DIVISION 9

SIGNING

SECTION 900
GENERAL REQUIREMENTS FOR SIGNING

900-1 DESCRIPTION

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

900-2 ACCEPTANCE OF SIGNS

Prior to 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 under the supervision 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, transportation, and storage of the signs will be cause for rejection of the signs.

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 prior to 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 and/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, D, E, and F ground mounted signs will be shown in the contract. In lieu 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 *Manual on Uniform Traffic Control Devices,* published by FHWA.

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 that have been erected on roads to traffic, but that are not yet applicable to traffic. Keep signs or portions of signs covered until instructed to remove the covering. Provide covering for entire signs by method approved 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
SIGN FABRICATION

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
Signs and Hardware	1092-1
Retroreflective Sheeting	1092-2

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 Signing Engineer.

All items shall be fabricated to within 3 mm of exact measurements.

Scribe each sign, shield, arrow, overlay and/or blank on the back with the month and year of manufacture and the metal treater of the aluminum sheets.

Do not begin fabrication for Type A & B signs until S dimensions 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 3 mm.

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. 3657 mm x 1219 mm] with a black permanent marker with numbers a minimum of 50.8 mm in height and located near the self-adhesive sticker.

(B) Department and Contractor Furnished Signs

The contract will show 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, backing plates, mounting bolts, washers, shims, and nuts.

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

Confirm in writing a minimum of 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 NC 39 near Bunn, North Carolina, unless otherwise indicated in the Specifications. Provide for all transportation.

The Engineer will inspect and approve the signs before they are packaged and crated for shipment. Any inspection by the Contractor will be done at no cost to the Department. Take delivery of all signs within 60 days of the date requested or the date they are made available, whichever occurs last, and within 96 hours of receiving the first sign. The Engineer shall approve any exception to the above delivery procedure. At the time the signs are delivered to the project, provide to

the Engineer one copy of the sales ticket furnished with the signs. Signs stored beyond these dates incur a storage fee of 5% of the cost of the sign per month or portion thereof.

After taking possession of the signs, be responsible for any damage and/or theft that occurs to signs prior to final acceptance by the Engineer. Comply with the reflective sheeting manufacturer's recommendations for handling, transporting, erecting, and storage of the signs. Acceptably repair or otherwise correct any damage to the signs or refabricate them at no cost to the Department. When requested by the Contractor, the Department may have the necessary repairs made, or the signs refabricated, and deduct the associated costs thereof from monies due the Contractor.

(C) Signs

Construct all signs, supporting frames and assemblies in accordance with the details shown in the contract.

TABLE 901-1
SIGN TYPE PARAMETERS

SIGN TYPE	VERT. AND HORIZ. DIMENSIONS mm	ALUMINUM PANELS (3657 mm x 1219 mm)	HORIZONTAL Z BARS	ALUMINUM THICKNESS mm
A	1. Vertical or Horizontal > 3657 or 2. Vertical and Horizontal > 1219	Multiple	Yes	3.2
B	1. Vertical and Horizontal ≤ 3657, and 2. Vertical or Horizontal ≤ 1219	Single	Yes	3.2
D		Single	No	See Table 901-2
E		Single	No	See Table 901-2
F		Single	No	See Table 901-2

(1) Type A Signs

Fabricate Type A signs from multiple 3.2 mm aluminum sheet increments, with welded studs for attachment to the supporting frame. Type A signs may be fabricated from multiple 2.0 mm aluminum sheet increments, with the use of very high bond acrylic foam tape capable of obtaining 966 kPa tensile adhesion, for attachment to the supporting frame.

Use aluminum sheets with increments of 1.2 m in width; except, for sign widths that are not multiples of 1.2 m, a maximum of two (2) panels may be cut to less than 1.2 m. No panel may be cut to less than 305 mm. Mount aluminum sheet increments vertically, and provide with backing strips at the vertical joints, held firmly in place, to keep the abutting sheets in proper alignment. Leave a minimum space of .50 mm to a maximum space of .80 mm between each panel.

Fabricate signs with a height of 3657 mm or less, without horizontal joints. One horizontal joint will be permitted for signs that are more than 3657 mm

in height. Locate the joint near the mid-height of the sign. Construct this joint according to the details as shown in the contract.

