

**Corpus Christi Regional Transportation  
Authority**

**IFB No. 2017-FC-04**

**ADA Bus Stop Improvements Phase VI**

**ZONE 3**

**TECHNICAL SPECIFICATIONS**

**EXHIBIT C-1**

Prepared By NEI/HANSON

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**FOR**  
**ADA BUS STOP IMPROVEMENTS PHASE VI**  
**CORPUS CHRISTI, TEXAS**

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*Gabriel Ortiz 12-03-2015*

## **CLARIFICATION**

## **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 DISPOSAL/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 Contractors responsibility to take whatever steps necessary to ensure the safety of individuals working on or visiting the site.

**11.2** The RTA calls the Contractors 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 Contractors 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 Betterment Fund allowance of Thirty Thousand Dollars (\$30,000) has been set aside to cover misc. Items, including irrigation lines. BIDDERS should include the Betterment Fund allowance in their bid price. A maximum Traffic Control Plan allowance of Forty Thousand Dollars (\$40,000) has been set aside. 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
- \* Return area to original condition using seeding and sod as necessary
- \* 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 Joints

**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 Joints

**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 \*\*\*\*\*

## SECTION 644

### SIGN RELOCATION

**1. DESCRIPTION:** Relocate existing small roadside sign assemblies, and furnish and fabricate materials as required.

**2. MATERIALS:** Furnish all materials unless otherwise shown on the plans. Furnish only new materials. Use galvanized steel, stainless steel, dichromate sealed aluminum, or other materials shown on the plans for pipe, bolts, nuts, washers, lock washers, screws, and other sign assembly hardware. When dissimilar metals are used, select or insulate the metals to prevent corrosion.

**3. CONSTRUCTION:** Install foundations in accordance with Item 656 of the TxDOT Standard Specification Book (2004), "Foundations for Traffic Control Devices." Plumb sign supports. Do not spring or rake posts to secure proper alignment. Use established safety practices when working near underground or overhead utilities. Consult the appropriate utility company before beginning work.

A. Fabrication. Fabricate sign supports in accordance with TxDOT Item 441, "Steel Structures." Ensure that all components fit properly. Verify the length of each post for each sign before fabrication to meet field conditions and sign-mounting heights shown on the plans. Galvanize fabricated parts in accordance with TxDOT Item 445, "Galvanizing." Punch or drill any holes in steel parts or members before the parts or members are galvanized. Repair any steel part or member on which the galvanizing has been damaged during assembly, transit, erection, or welding in accordance with Section 445.3.D, "Repairs."

B. Relocation. Unless otherwise shown on the plans, reuse the existing supports and shorten or lengthen them as required. Obtain approval before lengthening existing supports. Furnish and install new breakaway stub posts in new foundations for relocated signs. Erect the supports on the new breakaway stub posts, and attach the signs to the supports. Attach signs to support assemblies in accordance with the plans and pertinent Items. Remove existing foundations to be abandoned in accordance with Section 644.3.C, "Removal."

C. Removal. Remove existing concrete foundations that are to be abandoned to 2 ft. below finish grade. Backfill the remaining hole with material equal in composition and density to the surrounding area. Replace any surfacing with like material to equivalent condition.

D. Handling and Storage. Handle and store existing signs or portions of signs removed so that they are not damaged. Prevent any damage to the various sign assembly components. Replace any portion of the sign damaged by the Contractor designated for reuse or salvage, including messages removed. Stockpile all removed sign components that will be reused or that become the

property of the City at designated locations. Accept ownership of unsalvageable materials, and dispose of them in accordance with federal, state and local regulations.

E. Cleaning. After the sign has been installed, wash the entire sign with a biodegradable cleaning solution acceptable to the sheeting and screen ink manufacturers to remove dirt, grease, oil smears, streaks, finger marks, and other foreign materials.

**4. MEASUREMENT & PAYMENT:** Payment shall be in accordance with the Price Schedule.

\*\*\* END OF SECTION \*\*\*

SECTION 021020

**SITE CLEARING AND STRIPPING (S-5)**

**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, rubble and other objectionable matter as indicated on drawings and/or as directed by the Engineer. Tree stumps and roots shall be grubbed to a minimum depth of 2 feet below natural ground. Areas, which underlie compacted backfill, shall be stripped of all vegetation, humus and other objectionable matter encountered within the top 6" of the soil. All material removed from 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 site obtained by the Contractor.

**3. MEASUREMENT & PAYMENT:** Unless indicated otherwise in the Proposal, site clearing shall be measured by the acre. The payment shall include but not be limited to the removing and disposing of objectionable matter from site as indicated above.

## SECTION 021040

### SITE GRADING (S-6)

**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 Standard Specification Section 021020 (Site Clearing and Stripping). Unless specified otherwise on drawings, the existing surface shall be loosened by scarifying or plowing to a depth of not less than 6 inches. The loosened material shall be recompacted with fill.

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 and in layers not in excess of 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 test rolling to evaluate the uniformity of compaction. All irregularities, depressions, and soft spots which develop shall be corrected by the Contractor.

Excess material from excavation, that 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 & PAYMENT:** Unless indicated otherwise in the Proposal, Site Grading shall be measured by the horizontal square yard. This item shall include, but not be limited to, supplying, placing, and compacting of fill material; and removing and disposing of excess material.



## SECTION 02221-T

### EXCAVATION AND BACKFILL FOR STRUCTURES

**1. DESCRIPTION:** This Section shall control all work required for excavation and backfilling for structures. The work shall include necessary pumping, bailing drainage, sheathing and finish grading adjacent to the structure. The work shall also include, unless otherwise indicated, the disposal of excess excavated material as well as the removal and disposal of existing structures encountered in the excavation.

**2. MATERIALS:** Suitable material removed from the excavation shall be used for the backfill of structures, unless otherwise indicated by the Plans and/or Special Conditions. Suitable material shall be free of clods, muck, lumber, organic material, trash and other extraneous material.

Select material, when required, shall be free of clods, organic and foreign material, and shall have a Plasticity Index (PI) of between 7 and 17 and a Liquid Limit (LL) of less than 40.

Cement stabilized material, when required, shall consist of "clean concrete sand" mixed with a minimum of two (2) sacks of Portland Cement per cubic yard.

**3. CONSTRUCTION METHODS:** Forty-eight hours prior to excavation in Texas, the Contractor shall notify Texas One-Call in accordance with Revised Civil Statute Article 9033 Underground Damage Prevention and Safety Act.

The excavation shall conform to the lines and grades shown on the Plans. Topsoil, the top 6" on the site, shall be excavated and stockpiled separately. Stockpiles of materials shall be placed in such a manner that they will not endanger the integrity of the trench by direct pressure of overloading the bank and in a manner that is not detrimental to completion of the work. The bottom of the excavation shall be firm, stable, undisturbed soil of uniform density. Disturbed or loose soil shall be removed or re-compacted in place. When unsuitable material is encountered, it shall be removed to a maximum depth of two (2') feet, unless otherwise shown on the plans and replaced with suitable material, laid in uniform layers and compacted by rolling or tamping to provide a suitable foundation for the structure.

The Contractor shall provide pumping, bailing or other method of dewatering, including cofferdams, as required to complete and maintain the excavation to the required grades. When cofferdams are required, they shall conform to the requirements of the 1982 Texas State Department of Highways and Public Transportation Standard Specification, Item 400, "Structural Excavation", paragraph 400.3 Cofferdams.

All excavations shall be accomplished meeting all requirements of OSHA Safety and Health Standards, Part 1926, Subpart P.

The Contractor shall contact all known utility companies with facilities within the site whose installations may be affected. All known utilities shall be located and exposed by the Contractor prior to commencing the excavation. The Contractor shall safeguard, protect from damage and support, if necessary, existing utilities uncovered or encountered during the work. Should existing utilities conflict with the actual structure, the Engineer, upon adequate notice, shall direct the Contractor to relocate the structure or arrange by Change Order to adjust the utility.

Backfill of the structure shall be accomplished by placing suitable material in 8 inch maximum horizontal uniform loose lifts. Unless indicated otherwise on plans, material shall be moisture conditioned and mechanically compacted by rolling or tamping to a minimum of 95% standard proctor density at plus or minus 3% of the optimum moisture content.

Jetting is not allowed. Flooding is not allowed. The top 3 feet of backfill shall be mechanically compacted as described above. Topsoil excavated from the site shall be placed in the final lift unless located in an area to receive pavement, additional embankment or structure.

Excess and unsuitable material from the excavation shall be disposed of by the Contractor. Upon completion, the site shall be uniformly graded to drain or to the grades provided in the Plans.

#### **4. MEASUREMENT & PAYMENT:**

Payment shall be in accordance with the Price Schedule.

\*\*\* END OF SECTION \*\*\*

SECTION 025205-T

**PAVEMENT REPAIR, CURB, GUTTER, SIDEWALK,  
& DRIVEWAY REPLACEMENT (S-54)**

- 1. DESCRIPTION:** This specification shall govern the removal and replacing of all types of pavement and surfacing required to complete the project.
- 2. MATERIALS:** Unless otherwise specified on the plans, materials and proportions used along with this specification shall conform to the respective following specifications: “**TxDOT Item 247 – Type A Grade 1 Base**”; “**Hot Mix Asphaltic Pavement**”; “**Lime Stabilization**”; “**Portland Concrete Cement**”; “**Txdot Item 360 – Concrete Pavement.**”
- 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 Specification “Excavation & Backfill for Structures.”
- 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 replacements.

The pavement shall be placed in two lifts, 3” thick each, and rolled before placing the second lift.

The base material shall be 12” thick Flexible Base (Type A Grade 1) complying with specification 25220 “flexible Base.”

The Contractor shall be required to maintain at his own expense the existing roadway in good condition satisfactory to the Engineer from the time he first starts work until all work shall have been completed. Maintenance shall include immediate repairs of any defect that may occur in the existing pavement, which work shall be done by the Contractor at his own expense and repeated as often as may be necessary to keep the area continuously intact. Repairs are to be in a manner to insure restoration of a uniform surface and durability of the part repaired. Faulty work shall be replaced.

**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" each way. Any other type shall be replaced with like or better replacement.

**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 welded wire fabric. Shell or asphalt sidewalks shall be replaced with caliche or asphalt surface.

**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 Standard if required by the Engineer. Cuts through the curb shall be replaced with Class "A" concrete. Preserve original steel and reinforce all new curbs with 3 - #4 bars. Adjust grades for drainage.

**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.

**10. MEASUREMENT AND PAYMENT:** Unless indicated otherwise in the Price Schedule, Pavement Repair shall be measured by the square foot, curb and gutter replacement shall be measured by the linear foot, 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 will include all labor, materials, equipment, tools and incidentals, required to complete the work.

\*\*\* END OF SECTION \*\*\*

SECTION 025220

**FLEXIBLE BASE - CALICHE (S-24)**

**1. DESCRIPTION:** This Specification shall govern all work for furnishing and placing Flexible Base Caliche required to complete the project.

**2. MATERIALS:** The material shall consist of argillaceous limestone, crushed stone, crushed gravel and sand, and shall be free of vegetation. The material 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.

- Percentage
- (a) Gradation Limits (Before & After Compaction)
- |                             |       |
|-----------------------------|-------|
| Passing 2" Sieve            | 100   |
| Passing 1" Sieve.....       | 75-95 |
| Passing 3/8" Sieve.....     | 40-75 |
| Passing No. 4 Sieve .....   | 30-60 |
| Passing No. 10 Sieve .....  | 20-45 |
| Passing No. 40 Sieve .....  | 15-30 |
| Passing No. 200 Sieve ..... | 5-15  |
- (b) A representative sample of the material (raw caliche) shall be slaked for twenty-four (24) hours and then the washed minus 40 material shall have:
- |                               |         |
|-------------------------------|---------|
| Liquid Limit (L.L.) .....     | 45 max. |
| Plasticity Index (P.I.) ..... | 16 max. |
- (c) A representative sample of the material shall be tested in accordance with ASTM C-131 for abrasion loss. The maximum loss shall not exceed 55%.
- (d) All "Flexible Base-Caliche" shall be stabilized with lime at a minimum application rate of 1.8 lb. of lime per square yard for each 1" of in place thickness.

Lime slurry for admix shall be 3.3 pounds minimum of  $CA(OH)_2$  per gallon of slurry. Lime shall conform to standard specification "Lime Stabilization", 025210.

**3. TESTING:** The City will engage a laboratory and pay for one test each gradation, L.L., P.I., before and after lime admixing and moisture-density relation, 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, with or without lime admix, at the rate of one test for each 1,500 square yards. If material changes and this ratio of tests increases, 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 base, the surface of the previous course shall be finished true to line and grade as established and in conformity with the typical section shown on the plans. Grade tolerance shall be generally 1/2 inch, and highs and lows must approximately balance.

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

Piles and windrows shall be broken down to the bottom and all nests of coarse or loose material shall be corrected.

Mix uniformly, prior to the addition of lime. Lime slurry admix shall be spread at rate required and shall be placed only on that area where mixing can be completed that day. Material shall be mixed with pulverizing type mixer, so designed for this specific purpose, until mixed to the satisfaction of the Engineer.

Material shall be shaped and rolled after mixing and allowed to set at least 48 hours before compaction. Moisture content must be maintained in the material during the 48-hour period. Material shall be sprinkled or aerated to optimum moisture and compacted in layers (6 inches maximum loose) by approved power-drawn roller to uniform density of 95% modified proctor (AASHTO T180) on the set side of optimum. Use mechanical tamps in areas inaccessible to rollers.

