

**SUBSECTION 10.02
AIR AND WATER POLLUTION,
SOIL EROSION, AND SILTATION CONTROL**

I. SCOPE

This item includes control measures as shown on the plans, as ordered by the design Engineer, as required to mitigate pollution during a project. Projects over one (1) acres in area shall comply with a Pollution Prevention Plans and Notices of Intent as required by the EPA General NPDES Permit for Texas. The measures shall control water pollution, soil erosion, and siltation by using berms, dikes, dams, sediment basins, fiber mats, gravel, mulches, grasses, slope drains, and other erosion control devices or methods.

The temporary erosion control measures shall coordinate with the permanent erosion control measures to assure economical, effective, and continuous erosion control throughout the construction period and warranty period.

Temporary control may include work outside the construction limits such as borrow pit operations, equipment and material storage sites, disposal areas, and temporary plant sites. Contractor shall obtain permission to implement temporary erosion control measures on property not owned by him.

II. MATERIALS

- A. Grass:** Grass should not compete with the grasses sown later for permanent cover. Grass shall be a hardy quick-growing species (such as rye grass, Italian rye grass, or cereal grasses) suitable to provide temporary cover.
- B. Mulches:** Mulches may be hay, straw, fiber mats, netting, bark, wood chips, or other suitable material reasonably clean and free of noxious weeds and deleterious materials.
- C. Fertilizer:** Fertilizer shall be a standard commercial grade and shall conform to all Federal and state regulations and to the standards of the Association of Official Agricultural Chemists.
- D. Slope Drains:** Slope drains may be constructed of pipe, fiber mats, rubble, Portland cement concrete, bituminous concrete, or other materials that will adequately control erosion.
- E. Other:** All other materials shall meet commercial grade standards and shall be approved by the design Engineer before being incorporated into the project.

III. EQUIPMENT

Contractor shall provide the equipment that is necessary to complete this item.

IV. CONSTRUCTION METHODS

- A. General:** Any conflict between these requirements and pollution control laws, rules, or regulations of other Federal, state, or local agencies causes the more restrictive laws, rules, or regulations to apply.

The Contractor shall be responsible for compliance for construction practices, construction operations, and construction work.

- B. Schedule:** Prior to the start of construction, the Contractor shall submit in writing schedules for accomplishment of temporary and permanent erosion control work, as are applicable for clearing and grubbing, grading, construction, paving, and structures at watercourses.

The Contractor shall also submit a proposed method of erosion and dust control on haul roads and borrow pits and a plan for disposal of objectionable materials. Work shall not be started until the erosion control schedules and methods of operation for the applicable construction have been accepted by the design Engineer, the City or its Engineer.

The Contractor shall incorporate the following methods, where practicable, in his erosion control plan: exposing the minimum area of erodible earth; applying temporary mulch with or without seeding; using water sprinkler trucks; using covered haul trucks; using dust palliatives or penetration asphalt on haul roads; and using plastic sheet coverings.

- C. Authority of Engineer:** The design or City Engineer has the authority to limit the surface area of erodible earth material exposed by clearing and grubbing, to limit the surface area of erodible earth material exposed by excavation, borrow and fill operations, and to direct the Contractor to provide immediate permanent or temporary pollution control measures to minimize contamination of adjacent streams or other watercourses, lakes, ponds, or other areas of water impoundment.
- D. Construction Details:** The Contractor will be required to incorporate all permanent erosion control features into the project at the earliest practicable time. Except where future construction operations will damage slopes, the Contractor shall perform the permanent seeding and mulching and other specified slope protection work in stages, as soon as substantial areas of exposed slopes can be made available. Temporary erosion and pollution control measures will be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.

Where erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter if the project conditions permit; otherwise, temporary erosion control measures may be required between successive construction stages.

The design or City Engineer will limit the area of clearing and grubbing, excavation, borrow, and embankment operations in progress, commensurate with the Contractor's capability and progress in keeping the finish grading, mulching, seeding, and other such permanent control measures current in accordance with the accepted schedule. Should seasonal limitations make such coordination unrealistic, temporary erosion control measures shall be taken immediately to the extent feasible and justified.

In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of the work as scheduled or are ordered by the design or City Engineer, such work shall be performed at the Contractor's expense. The design or City Engineer may increase or decrease the area of erodible earth material to be exposed at one time as determined by analysis of project conditions.

The erosion control features installed by the Contractor shall be acceptably maintained by the Contractor during the construction period.

Whenever construction equipment must cross watercourses at frequent intervals, and such crossings will adversely affect the sediment levels, temporary structures should be provided.

Pollutants such as fuels, lubricants, bitumen, raw sewage, wash water from concrete mixing operations, and other harmful materials shall not be discharged into or near rivers, streams, and impoundments or into natural or manmade channels leading thereto.

V. MEASUREMENT

Temporary erosion and pollution control work as shown on the plans, as required for compliance with these specifications, and as applicable for compliance with state and federal regulations will be measured as a lump sum item

VI. PAYMENT

Payment for this item shall not be made separately unless otherwise shown in the bid proposal. Payment will be included in the various items of construction listed in the bid proposal. The prices bid in the various items in the bid proposal shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

If shown as a separate item in the proposal, payment shall be made at the contract unit price per lump sum for the erosion controls. These prices shall be full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the work.

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**SUBSECTION 10.03
PROJECT PREPARATION**

I. SCOPE

This item includes preparing the right of way or project site by removal and disposal of all obstructions as shown on the plans. Obstructions shall include, but not limited to, separate curb, concrete curb and gutter, concrete slab, retaining wall, asphaltic concrete, brick pavement, corrugated metal and reinforced concrete culverts, metal beam guard fence, mail boxes, trees, stumps, shrubs and other landscape features not designated to remain in place.

II. MATERIALS

The materials removed shall become the property of the Contractor unless otherwise shown on the plans or described in individual bid items in the proposal.

III. EQUIPMENT

The equipment shall conform to the requirements as specified in Subsection 4.02 "Earthwork".

IV. CONSTRUCTION METHODS

The right of way or project site shall be cleared of all structures and obstructions as shown on the plans or provided for in the proposal. All foliage designated for preservation shall be carefully protected during construction. Drainage structures shall be removed in proper sequence to maintain traffic and storm water flow.

Holes remaining after obstructions are removed shall be properly backfilled. The Contractor shall complete the right of way preparation by approved methods.

V. MEASUREMENT

Measurement for payment shall be made on the particular units specified for the various bid items provided in the proposal.

VI. PAYMENT

Work performed and measured as provided will be paid for at the unit prices as bid for the various project site or right of way preparation. The prices shall be full compensation for furnishing labor, equipment, tools, supplies, and incidentals to complete this specific work.

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SUBSECTION 10.04 REINFORCING STEEL

I. SCOPE

This item includes the furnishing and placing of reinforcing steel, deformed and smooth, of the size and quantity designated and in accordance with these specifications and with plan details.

II. MATERIALS

A. Unless otherwise designated on the plans, or herein, all bar reinforcement shall be deformed, and shall conform to one (1) of the following:

1. ASTM A 615, Grade 60, open hearth, basic oxygen, or electric furnace new billet steel, or ASTM A 617, Grade 60, axle-steel.
2. Where bending of bar sizes No. 14 or No. 18 of Grade 60 is required, bend testing shall be performed on representative specimens as described for smaller bars in the applicable ASTM Specification. The required bend shall be ninety degrees (90°) around a pin having a diameter of ten (10) times the nominal diameter of the bar.

Spiral reinforcement shall be either smooth or deformed bars, or wire, of the minimum size or gage shown on the plans. Bars for spiral reinforcement shall comply with ASTM A 675, A 615 or A 617. Wire shall comply with ASTM A 82.

Unless otherwise shown on the plans the minimum yield strength for spiral reinforcement shall be forty thousand (40,000) psi.

Report of chemical analysis, showing the percentages of carbon, manganese, phosphorus and sulphur will be required for all reinforcing steel.

