



SECTION 903

HIGHWAY SIGNING

903.1 Description. This work shall consist of furnishing and installing highway signs as shown on the plans. All signs shall be in accordance with the MUTCD. Any signs not detailed on the plans shall be in accordance with *Standard Highway Signs* by the U.S. Department of Transportation, Federal Highway Administration.

903.2 Material. All material shall be in accordance with Division 1000, Material Details, and specifically as follows:

Item	Section/Specification
Reinforcing Steel for Concrete	1036
Highway Sign Material	1042
Delineators, Mile and Marker Posts	1044
Paints for Structural Steel	1045
Electrical Conduit	1060
Expansive Mortars	1066
Carbon Steel Bolts, Nuts and Washers	1080
Structural Carbon Steel	1080
Structural Low Alloy Steel	1080
Low-Carbon Steel Anchor Bolts	ASTM F1554, Grade 36
High-Strength Anchor Bolts and Nuts	ASTM F1554, Grade 55
High-Strength Bolts, Nuts and Washers	1080
Galvanized Coating of Structural Steel, Tubular Steel Sign Supports, Sign Trusses and Appurtenances	1081

903.2.1 Sign Posts and Tubular Steel Sign Supports.

Item	Section/Specification
Perforated Square Steel Tube Posts	1044
Wood Posts	1050
Steel Pipe Posts	ASTM A53, Grade B, or ASTM A500, Grade B
Galvanizing of Steel Pipe Posts	ASTM A53
Structural Steel Welding Electrodes	AWS A5.1 or AWS A5.5
Structural Steel Posts	AASHTO M270 Grade 50 or 50w
U-Channel Posts	ASTM A499, Grade 60

903.2.2 Overhead Sign Trusses.

Item	Specification
Aluminum Extruded Tube	ASTM B221, 6061-T6

Aluminum Permanent Mold Castings	ASTM B108, A 356.0-T61
Aluminum Sand Castings	ASTM B26, 356.0-T6
Aluminum Plate	ASTM B209, 6061-T6
Aluminum Structural Shapes	ASTM B308, 6061-T6
Aluminum Pipe Handrail	ASTM B241, 6061-T6 or 6063-T6
Aluminum Pipe Fittings for Schedule 10 Pipe	ASTM B26, 356.0-T6 or ASTM B108, A 356.0-T61
Aluminum Grating Bearing Bars Cross Bars	ASTM B211, 6061-T6 or ASTM B221, 6061-T6 or 6063-T6 ASTM B211, 6061-T6 or ASTM B221, 6061-T6 or 6063-T5 or T6
Aluminum Washers	ASTM B209, 2024-T4 or Alclad 2024T4
Aluminum Beveled Washers	ASTM B221, 2024-T4
Filler Wire for Welding Aluminum	AWS A 5.10 ER5356, ER5556
Stainless Steel U-Bolts	ASTM A276 Chromium-Nickel Grade, min. yield 30,000 psi
Stainless Steel Bolts, Nuts, Screws and Washers	ASTM A320 or SAE J405D, Austenitic Steel, min. yield 30,000 psi
Structural Steel Welding Electrodes	AWS A 5.1 or AWS A 5.5

903.2.3 Hardware. Anchor bolts, bolts, nuts and washers specified to be galvanized shall be galvanized in accordance with AASHTO M 232 (ASTM A153), Class C or mechanically galvanized in accordance with ASTM B695, Class 55. Except for anchor bolts, galvanizing thickness shall not exceed 6 mils. For high strength bolts, the contractor shall furnish to the engineer a copy of the manufacturer's inspection test report for each production lot or shipping lot furnished, and shall certify the bolts furnished are in accordance with [Sec 1080](#).

903.2.4 Concrete. Concrete shall be of the class specified in the contract. Material, proportioning, mixing, slump and transporting of concrete shall be in accordance with [Sec 501](#) for the specific class specified. Concrete shall be placed, finished and cured in accordance with [Sec 703](#).

903.2.5 Equipment and Material. Equipment and material shall be of new stock unless the contract provides for relocation of existing units or use of units furnished by others. New equipment and material shall meet the approval of the engineer.

903.3 Construction Requirements.

903.3.1 Footings for Trusses and Posts.

903.3.1.1 Bolt-Down Installations. Bolt-down footings and end supports are those in which anchor bolts are cast into the footing, such as for overhead sign trusses and tubular steel sign supports. Class B concrete shall be used to construct bolt-down footings. ~~all footings and end supports for overhead sign trusses, tubular steel sign supports and posts with bolt-down bases.~~ Footings shall be formed, unless in the judgment of the engineer, soil conditions permit excavation to be made to the neat lines of the footings and the footings cast against the undisturbed vertical soil face. In all cases, the top 12 inches below finished ground line shall be formed. Footings shall be placed on firm, stable, undisturbed soil to the minimum depth shown on the plans. Backfill shall be thoroughly compacted, and care taken to prevent damage to finished concrete. Backfill shall be brought up level with the finished ground line. Anchor bolts shall be firmly held in proper position, supported at the top, during placement of concrete.

903.3.1.2 Embedded Installations. Embedded installations are defined as footings for pipe posts and structural steel posts only. Class B or B-1 concrete, or concrete of a commercial mixture meeting the requirements of Sec 501, or prepackaged dry commercial concrete mixture meeting the requirements of Sec 903.3.1.2.1 shall be used for the footings for embedded-type sign posts, ~~except as otherwise allowed herein.~~ Posts shall be supported in proper position until the concrete or other approved material has set. Excavation and backfill shall be in accordance with Sec 903.3.1.1, except forming will not be required unless soil conditions warrant forming. Tops of footings shall be finished flush with the slope of the ground. Footings shall be visually inspected for acceptance by the engineer.

903.3.1.2.1 ~~In lieu of the concrete material requirements in Sec 903.3.1.2, the contractor may use a p~~Pre-packaged dry commercial concrete mixture used for embedded footings shall have that has a manufacturer's 28-day compressive strength rating of no less than 4,000 psi for the footings for embedded-type sign posts. The concrete shall be thoroughly mixed in accordance with the manufacturer's recommendations. Strength requirements shall meet or exceed Class B concrete as specified in Sec 501.

903.3.1.2.2 ~~In lieu of concrete, the contractor may use a quick-setting polyurethane foam for the footings for embedded-type sign posts. The foam shall have a minimum compressive strength of 80 psi (550 kPa), in the direction of rise, when tested in accordance with ASTM D1621, and shall have a minimum density of 4 pounds per cubic foot (65 kg/m³) when tested in accordance with ASTM D1622. Foam shall not be placed in water. Polyurethane foam shall be mixed in accordance with manufacturer's recommendations. Polyurethane foam will not be permitted if soil conditions are such that forming is necessary.~~

903.3.1.3 Perforated Square Steel Tube Post Anchor Installations. Construction requirements and concrete material requirements for perforated square steel tube (PSST) anchor installations shall be in accordance with Sec 903.3.1.2. In lieu of concrete, polyurethane foam meeting the requirements of Sec 903.3.1.3.1 may be used, except that, concrete shall be used for post anchor installations for Emergency Reference Markers.

