

# JOB # 48 CITY OF WEST FARGO

SU-8-992(037)038

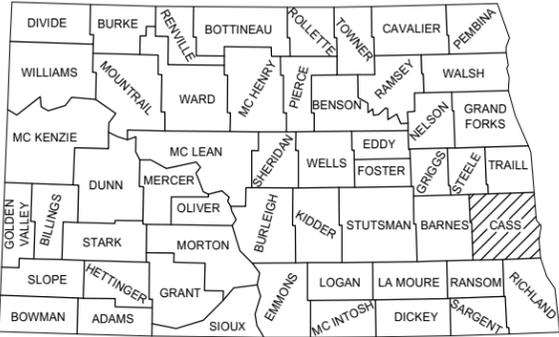
Cass County  
West Fargo, North Dakota  
City Wide Signals  
Emergency Vehicle Preemption (EVP),  
PTZ, Video Detection System, and Incidentals

STATE	PROJECT NO.	PCN	SECTION NO.	SHEET NO.
ND	SU-8-992(037)038	20857	1	1

GOVERNING SPECIFICATIONS:  
2014 Standard Specifications adopted by the North Dakota  
Department of Transportation and the Supplemental Specifications  
effective on the date the project is advertised.

PROJECT NUMBER \ DESCRIPTION	NET MILES	GROSS MILES
SU-8-992(037)038 \ Signal Upgrades	N/A	N/A

LEGAL DESCRIPTION  
TOWNSHIP 139N, RANGE 49W



STATE COUNTY MAP

DESIGNERS
Jay Forthun, EI
David Roedel, PE

I hereby certify that the attached plans were prepared by me or under my direct supervision and that I am a duly registered professional engineer under the laws of the state of ND.

APPROVED DATE 31 August, 2016

David A. Roedel, PE /s/  
Moore Engineering, Inc.

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## LIST OF STANDARD DRAWINGS

<u>Standard No.</u>	<u>Description</u>
D-101-01, 02, 03	NDDOT Abbreviations
D-101-10	NDDOT Utility Company and Organization Abbreviations
D-704-07,08	Breakaway Systems for Construction Zone Signs
D-704-09, 10, 11	Construction Sign Details
D-704-13	Barricade and Channelizing Device Details
D-704-15	Road Closure Layouts
D-704-21	Detour and Roadway Diversion Sign Layouts
D-704-23	Short Term Urban Detour and Lane Closure on a Divided Highway Layouts
D-704-25	Lane Closer on Urban Street Layouts
D-704-26	Miscellaneous Sign Layouts
D-704-50	Portable Sign Support Assembly
D-770-04	Lighting and Signal Detail
D-772-01	Feed Point-Traffic Signals
D-772-02, 03	Traffic Signal Standards
D-772-04	Traffic Signal Head Mounting
D-772-06	Span Wire Mounted Traffic Signals

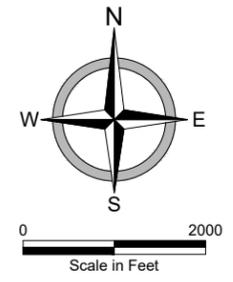
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- Legend**
- Intersection Improvements:  
"Revise Traffic Signal System - Site 1"
  - ◼ Intersection Includes:  
"Revise Traffic Signal System - Site 1" &  
"Revise Traffic Signal System - Site 2"



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Scope of Work

West Fargo, North Dakota



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**NOTES**

704-P01 TRAFFIC CONTROL: The Contractor will be required to maintain traffic at all times. Traffic control device list was created assuming contractor would have two crews working, one in each direction of travel on one intersection at a time. The Contractor may alter traffic management as needed for construction operations upon approval by the engineer prior to commencing work. Any traffic control methods and devices must be in accordance with MUTCD standards. Refer to NDDOT standard drawings D-704, quantities derived from D-704-23 Type P and D-704-15 Type A. Lane closer traffic control shall not be used when no work is being performed. Traffic control devices as listed in this plan will be measured once.

772-P01 REMOVE TRAFFIC SIGNAL SYSTEM: Disconnect and remove all Sonem emergency vehicle detector units. The removed Sonem EVP units shall become property of the City of West Fargo. The Contractor shall be responsible for coordinating with the city of West Fargo and delivering the salvaged items to the Public Works yard in West Fargo. The city contact will be determined at the pre-construction meeting. All cost, labor, and materials necessary for salvaging signal equipment shall be included in the price bid for "Remove Emergency Vehicle Detector."

772-P02 EMERGENCY VEHICLE PRE-EMPTION: The emergency vehicle preemption system shall be GTT Global GPS Vehicle Preemption; Opticom Model 3100 GPS Radio unit containing a GPS receiver with antenna and a 2.4 Ghz spread spectrum transceiver with antenna, Model 764 Multimode Phase Selector, Model 768 Auxiliary Interface Panel, Model 1040 GPS Card Rack, Model 1070 GPS Installation Cable, Model 7614 Multimode Phase Selector, and Model 792M Multimode Strobe emitter.

The location of the GPS EVP detector as denoted in the plans may vary based upon GPS signal availability. No splices are allowed between the controller cabinet and the EVP Equipment on the pole/arm. All indicator lamps shall be LED. Contractor to verify the EVP equipment placement and installation with manufacture's recommendations.

The EVP equipment shall be fully compatible with the other EVP equipment used in the City of West Fargo. The Contractor shall provide all labor and equipment necessary for the emergency vehicle preemption system to be fully operational. The Contractor shall notify City of West Fargo fire chief Daniel Fuller (701-433-5380) and city electrician Gary Robinson (701-306-8925) when the proposed signalized intersection EVP system is tested and operable. All costs, labor, materials and equipment necessary for furnishing and installing intersection equipment shall be included in the price bid "Revise Traffic Signal System - Site 1."

Additional EVP equipment at specified intersections shall include the Opticom Infrared System. All equipment shall be fully compatible with Opticom Multimode system and Opticom GPS system. The Opticom Infrared System will include the following equipment: Model 138 Detector cable, Model 700 series Detectors, Model 760 Card Rack (or Model 770 Card Rack for Gate Opener Applications), Model 7614 Phase Selector, and Model 768 Auxiliary Interface Panel. All costs, labor, materials and equipment necessary for furnishing and installing intersection equipment shall be included in the price bid "Revise Traffic Signal System - Site 2."

Approved Emergency Vehicles shall need the following equipment installed: Opticom Model 2100 High Priority Radio/GPS Control Unit or Model 2101 Low Priority Radio/GPS Control Unit, Model 1050 GPS/Radio Antenna, and Model 2171 Vehicle Interface Cable. Items are not included in current project and for reference use only.

772-P03 VIDEO DETECTION SYSTEM: Econolite ENCORE Video Detection Equipment type shall be used. Video detection units shall be replaced in the existing location. Mount video detection unit on riser with height approved by the City of West Fargo. All cable connections, camera aiming and system set-up, including programming detection zones and verification of reliable operation shall be provided by the manufacturer's representative. Cable and camera installation shall be performed by the contractor. Video detection camera locations in the plans are for guidance only. The Contractor shall provide all labor and equipment necessary for the Video detection system to be fully operational. Video monitors for each signalized intersection shall be meet LCDI-104-CCTV-LCD specifications. All costs, labor, materials and equipment necessary for furnishing and installing this item shall be included in the price bid for "Video Detection System." Refer to section 150 for location.

772-P04 TRAFFIC SIGNAL CABINET: The Traffic Signal Cabinet shall be upgraded to include: Econolite ASC/3 Controller, RENO MMU, and 2 spare load switches. Additional wiring is anticipated to replace existing Eagle Controller, refer to section 150 sheet 3 Approach Cross-Section 10. All cost, labor, materials, and equipment necessary for furnishing and installing these items shall be included in the price bid for "Controller Type 1." Refer to section 150 for locations.

772-P05 SALVAGED SIGNAL EQUIPMENT: Any removed equipment including SONEM emergency vehicle detector units and unnecessary cabling directly connected with only the SONEM units shall be salvaged and delivered to the City of West Fargo Electrician at 810 12th Avenue NW, West Fargo, ND. The Contractor shall coordinate delivery of salvaged equipment with city electrician Gary Robinson (701-306-8925). All costs, labor, materials and equipment necessary for salvaging signal equipment shall be included in the price bid for "Remove Emergency Vehicle Detector."

772-P06 WIRE SPLICING: No splicing will be allowed in pull boxes. Splicing may only take place in the signal base.

772-P07 LABEL ALL FIELD CABLES: All labeling materials shall be approved by the City. Labels shall be readable without moving the cables. When installing cable bundles in conduit, bundles will not be taped. All field cables installed by the Contractor shall be labeled. The Opticom Cable shall be labeled within 6" of the terminal with: Pre-empt/Location (i.e. NW, SW, etc.).

Labeling field cables is not a separate pay item; its cost shall be included in "Revise Traffic Signal System - Site 1" lump sum bid item.

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## NOTES

772-P08 PTZ CAMERA SYSTEM: The PTZ Camera system shall be PELCO Spectra IV to include all camera wires, camera equipment specified, and all labor involved in providing a fully functional camera system that can be viewed on the owners' network. This includes but is not limited to:

- A. Approved communications switch
- B. Cat 6 direct burial cable
- C. No 16. AWG 3 cable
- D. Camera system including manufacturer recommended mounting hardware
- E. 20 AMP four receptacle outlet with surge protection
- F. Fiber optic jumpers

Refer to General Details Section 20 for additional information and installation on the PELCO Spectra IV. Verify mast arm location with City of West Fargo prior to work. All cost, labor, materials, and equipment necessary for the placement of PTZ Camera System shall be included in the price bid for "Surveillance Camera System (PTZ)."

772-P09 ACCESSIBLE PEDESTRIAN SIGNALS (APS) PUSHBUTTON AND SIGN: All pedestrian pushbuttons shall meet the requirements of accessible pedestrian signal (APS) pushbuttons and include the features, installation procedures and be compliant with the following:

A. Features:

- 1. Rapid tick WALK indication, no more than 2-5dBA above ambient sound
- 2. Vibrotactile WALK indication
- 3. Speaker and vibrotactile indication located at pushbutton
- 4. Pushbutton locator tone
- 5. Tactile arrow on each device aligned in direction of travel on the crosswalk

B. Installation Procedures:

- 1. APS should be reachable from the level landing of the curb ramp for the crossing or from a level surface with an accessible path to the ramp (MUTCD Section 4E.08 and Proposed and Draft PROWAG).
- 2. APS should be within 5 feet of the crosswalk line furthest from the center of the intersection and within 10 feet of the curb (MUTCD Section 4E.08).
- 3. Tactile arrow shall be aligned with parallel to the direction of travel on the crosswalk (MUTCD Section 4E.12, P1).
- 4. Pushbutton required to be located within reach range for wheelchair users (Proposed PROWAG, R406).

C. Code Compliance:

- 1. Functionality: MUTCD 2009 - 4E
- 2. Temperature and Humidity: NEMA TS 2
- 3. Transient Voltage Protection: NEMA TS 2
- 4. Transient Suppression: IEC 61000-4-4. IEC 61000-4-5
- 5. Electronic Noise: FCC Title 47, Part 15, Class A
- 6. Mechanical Shock and Vibration: NEMA TS 2
- 7. EN4 PBS Enclosure: NEMA 250 - Type 4X
- 8. Electrical Reliability: NEMA TS 4

The cost for the accessible pedestrian signals pushbutton and sign shall not be bid separately but shall be included in the item "Controller Type 1".

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Notes

West Fargo, North Dakota

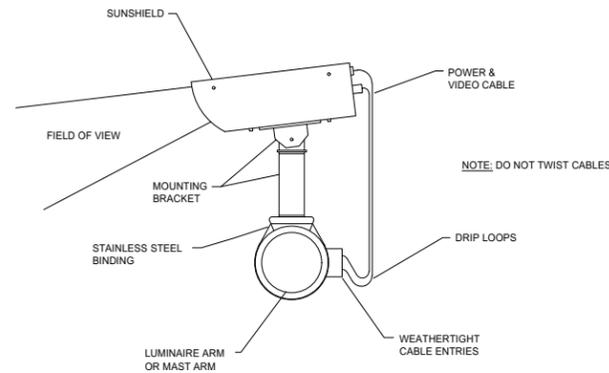
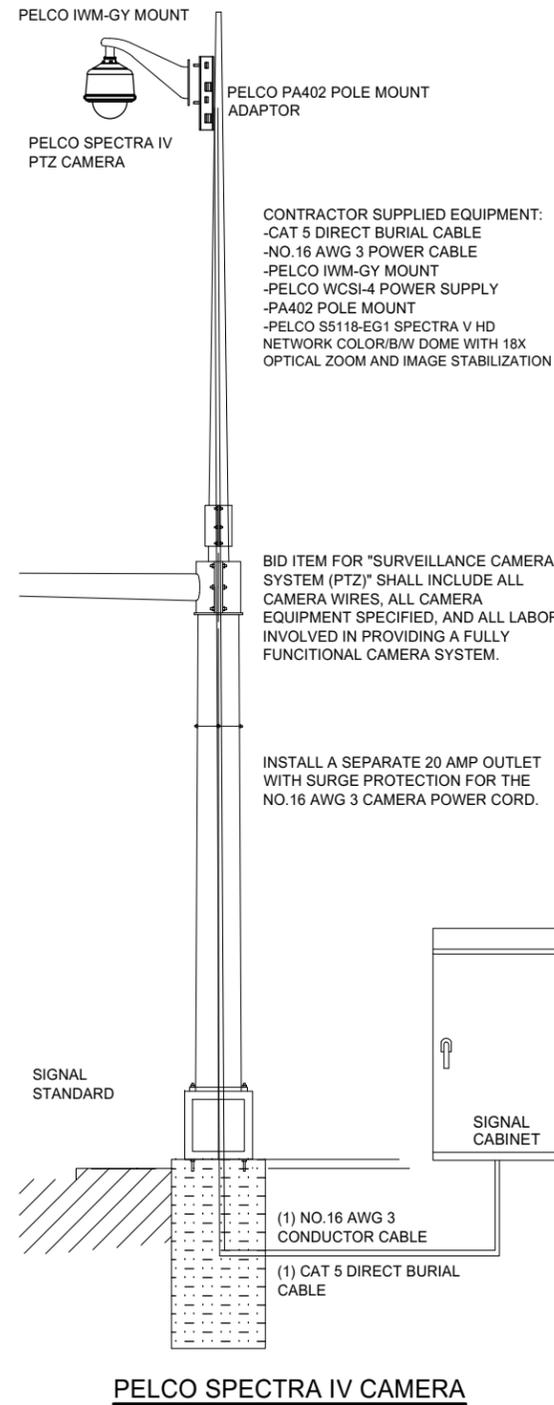
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ESTIMATE OF QUANTITIES

<u>SPEC</u>	<u>CODE</u>	<u>ITEM DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>
103	0100	CONTRACT BOND	LSUM	1
702	0100	MOBILIZATION	LSUM	1
704	0100	FLAGGING	MHR	40
704	1000	TRAFFIC CONTROL SIGNS	UNITS	1344
704	1060	DELINEATOR DRUMS	EA	40
704	1065	TRAFFIC CONES	EA	16
704	1086	SEQUENCING ARROW PANEL - TYPE B	EA	2
772	2265	VIDEO DETECTION SYSTEM	EA	1
772	2350	CONTROLLER TYPE 1	EA	3
772	2906	REVISE TRAFFIC SIGNAL SYSTEM - SITE 1	EA	20
772	2907	REVISE TRAFFIC SIGNAL SYSTEM - SITE 2	EA	1
772	3128	REMOVE EMERGENCY VEHICLE DETECTOR	EA	20
772	9300	SURVEILLANCE CAMERA SYSTEM (PTZ)	EA	2

Quantities  
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- NOTE:**
1. VIDEO CAMERA, SUNSHIELD, AND MOUNTING BRACKET SHALL BE POWDER COATED BLACK.
  2. DETAIL SHOWS VERTICAL INSTALLATION. IF HORIZONTAL INSTALLATION, MAKE ADJUSTMENTS TO MOUNTING BRACKET TO ACCOMMODATE VERTICAL INSTALLATION OF CAMERA ITSELF (UPRIGHT VIEW).

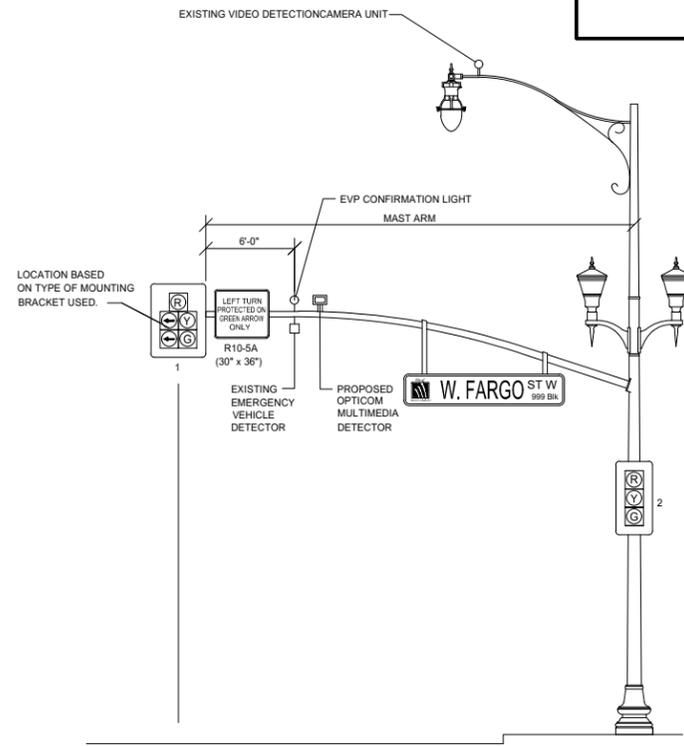
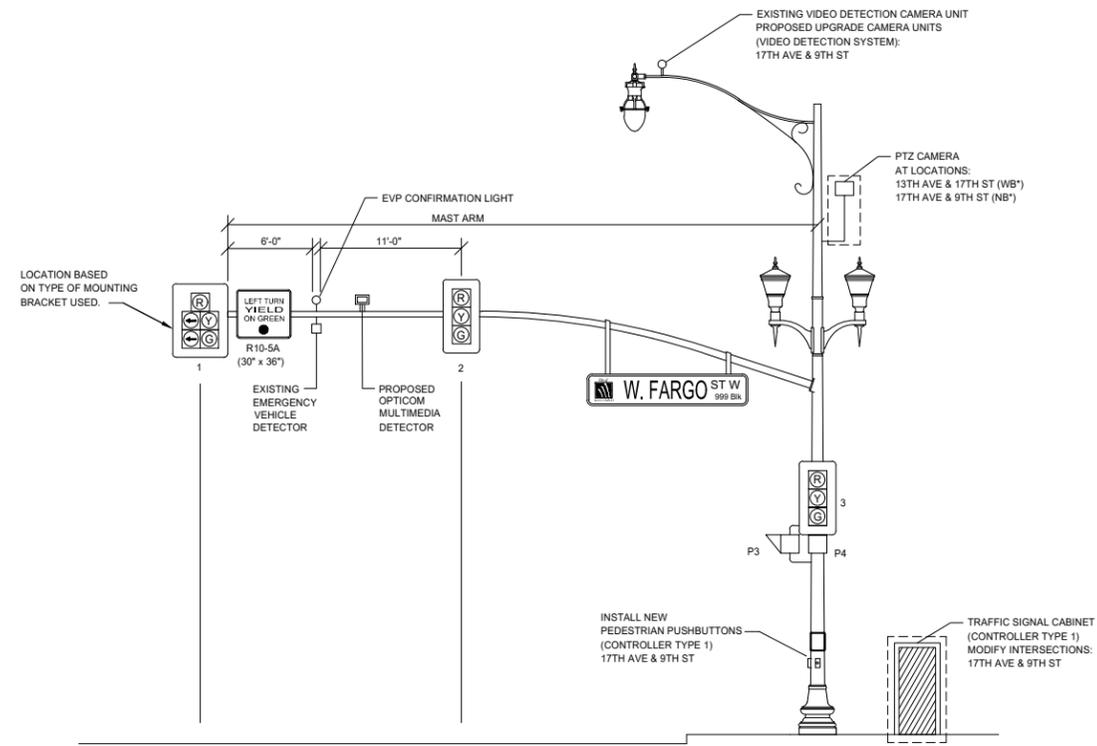
- SIGNAL NOTE:**
1. ALL EXISTING EQUIPMENT SHALL REMAIN UNLESS IDENTIFIED AS REMOVAL IN PLAN SET.
  2. EACH INTERSECTION SHALL MAINTAIN THE EXISTING PHASING CONTROLLER AND SIGNAL TIMING.
  3. REFER TO SECTION 6 NOTES FOR INSTALLATION OF THE EMERGENCY VEHICLE PRE-EMPTION EQUIPMENT.