Smooth bars, larger than No. 4, may be furnished in any steel that meets the physical requirements of ASTM A 36.

Smooth round bars shall be designated by size number through No.4. Smooth bars above No.4 shall be designated by diameter inches.

Wire fabric reinforcement shall be cold-drawn from rods hot-rolled from open hearth, basic oxygen, or electric furnace billeted. Wire shall conform to the requirements of the Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A 82 or A 496. Wire fabric, when used as reinforcement, shall conform to ASTM A 185 or A 497.

B. Bending: The reinforcement shall be bent cold, true to the shapes indicated on the plans. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection.

C. Tolerances: Fabricating tolerances for bars, from plan dimensions, shall not be greater than ASTM requirements.

D. Storing: Steel reinforcement shall be stored above the surface of the ground upon platforms, skids, or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil, or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the

minimum dimensions, cross sectional area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel specified.

- E. Splices:** No splicing bars, except when provided on the plans, or, specified herein, will be permitted without written approval of the Engineer.

Splices not provided for on the plans will be permitted in slabs not more than fifteen (15) inches in thickness, columns, walls and parapets, but not included for measurement, subject to the following:

Splices will not be permitted in bars thirty (30) feet or less in plan length. For bars exceeding thirty (30) feet in plan length, the distance center to center of splices shall not be less than thirty (30) feet minus one (1) splice length, with no more than one (1) individual bar length less than ten (10) feet. Splices not shown on the plans, but permitted hereby, shall be made in accordance with Table 1. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.

TABLE 1
Minimum Lap Length Requirements
For Bar Sizes Through No. 11

<u>SIZE</u>	<u>GRADE 60</u>
No. 3.....	1' - 0"
No. 4.....	1' - 9"
No. 5.....	2' - 2"
No. 6.....	2' - 7"
No. 7.....	3' - 5"
No. 8.....	4' - 6"
No. 9.....	5' - 8"
No. 10.....	7' - 3"
No. 11.....	8' - 11"

Spiral steel shall be lapped a minimum of one (1) turn. Sizes No. 14 and No. 18 may not be lapped.

Welding of reinforcing bars may be done only where shown on the plans or as permitted herein. All welding operations, process, equipment, materials, workmanship, and inspection shall conform to the requirements of the plans. All splices shall be of such dimension and character as to develop the full strength of the bar being spliced.

End preparation for butt welding reinforcing bars, shall be done in the field. Delivered bars shall be of sufficient length to permit this practice.

- F. Placing:** Unless otherwise shown on the plans, dimensions shown for reinforcement are to the centers of the bars. Reinforcement shall be placed as near as possible in the position shown on the plans. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from the plan placement by more than one-twelfth (1/12) of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than one-fourth (1/4). Cover of concrete to the nearest surface of steel shall meet the above requirements but shall never be less than two (2) inches.

The reinforcement shall be accurately located in the forms, and firmly held in place, before and during concrete placement, by means of bar supports, adequate in strength and number to prevent displacement, to keep the steel at the proper distance from the forms and to carry the reinforcing bars they support. Bars shall be supported by standard galvanized bar supports, bar supports with plastic tips, stainless steel bar supports, approved plastic bar supports or

approved pre-cast mortar or concrete blocks.

Mortar or concrete blocks shall be cast to uniform dimensions with adequate bearing area. A suitable tie wire shall be provided in each block for anchoring to the steel. They shall be accurately cast to the thickness required in molds approved by the Engineer. The surface placed adjacent to the form shall be a true plane, free of surface imperfections. The blocks shall be cured by covering with wet burlap or mats for a period of seventy-two (72) hours. Mortar for blocks shall contain approximately one (1) part cement to three (3) parts sand. Concrete for blocks shall contain nine (9) sacks of cement per cubic yards.

Individual bar supports shall be placed in rows at four (4) foot maximum spacing in each direction. Continuous type bar supports shall be placed at four (4) feet maximum spacing.

Reinforcing steel for bridge slabs, top slabs of culverts and the top slabs of prestressed box beams shall be tied at all intersections except that where the spacing is less than one (1) foot in each direction, alternate intersections only need to be tied. For reinforcing steel cages for other structural members, the steel shall be tied at enough intersections to provide a rigid cage of steel. Mats of wire fabric shall overlap each other one (1) full space as a minimum to maintain a uniform strength and shall be fastened securely at the ends and edges.

Before any concrete is placed, all mortar, mud, dirt, etc. shall be cleaned from the reinforcement. No concrete shall be deposited until the design Engineer or the City approves reinforcing steel placement.

If the reinforcement is not adequately supported or tied to resist settlement, floating upward, overturning of truss bars, or movement in any direction during concrete placement, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to insure compliance.

III. EQUIPMENT (not used)

IV. CONSTRUCTION METHODS (not used)

V. MEASUREMENT

Unless otherwise shown, the reinforcing steel will not be measured separately.

If reinforcing steel is measured separately, the measurement of quantities of bar reinforcement furnished and placed will be based on the calculated weights of the quantities as shown on the contract plans, with no allowance made for added bar lengths for splices requested by the Contractor, nor for extra metal used when bars larger than those specified are substituted with the permission of the design or City Engineer. Tie wires and supporting devices will not be included in the calculated weights. The calculated weight for bar reinforcement will be determined using the theoretical bar weight and the lengths shown on the plans. Permitted splices will not be measured for payment. Welded splices will not be measured, but shall be considered subsidiary to this item.

VI. PAYMENT

- A. Unless otherwise shown in the proposal, payment for reinforcing steel will not be separate, but will be included in the various items of construction listed in the proposal. The prices bid in the various items in the proposal shall be full compensation for furnishing, bending, fabricating, welding and placing the reinforcement, for all clips, blocks, metal spacers, ties, wire, or other materials used for fastening reinforcement in place, and for all tools, labor, equipment, and incidentals necessary to complete the work

- B.** If the proposal shows a separate item for reinforcing steel, the quantity to be paid for, will be that quantity shown on the contract plans and in the proposal, regardless of errors in calculation, except as may be modified by the following:
- 1.** When a complete structure element has been erroneously included or omitted from the plans, the quantity shown on the plans for that element will be added to or deducted from the plan quantity and included for payment. A complete structure element will be the smallest portion of a total structure for which a corresponding quantity of concrete is included on the plans.
 - 2.** When quantities are revised by a change in design the "plan quantity" will be increased or decreased by the amount involved in the design change.
 - 3.** The party to the contract requesting the adjustment shall present to the other, three copies of the description location, together with calculations of the quantity for the structure element involved. When this quantity is certified correct by the Engineer, it will become the revised plan quantity.
 - 4.** The unit price bid per pound for reinforcing steel, shall be full compensation for furnishing, bending, fabricating, welding and placing the reinforcement, for all clips, blocks, metal spacers, ties, wire, or other materials used for fastening reinforcement in place, and for all tools, labor, equipment, and incidentals necessary to complete the work.

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SUBSECTION 10.05 FENCE

I. SCOPE

This item includes chain link and barbed wire fencing. The Contractor shall furnish all material, labor, superintendence, tools, equipment, shop drawings, and incidentals necessary to complete this construction in accordance with the drawings and these specifications.