903.3.1.3.1 Polyurethane foam shall be a quick-setting hydrophobic, closed cell, high density polyurethane foam with a minimum compressive strength of 80 psi (550 kPa), in the direction of rise, when tested in accordance with ASTM D1621, and shall have a minimum density of 4 pounds per cubic foot (65 kg/m³) when tested in accordance with ASTM D1622. Foam shall not be placed in standing water. Polyurethane foam shall be mixed in accordance with manufacturer's recommendations. Polyurethane foam will not be permitted if soil conditions are such that forming is necessary. Material shall be tested in the presence of the engineer in accordance with Sec 625.10.2.1.4.

903.3.1.3.4 Optional Footings. Substructures for butterfly and cantilever overhead sign trusses and posts may be either drilled shafts or spread footings.

903.3.1.3.4.1 The quantities shown on the plans reflect the total cubic yards of substructure, based upon drilled shaft quantities.

903.3.1.3.4.2 No adjustment in payment will be made for providing the equivalent spread footing design that differs in area from the specified drilled shaft design.

903.3.1.3.4.3 If rock is encountered and the depth of drilled shafts is adjusted accordingly, cubic yard quantities will be recalculated for those locations and payment will be adjusted accordingly. Cubic yard quantities will not be recalculated for spread footings if rock is encountered, unless it is considered differing site conditions in accordance with Sec 104.2 of the standard specifications.

903.3.2 Posts for Ground Mounted Signs.

903.3.2.1 Post Lengths. Post lengths shown on the plans for ground-mounted signs are for bidding purposes only. The contractor shall be responsible for determining post lengths to provide the vertical clearance shown on the plans. Field cutting of posts will be permitted.

903.3.2.2 Post Alignment. Sign posts shall be vertical. Any post bent or otherwise damaged to the extent that the post is considered unfit for use shall be removed and replaced with an acceptable post at the contractor's expense.

903.3.2.2.1 Structural Steel Posts. Structural steel sign posts for ground mounting of signs shall be fabricated and erected as shown on the plans. Welds shall be of full section and sound throughout. Posts with dimensional defects and structural discontinuities will be rejected. Posts built up by welding two lengths together will be permitted, provided the welds are ground smooth and flush with the base metal. Posts and appurtenances shall be hot-dip galvanized after fabrication. Posts with breakaway assemblies shall be cut at the hinge prior to galvanizing, except for field cutting. Hinge plates shall not be attached to the posts at the time of galvanizing. All welds shall be cleaned before galvanizing. All exposed steel areas and damaged galvanizing shall be repaired in accordance with [Sec 1081](#).

903.3.2.2.2 Pipe Posts. Pipe posts shall be fabricated as shown on the plans and shall be hot-dip galvanized after fabrication. Welds shall be of full section and sound throughout. Posts with dimensional defects and structural discontinuities will be rejected. All welds shall be cleaned before galvanizing. Exposed steel areas and damaged galvanizing shall be repaired in accordance with [Sec 1081](#). Friction caps for pipe posts shall be of the dimensions shown on the plans and may be galvanized steel or aluminum alloy.

903.3.2.2.3 Perforated Square Steel Tube Posts. Perforated square steel tube posts ([PSST](#)) shall be installed at locations shown on the plans. Exposed steel areas and damaged galvanizing shall be repaired in accordance with [Sec 1081](#). A six foot 2.25" PSST insert shall be installed inside the 2.5" PSST post, above the breakaway assembly, when required per the plans.

903.3.2.2.4 U-Channel Posts. U-Channel posts shall be installed at locations shown on the plans. Exposed steel areas and damaged galvanizing shall be repaired in accordance with [Sec 1081](#).

903.3.2.2.5 Wood Posts. Wood posts shall be installed at locations shown on the plans.

903.3.2.3 Certification. The contractor shall furnish to the engineer ~~three copies of~~ the fabricator's certification that the material supplied is in accordance with the requirements specified.

903.3.3 Tubular Steel Sign Supports. Tubular sign supports for overhead mounting of signs shall include span, cantilever and butterfly types, complete with poles, beams, mast arms, sign bracket assemblies and other specified appurtenances. All steel shall be hot-dip galvanized after fabrication in accordance with [Sec 1081](#). All welds shall be cleaned before galvanizing. Shop drawings will not be required for these supports.

903.3.3.1 Tapered Steel Poles and Beams. Tapered steel poles and beams shall be a continuous taper tube, fabricated from one length of open hearth sheet steel with one continuous welded longitudinal seam. After fabrication, the material shall have a minimum yield strength of 48,000 psi. Straight steel arms shall be standard or extra heavy pipe, of the dimensions and grades shown on the plans. Bolts, nuts, washers, clamps and sign bracket assemblies shall be hot-dip galvanized or of stainless steel. Clamps shall be fabricated of low alloy steel.

903.3.3.2 Certification. The contractor shall furnish to the engineer ~~three copies of~~ the manufacturer's certification that the tubular steel sign supports are in accordance with the requirements specified.

903.3.3.3 Surfaces. Galvanized material shall be handled to avoid damage to the surfaces. Any material on which the galvanizing has been bruised or broken will be rejected or may, with approval from the engineer, be repaired in accordance with [Sec 1081](#).

903.3.4 Overhead Sign Trusses. Overhead sign trusses shall be steel or aluminum, and shall include all structural steel, structural aluminum, aluminum castings, pipe railing, gratings, supports and appurtenances above the top surface of the concrete footings. Shop drawings in accordance with [Sec 1080](#) shall be furnished to the engineer for approval.

903.3.4.1 Testing and Certification. The contractor shall furnish to the engineer a copy of certified mill test reports on all material furnished, providing the actual chemical analysis and the actual results of physical tests. In lieu of mill test reports for secondary members, the contractor may furnish a certification from the fabricator certifying the material supplied is in accordance with the requirements of these specifications. All test reports and certifications shall be furnished to the engineer before any requests for shop inspection are made.

903.3.4.2 Steel Fabrication and Erection. Structural steel fabrication and erection shall be in accordance with [Secs 712](#) and [1080](#), except as hereinafter specified.

903.3.4.3 Welder Qualifications. Before starting fabrication of structural aluminum, all welders shall be qualified in accordance with the latest edition of ANSI/AWS D1.2 – Structural Welding Code, Aluminum. The test specimens shall be made using a base metal of aluminum alloy 6061-T6 using filler metal acceptable for welding this alloy and inert gas shield arc. Requalification may be required any time there is specific reason to question the welder's ability.

