

Payment for Warning Clusters will be made at the contract unit price each complete in place.

Demountable Reflectorized Kilometer Marker with P-9 Post, Tenth-of-Kilometer Marker with P-9 Post and Tenth-of-Kilometer Marker (excluding post) will be paid for at the contract unit price each complete in place.

Demountable Reflectorized Delineators will be paid for at the contract unit price each complete in place.

Demountable Reflectorized Project Marker with P-9 Post (where applicable) shall be paid for at the contract unit price each complete in place.

Reflectorized Flexible Delineator Posts will be paid for at the contract unit price each complete in place.

Delineation for Guard Rail Termini will be paid for at the contract unit price each complete in place.

### 828.82 Payment Items.

827.21	600 millimeter Warning Cluster (H1-2) - Aluminum Panel (Type A)	Each
827.22	900 millimeter Warning Cluster (H1-2) - Aluminum Panel (Type A)	Each
827.31	Abutment Warning Sign (H1-3) - Plywood Panel	Each
827.33	Abutment Warning Sign (H1-3) - Aluminum Panel (Type A)	Each
828.1	Overhead Guide Sign - Aluminum Panel (Type B)	Square Meter
829.1	Roadside Guide Sign - (MR) - Aluminum Panel (Type B)	Square Meter
830.1	Roadside Guide Sign - (FR) - over 2.25 square meters - Aluminum Panel (Type B)	Square Meter
831.1	Roadside Guide Sign - (FR) - 2.25 square meters and under - Aluminum Panel (Type A)	Square Meter
832.1	Warning - Regulatory and Route Marker - Aluminum Panel (Type A)	Square Meter
833.1	1-WH Demountable Reflectorized Delineator (H1-4)	Each
833.11	1-AM Demountable Reflectorized Delineator (H1-8)	Each
833.2	2-WH Demountable Reflectorized Delineator (H1-7)	Each
833.3	2-AM Demountable Reflectorized Delineator (H1-5)	Each
833.4	3-AM Demountable Reflectorized Delineator (H1-6)	Each
833.5	Demountable Reflectorized Delineator - Guard Rail	Each
833.7	Delineation for Guard Rail Termini	Each
834.	Demountable Reflectorized Kilometer Marker	Each
834.1	Demountable Reflectorized Tenth-of-Kilometer Marker	Each
834.11	Demountable Reflectorized Tenth-of-Kilometer Marker (Excluding Post)	Each
834.17	Reflectorized Flexible Delineator Post (Amber)	Each
834.18	Reflectorized Flexible Delineator Post (White)	Each
835.	Demountable Reflectorized Hazard Marker (H1-1)	Each
836.	Demountable Reflectorized Project Marker with P-9 Post	Each
836.1	Demountable Reflectorized Project Marker (Excluding Post)	Each
836.5	Demountable Reflectorized Station Marker with P-9 Post	Each
836.6	Demountable Reflectorized Station Marker (Excluding Post)	Each

## SECTION 840

### SIGN SUPPORTS

#### DESCRIPTION

#### 840.20 General.

The work to be done hereunder consists of the fabrication and erection of steel structural supports on 30 MPa - 40 mm - 335 kg Cement Masonry Foundations.

The Contractor may select any structural sign support system meeting the design criteria of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals" (Current Edition) unless otherwise standardized by the Department. Acceptance of the structural sign supports system will be contingent upon the

review and approval of Shop Drawing submitted by the Contractor.

The plans for foundations and ground mounted supports shall be based on the data included on plans titled "Standard Sign Support Foundations" and "Standard Ground Mounted Sign Supports – Breakaway Design." The plans for overhead structures shall conform to the requirements of Section 828.21.

In the absence of boring samples, or the actual determination of the soil properties at the proposed spread footing location, the Department will accept an assumed soil bearing pressure of 100 kiloPascals for the design of the spread footing. Boring samples or actual determination of soil properties are required for core footings.

All unsuitable material within the limits of the footing must be removed at the direction of the Engineer (Peat, organic material, material that has been dumped, etc.).

The concrete for the footing shall be placed immediately after excavation to prevent water from collecting in the excavated area.

