Corpus Christi Regional Transportation Authority

IFB No. 2021-FC-04
ADA Bus Stop Improvements Phase VII

ZONE 2
TECHNICAL SPECIFICATIONS
EXHIBIT B-1

Prepared by
Zarinkelk Engineering Services, Inc.
## SECTION 00099
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FOR
ADA BUS STOP ZONE 2 IMPROVEMENTS PHASE VII
CORPUS CHRISTI, TEXAS

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GENERAL
SPECIAL CONDITIONS

1.0 EXISTING UTILITIES AND MAINTENANCE OF SERVICES

1.1 Contractor shall take all precautions in protecting existing utilities, both above and below ground. If the Contractor encounters utility services along the line of this work, it shall be their responsibility to maintain the services in continuous operation at the Contractor's expense. Repairs and all labor and materials connected with maintaining services in operation are considered subsidiary. Therefore, no separate or direct payment will be made.

1.2 The location of the underground utilities at each site is unknown. The Contractor shall be responsible for verifying the exact location of utilities prior to any construction. To locate utilities call in advance to the Texas One Call System, 1-800-245-4545 and Lone Star notification, 1-800-669-8344.

1.3 Contractor shall preserve in operating condition all active utilities traversing or adjoining the construction site. Utilities or appurtenances, driveways, drainage structures, roadways, or other improvements that are damaged by the Contractor shall be replaced to original condition at no cost to the RTA.

2.0 TEMPORARY UTILITIES

2.1 WATER: The responsibility shall be upon the Contractor to provide and maintain, at his/her expense, an adequate supply of water for his/her use for construction and domestic consumption, and to install and maintain necessary supply connections and piping for same, but only at such locations and in such manner as may be approved by the RTA. Before final acceptance, temporary connections and piping installed by the Contractor shall be removed in a manner satisfactory to the RTA.

2.2 ELECTRICAL: All electric current required by the Contractor shall be furnished by the Contractor shall be furnished by the Contractor. All temporary connections for electricity shall be subject to approval of the RTA. All temporary lines will be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the RTA and in compliance with the requirements of the National Electrical Code and all local ordinances. They shall be removed by the Contractor in like manner at his/her expense prior to completion of the construction.
3.0  WORKMANSHIP AND QUALITY OF MATERIALS

Workmanship shall be of the highest quality and shall be performed by workers skilled in their trade. Articles, materials, and equipment to be incorporated into the work under this Contract shall be new and unused.

4.0  MATERIALS TESTING

The RTA shall supply and pay the services of an independent testing laboratory to make any test necessary under these specifications. Retesting required by failure to pass the Contractor shall pay for initial testing. The RTA's Project Manager and the Contractor's supervisor shall coordinate testing.

5.0  CONTRACTOR USE OF THE PREMISES

5.1  Careful staging of the construction must be planned by the Contractor to insure safety of RTA bus passengers.

5.2  Unimpeded access and visibility shall be maintained to fire hydrants, police boxes, traffic control devices, and similar terms.

5.3  Contractor shall protect adjacent property from damage due to the progress of work. Contractor shall practice good housekeeping at the site. Any damage to public or private property adjacent to the work shall be repaired or replaced by the Contractor at their expense.

5.4  Upon completion of the work and before acceptance and final payment, Contractor shall remove rubbish, unused materials, and temporary structures from the limits of the project and restore, in a manner acceptable to the RTA, all property both public and private that has been damaged during the execution of the work. Contractor shall level and grade all portions of the work where the surface of the natural ground or street surface has been disturbed during construction and shall leave the site of the work in a neat and presentable condition, free from ruts or holes.

6.0  ACCESS TO THE WORK AND INSPECTIONS

Contractor shall obtain the RTA Project Manager's approval at least 24 hours before work is started at the location so arrangements can be made to relocate bus passengers.

The Contractor shall provide for access to the work at all times for the RTA and its authorized representatives. He/she shall provide facilities for proper inspection by the above persons and shall exclude no portion of the work from such inspection.
7.0 PERMITS

7.1 In the execution of the work, Contractor shall comply with all permit conditions and lawful instructions and requirements of the federal and state agencies having jurisdiction in the areas involved. Such permit conditions and lawful instructions addressed to the RTA that relate to the construction work included in the Contract shall be complied with.

7.2 The Contractor shall be responsible for obtaining any and all permits required in the locations where the improvements are being constructed and the cost for such permits, if any, shall be borne by the Contractor. The Contractor shall also call upon the proper authorities for compliance inspections and assume the fees for same.

7.3 City permits are to be obtained at Engineering Traffic Div. Raymond Chong 826-3500, if required.

- Traffic Control Plan City’s Permit
- Public Right-of-Way Blockage City’s permit

8.0 COOPERATION WITH OTHER AGENCIES

Contractor shall cooperate with all public and private agencies and utilities operating within the limits of each project site. Contractor shall provide 48-hour notice to any applicable agency when work is anticipated to proceed in the vicinity of any facility or affected utility. The Contractor shall make necessary arrangements with the Owner for access and storage provisions at each site. For the Contractors convenience, the following telephone numbers are listed:

Regional Transportation Authority (Project Manager) 289-2712
Traffic Engineer, City of CC 826-3500
Water Division 826-2489
Wastewater Services Division 826-2489
Gas Division 826-2489
Southwestern Bell 828-5127
Texas Department of Transportation 808-2384
Line Locate 811

9.0 CONSTRUCTION STAKING

Field staking for construction shall be the Contractor’s responsibility. In addition, all alignments shown on the construction drawings are based on information obtained from another sources and the Contractor may expect to find slight variances during construction. No separate or direct payment will be made for adjustments of these variances. During the construction period, the Project Manager may review the alignment of construction items and have the opportunity to make minor modifications as may be determined in the field prior
to excavation or concrete pouring to ensure the avoidance of conflicts with existing structures.

10.0 DISPOSITION/SALVAGE OF MATERIALS

Unwanted material shall become the property of the Contractor who shall remove it from the site within twenty-four (24) hours. The cost of hauling shall be considered subsidiary to the bid items of this Contract; and therefore, no separate or direct payment shall be made. All access material excavated from the site shall be removed and disposed of immediately by the Contractor. Liquidated damages shall be assessed at $50 per day for each day that the material is left at the site.

11.0 ACCIDENT PREVENTION

11.1 Contractor shall comply with all of the RTA's safety regulations and shall observe the requirements of the Occupational Safety and Health Act. Contractor shall comply with all procedures prescribed by the RTA for control and safety of persons visiting the job site. It is the Contractor's responsibility to take whatever steps necessary to ensure the safety of individuals working on or visiting the site.

11.2 The RTA calls the Contractor's attention to the necessity for its proper storage, use and disposal of all materials, proper use and storage of tools and devices, and proper control of construction procedures to assure the health and safety of workers and of others having access to the job site. It is the Contractor's responsibility to obtain from the manufacturers, sellers, and/or distributors of materials, tools, and devices all requirements for proper and safe usage, storage, and disposal and to follow these requirements and recommendations carefully. Particular attention is called to the use of paints, thinners, solvents, caulking and patching materials, chemical grouts, and surface treatment materials.

12.0 GUARANTY

12.1 Neither the final certificate of payment or occupancy of the premises by the RTA shall constitute an acceptance of the work not done in accordance with the project documents or relieve the Contractor of liability in respect to any express warranties or responsibilities for faulty materials or workmanship. Contractor shall remedy any defects in materials or workmanship that shall appear within a period of one year from the date of final acceptance of the work.

13.0 TRAFFIC CONTROL PLAN: The Contractor shall comply with the City of Corpus Christi's Uniform Barricading Standards and Practices as adopted by the City. Copies of this document are available through the City's Traffic Engineering Division. The Contractor is responsible for preparing a Traffic Control Plan for the site and for securing the City's approval of this plan. To obtain the City's permit, submit the Traffic Control Plan to the City's Traffic Engineering Division, attention Raymond Chong, Tel. 826-3500. The cost for the Traffic Control shall be covered under the Traffic Control Allowance, see allowances; item 16.
The Contractor is responsible for ensuring the safety of the pedestrians and all vehicular traffic from construction-related activities during the course of this project. **No construction shall commence without the City's approved traffic control plan in place.**

14.0 **SPRINKLER SYSTEM:** THE EXACT LOCATION OF EXISTING SPRINKLER SYSTEMS AT EACH SITE IS UNKNOWN. The exact location shall be determined by the Contractor prior to any excavation and he/she shall assume the cost for any damages caused to existing sprinkler systems due to negligence. Whenever a sprinkler system is present at the construction site, the Contractor shall be responsible for rerouting the system as necessary using a Sprinkler Company selected by the affected Owner or the RTA. Cost for sprinkler system rerouting due to construction improvements shall be covered as part of the Betterment Fund Allowance.

15.0 **ALLOWANCES:** A maximum Traffic Control Plan allowance of Twenty-Three Thousand Two Hundred Dollars ($23,200) has been set aside. A maximum Betterment Fund allowance of Ten Thousand Dollars ($10,000) has been set aside to cover misc. Items, including irrigation lines. BIDDERS should include the Betterment Fund allowance in their bid price. BIDDERS should include the Traffic Control Plan allowance in their bid price. Receipts for these items should be submitted to the Project Manager in order to be reimbursed. The Contractor will only be paid for actual expenses incurred. A final change order will be issued at the completion of the project to adjust this item and the Contract to the actual cost.

16.0 **DEFINITION OF BID ITEMS:** In completing his/her Price Schedule, the CONTRACTOR will make sure to allow in the unit price enough cost to cover the work outlined as follows:

**New Ramp Section:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation
* Placing sand bedding
* Providing and placing steel reinforcing
* Doweling into existing concrete
* Construction of expansion/control joints
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
* Return area to original condition using seeding and sod as necessary
* 6" curb as shown in the details
* Composite Cast In Place Tile Detectable Warning as shown on plan
* Adjusting conflicting utilities and valve boxes
* Relocating signs as needed
**New Landing Section:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation
* Placing sand bedding
* Providing and placing steel reinforcing
* Doweling into existing concrete
* Construction of expansion/control joints
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
* Return area to original condition using seeding and sod as necessary
* 6" curb as shown in the details
* Composite Cast In Place Tile Detectable Warning as shown on plan
* Adjusting conflicting utilities and valve boxes
* Relocating signs as needed
* Expansion Joints
* Control Joins

**Concrete Shelter Pad:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation, including grade beams
* Placing sand bedding
* Providing and placing steel reinforcing
* Doweling into existing concrete
* Construction of expansion/control joints
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
* Adjusting conflicting utilities and valve boxes
* Relocating signs as needed

**New Concrete Sidewalk:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation
* Sand bedding
* Providing and placing steel reinforcement
* Doweling into existing concrete
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
Return area to original condition using seeding and sod as necessary
* Adjusting conflicting utilities and valve boxes
* Relocating signs as needed
* Expansion Joints
* Control Joins

**New Curb and Gutter:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation
* Providing and placing steel reinforcement
* Doweling into existing concrete
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
* Provide proper slope to prevent ponding
* Return area to original condition using seeding and sod as necessary
* Adjusting conflicting utilities and valve boxes
* Relocating signs as needed
* Expansion Joints
* Control Joins

**Demolition of Existing Sidewalk:** Shall include, but is not limited to, the following items.

* Removing and disposing of existing concrete sidewalk
* Removing and disposing of existing 2x2 foundations
* Protect surroundings
* If sidewalk is not reconstructed, backfill and re-vegetated using seeding and sod

**Demolition of Existing Curb and Gutter:** Shall include, but is not limited to, the following items.

* Removing and disposing of existing concrete curb and gutter
* Protect surroundings

**Saw Cut Concrete Pavement (Full Depth):** Shall include, but is not limited to, the following items.

* Saw cutting concrete pavement and steel reinforcement to full depth

**Saw Cut Asphalt Pavement (Full Depth):** Shall include, but is not limited to, the following items.

* Saw cutting asphalt pavement and steel reinforcement to full depth
**Asphalt Pavement Repair:** Shall include, but is not limited to, the following items.

* Demolition and disposal of existing asphalt and base material
* Disposing of excess materials and site clean-up
* Excavation/base preparation
* Provide material and construct new base
* Providing and install 6" Type C Asphalt.

**Type “C” Thermo Plastic Cross Walk Striping and Stop Bar (12” Wide):** Shall include, but is not limited to, the following items.

* Type “C” thermo plastic Traffic marking paint
* Traffic Control Plan

**Type “C” Thermo Plastic Cross Walk Striping and Stop Bar (24” Wide):** Shall include, but is not limited to, the following items.

* Type “C” thermo plastic Traffic marking paint
* Traffic Control Plan

**New 6" Header Curb:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation
* Providing and placing steel reinforcement
* Doweling into existing concrete
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
* Provide proper slope to prevent ponding
* Return area to original condition using seeding and sod as necessary
* Expansion Joints
* Control Joins

**Relocating Existing Bus Stop Sign:** Shall include, but is not limited to, the following items.

* Removing and disposing of existing concrete pier
* Fill and compact existing location
* Reinstall to the same height, level as specified in the details

**New 12” Header Curb/Wall:** Shall include, but is not limited to, the following items.

* Staking of lines and grades
* Excavation/base preparation
* Providing and placing steel reinforcement
* Doweling into existing concrete
* Providing, placing and removing formwork
* Providing, placing, finishing, and curing concrete
* Disposing of excess materials and site clean-up
* Backfill and slope accordingly
* Provide proper slope to prevent ponding
* Return area to original condition using seeding and sod as necessary
* Expansion Joints
* Control Joins

**Demolition of Existing 6” Header Curb:** Shall include, but is not limited to, the following items.

* Removing and disposing of existing concrete curb
* Protect surroundings

**Bus Stop Striping:** Shall include, but is not limited to, the following items.

* Traffic marking paint (Max 60’)
* Traffic Control Plan

******* END OF SECTION *******
CITY OF CORPUS CHRISTI SPECIFICATIONS
1. DESCRIPTION

This specification shall govern all work necessary for clearing, grubbing and stripping of objectionable matter as required to complete the project, and shall include removing and disposing of trees, stumps, brush, roots, vegetation, rubbish and other objectionable matter from the project site.