903.3.4.4 Welding Inspection. All aluminum welds shall be inspected by the fabricator to verify the reliability of production as follows:

- (a) Visual inspection of all welds, proof testing of welds, and sufficient destructive testing of weld samples fabricated during the production welding.
- (b) Poor welding workmanship noted by visual inspection will be sufficient cause for rejection.

903.3.4.5 Contact Surfaces. Contact surfaces of aluminum flange castings shall be finished to provide at least 50 percent contact after assembly, as indicated by the Standard Machinist's Blue Test.

903.3.4.6 Fabrication of Aluminum Alloy. Fabrication of aluminum alloy material shall be in accordance with the manufacturer's recommendations and the following requirements. Flame cutting will not be permitted. All holes in castings shall be machined for final fit. Welding shall be done by the inert gas shielded arc method, and flux shall not be used. Precautions shall be taken to avoid scoring or marring of aluminum surfaces. The engineer will reject any scoring or marring that gives an objectionable appearance. Cast parts shall have all casting irregularities removed. Tubing shall be seamless, and exterior and interior surfaces shall be clean, smooth and free from slivers, laminations, grooves, cracks or other defects.

903.3.4.7 Shop Inspection. Shop inspection will be in accordance with [Sec 1080](#).

903.3.4.8 Wind Testing. Simulated wind-shop test loading for aluminum trusses will be required as shown on the plans. The load in kips and location of the point of application shall be indicated on the shop drawings.

903.3.4.9 Handling and Storage. Handling and storage of material shall be in accordance with [Sec 712](#). If specified, galvanized high strength bolts and washers shall be in accordance with [Sec 903.2.2](#). Bolts shall be snugly tightened. Connections in which steel and aluminum are in contact shall be protected as shown on the plans.

903.3.4.10 Surfaces. Galvanized and aluminum material shall be handled to avoid damage to the surfaces. Any material on which the galvanizing has been bruised or broken will be rejected or may, with approval from the engineer, be repaired in accordance with [Sec 1081](#).

903.3.5 Sign Storage, Certification and Erection.

903.3.5.1 Storage of Signs. Signs delivered for use on a project shall be stored in a manner meeting the approval of the engineer. Any sign damaged, discolored or defaced during transportation, storage or erection may be rejected.

903.3.5.2 Fabricator's Certification. The contractor shall furnish to the engineer, prior to sign erection, the fabricator's certification stating, "I hereby certify that only material and manufacturing processes in full compliance with the Missouri Department of Transportation job specification requirements were used in the fabrication of signs for Job _____, Route _____, County _____."

903.3.5.3 Erection of Signs. Sign posts shall be set vertically true to line such that the signs will be level, at the proper angle with the roadway, and with the minimum clearances shown on the plans. Mounted signs shall present a smooth flat surface varying no more than 3/8 inch from a 4-foot straightedge placed in any position on the face of the sign after erection. Signs on traffic signal posts shall be mounted with strap or clamp type sign supports as shown on the plans or as approved by the engineer. Signs shall not be mounted on light poles.

903.3.6 Delineators. Delineators shall be installed vertically and any delineator considered unfit for use by the engineer shall be removed and replaced at the contractor's expense.

903.4 Final Cleanup. Final cleanup of right of way shall be in accordance with [Sec 104.11](#).

903.5 Method of Measurement. Final measurement will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity. Where required, measurements will be made in the following manner.

Measurement of concrete for ~~bolt-down~~ footings and ~~embedded footings will be made separately to the nearest 0.01 cubic yard for each footing and to the nearest 0.1 cubic yard for the total, as shown on the plans. end supports for overhead sign trusses, tubular steel sign supports and posts bolt down bases, including all concrete, excavation, backfilling, reinforcing steel, anchor bolts and nuts, grout and other incidental items shown on the plans, will be made to the nearest 0.1 cubic yard. Concrete for footings for embedded type posts. No measurement will be made for concrete or polyurethane foam used in footings for perforated square steel tube posts (PSST), including perforated square steel tube, u channel and wood shall be incidental.~~

903.5.1 Measurement of the weight of structural steel and pipe posts will be made to the nearest pound for each post and to the nearest 10 pounds for the total, as shown on the plans. Weights will be computed using the theoretical weight of the various sections.

903.5.2 Measurement of sign areas will be made to the nearest 1/10 square foot for each sign and to the nearest square foot for the total. The area of each sign will be that of the smallest rectangular, triangular or trapezoidal shape that will encompass the sign panel.

903.5.3 Measurement of perforated square steel tube, u-channel and wood posts will be made to the nearest linear foot for each post, as shown on the plans.

903.5.4 Measurement of post anchors for PSST will be made per each for each post anchor type. Measurement of breakaway assemblies for PSST will be made per each complete assembly.

903.5.5 Measurement of delineators will be made per each.

903.6 Basis of Payment.

903.6.1 Breakaway assemblies for pipe posts and structural steel posts, including the base connection, hinge plate, fuse plate, structural bolts and all other fabrication, complete in place, are incidental, regardless of the post size or shape. Breakaway assemblies for perforated square steel tube posts, complete in place, will be paid for at the contract unit price each, regardless of the post size.

903.6.2 Highway signing will be paid for at the contract unit price for each of the items included in the contract. No direct payment will be made for incidental items necessary to complete the work, unless specifically provided as a pay item in the contract.

903.6.3 Delineator posts will be paid for at the contract unit price. No direct payment will be made for reflective sheeting or post anchors.

903.6.4 Perforated square steel tube (PSST), u-channel and wood posts will be paid for at the contract unit price for each of the items included in the contract. PSST post anchor installations will be paid for separately for each anchor type. All costs for PSST footing installations shall be considered included in the cost of the post anchor.

903.6.5 Concrete footings for bolt-down and embedded installations will be paid for separately at the contract unit price. Excavation, backfilling, reinforcing steel, anchor bolts and nuts, grout and other items shown on the plans will be considered included in payment for concrete footings. No payment will be made for concrete or polyurethane foam used for the installation of PSST footings.

903.6.6 Structural steel and pipe posts will be paid for at the contract unit price for each of the items included in the contract.



SECTION 1044

POSTS FOR MARKERS AND DELINEATORS

1044.1 Scope. This specification covers galvanized steel and flexible posts used for mounting mile and object markers, delineators, drain and right of way markers ~~signs~~ and other similar purposes.

1044.2 Steel Posts. Posts shall be rerolled rail steel, in accordance with the mechanical requirements of ASTM A 499, Grade 60, and to the chemical requirements of ASTM A 1.

1044.2.1 Shape and Dimensions. Posts shall be of a channel or modified channel section. Posts for mile markers, object markers and delineators shall be of the dimensions and weights (masses) shown on the plans.

