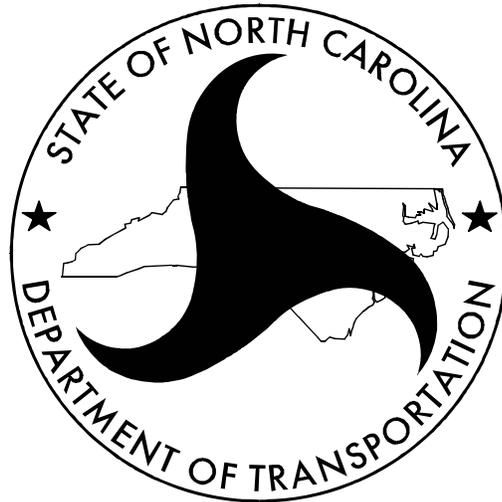


**NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH**

**STANDARD SPECIFICATIONS
FOR
ROADS AND STRUCTURES**



JANUARY 2012

FOREWORD

This publication has been prepared to provide a compilation of standard requirements used by the North Carolina Department of Transportation for construction contracts.

When this publication, entitled *Standard Specifications for Roads and Structures*, dated January 2012, is incorporated by reference into the Department's construction bid proposals or contracts; it is made a part of that document and shall be known as the *Standard Specifications*. The requirements stated herein may be revised or amended from time to time by Supplemental Specifications, by Standard Special Provisions which are unique to a select group of projects or by Project Special Provisions which are unique to the specific bid proposal or contract.

Working titles have a masculine gender, such as workman, workmen and foreman. Pronouns such as he, his, and him are used in the *Standard Specifications* for the sake of brevity and are intended to refer to persons of either sex and corporate entities.

Reference by title and date will be made to the governing provisions on plans and contract documents.

GENERAL INFORMATION

For general questions about this publication, please contact the Contract Standards and Development Unit at specs@ncdot.gov or (919) 707-6900.

ORDERING INFORMATION

Copies of the *Standard Specifications* and the *Roadway Standard Drawings* may be purchased through the Contract Standards and Development Unit:

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DIVISION 9 SIGNING

SECTION 900 GENERAL REQUIREMENTS FOR SIGNING

900-1 DESCRIPTION

Furnish, fabricate and erect complete traffic sign systems in accordance with the contract.

900-2 ACCEPTANCE OF SIGNS

Before final inspection of the signs, clean exposed sign and support surfaces and repair the site as may be deemed necessary to ensure the safety, effectiveness and neat appearance of the work.

Maintain responsibility for the signs until accepted. Any damaged sign will not be accepted. Any repairs to the signs before final acceptance of the project are to be approved.

Do not perform any repair work without written approval. Make repairs only in the presence of the Engineer.

Handle, transport and store all signs in accordance with the sheeting manufacturer's recommendations. Failure to comply with the manufacturer's recommendations during the handling, transporting and storing of the signs will be cause for rejection.

The Contractor may request early Department acceptance of part or all of the highway signs, including sign panels, retroreflective sheeting and associated hardware, before final project acceptance. Sign supports will not be accepted early. To be accepted before final project acceptance, the signs shall be required for traffic control at that phase of project construction.

If the Department accepts the signs, the Contractor will be relieved of the responsibility for any damage or theft that may occur to the signs, retroreflective sheeting or associated hardware, with exception of any damage caused by the Contractor or any subcontractor working on the project.

900-3 ALTERNATE DESIGN

Standard designs for Types A, B, C, D, E or F signs will be shown in the contract. Instead of the standard design, the Contractor may submit for approval an alternate design for sign panels differing in component parts and construction details from those shown in the contract. Provide any alternate designs that are in accordance with the MUTCD.

Submit complete details of the alternate sign designs to the Engineer for approval. Include the dimensions, thickness and alloys of the component parts, and typical shop drawings of all fabrication, erection and construction details.

Alternate design for supports and footings will not be permitted.

900-4 COVERING OF SIGNS

Cover signs or portions of signs with opaque material if erected on roads open to traffic and not yet applicable. Keep signs or portions of signs covered until instructed to remove the covering. Provide covering for entire signs by an approved method provided by sheeting manufacturer that will prevent the messages from being read or seen during both day and night conditions and that will cause no harm to the sheeting face.

Section 901

**SECTION 901
SIGN FABRICATION**

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901-1 DESCRIPTION

Fabricate and furnish signs, including sign face, supporting frames, hardware and package the signs for shipment.

901-2 MATERIALS

Refer to Division 10.

Item	Section
Retroreflective Sheeting	1092-2
Signs and Hardware	1092-1

901-3 CONSTRUCTION METHODS

(A) General

Details concerning the fabrication and erection of the signs are shown in the contract. Sign designs not shown in the contract are available from the Engineer.

Fabricate all items within 1/8" of design measurements. Scribe each sign, shield, arrow, overlay or blank on the back with the month and year.

Do not begin fabrication of Type A, B and C signs until S-dimension verification revisions have been approved.

Provide mounting holes in the Z-stringers of the signs in accordance with the details shown in the contract or approved shop drawings. Provide a space between the Z-bar and backing strip not greater than 1/8".

Date the erection of all signs and sign assemblies using printed self-adhesive stickers designed for punching the appropriate day, month and year numbers with a hole punch. Place the sticker on the back of each sign in the lower corner nearest the roadway. The Sign Fabricator will provide a sufficient quantity of the stickers for each sign. Print on the back of each sign the size of that sign [e.g. 144" x 48"] with a black permanent marker with numbers at least 2" in height and located near the self-adhesive sticker.