The surface of the compacted base shall be primed 025412, after meeting moisture/density requirements.

On completion of compaction and priming, the surface shall be smooth and conform to lines, grades, and sections shown on the plans. 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 materials, reshaping, and re-compacting by re-priming and rolling.

Moisture and density shall be maintained until the paving is complete.

**5. MEASUREMENT AND PAYMENT:** Unless indicated otherwise in the Proposal, Flexible Base Caliche shall be measured by the square yard. Payment includes all materials, royalty, hauling, labor and equipment to complete.

Lime shall be measured by the ton and paid under other bid item, when included in the proposal.

Prime shall be measured by the gallon per square yard, when included in the proposal.

## SECTION 025404

**ASPHALTS, OILS AND EMULSIONS (S-29)**

**1. DESCRIPTION:** This specification shall govern all work for asphalt cement, cut-back asphalts, emulsified asphalts, other miscellaneous asphaltic materials and latex additives required to complete the project.

**2. MATERIALS:** When tested according to Texas Department of Transportation Test Methods, the various materials shall meet the applicable requirements of this specification.

**(1) ASPHALT CEMENT.** The asphalt cement shall be homogeneous, shall be free from water, shall not foam when heated to 347 F and shall meet the requirements in Table 1.

**TABLE 1**

Viscosity Grade	AC-1.5		AC-3		AC-5		AC-10		AC-20		AC-30	
Property	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, 140 F, poises	100	200	250	350	400	600	800	1200	160	240	240	360
275 F, poises	0.7	-	1.1	-	1.4	-	1.9	-	0	0	0	0
									2.5	-	3.0	-
Penetration, 77 F 100 g, 5 sec	250	-	210	-	135	-	85	-	55	-	45	-
Flash Point, C.O.C., F	425	-	425	-	425	-	450	-	450	-	450	-
Solubility in Trichloroethylen e, %	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Spot Test	Negative for all grades											
Tests on Residue from Thin Film Oven Test: Viscosity, 140 F, poises	-	450	-	900	-	150	-	3000	-	600	-	900
Ductility, 77 F, 5 cm per min., cm	100	-	100	-	100	-	100	-	70	-	50	-
	*											

\*If the ductility at 77 F is less than 100 cm, the material will be acceptable if its ductility at 60 F is more than 100 cm.

CAUTION: Heating of asphaltic materials (except emulsions) constitutes a fire hazard. Proper precautions should be used in all cases, especially with RC cutbacks. The utmost care shall be taken to prevent open flames from coming in contact with the asphaltic material or the gases of same. The Contractor shall be responsible for damage from any fires or accidents which may result from heating the asphaltic materials.

**(2) LATEX MODIFIED ASPHALT.**

**(a) Latex Additive.** The latex additive shall be an emulsion of styrene-butadiene low-temperature copolymer in water. The emulsion shall have good storage stability and possess the following properties.

Monomer Ratio of Latex,	-	73 + 5
		-----
butadiene to styrene		27 + 5
Minimum Solids Content,	-	45
percent by weight		
Viscosity of Emulsion at	-	2000
77 + 1 F, cps, max		
(No. 3 spindle, 20 rpm,		
Brookfield RVT Viscometer)		

The manufacturer shall furnish the actual styrene-butadiene rubber (SBR) content for each batch of latex emulsion. This information shall accompany all shipments to facilitate proper addition rates.

**(b) Latex Modified Asphalt Cement.** The latex modified asphalt cement shall consist of an AC-5 or AC-10 asphalt cement in accordance with Subarticle 300.2 (1) to which a styrene-butadiene rubber latex has been added. The amount shown is based on latex solids in the finished asphalt cement-latex additive blend. Possible combinations and their intended uses are as follows:

	Material	Use
	AC-5 + 2% latex solids	Surface treatments
	AC-10 + 2% latex solids	Surface treatments or asphaltic
concrete	AC-10 + 3% latex solids	Asphaltic concrete
	AC-10 + 3% latex solids (High viscosity blend)	Asphaltic concrete where maximum high temperature toughness is needed.



The finished asphalt cement-latex additive blend shall be smooth, homogeneous, and comply with the requirements in Table 2.

TABLE 2

Type - Grade  Property	AC-5 + 2% Latex Solids	AC-10 + 2% Latex Solids	AC-10 + 3% Latex Solids	AC-10 + 3% Latex Solids (High Viscosity Blend)
Minimum SBR content, percent by wt. solids (IR determination)*	2.0	2.0	3.0	3.0
Penetration, 100g, 5 sec, 77 F, min	120	80	75	75
Viscosity, 140 F, poises, minimum	700	1300	1600	2300
Viscosity, 275 F, poises, maximum	7.0	8.0	12.0	12.0
Ductility, 39.2 F, 1cm/min, cm, minimum	-	-	100	100
Ductility, 39.2 F, 5 cm/min, cm, minimum	70	60	-	-
Separation of Polymer after 48 hrs. at 325 F	None	None	None	None
Separation of Polymer after 5 hrs. at 325 F **	None	None	None	None

\* The asphalt supplier shall furnish the Department samples of the asphalt cement and latex emulsion used in making the finished product.

\*\* Applies in lieu of the 48 hour requirement when the latex modified asphalt is to be used in asphaltic concrete and the latex additive is introduced separately at the mix plant, either by injection into the asphalt line or into the mixer.

**(c) Latex Modified Cutback Asphalt.** The latex modified cutback asphalt shall be a medium curing cutback produced from an asphalt cement to which has been added a styrene-butadiene rubber latex. The latex modified cutback asphalt shall comply with the requirements in Table 3.

TABLE 3

Type - Grade	MC-2400 Latex	
Property	Min	Max
Kinematic Viscosity @ 140 F, cst	2400	4800
Water, percent	-	0.2
Flash Point, T.O.C., F	150	-
Distillation Test:		
Distillate, percentage by volume of		
total distillate to 680 F		
to 500 F	-	35
to 600 F	35	80
Residue from Distillation, volume %	78	-
Tests on Distillation Residue:		
Minimum SBR Content percent by wt.		
solids (IR determination)*	2.0	-
Penetration, 100g, 5 sec., 77 F	150	300
Ductility, 5cm/min, 77 F, cm	50	-
Solubility in Trichloroethylene, %	99.0	-

\* The asphalt supplier shall furnish the Department samples of the asphalt cement and latex emulsion used in making the finished product.

**(3) CUTBACK ASPHALT.** Cutback asphalt shall meet the requirements indicated in Tables 4 and 5 for the specified type and grade.

TABLE 4  
RAPID CURING TYPE CUTBACK ASPHALT

Type - Grade	RC-250		RC-800		RC-3000	
Property	Min	Max	Min	Max	Min	Max
Kinematic Viscosity @ 140 F, cst	250	400	800	1600	3000	6000
Water, percent	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., F	80	-	80	-	80	-
Distillation Test:						
Distillate, percentage by volume of						
total distillate to 680 F						
to 437 F	40	75	35	70	20	55
to 500 F	65	90	55	85	45	75
to 600 F	85	-	80	-	70	-
Residue from distillation, volume %	70	-	75	-	82	-
Tests on Distillation Residue:						
Penetration, 100g, 5 sec., 77 F	80	120	80	120	80	120
Ductility, 5cm/min, 77 F, cm	100	-	100	-	100	-
Solubility in Trichloroethylene, %	99.0	-	99.0	-	99.0	-
Spot Test	Negative for all grades					

**CAUTION: R.C. CUTBACKS ARE EXTREMELY FLAMMABLE!**

TABLE 5  
MEDIUM CURING TYPE CUTBACK ASPHALT

Type - Grade	MC-30		MC-70		MC-250		MC-800		MC-3000	
Property	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Kinematic Viscosity @ 140 F, cst	30	60	70	140	250	500	800	160 0	300 0	600 0
Water, percent	-	0.2	-	0.2	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., F	100	-	100	-	150	-	150	-	150	-
Distillation Test:										
Distillate, percentage by volume of										
total distillate to 680 F										
to 437 F	-	25	-	20	-	10	-	-	-	-
to 500 F	40	70	20	60	15	55	-	35	-	15
to 600 F	75	93	65	90	60	87	45	80	15	75
Residue from Distillation, volume %	50	-	55	-	67	-	75	-	80	-
Tests on Distillation Residue:										
Penetration, 100g, 5 sec., 77 F	120	250	120	250	120	250	120	250	120	250
Ductility, 5cm/min, 77 F, cm	100*	-	100*	-	100*	-	100*	-	100*	-
Solubility in Trichloroethylene, %	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Spot Test	Negative for all grades									

\* If the penetration of residue is more than 200 and the ductility at 77 F is less than 100 cm, the material will be acceptable if its ductility at 60 F is more than 100.

**(4) EMULSIFIED ASPHALT.** Emulsified asphalt shall be homogeneous, shall show no separation of asphalt after thorough mixing and shall meet the requirements for the specified type and grade shown in Tables 6 through 9.

TABLE 6  
ANIONIC EMULSIONS

Type - Grade	Rapid Setting				Medium Setting		Slow Setting			
	RS-2		RS-2h		MS-2		SS-1		SS-1h	
Property	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol at 77 F, sec	-	-	-	-	-	-	20	100	20	100
at 122 F, sec	150	400	150	400	100	300	-	-	-	-
Sieve Test, %	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10
Miscibility (Standard Test)	-	-	-	-	-	-	Passing		Passing	
Cement Mixing, %	-	-	-	-	-	-	-	2.0	-	2.0
Demulsibility, 35 ml of 0.02 N CaCl <sub>2</sub> , %	60	-	60	-	-	30	-	-	-	-
Storage Stability, 1 day, %	-	1	-	1	-	1	-	1	-	1
Freezing Test, 3 cycles*	-	-	-	-	Passing		Passing		Passing	
Distillation Test:										
Residue by Distillation, % by weight	65	-	65	-	65	-	60	-	60	-
Oil Distillate, % by volume of emulsion	-	2	-	2	-	2	-	2	-	2
Tests on Residue from Distillation:										
Penetration at 77 F, 100 g, 5 sec	120	160	80	110	120	160	120	160	70	100
Solubility in Trichloroethylene, %	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-
Ductility at 77 F, 5 cm/min, cm	100	-	80	-	100	-	100	-	80	-

\* Applies only when the Engineer designates material for winter use.

TABLE 7  
HIGH FLOAT ANIONIC EMULSIONS

	Rapid Setting		Medium Setting	
Type - Grade	HFRS - 2		AES - 300	
Property	Min	Max	Min	Max
Viscosity, Saybolt Furol				
at 77 F, sec	-	-	75	400
at 122 F, sec	150	400	-	-
Sieve Test, %	-	0.10	-	0.10
Coating Ability and Water Resistance:				
Coating, dry aggregate	-	-	good	
Coating, after spraying	-	-	fair	
Coating, wet aggregate	-	-	fair	
Coating, after spraying	-	-	fair	
Demulsibility 35 ml of 0.02 N CaCl <sub>2</sub> , %	50	-	-	-
Storage Stability Test, 1 day, %	-	1	-	1
Distillation Test:				
Residue by Distillation, % by weight	65	-	65	-
Oil Distillate, by volume of emulsion, %	-	2	-	5
Tests on Residue from Distillation:				
Penetration at 77 F, 100 g, 5 sec	100	140	300	-
Solubility in Trichloroethylene, %	97.5	-	97.5	-
Ductility at 77 F, 5 cm/min, cm	100	-	-	-
Float Test at 140 F, sec	1200	-	1200	-

TABLE 8  
CATIONIC EMULSIONS

Type - Grade	Rapid Setting				Medium Setting				Slow Setting			
	CRS-2		CRS-2h		CMS-2		CMS-2s		CSS-1		CSS-1h	
Property	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol												
at 77 F, sec	-	-	-	-	-	-	-	-	20	100	20	100
at 122 F, sec	150	400	150	400	100	300	100	300	-	-	-	-
Sieve Test, %	-	0.1 0	-	0.1 0	-	0.1 0	-	0.1 0	-	0.1 0	-	0.10
Cement Mixing, %	-	-	-	-	-	-	-	-	-	2.0	-	2.0
Demulsibility, 35 ml 0.8 percent sodium dioctyl sulfosuccinate, %	40	-	40	-	-	-	-	-	-	-	-	-
Storage Stability, 1 day, %	-	1	-	1	-	1	-	1	-	1	-	1
Coating Ability and Water Resistance:												
Coating, dry aggregate	-	-	-	-	good		good		-	-	-	-
Coating, after spraying	-	-	-	-	fair		fair		-	-	-	-
Coating, wet aggregate	-	-	-	-	fair		fair		-	-	-	-
Coating, after spraying	-	-	-	-	fair		fair		-	-	-	-
Particle Charge Test	positive		positive		positive		positive		positive		positive	
Distillation Test:												
Residue by Distillation, % by wt	65	-	65	-	65	-	65	-	60	-	60	-
Oil Distillate, % by volume of emulsion	-	2	-	2	-	7	-	5	-	2	-	2
Tests on Residue from Distillation:												
Penetration at 77 F, 100 g, 5 sec	120	160	80	110	120	200	300	-	120	160	80	110
Solubility in Trichloroethylene, %	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-
Ductility at 77 F, 5 cm/min, cm	100	-	80	-	100	-	-	-	100	-	80	-

TABLE 9  
POLYMER MODIFIED EMULSIONS

	High Float Anionic Rapid Setting		Cationic Rapid Setting	
Type-Grade	HFRS-2P		CRS-2P	
Property	Min	Max	Min	Max
Polymer Content, percent by weight of the distillation residue *	3.0	-	3.0	-
Viscosity, Saybolt Furol at 122 F, sec	150	400	150	400
Storage Stability Test, 1 day, %	-	1	-	1
Demulsibility, 35 ml of 0.02 N CaCl <sub>2</sub> , %	40	-	-	-
Demulsibility, 35 ml 0.8 percent sodium dioctyl sulfosuccinate, %	-	-	40	-
Sieve Test, %	-	0.10	-	0.10
Particle Charge Test	-		Positive	
<b>**Distillation Test:</b>				
Oil distillate, by volume of emulsion, %	-	2	-	2
Residue, % by wt	65	-	65	-
<b>Tests on Residue from Distillation:</b>				
Float Value at 140 F, sec	1200	-	-	-
Penetration, 77 F, 100 g, 5 sec	100	140	110	150
Ductility, 39.2 F, 5 cm/min, cm	50	-	50	-
Viscosity at 140 F, poises	1500	-	1300	-
Solubility in Trichloroethylene, %	97	-	97	-



\* The emulsion supplier shall furnish the Department samples of the asphalt cement and polymer used in making the finished emulsion.