2. CONSTRUCTION METHODS

The site shall be cleared of all trees, stumps, brush, roots, vegetation, rubbish and other objectionable matter as indicated on the drawings and/or as directed by the Engineer or his designated representative. Tree stumps and roots shall be grubbed to a minimum depth of 2 feet below natural ground or 2 feet below base of subgrade, whichever is lower. Areas that underlie compacted backfill shall be stripped of all vegetation, humus and other objectionable matter encountered within the top six (6) inches of the soil. All material removed from the site under this operation shall become the Contractor's responsibility. The material shall be disposed of either at a disposal site indicated on the drawings or at a disposal site obtained by the Contractor.

3. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, site clearing and stripping or clear right-of-way shall be measured by the acre.

Payment shall be full compensation for all labor, equipment, tools and incidentals necessary for removing, handling, and disposing of objectionable matter from the site as indicated above.
SECTION 021040  
SITE GRADING

1. DESCRIPTION

This specification shall govern all work necessary for backfill and grading of the site to complete the project.

2. CONSTRUCTION METHODS

Prior to site grading, the site shall be cleared in accordance with City Standard Specification Section 021020 “Site Clearing and Stripping”. Unless specified otherwise on the drawings, the existing surface shall be loosened by scarifying or plowing to a depth of not less than six (6) inches. The loosened material shall be recompacted with fill required to bring the site to the required grades and elevations indicated on the plans.

Fill shall be uniform as to material, density and moisture content. Fill shall be free of large clods, large rocks, organic matter, and other objectionable material. No fill that is placed by dumping in a pile or windrow shall be incorporated into a layer in that position; all such piles and windrows shall be moved by blading or similar method. All fill shall be placed in layers approximately parallel to the finish grade in layers not to exceed six (6) inches of uncompacted depth, unless indicated otherwise on drawings.

The fill shall be compacted to a density which approximates that of natural ground unless indicated otherwise on drawings.

The Engineer may order proof rolling to test the uniformity of compaction. All irregularities, depressions and soft spots that develop shall be corrected by the Contractor.

Excess material from excavation, which is not incorporated into the site as fill, shall be become property of the Contractor and disposed of away from the job site, unless indicated otherwise on the drawings.

3. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, site grading shall not be measured for pay, but shall be considered subsidiary to other work.
SECTION 022080
EMBANKMENT

1. DESCRIPTION

This specification shall govern all work for Embankment required to complete the project.

2. CONSTRUCTION METHODS

Prior to placing embankment, the area to be covered shall be stripped of all vegetation and the material so removed shall be disposed of off the job site. Washes, gulleys, wet areas, and yielding areas shall be corrected as directed by the Engineer.

Unless otherwise indicated on the drawings, the surface of the ground which is to receive embankment shall be loosened by scarifying or plowing to a depth of not less than 6 inches. The loosened material shall be recompacted with the new embankment as hereinafter specified. Embankment shall be placed in layers not to exceed ten (10) inches uncompacted (loose) depth for the full width of the embankment, unless otherwise noted.

Where embankment is adjacent to a hillside or old roadbed, the existing slope shall be cut in steps to not less than the vertical depth of an uncompacted layer. The fill material shall be placed from the low side and compacted. Each layer shall overlap the existing embankment by at least the width indicated by the embankment slope.

Trees, stumps, roots, vegetation, debris or other unsuitable materials shall not be placed in embankment.

Each layer of embankment shall be uniform as to material, density and moisture content before beginning compaction. Where layers of unlike materials abut each other, each layer shall be feather-edged for at least 100 feet or the material shall be so mixed as to prevent abrupt changes in the soil. No material placed in the embankment by dumping in a pile or windrow shall be incorporated in a layer in that position, but all such piles or windrows shall be moved by blading or similar methods. Clods or lumps of material shall be broken and the embankment material mixed by blading, harrowing, disking or similar methods to the end that a uniform material of uniform density is secured in each layer. Except as otherwise required by the drawings, all embankments shall be constructed in layers approximately parallel to the finished grade and each layer shall be so constructed as to provide a uniform slope of 1/4 inch per foot from the centerline of the embankment to the outside.

Each layer shall be compacted to the required density and moisture by any method, type and size of equipment that will give the required compaction. Prior to and in conjunction with the rolling operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.

For each layer of earth embankment and select material, it is the intent of this specification to provide the density as required herein, unless otherwise shown on the drawings.
embankment shall be sprinkled with water as required to provide not less than optimum moisture and compacted to the extent necessary to provide not less than 95% Standard Proctor density (ASTM D698). Field density determinations will be made in accordance with approved methods.

After each layer of earth embankment or select material is complete, tests, as necessary, will be made by the Engineer. If the material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified compaction, and the compaction method shall be altered on subsequent work to obtain specified density. Such procedure shall be determined by, and subject to, the approval of the Engineer.

The Engineer may order proof rolling to test the uniformity of compaction of the embankment layers. All irregularities, depressions, weak or soft spots which develop shall be corrected immediately by the Contractor.

Should the embankment, due to any reason or cause, lose the required stability, density or moisture before the pavement structure is placed, it shall be recompacted and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent layer of granular material.

3. SELECTION OF MATERIAL

In addition to the requirement in the excavation items of the specifications covering the general selection and utilization of materials to improve the roadbed, embankments shall be constructed in proper sequence to receive the select material layers shown on drawings, with such modifications as may be directed by the Engineer. The layer of embankment immediately preceding the upper layer of select material shall be constructed to the proper section and grade within a tolerance of not more than 0.10 foot from the established section and grade when properly compacted and finished to receive the select material layer. Select material, when specified, shall meet the requirements in City Standard Specification Section 022100 "Select Material".

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, embankment shall not be measured and paid for separately, but shall be subsidiary to other items of work.
SECTION 022100
SELECT MATERIAL

1. DESCRIPTION

This specification shall govern the use of Select Material to be used to treat designated sections of roadways, embankments, trenches, etc. Select material shall be non-expansive sandy clay (CL) or clayey sand (SC), in accordance with the Unified Soil Classification System (ASTM D2487). Select Material shall meet the following requirements:

- Free of vegetation, hard lumps, rock fragments, or other debris
- No clay lumps greater than 2” diameter
- Liquid Limit (L.L.): < 35
- Plasticity Index (P.I.) Range: 8 to 20
- Moisture Content: as specified in the drawings

2. CONSTRUCTION METHODS

Select material shall be mixed uniformly and placed in layers as indicated, not to exceed 10 inches loose depth (or 12 inches maximum for sanitary sewer trench backfill per City Standard Details for Sanitary Sewers). Unless otherwise specified, the material shall be compacted to a minimum of 95% Standard Proctor density. Each layer shall be complete before the succeeding layer is placed.

The finished surface of the select material shall conform to the grade and section shown on the drawings.

3. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, select material shall not be measured for pay, but shall be subsidiary to the appropriate bid item.
SECTION 025205
PAVEMENT REPAIR, CURB, GUTTER, SIDEWALK AND DRIVEWAY REPLACEMENT

1. DESCRIPTION

This specification shall govern the removal and replacing of all types of pavements and surfacing required to complete the project.

2. MATERIALS

Unless otherwise specified on the drawings, materials and proportions used along with this specification shall conform to the respective following specifications:

City Standard Specifications
Section 022020 "Excavation and Backfill for Utilities"
Section 022100 "Select Material"
Section 025223 "Crushed Limestone Flexible Base"
Section 025424 "Hot Mix Asphaltic Concrete Pavement"
Section 025610 "Concrete Curb and Gutter"
Section 025612 "Concrete Sidewalks and Driveways"
Section 025620 "Portland Cement Concrete Pavement"
Section 030020 "Portland Cement Concrete", Class "A" Concrete
Section 032020 "Reinforcing Steel"
Section 038000 "Concrete Structures".

3. METHOD OF CUTTING

The outline of the trench shall be marked upon the surface of the pavement to be cut, and all cuts into the pavement shall be saw-cut as nearly vertical as it is possible to make them. All unwanted materials removed shall be disposed of by the Contractor and shall not be used as backfill material.

4. BACKFILL OF TRENCH

Excavation and backfilling of trench shall be in accordance with City Standard Specification Section 022020 "Excavation and Backfill for Utilities."
5. REPLACING STREET AND OTHER PAVEMENT

All pavements, driveways, sidewalks, and curbs and gutters which are cut shall be replaced in a workmanlike manner, with like or better materials or per pavement repair details to be provided on the drawings.

Pavement cuts in a street for any utility requires a permit from the Director of Development Services in accordance with City Ordinance 030040, Article III Cuts and Excavations (12-17-2013). The installation of a utility that crosses the ROW at a perpendicular or near perpendicular angle and has an OD of 6” or less will not be permitted to be installed by cutting the road section. Street excavation/cut for a utility in an asphalt roadway shall include a full lane overlay or pavement repair for parallel cuts, or a 12’ wide pavement repair for perpendicular cuts. Street excavation/cut for a utility in a concrete roadway shall include full panel replacement. The drawings and/or permit application should include a site specific pavement cut and restoration plan that indicates the general nature of the pavement and roadway (for examples, concrete arterial, asphalt residential) to be cut and restored, the existing pavement section (if known), the location and approximate area of the excavation/pavement repair, including the approximate length and width of the pavement repair in relation to the roadway travel lane(s).

6. REPLACING DRIVEWAY PAVEMENT

On all concrete driveway pavements, the replacement shall consist of a reinforced Class "A" concrete slab with a minimum thickness of six (6) inches. The type of finish for the replaced section shall be the same as that appearing on the old pavement. Reinforcement shall be #4 bars at 12 inches each way with additional diagonal bars as indicated on the drawings. Any other type shall be replaced with like or better replacement. Replacement shall, in general, be to original joint or score mark.

7. REPLACING SIDEWALKS

On all sidewalk pavements, the replacement shall consist of a reinforced Class "A" concrete slab four (4) inches thick. The type of finish for the replaced section shall be the same as that appearing on the old sidewalk. Replacement shall, in general, be to original joint or score marks. Reinforcement shall be 4" x 4" - W2.9 x W2.9 welded wire fabric located at mid-depth in the slab.

8. REPLACING CURB AND GUTTER

On all curb and gutter, the replacement shall consist of a section conforming in all details to the original section or to City of Corpus Christi Standard curb and gutter section, if required by the Engineer. Cuts through the curb shall be replaced with Class "A" concrete. Preserve the original steel reinforcing and reinforce all new curbs with three #4 bars. Adjust grades for positive drainage. Replacement shall, in general, be to original joint or score mark. For jointed concrete roadways, the joints in curb or in curb and gutter should match the concrete roadway joints.
9. REPAIRING STREET SHOULDERS AND UNIMPROVED STREETS

On streets or roads without curb and gutter where a shoulder is disturbed, it shall be restored to like or better condition. The shoulder surface shall be rolled to an acceptably stable condition. The requirements of City Ordinance 030040 as stated above apply also to unimproved streets unless a specific variance is granted by the Director of Development Services.

10. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, pavement repair shall be measured by the square yard of the type of repair specified; curb and gutter replacement shall be measured by the linear foot; and sidewalk and driveway replacement shall each be measured by the square foot. Payment will be made at the unit price bid for the completed work and shall be full compensation for all labor, materials, equipment, tools, and incidentals required to complete the work. No separate measurement or payment will be made for subgrade compaction, sand leveling course, geogrid, ordinary backfill, cement-stabilized sand backfill, flexible base, prime coat, hot-mix asphaltic concrete, etc.
SECTION 025223
CRUSHED LIMESTONE FLEXIBLE BASE

1. DESCRIPTION

This Specification shall govern all work for furnishing and placing Crushed Limestone Flexible Base required to complete the project.

2. MATERIAL

Crushed Limestone Flexible Base shall consist of crushed limestone produced from oversize quarried aggregate, sized by crushing and produced from a naturally occurring single source, meeting the requirements for Type ‘A’ material as specified in Texas Department of Transportation (TxDOT) Specification Item 247 “Flexible Base”. Crushed gravel or uncrushed gravel shall not be acceptable. No blending of sources and/or additive materials will be allowed. The material shall be free of vegetation and shall be approved by the Engineer. All acceptable material shall be screened and the oversize shall be crushed and returned to the screened material in such a manner that a uniform product will be produced which meets all of the physical requirements for Grade 1-2 as specified in TxDOT Specification Item 247 “Flexible Base”.

3. TESTING

The City will engage a laboratory and pay for one test each gradation, liquid limit, plasticity index, modified proctor, moisture-density relation, CBR, and necessary field densities. The Engineer may call for additional tests at any time. The cost of all retests, in case of failure to meet specifications, will be deducted from the Contractor’s payment. The City will pay for proctor and soil constants and abrasion tests at the rate described in the materials testing schedule. If material changes, the Contractor shall pay the cost of additional tests required by the Engineer. The Engineer may waive testing and/or lime admix for small amounts for unimportant uses.

4. CONSTRUCTION METHODS

Prior to placement of flexible base, the surface of the previous underlying course shall be finished true to line and grade as established, and in conformity with the typical section shown on the drawings. Grade tolerance shall be generally 1/2 inch, and highs and lows must approximately balance. If called for in the drawings or elsewhere in the contract documents, geogrid, as specified in City Standard Specification Section 022040 “Street Excavation”, shall be placed as indicated.

Flexible base shall be delivered and spread the same day if possible (no later than the next day).