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General Details  
 West Fargo, North Dakota

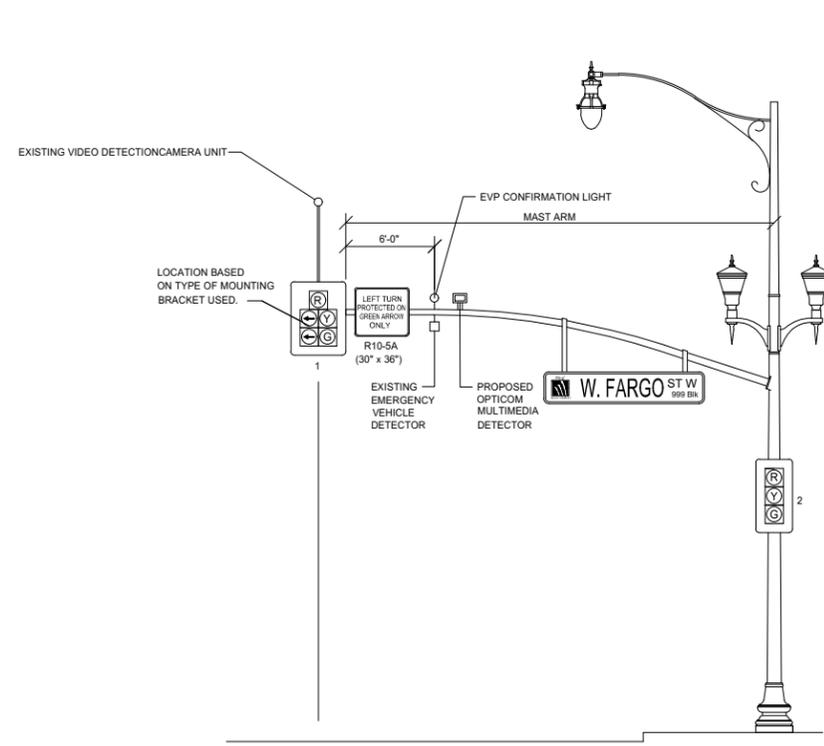
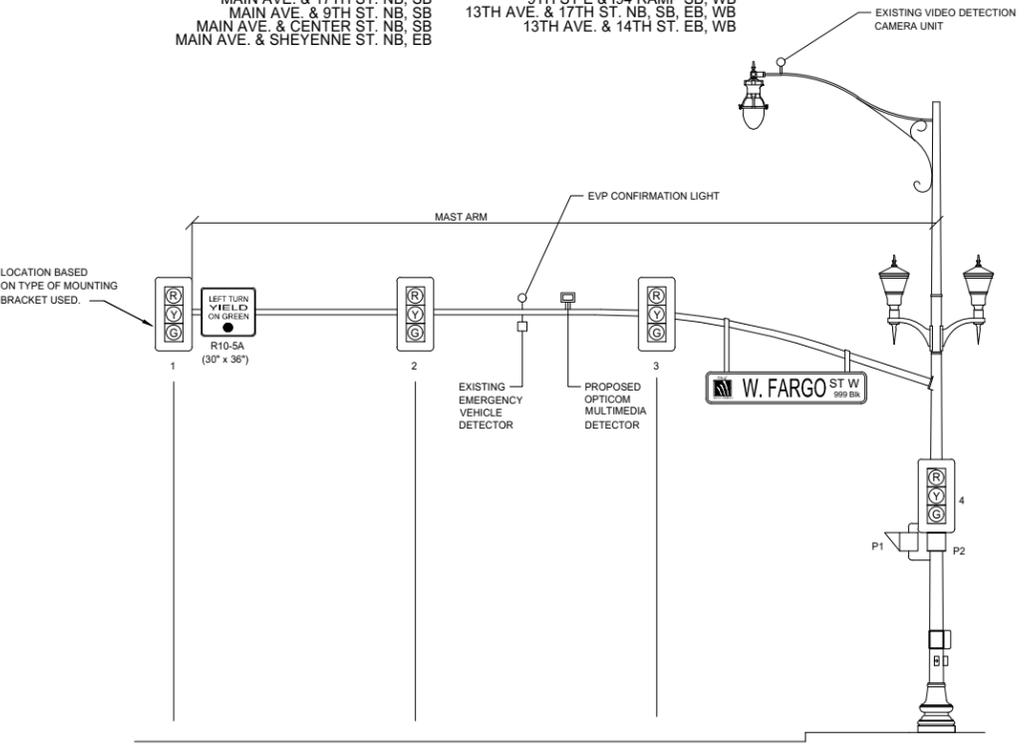


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- APPROACH CROSS-SECTION ①**
- 13TH AVE. & 9TH ST. SB, EB, WB
  - 13TH AVE. & 6TH ST. NB, SB, EB, WB
  - 17TH AVE. & 9TH ST. NB, SB, EB, WB
  - MAIN AVE. & 17TH ST. NB, SB
  - MAIN AVE. & 9TH ST. NB, SB
  - MAIN AVE. & CENTER ST. NB, SB
  - MAIN AVE. & SHEYENNE ST. NB, EB
  - 13TH AVE. & SHEYENNE ST. NB, SB
  - 13TH AVE. & SHEYENNE ST. EB
  - VETERAN'S BLVD & 194 RAMP NB, EB
  - 9TH ST E & 194 RAMP SB, WB
  - 13TH AVE. & 17TH ST. NB, SB, EB, WB
  - 13TH AVE. & 14TH ST. EB, WB

- APPROACH CROSS-SECTION ②**
- 13TH AVE. & 9TH ST. NB
  - 7TH AVE. & 9TH ST. NB, SB, EB, WB
  - 13TH AVE. & 14TH ST. NB, SB



- APPROACH CROSS-SECTION ③**
- MAIN AVE. & CENTER ST. EB, WB
  - MAIN AVE. & SHEYENNE ST. WB

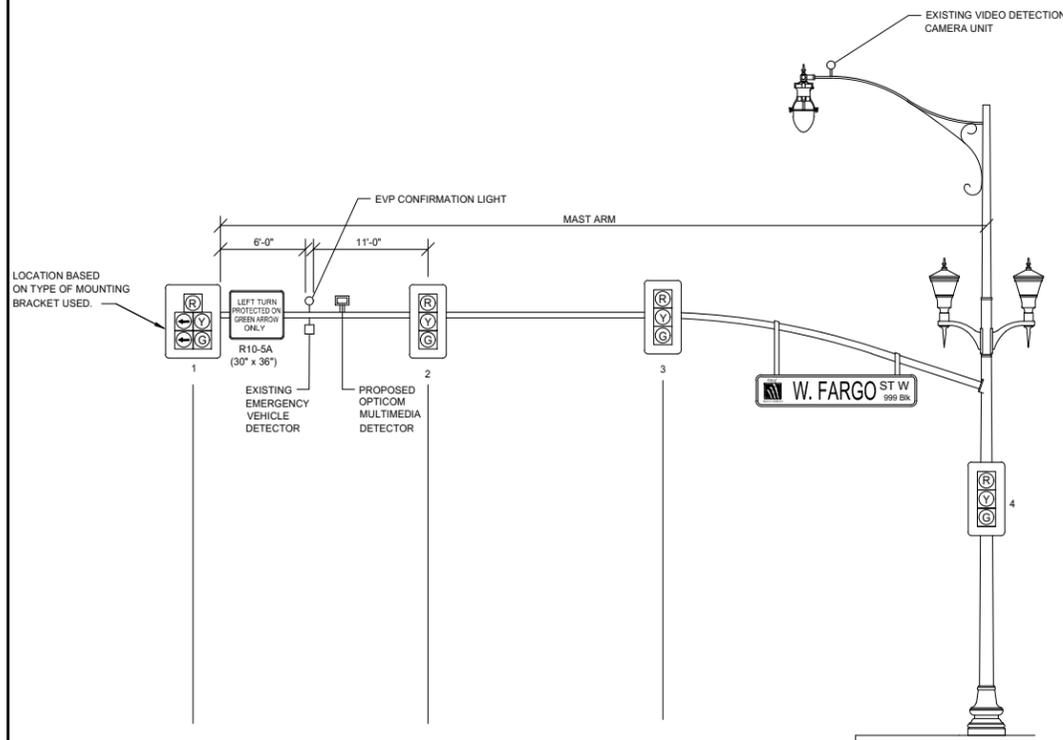
- APPROACH CROSS-SECTION ④**
- 4TH AVE. & 9TH ST. NB, SB, EB, WB

- NOTES:**
- ALL MAST ARM ITEM LOCATIONS ARE APPROXIMATE.
  - THE SONEM EMERGENCY VEHICLE DETECTOR UNITS SHALL BE REMOVED AND REPLACED WITH OPTICOM MULTIMODE DETECTOR EQUIPMENT. THE PROPOSED UNITS SHALL BE PLACED AT THE MANUFACTURERS RECOMMENDED DISTANCE FROM EXISTING EVP CONFIRMATION LIGHTS.
  - THE CONTRACTOR TO MEASURE ALL NEEDED CABLE LENGTHS PRIOR TO INSTALLATION. APPROXIMATE LENGTHS ARE PROVIDED FOR REFERENCE PURPOSE ONLY IN SECTION 150 SHEET 3.
  - SALVAGE EXISTING OPTICOM DETECTORS. MAINTAIN EXISTING MULTIMEDIA DETECTORS IF COMPATIBLE WITH EQUIPMENT SPECIFIED IN GENERAL NOTE 772-P02 (SECTION NO. 6 SHEET NO. 1).
  - THE MONITOR CAMERA PELCO SPECTRA IV SHALL BE PLACED IN CERTAIN LOCATIONS LISTED. REFER TO CROSS-SECTION LABEL AND CAMERA DETAIL IN SECTION 20.

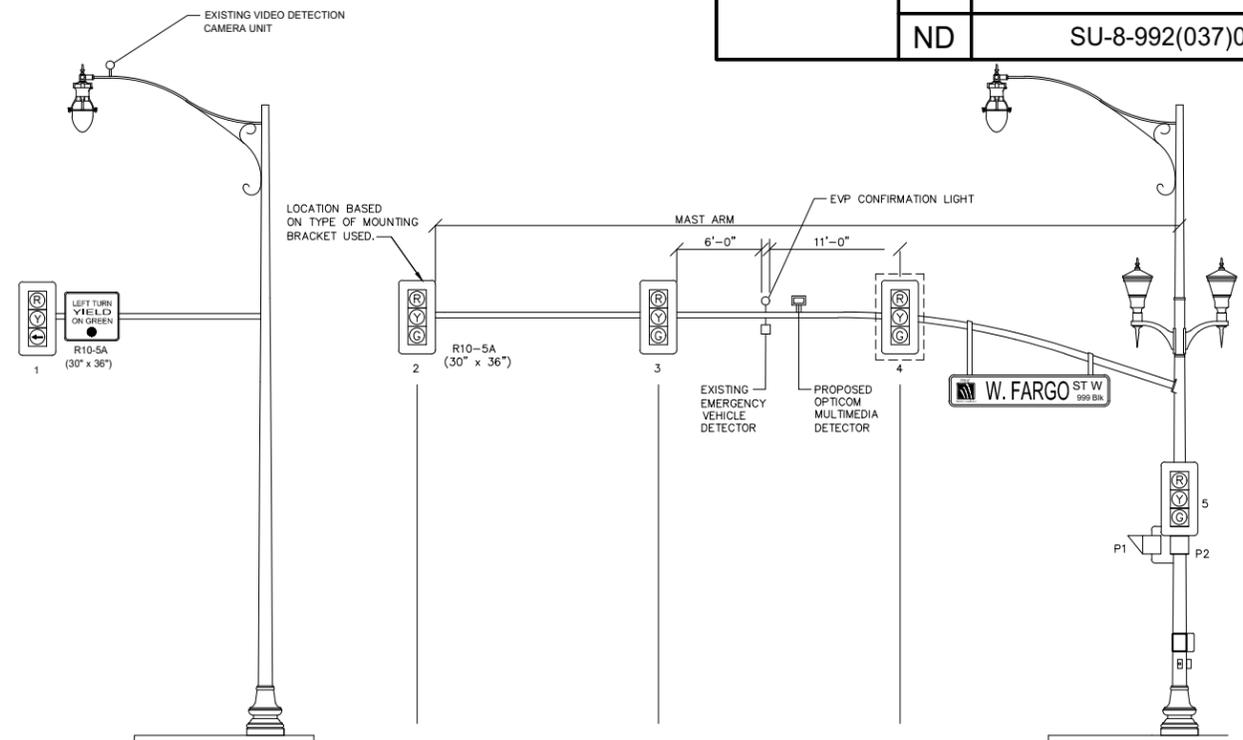
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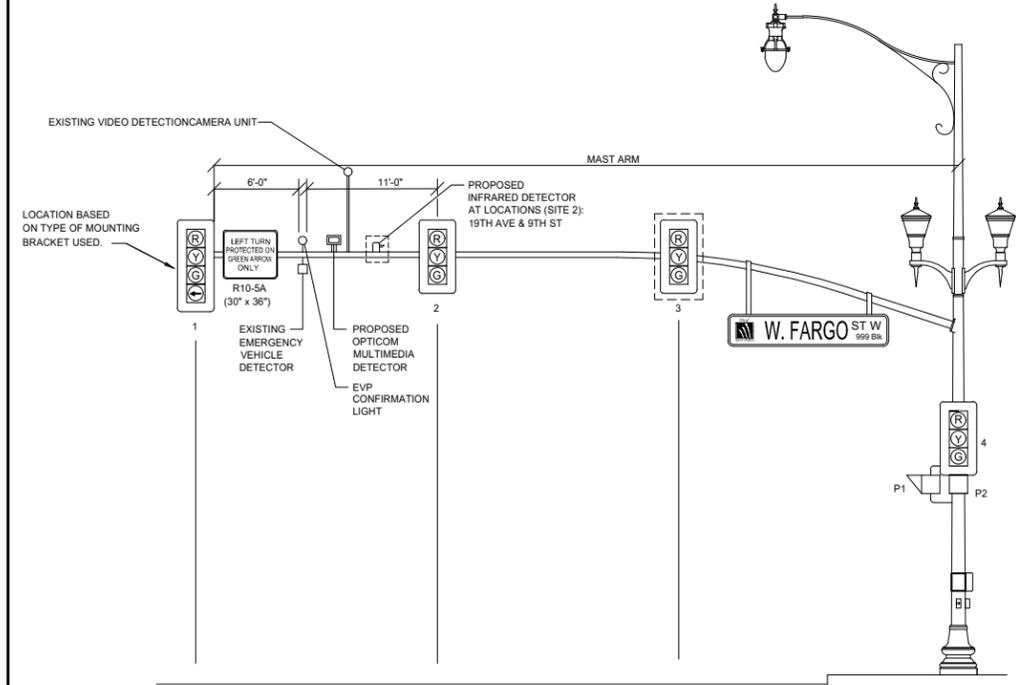


**APPROACH CROSS-SECTION ⑤**  
MAIN AVE. & 9TH ST. WB

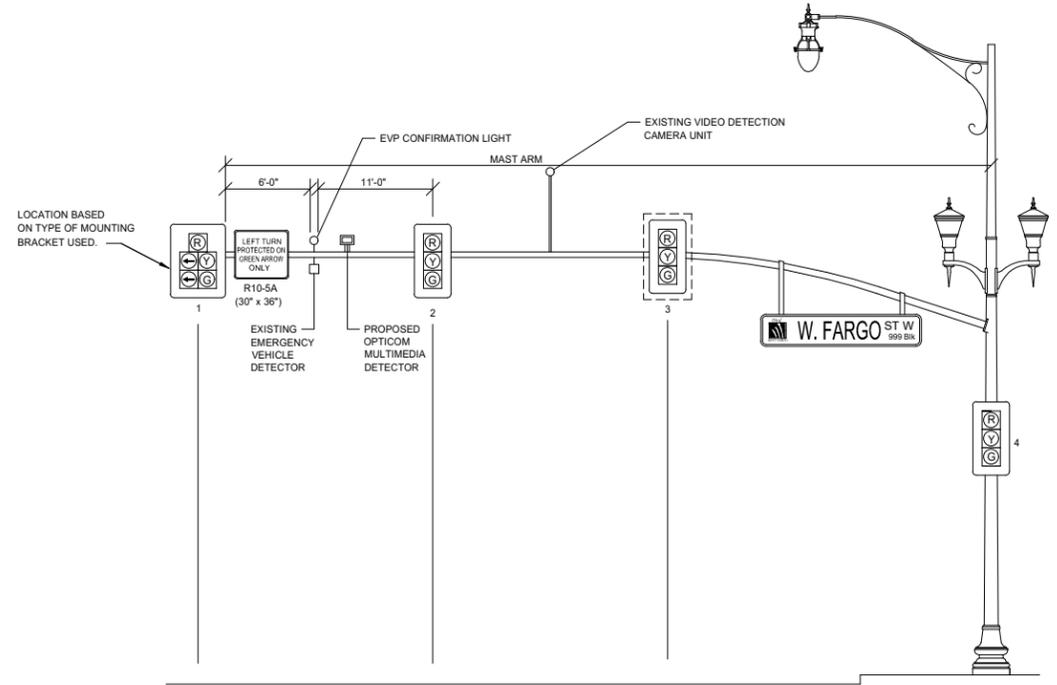


**APPROACH CROSS-SECTION ⑥**  
MAIN AVE. & 17TH ST. EB, WB  
MAIN AVE. & 9TH ST. EB

- NOTES:**
1. ALL MAST ARM ITEM LOCATIONS ARE APPROXIMATE.
  2. THE SONEM EMERGENCY VEHICLE DETECTOR UNITS SHALL BE REMOVED AND REPLACED WITH OPTICOM MULTIMODE DETECTOR EQUIPMENT. THE PROPOSED UNITS SHALL BE PLACED AT THE MANUFACTURERS RECOMMENDED DISTANCE FROM EXISTING EVP CONFIRMATION LIGHTS.
  3. THE CONTRACTOR TO MEASURE ALL NEEDED CABLE LENGTHS PRIOR TO INSTALLATION. APPROXIMATE LENGTHS ARE PROVIDED FOR REFERENCE PURPOSE ONLY IN SECTION 150 SHEET 3.
  4. SALVAGE EXISTING OPTICOM DETECTORS. MAINTAIN EXISTING MULTIMEDIA DETECTORS IF COMPATIBLE WITH EQUIPMENT SPECIFIED IN GENERAL NOTE 772-P02 (SECTION NO. 6 SHEET NO. 1).
  5. THE MONITOR CAMERA PELCO SPECTRA IV SHALL BE PLACED IN CERTAIN LOCATIONS LISTED. REFER TO CROSS-SECTION LABEL AND CAMERA DETAIL IN SECTION 20.