II. MATERIALS

A. Chain Link Fence:

1. **Wire Fabric:** The chain link fabric shall be zinc coated steel fabric. Zinc coating shall have a minimum weight of one and two tenths (1.2) ounces per square foot of uncoated wire surface. The fabric shall be No. 9 gauge with two (2) inch mesh for the height as shown on the plans or as specified. The fabric shall be knuckled at bottom selvage and twisted and bared at top selvage.
2. **P.I., Cross Member & End Posts:** Points of intersections, cross member and end posts shall be three and one-half (3 1/2) inch O.D. pipe, total length to be four feet greater than fence height, with a two hundred sixteen thousandths (0.216) inch wall thickness, weighing seven and fifty-eight hundredths (7.58) pounds per linear foot. Posts shall be hot-dip galvanized.
3. **Gate Posts:** Gate posts shall be four (4) inch O.D. pipe, total length to be four feet greater than fence height, with a two hundred twenty six thousandths (0.226) inch wall thickness, weighing nine and eleven hundredths (9.11) pounds per linear foot. Posts shall be hot-dip galvanized.
4. **Line Posts:** Line posts shall be two and three-eighths (2 3/8) inch O.D. pipe weighing three and sixty-five hundredths (3.65) pounds per linear foot with a wall thickness of one hundred fifty-four thousandths (0.154) inches. Line posts shall be a total length of forty-two inches plus the height of the fence and shall be hot-dip galvanized.
5. **Top and Bottom Rails:** All top and bottom rails shall be one and five-eighths (1 5/8) inch O.D. pipe weighing two and twenty-seven hundredths (2.72) pounds per linear foot with a wall thickness of one hundred twenty-five thousandths (0.125) inches. Top and bottom rails shall be hot-dip galvanized and shall be provided with approved couplings and connections. The fabric shall be tied to the rail with No. 9 gauge tie wires on a maximum spacing of twelve (12) inches.
6. **Post Tops:** Steel, wrought iron, or malleable iron, designed as weathertight closure cap. One cap per post, where barbed wire is not used.
7. **Tension Bars:** Tension bars to be 3/16 X 3/4 inch minimum, steel. Provide one piece for full height of fabric.
8. **Tension Wire:** Tension wire to be 7 gauge galvanized coated spring coil tension wire.
9. **Stretch Bars and Bands:** Provide 1/8 X 1 inch threaded through fabric and secured to posts with metal bands spaced not greater than 15 inches on center.
10. **Metal Bands:** Minimum .115 x 7/8 inch steel
11. **Guy Wire:** All guy wires shall be appropriate tensile strength cable, coated as specified

for the wire fabric, and shall be installed at all cross members, end posts, and P.I. posts. All guy wires shall be installed to the top of posts and anchored to the ground at a distance of six (6) feet from the fence using a standard mobile home anchoring system. End posts shall be anchored in line with the fence. Cross members shall be anchored at a ninety degree (90°) angle to the fence toward the center. P.I. posts shall be anchored at a ninety degree (90°) angle to the fences away from the center.

- 12. Fittings:** All fittings shall be steel of adequate size as approved.
- 13. Gates:** Gates shall be installed as shown on the plans. The fabric covering shall be the same as the fence. All gates shall be furnished complete with the fittings. Gate frames shall be one and five-eighths (1-5/8) inch O.D., hot-dip galvanized pipe weighing two and twenty-seven hundredths (2.27) pounds per linear foot with a wall thickness of one hundred twenty-five thousandths (0.125) inches.
- 14. Man Gates:** Man gates shall be installed as shown on the plans and per manufacturer's recommendation.
- 15. Gate Hardware:** Hinges to be pressed of forged steel or malleable iron, non-lift off heavy-duty type, offset to permit 180 degree gate opening. Provide 3 pair for each leaf of eight-foot height. Latches to be heavy-duty lockable latch. For double gates, lockable latch on one leaf and drop rod type latch on other leaf. Furnish suitable casting set in concrete to hold gate leaf in place when drip rod is engaged. Keepers to hold open gate until manually released
- 16. Cross Members:** At a maximum spacing of five hundred (500) feet intervals, cross members shall be installed. The cross members shall be constructed from three and one half (2-7/8) inches O.D. pipe weighing five and seventy-nine hundredths (5.79) pounds per linear foot with a wall thickness of two hundred three thousandths (0.203) inches. Spacing between posts for cross members shall be six (6) feet. Cross members shall be constructed in accordance with these specifications and the detailed drawing on the plans. A guy wire shall be installed at each cross member as specified.
- 17. Extension Arms:** Extension arms shall be steel with provisions for three (3) wires, and shall extend at a forty-five degree (45°) angle to the outside of the line posts.
- 18. Wire:** Each wire shall be of a smooth pattern with two strands of No. 12-1/2 gauge. Each strand shall be coated as specified for the fabric. A total of three (3) wires shall be installed along the entire length of the fence unless otherwise specified.
- 19. Barbed Wire:** Barbed wire on the top of the fence to be three (3) strands high and have 4-point barbs spaced at a maximum of five inches.
- 20. Concrete:** Concrete for posts shall be adequate to maintain the posts truly plumb under the stresses imposed and shall have a minimum twenty-eight (28) day compressive strength of three thousand (3000) pounds.

B. Barbed Wire Fence:

- 1. Metal Posts and Braces:** Steel pipe used for posts and braces shall conform to the specifications of ASTM A 120. Steel sections used for posts and braces shall be commercial quality weldable steel. All material shall be new and no used, rerolled or open seam material will be acceptable. All posts and braces shall meet the weight and length requirements shown on the plans. Galvanized steel sections shall conform to ASTM A 123. All posts and braces, except galvanized products, shall be painted with an approved anti-corrosive paint and after installation all areas where the paint coat has been

damaged shall be spot-coated with paint of the same color as the shop coat. No other painting will be required. All fittings required for posts and braces shall be pressed or rolled steel, forged steel, malleable iron or wrought iron of good commercial quality and shall conform to the details shown on the plans.

2. **Metal Line Posts, Pull Posts and Braces for Pull Posts:** Metal posts and braces shall be "H" column, tubular or any other approved shape and shall be properly adapted to provide means for attaching the fencing to the posts in a manner that will not damage the posts nor fencing material. Metal line posts, pull posts and braces for pull posts shall each be of the weight and dimensions shown on the plans. Line posts shall be provided with tapered anchor plates securely attached thereto. The anchor plates shall be of the area, size and weight shown on the plans. The anchor plate may be omitted provided the post is set in a concrete footing as shown on the plans.
3. **Metal Corner, End and Gate Posts:** Metal corner, end and gate posts and braces shall be any one of the shapes specified for line posts. Metal posts shall each be of the weight and dimensions shown on the plans.
4. **Untreated Wood Posts and Braces:** Untreated wood posts and braces shall be pine, cedar or mesquite of the length and size shown on the plans and shall be cut from sound timber. Posts shall have a minimum diameter as indicated on the plans and shall be approximately round, shall be trimmed of all knots and knobs and shall be straight and relatively smooth. The posts shall be free from defects such as injurious ring shakes, unsound or loose knots, splits or other defects that might impair their strength and durability. Sound knots will be permitted provided they are not in clusters and do not exceed one-third of the small diameter or least dimension of the posts. A line drawn from the center of each end of the post shall not fall outside the center of the post at any point more than two (2) inches.
5. **Treated Wood Posts and Braces:** Treated wood posts and braces shall be pine or fir timber of the size and dimensions shown on the plans. The timber shall be sound and free from all decay, shakes, splits or any other defects which would weaken the posts or braces or otherwise make them structurally unsuitable for the purposes intended.

The posts and braces shall be round, square or sawed rectangular shape. The slope of grain in sawed, square or rectangular posts for the full length shall not exceed one in ten and knots shall be sound, tight, well spaced and shall not exceed one-third of the small diameter or least dimension of the post. A line drawn from the center of each end of the post shall not fall outside the center of the post at any point more than two (2) inches. All braces shall have a creosote, pentachlorophenol, ACA or CCA treatment. Posts shall be inspected at time of treatment. Round posts and braces shall be peeled to remove all outer bark and all inner cambium bark, except that occasional strips of bark may remain if not over one-half (1/2) inch wide or over three (3) inches long. All knots shall be trimmed flush with the sides, spurs and splinters removed and the ends cut square. The allowable taper from end to end of round posts and braces shall not exceed one and one-half (1 1/2) inches.