\*\* The temperature on the lower thermometer shall be brought slowly to 350 F plus or minus 10 F and maintained at this temperature for 20 minutes. The total distillation shall be completed in 60 plus or minus 5 minutes from the first application of heat.

**(5) FLUXING MATERIAL.** Fluxing material shall be free from foreign matter and shall be comprised of flux oil or a blend of flux oil and aromatic oil. The materials, when tested separately, shall meet the following requirements:

**(a) Flux Oil.**

Properties	Minimum	Maximum
Water, weight percent .....	-	0.2
Kinematic Viscosity, 140 F, cst.....	60	200
Flash Point, C.O.C., F .....	200	-
Loss on Heating, 50 g, 5 hrs at 325 F,		
weight percent .....	-	10
Asphalt Content (100 to 200 Penetration		
residue by vacuum distillation), weight		
percent .....	25	-
Pour Point, F .....	-	60

**(b) Aromatic Oil.**

Properties	Minimum	Maximum
Water, weight percent .....	-	0.2
Kinematic Viscosity, 140 F, cst.....	-	150
Flash Point, C.O.C., F .....	250	-
Loss on Heating, 50 g, 5 hrs at 325 F,		
weight percent.....	-	12
Pour Point, F .....	-	60

The aromatic oil, when blended with a maximum of 30 percent by weight of bitumen recovered from limestone ..... rock asphalt by Test Method Tex-211-F, shall produce a material with a minimum penetration at 77 F of 85.

**(6) SPECIAL PRECOAT MATERIAL.** Special precoat material shall meet the following ..... requirements:

Properties	Minimum	Maximum
Minimum.....		
Maximum.....		

Water, % .....	-	0.2
Flash Point, C.O.C., F .....	200	-
Kinematic Viscosity at 140 F, cst.....	300	500
Distillation to 680 F:		
Initial Boiling Point, F .....	500	-
Residue by weight, % .....	70	-
Residue Penetration, 77 F, 100 g, 5 sec		200      300

**(7) CRACKED FUEL OIL.** Cracked fuel oil shall meet the following requirements:

Properties  
Minimum..... Maximum

Asphalt Content of 100 Penetration		
@ 77 F, %.....	65	80
Flash Point, C.O.C., F .....	250	-
Kinematic Viscosity at 140 F, cst.....	-	550
Loss at 212 F, 20 g, 5 hrs. %.....	-	3.0
Water and Sediment, % .....	-	2.0

**(8) CRACK SEALER.** This section sets forth the requirements for SS-1P polymer modified emulsion .....suitable for sealing fine cracks, and a rubber asphalt compound suitable for sealing cracks 1/8 inch or greater width. For cracks on the order of 1/8 inch width, HFRS-2P polymer modified emulsion as described in Section (4), Table 9 of this item may be used. Requirements for SS-1P and rubber-asphalt crack sealing compound are as follows:

**(a) SS-1P Polymer Modified Emulsion.** Specific requirements are as follows:

Properties  
Minimum..... Maximum

Polymer Content, percent by weight of the distillate residue* .....		
	3.0	-
Viscosity, Saybolt Furol at 77 F, sec .....	30	100
Storage Stability Test, one day, % .....	-	1
Cement Mixing, % .....	-	2.0
Sieve Test, % .....	-	0.10
Miscibility (Standard Test) .....	Passing	

\*\* Distillation:

Oil distillate, by volume of emulsion, % ..	-	2
Residue, % .....	60	-

Requirements on Residue from Distillation:

Penetration, 77 F, 100g, 5 sec .....	100	140
Ductility, 39.2 F, 5 cm/min, cm .....	50	-
Solubility in trichloroethylene, %.....	97	-
Viscosity at 140 F, poises.....	1300	-

\* The emulsion supplier shall furnish the Department samples of the asphalt cement and polymer used in ..... making the finished emulsion.

\*\* The temperature on the lower thermometer shall be brought slowly to 350 F plus or minus 10 F and ..... maintained at this temperature for 20 minutes. The total distillation shall be completed in 60 plus or minus 5 minutes from the first application of heat.

**(b) Rubber-Asphalt Crack Sealing Compound.** This may be a proprietary material. The compound ..... shall be capable of being melted and applied at a temperature of 400 F or less by a suitable oil jacketed kettle equipped with a pressure pump, a hose and a nozzle. It shall contain no water or highly-volatile matter. It shall not be tracked by traffic when cooled to road temperature.

The rubber-asphalt crack sealing compound shall meet the following requirements:

Properties		
Minimum.....	Maximum	
Rubber Content, percent by wt.....	22	26
Flash Point, Modified C.O.C., F* .....	400	-
Penetration at 77 F, 150 g, 5 sec ** .....	30	50
Penetration at 32 F, 200 g, 60 sec ** .....	12	-

\* The equipment and procedure shall be as specified in ASTM D 92 with the following modification. Prior to ..... passing the test flame over the cup, agitate the sealing compound with a 3/8 inch to 2 inch wide square-end metal spatula in a manner so as to bring the material on the bottom of the cup to the surface, i.e., turn the material over. This shall be done, starting at one side of the thermometer, moving around to the other, then returning to the starting point, using 8 to 10 rapid circular strokes. The agitation shall be accomplished in 3 to 4 seconds. The test flame shall be passed over the cup immediately after the stirring is completed. This procedure shall be repeated at each successive 10 F interval until the flash point is reached.

\*\* The penetration shall be determined by ASTM D 5 except that the cone specified in ASTM D 217 shall be ..... substituted for the penetration needle.

**Properties of Rubber Used in Sealer.** The rubber shall be one of the following types:

Type 1 - Ground tire rubber.

Type II - Mixture of ground tire rubber and high natural reclaimed scrap rubber. The natural rubber ..... content, determined by ASTM D 297, shall be a minimum of 25 percent.

The ground rubber shall comply with the following gradation requirements when

tested by Test Method Tex-200-F, Part 1.

U.S. Standard Sieve Size	Percent Retained	
	Type I	Type II
No. 8	0	-
No. 10	0-5	0
No. 30	90-100	50-70
No. 50	95-100	70-95
No. 100	-	95-100

The ground rubber shall be free from fabric, wire, cord or other contaminating materials.

**Packaging.** The rubber-asphalt crack sealing compound shall be packaged in boxes which contain two (2) 30-35 pound blocks that are individually packaged in a liner made of polyethylene, or other packaging approved by the Engineer.

**(9) ASPHALT RECYCLING AGENT.** The asphalt recycling agent shall be either a petroleum oil, referred to as recycling agent, or a petroleum oil emulsion, referred to as emulsified recycling agent. These agents may be used alone or the emulsified recycling agent may be used in conjunction with emulsified asphalt having the same particle charge, i.e., a cationic emulsified asphalt must be used with a cationic emulsified recycling agent and an anionic emulsified asphalt with an anionic emulsified recycling agent. The supplier must clearly state whether the emulsified recycling agent being furnished is cationic or anionic. Specific requirements are as follows:

**(a) Emulsified Recycling Agent.**

Properties	Minimum	Maximum
Viscosity, Saybolt Furol at 77 F, sec .....	15	100
Sieve Test, % .....	-	0.10
Miscibility * .....	No Coagulation	
Residue, % by wt. ** .....	60	-
Test on Residue from Evaporation Test:		
Flash Point, C.O.C., F .....	400	-
Viscosity at 140 F, cst.....	75	250
Viscosity at 275 F, cst.....	-	10.0

\* Performed according to Test Method Tex-521-C except that 0.02 N calcium chloride solution shall be used in place of water.

\*\* Residue shall be determined by the evaporation method set forth in ASTM D 244, except that the sample shall be maintained at 300 F until foaming ceases, then cooled and weighed.

The ability of the residue from the evaporation test to restore the original properties of an aged asphalt cement shall be determined as follows. The residue shall be blended uniformly in the laboratory with a standard 14 to 16 penetration asphalt at a maximum rate of 20 percent by weight of the asphalt. The resulting blend must

comply with all the requirements of Subarticle 300.2.(1) for AC-20 asphalt cement.

The standard asphalt cement for the above blend shall be obtained by subjecting an AC-20 produced by Fina Oil and Chemical, Big Spring, Texas, meeting all requirements of this Item, to the thin film oven test as specified in Test Method Tex-510-C except that the test period shall be increased so as to obtain the required penetration.

**(b) Recycling Agent.** When recycling agent (petroleum oil) is specified, it shall meet the same requirements indicated above for the Residue from Evaporation Test on emulsified recycling agent.

### 3. STORAGE, HEATING AND APPLICATION TEMPERATURES

Asphaltic materials should be applied at the temperature which provides proper and uniform distribution and within practical limits avoiding higher temperatures than necessary. Satisfactory application should usually be obtained within the recommended ranges shown below. No material shall be heated above the maximum temperatures shown in Table 10.

TABLE 10

TYPE - GRADE	Application		Storage Maximum, F
	Recommended Range, F	Maximum Allowable, F	
AC-1.5 and AC-3	220-300	350	350
AC-5, 10, 20, 30	275-350	375	400
AC-5 or AC-10 + 2% SBR	300-375	390*	375
AC-10 + 3% SBR	300-350	350	360
RC-250	125-180	200	200
RC-800	170-230	260	260
RC-3000	215-275	285	285
MC-30	70-150	175	175
MC-70	125-175	200	200
MC-250	125-210	240	240
MC-800	175-260	275	275
MC-3000 & MC-2400 Latex	225-275	290	290
SS-1, SS-1h, SS-1P, CSS-1, CSS-1h,			

recycling agent, emulsified			
recycling agent	50-130	140	140
RS-2, RS-2h, MS-2, CRS-2, CRS2h, CRS-2P, CMS-2, CMS-2s, HFRS-2, HFRS-2P, AES-300	110-160	170	170
Special Precoat Material	125-250	275	275
Flux Oil	-	275	275
Aromatic Oil	-	275	275
Cracked Fuel Oil	160-220	260	260
Rubber-Asphalt Crack Sealer	350-375	400	-

\*AC-5 + 2% SBR and AC-10 + 2% SBR which is designated for surface treatment work may be heated to a maximum temperature of 390 F by the supplier loading through an in-line heater, or, with the Engineer's permission, these materials may be heated to a maximum of 390 F by the Contractor just prior to application. When any of the SBR-modified asphalt cements are used in asphaltic concrete, the storage temperature at the mix plant should not exceed 350 F.

#### 4. MEASUREMENT AND PAYMENT

Asphalts, Oils, and Emulsions shall not be measured for payment, but shall be subsidiary to the appropriate bid item.

\*\*\* END OF SECTION \*\*\*

SECTION 025412

**PRIME COAT (S-30)  
(Asphalt Material Only)**

**1. DESCRIPTION:** This specification shall consist of an application of asphalt material on the completed base course and/or other approved area in accordance with this specification.

Prime Coat shall not be applied when the air temperature is below 60°F and falling, but it may be applied when the air temperature is above 50°F and is rising, being taken in the shade and away from artificial heat. Asphalt material shall not be placed when general weather conditions, in the opinion of the Engineer, are not suitable.

**2. MATERIALS:** The asphalt material used for the prime coat shall be MC-70, unless otherwise specified, and when tested by approved laboratory methods shall meet the requirements of the specification 025404 - Asphalts, Oils and Emulsions.

**3. CONSTRUCTION METHODS:** When, in the opinion of the Engineer, the area and/or base is satisfactory to receive the prime coat, the surface may be cleaned by sweeping or other approved methods. If found necessary by the Engineer, the surface shall be lightly sprinkled just prior to application of the asphalt material. The asphalt material shall be applied on the clean surface by an approved type of self-propelled pressure distributor so operated as to distribute the material in the quantity specified, evenly and smoothly under a pressure necessary for proper distribution. The Contractor shall provide all necessary facilities for determining the temperature of the asphalt material in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two distributor loads.

All storage tanks, piping, retorts, booster tanks and distributors used in storing or handling asphalt material shall be kept clean and in good operating condition at all times, and they shall be operated in such manner that there will be no contamination of the asphalt material with foreign material. It shall be the responsibility of the Contractor to provide and maintain in good working order a recording thermometer at the storage-heating unit at all times. The distributor shall have been recently calibrated and the Engineer shall be furnished an accurate and satisfactory record of such calibration. After beginning of the work, should the yield on the asphalt material applied appear to be in error, the distributor shall be calibrated in a manner satisfactory to the Engineer before proceeding with the work.

Prime shall be applied at a temperature within the recommended range per Standard Specification 025404 "Asphalts, Oils, and Emulsions with that range being 125 to 175 °F for MC-70. Application rate shall be 0.15 GAL/SY, unless otherwise specified.

The Contractor shall be responsible for the maintenance of the surface until the Engineer accepts the work.

No traffic hauling or placement of any subsequent courses shall be permitted over the freshly applied prime coat until authorized by the Engineer.

**4. MEASUREMENT & PAYMENT:** Unless indicated otherwise in the Proposal, PRIME COAT shall be measured by the gallon of prime applied. Payment shall include furnishing, heating, hauling and distributing the asphalt material as specified; for all freight involved; and for all manipulation, labor, tools, equipment and incidentals necessary to complete the work.

\*\*\* END OF SECTION \*\*\*



SECTION 025424-T

**HOT MIX ASPHALTIC CONCRETE PAVEMENT (Class A) (S-34)**

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.

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.

Deteriorious material in coarse aggregate shall not exceed 2% per 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 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 TEX-410-A.

Polish Value not less than 30 for aggregate used in the surface course per 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 passes the Los Angeles abrasion requirements per above. Screenings shall be blended with a maximum of 15% un-crushed 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:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
No. 10	100
No. 200	0-15

2.1.3 Filler shall consist of dry stone dust, Portland cement, hydrated lime, or other approved by the Engineer.

Grading of filler shall be as follows:

<u>Sieve Size</u>	<u>Minimum Percent Passing by Weight</u>
No. 30	95
No. 80	75
No. 200	55

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 TX DOT Methods and meets the applicable provisions of said TX DOT Item 340 and this specification.

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

2.3.1 Paving Mixture:

<u>APPLICATION</u>	<u>ASPHALT GRADE</u>
Residential or low volume	PG 64-22
Collector	
Surface Course	PG 70-22
Binder Course	PG 64-22
Arterial	
Surface Course	PG 76-22
Binder Course	PG 64-22
Base Courses	PG 64-22

2.3.2 Tack Coat shall be MC-30 and shall be installed in accordance with the manufacturer's written instructions at a rate recommended by the manufacturer.

### **3. PAVING MIXTURE**

3.1 Mix Design: The mixture shall be designed in accordance with TX DOT Bulletin C-14 and 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 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 differ 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 TEX-200-F (Dry Sieve Analysis):

Sieve Size	Type			
	A Coarse Base	B Fine Base	C Course Surface	D Fine Surface
1-1/2"	100			
1-1/4"	95-100			
1"		100		
7/8"	70-90	95-100	100	
5/8"		75-95	95-100	
1/2"	50-70			100
3/8"		60-80	70-85	85-100
1/4"				
No. 4	30-50	40-60	43-63	50-70
No. 10	20-34	27-40	30-40	32-42
No. 40	5-20	10-25	10-25	11-26
No. 80	2-12	3-13	3-13	4-14
No. 200	1-6*	1-6*	1-6*	1-6*
VMA % minimum	11	12	13	14

\* 2-8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.

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 courser than 3/8" and for Type D material courser than #4. Variations from job-mix shall not exceed the following limits, except as noted above:

<u>Item:</u>	<u>Tolerances Percent by Weight or Volume</u>
1" to No. 10	Plus or Minus 5.0
No. 40 to No. 200	Plus or Minus 3.0
Asphalt Weight	Plus or Minus 0.5
Asphalt Volume	Plus or Minus 1.2

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 TEX-208-F at an optimum density of 96% (plus or minus 1.5) of theoretical maximum per 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 weight 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 back-back street 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 Weight 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 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 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.

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 the specification, "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.

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 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 such that when properly compacted, the finished surface will be smooth or uniform density, and meet the requirements of the typical cross sections 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 six inches. Construction joints on surface courses shall coincide with lane lines, or as directed by the Engineer.

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 not individual determination shall be lower than 90%. Testing shall be in accordance with 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 HMA courses shall not be less than the amount specified on the drawings. No more than 10% of the measured thicknesses shall be more than 1/4" 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.

6.10 The Mays Roughness Value for each block (intersection to intersection) or 600-foot section, whichever is the lesser, shall not exceed ninety inches per mile per traffic lane.

For each block of 600-foot section not meeting this criteria, the Engineer shall have the option of requiring that block or 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:

Adjusted Unit Price = (Adjustment Factor) X Surface Course Unit Bid Price

The adjustment factor shall be:

For Residential Streets:

Adjustment Factor = 1.999 - 0.0111 M

For All Other Class Streets (Non Residential)

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.

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 ravel, it will be the contractor's responsibility to correct this condition at his expense.



## 7. MEASUREMENT & PAYMENT

Unless indicated otherwise in the Proposal, Hot Mix Asphalt Pavement shall be measured by one of the following methods:

- A. Measured by the square yard of the type and thickness of "Hot Mix Asphaltic Concrete" as shown on the plans.
- B. Measured by the total weight of "Hot Mix Asphaltic Concrete" of the type specified on the plans delivered to the job site.

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.

The prime coat, performed where required, will be measured and paid for in accordance with the provisions governing the specification, Section 025412 "Prime Coat".

All templates, straightedges, scales, and other weights 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.

\*\*\* END OF SECTION \*\*\*

## SECTION 025610-T

### CONCRETE CURB AND GUTTER (S-52)

**1. DESCRIPTION:** This specification shall consist of Portland Cement 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 plans.

**2. MATERIALS:** Unless otherwise specified on plans, materials and proportions for concrete used in construction under this specification shall conform the requirements as specified for Class "A" Concrete under specification, Section 030020 "Portland Cement Concrete". Reinforcing steel, if required, **shall be grade 60** and conform to the requirements as specified in the specification, Section 032020 "Reinforcing Steel". Expansion joint filler shall be redwood material meeting the requirements specified in specification, Section 038000 "Concrete Structures", unless specified otherwise in the plans.

**3. CONSTRUCTION METHODS:** The foundation shall be excavated and shaped to line, grade per typical cross section, and hand tamped and sprinkled. If dry, the foundation material shall be sprinkled lightly 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 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. **Where specifically permitted by the Engineer in writing, the Contractor may place concrete curb and gutter with extrusion machine.**

The reinforcing steel shall be placed in position as shown on the typical sections. Care shall be exercised to keep all 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 premoulded or board joint of cross section specified for the curb and gutter and of the thickness indicated on the plans.

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 plans. 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 plans. Other methods of curing as outlined in the specification, Section 038000 "Concrete Structures" will be acceptable with a required curing period of 72 hours.

**Fill and compact areas behind curbs and adjacent to sidewalks and driveways to the full height of the concrete without delay after completion of concrete work. The top 6" (where disturbed by construction or where unsatisfactory material is exposed by excavation) of finished earth grade shall be clean excavated material or topsoil capable of supporting a good growth of grass when fertilized and seeded or sodded. It shall be free of concrete, asphalt, shell, caliche, debris and any other material, which detracts from its appearance or hampers the growth of grass.**

**4. MEASUREMENT & PAYMENT:** Unless indicated otherwise in the Proposal, Concrete Curb and Gutter or Concrete Curb will be measured by the linear foot for each type of curb.

**Payment shall be in accordance with the Price Schedule and** shall each be full compensation for preparing the subgrade; furnishing and placing all materials including reinforcing steel and expansion material; for furnishing, placing, shaping and tamping backfill; and for all manipulation, labor, tools, equipment and incidentals necessary to complete the work.

\*\*\* END OF SECTION \*\*\*

SECTION 025612-T

**CONCRETE SIDEWALKS AND DRIVEWAYS (S-53)**

**1. DESCRIPTION:** The 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 plans.

**2. MATERIALS:** Materials and proportions used in construction under this item shall conform to the requirements as specified for Class "A" concrete under the specification Section 030020 "Portland Cement Concrete". Reinforcing steel, if required, **shall be grade 60** and conform to the requirements as specified in the specification Section 032020 "Reinforcing Steel". Expansion joint filler shall be red wood or premoulded material meeting the requirements specified in the 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. **A 2" layer of sand bedding shall be placed on the compacted subgrade prior to pouring concrete.** The subgrade shall be moist 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, if required, shall be placed in position as shown on the plans. Care shall be exercised to keep all steel in its proper location.

Sidewalks shall be constructed in sections of the lengths shown on plans. Unless otherwise provided by the plans, no section shall be 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 premoulded or board joint of the thickness shown on the plans, 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 material shall be placed along their entire length. Similar expansion 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 plans.

Sidewalks shall be marked into separate sections, each 4 feet in length, by the use of approved jointing tools.

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

**Upon removing formwork, all the areas around the concrete shall be backfilled using the existing material. The backfill shall be graded in such a manner as to drain effectively at all times.**

**In some instances the existing concrete will need to be removed. The concrete shall be saw cut to full depth. If an expansion joint exists within two feet (2') then the concrete shall be removed up to the expansion joint.**

**4. MEASUREMENT & PAYMENT:** Unless indicated otherwise in the Proposal, Concrete Sidewalk and Driveway will be measured by the square foot of surface area of completed sidewalks, driveways, or sidewalks and driveways as indicated in the plans.

**Payment shall be in accordance with the Price Schedule** and is full compensation for preparing the subgrade; for furnishing and placing all materials, including all reinforcing steel and expansion joint materials; and all manipulation, labor, tools, equipment and incidentals necessary to complete the work.

\*\*\* END OF SECTION \*\*\*

SECTION 025614-T

**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 of the Standard Specifications.

**All reinforcing steel shall be grade 60 meeting the requirements of Section 032020.** Reinforcement shall be 4x4 - W2.9 welded wire fabric in accordance with Section 032020 of the Standard Specifications.

Crushed granite shall be 1/2 inch, in accordance with AASHTO M43 Size Number 6.

- 3. **CONSTRUCTION METHODS:** The subgrade shall be shaped to line, grade, cross section, and shall be of uniform density and moisture, when concrete is placed. **A 2” layer of sand bedding shall be placed on the compacted subgrade prior to pouring concrete.** The subgrade shall be hand tamped and sprinkled to achieve the desired consistency and uniform support.

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 4", prior to application of exposed aggregate surface texture.

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

RAMPS

Ramp in direction of travel . . . . .	$S \leq 1:12$
Side slope of ramp (flare) . . . . .	$S \leq 1:10$
Cross Slope . . . . .	$1:100 \leq S \leq 1:50$

ADJOINING AREAS

Landings adjacent to ramp . . . . .	$S \leq 1:20$
Driveways abutting tied sidewalk . .	$S \leq 1:10$

Width of ramp shall be 36", exclusive of flare, unless shown otherwise in the Drawings. No ramp shall be less than 36" wide.

Obstructions shall be removed or relocated, as appropriate, or the location of the ramp may be shifted, if authorized.

Surfacing shall be as indicated in the details on the drawings.

**Upon removing the formwork, all the areas around the concrete shall be backfilled using the existing material. The backfill shall be graded in such a manner as to drain effectively at all times.**

**In some instances the existing concrete will need to be removed. The concrete shall be saw cut to full depth. If an expansion joint exists within two feet (2') then the concrete shall be removed up to the expansion joint.**

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 striping with respect to intersection and curb ramp. Properly constructed curb ramp shall be true to line, section, grade and shall be free of loose granite surfacing and irregularities.

**4. MEASUREMENT AND PAYMENT:** Unless indicated otherwise in the Proposal, 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. Measurement shall include, but not be limited to subgrade prep, form-work, concrete, rebar, granite surfacing, borders, molding and curing required to complete the curb ramp.

**Payment shall be in accordance with the price Schedule** include all labor, materials, equipment and other incidentals required to complete the concrete curb ramp complete in place and will be made at the unit price bid for Concrete Curb Ramps when included in the proposal.

\*\*\* END OF SECTION \*\*\*

SECTION 028020-T

**EROSION CONTROL BY SEEDING (S-14)**

1. **DESCRIPTION:** This specification shall govern all work necessary for fertilizing, planting seeds and maintaining vegetation required to complete the project.

2. **MATERIALS**

2.2 **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 (% 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. See drawings for mixture.

COMMON NAME	LB/ACRE OF PURE LIVE SEED				
	SCIENTIFIC NAME		FOR MIXTURES		
	<u>A</u>	<u>B</u>	<u>C</u>		
Green Sprangletop	Leptochloa	Dubia	1.4	1.4	-
Sideoats Grama (premier)	Bouteloua	Curtipendula	.6	-	.6
Bermudagrass (Hulled)	Cynodon	Dactylon	7.0	7.4	-
Bermudagrass (Unhulled)	Cynodon	Dactylon	-	-	30.0
K. R. Bluestem	Andropogon	Ischaemum	1.2	1.2	1.5
Buffalograss	Pennisetum	Ciliare	-	4.2	-
Annual Ryegrass	Lolium	Multiflorum	5.0	5.0	20.0



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, wood cellulose fiber type, asphaltic emulsion type or asphaltic emulsion over wood cellulose fiber type, whichever is indicated on the drawings.

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

Asphaltic Emulsion Type or Asphalt Emulsion Over Wood Cellulose Fiber Type - Shall conform to ASTM specification D 977, Grade SS-1 mixed with water (60% asphalt 40% water).

Wood Cellulose Fiber Type - Wood cellulose fiber shall have no growth inhibiting ingredients and shall be dried with a moisture content less than 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 thru 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 - See Section 021020, "Site Clearing and Stripping"

Grading - See Section 021040, "Site Grading".

Tilling - The area to be seeded shall be tilled to a depth of 2 to 6 inches by disking, plowing, or other approved methods until soil condition is acceptable.

- 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 a rate specified under materials A-14.2.2.

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 sick 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 two exceptions. 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. 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. As asphalt-water emulsion shall be applied at a rate of 1,500 to 1,800 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 seeds, fertilizer, water and other approved materials are added. Application shall be 1500 lb/acre on flats, 2000 lb/acre on 3:1 slopes, and 2500 lb/acre on 2:1 or greater. 100 lb. 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 will water, repair and reseed areas as required for a period of 45 days. 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 seedings have been damaged or destroyed, the affected portion shall be re-established to the specified condition prior to acceptance of the work.

GUARANTEE: The Contractor shall assure 95% of the seeded area has established growth at 45 calendar days after seeding, unless indicated otherwise on the drawings. Where established, growth is defined as at least one plant per square foot.

\*\*\* END OF SECTION \*\*\*

SECTION 028040-T

**EROSION CONTROL BY SODDING (S-8)**

**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 lb\acre (7.23 lb per 100 s.y). In the event that is necessary 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 .25 feet, or live St. Augustine with thickly matted roots throughout the soil with a minimum thickness of 1 inch or .08 feet. 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 source. Sod and soil shall be kept moist at all times during 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, alkalies, and salts which 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 lit is firmly against the bottom of the hole; the top of the sod shall not be more than ½ inch below finished grade. Soil shall be firmly 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 sodded shall be graded and shaped. Sod blocks shall be uniformly placed over the prepared area. The sodded area shall then be fertilized and watered. After the area is sufficiently dry, the area shall be rolled or tamped on 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, sloped may cause displacement, areas to be block sodded 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 plans.

Any section not true to lines and cross sections 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.

\*\*\* END OF SECTION \*\*\*

## SECTION 030020

### PORTLAND CEMENT CONCRETE (S-40)

#### 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 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

Cement: The cement shall be either Type I, II or III Portland Cement conforming to ASTM Designation: C 150, 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 - 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 tensile 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.

**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 nor than 1000 parts million of sulfates as SO<sub>4</sub>.

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 "Standard Method of Test for Quality of Water to be used in Concrete" (AASHTO Method T-26), except where such methods are in conflict with provisions of this specification.

**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 of weight of laminated and/or friable particles when tested in accordance with Test Method Tex-413.A. It shall have a wear of not more than 40 percent when tested in accordance with 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 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, 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

Aggregate Grade No.	Nominal Size	Percent Retained on each Sieve								
		2½ In.	2 In.	1-½ In.	1 In.	¾ In.	½ In.	¾ In.	No. 4	No. 8
1	2 in.	0	0 to 20	15 to 50		60 to 80			95 to 100	
2 (467)*	1-½ in.		0	0 to 5		30 to 65		70 to 90	95 to 100	
4 (57)*	1 in.			0	0 to 5		40 to 75		90 to 100	95 to 100
8	¾ in.						0	0 to 5	35 to 80	90 to 100

\*Numbers in parenthesis indicate conformance with ASTM C33.

The aggregate shall be washed. The Loss by Decantation (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.

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 (Test Method Tex-408-A), it shall not show a color a 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 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 Test Method Tex-612-J.

When tested by approved methods, the fine aggregate or combinations of aggregates, including mineral filler, shall conform to the grading requirements shown in Table 2.

Table 2  
Fine Aggregate Gradation Chart

Aggregate Grade No.	3/8 In.	Percent Retained on Each Sieve						
		No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
1	0	0 to 5	0 to 20	15 to 50	35 to 75	70 to 90	90 to 100	97 to 100

**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 (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 Class A and C and E Concrete, 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.

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

Mortar (Grout): 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.

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: C 494, 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 Entraining Admixture. The admixture shall meet the requirements of ASTM Designation: C 260 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 stock piles 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, stock piles 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 requirement 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.

In lieu of the above mix design responsibility, the Contractor may accept a design furnished by the Engineer, however, this will not relieve him of providing concrete meeting the requirements of these specifications.

Trial batches will be made and tested using all the proposed ingredients prior to the placing of 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 aggregate.

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 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 1-1/2 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 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 difference 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

Concrete Designation	Desired Slump	Max. Slump
Structural Concrete		
(1) Thin-Walled Sections (9" or less)	4	5
(2) Slabs, Caps, Columns, Piers, Wall Sections 9", etc.	3	4
Underwater or Seal Concrete	5	6
Riprap, Curb, Gutter and Other Miscellaneous Concrete	2.5	4

**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 ration, 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 will cast test cylinders or beams as a check on the compressive or flexural strength of the concrete actually placed.

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

Test beams or cylinders will be required as specified on the plans. 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 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 4  
Classes of Concrete

Class of Concrete	Sx. Cement per C.Y.	Min. Comp Strength (f'c) 28 Day psi	Min. Beam Strength 7 Day psi	Max. Water Cement Ratio	Coarse Aggr. No.
A*	5.0	3000	500***	6.5	2-4-8****
B*	4.5	2500	417	8.0	2-4-8****
C*	6.0	3600	600***	6.0	1-2-4**
D	6.0	3000	500	7.0	2-4
S	6.5	4000	570	5.0	2-4

\*Entrained Air (slabs, pier and bent concrete)

\*\*Grade 1 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, 460 psi. min.

\*\*\*\*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 specifications, 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 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 stock piles. Aggregate stock piles 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:**

(a) 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 under way 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 by 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 specifications items and concrete not meeting the slump, workability and consistency requirements of the governing specification item 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 agitator or a truck mixer operating at 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 revisions.
  - (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 Mixer: In addition, truck mixers shall comply with the following requirements:

An engine in satisfactory working condition and capable of accurately governing 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 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 "Part 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 nor more than 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 the specification, Section 038000 "Concrete Structures".

**13. MEASUREMENT:** The quantities of concrete of the various classifications which will constitute the completed and accepted structure of structures in place will be measured by the cubic yard, each, square foot, square yard, or linear foot as the case may be. Measurement will be as shown on the plans and in the proposal.

**14. PAYMENT:** The unit price bid for the various classifications of concrete shown shall be compensation for finishing, hauling, and mixing all concrete material; placing, curing and furnishing 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; and for all forms and falsework, labor, tools, equipment, and incidentals necessary to complete the work.

\*\*\* END OF SECTION \*\*\*

## SECTION 032020

### REINFORCING STEEL (S-42)

**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 40, 60 and 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 Grades 40 and 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 (Referenced to ASTM Designation: A 29 is voided. Dimensional tolerances shall be in accordance with ASTM Designation: A 615, or ASTM Designation: A 615, Grade 40 or 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 specifications 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 is as follows:

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

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

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

<u>Gauge Number</u>	<u>Equivalent Diameter Inches</u>	<u>Gauge Number</u>	<u>Equivalent Diameter Inches</u>
0	0.3065	8	0.1620
1	0.2830	9	0.1483
2	0.2625	10	0.1350
3	0.2437	11	0.1205
4	0.2253	12	0.1055
5	0.2070	13	0.0915
6	0.1920	14	0.0800
7	0.1770		

**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:

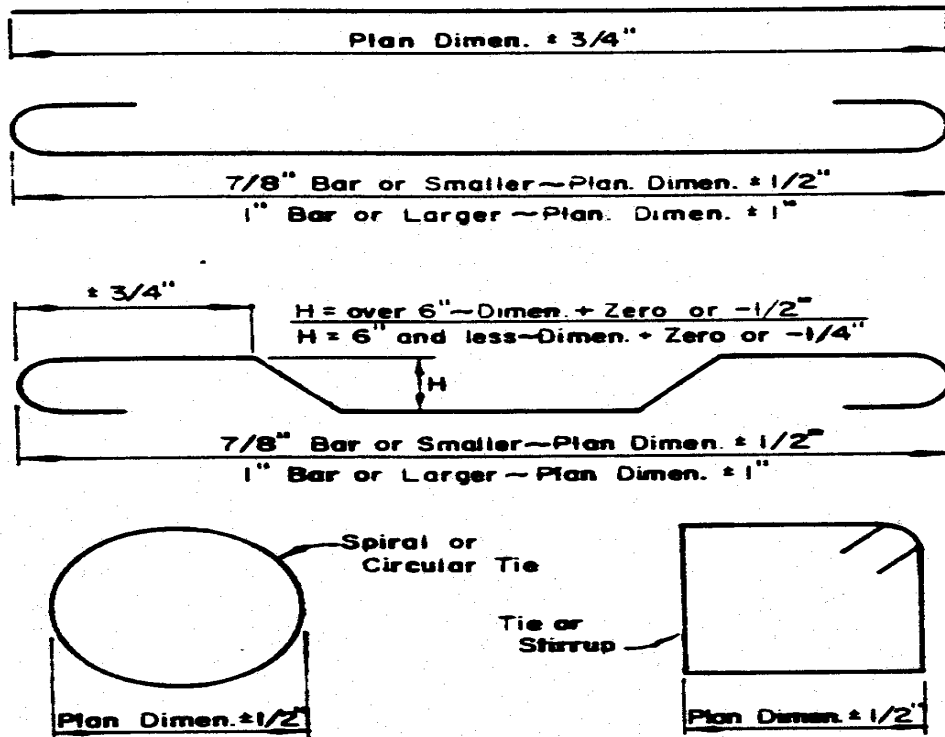
Bends of 90° and greater in stirrups, ties and other secondary bars that enclose another bar in the bend.

	<u>Grade 40</u>	<u>Grade 60</u>
#3, #4, #5	3d	4d
#6, #7, #8	4d	5d

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

	<u>Grade 40</u>	<u>Grade 60</u>	<u>Grade 75</u>
#3 thru #8	5d	6d	--
#9, #10	5d	8d	--
#11	5d	8d	8d
#14, #18	10d	10d	--

**4. TOLERANCES:** Fabricating Tolerances for bars shall be within 3% 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 not provided for on the plans will be permitted, but not included for measurement, in Grade 40 bars only, sizes No. 8 and smaller, subject to the following:

For bars exceeding 40 feet in plan length, the distance center to center of splices shall not be less than 40 feet and no individual bar length shall be less than 10 feet. Splices will not be permitted in bars less than 40 feet in plan length. Splices which are not shown on the plans, but permitted hereby, shall be made in accordance with Table 1 below. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.



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

TABLE 1  
Minimum Lap Requirements

<u>Lap</u>	<u>Uncoated</u>	<u>Coated</u>
Lap in inches	≥ 40d	60d

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 plans and of the specification, Section

050200 "Structural Welding". 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 extensions with more than one foot of fill, a minimum of 6 inch 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.

Vertical stirrups shall always pass around the main tensions 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 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 sited 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. Pre-cast 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 frustrum 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 cage 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 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;** Reinforcing steel is considered subsidiary to the various items shown in the proposal and shall not be measured and paid for as a separate item.

\*\*\* END OF SECTION \*\*\*

SECTION 038000

**CONCRETE STRUCTURES (S-41)**

**1. DESCRIPTION:** This specification shall govern for construction of all types of structures involving the use of structural concrete, except where the requirements are waived or revised by other governing specifications.

All concrete structures shall be constructed in accordance with the design requirements and details shown on the plans; in conformity with the pertinent provisions of the items contracted for; the incidental specifications referred to; and in conformity with the requirements herein.

**2. MATERIALS:**

(1) Concrete. All concrete shall conform to the provisions of the specification, "Portland Cement Concrete".

The class of concrete for each type of structure or unit shall be as specified on the plans, or by pertinent governing specifications.

(2) Expansion Joint Material

(a) Preformed Fiber Material. Preformed fiber expansion joint material shall be of the dimensions shown on the plans. At the Contractor's option, the material shall be one of the following types, unless otherwise noted on the plans:

1. "Preformed Bituminous Fiber Materials" shall meet the requirements of the Standard Specifications for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction, ASTM Designation: D1751.

2. "Preformed Non-Bituminous Fiber Material" shall meet the requirements of the Standard Specifications for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction, ASTM Designation: D1751, except that the requirements pertaining to bitumen content, density and water absorption shall be voided.

(b) Joint Sealing Materials. Unless otherwise shown on the plans, joint sealing material shall conform to the following requirements. The material shall adhere to the sides of the concrete joint or crack and shall form an effective seal against infiltration of water and incompressible. The material

shall not crack or break when exposed to low temperatures.

1. Class 1-a. (Two component, Synthetic Polymer, Cold Extruded Type). Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles. This type is specifically designed for vertical or sloping joints and hence not self leveling. It shall cure sufficiently at an average temperature leveling. It shall cure sufficiently at an average temperature of 77° F ± 3 F maximum of 24 hours. For performance requirements see under b-2 below.

2. Class 1-b. (Two component, Synthetic Polymer, Cold Pourable, Self Leveling Type). Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles. It shall cure sufficiently at an average temperature of 77° F ± 3 F maximum of 3 hours.

Performance Requirements. Class 1-a and 1-b, when tested in accordance with Test Method Tex-525-C, shall meet the above curing times and requirements as follows:

It shall be of such consistency that it can be mixed and poured, or mixed and extruded into joints at temperatures above 60 F.

Penetration, 77° F.	
150 gm. cone, 5 sec., max.-cm.....	0.90
Bond and Extension 75%, O° F, 5 cycles	
Dry Concrete Blocks.....	Pass
Wet Concrete Blocks.....	Pass
Steel Blocks...(Primed if specified by Manuf.).	Pass
Flow at 200° F.....	None
Water Content % by weight, max.....	5.0
Resilience	
Original sample min. % (cured).....	50
Oven aged at 158° F min. % .....	50
For Class 1-a Material Only	
Cold Flow (10 min.).....	None

(c) Asphalt Board. Asphalt Board shall consist of two liners of 0.016 inch asphalt impregnated paper, filled with a mastic mixture of asphalt and vegetable fiber and/or mineral filler. Boards shall be smooth, flat and sufficiently rigid to permit installation. When tested in accordance with Test

Method Tex-524-C, the asphalt board shall not deflect from the horizontal more than one inch in three and one-half inches.

(d) Rebonded Neoprene Filler. Rebonded neoprene filler shall consist of ground closed-cell neoprene particles, rebonded and molded into sheets of uniform thickness of the dimensions shown on plans.

Filler material shall have the following physical properties and shall meet the requirements of ASTM Designation: D1752, Type 1 where applicable:

<u>PROPERTY</u>	<u>METHOD</u>	<u>REQUIREMENT</u>
Color	ASTM D1752 Type 1	Black
Density	ASTM D1752 Type 1	40 PCF Min
Recovery	ASTM D1752 Type 1	90% Min.
Compression	ASTM D1752 Type 1	50 to 500 psi
Extrusion	ASTM D1752 Type 1	0.25 In. Max.
Tensile Strength	ASTM D1752 Type 1	20 psi Min.
Elongation		75% Min

The manufacturers shall furnish the Engineer with certified test results as to the compliance with the above requirements and a 12 inch x 12 inch x 1 inch sample from the shipment for approval.

(e) Wood. Wood shall be Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.
2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

(3) Curing Materials

(a) Membrane curing materials shall comply with the "Standard Specification Liquid Membrane-Forming Compounds for Curing Concrete", ASTM Designation: C 309, Type 1 clear or translucent, or Type 2 white pigmented. The material shall

have a minimum flash-point of 80° F when tested by the "Pensky-Martin Closed Cup Method".

It shall be of such consistency that it can be satisfactorily applied as a fine mist through an atomizing nozzle by means of approved pressure spraying equipment at atmospheric temperatures above 40° F.

It shall be of such nature that it will not produce permanent discoloration of concrete surfaces nor react deleteriously with the concrete or its components. Type 1 compound shall contain a fugitive dye that will be distinctly visible not less than 4 hours nor more than 7 days after application.

The compound shall produce a firm, continuous, uniform moisture impremeable film free from pinholes and shall adhere satisfactorily to the surfaces of damp concrete. It shall, when applied to the damp concrete surface, at the rate of coverage specified herein, dry to touch in not more than 4 hours and shall adhere in a tenacious film without running off or appreciable sagging. It shall not disintegrate, check, peel or crack during the required curing period.

The compound shall not peel or pick up under traffic and shall disappear from the surface of the concrete by gradual disintegration.

The compound shall be delivered to the job only in the manufacturer's original containers, which shall be clearly labeled with the manufacturer's name, the trade name of the material, and a batch number or symbol with which test samples may be correlated.

The water retention test shall be in accordance with Test Method Tex-219-F. Percentage loss shall be defined as the water lost after the application of the curing material was applied. The permissible percentage moisture loss (at the rate of coverage specified herein) shall not exceed the following:

24 hours after application.....	2 percent
72 hours after application.....	4 percent

Type 1 (Resin Base Only) curing compound will be permitted for slab concrete in bridge decks and top slabs of direct traffic culverts.

(b) Mat curing of concrete is allowed where permitted by Table 1 in this specification or where otherwise approved by the Engineer.

**3. EXPANSION JOINTS:** Joints and devices to provide for expansion and contraction shall be constructed where and as indicated herein or on the plans.

All open joints and joints to be filled with expansion joint material, shall be constructed using forms adaptable to loosening or early removal. To avoid expansion or contraction damage to the adjacent concrete, these forms shall be loosened as soon as possible after final concrete set to permit free movement without requiring full form removal.

Prior to placing the sealing material, the vertical facing the joint shall be cleaned of all laitance by sandblasting or by mechanical routing. Cracked or spalled edges shall be repaired. The joint shall be blown clean of all foreign material and sealed. Where preformed fiber joint material is used, it shall be anchored to the concrete on one side of the joint by light wire or nails, to prevent the material from falling out. The top one inch of the joint shall be filled with joint sealing material.

Finished joints shall conform to the indicated outline with the concrete sections completely separated by the specified opening or joint material.

Soon after form removal and again where necessary after surface finishing, all projecting concrete shall be removed along exposed edges to secure full effectiveness of the expansion joints.

**4. CONSTRUCTION JOINTS:** The joint formed by placing plastic concrete in direct contact with concrete that has attained its initial set shall be deemed a construction joint. The term monolithic placement shall be interpreted to mean at the manner and sequence of concrete placing shall not create construction joints.

Construction joints shall be of the type and at the locations shown on the plans. Additional joints will not be permitted without written authorization from the Engineer, and when authorized, shall have details equivalent to those shown on the plans for joints in similar locations.

Unless otherwise provided, construction joints shall be square and normal to the forms. Bulkheads shall be provided in the forms for all joints, except when horizontal.

Construction joints requiring the use of joint sealing material shall be as detailed on the plans. The material will be specified on the plans without referenced to joint type.

A concrete placement terminating at a horizontal construction joint shall have the top surface roughened thoroughly as soon as practicable after initial set is attained. The surfaces at bulkheads shall be roughened as soon as the forms are removed.

The hardened concrete surface shall be thoroughly cleaned of all loose material, laitance, dirt or foreign material and saturated with water so it is moist when placing fresh concrete against it. Forms shall be drawn tight against the placing of the fresh concrete.

## 5. FORMS

(1) General. Except where otherwise specified, forms may be of either timber or metal. Forms for round columns exposed to view shall be of steel, except that other materials will be allowed with written permission of the Engineer.

Forming plans shall be submitted to the Engineer for approval as specified. Forms shall be designed for the pressure exerted by a liquid weighing 150 pounds per cubic foot. The rate of placing the concrete shall be taken into consideration in determining the depth of the equivalent liquid. For job fabricated forms, an additional live load of 50 pounds per square foot shall be allowed on horizontal surfaces. The maximum unit stresses shall not exceed 125 percent of the allowable stresses used by the State Department of Highways and Public Transportation for the design of structures.

Commercially produced structural units used in form work shall not exceed the manufacturer's maximum allowable working load for moment, shear or end reaction. The maximum working load shall include a live load of 35 pounds per square foot of horizontal form surface and sufficient details and data shall be submitted for use in checking form work details for approval.

Forms shall be practically mortar-tight, rigidly braced and strong enough to prevent bulging between supports and maintained to the proper line and grade during concrete placement. Forms shall be maintained in a manner that will prevent warping and shrinkage.

Offset at form joints shall not exceed one-sixteenth of an inch.

Deflections due to cast-in-place slab concrete and railing shown in the dead load deflection diagram shall be taken into account in the setting of slab forms.

All forms and footing areas shall be cleaned of any extraneous matter before placing concrete.

Permission to place concrete will not be given until all such work is completed to the satisfaction of the Engineer.

If, at any stage of the work, the forms show signs of bulging or sagging, the portion of the concrete causing such condition shall be removed immediately, if necessary, and the forms shall be reset and securely braced against further movement.

(2) Timber Forms. Lumber for forms shall be properly seasoned, of good quality, and free from imperfections which would affect its strength or impair the finished surface of the concrete. The lumber used for facing or sheathing shall be finished on at least one side and two edges and shall be sized to uniform thickness.



Form lining will be required for all formed surfaces, except for the inside of culvert barrels, inlets and manholes; surfaces that are subsequently covered by backfill material or are completely enclosed; and, any surface formed by a single finished board. Lining will not be required when plywood forms are used.

Form lining shall be of an approved type such as masonite or plywood. Thin membranous sheeting, such as polyethylene sheets, shall not be used for form lining.

Forms may be constructed of plywood not less than one-half inch in thickness, with no form lining required. The grain of the face plies on plywood forms shall be placed parallel to the span between the supporting studs or joists.

Plywood used for forming surfaces which remain exposed shall be equal to that specified as B-B Plyform Class I or Class II Exterior of the U. S. Department of Commerce, National Bureau of Standard, latest edition.

Forms or form ladders to be reused shall be maintained clean and in good condition. Any lumber which is split, warped, bulged, marred or has defects that will produce inferior work shall not be used and, if condemned, shall be promptly removed from the work.

Studs and joists shall be spaced so that the facing form material remains in true alignment under the imposed loads.

Walls shall be spaced close enough to hold forms securely to the designated lines and scabbed at least 4 feet on each side of joints to provide continuity. A row of walls shall be placed near the bottom of each placement.

Facing material shall be placed with parallel and square joints and securely fastened to supporting studs.

Forms for surfaces receiving only an ordinary finish and exposed to view shall be placed with the form panels symmetrical, i.e., long dimensions set in the same direction. Horizontal joints shall be continuous.

Molding specified for chamfer strips or other uses shall be made of materials of a grade that will not split when nailed and which can be maintained to a true line without warping. Wood molding shall be mill cut and dressed on all faces. Unless otherwise provided, forms shall be filleted at all sharp corners and edges with triangular chamfer strips measuring three-fourths inch on the sides.

Forms for railing and ornamental work shall be constructed to standards equivalent to first-class millwork. All moldings, panel work and bevel strips shall be straight and true with

nearly mitered joints designed so the finished work is true, sharp and clean cut.

All forms shall be constructed to permit their removal without marring or damaging the concrete. The forms may be given a slight draft to permit ease of removal.

Metal form ties of an approved type or a satisfactory substitute shall be used to hold forms in place and shall be of a type that permits ease of removal of the metal as hereinafter specified.

All metal appliances used inside of forms for alignment purposes shall be removed to a depth of at least one-half inch from the concrete surface. They shall be made so the metal may be removed without undue chipping or spalling, and when removed, shall leave a smooth opening in the concrete surface. Burning off of rods, bolts or ties will not be permitted.

Any wire ties used shall be cut back at least one-half inch from the face of the concrete.

Devices holding metal ties in place shall be capable of developing the strength of the tie and adjustable to allow for proper alignment.

Metal and wooden spreaders which are separate from the forms shall be removed entirely as the concrete is being placed.

Adequate clean-out openings shall be provided for narrow walls and other locations where access to the bottom of the forms is not readily attainable.

Prior to placing concrete, the facing of all forms shall be treated with oil or other bond breaking coating of such composition that it will not discolor or otherwise injuriously affect the concrete surface. Care shall be exercised to prevent coating of the reinforcing steel.

- (3) Metal Forms. The foregoing requirements for timber forms as regard to design, mortar-tightness, filleted corners, beveled projections, bracing, alignment, removal, reuse and wetting shall also apply to metal forms, except that these will not require lining, unless specifically noted on the plans.

The thickness of form metal shall be as required to maintain the true shape without warping or bulging. All bolt and rivet heads on the facing sides shall be countersunk. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete. Metal forms which do not present a smooth surface or line up properly shall not be used. Metal shall be kept free from rust, grease or other foreign materials.

**6. PLACING REINFORCEMENT:** Reinforcement in concrete structures shall be

placed carefully and accurately and rigidly supported as provided in the specification, Section 032020 "Reinforcing Steel". Reinforcing steel supports shall not be welded to I-beams or girders.

**7. PLACING CONCRETE-GENERAL:** The minimum temperature of all concrete at the time of placement shall be not less than 50° F.

The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface. When conditions are such that additional moisture is needed for finishing, the required water shall be applied to the surface by fog spray only, and shall be held to a minimum amount. Fog spray for this purpose may be applied with hand operated fogging equipment.

The maximum time interval between the addition of cement to the batch, and the placing of concrete in the forms shall not exceed the following:

Air or Concrete Temperature	Maximum Time
Non-Agitated Concrete	
Up to 80° F	30 minutes
Over 80° F	15 minutes
Agitated Concrete	
90° F or above	45 minutes
75° F to 89° F	60 minutes
35° F to 74° F	90 minutes

The use of an approved retarding agent in the concrete will permit the extension of each of the above temperature-time maximums by 30 minutes for direct traffic culverts, and one hour for all other concrete except that the maximum time shall not exceed 30 minutes for non-agitated concrete.

Before starting work, the Contractor shall inform the Engineer fully of the construction methods he proposes to use, the adequacy of which shall be subject to the approval of the Engineer.

The Contractor shall give the Engineer sufficient advance notice before placing concrete in any unit of the structure to permit the inspection of forms, reinforcing steel placement, and other preparations. Concrete shall not be placed in any unit prior to the completion of form

work and placement of reinforcement therein.

Concrete mixing, placing and finishing shall be done in daylight hours, unless adequate provisions are made to light the entire site of all operations.

Concrete placement will not be permitted when impending weather conditions will impair the quality of the finish work. If rainfall should occur after placing operations are started, the Contractor shall provide ample covering to protect the work. In case of drop in temperature, the provisions set forth in Article "Placing Concrete in Cold Weather" of this specification shall be applied.

The placing shall be regulated so the pressures caused by the plastic concrete shall not exceed the loads used in form design.

The method of handling, placing and consolidation of concrete shall minimize segregation and displacement of the reinforcement, and produce a uniformly dense and compact mass. Concrete shall not have a free fall of more than 5 feet, except in the case of thin walls such as in culverts. Any hardened concrete spatter ahead of the plastic concrete shall be removed.

The method and equipment used to transport concrete to the forms shall be capable of maintaining the rate of placement approved by the Engineer. Concrete may be transported by buckets, chutes, buggies, belt conveyors, pumps or other acceptable methods.