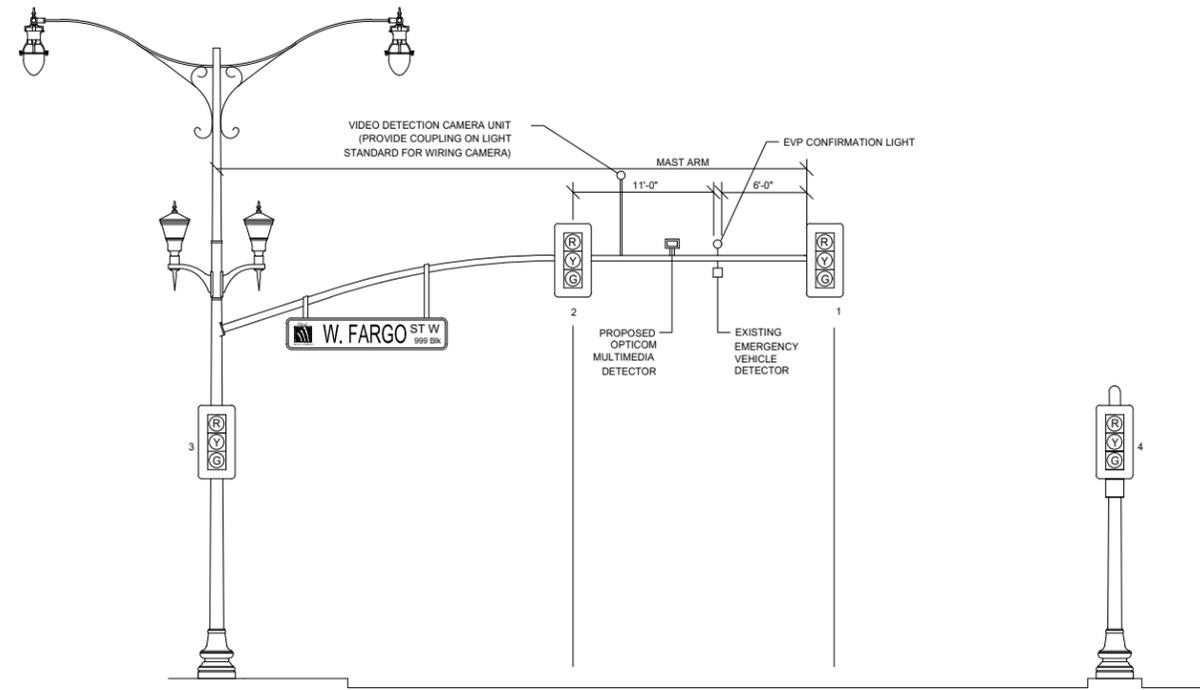
**APPROACH CROSS-SECTION ⑦**  
19TH AVE. & 9TH ST. NB, SB, EB, WB  
23RD AVE. & VETERAN'S BLVD EB  
26TH AVE. & VETERAN'S BLVD NB, SB, EB, WB  
32ND AVE. & VETERAN'S BLVD NB, SB, EB, WB  
32ND AVE. & 4TH ST NB, SB



**APPROACH CROSS-SECTION ⑧**  
23RD AVE. & VETERAN'S BLVD NB, SB, WB  
13TH AVE. & SHEYENNE ST. WB  
36TH AVE. & VETERAN'S BLVD NB, SB, EB, WB  
32ND AVE. & 4TH ST WB

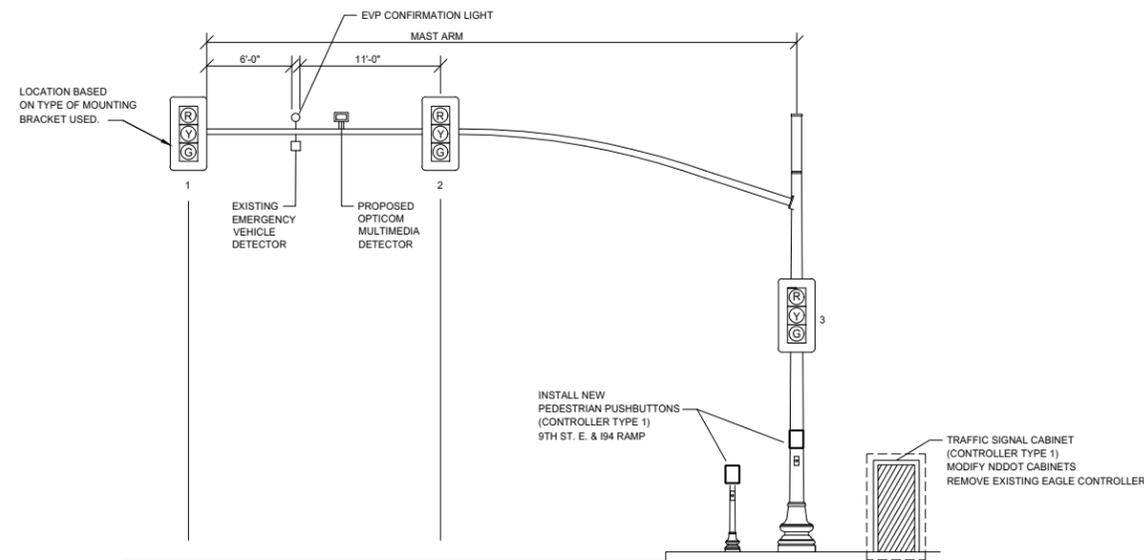
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Traffic Signal Profiles  
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**APPROACH CROSS-SECTION 9**  
32ND AVE. & 4TH ST. EB

Intersection	Included Approach	Included in Pay Item	Cable Size/Type	Approximate LF
Sheyenne St & Main Ave W	1, 3	772-2906	Emergency Vehical Detector Cable	700
Center St & Main Ave	1, 3	772-2906	Emergency Vehical Detector Cable	1050
9th St E & Main Ave E	1, 6	772-2906	Emergency Vehical Detector Cable	1050
17th St E & Main Ave E	1, 5, 6	772-2906	Emergency Vehical Detector Cable	850
9th St E & 4th Ave E	4	772-2906	Emergency Vehical Detector Cable	700
9th St E & 7th Ave E	2	772-2906	Emergency Vehical Detector Cable	700
Sheyenne St & 13th Ave E	1, 8	772-2906	Emergency Vehical Detector Cable	850
6th St E & 13th Ave E	1	772-2906	Emergency Vehical Detector Cable	850
9th St E & 13th Ave E	1, 2	772-2906	Emergency Vehical Detector Cable	1050
14th St E & 13th Ave E	1, 2	772-2906	Emergency Vehical Detector Cable	850
17th St E & 13th Ave E	1	772-2906	Emergency Vehical Detector Cable	850
		772-9300	CAT 5 Cable (Pan-Tilt-Zoom Video)	250
		772-9300	16 AWG 3 Conductor Cable (Pan-Tilt-Zoom Power)	250
9th St E & 17th Ave E	1	772-2906	Emergency Vehical Detector Cable	850
		772-2265	Video Detection Cable	900
		772-2350	16 AWG 2 Conductor Cable (Pushbutton)	550
		772-9300	CAT 5 Cable (Pan-Tilt-Zoom Video)	250
9th St E & 19th Ave E	7	772-2906	Emergency Vehical Detector Cable	850
		772-9300	16 AWG 3 Conductor Cable (Pan-Tilt-Zoom Power)	250
9th St E & 194 Westbound	1, 10	772-2906	Emergency Vehical Detector Cable	700
		772-2350	16 AWG 2 Conductor Cable (Pushbutton)	250
Veteran's Blvd & 194 Eastbound	1, 10	772-2906	Emergency Vehical Detector Cable	700
Veteran's Blvd & 23rd Ave E	7, 8	772-2906	Emergency Vehical Detector Cable	1050
Veteran's Blvd & 26rd Ave E	7	772-2906	Emergency Vehical Detector Cable	850
4th St E & 32nd Ave E	7, 8, 9	772-2906	Emergency Vehical Detector Cable	850
Veteran's Blvd & 32nd Ave E	7	772-2906	Emergency Vehical Detector Cable	1050
Veteran's Blvd & 36th Ave E	8	772-2906	Emergency Vehical Detector Cable	1050
TOTAL	ALL	772-2907	Emergency Vehical Detector Cable	17450
		772-2265	Video Detection Cable	900
		772-2350	16 AWG 2 Conductor Cable (Pushbutton)	800
		772-9300	CAT 5 Cable (Pan-Tilt-Zoom Video)	500
		772-9300	16 AWG 3 Conductor Cable (Pan-Tilt-Zoom Power)	500



**APPROACH CROSS-SECTION 10**  
VETERAN'S BLVD. & 194 RAMP SB  
9TH ST. E. & 194 RAMP NB

**NOTES:**

- ALL MAST ARM ITEM LOCATIONS ARE APPROXIMATE.
- THE SONEM EMERGENCY VEHICLE DETECTOR UNITS SHALL BE REMOVED AND REPLACED WITH OPTICOM MULTIMODE DETECTOR EQUIPMENT. THE PROPOSED UNITS SHALL BE PLACED AT THE MANUFACTURES RECOMMENDED DISTANCE FROM EXISTING EVP CONFIRMATION LIGHTS.
- THE CONTRACTOR TO MEASURE ALL NEEDED CABLE LENGTHS PRIOR TO INSTALLATION. APPROXIMATE LENGTHS ARE PROVIDED FOR REFERENCE PURPOSE ONLY.
- SALVAGE EXISTING OPTICOM DETECTORS. MAINTAIN EXISTING MULTIMEDIA DETECTORS IF COMPATIBLE WITH EQUIPMENT SPECIFIED IN GENERAL NOTE 772-P02 (SECTION NO. 6 SHEET NO. 1).
- THE MONITOR CAMERA PELCO SPECTRA IV SHALL BE PLACED IN CERTAIN LOCATIONS LISTED. REFER TO CROSS-SECTION LABEL AND CAMERA DETAIL IN SECTION 20.

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Traffic Signal Profiles  
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NDDOT ABBREVIATIONS

? 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 C 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  
 DInt delineate  
 DIntr 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

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
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NDDOT ABBREVIATIONS

D-101-2

FFP	fuel filler pipes	IPn	Iron Pin	MC	medium curing	Ped	pedestal
FLS	fuel leak sensor	IP	iron Pipe	M	mega	Ped	pedestrian
Furn	furnish/ed	Jt	joint	Mer	meridian	PPP	pedestrian pushbutton post
Gal	gallon	J	joule	M	meter	Pen.	penetration
Galv	galvanized	Jct	junction	M/s	meters per second	Perf	perforated
Gar	garage	K	kelvin	M	mid ordinate of curve	Per.	perimeter
Gs L	gas line	Kn	kilo newton	Mi	mile	PL	pipeline
G Reg	gas line regulator	Kpa	kilo pascal	MM	mile marker	PI	place
GMV	gas main valve	Kg	kilogram	MP	mile post	P&P	plan & profile
G Mtr	gas meter	Kg/m3	kilogram per cubic meter	MI	milliliter	PL	plastic limit
GSV	gas service valve	Km	kilometer	Mm	millimeter	PI	plate
GVP	gas vent pipe	K	Kip(s)	Mm/hr	millimeters per hour	Pt	point
GV	gate valve	LS	Land Surveyor (licensed)	Min	minimum	PCC	point of compound curve
Ga	gauge	LSIT	Land Surveyor In Training	Misc	miscellaneous	PC	point of curve
Geod	geodetic	Ln	lane	Mon	monument	PI	point of intersection
GIS	Geographical Information System	Lg	large	Mnd	mound	PRC	point of reverse curvature
G	giga	Lat	latitude	Mtbl	mountable	PT	point of tangent
GPS	Global Positioning System	Lt	left	Mtd	mounted	POC	point on curve
Gov	government	L	length of curve	Mtg	mounting	POT	point on tangent
Grd	graded/grade	Lens	lenses	Mk	muck	PE	polyethylene
Gr	gravel	Lvl	level	Mun	municipal	PVC	polyvinyl chloride
Grnd	ground	LB	level book	N	nano	PCC	Portland Cement concrete
GWM	ground water monitor	Lvng	leveling	NGS	National Geodetic Survey	Lb or #	pounds
Gdrl	guardrail	Lht	light	NS	near side	PP	power pole
Gtr	gutter	LP	light pole	Neop	neoprene	Preempt	preemption
H Plg	H piling	Ltg	lighting	Ntwk	network	Prefab	prefabricated
Hdwl	headwall	Lig Co	lignite coal	N	newton	Prfmd	performed
Ha	hectare	Lig Sl	lignite slack	N	North	Prep	preparation
Ht	height	LF	linear foot	NE	North East	Press.	pressure
HI	height of instrument	Liq	liquid	NW	North West	PRV	pressure relief valve
Hel	helical	LL	liquid limit	NB	Northbound	Prestr	prestressed
H	henry	L	litre	No. or #	number	Pvt	private
HZ	hertz	Lm	loam	Obsc	obscure(d)	PD	private drive
HDPE	high density polyethylene	Loc	location	Obsn	observation	Prod.	production/produce
HM	high mast	LC	long chord	Ocpd	occupied	Prog	programmed
HP	high pressure	Long.	longitude	Ocpy	occupy	Prop.	property
HPS	high pressure sodium	Lp	loop	Off Loc	office location	Prop Ln	property line
Hwy	highway	LD	loop detector	O/s	offset	Ppsd	proposed
Hor	horizontal	Lm	lumen	OC	on center	PB	pull box
HBP	hot bituminous pavement	Lum	luminaire	C	one dimensional consolidation		
HMA	hot mix asphalt	L Sum	lump sum	OC	organic content		
Hr	hour(s)	Lx	lux	Orig	original		
Hyd	hydrant	ML	main line	O To O	out to out		
Ph	hydrogen ion content	M Hr	man hour	OD	outside diameter		
Id	identification	MH	manhole	OH	overhead		
In or "	inch	Mkd	marked	PMT	pad mounted transformer		
Incl	inclinometer tube	Mkr	marker	Pg	pages		
IMH	inlet manhole	Mkg	marking	Pntd	painted		
ID	inside diameter	MA	mast arm	Pr	pair		
Inst	instrument	Matl	material	Pnl	panel		
Intchg	interchange	Max	maximum	Pk	park		
Intmdt	intermediate	MC	meander corner	PK	Parker-Kalon nail		
Intscn	intersection	Meas	measure	Pa	pascal		
Inv	invert	Mdn	median	PSD	passing sight distance		
IM	iron monument	MD	median drain	Pvmt	pavement		

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NDDOT UTILITY COMPANY AND ORGANIZATION ABBREVIATIONS

D-101-10

702COM	702 Communications	GT PLNS NAT GAS	Great Plains Natural Gas Company	RED RIV TEL	Red River Rural Telephone
ACCENT	Accent Communications	HALS TEL	Halstad Telephone Company	RESVTN TEL	Reservation Telephone
AGASSIZ WU	Agassiz Water Users Incorporated	IDEA1	Idea1	ROBRTS TEL	Roberts Company Telephone
AGC	Associated General Contractors of America	INT-COMM TEL	Inter-Community Telephone Company	R-RIDER ELEC	Roughrider Electric Coop
All PI	Alliance Pipeline	KANEB PL	Kaneb Pipeline Company	RRVW	Red River Valley & Western Railroad
ALL SEAS WU	All Seasons Water Users Association	KEM ELEC	Kem Electric Cooperative Incorporated	RSR ELEC	R.S.R. Electric Cooperative
AMOCO PI	Amoco Pipeline Company	KOCH GATH SYS	Koch Gathering Systems Incorporated	S E W U	South East Water Users Incorporated
AMRDA HESS	Amerada Hess Corporation	LKHD PL	Lakehead Pipeline Company	SCOTT CABLE	Scott Cable Television Dickinson
AT&T	AT&T Corporation	LNGDN RWU	Langdon Rural Water Users Incorporated	SHERDN ELEC	Sheridan Electric Cooperative
B PAW	Bear Paw Energy Incorporated	LWR YELL R ELEC	Lower Yellowstone Rural Electric	SHEYN VLY ELEC	Sheyenne Valley Electric Cooperative
BAKER ELEC	Baker Electric	MCKNZ CON	McKenzie Consolidated Telcom	SKYTECH	Skyland Technologies Incorporated
BASIN ELEC	Basin Electric Cooperative Incorporated	MCKNZ ELEC	McKenzie Electric Cooperative	SLOPE ELEC	Slope Electric Cooperative Incorporated
BEK TEL	Bek Communications Cooperative	MCKNZ WRD	McKenzie County Water Resource District	SOURIS RIV TELCOM	Souris River Telecommunications
BELLE PL	Belle Fourche Pipeline Company	MCLEOD	McLeod USA	ST WAT COMM	State Water Commission
BLM	Bureau of Land Management	MCLN ELEC	McLean Electric Cooperative	STATE LN WATER	State Line Water Cooperative
BNSF	Burlington Northern Santa Fe Railway	MCLN-SHRDN R WAT	McLean-Sheridan Rural Water	STER ENG	Sterling Energy
BOEING	Boeing	MDU	Montana-dakota Utilities	STUT RWU	Stutsman Rural Water Users
BRNS RWD	Barnes Rural Water District	MID-CONT CABLE	Mid-Continent Cable	SW PL PRJ	Southwest Pipeline Project
BURK-DIV ELEC	Burke-Divide Electric Cooperative	MIDSTATE TEL	Midstate Telephone Company	T M C	Turtle Mountain Communications
BURL WU	Burleigh Water Users	MINOT CABLE	Minot Cable Television	TCI	TCI of North Dakota
Cable One	Cable One	MINOT TEL	Minot Telephone Company	TESORO GHG PLNS PL	Tesoro High Plains Pipeline
CABLE SERV	Cable Services	MISS W W S	Missouri West Water System	TRI-CNTY WU	Tri-County Water Users Incorporated
CAP ELEC	Capital Electric Cooperative Incorporat	MNKOTA PWR	Minnkota Power	TRL CO RWU	Traill County Rural Water Users
CASS CO ELEC	Cass County Electric Cooperative	MOR-GRAN-SOU ELEC	Mor-gran-sou Electric Cooperative	UNTD TEL	United Telephone
CASS RWU	Cass Rural Water Users Incorporated	MOUNT-WILLI ELEC	Mountrail-williams Electric Cooperative	UPPR SOUR WUA	Upper Souris Water Users Association
CAV ELEC	Cavalier Rural Electric Cooperative	MRE LBTY TEL	Moore & Liberty Telephone	US SPRINT	U.S. Sprint
CBLCOM	Cablecom Of Fargo	MUNICIPAL	City Water And Sewer	USAF MSL CABLE	U.S.A.F. Missile Cable
CENEX PL	Cenex Pipeline	MUNICIPAL	City Of '.....'	USFWS	US Fish and Wildlife Service
CENT PL WATER DIST	Central Pipe Line Water District	N CENT ELEC	North Central Electric Cooperative	USW COMM	U.S. West Communications
CENT PWR ELEC	Central Power Electric Cooperative	N VALL W DIST	North Valley Water District	VRNDRY ELEC	Verendrye Electric Cooperative
COE	Corps of Engineers	ND PKS & REC	North Dakota Parks And Recreation	W RIV TEL	West River Telephone Incorporated
CONS TEL	Consolidated Telephone	ND TEL	North Dakota Telephone Company	WEB	W. E. B. Water Development Association
CONT RES	Continental Resource Inc	NDDOT	North Dakota Department of Transportation	WILLI RWA	Williams Rural Water Association
CPR	Canadian Pacific Railway	NDSU SOIL SCI DEPT	NDSU Soil Science Department	WILSTN BAS PL	Williston Basin Interstate Pipeline Company
D O E	Department Of Energy	NEMONT TEL	Nemont Telephone	WLSH RWD	Walsh Water Rural Water District
DAK CARR	Dakota Carrier Network	NODAK R ELEC	Nodak Rural Electric Cooperative	WOLVRTN TEL	Wolverton Telephone
DAK CENT TEL	Dakota Central Telephone	NOON FRMS TEL	Noonan Farmers Telephone Company	XLENER	Xcel Energy
DAK RWD	Dakota Rural Water District	NPR	Northern Plains Railroad	YSVR	Yellowstone Valley Railroad
DGC	Dakota Gasification Company	NSP	Northern States Power		
DICKEY R NET	Dickey Rural Networks	NTH PRAIR RW	Northern Prairie Rural Water Association		
DICKEY RWU	Dickey Rural Water Users Association	NTHN BRDR PL	Northern Border Pipeline		
DICKEY TEL	Dickey Telephone	NTHN PLNS ELEC	Northern Plains Electric Cooperative Incorporated		
DNRR	Dakota Northern Railroad	NTHWSTRN REF	Northwestern Refinery Company		
DOPE PL	Dome Pipeline Company	NW COMM	Northwest Communication Cooperation		
DVELEC	Dakota Valley Electric Cooperative	ONEOK	Oneok gas		
DVMW	Dakota, Missouri Valley & Western	OSHA	Occupational Safety and Health Administration		
ENBRDG	Enbridge Pipelines Incorporated	OTTR TL PWR	Otter Tail Power Company		
ENVENTIS	Enventis Telephone	P L E M	Prairielands Energy Marketing		
FALK MNG	Falkirk Mining Company	POLAR COM	Polar Communications		
FHWA	Federal Highway Administration	PVT ELEC	Private Electric		
G FKS-TRL WD	Grand Forks-traill Water District	QWEST	Qwest Communications		
GETTY TRD & TRAN	Getty Trading & Transportation	R&T W SUPPLY	R & T Water Supply Association		
GLDN W ELEC	Golden West Electric Cooperative	RAMSEY R SEW	Ramsey Rural Sewer Association		
GRGS CO TEL	Griggs County Telephone	RAMSEY RW	Ramsey Rural Water Association		
		RAMSEY UTIL	Ramsey County Rural Utilities		

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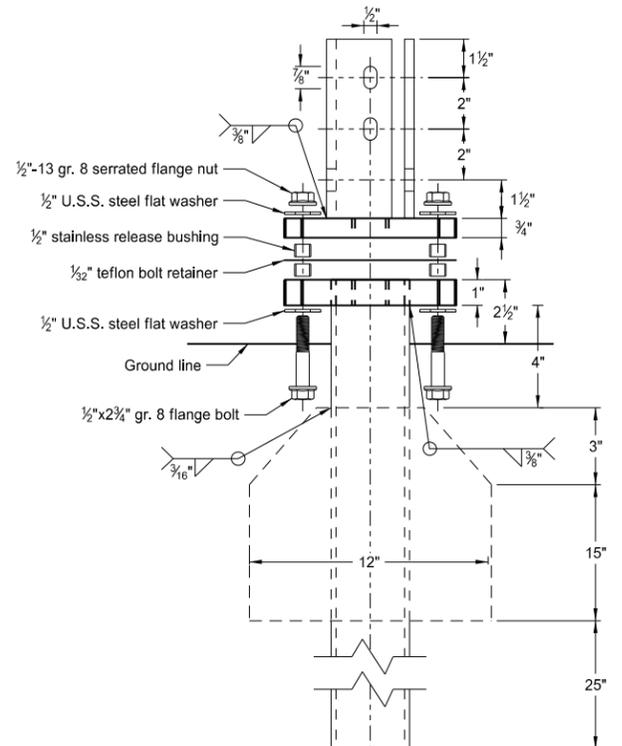
NDDOT ABBREVIATIONS

D-101-3

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

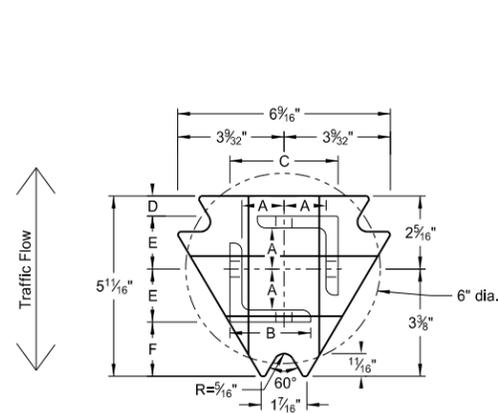
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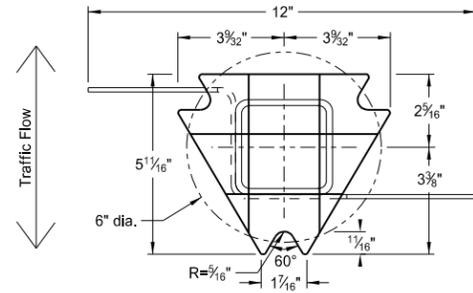


Multi-Directional Slip Base Assembly

Perforated Tube



Top Post Receiver  
Plate - ASTM A572 grade 50  
Angle Receiver - 2 1/2"x2 1/2"x3/8" 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

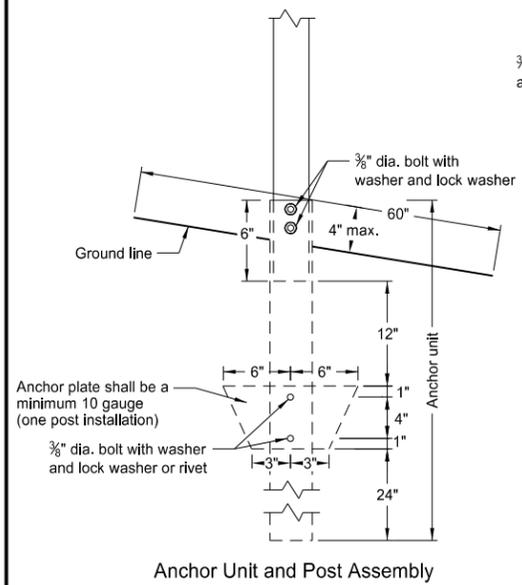
Notes:

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.

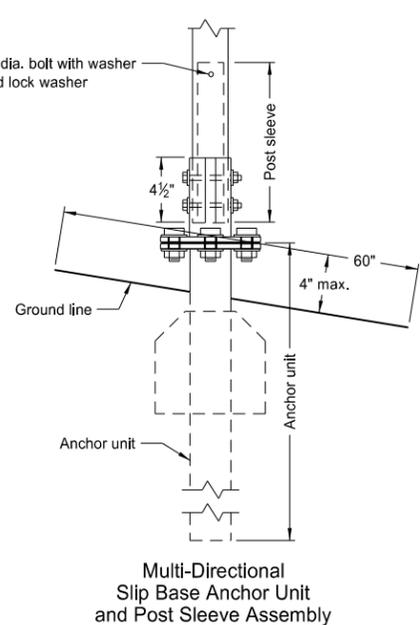
Telescoping Perforated Tube						
Number of Posts	Post Size in.	Wall Thickness Gauge	Sleeve Size in.	Wall Thickness Gauge	Slip Base	Anchor Size without Slip Base in.
1	2	12			No	2 1/4
1	2 1/4	12			No	2 1/2
1	2 1/2	12			(A)	3
1	2 1/2	10			Yes	
1	2 1/4	12	2	12	Yes	
1	2 1/2	12	2 1/4	12	Yes	
2	2	12			No	2 1/4
2	2 1/4	12			No	2 1/2
2	2 1/2	12			Yes	
2	2 1/2	12			Yes	
2	2 1/4	10	2	12	Yes	
2	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/2	12			Yes	
3 & 4	2 1/2	10			Yes	
3 & 4	2 1/2	12	2 1/4	12	Yes	
3 & 4	2 1/4	12	2	12	Yes	
3 & 4	2 1/2	10	2 3/16	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. <sup>4</sup>	Cross Sec. Area in. <sup>2</sup>	Section Modulus in. <sup>3</sup>
1 1/2 x 1 1/2	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
2 1/4 x 2 1/4	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
2 1/2 x 2 1/2	0.105	12	3.141	0.804	0.803	0.643
2 1/2 x 2 1/2	0.135	10	4.006	0.979	1.010	0.785

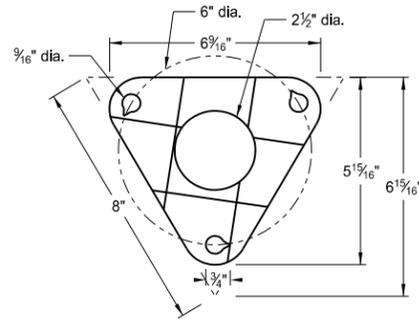
Top Post Receiver Data Table						
Square Post Sizes (B)	A	B	C	D	E	F
2 3/16"x10 ga.	1 9/64"	2 1/2"	3 1/32"	2 5/32"	1 33/64"	1 1/8"
2 1/2"x10 ga.	1 9/32"	2 1/2"	3 5/16"	5/8"	1 21/32"	1 3/4"



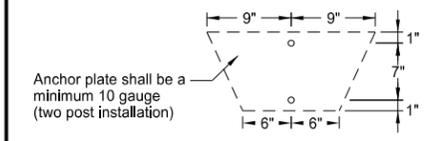
Anchor Unit and Post Assembly



Multi-Directional Slip Base Anchor Unit and Post Sleeve Assembly



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



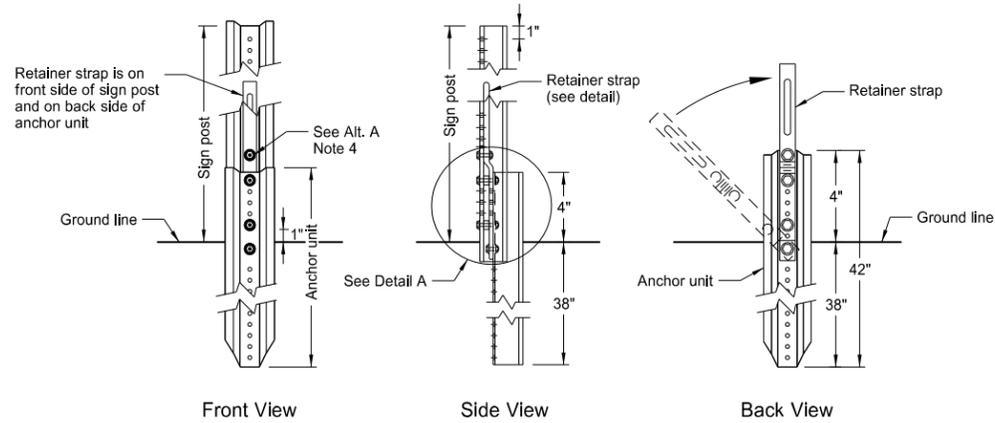
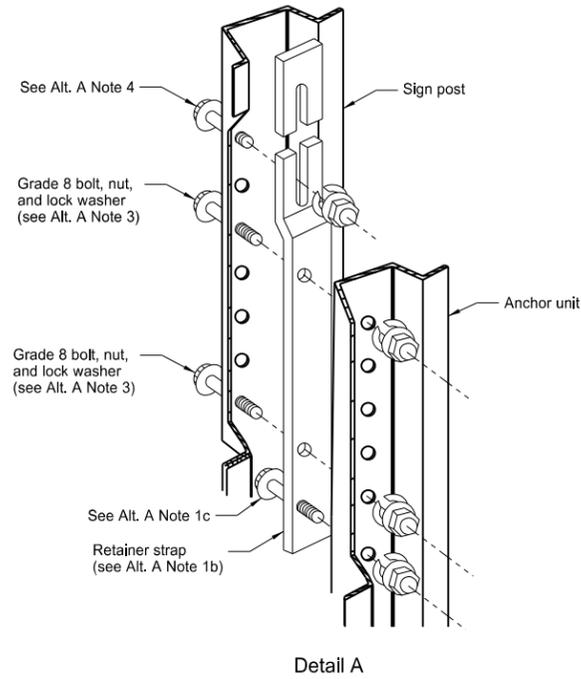
Anchor plate shall be a minimum 10 gauge (two post installation)

- (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 2 3/16"x10 ga. may be inserted into 2 1/2"x10 ga. for additional wind load.

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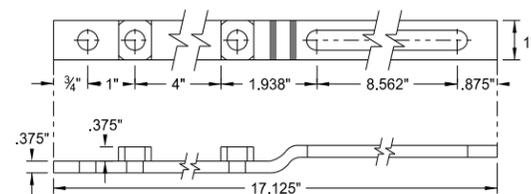
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U-Channel Post

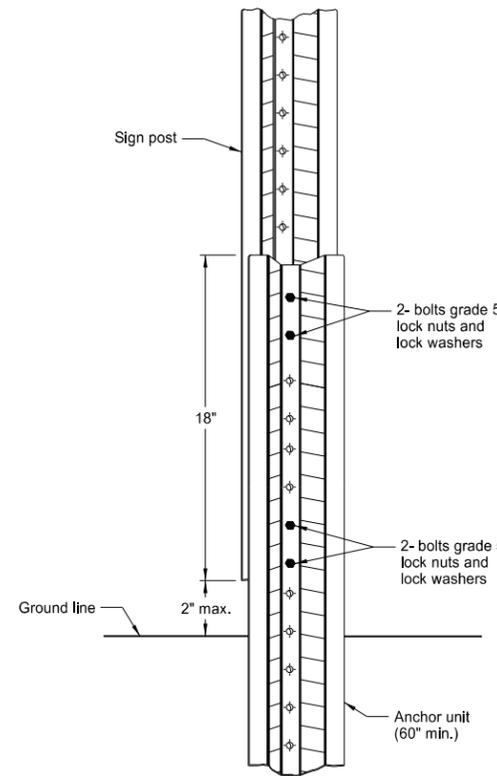


Breakaway U-Channel Detail Alternate A

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

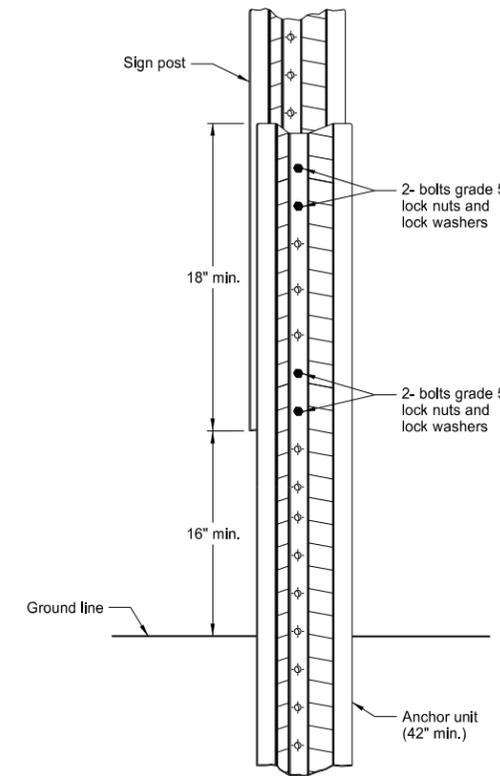


Retainer Strap Detail



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:

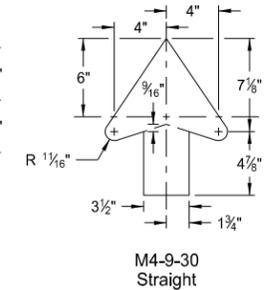
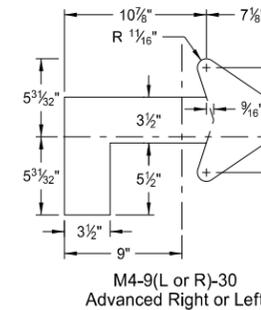
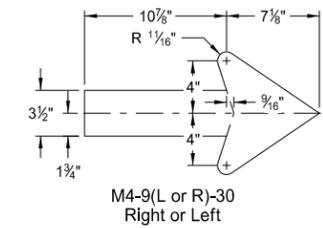
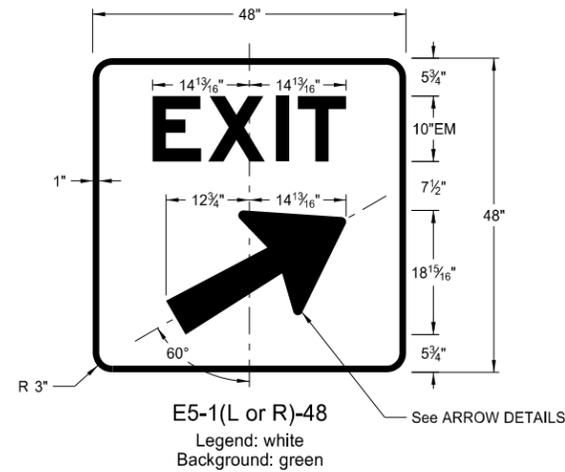
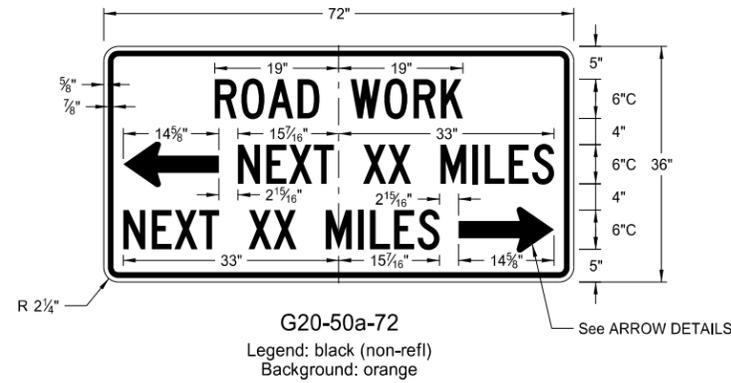
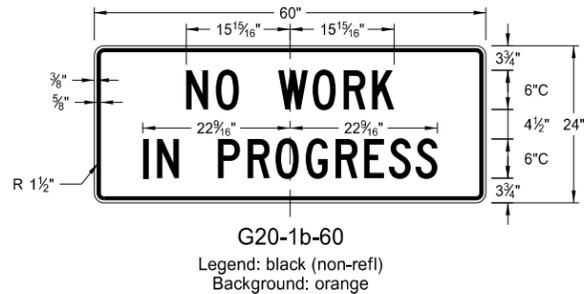
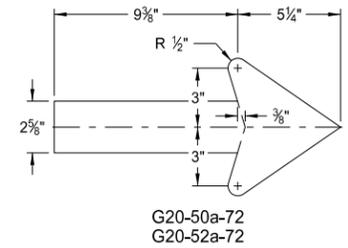
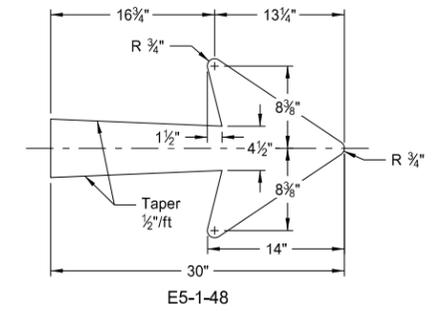
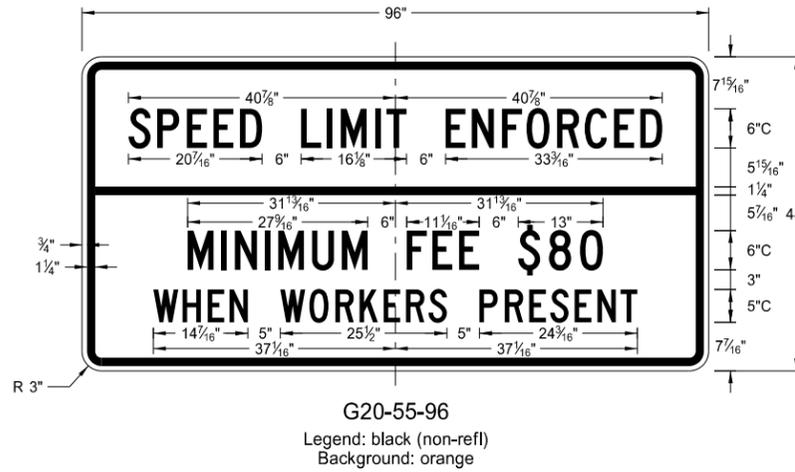
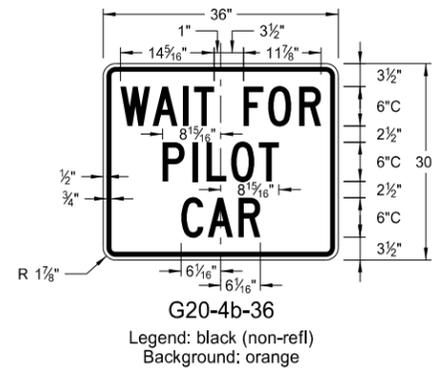
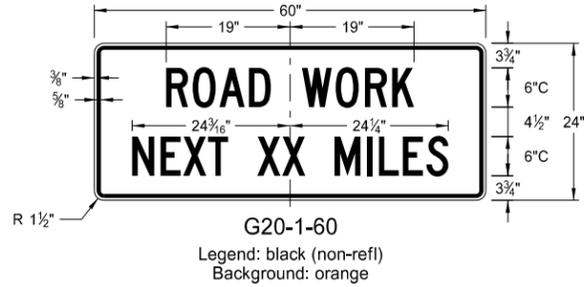
1. a) Drive anchor unit to within 12" of ground level.  
b) Proper assembly established by lining up the bottom hole of retainer strap with the 6th hole from the top of the anchor unit.  
c) Assemble strap to back of anchor unit using 5/16"x2" bolt, lock washer and nut.  
d) Rotate strap 90° to left.
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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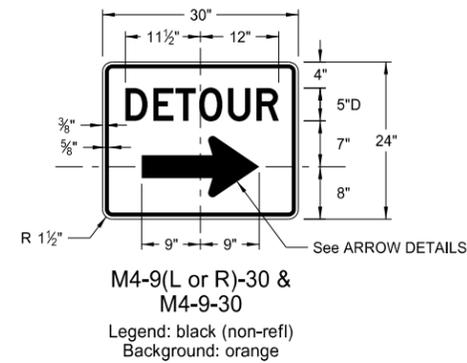
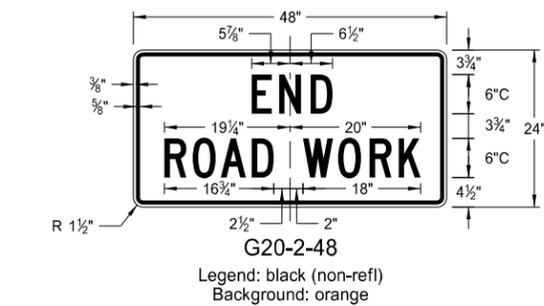
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CONSTRUCTION SIGN DETAILS  
 TERMINAL AND GUIDE SIGNS

D-704-9



ARROW DETAILS



NOTES:

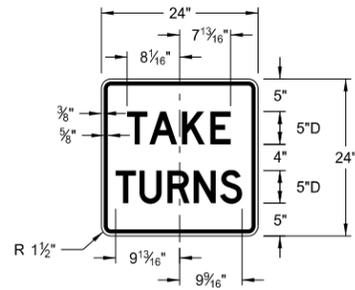
(A) Arrow may be right or left of the legend to indicate construction to the right or left.