(2) Type B Signs

Fabricate Type B signs from single 3.2 mm aluminum sheets, with welded studs for attachment to the supporting frame. Type B signs may be fabricated from single 2.0 mm aluminum sheets, with the use of very high bond acrylic foam tape capable of obtaining 966 kPa tensile adhesion, for attachment to the supporting frame

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

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

Construct Type E and F signs in accordance with the FHWA Standard Highway Signs or the NC Supplement to the MUTCD. 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 Types 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 from 1.6 mm aluminum sheeting, unless otherwise required by the contract. 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

TABLE 901-2
ALUMINUM THICKNESS REQUIREMENTS FOR SIGNS

VERTICAL OR HORIZONTAL DIMENSION mm	THICKNESS mm
0 - 302.3	.80
304.8 – 911.9	1.6
914.4 – 1216.7	2.0
1219.2 and larger	3.2
Milemarkers	2.0
Overlays	1.6

(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 prior to 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 1.1 to 3.8 mg per square decimeter on the entire surface area including along the edges of the sign substrate with a median of 2.75 mg per square decimeter as the optimum coating weight. The coating shall not appear dusty when wiped with a clean, lint-free cloth and shall not show excessive buildup at edges. Sand smooth all burrs and scratches before applying retroreflective sheeting, however 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-section stringers with vertical aluminum bar stiffeners in accordance with the details and dimensions shown in the contract. Use a nylon washer to attach all through- bolts with a minimum play of 4.8 mm. 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. Use an inert gas shielding atmosphere around the stud at the time of weld, if the manufacturer of the stud welding equipment, or studs to be used, recommends its use. 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 and B 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 the requirements of Article 1092-2 of the *Standard Specifications*.

Take retroreflectometer readings on all four 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 through-bolts by removing the affected sheeting from the metal. Then patch this area with a circular patch encompassing an area 6.4 mm 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 25.4 mm 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.

The retroreflective sheeting shall be prequalified and "Approved for Use". Obtain and assign to the Department in writing warranties for sign sheeting used in the fabrication of all permanent signs supplied by the Contractor from the Sheeting Manufacturer. Warrant the signs against defective reflective sheeting per the requirements outlined in the current signing contract held by the Department. NOTE: Permanent signs include types A, B, D, E, and F signs, overlays for all sign types, and milemarkers, and excludes 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 given in the following table:

Table 901-3
Sign Patching Limits

SIGN AREA	During Fabrication		Additional Patches After Field Erection	
SQ. METERS	Max. No. Patches per sign	Max. Patch Size per Patch Sq. mm	Max. No. Patches per sign	Max. Patch Size per Patch Sq. mm
0 to 1.4	0	0	0	0
1.41 to 4.65 (Single Panel)	1	645	1	645
2.79 to 7.43 (Increment Panel)	2	1290	1	1290
7.44 and Greater	*	1935	*	1935

* Average not to exceed 1 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 requirements of the latest edition of the *Standard Highway Signs*, prepared by the Federal Highway Administration. Use border widths, and design of route shields and arrows that conform to the requirements of the MUTCD.

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

Space and size of all legends and borders as shown in the contract or in 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, and use those that are of the type and color shown in the contract.

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

Use aluminum backing made of a minimum of .80 mm thick aluminum sheet 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.

Supply each letter, numeral, arrow, border, and shield with mounting holes, and secure to the sign surface with non-twist corrosion resistant aluminum rivets. Use letters, numerals, arrows, and borders that have rivets on all sides and ends spaced not more than 152.4 mm on centers, measured along the edges. Make sure that each legend piece has at least 1 rivet in each corner and at least 2 rivets in each end. Attach route shields as part of Type A or B signs with aluminum rivets spaced a maximum of 228.6 mm apart, measured along the edges of the shield(s).

Use a 6.4 mm diameter nylon washer under the head of all pull through type rivets for all demountable copy and shields.

(I) Silk Screening

Apply all legends and borders on Types E & F signs by silk-screening or reverse silk-screening after the sheeting is attached to the panels. Perform all screening as recommended by the manufacturer of the retroreflective sheeting. Use the color of all legends, borders, and backgrounds, and their placement on the sign, as shown in the contract.

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

Use transparent ink and thinner, for application on signs reflectorized with white retroreflective sheeting, as manufactured or recommended by the manufacturer of the retroreflective sheeting. Use colors that conform to the FHWA Color Tolerance Charts and AASHTO Designation M268 when thoroughly dry.

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

(J) Mounting Hardware

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

(K) Packaging, Shipping and Storage

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

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

Affix a label outlining the retroreflective sheeting manufacturer's recommendations for handling, transporting, and storing all types of signs to each

shipping carton or crate. Provide full details of such recommendations with each shipment of signs.

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

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

Individually rack or separate by foam or slip sheeting on A-frame racks all sheeted panels. Do not use spliced, overlapped, ripped or torn slipsheeting or foam.

