

## SECTION 422

### SIGNAL AND LIGHTING STANDARDS

422.1 GENERAL: This work shall consist of furnishing and installing traffic signal standards, street lighting standards, and anchor bolts, in compliance with the specifications, details shown on the plans, and Standard Drawings at the locations shown on the plans, or as established by the ENGINEER.

#### 422.2 REFERENCES.

422.2.1 Aluminum Association Standards, Latest Edition

422.2.2 American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications, Latest Edition

422.2.3 American National Standards Institute (ANSI) Standards, Latest Edition

#### SECTION 300 Stainless Steel

422.2.4 American Society for Testing and Materials (ASTM) Standard Specifications, Latest Edition

A36 Structural Steel

A123 Zinc Coating on Product Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips

A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

A307 Carbon Steel Bolts and Studs; 60,000 psi Tensile

A325 High-Strength Bolts for Structural Steel Joints

B108 Aluminum-Alloy Permanent Mold Castings

B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

M314 Steel Anchor Bolts

422.2.5 National Electrical Manufacturers Association (NEMA) Standards, Latest Edition

422.2.6 National Electrical Code (NEC), Latest Edition

422.2.7 This Publication, Latest Edition:

SECTION 101 PORTLAND CEMENT CONCRETE

SECTION 102 STEEL REINFORCEMENT

SECTION 501 EXCAVATION AND BACKFILL FOR STRUCTURES

SECTION 701 TRENCHING, EXCAVATION, AND BACKFILL

SECTION 1502 SUBMITTALS

422.3 MATERIALS.

422.3.1 STANDARD: A standard will consist of a shaft with a base, anchor bolts, mast arms (if required), and other hardware required to support the traffic signal and highway lighting apparatus.

Types of standards are as follows:

(a) Type I. A pedestal type support for traffic signals, controller cabinets, and splice cabinets.

(b) Type II. A mast arm traffic signal support including shaft, arm, and hardware.

(c) Type III. A combination mast arm traffic signal and roadway luminaire support.

(d) Type IV. A post top luminaire support.

(e) Type V. A mast arm luminaire support.

#### 422.3.1.1 Type I Standard

422.3.1.1.1 The pedestal type support shall be a threaded pole and a threaded (female) square cast aluminum base assembly with set screw(s) as detailed on the plans. The aluminum base shall be a break-away design approximately 15 inches high and shall have a covered hand hole of 8 inches x 8" inches minimum dimension.

422.3.1.1.2 The pole may be fabricated from steel and may be either 4-inch nominal diameter pipe, Schedule 40, or a tapered steel shaft of equal or greater wall thickness.

422.3.1.1.3 Type I Standard, Two Foot: shall be designed to support a post top mounted traffic signal controller or splice cabinet weighing 150 pounds with a projected area of 5 square feet.

422.3.1.1.4 Type I Standard, Ten Foot: shall be designed to support an assembly of traffic signals and signing mounted at the top of the support weighing 150 pounds with a projected area of 15 square feet.

422.3.1.1.5 Type I Standard, Thirteen Foot: shall be designed to support an assembly of traffic signals and signing mounted at the top of the support weighing 150 pounds with a projected area of 15 square feet.

422.3.1.1.6 Type I Standard, Fifteen Foot: shall be designed to support an assembly of traffic signals and signing mounted at the top of the support weighing 150 pounds with a projected area of 15 square feet.

#### 422.3.1.2 Type II Standard

422.3.1.2.1 Standards shall be a "trombone" truss arm design fabricated from either steel or aluminum as designated on plans, in conformance to details on the plans and these specifications. Standards shall in addition conform to the member attachment and size details in the plans for interchange ability and standardization between fabricators.

#### 422.3.1.2.2 Design Requirements

423.3.1.2.2.1 The standard installation shall be designed to support traffic signal heads, back plates, and signing as designated on the Standard Drawings.

423.3.1.2.2.2 Structures shall be designed according to the requirements of the latest edition of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

#### 422.3.1.2.3 Shaft

422.3.1.2.3.1 Steel shafts shall be fabricated from a weldable grade hot rolled steel, having a yield point, after fabrication, of not less than 55,000 pounds per square inch and a wall thickness not less than No. 7 U.S. Standard Gauge (0.1793 inch). The shaft may be round in cross section and tapered at a constant rate. After fabrication, the steel shaft shall be hot dip galvanized according to the requirements of ASTM A 123 and shall be cleaned to provide a uniform and stain free surface. Scratches shall be repaired in the field with an approved paint.

422.3.1.2.3.2 Aluminum shafts shall be fabricated from seamless round tapered tubing of alloy 6063-T6 or 6005-T5 conforming to the requirements of ASTM B 221, having a thickness not less than 0.188 inch. The shaft shall have no welds except at the lower end joining the shaft to the flange base. The shaft shall be finished by mechanical means providing a uniform appearance and shall not require any surface preparation at the time of installation.

422.3.1.2.3.3 A removable pole top cap or mast arm hand hole with cover shall be provided to allow access for the pulling of cable through the shaft.

#### 422.3.1.2.4 Arm

422.3.1.2.4.1 "Trombone" truss arms for Type II standards shall be fabricated from either steel or aluminum as designated on the plans. Material and finish shall be as specified for the shaft except that steel members shall all have a minimum thickness of No. 11 U.S. Standard Gauge (0.1196 inch) and aluminum tubing used in the fabrication shall have a minimum thickness of 0.156 inch.

422.3.1.2.4.2 Length and position of arms shall be as shown on the plans. Arms shall be attached securely to shafts in accordance with details in the plans.

#### 422.3.1.2.5 Transformer Base

422.3.1.2.5.1 Steel transformer bases shall be fabricated from hot rolled mild steel having a yield point of not less than 33,000 pounds per square inch and side wall thickness of not less than No. 7 U.S. Standard Gauge (0.1793 inch). The steel transformer base shall be galvanized after fabrication to the requirements of ASTM A 123.

422.3.1.2.5.2 Aluminum transformer bases shall be a one-piece casting of aluminum alloy 356-T6 complying with the requirements of ASTM B 108.

422.3.1.2.5.3 The bases shall be not less than 20 inches in height and shall have a hand hole with cover of not less than 8 x 12 inches in size, in one side. The transformer bases shall be designed to permit the shaft to be rotated a full 360 degrees and to be aligned irrespective of anchor bolts placement, in conformance to details in the plans.

422.3.1.2.6 Hardware: Hardware must be either steel or stainless steel. Steel hardware shall conform to the requirements of ASTM A 307 or A 325 and shall be galvanized in accordance with the requirements of ASTM A 153. Stainless steel hardware shall conform to ANSI 300 series stainless steel.

#### 422.3.1.2.7 Anchor Bolts

422.3.1.2.7.1 Four anchor bolts shall be furnished with each standard. The bolts may be fabricated from high strength steel bars with a guaranteed minimum yield strength of 55,000 pounds per square inch or steel meeting the requirements of AASHTO M 314. Unless otherwise detailed in plans, the bolts shall be of sufficient size and length to support the structure with the design loads, in accordance to the AASHTO Specifications.

422.3.1.2.7.2 The top of each bolt shall be threaded no less than 8 inches, and the full thread plus 6 inches shall be hot dipped galvanized. Each anchor bolt shall have an "L" bend at the bottom. One leveling nut and one hold-down nut shall be provided with each bolt.

422.3.1.3 Type III Standard: Type III standards shall be fabricated from steel and shall conform to the requirements for Type II standards. In addition, Type III standards shall support a luminaire by means of a shaft extension and arm in accordance with the details shown on the plans. Each arm shall be designed to support a luminaire of 75 pounds and a projected area

of 3.3 square feet. The shaft extensions shall conform to the requirements for Type II standards, except that steel shaft extensions may have a minimum thickness of No. 11 U.S. Standard Gauge (0.1196 inch).

422.3.1.4 Type IV Standard

422.3.1.4.1 Unless otherwise specified on the plans or in the special provisions, Type IV standards shall comply with the requirements for Type V standards, except that a mast arm will not be included on Type IV standards. The shaft shall include a tenon for luminaire mounting.

422.3.1.4.2 When laminated wood, concrete, and fiberglass standards are called for in the plans, only that material shall be used for fabrication, in conformance to the plans and special provisions.

422.3.1.5 Type V Standard

422.3.1.5.1 Standards shall be tapered shafts with davit type mast arm (unless otherwise called for on the plans) and in conformance with the dimensions and details on the plans. Unless otherwise called for in the plans or these specifications, breakaway bases shall be provided.

422.3.1.5.2 Design Requirements

422.3.1.5.2.1 The installation shall be designed according to the requirements of the latest edition of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. Each arm shall be designed to support a luminaire weighing 60 pounds and a projected area of 3.3 square feet.

422.3.1.5.2.2 The following tolerance for straightness of poles shall not be exceeded:

TOTAL MOUNTING HEIGHT (FEET)	STRAIGHTNESS (INCHES)
20	0.75
30	1.00
35	1.25
40	1.50
50	1.75

422.3.1.5.2.3 Dead load deflection should be limited in accordance to AASHTO Specifications.

422.3.1.5.2.4 The standard may be fabricated of spun aluminum, or galvanized steel as designated on the plans.

422.3.1.5.3 Spun Aluminum.

422.3.1.5.3.1 Shaft: Shafts shall be one-piece, seamless tapered tubes of aluminum alloy 6063 and

shall have a final mechanical strength of not less than T6 temper after fabrication. The shaft shall have a wall thickness of not less than 0.188 inch for 40-foot mounting height or less than 0.219 inch for a mounting height greater than 40 feet. The shaft shall have no longitudinal welds and only two circumferential welds which will be located at the lower end for joining the shaft to the anchor base. A one-piece cast aluminum anchor base of aluminum alloy 356-T6 shall be secured to the base. All exposed edges of the plate which make up the base assembly shall be finished smooth, and each base shall be furnished with four bolt covers.

The shaft shall be rotary sand polished and wrapped for protection during handling and shipping.

422.3.1.5.3.2 Mast Arm: Mast arms shall consist of seamless aluminum tubing, aluminum alloy 6063-T6, of the length and shape shown on the plans. Arms shall be attached to the shaft by means of a slip fitter and held in place by bolts as designated on the Standard Drawings. Davit arms shall be installed per manufacturer's recommendations to prevent rotation under wind loads. If arms rotate after erection, the CONTRACTOR shall lower the Type V standard, reassemble the arm, and reinstall the Type V standard with the arm in the proper position.

422.3.1.5.3.3 Hardware: Hardware shall be stainless steel.

422.3.1.5.3.4 Welding: Welding shall conform to the requirements of "Specifications for Aluminum Bridge and Other Highway Structures" published by the Aluminum Association.

422.3.1.5.4 Galvanized Steel.

422.3.1.5.4.1 Shaft

422.3.1.5.4.1.1 Shafts shall be fabricated from steel having a yield strength of not less than 40,000 pounds per square inch after fabrication, with a minimum wall thickness of No. 10 U.S. Standard Gauge (0.1345 inch), except that shafts with an after fabrication yield strength of 55,000 pounds per square inch or greater may have a minimum wall thickness of No. 11 U.S. Standard Gauge (0.1196 inch). The shaft shall be round in cross section and tapered at a constant rate.

422.3.1.5.4.1.2 The shaft shall be one section, except that for mounting heights greater than 50 feet, a two section design with a top section that will slipfit over the bottom section a minimum length of 1½ times the diameter at the point of overlap will be accepted. The shaft section(s) shall be formed into a continuous weld. The shaft shall be attached by two circumferential welds to a baseplate. The base shall be either a one-piece steel casting or fabricated from steel plate with a minimum yield strength of 36,000

pounds per square inch, conforming to any details on the plans.

422.3.1.5.4.2 Galvanizing and Finishing: All exposed welds except fillet welds shall be ground flush with the base metal. All steel poles shall be fully galvanized after fabrication to the requirements of ASTM A 123. After galvanizing, the poles shall be cleaned to provide a uniform and stain-free surface. All scratches due to erection and handling shall be repaired in the field with an approved paint.

422.3.1.5.4.3 Mast Arm: Arms shall be fabricated from the same material as the shaft and shall have a wall thickness of no less than No. 11 U.S. Standard Gauge (0.1196 inch). The separate section davit arm shall be attached by a slip fitter fixed into the shaft or arm and held by stainless steel screws, in conformance to any details in the plans. Davit arms shall be installed per manufacturer's recommendations to prevent rotation under wind loads. If arms rotate after erection, the CONTRACTOR shall lower the Type V standard, reassemble the arm, and reinstall the Type V standard with the arm in the proper position.

422.3.1.5.4.4 Anchor Bolts: Four steel anchor bolts shall be furnished with each Type V standard and shall be fabricated from steel meeting AASHTO M 314 or from other steel with a minimum yield point of 55,000 pounds per square inch. The top of the anchor bolts shall be threaded for approximately 9 inches and shall be galvanized for a minimum of 12 inches. Each anchor bolt shall be furnished with nuts and washers as required for breakaway base utilized or one nut, washer and shim(s) if anchor type base.

#### 422.3.1.5.4.5 Breakaway Bases

422.3.1.5.4.5.1 Unless otherwise noted on the plans, all Type V standards shall be designed to meet requirements for dynamic performance under vehicle impact as specified in the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. All bases shall be designed for a 16-inch diameter anchor bolt circle, unless otherwise noted on plans.

422.3.1.5.4.5.2 Type V standards located behind a barrier or bridge rail and so noted on the plans shall have an anchor base for direct, rigid mounting.

422.3.1.5.4.5.3 Steel standards may utilize a steel slip base or breakaway couplings conforming to the details in the plans. If the total weight of the standard and the luminaire assembly exceeds 600 pounds the CONTRACTOR shall furnish evidence of compliance in the form of test data obtained in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

422.3.1.5.4.5.4 Aluminum standards may utilize either a cast aluminum base or breakaway coupling, conforming to details in the plans. When requested by the ENGINEER, the CONTRACTOR shall furnish evidence of compliance in the form of test data obtained in accordance with the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals. The cast aluminum base shall be inserted a minimum of 12 inches into the shaft and shall be bonded to the shaft with weatherproof structural adhesive to fully develop the required strength.

422.3.1.5.4.5.5 Breakaway couplings shall be designed to be placed between the anchor bolts and the pole base, and of a frangible material that will breakaway under impact (shear). The coupling shall conform to the design and material detailed on the plans. The tensile or compressive strength of the coupling shall equal or exceed that required for the design wind loading of the furnished Type V standard.

422.3.1.5.4.5.6 The coupling installation shall include a "skirt" base cover of a material and design conforming to details on the plans.

#### 422.4 CONSTRUCTION REQUIREMENTS.

422.4.1 Installation shall include the erection of standards complete as shown on the plans, leveling of standards, any required grouting between standard bases and foundations, and the installation of anchor bolts in foundations.

422.4.2 All threaded holes and hubs shall be retapped and sealed against rust by heavy grease or other type of preservative. Required field-made holes (such as for mounting pedestrian push buttons) shall be neatly drilled. Use of a cutting torch will not be permitted.

422.4.3 When torque values are called for on the plans for anchor bolt nuts, breakaway couplings or slip bolts, the CONTRACTOR shall make all adjustments with an approved torque wrench. No other values shall be used unless approved by the ENGINEER.

422.4.4 New foundations for signal and lighting standards will be constructed in accordance with Section 423 - Foundations for Signal and Lighting Installations.

422.4.5 Existing signal and lighting standards to be relocated shall not be removed until new foundations are in place and are accepted by the ENGINEER. The CONTRACTOR shall give the ENGINEER at least five working days notice before removing and resetting designated signal and lighting standards. All shop drawings and other documents of record on the

existing in-place signal and lighting standards will be made available to the CONTRACTOR. All work and material required for rewiring relocated signal and lighting standards shall be included in this work.

422.4.6 Remove and Reset Street Lighting Standard & Luminaire: The CONTRACTOR shall construct new foundations for the Type V standards. The CONTRACTOR shall then remove the existing standards and luminaires and relocate standards and luminaires to the new foundations.

422.4.7 Remove and Reset Signal & Mast arms: The CONTRACTOR shall construct new foundations for the existing Type I or II Standards. The CONTRACTOR shall then remove existing Type I or II standards, traffic signals, and mast arms and relocate the standards, traffic signals, and mast arms to the new foundations.

422.4.8 Remove Existing Foundations: Existing foundations for traffic signal equipment and luminaire standards shall not be removed until the new foundation and conduit system is complete in place and are functioning. The foundation to be removed shall be completely removed or removed to a minimum of 12 inches below grade and backfilled in accordance with Section 701-Trenching, Excavation, and Backfill or as shown on the plans or approved by the ENGINEER.

422.4.9 OWNER Furnished Standards, Mast arms & Roadway Luminaires. When indicated on the plans for the material to be furnished by the OWNER, the CONTRACTOR shall load, haul, and install OWNER furnished lighting standards, mast arms, and roadway luminaires of the types and at the locations designated on the plans in compliance with the Standards Specifications, and as directed by the ENGINEER.

#### 422.5 MEASUREMENT AND PAYMENT.

422.5.1 Signal and lighting standards with anchor bolts will be measured by the unit complete in place.

422.5.2 Removing and resetting street lighting standard and luminaire will be measured by the unit complete in place.

422.5.3 Remove and reset signal standard and mast arm will be measured by the unit complete in place.

422.5.4 Installing OWNER furnished standards, mast arms, and roadway luminaires will be measured by unit complete in place.

422.5.5 Anchor bolts will be measured by the unit complete in place, only when specifically designated on the plans and when signal

and lighting standards are being furnished by others.

422.5.6 The accepted quantities of signal and lighting standards will be paid for at the contract unit price per unit of measurement for each of the pay items listed as shown on the bid proposal.