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8-13-13	
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DATE	CHANGE

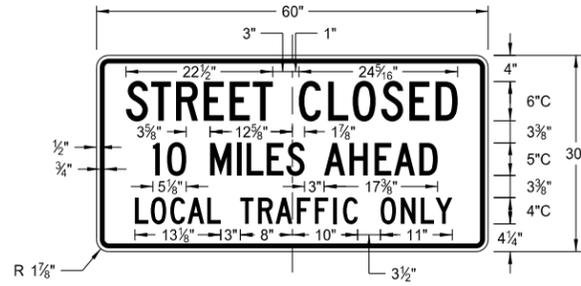
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CONSTRUCTION SIGN DETAILS  
REGULATORY SIGNS

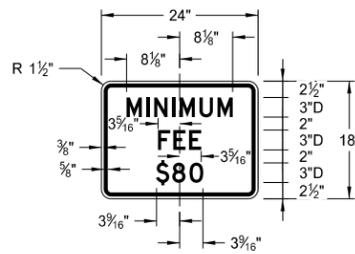
D-704-10



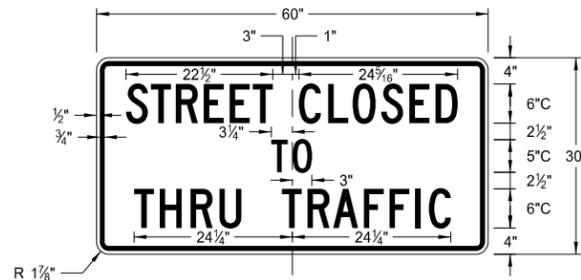
R1-50-24  
Legend: black (non-refl)  
Background: white



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



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



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



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

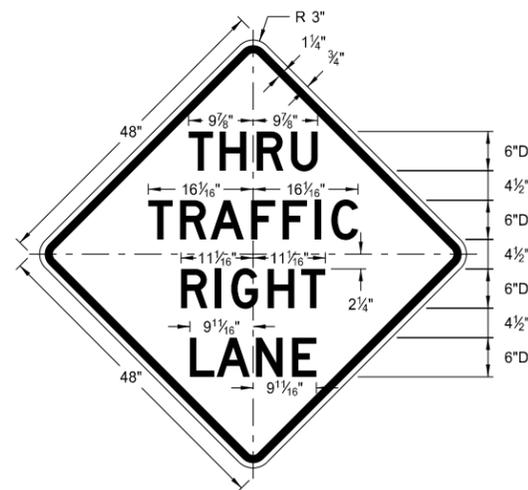
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8-13-13	
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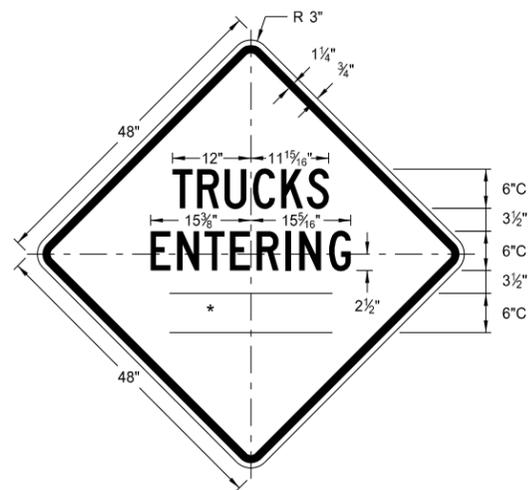
CONSTRUCTION SIGN DETAILS  
WARNING SIGNS

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

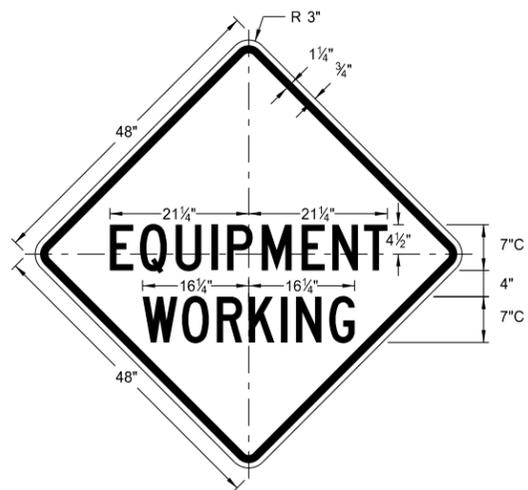
\* DISTANCE MESSAGES



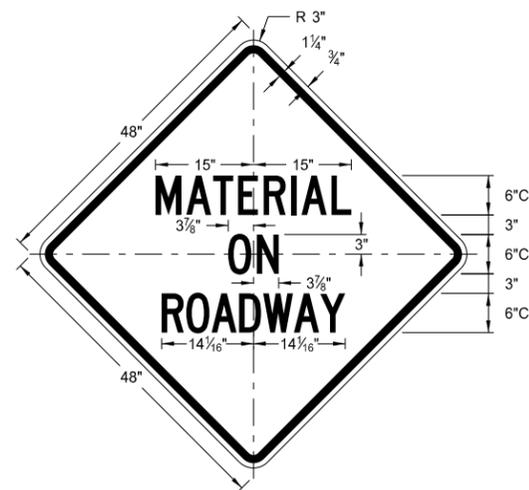
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Background: orange



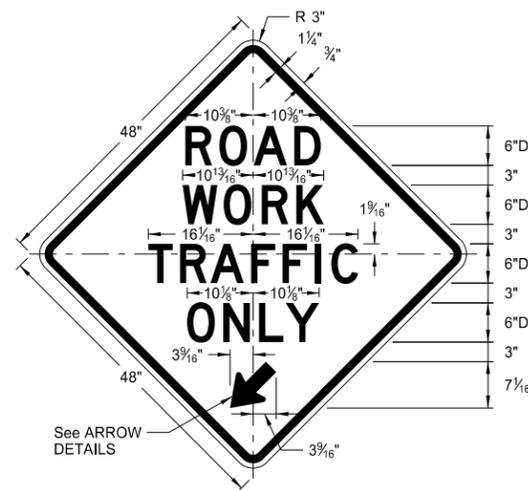
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Background: orange



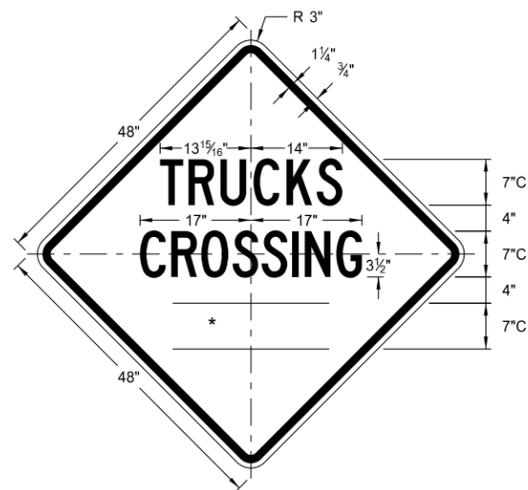
W20-51-48  
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Background: orange



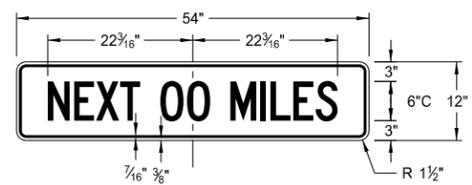
W21-51-48  
Legend: black (non-refl)  
Background: orange



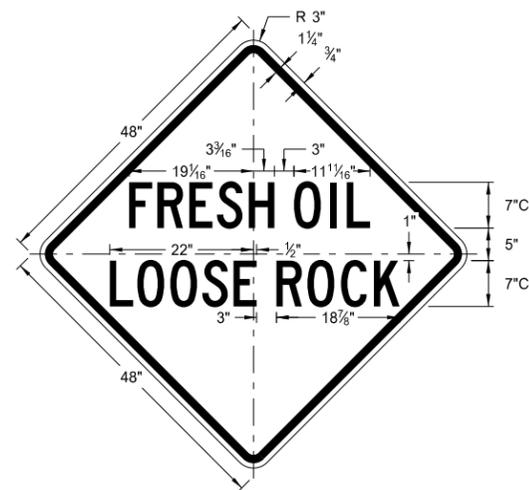
W5-9-48  
Legend: black (non-refl)  
Background: orange



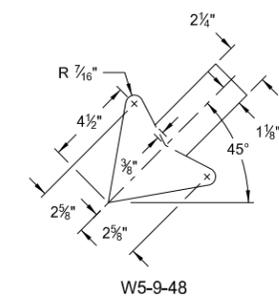
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Background: orange



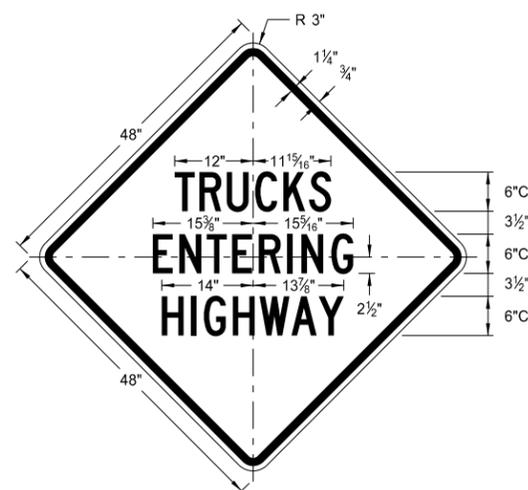
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Background: orange



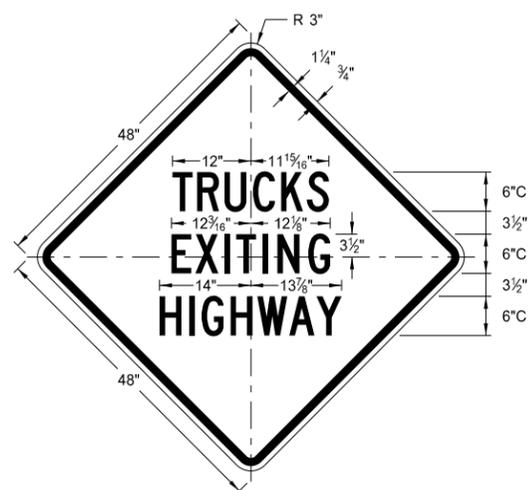
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Background: orange



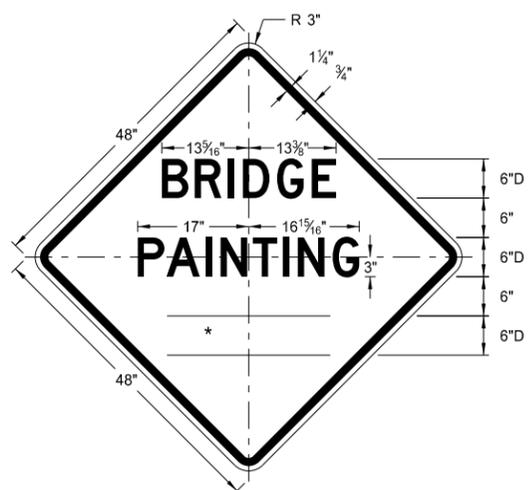
W5-9-48  
ARROW DETAILS



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



W8-56-48  
Legend: black (non-refl)  
Background: orange

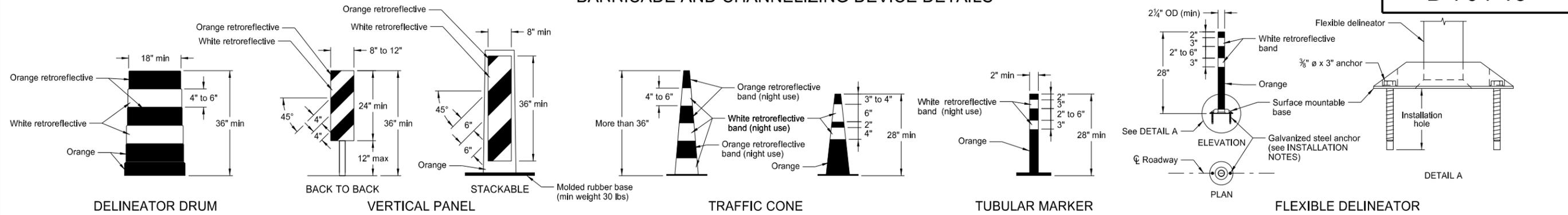


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Legend: black (non-refl)  
Background: orange

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BARRICADE AND CHANNELIZING DEVICE DETAILS



INSTALLATION NOTES:

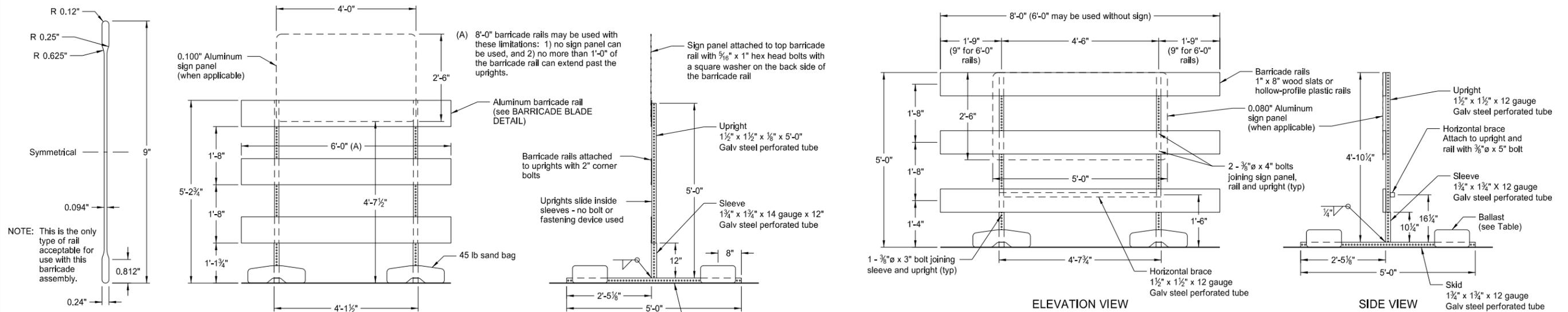
1. Drill installation holes to diameter and depth as required by manufacturer's specifications.
2. For removal, remove anchors and fill installation hole with an epoxy designed to bond to pavement surface.
3. In lieu of bolted down base, the contractor may use an 8" x 8" butyl pad or hot melt butyl.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

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.

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.

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.

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.



BARRICADE BLADE DETAIL

ELEVATION VIEW

BARRICADE ASSEMBLY DETAIL (Aluminum Barricade Rails)

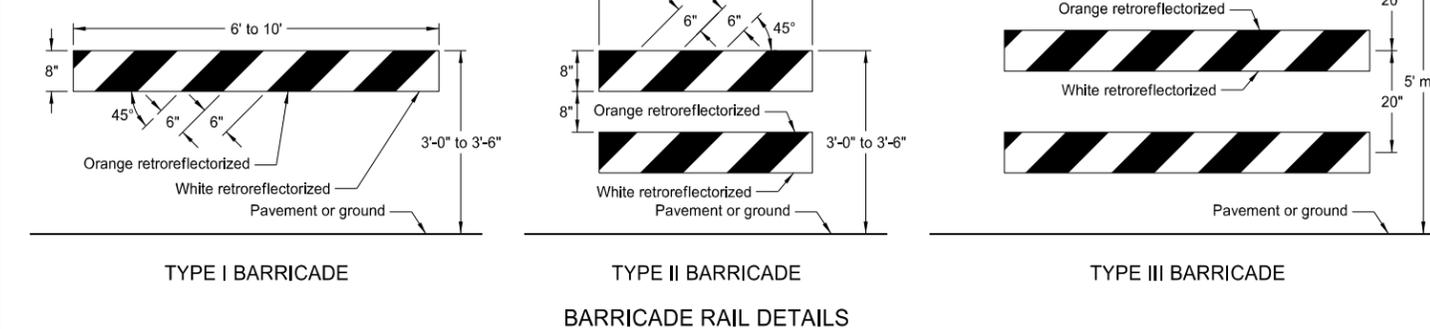
SIDE VIEW

ELEVATION VIEW

BARRICADE ASSEMBLY DETAIL (Wood or Plastic Rails)

SIDE VIEW

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".

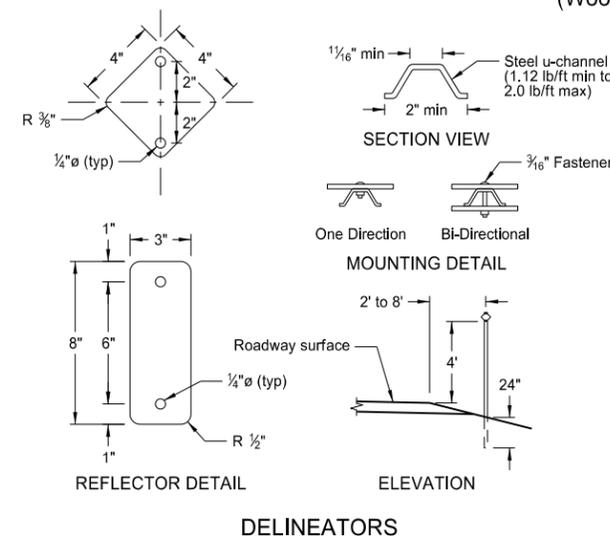


TYPE I BARRICADE

TYPE II BARRICADE

TYPE III BARRICADE

BARRICADE RAIL DETAILS



REFLECTOR DETAIL

DELINEATORS

MINIMUM BALLAST (For each side of barricade support)

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

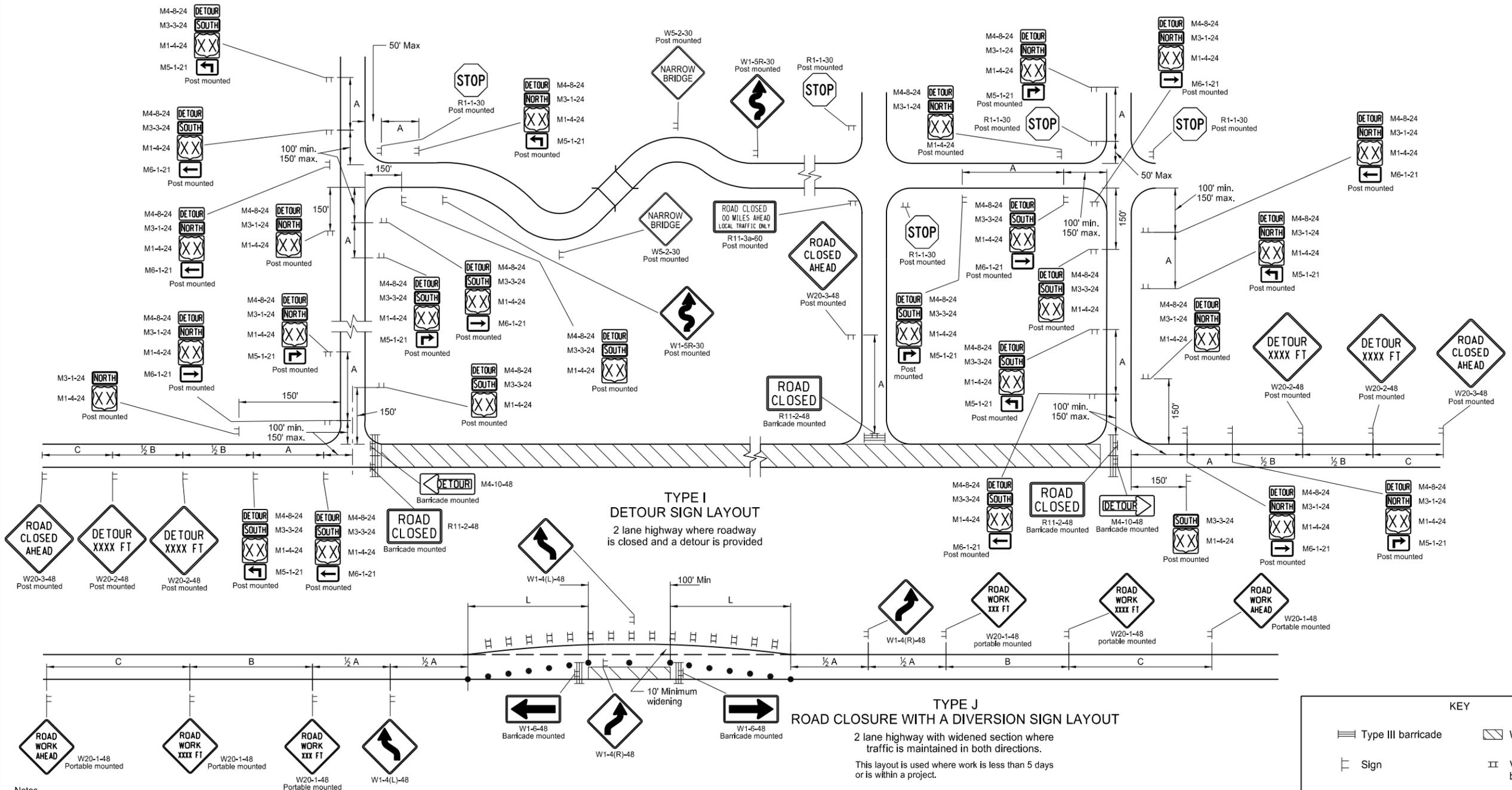
Note: The number of sandbags are based on a wind speed of 55 MPH. The sandbags are assumed to be placed at or near the ends of the skids.

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# DETOUR AND ROADWAY DIVERSION SIGN LAYOUTS

D-704-21



- Notes**
- Variables  
S=Numerical value of speed limit or 85th percentile. W=The width of taper.  
L=Minimum length of taper, or  $S \times W$  for freeways, expressways, and all other roads with speeds of 45 mph or greater, or  $W \times S^2 / 60$  for urban, residential, and other streets with speeds of 40 mph or less.
  - Barricades placed on roadway shall be on a moveable assembly. Signs placed on roadway shall be placed on skid mounted assemblies.
  - 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".  
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  $\frac{1}{2}$  B.
  - 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.
  - Existing speed limit signs within a reduced speed zone shall be covered.
  - Obliterated or covered pavement marking shall be paid for as Obliteration of Pavement Marking. The covering shall be approved by the engineer.
  - The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.

- A W24-1-48 sign may be used in place of the double reverse curve signs if the tangent between tapers is less than 60'.