When belt conveyors or pumps are used, sampling for testing will be done at the discharge end. Concrete transported by conveyors shall be protected from sun and wind, if necessary, to prevent loss of slump and workability. Pipes through which concrete is pumped shall be shaded and/or wrapped with wet burlap, if necessary, to prevent loss of slump and workability. Concrete shall not be transported through aluminum pipes, tubes or other aluminum equipment.

Chutes, troughs, conveyors or pipes shall be arranged and used so that the concrete ingredients will not be separated. When steep slopes are necessary, the chutes shall be equipped with baffle boards or made in short lengths that reverse the direction of movement, or the chute ends shall terminate in vertical down-spouts. Open troughs and chutes shall extend, if necessary, down inside the forms or through holes left in them. All transporting equipment shall be kept clean and free from hardened concrete coatings. Water used for cleaning shall be discharged clean of the concrete.

Each part of the forms shall be filled by depositing concrete as near its final position as possible. The coarse aggregate shall be worked back from the face and the concrete forced under and around the reinforcement bars without displacing them. Depositing large quantities at one point and running or working it along the forms will not be allowed.

Concrete shall be deposited in the forms in layers of suitable depth but not more than 36 inches in thickness, unless otherwise directed by the Engineer.

The sequence of successive layers or adjacent portions of concrete shall be such that they can be vibrated into a homogenous mass with the previously placed concrete without a cold joint. Not more than one hour shall elapse between adjacent or successive placement of concrete. Authorized construction joints shall be avoided by placing all concrete between the authorized joints in one continuous operation.

An approved retarding agent shall be used to control stress cracks and/or unauthorized cold joints in mass placements where differential settlement and/or setting time may induce stress cracking.

Opening in forms shall be provided, if needed, for the removal of laitance or foreign matter of any kind.

All forms shall be wetted thoroughly before the concrete is placed therein.

All concrete shall be well consolidated and the mortar flushed to the form surfaces by continuous working with immersion type vibrators. Vibrators which operate by attachment to forms or reinforcement will not be permitted, except on steel forms. At least one stand-by vibrator shall be provided for emergency use in addition to the ones required for placement.

The concrete shall be vibrated immediately after deposit. Prior to the beginning of work, a systematic spacing of the points of vibration shall be established to insure complete consolidation and thorough working of the concrete around the reinforcement, embedded fixtures, and into the corners and angles of the forms. Immersion type vibrators shall be inserted vertically, at point 18 to 30 inches apart, and slowly withdrawn. The vibrator may be inserted in a sloping or horizontal position in shallow slabs. The entire depth of each lift shall be vibrated, allowing the vibrator to penetrate several inches into the preceding lift. Concrete along construction joints shall be thoroughly consolidated by operating the vibrator along and close to but not against the joint surface. The vibration shall continue until thorough consolidation, and complete embedment of reinforcement and fixtures is produced, but not long enough to cause segregation. Vibration may be supplemented by hand spading or rodding, if necessary, to insure the flushing of mortar to the surface of all forms.

Slab concrete shall be mixed in a plant located off the structure. Carting or wheeling concrete batches over completed slabs will not be permitted until they have aged at least four full curing days. If carts are used, timber planking will be required for the remainder of the curing period. Carts shall be equipped with pneumatic tires. Curing operations shall

not be interrupted for the purpose of wheeling concrete over finished slabs.

After concrete has taken its initial set, at least one curing day shall elapse before placing strain on projecting reinforcement to prevent damage to the concrete.

The storing of reinforcing or structural steel on completed roadway slabs generally shall be avoided and, when permitted, shall be limited to quantities and distribution that will not induce excessive stresses.

## **8. PLACING CONCRETE IN COLD WEATHER**

- (1) **Cast-in-Place Concrete.** Concrete may be placed when the atmospheric temperature is not less than 35° F. Concrete shall not be placed in contact with any material coated with frost or having a temperature less than 32° F.

Aggregates shall be free from ice, frost and frozen lumps. When required, in order to produce the minimum specified concrete temperature, the aggregate and/or the water shall be heated uniformly, in accordance with the following:

The water temperature shall not exceed 180° F, and/or the aggregate temperature shall not exceed 150° F. The heating apparatus shall heat the mass of aggregate uniformly. The temperature of the mixture of aggregates and water shall be between 50° F and 85° F before introduction of the cement.

All concrete shall be effectively protected as follows:

- (a) The temperature of slab concrete of all unformed surfaces shall be maintained at 50° F or above for a period of 72 hours from time of placement and above 40° F for an additional 72 hours.
- (b) The temperature at the surface of all concrete in piers, culverts walls, retaining walls, parapets, wingwalls, bottoms of slabs, and other similar formed concrete shall be maintained at 40° F or above for a period of 72 hours from time of placement.
- (c) The temperature of all concrete, including the bottom slabs of culverts placed on or in the ground, shall be maintained above 32° F for a period of 72 hours from time of placement.

Protection shall consist of providing additional covering, insulated forms or other means,

and if necessary, supplementing such covering with artificial heating. Curing as specified under Article "Curing Concrete" of this specification shall be provided during this period until all requirements for curing have been satisfied.

When impending weather conditions indicate the possibility of the need for such temperature protection, all necessary heating and covering material shall be on hand ready for use before permission is granted to begin placement.

Sufficient extra test specimen will be made and cured with the placement to ascertain the condition of the concrete as placed prior to form removal and acceptance.

- (2) Precast Concrete. A fabricating plant for precast products which has adequate protection from cold weather in the form of permanent or portable framework and covering, which protects the concrete when placed in the forms, and is equipped with approved steam curing facilities, may place concrete under any low temperature conditions provided:
  - (a) The framework and covering are placed and heat is provided for the concrete and the forms within one hour after the concrete is placed. This shall not be construed to be one hour after the last concrete is placed, but that no concrete shall remain unprotected longer than one hour.
  - (b) Steam heat shall keep the air surrounding the concrete between 50° F and 85° F for a minimum of three hours prior to beginning the temperature rise which is required for steam curing.
  - (c) For fabricating plants without the above facilities and for job site precast products, the requirements of the Article "Curing Concrete" of this specification will apply.

The Contractor is responsible for the protection of concrete placed under any and all weather conditions. Permission given by the Engineer for placing during freezing weather will in no way relieve the Contractor of the responsibility for producing concrete equal in quality to that placed under normal conditions. Should concrete placed under such conditions prove unsatisfactory, it shall be removed and replaced at no additional cost.

**9. PLACING CONCRETE IN WATER:** Concrete shall be deposited in water only when specified on the plans or with written permission by the Engineer. The forms or cofferdams shall be sufficiently tight to prevent any water current passing through the space in which the concrete is being deposited. Pumping will not be permitted during the concrete placing, nor until it has set for at least 36 hours.

The concrete shall be placed with a tremie, closed bottom-dump bucket, or other approved

method, and shall not be permitted to fall freely through the water nor shall it be disturbed after it has been placed. Its surface shall be kept approximately level during placement.

The tremie shall consist of a water-tight tube 14 inches or less in diameter. It shall be constructed so that the bottom can be sealed and opened after it is in place and fully charged with concrete. It shall be supported so that it can be easily moved horizontally to cover all the work area and vertically to control the concrete flow.

Bottom-dump buckets used for underwater placing shall have a capacity of not less than one-half cubic yard. It shall be lowered gradually and carefully until it rests upon the concrete already placed and raised very slowly during the upward travel; the intent being to maintain still water at the point of discharge and to avoid agitating the mixture.

The placing operations shall be continuous until the work is complete.

**10. PLACING CONCRETE IN BOX CULVERTS:** In general, construction joints will be permitted only where shown on the plans.

Where the top slab and walls are placed monolithically in culverts more than 4 feet in clear height, an interval of not less than one nor more than 2 hours shall elapse before placing the top slab to allow for shrinkage in the wall concrete.

The base slab shall be finished accurately at the proper time to provide a smooth uniform surface. Top slabs which carry direct traffic shall be finished as specified for roadway slabs in Article "Finish of Roadway Slabs". Top slabs of fill type culverts shall be given a reasonable smooth float finish.

**11. PLACING CONCRETE IN FOUNDATIONS AND SUBSTRUCTURE:** Concrete shall not be placed in footings until the depth and character of the foundation has been inspected by the Engineer and permission has been given to proceed.

Placing of concrete footings upon seal courses will be permitted after the caissons or cofferdams are free from water and the seal course cleaned. Any necessary pumping or bailing during the concreting operation shall be done from a suitable sump located outside the forms.

All temporary wales or braces inside cofferdams or caissons shall be constructed or adjusted as the work proceeds to prevent unauthorized construction joints in footings or shafts.

When footings can be placed in a dry excavation without the use of cofferdams or caissons, forms may be omitted, if desired by the Contractor and approved by the Engineer, and the entire excavation filled with concrete to the elevation of the top of footing



in which case measurement for payment will be based on the footing dimensions shown on the plans.

**12. TREATMENT AND FINISHING OF HORIZONTAL SURFACES EXCEPT ROADWAY SLABS:** All uniformed upper surfaces shall be struck off to grade and finished. The use of mortar topping for surfaces under this classification will not be permitted.

After the concrete has been struck off, the surface shall be floated with a suitable float. Sidewalks shall be given a wood float or broom finish or; may be stripped with a brush, as specified by the Engineer. Other surfaces shall be wood float finished and stripped with a fine brush leaving a fine grained texture.

**13. FINISH OF ROADWAY SLABS:** As soon as the concrete has been placed and vibrated in a section of sufficient width to permit working, the surface shall be approximately leveled, struck off and screeded, carrying a slight excess of concrete ahead of the screed to insure filling of all low spots. The screed shall be designed rigid enough to hold true to shape and shall have sufficient adjustments to provide for the required camber. A vibrating screed may be used if heavy enough to prevent undue distortion. The screeds shall be provided with a metal edge.

Longitudinal screeds shall be moved across the concrete with a saw-like motion while their ends rest on headers or templates set true to the roadway grade or on the adjacent finished slab.

The surface of the concrete shall be screeded a sufficient number of times, and at such intervals to produce a uniform surface, true to grade and free of voids.

If necessary, the screeded surface shall be worked to smooth finish with a long handled wood or metal float of the proper size, or hand floated from bridges over the slab.

When required by the Engineer, the Contractor shall perform sufficient checks with a long handled 10 foot straightedge on the plastic concrete to insure that the final surface will be within the tolerances specified below. The check shall be made with the straightedge parallel to the centerline. Each pass thereof shall lap half of the preceding pass. All high spots shall be removed and all depressions over one-sixteenth inch in depth shall be filled with fresh concrete and floated. The checking and floating shall be continued until the surface is true to grade and free of depressions, high spots, voids or rough spots.

Rail support holes shall be filled with concrete and finished to match the top of the slab.

A broom finish shall be applied with longitudinal screeding. A broom or burlap drag finish shall be applied with transverse screeding.

Unless otherwise specified, the burlap drag shall consist of four or more layers of 10-ounce

burlap fabric, free of seams, dirt or hardened concrete. It shall be kept wet when in use and it shall be drawn over the surface in as many passes as required to produce the desired texture depth. Broom finishes shall be applied with stiff bristled brooms. The Contractor shall have on hand at all times brooms for the purpose of providing the desired texture depth when surface conditions are such that the burlap drag will not provide it.

Upon completion of the floating and/or straight edging and before the disappearance of the moisture sheen, the surface shall be given a broom or burlap drag finish. The grooves of these finishes shall be parallel to the structure centerline. It is the intent that the average texture depth resulting from the number of tests directed by the Engineer be not less than 0.035-inches with a minimum texture depth of 0.030-inches for any one test when tested in accordance with Test Method Tex-436-A. Should the texture depth fall below that intended, the finishing procedures shall be revised to produce the desired texture.

After the concrete has attained its final set, the roadway surface shall be tested with a standard 10 foot straight-edge. The straight-edge shall be placed parallel to the centerline of roadway to bridge any depressions and touch high spots. Ordinates of irregularities measured from the face of the straight-edge to the surface of the slab shall not exceed one-eighth of an inch, making proper allowances for camber, vertical curvature and surface texture. Occasional variations, not exceeding three-sixteenth of an inch will be acceptable, if in the opinion of the Engineer it will not effect the riding qualities.

When directed by the Engineer, irregularities exceeding the above requirements shall be corrected.

In all roadway slab finishing operations, camber for specified vertical curvature and transverse slopes shall be provided.

**14. CURING CONCRETE:** The Contractor shall inform the Engineer fully of the methods and procedures proposed for curing; shall provide the proper equipment and material in adequate amounts, and shall have the proposed method, equipment and material approved prior to placing concrete.

Inadequate curing and/or facilities therefore shall be cause for the Engineer to stop all construction on the job until remedial action is taken.

All concrete shall be cured for a period of 4 curing days except as noted herein.

#### EXCEPTIONS TO 4-DAY CURING

Description

Required Curing

Top slabs of Direct Traffic	8 curing days (Type I or III) cement
Culverts	10 curing days (Type II cement)
Concrete Piling (non-prestressed)	6 curing days

When the air temperature is expected to drop below 35° F, the water curing mats shall be covered with polyethylene sheeting, burlap-polyethylene blankets or other material to provide the protection required by Article "Placing Concrete in Cold Weather" of these specifications.

A curing day is defined as a calendar day when the temperature, taken in the shade away from artificial heat, is above 50° F for at least 19 hours, (colder days if satisfactory provisions are made to maintain the temperature at all surfaces of the concrete above 40° F for the entire 24 hours). The required curing period shall begin when all concrete therein has attained its initial set.