Ship all multi-panel signs to the project intact, completely assembled and ready to be installed. Fabricate signs taller than 12 ft as 2 separate signs with a horizontal splice, ready to be spliced and installed. No assembly other than a horizontal splice will be permitted except when a route shield or copy is required to be attached because of the horizontal splice.

(B) Department and Contractor Furnished Signs

Use the contract to determine whether the signs are to be fabricated and furnished by the Contractor or whether the Department will provide them to the Contractor.

For both Department and Contractor Furnished Signs, the Contractor provides all mounting hardware consisting of, but not limited to, shims, backing plates, mounting bolts, washers and nuts.

The sign fabricator will provide vertical Z-bars required for attaching secondary signs to the primary signs.

Confirm in writing at least 4 months in advance, the actual date the Department furnished signs will be required. The signs will be made available to the Contractor for pickup at the North Carolina Department of Correction sign fabrication facility on N.C. 39 near Bunn, North Carolina, unless otherwise indicated in the contract. Provide for all transportation.

1 The Engineer will inspect and approve the signs before they are packaged and crated for
 2 shipment. Take delivery of all signs within 60 days of the date requested or the date they
 3 are made available, whichever occurs last, and within 96 hours of receiving the first sign.
 4 The Engineer shall approve any exception to the above delivery procedure. At the time
 5 the signs are delivered to the project, provide to the Engineer one copy of the sales ticket
 6 furnished with the signs.

7 After taking possession of the signs, be responsible for any damage or theft that occurs to
 8 signs before final acceptance by the Engineer. Comply with the reflective sheeting
 9 manufacturer's recommendations for handling, transporting, erecting and storing of the
 10 signs. Acceptably repair or otherwise correct any damage to the signs or refabricate
 11 them. When requested by the Contractor, the Department may have the necessary repairs
 12 made or the signs refabricated, and deduct the associated cost thereof from monies due
 13 the Contractor.

14 (C) Signs

15 Construct all signs, supporting frames and assemblies in accordance with the details
 16 shown in the contract and Tables 901-1 and 901-2.

TABLE 901-1				
SIGN TYPE PARAMETERS				
Sign Type	Vertical and Horizontal Dimensions	144" x 48" Aluminum Panels	Horizontal Z-Bars	Aluminum Thickness
A	Vertical or Horizontal > 144" or Vertical and Horizontal > 48"	Multiple	Yes	0.125"
B	Vertical and Horizontal < 144" and Vertical or Horizontal < 48"	Single	Yes	0.125"
C	-	Single, Dual	Yes	0.125"
D	-	Single	No	See Table 901-2
E	-	Single	No	See Table 901-2
F	-	Single	No	See Table 901-2

17 (1) Type A Signs

18 Fabricate Type A signs from multiple aluminum sheet increments of the thickness
 19 shown in Table 901-1, with welded studs for attachment to the supporting frame.

20 Use aluminum sheets with increments of 4 ft in width; except, for sign widths that
 21 are not multiples of 4 ft, a maximum of 2 panels may be cut to less than 4 ft. No
 22 panel may be cut to less than one foot. Mount aluminum sheet increments vertically
 23 and provide with backing strips at the vertical joints, held firmly in place, to keep the
 24 abutting sheets in proper alignment. Leave a space of 0.020" to 0.032" between each
 25 panel sheeted with non-prismatic sheeting. Prismatic sheeting is to be trimmed at
 26 a 45° angle from the edge of each panel.

27 Fabricate signs with a height of 12 ft or less, without horizontal joints. One
 28 horizontal joint will be permitted for signs that are more than 12 ft in height. Locate
 29 the joint near the mid-height of the sign. Construct this joint according to the details
 30 in accordance with the contract.

Section 901

(2) Types B and C Signs

Fabricate Types B and C signs from multiple aluminum sheet increments of the thickness shown in Table 901-1, with welded studs for attachment to the supporting frame.

(3) Types D, E and F Signs and Milemarkers

Fabricate Types D, E and F signs and milemarkers from single sheets of the thickness shown in Table 901-2, with holes for bolting to the supports.

Construct Types E and F signs in accordance with the *FHWA Standard Highway Signs*. Apply the retroreflective sheeting to the separate signs in all Types E and F sign assemblies consecutively to provide correct color matching on each completed assembly. Adequately identify each individual sign to the correct assembly. Following the erection of Type E and F sign assemblies, leave the identification markings on the individual signs until Department personnel have verified compliance with these requirements.

(4) Overlays for Existing Signs

Manufacture all overlays for existing signs of the thickness shown in Table 901-2. Do not make holes for rivets in the overlays during fabrication, but instead field-drill them during the erection process.

(D) Aluminum

(1) Thickness Requirements

Vertical or Horizontal Dimension	Minimum Thickness
<i>Inches</i>	<i>Inches</i>
0-11.9	0.032
12-35.9	0.063
36-47.9	0.080
48 and larger	0.125
Milemarkers	0.080
Overlays	0.063

(2) Preparation of Aluminum Sign Surfaces

Do not handle any metal, except by appropriate handling devices or by workmen wearing clean gloves, between the beginning of the coating operations and the completion of the application of the retroreflective sheeting. Retreat aluminum sign surfaces that come into contact with grease, oils or other contaminants before the application of retroreflective sheeting.