1044.2.2 Drainage and Right of Way Markers. Posts for drainage and right of way markers shall weigh no less than 1.80 or more than 2.25 pounds per foot, all tolerances included, and shall be of the lengths shown on the plans. Permissible variations in length will be a maximum of one inch under and 2 inches over that shown on the plans. Posts shall have no less than five drilled or punched 3/8-inch holes along the centerline of the web. Holes shall be on 2-inch centers, beginning one inch from the top of posts. Anchors or pointed ends on posts will not be required.

1044.2.3 Fiberglass Composite Right of Way Markers. Fiberglass reinforced polymer composite posts for right of way markers shall be 3 and 3/4 inches wide of a multi rib design weighing no less than 0.35 pounds per foot and shall be of the color and length as shown on the plans. The markers shall have a right of way decal meeting the description as shown on the plans. The markers shall be pointed on one end for installation into the ground to the depth as shown on the plans.

1044.2.4 Galvanizing. Posts shall be galvanized after fabrication in accordance with AASHTO M 111.

1044.3 Channel Post Delineator. Channel post for delineators shall be manufactured from ductile ASTM A 36 or ASTM A 1011 Gr 60 and as shown on the plans. Posts shall be hot dipped galvanized after manufacture in accordance with [Sec 1080](#). Damaged coating shall be repaired in accordance with [Sec 1081](#). The contractor shall furnish to the engineer three copies of the fabricator's certification that the material supplied is in accordance with the requirements specified.

1044.4 ~~Square Steel Perforated~~Perforated Square Steel Tube Posts.

1044.4.1 Material.

1044.4.1.1 Steel. Steel shall be in accordance with ASTM A 1011, Grade 50, for hot rolled carbon sheet steel, structural quality. The average minimum yield strength after cold-forming shall be a minimum of 50,000 psi.

1044.4.1.2 Coating. Posts shall be galvanized in accordance with ASTM A 653, G90. The corner weld shall be zinc coated after the scarfing operation. The steel shall also be coated with a chromate conversion coating and a clear organic polymer topcoat. Both the interior and the exterior of the post shall be galvanized.

1044.4.2 Dimensions.

1044.4.2.1 Dimensional Tolerances. All dimensional tolerances shall be in accordance with ASTM A 513, excepted as noted.

1044.4.2.2 Length. The length of each post shall be as shown on the plans.

1044.4.2.3 Weight Per Foot. The weight per foot shall be in accordance with the following or as specified:

Square Steel Perforated Perforated Square Steel Tube Post			
Requirements			
Size	Thickness	Weight	Tolerance
2 in. x 2 in.	12 Gauge	2.42 lbs/foot	± 0.12 lbs/ft

1044.4.3 Cross Section. The cross section of the post shall be square tube formed of 12 gage steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii.

1044.4.4 Hole Punching. All holes shall be $7/16 \pm 1/64$ inch in diameter on one-inch centers on all four sides down the entire length of the post. The holes shall be on the centerline of each side in true alignment and opposite each other directly and diagonally.

1044.4.5 Telescoping Properties. Finished posts for telescoping post systems shall be in accordance with the general dimensional requirements and shall permit consecutive square tubes to telescope freely, for no less than 10 feet without the necessity of matching any particular face to any other face. The finished posts shall be straight, and shall have a smooth, uniform finish. All holes and ends shall be free from burrs, and ends shall be cut square.

~~1044.4.6 Bases. If bases are specified on the plans, one of the following FHWA accepted "Breakaway Anchor" systems shall be used:~~

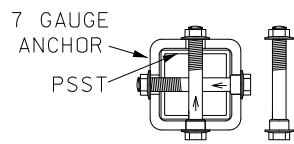
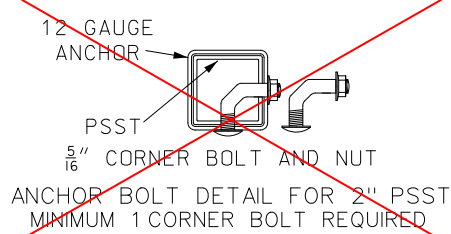
~~a) Single. The anchor shall be one size larger than the signpost and driven using an appropriate sized drive cap. All anchors shall be driven into the ground leaving one to two holes exposed for signpost connection.~~

~~b) Two Piece. An additional 18 inch outer sleeve, one size larger than the anchor, shall be used to double the anchor wall thickness at the critical bending area.~~

1044.4.76 Connecting Bolts and Nuts. Bolts used to connect posts to bases shall be 5/16 inch, 18NC threads, bent-truss head bolts in accordance with ASTM A 307, Grade A. The bolts shall be mechanically zinc galvanized in accordance with ASTM B 695, Class 25. The nuts shall be 5/16 inch, 18NC threads, serrated flange nuts in accordance with ASTM A 194 and zinc electroplated in accordance with ASTM B 633.

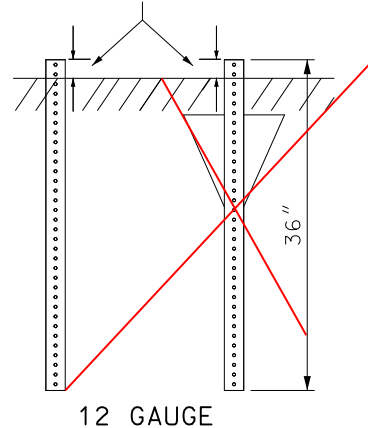
1044.4.87 Certification. The fabricator shall furnish to the engineer, a certification stating that the posts furnished comply with all requirements of this specification. The certification shall include or have attached specific results of tests of the mechanical and chemical properties. The certification shall accompany each shipment of the material to the destination.

1044.5 Acceptance. Acceptance of posts furnished under this specification will be based on [Sec 1040.2](#) and on the results of any tests deemed necessary by the engineer at destination to ascertain compliance with these specifications. If requested, two posts shall be furnished for testing purposes from such lots as the engineer may determine.



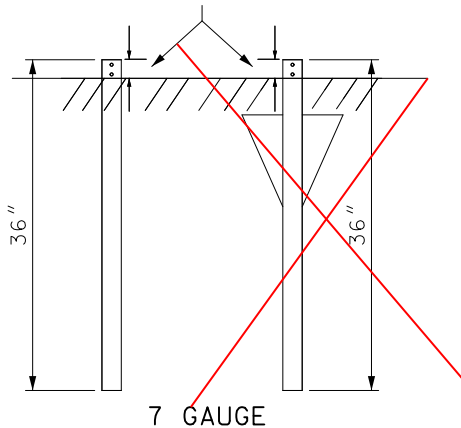
ANCHOR BOLT DETAIL

THE ANCHOR SHOULD BE A MAXIMUM OF 2.5" ABOVE THE GROUND LEVEL



ANCHOR INSTALLATION DETAIL

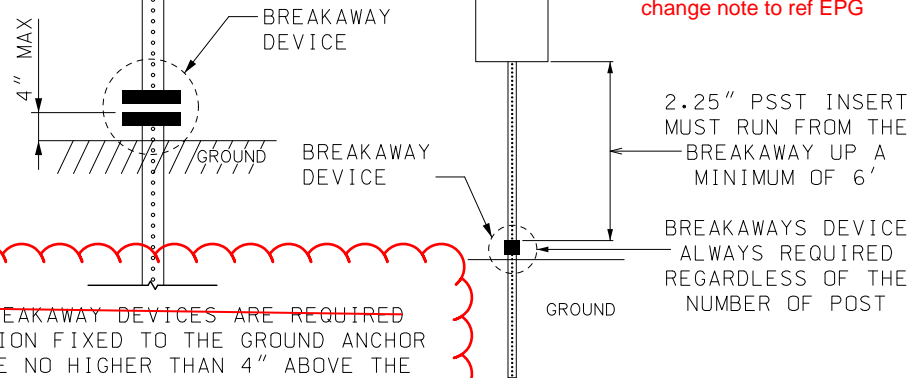
THE ANCHOR SHOULD BE A MAXIMUM OF 2.5" ABOVE THE GROUND LEVEL



ANCHOR INSTALLATION DETAIL

2.5" + 2.25" POST COMPRISED OF A 2 1/2" PSST POST WITH A 2.25" PIECE OF PSST INSERTED INSIDE TO INCREASE POST CAPACITY, USE AS INDICATED BY POST SELECTION CHARTS

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WHEN BREAKAWAY DEVICES ARE REQUIRED THE PORTION FIXED TO THE GROUND ANCHOR SHALL BE NO HIGHER THAN 4" ABOVE THE FINISHED GRADE.

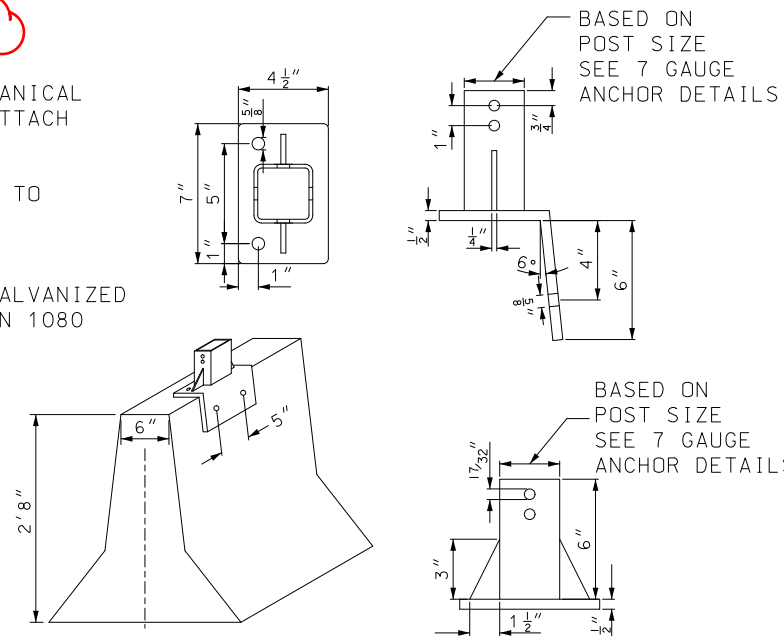
**BREAKAWAY DETAILS
2.5" + 2.25" POST DETAIL**

ANCHOR TUBE SHALL BE 7 GAUGE

1/2" X 4 1/2" GALVANIZED MECHANICAL FASTENERS SHALL BE USED TO ATTACH ANCHOR TO BARRIER WALL

SHOULDER BOLTS SHALL BE USED TO ATTACH PSST POST TO ANCHOR (SEE STANDARD PLAN 903.03)

ANCHOR SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION PER SECTION 1080



BARRIER WALL MOUNTING DETAIL

POST		ANCHOR		BREAKAWAY NEEDED		
		NORMAL OR OMNI-DIRECTIONAL		NUMBER OF POSTS		
GUAGE	SIZE	GUAGE	Actual SIZE	1	2	3
12	2" x 2"	12	2.25" X 2.25" X 36" OD	NO	NO	YES
		7 *	2.5" X 2.5" X 36" OD	NO	NO	YES
12	2.5" x 2.5"	7 *	3" X 3" X 36" OD	NO	YES	YES
12	(2.5" x 2.5") + (2.25" x 2.25")	7 *	3" X 3" X 36" OD	YES	YES	YES

* TO BE USED WITH CONCRETE FOOTINGS OR IS AN OPTION IN ROCK SOIL CONDITIONS

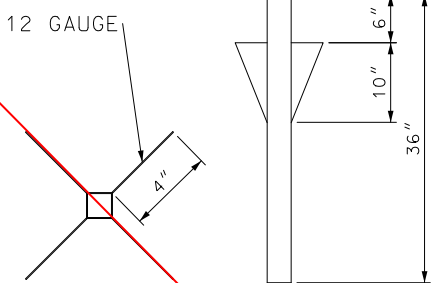
NOTES:

FOR GENERAL NOTES, SEE SHEET 1 OF 16.

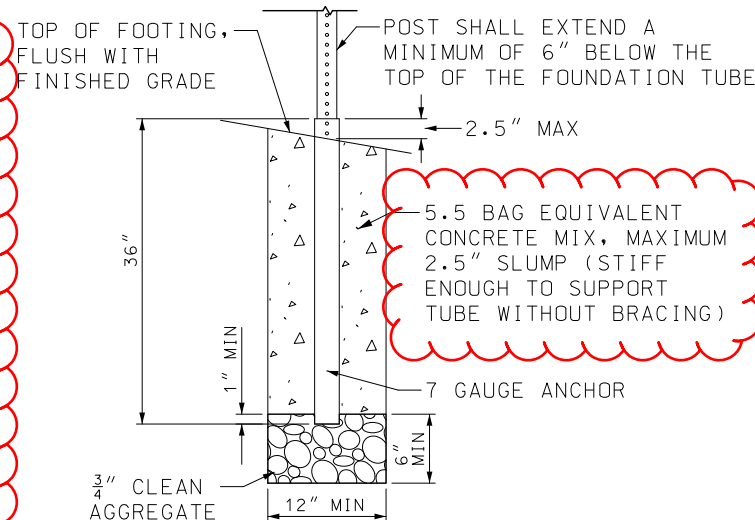
FOR MOUNTING HEIGHT AND OFFSET DETAILS, SEE SHEET 10 OF 16.

ALL BREAKAWAY DEVICES USED ON AN INSTALLATION SHALL BE CERTIFIED NCHRP 350 COMPLIANT.