Pack all signs standing at a seventy-five to ninety degree angle.

Turn all panels and sign faces to the inside of the crates, whenever possible.

When crating a one-panel sign, provide the face side with an extra piece of foam and cardboard taped to the outside of the face side of the package.

Pack panels of 2590.8 mm in length or longer in only two per package.

Ensure all signs are debris free on the back side, with no misplaced writing, tape or extraneous sheeting.

Crate to allow a 50.8 mm space on the inside dimensions larger than the size of the largest package.

Store completed Type A and B signs back to back with minimum of 304.8 mm between faces.

When crating two panels of different sizes, place the smaller panel with its face to the back of the larger panel and package with an extra piece of foam and cardboard taped to the outside of the larger panel, with its face to the outside of the crate. Provide extra packaging on both outsides of the package for double-faced signs.

Crate packaged panels to allow the passage of a 3.2 mm spacer on the inside of each side of the crate, so that the panels are not overly tight or binding in crate.

The Contractor shall inspect all signs and packaging before shipping to assure compliance with the contract and Specifications. The Department retains the right to inspect the signs and packaging before shipping.

(L) Transparent Films

Use transparent films in lieu of silk screening when authorized by the Department. Transparent film is a durable, transparent, acrylic colored film coated with transparent, pressure-sensitive adhesive. When the film is applied over reflective sheeting, the coefficient of retroreflectivity shall meet the color and type of sheeting in Tables 1093-1 through 1093-9. The transparent film shall be approved by the Department and must be approved by the manufacturer of the reflective sheeting to insure the materials meet the Manufacturer’s Warranty and Obligation in Section 1093-2 (F).

901-4 INSPECTION PROCEDURE

(A) General

This procedure establishes guidelines of inspection for a consistent method of inspecting the daytime appearance and nighttime reflective performance of sign sheeting. The primary function of a highway sign is to be seen by the traveling public and therefore the sign sheeting shall present a neat and balanced appearance free from visible defects.

Sheeting may be inspected before application to sign blanks, after installation to sign blanks, after completion of the sign in the sign fabricator's facility and after installation. Clean all installed signs prior to final field inspection.

(B) Daylight Visual Inspection

Under day light conditions, inspect the sign sheeting to detect color match problems, non-uniform color, streaks, spots, abrasions or other defects in the sheeting. Judge slight imperfections that may be visible at an extremely close distance and would not be visible in daytime viewing, under the nighttime inspection.

(C) Nighttime Visual Inspection

Inspect the sheeting with an inspection light while holding the inspection light at eye level and looking directly over the top of the light. Inspect to detect color match problems, non-uniform color, streaks, spots, abrasions, blistering or other defects in the sheeting.

(D) Inspection Lights

Use lights to inspect signs during fabrication that are 120 watt, 120 volt reflector flood lamp with a average rating of 1600 lumens. Use a light for field inspection that is a 50-watt, 12-volt spot lamp with a maximum output of 100,000 candlepower. In either case, use an inspection light will be bright enough to cause the sheeting to reflect, but not so bright as to cause the sheeting to be brilliantly illuminated.

(E) Silk Screening

The area supervisor will inspect the first five signs of each screening and then every fifth sign. When unacceptable signs are found, all signs shall be inspected individually.

Only three nonwets per 0.09 square meters, no larger than 1.6 mm in diameter, covering no more than one third of the total area of the sign are allowable. This includes nonwets from either the sheeting or the screen-printing.

Only one tadpole per 0.56 square meters, no longer than 38.1 mm and not readily visible under lighted inspection is allowable.

901-5 MEASUREMENT AND PAYMENT

Sign fabrication will be measured and paid for as the actual number of square meters of sign face areas of each type, including milemarkers and overlays, that have been acceptably fabricated. In measuring this quantity, the sign face areas will be calculated to the nearest 1/100 of a square meter, using the dimensions shown in the contract.

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

Payment will be made under:

Pay Item	Pay Unit
Contractor Furnished, Type ___ Sign	Square Meter
Department Furnished, Type ___Sign	Square Meter

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

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 150 mm 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. Perform the excavation so that the sides of the excavation area conform as nearly as possible to the required dimensions. Place concrete against undisturbed soil.

Construct concrete sign foundations in accordance with Section 825. Construct either reinforced or plain Class A concrete foundations as shown in 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 150 mm 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. Give the concrete an ordinary surface finish.

902-4 MEASUREMENT AND PAYMENT

The quantity of reinforced and plain concrete to be paid for will be the actual number of cubic meters of concrete that has been incorporated into the completed and accepted foundation. Computing the number of cubic meters 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 meter.

