724.05. ANCHOR BOLTS FOR BRIDGE STRUCTURES.

Anchor bolts for bridge structures shall be continuously threaded steel bars conforming to AASHTO M 270, Grade 50W (345W) with metric coarse thread series, ANSI B1.13M for the bolt size specified in the contract documents.

Grade 50W (345W) anchor bolts shall be used with nuts and washers made of weathering steels as specified for high-strength bolts, AASHTO M 164 (ASTM A 325) in subsection 724.02.

Anchor assemblies shall be galvanized when used with painted or galvanized anchor plates.

724.06. GALVANIZING.

When galvanizing is specified in the contract documents, ferrous metal products, other than fasteners and hardware items, shall be galvanized in accordance with the Standard Specifications for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, AASHTO M 111 (ASTM A 123). Fasteners and hardware items shall be galvanized in accordance with the Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, AASHTO M 232 (ASTM A 153), except as noted in subsection 724.02.

SECTION 725
MISCELLANEOUS METALS

725.01. DESCRIPTION.

This Section covers steel forging, cold- rolled shafting for pins and rollers, steel castings, iron castings (gray and ductile), and bronze castings.

725.02. STEEL FORGINGS AND STEEL STAFTING.

(a) **Steel Forgings.** Steel forgings shall conform to the Specifications for Steel Forgings Carbon and Alloy for General Use, AASHTO M 102 (ASTM A 668), Classes C, D, F, or G.

(b) **Cold Rolled Shafting for Pins and Rollers.** Pins and rollers up to 8 inches (200 mm) in diameter, unless marked as forging on the Plans, may be furnished from cold finished shafting meeting the requirements of the Standard Specifications for Commercial Cold Finished Carbon Steel Bars and Shafting, AASHTO M 169, Grade 1035 or 1045 (UNS Designations G10350 or G10450), providing that tensile tests made on specimens machined from the finished shafting shall develop a minimum tensile strength of 75 ksi (515 MPa).

725.03. STEEL CASTINGS.

(a) **General.** Castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended. All covers and gratings that fit into frames shall fit properly and seat uniformly and solidly.

Sandblast or otherwise effectively clean all castings of scale and sand so they present a smooth, clean, and uniform surface.

Castings will be accepted only from domestic foundries which have an approved quality control program. The quality control program and schedule shall be submitted to the Department for review and approval prior to casting production. See Subsection 725.04(a) General for lettering identification requirements.

(b) **Mild Steel Castings.** Steel castings for use in highway bridge components shall conform to the Standard Specification for Steel Castings for Highway Bridges, AASHTO M 192 (ASTM A 486), Class 70 (485), or Standard Specification for Steel Castings, Carbon, for General Application, AASHTO M 103 (ASTM A 27), Grade 70-36 (485-250), unless otherwise specified.

(c) **Chromium Alloy-Steel Castings.** Chromium alloy-steel castings shall conform to the Standard Specification for Corrosion-Resistant Iron-Chromium, Iron-Chromium-Nickel and Nickel Based Alloy Castings for General Application, AASHTO M 163 (ASTM A 743M). Furnish grade CA-15M unless otherwise specified.

725.04. IRON CASTINGS.

(a) **General.** Iron Castings shall be true to pattern in form, within industry- acceptable dimensional tolerances for the size and/or shape of the unit, and free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended. Castings shall be boldly filleted at angles and the arises shall be sharp and perfect.

All castings must be sandblasted or otherwise effectively cleaned of scale and sand so as to present a smooth, clean, and uniform surface. Remove runners, risers, fins, and other cast-on pieces. Where shown on the Plans, machine mating surfaces of cast assemblies to provide flat, true surfaces, and ensure well-mated, non-rocking and non-rattling components. All covers or grates that fit into frames shall fit tight and seat uniformly and solidly. They shall not rock nor rattle when installed.