Before applying retroreflective sheeting to the aluminum, treat the aluminum sign surfaces with a chromate conversion coating. Such coating shall be applied according to the manufacturer's instruction and shall conform to ASTM B449, Class 2, and should range in color from silvery iridescent to pale yellow. The coating weight shall be 10 mg/sf to 35 mg/sf on the entire surface area including along the edges of the sign substrate with a median of 25 mg/sf as the optimum coating weight. Ensure the coating does not appear dusty when wiped with a clean, lint-free cloth and does not show excessive buildup at edges. Sand smooth all burrs and scratches before applying retroreflective sheeting. Sheet all sanded aluminum within the same day to prevent the formation of corrosion on the metal. Do not sand or use abrasive materials on sheeted faces. Aluminum products shall be randomly tested.

(E) Supporting Frames

Use supporting frames for Types A and B signs consisting of 2 or more horizontal aluminum Z-stringers with vertical aluminum bar stiffeners in accordance with the details and dimensions shown in the contract. Use a nylon washer to attach all thru bolts with a play of at least 1/16" and no more than 1/8". Provide stringers with necessary holes and slots for bolting stiffeners, attaching aluminum sheet increments and mounting to supports. Do not field drill holes in any part of the structural assembly, except the field drilling of horizontal Z-bars for attaching new signs to existing supports when necessary.

(F) Welding

Weld studs to aluminum sheets by the capacitor discharge method. If the studs are welded after the retroreflective sheeting has been applied, insure that burn-through does not damage the retroreflective sheeting.

Shoot a test stud on each Type A, B and C sign in the lower left corner of the most left panel facing the back of the sign.

(G) Retroreflective Sheeting

Apply retroreflective sheeting to the aluminum sign panels in accordance with the retroreflective sheeting manufacturer's recommendations. For each multi-panel increment sign using glass beaded materials, sheet the entire sign from the same roll.

If a sign panel needs to be replaced after sign fabrication, the replacement panel may be sheeted with retroreflective materials from a different lot or drum number than the remainder of the sign; however, use material that visually color matches and meets Article 1092-2.

Take retroreflectometer readings on all 4 corners of each panel and document the readings on the sign design drawings.

Overlap all splices of any encapsulated or enclosed lens sheeting to allow water to run off without running into the splice.

Remove all foreign materials on the sheeted face with compressed air.

Keep a sample of each roll of sheeting and test for retroreflective compliance.

Patch wrinkles in the sheeting around thru bolts by removing the affected sheeting from the metal. Then patch this area with a circular patch encompassing an area 1/4" outside the affected area. This patch shall not exceed the standard patching limits shown in Table 901-3.

Ensure that all patches on the sign have a 1" minimum width or as recommended by the sheeting manufacturer.

Maintain documentation of the lot, drum, inspector, roll size, date received, date sheeted and metal treater on all signs, slip sheeting, copy, borders, shields, overlays, arrows and panels and retroreflectometer readings.

Obtain and assign to the Department in writing warranties for sign sheeting used in the fabrication of all permanent signs from the sheeting manufacturer. Warrant the signs against defective sheeting per the requirements outlined in the contract.

Define "permanent signs" as Types A, B, C, D, E and F signs, overlays for all sign types and milemarkers, and exclude any signs used only for traffic control while the project is under construction.

The reflective sheeting may be patched to repair incidental damage to the sheeting that might occur during manufacture, in transit or after installation; however, the patches cannot exceed the limits in Table 901-3.

Section 901

**TABLE 901-3
SIGN PATCHING LIMITS**

Sign Area	Maximum Number and Size of Patches During Fabrication		Maximum Number and Size of Additional Patches After Field Erection	
	Max. Number per Sign	Max. Size in Sq.In.	Max. Number per sign	Max. Patch Size in Sq.In.
0 to 15.0	0	0	0	0
15.1 to 50.0 (Single Panel)	1	1	1	1
30.0 to 80.0 (Increment Panel)	2	2	1	2
80.1 and Greater	A	3	A	3

A. Average not to exceed one patch per panel per sign. Maximum of 3 patches per panel allowed during fabrication with one additional patch per panel allowed after field erection.

(H) Reflectorized Letters, Numerals, Symbols, Border and Shields

(1) General

Use direct-applied retroreflective sheeting or demountable retroreflective sheeting letters, numerals, borders, shields and arrows as indicated on the sign designs.

Use designs of letters and numerals that conform to the *FHWA Standard Highway Signs*. Use border widths, design of route shields and arrows that conform to the MUTCD.

Route shields used on Type A or B signs or overlays shall be demountable.

Space and size all legends and borders in accordance with the contract or approved shop drawings. Any loose, deformed or misplaced legends and borders will be cause for rejection of the entire sign.

(2) Direct Applied

Provide direct-applied reflectorized letters, numerals, arrows and borders that are of the type and color of retroreflective sheeting shown in the contract for each sign. All direct applied copy or border not permanently affixed may be removed and replaced on signs if necessary during manufacture.

(3) Demountable

Attach demountable letters, numerals, borders, shields, arrows and alphabet accessories directly to sign faces with rivets as shown in the contract.

Use letters, numerals, arrows, borders and shields made of adhesive-coated retroreflective sheeting, permanently adhered to a flat aluminum backing, in accordance with the contract.

Use aluminum backing of at least .032" thick aluminum sheeting of 3004 H38, 5052 H38 or 6061 T6 alloy. Treat with a light, tight, amorphous chromate-type coating in accordance with the recommendations of the retroreflective sheeting manufacturer. Apply the retroreflective sheeting to the properly prepared aluminum using the method and equipment prescribed by the sheeting manufacturer.

1 Supply each letter, numeral, arrow, border and shield with mounting holes, and
 2 secure to the sign surface with non-twist corrosion resistant aluminum rivets. Use
 3 letters, numerals, arrows and borders that have rivets on all sides and ends spaced not
 4 more than 6" on centers, measured along the edges. Make sure that each legend
 5 piece has at least one rivet in each corner and at least 2 rivets in each end. Attach
 6 route shields as part of Type A or B signs with aluminum rivets spaced not more
 7 than 9" apart, measured along the edges of the shield.

8 Use a 1/4" diameter nylon washer under the head of all pull through type rivets for
 9 all demountable copy and shields.

10 **(I) Silk Screening**

11 Apply all legends and borders on Type E and F signs by silk-screening or reverse
 12 silk-screening after the sheeting is attached to the panels. Perform all screening as
 13 recommended by the manufacturer of the retroreflective sheeting. Use the color of all
 14 legends, borders and backgrounds, and their placement on the sign, in accordance with
 15 the contract.

16 Use opaque black ink for nonreflectorized message application, as manufactured or
 17 recommended by the manufacturer of the retroreflective sheeting.

18 Use transparent ink and thinner, for application on signs reflectorized with white
 19 retroreflective sheeting, as manufactured or recommended by the manufacturer of the
 20 retroreflective sheeting. Use colors that conform to the *FHWA Color Tolerance Charts*
 21 and AASHTO M 268 when thoroughly dry.

22 Test all lots of transparent ink for compliance with the minimum coefficient of
 23 retroreflection equal to 70% of the specified minimum retroreflection of the
 24 corresponding sheeting color and document the retroreflection value.

25 Inspect the first 5 signs of each screening and then every fifth sign. When unacceptable
 26 signs are found, all signs shall be inspected individually.

27 Only 3 nonwets per square foot, no larger than 1/16" in diameter, covering no more than
 28 1/3 of the total area of the sign are allowable. This includes nonwets from either the
 29 sheeting or the screen-printing.

30 Only one tadpole per 6 sf, no longer than 1 1/2" and not readily visible under lighted
 31 inspection is allowable.

32 **(J) Mounting Hardware**

33 Provide all mounting hardware consisting of, but not limited to, shims, backing plates,
 34 mounting bolts, washers and nuts. Provide mounting holes in the Z-stringers of the
 35 ground mounted signs in accordance with the details shown in the contract.

36 **(K) Packaging, Shipping and Storing**

37 Protect all signs during shipment and storage. Before shipping, make sure that all signs
 38 are free of moisture and that all inks are thoroughly dry. Do not apply adhesive tapes to
 39 any sign surface. Keep all packaged signs entirely dry.

40 Use assembled or partially assembled signs other than flat sheet signs that have sufficient
 41 braces securely attached to prevent buckling or warping at all times.

42 Affix a label outlining the retroreflective sheeting manufacturer's recommendations for
 43 handling, transporting and storing all types of signs to each shipping carton or crate.
 44 Provide full details of such recommendations with each shipment of signs.

45 Label each crate or package of signs or panels as to the contents (arrows, shields, etc.),
 46 WBS number and sequence of packages if more than one package is for a single sign.

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- 1 Maintain documentation of the lot, drum, inspector, roll size, date received, date sheeted,
2 metal treater on all signs, slipsheeting, copy, borders, shields, overlays, arrows, panels
3 and retroreflectometer readings.
- 4 Individually rack or separate by foam or slip sheeting on A-frame racks all sheeted
5 panels. Do not use spliced, overlapped, ripped or torn slipsheeting or foam.
- 6 Store all packed signs standing at a 75° to 90° angle.
- 7 Turn all panels and sign faces to the inside of the crates, whenever possible.
- 8 When crating a one-panel sign, provide the face side with an extra piece of foam and
9 cardboard taped to the outside of the face side of the package.
- 10 Pack panels of 102" in length or longer in only 2 per package.
- 11 Ensure all signs are debris free on the back side, with no misplaced writing, tape or
12 extraneous sheeting.
- 13 Crate to allow a 2" space on the inside dimensions larger than the size of the largest
14 package.
- 15 Store completed Type A and B signs back to back with at least 12" between faces.
- 16 When crating 2 panels of different sizes, place the smaller panel with its face to the back
17 of the larger panel and package with an extra piece of foam and cardboard taped to the
18 outside of the larger panel, with its face to the outside of the crate. Provide extra
19 packaging on both outsides of the package for double-faced signs.
- 20 Crate packaged panels to allow the passage of a 1/8" spacer on the inside of each side of
21 the crate, so that the panels are not overly tight or binding in crate.
- 22 Inspect all signs and packaging before shipping to assure compliance with the contract
23 and the *Standard Specifications*. The Department retains the right to inspect the signs
24 and packaging before shipping.

25 (L) Transparent Films

- 26 Use transparent films instead of silk screening when authorized by the Department.
27 Transparent film is a durable, transparent, acrylic colored film coated with transparent,
28 pressure-sensitive adhesive. When the film is applied over reflective sheeting, the
29 coefficient of retroreflectivity shall meet the color and type of sheeting in Tables 1092-3,
30 1092-4 and 1092-5. Use Department approved transparent film approved by the
31 manufacturer of the reflective sheeting to insure the materials meet the manufacturer's
32 warranty and obligation in Subarticle 1092-2(B).

33 901-4 SIGN QUALITY

- 34 Provide signs that present a uniform appearance free from color match problems, non-uniform
35 color, streaks, spots, abrasions, blistering or other defects in the sheeting.
- 36 Sheeting may be inspected before application to sign blanks, after installation to sign blanks,
37 after completion of the sign in the sign fabricator's facility and after installation. Clean all
38 installed signs before final field inspection.

