

## **SECTION 435 - OVERHEAD SPAN VARIABLE MESSAGE SIGN AND VARIABLE SPEED LIMIT SIGN SUPPORT STRUCTURES**

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### **435.01 DESCRIPTION**

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This work shall consist of the fabrication, furnishing, and erection of overhead span Variable Message Sign and Variable Speed Limit Sign (VMS/VLS) support structures, including the required concrete foundations and anchorages, in accordance with the details as shown or as ordered.

Materials and construction methods not specifically covered in the Plans and Specifications shall be in accordance with AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

### **435.02 MATERIALS**

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Materials shall conform to the following Sections and Subsections:

Admixtures and Curing Material .....	906
Electrical Conduit and Fittings .....	918.08
Fasteners .....	909.02
Portland Cement Concrete.....	905.05
Reinforcement Steel for Structures.....	908.01
Steel Pipes for Sign Support Structures.....	909.10
Structural Steel.....	909.01
Zinc Coating (Galvanizing) on Steel .....	909.11
Epoxy Resin Waterproofing .....	923.06

Overhead span VMS/VLS support structures shall be fabricated from the following optional materials:

High-strength low-alloy steel HSS square tubing of the nominal size and thickness of the member as shown on the plans, or fabricated plate with a single longitudinal seam weld of thicknesses and dimensions as called for on the plans.

All bolts, nuts, washers, and bolts of 1/2" in diameter or greater and anchor bolts shall be galvanized. All bolts, nuts, and washers less than 1/2" in diameter shall be manufactured from a stainless steel with a minimum Chromium content of 18% and a minimum Nickel content of 8% (Type 18-8).

Steel surfaces shall be prevented from coming in contact with aluminum surfaces by means of approved pads of Neoprene or similar material placed between the dissimilar metals. Where steel elements are to be bolted to aluminum elements, only stainless steel fasteners shall be used.

Electrodes for welding steel shall be coated or covered electrodes conforming to the requirements of AWS Specification A5.1 for electrodes of the type or types suitable for the conditions of intended use, and must be approved by the Engineer.

Specific appurtenances and materials for the overhead span VMS/VSLs support structures shall be as per the approved bill of materials shown in the plans. Substitutions shall be permissible at the written consent of the Authority.

Variable Message Signs and Variable Speed Limit Sign units shall be furnished to the Contractor by the Authority. The Contractor will be responsible for inspecting the units and verifying that they are in good working order prior to acceptance from the Authority. The Contractor shall take care not to damage the units either in storing or handling after acceptance from the Authority. After acceptance by the Authority, any units which do not function to the satisfaction of the Engineer will be repaired or replaced at no additional cost to the Authority.

### **435.03 SHOP DRAWINGS**

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Shop, erection, and other drawings necessary for the fabrication and erection of sign support structures shall be furnished in accordance with Subsection 104.08.

### **435.04 FABRICATION**

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The fabrication of overhead span VMS/VSLs support structures shall conform to the applicable requirements of AASHTO Standard Specifications for Highway Bridges relating to the construction of "Steel Structures" and to AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 2001, 4<sup>th</sup> Edition with interims through 2006. Welding shall conform to ANSI/AASHTO/AWS D1.1 Structural Welding Code - Steel and the requirements of Subsection 403.06.

The truss of all overhead span VMS/VSLs support structures shall be capable of being cambered to the dimensions as shown on the plans. Cambering shall be accomplished by extending the top chord of the truss and shortening the bottom chord of the truss, or by other acceptable means as approved by the Engineer.

Ends of sections shall be cut true and smooth, free from burrs and ragged breaks. The interior of all tubular members shall be free of loose material, including but not limited to laitance, shavings, cutting fluids, and loose hanging burrs prior to the member being sealed via welded joint fabrication or end cap installation. Open ends of tubular sections shall be capped as shown on the plans. Drain holes shall be provided wherever shown or necessary.

All tube-to-tube joints of the sign support truss shall be fully welded. No splices will be permitted in chord members. All welding shall be performed by qualified welders. Certified proof of the qualifications of welders shall be provided by the Contractor to the Engineer prior to fabrication. Certification shall be from a commercial or public testing laboratory, with qualifications based on the test prescribed in part B, Section IX, of the ASME Boiler and Pressure Vessel Code.

All welding shall be performed in the shop by the inert gas shielded-arc method using electrodes as specified in Subsection 435.02. Welded joints shall be subject to visual inspection by the Engineer and, where deemed necessary, questionable welds shall be tested by radiographic and/or by dye penetrant method. Defects so detected shall be corrected by removing and replacing the entire weld.

Bolt holes shall be drilled to finished size or sub-punched smaller than the nominal diameter of the fastener and reamed to size. The amount by which the diameter of a subpunched hole is smaller than that of the finished hole shall be at least one-quarter the thickness of the piece. The finished diameter of shop drilled holes shall be not more than 1/16" greater than the nominal diameter of the fastener and the finished diameter of field drilled holes shall be not more than 1/8" greater than the nominal diameter of the fastener.

