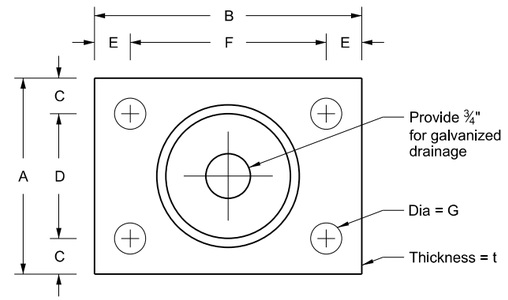



Elevation

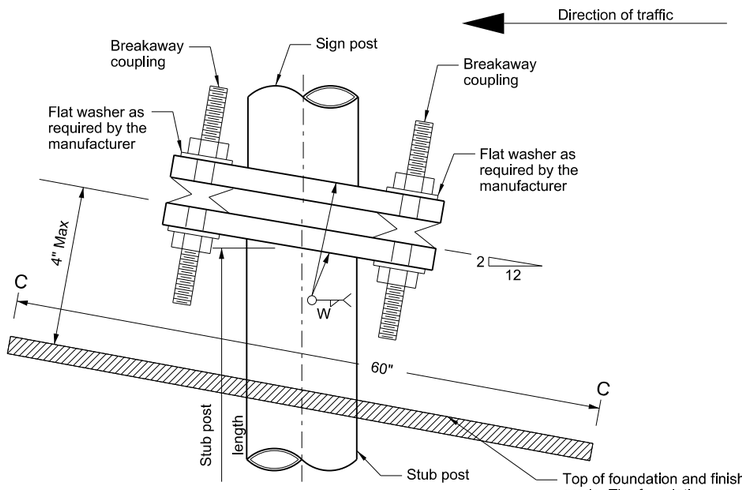
Two or More Post Sign and Stub Post
For two post signs with 8' or more post spacing and all three or more post signs
Type C

Notes:

1. In lieu of the breakaway base system on standards D-754-3 and D-754-4 the breakaway coupler system may be used. The breakaway coupler system shall be 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. Fuse Joint Cuts - Steel posts may be cut after galvanizing and cut surface treated in accordance with ASTM A780 or the cut may be galvanized after fabrication. Aluminum posts will need no treatment.
3. Shim as required to plumb post.
4. Tighten all bolts the maximum possible with 12" to 15" wrench.

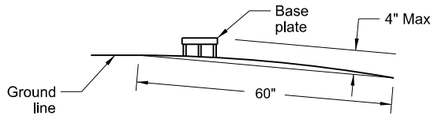



Plan Base Plate




Elevation

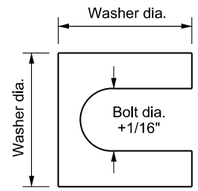
Two Post Sign and Stub Post
For signs with less than 8' post spacing
Type B




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 | Base Table Data: 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. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 10-3-2013 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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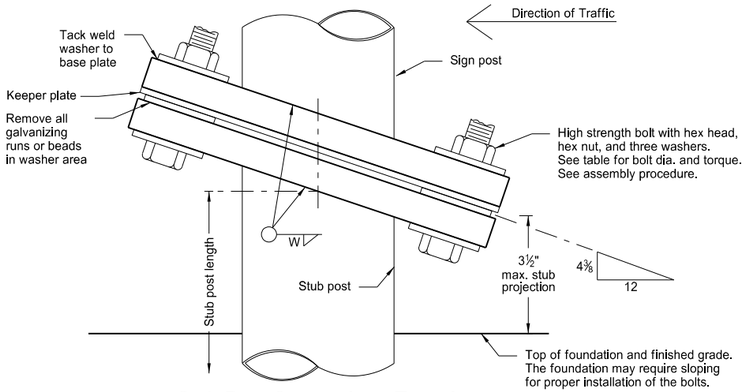
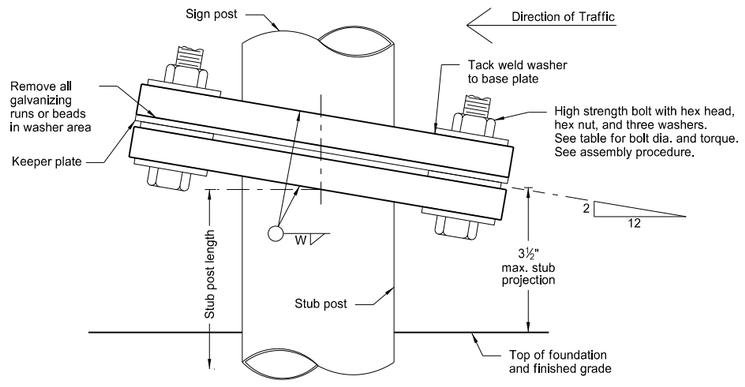
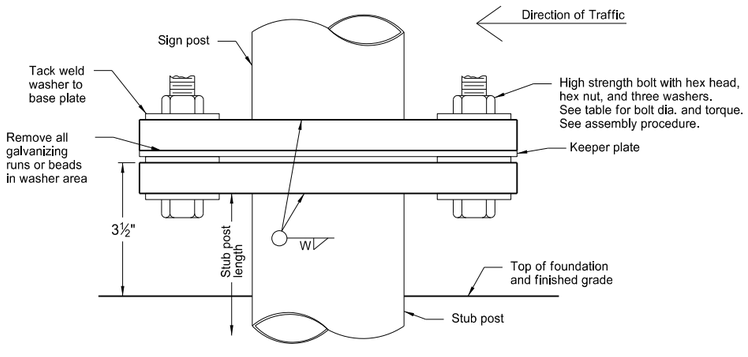
# Breakaway System for Standard Pipe Stub Post



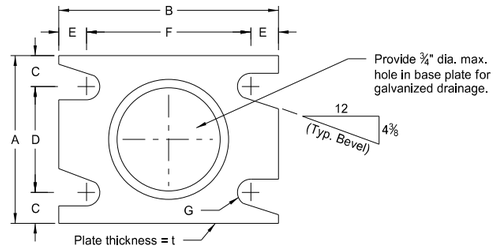

## Stub Post Connection - Type A
Elevation View
(Single Post)



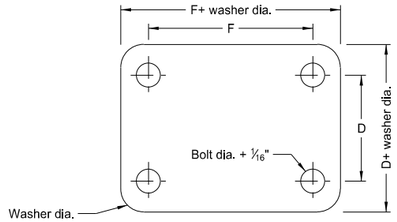

## Stub Post Connection - Type B
Elevation View
(Two Posts)



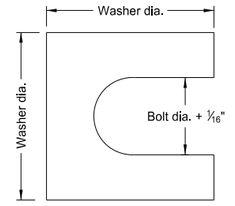

## Stub Post Connection - Type C
Elevation View
(Two Posts)




## Base Plate Plan View
The bevel shall be toward the roadway on the approach side and away on the other.




## Keeper Plate Detail
Keeper plate shall be placed above the center washer between the top and bottom slip bases. Keeper plate shall be fabricated from 28 gauge material, galvanized after fabrication conforming to ASTM A653 G60 coating.




## 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.

Notes:
When the base plate is fabricated in aluminum, the aluminum base plate washers shown shall be tack welded to the base as shown.

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

Assembly Procedure:
1. Assemble post to stub with bolts and with 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 and 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. The liquid locking resin shall conform to ASTM D5363-03 (2008). The thread locker shall secure the entire assembly from vibration, pressure and corrosion. The thread locker shall fill the gaps between the thread and the mating surface to form solid, one part assemblies.
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 | |
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| 11-21-11 | |
| REVISIONS | |
| DATE | CHANGE |
| 2-28-14 | Removed lower post and foundation details. |

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# 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. All reinforcing steel shall be Grade 60 steel.

NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

10-3-13

REVISIONS

| DATE | CHANGE |
|---|---|
| | |

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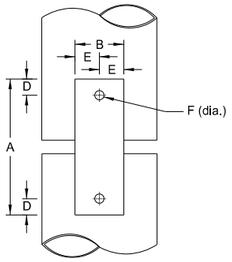
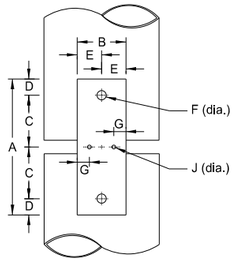
# Hinge Plate, Fuse Plate and Foundation Details for Standard Pipe

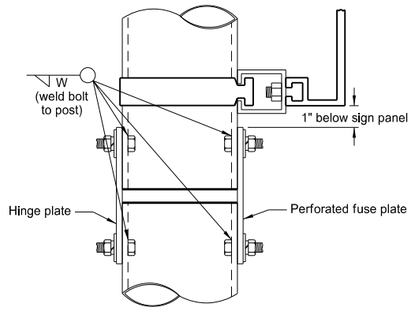
D-754-6



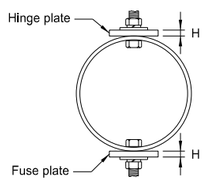

Hinge Plate



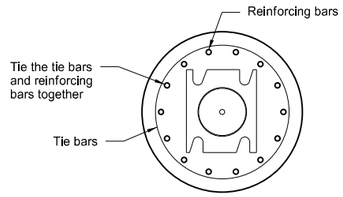

Perforated Fuse Plate




Side View




Top View




Top View

See standard drawing D-754-5 for size, number and length of rebar. If using Type D only 3 bolt base plate is required.

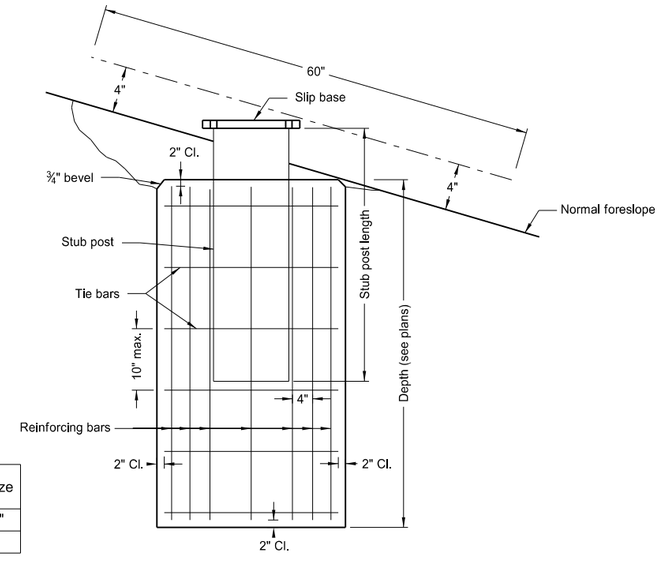
Notes:
Fuse joints cuts for steel posts may be cut after galvanizing and cut surface shall be treated with an approved method meeting ASTM A780 or the cut may be galvanized after fabrication. Aluminum posts will not require treatment.

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

The vertical clearance of the break-away base, 4" height and 60" clearance, shall be made above and below post location, and also back and ahead of post.

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.




Foundation
Front View

Foundation detail for breakaway base with stub post connection.

| Foundation diameter | Post Size |
|---|---|
| 1'-4" | 3½"-4" |
| 1'-9" | 5"-6" |

| Round Metal Posts | | | | | | | |
|---|---|---|---|---|---|---|---|
| Dimensions | | | | Properties | | | |
| Nominal dia. in. | Outside dia. in. | Inside dia. in. | Wall Thickness in. | Weight per Foot Pound | Moment of Inertia in.$^4$ | 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" |

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| | |

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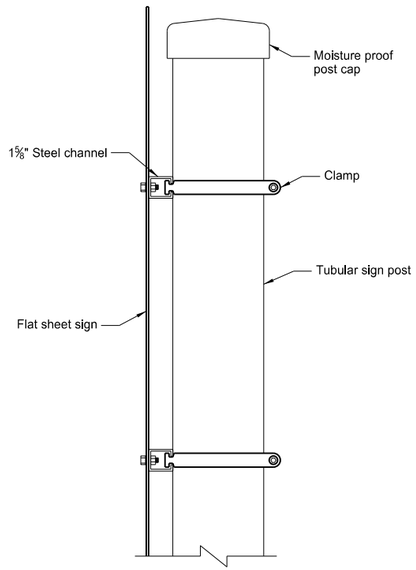
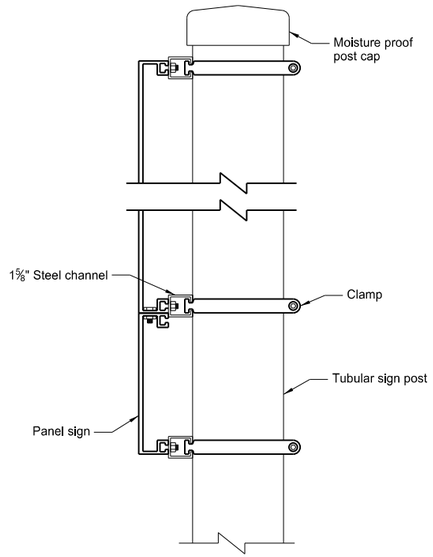
# PIPE SUPPORT AND SIGN MOUNTING DETAILS

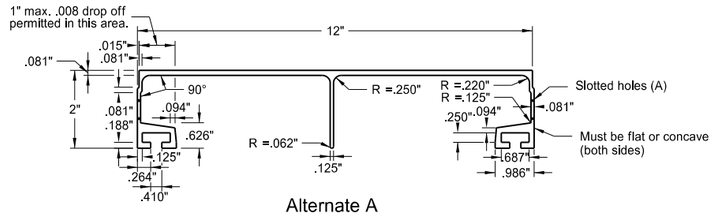
D-754-7



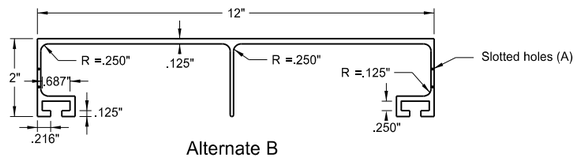

Side View



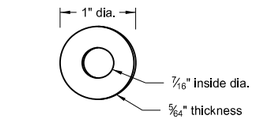

Side View




Alternate A
12" Extruded Panel




Alternate B
12" Extruded Panel




Flat Washer Detail




Slotted Hole Detail

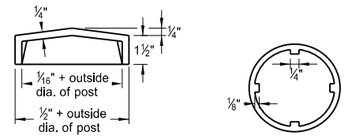
6" Extruded Panel

## Aluminum Panel Details

(A) Slotted holes shall be punched in the aluminum panels at 1'-0" on center, spacing 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. |

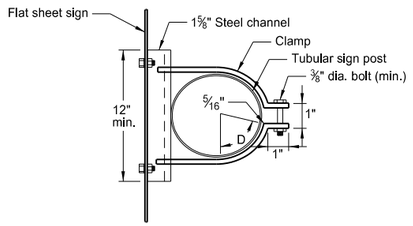
Wall thickness = .078" unless specified otherwise.
All inside and outside corners = .031" radius unless specified otherwise.




Side View Top View

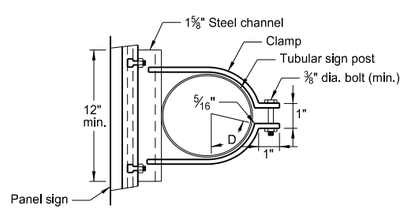
## Post Cap Detail

Post caps shall be furnished for all steel or aluminum posts.
In place of post cap, a ⅛" plate welded all around may be used.



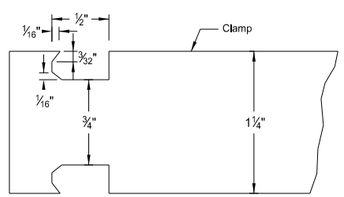

Top View

Flat Sheet Sign Clamp Mounting Details

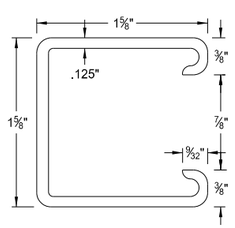



Top View

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 | 29⅝ |

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| | |

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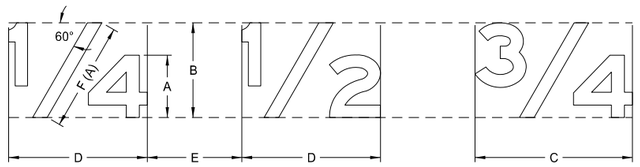
# LETTER AND ARROW DETAILS FOR VARIABLE LENGTH SIGNS

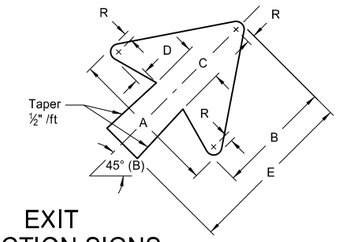
D-754-9




SIZE OF THE FRACTION IS DETERMINED 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 |

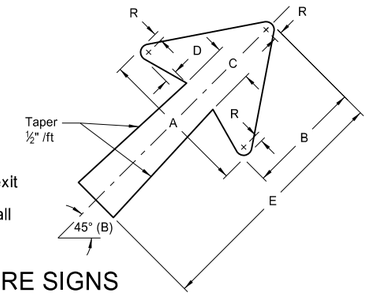
(A) Diagonal stroke of fraction is to be centered optically.




EXIT
DIRECTION SIGNS

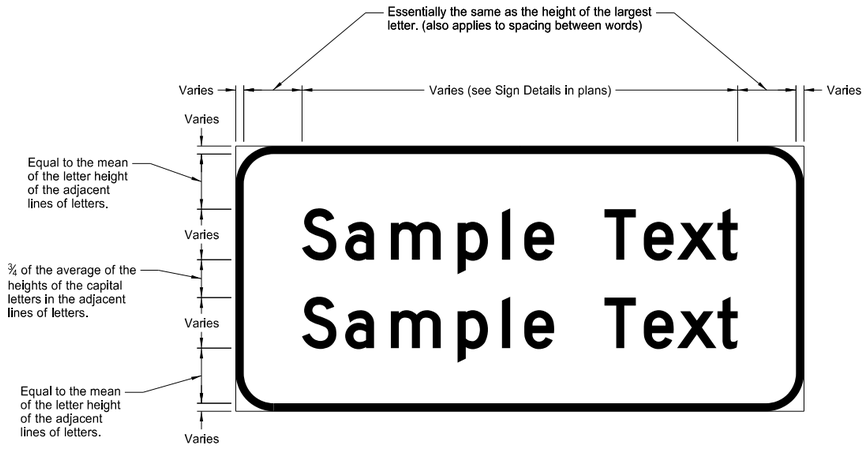
| LETTER SIZE (Upper Case) | A | B | C | D | E | R |
|---|---|---|---|---|---|---|
| 8" | 15⅛" | 11 9/16" | 3¾" | 1 5/16" | 17" | 13/16" |
| 10" - 13⅓" | 18¼" | 14" | 4½" | 1½" | 20" | ¾" |
| 16" - 20" | 22¼" | 17" | 5⅜" | 1¾" | 25" | 1" |

(B) When there is no exit number in the sign face, the arrow shall be at 30°

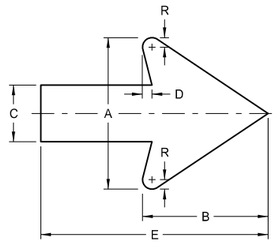



GORE SIGNS

| "EXIT" LETTER SIZE (Upper Case) | A | B | C | D | E | R |
|---|---|---|---|---|---|---|
| 8" | 15⅛" | 11 9/16" | 3¾" | 1 5/16" | 25" | 13/16" |
| 10" - 13⅓" | 18¼" | 14" | 4½" | 1½" | 30" | ¾" |

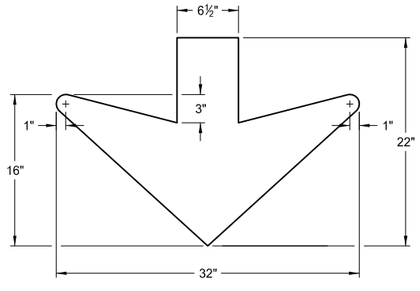



TYPICAL SPACING




DISTANCE AND
DESTINATION SIGNS

| LETTER SIZE (Upper Case) | A | B | C | D | E | R |
|---|---|---|---|---|---|---|
| 4" | 4" | 3 5/16" | 1½" | ¼" | 6" | ¼" |
| 6" | 6" | 4⅞" | 2¼" | ⅜" | 9" | ⅜" |
| 8" | 8" | 6⅝" | 3" | ½" | 12" | ½" |
| 12" | 12" | 10" | 4½" | ⅞" | 18" | ⅞" |




DOWN ARROW

| 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 |

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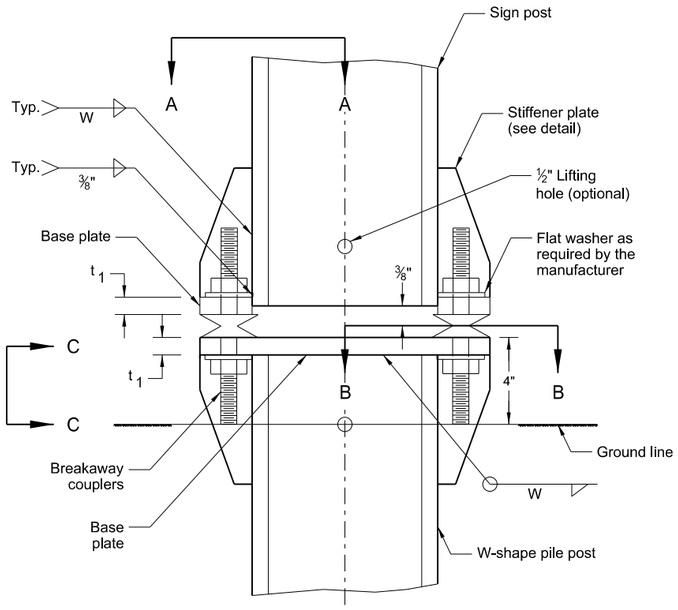
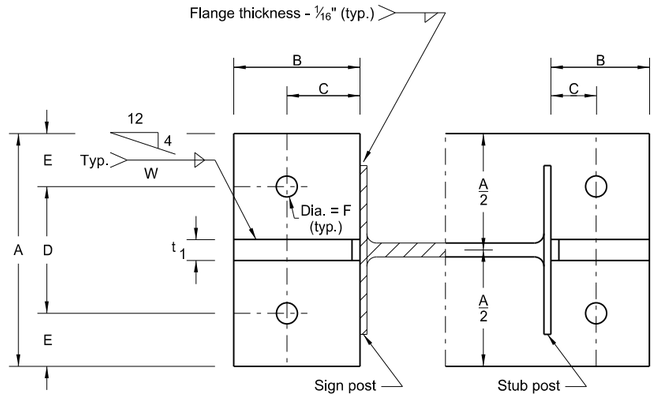
# Breakaway Coupler System
# Structural Details
# for W-Shape Supports

D-754-12



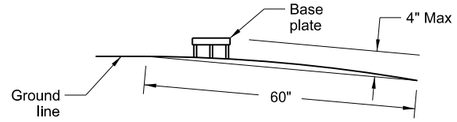

Sign Post and Stub Post
Elevation




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

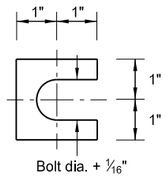
Notes:

1. In lieu of the breakaway base system shown on standard D-754-13 the breakaway coupling system may be used. The breakaway coupling system shall be 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. Structural steel shall conform to Sec. 894.03 B.6. High strength bolts shall conform to ASTM - A325. Refer to"Sign Summary" sheet for specific data on each individual sign installation.
3. Assembly procedure according to the manufacturer's recommendations.

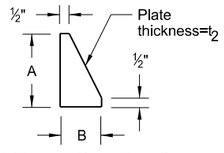



Section C - C

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.



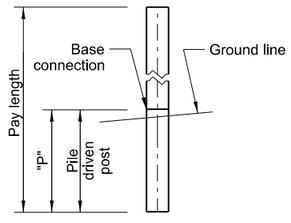

Shim Detail




Stiffener Plate Detail
(See Table for Dimensions)

Furnish 2 - .012"± thick and 2 - .032"± thick shims per post. Shims shall be fabricated 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 |

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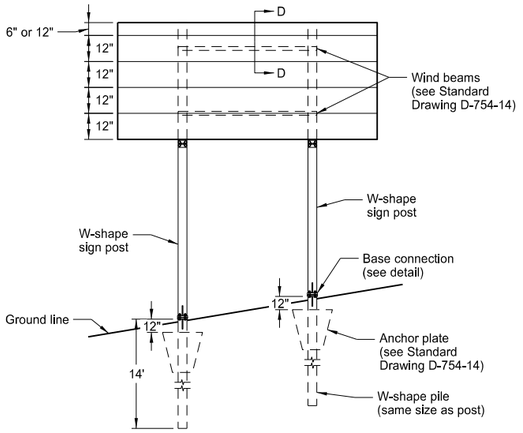
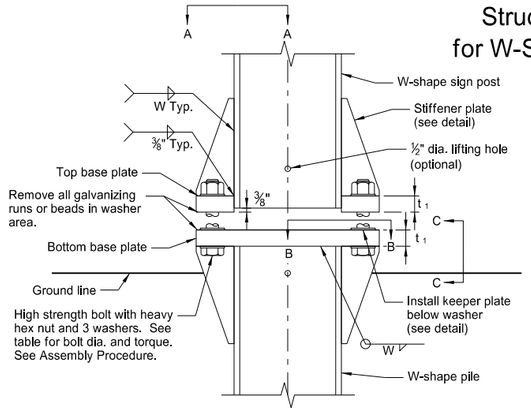
# Breakaway System Structural Details for W-Shape Supports

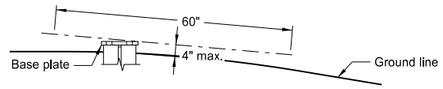
D-754-13




Typical Panel Mounting on W-shape Sign Posts

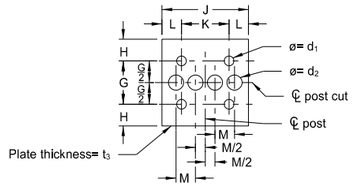



Base Connection Detail

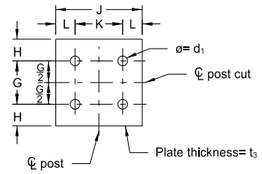



Section C-C
Stub Height Requirements

Maximum projection of base plate shall not extend above 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:

Structural steel shall conform to Section 894.03 B.6 of the Standard Specifications. High strength bolts shall conform to ASTM A325.

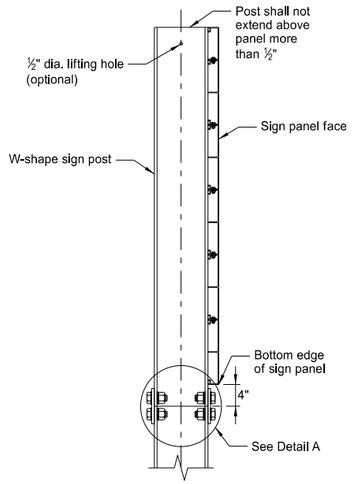
Refer to Sign Summary sheet for specific data on each individual sign installation.

Perforated fuse plate shall be installed on side of post facing traffic.

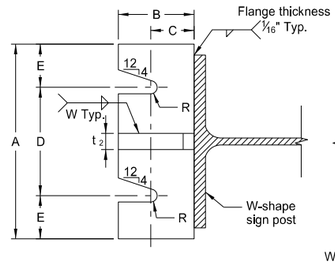
All posts shall be saw cut. Plates may be sheared or flame cut using a mechanically guided cutting torch in accordance with Section 754.04 D.4.b of the Standard Specifications. Edge preparation shall be in accordance with Section 754.04 D.4.c of the Standard Specifications.

Assembly Procedure:

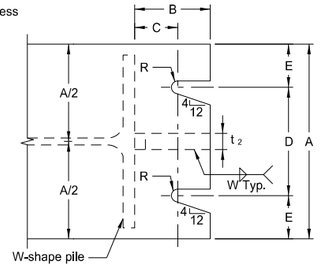
1. Assemble base plates together with bolts and with one flat washer between top base plate and the keeper plate.
2. Shim as required to plumb post.
3. Tighten all base connection bolts the maximum possible with 12" to 15" wrench to bed washers and shims and to clean bolt threads.
4. Loosen each bolt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




Fuse Joint
(Side View)

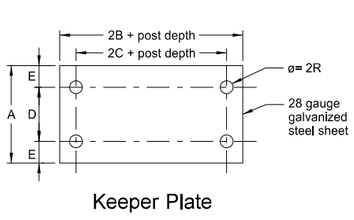



Section A-A

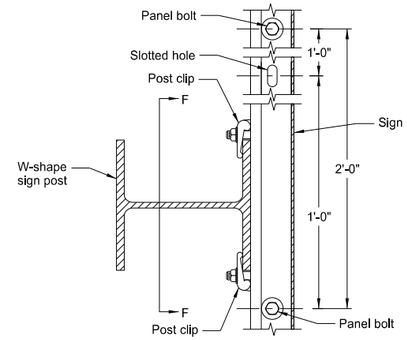



Section B-B

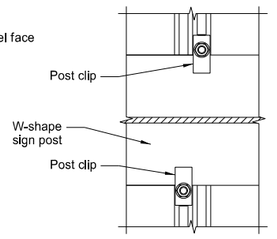
Sections shown are for installations on right shoulder. Installations on the left shoulder shall have the plate slot bevels reversed.




Keeper Plate

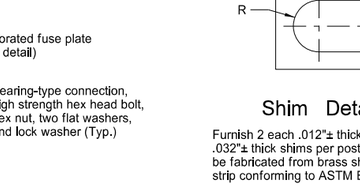



Section E-E

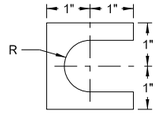



Section F-F

Post clips shall be installed on both sides of each post at each panel joint as indicated.

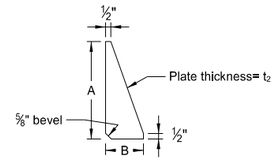



Detail A

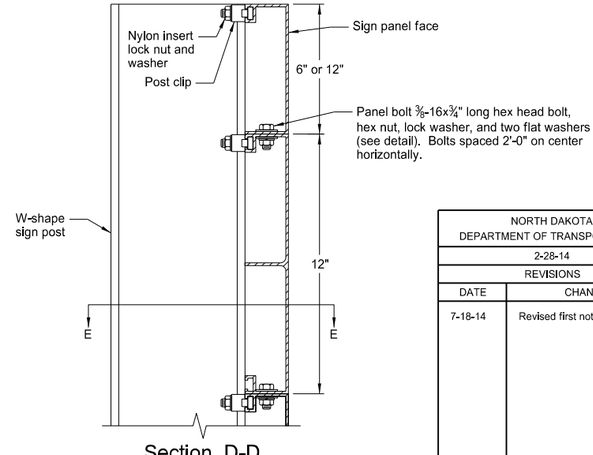



Shim Detail

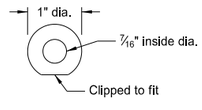
Furnish 2 each .012"± thick and 2 each .032"± thick shims per post. Shims shall be fabricated from brass shim stock or strip conforming to ASTM B36.




Stiffener Plate




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 | 3/4" ø x 3 1/2" Torque = 600 in-lb | 6" | 2 1/2" | 1 1/2" | 3 1/2" | 1 1/4" | 1" | 1/2" | 1/4" | 13/32" | 2" | 1 1/4" | 4" | 2 1/4" | 7/8" | 1" | 11/16" | 3/4" | 3/8" | 5/8" |
| W5x16 | 3/4" ø x 3 1/2" Torque = 600 in-lb | 6" | 2 1/2" | 1 1/2" | 3 1/2" | 1 1/4" | 1" | 1/2" | 1/4" | 13/32" | 2 1/2" | 1 1/4" | 5" | 2 3/4" | 1 1/8" | 1 1/8" | 13/16" | 7/8" | 3/8" | 3/4" |
| W6x20 | 7/8" ø x 4 1/4" Torque = 800 in-lb | 8" | 3" | 1 3/4" | 4" | 2" | 1 1/4" | 1/2" | 1/4" | 15/32" | 2 1/2" | 1 1/4" | 6" | 3 1/2" | 1 1/4" | 1 3/8" | 13/16" | 1 1/8" | 3/8" | 3/4" |
| W8x24 | 7/8" ø x 4 1/4" Torque = 800 in-lb | 8" | 3" | 1 3/4" | 4" | 2" | 1 1/4" | 1/2" | 1/4" | 15/32" | 2 1/2" | 1 1/2" | 6 1/2" | 3 1/2" | 1 1/2" | 1 1/2" | 15/16" | 1 1/4" | 1/2" | 7/8" |
| W8x28 | 1" ø x 5" Torque = 1000 in-lb | 8" | 3" | 2" | 4" | 2" | 1 1/2" | 3/4" | 5/16" | 17/32" | 2 1/2" | 1 1/2" | 6 1/2" | 3 1/2" | 1 1/2" | 1 5/8" | 1 1/16" | 1 1/8" | 1/2" | 1" |
| W8x31 | 1 1/8" ø x 5" Torque = 1200 in-lb | 9" | 3 1/2" | 2" | 5" | 2" | 1 1/2" | 3/4" | 5/16" | 19/32" | 3" | 1 3/4" | 8" | 5 1/2" | 1 1/4" | 2" | 1 1/16" | 1 1/2" | 1/2" | 1" |
| W10x39 | 1 1/8" ø x 5" Torque = 1200 in-lb | 9" | 3 1/2" | 2" | 5" | 2" | 1 1/2" | 3/4" | 5/16" | 19/32" | 3" | 1 3/4" | 8" | 5 1/2" | 1 1/4" | 1 7/8" | 1 3/16" | 1 3/8" | 1/2" | 1 1/8" |

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 2-28-14 | |
| REVISIONS | |
| DATE | CHANGE |
| 7-18-14 | Revised first note |

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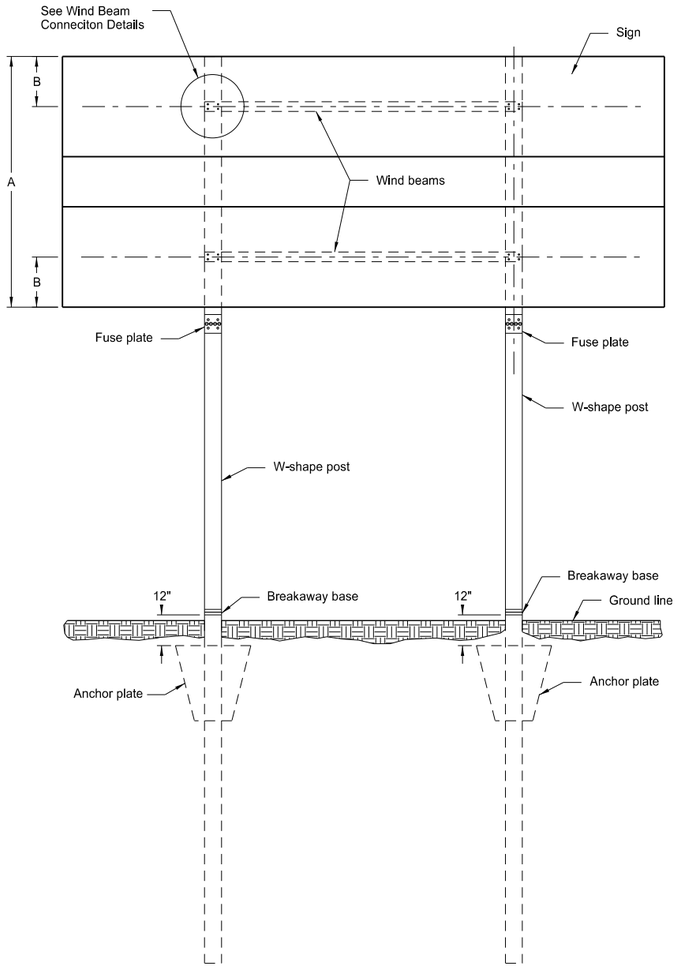
# WIND BEAMS AND ANCHOR PLATES FOR W-SHAPE SUPPORTS



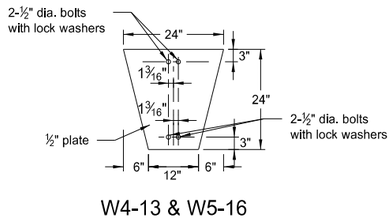

## ASSEMBLY DETAIL FOR WIND BEAMS AND ANCHOR PLATES

Notes:

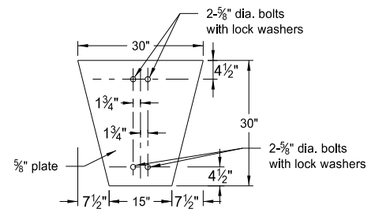
The B distance is calculated by the following formula, B=A/4.

The wind beam shall conform to Section 894.03 B.6 of the Standard Specifications.

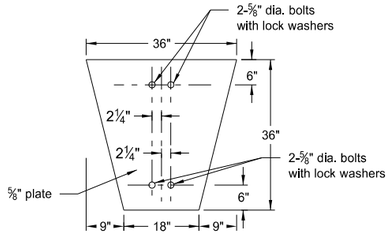
The bolts shall conform to requirements of ASTM A307 and galvanized according to ASTM A153.




W4-13 & W5-16

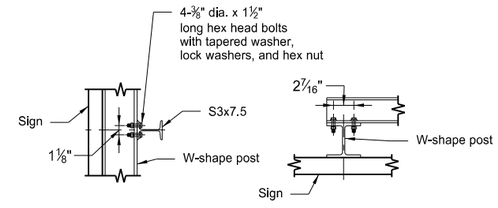



W6-20, W8-24 & W8-28



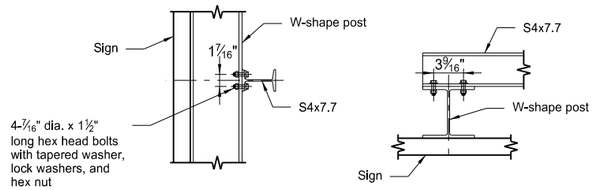

W8-31 & W10-39

## ANCHOR PLATE DETAILS



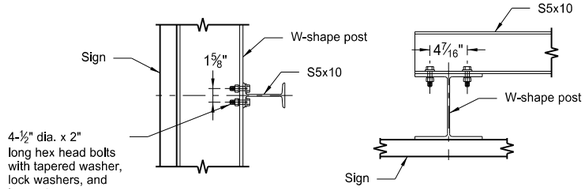

End View Top View

W4-13 & W5-16



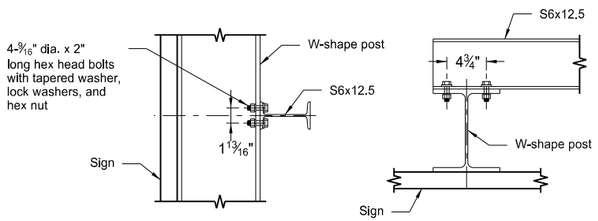

End View Top View

W6-20, W8-24 and W8-28




End View Top View

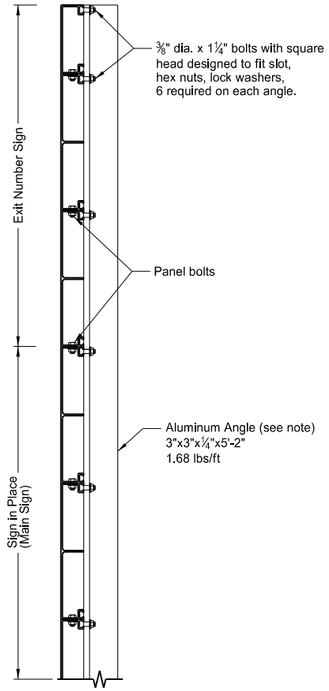
W8-31




End View Top View

W10-39

## WIND BEAM CONNECTION DETAILS




## ASSEMBLY DETAIL FOR EXIT NUMBER SIGNS

Note: Two aluminum angles required on each sign. The distance between angles varies depending on post spacing of sign in place. Angles shall be placed as near as possible to posts. The Engineer shall determine the exact location.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 10-3-13 | |
| REVISIONS | |
| DATE | CHANGE |
| 7-8-14 | Revised second note |

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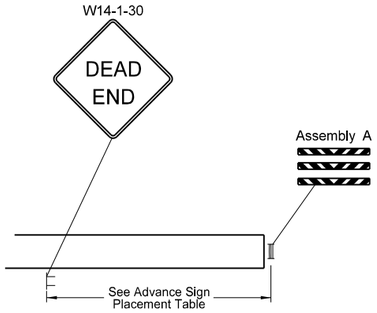
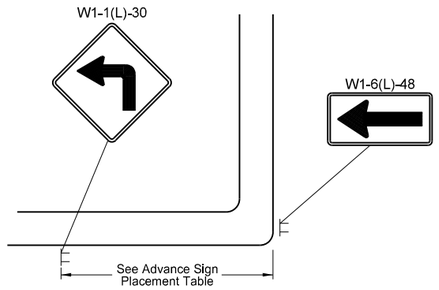
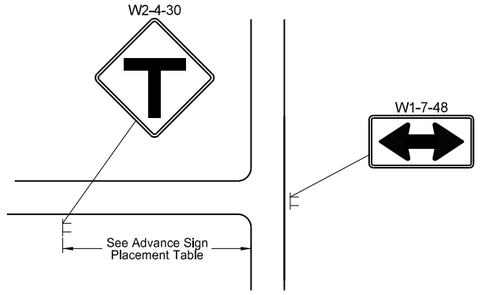
# BARRICADE AND ADVANCE SIGNS FOR FORWARD ROADWAY TERMINATION




Roadway Termination with Dead End Type A




Roadway Termination with Right or Left Turn Type B




Roadway Termination with T-Intersection Type C

Notes:

Barricade Rails: Rails shall be 8" or 9" x 120". Barricade rail shall be fabricated from anodized aluminum and shall be attached to the perforated tube posts with ⅜" diameter bolts placed between the reinforcing ribs, two bolts per post.

Barricade Supports: Barricade supports shall be made of material as specified for sign supports.

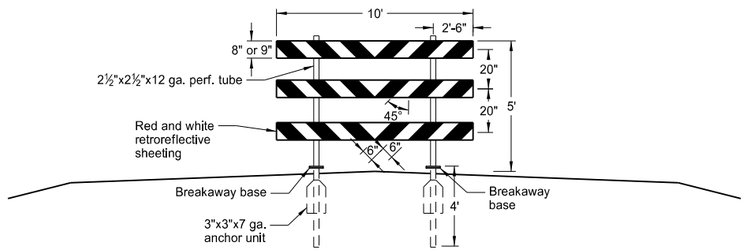
Method of Measurement: The number of each location completed, in place, and accepted by the Engineer.