Where mass is specified on the Plans, castings shall conform to such requirements. All castings shall be identified in an area as shown on the Plans or in an area visible when the unit is installed. The lettering shall be recessed 1/16 inch (1.6 mm) from the surrounding surface. In the case of a surface having a grid pattern, the lettering shall be recessed into a non-gridded area. Lettering content required shall be sufficient for identification, including manufacturer or distributor, heat and/or pour number, and date of casting. Castings will be accepted only from domestic foundries which have an approved quality- control program. Submit the quality- control program and schedule to the Department for review and approval prior to any casting production.

(b) **Gray Iron Castings.** Gray iron castings shall meet the requirements of AASHTO M 105 (ASTM A 48) and shall be Class 35 B for manhole covers and inlet grates. All others shall be Class 30 B unless otherwise shown on the Plans or specified herein.

(c) **Ductile Iron Castings.** Ductile iron castings shall conform to the Standard Specifications for Ductile Iron Castings, ASTM A 536, Grade 65-45-12 (414-276-18), unless otherwise specified. In addition to the specified test coupons, test specimens from parts integral with the castings, such as risers, shall be tested for castings with a mass more than 1000 pounds (450 kg) to determine that the required quality is obtained in the castings in the finished condition.

(d) **Malleable Iron Castings.** Malleable iron castings shall meet the requirements of the Standard Specification for Ferritic Malleable Iron Castings, ASTM A 47, Grade 24118, unless otherwise specified.

725.05. ACCESSORIES FOR CASTINGS AND SPECIAL FABRICATED UNITS.

(a) **General.** Bolts required for casting assemblies shall meet the requirements of AASHTO M 164. They shall be machine bolts furnished galvanized (zinc-coated), cadmium plated, or stainless steel. Support beams required for casting assemblies shall meet the requirements of AASHTO M 183. Furnish "T" handles as shown on standard drawings for locking manhole covers. The minimum shall be two handles for up to and including 20 locking manhole covers and one for every 20 thereafter.

(b) **Special Fabricated Drainage Grates.** Welded steel drainage grates shall meet the material requirements of AASHTO M 183 for the load- bearing members. Stiffeners shall be specified by the manufacturer. Welding shall meet all applicable standards as covered in Section 724 and references.

Furnish grate units that have been galvanized after fabrication or painted with an inorganic zinc ethyl silicate base primer and vinyl finish coat. Galvanization shall be in accordance with the requirements of AASHTO M 111. Paint shall meet the materials requirements of Section 730.

Cleaning of grate units (for either procedure) and paint application shall be as covered in Subsection 506.04(d) Painting. Only those procedures which apply to grate sized units shall apply, and shop-applied paint shall be utilized for both coats.

Pipe for use in fabricated grates shall meet the requirements of ASTM A 53 and be furnished in standard mass, unthreaded mill finish unless otherwise stated. Hydrostatic pressure testing shall be waived. After welding, thoroughly clean the grate units, and for galvanized units only, punch or drill a pressure vent. See Plans for location of vent holes. See above for paint and painting requirements. Angle iron and strap iron used for end members or spacers shall meet the requirements of AASHTO M 183 mill-finish.

Butt welded pipe shall be acceptable for use as grate members with the approval of the Engineer.

725.06. BRONZE.

Bronze castings shall conform to the requirements of AASHTO M-107, Copper Alloy UNS No. C91100. Bronze bearings and expansion plates shall conform to the requirements of the Specifications for Rolled Phosphor Bronze Bearings and Expansion Plates for Bridges and Structures, AASHTO M 108 Copper Alloy UNS No. C51000. The class of metal shall be shown on the Plans.

SECTION 726
DRAINAGE CONDUITS

726.01. DESCRIPTION.

This section covers the materials requirements for surface and subsurface drainage conduits of the kind specified on the Plans and the requirements of Section 613.

726.02. MATERIALS.

(a) **Rigid Conduits.** Materials covered in this Subsection are as follows: nonreinforced concrete pipe, drain tile porous and perforated pipe, reinforced concrete circular, elliptical, and arch pipe, cast (ductile) iron, precast reinforced concrete box sections, manhole sections, inlet boxes, and junction boxes, all meeting the following requirements: