

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

500.00 INCIDENTAL STRUCTURES

501.00 EXCAVATION FOR STRUCTURES

501.01 DESCRIPTION. This work shall consist of excavation and backfill or disposal of all materials required for the construction of bridges, box culverts, and other minor structures in accordance with these Specifications and in reasonably close conformity with the lines, grades and typical cross-sections shown on the Plans or established by the Engineer.

This work shall also include removal of existing structures, unless provided for as a separate item. The clearing of the right-of-way, construction and removal of any necessary cofferdams, and pumping and incidentals as may be required for the proper execution of the work.

501.04 CONSTRUCTION METHODS.

A. *Clearing and Preservation of Channel.* The right-of-way shall be cleared in accordance with Section 201 for the full length of the bridge unless otherwise specified on the Plans.

Creek and river banks shall be kept in their natural state as much as possible. Banks up or downstream shall not be excavated or cut except as shown on the Plans or with written approval of the Bridge Engineer. Work roads shall be located in locations approved in writing by the Engineer. The Contractor shall restore all bank cuts and work roads to their original shape, density and condition in a manner approved by the Engineer.

Excavation or dredging shall not be made without prior approval of the Engineer outside of caissons, cribs, cofferdams, steel piling or sheeting, and the natural stream bed adjacent to the structure shall not be disturbed.

When approved excavation or dredging is made before caissons, cribs, or cofferdams are in place, the Contractor shall, without extra charge, backfill and compact all such excavation outside the structure in accordance with Section 202 to the original ground surface. Excavation in the stream bed shall be backfilled to the original ground line. Compaction in accordance with Section 202 will not be required. Material deposited within the stream area from foundation or other excavation or from filling of cofferdams shall be removed and the stream area restored to its natural condition.

B. *Removal of Existing Structures.* Removal of existing structures when shown on the Plans shall be in accordance with Subsection 619.04 B.

C. *Cofferdams.* Cofferdams for foundation construction shall be designed and constructed to be as watertight as is necessary for the proper performance of the work which must be done inside them. Cofferdams shall be of sufficient

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

size to allow pumping from outside the concrete forms so that all concrete is placed in the dry. A clay or concrete puddle wall may be required between the base forms and outside cofferdam, if necessary, to protect the base concrete from wash while bases are being placed.

Timber braces shall not extend into the concrete and structural members used for bracing shall not be left in the concrete.

Round pier bases of equal stability may be considered where square or rectangular bases are indicated on the Plans. Plans for round bases must be submitted to and approved by the Bridge Engineer before construction is started.

D. Treatment of Foundation Materials. Solid rock or other hard foundation material shall be excavated to a depth shown on the Plans or as directed by the Engineer and all loose and disintegrated material shall be removed. The final surface shall be entirely level or in level steps as shown on the Plans or directed by the Engineer.

When the footing is to rest on the material other than rock, the final finishing of the bearing surface shall be made immediately prior to placing concrete.

E. Placing Concrete for Foundations. Concrete shall not be placed in foundations until the Engineer has approved the depth and character of the foundation. All concrete shall be placed in the dry. Concrete for pier, abutment and retaining wall footings shall be placed against the solid rock or other approved foundation material. Quantities in such footing shall be measured and paid to the dimensions shown on the Plans. Additional concrete required to fill any excavation outside the neat lines shown on the Plans shall be at the Contractor's expense.

F. Soundings. Soundings to determine the depth and characteristics of foundation material may be made at the locations of structures. Boring logs if shown on the Plans were made for the purpose of selection of foundation types used in the design. The interpretation and confirmation of the boring information is the responsibility of the Contractor.

G. Pumping. Pumping will not be permitted during the placing of concrete or for at least 12 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other effective means. This period may be extended at the direction of the Engineer. Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure.

H. Box Culvert Excavation. This work includes box culverts in the bridge classification. Poor foundation material below the normal designed elevation shall be removed as directed by the Engineer. Material removed below designed elevation shall be replaced with material approved by the Engineer.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

Unless otherwise directed, outlets shall be opened for the effective width of the structure before constructing footings of box culverts.

- I. *Abutments, Wings, and Retaining Wall Excavation.*** Excavation adjacent to abutments, wings, and retaining walls shall be vertical or broken by stepping before backfilling.
- J. *Backfilling.*** Backfill and embankment shall be placed and compacted in accordance with Subsection 202.04 C.

Backfill shall not be placed against cantilever abutments, retaining walls, or other structures or portions of structures where the embankment is placed on one side only for a period of 14 days after the walls are in place. This period may be decreased when test beams meet the minimum strength requirements specified in Subsection 701.01 D. In the case of a rigid frame bridge or a bridge where the abutments are designed to be integral with the superstructure, the abutments shall not be backfilled until the superstructure is in place and forms supporting girders and deck are removed.

Embankment shall not be placed around any supporting form. Backfill above the flow line around concrete boxes shall not be placed in less than 7 days after the last concrete is placed in the section of the structure.

Rollers, vibrators, or other approved compactors shall be operated parallel to the outside lines of barrels and wing walls of cross drains. Any areas inaccessible to rolling equipment shall be compacted with mechanical tampers.

The excavated areas around piers shall be uniformly backfilled and compacted to the elevation of the original surface or as established by the Engineer.

- K. *Disposal of Surplus.*** Excess material shall not be placed in the bed of the stream. Areas affected by the Contractor's operation shall be cleaned up in accordance with Subsection 104.08. Obstructions that may collect drift, induce scour, or endanger the work shall be removed as directed by the Engineer.
- L. *Variation in Footing Elevations.*** The elevations of the bottom of footings, as shown on the Plans, will be considered as approximate only. The Engineer may order in writing such changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

508.00 CONCRETE CULVERTS, HEADWALLS AND RETAINING WALLS

508.01 DESCRIPTION. This work shall consist of constructing concrete culverts, headwalls and retaining walls in accordance with these Specifications and in reasonably close conformity with the lines and grades shown on the Plans or established by the Engineer.

Precast concrete box culverts in lieu of cast-in-place concrete box culverts will be considered by the Engineer if requested by the Contractor.

508.02 MATERIALS. Materials shall meet the requirements specified in the following Subsections of Section 700 – Materials.

| | |
|--------------------------|-----|
| Portland Cement Concrete | 701 |
| Reinforcing Steel | 723 |

Precast concrete box sections for culverts shall meet the requirements of AASHTO M 259 or M 273.

Joint materials shall meet the requirements specified under Subsection 726.02 A.

508.04 CONSTRUCTION METHODS.

A. General. The construction methods shall conform to requirements of these specifications under the several items entering the work with specific reference to Sections 509, 510, and 511, and in addition shall meet the following requirements.

Cutoff walls shall be constructed as required by the Engineer and may be varied from the Standard Plans to insure protection against undermining.

Before any concrete is placed in the walls, the footing shall be carefully cleaned of all chips, sawdust, dirt and other extraneous materials, and the concrete surface wetted and thoroughly grouted with neat cement paste immediately ahead of the concrete placement.

In the construction of box culverts more than 4 feet in height, care shall be exercised that the concrete in the walls shall be placed and allowed to set before the top slab is placed. Each wing shall be completed as a monolith. A header shall be installed in the forms if the top slab and curb are not to be completed at the time the walls are concreted.

B. Excavation and Backfill. Excavation and backfill shall be in accordance with Section 501.

C. Forms. Forms shall be in accordance with Section 509.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

- D. Curing.** Curing shall be in accordance with Subsection 509.04 H.
- E. Finish.** The exposed surface of all wings, curbs, rails and retaining walls shall be given a concrete surface finish as provided under Subsection 509.04 O. of these Specifications. A second concrete surface will be required when the first finish is rough, not uniform in color, has poor chamfer lines, or in any respect defective.
- F. Bedding.** Bedding for precast concrete box culverts shall be a minimum depth of 4 inches below the precast box sections unless otherwise specified on the Plans. Bedding material shall meet the requirements for Class B Bedding in accordance with Subsection 613 C.
- G. Laying Precast Sections.** Precast concrete box sections shall not be laid unless the foundation is in a condition satisfactory to the Engineer. Precast sections shall not be dropped onto the bedding material, but shall be lowered and placed into its final position by hoisting equipment adequate to handle the section without damage to the section or the bedding material. Damaged sections shall be replaced by the Contractor at his expense. The inside of the barrel shall be clean and free of debris when the sections are lowered into place.
- The conduit laying shall begin at the downstream end of the culvert. The sections shall be laid reasonably true to the established line and grade. After the precast culvert has been inspected and approved, it shall be backfilled, with care being taken in placing the backfill material so as to prevent displacement or damage of the sections.
- H. Joining Precast Sections.** The precast sections shall be joined as required in Subsection 613.04 E.
- I. Box Culvert End Sections.** End sections for all concrete box culverts shall be cast-in-place. End sections include wingwalls, curbs, end of barrels, curtain walls, and aprons. When precast sections are used for skewed structures, the wings shown on the Plans for cast-in-place concrete box culverts will be used at the same skewed relationship to the culvert walls as shown for the cast-in-place culvert. Curbs and curtain walls shall be built perpendicular to the barrels of precast sections for skews between 90° and 60°.
- J. Contractor's Drawings for Special Precast Box Sections, Special End Sections, Transition Sections and Stub-ins.**

Prior to construction of precast concrete box culverts requiring stub-ins of storm sewers, junctions with other structures, transitions in box dimensions, end sections for skews less than 60° or design loads or sizes not covered by AASHTO M 259 or M 273, the Contractor shall furnish fully engineered and sealed plans of the proposed construction to the Engineer for approval. Plans

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

shall show complete details of reinforcing steel and concrete dimensions.

508.05 METHOD OF MEASUREMENT. The quantities which constitute the completed and accepted structure will be measured for payment according to the Plans and Specifications for the several pay items as provided under Sections 509 and 511 of these Specifications, which shall include full compensation for all materials, falsework, labor, equipment, and incidentals necessary to complete the work as specified.

Payment for precast concrete box culverts will be made based on unit prices bid for the items and quantities of a cast-in-place box of the length required as determined by field measurements for the construction.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

509.00 STRUCTURAL CONCRETE

509.01 DESCRIPTION. This work shall consist of furnishing and placing portland cement concrete for structures and incidental construction in accordance with these Specifications and in reasonably close conformity with the lines, grades and dimensions as shown on the Plans or established by the Engineer.