Base shall be mixed as required to produce a uniform mixture with water. Base shall be placed in uniform lifts not to exceed 10 inch loose lifts or 8 inch compacted lifts. Moisture and density requirements shall be as indicated on the drawings, typical minimum 98% Modified Proctor
(ASTM D1557) under flexible pavements or typical minimum 98% Standard Proctor (ASTM D698) under concrete pavement and to within ±2% of optimum moisture. The section may be accepted if no more than 1 of the 5 most recent moisture or density tests is outside of the specified limits, and the failed test is within ±1% deviation from specified moisture or density requirements.

The surface of the compacted base, after meeting moisture and density requirements, shall be primed in accordance with City Standard Specification Section 025412 “Prime Coat”.

On completion of compaction and priming, the surface shall be smooth and conform to lines, grades, and sections shown on the drawings. Areas with any deviation in excess of 1/4 inch in cross-section and in lengths of 16 feet measured longitudinally shall be corrected by loosening, adding or removing material, reshaping, and recompacting by repriming and rolling.

Moisture and density shall be maintained until the paving is complete. Excessive loss of moisture shall be prevented by sprinkling, sealing, or covering with a subsequent layer. Should the base, due to any reason or cause, lose the required stability, density, or moisture before it is protected by placement of the next layer, it shall be re-compacted, refinshed, and retested at the expense of the Contractor until acceptable to the City.

5. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, crushed limestone flexible base shall be measured by the square yard complete in place. Payment shall be full compensation for all materials, royalty, hauling, placing, compacting, labor, equipment, tools, and incidentals necessary for the completion of work.

Prime shall be measured and paid under separate bid item if specified on the Bid Form.

Geogrid shall be measured and paid under separate bid item if specified on the Bid Form.
SECTION 025424
HOT MIX ASPHALTIC CONCRETE PAVEMENT (Class A)

1. DESCRIPTION

This specification shall govern all work required for furnishing and laying Hot Mix Asphalt Concrete (HMAC) surface, binder and base courses required to complete the project.

All subsurface utilities must be inspected, tested, and accepted prior to any paving.

2. MATERIALS

2.1. Aggregate. The aggregate shall consist of a blend of course aggregate, fine aggregate and, if required, a mineral filler.

2.1.1. Coarse Aggregate shall consist of that fraction of aggregate retained on a No. 10 sieve and shall consist of crushed furnace slag, crushed stone, or crushed gravel.

Deleterious material in course aggregate shall not exceed 2% per TxDOT Test Method TEX-217-F.

Course aggregate shall be crushed such that a minimum of 85% of the particles have more than one crushed face, unless noted otherwise on the plans.

Los Angeles abrasion losses for course aggregate shall not exceed 40% by weight for the surface course and 45% for the binder and base courses per TxDOT Test Method TEX-410-A.

Polish Value not less than 30 for aggregate used in the surface course per TxDOT Test Method TEX-438-A.

2.1.2. Fine Aggregate is defined as the fraction passing a No. 10 sieve and shall be of uniform quality.

Fine aggregate shall consist of screenings of material that pass the Los Angeles abrasion requirements in paragraph 2.1.1 above. Screenings shall be blended with a maximum of 15% uncrushed aggregate or field sand for Type D mixes, or a maximum of 10% uncrushed aggregate or field sand for Type A, B, and C mixes.

Grading of fine aggregate shall be as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 10</td>
<td>100</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-15</td>
</tr>
</tbody>
</table>
2.1.3 Filler shall consist of dry stone dust, Portland cement, hydrated lime, or other mineral dust approved by the Engineer.

Grading of filler shall be as follows:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Minimum Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 30</td>
<td>95</td>
</tr>
<tr>
<td>No. 80</td>
<td>75</td>
</tr>
<tr>
<td>No. 200</td>
<td>55</td>
</tr>
</tbody>
</table>

2.2. **Reclaimed Asphalt Pavement (RAP).** Reclaimed asphalt pavement may be incorporated into the hot mix asphalt concrete furnished for the project, provided that the mixture is designed per the TxDOT Methods and meets the applicable provisions of said TxDOT Item 340 and this specification.

2.3. **Asphalt.** Asphalt Material shall be in accordance with Standard Specification Section 025404 "Asphalt, Oils and Emulsions" and AASHTO.

2.3.1. **Paving Mixture:**

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>ASPHALT GRADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential or low volume</td>
<td>PG 64-22</td>
</tr>
<tr>
<td>Collector</td>
<td></td>
</tr>
<tr>
<td>Surface Course</td>
<td>PG 70-22</td>
</tr>
<tr>
<td>Binder Course</td>
<td>PG 64-22</td>
</tr>
<tr>
<td>Arterial</td>
<td></td>
</tr>
<tr>
<td>Surface Course</td>
<td>PG 76-22</td>
</tr>
<tr>
<td>Binder Course</td>
<td>PG 64-22</td>
</tr>
<tr>
<td>Base Courses</td>
<td>PG 64-22</td>
</tr>
</tbody>
</table>

2.3.2. Tack Coat shall consist of an emulsion, SS-1 diluted with equal volume of water and applied at a rate ranging from 0.05 to 0.15 gallon per square yard.

3. **PAVING MIXTURE**

3.1. **Mix Design.** The mixture shall be designed in accordance with TxDOT Bulletin C-14 and TxDOT Test Method TEX-204-F to conform to the requirements of this specification. The Contractor shall furnish the mix design for the job-mix to be used for the project, unless shown otherwise on the drawings. The mix design shall be submitted prior to placement of the mixture.

The design procedures are actually intended to result at a job-mix with properties in compliance with these specifications, and when properly placed the job-mix will be durable.
and stable. The sieve analysis of the job-mix shall be within the range of the Master Gradation and Tolerances specified herein. The job-mix shall meet the density and stability requirements as specified and shall be included with the mix design as submitted per above.

If the specific gravity of any of the types of aggregates differs by more than 0.3, use volume method.

Plot sieve analysis of job-mix; percent passing versus size on four-cycle semi-log paper or other appropriate type paper. Show tolerance limits and Limits of Master Gradation.

3.2. Master Gradation of Aggregate. The aggregate for the type of mix specified shall be within the following tabulated limits per TxDOT Test Method TEX-200-F (Dry Sieve Analysis):

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Course Base</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>95-100</td>
</tr>
<tr>
<td>1&quot;</td>
<td>100</td>
</tr>
<tr>
<td>7/8&quot;</td>
<td>70-90</td>
</tr>
<tr>
<td>5/8&quot;</td>
<td>75-95</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>50-70</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>60-80</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td></td>
</tr>
<tr>
<td>No. 4</td>
<td>30-50</td>
</tr>
<tr>
<td>No. 10</td>
<td>20-34</td>
</tr>
<tr>
<td>No. 40</td>
<td>5-20</td>
</tr>
<tr>
<td>No. 80</td>
<td>2-12</td>
</tr>
<tr>
<td>No. 200</td>
<td>1-6*</td>
</tr>
<tr>
<td>VMA % minimum</td>
<td>11</td>
</tr>
</tbody>
</table>
3.3. **Tolerances.** The mixture delivered to the job site shall not vary from the job-mix by more than the tolerances specified below. The gradation of the produced mix shall not fall outside the Master Grading Limits, with the following exceptions: for Type B material coarser than 3/8" and for Type D material coarser than #4. Variations from job-mix shall not exceed the following limits, except as noted above:

<table>
<thead>
<tr>
<th>Item:</th>
<th>Tolerances Percent by Weight or Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; to No. 10</td>
<td>Plus or Minus 5.0</td>
</tr>
<tr>
<td>No. 40 to No. 200</td>
<td>Plus or Minus 3.0</td>
</tr>
<tr>
<td>Asphalt Weight</td>
<td>Plus or Minus 0.5</td>
</tr>
<tr>
<td>Asphalt Volume</td>
<td>Plus or Minus 1.2</td>
</tr>
</tbody>
</table>

3.4. **Mix Properties.** The mixture shall have a minimum Hveem stability of 40 for Type A, B, and C mixes, and 35 for Type D mixes per TxDOT Test Method TEX-208-F at an optimum density of 96% (plus or minus 1.5) of theoretical maximum density per TxDOT Test Methods TEX-227-F and TEX-207-F.

3.5. **Sampling and Testing of Raw Materials.** The Contractor shall sample materials as necessary to produce a mix in compliance with these specifications.

4. **EQUIPMENT**

4.1. **Mixing Plants.** Mixing plants shall be either the weigh batching type or the drum mix type. Both types shall be equipped with satisfactory conveyors, power units, aggregate handling equipment, aggregate screens and bins (weigh batch only), and pollution control devices as required.

4.2. **Truck Scales.** A set of truck scales, if needed for measurement, shall be placed at a location approved by the Engineer.

4.3. **Asphalt Material Heating Equipment.** Asphalt material heating equipment shall be adequate to heat the required amount of material to the desired temperature. Agitation with steam or air will not be permitted. The heating apparatus shall be equipped with a recording thermometer with a 24-hour continuous chart that will record the temperature of the asphalt at the highest temperature.

4.4. **Surge-Storage System.** A surge-storage system may be used provided that the mixture coming out of the bins is of equal quality to that coming out of the mixer. The system shall be equipped with a gob hopper, rotating chute or other devices designed to minimize segregation of the asphalt mixture.

4.5. **Laydown Machine.** The laydown machine shall be capable of producing a surface that will meet the requirements of the typical cross section, of adequate power to propel the
delivery vehicles, and produce the surface tolerances herein required. It shall be wide enough to lay a 28-foot street (back-to-back of curbs) in a maximum of two passes.

4.6. **Rollers.** All rollers shall be self-propelled and of any type capable of obtaining the required density. Rollers shall be in satisfactory operating condition and free from fuel, hydraulic fluid, or any other fluid leaks.

5. **STORAGE, PROPORTIONING AND MIXING**

5.1. **Storage and Heating of Asphalt Materials.** Asphalt cement shall not be heated to a temperature in excess of that recommended by the producer. Asphalt storage equipment shall be maintained in a clean condition and operated in such a manner that there will be no contamination with foreign matter.

5.2. **Feeding and Drying of Aggregates.** The feeding of various sizes of aggregate to the dryer shall be done in such a manner that a uniform and constant flow of materials in the required proportions will be maintained. In no case shall the aggregate be introduced into the mixing unit at a temperature in excess of 350 degrees F.

5.3. **Proportioning.** All materials shall be handled and proportioned in a manner that yield an acceptable mixture as herein specified and as defined by the job-mix.

5.4. **Mixing.**

5.4.1. **Weigh Batch Plant.** In charging the weigh box and in charging the pugmill from the weigh box, such methods or devices shall be used as necessary to minimize segregation of the mixture.

5.4.2. **Drum Mix Plant.** The amount of aggregate and asphalt cement entering the mixer and the rate of travel through the mixer shall be coordinated so that a uniform mixture of the desired gradation and asphalt content will be produced.

5.4.3. **The mixture produced from each type of plant shall not vary from the job-mix by more than the tolerances and restrictions herein specified.** The mixture when discharged from the plant shall have a moisture content not greater than one percent by weight of total mix when determined by TxDOT Test Method TEX-212-F.

5.4.4. **The mixture produced from each type of plant shall be at a temperature between 250 and 325 degrees F.** After a target mixing temperature has been established, the mixture when discharged from the mixer shall not vary from this temperature by more than 25 degrees F.

6. **CONSTRUCTION METHODS**

6.1. **Construction Conditions.** For mat thicknesses greater than 1.5 inches, the asphalt material may be placed with a laydown machine when the air temperature is 40 degrees F and
rising but not when the air temperature is 50 degrees F and falling. In addition, mat thickness less than and including 1.5 inches shall not be placed when the temperature of the surface on which the mat is placed is below 50 degrees F.

All subsurface utilities shall be inspected, tested, and accepted prior to paving.

6.2. **Prime Coat.** If a prime coat is required, it shall be applied and paid for as a separate item conforming to the requirements of City Standard Specification Section 025412 "Prime Coat", except the application temperature shall be as provided above. The tack coat or asphaltic concrete shall not be applied on a previously primed flexible base until the primed base has completely cured to the satisfaction of the Engineer.

6.3. **Tack Coat.** Before the asphalt mixture is laid, the surface upon which the tack coat is to be placed shall be thoroughly cleaned to the satisfaction of the Engineer. The surface shall be given a uniform application of tack coat using materials and rates herein specified and/or as shown on the plans. The tack coat shall be rolled with a pneumatic tire roller as necessary. Tack coat is required before any pavement course not placed immediately following the previous course placement.

6.4. **Transporting Asphalt Concrete.** The asphalt mixture shall be hauled to the job site in tight vehicles previously cleaned of all foreign matter. In cool weather or for long hauls, canvas covers and insulated truck beds may be necessary. The inside of the bed may be given a light coating of lime water or other suitable release agent necessary to prevent from adhering. Diesel oil is not allowed.

6.5. **Placing.** The asphalt mixture shall be spread on the approved prepared surface with a laydown machine or other approved equipment in such a manner that when properly compacted, the finished surface will be smooth and of uniform density, and meet the requirements of the typical cross section as shown on the plans.

6.5.1. **Flush Structures.** Adjacent to flush curbs, gutters, liners and structures, the surface shall be finished uniformly high so that when compacted, it will be slightly above the edge of the curb and flush structure.

6.5.2. **Construction joints of successive courses of asphaltic material shall be offset at least 6 inches.** Construction joints on surface courses shall coincide with lane lines, or as directed by the Engineer, but shall not be in the anticipated wheel path of the roadway.

6.6. **Compacting.** The asphalt mixture shall be compacted thoroughly and uniformly with the necessary rollers to obtain the required density and surface tolerances herein described and any requirements as shown on the plans. Regardless of the method of compaction control followed, all rolling shall be completed before the mixture temperature drops below 175 degrees F.
6.7. **In-Place Density.** In-place density control is required for all mixtures except for thin, irregular level-up courses. Material should be compacted to between 96% and 92% of maximum theoretical density or between 4% and 8% air voids. Average density shall be greater than 92% and no individual determination shall be lower than 90%. Testing shall be in accordance with TxDOT Test Methods TEX-207-F and TEX-227-F.