**KEY**

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

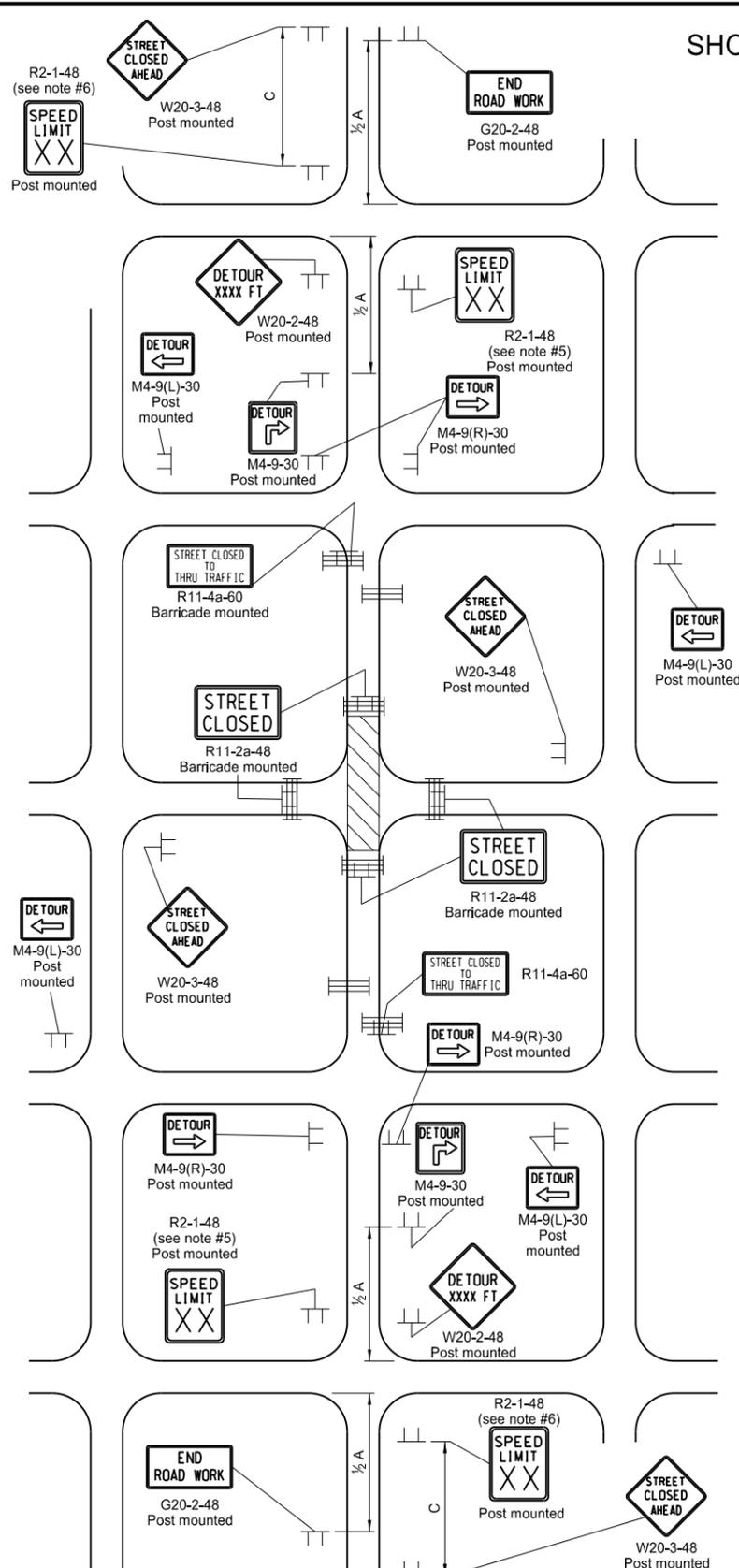
ADVANCE WARNING SIGN SPACING			
Road Type	Distance Between Signs Min. (ft)		
	A	B	C
Urban - Low Speed (30 mph or less)	150	150	150
Urban - Low Speed (over 30 to 40 mph)	280	280	280
Urban - High Speed (over 40 mph to 50 mph)	360	360	360
Rural - High Speed (over 50 mph to 65 mph)	720	720	720
Urban Expressway 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

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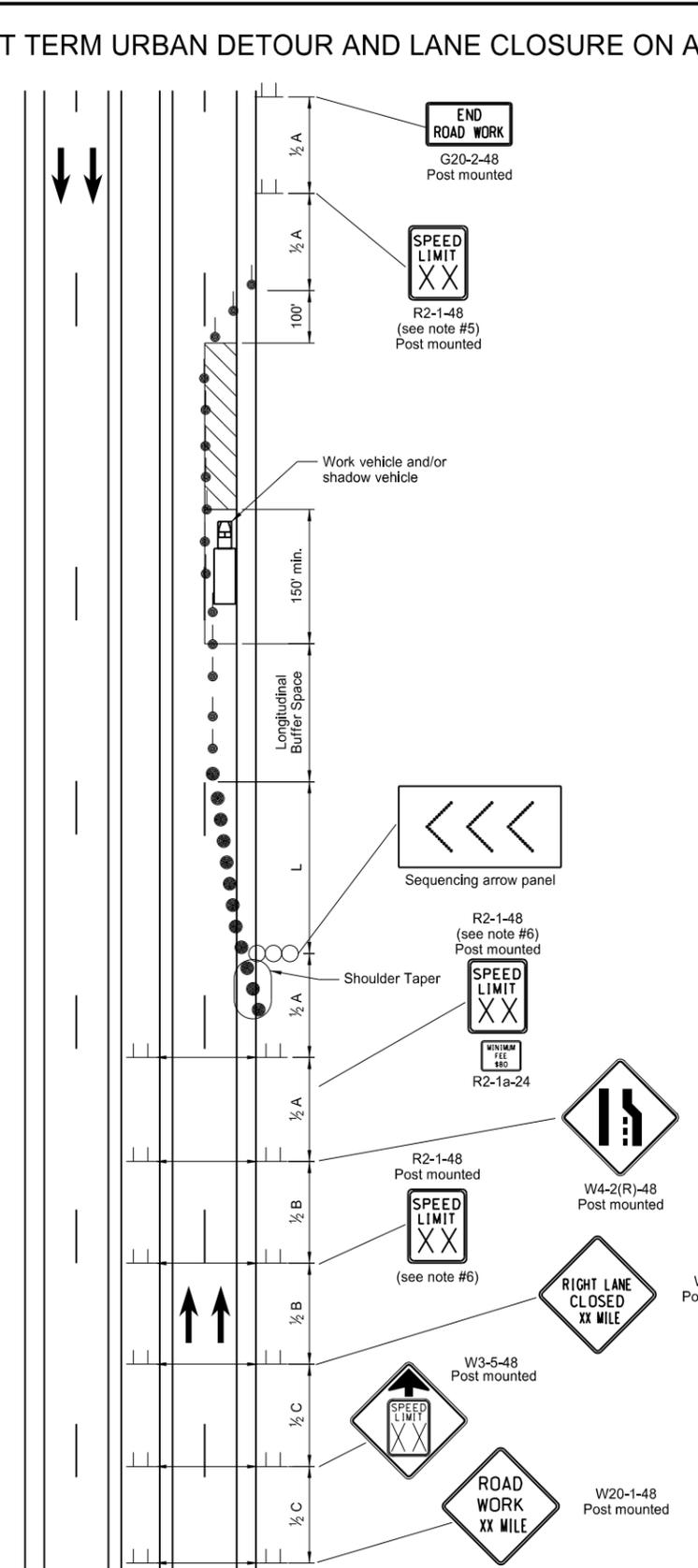
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# SHORT TERM URBAN DETOUR AND LANE CLOSURE ON A DIVIDED HIGHWAY LAYOUTS

D-704-23



**TYPE Q**  
**DETOUR FOR A CLOSED STREET**  
 Where city streets are used for detouring traffic.  
 Urban projects do not require the G20-55-96 and R2-1a-24 signs.



**TYPE P**  
**STATIONARY LANE CLOSURE ON A DIVIDED HIGHWAY**  
 4 lane divided roadway where 1/2 of roadway is closed.  
 Short-term (more than 1 hour within a single daylight period.)

- Notes
- Variables
    - S = Numerical value of speed limit or 85th percentile.
    - W = The width of taper
    - L = Minimum length of taper, or  $S \times W$  for freeways, expressways, and all other roads with speeds of 45 mph or greater, or  $W \times S^2 / 60$  for urban, residential, and other streets with speeds of 40 mph or less.
  - Barricades placed on roadway shall be on a moveable assembly. Signs placed on the roadway shall be placed on skid mounted assemblies.
  - Delinicator drums used for tapering traffic shall be spaced at dimension "S". Delinicator drums or tubular markers used for tangents shall be spaced at 2 times "S".
  - Sequencing Arrow Panels
    - Panels should normally be placed at the beginning of the taper. Where shoulder width does not provide sufficient room the panel should be moved closer to the work area so that it can be placed on the roadway surface.
    - Type A shall be used on roadways with slow moving traffic speeds and low volume (25 mph 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).
  - The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
  - 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 1/2 B.
  - 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.
  - Existing speed limit signs within a reduced speed zone shall be covered.
  - Obliterated or covered pavement marking shall be paid for as Obliteration of Pavement Marking. The covering shall be approved by the engineer.
  - Intersection control for Type Q may have to be changed on detour. The Engineer in the field shall determine what control is necessary.
  - Where necessary, safe speed to be determined by the Engineer. When parking is present, signs shall be placed so they are entirely visible above parked vehicles or placed at the edge of the parking area so they are visible to oncoming traffic. These signs may be skid mounted when placed on the roadway surface.
  - The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.

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

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

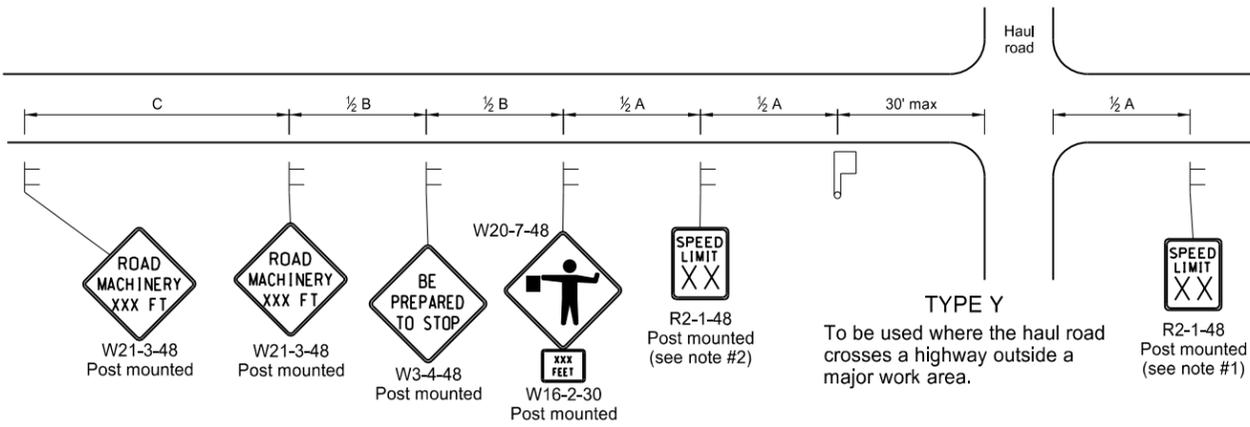
	Type III barricade		Work area
	Sign		Sequencing arrow panel
	Delineator Drum		Tubular Markers

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9-27-13	
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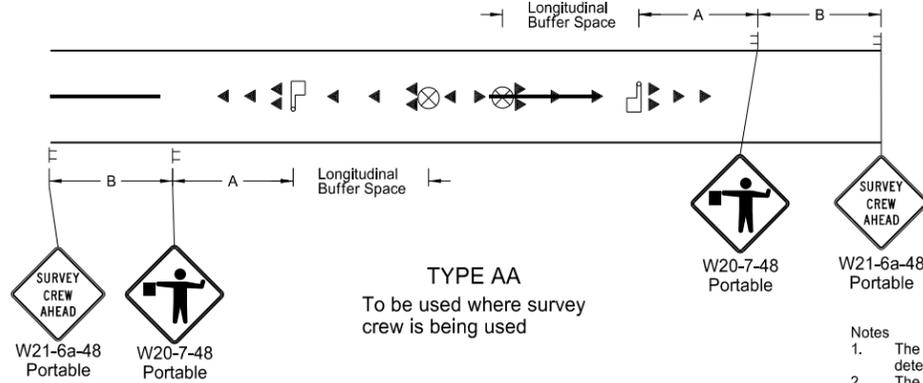
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MISCELLANEOUS SIGN LAYOUTS

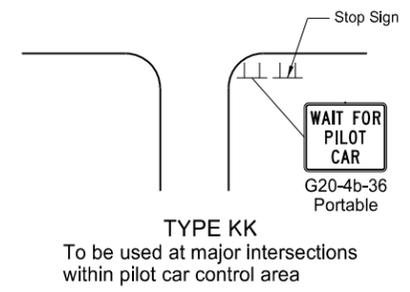
D-704-26



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

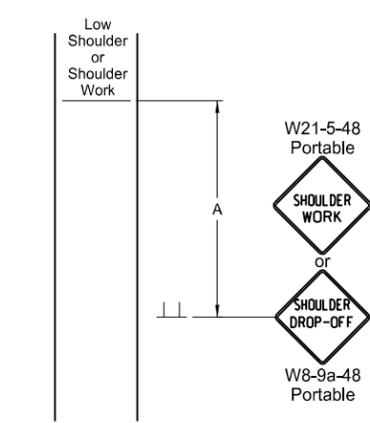


**TYPE AA**  
To be used where survey crew is being used

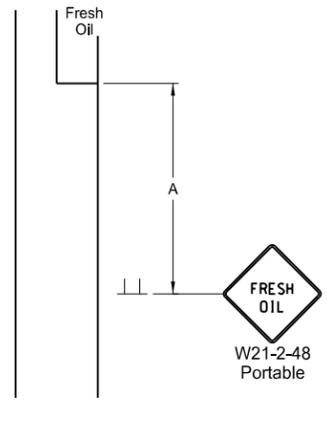


**TYPE KK**  
To be used at major intersections within pilot car control area

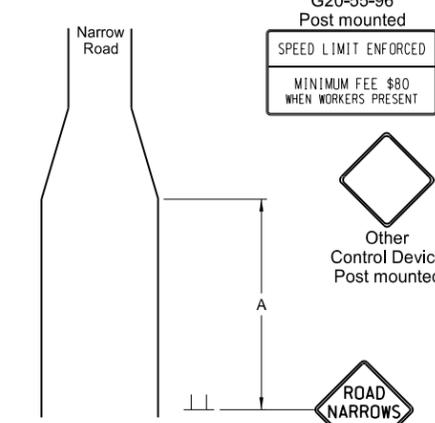
- Notes
- The speed limit shall be re-established. The exact speed limit shall be determined in the field, dependent on location and conditions.
  - The reduced speed limit shall be determined dependent on the in place speed limit before construction. The speed limit reduction should not exceed 10 mph 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 1/2 B.
  - 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.
  - Existing speed limit signs within a reduced speed zone shall be covered.
  - The contractor has the option of using portable sign supports in lieu of post mounted signs in accordance with the NDDOT Standard Specifications.
  - 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.
  - 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.



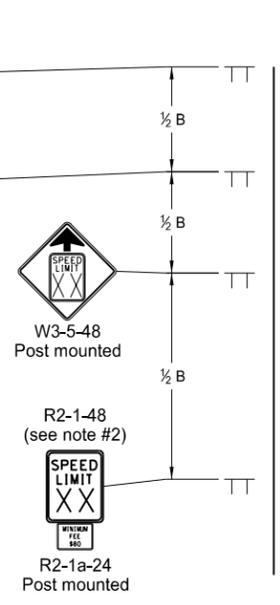
**TYPE BB**  
To be used within a major work area where the sign conditions exist



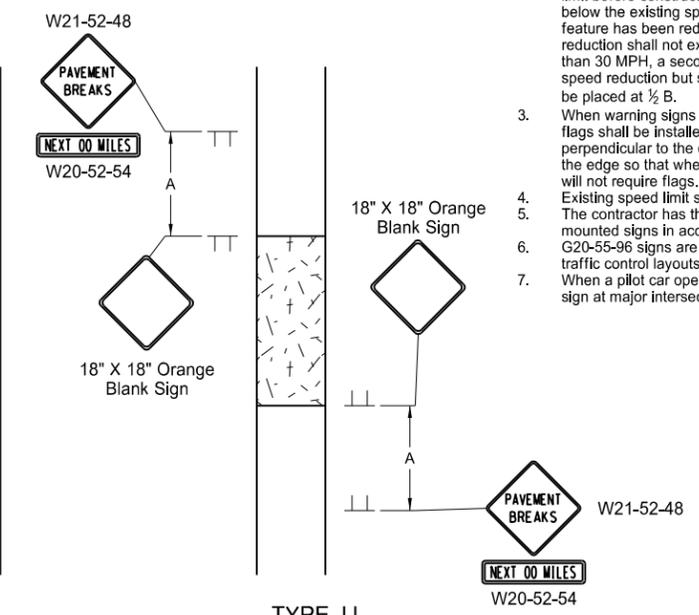
**TYPE CC**  
To be used where the sign conditions exist



**TYPE DD**  
To be used where the sign conditions exist



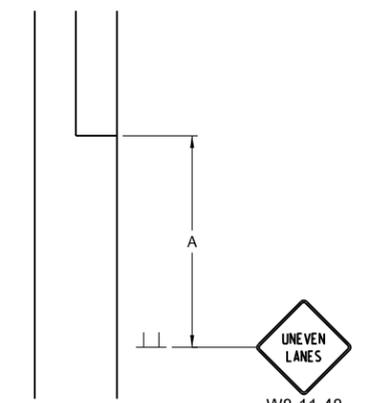
**TYPE Z**  
To be used where speed zone is needed



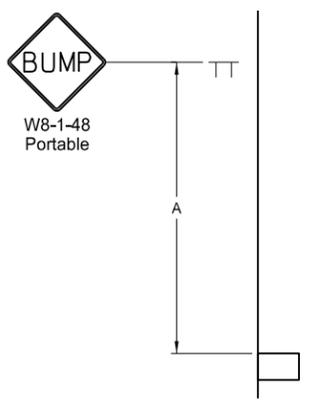
**TYPE JJ**  
To be used where there is a break in the pavement. These signs may be skid mounted or post mounted and shall be installed when conditions exist and removed when not applicable.

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

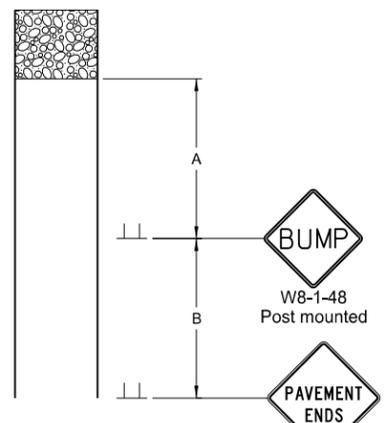
\* Posted speed, off-peak 85th percentile speed prior to work starting, or the anticipated operating speed in mph.