509.02 MATERIALS.

A. Materials shall meet the requirements specified in the following Subsections of Section 700 - Materials.

| | |
|--|--------|
| Portland Cement Concrete | 701 |
| Elastomeric Bearing Pads | 733.06 |
| Concrete Surface Finish for Structures | 737 |
| Curing Materials | 701 |

B. High Early Strength Concrete. High early strength concrete shall meet the requirements as provided in Subsection 701.01 A. It shall be used for structures or portions of structures only when shown on the Plans or approved by the Engineer.

509.03 EQUIPMENT.

A. General. Equipment and tools necessary for handling materials and performing all parts of the work shall meet the requirements of Subsection 414.03.

509.04. CONSTRUCTION METHODS.

A. Handling, Measuring, and Batching. Handling, measuring and batching materials shall be in accordance with Subsection 414.04 D.

B. Mixing. The mixing of concrete shall be in accordance with Subsection 414.04 E.

C. Limitation of Mixing. The limitations of mixing concrete shall be in accordance with Subsection 414.04 F., except that the maximum temperature of the concrete shall not exceed 85[^]OF at the time of placement.

D. Forms. Forms shall be so designed and constructed that they will hold reasonably true to lines and grades as shown on the Plans and may be removed without injuring the concrete.

The material to be used in the forms for exposed surface shall be sized and dressed lumber, masonite, plywood or equal, or metal in which all bolt and rivet heads are countersunk, so that in any case a plain, smooth surface is

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

obtained. Undressed lumber may be used for backing or other unexposed surfaces.

The forms shall be built reasonably true to line and grade and braced in a substantial and unyielding manner. They shall be mortar tight. All corners, except at tops of footings or bases, shall be chamfered. Chamfer or molding strips shall be finished lumber, cut with true edges, and shall not be warped, cracked or frayed. No two pieces of chamfer strips of unequal width shall be used in the same chamfer line. Chamfer shall be held true to line and kept securely nailed to forms while placing concrete.

Form lumber for all curbs on bridges and culverts shall have a nominal thickness of 2 inches or more. Studding on all forms shall be spaced so that no bulge or deflection is apparent between the studs.

Form lumber which is to be used a second time shall be free from bulge or warp and shall be thoroughly cleaned. The forms shall be inspected immediately preceding the placing of concrete. Any bulging, warping or offset in adjacent boards shall be remedied.

All dimensions shall be carefully checked by the Contractor after the forms are erected and before any concrete is placed. The Contractor will be held responsible for the accuracy of all construction. The interior surfaces of the forms shall be adequately oiled or greased to insure the non-adhesion of mortar.

E. Handling, Placing and Vibrating Concrete.

1. *General.* In preparation for the placing of concrete, all saw dust, chips, and other debris shall be removed from the interior of forms. Struts, stays and braces serving temporarily to hold the forms in correct shape and alignment pending the placing of concrete at their locations shall be removed when the concrete placing has reached an elevation rendering their service unnecessary. All temporary wood members shall be removed from the forms and not buried in the concrete.

When vibrating concrete containing epoxy-coated reinforcing steel, the vibrator shall be equipped with a sheath designed to prevent damage to the epoxy coating.

Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. The Engineer may order the discontinuance of any type of conveyance or method of placing if the concrete is not being satisfactorily placed.

Open troughs and chutes shall be mortar tight. Where steep slopes are required, the chutes shall be equipped with baffles or be in short lengths

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

that change the direction of movement.

All chutes, troughs and pipes shall be kept clean and free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of the structure.

When placing operations would involve dropping the concrete more than 5 feet, it shall be deposited through approved sheet metal chutes, pipes, or flexible tubing. As far as practicable, the pipes shall maintain an even flow of concrete during the placing and their lower ends shall be kept level with the newly placed concrete. After the initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of reinforcing bars which project.

Concrete during and immediately after depositing shall be thoroughly consolidated by mechanical vibration, subject to the following provisions:

The vibration for Class A and AA concrete shall be internal unless special authorization of other methods is given by the Engineer or as provided herein.

Vibrators shall be of a type and design approved by the Engineer. The manufacturer's rated capacity shall be not less than 4,000 impulses per minute.

The intensity of vibration shall be such as to visibly affect a mass of concrete of one inch slump over a radius of at least 18 inches.

The Contractor shall provide a sufficient number of vibrators to properly consolidate each batch of concrete immediately after it is placed in the forms.

Vibrators shall be manipulated so as to thoroughly work the concrete around the reinforcement and imbedded fixtures and into the corners and angles of the forms. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation.

Application of vibrators shall be at points uniformly spaced and not farther apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

Vibration shall be supplemented by such spading as is necessary to insure smooth surfaces and dense concrete along form surfaces and in corners and locations impossible to reach with the vibrators.

The provisions of this article shall apply to the filler concrete for steel grid floor, except that the vibrator shall be applied to the steel.

The provisions of this article shall apply to precast piling, concrete cribbing and other precast members except that, if approved by the Engineer, the manufacturer's methods of consolidation may be used.

Concrete shall be placed in horizontal layers no more than 12 inches thick except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken initial set. Each layer shall be compacted so as to avoid the formation of a construction joint with a preceding layer before it has taken initial set.

When the placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to retain its form, shall be cleaned of the laitance and other objectionable material to a sufficient depth to expose sound concrete. Where a feather edge might be produced at a construction joint, as in the sloped top surface of a wingwall, inset form work shall be used to produce a blocked out portion in the preceding layer which shall produce an edge thickness of not less than 6 inches in the succeeding layer. Work shall not be discontinued within 18 inches of the top of any face, unless provision has been made for a coping less than 18 inches thick, in which case, if permitted by the Engineer, the construction joint may be made at the underside of the coping.

Immediately following the discontinuance of placing concrete, all accumulation of mortar splashed upon the exposed reinforcing steel and surfaces of the forms shall be removed. Dried mortar chips and dust shall not be puddled into the unset concrete. Care shall be exercised not to injure or break the concrete-steel bond at and near the surface of the concrete while cleaning the reinforcing steel.

2. *Reinforced Concrete Boxes.* In general, the base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. Provisions shall be made for bonding the sidewalls to the culvert base, by means of raised longitudinal keys so constructed as to prevent the percolation of water through the construction joint.

Before concrete is placed in the side walls, the culvert footings shall be thoroughly cleaned and the surface carefully chipped and roughened in

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

accordance with the method of bonding construction joints as specified herein.

In the construction of box culverts 4 feet or less in height, the sidewalls and top slab may be constructed as a monolith. When this method of construction is used, any necessary construction joints shall be vertical and at right angles to the axis of the culvert.

In the construction of box culverts more than 4 feet in height, the concrete in the walls shall be placed and allowed to set before the top slab is placed. Appropriate keys shall be left in the sidewalls for anchoring the cover slab.

3. *Columns.* Concrete in columns shall be placed in one continuous operation, unless otherwise directed. The concrete shall be allowed to set at least two hours before the caps are placed.

Concrete shall not be placed in the superstructure until the column forms have been stripped sufficiently to determine the character of the concrete in the column. The load of the superstructure shall not be allowed to come upon the columns until they have been in place at least five days, unless otherwise permitted by the Engineer.

4. *Pneumatic Placing.* Pneumatic placing of concrete will be permitted only if specified.
5. *Pumping.* Placement of concrete by pumping will be permitted provided the equipment is so arranged that vibrations will not damage freshly placed concrete.

Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. Aluminum pipe shall not be used. The operation of the pump shall be such that a continuous stream of concrete without air pockets is delivered.

- F. *Placing Concrete Under Adverse Weather Conditions.*** Concrete for structures shall not be placed on frozen ground nor shall it be mixed or placed while the atmospheric temperature is below 35° F, unless adequate means are employed to heat the aggregates and water, and satisfactory provisions have been made for protecting the work.

Concrete slab shall not be placed on frozen ground, nor shall concrete be mixed or placed when the atmospheric temperature is below 35° F, or when conditions indicate that the temperature may fall to 35° F within 24 hours, except with the written permission of the Engineer and only after such precautionary measures for the protection of the concrete have been taken as

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

the Engineer may direct.

Concrete shall be effectively protected from freezing or frost for a period of 5 days after placing.

Concrete for structures shall not be mixed or placed while the atmospheric temperature is above 100° F unless adequate means are employed to cool the aggregate and water and satisfactory provisions have been made for protecting the work. In any case, the temperature of the concrete placed shall not exceed 90° F.

Concrete placement shall be stopped when rainfall is sufficient to cause damage to the work.

G. *Placing Concrete under Water.* Concrete shall be deposited in water only with the permission of the Engineer and under his supervision. When depositing in water is allowed, the concrete shall be carefully placed in the space in which it is to remain in a compact mass by means of a tremie or a bottom dumping bucket that does not permit the concrete to fall through the water. Concrete placed under water shall be deposited in one continuous operation and shall be allowed to set for a period of at least 48 hours before the caisson is dewatered. After dewatering, the laitance and soft concrete shall be cut away and the top surface cleaned. Concrete shall not be placed in running water, and forms which are not reasonably watertight shall not be used for holding concrete deposited under water. The concrete shall not be disturbed after being deposited.

Ten percent of additional cement shall be added to all concrete placed under water. No allowance will be made to the Contractor for additional cement required for placing concrete under water. The water pressure shall be equal inside and outside the forms before any concrete is placed under water. The quantity of mixing water shall be the minimum amount to permit the passage of concrete through the tremie or it shall not have a slump in excess of 2 inches when placed with a dump bottom bucket.

When a tremie is used, it shall have a diameter of not less than 10 inches and shall be of sufficient tightness at joints to prevent loss of mortar. Equipment for supporting a tremie shall be adequate to raise, lower or change the position of the tremie laterally when it is entirely full of concrete. The discharge end shall be entirely sealed at all times and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper the tremie shall be slightly raised, but not out of the concrete at the bottom, until the batch discharges to the bottom of the hopper. The flow shall then be stopped by lowering the tremie.

When concrete is placed by means of a bottom dump bucket, the bucket shall have a capacity of not less than 1/3 cu. yd. It shall open in two parts at the

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

center of the bottom perimeter; the trip being so arranged that it will function properly. It shall be tested for tripping with a load before concreting. The empty bucket shall be lowered to the bottom of the footing and the load line marked before the first batch is placed. The bucket shall be slowly and carefully lowered until it rests upon the concrete already placed. It shall then be raised very slowly during the discharge in order to maintain, as nearly as possible, still water at the point of discharge and avoid agitating the mixture.