Pavement specimens, which shall be either cores or sections of the compacted mixture, will be tested as required to determine the percent air voids. Other methods, such as nuclear determination of in-place density, which correlate satisfactorily with actual project specimens may be used when approved by the Engineer.

6.8. **Thickness.** The total compacted average thickness of the combined HMAC courses shall not be less than the amount specified on the drawings. No more than 10% of the measured thickness(es) shall be more than 1/4 inch less than the plan thickness(es). If so, the quantity for pay shall be decreased as deemed appropriate by the Engineer.

6.9. **Surface Smoothness Criteria and Tests.** The pavement surface after compaction, shall be smooth and true to the established lines, grade and cross-section. The surface shall be tested by the City with the Mays Roughness Meter. The Mays Roughness Value for each 600-foot section shall not exceed ninety inches per mile per traffic lane.

For each 600-foot section not meeting this criteria, the Engineer shall have the option of requiring that section to be reworked to meet the criteria, or paying an adjusted unit price for the surface course. The unit price adjustment shall be made on the following basis:

\[
\text{Adjusted Unit Price} = (\text{Adjustment Factor}) \times \text{Surface Course Unit Bid Price}
\]

The adjustment factor shall be:

**For Residential Streets:**

\[
\text{Adjustment Factor} = 1.999 - 0.0111 M
\]

**For All Other Class Streets (Non Residential)**

\[
\text{Adjustment Factor} = 1.287 - 0.0143 M
\]

Where \( M \) = Mays Roughness Value

In no case shall the Contractor be paid more than the unit bid price. If the surface course is an inverted penetration (surface treatment) the Mays Roughness Value observed will be reduced by ten inches per mile, prior to applying the above criteria.

Localized defects (obvious settlements, humps, ridges, etc.) shall be tested with a ten-foot straightedge placed parallel to the roadway centerline. The maximum deviation shall not
exceed 1/8 inch in ten feet. Areas not meeting this criteria shall be corrected to the satisfaction of the Engineer.

Pavement areas having surface irregularities, segregation, raveling or otherwise deemed unacceptable by the Engineer shall be removed and replaced by the Contractor in a manner approved by the Engineer, at no additional cost to the City.

6.10 Opening to Traffic. The pavement shall be opened to traffic when directed by the Engineer. The Contractor's attention is directed to the fact that all construction traffic allowed on pavement open to the public will be subject to the State laws governing traffic on highways.

If the surface ravelles, it will be the Contractor's responsibility to correct this condition at his expense.

7. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, hot mix asphaltic concrete pavement shall be measured by the square yard of the type and thickness of "Hot Mix Asphaltic Concrete" as shown on the drawings.

The Contractor shall provide the Engineer with copies of the "pay ticket" identifying the truck and showing the gross empty weight of the truck with driver as it arrives at the plant and the gross loaded weight of the truck with driver as it leaves the plant. The measured amount will be the difference of the loaded and empty trucks converted to tons.

Payment shall be full compensation for quarrying, furnishing all materials, freight involved; for all heating, mixing, hauling, cleaning the existing base course or pavement, tack coat, placing asphaltic concrete mixture, rolling and finishing; and for all manipulations, labor, tools, equipment, and incidentals necessary to complete the work except prime coat when required.

Prime coat, performed where required, will be measured and paid for in accordance with the provisions governing City Standard Specification Section 025412 "Prime Coat".

All templates, straightedges, scales, and other weight and measuring devices necessary for the proper construction, measuring and checking of the work shall be furnished, operated and maintained by the Contractor at his expense.

Any paving placed prior to inspection, testing, and acceptance of underground utilities may be rejected by the City and will be replaced at the Contractor's expense after correcting any subsurface utility defects. Pavement that fails to meet the in place density criteria may be rejected by the City and will be replaced at the Contractor's expense, or such pavement may, at the City's discretion, be accepted by the City and the unit price for payment shall be reduced as deemed appropriate by the Engineer.
SECTION 025610
CONCRETE CURB AND GUTTER

1. DESCRIPTION

This specification shall consist of Portland cement concrete combined concrete curb and gutter or separate concrete curb with or without reinforcing steel as required, constructed on an approved subgrade or foundation material in accordance with these specifications, in conformity with the lines and grades established by the Engineer and details shown on the drawings.

2. MATERIALS

Unless otherwise specified on the drawings, materials and proportions for concrete used in construction under this specification shall conform to the requirements as specified for Class "A" Concrete under City Standard Specification Section 030020 "Portland Cement Concrete". Reinforcing steel shall conform to the requirements as specified in City Standard Specification Section 032020 "Reinforcing Steel". Expansion joint filler shall be redwood material meeting the requirements specified in City Standard Specification Section 038000 "Concrete Structures".

3. CONSTRUCTION METHODS

The foundation shall be excavated and shaped to line, grade and cross-section, and hand tamped and sprinkled. If dry, the subgrade or foundation material shall be sprinkled lightly with water and compacted to not less than 98% Standard Proctor density, or as required on the drawings. Flexible base shall be compacted to specified density and moisture immediately before concrete is deposited thereon.

Outside forms shall be of wood or metal, of a section satisfactory to the Engineer, straight, free of warp, and of a depth equal to the depth of the curb and gutter. They shall be securely staked to line and grade, and maintained in a true position during the depositing of concrete. Inside forms for the curb shall be approved material, shall be of such design as to provide the curb required, and shall be rigidly attached to the outside forms. For reinforced concrete roadways, all jointing must be reflected through the curb, including redwood expansion joints and construction joints. Driveway gutter shall be placed integrally with the driveway as shown on the City Standard Details.

The reinforcing steel shall be placed in position as shown on the typical details. Care shall be exercised to keep all reinforcing steel in its proper location.

Concrete for curb and gutter shall be mixed in a manner satisfactory to the Engineer. The curb and gutter shall be placed in sections of the length indicated on the plans, and each section shall be separated by a premolded insert or board joint of cross-section specified for the curb and gutter, and of the thickness indicated on the drawings.
After the concrete has been struck off and after it has become sufficiently set, the exposed surfaces shall be thoroughly worked with a wooden float. The exposed edges shall be rounded by the use of an edging tool to the radius indicated on the drawings. All exposed surfaces of curb and gutter, or curb, shall be brushed to a smooth and uniform surface.

The completed curb and gutter shall be cured with Type 2, white pigmented curing compound unless shown otherwise on the drawings. Other methods of curing as outlined in City Standard Specification Section 038000 "Concrete Structures" will be acceptable with a required curing period of 72 hours.

The area behind the curb shall be backfilled, tamped, and sloped as directed as soon as possible and no later than 48 hours after the removal of forms. Backfill shall be placed to the full height of the curb, or as otherwise specified.

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, concrete curb and gutter or concrete curb will be measured by the linear foot for each type of curb, complete in place. Payment shall be full compensation for preparing the subgrade; for furnishing and placing all materials including reinforcing steel and expansion joint material; for furnishing, placing, shaping and tamping backfill; and for all manipulation, labor, tools, equipment and incidentals necessary to complete the work.
SECTION 025612
CONCRETE SIDEWALKS AND DRIVEWAYS

1. DESCRIPTION

This specification shall consist of sidewalks and driveways, with or without reinforcing steel, composed of Portland cement concrete, constructed as herein specified on an approved subgrade, in conformity with the lines and grades established by the Engineer and the details shown on the drawings.

2. MATERIALS

Materials and proportions used in construction under this item shall conform to the requirements as specified for Class "A" concrete under City Standard Specification Section 030020 "Portland Cement Concrete". Reinforcing steel shall conform to the requirements as specified in City Standard Specification Section 032020 "Reinforcing Steel". Expansion joint filler shall be redwood meeting the requirements specified in City Standard Specification Section 038000 "Concrete Structures". Cap seal shall be “Greenstreak” or approved equal.

3. CONSTRUCTION METHODS

The subgrade shall be excavated, compacted and shaped to line, grade and cross-section and hand tamped and sprinkled with water. Subgrade under concrete sidewalks and driveways shall be compacted to not less than 95% Standard Proctor density. The subgrade shall be within 0-3% of optimum moisture content at the time the concrete is placed.

Forms shall be of wood or metal, of a section satisfactory to the Engineer, straight, free from warp, and of a depth equal to the thickness of the finished work. They shall be securely staked to line and grade and maintained in a true position during the depositing of concrete.

The reinforcing steel shall be placed in position as shown on the drawings. Care shall be exercised to keep all reinforcing steel in its proper location.

Driveways shall incorporate the gutter in a unified concrete placement as shown in the City Standard Detail for driveways.

Sidewalks shall be constructed in sections of the lengths shown on drawings. Unless otherwise provided by the drawings, no section shall be of a length less than 8 feet, and any section less than 8 feet shall be removed by the Contractor at his own expense.
The different sections shall be separated by a pre molded insert or board joint of the thickness shown on the drawings, placed vertically and at right angles to the longitudinal axis of the sidewalks. Where the sidewalk or driveways abut a curb or retaining wall, approved expansion joint material shall be placed along their entire length. Similar expansion joint material shall be placed around all obstructions protruding through sidewalks or driveways.

Concrete shall be mixed in a manner satisfactory to the Engineer, placed in the forms to the depth specified and spaded and tamped until thoroughly compacted and mortar entirely covers the surface. The top surface shall be floated with a wooden float to a gritty texture. The outer edges and joints shall then be rounded with approved tools to the radii shown on drawings.

5-foot wide sidewalks shall be marked into separate sections, each 5 feet in length, by the use of approved jointing tools. For other widths of sidewalk, joints to be spaced longitudinally to match the transverse width.

When completed, the sidewalks and driveways shall be cured with Type 2, white pigmented curing compound. Other methods of curing as outlined in City Standard Specification Section 038000 "Concrete Structures" will be acceptable with a required curing period of 72 hours.

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, concrete sidewalks and driveways shall be measured by the square foot of surface area of completed sidewalks, driveways, or sidewalks and driveways, as indicated on the drawings.

Payment shall be full compensation for preparing and compacting the subgrade; for furnishing and placing all materials including concrete, reinforcing steel and expansion joint material; and for all manipulation, labor, tools, equipment and incidentals necessary to complete the work.
SECTION 025614
CONCRETE CURB RAMPS

1. DESCRIPTION

This specification shall govern all work necessary for constructing Concrete Curb Ramps required to complete the project.

2. MATERIALS

Concrete shall be Class "A" in accordance with Section 030020 “Portland Cement Concrete” of the City Standard Specifications.

Reinforcement shall be 4x4 - W2.9xW2.9 welded wire fabric or #4 steel reinforcing bars spaced at 12 inches each way in accordance with Section 032020 “Reinforcing Steel” of the City Standard Specifications.

3. CONSTRUCTION METHODS

The subgrade shall be shaped to line, grade and cross-section, and shall be of uniform density and moisture when concrete is placed. The subgrade shall be hand tamped and sprinkled with water to achieve the desired consistency and uniform support. Subgrade compaction shall not be less than 95% Standard Proctor density.

Ramps shall be constructed of Class "A" concrete to line and section as shown on the plans. Unless shown otherwise on the drawings, ramps shall have a minimum concrete thickness in excess of 5 inches, prior to application of the detectable warning surfacing.

Slopes, S, shall be as follows, unless shown otherwise on the drawings:

RAMPS
Ramp in direction of travel . . . . . . S ≤ 1:12
Side slope of ramp (flare) . . . . . . S ≤ 1:10
Cross slope . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1:100 ≤ S ≤ 1:50

ADJOINING AREAS
Landings adjacent to ramp . . . . . . S ≤ 1:20
Driveways abutting tied sidewalks . S ≤ 1:10

Width of ramp shall be 60 inches (minimum), exclusive of flare, unless specifically shown otherwise on the drawings. No ramp shall be less than 36 inches wide under any circumstances. Obstructions
shall be removed or relocated, as appropriate, or the location of the ramp may be shifted, if authorized.

Detectable warning surface shall be polymer composite material detectable warning panels as shown on the drawings. Surfacing shall be flush with abutting areas and placed using a template as required to achieve an esthetic well-defined edge. Surfacing shall be subsidiary work and will not be measured for separate pay.

Pavement markings for street crossings shall be placed such that the crosswalk is properly aligned with respect to the curb ramp. See striping details for proper alignment of pavement markings with respect to intersection and curb ramp.

Properly constructed curb ramp shall be true to line, section and grade, and shall be free of loose material and irregularities.

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, concrete curb ramps shall be measured by the horizontal square foot of ramp surface area, including side flares when used. Adjoining curbs, gutters, sidewalks, and driveways will be excluded from said measurement.

Payment shall include, but not be limited to, subgrade preparation, formwork, concrete, rebar, detectable warning surfaces, borders, molding and curing required to complete the curb ramp, and shall be full compensation for all labor, materials, equipment and incidentals required to complete the work.
SECTION 025802
TEMPORARY TRAFFIC CONTROLS DURING CONSTRUCTION

1. DESCRIPTION

This specification shall govern all work required for Temporary Traffic Controls during construction. The work shall include furnishing, installing, moving, replacing, and maintaining all temporary traffic controls including, but not limited to, barricades, signs, barriers, cones, lights, signals, temporary detours, temporary striping and markers, flagger, temporary drainage pipes and structures, blue business signs, and such temporary devices as necessary to safely complete the project.

2. MATERIALS


3. METHODS

Sufficient traffic control measures shall be used to assure a safe condition and to provide a minimum of inconvenience to motorists and pedestrians.

If the Traffic Control Plan (TCP) is included in the drawings, any changes to the TCP by the Contractor shall be prepared by a Texas licensed professional engineer and submitted to the City Traffic Engineer for approval, prior to construction. If the TCP is not included in the drawings, the Contractor shall provide the TCP prepared by a Texas licensed professional engineer and submit the TCP to the City Traffic Engineer for approval, prior to construction.

The Contractor is responsible for implementing and maintaining the traffic control plan and will be responsible for furnishing all traffic control devices, temporary signage and ATSSA certified flaggers. The construction methods shall be conducted to provide the least possible interference to traffic so as to permit the continuous movement of traffic in all allowable directions at all times. The Contractor shall cleanup and remove from the work area all loose material resulting from construction operations at the end of each workday.

All signs, barricades, and pavement markings shall conform to the BC standard sheets, TCP sheets and the latest version of the "Texas Manual on Uniform Traffic Control Devices".

The Contractor may be required to furnish additional barricades, signs, and warning lights to maintain traffic and promote motorists safety. Any such additional signs and barricades will be considered subsidiary to the pay item for traffic control. All signs, barricades, and posts will be either new or freshly painted.

The contractor and any traffic control subcontractor must be ATSSA certified for Traffic Control.
A competent person, responsible for implementation of the TCP and for traffic safety, shall be designated by the Contractor.

The name and off-hours phone number of the competent person shall be provided in writing at the Pre-Construction Conference.

The competent person shall be on site, during working hours and on call at all times in the event of off-hour emergency.

The contractor must provide temporary blue sign boards that direct traffic to businesses and driveways during each phase of construction – see example below. The sign boards may be either skid mounted or barrel mounted. The City will assist the contractor in determining which businesses and driveways will receive signage during various construction phases. The provision, installation, and removal of signage will be considered to be subsidiary to the contract items provided for “Traffic Control.”

Example Blue Sign

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, temporary traffic controls during construction shall be measured as a lump sum. Payment shall include, but not be limited to, furnishing, installing, moving, replacing and maintaining all temporary traffic controls including, but not limited to, barricades, signs, barriers, cones, lights, signals, temporary striping and markers, flaggers, removable and non-removable work zone pavements markings and signage, channelizing devices, temporary detours, temporary flexible-reflective roadway marker tabs, temporary traffic markers, temporary drainage pipes and structures, blue business signs, and such temporary devices and relocation of existing signs and devices. Payment shall be full compensation for all labor, equipment, materials, personnel, and incidentals necessary to provide a safe condition during
construction of all phases and elements of the project and to complete the work.

Payment will be made on the following basis: The initial monthly estimate will include 50% of the lump sum bid amount minus retention (typically 5%). The balance will be paid with the final estimate, upon completion of the project.
SECTION 025807

PAVEMENT MARKINGS
(PAINT AND THERMOPLASTIC)

1. DESCRIPTION

This item shall consist of markings and stripes on the surface of the roadways or parking facilities applied in accordance with this specification and at the locations shown on the drawings or as directed by the Engineer.

2. MATERIALS

Type I Pavement Marking Materials shall be in accordance with TxDOT Departmental Material Specification DMS-8220 "Hot Applied Thermoplastic". All roadway markings shall be thermoplastic.

Type II Pavement Marking Materials shall be in accordance with TxDOT Departmental Material Specification DMS-8200 "Traffic Paint" and are not to be used for roadway markings except as primer/sealer for Type 1 markings. Type II Pavement Markings shall be allowed for parking facilities if called for in the plans.

Glass Traffic Beads shall be drop-on glass beads conforming to TxDOT Departmental Material Specification DMS-8290 "Glass Traffic Beads".

3. CONSTRUCTION METHODS

3.1 Weather Limitations - Pavement marking shall be performed only when the existing surface is dry and clean, when the atmospheric temperature is above 40°F., and when the weather is not excessively windy, dusty, or foggy. The suitability of the weather will be determined by the Engineer.

3.2 Equipment - All equipment for the work shall be approved by the Engineer and shall include the apparatus necessary to properly clean the existing surface, and mechanical marking machine, and such auxiliary hand painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an approved atomizing spray-type marking machine suitable for application of pavement markings. It shall produce an even and uniform film thickness at the required coverage and shall be designed so as to apply markings of uniform cross-sections and clear-out edges without running of spattering and within the limits for straightness set forth herein.
Suitable adjustments shall be provided on the sprayer(s) of a single machine or by furnishing additional equipment for marking the width required.

3.3 **Preparation of Existing Surface** - Immediately before application of the paint or thermoplastic, the existing surface shall be dry and entirely free from old pavement markings and markers, dirt, grease, oil, acids, laitance, or other foreign matter which could reduce the bond between the marking and the pavement. The surface shall be thoroughly cleaned by sweeping and blowing as required to remove all dirt, laitance and loose materials. Areas that cannot be satisfactorily cleaned by brooming and blowing shall be scrubbed as directed with a water solution of trisodium phosphate (10% Na₃PO₄ by weight) or an approved equal solution. After scrubbing, the solution shall be rinsed off and the surface dried prior to marking.

3.4 **Layouts and Alignments** - Suitable layouts and lines of proposed stripes shall be spotted in advance of the marking application. Control points shall be spaced at such intervals as will insure accurate location of all markings.

The Contractor shall provide an experienced technician to supervise the location, alignment, layout, dimensions, and application of the markings.

At least 72 hours prior to applying the permanent pavement markings, the Contractor shall notify the Engineer and City Construction Inspector to obtain City approval for the location, alignment and layout of the pavement markings.

3.5 **Application** - Markings shall be applied at the locations and to the dimensions and spacing indicated on the plans or as specified. Markings shall not be applied until the layouts, indicated alignment, and the condition of the existing surface have been approved by the Engineer.

In the application of straight stripes, any deviation of the edges exceeding 1/2 inch in 50 feet shall be obliterated and the marking corrected. The width of the markings shall be as designated within a tolerance of 5%. All markings shall be performed to the satisfaction of the Engineer.

Paint shall be applied uniformly by suitable equipment at a rate of not less than 105 or more than 115 square feet per gallon.

The Contractor shall furnish a certified report on the quality of materials ordered for the work. This report shall not be interpreted as a basis for final acceptance. The Engineer shall be notified upon arrival of shipment for inspecting and sampling of the materials. When required, all emptied containers shall be returned to the paint material storage or made available for tallying by the Engineer. The containers shall
not be removed from the job site or destroyed without permission. The Contractor shall make an accurate accounting of the paint materials used in the accepted work.

3.6 Protection - After application, all markings shall be protected while drying. The fresh markings shall be protected from damage of any kind. The Contractor shall be directly responsible for protecting the markings and shall erect or place suitable warning signs, flags or barricades, protective screens or coverings as required. All surfaces shall be protected from disfiguration by spatter, splashes, spillage, drippings of paint or other materials.

3.7 Defective Workmanship or Material - When any material not conforming to the requirements of the specifications or drawings has been delivered to the project or incorporated in the work, or any work performed is of inferior quality, such material or work shall be corrected as directed by the Engineer, at the expense of the Contractor.

4. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, pavement markings shall be measured by the square foot or linear foot of each type of marking. Eliminating existing pavement markings and markers will not be measured and paid for separately, but shall be subsidiary to the pavement marking items.

Payment shall be full compensation for furnishing all materials and for eliminating existing pavement markings and markers, for all preparation, layout and application of the materials, and for all labor, equipment, tools and incidentals necessary to complete the work.
SECTION 028020  
SEEDING

1. DESCRIPTION

This specification shall govern all work necessary for tilling, fertilizing, planting seeds, mulching, watering and maintaining vegetation required to complete the project.

2. MATERIALS

2.1 FERTILIZER: All fertilizer shall be delivered in bags or clearly marked containers showing the analysis, name, trademark and warranty. The fertilizer is subject to testing by the State Chemist in accordance with the Texas fertilizer law. Fertilizer shall have an analysis of 12-12-12 (percent of nitrogen, phosphoric acid and potash) as determined by the Association of Official Agricultural Chemists. Fertilizer shall be free flowing and uniform in composition.

2.2 SEED: Seed shall be labeled and meet the requirements of the Texas Seed Law. Labels shall indicate purity, germination, name and type of seed. Seed furnished shall be of the previous season's crop, and the date of analysis shown on each bag shall be within twelve months of delivery to the project.

The quantity of "Commercial Seed" required to equal the quantity of "Pure Live Seed" shall be computed by the following formula:

\[
\text{Commercial Seed} = \text{Pure Live Seed} \times \frac{10,000}{\% \text{ Purity} \times \% \text{ Germination}}
\]

The quantity of pure live seed and type required are indicated below. Mixture A or C shall be used for this project, depending on the time of the year planting is performed.

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>SCIENTIFIC NAME</th>
<th>FOR MIXTURES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Green Sprangletop</td>
<td>Leptochloa Dubia</td>
<td>1.4</td>
</tr>
<tr>
<td>Sideoats Grama (premier)</td>
<td>Bouteloua Curtipendula</td>
<td>0.6</td>
</tr>
<tr>
<td>Bermudagrass (Hulled)</td>
<td>Cynodon Dactylon</td>
<td>7.0</td>
</tr>
<tr>
<td>Bermudagrass (Unhulled)</td>
<td>Cynodon Dactylon</td>
<td></td>
</tr>
<tr>
<td>K-R Bluestem</td>
<td>Andropogon Ischaemum</td>
<td>1.2</td>
</tr>
<tr>
<td>Buffalo grass</td>
<td>Buchloe Dactyloides</td>
<td></td>
</tr>
<tr>
<td>Annual Ryegrass</td>
<td>Lolium Multiflorum</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Mixture - A: Recommended for clay or tight soil planted between December 1 thru May 1.
Mixture - B: Recommended for sandy soil planted between December 1 thru May 1.
Mixture - C: Recommended for all soils planted between May 2 thru November 30.
2.3 **MULCH:** Mulch shall be either the straw type or wood cellulose fiber type.

Straw Type mulch shall be of straw from stalks of domestic grain, Bermudagrass or cotton hulls, or other approved by the Engineer.

Wood Cellulose Fiber Type mulch shall have no growth inhibiting ingredients and shall be dried with a moisture content less that 10% by weight. Fibers shall be dyed an appropriate color to facilitate visual metering and application of mulch. The cellulose fiber shall be manufactured so that after addition and agitation in slurry tank with fertilizers, seeds and other approved additives, the fibers in the material will become uniformly suspended to form a homogeneous slurry; when sprayed on the ground, the material shall form a uniform cover impregnated with seeds; the cover shall allow added water to percolate to the underlying soil. The fiber material shall be supplied in packages of not more than 100 lb. gross weight and shall be marked by the manufacturer to indicate the dry weight content.

2.4 **EQUIPMENT:** The fertilizing, seeding and/or mulching operations shall be accomplished with equipment suitable to the required function. It shall be of current design and in good operating condition. Special seeding and mulching equipment must also meet the following requirements:

**Seeder** - Equipment for applying a seed-fertilizer mix shall be a hydraulic seeder designed to pump and discharge a waterborne, homogeneous slurry of seed and fertilizer. The seeder shall be equipped with a power driven agitator and capable of pressure discharge.

**Straw Mulch Spreader** - Equipment used for straw mulch application shall be trailer mounted, equipped with a blower capable of 2000 r.p.m. operation, and that will discharge straw mulch material through a discharge boom with spout at speeds up to 220 feet per second. The mulch spreader shall be equipped with an asphalt supply and application system near the discharge end of the boom spout. The system shall apply asphalt adhesive in atomize form to the straw at a predetermined rate. The spreader shall be capable of blowing the asphalt-coated mulch, with a high velocity airstream, over the surface at a uniform rate, forming a porous, stable erosion-resistant cover.

**Wood Cellulose Fiber Mulch Spreader** - Equipment used for this application of fertilizer, seeds, wood pulp, water and other additives shall have a built-in agitation system with sufficient capacity to agitate, suspend and homogeneously mix a slurry containing up to 40 lbs. of fiber plus the required fertilizer solids for each 100 gallons of water. It shall have sufficient agitation and pump capacity to spray a slurry in a uniform coat over the area to be mulched.
3. CONSTRUCTION METHODS

3.1 PREPARATION OF SEEDBED: The area to be treated along with requirements for seed, fertilizer and other treatments, shall be done as indicated on the drawings and as specified below.

Clearing - Refer to City Standard Specification Section 021020, "Site Clearing and Stripping".

Grading - Refer to City Standard Specification Section 021040, "Site Grading".

Tilling - The area to be seeded shall be tilled to a depth of 4 to 6 inches by diskng, plowing, or other approved methods until soil condition is acceptable.

Topsoiling – If the native soils are not conducive to the establishment and maintenance of grass growth, or if called for on the drawings, topsoil shall be placed over the area to be seeded to a depth of 5 inches after tilling. Topsoil shall have a pH range of 5.5 to 7; shall contain between 2 and 20 percent organic material content in accordance with ASTM D5268; and shall be free of stones larger than one inch, debris, and extraneous materials harmful to plant growth.

3.2 FERTILIZING: Fertilizer shall be uniformly applied at a rate of 400 lb/acre, after tilling. Fertilizing and seeding shall be done concurrently. If seeds and fertilizer are distributed in a water slurry, the mixture shall be applied to the area to be seeded within 30 minutes after all the components have come into contact.

3.3 SEEDING: The seed mixture shall be uniformly distributed at the rate specified above.

Broadcast Seeding - Seed shall be placed with fertilizer, after tilling. After planting, the area shall be rolled on contour with a corrugated roller.

Straw Mulch Seeding - Seed shall be placed with fertilizer, after tilling. After placement of the seed and fertilizer mixture, straw mulch shall be uniformly placed at a rate of 2 tons per acre. As soon as the mulch has been spread, it shall be anchored to the soil a minimum depth of 3 inches by use of a heavy, dulled disk harrow, set nearly straight. Disks shall be set approximately 9 inches apart.

Straw Mulch With Asphalt Seeding - Seed, fertilizer and straw mulch shall be placed as described in "Straw Mulch Seeding" with the following two exceptions: 1) An asphalt-water emulsion shall be applied to the mulch near the discharge end of the boom spout at a rate of 300 to 600 gallons per acre. 2) Mechanical anchoring by disking will not be required.