Payment will be made under:

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

SECTION 903
GROUND MOUNTED SIGN SUPPORTS

903-1 DESCRIPTION

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

The types of supports covered by this section are:

(A) Breakaway steel beam sign supports

(B) Simple steel beam sign supports

(C) 4.5 kg steel U-channel posts

(D) 3.0 kg steel U-channel posts

(E) Barrier sign support assembly

(F) Wood supports

(G) Steel square tube posts

903-2 MATERIALS

Refer to Division 10.

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

903-3 CONSTRUCTION METHODS

(A) Location and Field Verification

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

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

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

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

(B) Clearing for Sign Sight Distance

Clear vegetation in front of signs where necessary to achieve proper sight distance to the sign. The sight distance area includes the triangular region of land extending from the edge of the travel lane 244 m in advance of the sign to 1.2 m beyond the furthest edge of the sign from the travel lane. The Engineer will determine where clearing is required, and the amount of clearing at the sign locations. Perform the clearing in accordance with Section 200. Clearing work required outside of the original project limits will be paid for as Supplementary Clearing and Grubbing.

(C) Breakaway Steel Beam and Simple Steel Beam

Fabricate and install the supports as shown in the contract. Punch, cut, or weld supports prior to galvanizing. Galvanize each component part in accordance with ASTM A123 prior to assembly. Provide supports that are uniformly straight to within 3.2 mm tolerance for pieces less than 6.1 m in length and 6.4 mm tolerance for pieces over 6.1 m in length.

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

Provide supports that are plumb. Do not shim the supports. Take adequate care during erection of supports to prevent damage to the surface finish. Use two coats

of an approved organic non-aerosol zinc repair paint in touching up damaged areas on all galvanized materials.

(D) Steel U-Channel

Use 4.5 kg galvanized steel U-channel posts for Types D, E, and F signs. Use 3.0 kg galvanized steel U-channel posts for milemarkers. Use posts of sufficient length to permit the appropriate sign mounting height or splice posts if required as shown in the contract.

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

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

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

Use two coats of an approved organic non-aerosol zinc repair paint in touching up the tops of U-channel posts that may have been damaged in driving, cut ends of U-channel posts, frames and cross-bracing, and damaged areas on these and all other galvanized materials.

(E) Barrier Supports

(1) (Small)

Attach brackets and U-channel posts to the median or shoulder barrier for the erection of Type E Signs, Type F Signs, or Milemarkers as required in the contract.

(2) (Large)

Attach brackets, anchorage and pipe posts to the median or shoulder barrier for the erection of Type E Signs as required in the contract.

(F) Wood Supports

Use wood supports as shown in the contract.

Replace any post that is damaged during erection.

Breakaway wood supports shall be drilled in accordance with the contract. All wood supports larger than 101.6 mm x 101.6 mm that have not been drilled shall be behind guardrail.

(G) Steel Square Tube Supports

Use square tube posts as shown in the contract. Use posts of sufficient length to permit the appropriate sign mounting height or splice posts if required as shown in the contract.

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

Replace any post that is bent or otherwise damaged in driving.

Do not weld or cut supports in the field.

Use two coats of an approved organic non-aerosol zinc repair paint in touching up damaged areas on the posts.

903-4 MEASUREMENT AND PAYMENT

The supports specified in this Specification that have been installed and accepted will be measured for payment as follows:

The actual number of kilograms of structural steel. The computed nominal weights shown in the final revised plans will be used in determining this quantity. Measurement will not be made of the weight of nuts, bolts, and washers that are part of the sign support, as they will be considered incidental to the work.

Actual number of linear meters of 4.5 kg steel u-channel posts incorporated into the completed and accepted supports and assemblies. Measurements of length will be made to the nearest 1/10 of a meter.

Actual number of 3.0 kg steel U-channel post.

Actual number of Supports, Barrier (Small) and (Large).

Actual number of linear meters of wood support incorporated into the completed and accepted supports. Measurements of length will be made to the nearest tenth of a linear meter. The computed linear meters of sign supports, as indicated in the final revised plans will be used in determining this quantity.

Actual number of linear meters of steel square tube posts incorporated into the completed and accepted supports and assemblies. Measurements of length will be made to the nearest tenth of a meter.