1 The retroreflective sheeting will be unsatisfactory if it has deteriorated due to any cause
 2 except defacement resulting from vandalism or damage resulting from impact by a motor
 3 vehicle or other object to the extent that:

4 (A) The sign is ineffective for its intended purpose when viewed from a moving vehicle
 5 under normal day and night driving conditions, or

6 (B) The coefficient of retroreflection is less than the minimum specified for that sheeting as
 7 shown in Tables 1092-3, 1092-4 and 1092-5 when measured by a Department approved
 8 retroreflectometer, or

9 (C) The screened message and border or reverse screened background has stained,
 10 discolored, streaked, faded, turned dark or has developed cracks, scaling, pitting and/or
 11 blistering, or

12 (D) The sign is unsatisfactory with regard to uniform appearance due to cracking, streaking,
 13 delamination, blistering, crazing or discoloration of the sheeting, or

14 (E) The sign is unsatisfactory with regard to remaining uniform in color over the entire
 15 reflecting surface both day and night and displaying the same color both in daylight and
 16 under lights at night.

17 (1) For glass bead material, sheeting will be subjected to a visual test with the human
 18 eye as the test instrument. Objectionable non-uniformity of color and reflectivity
 19 (retroreflection) under light at night is cause for the sign to be tested for
 20 retroreflection to determine compliance with the following requirements:

21 The retroreflection values on any sign shall not vary from each other by more than
 22 a ratio of 1.10 (1.20 white) at any 2 points at least 12" apart, nor more than
 23 1.30 (1.30 white) at any 2 points anywhere on the sign, nor more than,
 24 1.10 (1.20 white) at any 2 points on the border or between any 2 adjacent letters,
 25 numerals or symbols. Failure to meet the above requirements will result in sign
 26 rejection. Retroreflection will be tested using a Delta RetroSign retroreflectometer.

27 (2) For prismatic material, sheeting will be subjected to a visual test with the human eye
 28 as the test instrument.

29 **901-5 MEASUREMENT AND PAYMENT**

30 Sign fabrication will be measured and paid as the actual number of square feet of sign face
 31 areas of each type, including milemarkers and overlays acceptably fabricated. In measuring
 32 this quantity, the sign face areas will be calculated to the nearest 1/100 of a square foot, using
 33 the dimensions shown in the contract.

34 The areas of odd-shaped signs (e.g. stop signs and shield-shaped route markers) will be
 35 calculated as squares or rectangles using the dimensions shown in the contract. The areas of
 36 round, diamond and triangular signs will be calculated for their true shapes using plan
 37 dimensions.

38 Repair or otherwise correct any damage to the signs or refabricate them at no cost to the
 39 Department. When requested by the Contractor, the Department may have the necessary
 40 repairs made or the signs refabricated, and deduct the associated costs thereof from monies
 41 due the Contractor.

42 Payment will be made under:

Pay Item	Pay Unit
Contractor Furnished, Type ____ Sign	Square Foot
Department Furnished, Type ____ Sign	Square Foot

Section 902

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**SECTION 902
FOUNDATIONS FOR GROUND MOUNTED SIGNS**

902-1 DESCRIPTION

Construct foundations for sign supports including locating, staking, excavating, shoring, backfilling, forming, landscaping and other necessary tasks as required.

902-2 MATERIALS

Refer to Division 10.

Item	Section
Joint Sealer	1028-2
Organic Non-Aerosol Zinc Repair Paint	1080-9
Portland Cement Concrete Production and Delivery	1000
Reinforcing Steel	1070
Select Material and Borrow Material	1016 and 1018

902-3 CONSTRUCTION METHODS

Establish the proper offset, longitudinal location and foundation elevation of each ground mounted sign support. Provide proper level and orientation of all supports.

Thoroughly compact all backfill in 6" layers. Remove all unneeded excavated material from the site.

Perform all excavation necessary for foundation construction to the elevations and dimensions shown in the contract. Place concrete against undisturbed soil.

Construct concrete sign foundations in accordance with Section 825. Construct either reinforced or plain Class A concrete foundations in accordance with the contract. Shape the tops of the foundations to conform with finished ground elevations such that water will not collect against the supports. No construction joints will be permitted.

Form the top 6" of foundations by approved methods. Center the supports in the foundations, securely brace and hold in proper position and alignment during placement of the concrete. Provide an ordinary surface finish to the concrete.

902-4 MEASUREMENT AND PAYMENT

The quantity of reinforced and plain concrete to be paid will be the actual number of cubic yards of concrete incorporated into the completed and accepted foundation. Computing the number of cubic yards of concrete will be done from the dimensions shown in the contract or from revised dimensions authorized by the Engineer, calculated to the nearest 1/100 of a cubic yard.

Payment will be made under:

Pay Item	Pay Unit
Reinforced Concrete Sign Foundations	Cubic Yard
Plain Concrete Sign Foundations	Cubic Yard

**SECTION 903
GROUND MOUNTED SIGN SUPPORTS**

903-1 DESCRIPTION

Furnish, fabricate, clear for sight distance and install ground mounted and barrier mounted signs supports.

1 The types of supports covered by this section are:

2 (A) Breakaway steel beam sign supports

3 (B) Simple steel beam sign supports

4 (C) 3-lb steel U-channel supports

5 (D) 2-lb steel U-channel supports

6 (E) Barrier sign support assembly

7 (F) Wood supports

8 (G) Steel square tube supports

9 **903-2 MATERIALS**

10 Refer to Division 10.

Item	Section
Breakaway or Simple Steel Beam Sign Supports (W- or S-Shapes)	1094-1(A)
Ground Mounted Signs	1094
Joint Sealer	1028-2
Organic Non-Aerosol Zinc Repair Paint	1080-9
Signing Materials	1092
Steel Square Tube Supports	1094-1
Steel U-Channel Supports	1094-1

11 **903-3 CONSTRUCTION METHODS**

12 **(A) Location and Field Verification**

13 The support lengths and dimensions for steel and wood ground mounted supports shown
14 in the contract are estimated for project bid purposes.

15 The Engineer or contract surveyor will establish the proper offset, longitudinal location;
16 foundation elevation and S-dimension of each ground mounted and barrier mounted sign
17 support. The Signing and Delineation Unit will issue a revision of the Sign Support
18 Chart Sheet following receipt of field-verified S-dimensions.

19 Order supports for ground mounted signs when the revised support lengths, dimensions
20 and sizes have been determined and the appropriate plan revision is completed.

21 Provide the proper vertical plumb, level and orientation of all signs and supports.

22 **(B) Clearing for Sign Sight Distance**

23 Clear vegetation in front of signs where necessary to achieve proper sight distance to the
24 sign. The sight distance area includes the triangular region of land extending from the
25 edge of the travel lane 800 ft in advance of the sign to 4 ft beyond the furthest edge of the
26 sign from the travel lane. The Engineer will determine where clearing is required and the
27 amount of clearing at the sign locations. Perform the clearing in accordance with
28 Section 200.

29 **(C) Breakaway Steel Beam and Simple Steel Beam**

30 Fabricate and install the supports in accordance with the contract. Punch, cut or weld
31 supports before galvanizing. Galvanize each component part in accordance with
32 ASTM A123 before assembly. Provide supports that are uniformly straight to within
33 1/8" tolerance for pieces less than 20 ft in length and 1/4" tolerance for pieces over
34 20 ft in length.

Section 903

1 Cut the upper and middle sections of breakaway supports from the same member. Bolt
2 the hinge joint in the breakaway supports to ensure true alignment of the 2 sections.
3 After bolting of hinge connections make sure that the 2 sections are in the same position
4 relative to each other, as before being cut. Completely assemble breakaway supports
5 before erection.

6 Provide supports that are plumb. Do not shim the supports. Take adequate care during
7 erection of supports to prevent damage to the surface finish. Use 2 coats of an approved
8 organic non-aerosol zinc repair paint in touching up damaged areas on all galvanized
9 materials.

10 (D) Steel Supports

11 (1) General

12 Drive the supports to the required depth, being sure they are plumb. Drive the
13 supports by hand or by mechanical means. Protect the supports with an appropriate
14 driving cap. Concrete foundations are not required. In island applications, cored
15 holes shall be to the soil depth.

16 Replace any support that is bent, or otherwise damaged in driving.

17 Do not weld or cut supports in the field, except for the saw cutting of U-channel
18 support material for the frames and cross braces that may be required for
19 Types D, E and F signs with 2 or more supports.

20 Use 2 coats of an approved organic non-aerosol zinc repair paint in touching up the
21 tops of U-channel supports that may have been damaged in driving. Cut ends of
22 supports, frames, cross bracing and damaged areas on these and all other galvanized
23 materials.

24 Use supports of sufficient length to permit the appropriate sign mounting height.
25 Spliced supports are not permitted on new construction.

26 (2) U-Channel

27 Use 3-lb galvanized steel U-channel supports for Types D, E and F signs. Use
28 2-lb galvanized steel U-channel supports for milemarkers.

29 (3) Perforated Square Tubing

30 Use square tube supports in accordance with the contract.

31 (E) Barrier Supports

32 (1) Small

33 Attach brackets and U-channel supports to the median or shoulder barrier for the
34 erection of Type E or F signs or milemarkers in accordance with the contract.

35 (2) Large

36 Attach brackets, anchorage and pipe supports to the median or shoulder barrier for
37 the erection of Type E signs in accordance with the contract.

38 (F) Wood Supports

39 Use wood supports in accordance with the contract.

40 Replace any support that is damaged during erection.

41 Breakaway wood supports shall be drilled in accordance with the contract. All wood
42 supports larger than 4" x 4" that have not been drilled shall be behind guardrail.

1 **903-4 MEASUREMENT AND PAYMENT**

2 The supports, specified in these *Standard Specifications*, installed and accepted, will be
3 measured for payment as follows:

4 *Supports, Breakaway Steel Beam* and *Supports, Simple Steel Beam* will be measured and paid
5 as the actual number of pounds of structural steel installed and accepted. The computed
6 nominal weights shown in the final revised plans will be used in determining this quantity.
7 Measurement will not be made of the weight of nuts, bolts and washers that are part of the
8 sign support, as they will be incidental to the work.

9 *Supports, 3-lb Steel U-Channel* will be measured and paid as the actual number of linear feet
10 of 3-lb steel U-channel supports incorporated into the completed and accepted supports and
11 assemblies. Measurements of length will be made to the nearest 1/10 of a foot.

12 *Supports, 2-lb Steel U-Channel* will be measured and paid as the actual number of
13 2-lb steel U-channel support installed and accepted.

14 *Supports, Barrier (Small)* will be measured and paid as the actual number of small barrier
15 supports installed and accepted.

16 *Supports, Barrier (Large)* will be measured and paid as the actual number of large barrier
17 supports installed and accepted.

18 *Supports, Wood* will be measured and paid as the actual number of linear feet of wood support
19 incorporated into the completed and accepted supports. Measurements of length will be made
20 to the nearest 1/10 of a linear foot. The computed linear feet of sign supports, as indicated in
21 the final revised plans will be used in determining this quantity.

22 *Supports, Steel Square Tube* will be measured and paid as the actual number of linear feet of
23 steel square tube supports incorporated into the completed and accepted supports and
24 assemblies. Measurements of length will be made to the nearest 1/10 of a foot.

