

## SECTION 720 - STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS

720.01 Aluminum Supports Extrusions for aluminum supports shall conform to ASTM B221M (ASTM B221) or ASTM B429, Alloy 6061-T6 or 6063-T6. Castings for use with aluminum supports shall conform to ASTM B26/B26M or B108, Alloy 356.0-T6, except that castings for parts having a non-structural application, such as pole caps or bolt covers, may be temper F. The T6 tempers specified for Alloys 6063 and 356.0 shall be obtained by the proper heat treatment of the assemblies after all welding for the base and if required, for the handhole reinforcement has been completed. No welding will be allowed on the shaft other than as required for the attachment of the shoe base, handhole reinforcement and bracket arm. All welding for aluminum light standards shall conform to the current edition of AWS Structural Welding Code - Aluminum D1.2.

The exterior of all parts shall have a satin brushed or satin etched finish. The assemblies shall be free of bulges, dents, and cracks and on external surfaces, discoloration and scratches. The presence of any of these defects or any other imperfection detrimental to strength or appearance may be cause for rejection by the Resident. All assemblies shall be tire wrapped for protection during shipment, storage, and handling.

All ends of shafts open to the weather shall be fitted with a cast-aluminum or formed aluminum cap secured in place with set screws.

All assemblies shall be permanently marked on the edge of the base plate or flange, indicating alloy and temper of base plate/flange and shaft, as well as the diameter and wall thickness of the shaft.

a. Light Standards, Mast Arm Poles, Strain Poles and Dual Purpose Poles Shafts shall be round, tapered and seamless and shall be fabricated as a single continuous unit without splices, except that shafts with a length of over 12 m [40 ft] may be fabricated with one splice at approximately mid-height and dual purpose poles may be fabricated with a splice immediately above the mast arm attachment. The minimum wall thickness of the shaft shall be 4.78 mm [0.188 in]. A hand hole of approximately 0.016 m<sup>2</sup> [25 in<sup>2</sup>] in area, reinforced to maintain the full design strength of the shaft, shall be provided with the handhole center approximately 450 mm [18 in] above the base. Provisions for internal grounding shall be incorporated in the handhole reinforcement. A hole, fitted with a rubber grommet, shall be provided in the shaft to match the wire-way of the

bracket arm or mast arm, except that strain poles shall be provided with a wire inlet as shown on the standard details. Bases shall be shoe type and shall be supplied with suitable covers for the anchor bolts. Anchor bolt covers shall be securely fastened to the base by means of one or more stainless steel Phillips or hex head screws with a minimum size of 6 mm [ $\frac{1}{4}$  in]. Bases shall be welded to the shaft with both an internal and external continuous fillet weld. The use of sleeve type bases or other bases not requiring welding of the shaft to the base and the use of reinforcing sleeves will not be allowed.

Dual-purpose poles shall be provided with a pull wire for the luminaire.

b. Colonial Light Standards Shafts shall be round, tapered and seamless and shall be fabricated as a single continuous unit without splices. The minimum wall thickness shall be 3.175 mm [0.125 in] and the minimum diameter at the base shall be 125 mm [5 in]. The length of the shaft plus the base shall be 4.34 m [ $14\frac{1}{4}$  ft], with a 100 mm [4 in] long by 75 mm [3 in] OD straight section at the top to accept the pole top luminaire. The entire assembly of pole and base shall be black anodized. Bases shall be handhole type with a handhole of approximately 0.016 m<sup>2</sup> [25 in<sup>2</sup>] in area and equipped with an approved locking device on the handhole cover. The bases shall have internal flanges capable of accepting four M20 [ $\frac{3}{4}$  in] anchor bolts, equally spaced on a 250 mm [10 in] diameter bolt circle. The bases shall be welded to the shaft with both an internal and an external continuous fillet weld.

c. Pedestal Poles Shafts shall be round, tapered and seamless and shall be fabricated as a single continuous unit without splices. The minimum outside diameter at the base shall be 150 mm [6 in] and the minimum wall thickness shall be 3.175 mm [ $\frac{1}{8}$  in]. The length of the pole plus the base shall be 3 m [10 ft], except that the length of poles supporting only pedestrian heads shall be 2.4 m [8 ft]. Bases shall be transformer type with suitable covers for the anchor bolts. The bases shall be welded to the shaft with an external and an internal fillet weld.

d. Bridge, Cantilever and Butterfly Type Sign Support Structures The configuration of the foundations, bases, shafts, and trusses shall be of the Contractor's design, as approved by the Engineer, and shall use only material as specified above. Sleeve type bases or other bases not requiring welding to the shaft and the use of reinforcing sleeves will not be allowed.