Basis of Payment: The number of locations. The unit price bid for each location shall be full compensation for furnishing, delivering, and installing all necessary signs and barricades at each location shown on the plans or directed by the Engineer.

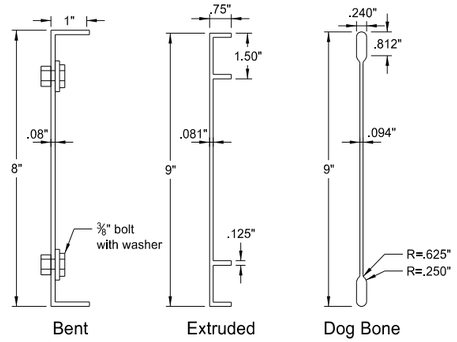
Vertical Clearance: 5' minimum, 7' residential and business districts where parking and/or pedestrian movements will occur.

Breakaway base and anchor unit as shown on D-754-24 or D-754-24A.

Reflective sheeting shall be Type XI.




Type III Barricade Assembly A



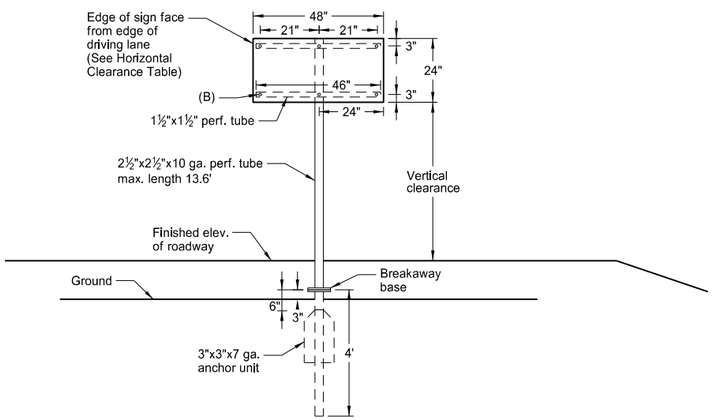

Barricade Bar Details

| 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 |

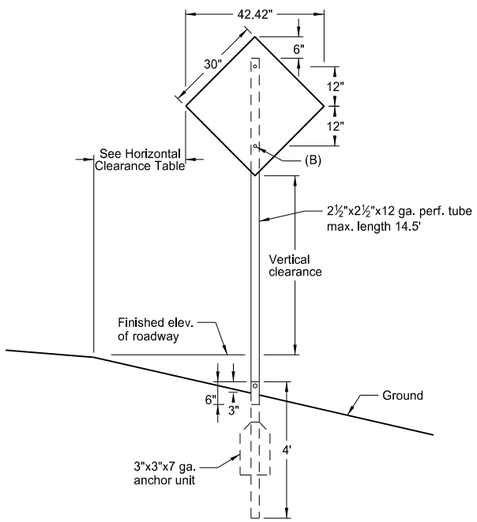
| Advance Sign Placement Table (A) | |
|---|---|
| Posted or 85th Percentile Speed | Minimum Distance |
| 0 to 40 mph | 125 ft |
| 45 mph | 175 ft |
| 50 mph | 250 ft |
| 55 mph | 325 ft |
| 60 mph | 400 ft |
| 65 mph | 475 ft |
| 70 mph | 550 ft |
| 75 mph | 650 ft |

(A) If roadway termination is ½ mile or less from a section line road, the advanced warning sign shall be placed just after the section line road.

(B) Holes to be punched round for ⅜" fasteners.




Assembly Detail for Directional Arrow Signs




Assembly Detail for 30" Signs

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 10-3-13 | |
| REVISIONS | |
| DATE | CHANGE |
| 11-4-13 | Non bkwy base for 30" signs |
| 7-8-14 | Note added for Refl. sheeting and revised Assembly detail for directional arrow signs. |

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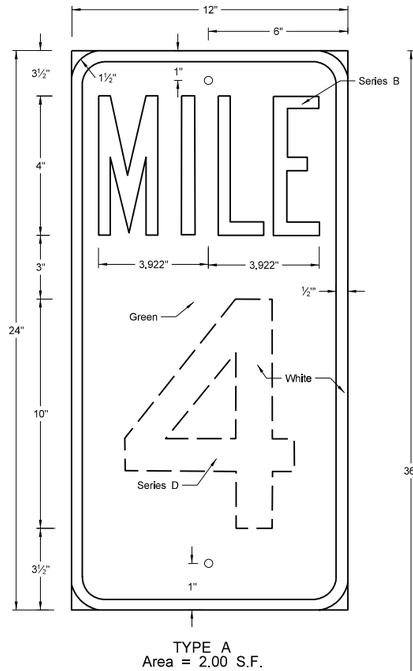
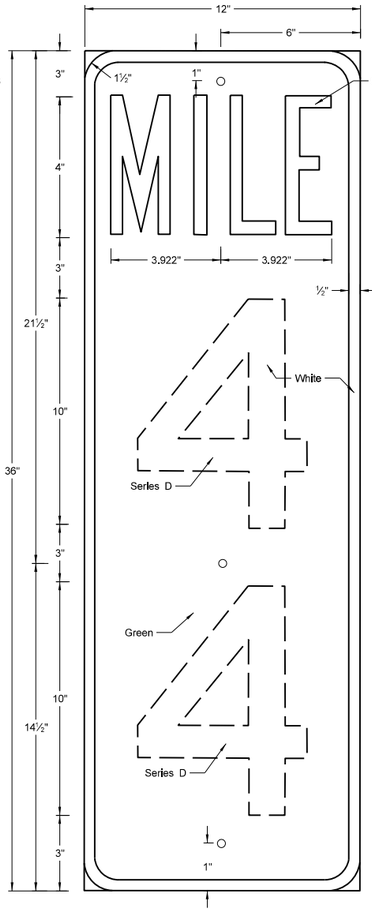
# (EXPRESSWAY-FREEWAY USE) MILE POSTS

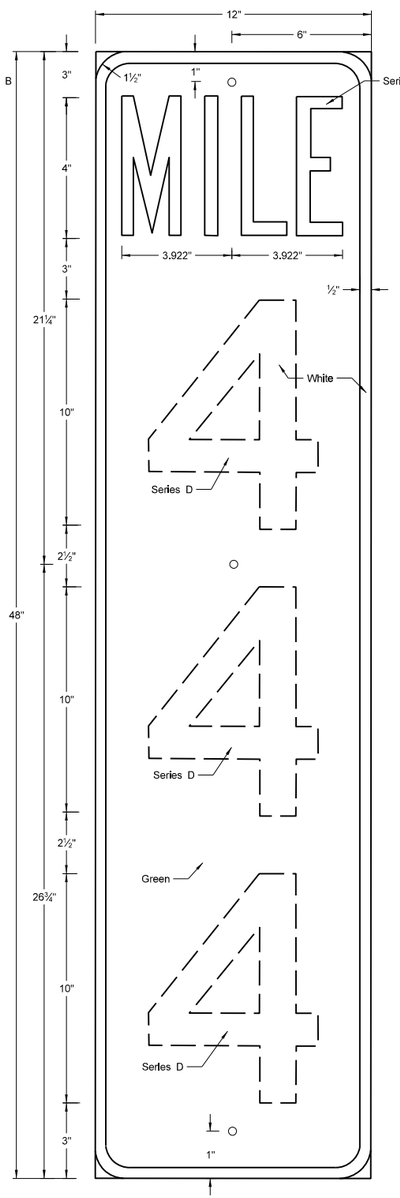
D-754-20



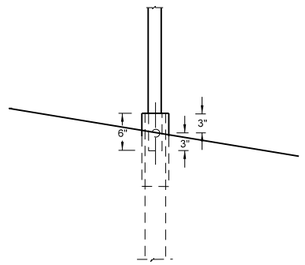

TYPE A
Area = 2.00 S.F.




TYPE B
Area = 3.00 S.F.

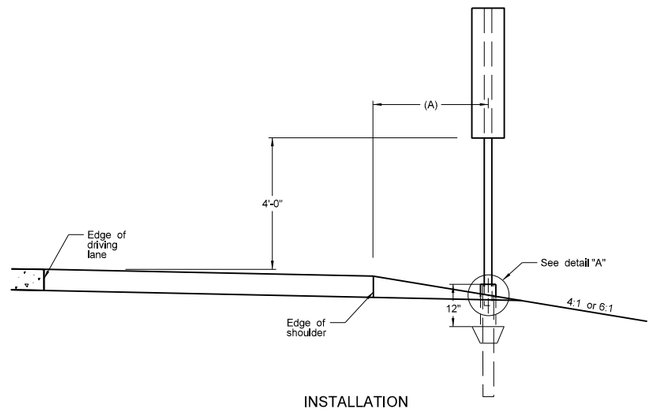



TYPE C
Area = 4.00 S.F.




DETAIL "A"

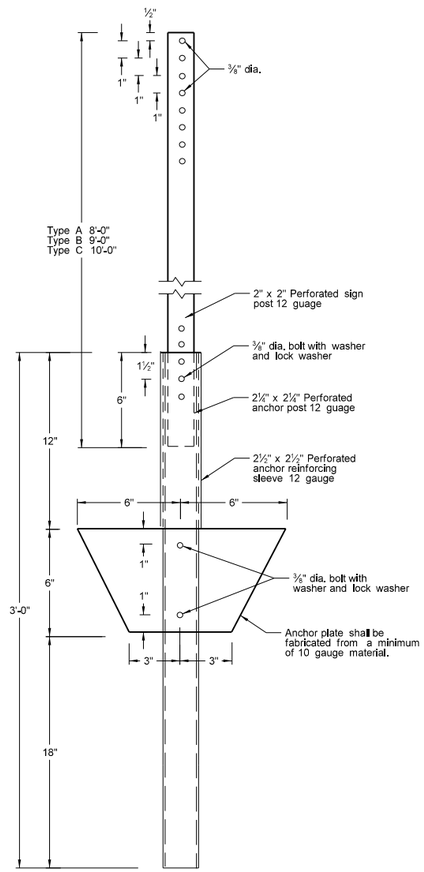
(A) 8' Clearance to finished shoulder or in line with existing delineator posts




INSTALLATION




ASSEMBLY DETAIL




POST AND ANCHOR PLATE DETAIL

NOTES:
Installation: Posts shall be installed along right shoulder in line with delineators.

Mile Sign Backing: Backing shall be fabricated of 0.080 aluminum. Sheeting shall conform to section 894.01 of the Standard Specifications.

Posts: Posts shall conform to section 894.03 of the Standard Specifications.

Fasteners: The mile signs shall be attached to the post by tension pin type fastener or other suitable vandal resistant non-rust fastener.

Reflective Sheeting: Sheeting shall be Type IV.

Numbers: Numbers shall be of the series shown and may be screened or applied copy. Screening and reflective sheeting for applied copy shall conform to section 754 & 894 of the Standard Specifications.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 12-1-10 | |
| REVISIONS | |
| DATE | CHANGE |
| 7-8-14 | Revised post and reflective sheeting notes |

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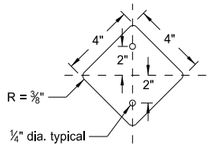
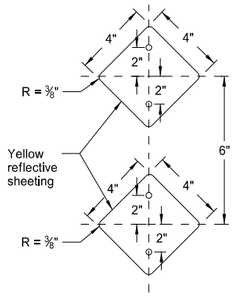
# REFLECTORIZED DELINEATORS

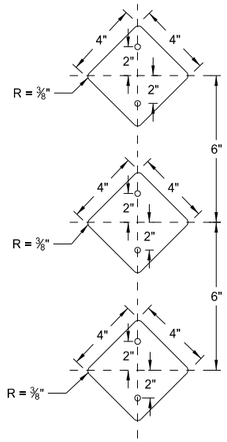
D-754-21



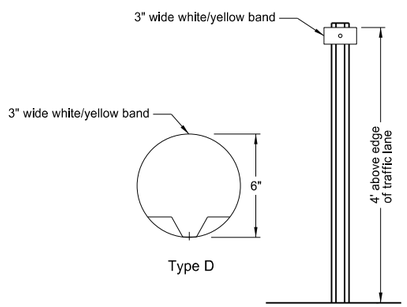

Main line
One reflector
(Type A delineator)



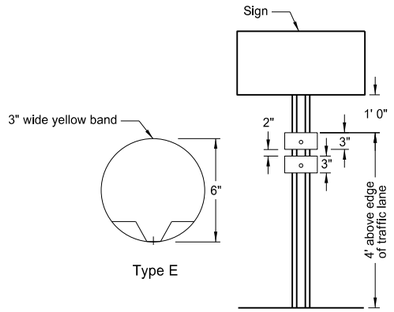

Ramps
Two reflectors
(Type B delineator)



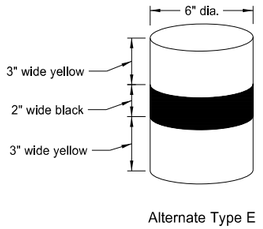

Narrow Bridges
Three reflectors
(Type C delineator)



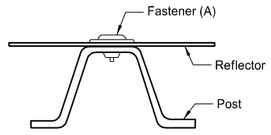

Median
One reflector
(Type D delineator)



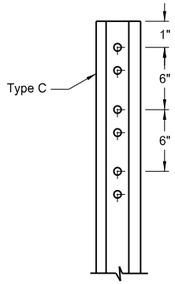

Median
One or Two reflectors
(Type E delineator)

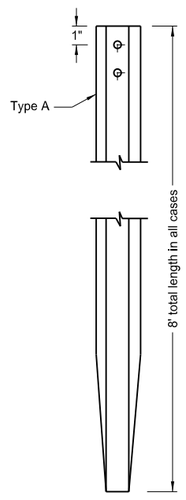



Alternate Type E

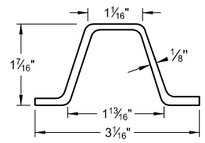



Delineator Attachment Detail

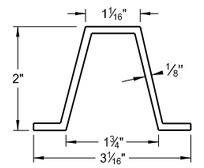


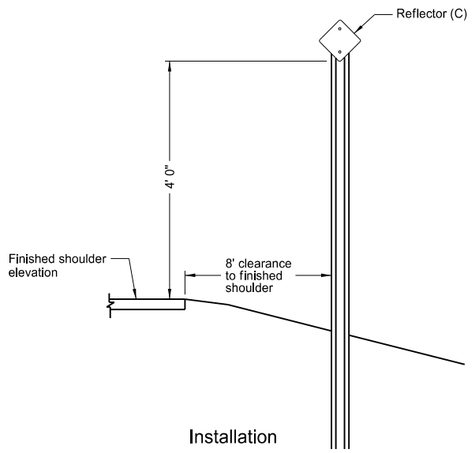

U-type Post



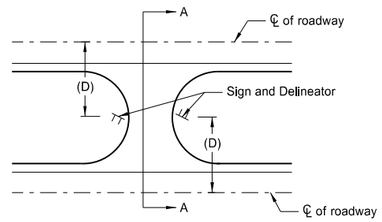

Steel Post Detail
Approx. 2.0 lbs/ft

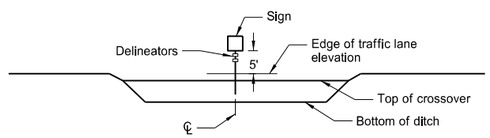



Aluminum Post Detail
Approx. 0.88 lbs/ft




Installation




Section A - A

Median Crossovers
Signing and Delineation system

Delineator Details

Type A, B, and C

Installation: Posts are to be installed along the right shoulder line unless shown otherwise on the plans.

Reflectors: Reflector shall be the same color as the adjacent pavement marking.

Spacing: Delineator spacing along main line tangents and curves with radius greater than 11500' (less than 0° 30') shall be at 528' centers. Curves with a radius less than 11500' but greater than 1200' the spacing shall be at 264' centers. With curves less than 1200' use spacing (S) = 3*√R-50

Type E

Alternate: One unit band consisting of two yellow stripes separated by a 2" black stripe may be used in place of two 3" yellow bands.

(A) The fastener shall be ⅜" dia. with flat washer having a min. outside dia. of 13/16". Fasteners shall be tension pin type or other non-rust vandal resistant fastener.

(B) The contractor may 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) Reflector to be mounted facing traffic at an angle of 93° away from oncoming traffic.

(D) The median width may vary. The sign and delineator assembly shall be placed 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 |

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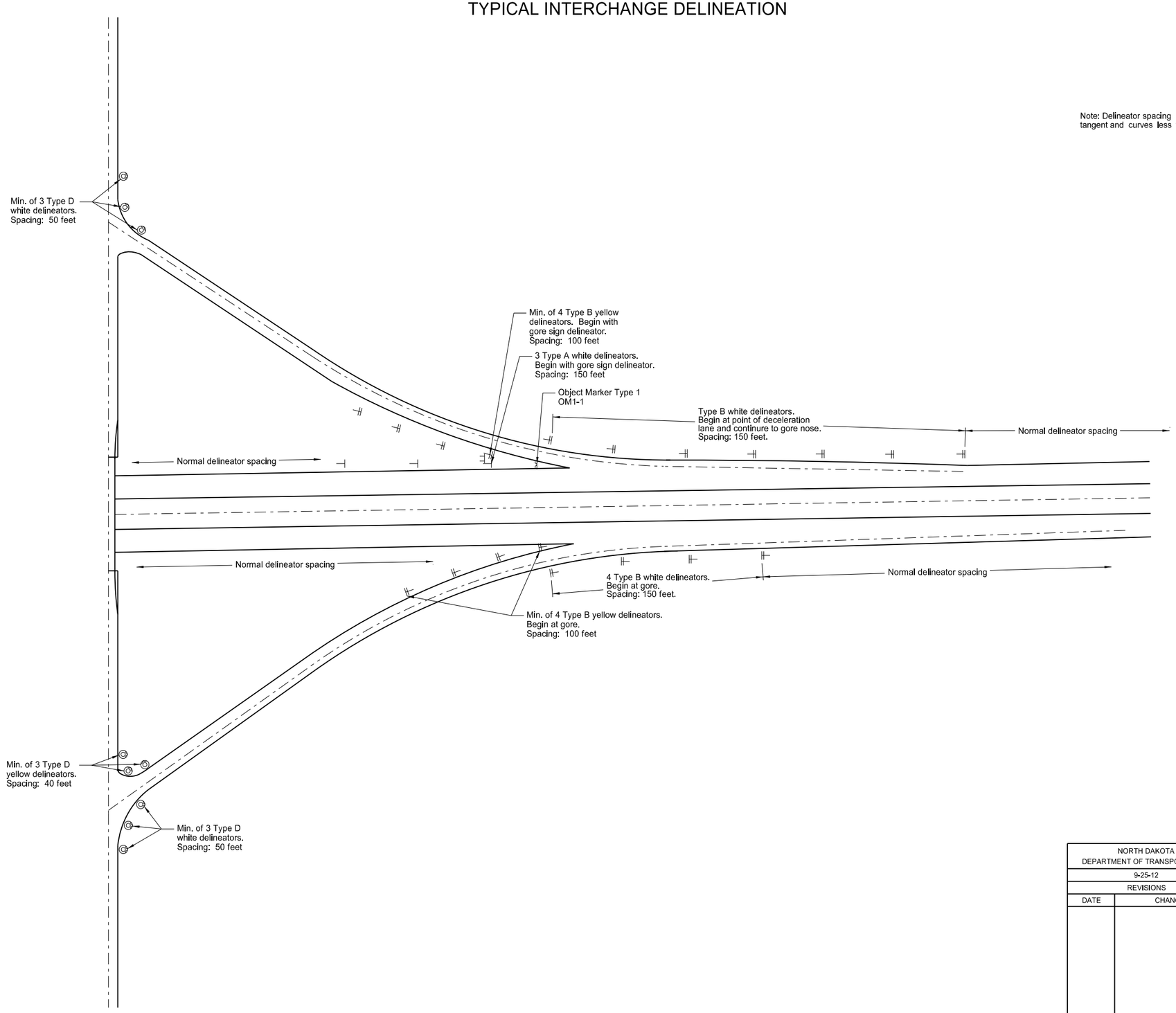
# TYPICAL INTERCHANGE DELINEATION

D-754-22A

Note: Delineator spacing along interstate mainline shall be at 528' centers on tangent and curves less than 0°30' and 264' on curves 0°30' and greater.

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| 9-25-12 | |
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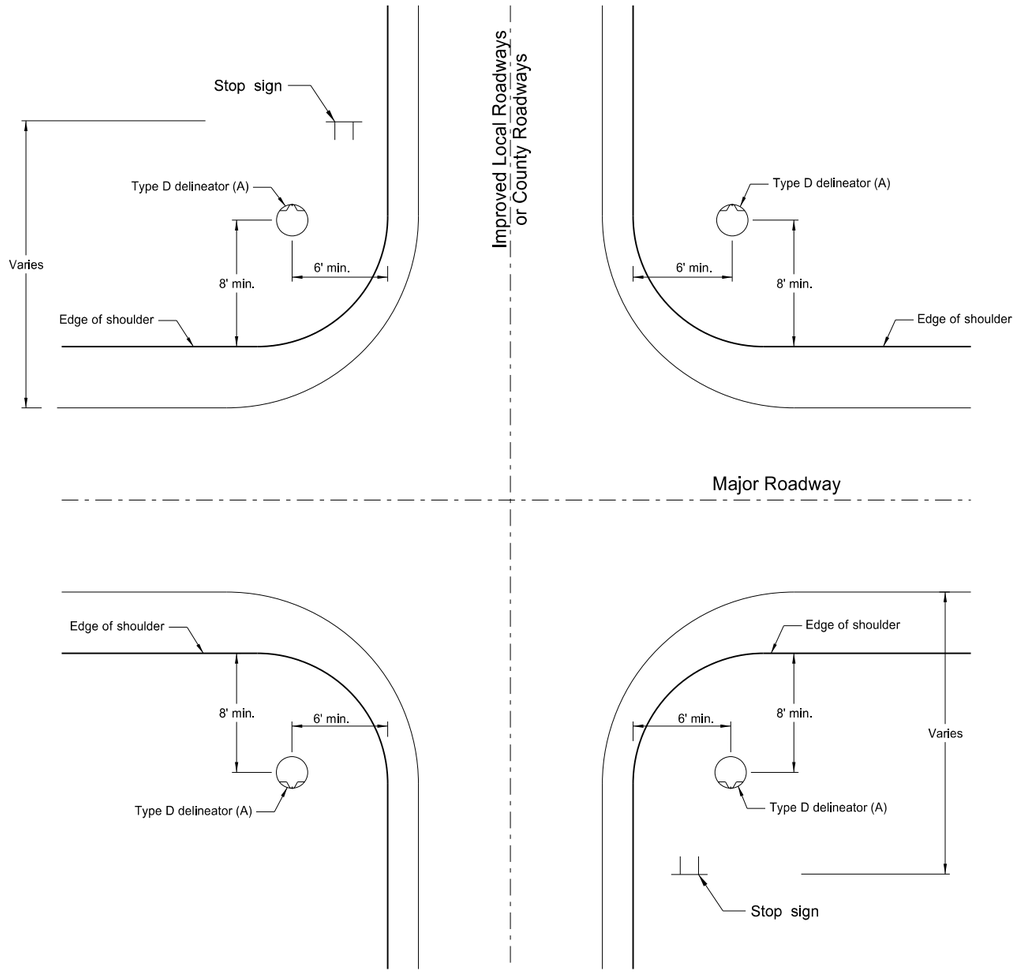
# APPROACH DELINEATION

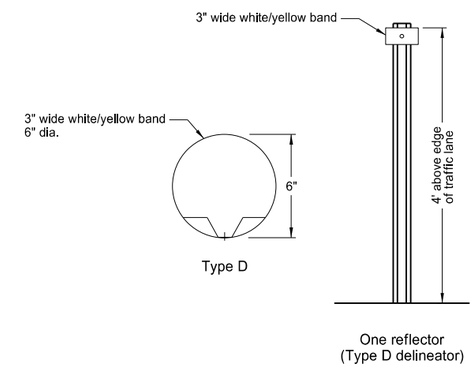
D-754-22C

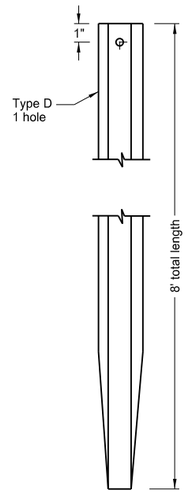



(A) Delineators shall be installed as shown in the plan layout. When a stop sign is present, a delineator may be placed on the stop sign post at the height shown for the delineator. The opposite delineator shall be placed directly across from the stop sign.

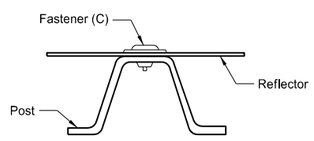
(B) Contractor may drill only those holes required to attach reflectors on the post or provide posts with holes the entire length at 1" centers.

(C) The fastener shall be ⅜" dia. with flat washer having a min. outside dia. of $1^{3}/_{16}$". Fasteners shall be tension pin type or other non-rust vandal resistant fastener.

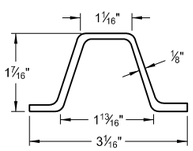


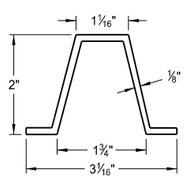

U-type Post




Fastener Detail




Steel Post Detail
(approx. 2 lb/ft)




Aluminum Post Detail
(approx. 0.88 lb/ft)

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# PERFORATED TUBE ASSEMBLY DETAILS

D-754-23

Notes:

1. Curbed Roadways: The clearance from the face of the curb should be 3' except where right of way or sidewalk width is limited, a minimum clearance of 2' shall be provided. The horizontal clearance may need to be increased to maintain a minimum sidewalk clear width of 4' from the sign support, not including any attached curb.

2. Minimum vertical clearance: Signs installed at the side of the road in rural districts shall be at least 5' measured from the bottom of the sign to the edge of the driving lane or auxiliary lane. Where parking or pedestrian movements occur, the clearance to the bottom of the sign shall be at least 7'.

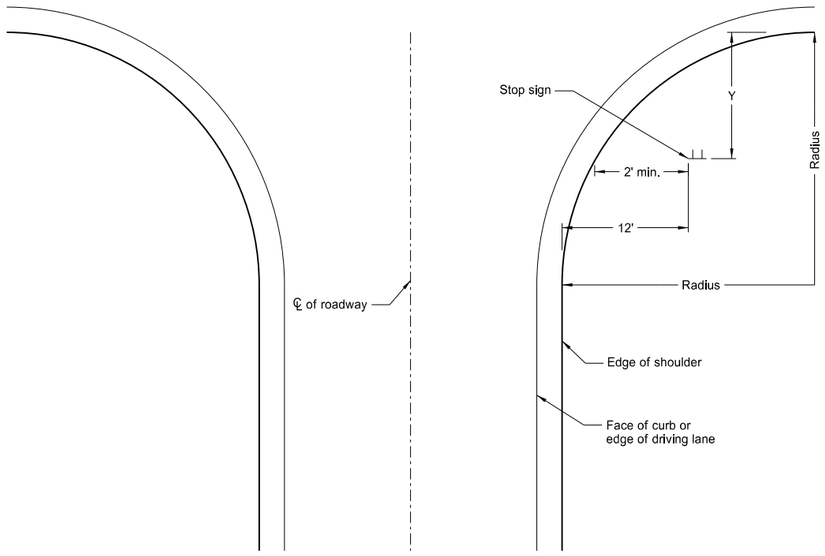
   Signs on expressways shall be installed with a minimum height of 7'.

   Adopt-a-highway signs installed on Freeways shall be at least 7' above the edge of the driving lane.

   The vertical clearance shall have a maximum height of 6" above the vertical clearance specified above.

3. Offset signs: Where signs are placed at least 30 feet or more from the edge of the traveled way, the height to the bottom of such sign shall be 5' above the edge of the driving lane.

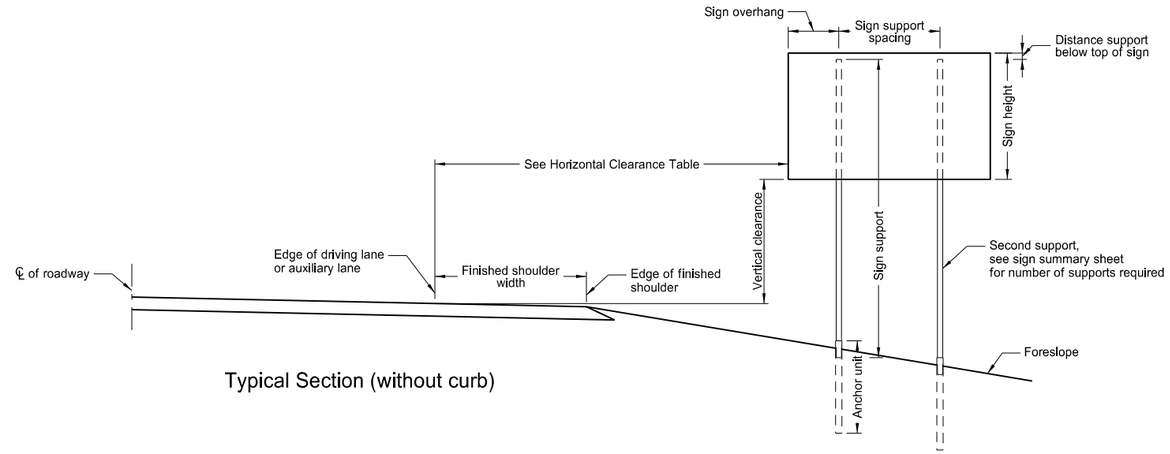
4. The clearance from edge of shared use path to edge of sign should be 3' except where width is limited, a minimum clearance of 2' shall be provided.




Stop Sign Location
Wide Throat Intersection

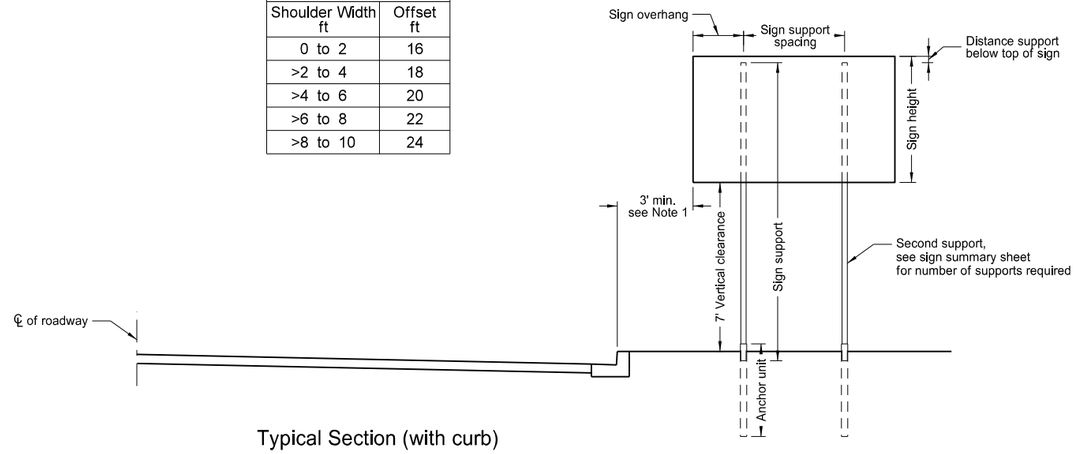
This layout is to be used for the placement of "Stop" signs.

| 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 |



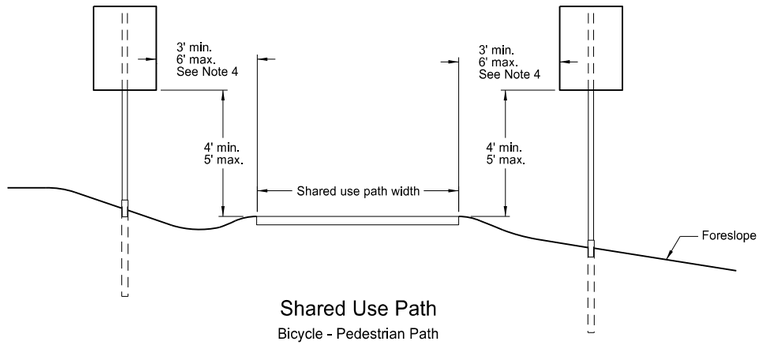

Typical Section (without curb)

| 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 | |
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| 7-8-14 | Revised note 2, added note 4. |

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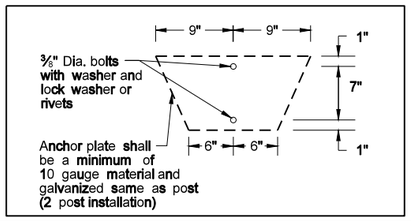
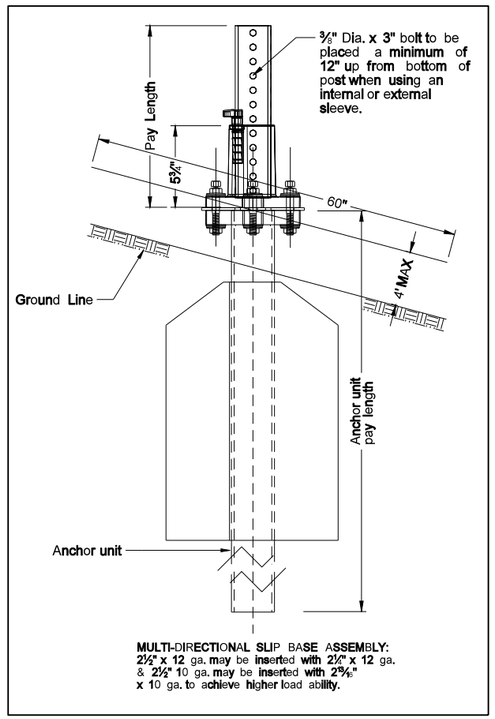
# Mounting Details Perforated Tube

D-754-24

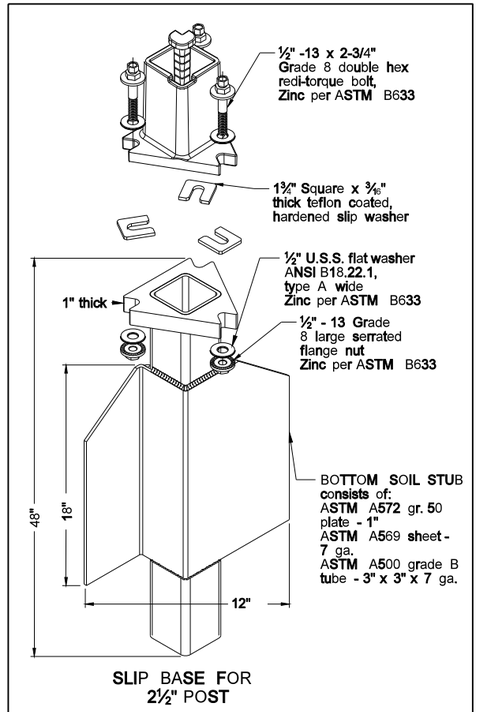
| Number of Posts | Telescoping Perforated Tube | | | | | | |
|---|---|---|---|---|---|---|---|
| | Post Size In. | Wall Thickness Gauge | Sleeve Size In. | Wall Thickness Gauge | Slip Base | Anchor Size Without Slip Base In. | Anchor Wall Thickness Gauge |
| 1 | 2 | 12 | | | No | 2½ | 12 |
| 1 | 2½ | 12 | | | No | 2½ | 12 |
| 1 | 2½ | 12 | | | (B) | 3(C) | 7 |
| 1 | 2½ | 10 | | | Yes | | 7 |
| 1 | 2½ | 12 | 2⅛(D) | 12 | Yes | | 7 |
| 1 | 2½ | 12 | 2½ | 12 | Yes | | 7 |
| 2 | 2½ | 10 | | | Yes | | 7 |
| 2 | 2½ | 12 | 2⅛(D) | 12 | Yes | | 7 |
| 2 | 2½ | 12 | 2½ | 12 | Yes | | 7 |
| 3 & 4 | 2½ | 12 | | | Yes | | 7 |
| 3 & 4 | 2½ | 10 | | | Yes | | 7 |
| 3 & 4 | 2½ | 12 | 2½ | 12 | Yes | | 7 |
| 3 & 4 | 2½ | 12 | 2⅛(D) | 12 | Yes | | 7 |
| 3 & 4 | 2½ | 10 | 2⅜ | 10 | Yes | | 7 |

(B) - The 2½", 12 gauge posts do not need breakaway bases when placed in standard soils, but require a shim as specified by the manufacturer. The breakaway base is required when the support is placed in weak soils. The Engineer shall 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.

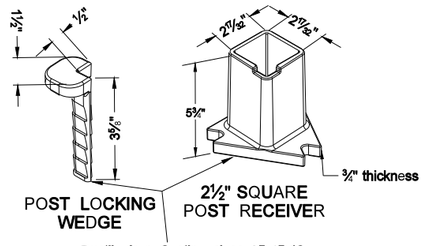


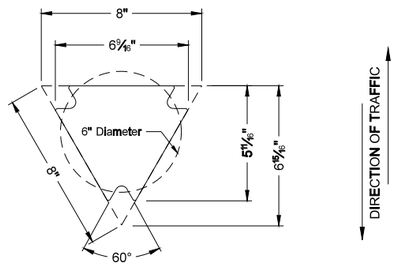

MULTI-DIRECTIONAL SLIP BASE ASSEMBLY: 2½" x 12 ga. may be inserted with 2½" x 12 ga. & 2½" 10 ga. may be inserted with 2⅜" x 10 ga. to achieve higher load ability.




SLIP BASE FOR 2½" POST




Ductile Iron Casting class 65-45-12. Hot Dip Galvanize ASTM A153



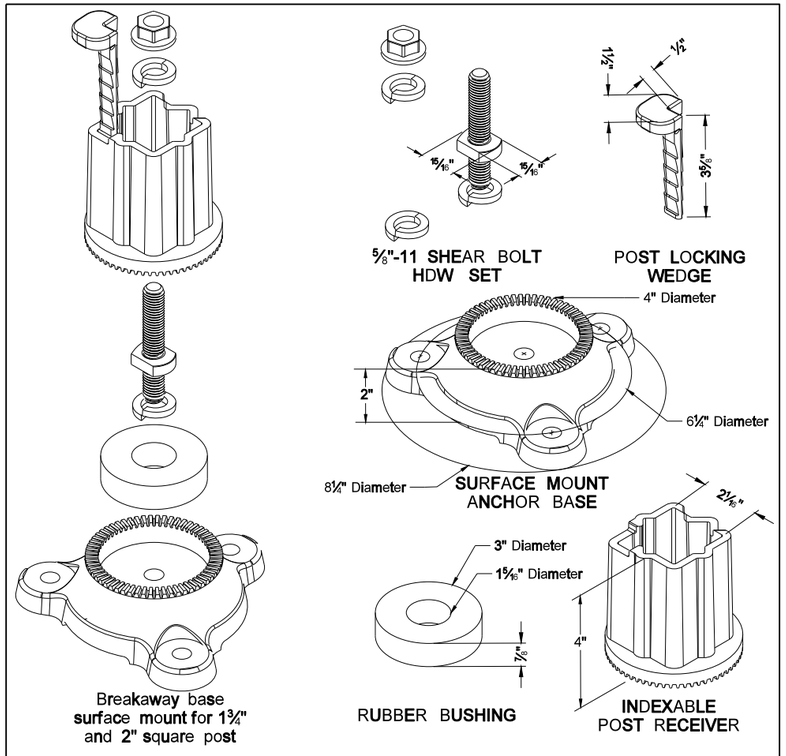

SLIP BASE DETAIL

| 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 ⅜" 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:

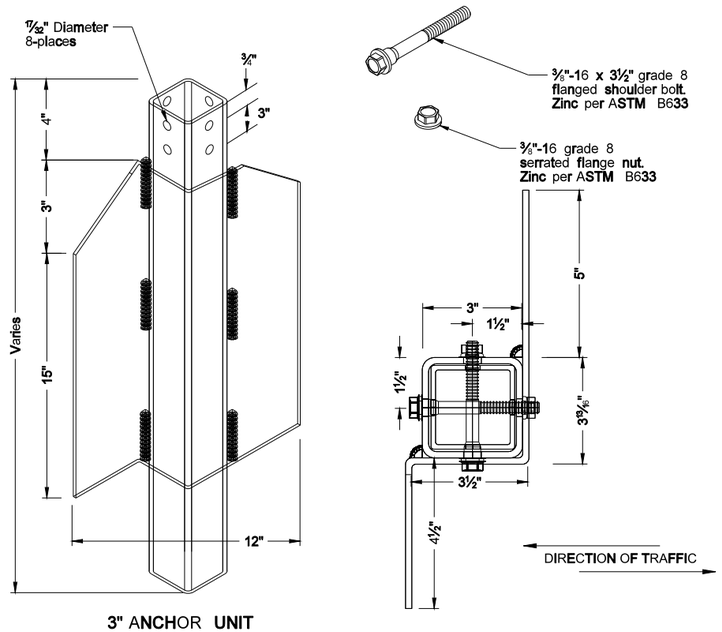
1. 4" Vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.
2. Anchor material shall be 7 guage H.R.P.O. Commmercial quality ASTM A569 and 3" x 3" x 7" guage ASTM A500 grade B. Anchor shall have a yield strength 43.9 KSI and tensile strength of 59.3 KSI. Anchor shall be hot dipped galvanized per ASTM A123/153. All tolerances on anchor unit and slip base bottom assembly are +/- 0.005" unless otherwise noted.
3. When used in concrete sidewalk, anchor shall be the same concept without the wings
4. Four post signs shall have over 8' between the first and fourth posts.
5. Installation procedures as per manufacturers recommendation.
6. Concrete fasteners for surface mount breakaway base shall be a minimum ½" diameter x 4" grade 8.