Asphalt Mulch Seeding - The seed and fertilizer shall be placed as described for "Broadcast Seeding". After the area has been rolled, the area shall be watered sufficiently to assure a uniform moisture to a minimum depth of 4 inches. An asphalt-water emulsion shall be applied at a rate of 1500 to 1800 gallons per acre, immediately after watering. Asphalt shall be applied to the area in such a manner that a complete film is obtained and the finished surface shall be
comparatively smooth.

**Wood Cellulose Fiber Mulch Seeding** - After tilling, mulch shall be applied. Wood cellulose fibers shall be added to the hydraulic seeder after the proportionate amounts of seed, fertilizer, water and other approved materials are added. Application shall be 1500 lb./acre on flats, 2000 lb./acre on slopes up to 3:1, and 2500 lb./acre on slopes steeper than 3:1. One hundred (100) pounds of fiber per acre shall be used when asphalt is to be applied over cellulose mulch. The mulch shall provide a uniform cover over the soil surface.

**Asphalt Over Wood Cellulose Fiber Mulch Seeding** - "Wood Cellulose Fiber Mulch Seeding" shall be done as described above. After mulch has been placed, an asphalt-water emulsion shall be uniformly spread over the mulch at a rate of 1200 gallons per acre.

3.4 **MAINTENANCE:** The Contractor shall water, repair and reseed areas as required for a period of 45 days or until growth has been established, whichever is longer. This includes erosion damage. Maintenance does not include mowing or weed control, unless indicated on the plans. If at any time the seeded area becomes gullied or otherwise damaged, or the seeds have been damaged or destroyed, the affected portion shall be re-established to the specified condition prior to acceptance of the work.

3.5 **GUARANTEE:** The Contractor shall assure 95% of the seeded area has established grass growth at 45 calendar days after seeding, unless indicated otherwise on the drawings. Where established, grass growth is defined as at least one plant per square foot with no bare spots larger than three (3) square feet. The Contractor shall re-establish grass growth as directed by the Engineer during the one-year warranty period.

4. **MEASUREMENT AND PAYMENT**

Unless otherwise specified on the Bid Form, seeding will be measured by the horizontal square yard of area seeded within the areas designated on the drawings. Areas disturbed by the Contractor that are outside of the designated areas (such as field office, laydown/ storage area, stockpile areas, etc.) shall be seeded by the Contractor for erosion control per the stormwater pollution prevention plan but will not be measured for payment.

Payment shall be full compensation for all labor, materials, tools, equipment and incidentals necessary to complete the work, and shall include, but not be limited to, tilling soil, topsoiling, fertilizing, planting, mulching, watering and maintaining vegetation. Payment shall be due and payable only after grass growth has been established as described above.
1. DESCRIPTION

This specification shall govern all work necessary for furnishing and placing sod as required to complete the project.

2. MATERIALS

Fertilizer: All fertilizer used shall be delivered in bags or containers with clearly marked analysis. A granulated fertilizer shall be used with an analysis of 10-20-10. These figures represent the percent of nitrogen, phosphoric acid and potash nutrients, respectively, as determined by the methods of the Association of Official Agricultural Chemists. The rate of application shall be not less than 350 pounds per acre (7.23 lb. per 100 SY). In the event that it is necessary to substitute a fertilizer with a different analysis, it shall be granulated fertilizer with a lower concentration. The total nutrients applied per unit area shall not be less that the specified amount of each nutrient.

Sod: Sod shall consist of live Bermuda grass with thickly matted roots throughout the soil and with a minimum thickness of 3 inches or 0.25 foot, or live St. Augustine with thickly matted roots throughout the soil with a minimum thickness of 1 inch or 0.08 foot. The Contractor shall not use sod where grass is thinned out. Grass shall be mowed and raked to remove all weeds and long stems prior to extraction at the source. Sod and soil shall be kept moist at all times during the sodding process. Care must be taken at all times to retain native soil on the root system.

Water: Water shall be free from oils, acids, alkalis, and salts that may inhibit grass growth. Unless indicated otherwise on the drawings, water shall be provided by the City and shall be transported and applied by the Contractor.

3. CONSTRUCTION METHODS

Spot Sodding: Prior to planting, the area to be sodded shall be graded and shaped. Squares of sod with a minimum width of 3 inches shall be planted in rows on 15-inch centers in both directions. Sod shall be placed so that it is firmly against the bottom of the hole, and the top of the sod shall not be more than 1/2 inch below finished grade. Soil shall be firmly packed against all sides of the sod. Soil shall not be allowed to cover the sod except for soil incidental to raking, provided that the quantity of soil is not enough to hinder the growth. Areas to be spot sodded shall be indicated on the drawing or as directed by the Engineer in field. After sod has been planted, the area shall be fertilized and watered.
**Block Sodding:** Prior to planting, the area to be soded shall be graded and shaped. Sod blocks shall be uniformly placed over the prepared area. The soded area shall then be fertilized and watered. After the area is sufficiently dry, the area shall be rolled or tamped to form a thoroughly compacted mat. Any voids in the mats shall be filled with additional sod and tamped. If, in the opinion of the Engineer, slopes may cause displacement, areas to be block soded shall be indicated on the drawings or as directed by the Engineer in the field.

**Mulch Sodding:** The sod source shall be disked in two directions cutting the sod thoroughly to a depth of not less than 4 inches or more than 10 inches, being careful to avoid having soil containing no grass roots. The disked sod may be windrowed or otherwise handled in a manner satisfactory to the Engineer. The material shall be rejected if not kept in a moist condition.

Prior to placing mulch sod, the cut slopes shall be scarified by plowing furrows 4 inches to 6 inches deep along horizontal slope lines at 2-foot vertical intervals. Excavated material from the furrows shall not protrude more than 3 inches above the original surface of the cut. Fertilizer shall be distributed uniformly over the area. The sod shall then be dumped upon the prepared area and spread uniformly to the required approximate thickness shown on the plans.

Any section not true to lines and cross section shall be remedied by the addition of sod material. After the sod material has been spread and shaped, it shall be compacted with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour. The area to be mulch sodded shall be indicated on the drawings or as directed by the Engineer in the field.

4. **MEASUREMENT AND PAYMENT**

Unless otherwise specified on the Bid Form, spot sodding and block sodding shall be measured by the square yard taken in a horizontal plane.

Payment shall include, but not be limited to, excavation, transporting, storing and placing of sod, and application of fertilizer and water.
1. DESCRIPTION

This specification shall govern for the materials used; for the storing and handling of materials; and for the proportioning and mixing of concrete for culverts, manholes, inlets, curb and gutter, sidewalks, driveways, curb ramps, headwalls and wingwalls, riprap, and incidental concrete construction.

The concrete shall be composed of Portland cement, aggregates (fine and coarse), admixtures if desired or required, and water, proportioned and mixed as hereinafter provided.

2. MATERIALS

(1) Cement

The cement shall be either Type I, II or III Portland cement conforming to ASTM Designation: C150, modified as follows:

Unless otherwise specified by the Engineer, the specific surface area of Type I and II cements shall not exceed 2000 square centimeters per gram (Wagner Turbidimeter – TxDOT Test Method Tex-310-D). For concrete piling, the above limit on specific surface area is waived for Type II cement only. The Contractor shall furnish the Engineer, with each shipment, a statement as to the specific surface area of the cement expressed in square centimeters per gram.

For cement strength requirements, either the flexural or compressive test may be used.

Either Type I or II cement shall be used unless Type II is specified on the plans. Except when Type II is specified on the plans, Type III cement may be used when the anticipated air temperature for the succeeding 12 hours will not exceed 60°F. Type III cement may be used in all precast prestressed concrete, except in piling when Type II cement is required for substructure concrete.

Different types of cement may be used in the same structure, but all cement used in any one monolithic placement shall be of the same type and brand. Only one brand of each type will be permitted in any one structure unless otherwise authorized by the Engineer.

Cement may be delivered in bulk where adequate bin storage is provided. All other cement shall be delivered in bags marked plainly with the name of the manufacturer and the type of cement. Similar information shall be provided in the bills of lading accompanying each shipment of packaged or bulk cement. Bags shall contain 94 pounds net. All bags shall be in good condition at time of delivery.

All cement shall be properly protected against dampness. No caked cement will be accepted.

Cement remaining in storage for a prolonged period of time may be retested and rejected if it fails to conform to any of the requirements of these specifications.
(2) **Mixing Water**

Water for use in concrete and for curing shall be free from oils, acids, organic matter or other deleterious substances and shall not contain more than 1000 parts per million of chlorides as Cl or more than 1000 parts per million of sulfates as SO₄.

Water from municipal supplies approved by the State Health Department will not require testing, but water from other sources will be sampled and tested before use in structural concrete.

Tests shall be made in accordance with the "Method of Test for Quality of Water to be Used in Concrete" (AASHTO Method T26), except where such methods are in conflict with provisions of this specification.

(3) **Coarse Aggregate**

Coarse aggregate shall consist of durable particles of gravel, crushed blast furnace slag, crushed stone, or combinations thereof; free from frozen material or injurious amount of salt, alkali, vegetable matter, or other objectionable material either free or as an adherent coating; and its quality shall be reasonably uniform throughout. It shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale, nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TxDOT Test Method Tex-413-A. It shall have a wear of not more than 40 percent when tested in accordance with TxDOT Test Method Tex-410-A.

Unless otherwise specified on the plans, coarse aggregate will be subjected to five cycles of the soundness test in accordance with TxDOT Test Method Tex-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used, or 18 percent when magnesium sulfate is used.

Permissible sizes of aggregate shall be governed by Table 4 and Table 1, except that when exposed aggregate surfaces are required, coarse aggregate gradation will be as specified on the plans.

When tested by approved methods, the coarse aggregate, including combinations of aggregates when used, shall conform to the grading requirements shown in Table 1.
TABLE 1
Coarse Aggregate Gradation Chart

<table>
<thead>
<tr>
<th>Aggregate Grade No.</th>
<th>Nominal Size</th>
<th>2-½ In.</th>
<th>2 In.</th>
<th>1-½ In.</th>
<th>1 In.</th>
<th>3/4 In.</th>
<th>1/2 In.</th>
<th>3/8 In.</th>
<th>No. 4</th>
<th>No. 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 in.</td>
<td>0</td>
<td>0 to 20</td>
<td>15 to 50</td>
<td>60 to 80</td>
<td></td>
<td></td>
<td></td>
<td>95 to 100</td>
<td></td>
</tr>
<tr>
<td>2 (467)*</td>
<td>1-½ in.</td>
<td>0</td>
<td>0 to 5</td>
<td>30 to 65</td>
<td>70 to 90</td>
<td></td>
<td></td>
<td></td>
<td>95 to 100</td>
<td></td>
</tr>
<tr>
<td>4 (57)*</td>
<td>1 in.</td>
<td>0</td>
<td>0 to 5</td>
<td>40 to 75</td>
<td>90 to 100</td>
<td></td>
<td></td>
<td></td>
<td>95 to 100</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3/8 in.</td>
<td>0</td>
<td>0 to 5</td>
<td>35 to 80</td>
<td>90 to 100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Numbers in parenthesis indicate conformance with ASTM C33.

The aggregate shall be washed. The Loss by Decantation (TxDOT Test Method Tex-406-A) plus the allowable weight of clay lumps, shall not exceed one percent, or the value shown on the plans, whichever is smaller.

(4) Fine Aggregate

Fine aggregate shall consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps. When subjected to the color test for organic impurities (TxDOT Test Method Tex-408-A), it shall not show a color darker than standard.

The fine aggregate shall produce a mortar having a tensile strength equal to or greater than that of Ottawa sand mortar when tested in accordance with TxDOT Test Method Tex-317-D.

Where manufactured sand is used in lieu of natural sand for slab concrete subject to direct traffic, the acid insoluble residue of the fine aggregate shall be not less than 28 percent by weight when tested in accordance with TxDOT Test Method Tex-612-J.

When tested by approved methods, the fine aggregate or combination of aggregates, including mineral filler, shall conform to the grading requirements shown in Table 2.
TABLE 2
Fine Aggregate Gradation Chart

<table>
<thead>
<tr>
<th>Aggregate Grade No.</th>
<th>3/8 In.</th>
<th>No. 4</th>
<th>No. 8</th>
<th>No. 16</th>
<th>No. 30</th>
<th>No. 50</th>
<th>No. 100</th>
<th>No. 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0 to 5</td>
<td>0 to 20</td>
<td>15 to 50</td>
<td>35 to 75</td>
<td>70 to 90</td>
<td>90 to 100</td>
<td>97 to 100</td>
</tr>
</tbody>
</table>

**NOTE 1:** Where manufactured sand is used in lieu of natural sand, the percent retained on the No. 200 sieve shall be 94 to 100.

**NOTE 2:** Where the sand equivalent value is greater than 85, the retainage on the No. 50 sieve may be 70 to 94 percent.

Fine aggregate will be subjected to the Sand Equivalent Test (TxDOT Test Method Tex-203-F). The sand equivalent shall not be less than 80 nor less than the value shown on the plans, whichever is greater.

For concrete Classes ‘A’ and ‘C’, the fineness modulus as defined below for fine aggregates shall be between 2.30 and 3.10.

The fineness modulus will be determined by adding the percentages by weight retained on the following sieves, and dividing by 100; Nos. 4, 8, 16, 30, 50 and 100.

(5) **Mineral Filler**

Mineral filler shall consist of stone dust, clean crushed sand, or other approved inert material.

(6) **Mortar (Grout)**

Mortar for repair of concrete shall consist of 1 part cement, 2 parts finely graded sand, and enough water to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce the color required. When required by the Engineer, latex adhesive shall be added to the mortar.

(7) **Admixtures**

Calcium Chloride will not be permitted. Unless otherwise noted, air-entraining, retarding and water-reducing admixtures may be used in all concrete and shall conform to the following requirements:

A "water-reducing, retarding admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and will retard the initial set of the concrete.