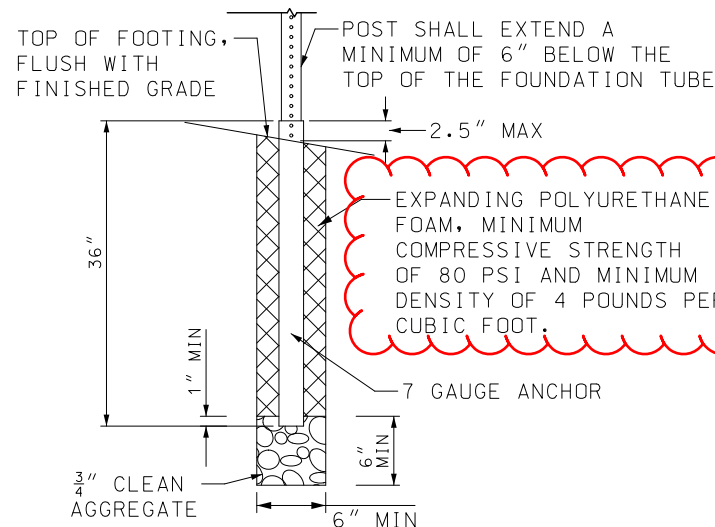
~~48" FOOTINGS MAY BE USED WITH 12 GAUGE OR 7 GAUGE ANCHORS.~~



4-PIN OMNI-DIRECTIONAL ANCHOR DETAIL FOR BOTH 12 AND 7 GAUGE



CONCRETE FOOTING DETAIL



EXPANDING FOAM FOOTING DETAIL

MoDOT MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION
105 WEST CAPITOL JEFFERSON CITY, MO 65102
1-888-ASK-MODOT (1-888-275-6636)

STATE OF MISSOURI
NICOLE A. KOLB HOOD
NUMBER PE-2001018754
PROFESSIONAL ENGINEER
THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.

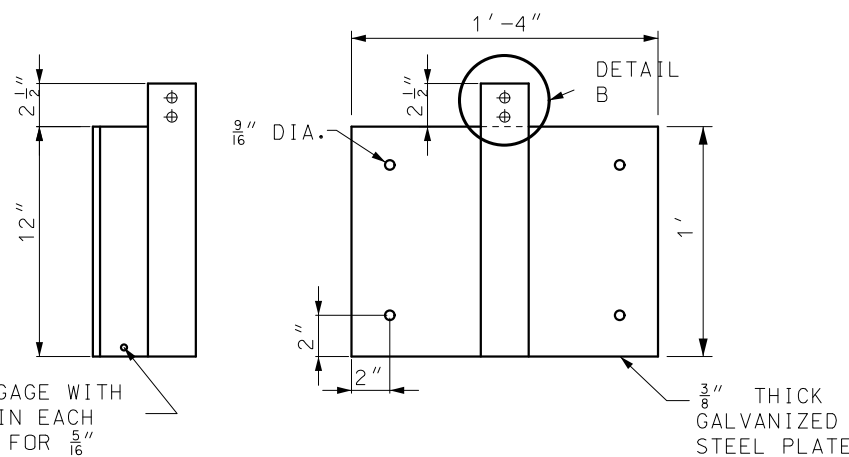
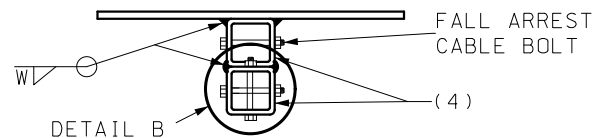
POST INSTALLATION DETAILS
PERFORATED SQUARE STEEL TUBE (PSST)

DATE EFFECTIVE: 01/01/2021
DATE PREPARED: 10/14/2020

903.03BN

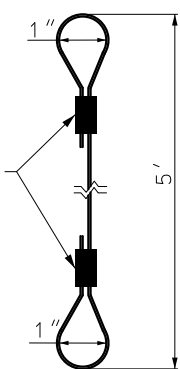
SHEET NO. 7 OF 16

IF A SEAL IS PRESENT ON THIS SHEET IT HAS BEEN ELECTRONICALLY SEALED AND DATED.