The following methods are permitted for curing concrete subject to the restrictions of Table 1 and the following requirements for each method of curing.

- (1) Form Curing. When forms are left in contact with the concrete, other curing methods will not be required except for cold weather protection.
- (2) Water Curing. All exposed surfaces of the concrete shall be kept wet continuously for the required curing time. The water used for curing shall meet the requirements for concrete mixing water as specified in the specification, Section 030030 "Concrete for Structures". Sea water will not be permitted. Water which stains or leaves an unsightly residue shall not be used.
  - (a) Wet Mat. Cotton mats shall be used for this curing method. They shall be placed as soon as possible after the surface has sufficiently hardened to prevent damage to the concrete. (See Article, "Placing Concrete" of this specification.) Damp burlap blankets made from nine ounce stock may be placed on the damp concrete surface for temporary protection prior to the application of the cotton mats which may be placed dry and wetted down after placement.

The mats shall be weighted down adequately to provide continuous contact with all concrete surfaces where possible. The surfaces of the concrete shall be kept wet for the required curing time. Surfaces

which cannot be cured by contact shall be enclosed with mats, anchored positively to the forms, or to the ground, so that outside air cannot enter the enclosure. Sufficient moisture shall be provided inside the enclosure to keep all surfaces of the concrete wet.

- (b) Water Spray. This method shall consist of overlapping sprays or sprinklers, that keeps all unformed surfaces continuously wet.
  - (c) Ponding. This method requires the covering of the surfaces with a minimum of two inches of clean granular material, kept wet at all times, or a minimum of one-inch depth of water. Satisfactory provisions shall be made to provide a dam to retain the water or saturated sand.
- (3) Membrane Curing. This consists of curing concrete pavement, concrete pavement (base), curbs, gutters, retards, sidewalk, driveways, medians, islands, concrete riprap, cement stabilized riprap, concrete structures and other concrete as indicated on the plans by impervious membrane method.

Unless otherwise provided herein or shown on the plans, either Type 1 or Type 2 membrane curing compound may be used where permitted except that Type 1 (Resin Base Only) will be permitted for slab concrete in bridge decks and top of direct traffic culverts.

(SEE TABLE 1 ON NEXT PAGE)

TABLE 1

STRUCTURE UNIT DESCRIPTION	REQUIRED		PERMITTED	
	WATER FOR CURING	MEMBRANE FOR INTERIM CURING	WATER FOR CURING	MEMBRANE FOR INTERIM CURING
1 Top slabs of direct traffic culverts	X	X		
2 Top surface of any concrete unit upon which concrete is to be placed and bonded at a later interval (Stub walls, risers, etc.) Other superstructure concrete (wing walls, parapete walls, etc.)	X			
3 Concrete pavement (base), curbs, gutters, retards, sidewalks, driveways, medians,			X*	X*

islands, concrete structures, concrete riprap, etc.

- |   |                                                                                    |    |    |
|---|------------------------------------------------------------------------------------|----|----|
| 4 | All substructure concrete, culverts, box sewers, inlets, manholes, retaining walls | X* | X* |
|---|------------------------------------------------------------------------------------|----|----|

\*Polyethylene sheeting, burlap polyethylene mats or laminated mats to prevent outside air from entering will be considered equivalent to water or membrane curing for items 3 and 4.

Membrane curing shall be applied to dry surfaces, but shall be applied just after free moisture has disappeared. Formed surfaces and surfaces which have been given a first rub shall be dampened and shall be moist at the time of application of the membrane.

When membrane is used for complete curing, the film shall remain unbroken for the minimum curing period specified. Membrane which is damaged shall be corrected immediately by reapplication of membrane. Unless otherwise noted herein or on the plans, the choice of membrane type shall be at the option of the Contractor. Only one type of curing compound will be permitted on any one structure.

The membrane curing compound shall be applied after the surface finishing has been completed, and immediately after the free surface moisture has disappeared. The surface shall be sealed with a single uniform coating of curing compound applied at the rate of coverage recommended by the manufacturer and directed by the Engineer, but not less than 1 gallon per 180 square feet of area. The Contractor shall provide satisfactory means and facilities to properly control and check the rate of applications of the compound.

The compound shall be thoroughly agitated during its use and shall be applied by means of approved mechanical power pressure sprayers. The sprayers used to apply the membrane to concrete pavement or concrete pavement (base) shall travel at uniform speed along the forms and be mechanically driven. The equipment shall be of such design that it will insure uniform and even application of the membrane material. The sprayers shall be equipped with satisfactory atomizing nozzles. Only on small miscellaneous items will the Contractor be permitted to use hand-powered spray equipment. For all spraying equipment, the Contractor shall provide facilities to prevent the loss of the compound

between the nozzle and the concrete surface during the spraying operations.

The compounds shall not be applied to a dry surface and if the surface of the concrete has become dry, it shall be thoroughly moistened prior to application of membrane by fogging or mist application. Sprinkling or coarse spraying will not be allowed.

At locations where the coating shows discontinuities, pinholes, or other defects; or if rain falls on the newly-coated surface before the film has dried sufficiently to resist damage, an additional coat of the compound shall be applied immediately at the same rate of coverage specified herein.

To insure proper coverage, the Engineer shall inspect all treated areas after application of the compound for the period of time designated in the governing specification for curing, either for membrane curing or for other methods. Should the foregoing indicate that any area during the curing period is not protected, an additional coat or coats of the compound shall be applied immediately, and the rate of application of the membrane compound shall be increased until all areas are uniformly covered.

When temperatures are such as to warrant protection against freezing, curing by this method shall be supplemented with an approved insulating material capable of protecting the concrete for the specified curing period.

If at any time there is reason to believe that this method of curing is unsatisfactory or is detrimental to the work, the Contractor, when notified, shall immediately cease the use of this method and shall change to curing by one of the other methods specified under this contract.

**15. REMOVAL OF FORMS:** Except as herein provided, forms for vertical surfaces may be removed when the concrete has aged not less than one day when Type I and Type II cement is used, and not less than one-half day when Type III cement is used, provided it can be done without damage to the concrete.

Forms for inside curb faces may be removed in approximately three hours provided it can be done without damage to the curb.

**16. FINISHING EXPOSED SURFACES:** Concrete shall be finished as required in the Standard Specifications for the respective items or as otherwise specified on the plans.

An ordinary surface finish shall be applied to all concrete surfaces either as a final finish or preparatory to a higher finish.

Ordinary Surface Finish shall be as follows:

After form removal, all porous or honey-combed areas and spalled areas shall be corrected by chipping away all loose or broken material to sound concrete.

Feather edges shall be eliminated by cutting a face perpendicular to the surface. Shallow cavities shall be repaired using adhesive grout or epoxy grout. If judged repairable by the Engineer, large defective areas shall be corrected using concrete or other material approved by the Engineer.

Holes and spalls caused by removal of metal ties, etc., shall be cleaned and filled with adhesive grout or epoxy grout. Exposed parts of metal chairs on surfaces to be finished by rubbing, shall be chipped out to a depth of one-half inch and the surface repaired.

All fins, runs, drips or mortar shall be removed from surfaces which remain exposed. Form marks and chamfer edges shall be smoothed by grinding and/or dry rubbing.

Grease, oil, dirt, curing compound, etc., shall be removed from surfaces requiring a higher grade of finish. Discolorations resulting from spillage or splashing of asphalt, paint or other similar material shall be removed.

Repairs shall be dense, well bonded and properly cured, and when made on surfaces which remain exposed and do not require a higher finish, shall be finished to blend with the surrounding concrete.

**17. MEASUREMENT AND PAYMENT:** No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this specification, but it shall be considered subsidiary to the particular items required by the plans and the contract.

\*\*\* END OF SECTION \*\*\*





## SPECIFICATION

### PERFORMED THERMOPLASTIC PAVEMENT MARKINGS

1. **USE :** A durable, retro reflective pavement marking material suitable for use as roadway, intersection, commercial or private pavement delineation markings.
  - 1.1 The markings must be a resilient white, yellow, or other color thermoplastic product with uniformly distributed glass beads throughout the entire cross sectional area. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids, antifreeze, etc. Lines, legends and symbols are capable of being affixed to bituminous and/or Portland cement concrete pavements by the use of the normal heat of a propane torch. Other colors shall be available as required.
  - 1.2 The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastic when heated with the torch.
  - 1.3 The markings shall not have minimum ambient and road temperature requirements for application, storage, or handling.
2. **MANUFACTURING CONTROL AND ISO CERTIFICATION:** The manufacturer must be ISO 9001:2008 certified and provide proof of current certification. The scope of the certification shall include manufacture of preformed thermoplastic marking materials.
3. **MATERIAL:** Must be composed of an ester modified rosin resistant to degradation by motor fuels, lubricants etc. in conjunction with aggregates, pigments, binders and glass beads which have been factory produced as a finished product, and meets the requirements of the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. The thermoplastic material conforms to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state.
  - 3.1 Graded Glass Beads:
    - 3.1.1. The material must contain a minimum of thirty percent (30%) intermixed graded glass beads by weight. The intermixed beads

shall be conforming to AASHTO designation M247, with minimum 80% true spheres and minimum refractive index of 1.50.

3.1.2. The material must have factory applied coated surface beads in addition to the intermixed beads at a rate of 1 lb. ( $\pm$  10%) per 10 sq. ft. These factory applied coated surface beads shall have a minimum of 90% true spheres, minimum refractive index of 1.50, and meet the following gradation.

Size Gradation		Retained, %	Passing, %
US Mesh	$\mu\text{m}$		
12	1700	0-2%	98 – 100%
14	1400	0-3.5%	96.5-100%
16	1180	2-25%	75-98%
18	1000	28-63%	37-72%
20	850	63-72%	28-37%
30	600	67-77%	23-33%
50	300	89-95%	5-11%
80	200	97-100%	0-3%

### 3.2 Pigments:

3.2.1 White: The material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected.

3.2.2. Red, Blue and Yellow: The material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected. The yellow pigments must be organic and must be heavy-metal free.

3.2.3. Other Colors: The pigments must be organic and must be heavy-metal free.

3.3 Heating Indicators: The top surface of the material (same side as the factory applied surface beads) shall have regularly spaced indents. These indents shall act as a visual cue during application that the material has reached a molten state so satisfactory adhesion and proper bead

embedment has been achieved and a post-application visual cue that the installation procedures have been followed.

- 3.4. Skid Resistance: The surface, with properly applied and embedded surface beads, must provide a minimum resistance value of 45 BPN when tested according to ASTM E 303.
- 3.5 Thickness: The material must be supplied at a minimum thickness of 125 mils (3.15 mm).
- 3.6 Versatility: As an option, turn arrows and combination arrows may come without surface applied glass beads, thus facilitating the use of those arrows as either left or right indicators, thereby reducing inventory requirements.
- 3.7 Environmental Resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.
- 3.8 Retroreflectivity: The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of sufficient nighttime retroreflection when tested in accordance to ASTM E 1710. The applied material must have an initial minimum intensity reading of  $500 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{1x}^{-1}$  for white and  $300 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{1x}^{-1}$  for yellow as measured with an LTL-2000 or LTL-X Retroreflectometer.

Note: Initial retroreflection is affected by the amount of heat applied during installation. When ambient temperatures are such that greater amounts of heat are required for proper installation, initial retroreflection levels may be affected.

#### **4. APPLICATION:**

- 4.1. Asphalt: The materials shall be applied using the propane torch method recommended by the manufacturer. The material must be able to be applied without minimum requirements for ambient and road temperatures and without any preheating of the pavement to a specific temperature. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry and free of debris. Supplier must enclose application instructions in English and Spanish with each box/package.

4.2 Portland Cement Concrete: The same application procedure shall be used as described under Section 4.1. However, a compatible primer sealer shall be applied before application to assure proper adhesion.

5. **PACKAGING:** The preformed thermoplastic markings shall be placed in protective plastic film with cardboard stiffeners where necessary to prevent damage in transit. Linear material must be cut to a maximum of 3' long pieces. Legends and symbols must also be supplied in flat pieces. The cartons in which packed shall be non-returnable and shall not exceed 40" in length and 25" in width, and be labeled for ease of identification. The weight of the individual carton must not exceed seventy (70) pounds. A protective film around the box must be applied in order to protect the material from rain or premature aging.
6. **TECHNICAL SERVICES:** The successful bidder shall provide technical services as required.
7. **PERFORMANCE:** The preformed thermoplastic markings shall meet state specifications and be approved for use by the appropriate state agency.

\*\*\* END OF SECTION \*\*\*

\*\*\* END OF SECTION \*\*\*

## SPECIFICATION

### PORTLAND CEMENT CONCRETE SEALER

1. **USE:** A transparent acrylic primer used to enhance the bond strength between the road surface and thermoplastic pavement markings.
2. **COMPOSITION:** The sealer shall be a solvent-based liquid composed of fillers, modified acrylic resins n aromatic and oxygenated solvent.
3. **PROPERTIES:**

Appearance:	Liquid
Color:	Amber
Odor:	Aromatic-like solvent
Density:	0.95 ± 0.03 g/cc
Density of Volatile Contents:	0.83 g/cc
Boiling Point:	Initial 56°C (133°F)
Solubility in water:	None
VOC Content:	Less than 350 g/l
Flash point:	-15°C (5°F)
4. **APPLICATION:** The sealer shall be capable of being applied to the road surface either by brush, roller, or sprayer. It shall be capable of being applied in a thin, even, uniform coat.
5. **PACKAGING:** The sealer shall be available in 1 gallon and 5 gallon pails. Shelf life shall be twelve (12) months in an unopened container.

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