A "water-reducing admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a
given consistency.

(a) **Retarding and Water-Reducing Admixtures.** The admixture shall meet the requirements for Type A and Type D admixture as specified in ASTM Designation: C494, modified as follows:

1. The water-reducing retarder shall retard the initial set of the concrete a minimum of 2 hours and a maximum of 4 hours, at a specified dosage rate, at a temperature of 90°F.

2. The cement used in any series of tests shall be either the cement proposed for specific work or a "reference" Type I cement from one mill.

3. Unless otherwise noted on the plans, the minimum relative durability factor shall be 80.

The air-entraining admixture used in the referenced and test concrete shall be neutralized Vinsol resin.

(b) **Air-Entering Admixture.** The admixture shall meet the requirements of ASTM Designation: C260, modified as follows:

1. The cement used in any series of tests shall be either the cement proposed for specific work or a "reference" Type I cement from one mill.

2. Unless otherwise noted on the plans, the minimum relative durability factor shall be 80.

The air-entraining admixture used in the referenced concrete shall be neutralized Vinsol resin.

3. **STORAGE OF CEMENT**

All cement shall be stored in well-ventilated weatherproof buildings or approved bins, which will protect it from dampness or absorption of moisture. Storage facilities shall be ample, and each shipment of packaged cement shall be kept separated to provide easy access for identification and inspection.

The Engineer may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

4. **STORAGE OF AGGREGATE**

The method of handling and storing concrete aggregate shall prevent contamination with foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be clear of all vegetation and level. The bottom layer of aggregate shall not be disturbed or used without recleaning.
When conditions require the use of two or more sizes of aggregates, they shall be separated to prevent intermixing. Where space is limited, stockpiles shall be separated by physical barriers.

Methods of handling aggregates during stockpiling and subsequent use shall be such that segregation will be minimized.

Unless otherwise authorized by the Engineer, all aggregate shall be stockpiled at least 24 hours to reduce the free moisture content.

5. MEASUREMENT OF MATERIALS

The measurement of the materials, except water, used in batches of concrete, shall be by weight. The fine aggregate, coarse aggregate and mineral filler shall be weighed separately. Where bulk cement is used, it shall be weighed separately, but batch weighing of sacked cement will not be required. Where sacked cement is used, the quantities of material per batch shall be based upon using full bags of cement. Batches involving the use of fractional bags will not be permitted.

Allowance shall be made for the water content in the aggregates.

Bags of cement varying more than 3 percent from the specified weight of 94 pounds may be rejected, and when the average weight per bag in any shipment, as determined by weighing 50 bags taken at random, is less than the net weight specified, the entire shipment may be rejected. If the shipment is accepted, the Engineer will adjust the concrete mix to a net weight per bag fixed by an average of all individual weights which are less than the average weight determined from the total number weighed.

6. CLASSIFICATION AND MIX DESIGN

It shall be the responsibility of the Contractor to furnish the mix design, using a coarse aggregate factor acceptable to the Engineer, for the class(es) of concrete specified. The mix shall be designed by a qualified concrete technician to conform with the requirements contained herein and in accordance with the THD Bulletin C-11. The Contractor shall perform, at his own expense, the work required to substantiate the design, except the testing of strength specimens, which will be done by the Engineer. Complete concrete design data shall be submitted to the Engineer for approval.

It shall also be the responsibility of the Contractor to determine and measure the batch quantity of each ingredient, including all water, so that the mix conforms to these specifications and any other requirements shown on the plans.

Trial batches will be made and tested using all of the proposed ingredients prior to placing the concrete, and when the aggregate and/or brand of cement or admixture is changed. Trial batches shall be made in the mixer to be used on the job. When transit mix concrete is to be used, the trial designs will be made in a transit mixer representative of the mixers to be used. Batch size shall not be less than 50 percent of the rated mixing capacity of the truck.

Mix designs from previous or concurrent jobs may be used without trial batches if it is shown that
no substantial change in any of the proposed ingredients has been made.

The coarse aggregate factor shall not be more than 0.82, except that when the voids in the coarse aggregate exceed 48 percent of the total dry loose volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor shall not be less than 0.70 for Grades 1, 2 and 3 aggregates.

If the strength required for the class of concrete being produced is not secured with the cement specified in Table 4, the Contractor may use an approved water-reducing or retarding admixture, or he shall furnish aggregates with different characteristics which will produce the required results. Additional cement may be required or permitted as a temporary measure until the redesign is checked.

Water-reducing or retarding agents may be used with all classes of concrete at the option of the Contractor.

When water-reducing or retarding agents are used at the option of the Contractor, reduced dosage of the admixture will be permitted.

Entrained air will be required in accordance with Table 4. The concrete shall be designed to entrain 5 percent air when Grade 2 coarse aggregate is used and 6 percent when Grade 3 coarse aggregate is used. Concrete as placed in the structure shall contain the proper amount as required above with a tolerance of plus or minus 1.5 percentage points. Occasional variations beyond this tolerance will not be cause for rejection. When the quantity of entrained air is found to be above 7 percent with Grade 2 coarse aggregate or above 8 percent for Grade 3 coarse aggregate, additional test beams or cylinders will be made. If these beams or cylinders pass the minimum flexural or compressive requirements, the concrete will not be rejected because of the variation in air content.

7. CONSISTENCY

In cases where the consistency requirements cannot be satisfied without exceeding the maximum allowable amount of water, the Contractor may use, or the Engineer may require, an approved water-reducing or retarding agent, or the Contractor shall furnish additional aggregates or aggregates with different characteristics, which will produce the required results. Additional cement may be required or permitted as a temporary measure until aggregates are changed and designs checked with the different aggregates or admixture.

The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface. When field conditions are such that additional moisture is needed for the final concrete surface finishing operation, the required water shall be applied to the surface by fog spray only, and shall be held to a minimum. The concrete shall be workable, cohesive, possess satisfactory finishing qualities, and of the stiffest consistency that can be placed and vibrated into a homogenous mass. Excessive bleeding shall be avoided. Slump requirements will be as specified in Table 3.
TABLE 3
Slump Requirements

<table>
<thead>
<tr>
<th>Concrete Designation</th>
<th>Desired Slump</th>
<th>Max. Slump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Concrete:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Thin-Walled Sections (9&quot; or less)</td>
<td>4 inches</td>
<td>5 inches</td>
</tr>
<tr>
<td>(2) Slabs, Caps, Columns, Piers,</td>
<td>3 inches</td>
<td>4 inches</td>
</tr>
<tr>
<td>Wall Sections over 9&quot;, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underwater or Seal Concrete</td>
<td>5 inches</td>
<td>6 inches</td>
</tr>
<tr>
<td>Riprap, Curb, Gutter and Other</td>
<td>2.5 inches</td>
<td>4 inches</td>
</tr>
<tr>
<td>Miscellaneous Concrete</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: No concrete will be permitted with slump in excess of the maximums shown.

8. QUALITY OF CONCRETE

General

The concrete shall be uniform and workable. The cement content, maximum allowable water-cement ratio, the desired and maximum slump and the strength requirements of the various classes of concrete shall conform to the requirements of Table 3 and Table 4 and as required herein.

During the process of the work, the Engineer or his designated representative will cast test cylinders or beams as a check on the compressive or flexural strength of the concrete actually placed. Test cylinders must be picked up by the testing lab within 24 hours.

A test shall be defined as the average of the breaking strength of two cylinders or two beams, as the case may be. Specimens will be tested in accordance with TxDOT Test Methods Tex-418-A or Tex-420-A.

Test beams or cylinders will be required as specified in the contract documents. For small placements on structures such as manholes, inlets, culverts, wingwalls, etc., the Engineer may vary the number of tests to a minimum of one for each 25 cubic yards placed over a several day period.

All test specimens, beams or cylinders, representing tests for removal of forms and/or falsework shall be cured using the same methods, and under the same conditions as the concrete represented.

"Design Strength" beams and cylinders shall be cured in accordance with THD Bulletin C-11.

The Contractor shall provide and maintain curing facilities as described in THD Bulletin C-11 for the purpose of curing test specimens. Provision shall be made to maintain the water in the curing tank at temperatures between 70°F and 90°F.

When control of concrete quality is by twenty-eight-day compressive tests, job control will be by seven-day compressive tests which are shown to provide the required twenty-eight-day strength, based on results from trial batches. If the required seven-day strength is not secured with the
cement specified in Table 4, changes in the batch design will be made.

<table>
<thead>
<tr>
<th>Class of Concrete</th>
<th>Sacks Cement per C.Y. (min.)</th>
<th>Minimum Compressive Strength (f'c) 28-Day(ksi)</th>
<th>Min. Beam Strength 7-Day (ksi)</th>
<th>Maximum Water-Cement Ratio (gal/sack)</th>
<th>Coarse Aggregate No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A*</td>
<td>5.0</td>
<td>3000</td>
<td>500***</td>
<td>6.5</td>
<td>2-4-8****</td>
</tr>
<tr>
<td>B*</td>
<td>4.5</td>
<td>2500</td>
<td>417</td>
<td>8.0</td>
<td>2-4-8****</td>
</tr>
<tr>
<td>C*</td>
<td>6.0</td>
<td>3600</td>
<td>600***</td>
<td>6.0</td>
<td>1-2-4**</td>
</tr>
<tr>
<td>D</td>
<td>6.0</td>
<td>3000</td>
<td>500</td>
<td>7.0</td>
<td>2-4</td>
</tr>
<tr>
<td>S</td>
<td>6.5</td>
<td>4000</td>
<td>570</td>
<td>5.0</td>
<td>2-4</td>
</tr>
</tbody>
</table>

*Entrained Air (slabs, piers and bent concrete).

**Grade I Coarse Aggregate may be used in foundation only (except cased drilled shafts).

***When Type II Cement is used with Class C Concrete, the 7-day beam break requirement will be 550 psi; with Class A Concrete, the minimum 7-day beam break requirement will be 460 psi.

****Permission to use Grade 8 Aggregate must have prior approval of the Engineer.

9. MIXING CONDITIONS

The concrete shall be mixed in quantities required for immediate use. Any concrete which is not in place within the limits outlined in City Standard Specification Section 038000 "Concrete Structures", Article "Placing Concrete-General", shall not be used. Retamping of concrete will not be permitted.

In threatening weather, which may result in conditions that will adversely affect the quality of the concrete to be placed, the Engineer may order postponement of the work. Where work has been started and changes in weather conditions require protective measures, the Contractor shall furnish adequate shelter to protect the concrete against damage from rainfall, or from freezing temperatures. If necessary to continue operations during rainfall, the Contractor shall also provide protective coverings for the material stockpiles. Aggregate stockpiles need be covered only to the extent necessary to control the moisture conditions in the aggregates to adequately control the consistency of the concrete.

10. MIXING AND MIXING EQUIPMENT

All equipment, tools, and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work underway without excessive delays for repairs or replacements.

The mixing shall be done in a batch mixer of approved type and size that will produce uniform
distribution of the material throughout the mass. Mixers may be either the revolving drum type or the revolving blade type, and shall be capable of producing concrete meeting the requirements of these specifications.

After all the ingredients are assembled in the drum, the mixing shall continue not less than 1 minute for mixers of one cubic yard or less capacity plus 15 seconds for each additional cubic yard or portion thereof.

The mixer shall operate at the speed and capacity designated by the Mixer Manufacturers Bureau of the Associated General Contractors of America. The mixer shall have a plate affixed showing the manufacturer's recommended operating data.

The absolute volume of the concrete batch shall not exceed the rated capacity of the mixer.

The entire contents of the drum shall be discharged before any materials are placed therein for the succeeding batch.

The first batch of concrete materials placed in the mixer for each placement shall contain an extra quantity of sand, cement and water sufficient to coat the inside surface of the drum.

Upon the cessation of mixing for any considerable length of time, the mixer shall be thoroughly cleaned.

The concrete mixer shall be equipped with an automatic timing device which is put into operation when the skip is raised to its full height and dumping. This device shall lock the discharging mechanism and prevent emptying of the mixer until all the materials have been mixed together for the minimum time required, and it shall ring a bell after the specified time of mixing has elapsed.

The water tank shall be arranged so that the amount of water can be measured accurately, and when the tank starts to discharge, the inlet supply shall cut off automatically.

Whenever a concrete mixer is not adequate or suitable for the work, it shall be removed from the site upon a written order from the Engineer and a suitable mixer provided by the Contractor.

Pick-up and thro-over blades in the drum of the mixer which are worn down more than 10 percent in depth shall be repaired or replaced with new blades.

Improperly mixed concrete shall not be placed in the structure.

Job mix concrete shall be concrete mixed in an approved batch mixer in accordance with the requirements stated above, adjacent to the structure for which the concrete is being mixed, and moved to the placement site in non-agitating equipment.

11. READY-MIX PLANTS

A. General. It shall be the Contractor's responsibility to furnish concrete meeting all requirement of the governing specification sections, and concrete not meeting the slump, workability and consistency requirements of the governing specification sections shall not
be placed in the structure or pavement.

Ready-Mixed Concrete shall be mixed and delivered by means of one of the following approved methods.

(1) Mixed completely in a stationary mixer and transported to the point of delivery in a truck agitator or a truck mixer operating at truck agitator or truck mixer agitation speed. (Central-Mix Concrete)

(2) Mixed complete in a truck mixer and transported to the placement site at mixing and/or agitating speed (Transit-Mix Concrete), subject to the following provisions:

(a) Truck mixers will be permitted to transport concrete to the job site at mixing speed if equipped with double actuated counters which will separate revolutions at mixing speed from total revolutions.

(b) Truck mixers equipped with a single actuated counter counting total revolutions of the drum shall mix the concrete at the plant not less than 50 nor more than 70 revolutions at mixing speed, transport it to the job site at agitating speed and complete the required mixing before placing the concrete.