Payment will be made under:

Pay Item	**Pay Unit**
Supports, Breakaway Steel Beam	Kilogram
Supports, Simple Steel Beam	Kilogram
Supports, 4.5 kg Steel U-Channel	Linear Meter
Supports, 3 kg Steel U-Channel	Each
Supports, Barrier (Small)	Each
Supports, Barrier (Large)	Each
Supports, Wood	Linear Meter
Supports, Steel Square Tube	Linear Meter

SECTION 904
SIGN ERECTION

904-1 DESCRIPTION

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

The types of signs covered by this Specification are:

(A) Type A (Overhead) signs
(B) Type A (Ground Mounted) signs
(C) Type B (Overhead) signs
(D) Type B (Ground Mounted) signs
(E) Type D signs
(F) Type E signs
(G) Type F signs
(H) Milemarkers
(I) Overlay (Overhead) signs
(J) Overlay (Ground Mounted) signs
(K) Reposition (Overhead) signs
(L) Logo Trailblazer
(M) Logo to panel
(N) Relocation (Ground Mounted) signs

904-2 MATERIALS

Refer to Division 10.

Item	Section
Signing Materials	1092
Organic Non-Aerosol Zinc Repair Paint	1080-9

904-3 CONSTRUCTION METHODS

(A) General

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

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

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

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

(B) Type A and B

(1) General

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

(2) Ground Mounted

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

(3) Overheads

For new overhead supports, erect overhead secondary signs as shown in the approved shop drawings.

For existing overhead supports, design and furnish all new structural members and mounting hardware necessary to erect the new signs. Prepare and submit to the Engineer for approval complete shop drawings and design computations for the bracing and accessory hardware required to attach the sign to the existing overhead sign support. Prepare the design in accordance with the *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, as published by AASHTO, the structure line drawings and wind speed shown in the contract. Upon request, the Engineer will provide the Contractor with copies of the shop drawings for existing overhead sign supports.

Attach a new sign above a designated existing overhead sign as shown in the contract. Furnish all new structural members and mounting hardware necessary to erect the new sign.

(C) Type D, E, F and Milemarkers

Attach the signs to U-channel or square tube posts as shown in the contract. Use mounting hardware as shown in the contract.

(D) Overlay (Ground Mounted and Overhead)

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

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

Field-drill 4.0 mm holes in both the overlay and the existing sign simultaneously, according to the rivet spacing requirements shown in the contract. Attach the proposed overlays with 3.2 mm diameter aluminum rivets of the "pull-through" type. Exercise sufficient care in attaching the overlays to ensure that the finished sign face is completely flat and without any ripples and/or buckles.

(E) Reposition Overhead Signs

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

When required, drill new holes in the existing vertical attachment members, in order to maintain a minimum clearance of 5.2 m to the roadway surface at the new location on the structure. No other field drilling will be allowed.

Adjust and relocate conduit and junction boxes as required.

(F) Logo Trailblazer

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

(G) Logo to Panel

All logos will be made available for pick up at the Division Traffic Services' sign shop. Attach logos to the mainline signs with ten 3.2 mm diameter rivets of the pull through type. Attach logos to the ramp signs with four 3.2 mm diameter rivets of the pull through type. Drill 4.0 mm holes in the background signs to match those in the logos for attaching the logos to the background signs. Place logos as shown on the contract.

(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 as required in 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 for as actual number of ground mounted and overhead signs erected and accepted. Each type F

sign assembly will be measured as one sign. Payment for signs erected on new overhead sign supports will be made in accordance with the contract Overhead Sign Supports. Walkway pay item will be used only when adding or modifying an existing overhead sign structure.

The amount of sign relocations to be paid for will be the actual number of signs that have been acceptably relocated. Secondary signs will be considered 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, Walkway	Linear Meter
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 at no cost to the Department.

(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.

Cut and remove electrical conduit to at least 450 mm below finished ground elevation. Plug or seal the ends of the cut conduit by methods approved by the Engineer.

Remove foundations, including any reinforced steel or anchor bolts, to a minimum depth of 0.6 m below the finished ground elevation unless otherwise indicated by the contract.

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

(C) Disposal

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

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

(D) Stockpile

The Department maintains ownership of all materials to be stockpiled. Transport and stockpile designated items to location(s) approved by the Engineer. Sort and stockpile all materials neatly in stacks or storage bins.

Repair or replace materials damaged in removal or while in storage at no cost to the Department.

Prior to stockpiling, remove signs from posts.

907-3 MEASUREMENT AND PAYMENT

The amount of disposal or stockpiling to be paid for will be the actual number of signing components that have been acceptably stockpiled or disposed. Removal is incidental to stockpiling and disposal. Secondary signs will be considered incidental work in conjunction with the primary sign. Sign assemblies consisting of more than one sign panel will be considered one sign. Overhead sign systems include signs, supports, walkways and all electrical components. Sign systems include signs, supports and foundations. Supports include any foundations.

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 or B, (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