H. Joints. Whenever the work of placing concrete is delayed until the concrete shall have taken its initial set, the point of stopping shall be deemed a construction joint. So far as possible, the location of construction joints shall be planned in advance, and the placing of concrete carried continuously from joint to joint. These joints shall be perpendicular to the principal lines of stress.

Where dowels, reinforcing bars, or other adequate methods are not shown on the Plans, keys shall be made by placing water-soaked beveled timbers of a size shown on the details, or as directed by the Engineer. The key material shall be removed when the concrete has set. In resuming work, the surface of the concrete previously placed shall be thoroughly cleaned of laitance or other soft material with stiff wire brushes, and if deemed necessary by the Engineer, shall be roughened by a steel tool.

Construction joints shall be made only where located on the Plans or shown in the placing schedule, unless otherwise approved by the Engineer. Shear keys or continuous reinforcement shall be used to transmit shear or bond the two sections together.

In parapets, railings, and other light work superimposed on heavy work, the expansion joints shall be placed as shown on the Plans.

In order to maintain the proper alignment of the different parts of the work, they shall be provided with keys at approximately 1/3 of the area of the cross-sections of the wall or with the equivalent thereof in dowels.

I. Curing Concrete.

1. *General.* All concrete shall be cured as provided in these Specifications for the various parts of structures. The approved method of cure and minimum curing time shall be as follows:

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

| ITEM | CURE TIME* (MINIMUM) | METHOD |
|--|---------------------------------|---------------|
| Piers | 3 Days | A,B,C,D |
| Columns | 5 Days | A,B,C,D |
| Abutments | 3 Days | A,B,C,D |
| Retaining Walls | 3 Days | A,B,C,D |
| Wing Walls | 3 Days | A,B,C,D |
| Parapets | 3 Days | A,B,C,D,E |
| Rails | 3 Days | A,B,C,D,E |
| Reinforced Concrete Box | 3 Days | A,B,C,D |
| Bridge Floors | 6 Days | E,F** |
| Slabs & Girders | 5 Days | A,B,C,D |
| Curbs | 3 Days | A,B,C,D |
| Sidewalks | 3 Days | A,B,C,D |
| *During unfavorable weather conditions where the temperature does not exceed 50° F, the cure time may be extended at the discretion of the Engineer. | | |
| **Both E & F required on bridge floors. | | |

The approved methods for curing shall be:

- (A) Curing with an approved polyethylene burlap.
- (B) Curing with three layers of wet burlap.
- (C) Curing with wetted cotton mats as specified under Subsection 414.04 M.
- (D) Curing with an approved membrane compound (Red) as specified below and in Subsection 701.07.
- (E) Linseed oil emulsion curing.
- (F) Water curing.

Curing compound shall be applied under pressure, by means of a spray nozzle, in such a manner as to cover the entire exposed surface thoroughly and completely with a uniform film. Sufficient pressure shall be applied to the spray machine to force the compound to leave the nozzle as a fine mist. The application of curing compound shall be close to the finishing at all times and all finished concrete shall be sprayed immediately after the superficial water, if any, has subsided.

Formed surfaces shall be coated with curing compound as soon as practicable after removal of the forms.

Curing compound shall be applied on concrete for sidewalks, curbs and floors, other than concrete bridge floors, as soon as possible after finishing. On surfaces requiring a surface finish or surfaces poured against forms, the curing materials which adversely affect the bond on surface finish shall not be applied.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

If hair checking develops before the curing compound can be applied, the procedure set forth above shall be modified in that initial curing with wet burlap shall be performed as specified for the particular type of work under construction.

If discontinuities, pinholes, or abrasions in the membrane exist, a second coat shall be applied to the affected areas. Walking on the cured surface will not be permitted for 24 hours after application. If any abrasions occur within 24 hours, they shall be corrected by the use of additional compound.

Rate of Application.

The sealing compound shall not be applied at a coverage rate lighter than specified below:

| | |
|---------------------|------------------------|
| Steel trowel finish | 225 sq. ft. per gallon |
| Rough float finish | 200 sq. ft. per gallon |

Whenever the atmospheric temperature is 100° F or more, the Engineer may require an additional coat at a rate of approximately 270 square feet per gallon, if he deems the additional material essential to obtain adequate water retention. When required, the second coat shall be applied 30 minutes after the first.

When the desired results are not obtained by this method, the membrane method shall be discontinued and the curing shall be by other methods specified in the Specifications.

1.1 Linseed Oil Emulsion Curing. Linseed oil emulsion shall be applied under pressure, by means of an atomizing type spray nozzle, in such a manner as to cover the entire exposed surface uniformly at the rate of not less than one gallon per 175 square feet. Sufficient pressure shall be applied by the spray machine to force the compound to leave the nozzle as a fine mist. Care shall be exercised when spraying linseed oil emulsion to prevent the emulsion from coating exposed reinforcing steel.

Linseed oil emulsion shall not be applied when the temperature of the emulsion is less than 35° F or more than 95° F.

Any container of linseed oil emulsion that exhibits separation, segregation or skimming of surface shall not be used.

The estimated wind velocity at the time of application should be noted and the rate of application adjusted to assure the yield of one gallon of emulsion for each 175 sq. ft. covered.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

The oil emulsion shall be applied to the fresh concrete immediately after finishing.

The linseed oil shall be applied to the sides of parapets and other formed surfaces immediately following the removal of forms. Caution shall be exercised in applying linseed oil emulsion to surfaces to be finished. The Contractor shall furnish evidence that the proposed finish is compatible with linseed oil emulsion cured surfaces.

All surfaces cured with linseed oil emulsion shall be protected from damage for a period of 72 hours after application. Walkways shall be provided for workmen and any materials or equipment placed on mats.

1.2 Water Curing. Floors shall be covered with wet cotton mats as soon as the condition of the concrete surface will permit. The cotton mats shall be kept wet continuously from the time the first mat is placed until the curing period has expired.

Curbs and parapets shall be covered with wet burlap as soon as finishing is completed. The curb and parapet shall be kept continuously wet from the time the first burlap is placed until the curing period has expired.

Water used for curing shall meet the requirements for concrete mixing water.

J. Removal of Forms. In order to make possible the obtaining of a satisfactory surface finish, forms on ornamental work, railing, parapets and vertical surfaces which do not carry loads and which require a special concrete surface finish shall be removed as soon as practicable.

Form removal shall be governed by the following table:

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

| ITEM | SPECIFIED FORM REMOVAL TIME | MINIMUM FORM REMOVAL TIME* |
|--|--|-----------------------------------|
| Vertical Walls: Columns Piers Abutments Retaining Walls up to 6 feet Retaining Walls over 6 feet Wingwalls | 12 hours 12 hours 12 hours 12 hours 24 hours 12 hours | |
| Concrete Girder Bridges: Floors between girders Main Slab Girders | 14 days 21 days 21 days | 10 days 14 days 14 days |
| Prestress Concrete, Steel Beam & Truss: Floors | 14 days | 10 days |
| Reinforced Concrete Boxes: Span 8 ft. or less Span 8 ft. to 10 ft. Span 10 ft. & over | 14 days 14 days 21 days | 7 days 10 days 14 days |
| Supporting Forms: Pier Caps Web Walls | 14 days 14 days | 10 days 10 days |
| Bridge Floors: Open to traffic | 21 days | 10 days |
| *Specimens shall be made, cured and tested as provided in Subsection 701.01 D. In unfavorable weather or during a period of time the temperature does not exceed 50° F, the specified time may be increased at the discretion of the Engineer. | | |

When H.E.S. concrete is used, in no case shall forms under parts of structures carrying loads be removed in less time than shown.

After removal of forms, supports and centering, concrete may be subjected to not more than the design load of the structure.

As soon as the forms are removed, all rough places, holes, and porous spots shall be filled, and all bolts, wires or other appliances used to hold the forms and which pass through the concrete shall be cut off flush with the surface. For all finished surfaces, all wires shall be cut off ¼ inch below the surface and depression filled with cement mortar at once. This shall be left rough for several hours and then rubbed smooth with the surface.

Honeycomb shall be repaired as soon as the forms are taken off by removing any aggregate that is loose or that is not thoroughly bonded to concrete mass, washing the surface with clean water, using a wire brush to remove any loose

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

particles, and applying a thin coating of neat cement mortar.

Patched areas shall be dressed flush with the surrounding area.

Small cavities shall be neatly pointed up with cement mortar of the same mix as used in the body of the work, immediately after removing forms. Care shall be taken to remove any thin surfaces or edges and expose the whole cavity before pointing up.

- K. Defective Work.** Any defective work discovered after the forms have been stripped shall be removed immediately and replaced. If the surface of the concrete is bulged, uneven, or shows excess honeycombing or settlement, which cannot be repaired satisfactorily, the entire section shall be removed and replaced. No additional compensation will be allowed for this work.
- L. Drainage and Weep Holes.** Drainage openings and weep holes shall be constructed in the manner and where indicated on the Plans or directed by the Engineer.
- M. Placing Pipes and Conduits.** Pipes and conduits for utility service lines which are to be encased in the concrete shall be placed by the Contractor during construction.
- N. Placing Anchors, Bolts, Grillages, etc.** The Contractor shall place all anchors, bolts, grillages, etc., securely and accurately in the locations shown on the Plans or as otherwise required.
- O. Waterproofing.** Reinforced retaining walls, abutments, earth filled arches, etc., shall be waterproofed whenever shown on the Plans or directed by the Engineer. This waterproofing shall conform to Sections 606 or 607, depending upon the type specified.
- P. Finishing.** Unless otherwise specified on the Plans, a special finish conforming to one of the following methods shall be applied after penetrating water repellent treatment of concrete surfaces, when specified. Before the surface finish is applied, the surface shall be inspected by the Engineer to assure compliance with Subsection 509.04 I. The finish coat shall be uniformly textured and colored in a manner approved by the Engineer.

Option I. Heavy cement base mortar mixed with an acrylic bonding agent.

Option II. Paint type spray finish.

The special finish shall consist of one or more applications of the materials specified for Option I or Option II. The intent of this Specification is to attain a durable finish reasonably uniform in appearance as to texture and color, the

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

color to be somewhat lighter than the natural color of concrete unless otherwise specified on the Plans.