25 Payment will be made under:

Pay Item	Pay Unit
Supports, Breakaway Steel Beam	Pound
Supports, Simple Steel Beam	Pound
Supports, 3-lb Steel U-Channel	Linear Foot
Supports, 2-lb Steel U-Channel	Each
Supports, Barrier (Small)	Each
Supports, Barrier (Large)	Each
Supports, Wood	Linear Foot
Supports, Steel Square Tube	Linear Foot

26

**SECTION 904
SIGN ERECTION**

27

28 **904-1 DESCRIPTION**

29 Erect existing and proposed ground mounted and overhead signs to existing and proposed
30 supports and furnish mounting hardware. Relocate existing signs in accordance with the
31 contract and Specifications.

Section 904

1 The types of signs covered by this section are as follows:

2 (A) Type A signs

3 (B) Type B signs

4 (C) Type C signs

5 (D) Type D signs

6 (E) Type E signs

7 (F) Type F signs

8 (G) Milemarkers

9 (H) Overlay signs

10 (I) Reposition signs

11 (J) Logo Trailblazer

12 (K) Logo to panel

13 (L) Relocation signs

14 904-2 MATERIALS

15 Refer to Division 10.

Item	Section
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Signing Materials	1092
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Organic Non-Aerosol Zinc Repair Paint	1080-9
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16 904-3 CONSTRUCTION METHODS

17 (A) General

18 Provide new mounting bolts, washers, hex nuts, backing plates and all hardware for signs
19 to be mounted on existing or proposed supports. Do not weld, cut or fabricate in any
20 manner in the field, except for as allowed under Section 903 and for the drilling of holes
21 for attaching demountable legends and borders that cannot be attached in the shop. Field
22 drill Z-bars for attaching signs to supports as required.

23 Use 2 coats of an organic non-aerosol zinc repair paint in touching up field-drilled holes
24 and damaged areas on all galvanized materials as covered under Section 903.

25 Make sure that the horizontal edges of signs are level and that the faces of signs are
26 vertical.

27 Refer to Sections 900 and 901 for requirements of care and handling of signs, final clean
28 up and covering of signs.

29 (B) Type A , B and C

30 (1) General

31 Attach the signs to supports in accordance with the contract or the approved shop
32 drawings. Make sure that the face of the sign is flat. Any appreciable buckling or
33 warping of the sign face will be cause for rejection of the entire sign.

34 (2) Ground Mounted

35 Erect ground mounted Type A, B and C secondary signs by the required method of
36 attachment shown in the contract. Affix these signs by bolting the horizontal
37 Z-stringers directly to the supports or by bolting vertical Z-bars to the horizontal
38 Z-stringers of the primary sign.

39 (3) Overheads

40 For new overhead supports, erect overhead secondary signs in accordance with the
41 approved shop drawings.

1 For existing overhead supports, design and furnish all new structural members and
 2 mounting hardware necessary to erect the new signs. Prepare and submit to the
 3 Engineer for approval complete shop drawings and design computations for the
 4 bracing and accessory hardware required to attach the sign to the existing overhead
 5 sign support. Prepare the design in accordance with *AASHTO Structural Supports for*
 6 *Highway Signs, Luminaires and Traffic Signals*. Upon request, the Engineer will
 7 provide the Contractor with copies of the shop drawings for existing overhead sign
 8 supports.

9 Attach a new sign above a designated existing overhead sign in accordance with the
 10 contract. Furnish all new structural members and mounting hardware necessary to
 11 erect the new sign.

12 **(C) Type D, E, F and Milemarkers**

13 Attach the signs to U-channel or perforated square tube supports

14 **(D) Overlay (Ground Mounted and Overhead)**

15 Attach overlays to designated existing ground mounted or overhead signs as required by
 16 the contract.

17 Remove and dispose of all conflicting demountable legends, borders and overlays before
 18 attaching new overlays. Employ any method of removal necessary, provided it does not
 19 damage the existing sign or the attached overlay. Perform such minor repairs to existing
 20 signs as necessary before the attachment of overlays to ensure a finished sign face that is
 21 completely flat.

22 Field-drill 5/32" holes in both the overlay and the existing sign simultaneously, according
 23 to the rivet spacing requirements shown in the contract. Attach the proposed overlays
 24 with 1/8" diameter aluminum rivets of the "pull-through" type. Exercise sufficient care
 25 in attaching the overlays to ensure that the finished sign face is completely flat and
 26 without any ripples and/or buckles.

27 **(E) Reposition Overhead Signs**

28 Reposition existing signs on existing overhead sign supports as required by the contract.
 29 Reposition associated lighting systems and secondary signs along with the signs.

30 When required, drill new holes in the existing vertical attachment members, in order to
 31 maintain a minimum clearance of 17 ft to the roadway surface at the new location on the
 32 structure. No other field drilling will be allowed.

33 Adjust and relocate conduit and junction boxes as required.

34 **(F) Logo Trailblazer**

35 All logos will be made available for pick up at the Division Traffic Services' sign shop.
 36 Erect logos on U-channel or perforated square tube supports in accordance with
 37 Type F sign details shown in the contract.

38 **(G) Logo to Panel**

39 All logos will be made available for pick up at the Division Traffic Services' sign shop.
 40 Attach logos to the mainline signs with ten 1/8" diameter rivets of the pull through type.
 41 Attach logos to the ramp signs with four 1/8" diameter rivets of the pull through type.
 42 Drill 5/32" holes in the background signs to match those in the logos for attaching the
 43 logos to the background signs. Place logos as shown on the contract.