SURFACE MOUNT ANCHOR BASE

## SHOULDER BOLT

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




3" ANCHOR UNIT

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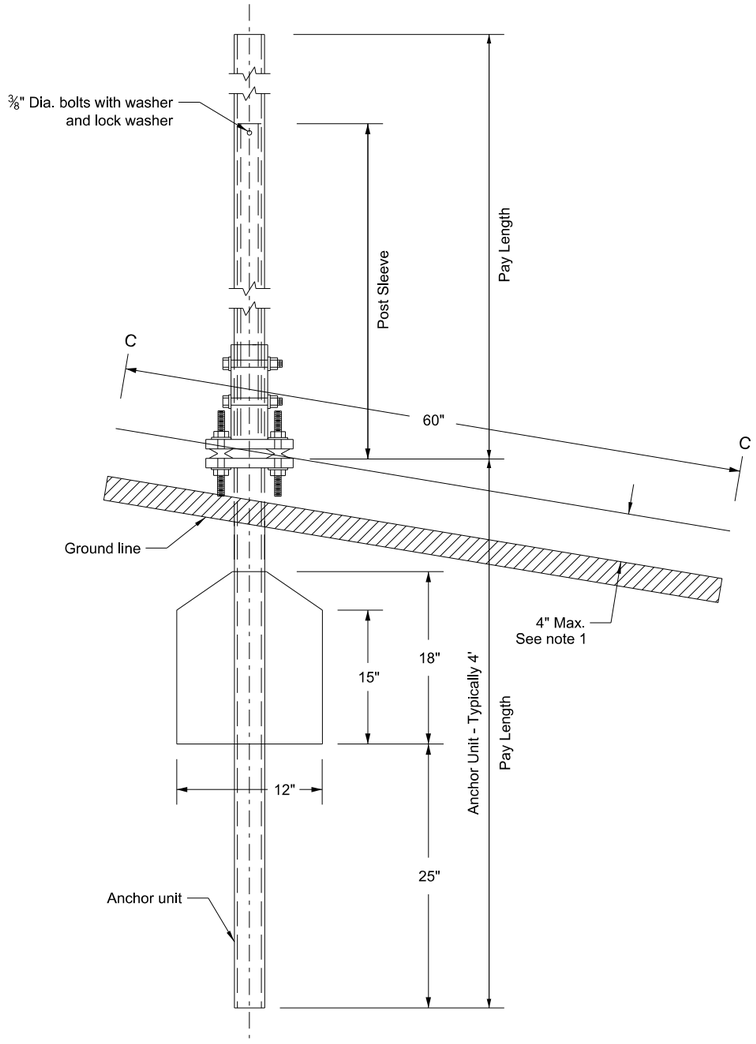
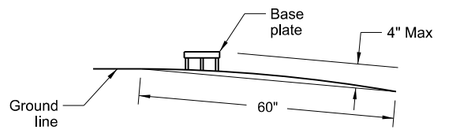
# D-754-24A

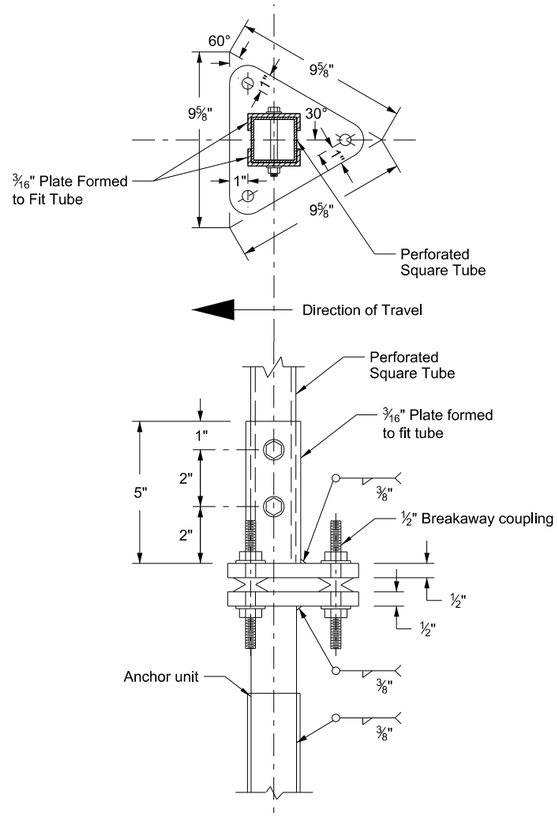
## Breakaway Coupler System for Perforated Tubes



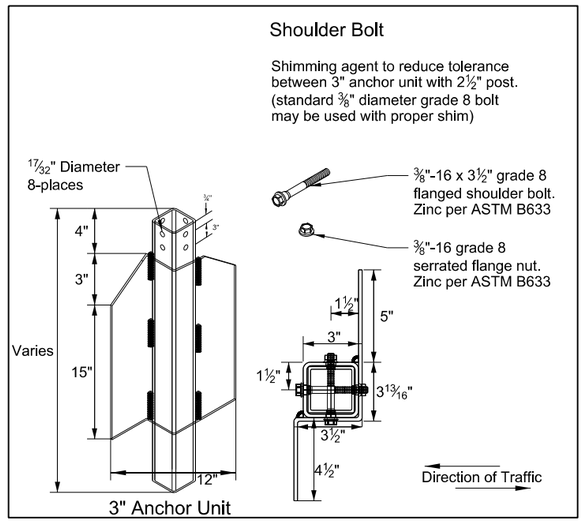




Section C-C

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.




Base Plate with Breakaway Coupler




3" Anchor Unit

Notes:

1. 4" Vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.
2. Anchor unit shall be the same size as the post and shall have the same specification as the post.
3. Four post signs shall have over 8' between the first and fourth post.
4. In lieu of the breakaway base system on standard D-754-24 the breakaway coupling system may be used. The breakaway coupler system shall be manufactured from material meeting the requirements of ASTM A325 fasteners with the special requirements as 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) - The 2½" 12 gauge posts do not need breakaway bases when placed in standard soils. The breakaway base is required when the support is placed in weak soils. The Engineer shall determine if the soils are weak. Weak soils are classified as boggy, wet, or loose soil areas.

(C) - 3" anchor unit

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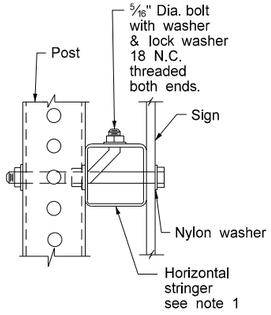
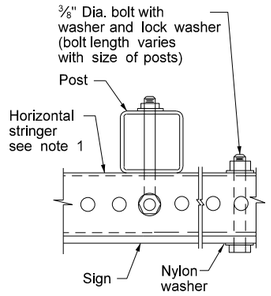
# Mounting Details Perforated Tube

D-754-25

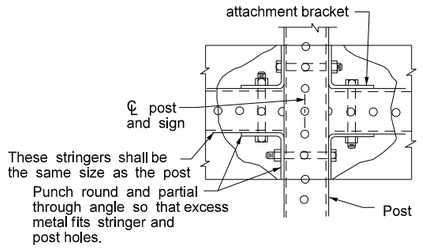



Side View




Top View

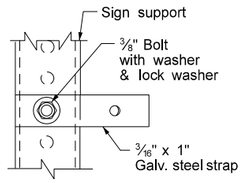
STRINGER MOUNTING
(WITH STRINGER IN FRONT OF POST)



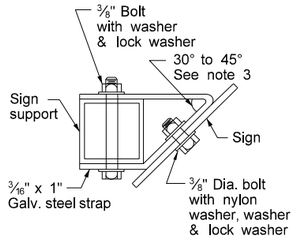

STREET NAME SIGNS
AND ONE WAY SIGNS
SINGLE POST ASSEMBLY
ONE STRINGER OR
BACK TO BACK MOUNTING

Note:

1. Horizontal stringers - In lieu of perforated tubes, the contractor may substitute z bar stringers. The z bar stringers shall be 1¾" x 3/16" thick, 1.08 lbs./ft aluminum or 3.16 lbs./ft steel.
2. Metal washers used on sign face shall have a minimum outside diameter of 15/16" ± 1/16" and 10 gauge thickness.
3. No Parking Signs: All no parking signs with directional arrows shall be placed at a 30 to 45 degree angle with the line of traffic flow. No parking signs required at the above angles may have the support turned to the correct angle. If the no parking sign is placed with another sign that has to be placed at a 90 degree angle with the line of traffic flow, the detailed angle strap should be used to mount the no parking sign. Flat washers and lock washers shall be used with all nylon washers.
4. In lieu of using the bent bolt to attach the post to the stringer, the contractor may choose to punch the sign backing and place the bolt through the sign, the stringer and the post.
5. 4" vertical clearance of anchor or breakaway base. The 4" x 60" measurement shall be made above and below post location and also back and ahead of post.

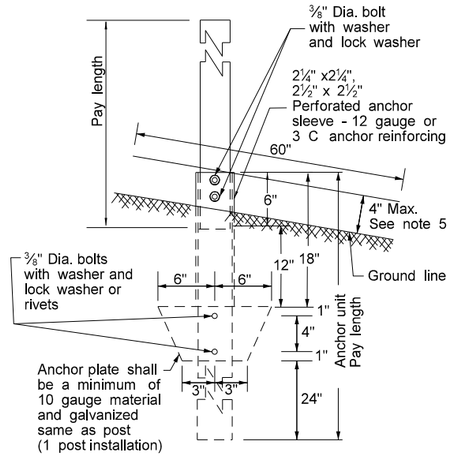



Side View




Top View

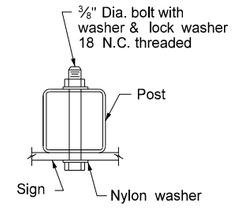
STRAP DETAIL



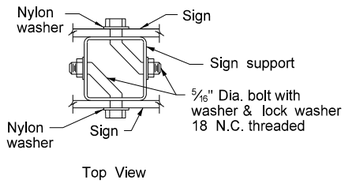

ANCHOR UNIT AND
POST ASSEMBLY

| 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) - The 2½", 12 gauge posts do not need breakaway bases when placed in standard soils, but require a shim as specified by the manufacturer. The breakaway base is required when the support is placed in weak soils. The Engineer shall 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.

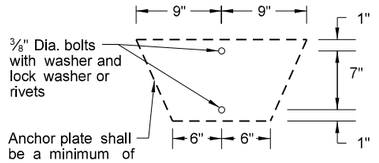



BOLT MOUNTING




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 |

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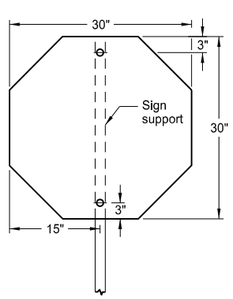
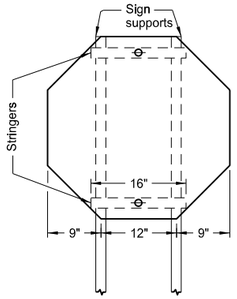
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS REGULATORY, WARNING AND GUIDE SIGNS

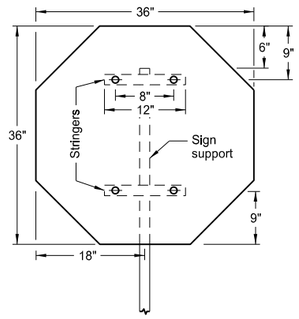



1 Post




2 Posts

Assembly No. 1

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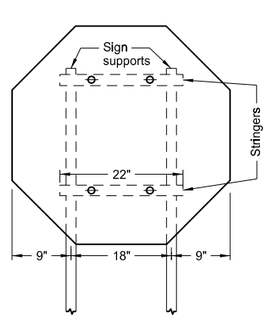
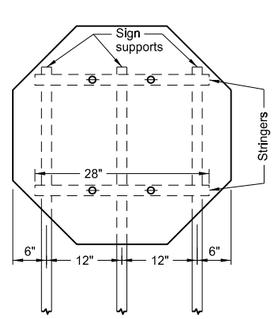



2 Posts




3 Posts

Assembly No. 2

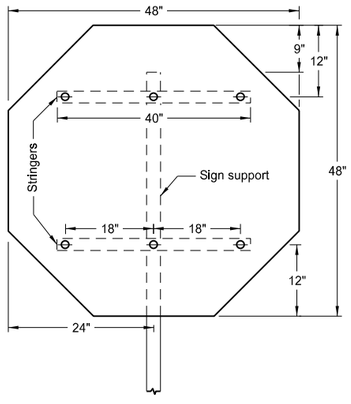
Notes:

1. See Standard D-754-25 for mounting details.

2. The minimum sign backing material thickness shall be 0.100 inch.

3. Perforated square tube stringer shall be 1½" x 1½".

4. All holes shall be punched round for ⅜" bolt.

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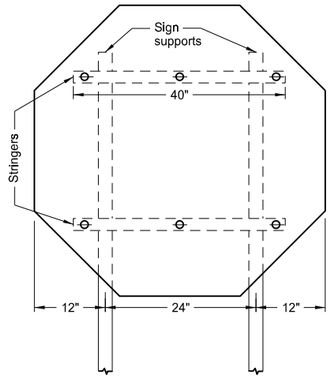
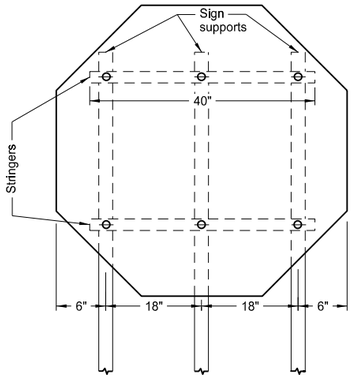
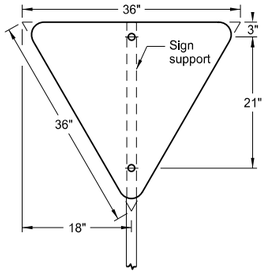



2 Posts




3 Posts

Assembly No. 3

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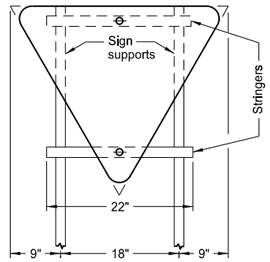
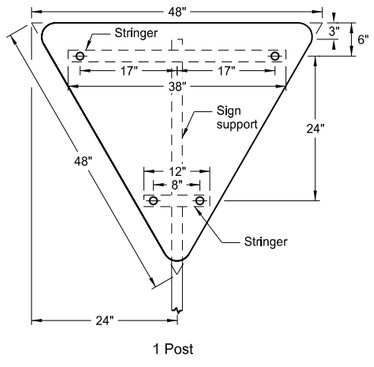
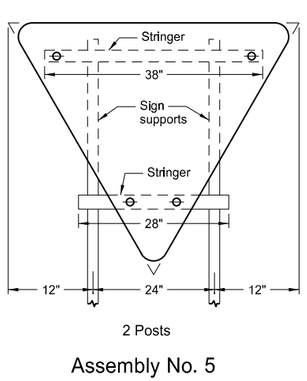



2 Posts

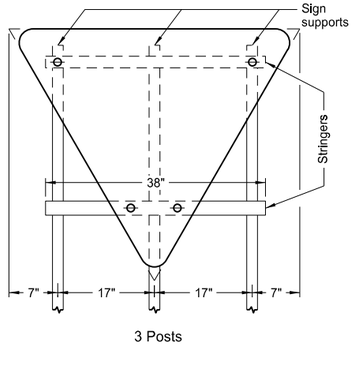
Assembly No. 4




1 Post




2 Posts




3 Posts

Assembly No. 5

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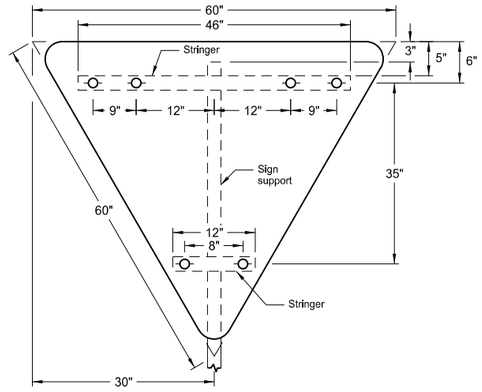
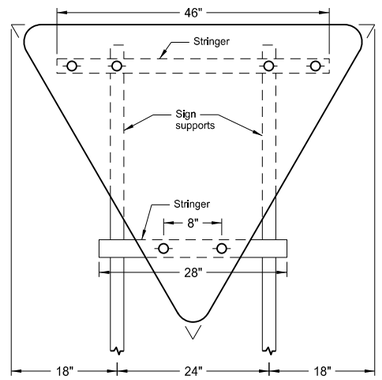
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION
# DETAILS REGULATORY, WARNING AND GUIDE SIGNS

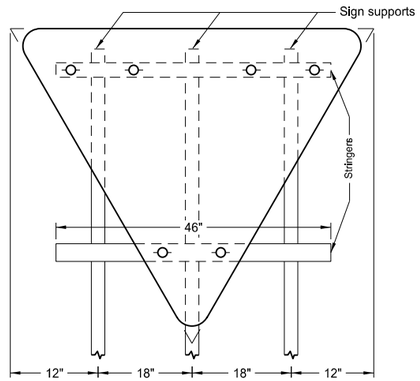
D-754-27




1 Post




2 Posts




3 Posts

Assembly No. 6

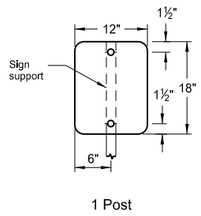
Notes:

1. See Standard D-754-25 for mounting details.

2. The minimum sign backing material thickness shall be 0.100 inch.

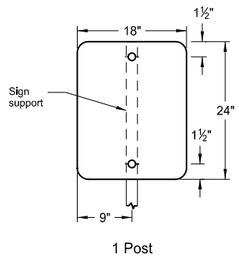
3. Perforated square tube stringer shall be 1½" x 1½".

4. All holes shall be punched round for ⅜" bolt.



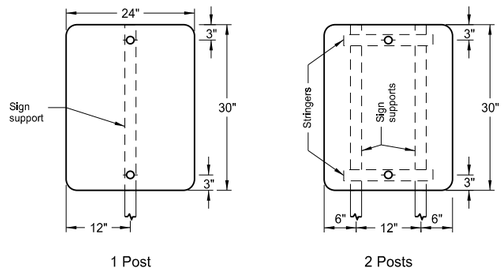

1 Post

Assembly No. 7




1 Post

Assembly No. 8




1 Post 2 Posts

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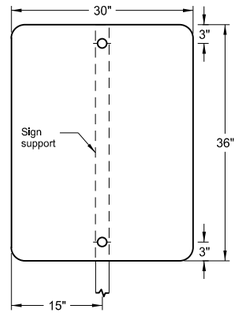


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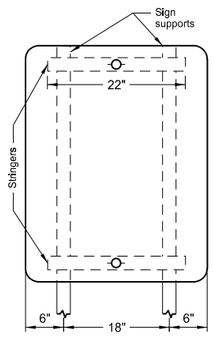
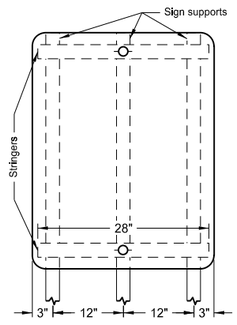
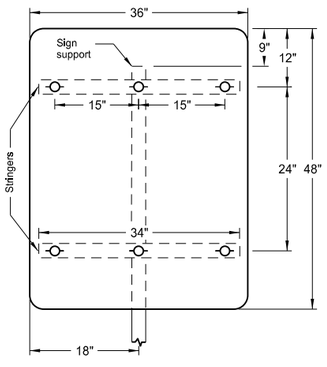



2 Posts




3 Posts

Assembly No. 10

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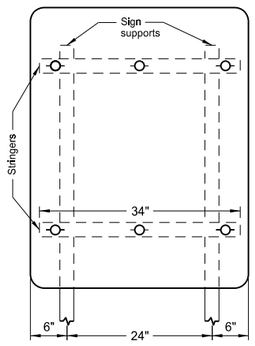


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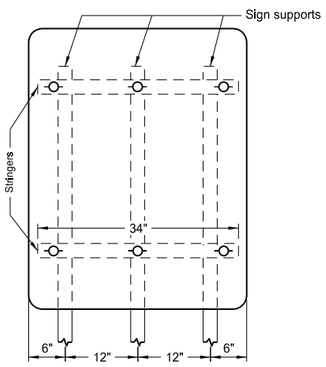


3 Posts

Assembly No. 11

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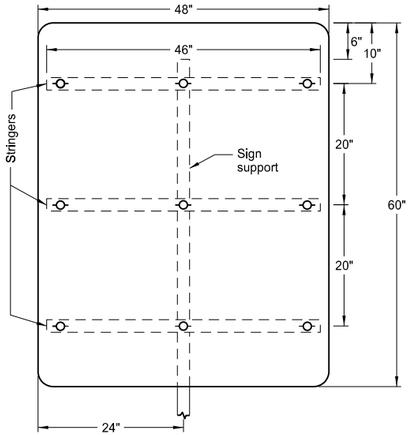
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION
# DETAILS REGULATORY, WARNING AND GUIDE SIGNS

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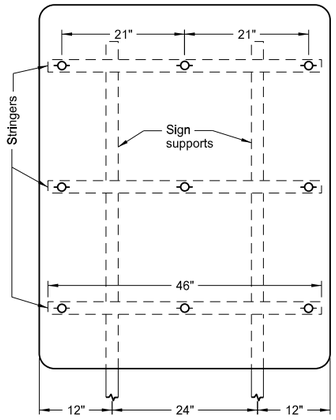
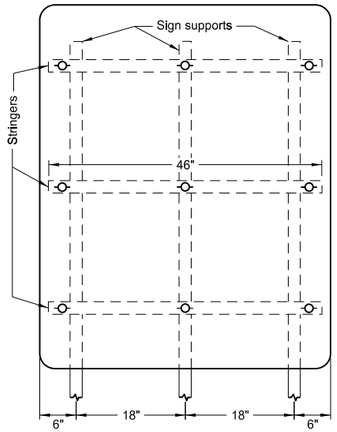
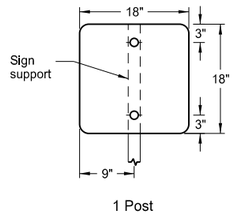



2 Posts




3 Posts

Assembly No. 12




1 Post

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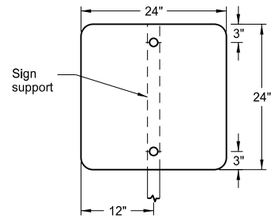


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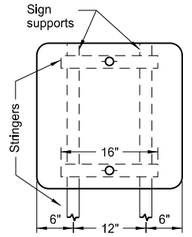


2 Posts

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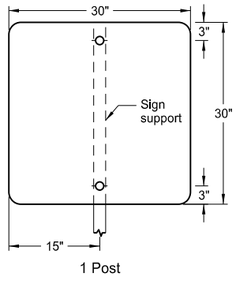


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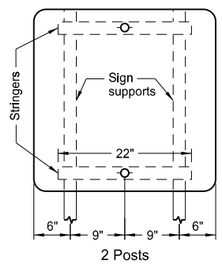
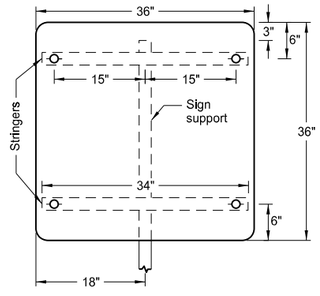



2 Posts

Assembly No. 15

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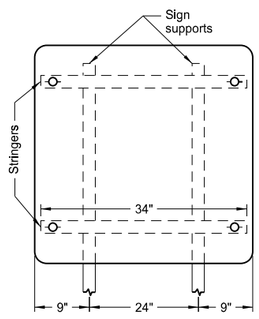
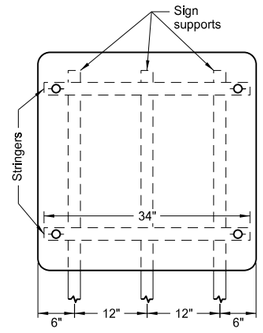
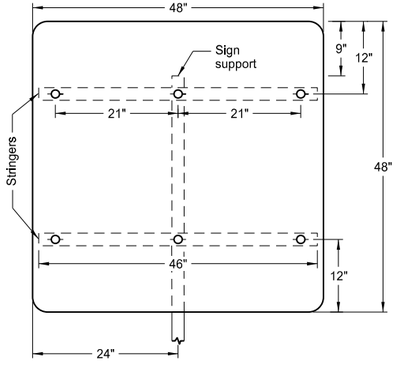



2 Posts




3 Posts

Assembly No. 16

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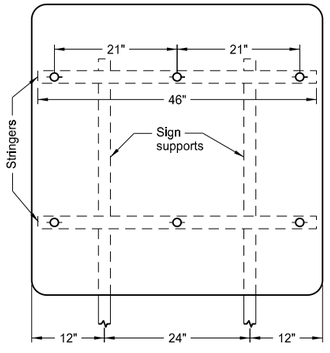


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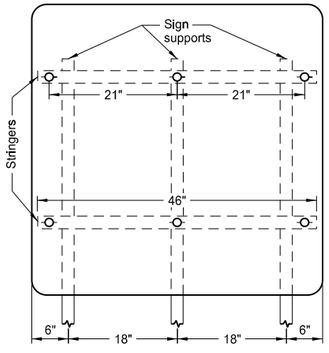


3 Posts

Assembly No. 17

Notes:

1. See Standard D-754-25 for mounting details.

2. The minimum sign backing material thickness shall be 0.100 inch.

3. Perforated square tube stringer shall be 1½" x 1½".

4. All holes shall be punched round for ⅜" bolt.

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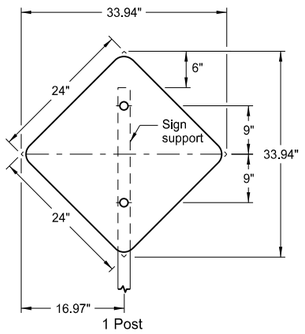
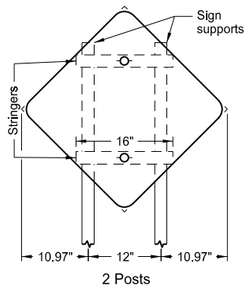
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS REGULATORY, WARNING AND GUIDE SIGNS

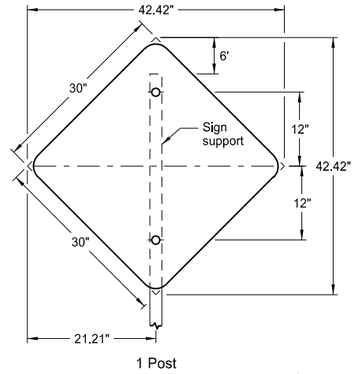



1 Post




2 Posts

Assembly No. 18

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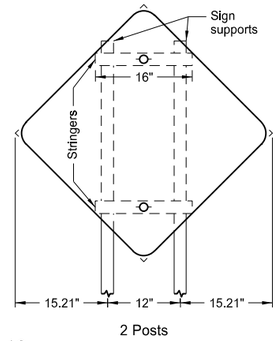
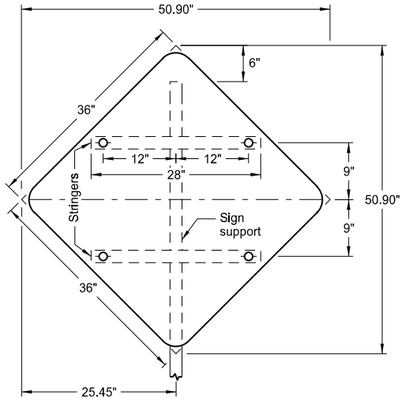



2 Posts

Assembly No. 19

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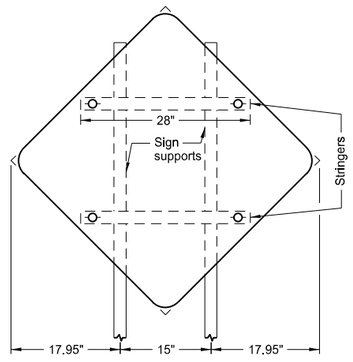
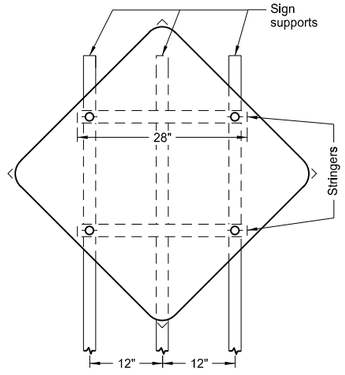
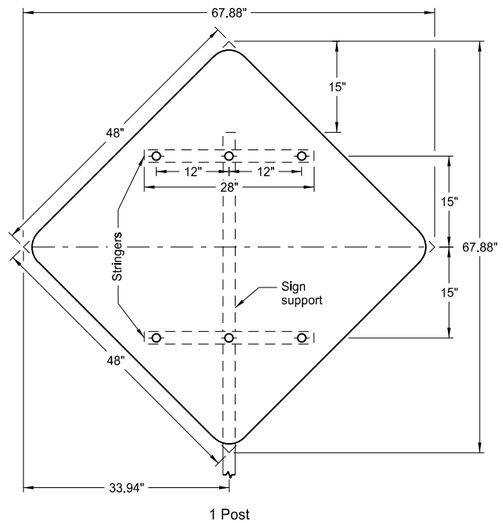



2 Posts

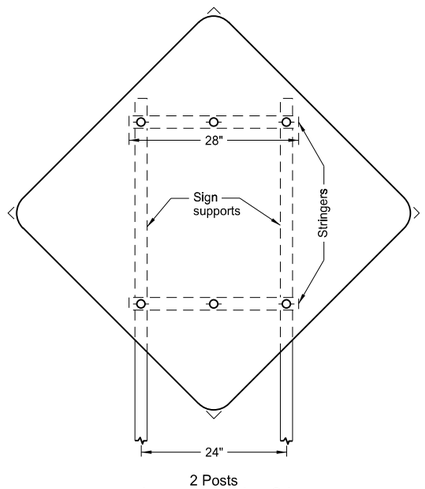



3 Posts

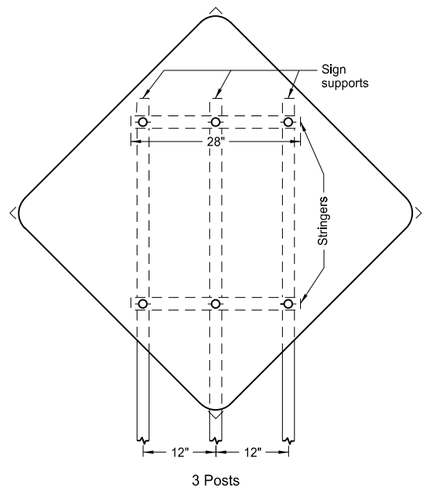
Assembly No. 20




1 Post




2 Posts




3 Posts

Assembly No. 21

Notes:

1. See Standard D-754-25 for mounting details.
2. The minimum sign backing material thickness shall be 0.100 inch.
3. Perforated square tube stringer shall be 1½" x 1½".
4. All holes shall be punched round for ⅜" bolt.

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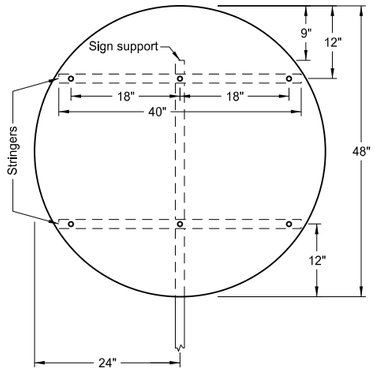
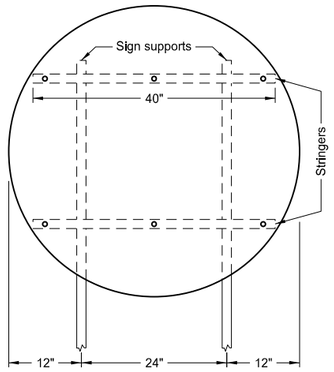
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS
# REGULATORY, WARNING AND GUIDE SIGNS

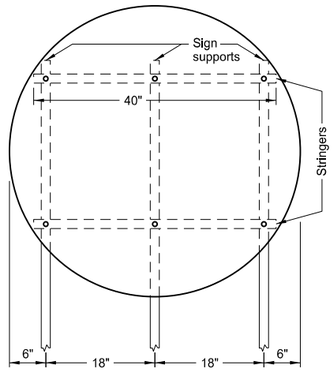
D-754-41




1 Post




2 Posts

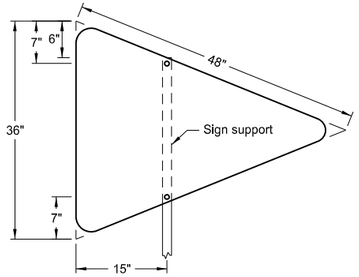



3 Posts

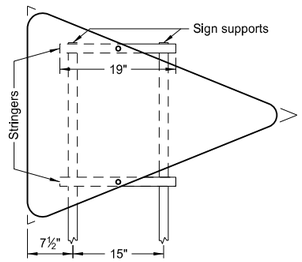
ASSEMBLY NO. 64

Notes:

1. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1½"x1½".
3. All holes shall be punched round for ⅜" bolt.

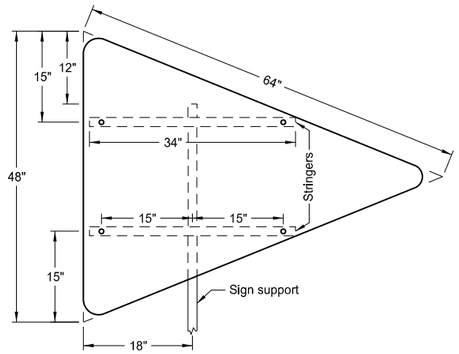



1 Post

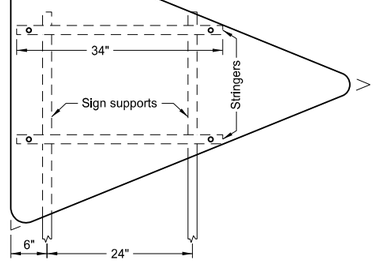



2 Posts

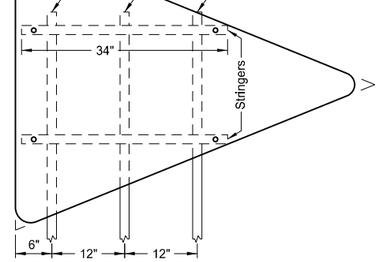
ASSEMBLY NO. 65




1 Post

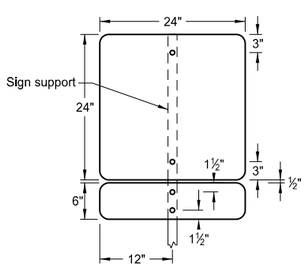



2 Posts

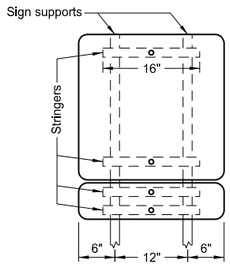



3 Posts

ASSEMBLY NO. 66




1 Post




2 Posts

ASSEMBLY NO. 67

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 8-22-12 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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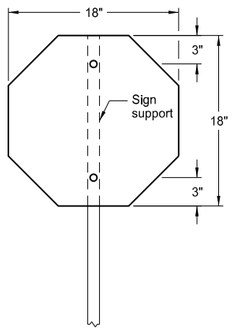
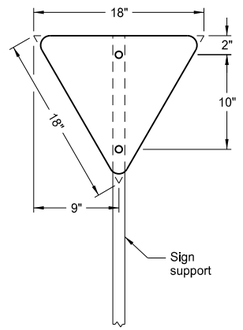
# PUNCHING, STRINGER, AND SUPPORT LOCATION DETAILS FOR REGULATORY, WARNING AND GUIDE BIKE ROUTE SIGNS

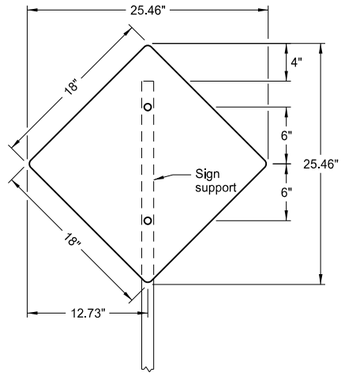
D-754-46



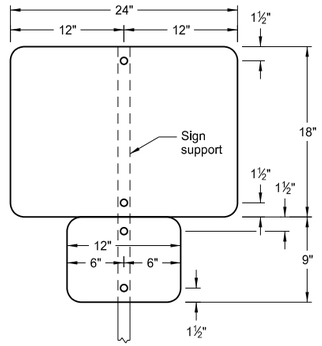

1 Post
Assembly No. 100



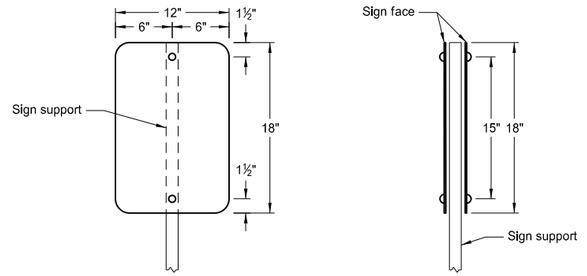

1 Post
Assembly No. 101



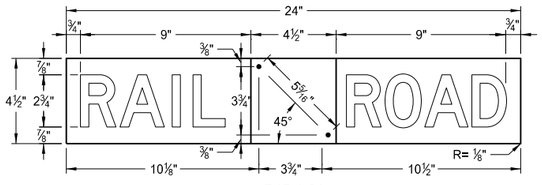

1 Post
Assembly No. 102



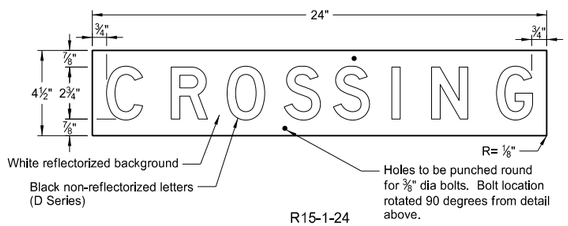

1 Post
Assembly No. 103




1 Post
back to back
Assembly No. 104

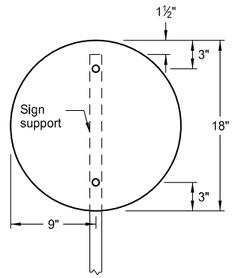



R15-1-24

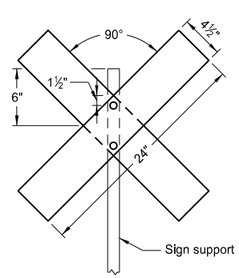



R15-1-24

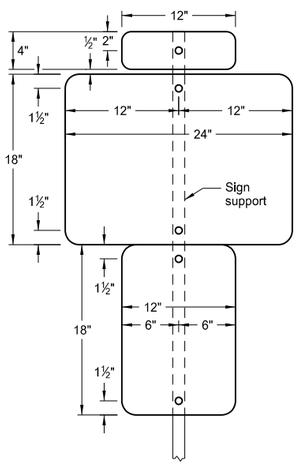
Railroad Crossing Sign Details

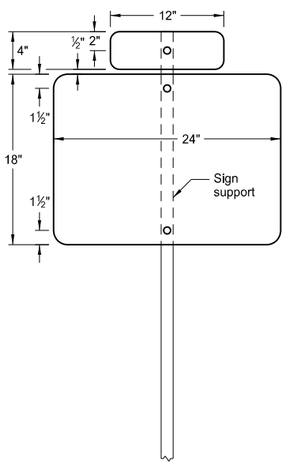


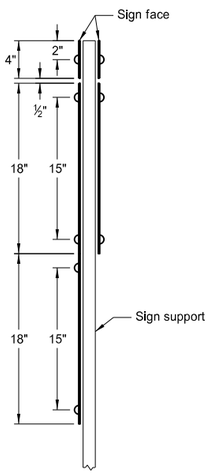

1 Post
Assembly No. 106



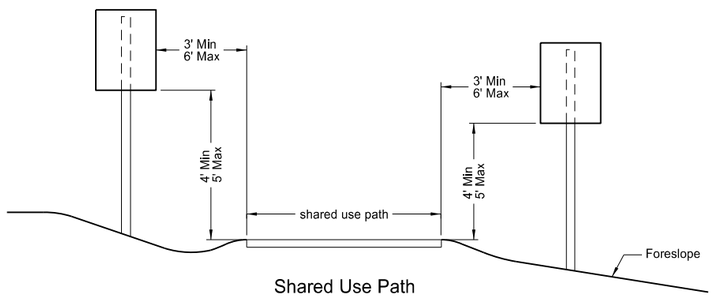

1 Post
Assembly No. 107




1 Post
back to back
Assembly No. 105




Shared Use Path
Bicycle - Pedestrian Path

Notes:

1. The minimum sign backing material thickness shall be 0.100 inch.
2. All holes shall be punched round for ⅜" bolt.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 8-22-12 | |
| REVISIONS | |
| DATE | CHANGE |
| 9-18-15 | Revised Title Name |

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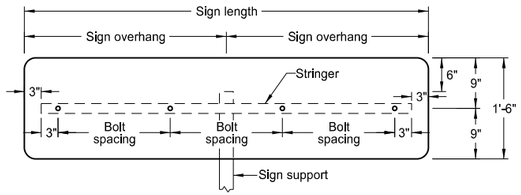
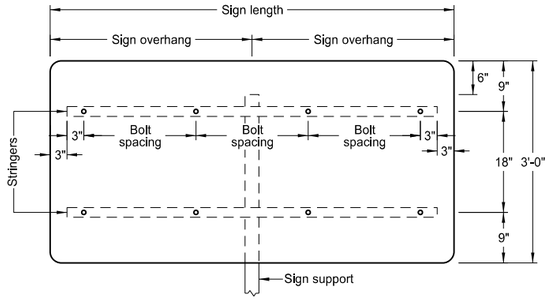
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR VARIABLE LENGTH SIGNS

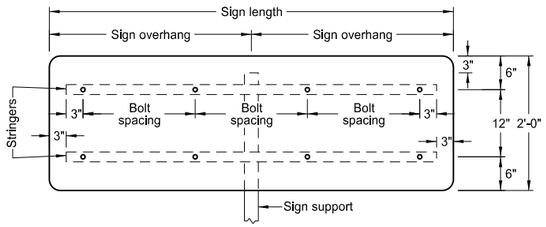
D-754-47



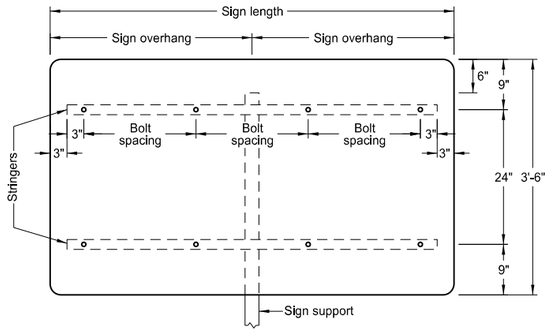

VARIES X 1'-6"



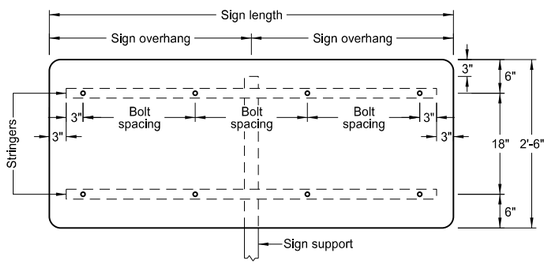

VARIES X 3'-0"




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. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1½" x 1½".
3. All holes shall be punched round for ⅜" bolt.
4. Single stringer and single post signs shall have stringers attached to the post using the special stringer angle, shown on the "Mounting Details Perforated Tube" standard drawing.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 9-25-12 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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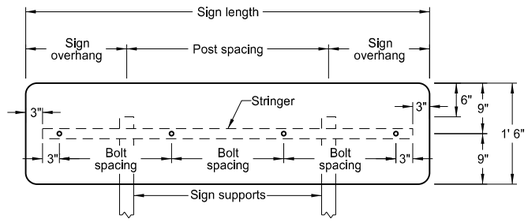
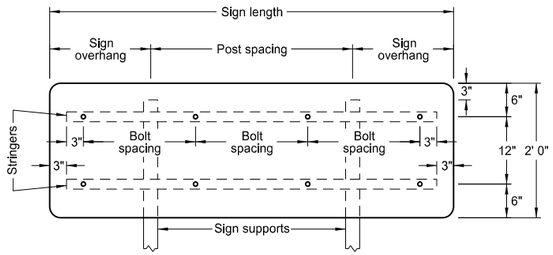
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR VARIABLE LENGTH SIGNS

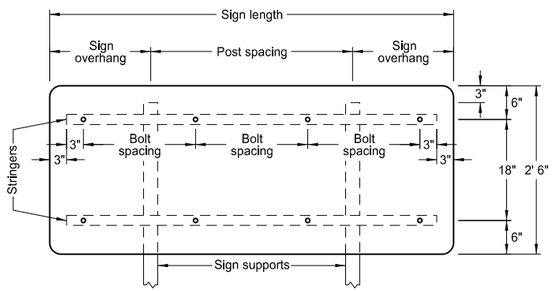
D-754-48



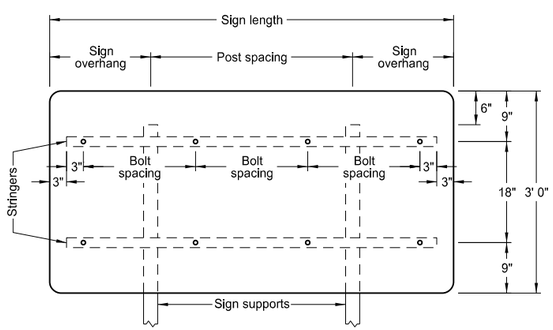

VARIES X 1'-6"



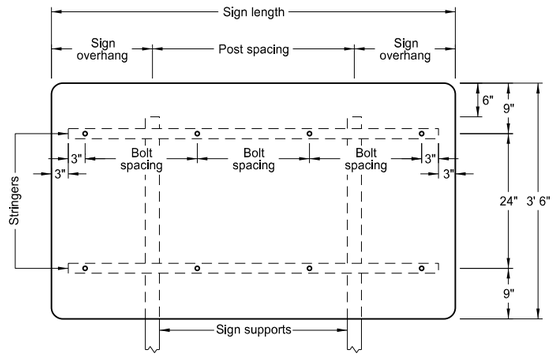

VARIES X 2'-0"



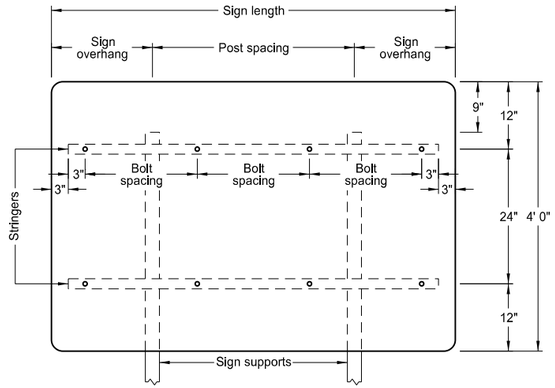

VARIES X 2'-6"



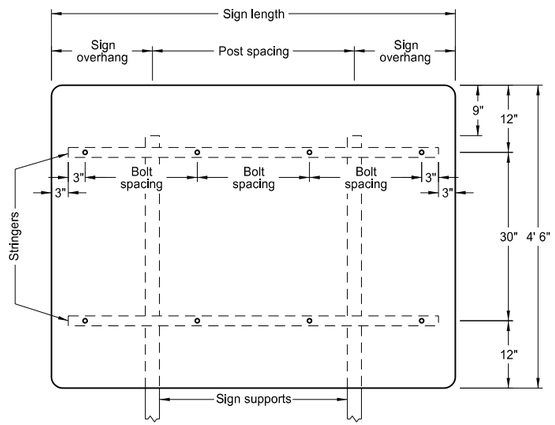

VARIES X 3'-0"



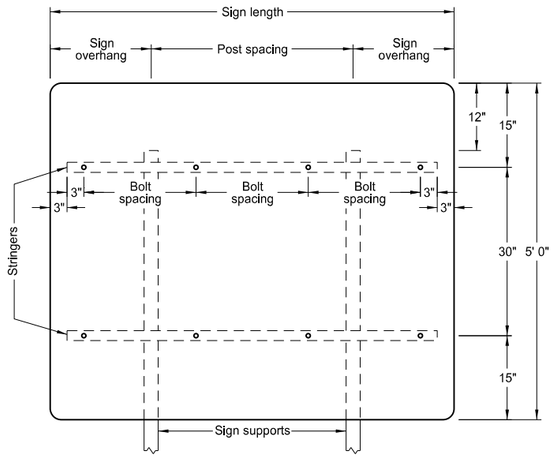

VARIES X 3'-6"



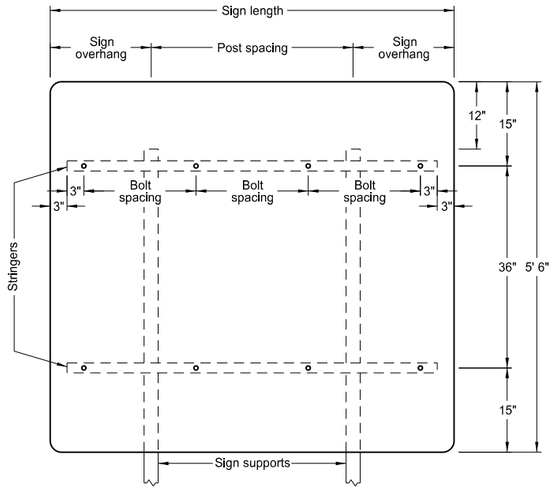

VARIES X 4'-0"




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. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1½" x 1½".
3. All holes shall be punched round for ⅜" bolt.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 9-25-12 | |
| REVISIONS | |
| DATE | CHANGE |
| | |

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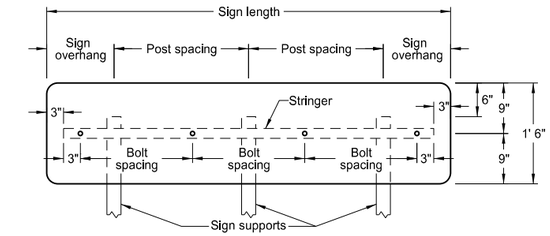
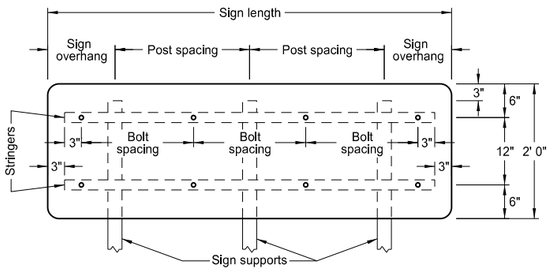
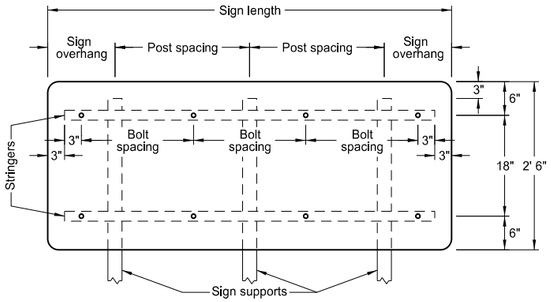
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR VARIABLE LENGTH SIGNS



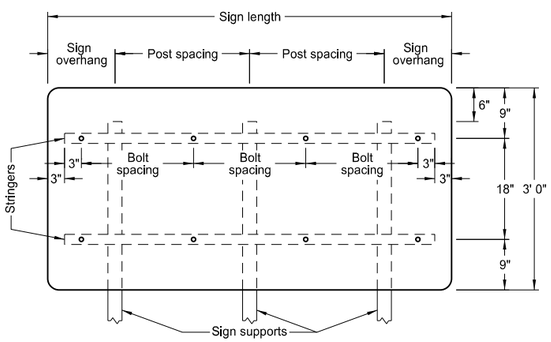

VARIES X 1'-6"



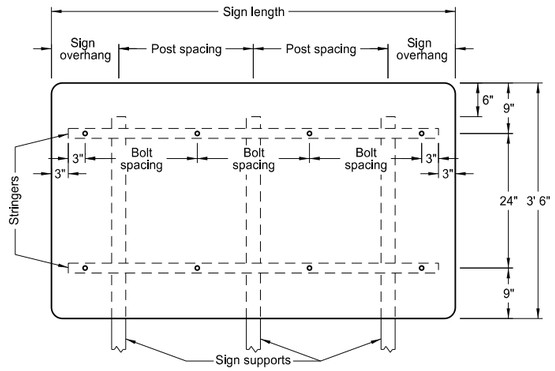

VARIES X 2'-0"



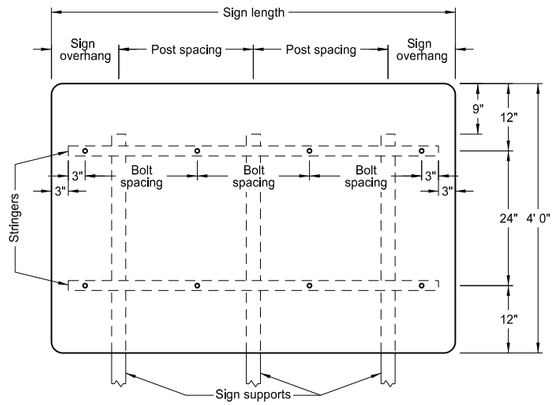

VARIES X 2'-6"



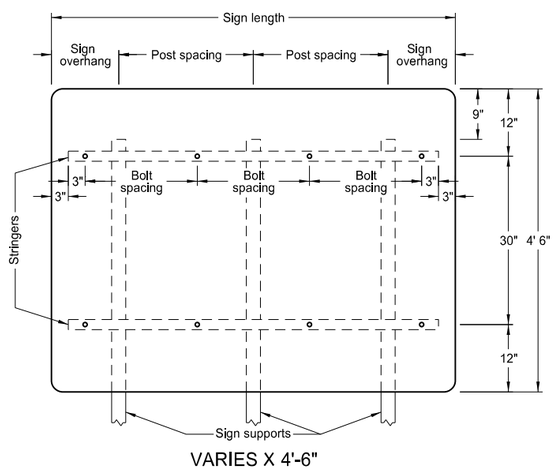

VARIES X 3'-0"



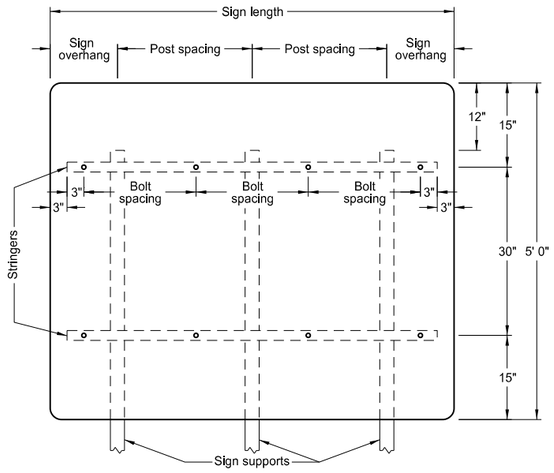

VARIES X 3'-6"



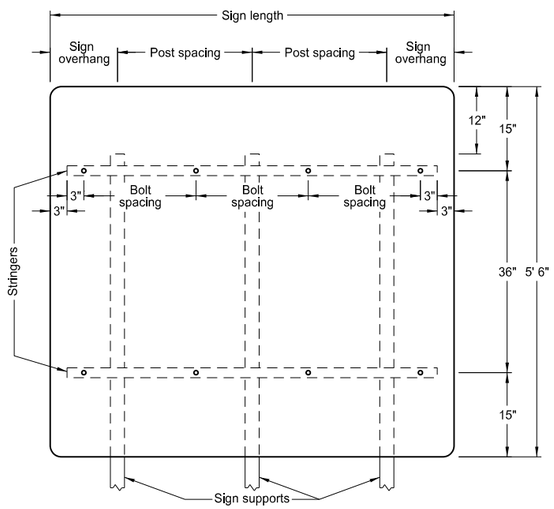

VARIES X 4'-0"




VARIES X 4'-6"




VARIES X 5'-0"




VARIES X 5'-6"

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

Notes:

1. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1½" x 1½".
3. All holes shall be punched round for ⅜" bolt.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
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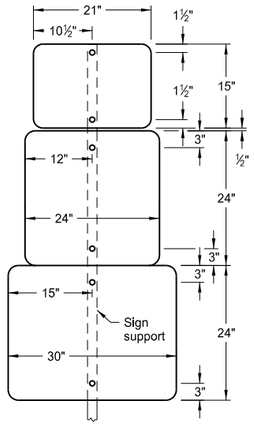
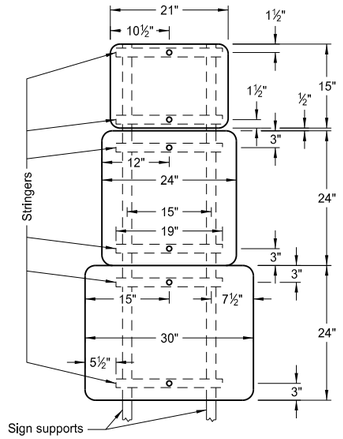
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS - ROUTE MARKER SIGNS

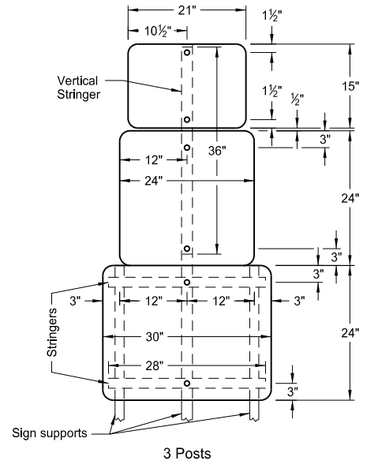
D-754-58




1 Post

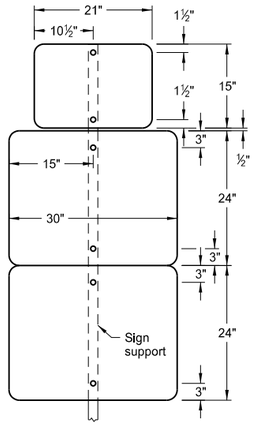



2 Posts

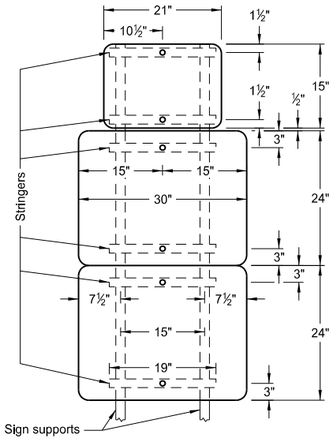



3 Posts

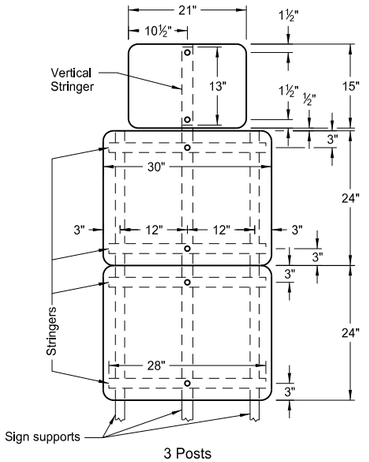
ASSEMBLY 396




1 Post

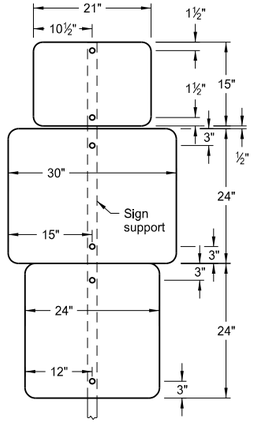



2 Posts

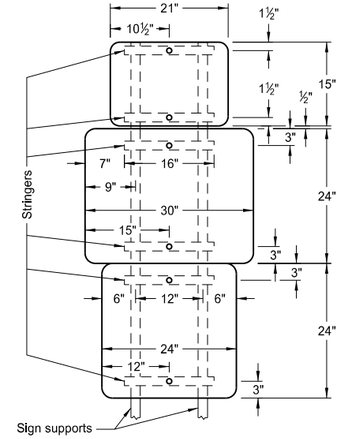



3 Posts

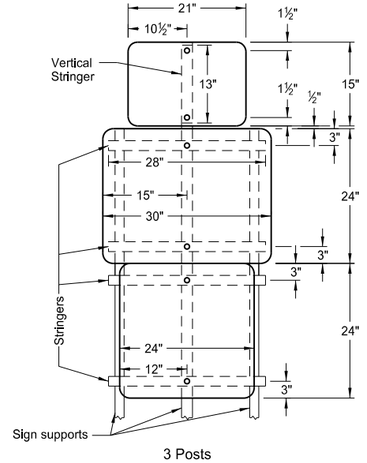
ASSEMBLY 397




1 Post

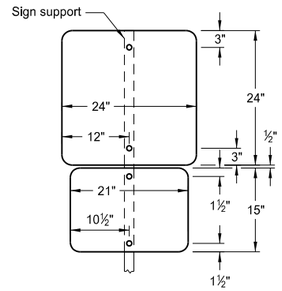



2 Posts

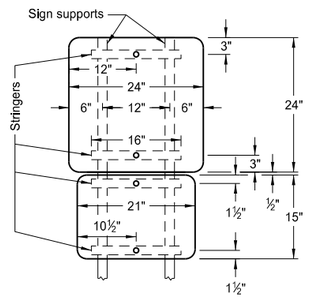



3 Posts

ASSEMBLY 398




1 Post




2 Posts

ASSEMBLY 399

Notes:

1. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1½"x1½".
3. All holes shall be punched round for ⅜" bolt.

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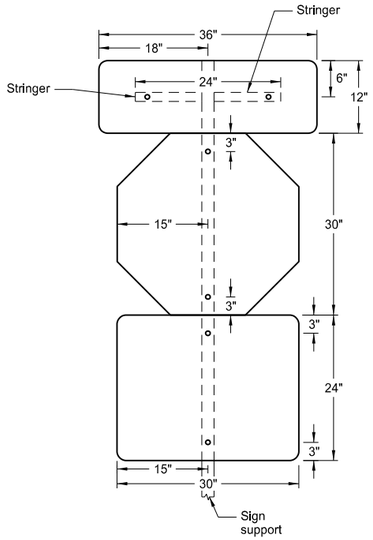
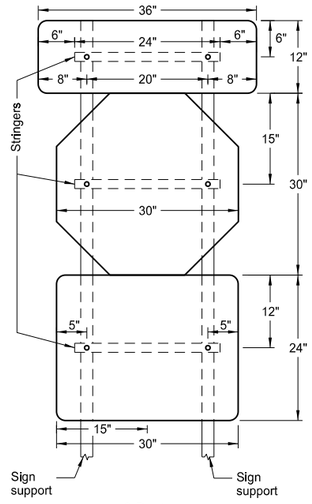
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS - DIVIDED HIGHWAY CONTROL SIGNS

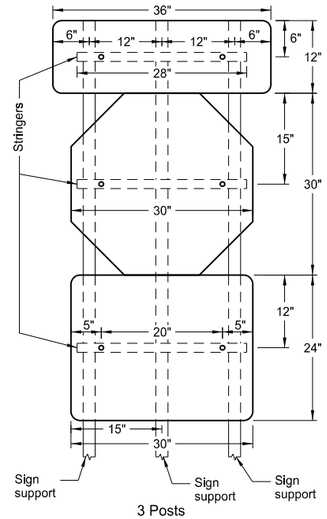
D-754-77




1 Post

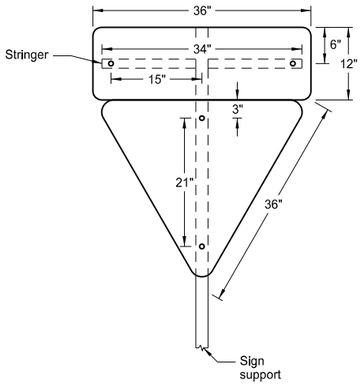



2 Posts

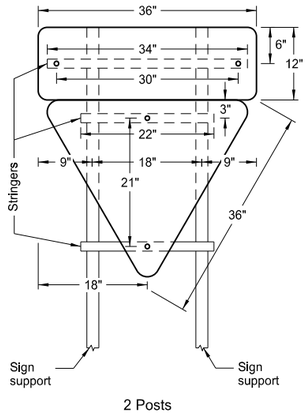



3 Posts

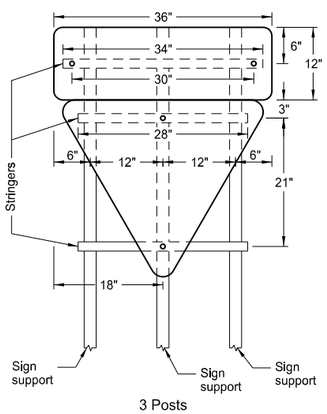
ASSEMBLY NO. 445 & 449




1 Post




2 Posts




3 Posts

ASSEMBLY NO. 446 & 450

Notes:

1. The minimum sign backing material thickness shall be 0.100 inch.
2. Perforated square tube stringer shall be 1½"x1½".
3. All holes shall be punched round for ⅜" bolt.
4. Assemblies 445 and 446 have single one way signs. Assemblies 449 and 450 have back to back one way signs.

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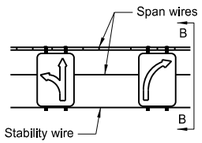
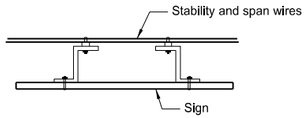
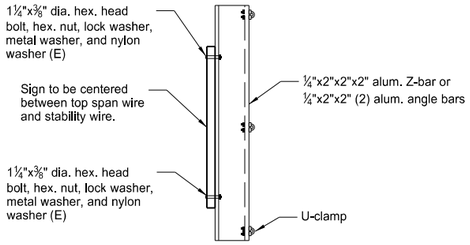
# LIGHT STANDARD, SIGNAL STANDARD, AND SPAN WIRE MOUNTED SIGN ASSEMBLY DETAIL

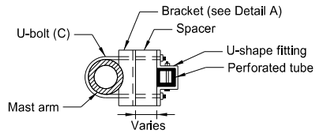


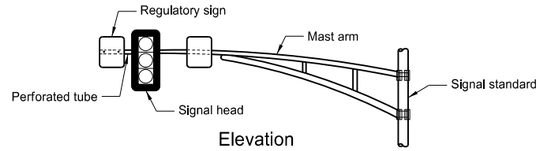

Plan



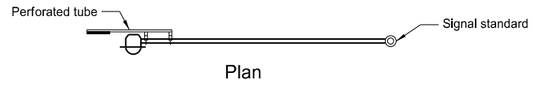

Section B-B
Span Wire Mounted Sign Detail



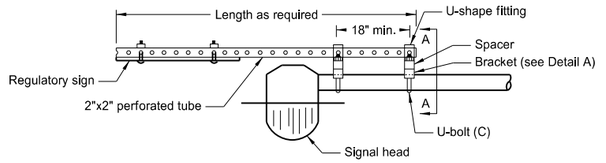

Section A-A



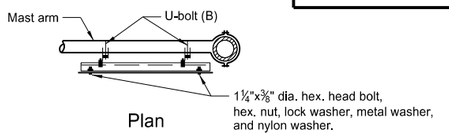

Elevation



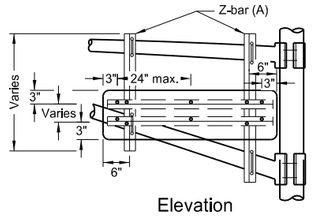

Plan




Sign Mounted Beyond End of Mast Arm Detail

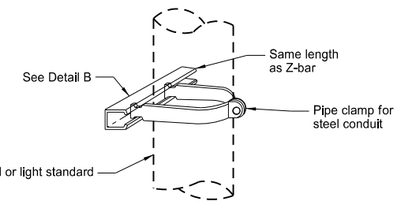



Plan

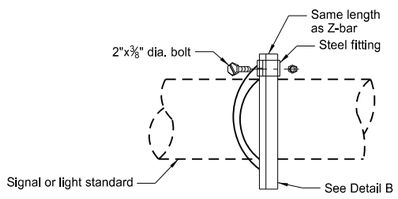



Elevation

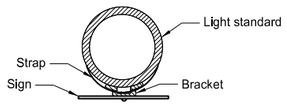
Mast Arm Mounted Street Name Sign Detail



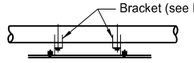

Vertical Mounting
(2 clamps required per sign)



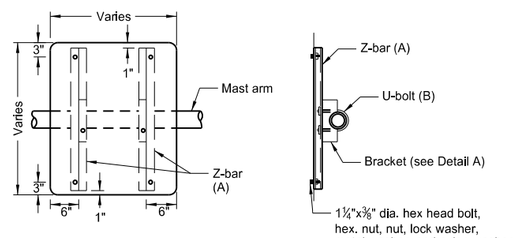

Horizontal Mounting
alternate clamp mounting
(2 clamps required per sign)




Light Standard Mounted Sign Bracket Detail
Max. 24"x30" signs (D)




Plan

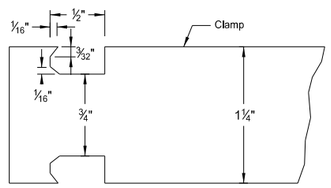



Elevation

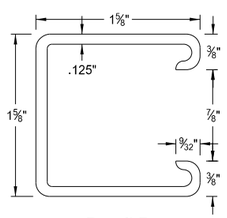



Side View

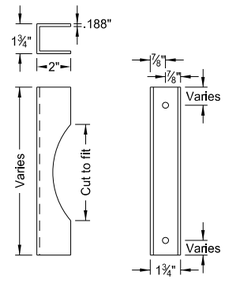
Mast Arm Mounted Regulatory Sign Detail




Clamp Detail




Detail B
Steel Channel




Detail A

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

| Clamp | |
|---|---|
| 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 | 29⅝ |

Notes:

(A) Z-bar - Use 1¾"x3/16" thick 1.08 lb/ft aluminum alloy. In place of Z-bar, two angles bolted together may be used or a channel. 1¾"x1¾"x3/16" angles or 1¾"x2"x.188" channels.

(B) ⅜" U-bolt, hex. nut, lock washer, and length depends on dia. of mast arm.

(C) ⅜" U-bolt, hex. nut, lock washer, and length depends on dia. of mast arm.
2"x2" maximum support length 9.9'
2¼"x2¼" maximum support length 12.6'
2½"x2½" maximum support length 15.7'

(D) Bracket shall be of galv. steel consisting of strap and sign attachment bracket similar to the one shown in the detail. The cost of the bracket assembly is to be included in the price bid for flat sheet signs. Punching shall be as shown on the Standard Drawings. There shall be a 7' vertical clearance to the bottom of all signs mounted on light standards.

(E) Metal washers and nylon washers used on sign face shall have a minimum outside dia. of 15/16" ± 1/16" and 10 gauge thickness.

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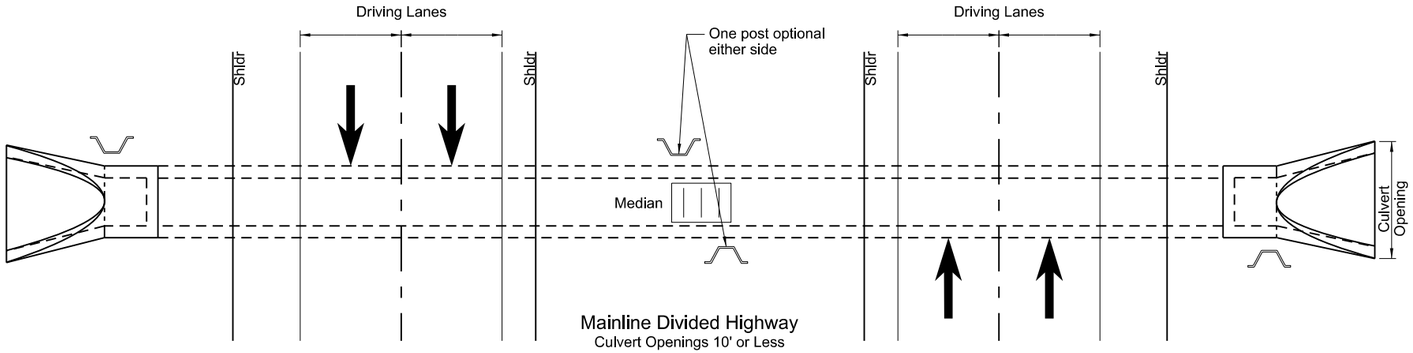
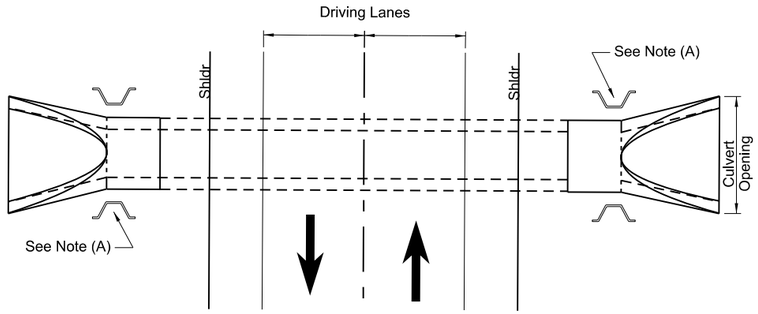
# OBJECT MARKERS - CULVERTS

D-754-83

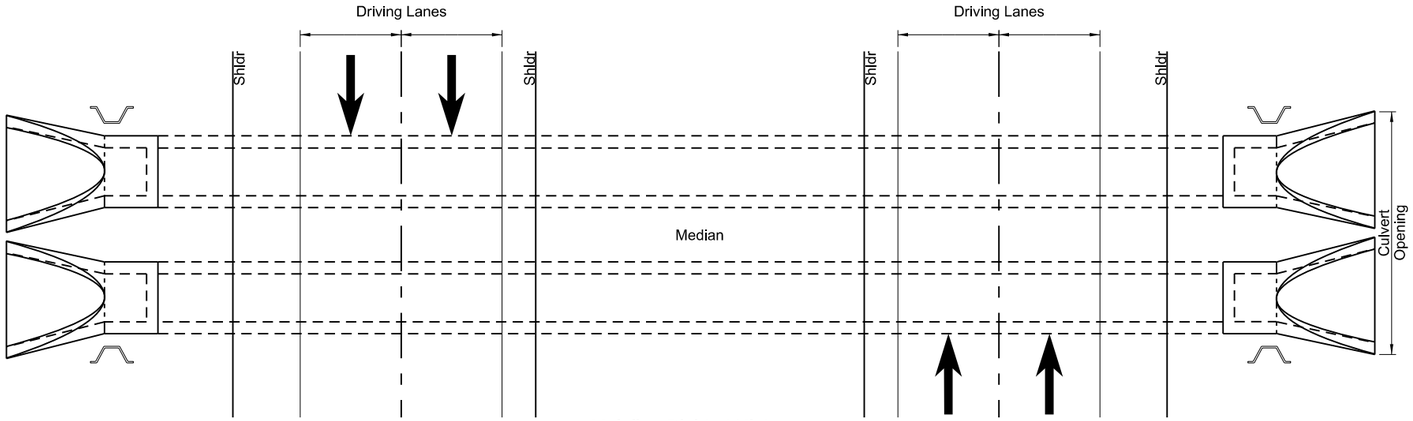



Mainline Divided Highway
Culvert Openings 10' or Less

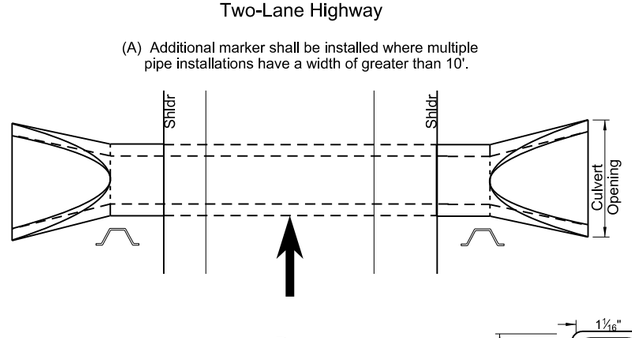



Two-Lane Highway

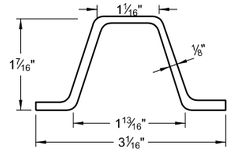
(A) Additional marker shall be installed where multiple pipe installations have a width of greater than 10'.



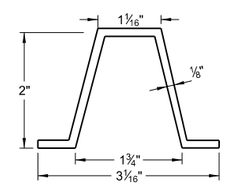

Mainline Divided Highway
Culvert Openings Greater than 10'
Multiple Installations




Ramp




Steel Post Detail
Approx. 2.0 lbs/ft




Aluminum Post Detail
Approx. 0.88 lbs/ft

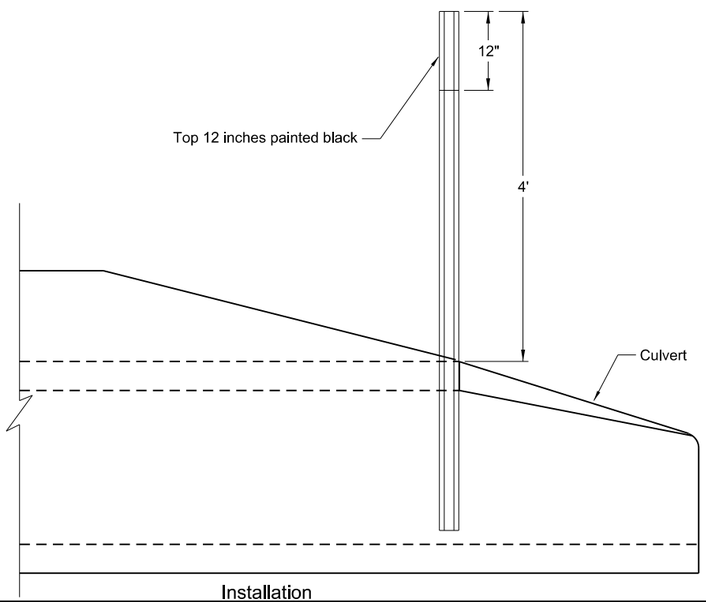
Post Location

## Notes:

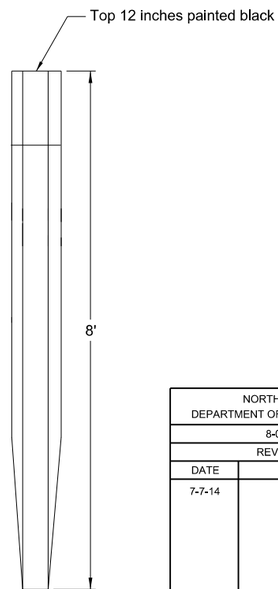
Installation: Construction requirements shall meet 754.04D. Each end of culverts crossing the roadway within the right-of-way shall be marked with a post as shown. Posts are to be installed in front of the culvert in the direction of travel along the side of the culvert and one foot from the culvert opening unless shown otherwise on the plans.

Posts: Posts shall conform to section 894.04A of the Standard Specifications with the exception that the post may or may not have holes drilled.

Basis of Payment: The quantity will be measured by the number of object markers each installed. All costs for furnishing and installing the markers shall be included in the price bid for the item "Object Markers - Culverts".




Installation




U-Type Post

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 8-05-13 | |
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| DATE | CHANGE |
| 7-7-14 | Revised Notes |

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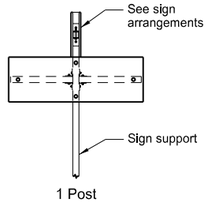
# SIGN PUNCHING, STRINGER AND SUPPORT LOCATION DETAILS FOR STREET NAME SIGNS AND 911 SIGNS

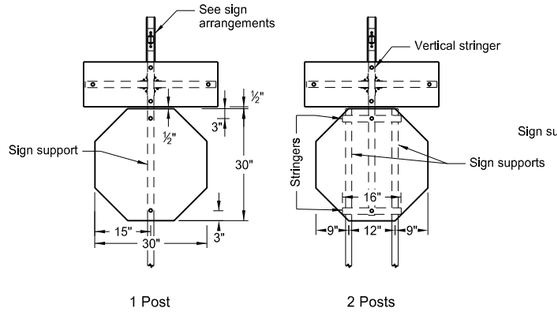
D-754-87

A - Single sign
B - Single sign back to back
C - Single sign each direction
D - Single sign one direction, back to back other direction
E - Back to back both directions



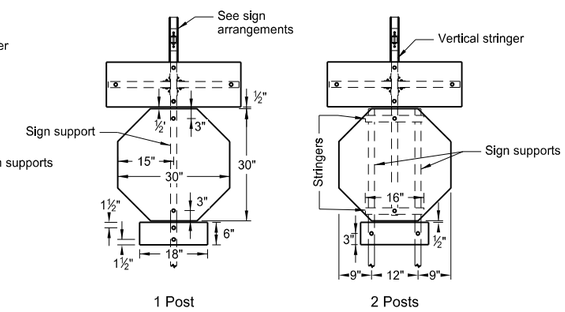

1 Post

Special Assembly 1 (A, B, C, D or E)



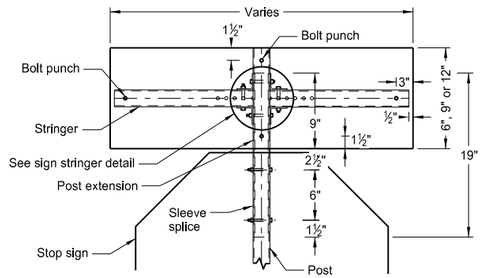

1 Post 2 Posts

Special Assembly 2 (A, B, C, D or E)




1 Post 2 Posts

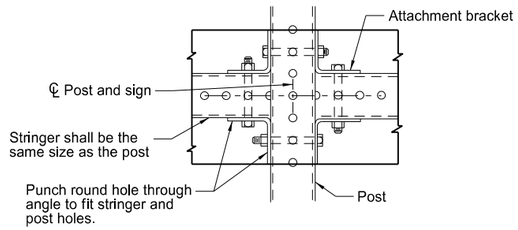
Special Assembly 3 (A, B, C, D or E)




Front View

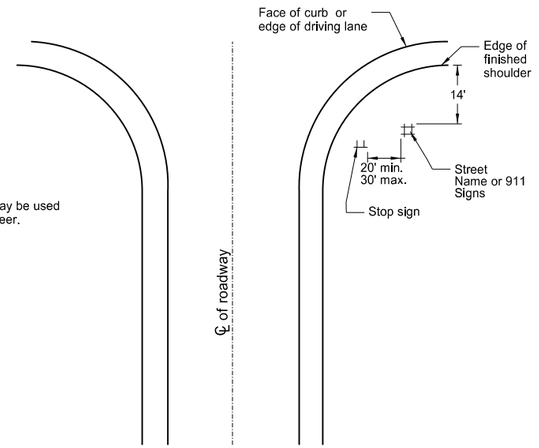
Sleeve Splice Detail

Note: The splice method may be used upon approval of the engineer.



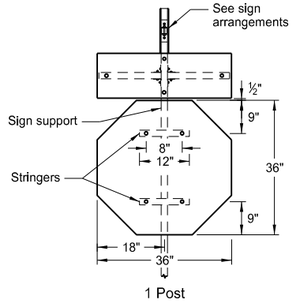

Sign Stringer Detail

Note: See Standard Drawing D-754-86 for 911 support information and sign layout details.

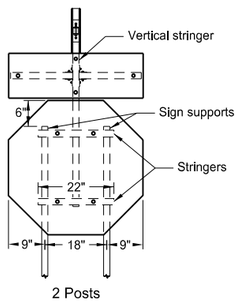



Intersection Layout

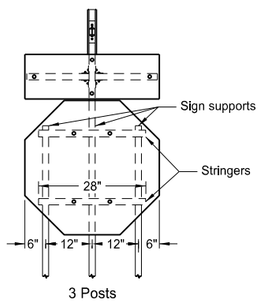
Note: This layout is to be used for street name signs or 911 signs that are used with Special Assembly 1 .




1 Post

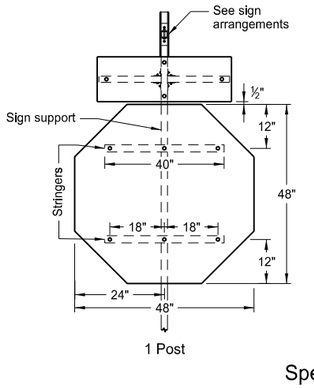



2 Posts

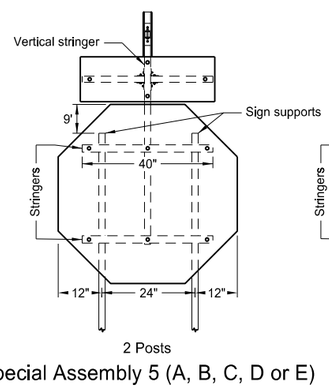



3 Posts

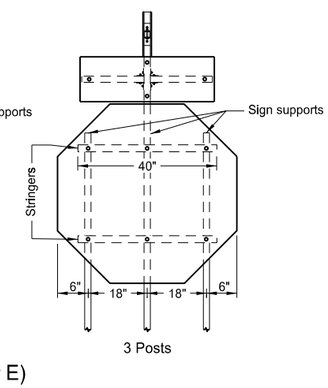
Special Assembly 4 (A, B, C, D or E)




1 Post

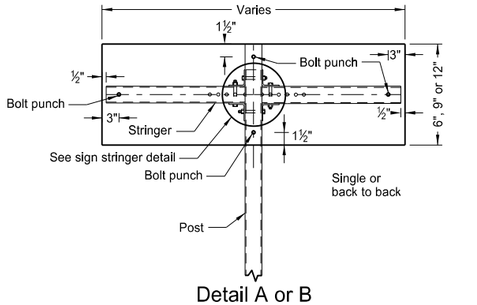



2 Posts

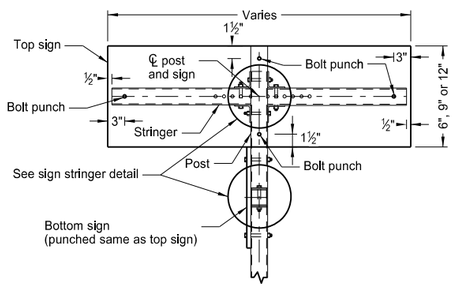



3 Posts

Special Assembly 5 (A, B, C, D or E)

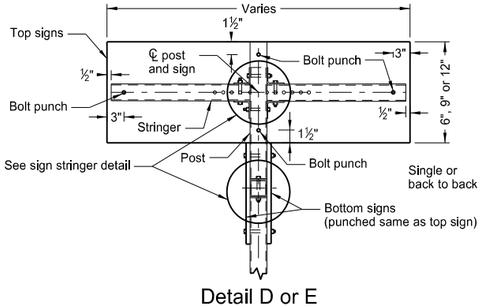



Detail A or B




Detail C

Sign Arrangements




Detail D or E

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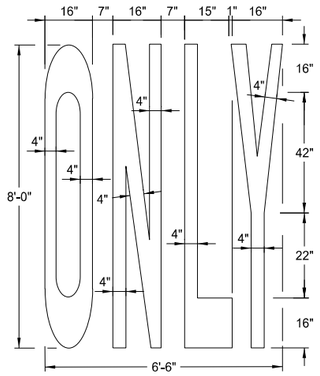
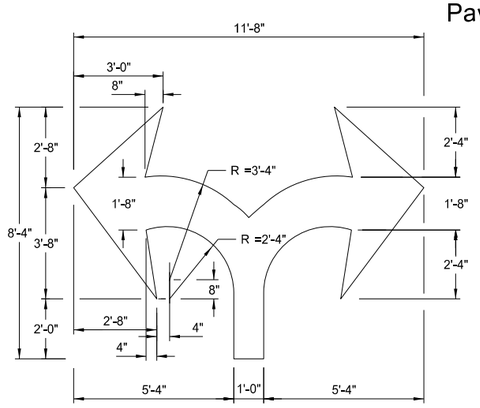
# Pavement Marking Message Details

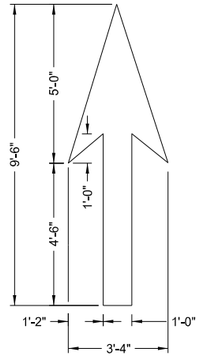
D-762-1



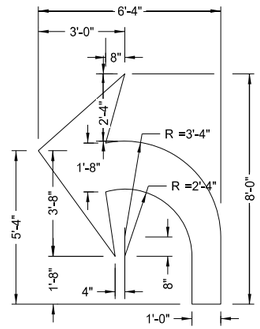

22 S. F.



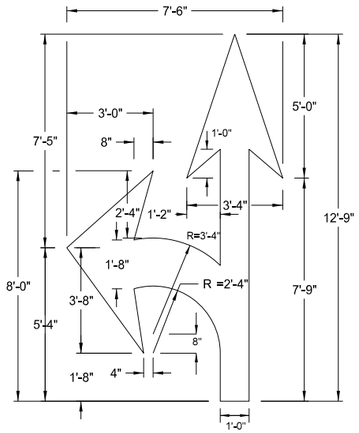

29 S. F.



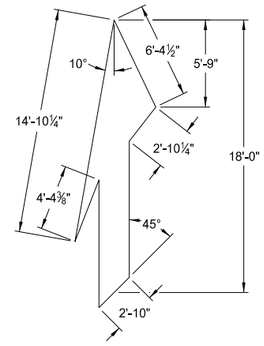

12 S. F.




16 S. F.

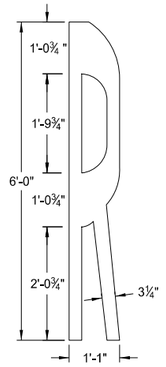



27 S. F.

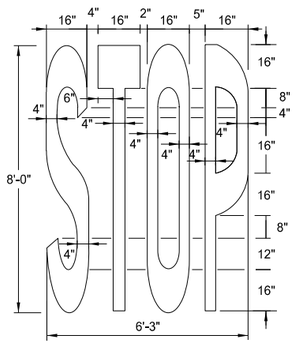



41 S. F.

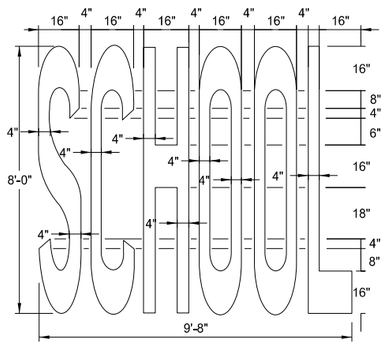
Note:
The merge arrow shall be rotated 20° from the edge of the roadway.



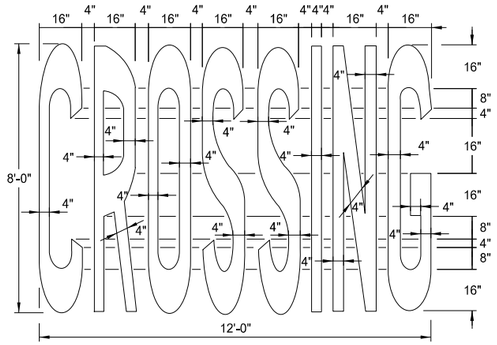

4 S. F.




22 S. F.



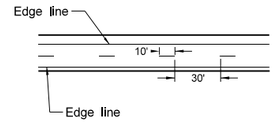

34.5 S. F.



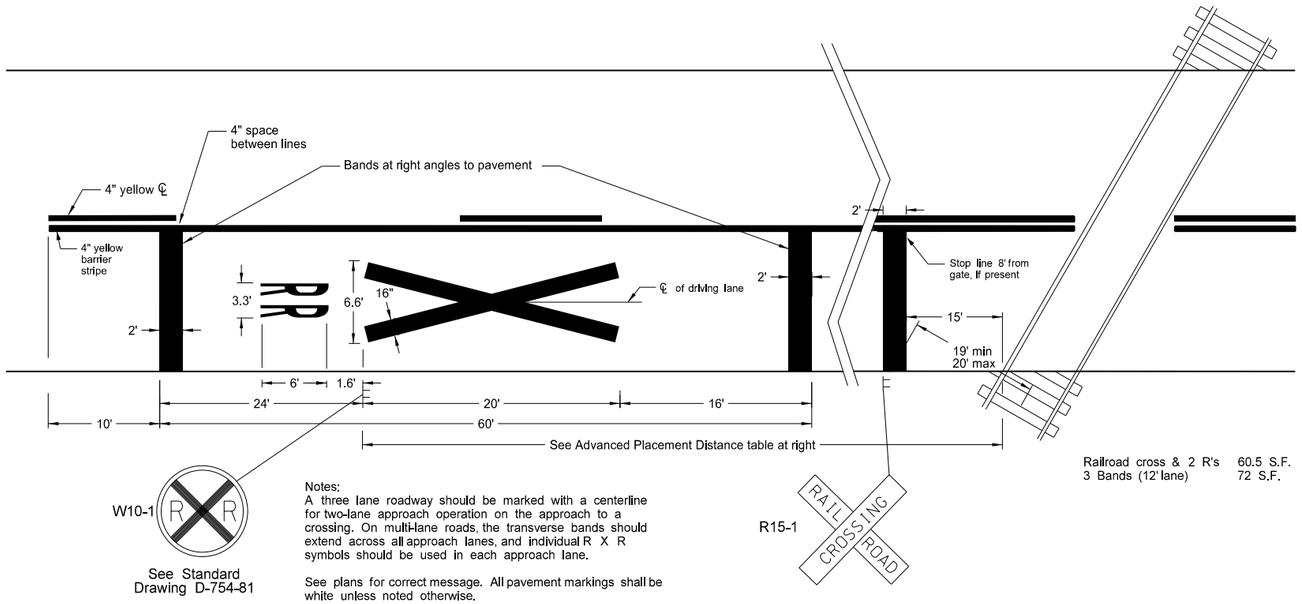

46 S. F.

| Speed Limit | Chevron Width | Chevron Spacing 45° to Traffic |
|---|---|---|
| 0-25 mph | 8" | 5' |
| 30-40 mph | 8" | 15' |
| 45 mph and above | 12" | 25' |

Chevron Crosshatching Table



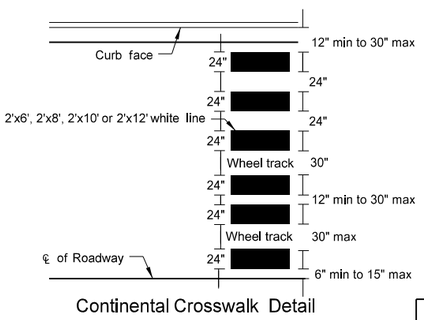

Centerline Pavement Marking Skip Spacing Detail




Railroad cross & 2 R's 60.5 S.F.
3 Bands (12' lane) 72 S.F.

Notes:
A three lane roadway should be marked with a centerline for two-lane approach operation on the approach to a crossing. On multi-lane roads, the transverse bands should extend across all approach lanes, and individual R X R symbols should be used in each approach lane.

See plans for correct message. All pavement markings shall be white unless noted otherwise.




Continental Crosswalk Detail

| Advance Placement Distance for Railroad Warning Signs | |
|---|---|
| Posted or 85th Percentile Speed | Advance Distance |
| 20 mph | min. 100 ft |
| 25 mph | min. 100 ft |
| 30 mph | min. 100 ft |
| 35 mph | min. 100 ft |
| 40 mph | 125 ft |
| 45 mph | 175 ft |
| 50 mph | 250 ft |
| 55 mph | 325 ft |
| 60 mph | 400 ft |
| 65 mph | 475 ft |
| 70 mph | 550 ft |

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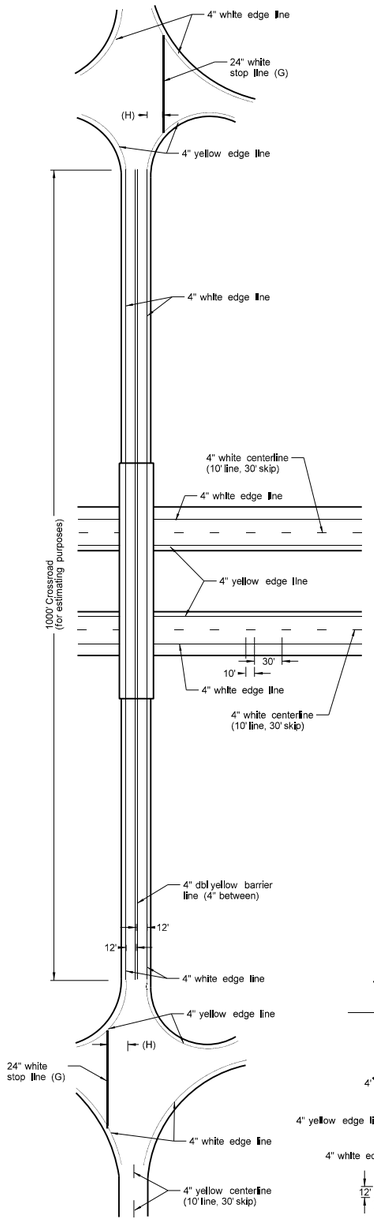
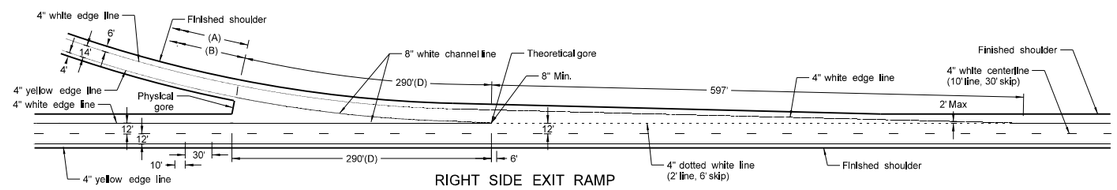
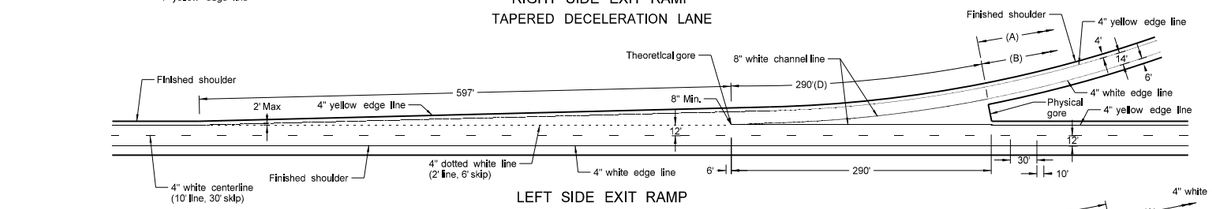
# INTERSTATE PAVEMENT MARKING
# 4 LANE DIVIDED HIGHWAY



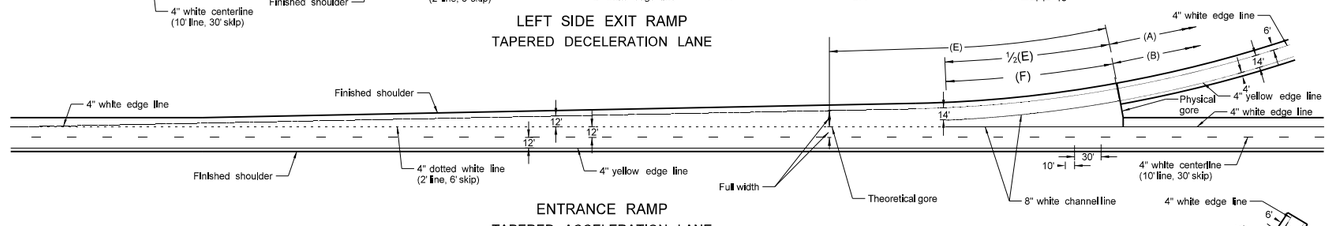

CROSS-ROAD & STRUCTURE
The engineer in the field shall determine the length to be striped.



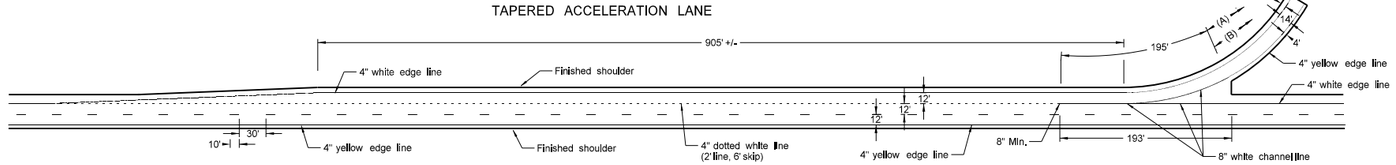

RIGHT SIDE EXIT RAMP
TAPERED DECELERATION LANE



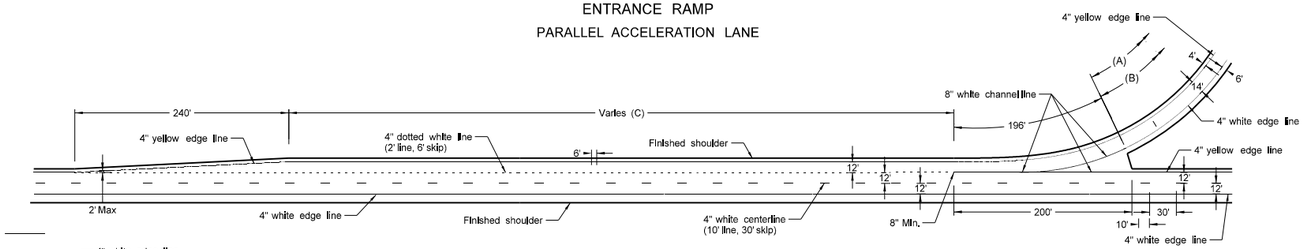

LEFT SIDE EXIT RAMP
TAPERED DECELERATION LANE



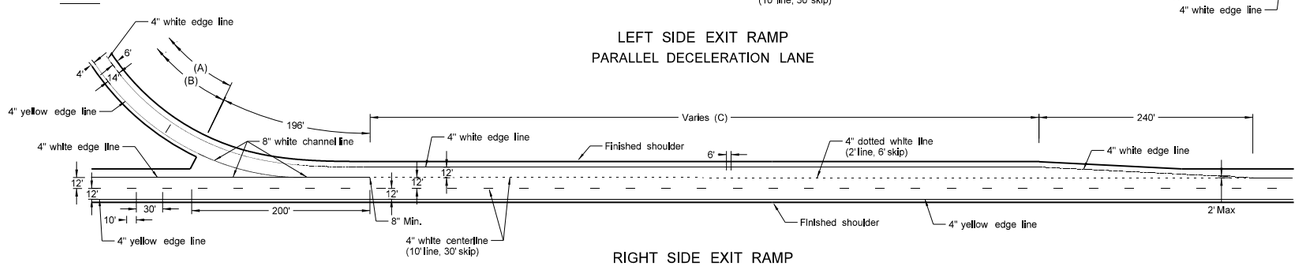

ENTRANCE RAMP
TAPERED ACCELERATION LANE




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" to equal 790' for purpose of estimate. The pavement marking shall begin at the beginning of the taper and end at the 8" line.
(D) Beginning of physical gore to theoretical gore.
(E) If the dlstace Is less than 350' then extend the 8" channel line to the theoretical gore, otherwise use 195'.
(F) 195' was used for estimating purposes.
(G) Not required when crossroad approaches have gravel surface.
(H) 4' minimum, 15' maximum from the nearest edge of the Intersection traveled way.

| 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 |

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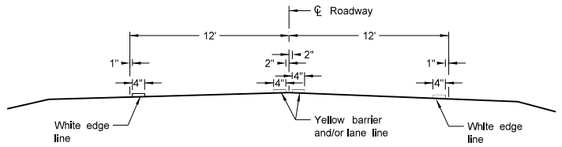
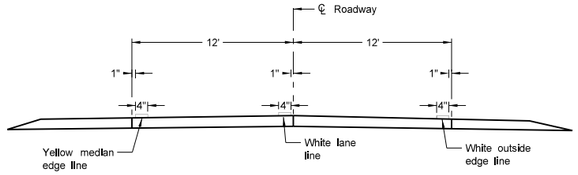
# PAVEMENT MARKING

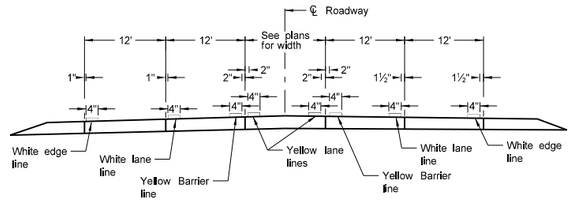
D-762-4




Two Lane Two Way
RURAL ROADWAY



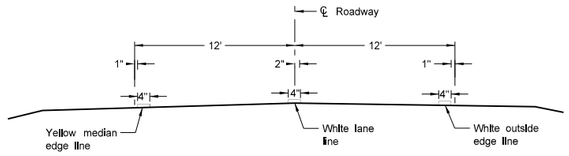

Two Lane Roadway
INTERSTATE HIGHWAY
Concrete Section



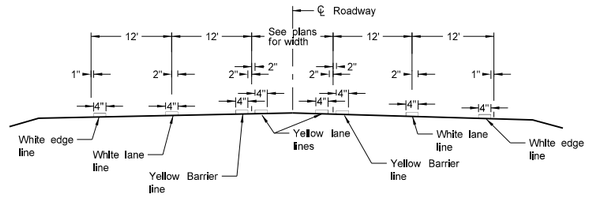

RURAL FIVE LANE ROADWAY
Concrete Section

NOTES:

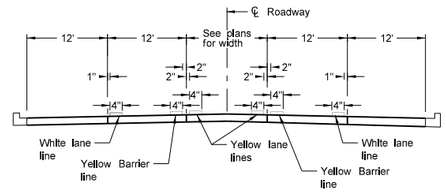
1. Edge lines shall be continued through private drives and field drives and broken for intersections.



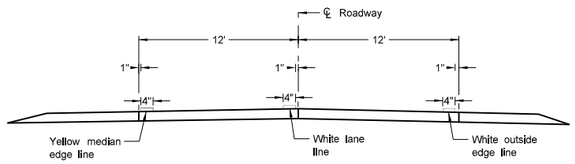

Two Lane Divided
Rural Roadway
PRIMARY HIGHWAY
Asphalt Section



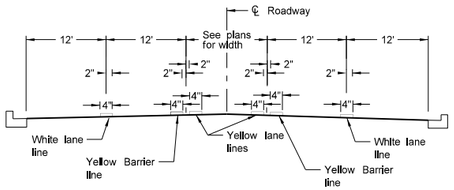

RURAL FIVE LANE ROADWAY
Asphalt Section



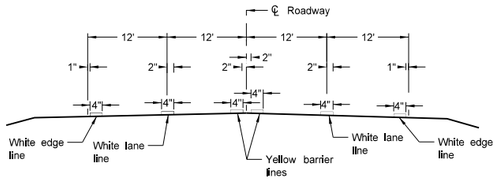

URBAN FIVE LANE SECTION
Concrete Section



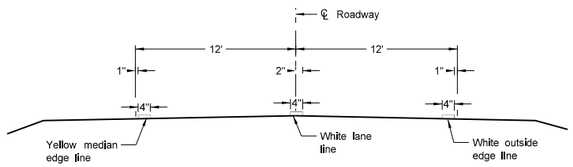

Two Lane Roadway
PRIMARY HIGHWAY
Concrete Section



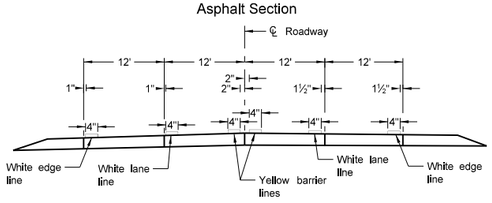

URBAN FIVE LANE SECTION
Asphalt Section



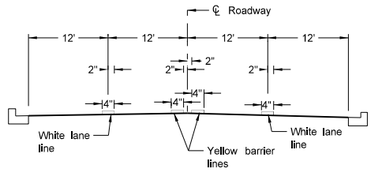

RURAL FOUR LANE ROADWAY
Asphalt Section



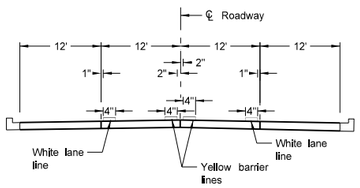

Two Lane Roadway
INTERSTATE HIGHWAY
Asphalt Section



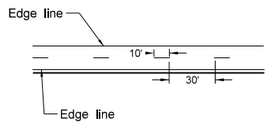

RURAL FOUR LANE ROADWAY
Concrete Section




URBAN FOUR LANE SECTION
Asphalt Section




URBAN FOUR LANE SECTION
Concrete Section




CENTERLINE PAVEMENT MARKING SKIP SPACING DETAIL

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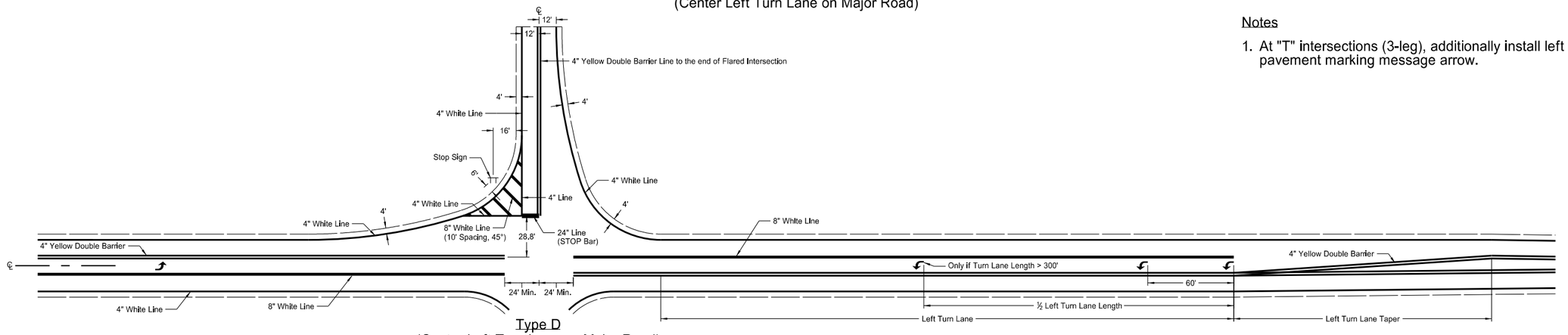
# PAVEMENT MARKING FOR STANDARD 90 DEGREE FLARED INTERSECTION

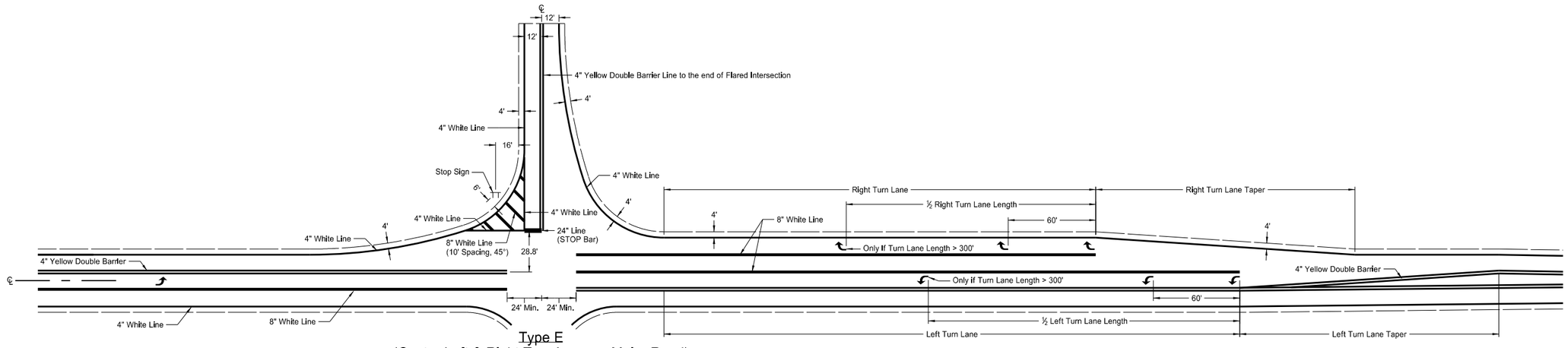
D-762-6

(Center Left Turn Lane on Major Road)



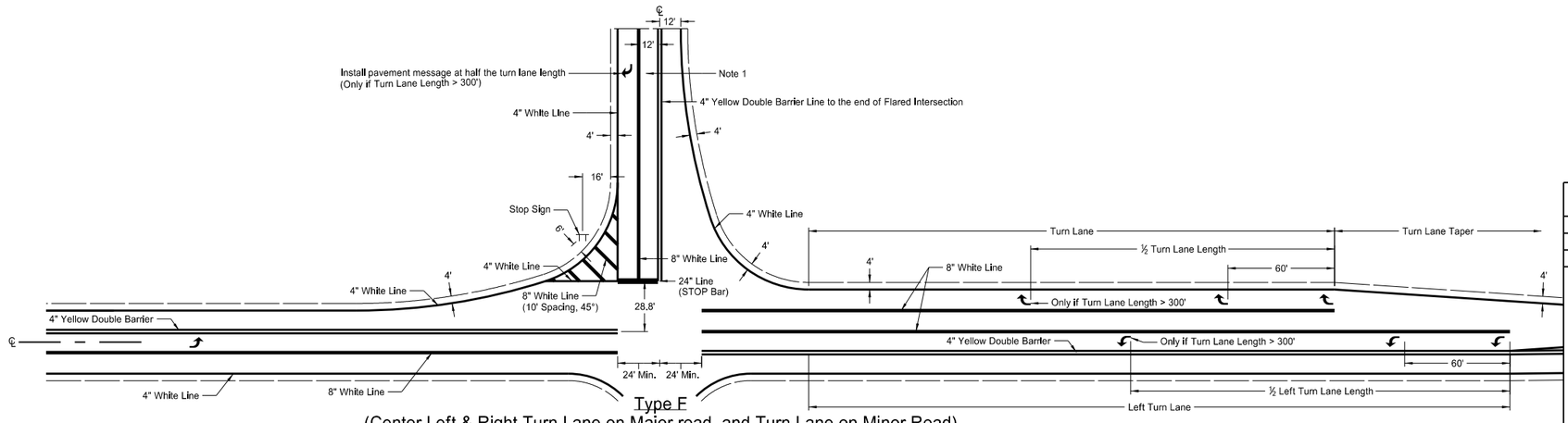

Type D

(Center Left Turn Lane on Major Road)




Type E

(Center Left & Right Turn Lane on Major Road)




Type F

(Center Left & Right Turn Lane on Major road, and Turn Lane on Minor Road)

Notes

1. At "T" intersections (3-leg), additionally install left turn pavement marking message arrow.

4" Marking

8" Marking

24" Marking

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| 3-29-16 | |
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| DATE | CHANGE |
| | |

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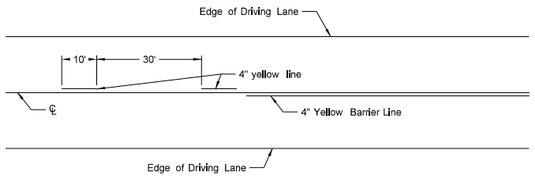
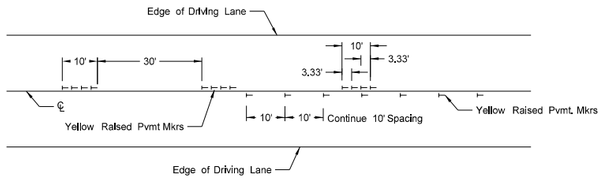
# SHORT-TERM PAVEMENT MARKING

D-762-11

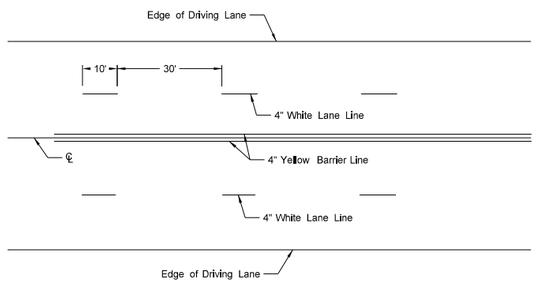



Painted or Tape Lines

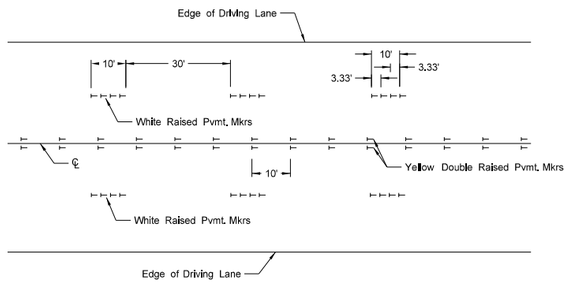



Raised Pavement Markers

TWO-LANE TWO-WAY ROADWAY

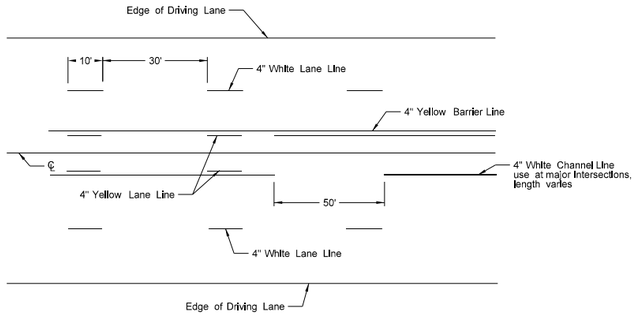



Painted or Tape Lines

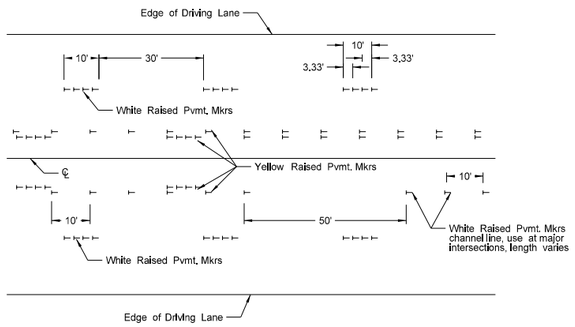



Raised Pavement Markers

FOUR LANE ROADWAY

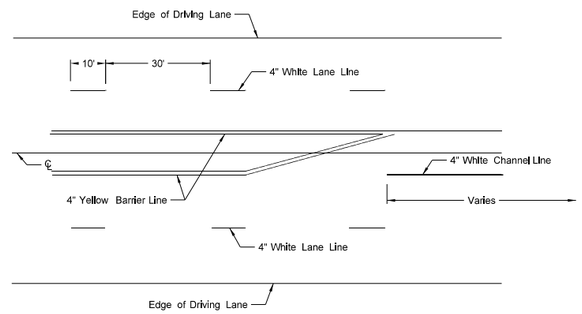



Painted or Tape Lines

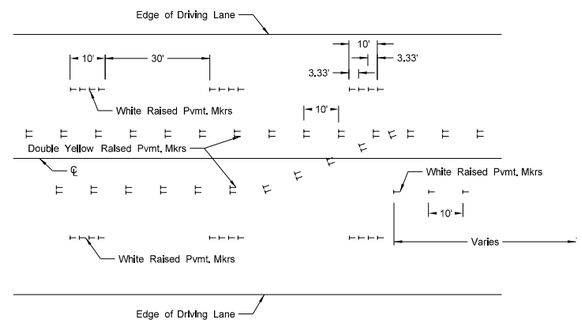



Raised Pavement Markers

FIVE LANE ROADWAY TWO WAY LEFT TURN




Painted or Tape Lines




Raised Pavement Markers

FIVE LANE ROADWAY WITH MARKED ISLANDS

NOTES:

1. Two-lane two-way roadways shall have no passing zones placed as shown. No passing zone signs may be placed in lieu of short term no passing zone pavement markings. These signs will be allowed to remain in place for three days, at which time the short term no passing zone pavement marking shall be placed.

2. Short term center line stripe (paint) on top lift shall be carefully placed with exact spacing so that the permanent stripe will match when applied.

3. Raised markers and tape markings shall be removed after permanent pavement marking has been installed. Removed markings shall become the property of the contractor.

| 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) |

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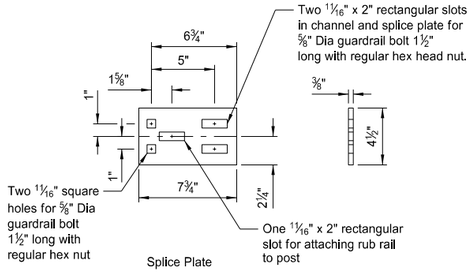
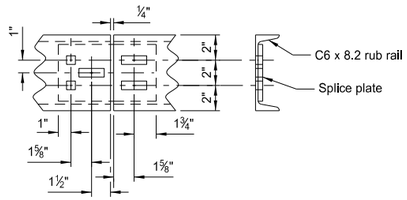
# W-BEAM GUARDRAIL GENERAL DETAILS

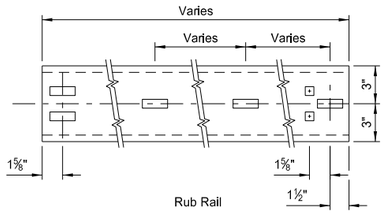
D-764-1




Splice Plate

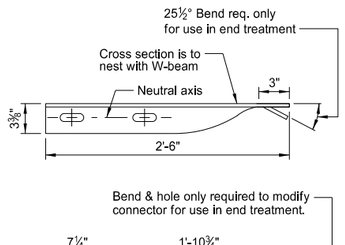



Splice Detail

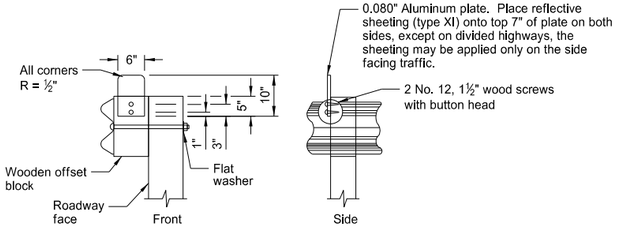



Rub Rail

## C6x8 RUB RAIL AND SPLICE PLATE

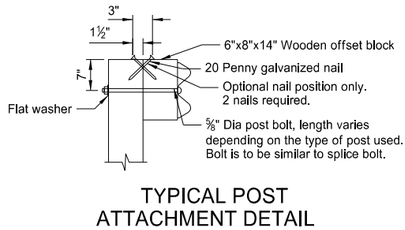



## W BEAM TERMINAL CONNECTOR

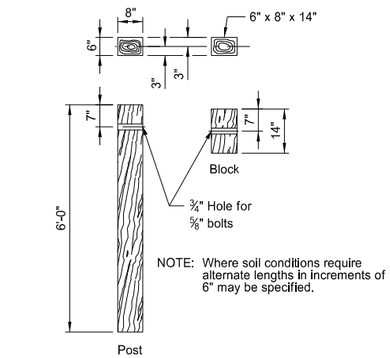



## REFLECTORIZED PLATE DETAIL

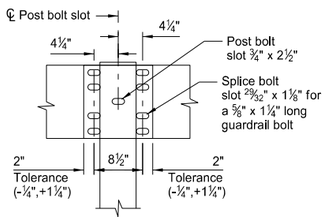
Additional reflectors are added to the W-beam guardrail quantities for placement on end treatment.



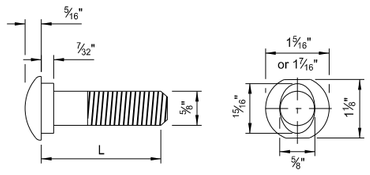

## TYPICAL POST ATTACHMENT DETAIL



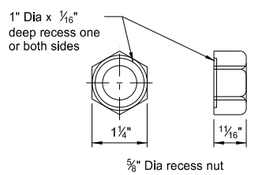

## 6"x8" TIMBER POST & BLOCK



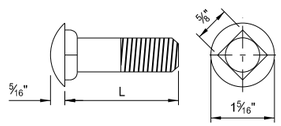

## SPLICE DETAIL




| 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 |

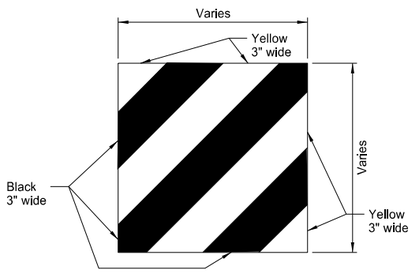



## 5/8" GUARDRAIL BOLT & RECESS NUT

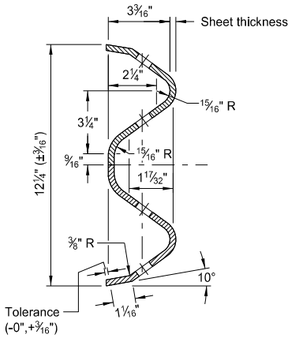



| 5/8" Diameter Carriage Bolt | |
|---|---|
| L | Thread Length |
| 1 1/2" | Full length thread |
| 3" | 1 1/2" Min thread length |
| 11" | 1 3/4" Min thread length |
| 13" | 1 3/4" Min thread length |


## 5/8" CARRIAGE BOLT & NUT




## IMPACT HEAD OBJECT MARKER




## W-BEAM CROSS SECTION

NOTES:

1. Reflectorized plates: Reflector plates shall begin at the first post and be spaced at 25' centers on guardrail less than 250' in length and at 50' centers for guardrail over 250' in length. The reflector shall be the same color as the pavement marking adjacent to that reflector unless noted otherwise on the plans.
2. Manner of replacing bituminous material at guardrail post: All excess earth from excavations for guard posts shall be disposed of 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. The Object Marker shall fit within the vertical edges of the Impact Plate. The retroreflective sheeting shall be type XI sheeting meeting the requirements of Section 894.02.B of the standard specifications. The sheeting shall be applied to 0.100 Aluminum sheeting meeting the requirements Section 894.01.A. The Object Marker shall attach to the Impact Head Plate with rivets or some other attachment device. The rivets or attachment device shall be non-rust. The stripes shall slope downward toward the roadway side.
4. Guardrail installation height tolerance = - 1/4" , + 1".