The Engineer shall be informed in writing of the option selected by the Contractor and materials approved prior to the beginning of the finishing operation.

Test Panel: At the beginning of the first finishing operation, a test panel or area shall be prepared showing surface texture and method of application and shall be approved by the Engineer. This area shall be maintained throughout the duration of the project as a standard for comparison purposes.

Before the surface finish is applied, when using the heavy cement base mortar material option, the surface shall be thoroughly washed with clean water applied with a jet spray. The application of the surface finish shall be applied with an approved plaster type spray gun or by the brush and float method, as recommended by the manufacturer. No application is to be made when the atmospheric temperature is 40° F or below or when the temperature is expected to drop to freezing within 12 hours. Curing shall be done in the same manner as required for curing concrete. Application of the special surface finish shall not be started until all other work which might mar or deface the surface finish has been completed.

Under Option II, the following conditions shall be met:

Samples: At the time of original request for approval of the surface finish, the manufacturer shall submit a one-gallon sample of the material.

Application: At the time of application of spray finish, concrete surfaces shall be free of moisture as determined by both sight and touch and in a condition consistent with the manufacturer's recommendations.

Surfaces shall be protected by paper, cloth, or other means from spatter of the sprayed material. Any concrete areas which are not intended to be covered by the spray finish and which are stained or spattered by the spray shall be cleaned by wire brushing, sandblasting, or other methods satisfactory to the Engineer.

The spray finish shall be applied at a rate of 45 + 5 square feet per gallon with heavy duty spray equipment (4:1 ration or larger) capable of maintaining a constant pressure as necessary for proper application.

The completed finish shall be tightly bonded to the structure and present a uniform appearance and texture. If necessary, additional coats shall be applied to produce the desired surface texture and uniformity. Upon failure to adhere positively to the structure without chipping or cracking or to attain the desired surface appearance, the surface shall be refinished to the satisfaction

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

of the Engineer at no additional cost to the City.

- Q. Concrete Surface Finish.** All surfaces of piers and abutments exposed to the traveling public shall receive a concrete surface finish in accordance with Subsection 509.04 P. All other surfaces exposed to the public shall receive a concrete surface finish.

The surfaces of piers to receive a surface finish shall be made a smooth and uniform texture by face lining the forms or by the use of steel forms. Rubbing of the surfaces will not be required unless honeycombed areas, form marks or other defects occur. In case these defects occur, the areas immediately affected will require rubbing. Such rubbing shall extend over a sufficient area around the blemished portions to blend the rubbed area into the surrounding unfinished surface without causing an unsightly appearance, but this shall not be construed to require rubbing of large areas of unblemished surfaces to gain absolute uniformity of color and texture on the entire surface of the piers.

No compensation will be allowed for the extra work or materials involved in eliminating these defects.

Special care shall be given the concrete surfaces that are exposed to the traveling public. Concrete handrails, posts and curbs on regular structures and all of the exposed surfaces of the substructure and all of the exposed surfaces of the substructure on grade separation structures shall be finished to a uniform color and texture. Care shall be taken in the finishing operations to maintain sharp or well-defined corners on chamfer lines. A second or final finish will generally be required. The final finish must produce neat lines, uniform color and smooth finish.

509.05 METHOD OF MEASUREMENT. Structural concrete will be measured by the cubic yard in accordance with the dimensions shown on the Plans or directed by the Engineer. Concrete for small structures will be measured by the cubic yard when the total volume of concrete in the whole structure does not exceed ten cubic yards.

509.06 BASIS OF PAYMENT. Accepted quantities of structural concrete will be paid for at the contract unit price per cubic yard for:

| | | |
|-----|---------------------------------------|---------|
| (A) | Class AA Concrete | Cu. Yd. |
| (B) | Class A Concrete | Cu. Yd. |
| (C) | Class A Concrete for Small Structures | Cu. Yd. |
| (D) | Class B Concrete | Cu. Yd. |
| (E) | Class C Concrete | Cu. Yd. |

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

511.00 REINFORCING STEEL

511.01 DESCRIPTION. This work shall consist of furnishing and placing reinforcing steel in accordance with these Specifications and in conformity with the Plans.

All reinforcement shall consist of deformed bars, epoxy coated deformed bars, or cold drawn wire mesh as specified.

Deformed bars shall be of an approved deformed type such that a mechanical bond will be provided between the concrete and steel at frequent intervals. The size shall be such that the minimum net sectional area of the bar shall be equal to the section of a plain bar of the nominal size indicated.

511.02 MATERIALS. Materials shall meet the requirements of Section 723.

Reinforcing steel bars of structural grade 60 shall be furnished when shown on the Plans and specified. When the grade is not specified, grade 40 or grade 60 may be used and will be measured and paid for at the lowest grade required.

Spiral ties and other reinforcing, designated on the plans in W (wire) sizes, shall be cold drawn wire.

Bar List. The bar list and bending schedule are made for the purpose of arriving at an estimate of quantities. The Contractor shall verify the quantity, size and shape of the bar reinforcement against the structure drawings and make the necessary corrections, if any, before ordering. Errors in the bar list and bending schedule shall not be cause for adjustment of the contract unit price.

511.04 CONSTRUCTION METHODS. Reinforcing steel shall be protected at all times from damage. When placed in the work, the reinforcing steel shall be substantially free from dirt, detrimental scale, paint, oil or other foreign substance.

Thin powdery rust and tight rust that does not reduce the effective cross-section is not considered detrimental and need not be removed.

Epoxy-coated reinforcing bars sheared and/or cut ends shall be promptly coated or repaired before visible oxidation occurs with coating materials meeting the requirements of AASHTO M 284.

Unless otherwise permitted, all reinforcing bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as shown on the Plans and in a manner approved by the Engineer. Should the Engineer approve the application of the heat for field bending reinforcing bars, precautions shall be taken to assure that the physical properties of the steel will not be materially altered.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

All reinforcing steel shall be accurately placed within the tolerances specified herein. During the placing of concrete, reinforcing steel shall be firmly held by approved supports in the position shown on the Plans. Reinforcing bars shall be fastened at alternate intersections with wire ties unless this results in ties being more than 12 inches apart in which case each intersection shall be tied. Spot welding of reinforcing steel will not be permitted. Spacing of parallel bars is shown center to center. Bar bends are out to out and distance from face of concrete to reinforcing steel is clear distance. In the plane of the steel parallel to the nearest surface of concrete, individual bar spacing shall not vary from Plan placement by more than 1/6 of the spacing between bars, and the average over ten spaces shall not vary more than 1/20 of the specified spacing. Perpendicular to the nearest surface of concrete, bars shall not vary from Plan placement by more than 1/4 inch in slabs and walls up to and including 8 inches in total thickness, and for slabs and walls over 8 inches in total thickness, the bars shall not vary more than 1/2 inch from Plan placement. The placement of deck reinforcement in bridge floors shall not deviate more than 1/4 inch from Plan placement in the vertical direction.

Approved metal bar supports of adequate strength, of proper depth and in sufficient number shall be used for supporting the bars in slabs, beams, and girders. Both low and high approved metal chairs shall be used in I-Beam, truss and girder floors.

The placing, wiring and supporting reinforcement in each section of the work shall be approved by the Engineer before any concrete is deposited in the section.

All reinforcement shall be furnished in the full lengths indicated on the Plans. Splicing of bars, except where shown on the Plans, will not be permitted without written approval of the Engineer. Splices shall be staggered when possible.

Unless otherwise shown on the Plans, bar splices in the bottom of beams and girders, and in walls, columns and haunches shall be lapped as given in the table below for other bars. Bar splices near the top of beams and girders having more than 12 inches of concrete under the bars shall be lapped as given in the following table for top bars:

| REQUIRED LENGTH OF LAP IN INCHES | | | | | | | | |
|---|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|
| SIZE | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 | No. 9 | No. 10 | No. 11 |
| Top Bars | 15 | 19 | 24 | 32 | 42 | 54 | 68 | 83 |
| Other Bars | 12 | 13 | 17 | 23 | 30 | 38 | 49 | 60 |

The required length for lap splices given in the table is based on Grade 40 Reinforcing Steel. If Grade 60 Reinforcing Steel is specified the required length for lap splices shall be increased by 50 percent. No more than 1/2 of the bars should be lap spliced within a required lap length.

Bars larger than No. 11 bars shall not be lap spliced but shall be weld spliced in accordance with current AWS Specifications or spliced with other positive mechanical methods. The splice methods or devices shall be approved by the

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

Engineer prior to use.

The minimum spacing, center to center, of parallel bars shall be 2½ times the diameter, but in no case shall the clear distance between the bars be less than 1½ times the maximum size of the coarse aggregate.

The minimum covering, measured from the surface of the concrete to the face of any reinforcing bar, shall be not less than 2 inches or as otherwise shown on the Plans. In the footings of abutments and retaining walls and in piers the minimum covering shall be 3 inches.

When epoxy coated bars are used, tie wires shall be plastic coated. Chairs, supports and clips shall be one of the following:

1. Steel, fully coated with epoxy or plastic.
2. Galvanized steel, with cradle and upper 3 inches of the chair, support or clip coated with epoxy or plastic.

The plastic or epoxy coating on accessories shall be of sufficient thickness to prevent physical damage to the coated reinforcing during installation. The coating will be inspected and approved by the Engineer prior to use.

511.05 METHOD OF MEASUREMENT. Deformed bars, epoxy coated deformed bars, cold drawn wire and wire mesh will be measured by the pound, based on the theoretical number of pounds complete in place as shown on the Plans or placed as ordered.

The quantities of materials furnished and placed shall be based upon the calculated weights of the reinforcing steel actually placed in accordance with these Specifications. The weights calculated shall be based upon the following table:

| DEFORMED BAR WEIGHTS | |
|-----------------------------|----------------------|
| BAR DESIGNATION NO. | NOMINAL LB/FT |
| ¼ | 0.167 |
| 3 | 0.376 |
| 4 | 0.668 |
| 5 | 1.043 |
| 6 | 1.502 |
| 7 | 2.044 |
| 8 | 2.670 |
| 9 | 3.400 |
| 10 | 4.303 |
| 11 | 5.313 |
| 14S | 7.650 |
| 18S | 13.600 |

No allowance will be made for clips, metal spacers, ties, wire, etc., or other material

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

514.00 TIMBER, CONCRETE AND STEEL PILES

514.01 DESCRIPTION. This work shall consist of furnishing and driving timber, precast concrete and steel piles of the kind and dimension designated. It shall also include cutting off or building up concrete and steel piling when required. Piling shall conform to and be driven in accordance with these Specifications and at the location, manner and to the elevation, penetration and bearing shown on the Plans or as directed by the Engineer. When test piles are required, the pile lengths shown on the Plans are for estimating purposes only and the actual lengths to be furnished for the types of piles specified will be determined after driving test piles.