Section 907

(H) Relocation (Ground Mounted) Signs

Maintain signs in good serviceable condition throughout the duration of the project. Repair any areas or materials within the project limits disturbed or damaged in performance of the work required under this section as directed by the Engineer at no cost to the Department.

Remove existing signs from their existing locations and relocate to their new location in accordance with the contract. Repair or replace signs damaged in relocating at no cost to the Department. Refer to Section 907 for disposal of sign components.

Erect signs and supports according to requirements of Sections 903 and 904. Immediately relocate all warning and regulatory signs to new locations. Relocate all other signs to new locations in no more than 12 hours.

904-4 MEASUREMENT AND PAYMENT

Sign Erections (Ground Mounted and Overhead) will be measured and paid as the actual number of ground mounted and overhead signs erected and accepted. Each type F sign assembly will be measured as one sign.

Sign Erection, Relocate Type ____ (Ground Mounted) will be measured and paid as the actual number of signs acceptably relocated. Secondary signs will be incidental work in conjunction with the primary sign. Sign assemblies consisting of more than one sign panel will be considered one sign.

Payment will be made under:

Pay Item	Pay Unit
Sign Erection, Type ____ (Overhead)	Each
Sign Erection, Type ____ (Ground Mounted)	Each
Sign Erection, Type ____	Each
Sign Erection, Milemarkers	Each
Sign Erection, Overlay (Overhead)	Each
Sign Erection, Overlay (Ground Mounted)	Each
Sign Erection, Reposition Overhead	Each
Sign Erection, Logo to Panel	Each
Sign Erection, Logo Trailblazer	Each
Sign Erection, Relocate Type ____ (Ground Mounted)	Each

SECTION 907

DISPOSAL AND STOCKPILING OF SIGNING COMPONENTS

907-1 DESCRIPTION

Properly dispose of or stockpile signing components.

907-2 CONSTRUCTION METHODS

(A) General

Repair any areas or materials within the project limits disturbed or damaged in performance of the work required under this section as directed by the Engineer.

(B) Removal

Do not remove existing signing components until required replacements have been erected and are available for use by traffic or are available for immediate replacement.

Remove signing components by methods that will not damage other portions of the project or facility. Repair any damage by methods satisfactory to the Engineer.

1 Cut and remove electrical conduit to at least 18" below finished ground elevation. Plug
2 or seal the ends of the cut conduit by methods approved by the Engineer.

3 Remove foundations, including any reinforced steel or anchor bolts, to a minimum depth
4 of 2 ft below the finished ground elevation unless otherwise indicated by the contract.

5 Promptly backfill and compact areas disturbed by removal of foundations with suitable
6 materials and match the finished ground elevation. Seed disturbed areas in accordance
7 with Section 1661.

8 **(C) Disposal**

9 All materials to be removed and disposed of will become the property of the Contractor.
10 Promptly transport the materials from the project after they have been removed unless
11 otherwise permitted by the Engineer.

12 Promptly dispose of the concrete, reinforcing steel and anchor bolts from the project.

13 **(D) Stockpile**

14 Before stockpiling, remove signs from supports. The Department maintains ownership of
15 all materials to be stockpiled. Transport and stockpile designated items to locations
16 approved by the Engineer. Sort and stockpile all materials neatly in stacks or storage
17 bins. Repair or replace materials damaged in removal or while in storage.

18 **907-3 MEASUREMENT AND PAYMENT**

19 *Disposal of ____ and Stockpile ____* will be measured and paid as the actual number of
20 signing components acceptably disposed or stockpiled. Removal is incidental to stockpiling
21 and disposal. Secondary signs will be incidental work in conjunction with the primary sign.
22 Sign assemblies consisting of more than one sign panel will be considered one sign.
23 Overhead sign systems include signs, supports, walkways and all electrical components. Sign
24 systems include signs, supports and foundations. Supports include any foundations.

25 Repair or replacement of any materials or areas within the project limits disturbed or damaged
26 in performance of the work required under this section will be at no cost to the Department.

Section 907

1 Payment will be made under:

Pay Item	Pay Unit
Disposal of Sign System, Overhead	Each
Disposal of Sign System, Steel Beam	Each
Disposal of Sign System, U-Channel	Each
Disposal of Sign System, Wood	Each
Disposal of Sign, A, B or C, (Ground Mounted)	Each
Disposal of Sign, A or B, (Overhead)	Each
Disposal of Sign, D, E or F	Each
Disposal of Sign, Milemarker	Each
Disposal of Sign, Overlay (Overhead)	Each
Disposal of Sign, Overlay (Ground Mounted)	Each
Disposal of Support, Overhead Structure	Each
Disposal of Support, Steel Beam	Each
Disposal of Support, U-Channel	Each
Disposal of Support, Wood	Each
Disposal of Lighting System	Each
Disposal of Lighting Fixtures	Each
Disposal of Walkway	Each
Stockpile Sign System, Overhead	Each
Stockpile Sign System, Steel Beam	Each
Stockpile Sign System, U-Channel	Each
Stockpile Sign System, Wood	Each
Stockpile Sign, A or B, (Overhead)	Each
Stockpile Sign, A, B or C, (Ground Mounted)	Each
Stockpile Sign, D, E or F	Each
Stockpile Sign, Milemarker	Each
Stockpile Support, Overhead Structure	Each
Stockpile Support, Steel Beam	Each
Stockpile Support, U-Channel	Each
Stockpile Support, Wood	Each
Stockpile Lighting System	Each
Stockpile Lighting Fixtures	Each
Stockpile Walkway	Each