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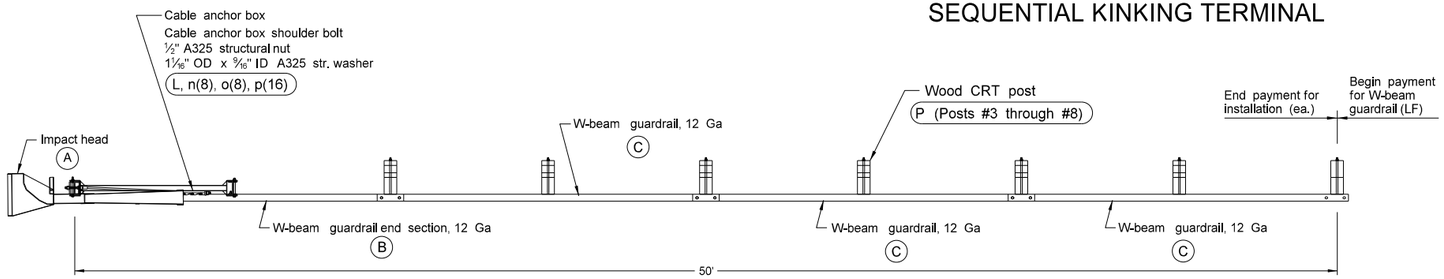
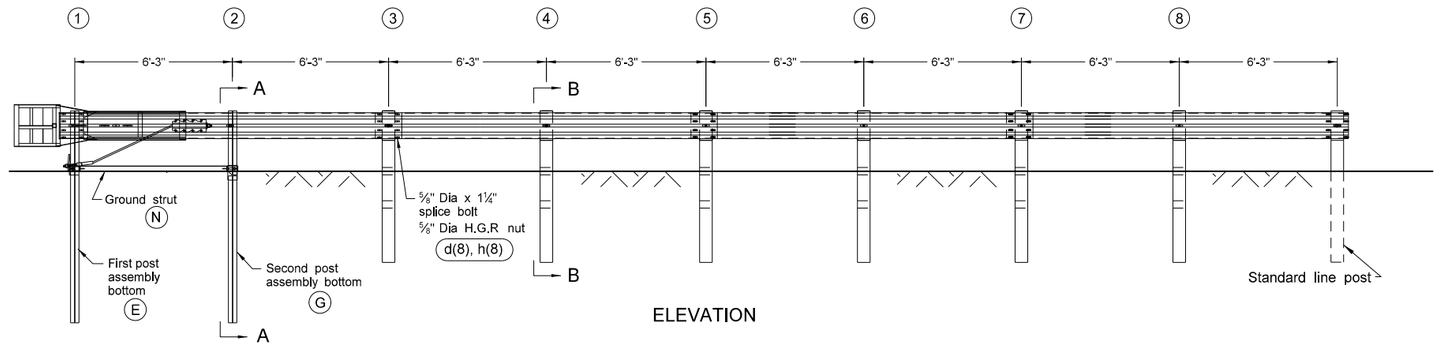
# SEQUENTIAL KINKING TERMINAL

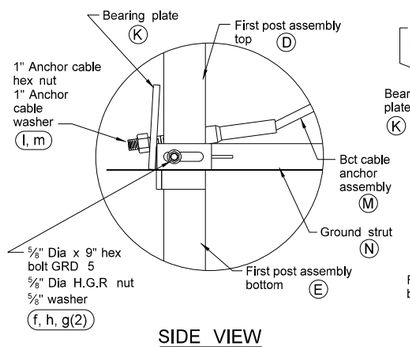
D-764-5



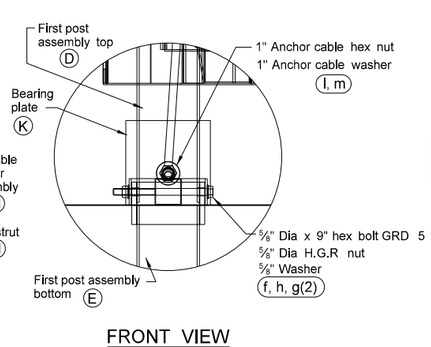

PLAN




ELEVATION

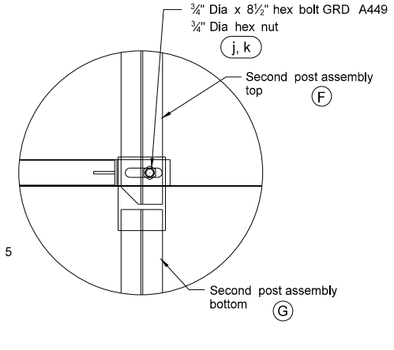



SIDE VIEW

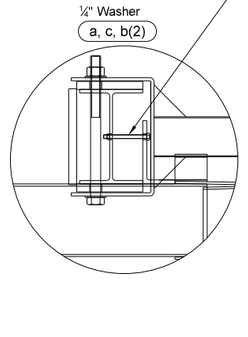



FRONT VIEW

POST #1 CONNECTION DETAILS




SIDE VIEW DETAIL OF POST #2

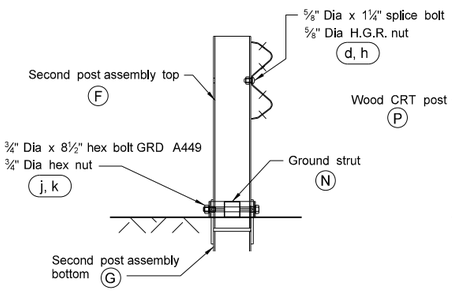



IMPACT HEAD CONNECTION DETAIL

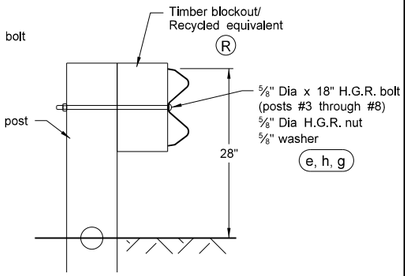
GENERAL NOTES:

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.

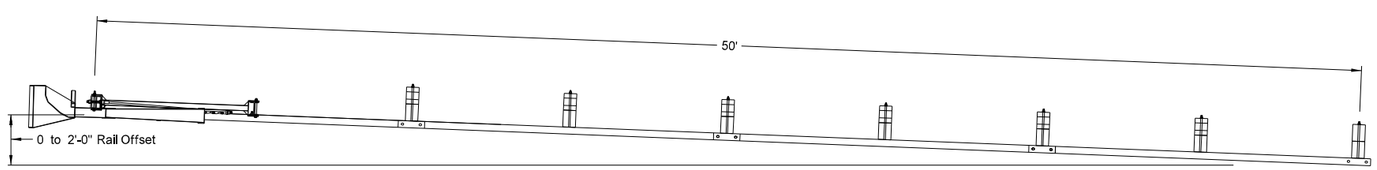
| ITEM | QTY | BILL OF MATERIALS |
|---|---|---|
| A | 1 | IMPACT HEAD |
| B | 1 | W-BEAM GUARDRAIL END SECTION, 12 Ga |
| C | 3 | W-BEAM GUARDRAIL, 12 Ga |
| D | 1 | FIRST POST ASSEMBLY TOP |
| E | 1 | FIRST POST ASSEMBLY BOTTOM |
| F | 1 | SECOND POST ASSEMBLY TOP |
| G | 1 | SECOND POST ASSEMBLY BOTTOM |
| 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

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| 10-11-13 | |
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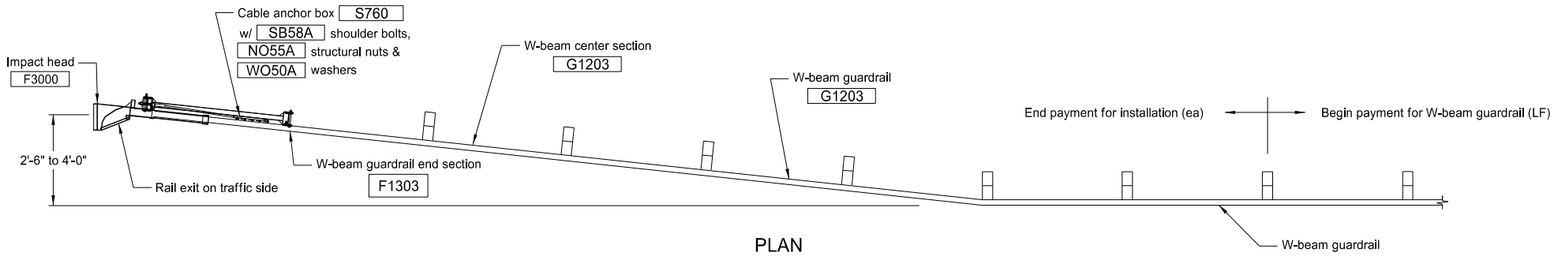
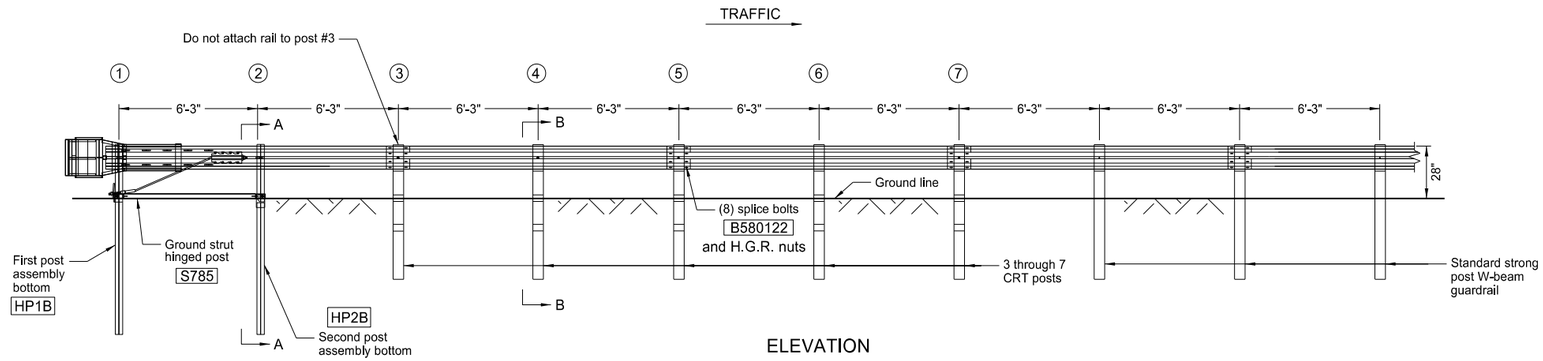
# FLARED ENERGY ABSORBING TERMINAL

D-764-6




PLAN

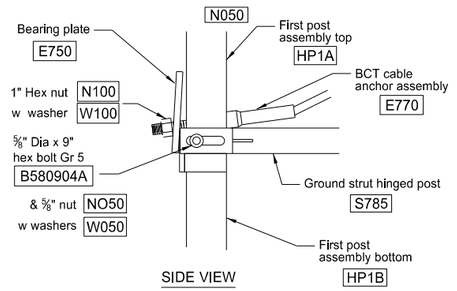



ELEVATION

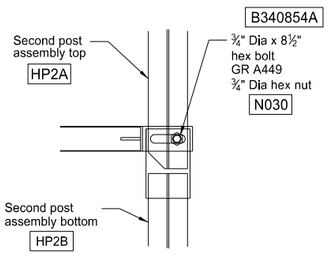
| ITEM # | QTY | BILL OF MATERIALS |
|---|---|---|
| F3000 | 1 | IMPACT HEAD |
| F1303 | 1 | W-BEAM GUARDRAIL END SECTION, 12 GA |
| G1203 | 2 | W-BEAM GUARDRAIL, 12 GA |
| HP1A | 1 | FIRST POST ASSEMBLY TOP |
| HP1B | 1 | FIRST POST ASSEMBLY BOTTOM |
| HP2A | 1 | SECOND POST ASSEMBLY TOP |
| HP2B | 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

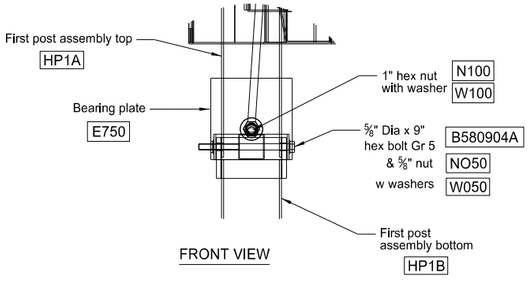
1. Wood posts are required with the Flared Energy Absorbing Terminal except posts #1 and #2.
2. All bolts, nuts, cable assemblies, cable anchors and bearing plates shall be galvanized.
3. The lower sections of the posts shall not protrude more than 4 inches above the ground (measured along a 60 inch 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

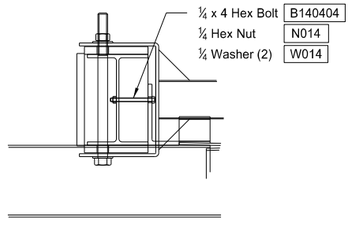



SIDE VIEW DETAIL OF POST #2

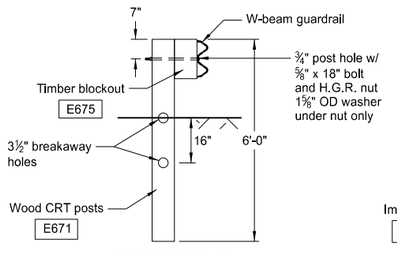



FRONT VIEW

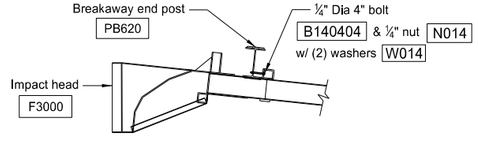
POST #1 CONNECTION DETAILS



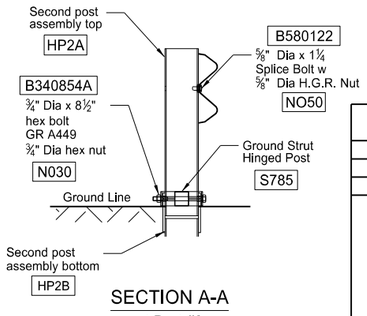

IMPACT HEAD CONNECTION DETAIL




SECTION B-B
POST 3 THRU 7




IMPACT HEAD CONNECTING DETAIL




SECTION A-A
at Post #2

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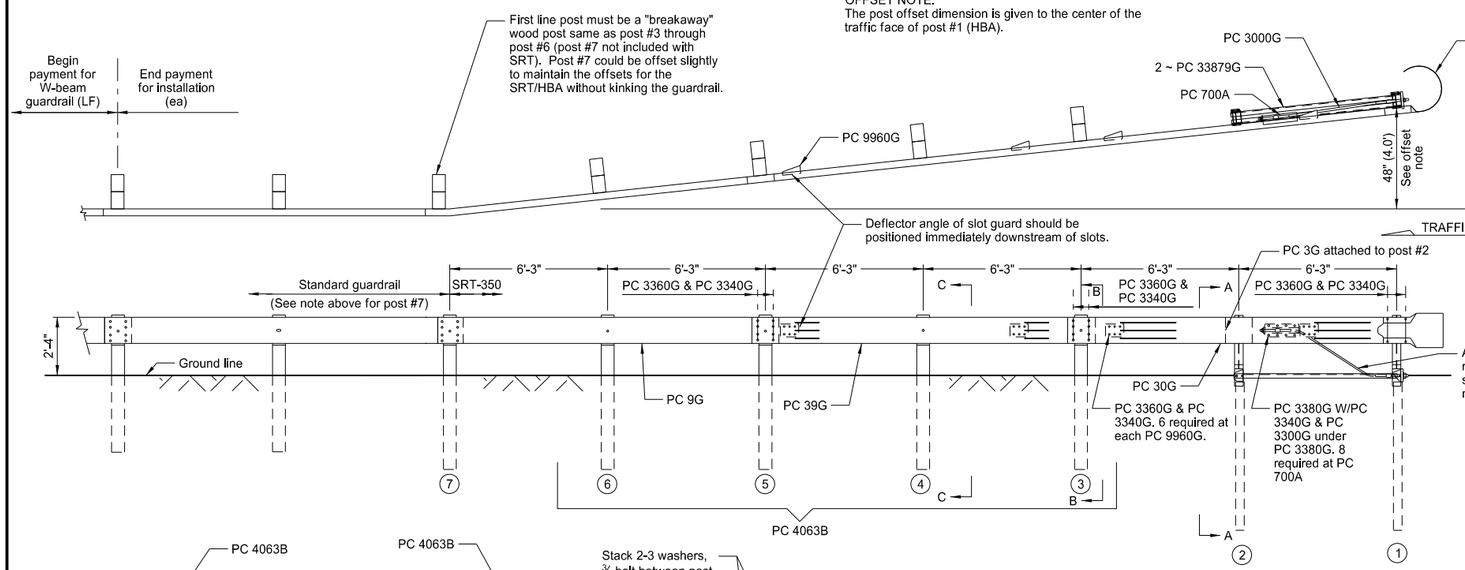
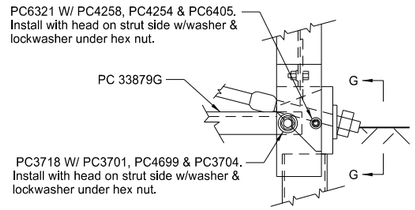
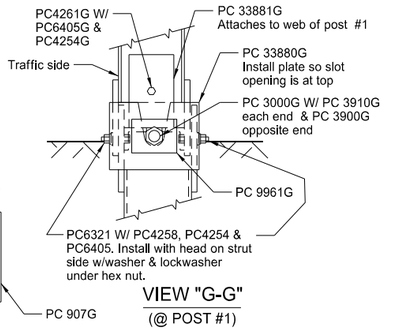
# SLOTTED RAIL TERMINAL

D-764-7

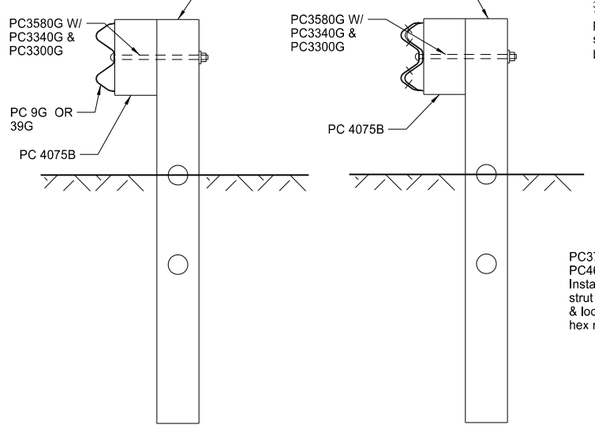



DETAIL "G"
(@ POST #1)



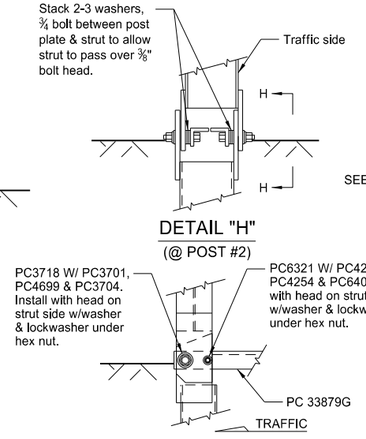

VIEW "G-G"
(@ POST #1)




SECTION "C-C"
(@ POST #4 & #6)

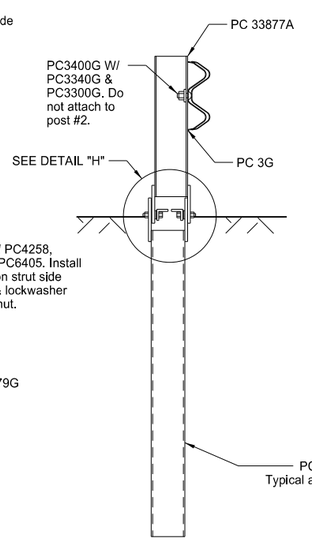



SECTION "B-B"
(@ POST #3 & #5)

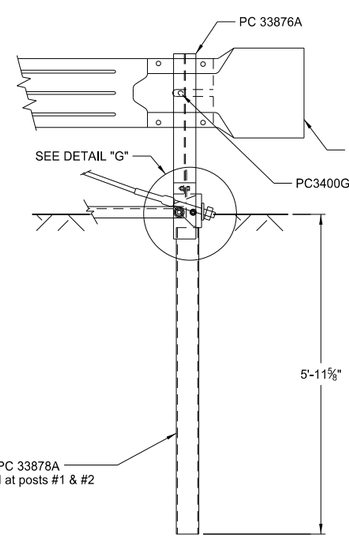



DETAIL "H"
(@ POST #2)

VIEW "H-H"
(@ POST #2)




SECTION "A-A"




ENLARGED VIEW @ POST #1

| BILL OF MATERIAL | | |
|---|---|---|
| PC | QTY | DESCRIPTION |
| 3G | 1 | 12/12"/BACKUP (GUARDRAIL) |
| 9G | 1 | 12/12'6/6'3/S (GUARDRAIL) |
| 30G | 1 | 12/12'6/S SRT-1 (GUARDRAIL) |
| 39G | 1 | 12/12'6/S SRT-2 (GUARDRAIL) |
| 700A | 1 | CABLE ANCHOR BRACKET |
| 907G | 1 | 12/BUFFER/ROLLED (TERMINAL) |
| 3000G | 1 | 3/4 x 6'6" CABLE |
| 3300G | 14 | 5/8" WASHER |
| 3340G | 58 | 5/8" HEX NUT |
| 3360G | 44 | 5/8"ø x 1 1/4" SPLICE BOLT |
| 3380G | 8 | 5/8"ø x 1 1/2" HEX HD BOLT |
| 3400G | 2 | 5/8"ø x 2" POST BOLT |
| 3580G | 4 | 5/8"ø x 18" POST BOLT |
| 3701G | 10 | 3/4" WASHER |
| 3704G | 4 | 3/4" HEX NUT |
| 3718G | 4 | 3/4"ø x 3" HEX HD BOLT (A325) |
| 3900G | 1 | 1" WASHER |
| 3910G | 2 | 1" HEX NUT |
| 4063B | 4 | 6' POST 6" x 8" |
| 4075B | 4 | 14" BLOCK 6" x 8" |
| 4254G | 5 | 3/8" WASHER |
| 4258G | 4 | 3/8" LOCKWASHER |
| 4261G | 1 | 3/8"ø x 1 1/2" HEX HD BOLT (GR 5) |
| 4699G | 4 | 3/4" LOCKWASHER |
| 6321G | 4 | 3/8"ø x 2" HEX HD BOLT (GR 5) |
| 6405G | 5 | 3/8" HEX NUT |
| 9960G | 4 | SLOT GUARD |
| 9961G | 1 | 3/8" x 3" x 4" PLATE WASHER |
| 33876A | 1 | HBA POST 1 TOP (W6 x 8.5) |
| 33877A | 1 | HBA POST 2 TOP (W6 x 8.5) |
| 33878A | 2 | HBA POST 1 & 2 BOT (TS 6 x 4) |
| 33879G | 2 | ANGLE STRUT 2" x 2" x 3/8" |
| 33880G | 1 | 1" x 6" x 8" BEARING PLATE |
| 33881G | 1 | CABLE WEB PL 4" x 1/4" x 6 1/2" |

GENERAL NOTES:

1. Wood posts are required with the slotted rail terminal except posts #1 and #2.
2. All bolts, nuts, cable assemblies, cable anchors, bearing plates, slot guards, struts, nails, pipes soil tubes and soil plates shall be galvanized.
3. The breakaway cable assembly must be taut. A locking device (vice grips or channel lock pliers) should be used to prevent cable from twisting when tightening nuts.
4. The wood blockouts shall be "toe nailed" to the rectangular wood posts to prevent them from turning when wood shrinks. The 2 nails required per blockout shall be 20 penny and galvanized.
5. For curb installation, the curb must end prior to post #7. Where the curb is extended beyond post #7, the flared SRT can not be used. A straight end treatment shall be used at the end of the straight guardrail that is placed at the face of the curb.
6. For details not shown, see the manufacturer's installation manual.
7. Minimum length of rail, including end terminal, in advance of fixed objects shall be 175 feet when the slotted rail terminal is used as the end terminal.

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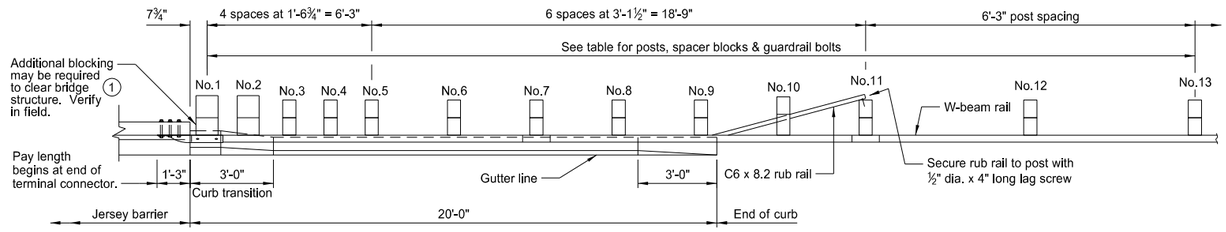
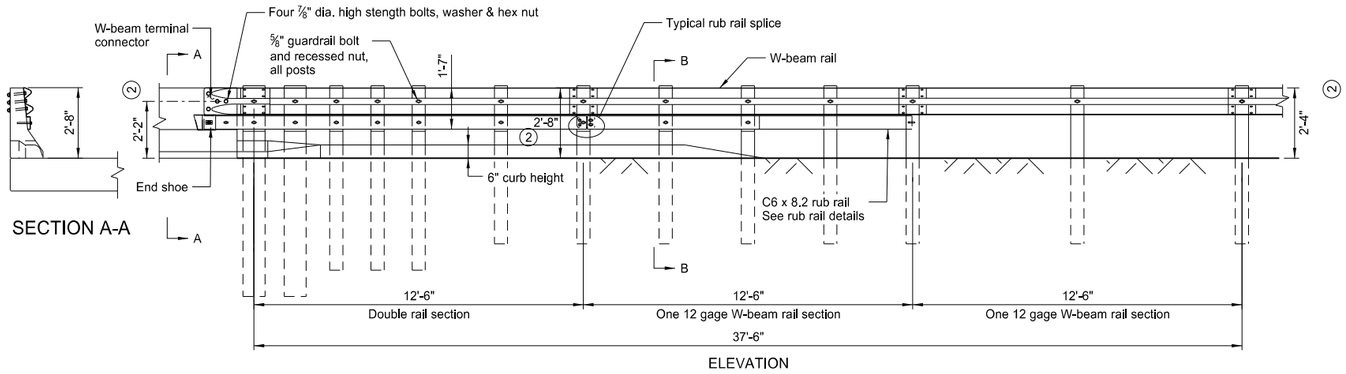
# W-BEAM TRANSITION TO CONCRETE JERSEY BARRIER WITH APPROACH CURB

D-764-9



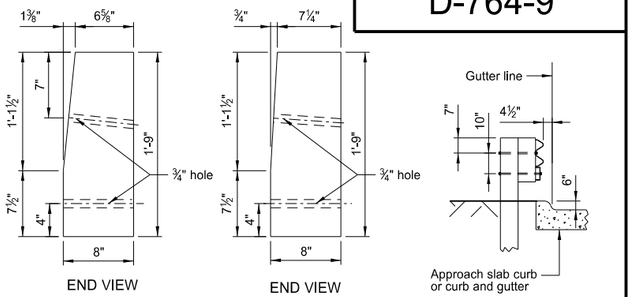

PLAN




SECTION A-A

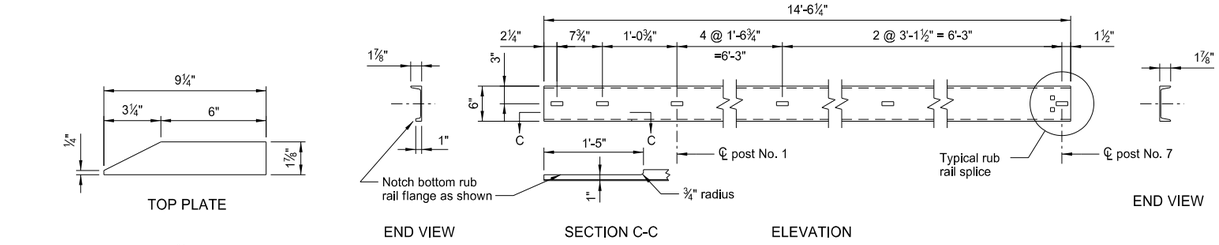
ELEVATION

## GENERAL ASSEMBLY DETAILS

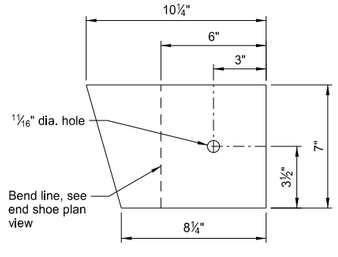



## TAPERED TIMBER BLOCK DETAILS

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

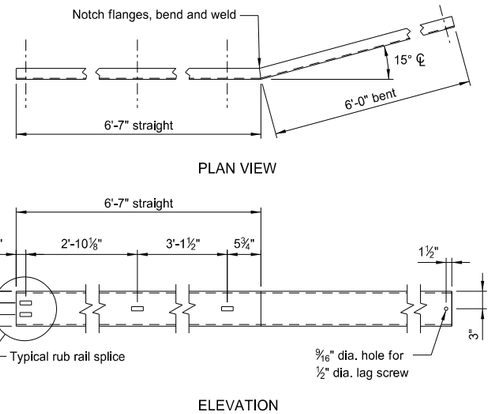



RUB RAIL STRAIGHT SECTION

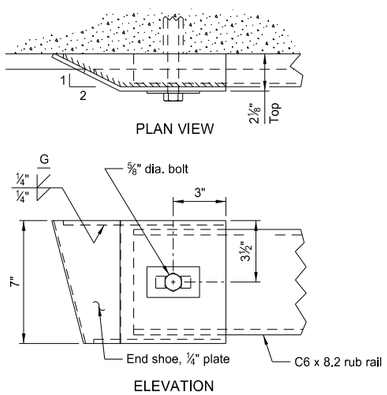



END SHOE PLATE DETAILS

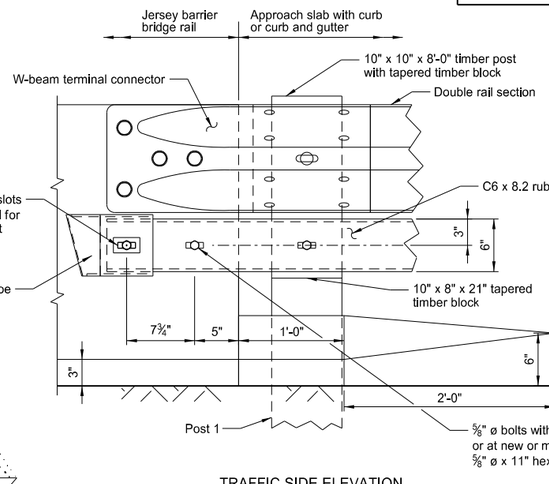
( ¼" plate )

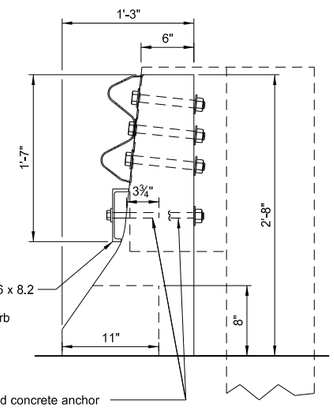



RUB RAIL BENT SECTION




RUB RAIL END SHOE ASSEMBLY




## RAIL ATTACHMENT AND CURB DETAIL

(1) Additional blocking may be required at post No.1.

(2) Height is 2'-8" from 0' to 12'-6" from bridge. Height tapers from 2'-8" to 2'-4" between 12'-6" to 37'-6" from bridge.

NOTES:

C6 x 8.2 rub rail and structural steel shall be AASHTO 270M Grade 250, and shall be galvanized after fabrication in accordance with AASHTO M111.

All slotted holes are $^{1}\!/_{16}$" x 2".

All square holes are $^{1}\!/_{16}$".

Galvanize all hardware in accordance with AASHTO M232.

All posts and blocks for the W-beam guardrail shall be timber.

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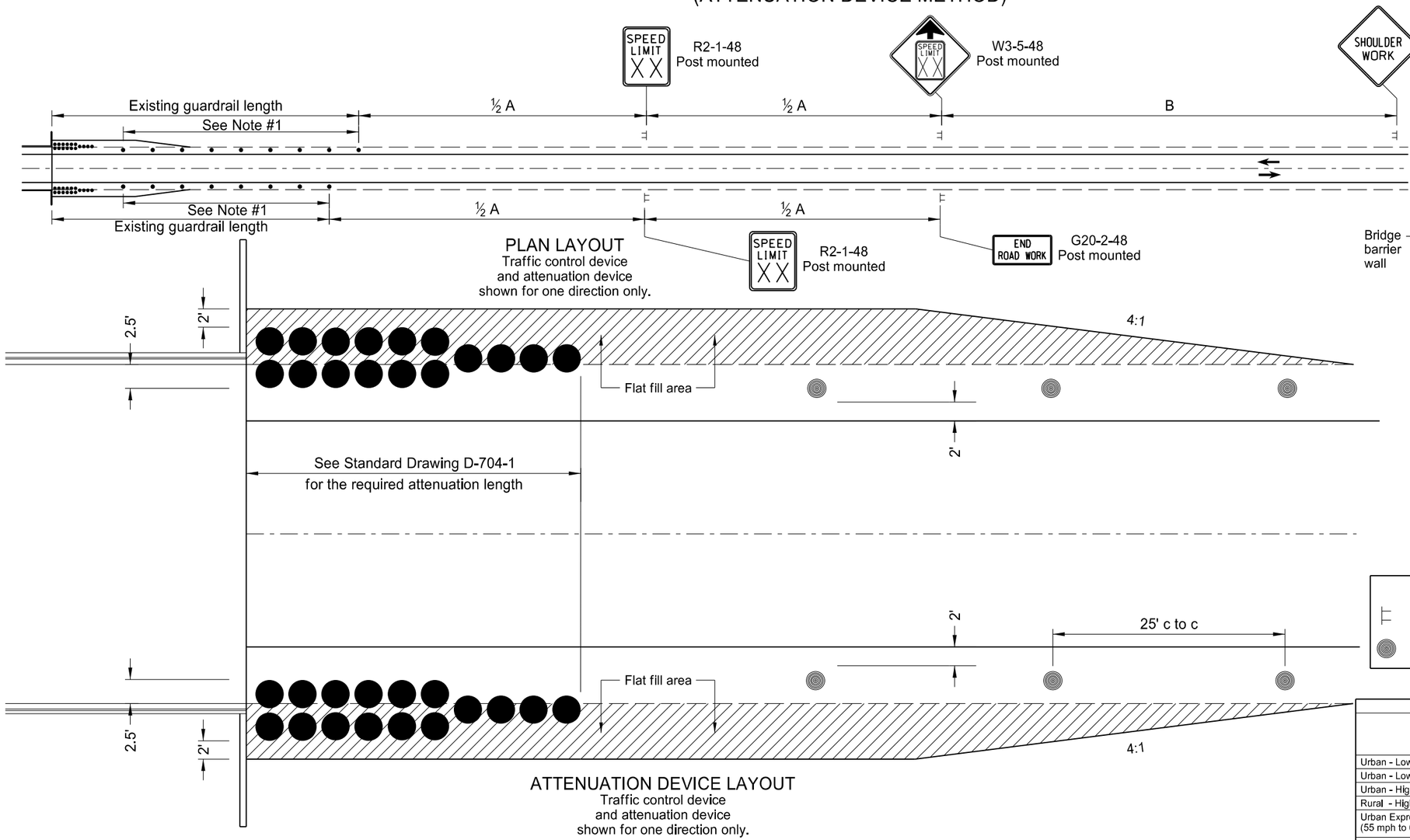
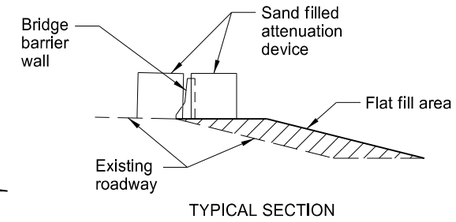
D-764-20

# SHORT TERM END TREATMENT FOR BRIDGES
# (ATTENUATION DEVICE METHOD)




KEY

- Sign
- Attenuation Module
- Delineator drum

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

Notes

1. If the shoulder width is less than 3', the vertical panels shall be used and placed as far from the driving lane as possible and still be on the finished shoulder. When there is no shoulder, the vertical panels shall be placed as near as possible to the driving lane on the foreslope of the shoulder.
2. If the bridge is within construction zone signing, the reduced speed ahead sign can be eliminated.
3. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 mph. Where speed limits are to be reduced more than 30 mph, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 mph. The second speed limit shall be placed at ½ B.
4. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
5. Existing speed limit signs within a reduced speed zone shall be covered.

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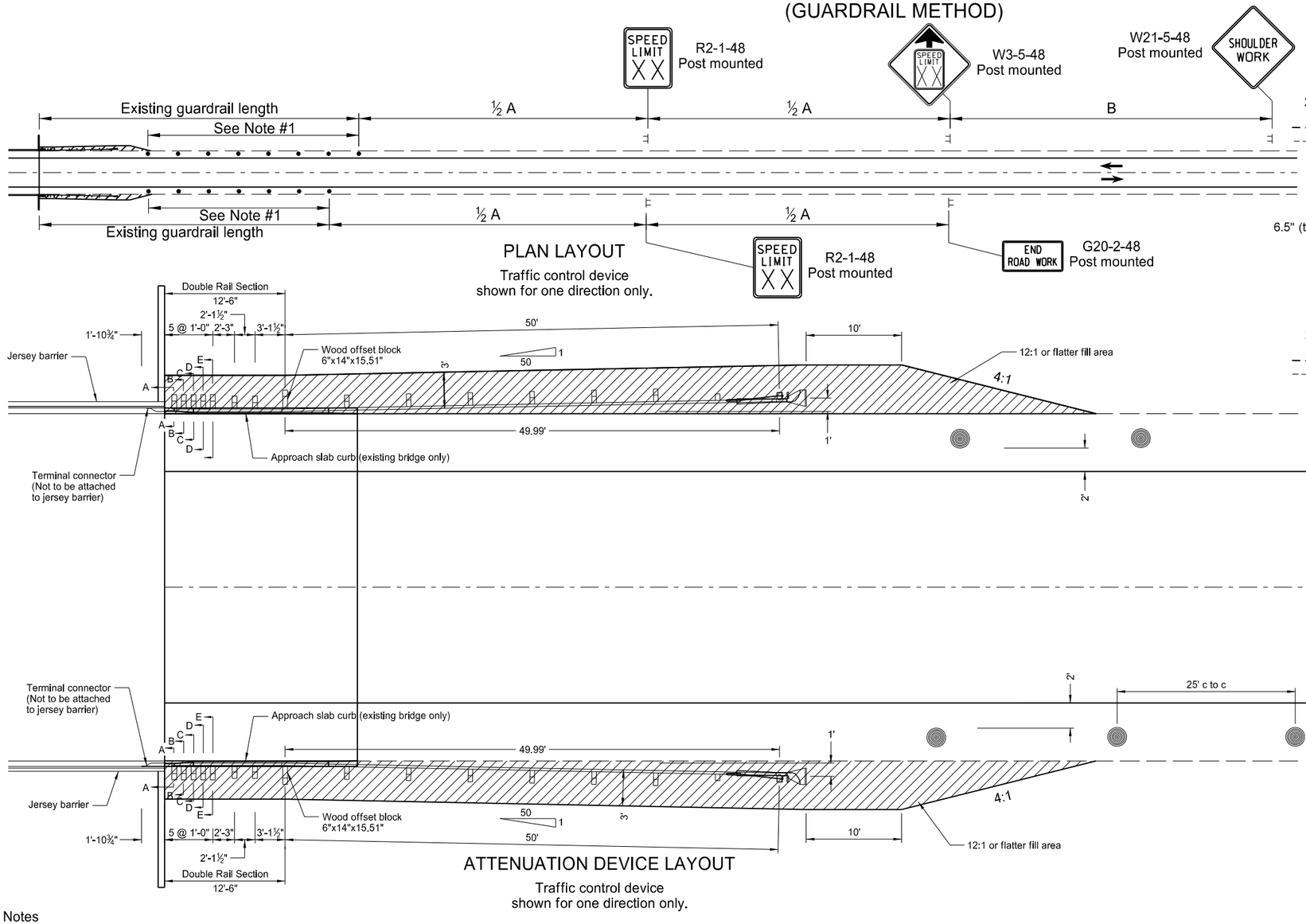
# SHORT TERM END TREATMENT FOR BRIDGES (GUARDRAIL METHOD)

D-764-21



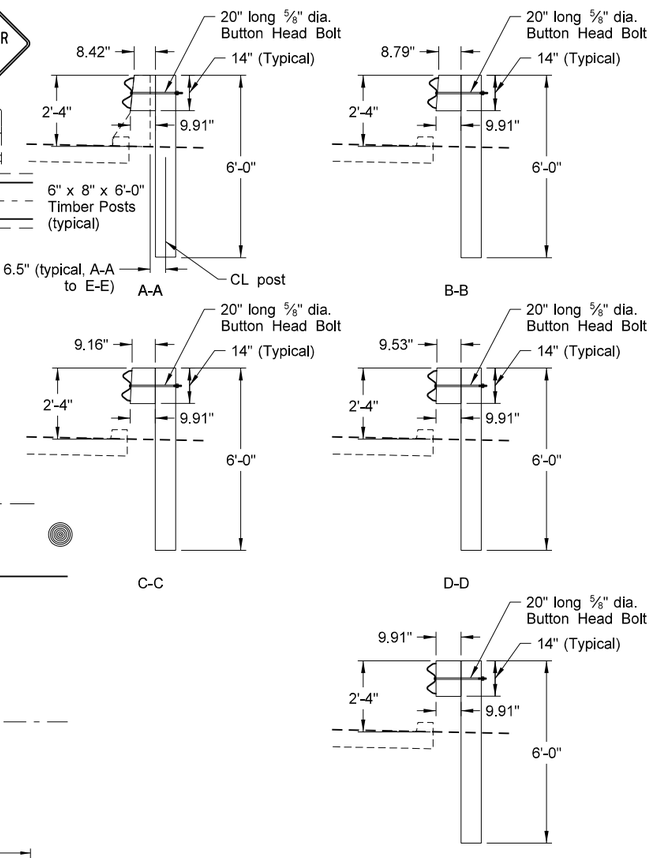

## PLAN LAYOUT

Traffic control device shown for one direction only.




## ATTENUATION DEVICE LAYOUT

Traffic control device 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 |

Notes

1. If the shoulder width is less than 3', vertical panels shall be used in place of delineator drums and placed as far from the driving lane as possible and still be on the finished shoulder. When there is no shoulder, the vertical panels shall be placed as near as possible to the driving lane on the foreslope of the shoulder.
2. If the bridge is within construction zone signing, the reduced speed ahead sign can be eliminated.
3. The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph below the existing speed limit, unless the design speed of the work zone feature has been reduced below the 10 mph. In this case, the speed limit reduction shall not exceed 30 mph. Where speed limits are to be reduced more than 30 mph, a second speed limit sign shall be installed with the desired speed reduction but shall not exceed 30 mph. The second speed limit shall be placed at ½ B.
4. The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
5. Existing speed limit signs within a reduced speed zone shall be covered.

KEY

Sign — Delineator drum

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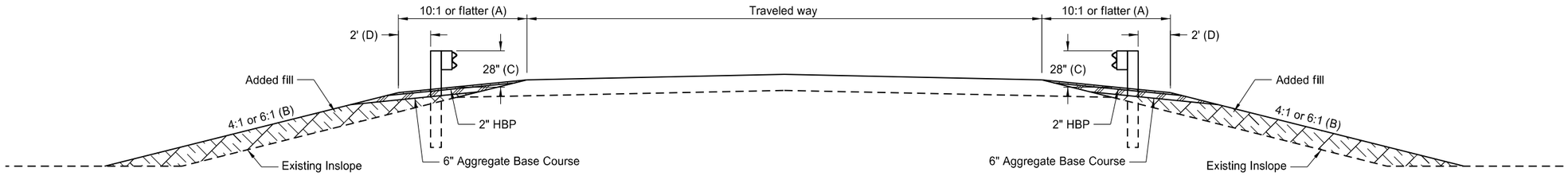
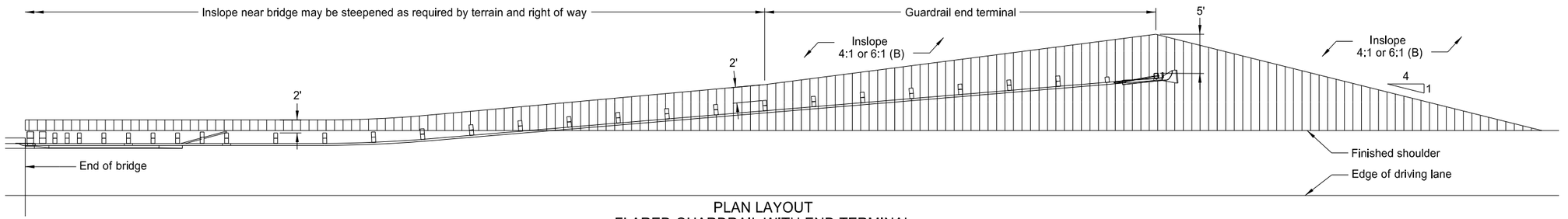
D-764-22

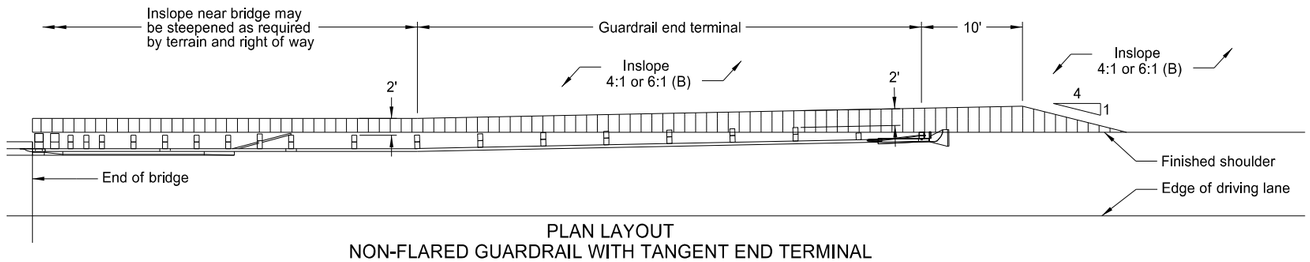
# TYPICAL GRADING AT BRIDGE ENDS WITH W-BEAM GUARDRAIL



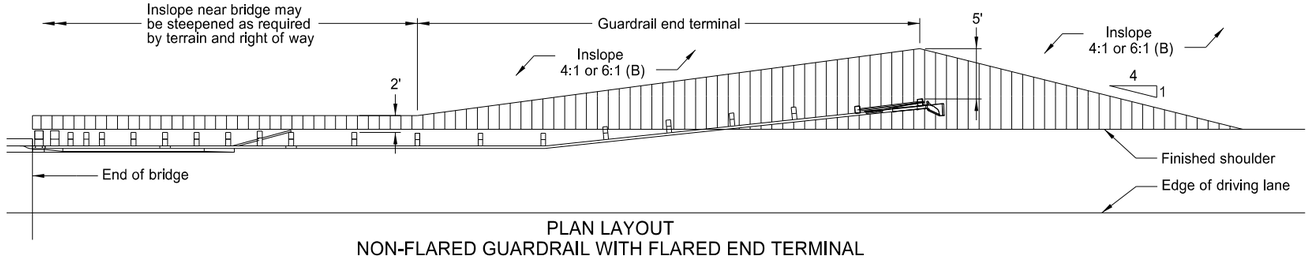

TYPICAL SECTION




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.

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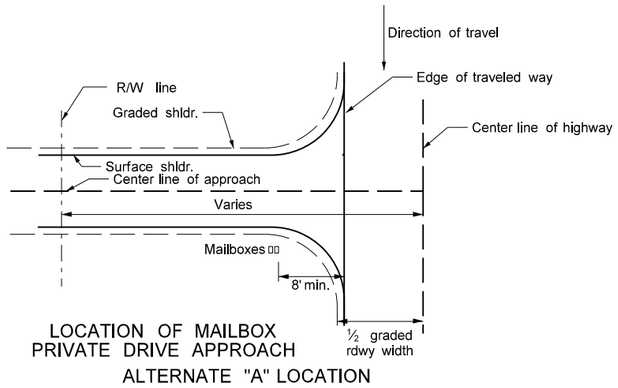
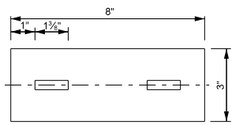
# MAILBOX LOCATION DETAILS

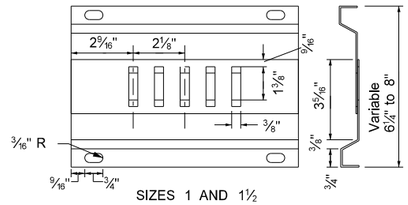
D-766-1



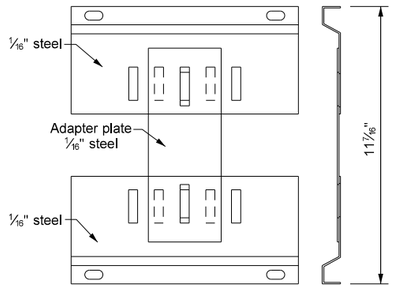

LOCATION OF MAILBOX
PRIVATE DRIVE APPROACH
ALTERNATE "A" LOCATION



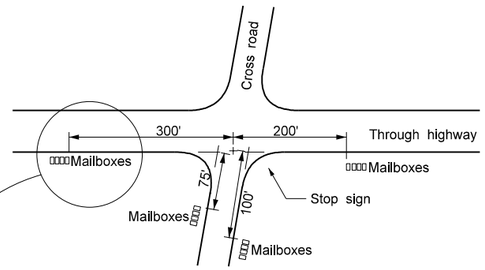

ADAPTOR PLATE



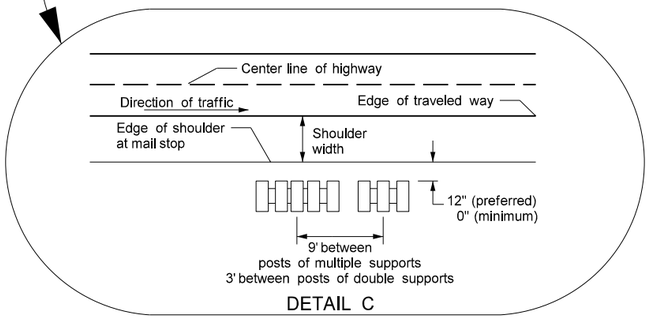

SIZES 1 AND 1½
MOUNTING BRACKET



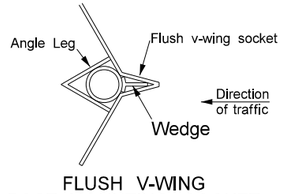

SIZE 2 WITH ADAPTOR PLATE
MOUNTING BRACKET



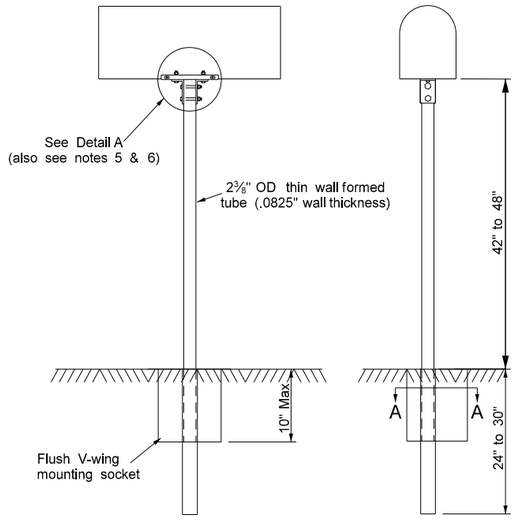

MINIMUM CLEARANCE DISTANCE TO NEAREST
MAILBOX ALONG ROADWAY AT INTERSECTIONS
ALTERNATE "B" LOCATION



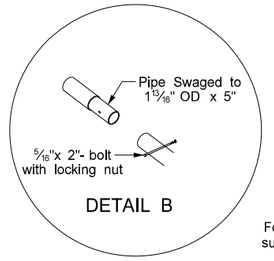

DETAIL C



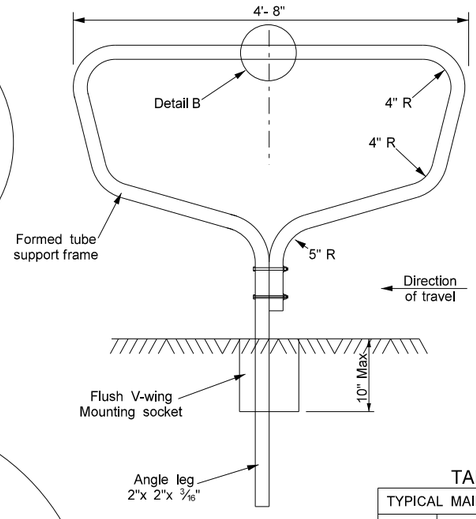

FLUSH V-WING
POST MOUNTING SOCKET
SECTION A-A



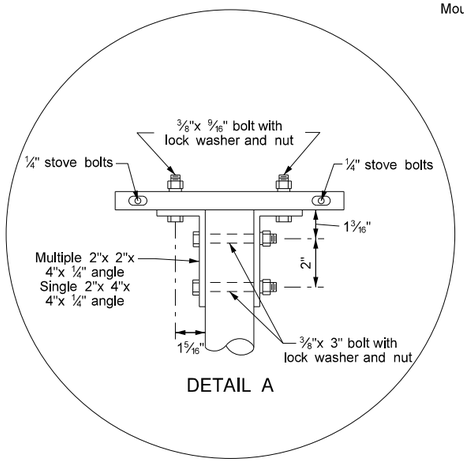

SIDE FRONT
SINGLE SUPPORT




DETAIL B




FRONT




DETAIL A

Notes:

1. The mailbox support and hardware details shall consist of the "V-Loc Mailbox Support System" manufactured by:

   Tapco
   Traffic & Parking Control Co. Inc.

   Any other equal support system meeting the requirements of NCHRP Report 350, which has been crash tested, and approved by the Federal Highway Administration may be used. Approved alternate mailbox assemblies shall be installed in the manner and arrangement crash tested.

2. The preferred location for all mailboxes is the Alternate "A" location. However, the Engineer may approve the Alternate "B" location if warranted by existing field conditions.

3. Postal regulations require that mailboxes must be located on the right-hand side of the road in the direction traveled by the carrier. Therefore, the Engineer shall contact the local carrier or postmaster before installing new mailboxes to verify the direction of travel.

4. Mailboxes installed on private drive approaches must always be located on the downstream side of the approach.

5. Install angle connection parallel to traffic flow for size 2 mailbox mounted on single posts.

6. Size 2 mailbox mounted on multiple support requires 2 each, ⅜" by ⁹⁄₁₆" bolts with lock washers and nuts to attach the adapter plate to mounting bracket. The unit will then require 4 angle connections to attach to the formed tube support frame. See Detail A.

7. Space multiple support frames a minimum of 4 feet apart. Space single support frames a minimum of 3 ft apart. Do not place more than five No. 1 mailboxes, three No. 2 mailboxes, or any combination of four No. 1-A and No. 2 mailboxes on multiple support frames.

TABLE A

| TYPICAL MAILBOX DIMENSIONS | | | |
|---|---|---|---|
| Size | Width | Height | Length |
| 1 | 6.5" | 8.5" | 19" |
| 1A | 8" | 10.5" | 21" |
| 2 | 11.5" | 13.5" | 23.5" |

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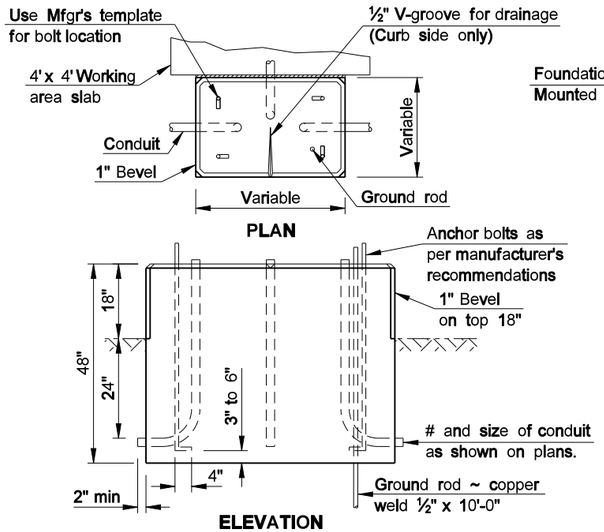
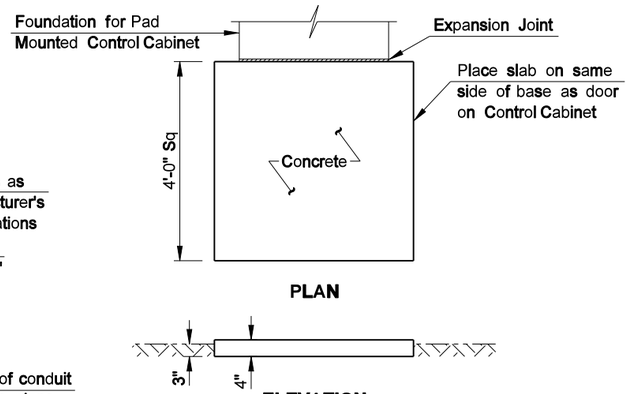
# CONCRETE FOUNDATIONS
# (TRAFFIC SIGNALS & HIGHWAY LIGHTING)

**D-770-1**



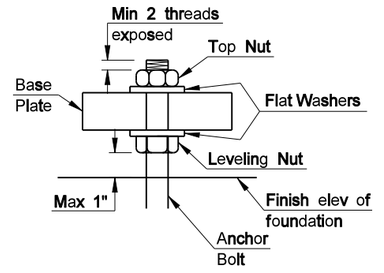

## CONTROLLER CABINET FOUNDATION PAD MOUNT

The Controller Cabinet Foundation shall be bid as Concrete Foundation - Traffic Signals.

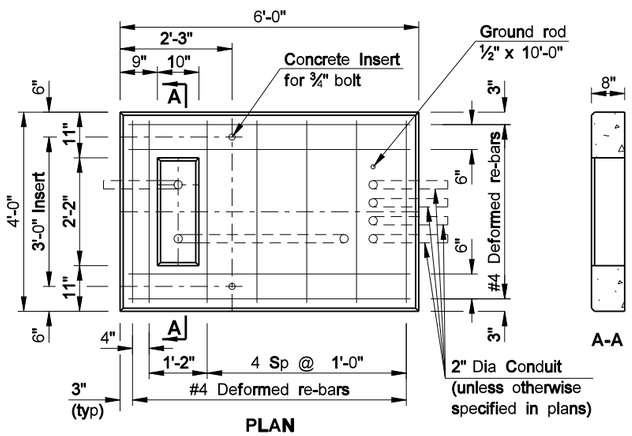


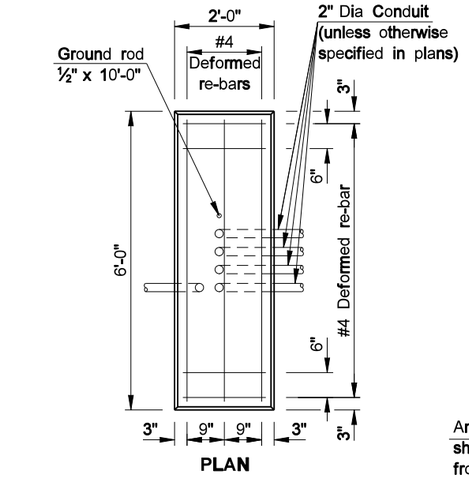

## WORKING AREA SLAB

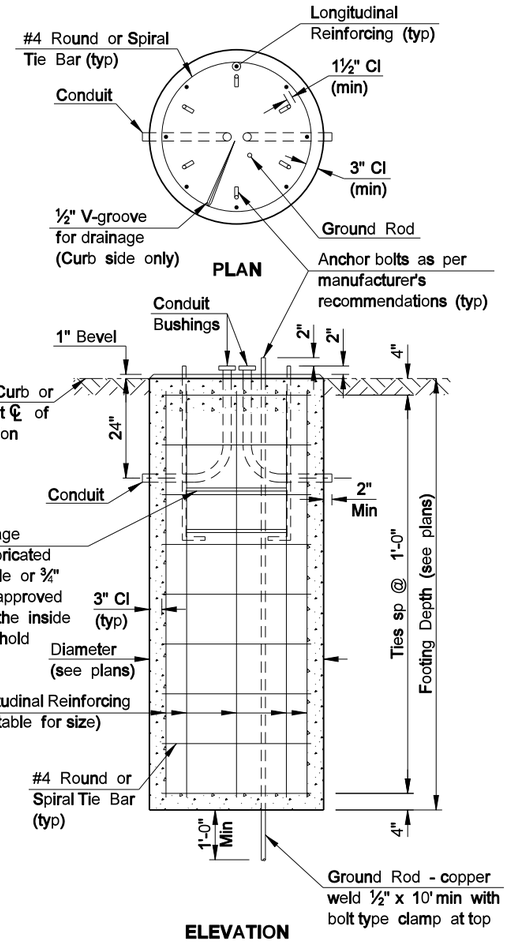
The Working Area Slab shall be installed where shown on the plans and shall not be bid separately but shall be included in the price bid for Concrete Foundation - Traffic Signals.



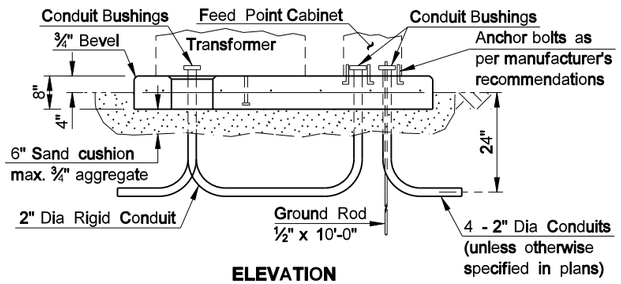

## ANCHOR BOLT DETAIL



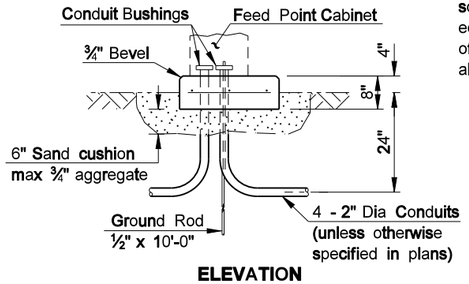




## LIGHT & SIGNAL STANDARD FOUNDATION




## TRANSFORMER & FEED POINT CABINET FOUNDATION PAD MOUNT

The Transformer & Feed Point Cabinet Foundation Pad Mount shall be bid as Concrete Foundation ~ Feed Point ~ Type A.




## FEED POINT CABINET FOUNDATION PAD MOUNT

The Feed Point Cabinet Foundation Pad Mount shall be bid as Concrete Foundation ~ Feed Point ~ Type B.

## NOTES:

LIGHT & SIGNAL STANDARD FOUNDATIONS: See plans for conduit size, number of bends and correct position for each foundation. When conduit does not continue beyond the foundation, conduit with a 105° bend and bushings on both ends may be substituted for the 90° bends shown. See plans for correct size & location of foundations. The grade and exact location shall be established by the Engineer in the field. All reinforcing shall be Grade 60. Tie bars shall have a minimum of a 12" lap. Reinforcing may be omitted for Type I, II, V, VI & VII signal standard foundations if the anchor bolts extend to within 3" to 6" above the bottom of the foundation. A minimum of 6 anchor bolts shall be used for cantilevered structures.

CONTROLLER CABINET FOUNDATION PAD MOUNT FOUNDATION: See plans for the number of 90° bends per foundation and correct positioning. The foundation for Pad Mounted Controller Cabinet shall be of sufficient size so that there is a minimum of 3" of clearance from the outside edge of cabinet to the outside edge of the foundation on any side. The contractor shall ensure a water-tight seal between the controler cabinet and the foundation by caulking, except for V-groove.

WORKING AREA SLAB: The materials and preparation of this slab shall be as approved by the Engineer in the field.

TRANSFORMER & FEED POINT CABINET FOUNDATION PAD MOUNTED: The foundation shall have a wood float finish. All conduits shown shall be installed. Conduit that is not used at this time shall be plugged with an expandable plug.

FEED POINT CABINET FOUNDATION PAD MOUNTED: The foundation shall have a wood float finish. All conduits shown shall be installed. Conduit that is not used at this time shall be plugged with an expandable plug.

| LIGHT & SIGNAL FOUNDATION TABLE | |
|---|---|
| FOOTING DEPTH (ft) | LONGITUDINAL REINFORCING |
| ≤ 12 | 8 - #5 |
| 13 - 14 | 8 - #6 |
| 15 - 16 | 8 - #7 |
| 17 - 19 | 8 - #8 |

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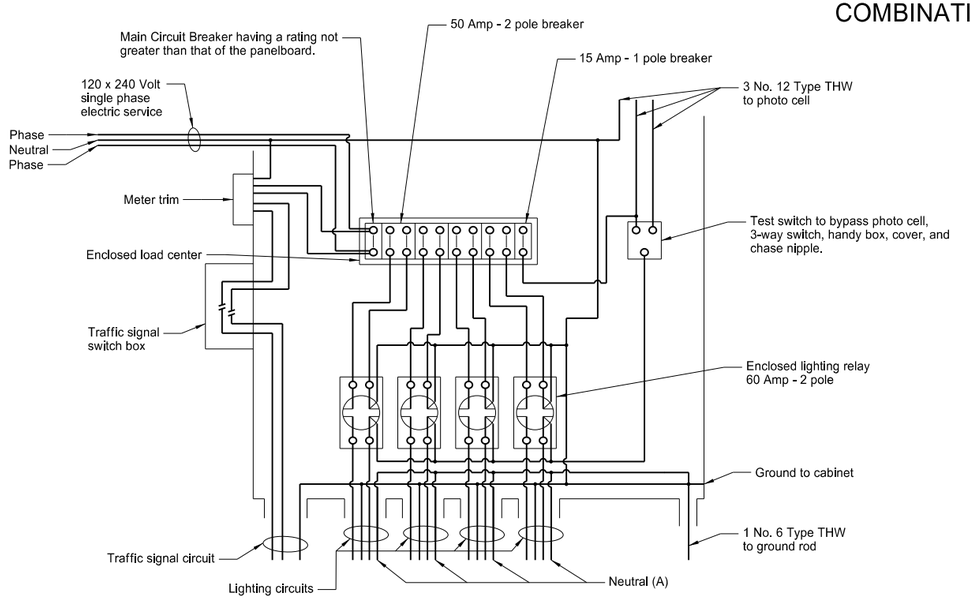
# COMBINATION FEED POINT DETAILS

D-770-2A




Combination Lighting and Signal
Feed Point Type IV

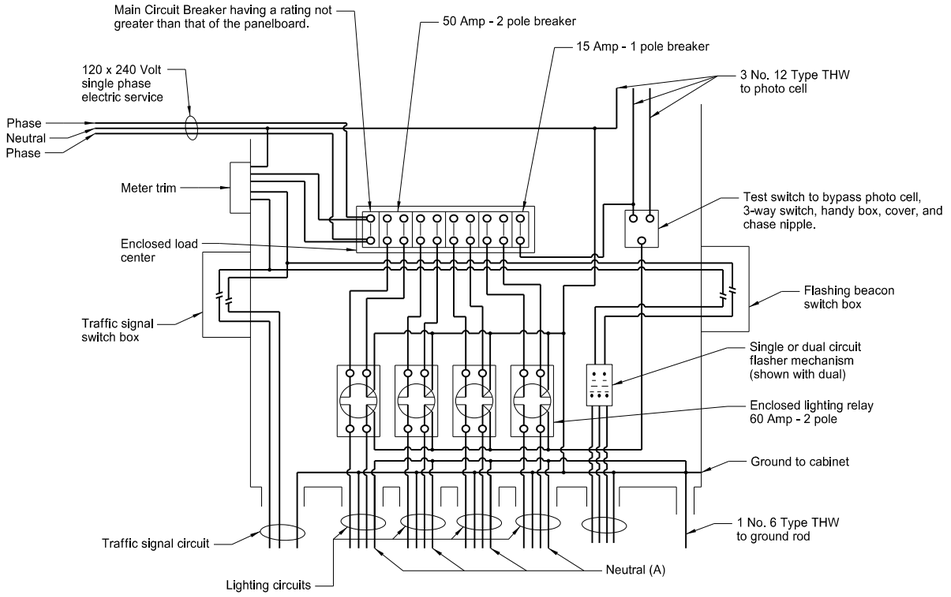
Notes:

Type I feed point is similar to Type IV except only one electrical circuit, one 50 Amp - 2 pole breaker and one lighting relay, normally open, shall be installed.

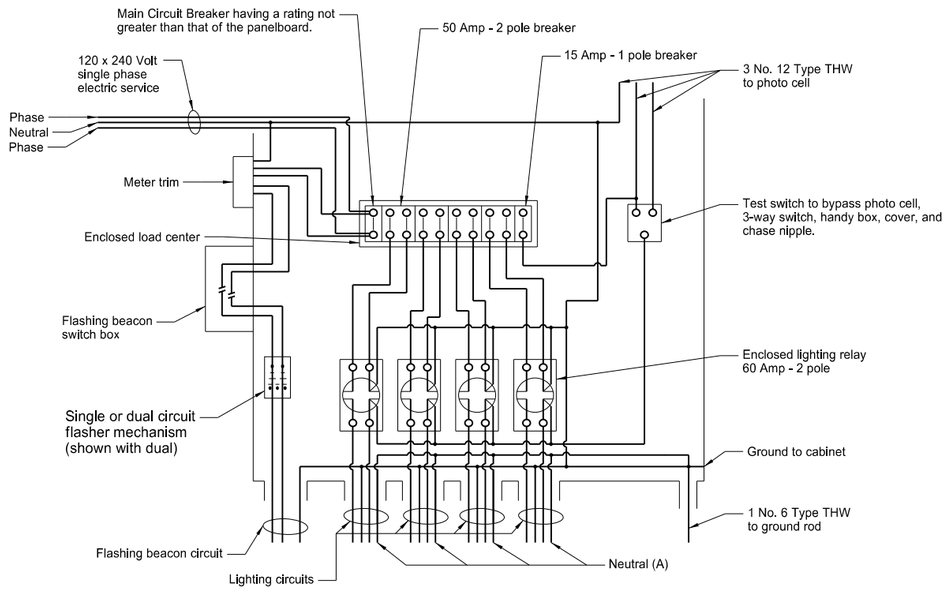
Type II feed point is similar to Type IV except only two electrical circuits, two 50 Amp - 2 pole breakers and two lighting relays, normally open, shall be installed.

Type III feed point is similar to Type IV except only three electrical circuits, three 50 Amp - 2 pole breakers and three lighting relays, normally open, shall be installed.

(A) Install when festoon circuits are required




Combination Lighting, Signal, and Flashing Beacon
Feed Point Type IV




Combination Lighting and Flashing Beacon
Feed Point Type IV

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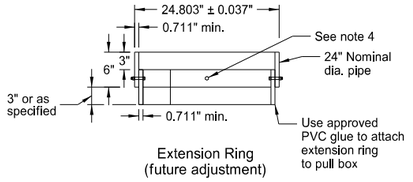
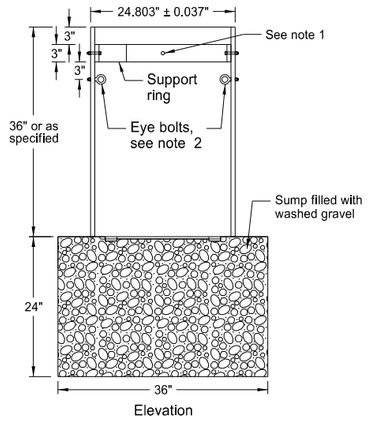
# PULL BOX DETAILS

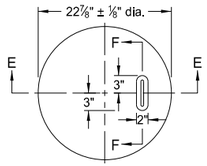
D-770-3



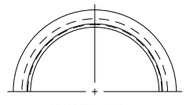

Extension Ring
(future adjustment)



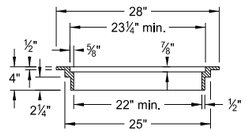

Elevation



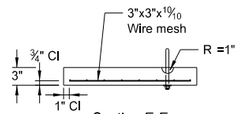

Concrete Cover



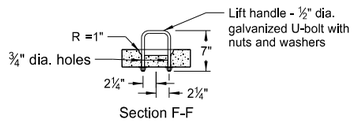
Half Top View



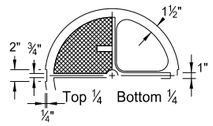

Section Frame

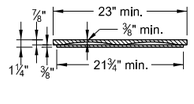



Section E-E



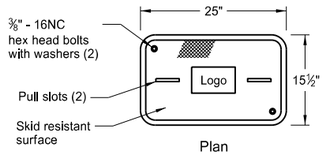

Section F-F



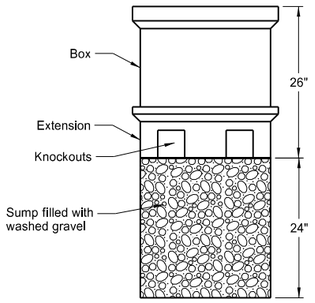




Section Cover

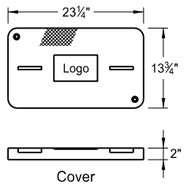
Cast Iron Frame and Cover



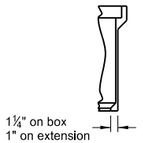

Plan




Elevation




Cover



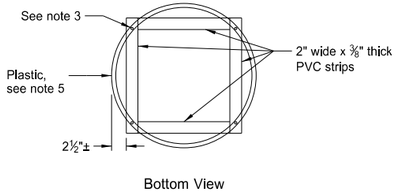

Polymer Concrete Pull Box

Note: Polymer concrete reinforced by a heavy weave fiberglass

Notes:

1. Place top of pull box flush with surfaced area and approximatley one inch above earth or sodded areas on level surfaces.
2. Pull box shall have at least one knockout per side.
3. Polymer Concrete pull box shall be Tier 22 as per ANSI / SCTE 77.

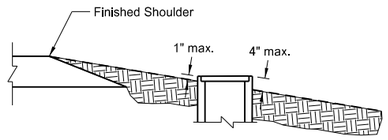
## PVC Pull Box




Bottom View

PVC Pull Box Notes:

1. Attach split 24" nominal diameter PVC cover support ring with four ⅜" dia. x 2" long stainless steel hex head bolts with nuts at 90 degrees apart.
2. Two type 2 shoulder eye bolts, ⅜" dia. x 1¼" shank length with hex nuts 180 degrees apart (for lifting pull box and supporting electric cable).
3. Four ¼" x 1¼" long galvanized lag screws. Screw assembly together.
4. Attach split 24" nominal diameter PVC cover support extension ring with four ⅜" dia. x 2" long stainless steel hex head bolts with nuts at 90 degrees apart.
5. Bolt assembly together.
6. Conduit holes located in barrel section shall be sized no more than 1" larger than size of conduit being used.
7. After pull box and conduit installation all inside walls and cover shall be made water tight to the satisfaction of the Engineer.
8. PVC pipe to meet requirements of ASTM F679T-1 or equal.
9. Hex head bolts and nuts shall be austenitic stainless steel. Other fasteners to be galvanized as per AASHTO M-232.
10. Concrete cover shall be coated on top and sides with an approved epoxy coating. The epoxy protective coating shall be light gray, clear, or neutral in color and shall be applied as recommended by the manufacturer. The surfaces of the concrete to which the epoxy protective coating is applied, shall be cleaned by wire brush and shall be dry before application.
11. Cast Iron Cover castings shall be gray iron as per AASHTO M 105, Class 35B.




Typical Pull Box in Rural Section

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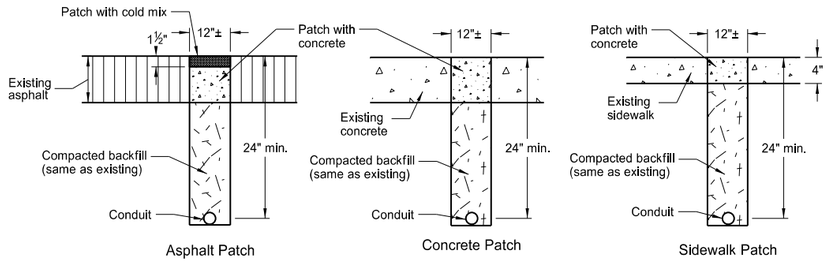
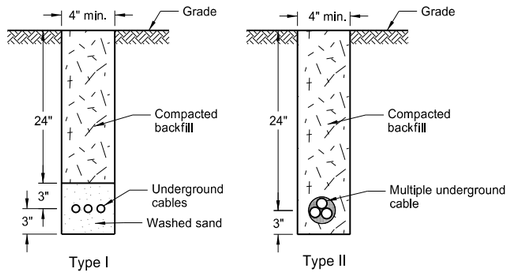
# LIGHTING AND SIGNAL DETAILS



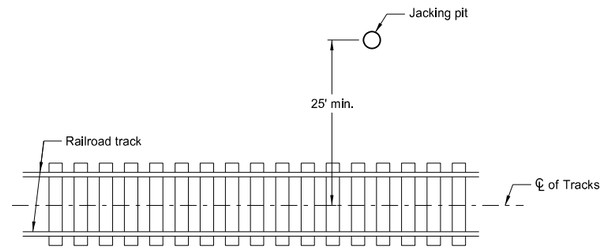

## Surface Patch Details

Note: All trenches shall be saw cut. The replacement concrete shall be P.C.C. pavement and the coarse aggregate gradation, maximum size and method of curing shall be as approved by the Engineer. Immediately prior to pouring replacement concrete, all surfaces shall be painted with an approved epoxy compound.

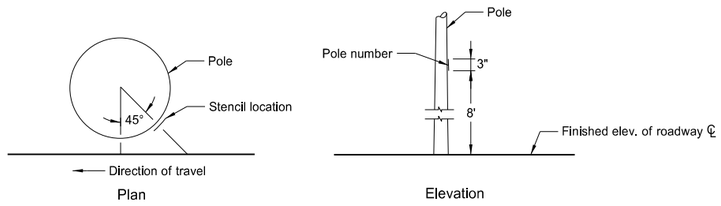



## Cable Trench

Note: The entire area which is disturbed by the trenching shall be sodded or as directed by the Engineer.

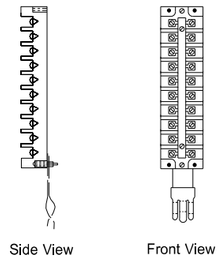



Plan View

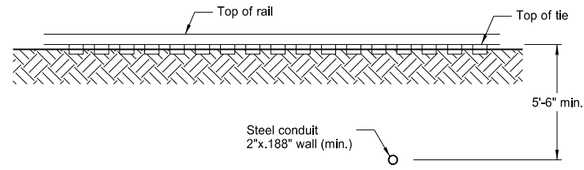



## Light Standard Numbering

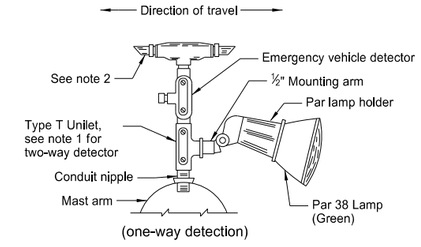
Note: On the roadway side of each light standard, the Contractor shall stencil on the pole number using black paint or an adhesive coated plastic such as Scotchcal by 3M or as approved by the Engineer. See layout sheets for pole numbers.



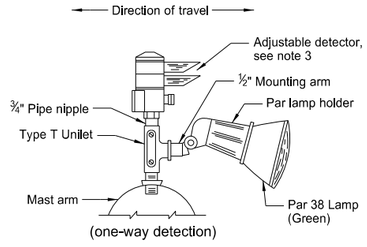

## Terminal Block Detail




## Conduit Placement under Railroad Tracks

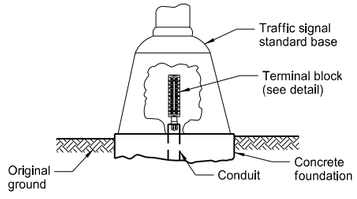



## Emergency Vehicle Detector Detail

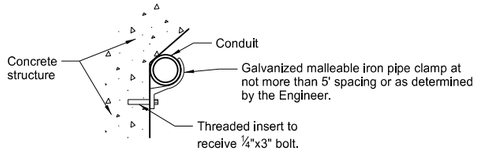



## Alternate Emergency Vehicle Detector Detail (adjustable)

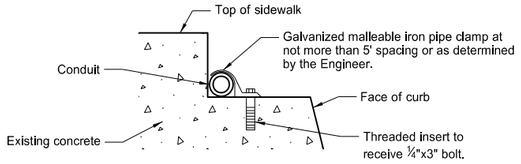
Notes:
1. Two-way Detector shall have Type X Unilet with two Par lamp holders and lamps. (one in each direction).
2. One-way Detector shall have the unused end plugged with metal pipe plug.
3. Two-way Detector shall have the detector lens rotated to face the direction of travel, and shall have Type X Unilet with two Par lamp holders and lamps (one in each direction).



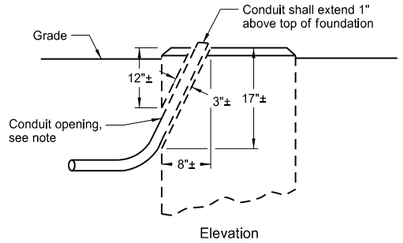

## Terminal Block
(rigid mounted)




## Bridge Mounted Conduit Hanger




## Curb Mounted Conduit




## Revise Concrete Foundation

Note: Jackhammer or drill to remove material and provide a location for conduit. Make opening no larger than necessary. Place conduit, fill with concrete and finish foundation to original appearance.

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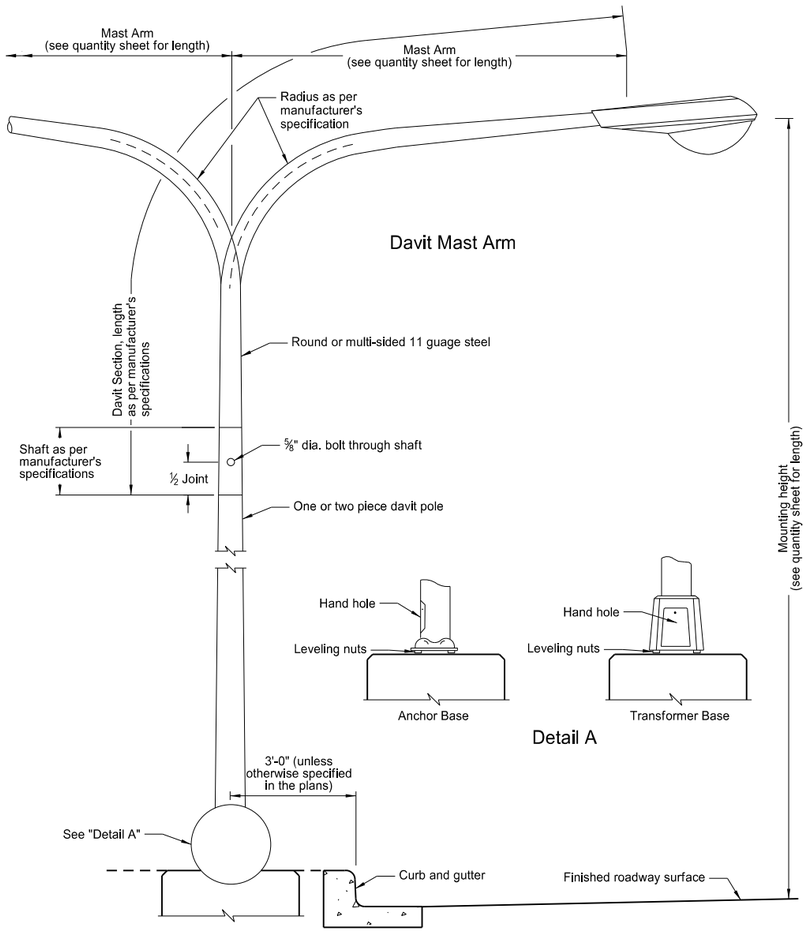
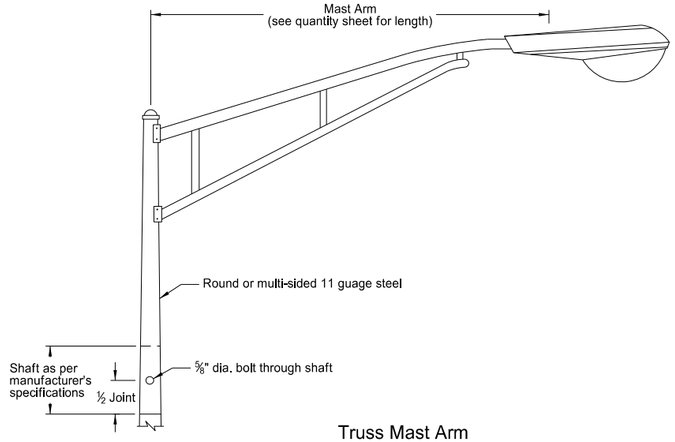
# LIGHT STANDARD DETAILS

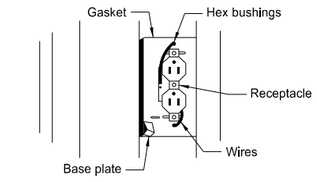
D-770-5



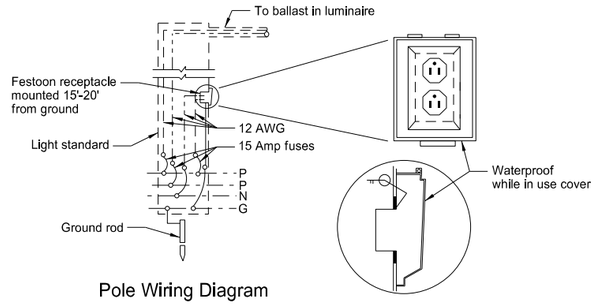

Light Standard Details




Truss Mast Arm



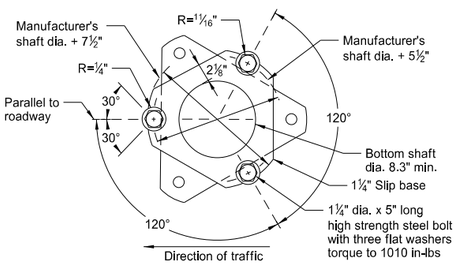

Optional: Festoon receptacle
mounted on multi-sided pole.



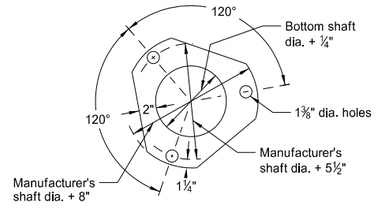

Pole Wiring Diagram

Receptacle Mounting Detail (B)

(B) Receptacle shall be mounted on the side of the pole that faces the street side. Festoon Receptacle shall be installed only when specified in the plans.




Top View




Plan View

Keeper Plate Detail (A)

(A) ASTM A446 Grade "A" 28 gauge keeper plate on top of middle flat washer. The Keeper plate shall be galvanized after fabrication.

Notes:

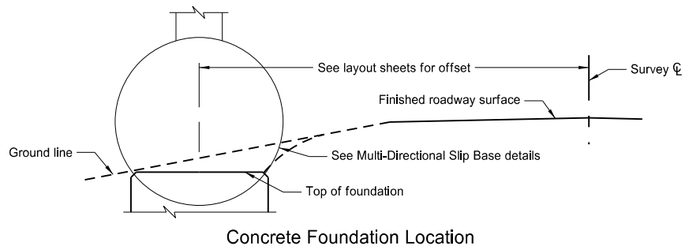
Light Standard Locations: The offset distance shall have a minimum offset from the curb face of 3 feet. Light standards that are placed in urban areas and where speeds are less than 30 mph, may be placed at 3 feet. Where speeds are 30 mph or more, light standards shall be placed at least 16 feet from the driving lane.

Steel Standards: Marred or scratched areas shall be touched up after erection.

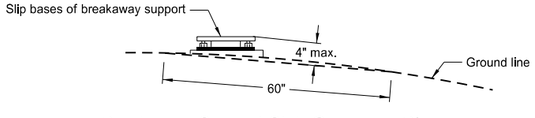
Luminaire: Shall be internal ballast-constant wattage 120x240 voltage. See layout sheets for type of luminaire, wattage, I.E.S. distribution, and operating system.

Fusing: Fusing in base, see specifications.

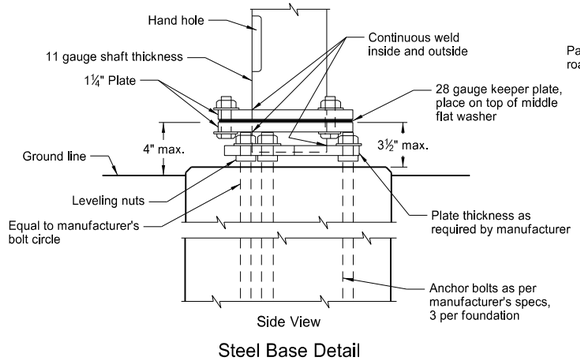
Slip Base Bolt Torque Procedure:
1. Tighten all bolts the maximum possible with 12" to 15" wrench to bed washers and to clean bolt threads, then loosen.
2. Retighten bolts with a systematic order to prescribed torque.
3. Loosen each bolt and retighten to prescribed torque in the same order as initial retightening.
4. Burr threads of junction with nut using center punch to prevent nut loosening.




Concrete Foundation Location

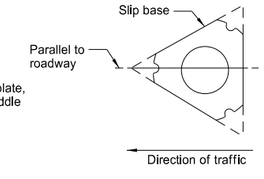



Breakaway Support Stub Clearance Diagram

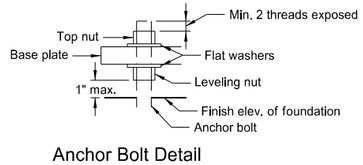



Side View

Steel Base Detail




Slip Base Placement Detail




Anchor Bolt Detail

Multi-Directional Slip Base

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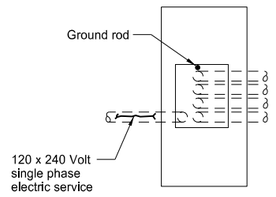
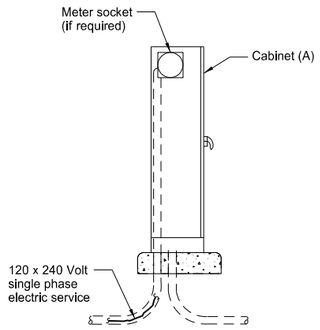
# FEED POINT - TRAFFIC SIGNALS

D-772-1



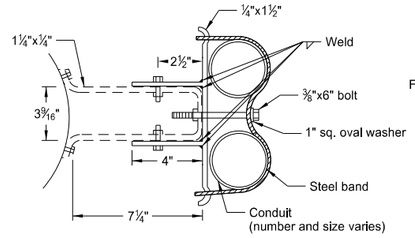

Plan

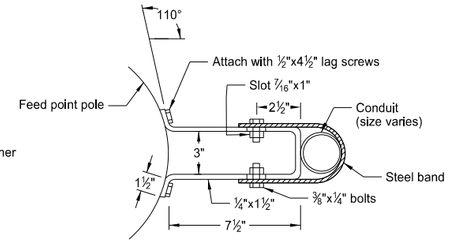


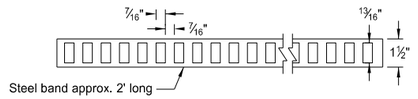

Elevation

## Circuit Breaker Cabinet Pad Mounted

(A) Cabinet shall be 56 in. high x 26 in. wide x 14 in. deep, 12 gauge steel (min.) or aluminum with provisions for padlock. Cabinet shall be weatherproof. A steel cabinet shall have one coat of primer and two coats of exterior dark green enamel.

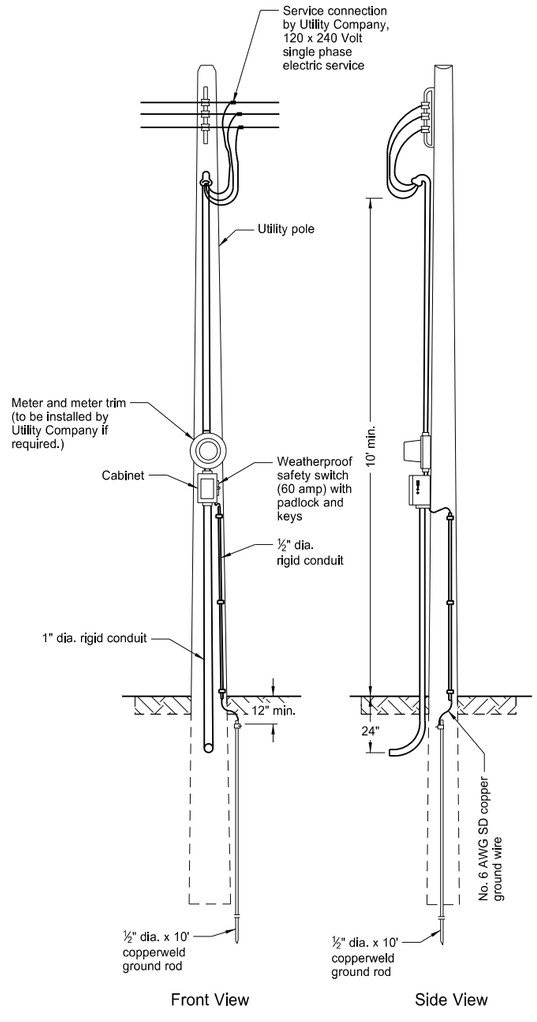


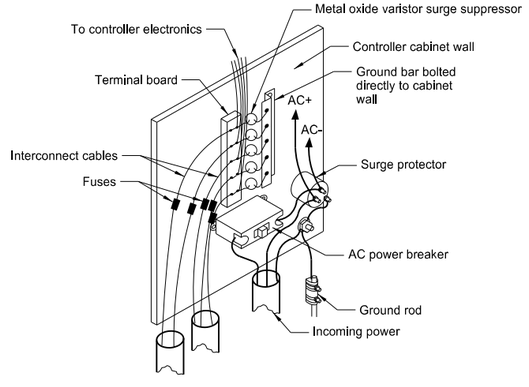

## Conduit Standoff Bracket

To be used when required by local Utility Company.

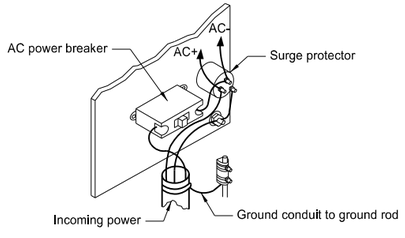



Front View

Side View




## Controller Cabinet
## Interconnect and Power Cable
## Lightning Protection




## Feed Point Cabinet
## Lightning Protection

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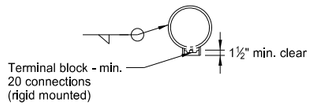
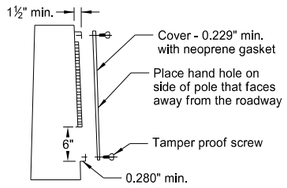
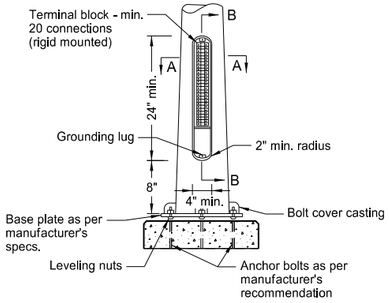
# TRAFFIC SIGNAL STANDARDS



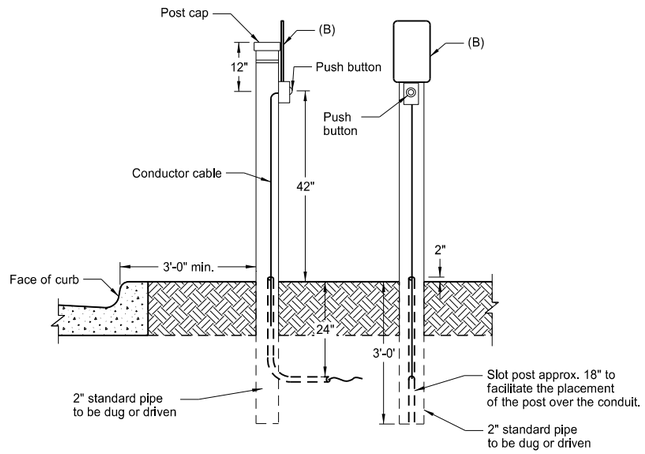

Section A-A




Section B-B

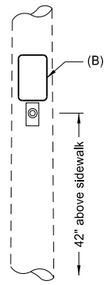



Alternate Signal Standard Base
For use only with Type V, VI, and VII signal standards.

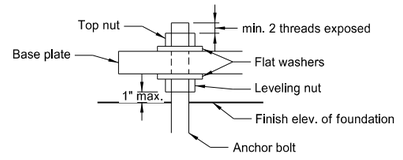



Side View Front View

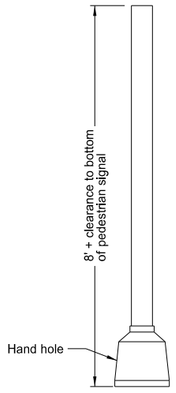
Pedestrian Push Button Post Details (A)



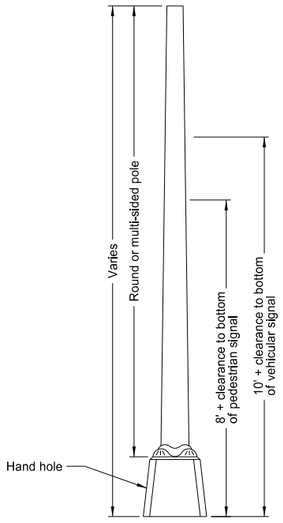

Signal Standard Mounted
Pedestrian Push Button Detail



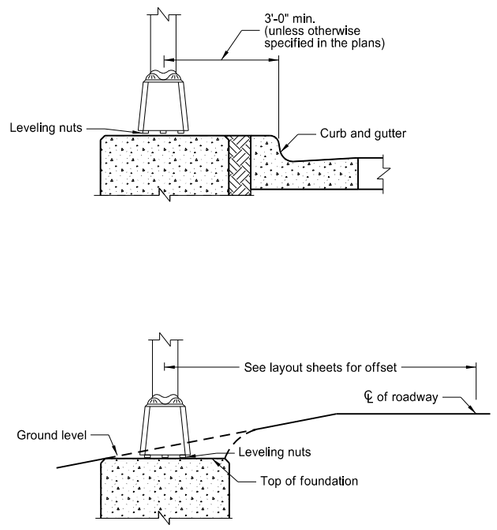

Anchor Bolt Detail




Type II




Type V, VI, VII




Signal Standard
Minimum Clearance Details

(A) The positioning of the sign, pushbutton, and direction of arrow shall clearly indicate which crosswalk is actuated by the push button. The type of sign will depend on the jurisdiction they are to be placed in.

(B) Sign shall be attached to post using rust resistant bracket and banding. The material shall be 0.081 aluminum. See Standard Signs book for dimensions and legend series. See plans for type of sign.

Notes:

Signal Heads: See traffic signal layout for correct mounting position, number, size, and arrangement of lenses.

Steel Standards: The center of the signal standard shall be a minimum of 3 ft. from the face of the curb unless shown otherwise on the layout sheets.

Paint: See note sheet for required color of paint.

Transformer Base: In lieu of the transformer base the contractor may use the alternate signal standard base.

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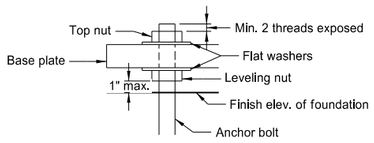
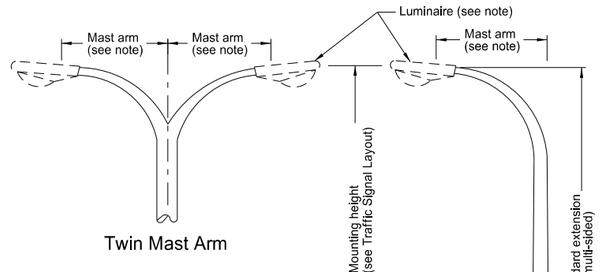
# TRAFFIC SIGNAL STANDARDS
# (MAST ARM TYPE)

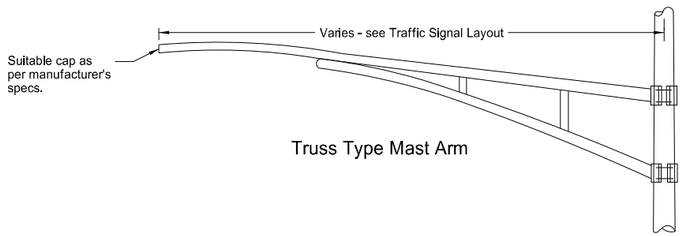
D-772-3



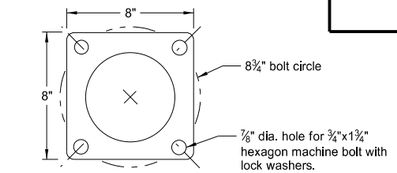

Anchor Bolt Detail



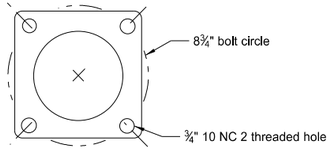

Twin Mast Arm




Truss Type Mast Arm




¾" Top Plate



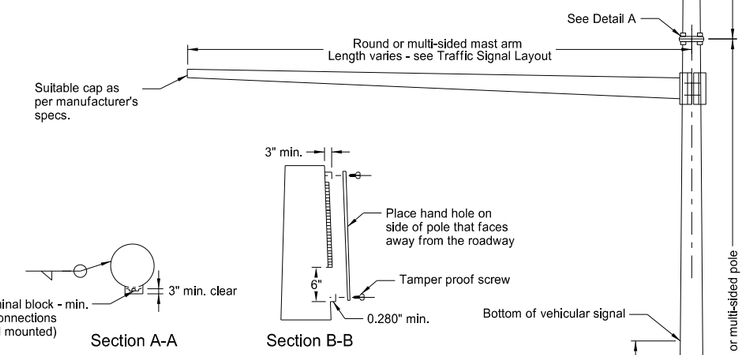

¾" Bottom Plate

Detail A

Note: In lieu of the plate type connection a telescoping clamp type extension may be used.

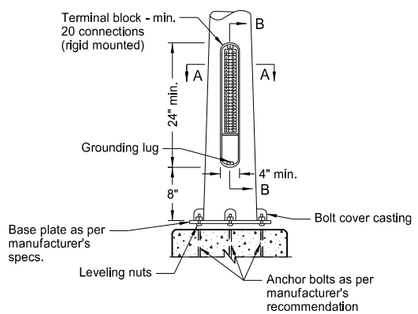
| Combination Signal and Light Standard | | | |
|---|---|---|---|
| Signal Standard Type | Luminaire Mounting height (ft) | Install Light Standard Extension and Luminaire | Luminaire Mast Arm |
| A | 30 | yes | single |
| B | 30 | (A) | single |
| C | 40 | yes | single |
| D | 40 | (A) | single |
| E | 30 | yes | twin |
| F | 30 | (A) | twin |
| G | 40 | yes | twin |
| H | 40 | (A) | twin |
| I | 50 | yes | single |
| J | 50 | yes | twin |

(A) The light standard extension for these signal standards shall be installed at a later date under a separate contract.



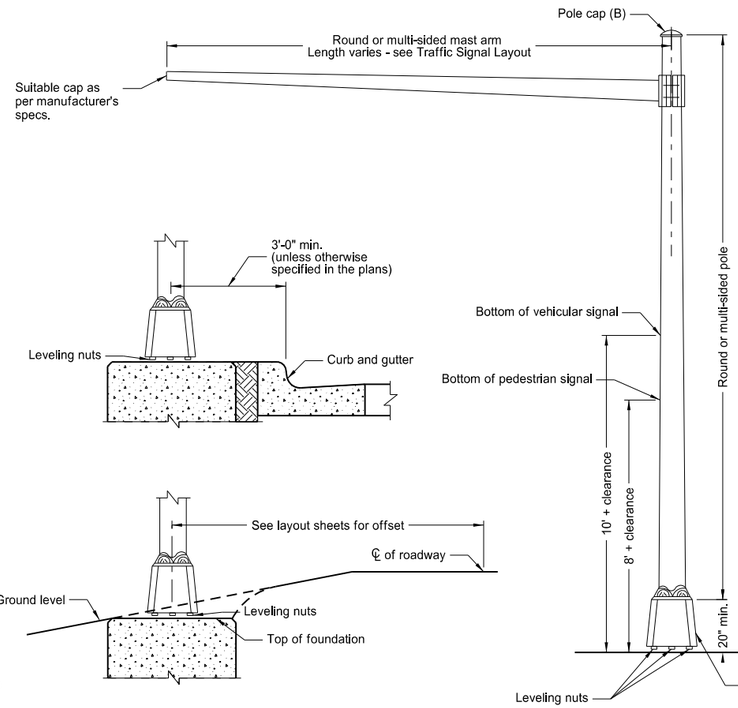

Section A-A

Section B-B




Alternate Signal Standard Base

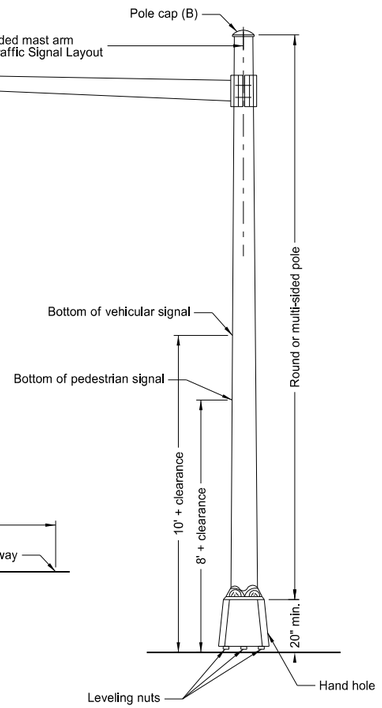
Note: For use only with Type IV and combination signal standards




Combination Signal and Light Standard




Signal Standard Minimum Clearance Detail




Type IV Signal Standard

(B) On combination signal and light standards Type B, D, F, and H, and on all Type IV signal standards install a suitable pole cap as per manufacturer's specifications.

Notes:

Light standard extension: The mast arm shall be 6 ft. unless otherwise noted on the plans. The light standard extension shall be galvanized. Galvanizing shall be in accordance with ASTM A 123.

Luminaire: Luminaires shall be internal ballast - constant wattage 120 x 240 voltage. See layout sheets for type of luminaire, wattage, and I.E.S. distribution.

Signal head: See Traffic Signal Layout for correct mounting position, number, size, and arrangement of lenses. Clearance from the ℄ of the roadway to the bottom of mast arm mounted signal heads shall be 17 ft. minimum and 19 ft. maximum.

Multi-sided poles: Shall have a means that will not allow the mast arm to be rotated by wind forces other than friction. The pole shall be so fabricated so that the mast arm is rotatable. This feature shall be approved by the Engineer.

Transformer base: In lieu of the transformer base the Contractor may use the alternate signal standard base.

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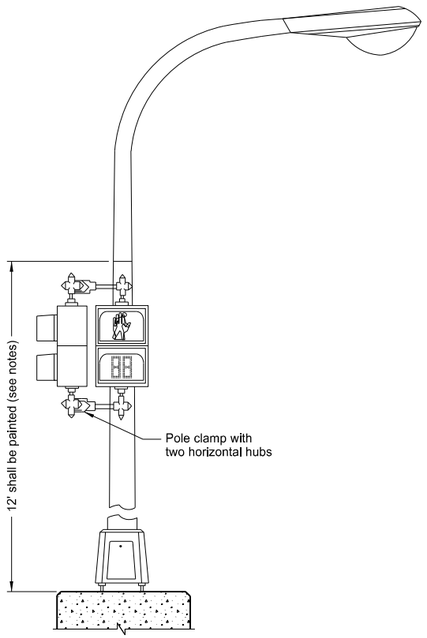
# TRAFFIC SIGNAL HEAD MOUNTING

D-772-4



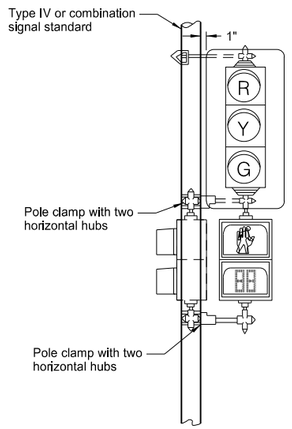

Light Standard Mounted
Pedestrian Signal Head (A)

Pedestrian countdown timer

(A) See plans for the appropriate orientation and type of pedestrian signal head to use.

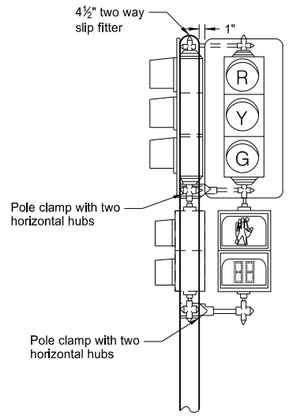
Type II

Pedestal Mounted - Pedestrian (A)



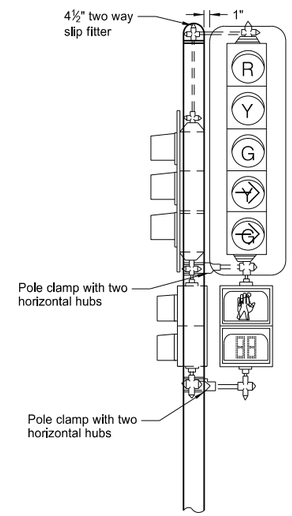

Type IV

Post Mounted - Vehicular
Post Mounted - Pedestrian (A)



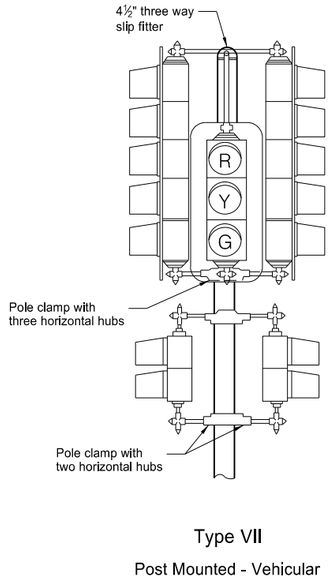

Type V

Post Mounted - Vehicular
Post Mounted - Pedestrian (A)



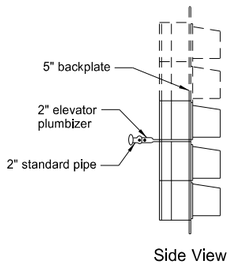

Type VI

Post Mounted - Vehicular
Post Mounted - Pedestrian (A)



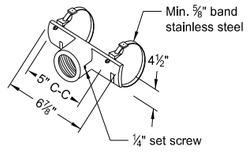

Type VII

Post Mounted - Vehicular
Post Mounted - Pedestrian (A)

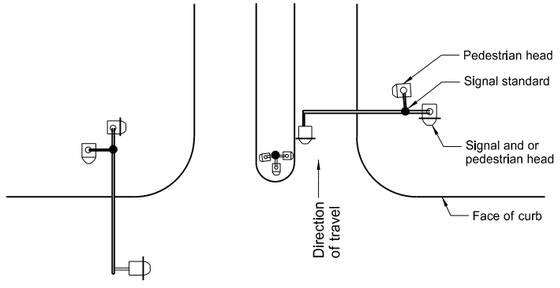



Side View

Mid-Span Mounted and
Mast Arm Rigid Mounted
Signal Heads

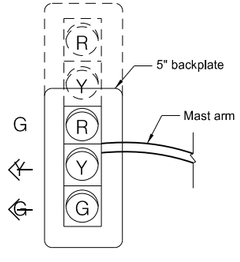



Mast Arm Signal
Head Bracket

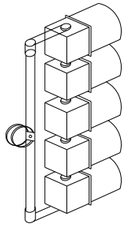



Plan Layout
(typical)

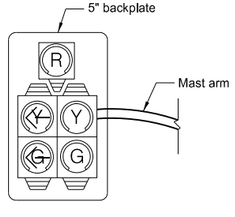
Note: Signal heads shall not protrude over the face of the curb.



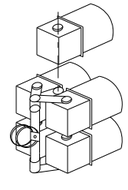

Front View



Isometric View




Front View



Isometric View

End Mounted and Mast Arm Rigid Mounted
Signal Heads

Notes:

Reinforcing Plates: Polycarbonate signal heads shall have reinforcing plates installed where the mounting hardware attaches to the signal head. Where a plumbizer is used reinforcing plates shall be placed on each side of the plumbizer.

Clearance: Clearance from the ground line or sidewalk to the bottom of post or pedestal mounted vehicular signal heads shall be 10 ft. minimum, from pedestrian signal heads shall be 8 ft. minimum.

Signal Heads: See traffic signal layout for correct mounting position, numbers, size, and arrangement of lenses.

Pole Clamps: A pole plate with suitable banding material, as approved by the Engineer, may be substituted for the pole clamps. Where traffic signal heads and pedestrian signal heads are mounted one above the other, one pole clamp assembly may be used.

Paint: Signal housing shall be painted yellow. Backplates shall be painted dull black. Pole clamps and signal head mounting hardware shall be painted the same color as the signal standard shaft.

When pedestrian heads are light standard mounted, the lower 12 ft. shall be painted the same color as the other traffic signal standards.

Mounting Details: All signal heads shown are viewed from direction of travel.

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 11-14-13 | |
| REVISIONS | |
| DATE | CHANGE |
| 7-8-14 | Added reinforcing plate note |

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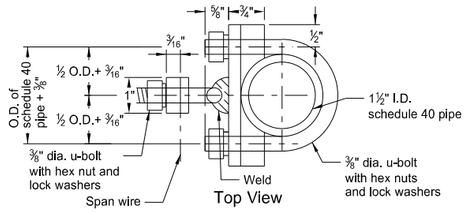
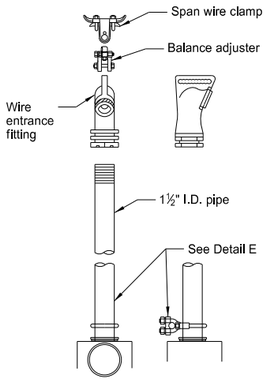
# FLASHING BEACON

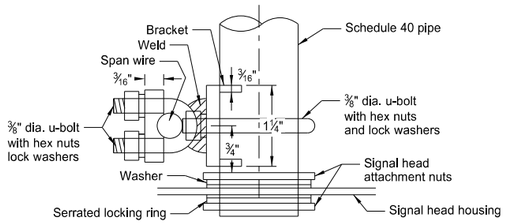
D-772-7




Top View

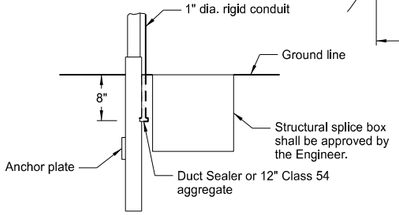



Detail D



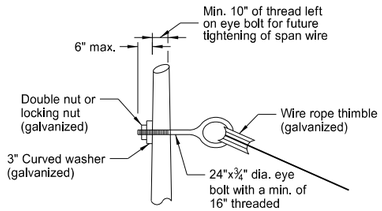

End View

Detail E

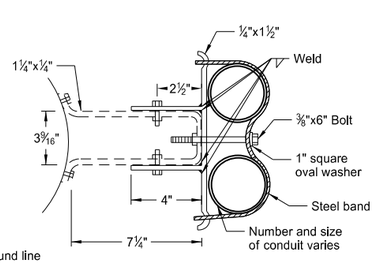


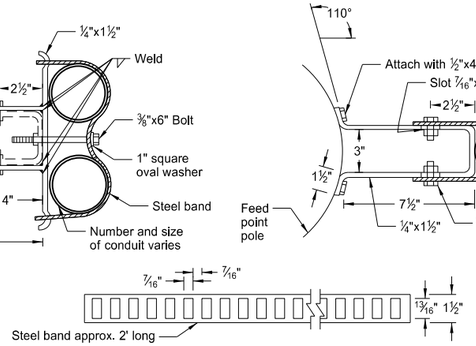

Detail C

Detail where more than one set of wires pass through Flashing Beacon location.



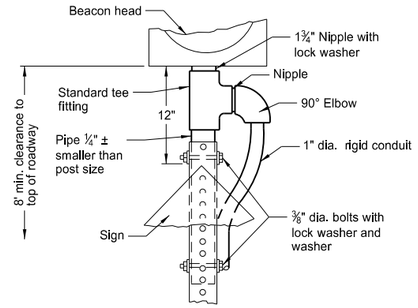

Eye Bolt Detail



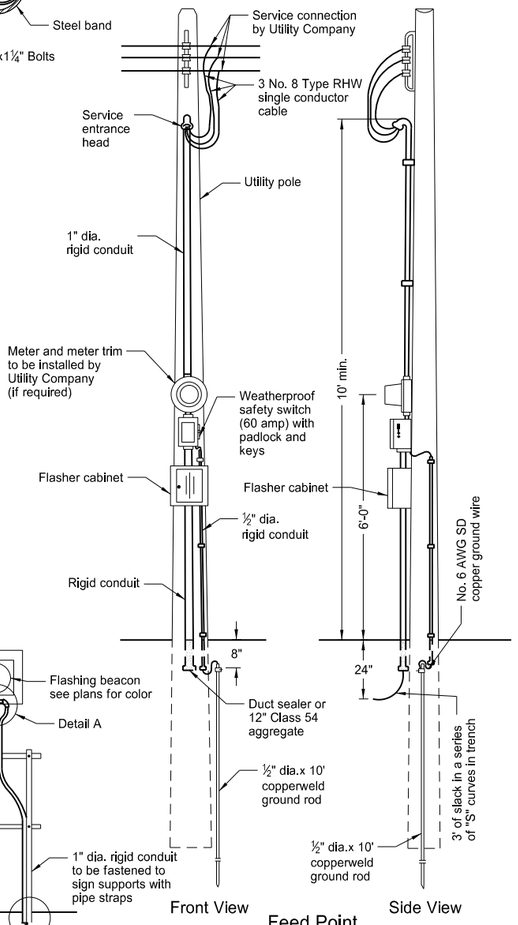




Conduit Standoff Bracket

To be used when required by local Utility Company




Detail A

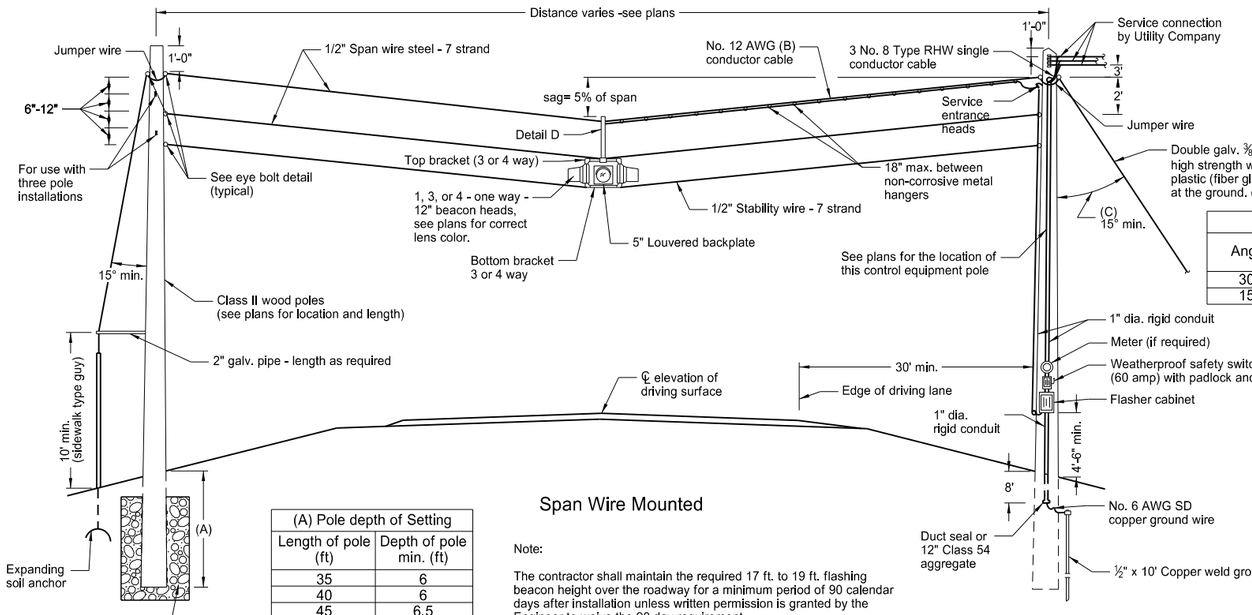



Front View

Side View

Feed Point (Post Mounted)

Flasher shall be operated on 120 volts.




Span Wire Mounted

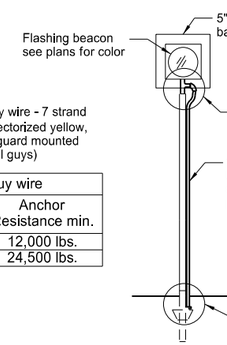
| (C) Guy wire | |
|---|---|
| Angle | Anchor Resistance min. |
| 30° | 12,000 lbs. |
| 15° | 24,500 lbs. |

| (A) Pole depth of Setting | |
|---|---|
| Length of pole (ft) | Depth of pole min. (ft) |
| 35 | 6 |
| 40 | 6 |
| 45 | 6.5 |
| 50 | 7 |
| 55 | 7.5 |

(B) See layout for number

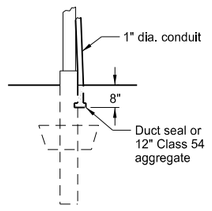
Note:

The contractor shall maintain the required 17 ft. to 19 ft. flashing beacon height over the roadway for a minimum period of 90 calendar days after installation unless written permission is granted by the Engineer to waive the 90 day requirement.




Post Mounted

For sign and sign support details, see standard drawings.




Detail B

| NORTH DAKOTA DEPARTMENT OF TRANSPORTATION | |
|---|---|
| 2-28-14 | |
| REVISIONS | |
| DATE | CHANGE |
| 7-8-14 | Span wire size and sag |

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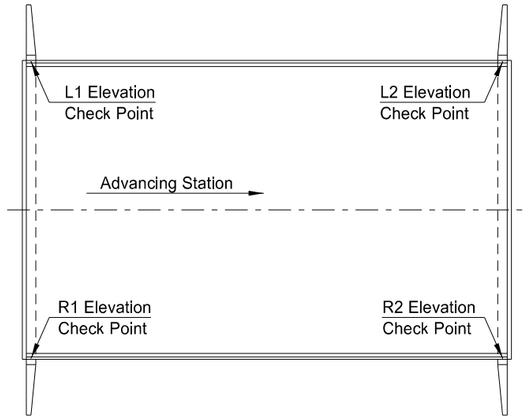
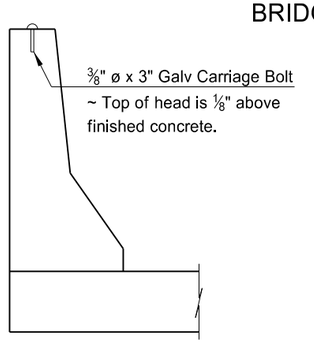
# BRIDGE BENCH MARKS

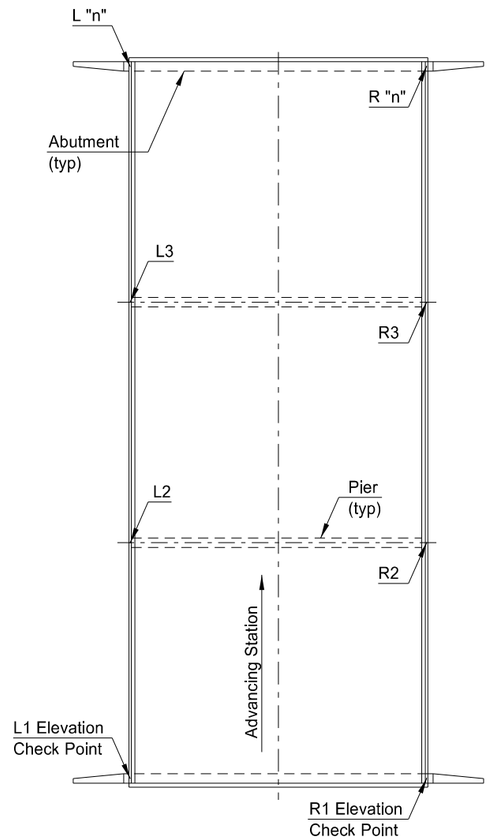
D-900-1



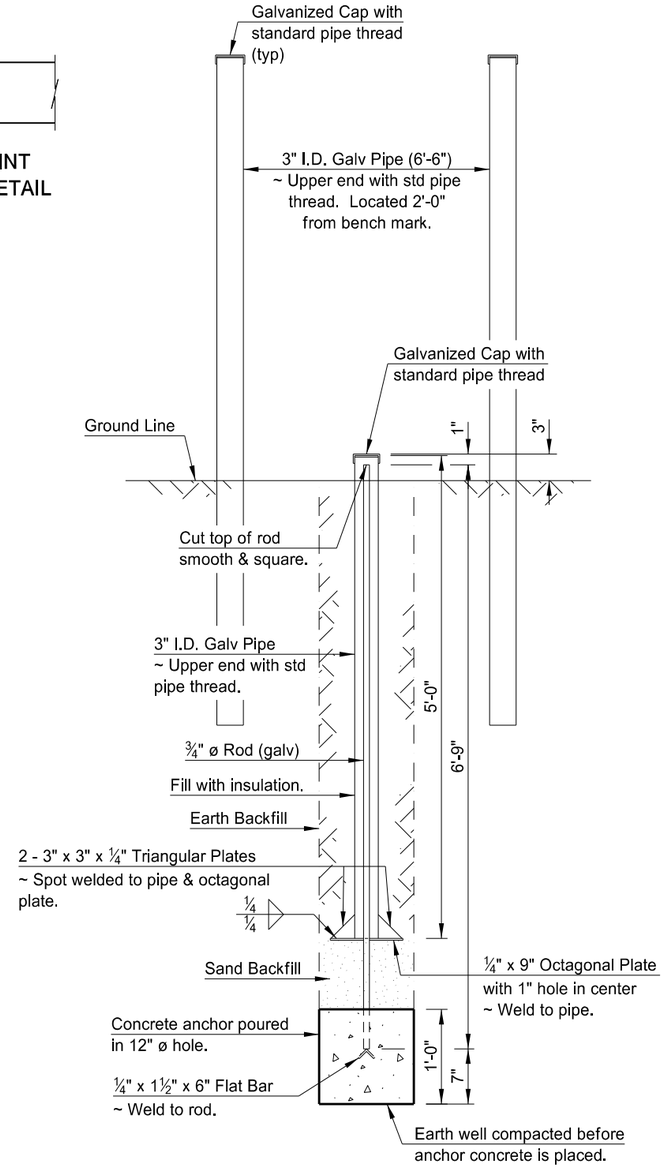

GENERAL LAYOUT FOR
SINGLE SPAN




CHECK POINT
LOCATION DETAIL




GENERAL LAYOUT FOR
MULTIPLE SPAN




BENCH MARK DETAIL

## NOTES:

Elevation check points shall consist of 3/8" ø x 3" galvanized carriage bolts (or equal) set in the concrete barrier at the points indicated on the General Layout sketches. The top of the bolt head shall project above the finished concrete 1/8". Elevation check points shall be placed on each barrier over each unit of the substructure for each bridge at a structural location.

Two bench marks as detailed hereon shall be set at diagonal opposite positions away from the structure location and at least 300 feet from the nearest point on the bridge or bridges (if more than one at a location). These bench marks shall be constructed as detailed on this sheet and located near the Highway Right of Way lines. The two pipes shall extend 4'-0" above ground and be painted with two coats of white paint suitable for galvanized steel surfaces.

The Project Engineer shall run a set of levels determining the elevation of each check point on the structure and the two bench marks immediately after the completion of the bridge. Bench Mark #1 can be listed as having elevation 1000 or the actual surveyed elevation. This information shall be recorded on SFN 13420 and submitted to the Bridge Engineer with adequate information locating each check point and bench mark.

All metal parts are to be hot dip galvanized after punching, shearing, welding and fabrication.

Threads of cap and pipe are not to be galvanized. At the time of installation these threads are to be coated with synthetic grease with teflon and cap screwed to a snug fit.

METHOD OF MEASUREMENT:

Each set of Bridge Bench Marks consisting of two bench marks and the required number of elevation check points shall be considered as one unit for bidding purposes and the quantity to be paid for shall be the number of sets of bridge bench marks which have been installed complete in place and accepted by the Engineer.

BASIS OF PAYMENT:

Bridge Bench Marks shall be paid for at the contract price bid for each set of Bridge Bench Marks, which price shall be full compensation for all excavation, backfill and clean-up, and for furnishing, hauling and placing all elevation check points, galvanized pipe, caps, rods, sand backfill, concrete, rock equipment, tools and incidentals, including galvanizing and greasing, necessary to complete this item.

GALVANIZING:

After fabrication the complete assembly shall be hot-dip galvanized.

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|---|---|
| 09/14/11 | |
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| DATE | CHANGE |
| | |

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