514.02 MATERIALS. Materials shall meet the requirements specified in the following Subsections of Section 700 - Materials.

| | |
|---------------------------------|--------|
| Portland Cement Concrete | 701.01 |
| Reinforcing Steel | 723 |
| Structural Steel | 724 |
| Casting for Pile Shoes | 725.05 |
| Timber Piles | 728 |
| Paint | 730.05 |
| Timber Preservative & Treatment | 731 |

514.03 EQUIPMENT FOR DRIVING PILES.

A. Timber Piles. Timber piles shall be driven with a steam, air or diesel pile hammer, unless otherwise provided on the Plans or in the Proposal. The hammer shall develop an energy per blow at each full stroke of the piston of not less than 7,250 foot-pounds for a single acting hammer or 6,000 foot-pounds for a double acting hammer, operating at not less than 80 percent of the manufacturer's rated capacity.

When the use of a gravity hammer is permitted, it shall weigh not less than 2,400 pounds and the height of drop shall not exceed 15 feet, but in no case shall the weight of the hammer be less than the combined weight of driving head and pile.

Water jets or pilot holes may be required to secure the penetration shown on the Plans or as directed by the Engineer.

B. Concrete and Steel Piles. Concrete and steel piles shall be driven with a steam, air or diesel pile hammer, unless otherwise provided on the Plans or in the Proposal. The hammer shall have sufficient energy to produce a penetration of the pile, of one inch in ten blows at the driving resistance required on the Plans, when calculated in accordance with the formula in Subsection 514.04 without any reduction for driver efficiency.

If necessary to obtain the required penetration without damage to piles, pilot

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

holes having a diameter not greater than 2 inches less than the least dimension of the body of the pile may be drilled or a pump and equipment sufficient to furnish 500 gallons per minute or 100 pounds per square inch at two 3/4 inch nozzles. When the jets are used, they shall be removed and the piles shall be driven a minimum of 5 feet by the hammer to secure the final penetration. This procedure may be changed at the direction of the Engineer if the desired results are not obtained.

Vibrating hammers and the use of pile followers will not be used except when specifically authorized and under conditions specified by the Bridge Engineer.

Unless otherwise specified, piling will be driven with rigid or swinging leads of sufficient size and strength to control the pile at all times.

514.04 CONSTRUCTION METHODS.

A. Driving Resistance. The calculated driving resistance for piles shall be determined by the following formulas:

$P(2WH) / (S1.0)$ for gravity hammers
 $P(2WH) / (S0.1)$ for single-acting steam or air hammers.
 $P(2H(WAp)) / (S0.1)$ for double-acting steam or air hammers.
 $P(2E) / (S0.15)$ for free-fall diesel hammers.

Where:

E=foot pounds of energy per blow (Manufacturer's rating for hammer)
P=driving resistance in pounds
W=weight in pounds of striking parts of hammer
H=height of fall in feet
A=area of piston in square inches
p=steam pressure in pounds per square inch
S=the average penetration in inches per blow for the last 5 to 10 blows for gravity hammers and the last 10 to 20 blows for steam hammers.

The above formulas are applicable only when:

1. The hammer has a free fall.
2. The head of the pile is free from broken concrete broom or crushed wood fiber.
3. The penetration is at a reasonably quick and uniform rate.
4. There is no excessive bounce after the blow. Twice the height of the bounce shall be deducted from H to determine its true value in the formulas.
5. The hammer shall be operated at the maximum efficiency

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

attainable at all times.

The bearing capacity of timber piles, as determined by the foregoing formulas, shall be considered effective only when they are less than the crushing strength of the piles. In general, timber piles shall be required to develop a bearing capacity of not less than the maximum bearing required on the Plans and not more than 40 tons. Should the bearing capacity of timber piles as computed by either of the above formulas be in excess of 40 tons, pilot holes or jetting shall be used, if required by the Engineer, to secure a satisfactory penetration without damage to the pile. The character of the soil penetrated, conditions of driving, sizes and lengths of the piles involved and the computed load per pile shall be given due consideration in determining the reliability of driven piles.

In case water jets are used in connection with the driving, the bearing capacity shall be determined by the above formulas from the results of driving after the jets have been withdrawn or a load test may be applied.

B. Loading Tests. When required, the size and/or number of pile will be determined by actual loading tests. In general, unless otherwise specified, these tests will be made in accordance with ASTM Specification D 1143 Quick Load Test Method, paragraph 5.6.

C. Test Piles. Test piles shall be driven when shown on the Plans and at the locations and of lengths as specified. In general, the specified length of test piles will be greater than the assumed length of regular piles in order to provide for variation in soil conditions. The equipment used for driving test piles shall be identical to that which the Contractor proposes to use on the regular or permanent piling and shall conform to the requirements of these Specifications.

Test piles shall be driven to one foot above the grade shown on the Plans for permanent piles or practical refusal (1/2 inch ten blows). If piles have not attained Plan minimum bearing capacity, they will be allowed to set up for 24 hours. If bearing value is not attained when driving is resumed, no more than 1/2 the remaining length will be driven and the set-up procedure repeated. Test piles driven to grade shall have at least the minimum bearing capacity called for on the Plans. Concrete test piles driven to plan grade and not having the bearing required, shall be driven until the required bearing is obtained. Build up of concrete test piles will be measured for payment as specified for splices and build up under reinforced concrete piling. Splices and build up for steel test piles, when required, will be measured for payment in the manner specified for steel piling.

A record of driving of test piles, showing the type and weight of hammer used, the length of test pile, fall of hammer, penetration in ground and distance of pile tip below cutoff elevation will be required. In addition, the bearing

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

capacity at 5 foot intervals will be required throughout the driving and the intervals shall be decreased as the driving becomes harder until the readings for bearing capacity shall be one foot intervals on the last five feet of driving. The Contractor shall not order piling to be used in the permanent structure until test pile data has been reviewed and permanent pile lengths are authorized by the Engineer.

Concrete test piles shall meet the requirements of Subsection 514.04 H.

D. Required Bearing Capacity. Piling shall be driven to the penetration shown on the Plans or to a greater depth if necessary to obtain the required bearing. Piling shall not be driven after practical refusal (1/2 inch in ten blows) or 120 tons bearing has been obtained. If necessary to obtain satisfactory penetration, jetting or other methods shall be used.

E. Preparation and Driving. The heads of all concrete piles, and the heads of timber piles when the nature of the driving is such as to unduly injure them, shall be protected by caps of approved design, preferably having a plywood or other similar approved material cushion next to the pile head and fitting into a casting which in turn supports a timber shock block. The minimum thickness of the cushion shall be 4 inches and be replaced as necessary to provide an effective cushion.

Piling should be driven to the position shown on the Plans with a permissible variation of not more than 1/4 inch per foot from the vertical or from the batter as shown. Piles for trestle bents shall be so driven that the cap may be placed in its proper location and in event the cap is reinforced concrete, no pile shall be nearer than 4 inches from any edge of the cap. Any increase in size of cap to meet this edge distance requirement will be at the Contractor's expense. Foundation piles out of the position shown on the Plans more than 6 inches after driving shall be evaluated for structural adequacy by the Bridge Engineer.

In general, starting holes for piles shall not be drilled more than 20 percent of the total pile length below the ground surface, unless otherwise shown on the Plans or directed by the Engineer. Cushions and leads shall be so arranged that a full square blow is delivered to the pile heads. Care shall be taken to keep piling leads vertical while driving, unless battered piles are specified. Pulling or imposing lateral loads while driving will not be permitted.

F. Unsatisfactory Piles. Piles that have been broken, split, or otherwise damaged to the extent that in the opinion of the Engineer they are not suitable to leave in the finished structure shall be removed immediately and replaced by sound ones at the Contractor's expense. In removing piles, jets shall be used in conjunction with jacks or other devices for pulling in an effort to remove the whole pile. All piles raised (heaved) more than 1/2 inch during the driving process, shall be re-driven to the required resistance.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

G. Timber Piles. Piles shall be pointed. When necessary, piles shall be shod with metal shoes. The piles shall be carefully shaped to secure an even and uniform bearing on the shoes. Collars and bands to protect the piles against brooming and splitting shall be provided when necessary. When the area of the pile heads are greater than the face of the hammer, suitable caps shall be provided to distribute the blow of the hammer throughout the cross-section of the piles. The top of piles shall be sawed off in a true plane as shown on the Plans and at the elevation set by the Engineer.

After making cutoffs, creosoted piles supporting concrete caps shall be treated with three applications of hot creosote oil. They shall then be covered with a piece of three-ply asphalt roofing felt having a diameter of not less than 24 inches. This shall be closely and securely tacked around and to the top of piles before concrete is placed in caps.

Piles supporting timber caps or grillage work shall be given three coats of hot creosote oil. They shall then be covered with a coat of hot tar pitch over which shall be placed a sheet of galvanized iron or a covering may be built up of alternate layers of hot tar pitch and three-ply roofing felt, using four layers of tar and three of roofing felt. Either covering shall measure at least 6 inches more in each dimension than the diameter of the pile and shall be bent down over the pile and the edges fastened with large headed nails or secured by binding with galvanized wire.

Metal shoes shall be used when specified on the Plans, they shall be fastened to the pile and have the dimensions shown on the Plans. When shoes are used they shall be used on the timber test piles.

H. Concrete Piles.

1. *Class of Concrete.* Class AA concrete shall be used for precast concrete piles. Class AA high early strength concrete may be used when Class AA concrete is specified on the Plans.
2. *Reinforcement.* Reinforcement for precast concrete piles and test piles shall consist of longitudinal bars in combination with lateral reinforcement in the form of hoops or spirals. It shall be of the size and spacing as shown on the Plans. It shall be rigidly wired or fastened at all intersections and held in true position in the forms. Reinforcement shall be placed at a clear distance from the face of the pile of not less than 2 inches and when the piles are for use in salt water or alkali soils this clear distance shall not be less than three inches.
3. *Form Work.* Forms for precast concrete piles shall conform to the general requirements for concrete form work. Forms shall be accessible for tamping and consolidation of the concrete. Under good weather curing

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

conditions, side forms may be removed at any time within 48 hours subsequent to placing concrete, but the entire pile shall remain supported for at least 5 days and shall not be subject to any handling stress until the concrete has set for at least 7 days and for a longer period in cold weather, the additional time to be determined by the Engineer.