(3) Mixed completely in a stationery mixer and transported to the job site in approved non-agitating trucks with special bodies. This method of transporting will be permitted for concrete pavement only.

B. Equipment.

(1) Batching Plant. The batching plant shall be provided with adequate bins for batching all aggregates and materials required by the specifications.

Bulk cement shall be weighed on a scale separate from those used for other materials and in a hopper entirely free and independent of that used for weighing the aggregates.

(2) Mixers and Agitators.

(a) General: Mixers shall be of an approved stationary or truck-type capable of combining the ingredients into a thoroughly mixed and uniform mass.

Facilities shall be provided to permit ready access to the inside of the drum for inspection, cleaning and repair of blades.

Mixers and agitators shall be subject to daily examination for changes in condition due to accumulation of hardened concrete and/or wear of blades, and any hardened concrete shall be removed before the mixer will be permitted to be used. Worn blades shall be repaired or replaced with new in
accordance with the manufacturer's design and arrangement for that particular unit when any part or section is worn as much as 10 percent below the original height of the manufacturer's design.

(b) **Stationary Mixers:** These shall conform to the requirements of Article "Mixing and Mixing Equipment". Truck mixers mounted on a stationary base will not be considered as a stationary mixer.

(c) **Truck Mixers:** In addition, truck mixers shall comply with the following requirements:

An engine in satisfactory working condition and capable of accurately gauging the desired speed of rotation shall be mounted as an integral part of the mixing unit for the purpose of rotating the drum. Truck mixers equipped with a transmission that will govern the speed of the drum within the specified revolutions per minute (rpm) will not require a separate engine.

All truck mixers shall be equipped with actuated counters by which the proper number of revolutions of the drum, as specified in Article 11. A. above, may be readily verified. The counters shall be read and recorded at the start of mixing at mixing speeds.

Each until shall have adequate water supply and accurate metering or gauging devices for measuring the amount used.

(d) **Agitators:** Concrete agitators shall be of the truck type, capable of maintaining a thoroughly mixed and uniform concrete mass and discharging it within the same degree of uniformity specified for mixers. Agitators shall comply with all of the requirements for truck mixers, except for the actual mixing requirements.

C. **Operation of Plant and Equipment.**

Delivery of ready-mixed concrete shall equal or exceed the rate approved by the Engineer for continuous placement. In all cases, the delivery of concrete to the placement site shall assure compliance with the time limits in the applicable specification for depositing successive batches in any monolithic unit. The Contractor shall satisfy the Engineer that adequate standby trucks are available.

A standard ticket system will be used for recording concrete batching, mixing and delivery date.

Tickets will be delivered to the job inspector.

Loads arriving without ticket and/or in unsatisfactory condition shall not be used.

When a stationary mixer is used for the entire mixing operation, the mixing time for one cubic yard of concrete shall be one minute plus 15 seconds for each additional cubic yard or portion thereof. This mixing time shall start when all cement, aggregates and initial water have entered the drum.
The mixer shall be charged so that some of the mixing water will enter the drum in advance of the cement and aggregate. All of the mixing water shall be in the drum by the end of the first one-fourth of the specified mixing time. Water used to flush down the blades after charging shall be accurately measured and included in the quantity of mixing water. The introduction of the initial mixing water, except blade wash down water and that permitted in this Article, shall be prior to or simultaneous with the charging of the aggregates and cement.

The loading of truck mixers shall not exceed 63 percent of the total volume of the drum. When used as an agitator only, the loading shall not exceed 80 percent of the drum volume.

When Ready-Mix Concrete is used, additional mortar (one sack cement, three parts sand and sufficient water) shall be added to the batch to coat the drum of the mixer or agitator truck, and this shall be required for every load of Class C concrete only and for the first batch from central mix plants.

A portion of the mixing water, required by the batch design to produce the desired slump, may be withheld and added at the job site, but only with permission of the Engineer and under his supervision. When water is added under the above conditions, it shall be thoroughly mixed as specified below for water added at the job site.

Mixing speed shall be attained as soon as all ingredients are in the mixer, and each complete batch (containing all the required ingredients) shall be mixed not less than 70 nor more than 100 revolutions of the drum at mixing speed except that when water is added at the job site, 25 revolutions (minimum) at mixing speed will be required to uniformly disperse the additional water throughout the mix. Mixing speed shall be as designated by the manufacturer.

All revolutions after the prescribed mixing time shall be at agitating speed. The agitating speed shall be not less than one (1) nor more than five (5) rpm. The drum shall be kept in continuous motion from the time mixing is started until the discharge is completed.

12. PLACING, CURING AND FINISHING

The placing of concrete, including construction of forms and falsework, curing and finishing, shall be in accordance with City Standard Specification Section 038000 "Concrete Structures".

13. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, the quantities of concrete of the various classifications which will constitute the completed and accepted structure(s) in-place will be measured by the cubic yard, per each, square foot, square yard or linear foot, as the case may be. Measurement will be as shown on the drawings and/or in the Bid Form.

Payment shall be full compensation for furnishing, hauling, mixing, placing, curing and finishing all concrete; all grouting and pointing; furnishing and placing drains; furnishing and placing metal flashing strips; furnishing and placing expansion joint material required by this specification or shown on the plans; and for all forms and falsework, labor, tools, equipment and incidentals necessary to complete the work.

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Rev. 10-30-2014
SECTION 032020
REINFORCING STEEL

1. DESCRIPTION

This specification shall govern the furnishing and placing of reinforcing steel, deformed and smooth, of the size and quantity designated on the plans and in accordance with these specifications.

2. MATERIALS

Unless otherwise designated on the plans, all bar reinforcement shall be deformed, and shall conform to ASTM Designation: A 615, Grades 60 or 75, and shall be open hearth, basic oxygen, or electric furnace new billet steel.

Large diameter new billet steel (Nos. 14 and 18), Grade 75, will be permitted for straight bars only.

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 90 degrees around a pin having a diameter of 10 times the nominal diameter of the bar.

Spiral reinforcement shall be smooth (not deformed) bars or wire of the minimum diameter shown on the plans, and shall be made by one or more of the following processes: open hearth, basic oxygen, or electric furnace. Bars shall be rolled from billets reduced from ingots and shall comply with ASTM Designation: A 306, Grade 65 minimum (references to ASTM Designation: A 29 is voided). Dimensional tolerances shall be in accordance with ASTM Designation: A 615, or ASTM Designation: A 615, Grade 60, except for deformations. Wire shall be cold-drawn from rods that have been hot-rolled from billets and shall comply with ASTM Designation: A 185.

In cases where the provisions of this specification are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this specification shall govern.

Report of chemical analysis showing the percentages of carbon, manganese, phosphorus and sulphur will be required for all reinforcing steel when it is to be welded.
The nominal size and area and the theoretical weight of reinforcing steel bars covered by this specification are as follows:

<table>
<thead>
<tr>
<th>Bar Size Number</th>
<th>Nominal Diameter, In.</th>
<th>Nominal Area, Sq. In.</th>
<th>Weight per Linear Foot, Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>0.250</td>
<td>0.05</td>
<td>0.167</td>
</tr>
<tr>
<td>3</td>
<td>0.375</td>
<td>0.11</td>
<td>0.376</td>
</tr>
<tr>
<td>4</td>
<td>0.500</td>
<td>0.20</td>
<td>0.668</td>
</tr>
<tr>
<td>5</td>
<td>0.625</td>
<td>0.31</td>
<td>1.043</td>
</tr>
<tr>
<td>6</td>
<td>0.750</td>
<td>0.44</td>
<td>1.502</td>
</tr>
<tr>
<td>7</td>
<td>0.875</td>
<td>0.60</td>
<td>2.044</td>
</tr>
<tr>
<td>8</td>
<td>1.000</td>
<td>0.79</td>
<td>2.670</td>
</tr>
<tr>
<td>9</td>
<td>1.128</td>
<td>1.00</td>
<td>3.400</td>
</tr>
<tr>
<td>10</td>
<td>1.270</td>
<td>1.27</td>
<td>4.303</td>
</tr>
<tr>
<td>11</td>
<td>1.410</td>
<td>1.56</td>
<td>5.313</td>
</tr>
<tr>
<td>14</td>
<td>1.693</td>
<td>2.25</td>
<td>7.6</td>
</tr>
<tr>
<td>18</td>
<td>2.257</td>
<td>4.00</td>
<td>13.60</td>
</tr>
</tbody>
</table>

Smooth round bars shall be designated by size number through No. 4. Smooth bars larger than No. 4 shall be designated by diameter in inches.

When wire is ordered by gauge numbers, the following relation between gauge number and diameter, in inches, shall apply unless otherwise specified:

<table>
<thead>
<tr>
<th>Gauge Number</th>
<th>Equivalent Diameter, Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.3065</td>
</tr>
<tr>
<td>1</td>
<td>0.2830</td>
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<td>0.2625</td>
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<td>3</td>
<td>0.2437</td>
</tr>
<tr>
<td>4</td>
<td>0.2253</td>
</tr>
<tr>
<td>5</td>
<td>0.2070</td>
</tr>
<tr>
<td>6</td>
<td>0.1920</td>
</tr>
<tr>
<td>7</td>
<td>0.1770</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equivalent Diameter, Inches</th>
<th>Gauge Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1620</td>
<td>8</td>
</tr>
<tr>
<td>0.1483</td>
<td>9</td>
</tr>
<tr>
<td>0.1350</td>
<td>10</td>
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<tr>
<td>0.1205</td>
<td>11</td>
</tr>
<tr>
<td>0.1055</td>
<td>12</td>
</tr>
<tr>
<td>0.0915</td>
<td>13</td>
</tr>
<tr>
<td>0.0800</td>
<td>14</td>
</tr>
</tbody>
</table>
3. 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.

Unless otherwise shown on the plans, the inside diameter of bar bends, in terms of the nominal bar diameter (d), shall be as follows:

Bends of 90 degrees and greater in stirrups, ties and other secondary bars that enclose another bar in the bend:

<table>
<thead>
<tr>
<th>Grade 60</th>
<th>Grade 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3, #4, #5</td>
<td>4d</td>
</tr>
<tr>
<td>#6, #7, #8</td>
<td>5d</td>
</tr>
</tbody>
</table>

All bends in main bars and in secondary bars not covered above:

<table>
<thead>
<tr>
<th>Grade 60</th>
<th>Grade 75</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3 thru #8</td>
<td>6d</td>
</tr>
<tr>
<td>#9, #10</td>
<td>8d</td>
</tr>
<tr>
<td>#11</td>
<td>8d</td>
</tr>
<tr>
<td>#14, #18</td>
<td>10d</td>
</tr>
</tbody>
</table>
4. TOLERANCES

Fabricating tolerances for bars shall be within 3 percent of specified or as follows:

5. 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 crushed specimen meets the physical requirements for size and grade of steel specified.

6. SPLICES

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

Splices will not be permitted in main reinforcement at points of maximum stress. When permitted in main bars, splices in adjacent bars shall be staggered a minimum of two splice lengths.
TABLE 1
Minimum Lap Requirements

<table>
<thead>
<tr>
<th>Lap in inches</th>
<th>Uncoated</th>
<th>Coated</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 40d</td>
<td>60d</td>
<td></td>
</tr>
</tbody>
</table>

Where: d = bar diameter in inches

Welding of reinforcing bars may be used only where shown on the plans or as permitted herein. All welding operations, processes, equipment, materials, workmanship and inspection shall conform to the requirements of the drawings and industry standards. All splices shall be of such dimension and character as to develop the full strength of 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.

For box culvert extensions with less than one foot of fill, the existing longitudinal bars shall have a 20-diameter lap with the new bars. For box culvert extensions with more than one foot of fill, a minimum of 6 inches lap will be required.

Unless otherwise shown on the plans, dowel bars transferring tensile stresses shall have a minimum embedment equal to the minimum lap requirements shown in Table 1. Shear transfer dowels shall have a minimum embedment of 12 inches.

7. PLACING

Reinforcement shall be placed as near as possible in the position shown on the plans. Unless otherwise shown on the plans, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than one-twelfth 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-quarter inch. Cover of concrete to the nearest surface of steel shall meet the above requirements but shall never be less than one inch or as otherwise shown on the plans.

Vertical stirrups shall always pass around the main tension members and be attached securely thereto. The reinforcing steel shall be spaced its required distance from the form surface by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers, or approved pre-cast mortar or concrete blocks. For approval of plastic spacers on the project, representative samples of the plastic shall show no visible indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.

All reinforcing steel shall be tied at all intersections, except that where spacing is less than one foot in each direction, alternate intersections only need be tied.

Before any concrete is placed, all mortar shall be cleaned from the reinforcement. Precast mortar or concrete blocks to be used for holding steel in position adjacent to formed surfaces shall be cast in molds meeting the approval of the Engineer and shall be cured by covering with wet burlap or
cotton mats for a period of 72 hours.

The blocks shall be cast in the form of a frustum of a cone or pyramid with the smaller face placed against the forms.

A suitable tie wire shall be provided in each block, to be used for anchoring to the steel. Except in unusual cases, and when specifically otherwise authorized by the Engineer, the size of the surface to be placed adjacent to the forms shall not exceed two and one-half inches square or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be cast accurately to the thickness required, and the surface to be placed adjacent to the forms shall be a true plane free of surface imperfections.

Reinforcement shall be supported and tied in such manner that a sufficiently rigid case of steel is provided. If the cage is not adequately supported to resist settlement or floating upward of the steel, 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 with the first paragraph of Article 7 of this specification.

Mats of wire fabric shall overlap each other sufficiently to maintain a uniform strength and shall be fastened securely at the ends and edges.

No concrete shall be deposited until the Engineer has inspected the placement of the reinforcing steel and given permission to proceed.

8. MEASUREMENT AND PAYMENT

Unless otherwise specified on the Bid Form, reinforcing steel is considered subsidiary to the various items shown in the Bid Form and shall not be measured and paid for as a separate item.