6. **Gates and Gate Posts:** Gates and gate posts shall be of the materials and to the dimensions detailed on the plans.
7. **Barbed wire:** Barbed wire shall conform to ASTM A 121, Class 1. The barbed wire shall consist of two strands of 12-1/2-gauge wire, twisted with two-point 14-gauge barbs spaced not more than five (5) inches apart, or may be as specified on the plans for high tensile wire.

- 8. Wire Mesh:** Wire mesh fabric shall conform to ASTM A 116, Class 1. The wire mesh shall be of the height and design shown on the plans. The top and bottom wires shall be 10-gauge minimum and the intermediate wires and vertical stays shall be 12-1/2-gauge minimum.
- 9. Miscellaneous:** Galvanized bolts and nuts for attaching braces and straps to metal posts and suitable galvanized devices for holding barbed wire and wire mesh firmly in position shall be of good commercial quality and design.

Staples used to secure barbed wire and wire mesh fabric to wood posts shall be not less than one and one-half (1 1/2) inches long and the wire from which they are made shall be galvanized.

III. EQUIPMENT

The Contractor shall use proper equipment to install the proposed fence.

IV. CONSTRUCTION METHODS

- A. Chain Link Fence:** Do not start fence installation before final grading is complete and finish elevations are established. Line posts shall be spaced a maximum of ten (10) feet apart. Gate posts shall be spaced to fit the gates furnished. All line, gate and P.I. posts shall be set at least forty-two (42) inches deep. All line posts shall be set in holes not less than nine (9) inches in diameter, and all gate, end and P.I. posts shall be set in holes not less than twelve (12) inches in diameter, and filled with concrete. Concrete shall extend one 1 inch above finished grade and be sloped away from the post in all directions such that water shall not pond around the post. Fabric shall be stretched taut and securely attached to the line posts with clips spaced twelve (12) inches apart. Suitable stretcher bars and bands shall be used at all end posts, P. I. posts, and gate posts. The guy wires shall be tightly stretched and securely attached to the top of cross member posts. The fence shall be installed in accordance with the manufacturer's instructions, in a neat and workmanship like manner.

Install fence in true and correct alignment with posts vertical. Fence shall be tight and free of sags and bulges. Place fence with bottom edge of fabric, tension rod and/or rail 1 inch above grade. Correct minor irregularities in earth to maintain maximum 1-inch clearance.

Provide expansion couplings in top rails at not more than 20-foot intervals. Anchor top rails to maintain posts with appropriate wrought or malleable fittings. Provide center rails in one piece between corner posts and line post, flush with posts on fabric side. Use special offset fittings as required.

Construct gate frames by welding, to produce rigid and weatherproof joints and a rigid, nonsagging, nontwisting gate. Hot dip galvanize the gate frame. Use same fabric as fence fabric, similarly attached.

Install nuts for tension bar and hardware bolts on side of fence opposite fabric side. All nuts and bolts fully tightened. Secure all mechanical fittings with Loctite.

- B. Barbed Wire Fence:** Fence posts shall be spaced at the intervals and set to the depth shown on the plans. Posts shall be set in a vertical position. Corner and pull posts shall be braced in two directions. End and gate posts shall be braced in one direction. Where alignment changes thirty degrees (30°) or more, a corner post shall be installed. At alignment angles varying from fifteen (15) to less than thirty degrees (30°), the angle post shall be braced to adjacent line posts by diagonal tension wires. Where steel posts are specified, a pull post assembly shall be installed at approximately five hundred (500) foot intervals and where wood posts are specified the spacing of pull post assemblies shall be approximately one thousand (1000)

feet, unless otherwise shown on the plans. Metal line posts may be driven in place providing such driving does not damage the posts. Metal corner, end, pull posts and braces shall be set in Portland cement concrete footings crowned at the top to shed water. All posts shall be placed the minimum depth below ground as shown on the plans or as directed by the Engineer. Posts shall be set plumb and firm to the line and grade shown on the plans. Backfilling shall be thoroughly tamped in four (4) inch layers. The timber post braces shall be notched as shown on plans.

The corner, end or angle post assembly shall be installed before stretching the wire between line posts. At all grade depressions where stresses tend to pull the posts out of the ground, the fencing shall be snubbed or guyed at the critical point by means of a double 9-gauge galvanized wire connected to each horizontal line of barbed wire or to the top and bottom wire or wire mesh fabric, and to a deadman weighing not less than one hundred (100) pounds, buried in the ground as shown on plans. The fencing shall be stretched before being snubbed and guyed. Existing cross-fences shall be connected to the new fences and corner posts with braces which shall be connected to the new fences and corner posts with braces which shall be placed at junctions with existing fences. The barbed wire and wire fabric shall be drawn taut and fastened to posts with galvanized ties or staples as specified on the plans.

V. MEASUREMENT

The fence as constructed shall be measured as shown on the project plans and detailed in the project proposal.

VI. PAYMENT

The cost of furnishing and installing the fence complete as specified shall be included in the price bid for the fence installation.

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SUBSECTION 10.06 STRUCTURAL PORTLAND CEMENT CONCRETE

I. SCOPE

This item includes reinforced structural portland cement concrete, prepared and constructed in accordance with these specifications, at the locations and of the form and dimensions shown on the plans.

II. SUBMITTALS

A. Aggregates

1. Sieve analysis and source of fine and coarse aggregates
2. LA abrasion of coarse aggregates
3. Soundness of coarse and fine aggregates

B. Mix Design

1. Proportioning of all materials
2. Slump
3. Air entrainment
4. 7 and 28 day compressive strengths
5. Unit weight of fresh concrete

III. MATERIALS

Only approved materials conforming to these specifications shall be used in the work. They may be subjected to inspection and tests at any time during the progress of their preparation or use. The source of supply of each of the materials shall be approved by the Engineer before delivery or use is started. Representative preliminary samples of the materials shall be submitted by the Contractor, when required, for examination and testing. Materials shall be handled to insure their quality and fitness for use and shall be located to facilitate prompt inspection. All equipment for handling and transporting materials and concrete must be clean before any material or concrete is placed.

In no case shall the use of pit-run or naturally mixed aggregates be permitted. Naturally mixed aggregate shall be screened and washed, and all fine and coarse aggregates shall be stored separately and kept clean. The mixing of different kinds of aggregates from different sources in one stockpile or alternating batches of different aggregates will not be permitted.

A. Coarse Aggregate:

1. The coarse aggregate for concrete shall meet the requirements of ASTM C 33.
2. Coarse aggregate shall be well graded from coarse to fine and shall meet one of the gradations shown in Table 1, using ASTM C 136.

B. Fine Aggregate:

1. The fine aggregate for concrete shall meet the requirements of ASTM C 33.

- The fine aggregate shall be well graded from fine to coarse and shall meet the requirements of Table 2, when tested in accordance with ASTM C 136:

Sieve Designation (square openings)	Percentage by Weight Passing Sieves						
	2"	1-1/2"	1"	3/4"	1/2"	3/8"	#4
No. 4 to 3/4 in. (4.75-19.0 mm)			100	90-100		20-55	0-10
No. 4 to 1 in. (4.75-25.0 mm)		100	90-100		25-60	0-10	
No. 4 to 1-1/2 in. (4.75-38.1 mm)	100	95-100		35-70		10-30	0-5

TABLE 2. GRADATION FOR FINE AGGREGATE

Sieve Designation (square openings)	Percentage by Weight Passing Sieves
3/8 inch (9.5 mm)	100
No. 4 (4.75 mm)	95 -100
No. 16 (1.18 mm)	45-80
No. 30 (0.60 mm)	25-55
No. 50 (0.30 mm)	10-30
No. 100 (0.15 mm)	2-10

Blending will be permitted, if necessary, in order to meet the gradation requirements for fine aggregate. Fine aggregate deficient in the percentage of material passing the No. 50 mesh sieve may be accepted, provided that such deficiency does not exceed five (5) percent and is remedied by the addition of pozzolanic or cementitious materials other than Portland cement, as specified for admixtures, in sufficient quantity to produce the required workability as approved by the Engineer.