All overhead and cantilever sign support structures shall be designed so as to be supported by single poles or end frames having not more than two (2) vertical main members.

All overhead and cantilever sign structures shall have as an integral part of the structure, a Department approved damping device, which shall be installed during erection of the structure.

The damping devices shall be installed as follows:

Overhead structures shall have the damping devices installed at the midpoint of the span (plus or minus 300 millimeters), regardless of sign panel location.

Two-chord structures shall have the damper attached to the top chord at mid-span.

Tri-chord structures shall have the damper attached to the middle chord at mid-span.

Box truss structures shall have the damper attached to the rear top chord at mid-span.

Cantilever structures shall have the damper attached to the outer end of the horizontal member.

Existing structures which do not have damping devices shall have dampers installed as part of the contract.

Existing structures, which have dampers not attached as specified above, shall have them removed and attached as specified above.

The approximate locations for the new signs are shown on the plans, the exact locations to be determined by the Engineer on the project.

The Department will mark or stake the center point for each sign foundation only once whereupon it shall be the responsibility of the Contractor to furnish and set at his/her own expense all tie and construction stakes necessary for the erection of the sign.

All measurements to fabricate and erect the overhead sign structures and supports for ground mounted signs shall be made by the Contractor. Field measurements needed to determine the exact span and height of each structure should be taken immediately upon award of the Contract for incorporation in the structural layout on the shop drawings prior to submission for review.

The Contractor shall submit all design work, together with hand or computerized calculations and plans used for design purposes, to the Department; these to become the property of the Department and for which he/she shall receive no additional compensation. All design work shall bear the seal of a Registered Professional Engineer registered in Massachusetts.

Certificates of compliance shall conform to the requirements of Subsection 6.01.

Before fabricating the sign support structures the Contractor shall submit erection plans and shop drawings for approval of the Engineer in accordance with Subsections 5.02, 828.21 and 960.60 of these Specifications. Span lengths, post heights, vertical and horizontal clearances, material specifications (grade and/or alloy), anchor bolt layout, and all pertinent information shall be included on the shop drawings. Provisions for cambering shall also be shown to insure that horizontal cross beams will not deflect below the horizontal.

A handhole 100 millimeters x 175 millimeters (minimum size) with frame and cover shall be installed in each overhead support structure post and positioned approximately 300 millimeters above the top of footing. The frames and covers shall be the same material as the posts. A removable cap with set screws shall be furnished on the top of each overhead support structure post.

All supports for ground mounted signs shall be of the "Breakaway" type. The design, fabrication and erection shall conform with the plans.

The work to be done hereunder shall include the furnishing and installation of Breakaway Post Assemblies for ground mounted signs (not guide), in accordance with Department Standard Drawings and as shown on the plans.

This specification covers the use of standard, tapered, square, rectangular, round and special shape structural

metals for sign supports.

Breakaway sign supports shall be designed and fabricated in conformance with plans titled "Standard Ground Mounted Supports Breakaway Design."

All vertical supports shall be erected plumb.

Both ends of each truss spanning a roadway shall be set at the same elevation.

Sign panels shall be mounted symmetrically about the horizontal truss or beam and provide a minimum vertical clearance above the roadway surface as shown on the plans.

## MATERIALS

### 840.30 General.

All materials shall be new and shall meet the requirements specified in the following Subsections of Division III, Materials:

30 MPa - 40 mm - 335 kg Cement Concrete Masonry	M4.02.00
Reinforcing Steel	M8.01.0
Anchor Bolts	M8.01.5
Steel Sign Supports	M8.18.5

## FABRICATION

### 840.40 General.

Welding shall conform to the applicable provisions of Subsection 960.61 of the Standard Specifications.

No transverse welds will be permitted in the tubular shafts, except at the base plate and flange plate connections or where reinforcing sleeves are required. The shaft shall telescope the flange and the base plate and be welded by two continuous welds, one on the inside of the plate at the end of the shaft and the other on the outside surface of the plate. All welds shall develop the full strength of the section at the point of connection.

## CONSTRUCTION METHODS

### 840.60 General.

Work hereunder includes excavation, reinforcing steel 30 MPa - 40 mm - 335 kg cement concrete masonry, anchor bolts, backfilling, grading and all other labor, material and equipment required to construct foundations conforming to the details shown on the plans and as directed.