**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 (represented by a vertical line with a horizontal bar)

Cones (represented by a triangle)

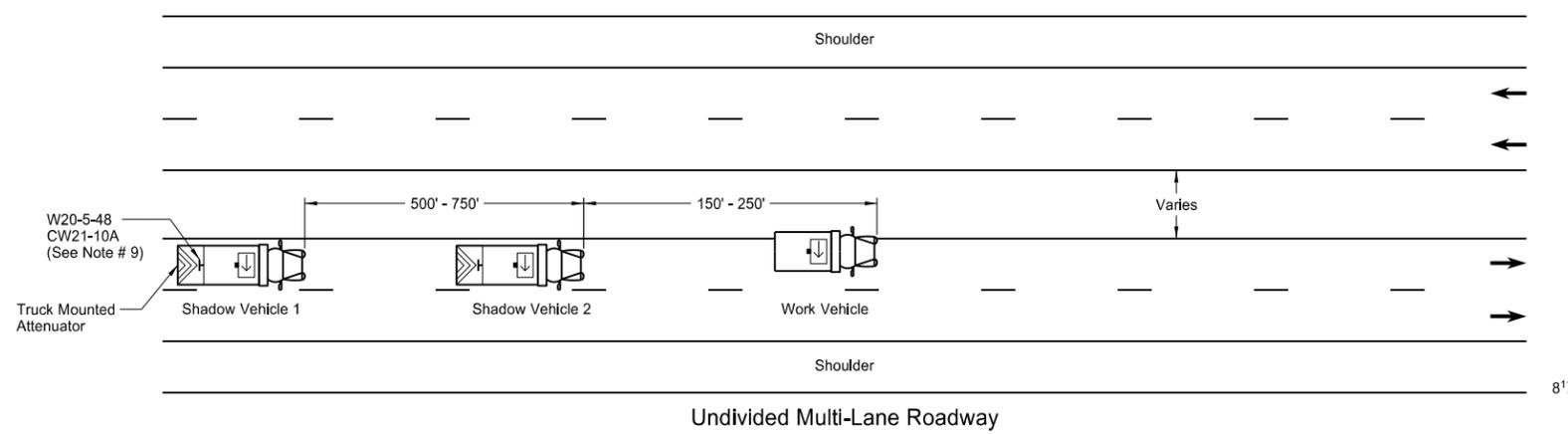
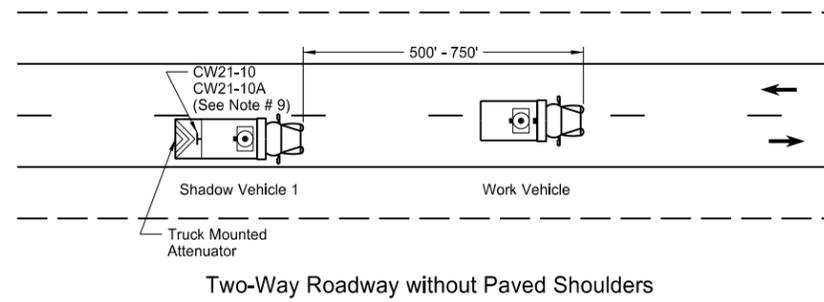
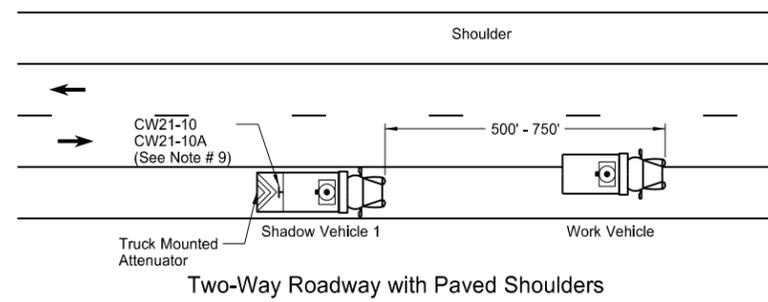
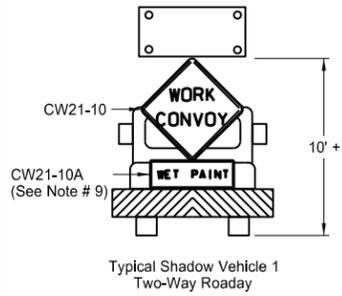
Flagger (represented by a square with a diagonal line)

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE

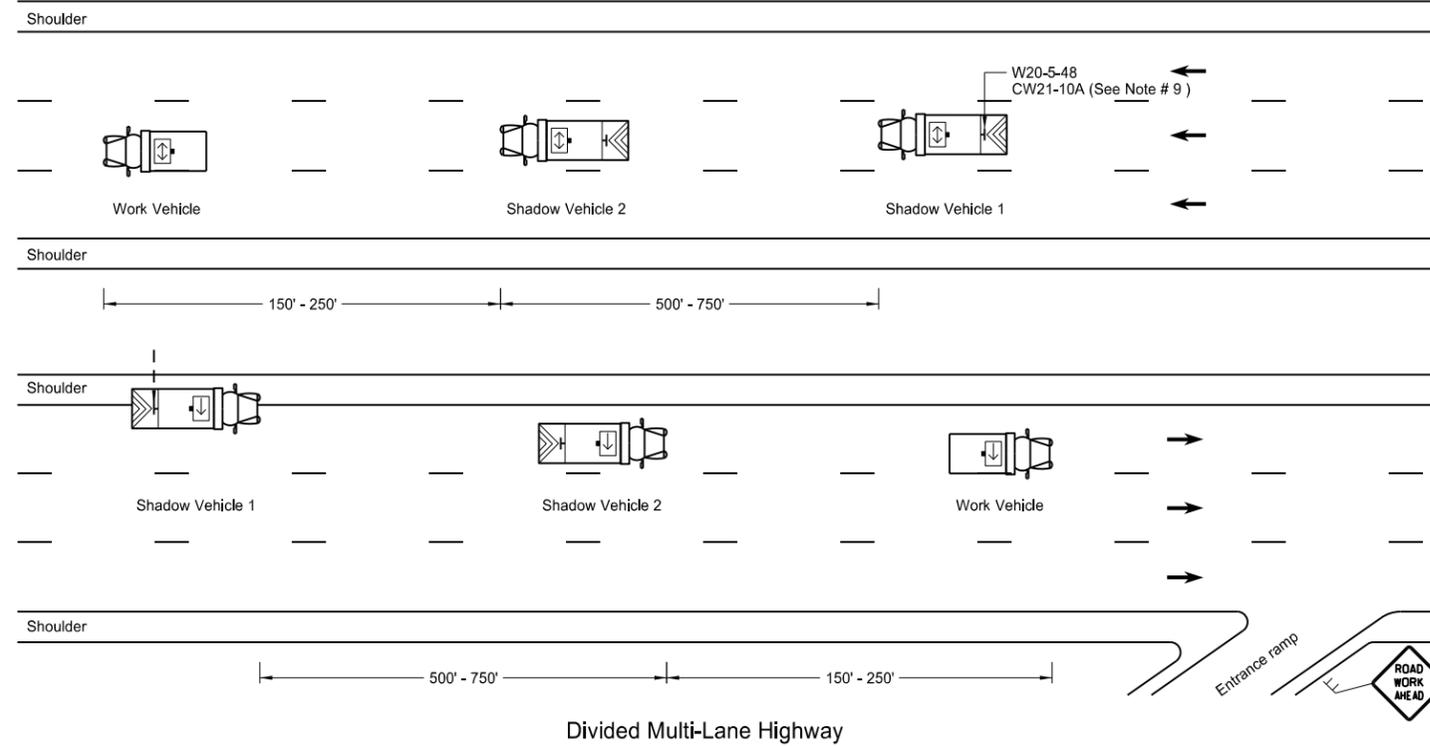
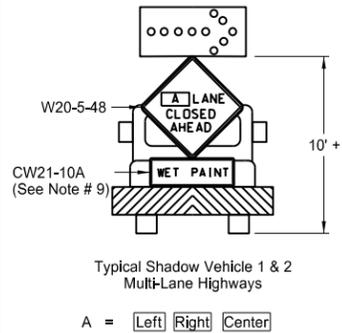
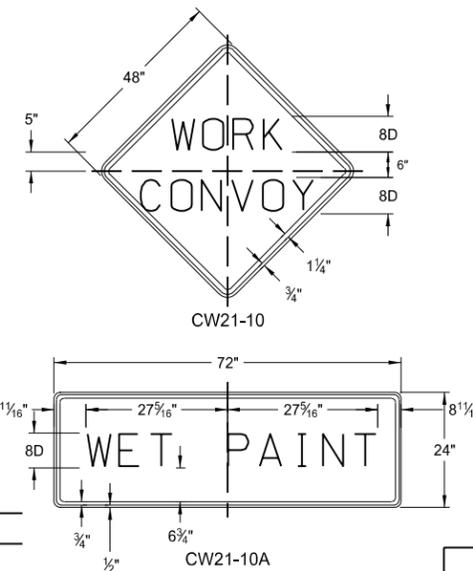
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# TRAFFIC CONTROL PLAN FOR MOVING OPERATIONS

D-704-27



### Sign Details



### Notes

- 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.
- Shadow and work vehicles shall display yellow rotating beacons or strobe lights unless otherwise stated elsewhere in the plans.
- Flashing arrow panels shall be Type B or Type C. The panel operation shall be controlled from inside the vehicle.
- Each vehicle shall have two-way electronic communication capability.
- When work convoys must change lanes, shadow vehicle 1 should change lanes first to shadow other convoy vehicles.
- 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.
- Sign Colors  
Letters = Black  
Border = Black  
Background = Orange
- Shadow vehicle 2 may be used as the paint tender vehicle.
- Sign CW21-10A shall only be used during a painting operation.
- On two lane - two way roadways, the work and shadow vehicles should pull over periodically to allow motor vehicle traffic to pass.

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

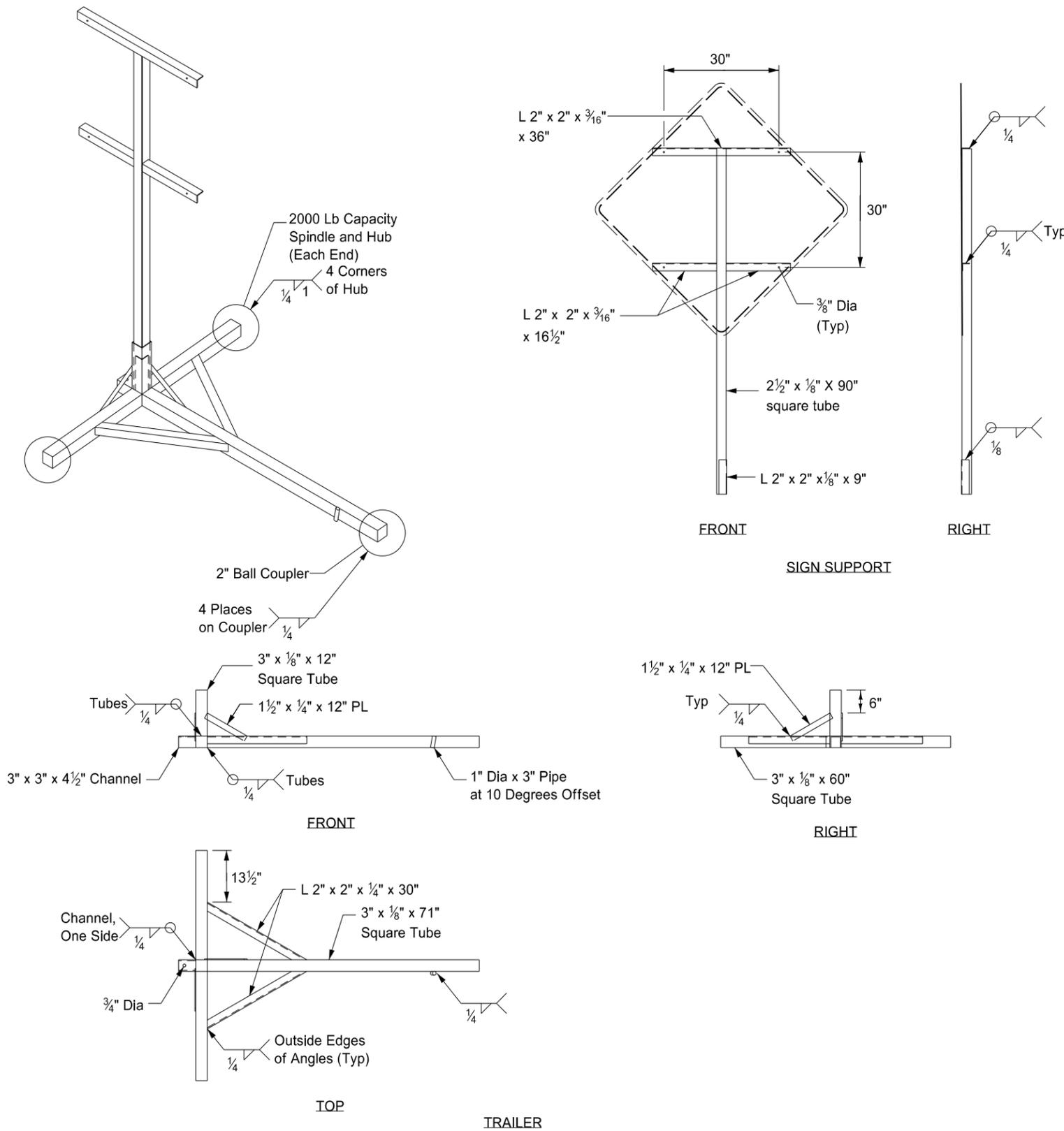
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
9-27-13	
REVISIONS	
DATE	CHANGE
6-18-14	Removed shadow vehicle 2 on two lane roadways

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 of Transportation



PORTABLE SIGN SUPPORT ASSEMBLY

D-704-50



Notes:

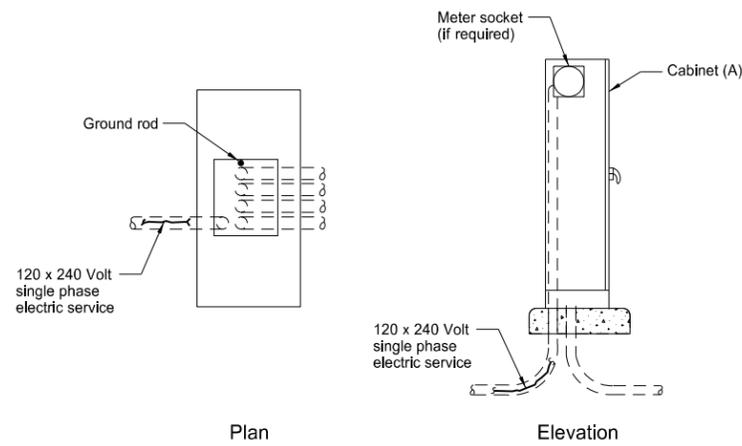
- ① The maximum weight of the assembly is 250 pounds.
- ② Use a 14" wheel and tire.
- ③ Automotive and equipment axle assemblies may not be used for trailer-mounted sign supports.
- ④ Other NCHRP 350 crash tested assemblies are acceptable.

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

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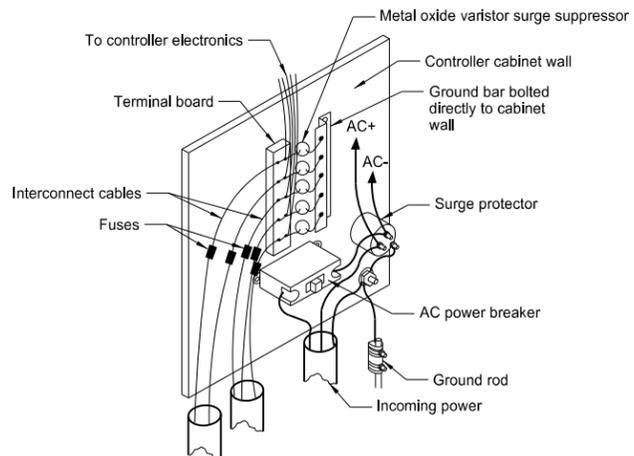
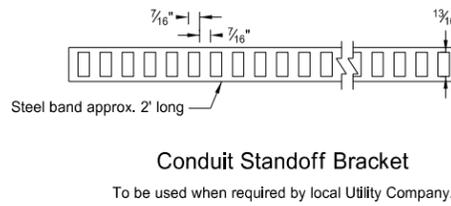
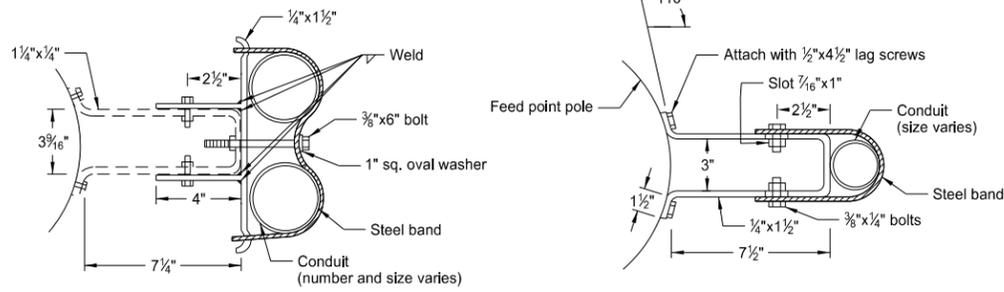
FEED POINT - TRAFFIC SIGNALS

D-772-1

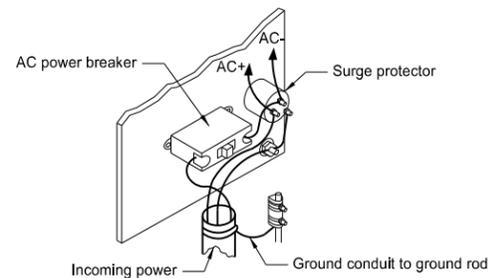


Circuit Breaker Cabinet Pad Mounted

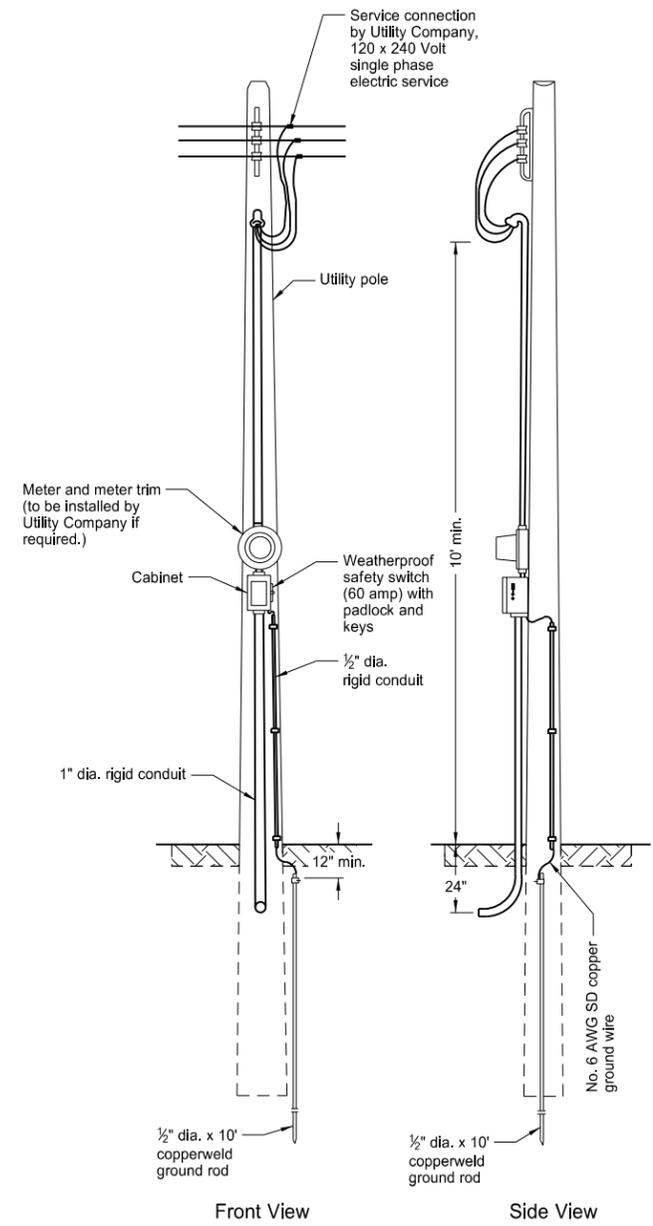
(A) Cabinet shall be 56 in. high x 26 in. wide x 14 in. deep, 12 gauge steel (min.) or aluminum with provisions for padlock. Cabinet shall be weatherproof. A steel cabinet shall have one coat of primer and two coats of exterior dark green enamel.



Controller Cabinet Interconnect and Power Cable Lightning Protection



Feed Point Cabinet Lightning Protection

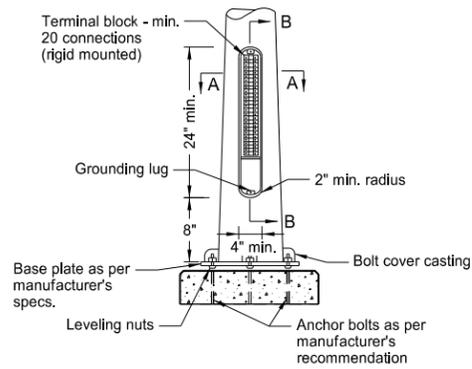
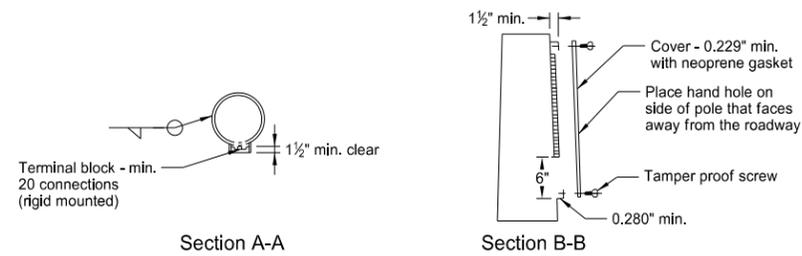