4. *Casting.* Piling may be cast either in a vertical or horizontal position. When vertical forms are used, special care shall be exercised to consolidate the concrete around the reinforcing and to avoid the formation of stone pockets. When horizontal forms are used, the piles may be cast either separately or in tiers. If cast in tiers, the tiers shall be separated by suitable material carefully placed.

Concrete in the upper tier shall not be placed until test beams or test cylinders meet strength requirements as provided in Section 701.

Not more than two tiers shall be used unless the additional tiers are supported independently.

If alternate piles are cast in tiers, the intermediate piles shall not be cast until 2 days after the casting of the adjacent piles.

Concrete shall be placed continuous in each pile and shall be carefully consolidated with special care being exercised to avoid horizontal and diagonal cleavage planes and to see that the reinforcement is properly embedded in the concrete.

As soon as the forms are removed, concrete piles shall be carefully examined and pointed with 1:2 mortar, filling up all cavities or irregularities. Trestle piling exposed to view shall be finished above ground line in accordance with the provisions of Section 509. Foundation piling that portion of trestle piling which will be below the ground surface and piles for use in salt water or alkali soils shall not be finished except by pointing as above set forth.

5. *Curing.* As soon as the top surface of piles have been finished, they shall be cured with one of the following methods.

5.1 Covering with wet burlap as soon as finishing is completed. The following day the piles shall be covered with 2 inches of sand and kept wet for an additional 5 days. Piles must be kept wet continuously from the time the first burlap is placed until curing time has expired.

5.2 Covered with wetted cotton mats as specified in Subsection 414.04 M.

5.3 Cured with an approved membrane curing compound as

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

specified in Section 701.

5.4 Cured with an approved polyethylene burlap for 6 days.

5.5 The side forms on concrete piles may be left in place for at least 6 days or if removed before the 6 days have elapsed, the surfaces shall be cured for the remaining time by one of the methods specified herein. Surfaces that require a concrete surface finish shall be shrouded with wet burlap or wet mats from the time the forms are removed until the 6-day curing period has elapsed.

6. *Handling Piling.* Removal of forms, curing, storing, transporting and handling precast concrete piles shall be done in such a manner as to avoid excessive bending stresses, cracking, spalling or other damage.

Piling which has been cracked or otherwise damaged in handling, storage, or transportation to the extent that they would not be suitable for use in the structure shall be replaced at the Contractor's expense.

Concrete piling cast in cold weather shall conform to the requirements of Section 414.

Concrete piles, including test piles, made of Class AA or high early strength concrete may be driven when test beams or test cylinders made, cured and tested in accordance with Subsection 701.01 D. indicate a strength of 600 pounds per square inch when tested with the third point method or 700 pounds per square inch when tested by the midpoint method or test cylinders have a compressive strength of not less than 4000 pounds per square inch. In no case shall concrete piles be driven in less than 7 days after casting.

7. *Build Up.* Extensions, splices or build up on concrete piles should be avoided, but when necessary, they shall be made as follows:

After the driving is completed, the concrete at the end of the pile shall be cut away, leaving the reinforcing steel exposed for a length of 40 diameters. The final cut of the concrete shall be perpendicular to the axis of the pile. Reinforcement similar to that used in the piles shall be securely fastened to the projecting steel and the necessary form work shall be placed, care being taken to prevent leakage along the pile. The concrete shall be of the same quality as that used originally in the pile. Just prior to placing concrete, the top of the pile shall be thoroughly wetted and covered with a thin coating of neat cement. The forms shall remain in place not less than 7 days and shall then be carefully removed and the entire exposed surface of the pile finished as herein specified. Built-up piles may be further driven when a modulus of rupture of test beams has been attained, as provided in Subsection 701.01 D., but in no

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

case in less than 7 days after casting.

- I. Steel Piling.** Steel piling lengths and weight shall be as shown on the Plans. The steel shall comply with the requirements of Section 506. When steel piles extend above the ground surface or water surface they shall be protected by painting as specified in Section 506. The paint shall be applied from low water to top of pile and in dry river beds from 2 feet below the ground line to top of the pile. Field paint shall not be applied until the bent is completed in place. When untested steel piling is received on the job site, the Contractor shall furnish, at his expense, enough extra length from each heat number for testing.

Piling shall be cut off at the required elevation in a neat and workmanlike manner. If capping is required, the connection shall be as shown on the Plans.

514.05 METHOD OF MEASUREMENT.

- A. Test Piles.** Test piles whether of timber, concrete or steel will be measured by the actual number of piles driven as shown on the Plans or directed by the Engineer.
- B. Untreated Timber Piling.** The number of linear feet of untreated timber piling measured for payment shall be the actual number of feet remaining in the finished structure. Cutoffs measured for payment will be the difference in length between the piles of approved length placed in the leads and the actual number of feet remaining in the finished structure. Cutoffs, in excess of one foot, which are necessitated by damaged pile heads will not be measured for payment.
- C. Treated Timber Piling.** The method of measurement for treated timber piling shall be as specified for untreated timber piling in Subsection 514.05 B.
- D. Reinforced Concrete Piling.** The number of linear feet of reinforced concrete piling measured for payment shall be the actual number of feet remaining in the finished structure. Cutoffs and buildups measured for payment will be the difference in length between the piles of approved length placed in the leads and the actual number of feet remaining in the finished structure. An additional length of up to 2 feet for each pile cut off will be measured for payment as reinforced concrete piling. For cutoffs of 2 feet or less, the reinforcing steel shall not be cut off but shall be bent into the adjacent concrete. Splices measured for payment will be the length of pile cut back for making build-ups. No measurement will be made of lengths cut back or splices made which were necessitated by damage to piling.
- E. Steel Piling.** The number of linear feet of steel piling measured for payment shall be the actual number of feet remaining in the finished structure. Cutoffs measured for payment will be the actual length of pile cut off but will

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

(D) Reinforced Concrete Piling Lin. Ft.

The length of build-ups, when re-driving is not required, will be paid for at the contract unit price per linear foot for reinforced concrete piling. Build-ups of reinforced concrete piling, when re-driving is required, will be paid for at 1 1/2 times the contract unit price per linear foot for reinforced concrete piling.

E. Steel Piling. Cutoffs, measured as provided in method of measurement, will be paid for at 60 percent of the bid price per linear foot for steel piling. Splices will be paid for as provided herein. Piling splices, when necessitated by the construction, shall be measured as provided in paragraph 514.05 E. and shall be paid for at 2 times the contract unit price for one linear foot of the pile specified.

(E) Steel Piling Lin. Ft.

F. Metal Pile Shoes. Metal pile shoes, except for test piles, will be paid for at the contract unit price for each metal pile shoe, which shall include furnishing of all material, equipment and labor incidental to this item.

(F) Metal Pile Shoes Ea.

G. Loading Tests. When loading tests are specified on piling, they will be paid for on a lump sum basis.

(G) Loading Tests Lump Sum

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

515.00 PENETRATING WATER REPELLENT TREATMENT OF CONCRETE SURFACES

515.01 DESCRIPTION. This work shall consist of furnishing necessary labor, materials, and equipment to treat concrete surfaces with a penetrating water repellent treatment solution including surface preparation and application as shown on the Plans, and in accordance with these Specifications.

515.02 MATERIALS. The penetrating water repellent treatment solution shall meet the requirements of Subsection 701.12.

515.03 EQUIPMENT.

A. General. All necessary equipment shall be furnished by the Contractor in accordance with the requirement of Subsection 108.06. Minimum requirements for construction equipment required for surface preparation and application of the penetrating water repellent treatment solution are specified herein.

B. Equipment Required for Sand Blasting Methods of Surface Preparation.

1. *Sand Blasting Unit.* Compressed air pressure type sand blasting equipment of proper size and capacity to clean concrete surfaces as specified.

C. Equipment Required for Water Washing Methods of Surface Preparation.

1. *Hot Water Pressure Washer.* Hot water pressure system for cleaning concrete surfaces as specified, utilizing 160° F water temperature at 1,800 pounds per square inch minimum nozzle pressure.

2. *Hydroblast Washer.* High pressure cold water washer unit for cleaning concrete surfaces as specified, using 7,000 pounds per square inch minimum nozzle pressure.

3. *Steam Cleaning Unit.* Steam jet cleaning equipment for preparing concrete surfaces as specified, utilizing 320° F water temperature under 305 pounds per square inch operating pressure.

D. Equipment for Application of Treatment Solution.

1. *Spray Equipment.* Low pressure airless type spray equipment with 15 to 40 pounds per square inch application pressure.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

515.04 CONSTRUCTION METHODS.

A. General. Concrete surfaces may be cleaned by utilizing either sand blasting or water washing equipment as specified. The use of other methods and equipment for surface preparation equal to or exceeding the minimum requirements specified for sand blasting or water washing methods may be approved for use under the requirements of Subsection 108.06.

B. Surface Preparation. All concrete surfaces prepared for treatment shall be thoroughly cleaned prior to application of the penetrating water repellent treatment solution. The method of cleaning shall remove all traces of curing compound, laitance, dirt, dust, salt, oil, asphalt or other foreign materials.

Surface preparation may include the application of pretreatment cleaning agents prior to the use of water washing cleansing methods.

If necessary, solvents and hand tools shall be used as required to remove bonded materials detrimental to treatment of the concrete surface.

When water washing methods of cleaning are utilized the addition of detergents may be used to reduce surface tension of the cleaning water. The addition of such detergents may be used in proportions of 2 percent or less by weight.

The cleaning process shall not cause any undue damage to the concrete surface, remove or alter the existing surface finish, or expose the coarse aggregate of the concrete. The method of cleaning shall be performed in such a manner as to provide a reasonably uniform appearing surface color.

When water washing methods of cleaning are employed all concrete surfaces shall be free of any standing water or excess moisture at the time of treatment which may restrain surface penetration of the water repellent treatment solution.

Concrete surfaces prepared for treatment shall be approved by the Engineer.