Single pole foundation holes, except in ledge, shall be excavated by the auger method to the neat lines of the outside dimensions of the footings without disturbing the soil around or below the proposed footing.

In areas where rock or ledge is encountered the bottom of the footing shall be placed to the design depth shown on the typical detail plan. Concrete for footings where rock has been excavated shall fill the entire volume of the excavation to the full depth of footing as designed.

Concrete foundations shall be poured monolithically to grade, except that where the foundation requires a spread footing it may be poured separately and the pedestal then poured to grade. The lower portion of the footing may be poured separately and the pedestal then poured to grade. The lower portion of the footing may be poured against the embankment but the top 150 millimeters below finished grade shall be formed.

Anchor bolts shall be set to conform with the base-plate template as furnished in conformance with the typical detail plans.

The top of the foundation shall be properly finished and dressed to assure that full bearing will be provided on the leveling nuts which are to be set in concrete. All exposed edges shall have a 13 millimeter chamfer. Drain grooves shall be provided as shown on the typical plans.

Backfill for foundations, if required by the Engineer, shall be gravel borrow conforming to the requirements of Subsection M1.03.0 of the Standard Specifications, except that no stone having any dimensions greater than 32 millimeters shall be allowed.

The gravel shall be placed in layers not exceeding 150 millimeters in depth before compaction. Each layer of backfill shall be thoroughly compacted by use of power tampers to a minimum of 95% density. All backfilling and

compaction shall be in accordance with the applicable provisions of Subsection 150.64 of these Specifications.

### COMPENSATION

#### 840.80 Method of Measurement.

The foundation, excavation, backfilling and compaction for foundations and the structural supports shall be considered as one lump sum unit.

Breakaway P-5 Post Assembly, single or double, complete in place, shall be considered as one unit.

#### 840.81 Basis of Payment.

Compensation for the work done under Items 840 through 846 shall be by the lump sum bid price and compensation for Items 847 and 848 shall be at the contract bid price each for Sign Support (not Guide) and Route Marker including Breakaway Post Assembly.

The contract price shall be full compensation for designing, furnishing and erecting the supports, including construction of the concrete bases, steel reinforcement and anchor bolts; furnishing and installing post assembly and all excavation including Class B Rock, gravel backfill and compensation.

#### 840.82 Payment Items.

840.101 to 840.199	Supports for Overhead Guide Sign (OD-1 thru OD-99) Steel	Lump Sum
841.101 to 841.199	Supports for Guide Sign (D6-1 through D6-99) Steel	Lump Sum
842.101 to 842.199	Supports for Guide Sign (GF-1 through GF-99) Steel	Lump Sum
843.101 to 843.199	Supports for Guide Sign (D10-1 through D10-99) Steel	Lump Sum
844.101 to 844.199	Supports for Guide Sign (G1 through G99) Steel	Lump Sum
845.1	Supports for Guide Sign (E5-1) Steel	Lump Sum
846.1	Supports for Guide Sign (E5-1A) (I) Steel	Lump Sum
847.1	Sign Support (Not Guide) and Route Marker w/1 Breakaway Post Assembly - Steel	Each
848.1	Sign Support (Not Guide) and Route Marker w/2 Breakaway Post Assembly - Steel	Each

## SECTION 850

### TRAFFIC CONTROLS FOR CONSTRUCTION AND MAINTENANCE OPERATIONS

#### DESCRIPTION

#### 850.20 General.

Work under this Section consists of providing, installing and maintaining various traffic control devices for the protection of the traveling public and working personnel during construction and maintenance operations, and includes channelizing devices, signs, barricades, markings, lighting devices, and hand signal devices. The design, application, and installation of all devices shall conform to the "Manual on Uniform Traffic Control Devices" latest edition, Part VI, hereinafter referred to as MUTCD, and/or as directed.

The Contractor shall be responsible for the installation of adequate safety precautions for the protection of the traveling public and his/her own personnel.

All materials provided by the Contractor under the items of this section shall remain the property of the Contractor upon completion of the project.

All work under this Section shall conform to the approved Traffic Control Plan.