C. Cement:

- Cement shall conform to the requirements of ASTM C 150 - Type II.
- The Contractor shall furnish vendors' certified test reports for each carload, or equivalent, of cement shipped to the project. The report shall be delivered to the Engineer before permission to use the cement is granted. All such test reports shall be subject to verification by testing sample materials received for use on the project.

D. Water: The water used in concrete shall be free from sewage, oil, acid, strong alkalies, vegetable matter, and clay and loam. If the water is of questionable quality, it shall be tested in accordance with AASHTO T 26.

E. Admixtures:

- The use of any material added to the concrete mix shall be approved by the Engineer. Before approval of any material, the Contractor shall be required to submit the results of complete physical and chemical analyses made by an acceptable testing laboratory. Subsequent tests shall be made of samples taken by the Engineer from the supply of the

material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

2. Pozzolanic admixtures shall be fly ash or raw or calcined natural pozzolans meeting the requirements of ASTM C 618. All pozzolanic admixtures shall be specifically approved by the City or its Engineer prior to incorporation in a mix design.
3. Air-entraining admixtures shall meet the requirements of ASTM C 260. Air-entraining admixtures shall be added at the mixer in the amount necessary to produce the specified air content.
4. Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C 494, Type A, water-reducing or Type D, water-reducing and retarding. Water-reducing admixtures shall be added at the mixer separately from air-entraining admixtures in accordance with the manufacturer's printed instructions. Calcium chloride, and admixtures containing calcium chloride, shall not be permitted.

F. Premolded Joint Material: Premolded joint material for expansion joints shall meet the requirements of ASTM D 1751.

G. Joint Filler: The filler for joints shall meet the requirements as shown on the plans.

H. Steel Reinforcement: Reinforcing shall consist of welded wire fabric and deformed bars conforming to the requirements of ASTM A 185 with a minimum yield strength of sixty-thousand (60,000) psi and ASTM A 615 grade 60, respectively.

I. Cover Materials For Curing: Curing materials shall conform to one of the following specifications:

Waterproof paper for curing concrete	ASTM C 171
Polyethylene Sheeting for Curing Concrete	ASTM C 171
Liquid Membrane-Forming Compounds for Curing Concrete.	ASTM C 309, Type 2

III. CONSTRUCTION METHODS

A. General: The Contractor shall furnish all labor, materials, and services necessary for, and incidental to, the completion of all work as shown on the drawings and specified herein. All machinery and equipment owned or controlled by the Contractor, which he proposes to use on the work, shall be of sufficient size to meet the requirements of the work, and shall be such as to produce satisfactory work; all work shall be subject to the inspection and approval of the Engineer.

B. Concrete Composition: The concrete shall develop a compressive strength of three thousand five hundred (3500) psi in twenty-eight (28) days as determined by test cylinders made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The concrete shall contain not less than four hundred eighty (480) pounds of cement per cubic yard. The concrete shall contain between three (3) percent and seven (7) percent of entrained air, as determined by ASTM C 231 and shall have a slump of not more than four (4) inches as determined by ASTM C 143.

C. Acceptance Sampling and Testing:

1. Concrete for each structure will be accepted on the basis of the compressive strength specified in III B. The concrete shall be sampled in accordance with ASTM C 172. Compressive strength specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39.

2. Concrete cylindrical test specimens shall be made in accordance with ASTM C 31 and tested in accordance with ASTM C 39. The testing laboratory shall cure and store the test specimens under such conditions as required by the ASTM standard. The actual tests on the specimens are to be at the Contractor's expense.

D. Proportioning and Measuring Devices: When package cement is used, the quantity for each batch shall be equal to the weight indicated in the mix design, rounded up to the next whole sack of cement. The aggregates shall be measured separately by weight. If aggregates are delivered to the mixer in batch trucks, the exact amount for each mixer charge shall be contained in each batch compartment.

Weighing boxes or hoppers shall be approved by the Engineer and shall provide means of regulating the flow of aggregates into the batch box so that the required and exact weight of aggregates can be readily obtained.

E. Consistency: The consistency of the concrete shall be checked by the slump test specified in ASTM C 143. The slump shall range from one (1) to four (4) inches. Tolerance of up to one inch above the indicated maximum may be allowed for individual batches, provided that the average slump for all batched or the most recent ten batches tested, which ever is fewer, does not exceed the maximum limit. The maximum slump when a high range water reducer is used, may be increased to eight (8) inches if approved during the submittal process. Mixing water may be added on the project site, to improve workability, only when the delivery tickets indicate the maximum amount of water to be added to reach the mix design water / cement ratio (not to exceed $w/c = 0.44$ or 5.0 gals./sk). If the concrete exceeds the mix design water / cement ratio or if the slump is exceeded it shall not be placed.

F. Mixing: Concrete may be mixed at the construction site, at a central point, or wholly or in part in truck mixers. The concrete shall be mixed and delivered in accordance with the requirements of ASTM C 94.

G. Mixing Conditions:

1. The concrete shall be mixed only in quantities required for immediate use. Concrete shall not be mixed while the air temperature is below forty degrees (40°) F. The Contractor shall be held responsible for any defective work, resulting from freezing or injury in any manner during placing and curing, and shall replace such work at his expense.
2. Retempering of concrete by adding water or any other material shall not be permitted.
3. The delivery of concrete to the job shall be in such a manner that batches of concrete will be deposited at uninterrupted intervals.

H. Forms:

1. Concrete shall not be placed until all the forms and reinforcements have been inspected and approved by the Engineer. Forms shall be of suitable material and shall be of the type, size, shape, quality, and strength to build the structure as designed on the plans. The forms shall be true to line and grade and shall be mortar-tight and sufficiently rigid to prevent displacement and sagging between supports. The Contractor shall bear responsibility for their adequacy. The surfaces of forms shall be smooth and free from irregularities, dents, sags, and holes.
2. The internal ties shall be arranged so that, when the forms are removed, no metal will show in the concrete surface or discolor the surface when exposed to weathering. All forms shall be wetted with water or with a nonstaining mineral oil which shall be applied shortly before the concrete is placed. Forms shall be constructed so that they can be removed without injuring the concrete or concrete surface. The forms shall not be

removed before the expiration of at least thirty (30) hours from vertical faces, walls, slender columns, and similar structures; forms supported by falsework under slabs, beams, girders, arches, and similar construction shall not be removed until tests indicate that at least sixty (60) percent of the design strength of the concrete has developed.

- I. Placing Reinforcement:** All reinforcement shall be accurately placed, as shown on the plans, and shall be firmly held in position during concreting. Bars shall be fastened together at intersections. The reinforcement shall be supported by approved metal or plastic chairs. Shop drawings, lists, and bending details shall be supplied by the Contractor when required.
- J. Embedded Items:** Before placing concrete, any items that are to be embedded shall be firmly and securely fastened in place as indicated. All such items shall be clean and free from coating, rust, scale, oil, or any foreign matter. The embedding of wood shall be avoided. The concrete shall be spaded and consolidated around and against embedded items.
- K. Placing Concrete:**
1. All concrete shall be placed during daylight. The concrete shall not be placed until the depth and character of foundation, the adequacy of forms and falsework, and the placing of the steel reinforcing have been approved by the City or the Engineer. Concrete shall be placed as soon as practical after mixing and in no case later than one (1) hour after water has been added to the mix. The method and manner of placing shall be such to avoid segregation and displacement of the reinforcement. Troughs, pipes, and chutes shall be used as an aid in placing concrete when necessary. Dropping the concrete a distance of more than three (3) feet, or depositing a large quantity at one point, will not be permitted. Concrete shall be placed upon clean, damp surfaces, free from running water, or upon properly consolidated soil.
 2. The concrete shall be compacted with suitable mechanical vibrators operating within the concrete. When necessary, vibrating shall be supplemented by hand spading with suitable tools to assure proper and adequate compaction. Vibrators shall be manipulated so as to work the concrete thoroughly around the reinforcement and embedded fixtures and into corners and angles of the forms. The vibration at any joint shall be of sufficient duration to accomplish compaction but shall not be prolonged to the point where segregation occurs. Vibration shall not be used as a method to move concrete. Concrete deposited under water shall be carefully placed in a compact mass in its final position by means of a tremie, a closed bottom dump bucket, or other approved method and shall not be disturbed after being deposited.
- L. Construction Joints:** When the placing of concrete is suspended, necessary provisions shall be made for joining future work before the placed concrete takes its initial set. For the proper bonding of old and new concrete, such provisions shall be made for grooves, steps, keys, dovetails, reinforcing bars or other devices as may be prescribed or shown on the plans. The work shall be arranged so that a section begun on any day shall be finished during daylight of the same day. Before depositing new concrete on or against concrete which has hardened, the surface of the hardened concrete shall be cleaned by a heavy steel broom, roughened slightly, wetted, and covered with a neat coating of cement paste or grout.
- M. Expansion Joints:** Expansion joints shall be constructed at such points and of such dimensions as may be indicated on the drawings. The premolded filler shall be cut to the same shape as that of the surfaces being joined. The filler shall be fixed firmly against the surface of the concrete already in place in such manner that it will not be displaced when concrete is deposited against it.
- N. Defective Work:** Any defective work disclosed after the forms have been removed shall be immediately removed and replaced. If any dimensions are deficient, or if the surface of the concrete is bulged, uneven, or shows honeycomb, which in the opinion of the Engineer

cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

O. Surface Finish:

1. All exposed concrete surfaces shall be true, smooth, free from open or rough spaces, depressions, or projections. The concrete in horizontal plane surfaces shall be brought flush with the finished top surface at the proper elevation and shall be struck-off with a straightedge and floated. Mortar finishing shall not be permitted, nor shall dry cement or sand-cement mortar be spread over the concrete during the finishing of horizontal plane surfaces.
2. When directed, the surface finish of exposed concrete shall be a rubbed finish. If forms can be removed while the concrete is still green, the surface shall be pointed and wetted and then rubbed with a wooden float until all irregularities are removed. If the concrete has hardened before being rubbed, a carborundum stone shall be used to finish the surface. When approved, the finishing can be done with a rubbing machine.

P. Curing and Protection: All concrete shall be properly cured and protected by the Contractor. The work shall be protected from the elements, flowing water, and from defacement of any nature during the building operations. The concrete shall be cured as soon as it has sufficiently hardened by covering with an approved material. Water-absorptive coverings shall be thoroughly saturated when placed and kept saturated for a period of at least three (3) days. All curing mats or blankets shall be sufficiently weighted or tied down to keep the concrete surface covered and to prevent the surface from being exposed to currents of air. Where wooden forms are used, they shall be kept wet at all times until removed to prevent the opening of joints and drying out of the concrete. Traffic shall not be allowed on concrete surfaces for seven (7) days after the concrete has been placed.

Q. Drains or Ducts: Drainage pipes, conduits, and ducts that are to be encased in concrete shall be installed by the Contractor before the concrete is placed. The pipe shall be held rigidly so that it will not be displaced or moved during the placing of the concrete.

R. Cold Weather Protection:

1. When concrete is placed at temperatures below fifty degrees (50°) F, the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing. The aggregates, or water, or both, shall be heated in order to place the concrete at temperatures between fifty (50) and one hundred degrees (100°) F.
2. Calcium chloride may be incorporated in the mixing water ONLY with the written approval of the City or the Engineer. Not more than two (2) pounds (908 grams) of Type 1 nor more than one and six-tenth (1.6) pounds (726 grams) of Type 2 shall be added per bag of cement. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than fifty degrees (50°) F until at least sixty (60) percent of the designed strength has been attained.
3. The Contractor shall maintain the placed concrete above any damaging temperatures and/or weather conditions without exception.

S. Filling Joints: All joints which require filling shall be thoroughly cleaned, and any excess mortar or concrete shall be cut out with proper tools. Joint filling shall not be started until after final curing and shall be done only when the concrete is completely dry. The cleaning and filling shall be carefully done with proper equipment and in a manner to obtain a neat looking joint free from excess filler.

IV. METHOD OF MEASUREMENT

- A. Portland cement concrete:** Portland cement concrete shall not be measured separately unless shown as a separate item in the proposal.

If shown as a separate item in the proposal, Portland cement concrete shall be measured by the number of cubic yards of concrete complete in place and accepted. In computing the yardage of concrete for payment, the dimensions used shall be those shown on the plans or ordered by the Engineer. No measurements or other allowances shall be made for forms, falsework, cofferdams, pumping, bracing, expansion joints, or finishing of the concrete. No deductions in yardage shall be made for the volumes of reinforcing steel or embedded items.

- B. Reinforcing steel:** Reinforcing steel shall not be measured separately unless shown as a separate item in the proposal.

If shown as a separate item in the proposal, reinforcing steel shall be measured by the calculated theoretical number of pounds placed, as shown on the plans, complete in place and accepted. The unit weight used for deformed bars shall be the weight of plain square or round bars of equal nominal size. If so indicated on the plans, the poundage to be paid for shall include the weight of metal pipes and drains, metal conduits and ducts, or similar materials indicated and included.

V. PAYMENT

Payment of this item not be paid for separately unless otherwise shown in the proposal. Payment will be included in the various items of construction listed in the proposal. The prices bid in the various items in the proposal shall be full compensation for furnishing all materials and for all preparation, delivering, and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the work.

If shown as a separate item in the proposal, payment shall be made at the contract unit price per cubic yard for structural Portland cement concrete and per pound for reinforcing steel. These prices shall be full compensation for furnishing all materials and for all preparation, delivering and installation of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

LAST PAGE OF THIS SUBSECTION

**SUBSECTION 10.07
SEEDING AND TOPSOILING**

I. SCOPE

This item includes preparing the ground surface for topsoil application, removing topsoil from designated stockpiles or areas to be stripped on the site or from approved sources off the site, placing and spreading the topsoil on prepared areas soil preparation, seeding, and fertilizing in accordance with this specification at the locations shown on the plans or as directed by the Engineer.

II. MATERIALS

A. Seed:

- 1. Native Grass Areas:** The species and application rates of grass, legume, and cover-crop seed furnished shall be those stipulated herein. Seed shall conform to the requirements of Fed. Spec. JJJ-S-181.

Seed shall be furnished separately or in mixtures in standard containers with the seed name, lot number, net weight, percentages of purity and of germination and hard seed, and percentage of maximum weed seed content clearly marked for each kind of seed. The Contractor shall furnish the Engineer duplicate signed copies of a statement by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within six (6) months of date of delivery. This statement shall include: name and address of laboratory, date of test, lot number for each kind of seed, and the results of tests as to name, percentages of purity and of germination, and percentage of weed content for each kind of seed furnished, and, in case of a mixture, the proportions of each kind of seed.

Seeds shall be applied as follows:

Seed Type	Minimum Rate Pure Live Seed lbs/acre
Sideoats Grama (El Reno).....	7.2
Blue Grama (Hachita)	2.4
Buffalograss (Texoka).....	3.6

Seeding shall be performed during the period between January 15 and June 15, inclusive.

- 2. Developed Areas with Bluegrass, Fescue, or Hybrid Bermuda:** Seed or sod as designated on the plans.

- B. Lime:** Lime shall be ground limestone containing not less than eighty-five (85) percent of total carbonates, and shall be ground to such fineness that ninety (90) percent will pass through a No. 20 mesh sieve and fifty (50) percent will pass through a No. 100 mesh sieve. Coarser material will be acceptable, providing the rates of application are increased to provide not less than the minimum quantities and depth specified in the special provisions on the basis of the two sieve requirements above.

Dolomitic lime or a high magnesium lime shall contain at least ten (10) percent of magnesium oxide. Lime shall be applied at the recommended USDA NRCA rate. All liming materials shall conform to the requirements of ASTM C 602.

- C. Fertilizer:** Fertilizer shall be standard commercial fertilizers supplied separately or in mixtures containing the percentages of total nitrogen, available phosphoric acid, and water-soluble potash. They shall be applied at the rate and to the depth specified herein, and shall meet the requirements of Fed. Spec. O-F-241 and applicable state laws. They shall be

furnished in standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon. No cyanamide compounds or hydrated lime shall be permitted in mixed fertilizers.

The fertilizers may be supplied in one of the following forms:

1. A dry, free-flowing fertilizer suitable for application by a common fertilizer spreader;
2. A finely-ground fertilizer soluble in water, suitable for application by power sprayers; or
3. A granular or pellet form suitable for application by blower equipment.

Fertilizers shall be 16-20-0 or 16-8-8 commercial fertilizer and shall be spread at the rate of four hundred (400) pounds per acre.

- D. Topsoil:** Topsoil shall be the surface layer of soil with no admixture of refuse or any material toxic to plant growth, and it shall be reasonably free from subsoil and stumps, roots, brush, stones (two (2) inches or more in diameter), clay lumps or similar objects. Brush and other vegetation which will not be incorporated with the soil during handling operations shall be cut and removed. Ordinary sods and herbaceous growth such as grass and weeds are not to be removed but shall be thoroughly broken up and intermixed with the soil during handling operations. The topsoil or soil mixture, unless otherwise specified or approved, shall have a pH range of approximately 5.5 pH to 7.6 pH, when tested in accordance with the methods of testing of the association of official agricultural chemists in effect on the date of invitation of bids. The organic content shall be not less than three (3) percent nor more than twenty (20) percent as determined by the wet-combustion method (chromic acid reduction). There shall be not less than twenty (20) percent nor more than eighty (80) percent of the material passing the 200 mesh (0.075 mm) sieve as determined by the wash test in accordance with ASTM C 117.

The soil for fill and topsoiling of areas to be repaired shall be at least of equal quality to that which exists in areas adjacent to the area to be repaired. The soil shall be relatively free from large stones, roots, stumps, or other materials that will interfere with subsequent sowing of seed, compacting, and establishing turf, and shall be approved by the Engineer before being placed.

Natural topsoil may be amended by the Contractor with approved materials and methods to meet the above specifications.

III. CONSTRUCTION METHODS

- A. Advance Preparation for Topsoil:** Areas to be topsoiled shall be shown on the plans or disturbed during construction. If topsoil is available on the site, the location of the stockpiles or areas to be stripped of topsoil and the stripping depths shall be shown on the plans or specified.

Suitable equipment necessary for proper preparation and treatment of the ground surface, stripping of topsoil, and for the handling and placing of all required materials shall be on hand, in good condition, and approved by the Engineer before the various operations are started.

Immediately prior to dumping and spreading the topsoil on any area, the surface shall be loosened by discs or spike-tooth harrows, or by other means approved by the Engineer, to a minimum depth of two (2) inches (50 mm) to facilitate bonding of the topsoil to the covered subgrade soil. The surface of the area to be topsoiled shall be cleared of all stones larger than two (2) inches (50 mm) in any diameter and all litter or other material which may be detrimental to proper bonding, the rise of capillary moisture, or the proper growth of the desired planting. Limited areas, as shown on the plans, which are too compact to respond to these operations shall receive special scarification.

Grades on the area to be topsoiled, which have been established by others as shown on the plans, shall be maintained in a true and even condition. Where grades have not been established, the areas shall be smooth-graded and the surface left at the prescribed grades in an even and properly compacted condition to prevent, insofar as practical, the formation of low places or pockets where water will stand.

- 1. Obtaining Topsoil:** Prior to the stripping of topsoil from designated areas, any vegetation, briars, stumps and large roots, rubbish or stones found on such areas, which may interfere with subsequent operations, shall be removed using methods approved by the Engineer. Heavy sod or other cover, which cannot be incorporated into the topsoil by discing or other means shall be removed.

When suitable topsoil is available on the site, the Contractor shall remove this material from the designated areas and to the depth as approved by the Engineer. The topsoil shall be spread on areas already tilled and smooth-graded, or stockpiled in areas approved by the Engineer. Any topsoil stockpiled by the Contractor shall be rehandled and placed without additional compensation. Any topsoil that has been stockpiled on the site by others, and is required for topsoiling purposes, shall be removed and placed by the Contractor. The sites of all stockpiles and areas adjacent thereto which have been disturbed by the Contractor shall be graded if required and put into a condition acceptable for seeding.

When suitable topsoil is secured off the site, the Contractor shall locate and obtain the supply, subject to the approval of the Engineer. The Contractor shall notify the Engineer sufficiently in advance of operations in order that necessary measurements and tests can be made. The Contractor shall remove the topsoil from approved areas and to the depth as directed. The topsoil shall be hauled to the site of the work and placed for spreading, or spread as required. Any topsoil hauled to the site of the work and stockpiled shall be rehandled and placed without additional compensation.

- 2. Placing Topsoil:** The topsoil shall be evenly spread on the prepared areas to a uniform minimum depth of four (4) inches (50 mm) after compaction, unless otherwise shown on the plans or stated in the special provisions. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Spreading shall be carried on so that turfing operations can proceed with a minimum of soil preparation or tilling.

After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (two (2) inches (50 mm) or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the Engineer. The compacted topsoil surface shall conform to the required lines, grades, and cross sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

- 3. Inspection and Tests:** Within ten (10) days following acceptance of the bid, the Engineer shall be notified of the source of topsoil to be furnished by the Contractor when required by the proposal. The topsoil shall be inspected to determine if the selected soil meets the requirements specified and to determine the depth to which stripping will be permitted. At this time, the Contractor may be required to test representative soil samples from several locations within the area under consideration and to the proposed stripping depths, for verification with compliance with the specifications and for submittals for approval of the material.

B. Advance Preparation and Cleanup for Seeding: After grading of areas has been completed and before applying fertilizer and ground limestone, areas to be seeded shall be raked or otherwise cleared of stones larger than two (2) inches (50 mm) in any diameter, sticks, stumps, and other debris which might interfere with sowing of seed, growth of grasses, or subsequent maintenance of grass-covered areas. If any damage by erosion or other causes has occurred after the completion of grading and before beginning the application of fertilizer and ground limestone, the Contractor shall repair such damage. This may include filling gullies, smoothing irregularities, and repairing other incidental damage. An area to be seeded shall be considered a satisfactory seedbed without additional treatment if it has recently been thoroughly loosened and worked to a depth of not less than five (5) inches (125 mm) as a result of grading operations and, if immediately prior to seeding, the top three (3) inches (75 mm) of soil is loose, friable, reasonably free from large clods, rocks, large roots, or other undesirable matter, and if shaped to the required grade.

When the area to be seeded is sparsely sodded, weedy, barren and unworked, or packed and hard, any grass and weeds shall first be cut or otherwise satisfactorily disposed of, and the soil then scarified or otherwise loosened to a depth not less than five (5) inches (125 mm). Clods shall be broken and the top three (3) inches (75 mm) of soil shall be worked into a satisfactory seedbed by discing, or by use of cultipackers, rollers, drags, harrows, or other appropriate means.