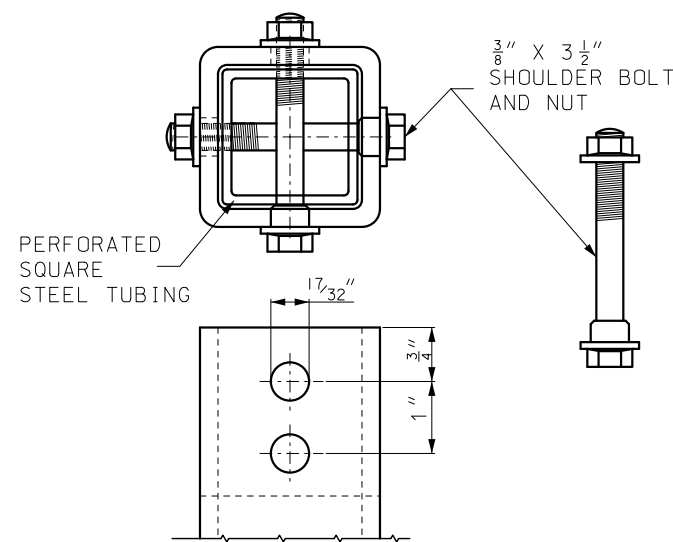


2 1/2" X 2 1/2" 7 GAGE WITH 5/16" DIA HOLE IN EACH SIDE OF TUBE FOR 5/16" THROUGH BOLT TO RETAIN FALL ARREST CABLE

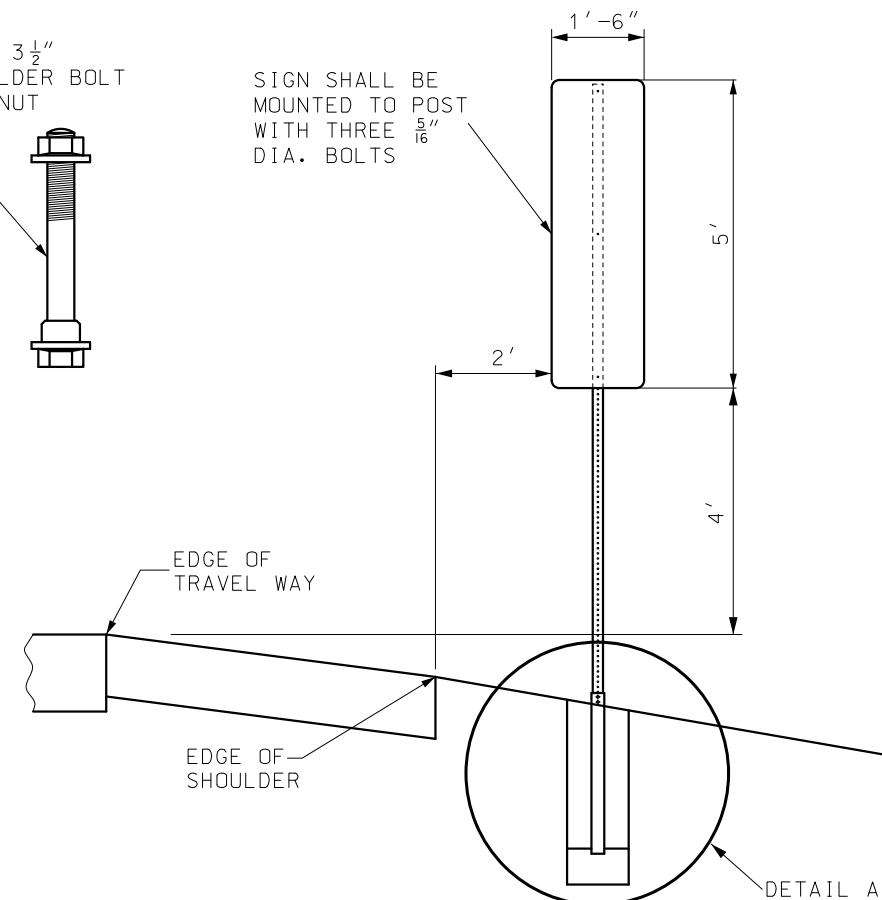
MOUNTING PLATE DETAIL



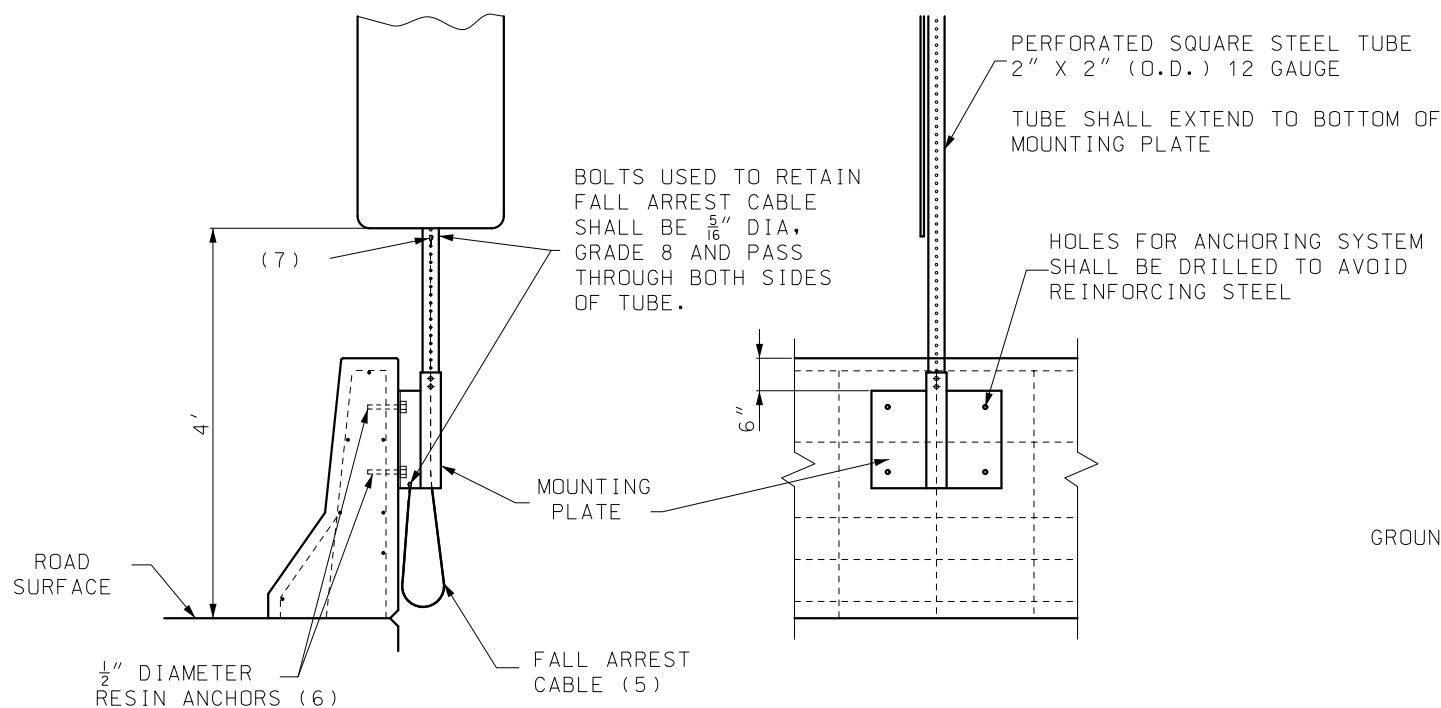
FALL ARREST CABLE DETAIL



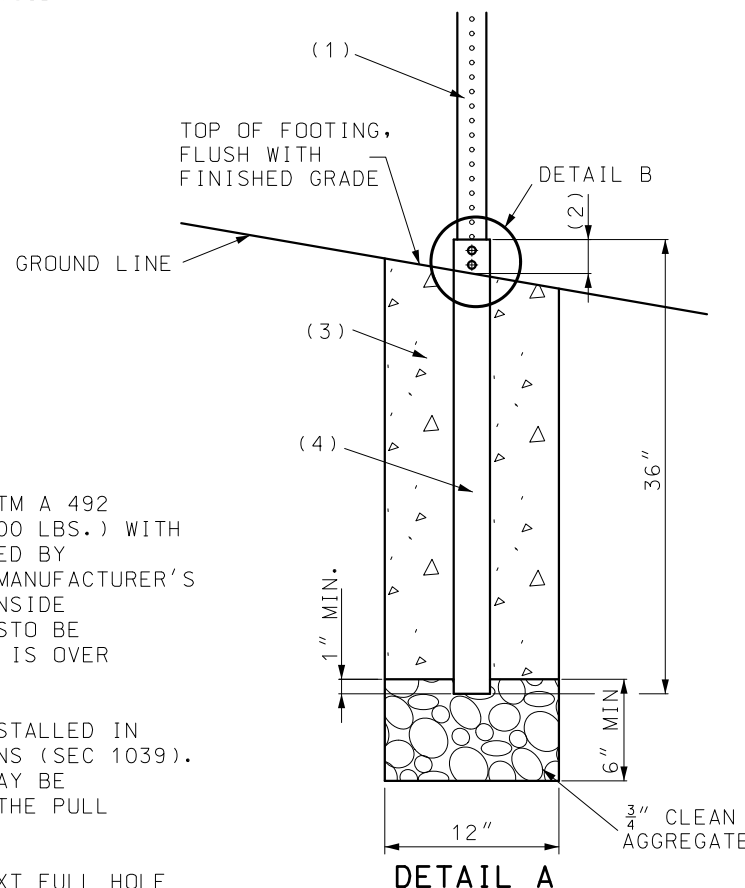
DETAIL B SHOULDER BOLT



GROUND INSTALLATION



BARRIER WALL INSTALLATION



DETAIL A

NOTES:

FOR GENERAL NOTES, SEE SHEET 1 OF 16.