C. Weather Limitations. The penetrating water repellent treatment solution shall not be applied when the air or concrete surface temperature is less than 40° F, or otherwise below or above the manufacturer's recommended application temperature range. The solution shall not be sprayed when blowing winds or other conditions prevent proper application.

D. Application. The penetrating water repellent treatment solution shall be used as supplied by the manufacturer and not diluted or altered in any way. The solution shall be sprayed onto concrete surfaces prior to concrete surface finish specified by Subsection 509.04 O. at the manufacturer's recommended rate of coverage as approved for use under these

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

Specifications unless otherwise specified.

Surface treatment of new concrete prior to 28 days curing will not be permitted.

E. Traffic. Traffic shall be kept off treated surfaces until the solution has completely penetrated and is surface dry.

515.05 METHOD OF MEASUREMENT. The penetrating water repellent treatment will be measured by the square yard of treated concrete surface area.

515.06 BASIS OF PAYMENT. Accepted quantities of penetrating water repellent treatment will be paid for at the contract unit price for:

| | |
|--|---------|
| Penetrating Water Repellent Surface Treatment | Sq. Yd. |
|--|---------|

which shall be full compensation for furnishing all materials, equipment, labor and incidentals to complete the work as specified.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

516.00 DRILLED SHAFT FOUNDATIONS

516.01 DESCRIPTION. This work shall consist of the construction of foundations of reinforced concrete shafts with or without bell type concrete footings. Concrete shafts shall be placed in drilled excavation when the shafts are without bell type footing and in drilled and under reamed excavation when shafts are with bell type footings. Such foundations shall be constructed in accordance with these Specifications and in reasonably close conformity with the details and governing dimensions shown on the Plans or established by the Engineer.

516.02 MATERIALS. Materials shall meet the requirements specified in the following Subsections of Section 700 - Materials.

| | |
|--------------------------|-----------------|
| Portland Cement Concrete | 701.01 |
| Reinforcing Steel | 723.01 & 723.02 |

All concrete shall be Class AA unless otherwise shown on the Plans.

The slump of the drilled shaft concrete shall be 6 inches + 1 inch. The maximum water cement ratio specified in Subsection 701.01 shall not be increased. An approved water reducing agent may be used to obtain desired workability.

An approved set retarding agent will be required in all concrete when the casing method is used.

When the prevailing maximum temperature is 75° F or above, an approved water reducing agent or an approved set retarding agent will be required in all drilled shaft concrete.

The temperature of concrete to be placed in the drilled shaft shall not exceed 85° F.

The materials in the inner casing of the Double Casing Method shall meet the requirements of AASHTO M 36.

516.04 CONSTRUCTION METHODS.

A. General. The methods covered by this Specification are the dry method, the casing method, and the double casing method.

The Contractor shall perform the excavation required for the shafts and bell footings, through whatever materials encountered, to the dimension and elevations shown on the Plans or required by the site conditions.

Shafts and bells may be excavated either by hand or by mechanical methods. Blasting may be used only with the permission of the Engineer and shall be controlled to avoid disturbance to the formations below or outside the limits of the proposed shaft.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

The drilled shaft must be installed so that the axis of the shaft at the top is no more than 3 inches from its plan location. Drilled shafts must be plumb to within one percent of the total length of the shaft. The diameter of the stem of the drilled shaft must be no less than one inch smaller than plan dimension. The bearing area of the bell must be as large as that shown on the Plans.

When the plans require drilled shafts in abutments, the embankment at the bridge ends shall be completed to grade and thoroughly compacted prior to drilling.

Material excavated from shafts and bells, including drilling mud, and not used in the backfill around the compacted pier or abutment shall be disposed of in a manner approved by the Engineer and shall not be placed in a stream channel or otherwise impair the efficiency or appearance of the bridge or other parts of the work.

Any excavation for the shaft or bells beyond the lines required by the plans shall be filled with Class AA concrete at the Contractor's expense.

If the elevation of the top of shaft is below ground level at the time of concrete placement, an oversize surface casing from ground elevation to a point below the top of the shaft will be required to control caving of any substance into freshly placed concrete. This provision will apply to the dry method, the casing method and the double casing method if the top of the outer casing, as well as the top of the inner casing, is below ground level.

It is the responsibility of the Contractor to report to the Engineer any significant deviation from subsurface conditions as shown on the Plans, thereby allowing redesign of foundations as necessary. An example of a significant deviation would be finding the bearing stratum at a lower elevation than shown on the Plans.

In order that the Engineer may judge the adequacy of a proposed foundation, the Contractor shall take cores to such cores will not be required to exceed 5 feet below the foundation base elevation. It is the intent of this provision that cores shall be made at the time the excavation in each foundation is approximately complete.

At any time when a person is in the hole, the Contractor shall make provisions for pumping fresh air to the workmen and protecting against possible collapse of the excavation by adequate casing.

The Contractor shall provide suitable access and lighting for the Engineer to inspect the completed foundation excavation and check the dimensions and alignment of the shaft and bell excavation.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

Any required lighting shall be electric. Any mechanical equipment used within the excavation shall be operated by air or electricity. The use of gasoline driven engines within the excavation for any purpose will not be permitted. Prior to placing concrete, excessive loose material shall be removed from the bottom of the excavation; excessive loose material is defined as more than one inch of loose material.

B. *Obstructions.* Obstructions when encountered will be measured for payment. An obstruction is defined as an extremely hard ledge or boulder, or any other natural or man-made object such as metal that cannot be drilled through or under reamed by use of normal drilling techniques and tools. Normal tools are defined to be an auger with or without rock bits that is the full size of the shaft being drilled, and a full size under reamer. Other techniques and tools, such as blasting within the shaft, drilling at least three additional smaller shafts within the planned shaft, or excavating the shaft or bell by hand, shall only be used with the permission of the Engineer. A hard material in which the shaft is founded will be considered an obstruction if it cannot be drilled by normal drilling techniques and tools as defined above.

C. *Reinforcing Steel.* The reinforcing steel cage shall be completely assembled, and immediately prior to concrete placement it shall be placed as a unit.

The clearance between the edge of the drilled shaft and the reinforcing steel shall be 3 inches.

Where spiral reinforcing is used, it shall be tied to the longitudinal bars at a spacing not to exceed 12 inches on centers, unless otherwise shown on the Plans, to provide a rigid unit.

The minimum length of steel required for lap with the column steel, as shown on the Plans, shall be maintained. Dowel bars may be used if the proper lap length is provided both into the shaft and into the column.

The cage shall be supported from the top by some positive method to minimize its slumping downward during concrete placement and/or extraction of the casing. The support shall be concentric with the cage to prevent racking and distortion of the steel. For shafts built using the Casing Method, a minimum of 1/2 of the vertical bars shall be supported from the top.

The elevation of the top of the steel cage shall be carefully checked before and after casing extraction. Generally any upward movement of the steel not exceeding 2 inches, or any downward movement thereof not exceeding 6 inches per 20 feet of shaft length will be acceptable. Any upward movement of the concrete or displacement of the steel beyond the above limits will be cause for rejection.

When additional length of shaft requires reinforcing to be spliced, the added

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

length required in the splice will be paid for at the contract price for reinforcing steel under Subsection 511.06.

D. Drilled Shafts.

1. *Dry Method.* The excavation shall be made without the use of water, drilling mud, or casing, except for possibly a surface casing. Unless obstructions are encountered, the excavation shall be completed in a continuous operation and the concrete shall be placed without undue delay.

In uncased shafts, concrete spacer blocks or steel chairs shall be used at sufficient intervals to insure concentric spacing of the entire length of the cage. In cased shafts, concrete spacer blocks shall not be used. Metal chair type spacers or bent pieces of steel bars shall be placed at sufficient intervals around the steel cage to insure concentric spacing inside the casing.

2. *Casing Method.* Where caving conditions are encountered or where excess water begins seeping into the excavation, no further drilling will be allowed until the Contractor selects a method to prevent ground movement and/or water flow. The Contractor may elect to place a temporary casing by appropriate means or advance the excavation by stabilizing the hole by use of a fluid of the appropriate density.

Temporary casing, when employed, shall be of metal and of ample strength to withstand handling stresses and the external pressure of the caving soil and/or water, and it shall be water-tight. When necessary, the Contractor shall prepare the bottom of the casing with cutting teeth to facilitate seating in the founding stratum. The casing shall be smooth, well oiled, and shall extend approximately to the top of the shaft. Normally the casing shall extend above the ground surface. Casing shall not be employed in a hole with a nominal diameter less than 18 inches. The outside diameter of the casing shall not be less than the specified diameter of the drilled shaft. Casing shall not be left in the ground except by permission of the Engineer and if left in ground, it shall be adequately backfilled with concrete grout or sand as specified by the Engineer.

When a stratum of soil is encountered that will not cave or admit a significant flow of water and where the excavation is to be completed, the bottom of the casing will be sealed in that formation so as not to admit fluid. The excavation will be completed according to plan in the stratum specified.

The Contractor will be permitted to backfill around the upper portions of the casing with pea size gravel or other granular material, but space shall

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

be provided to allow for escape of muck, slurry, or water displaced from outside the casing by the concrete.

If an oversize casing is used, no extra compensation will be allowed for the concrete required to fill the oversize casing.

The elapsed time from the beginning of concrete placement in the cased portion of the shaft until extraction of the casing is begun shall not exceed one hour unless additional time is approved by the Engineer before concrete placement is begun.

Under normal operations, the removal of the casing shall not be started until the level of the concrete approaches the top of the drilled shaft. Under no circumstances shall removal of the casing begin until the level of the concrete is higher than the level of fluid, such as drilling mud or water, outside the casing. Throughout removal of the casing the level of the concrete must be maintained above the level of the fluid outside the casing. Movement of casing for short pulls of a few inches, rotating, exerting downward pressure, and tapping it to facilitate extraction will be permitted. Under normal conditions, the casing will be removed in a continuous operation while maintaining the head of concrete. Casing extraction shall be at a slow, uniform rate and the pull shall be vertical.

3. *Double Casing Method.* This method is to be used when severe groundwater problems or unstable soil conditions are encountered.

The temporary outer casing shall be as specified in Subsection 516.40 D. 2. except that it shall be 6 inches larger in diameter than the drilled shaft. The outer casing shall be driven into the founding stratum for sealing off water.

After the outer casing is in place, the foundation excavation shall be completed to the plan diameter of the drilled shaft.