C. Dry Application Method for Seeding:

1. **Liming:** Lime shall be applied separately and prior to the application of any fertilizer or seed and only on seedbeds which have previously been prepared as described above. The lime shall then be worked into the top three (3) inches (75 mm) of soil after which the seedbed shall again be properly graded and dressed to a smooth finish.
2. **Fertilizing:** Following advance preparations and cleanup fertilizer shall be uniformly spread at the rate which will provide not less than the minimum quantity stated.
3. **Seeding:** Grass seed shall be sown at the rate specified immediately after fertilizing, and the fertilizer and seed shall be raked within the depth range stated in the special provisions. Seeds of legumes, either alone or in mixtures, shall be inoculated before mixing or sowing, in accordance with the instructions of the manufacturer of the inoculant. When seeding is required at other than the seasons shown on the plans or in the special provisions, a cover crop shall be sown by the same methods required for grass and legume seeding.
4. **Rolling:** After the seed has been properly covered, the seedbed shall be immediately compacted by means of an approved lawnroller, weighing forty (40) to sixty-five (65) pounds per foot of width for clay soil or any soil having a tendency to pack, and weighing one hundred fifty (150) to two hundred (200) pounds per foot (223 to 298 kg per meter) of width for sandy or light soils.

D. Wet Application Method for Seeding:

1. **General:** The Contractor may elect to apply seed and fertilizer by spraying them on the previously prepared seedbed in the form of an aqueous mixture and by using the methods and equipment described herein. The rates of application shall be as specified in the special provisions.
2. **Spraying Equipment:** The spraying equipment shall have a container or water tank equipped with a liquid level gauge calibrated to read in increments not larger than fifty (50) gallons over the entire range of the tank capacity, mounted so as to be visible to the nozzle operator. The container or tank shall also be equipped with a mechanical power-driven agitator capable of keeping all the solids in the mixture in complete suspension at all times until used.

The unit shall also be equipped with a pressure pump capable of delivering one hundred (100) gallons per minute at a pressure of one hundred (100) pounds per square inch. The pump shall be mounted in a line which will recirculate the mixture through the tank whenever it is not being sprayed from the nozzle. All pump passages and pipelines shall be capable of providing clearance for five-eighths (5/8) inch solids. The power unit for the pump and agitator shall have controls mounted so as to be accessible to the nozzle operator. There shall be an indicating pressure gauge connected and mounted immediately at the back of the nozzle.

The nozzle pipe shall be mounted on an elevated supporting stand in such a manner that it can be rotated through three hundred sixty (360°) degrees horizontally and inclined vertically from at least twenty degrees (20°) below to at least sixty degrees (60°) above the horizontal. There shall be a quick-acting, three-way control valve connecting the recirculating line to the nozzle pipe and mounted so that the nozzle operator can control and regulate the amount of flow of mixture delivered to the nozzle. At least three different types of nozzles shall be supplied so that mixtures may be properly sprayed over distance varying from twenty (20) to one hundred (100) feet. One shall be a close-range ribbon nozzle, one a medium-range ribbon nozzle, and one a long-range jet nozzle. For case of removal and cleaning, all nozzles shall be connected to the nozzle pipe by means of quick-release couplings.

In order to reach areas inaccessible to the regular equipment, an extension hose at least fifty feet (50) in length shall be provided to which the nozzles may be connected.

3. **Mixtures:** Lime, if required, shall be applied separately, in the quantity specified, prior to the fertilizing and seeding operations. Not more than two hundred twenty (220) pounds of lime shall be added to and mixed with each one hundred (100) gallons of water. Seed and fertilizer shall be mixed together in the relative proportions specified, but not more than a total of two hundred twenty (220) pounds of these combined solids shall be added to and mixed with each one hundred (100) gallons of water.

All water used shall be obtained from fresh water sources and shall be free from injurious chemicals and other toxic substances harmful to plant life. Brackish water shall not be used at any time. The Contractor shall identify to the Engineer all sources of water at least two (2) weeks prior to use. The Engineer may require the Contractor to take samples of the water at the source or from the tank at any time and have a laboratory test the samples for chemical and saline content. The Contractor shall not use any water from any source which is disapproved by the Engineer following such tests.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. All such mixtures shall be used within two (2) hours from the time they were mixed or they shall be wasted and disposed of at locations acceptable to the Engineer.

4. **Spraying:** Lime, if required, shall be sprayed only upon previously prepared seedbeds. After the applied lime mixture has dried, the lime shall be worked into the top three (3) inches, after which the seedbed shall again be properly graded and dressed to a smooth finish.

Mixtures of seed and fertilizer shall only be sprayed upon previously prepared seedbeds on which the lime, if required, shall already have been worked in. The mixtures shall be applied by means of a high-pressure spray which shall always be directed upward into the air so that the mixtures will fall to the ground like rain in a uniform spray. Nozzles or sprays shall never be directed toward the ground in such a manner as might produce erosion or runoff.

Particular care shall be exercised to insure that the application is made uniformly and at the prescribed rate and to guard against misses and overlapped areas. Proper predetermined quantities of the mixture in accordance with specifications shall be used to cover specified sections of known area. Checks on the rate and uniformity of application may be made by observing the degree of wetting of the ground or by distributing test sheets of paper or pans over the area at intervals and observing the quantity of material deposited thereon.

On surfaces which are to be mulched as indicated by the plans or designated by the Engineer, seed and fertilizer applied by the spray method need not be raked into the soil or rolled. However, on surfaces on which mulch is not to be used, the raking and rolling operations will be required after the soil has dried.

- E. Maintenance of Seeded Areas:** The Contractor shall protect seeded areas against traffic or other use by warning signs or barricades, as approved by the Engineer. Surfaces gullied or otherwise damaged following seeding shall be repaired by regrading and reseeding as directed. The Contractor shall mow, water as directed, and otherwise maintain seeded areas in a satisfactory condition until final inspection and acceptance of the project.

When either the dry or wet application method outlined above is used for work done out of season, it will be required that the Contractor establish a good stand of grass of uniform color and density to the satisfaction of the Engineer. If at the time when the contract has been otherwise completed it is not possible to make an adequate determination of the color, density, and uniformity of such stand of grass, payment for the unaccepted portions of the areas seeded out of season will be withheld until such time as these requirements have been met.

IV. MEASUREMENT

The quantity of seeding to be paid for shall be the number of acres measured on the ground surface, completed and accepted.

Topsoil obtained on or off the site shall be measured by the number of cubic yards of topsoil measured in its original position and stripped or excavated. Topsoil shall be measured by volume in cubic yards computed by the method of end areas.

V. PAYMENT

Payment shall be made at the contract unit price per acre or fraction thereof, which price and payment shall be full compensation for furnishing and placing all seeding material, fertilizer, grass seed, and for all labor, equipment, tools, testing, and incidentals necessary to complete the work prescribed in this item.

Payment will be made at the contract unit price per cubic yard for topsoiling obtained on or off the site. This price shall be full compensation for furnishing all materials and for all preparation, placing, and spreading of the materials, and for all labor, equipment, tools, testing, and incidentals necessary to complete the item.

LAST PAGE OF THIS SUBSECTION

SUBSECTION 10.09 TRENCH SAFETY

I. DESCRIPTION:

This specification consists of the basic requirements which the Contractor must comply with in order to provide for the safety and health of workers in a trench. This specification is for the purpose of providing minimum performance specifications, and the Contractor shall develop, design, and implement the trench safety system. The Contractor shall bear the sole responsibility for the adequacy of the trench safety system and providing "a safe place to work" for the worker.

Should the trench safety protection system require wider trenches than specified elsewhere, the Contractor shall be responsible for the costs associated with determining adequacy of pipe bedding and class, as well as, purchase and installation of alternate materials.

II. STANDARDS:

The following standard shall be the minimum governing requirement of the specification and is hereby made a part of this specification as if written in its entirety: Occupational Safety and Health Standards - Excavations (29CFR Part 1926), U.S. Department of Labor, latest edition. Contractor must comply with all applicable Federal, State, and local rules, regulations, and ordinances.

III. PRODUCTS: - Not used

IV. EXECUTION: - Not used

IV. MEASUREMENT

This item will be measured by the linear foot for the length of the excavation as required for construction in compliance with these specifications. Lengths longer than that required in these specifications will not be measured for payment

V. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Trench Safety System". This price shall be full compensation for all design, labor, tools, equipment, testing and incidentals necessary to complete the work.

LAST PAGE OF THIS SUBSECTION