PERFORATED SQUARE STEEL TUBE SHALL BE SECURED TO FOUNDATION TUBE OR BARRIER WALL MOUNTING PLATE WITH A SHOULDER BOLT PER PERFORATED SQUARE STEEL TUBE MANUFACTURER'S SPECIFICATION.

- (1) PERFORATED SQUARE STEEL TUBE 2" X 2" (O.D.) 12 GAUGE. TUBE SHALL EXTEND A MINIMUM OF 6" BELOW THE TOP OF THE FOUNDATION TUBE.
- (2) TUBE TO EXTEND ABOVE FOUNDATION ONLY ENOUGH TO ALLOW BOLT TO BE INSERTED 2 1/2" MAXIMUM.
- (3) CONCRETE MIX TO HOLD FOUNDATION TUBE PLUMB WITHOUT BRACING SHALL HAVE A MINIMUM OF 5.5 SACKS OF CEMENT PER CUBIC YARD AND A MAXIMUM SLUMP OF 2 1/2".
- (4) 2 1/2" X 2 1/2" (O.D.) SQUARE TUBE GALVANIZED 7 GAGE WITH TWO 1 7/32" DIAMETER HOLES IN EACH FACE 3/4" BELOW TOP OF TUBE.
- (5) 1/8" X 5' LONG STAINLESS STEEL CABLE (ASTM A 492 TYPE 304 MINIMUM BREAKING STRENGTH 200 LBS.) WITH A 1" DIA. LOOP AT EACH END FORMED BY MECHANICAL CRIMP TYPE CONNECTION PER MANUFACTURER'S SPECIFICATIONS. CABLE IS TO BE RUN INSIDE PERFORATED SQUARE STEEL TUBE. CABLE IS TO BE USED ONLY WHEN SIGN MOUNTING LOCATION IS OVER ANOTHER TRAVELWAY.
- (6) 1/2" DIAMETER RESIN ANCHORS SHALL BE INSTALLED IN ACCORDANCE WITH STANDARD SPECIFICATIONS (SEC 1039). AN APPROVED MECHANICAL TYPE ANCHOR MAY BE USED IF THE DEVICE EQUALS OR EXCEEDS THE PULL TEST REQUIREMENTS OF SEC. 1039.
- (7) FALL ARREST CABLE TO BE SECURED TO NEXT FULL HOLE BELOW SIGN

material same as sheet 7

<p>MISSOURI HIGHWAYS AND TRANSPORTATION COMMISSION</p> <p>105 WEST CAPITOL JEFFERSON CITY, MO 65102 1-888-ASK-MODOT (1-888-275-6636)</p>	
<p>STATE OF MISSOURI NICOLE A. KOLB HOOD NUMBER PE-2001018754 PROFESSIONAL ENGINEER</p> <p>THIS SHEET HAS BEEN SIGNED, SEALED AND DATED ELECTRONICALLY.</p>	<p>SIGN MOUNTING DETAILS</p> <p>EMERGENCY REFERENCE MARKERS</p>
<p>DATE EFFECTIVE: 01/01/2021</p> <p>DATE PREPARED: 10/14/2020</p>	<p>903.03BN</p>
<p>SHEET NO. 16 OF 16</p>	

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SIGNS						FOOTINGS		STRUCTURAL STEEL POSTS *				PIPE POSTS *				BACKING BARS **				U-CHANNEL POST	PERFORATED SQUARE STEEL TUBE										REMARKS AND OTHER REQUIRED ITEMS
902 SIGNAL SIGNS TABULATED ON D-37A SHEET						EMBD ITEM NO. 9031010 CY	BOL DO ITEM NO. 9031020 CY	POST DES NO.	POST NO. 1 LF	POST NO. 2 LF	POST NO. 3 LF	LBS PER FT	TOTAL ITEM NO. 9031210 LBS	PIPE SIZE IN.	POST NO. 1 LF	POST NO. 2 LF	LBS PER FT	TOTAL ITEM NO. 9031220 LBS	2" X 3/8" BARS @ 2.55 LBS PER FT	ITEM NO. 9031250A LF	2 IN. POST					2.5 IN. POST					BREAK- AWAY ASSEMBLY ITEM NO. 9031241 EA
SIGN NO.	SIGN SIZE	STATION	HORZ CLEAR IF NOT STD	LOCATION	SIGN DTL. SHT. NO.																NO.	LGTH IN.	TOTAL LF	TOTAL LBS	NO. 1	NO. 2	TOTAL	12-GA. DRIVEN ITEM NO. 9031271A EA	7-GA. DRIVEN ITEM NO. 9031273A EA	7-GA. CONCRETE ITEM NO. 9031274 EA	
<div style="font-size: 48px; opacity: 0.2; transform: rotate(-15deg); pointer-events: none;"> DRAFT </div>																															
SUBTOTAL																															
TOTAL																															

* BREAKAWAY ASSEMBLY IS INCIDENTAL FOR STRUCTURAL STEEL AND PIPE POSTS.
 ** BACKING BARS ARE TOTALED WITH STRUCTURAL STEEL OR PIPE POSTS.

NOM. SIZE (IN.)	WEIGHT		STUB LENGTH	FOOTING		CONCRETE C.Y.
	LBS/FT	LBS/IN		DIA.	DEPTH	
2 1/2	5.79	0.48	4'-3 1/2"	12"	4'-6"	0.13
3	7.58	0.63	4'-3 1/2"	12"	4'-6"	0.13
4	10.79	0.90	5'-3 1/2"	18"	5'-6"	0.36

POST DES. NO.	NOM. SIZE	POST			DIA.	FOOTING																					
		WEIGHT		STUB LENGTH		LEVEL GROUND				6:1 GRADE				4:1 GRADE				3:1 OR 2:1 GRADE									
		LBS/FT	LBS/IN			DEPTH	C.Y.	DEPTH	C.Y.	DEPTH	C.Y.	DEPTH	C.Y.	DEPTH	C.Y.	DEPTH	C.Y.										
1	W6	9.0	0.75	3'-0"	15"	3'-0"	0.14	3'-2"	0.15	3'-3"	0.16	3'-6"	0.17														
2	W6	15.0	1.25	4'-0"	24"	4'-0"	0.47	4'-2"	0.50	4'-3"	0.51	4'-6"	0.54														
3	W8	18.0	1.50	4'-6"	28"	4'-6"	0.71	4'-8"	0.73	4'-9"	0.74	5'-0"	0.78														
4	W10	22.0	1.83	5'-0"	36"	5'-0"	1.31	5'-2"	1.36	5'-3"	1.39	5'-6"	1.45														
5	W10	26.0	2.17	5'-0"	36"	5'-0"	1.31	5'-3"	1.37	5'-5"	1.43	5'-9"	1.52														
6	W12	35.0	2.92	5'-6"	36"	5'-6"	1.44	5'-9"	1.52	5'-11"	1.56	6'-3"	1.65														

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