A permanent inner casing, the same diameter as the drilled shaft diameter, shall be set into the founding stratum and braced at the top. The inner casing shall be a round corrugated galvanized steel pipe with 3 x 1 inch corrugations, and shall be of sufficient gauge to maintain the round shape and withstand the pressure of the concrete.

After the complete drilled shaft concrete is poured, the outer casing may be removed provided initial set of the concrete has not taken place. If initial set has taken place, the outer casing shall not be removed for 12 hours. The inner casing shall remain in place.

- E. Concrete.** The work shall be performed in accordance with the provisions of Section 509 and in conformance with the requirements herein.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

At the time the concrete is placed, the excavation shall be free from accumulated seepage water unless an underwater pour is authorized by the Engineer.

Concrete shall be placed as soon as possible after all excavation is complete and reinforcing steel placed, and shall be of such workability that vibrating or rodding will not be required.

After concrete placement is completed, the top surface shall be cured and any construction joint area shall be treated as prescribed in Section 509.

Placing of drilled shaft concrete underwater shall be done only with permission of the Engineer in strict conformance with the procedures outlined below for underwater pour. Underwater pour shall not be permitted with the dry method of shaft construction.

1. *Concrete Poured in the Dry.* All drilled shaft concrete placed in the dry shall be placed through a suitable rigid tremie or by pumping through a suitable rigid tube to prevent segregation of materials. The tremie shall consist of a suitable rigid tube with a diameter of no more than 14 inches or less than 10 inches. It shall be constructed and supported so that it can be moved horizontally to cover the work area and moved vertically to control the concrete flow as the level of the concrete in the shaft is raised. The bottom of the tremie or pump pipe must remain below the top of the concrete at all times but shall not be left at the bottom of the hole during the entire pour.

Placing of concrete by pumping will require that the portion of the tube inside the excavation meets all the requirements above, but only that portion of the pumping tube in contact in place will be required to be rigid.

2. *Concrete Poured Underwater.* If it becomes apparent that pumping and other dewatering methods are not adequate to dry the hole, the Engineer may authorize underwater placement of concrete. In this case, the water in the hole shall be permitted to seek its natural hydrostatic head to prevent any possibility of pressure washing of the concrete being placed.

The tremie requirements and concrete placement procedure shall be the same as specified above for concrete poured in the dry except the tremie shall be watertight and shall be constructed so that the bottom can be sealed and then opened after it is in place and fully charged with concrete.

516.05 METHOD OF MEASUREMENT. Acceptable drilled shafts, complete in place, of the specified diameter will be measured by the linear foot as constructed to the dimensions shown on the Plans or approved by the Engineer from bottom to

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

top of shaft without regard to the method of construction.

Acceptable footing bells, complete in place, will be measured by the cubic yard as constructed to the dimensions shown on the Plans or approved by the Engineer.

The volume of footing bells will be measured outside the neat lines of the drilled shaft.

Corrugated galvanized steel pipe, in place as the permanent inner casing of a completed drilled shaft, will be measured by the linear foot as constructed to the dimensions shown on the Plans or approved by the Engineer.

Obstructions, as defined above in Subsection 516.04 B., shall be measured by the linear foot in the shaft where the obstruction occurs. No reduction shall be made in drilled shaft or footing bell measurements due to obstructions.

516.06 BASIS OF PAYMENT. Accepted quantities of drilled shafts, measured as provided above, will be paid for at the contract unit price for:

- | (A) Drilled Shafts | Lin. Ft. |
|--------------------|--|
| 1. | Payment for individual completed shaft lengths plus or minus one foot of plan length, will be made at the unit price bid per linear foot of the specified diameter of drilled shafts. |
| 2. | Payment for that portion of individual completed shaft length in excess of one foot more than the plan length shaft, will be made at a unit price equal to 125 percent of the unit price bid per linear foot of the specified diameter of drilled shafts. |
| 3. | When individual completed shaft lengths are more than one foot less than the plan length, the Contractor will be paid an amount equal to 25 percent of the unit price bid per linear foot of the specified diameter of drilled shafts for each foot of the reduction in length from plan length. |
| 4. | Obstructions as measured above shall be paid for at 200 percent of the unit price bid for linear foot of drilled shaft of the size specified. |

Accepted quantities of footing bells, measured as provided above, will be paid for at the contract unit price for:

- | (B) Footing Bells | Cu. Yd. |
|-------------------|---------|
|-------------------|---------|

The foregoing unit prices shall be full compensation for making all excavations using normal drilling techniques and tools; for doing any necessary pumping; for furnishing, placing, and removing any temporary casings; for furnishing and placing all concrete and reinforcing steel; for all backfilling; and for furnishing all

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

tools, materials, labor, equipment, and incidentals necessary to complete the work. When the bottom of any drilled shaft is ordered to be placed at an elevation below plan grade and a splice of reinforcement is required, no payment will be made for the extra reinforcing required, but it shall be considered subsidiary to the price bid per foot of shaft. However, the added reinforcing in the lap splice will be paid for at the contract price for reinforcing steel. No extra payment will be made for temporary casings left in place.

Accepted quantities of corrugated galvanized steel pipe, measured as provided above, will be paid for at the contract unit price for:

(C) Corrugated Galvanized Steel Pipe Lin. Ft.

which shall be full compensation for furnishing and placing the pipe.

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

529.00 LOW STRENGTH BACKFILL MATERIAL

529.01 DESCRIPTION. This work shall consist of the placement of a flowable mixture of portland cement, fly ash and sand, termed CLSM (controlled low strength material) for backfilling bridge abutments, street repairs, culverts, concrete reinforced boxes, or other identified structures in close conformity with the lines, grades, dimensions and details shown on the Plans or established by the Engineer. Before any CLSM is poured, the Engineer shall verify that the CLSM trial mix satisfied the strength requirement as stated in this Specification.

529.02 MATERIALS.

- A. Portland Cement.** Portland cement shall conform to the requirements of Subsection 701.02 of the Standard Specifications.
- B. Fly Ash.** Fly Ash shall conform to ASTM Designation C-618, Class "C" or Class "F" mineral chemical composition and physical requirements. Alternate materials may be used for fly ash provided the alternate material meets the approval of the Engineer.
- C. Fine Aggregate (Sand).** Fine aggregate shall conform to the requirements of Subsection 701.05 A. of the Standard Specifications.
- D. Water.** All water shall conform to the requirements of Subsection 701.04 of the Standard Specifications.

529.03 MORTAR MIX.

- A. Mix Proportioning.** The initial trial mixture shall consist of the following approximate quantities of materials per cubic yard.

| CLSM | |
|-------------------------------|------------|
| Cement | 50 lbs. |
| Fly Ash | 250 lbs. |
| Sand (SSD)* | 2,910 lbs. |
| Water | 500 lbs. |
| *(-saturated - surface - dry) | |

The Contractor shall submit a proposed mix with trial batch test data for the Engineer's acceptance. The Engineer may require trial batches. Adjustments of the proportions may be made by the Contractor, providing the total absolute volume of the materials is maintained. During the progress of the work no change shall be made in the batch proportions of the ingredients without the approval of the Engineer. The Contractor may use air entrainment.

The batch proportions accepted by the Engineer apply only for materials from the same source and having the same characteristics as the materials used in

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

the mix design. Materials from any other source shall be used only with the approval of the Engineer.

Should a change in sources of materials be made, a new mix design formula shall be established by the Contractor before the new material is used. When unsatisfactory results or other conditions make it necessary, the Contractor shall establish a new mix design formula to get the desired results.

- B. *Mix Adjustment.*** To expedite consolidation of the mortar, it will be necessary for bleed water to appear on the surface immediately after the CLSM levels off. A delay in bleeding indicates there are too many fines in the mixture, so the fly ash quantity shall be reduced in increments of 50 pounds until mixture is bleeding freely. Approximately 60 pounds of sand shall be added to replace each 50 pound increment of fly ash to maintain the original yield.

529.04 CONSTRUCTION METHODS.

- A. *Mixing equipment.*** Sufficient mixing capacity of mixers shall be provided to permit the mortar to be placed without interruption.
- B. *Placing CLSM.*** CLSM shall be discharged from the mixer by any reasonable means into the space to be filled. The fill material shall be brought up uniformly to the fill line shown on the Plans or as directed by the Engineer. Placing of material over controlled low strength material (CLSM) may commence as soon as the surface water is gone or as directed.
- C. *Sampling.*** The standard test specimen shall be the 4x8 inches cylinder for strength tests and an open-ended 3x6 inches cylinder for the flow test. Four test specimens shall be made for the strength tests. Samples for strength tests shall not be rodded and cylinders shall be allowed to stand undisturbed for at least 14 days before being shipped to the lab. Single use cardboard cylinder molds, split forms, or polystyrene molds are recommended for easier removal of the sample. Extrusion shall not be used to remove samples from the cylinders.
- D. *Testing.*** Laboratory tests for CLSM Flowability, strength and uniformity shall be made prior to placement. These laboratory tests shall consist of the following.
1. *Flow Test or Slump Test.* Flow test shall consist of filling a 3x6 inches open-ended cylinder to the top with the CLSM mixture. If necessary, strike off the top of the cylinder so that the mixture is level. Pull the cylinder straight up and measure the approximate diameter of the CLSM mixture. In order to provide ample flowability, the diameter of the material spread shall be a minimum of 8 inches.
 2. *Strength Tests.* All strength tests shall be made by the lab. The

CITY OF EDMOND
STANDARD SPECIFICATIONS FOR CONSTRUCTION

compressive strength testing shall follow the procedure set forth in AASHTO T-106 with modifications in regard to the cylinder size and rodding requirements. The cylinders size shall be 4x8 inches. Samples shall not be rodded. The maximum acceptable strength for CLSM trial batches is 350 psi and the recommended minimum is 130 psi. Compressive strength is based on the average of three cylinders at 28 days.

3. *Test for Unit Weight.* Test for unit weight shall conform to AASHTO T-121.

529.05 METHOD OF MEASUREMENT. The quantities which constitute the completed and accepted structure will be measured for payment by the cubic yard as constructed to the dimensions shown on the Plans or approved by the Engineer.

529.06 BASIS OF PAYMENT. Accepted quantities of CLSM, measured as provided above, shall be paid for at the Contract unit price for:

| | |
|--------------------------------|------|
| Low Strength Backfill Material | C.Y. |
|--------------------------------|------|

which shall be full compensation for all materials, equipment, labor, and incidentals required to complete the work as specified.