**720.02 Aluminum Mast Arm and Bracket Arm** Mast arms and bracket arms shall be of the same materials as the matching pole and have a similar finish. Member cross sections shall be either round or elliptical and have a minimum wall thickness of 3.175 mm [ $\bullet$  in]. Internal diameters, bends, joints, and attachments shall permit internal wiring in the upper member of the arms. Fixtures for attaching the arms to the poles shall be either castings or extrusions, sized to meet the design requirements, and shall be designed to prevent rotation of the arms about the poles. Any mechanical means used to prevent rotation shall completely penetrate both the fixture and the shaft and the use of set screws will not be allowed. All welding for aluminum light standards shall conform to the current edition of AWS Structural Welding Code - Aluminum D1.2.

**a. Mast Arms for Signals** Mast arms shall be of the tapered tube truss type design, consisting of an upper and a lower member with vertical struts, welded to form an integral unit or single member tapered arm. Mast arms shall be equipped with sturdy signal hangers and/or appropriate tenons for mounting the signal heads and shall have weatherproof wire inlets located close to the suspended signal heads.

**b. Bracket Arms for Luminaires** Bracket arms shall be of the single member or truss type. Single member type bracket arms shall be of the tapered upsweep design. Truss type bracket arms shall be of a tapered tube design, consisting of an upper and a lower member and a single vertical strut, welded to form an integral unit. Arms shall be equipped with an appropriate tenon for the attachment of the luminaire.

**720.03 Steel Supports** Tapered shafts for steel supports shall conform to ASTM A595, Grade A or approved equal. Straight shafts for steel supports shall conform to ASTM A53, Grade B, ASTM A500, Grade A and B, or an approved equal. Base plates and flanges shall be fabricated of steel plate conforming to ASTM A709M/A709, Grade 250 or 345 [Grade 36 or 50] and sized to transmit the full design load of the shaft. Steel shapes shall conform to the requirements of ASTM A992/A992M. Flange chord splice plates and base plates are considered main load carrying members and shall comply with the requirements of Section 713.01 - Structural Steel. All work shall conform to the applicable provisions of Section 504 - Structural Steel.

The interior and exterior of all support structure components shall be hot-dip galvanized in conformance with AASHTO M111 (ASTM A123).

Chord flange splice fastener assemblies shall conform to ASTM A325M, Type 1, and

galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1). Other fastener assemblies shall be as specified in Section 719.07, or as approved by the Engineer.

All ends of shafts open to the weather shall be fitted with an appropriate cast aluminum or galvanized cast iron cap secured in place with stainless steel set screws conforming to the requirements of ASTM F593.

All assemblies of each structure shall be permanently marked on the edge of the base plate or flange indicating steel specification, type and grade of base plate/flange and shaft, as well as the diameter and wall thickness of the shaft.

a. Light Standards, Mast Arm Poles, Strain Poles and Dual Purpose Poles Shafts shall be round, unless otherwise specified in the contract plans, and either tapered or of uniform cross section and shall be fabricated as a single continuous unit without splices, except that shafts with length over 12 m [40 ft] may be fabricated with one splice at approximately mid-height and dual purpose poles may be fabricated with a splice immediately above the mast arm attachment. The minimum wall thickness of the shafts shall be number 7 gauge. A hand hole of approximately 0.016 m<sup>2</sup> [25 in<sup>2</sup>] in area, reinforced to maintain the full design strength of the shaft, shall be provided with the hand hole center approximately 450 mm [18 in] above the base plate. Provisions for internal grounding shall be provided in a location accessible through the hand hole. A hole, fitted with a rubber grommet, shall be provided in the shaft to match the wire-way of the bracket arm or mast arm, except that strain poles shall be provided with a wire inlet as shown on the standard details. On dual-purpose poles, a pull wire shall be provided for the luminaire.

b. Pedestal Poles Shafts shall be 100 mm [4 in] nominal ID, schedule 40 pipe without splices. The length of the pole plus the base shall be 3 m [10 ft], except that the length of poles supporting only pedestrian heads shall be 2.4 m [8 ft].

c. Bridges, Cantilever, and Butterfly Type Sign Support Structures The configuration of the foundations, bases, shafts, and trusses shall be of the Contractor's design as approved by the Engineer and shall use only material specified above.