Front View

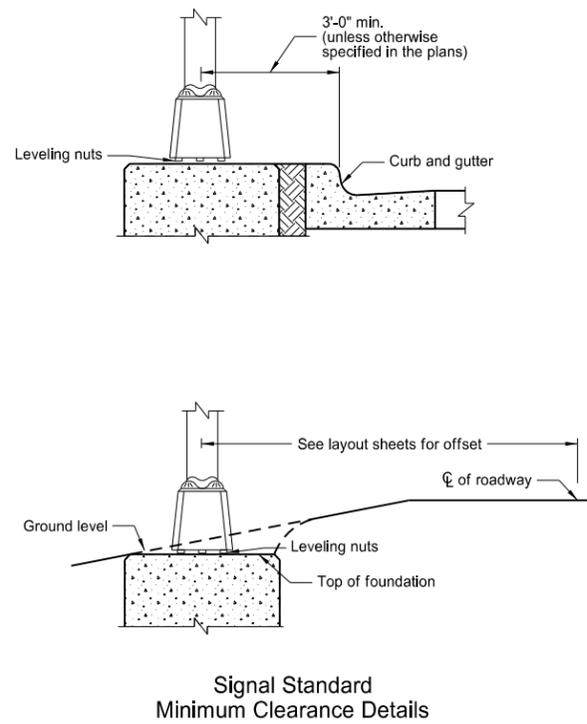
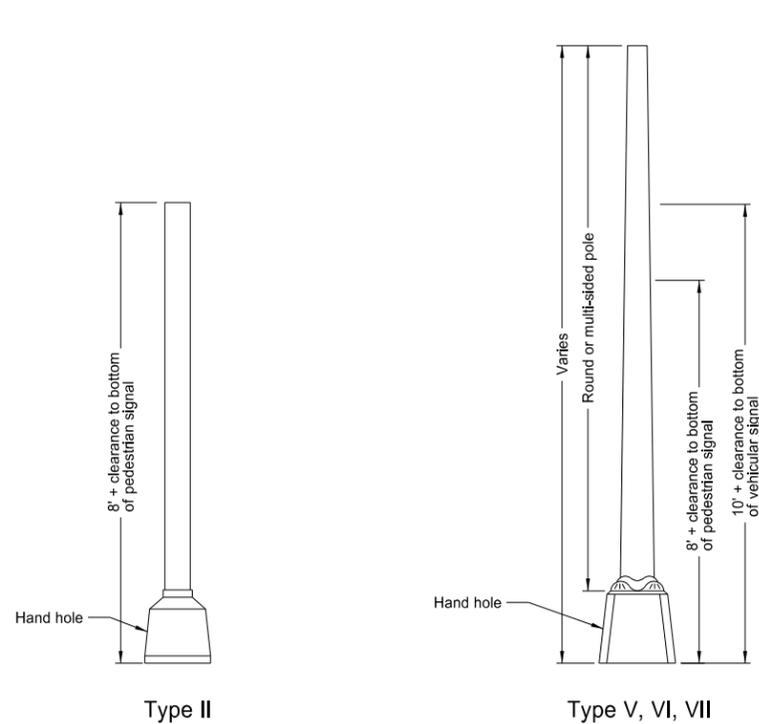
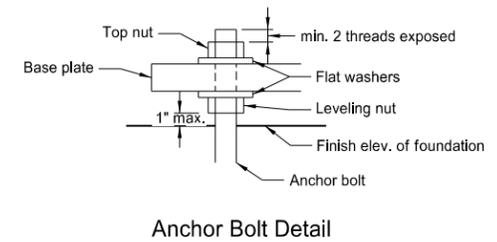
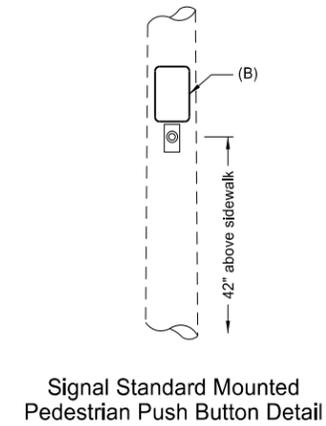
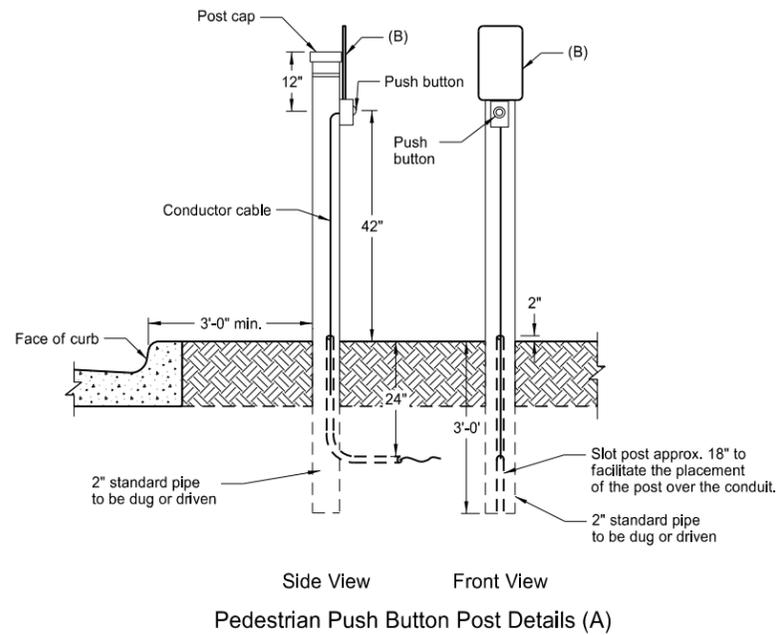
Side View

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11-14-13	
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Alternate Signal Standard Base  
For use only with Type V, VI, and VII signal standards.



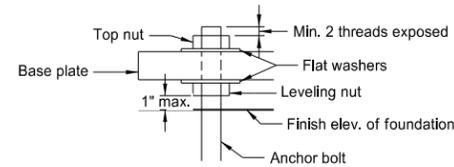
- (A) The positioning of the sign, pushbutton, and direction of arrow shall clearly indicate which crosswalk is actuated by the push button. The type of sign will depend on the jurisdiction they are to be placed in.
- (B) Sign shall be attached to post using rust resistant bracket and banding. The material 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.

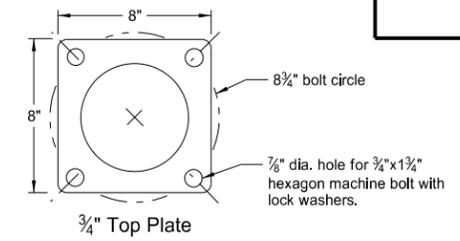
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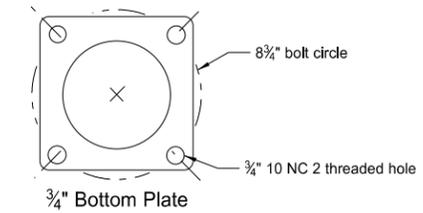
TRAFFIC SIGNAL STANDARDS  
(MAST ARM TYPE)



Anchor Bolt Detail



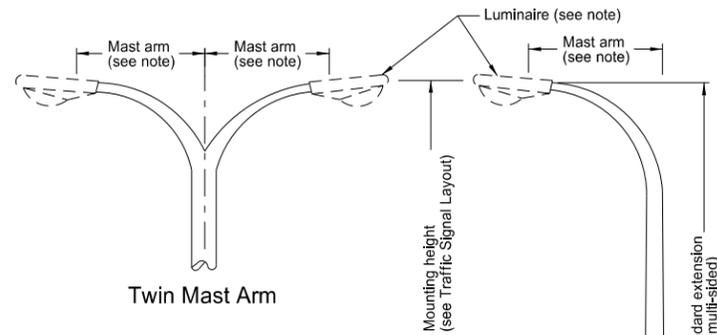
3/4" Top Plate



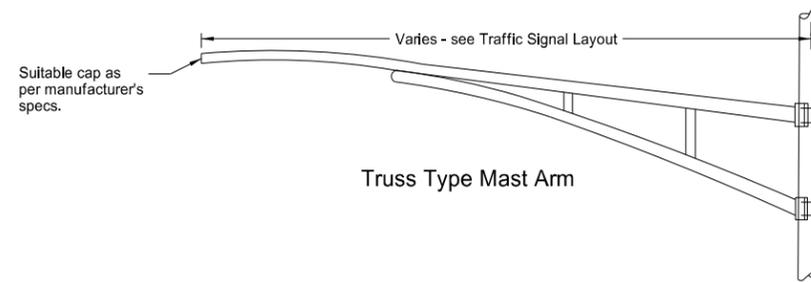
3/4" Bottom Plate

Detail A

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



Twin Mast Arm



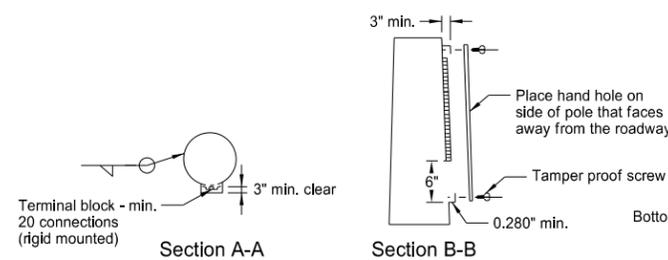
Truss Type Mast Arm

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.

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 centerline 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.

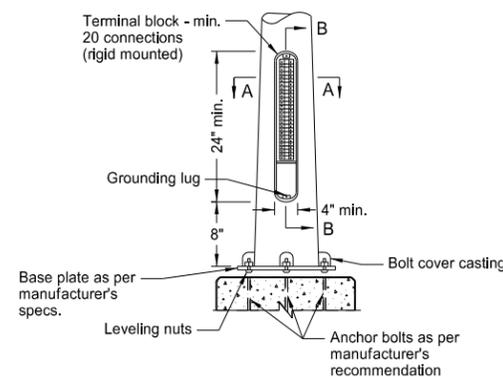


Section A-A

Section B-B

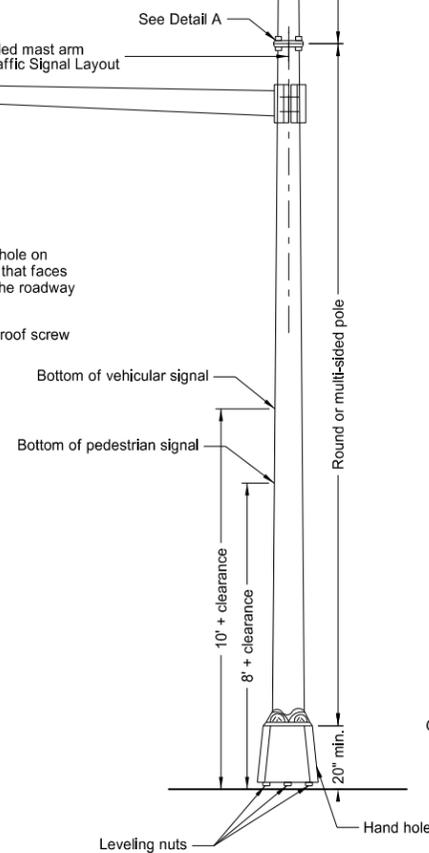
Terminal block - min. 20 connections (rigid mounted) 3" min. clear

3" min. Place hand hole on side of pole that faces away from the roadway Tamper proof screw 0.280" min.

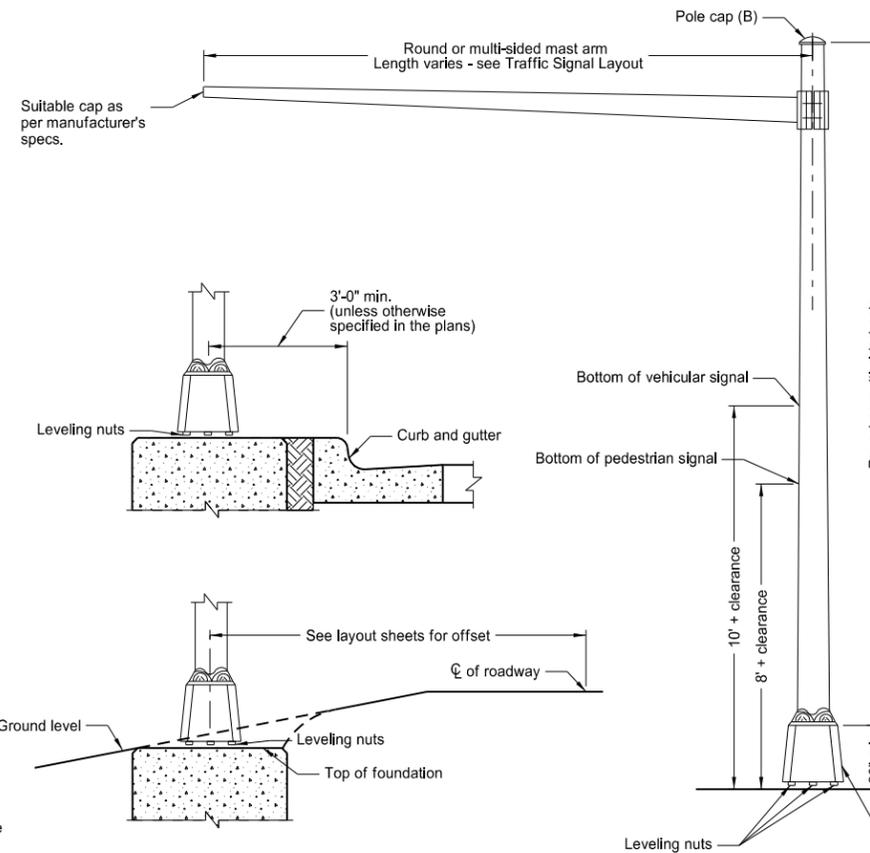


Alternate Signal Standard Base

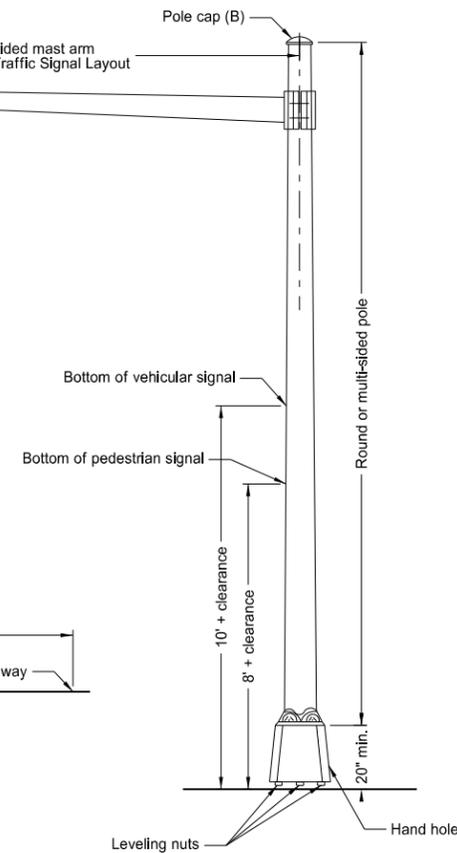
Note: For use only with Type IV and combination signal standards



Combination Signal and Light Standard



Signal Standard Minimum Clearance Detail



Type IV Signal Standard

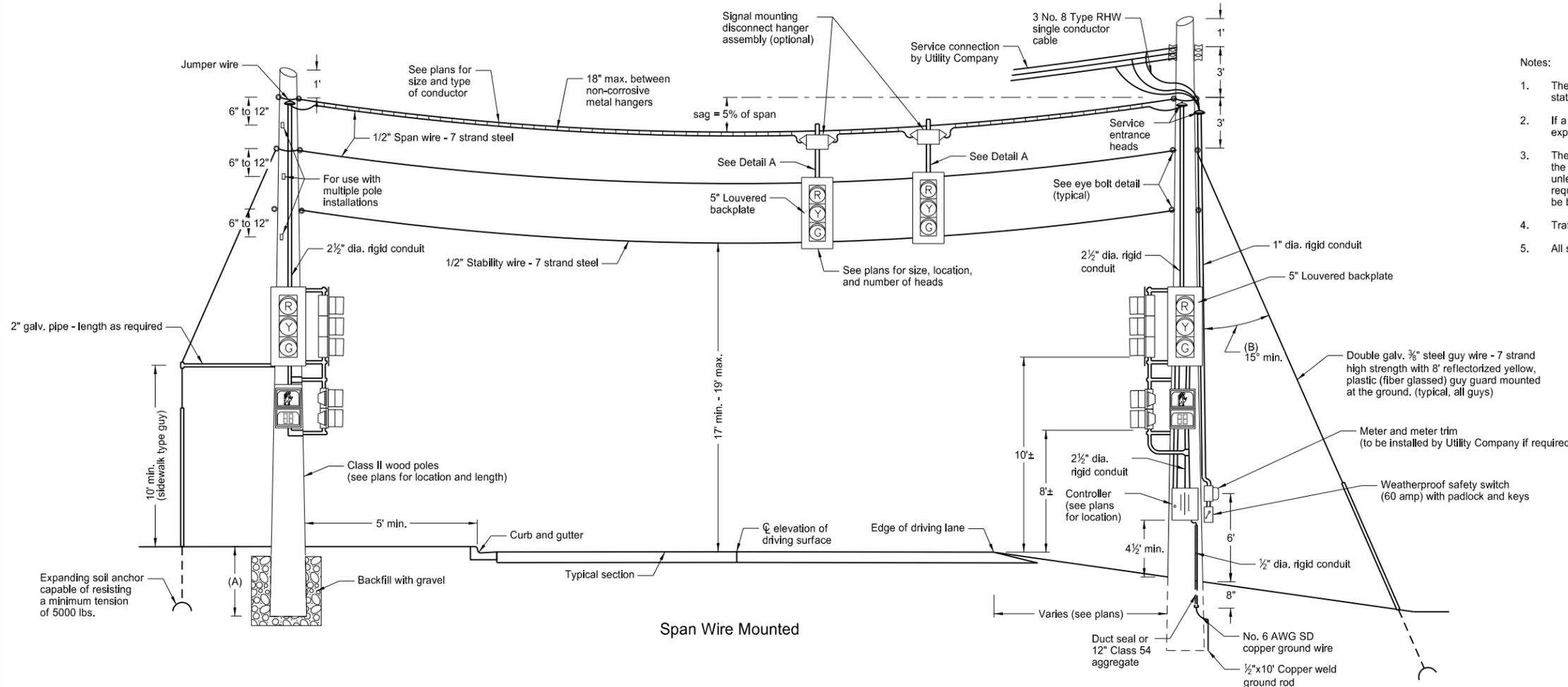
(B) On combination signal and light standards Type B, D, F, and H, and on all Type IV signal standards install a suitable pole cap as per manufacturer's specifications.

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
11-14-13	
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DATE	CHANGE

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# SPAN WIRE MOUNTED TRAFFIC SIGNALS

D-772-6



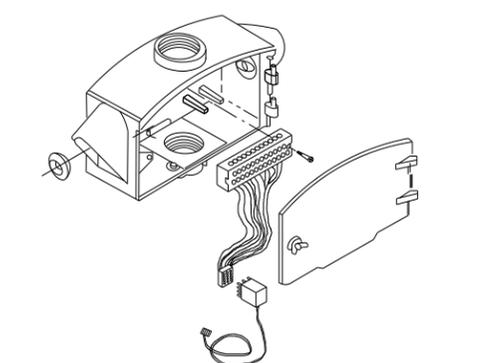
- Notes:
1. The span wire mounted traffic signals shall meet the requirements as stated in the Standard Specifications Section 772 and 896.
  2. If a guy wire angle of less than 45° is used, the capability of the expanding soil anchor to resist tensions on site must be increased.
  3. The contractor shall maintain the required 17 to 19 ft. signal height over the roadway for a minimum period of 90 calendar days after installation, unless written permission is granted the engineer to waive the 90 day requirement. The cost of maintaining the signal head elevation shall not be bid separately but shall be included in the price bid for interim signals.
  4. Traffic signal controller shall be operated on 120 volts.
  5. All span wire and stability wire shall have thimble type connections.

Length of pole (ft)	Depth of pole min. (ft)
35	6
40	6
45	6.5
50	7
55	7.5

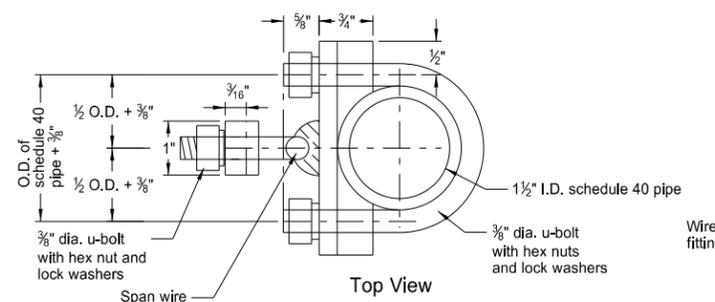
Angle	Anchor Resistance min.
30°	12,000 lbs.
15°	24,500 lbs.

Expanding soil anchor capable of resisting a minimum tension of 5000 lbs.

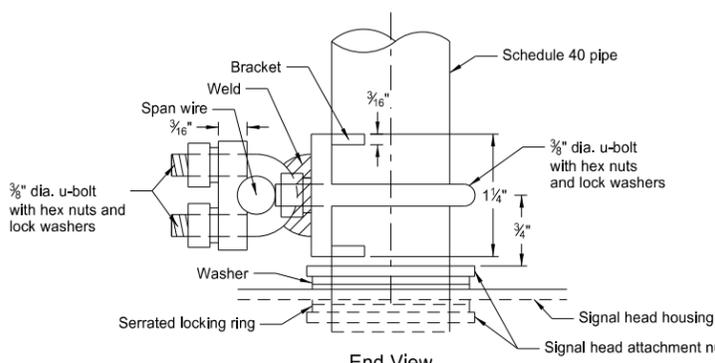
Span Wire Mounted



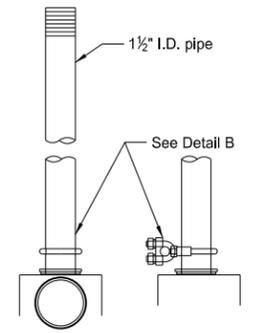
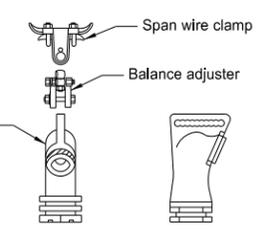
Signal Mounting Disconnect Hanger Assembly



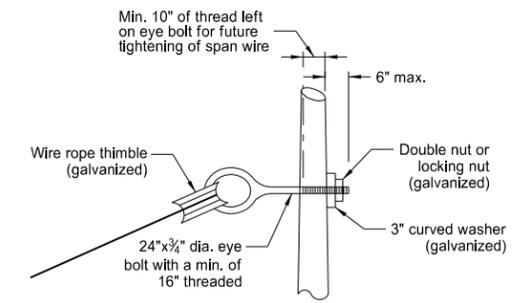
Top View



End View Detail B



Detail A



Eye Bolt Detail

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION	
2-28-14	
REVISIONS	
DATE	CHANGE
7-8-14	Title change, span wire size and sag

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