The Contractor shall furnish, fabricate, and install walkway grating, expanded metal fencing, access ladder and door assemblies, and all associated hardware and appurtenances on overhead span VMS/VSLs support structures in accordance with the plans or as directed by the Engineer.

Steel walkway gratings shall be fabricated in accordance with the manufacturer's recommendation, cut to the prescribed sizes, and bolted to the structure truss in accordance with the plans.

The workmanship and finish of fabricated materials shall be equal to the best general practice in modern fabricating shops.

Inspection of Welds. The fabricator shall be required to make his own inspection to maintain quality control. Such inspection shall comply with the provisions of the section on inspection of the American Welding Society Structural Welding Code - Steel (AWS D1.1) by AWS certified welding inspectors in accordance with the appropriate subsections thereof. All welds shall meet the "quality of welds" requirements specified in the sections on "Design of New Bridges" and "Tubular Structures" of the structural welding code. All welds not meeting these quality requirements shall be repaired and/or replaced by the Contractor to meet these requirements and check-tests, with no additional cost to the Authority.

Welds shall be visually inspected as specified for procedures techniques and standards of acceptance in accordance with AWS D1.1.

Welds shall be tested using the magnetic particle inspection procedure in accordance with Subsection 403.06 as follows:

- (1) 100% of the welds between the end frame columns and upper and lower base plates.
- (2) 25% of each other type of weld within the complete structure.

Transverse butt welds shall be tested throughout their entire length using radiographic inspection procedures. Longitudinal seam welds shall be tested throughout their entire length using ultrasonic inspection procedures.

The procedures, techniques, standards of acceptance, and methods of repair shall be in accordance with the requirements of AWS D1.1.

All testing of welds, as herein required, shall be certified by a qualified laboratory engaged by the Contractor and approved by the Engineer. The Contractor shall forward the certifications to the Engineer and shall pay for all costs of weld inspection and certification as herein specified.

The Engineer reserves the right to inspect by nondestructive testing techniques all welds and adjacent base metal as he deems warranted. All such additional testing shall be paid for by the Authority and at no cost to the Contractor.

### **435.05 ERECTION**

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The erection of Overhead Span VMS/VLSL Support Structures shall be in accordance with the applicable provisions of Section 403, the section on "Steel Structures" of the AASHTO Standard Specifications for Highway Bridges, the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals and as specified herein.

The Contractor shall refer to the Plans for project specific details for Maintenance and Protection of Traffic to erect the VMS/VLSL Support Structures.

Attention is directed to Sections 801, 802 of the Standard Supplementary Specifications regarding the maintenance and protection of traffic during work adjacent to or over active roadways. The Contractor is advised that any work on the erection of the overhead span VMS/VLSL support structure or other work that might endanger traffic on active Turnpike roadways shall not be commenced until the proper lane closings have been made or traffic slow downs have been instituted, in accordance with the requirements of Subsection 802.03 of the Standard Supplemental Specification.

After the end frame of the structure has been placed over the anchor bolts onto the leveling nuts, the nuts shall be adjusted until the end frame is truly vertical. The upper nuts shall then be placed and tightened.

Under no circumstances shall the horizontal section of span type support structures be erected before the expiration of the pedestal concrete curing period as specified in Subsection 401.04.

In order to avoid performing any work outside of the limits of the protected interior of the structure truss while over roadways in use, the truss for shall be fully fitted with both the VMS and VLSL units, walkways, and other accessories required shall be fully installed thereon before erecting the complete assembly on to the previously erected end frames. The assembled truss shall be handled and erected with great care and in such a manner as not to damage the truss nor any of the installations thereon.

Details of the exact erection method and procedure the Contractor proposes to use shall be submitted to the Engineer for approval and such changes as may be deemed advisable in the opinion of the Engineer shall be made.

The elevation of the top of the pedestal, together with the end post dimensions and the maximum panel height, have been selected to provide a minimum clearance of 18'-0" from the high point of the roadway cross section. This clearance must be maintained.

Before final acceptance, all metal surfaces shall be cleaned free of oil, grease, soil or other discoloration. Cleaning shall be with suitable solvents or by other approved means to the

satisfaction of the Engineer. If cleaning is necessary after erection over roadways in use, suitable means shall be provided for the protection of traffic during the cleaning operations.

## **435.06 SUPPORT STRUCTURE FOUNDATIONS**

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Before any construction is started on the concrete foundation, the Contractor shall first carefully locate the existing underground facilities within or adjacent to the area of excavation, utilizing hand excavation where necessary. Excavation and backfilling for construction of the footings and pedestals of the various overhead and ground mounted sign support structures shall conform to the requirements of Section 205 and as specified herein.

Preparation and placing of concrete and reinforcement steel shall conform to the requirements of Section 401.

Construction of drilled shaft foundations shall conform to the requirements of Section 436

Care shall be taken not to damage surrounding grassed areas during any of the Contractor's operations. All damaged surfaces of grassed berm and median areas shall be restored to their original conditions after completion of all work on the foundations, VMS/VSLs support structure, and guard rail construction or replacement, in a manner satisfactory to the Engineer.

Topsoiling, seeding, fertilizing, and mulching shall be performed in accordance with the requirements of the Sections of Division 700, and as directed by the Engineer.

Reconstruction of existing Berm and Shoulder Pavement shall be performed in accordance with the requirements of Subsections 303 and 310, as applicable.

Demolition of existing Median Barrier, where required, shall be performed in accordance with Subsection 210. Reconstruction of Median Barrier, where required, will be performed in accordance with Subsection 508.

Removal and Resetting of Guard Rail shall be performed in accordance with Subsection 510.

Temporary or permanent sheeting, as designated on the Plans or directed, shall conform to the requirements of Sections 415 and 416, respectively.

Piles, where required, shall be furnished and driven in accordance with Section 405.

### (A) Excavation and Backfill.

Excavation for overhead sign structure foundations adjacent to active roadways shall be sheeted on at least three sides closest to the roadway in berm areas and on all sides when located in the median, or at other locations where two opposite edges of a footing are less than eleven feet away from the edge of its adjacent shoulders. Sheeting is not required for drilled shaft foundations.

Sheeting shall extend to at least four (4) feet above the adjacent roadway surface. The sheeting shall be provided with flashing amber lights mounted in view of oncoming traffic. Sides of sheeting facing traffic shall be painted white as soon as it is driven.

The bottom of all excavations shall be firm undisturbed earth to provide a suitable bearing area for the foundation. Excavation below the prescribed minimum depth shown on the plans shall be filled with concrete placed directly on the undercut surface, thus increasing the total thickness of the footing by the amount of undercut. Unless ordered by the Engineer to excavate below the prescribed minimum depths, the cost of furnishing and placing such additional concrete shall be borne solely by the Contractor.

All excavations shall be backfilled around the concrete foundation and pedestal and thoroughly compacted up to the surrounding ground lines. Excess excavated materials shall be properly disposed of in a manner satisfactory to the Engineer.

(B) Foundations for Overhead Span VMS/VSLs Support Structures. The foundations for overhead span VMS/VSLs support structures shall be constructed to the shapes, dimensions, and elevations shown on the Plans.

Forms for exposed faces of the pedestals shall be of plywood, using the minimum practical number of sheets for each face. Form ties will not be permitted through the concrete placed above grade.

Anchor bolts shall be set accurately by means of a template and held rigidly in position during the placement of pedestal concrete. Great care shall be taken to ensure orientation of the anchor bolt template is correct prior to placing concrete. The Contractor shall make periodic checks of the bolt positions and elevations during concreting operations. It is essential that the distance between the centers of anchor bolt groups of the two foundations for each overhead sign support frame be exactly the span length shown on the plans at 68°F. Care shall be taken to protect the threaded portions of anchor bolts and the leveling nuts from damage by concrete or equipment.

Concrete shall be placed and vibrated in the pedestal to within approximately three inches of the final top surface elevation of the pedestal, as indicated on the plans. The top surface of the concrete shall be kept wet for at least 24 hours; after which the end supports and bases of the overhead structure shall be set onto the leveling nuts, the nuts adjusted, and the upper nuts placed and tightened. Exposed portions of the top surface shall be sloped down away from the end frame bases. After the curing period has expired, the forms shall be removed and surface defects pointed with a matching mortar to the satisfaction of the Engineer.

Epoxy Resin Waterproofing shall be applied to the tops of the support structure pedestals to the limits shown on the Plans and as indicated in Section 410.03 (D) of the Standard Specifications.

## **435.07 MEASUREMENT**

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Overhead span VMS/VSLs support structures will be measured on a unit basis for each separate sign support structure location.

Concrete Foundations will be measured by the volume of concrete in place with the exception of drilled shafts. Drilled Shafts, regardless of diameter, will be measured in accordance with Section 436.

Concrete Pedestals will be measured by volume of concrete in place.

**435.08 PAYMENT**

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Payment will be made under:

<i>PAY ITEM</i>	<i>PAY UNIT</i>
Overhead Span VMS/VSLS Support Structure_____	Lump Sum

Payment for demolition of median barrier will be made in accordance with Section 210

Payment for construction of median barrier will be made in accordance with Section 508

Payment for restoration of berm and / or shoulder pavement will be made in accordance with Sections 303 and 310, as applicable.

Payment for reinforcement steel will be made in accordance with Section 401.

Payment for piles will be made in accordance with Section 405.

Payment for drilled shafts will be made in accordance with Section 436

Payment for electrical items will be made in accordance with Sections 601-603.

Payment for sheeting will be made in accordance with Sections 415 or 416, as applicable.

Payment for Epoxy Resin Waterproofing shall be in accordance with Section 410

Separate payment will not be made for foundation excavation for overhead span VMS/VSLS support structures.

VMS and VSLS will be furnished to the Contractor by the Authority. Separate payment will not be made for picking-up signs from their place of storage, delivery to the site or installation of the signs onto the sign structures, the costs of which shall be included in the costs bid the Pay Item Overhead Span VMS/VSLS Support Structure\_\_\_\_\_.