720.04 Steel Mast Arm and Bracket Arm Material for mast arms and bracket arms shall be as specified in Section 720.03. Internal diameters, bents, joints, and attachments shall

permit internal wiring in the upper member of the arms. Arms shall be hot dipped galvanized, both inside and outside, in conformance with AASHTO M111 (ASTM A123). All work shall conform to the applicable provisions of Section 504 - Structural Steel.

a. Mast Arms for Signals Mast arms may be of the single member or the truss type. Single member type mast arms shall be a single, straight or tapered, round member and may incorporate a maximum of 2 telescopic splices. Truss type mast arms shall be of a tapered design consisting of an upper and a lower member connected by vertical struts welded to form an integral unit. Mast arms shall be equipped with sturdy signal hangers and/or appropriate tenons for mounting the signal heads and shall have weatherproof wire inlets located close to the suspended signal heads.

b. Bracket Arms for Luminaires Bracket arms may be of the single member or the truss type. Single member type bracket arms shall be of the tapered upsweep design. Truss type bracket arms shall be of a tapered design consisting of an upper and lower member connected by a single vertical strut, welded to form an integral unit. Bracket arms shall be equipped with an appropriate tenon for the attachment of the luminaire.

720.05 High Mast Light Standard High mast light standards shall have a cross section that is either round or polygonal with not less than 12 sides, and shall have a uniform taper from the base to the top, except that an expanded base section may be used, if required, to accommodate the electrical and mechanical equipment. All work shall conform to the applicable provisions of Section 504 - Structural Steel.

For unpainted high mast structures, material for the shaft, base and attachments shall conform to the requirements ASTM A709M, Grade 345W [A709, Grade 50W] or ASTM A595, Grade C.

The base plate and reinforcing components of high mast poles shall be considered main load carrying members and shall comply with the requirements of Table A, Section 713.01 - Structural Steel. If applicable, the Contractor shall submit a proposed coating specification for approval by the Fabrication Engineer.

A Certificate of Compliance shall be provided for all material in accordance with the requirements of the General Statement of Division 700 - Materials.

720.06 Steel H-beam Posts Steel H-beam Posts shall conform to the requirements of

ASTM A992/A992M. All work shall conform to the applicable provisions of Section 504 - Structural Steel. Steel shall be hot-dip galvanized in accordance with AASHTO M111 (ASTM A123). All steel hardware for use with H-beam poles shall be hot-dip galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1).

720.07 Anchor Bolts Anchor bolts and nuts supplied for aluminum and/or steel supports shall conform to ASTM A449, Type 1, or ASTM F1554, Grade 55, both with a minimum yield strength of 380 Mpa [55 ksi]. Anchor bolts shall be supplied with 2 heavy hex nuts and 2 hardened washers and unless otherwise specified the anchor bolts shall have a 90° bend with a 150 mm [6 in] minimum leg length at the lower end. The anchor bolts, nuts and hardened washers shall be hot-dip galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1). The bolt shall be zinc-coated 300 mm [12 in] from the exposed end, unless otherwise specified. If the anchor bolts are to be used with breakaway devices incorporating the function of a nut, for example, longitudinally grooved breakaway couplings, nuts or washers will not be required.

Alternate materials, grades, and designs may be used for the anchor bolts subject to approval of the Engineer.

720.08 U-Channel Posts Except as otherwise authorized, U-Channel posts for signs of less than 0.37 m<sup>2</sup> [4 ft<sup>2</sup>] in area, shall be fabricated of steel weighing 3.7 kg/m [2.5 lb/ft], and shall not be doubled-up. Aluminum U-channel posts having the same strength characteristics as steel U-channel posts may be used, subject to the approval of the Engineer. The steel U-channel posts shall be galvanized in accordance with AASHTO M111 (ASTM A123).

720.09 Wood Ornamental Light Standard Material for wood light standards shall be Western Red Cedar (*Rhuja Plicata*) or other species with equal or better decay resistance, approved by the Engineer.

The wood cross section shall be 250 mm by 250 mm [10 in by 10 in] minimum. The mounting height and depth of burial shall be as shown on the plans.

The following items shall be supplied, a 50 mm [2 in] slipfitter of corrosion resistant material of adequate length to support the luminaire, a sideplowed wire-way covered by a suitable flush filler strip to accommodate three, number 12 conductors, a pair of two-piece plinths for conduit entrance and splice box.

All bolts shall be hot-dip galvanized in accordance with AASHTO M232 (ASTM A153 or B695, Class 50, Type 1).

All parts of the wood light standard shall be prefitted and predrilled, holes shall be counterbored to conceal bolts and filled with mastic compound.

The wood light standard surface finish shall be as indicated on the plans.

720.10 Wood Utility Pole Wood Utility poles shall be Douglas Fir or Southern Yellow Pine, conforming to ANSI Standard Specification 05.1 and of the class and length as indicated on the plans.

Poles shall not have more than 180° twist in grain over the full length. Sweep shall be no more than 100 mm [4 inches]. Tops of poles shall be beveled.

Wood Utility poles shall be pressure treated, after fabrication, with creosote, pentachlorophenol (oil borne), pentachlorophenol liquefied petroleum gas solution or copper naphthenate (oil borne), in accordance with the latest AWWA Specification C4 for pressure treated wood poles.

720.11 Mast Arms for Wood Utility Poles All mast arms for wood Utility pole attachment shall be standard 50 mm [2 in] diameter pipe of specified length and shall include a mast arm head, universal joint, insulated wire inlet, tie rods, cross arm and mounting brackets. The vertical distance between the mast arm and point of attachment of the cross arm shall not be less than 40% of the mast arm length. All attachments for mast arm assemblies shall be designed to withstand stresses due to the mast arm and signal weights and wind loads generated by a 160 km/hr [100 mph] wind.

720.12 Wood Sign Posts Wood sign posts shall be rectangular, straight and sound timber, cut from live growing native spruce, hemlock, cedar or Douglas Fir trees, free from loose knots or other structurally weakening defects of importance, such as shake or holes and heart rot. A tolerance of 25 mm [1 in] in length and 6 mm [¼ in] in width or thickness is permitted in the dimensions of rectangular posts. They shall be sawn true and planed 4 sides. Nominal dimensions of rectangular posts shall be as given in the Contract documents.

Breakaway requirements 100 mm by 150 mm [4 in by 6 in] posts shall have two 38

mm [1½ in] diameter holes drilled perpendicular to traffic, one hole centered at 100 mm [4 in] above ground level and one centered at 460 mm [18 in] above ground level (posts shall be installed with the 150 mm [6 in] length parallel to the roadway); 150 mm by 150 mm [6 in by 6 in] posts shall have two 50 mm [2 in] diameter holes drilled perpendicular to traffic, one hole centered at 100 mm [4 in] above ground level and one centered at 460 mm [18 in] above ground level; 100 mm by 100 mm [4 in by 4 in] posts need not be modified.

When pressure treated wood sign posts are called for on the plans, the wood shall be Yellow Pine, Number 2 or better, .40 CCA, D4 S. The pressure treated wood shall meet AWWA Standard P-5 or Federal Standard TT-W-550. The treating process shall meet Federal Specification TT-W-571, or AWWA Commodity Standards as applicable.

## SECTION 721 - BREAKAWAY DEVICES

721.01 Breakaway Devices Breakaway devices shall be capable of supporting all design loads and shall conform in all respects to the requirements of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals" and all applicable commentary. Breakaway Support Certification of both breakaway and structural adequacy shall be provided by the Manufacturer. Design calculations or test data of production samples to support certification shall be provided. Breakaway support components shall provide the same or greater structural strength as the support post or pole utilizing the breakaway device.

## SECTION 722 - GEOTEXTILES

722.01 Stabilization/Reinforcement Geotextile The geotextile shall have property values expressed as Minimum Average Roll Value (MARV) in the weakest principal direction, which meet or exceed the values stated below. Sampling and conformance testing shall be in accordance with ASTM D4354. Geotextile product acceptance shall be based on ASTM D4759. Geotextile Storage and Handling requirements shall be based on ASTM D4873.

Woven and non-woven geotextiles are acceptable and must meet the following requirements: