THE CITY OF

Seguin

TEXAS

CONTRACT DOCUMENTS & SPECIFICATIONS

S. Austin St, E. Court St. and W. Nolte St.

Sidewalk Improvements Project Bid No. TF-2016-03

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SEGUIN CITY COUNCIL

Don Keil – Mayor

Ernest Leal	Jeannette "Jet" Crabb
Phil Seidenberger	Tomas V. Castellon, Jr.
Carlos Medrano	Fonda Mathis
Donna Dodgen	Mark Herbold

Douglas G. Faseler, City Manager

Ricardo Cortes, Assistant City Manager

Thalia Patlan Stautzenberger, City Secretary

Jose (Joe) R. Ramos, Jr., P.E.
City Engineer

Prepared By
City of Seguin
and
M&S Engineering, LLC

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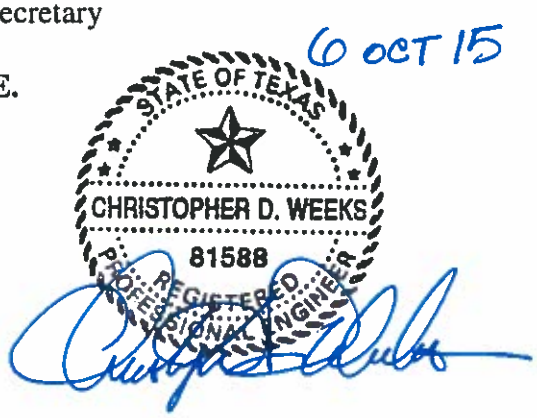

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ADVERTISEMENT FOR BIDS

Sealed bids addressed to the City Manager of the City of Seguin, Texas will be received at the Seguin City Hall, 205 North River, Seguin, Texas, 78155, until **2:30 P.M. October 27, 2015 (CDST)** for the proposed **S. Austin St, E. Court St. and W. Nolte St. Sidewalk Improvements Project**. Any bid received after closing time will be returned unopened. The bids will be publicly opened and read aloud at the Seguin City Hall at 3:00 P.M. Bids shall be submitted in a sealed envelope (8 ½" x 11" minimum), clearly marked as follows:

SEALED BIDS
S. Austin St, E. Court St. and W. Nolte St.
Sidewalk Improvements Project
Bid No. TF-2016-03
To be opened at 3:00 P.M., Tuesday October 27, 2015

Principle items of construction will include:

Construction of sidewalks on select segments of S. Austin St, E. Court St. and W. Nolte St. in the City of Seguin. The work effort includes removal of existing concrete sidewalk and curb, construction of new curb, sidewalks, ramps, railing and other miscellaneous items.

Each bid must be accompanied by a certified or cashier's check, or an approved bidders bond in an amount not less than 5% of the maximum total bid, payable to the City of Seguin, Texas without recourse, as a guarantee that the Bidder will enter into a contract and execute performance and payment bonds on the forms provided, within ten (10) days after the award of contract.

A hardcopy of the bid forms, plans, and specifications will be available October 2, 2015 and may be examined at the City Hall, 205 N. River, Seguin, Texas. They may also be obtained from the City of Seguin website www.seguintexas.gov/bid_opportunities and www.civcastUSA.com.

The City of Seguin reserves the right to reject any or all bids and to waive informalities. No bid may be withdrawn within sixty (60) days after the date on which bids are received.

Douglas G. Faseler, City Manager
CITY OF SEGUIN, TEXAS

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SPECIAL INSTRUCTIONS

1. SCOPE OF PROJECT

The City of Seguin (herein called the OWNER) invites proposals for a Sidewalk Improvements Project. Principal items of construction will include:

Construction of sidewalks on select segments of S. Austin St, E. Court St. and W. Nolte St. in the City of Seguin. The work effort includes removal of existing concrete sidewalk and curb, construction of new curb, sidewalks, ramps, handrailing, and other miscellaneous items.

2. PROPOSALS AND METHOD OF BIDDING

2.1 The proposal consists of various major items of work Bidders will provide prices for each item in the proposal. The prices will be entered in the appropriate spaces in both script and figures. Should the Bidder have costs for any incidental work where a bid item does not occur, the costs of such work will reflected in the unit costs of the bid items in the proposal. No separate payment will be made for any work other than those items occurring in the proposals.

2.2 At the time of proposal submittal, bidders will provide a Contractor Work Plan, which details the approach and scope of the work to be performed. The Contractor Work Plan shall include a proposed schedule for completion of all work to be performed.

2.3 Bidders are hereby notified of the number of calendar days for completion of the project in Article 55 of this section.

2.4 Bidders shall bid on all items of the Bid.

3. OBLIGATION OF BIDDER

At the time of the opening of bids each Bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any Bidder to examine any form, instrument or document shall in no way relieve any Bidder from any obligation with respect to his bid.

4. RECEIPT AND OPENING OF BIDS

Bids will be received at Seguin City Hall, 205 North River, Seguin, Texas 78155, until **2:30 P.M., October 27, 2015 (CDST)**. Any bid received after closing time will be returned unopened. The bids will be publicly opened and read aloud at the Seguin City Hall at 3:00 p.m. Bids shall be submitted in a sealed envelope (8 ½" x 11" minimum). Clearly marked as follows:

SEALED BIDS
S. Austin St, E. Court St. and W. Nolte St. Sidewalk Improvements Project
Bid No. TF-2016-03
To be opened at 3:00 P.M., Tuesday October 27, 2015

5. BID SECURITY

5.1 Each bid must be accompanied by cash, certified check of the Bidder or a bid bond, duly executed by the Bidder as principal and having as surety thereto a surety company approved by the Owner, in the amount of 5% of the bid. Such cash, checks or bid bonds will be returned within ninety (90) days after the date of the opening of bids, upon demand of the Bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid.

5.2 Any cash, check, or bid bond is a guarantee that the Bidder will enter into a Contract and execute performance and payment bonds on the forms provided, within ten (10) days after the award of Contract. Failure to execute these documents within the required time shall be justification for the Owner to consider this a forfeiture of the security by the Bidder to the Owner.

6. QUALIFICATIONS OF BIDDER

6.1 The Owner may make such investigations as he deems necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request.

6.2 The Owner may request a list of recent projects of equal difficulty and size that the low bidder has performed. Bidders hereby agree to supply such a list prior to award upon request to the Owner. Quantity or proportionate share of the project to be performed by subcontractors not on the prime contractor's payroll will be considered by the Owner.

6.3 The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work therein.

6.4 Bidders may be required to submit evidence that they have a practical knowledge of the particular Work bid upon, and that they have the financial resources to complete the proposed Work.

6.5 In determining the Bidder's qualifications, the following factors will be considered: work previously completed by the Bidder and whether the Bidder (a) maintains a permanent place of business, (b) has adequate personnel and equipment to do the work properly and expeditiously, (c) has the financial resources to meet all obligations incidental to the Work, and (d) has appropriate technical experience.

6.6 Each Bidder's claim history may be reviewed in the evaluation of the bid. The Bidder may be required to show that he has handled former work so that no just claims are pending against such work. No bid will be accepted from a Bidder who is engaged on any work which would impair his ability to perform or finance his Work.

7. TIME OF COMPLETION AND LIQUIDATION DAMAGES

Bidder must agree to commence on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the construction of the project within the number of calendar days proposed on the last sheet of the proposal, or pay as liquidated damages the sum for each consecutive calendar day thereafter as hereinafter provided in the General Information.

8. SECURITY FOR FAITHFUL PERFORMANCE

Simultaneously with his delivery of the executed Contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of the Contract and for the payment of all persons performing labor on the project under this Contract and furnishing materials in connection with this Contract, as specified in the General Conditions included herein. The Surety on such bond or bonds shall be duly authorized surety company satisfactory to the Owner.

9. POWER OF ATTORNEY

Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

10. LAWS AND REGULATIONS

The Bidder's attention is directed to the fact that all applicable State laws, municipal ordinances and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though written out in full.

11. SUBCONTRACTS

11.1 The Bidder is specifically advised that any person, firm or other party to whom it is proposed to award a Contract under this Contract must be acceptable to the Owner and Engineer.

11.2 The Bidder shall provide a list of all major subcontractors and vendors with his bid. Failure to provide may constitute a rejection of the bid.

12. PAYMENTS

On or before the 25th day or each month, the Contractor shall prepare and submit to the Engineer an application for payment showing as completely as practicable the total value of the work done by the Contractor up to and including the last day immediately preceding the date of such application and the value of all sound materials delivered on the site of the work that are to be fabricated into work.

The Engineer shall verify Contractor's application, shall either approve or modify the total value of the work done by the Contractor and the value of Materials delivered to the site, and shall submit to Owner such application for payment as approved or modified with Engineer's verification affixed thereto on or before the 5th days of the month following the receipt of the application from Contractor.

The Owner shall pay the Contractor on or before the 25th day of the month in which the Owner receives the approved application from the Engineer the total amount of the approved and verified application, less five (5) percent of the amount thereof, which five (5) percent shall be retained until final payment, and further less all previous payments and all further sums that may be retained by the Owner under the terms of this Agreement. It is understood, however, that in case the whole work be near to completion and some unexpected and unusual delay occurs due to no fault or neglect on the part of the Contractor, the Owner may, upon written recommendation of the Engineer, pay a reasonable and equitable portion of the retainage to the Contractor, or the Contractor, at the Owner's option, may be relieved of the obligation to fully complete the work and, thereupon, the Contractor shall receive payment of the balance due him under the contract subject only to the conditions stated under "Final Payment." Any such payments of retainage by Owner to Contractor prior to final payment must be agreed to in writing by the surety or sureties on Contractor's payment and performance bonds.

The Contractor shall submit to the Engineer, copies of the material invoices with the application for payment. No payment will be made to the Contractor until the quantities or work submitted have been checked and verified by the Engineer.

13. METHOD OF AWARD

13.1 An award will be made to only **one** Contractor. The award may be made for the lowest base bid **or** the lowest base bid including alternate bid item(s), if applicable.

13.2 The Owner reserves the right to waive informalities, to reject any or all bids, and to accept the bid most advantageous to the public interest. The right is also reserved to increase or decrease the total proposal amount by 25%, by increasing or decreasing quantities if the total proposal exceeds or is below the funds available. The right is also reserved to eliminate any item(s) in the proposal if the total proposal exceeds the funds available.

14. ENGINEER

The word "Engineer" as used herein refers to the City Engineer or his designated staff.

15. TRAFFIC CONTROL

15.1 The Contractor will be responsible for furnishing and using all barricades, warning lights, signs, etc. necessary to protect his work and maintain traffic flow satisfactory to the Owner and TXDOT. Warning devices shall be as required in the Texas Manual on Uniform Traffic Control Devices. All work scheduling shall be coordinated with the City staff, and be approved by the City staff before work can proceed. **No separate** payment will be made for traffic control. A Traffic Control Plan may possibly be required by TX DOT, including all Traffic Control Permits in scope of project.

16. OWNERSHIP OF PROJECT

Until final acceptance of the total project by the Owner and Engineer, the Contractor shall take full responsibility for the welfare of the partially completed work. Damage to the Contractor's work from any cause shall be repaired at the Contractor's expense.

17. REPLACEMENT OF MISCELLANEOUS IMPROVEMENTS

The Contractor shall repair or replace all existing utilities, water mains, fences, concrete walls, sidewalks, concrete curbs and concrete pavement, signs, culverts, asphalt payment, building walls and attachments and other miscellaneous improvements damaged by the Contractor due to his operations on this project, to a condition equal to or better than their condition before construction, at no additional expense to the Owner. No direct payment will be made for this item.

18. MAINTENANCE GUARANTEE

18.1 The Contractor shall maintain and guarantee the work, which he does against defective workmanship and materials for a period of one (1) year from the date of final acceptance of the work by the Owner.

18.2 Prior to the expiration of the one (1) year warranty period, the City will conduct a thorough inspection of the improvements to verify the integrity of the project. This inspection will include visual examination of the improvements and may include other inspection techniques to verify the integrity of the improvements.

18.3 Where defective workmanship and/or materials are discovered, requiring repairs to be made under this guarantee, all such repair work shall be done by the Contractor at his own expense within five (5) days after written notice of such defect has been given to him by the Owner. Should the Contractor fail to repair such defective workmanship and/or materials within five (5) days after being notified, the Owner may make the necessary repairs and charge the Contractor with the actual cost of all labor and materials required.

18.4 The Contractor shall arrange to have his faithful performance bond run for a period of one (1) year after the date of completion of the construction work to cover his guarantee as set forth above.

19. CLEAN-UP

19.1 The Contractor shall at all times keep the jobsite as free from all material, debris, and rubbish as is practicable and shall remove same from any portion of the job site when it becomes objectionable in the opinion of the Engineer.

19.2 After construction work is completed and before final acceptance of improvements by Owner, Contractor shall remove all debris from site of project, including all existing debris to an approved place of disposal. Temporary structures, forms, equipment, objectionable rocks, concrete and other debris shall be remove in such a manner as to leave the site of work in a neat and presentable condition throughout; and restore in an acceptable manner all property damaged in the progress of this work. No direct payment will be made for clean-up.

19.3 Materials cleared from project shall not be deposited on adjacent public or private property without written permissions of the Owner's thereof filed with Owner's Agent; and any materials so deposited shall be leveled and left in a condition satisfactory to the Owner's Agent.

20. EXCAVATION

Excavation in this Contract shall be **unclassified**. There is no separate pay item under this Contract for excavation and its cost shall be included in such pay items as are provided in the Contract and proposal.

21. AFFIDAVIT OF BILLS PAID

Upon completion of the project and final acceptance by the Owner and Engineer, the Contractor shall be required to furnish the Owner with an Affidavit certifying that all suppliers and subcontractors have been paid, before final payment will be made by Owner.

22. ADDENDA AND INTERPRETATIONS

22.1 No interpretation of the meaning of the plans, specifications or other prebid documents will be made to any bidder orally. Every request for such interpretations should be in writing addressed to Twila Wood, Purchasing Manager, City of Seguin, PO Box 591, Seguin, Texas 78156-591, or by email to twood@seguintexas.gov , and to be given consideration must be received at least seven (7) days prior to the date fixed for the opening of bids.

22.2 Any and all such interpretations and supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be emailed to all prospective bidders (at the respective addresses furnished for such purposes), not later than five (5) days prior to the date fixed for the opening of bids. Addenda will be posted on the City's website: www.seguintexas.gov/bid_opportunities Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.

23. EXISTING UTILITIES

23.1 Existing surface and subsurface structures (gas mains, water mains, sewer mains, storm sewers, telephone cables, sprinkler systems, etc.) are shown on the plan if their location has been determined, but it shall be the responsibility of the Contractor to avoid damaging these existing structures whether or not they are shown on the plans. The Owner and Engineer assume no responsibility for failure to show any or all of those structures on the plans or to show them in their exact location. It is mutually agreed that such failure to show these structures will not be considered sufficient basis for claims for additional compensation for extra work or for increasing the pay quantities in any manner whatsoever. If any structure is damaged by the Contractor it shall be his responsibility to repair the damage at his own expense and restore the structure to its functional use.

23.2 Contractor shall locate and determine (verify if depth is shown on plans) elevation of all existing underground utilities. If a utility is found to be in conflict with proposed grades, the Engineer shall be contacted and grades adjusted to avoid conflict. **No separate pay.**

24. RECORD DRAWINGS

The Contractor will be furnished one set of plans on which he shall indicate changes made during construction. All notes and comments necessary to give a clear conception of exactly how all items were constructed including location shall be shown. This set of plans shall be reviewed with the Engineer at the completion of the project and returned to the Engineer at that time.

25. PRECONSTRUCTION CONFERENCE

After award and execution of a contract between the Owner and Contractor, a formal preconstruction conference will be held in City Hall prior to commencement of the work. This conference will include review of technical specifications in order to insure clarity as to the type of construction machinery to be used, construction methods to be used, and materials to be used, obligations of both the Contractor and the City forces, personnel, safety, issues/requirements, meetings, control of the project, guaranty/warranty, and the method of inspection and decision-making to be used during this project.

26. ORDER OF CONSTRUCTION/WORKING HOURS

26.1 The Contractor shall submit to the Engineer prior to the pre-construction conference a construction schedule, which shall meet the Engineer's approval before construction can begin.

26.2 Generally, the Contractor shall perform all construction activities between 8:00a.m. To 5:00p.m., Monday through Friday only. However, the Contractor may be allowed to work weekends and holidays upon the Engineer's written approval. Contractor shall be responsible for paying all costs, fees, etc. related to Owner representatives during hours on weekends, holidays, and outside 8:00 am to 5:00 p.m.

26.3 The Contractor shall keep the Owner and the Owner's Engineer informed as to his construction progress. Because of traffic congestion, the contractor may be required to schedule construction in some areas between the hours of 8:30am and 4:00pm, OR

8:00pm and 4:00am if the City staff or Engineer determines it to be necessary. Contractor will be required to perform work in a fashion that will cause the least amount of inconvenience to the general public.

26.4 The Contractor will be required to totally complete portions of the project prior to proceeding with other portions. The Contractor shall submit to the Engineer prior to the preconstruction conference a construction schedule which shall meet the Engineer's approval before construction can begin. All work scheduling shall be coordinated with City staff and approved by City staff before work can proceed. The Contractor will be required to have someone on call 24 hours per day during the course of the project.

27 LABOR FORCE

27.1 The Contractor may bring his superintendent, foreman, sub-foreman, machine operators, and sufficient key men to round his organization.

27.2 The Contractor shall abide by the Wage and Hour Laws of the State and must not pay less than the rates legally prescribed.

27.3 The Contractor shall maintain his superintendent or foreman onsite for the duration of the project and have at least two employees whom are a 24hour contact. Subcontractor employees shall not be considered the superintendent or foreman on site.

28 CONTRACTOR'S RESPONSIBILITY AND LIABILITY FOR PERFORMANCE OF WORK

28.1 It is expressly understood and agreed by the Contractor that, regardless of the extent of inspection and supervision provided by the Owner and the Engineer, it is the Contractor's responsibility to perform and complete work in accordance with the drawings and specifications, and that the Owner and Engineer have no liability or responsibility whatever to the Contractor for any work performed by the Contractor which is not in accordance with the drawings and specifications regardless of the time when discovered and whether discovered at any time during the course of construction or after acceptance of the work.

28.2 The Engineer shall inform the Contractor of any work that is not in accordance with the drawings and specifications when it becomes known to him. If any work is performed which is not in accordance with drawings and specifications and is not discovered until a later time, neither the Owner nor the Engineer shall have any responsibility to the Contractor, or be liable to the Contractor for the correction or removal of unsatisfactory work or of any work subsequently performed or affected by it.

28.3 The correction or removal of such unsatisfactory work and the replacement with satisfactory work shall be performed by the Contractor at his own expense, and is understood to be fully included in his contract requirements, without any additional compensation or claims upon the Owner or Engineer.

29 NOTIFICATION OF CONSTRUCTION PROGRESS

29.1 Contractor shall keep the Owner and Engineer informed at all times with respect to the progress of the Services and the results obtained there from. Without limitation of the generality of the immediately preceding sentence, Contractor shall furnish verbal reports to Engineer as requested but no less than on a weekly basis specifying the days spent and Work accomplished by Contractor since the preceding report; and promptly notify Engineer in writing of all accidents, claims (including, without limitation, asserted liens, and other encumbrances), and losses arising out of or in connection with the Services.

29.2 The Contractor shall give the Engineer 48 hours' notice for inspection of any subsurface activity.

29.3 If work is delayed or behind schedule, the Contractor shall submit additional progress reports at such intervals as Engineer may request. Each progress report shall include sufficient description of current and anticipated delaying factors, their effect on the construction schedule, and proposed actions that the Contractor will take to complete the project within the time allotted. If considered necessary, the Engineer will schedule additional meetings to discuss progress with the Contractor.

30 CHANGE OF LOCATION

No change in the alignment is contemplated; however, should a change be necessary, the Owner reserves the right to make such changes; unless it can be clearly shown that such changes would result in an undue hardship on the Contractor, no extra compensation will be allowed the Contractor.

31 SEARCHING FOR EXISTING UTILITIES

Existing sewer mains may be difficult to locate. The approximate location of these facilities has been shown on the plans ("EXISTING UTILITIES" above), and City forces with budget constraints have not produced exact locations. The Contractor will be required to excavate and locate these facilities, and to conduct such investigations as necessary to perform the work contemplated on the plans. The Owner will provide liaison with property owners and the limited information it has concerning existing locations, sizes, materials, etc., but any delays or investigations required of the Contractor shall be deemed incidental to the project. **No separate payment will be made**. No machine time will be provided by the Owner in this regard.

32 SALVAGE RIGHTS

32.1 All materials and appurtenances of any kind, etc., excavated, removed, or produced during the project by the Contractor shall be delivered to the Owner's yard, if desired by Owner. No separate payment will be made.

32.2 If the Owner desires not to keep these materials, they shall be disposed of properly and according to current laws. No separate payment will be made.

32.3 The City of Seguin does not have an active landfill.

33 DISPOSAL OF EXCAVATED MATERIALS

All excavated materials not used in backfilling will be disposed of by the Contractor at a site obtained by the Contractor and approved by the Owner. Disposal of excavated materials shall be in accordance with all rules and regulations of the Texas Commission on Environmental Quality (TCEQ). Any pieces of material such as broken concrete, asphalt, or pipe measuring twelve inches (12") or larger in any dimension, shall be disposed of by the Contractor at an approved landfill or as directed by the Owner. Spoil areas shall be leveled with a motor grader for future mowing. The Contractor shall include in his bid the cost to dispose of the materials.

34 SUBMITTAL DATA

The Contractor shall furnish submittals for any such parts of the work and equipment as set forth in the specifications and indicated on the plans. The procedures for review of the submittals shall be as follows:

34.1 The Contractor shall submit to the Engineer for his review, four (4) prints of drawings, plus whatever number of prints the Contractor desires to be returned to him. The submittal prints shall be accompanied by a letter of transmittal, which shall be of the form supplied by or approved by the Engineer.

34.2 When a drawing is satisfactory to the Engineer, the number of prints the Contractor desires returned to him will be stamped or marked, "Approved as Corrected" or "Approved as Submitted", will be dated and will be returned to the Contractor by letter.

34.3 Should a drawing be unsatisfactory to the Engineer, he will stamp thereon "Revise and Resubmit" or "Rejected", and will return one (1) or more copies thereof to the Contractor with the necessary corrections and changes indicated. The Contractor must make such corrections and changes, and again submit at least four (4) prints of the drawings for approval. The Contractor shall revise and resubmit the working drawings, as required by the Engineer, until satisfactory review thereof is obtained.

34.4 The Contractor shall allow sufficient time for preliminary review, correction and re-submission, and final review of all working (shop) drawings. The Contractor should allow not less than fourteen (14) days for each review. Drawings of items critical to job progress, when requested in writing by the Contractor, will be given priority review.

35 SANITARY FACILITIES

The Contractor shall provide chemical toilet facilities for the use of his forces. Adequacy of these facilities will be subject to the approval of the Engineer and maintenance of same must be satisfactory to the Engineer at all times. Contractor shall provide a maintenance schedule to the Owner for approval.

36 WITHDRAWAL OF BIDS

Contractors may withdraw their bid at any time until the specified closing time for acceptance of bids. After the specified time, no bid may be withdrawn for a period of ninety (90) days or until a contract is awarded, whichever occurs first.

37 SUB-SURFACE CONDITIONS

It shall be the responsibility of the Contractor to satisfy himself as to the soil conditions and nature and type of geological formations in and through which this project will be constructed, and to make appropriate allowances in the proposal he submits for doing the work. Such information as may be obtained from the test borings and accompanying notations shown on the plans is merely for the guidance of the Contractor and is not to be construed in any manner as a guarantee by the Owner that such conditions of sub-surface strata are infallible.

38 STAKING FOR CONSTRUCTION

The Contractor will provide all construction survey staking services for the project. The cost of these services will be reflected in the unit price amount bid in the proposal. **No separate payment will be made.**

39 BID PROPOSALS

39.1 Bidders are requested to submit bids on all bid items as listed in the proposal, so that an adequate evaluation of the total project can be made.

39.2 The Owner reserves the right to reject any or all bids, or to accept the bid or combination of bids that they deem most advantageous to the public interest.

39.3 Bidders must submit their bids based on the design as set forth in the plans and specifications. Any bids submitted on the basis of unspecified alternate designs will be immediately rejected and returned to the bidder.

39.4 The prices bid in the Proposal shall be full compensation for furnishing all material, labor, equipment, and performing all operations required to complete the project ready for use. All materials, labor, equipment, and work required to complete the project ready for use, must be included in the price bid for the various items provided in the Proposal and no other compensation will be allowed.

39.5 Prices in the proposal shall be stated in both script and numerals.

40 CONTRACT DRAWINGS AND SPECIFICATIONS

40.1 All items shown on the drawings or included in the specifications shall be furnished, installed, and connected with accessories and appurtenances as shown or indicated on the plans and in the specifications.

40.2 Any work or item called for on the drawings and not particularly mentioned in the specifications, or work and items described in the specifications and not shown on the drawings is to be regarded as included under the contract the same as if set forth in the specifications and exhibited on the drawings.

41 SETTLEMENT OF INSURANCE CLAIMS

41.1 Losses insured under policies that include Owner/Engineer as a named insured shall be adjusted with Owner/Engineer and made payable to Owner/Engineer as trustee for the insured's, as their interests may appear.

41.2 Owner/Engineer and Contractor waive all rights against each other for damages caused by fire or other perils to the extent covered by insurance, except such rights as they may have to insurance proceeds held by owner as trustee. Contractor shall require similar waivers by Subcontractor as provided in General Conditions.

42 SPECIFICATIONS

The Specifications which govern materials and equipment to be furnished and the work to be performed under this contract are listed in the Table of Contents at the beginning of this volume.

43 PAYMENT

Contractor can make monthly payment requests with retainage withheld until the project is accepted. Retainage shall be 5%.

44 EXCAVATION, TRENCHING, AND SHORING

All excavation, trenching, and shoring shall conform to the U.S. Department of Labor, Occupational Safety, and Health Administration Guidelines (Subpart P – Excavation, Trenching, and Shoring). The Contractor will be required to submit an excavation, trenching, and shoring plan to the Engineer for approval prior to construction.

45 BUY AMERICAN

In accordance with the Buy American provision in Public Law 95-117 (section 215 of Public Law 92-500 as amended) the Contractor agrees that preference will be given to domestic material, by the contractor, subcontractors, material men, and suppliers and owner in the performance of this contract.

46 WAGE SCALE

All employees of the Contractor on this project shall be paid, at least, the amount shown in the wage decision attached herein.

47 BACKFILL AND PAVEMENT REPAIR

Separate payment **WILL NOT** be made for repair of gravel, asphaltic or concrete surfaces crossed or damaged by the Contractor's work.

48 NO SEPARATE PAYMENT

Several notes on the plans indicate work to be performed with "No Separate Payment". Contractor shall include the cost of this work in other bid items provided.

49 SPOIL DISPOSAL

The Contractor's bid shall include spoil disposal (offsite) for items that cannot be used for on-site fill (asphalt, concrete, wire, etc.) in accordance with applicable TCEQ regulations.

50 INGRESS/EGRESS

Ingress/Egress to the construction area by the Contractor shall be done only on the construction easements shown on the plans or as approved by the Owner, no exceptions. No separate payment will be provided for these services.

51 COOPERATION AND COORDINATION WITH PUBLIC

The Contractor shall conduct his work so as to cause the least amount of disruption to the public. Closing of any streets or lanes of traffic will be coordinated with City staff. All citizens along each street will be notified by the Contractor in advance of construction activities.

52 VIDEO OF CONSTRUCTION DATA

The Contractor shall provide the City with a video recording on a digital video disc (dvd) showing the construction area in detail prior to construction, to include audio, to describe location.

53 SCHEDULE

The Contractor shall submit to the Engineer and Owner a construction schedule on the first day of each month for the duration of the project. Schedule shall include but not be limited to remaining activities, anticipated start/finish time, etc.

54 PUMPING, BAILING AND DRAINING

The Contractor shall immediately remove all surface or seepage water from ditches and other sources which may accumulate during the excavation and construction work by providing the necessary underdrains or otherwise, and by doing the necessary pumping, bailing or draining. The Contractor shall have available at all times sufficient equipment in proper working order for doing the work herein required. All water removed from excavations shall be disposed of in an approved manner so as to not create unsanitary conditions or to interfere unduly with the use of streets, private driveways or entrances. Pumping, bailing, draining, underdrains, ditches, etc., shall be considered incidental work and will not be paid for as separate items, but their cost shall be included in the contract prices bid in the Proposal for the various units of excavation measure.

55 TIME ALLOWED FOR COMPLETION

The time allotted for the completion of all items of work shall be __60__ calendar days. The Work Order shall consist of a written request by the Engineer for the Contractor to proceed with the construction of the project.

56 BARRICADES AND DANGER SIGNALS

56.1 Where the work is carried on, in or adjacent to any street, alley, or public place, the Contractor shall, at his own cost and expense, furnish and erect barricades and/or fences, lights and/or danger signals, and take any other steps necessary for the protection of persons or property.

56.2 Barricades shall have the correct retro-reflectivity as required by the Texas Manual on Uniform Traffic Control Devices . From sunset to sunrise, the Contractor shall furnish and maintain lights at each barricade. Barricades shall be erected to endeavor to keep vehicles from being driven on or into any work under construction.

56.3 The Contractor will be held responsible for all damage to the work due to the failure of barricades, signs, lights, and watchmen to protect it, and whenever evidence is found of such damage, the Engineer may order the damaged portion immediately removed and replaced by the Contractor, at his cost and expense. The Contractor's responsibility for the maintenance of barricades, signs, and lights and for providing watchmen shall not cease until the project has been accepted by the Engineer.

56.4 The Contractor shall meet all applicable local, state, and federal regulations for barricades and danger signals.

57 SAFETY

57.1 Contractor shall place the highest priority on health and safety, and shall maintain a safe working environment during performance of the Work. The site shall be considered to be drug and alcohol free and such policy will be strictly enforced. All employees shall adhere to these policies while on site. Contractor shall comply, and shall secure compliance by its employees, agents, and lower tier Contractors, with all applicable health, safety, and security laws and regulations, any health regulations including without limitation, federal, state and local laws and regulations, and health and safety plans issued by the Owner's Agent as well as all policies and regulations of the Owner. Compliance with such requirements shall represent the minimum standard required of Contractor. Contractor will be performing Work on the Owner's property.

57.2 At all times, the Contractor shall provide an on-site construction supervisor. The Contractor's construction supervisor shall hold and document safety meetings.

57.3 Contractor agrees to furnish protective devices and clothing as required by applicable laws, regulations, health and safety plans and Engineer rules and regulations, and to ensure that such devices or clothing are properly used by its employees, agents, lower tier Contractors and other invitees of Contractor at the jobsite. Safety protection is required at all times while working onsite including a hardhat, a high visibility, tear-off reflective vest, lace-up leather safety boots with steel shank and steel toes, and safety glasses with permanently affixed side-shields.

58 PROJECT MAINTENANCE

The Contractor shall maintain and keep in good repair the improvements covered by these plans and specifications during the life of his contract. Existing improvements shall at all times be protected by the Contractor during the construction of the work as specified herein All such improvements shall be left in a condition equal to that prior to start of construction.

59 PROPERTY LINES AND MONUMENTS

The Contractor shall protect all property corner markers, and when any such markers or monuments are in danger of being disturbed, they shall be properly referenced and if disturbed, shall be reset at the expense of the Contractor.

60 OFF-SITE STORAGE

Off-site storage for any materials and equipment not incorporated into the Work but included in the Applications for Payment shall not be allowed, unless the contractor obtains their own agreement for use of private property to store construction materials, equipment, vehicles, etc.

61 NOTICES TO OWNERS AND AUTHORITIES

Utilities and other concerned agencies shall be notified at least 48 hours prior to excavating near underground utilities or pole lines or in accordance with the regulations of the utilities, Texas Digger's Hotline (811), and concerned agencies.

62 UNFAVORABLE CONSTRUCTION CONDITIONS

During unfavorable weather, wet ground, or other unsuitable conditions, the Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by the Contractor to perform the Work in a proper and satisfactory manner.

63 DEWATERING

63.1 The Contractor shall at his own expense remove any water that may be encountered during the course of the work by pumping, well pointing, or other approved methods. The water shall be stored in a storage tank provided by the Contractor and disposed of in accordance with all applicable State rules and regulations. Newly placed concrete or grout shall be adequately protected from possible injury resulting from groundwater or from handling and disposal of water.

63.2 All surface drainage or natural waterways shall be controlled by dikes or ditches without damage to adjacent property or structures and without interference with the right of either public or private owners.

63.3 No separate payment will be made for dewatering.

64 EXISTING STRUCTURES/EQUIPMENT

Exact dimensions of existing structures, buildings, equipment roads, utility locations, etc. shown on the plans have not been field verified by the Engineer. Prior to submittal preparation by the Contractor, or construction activities as applicable, all dimensions of these existing items shall be verified by the Contractor in the field. It shall be the Contractor's responsibility to field verify all field dimensions.

00200

S. Austin St, E. Court St. and W. Nolte St. Sidewalk Improvements Project
BID NO. TF-2016-03

DATE: _____

Gentlemen:

Having carefully examined the Instructions to Bidders, Standard Form of Contract, Specifications, and Plans therein referred to, the undersigned bidder declares that the only person or parties interested in this Bid as Principals are those named herein; that this Bid is made without collusion with any other person, firm or corporation; that the Bidder has carefully examined, and this Bid is made in accordance therewith, locations, conditions and classes of materials of the proposed work; and agrees that the Bidder will provide all the necessary superintendence, labor, machinery, equipment, tools, apparatus and other means of construction, and to complete all the work and furnish all the materials called for in the Contract and Specifications in the manner prescribed therein and according to the requirements of the City Engineer, as therein set forth.

The Bid Form attached lists the items of construction contemplated in the Plans and Specifications. Bid prices must be shown in words and figures for each item listed in the Proposal, and in the event of a discrepancy, the words shall control.

It is understood that the following quantities of work to be done are approximate only, and are intended primarily to serve as a guide for the comparison and tabulation of the bids.

Receipt is hereby acknowledged of the following addenda to the Contract Documents:

Addendum No.1 dated _____ Received _____

Addendum No.2 dated _____ Received _____

Addendum No.3 dated _____ Received _____

Bidder agrees to perform all of the work listed in the proposal and as described in the specifications and shown on the plans, for the following prices:

00210

PROPOSAL

S. Austin St, E. Court St. and W. Nolte St. Sidewalk Improvements Project

BID NO. TF-2016-03

Item No.	Estimated Quantity	Description and Unit Price of Item In Words	Unit Price In Figures	Total Price

ITEM NO.	ESTIMATED QUANTITY	DESCRIPTION AND UNIT PRICE OF ITEM IN WORDS	UNIT PRICE IN FIGURES	TOTAL PRICE
1	3,137 S.F.	Demolish and dispose of concrete sidewalk, curb and pavement for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
2	4,676 S.F.	Construct reinforced concrete sidewalk for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
3	3 each	Construct perpendicular curb ramp (type 1) for the sum of _____ dollars and _____ cents per each.	$_____	$_____
4	80 S.F.	Install detectable warning surface for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
5	210L.F.	Construct reinforced concrete curb for the sum of _____ dollars and _____ cents per linear foot.	$_____	$_____
6	107 S.F.	Replace asphaltic - concrete pavement at new curb for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
7	4 each	Construct directional ramp within radius (type 10) for the sum of _____ dollars and _____ cents per each.	$_____	$_____
8	48 S.F.	Demolish and dispose of asphaltic - concrete pavement for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____

9	3 each	Adjust water meter box at proposed sidewalk for the sum of _____ dollars and _____ cents per each.	$_____	$_____
10	1 each	Remove and reinstall existing street sign and pole for the sum of _____ dollars and _____ cents per each.	$_____	$_____
11	1 each	Adjust water Valve box at proposed sidewalk for the sum of _____ dollars and _____ cents per each	$_____	$_____
12	1 L.S.	Remove and dispose of existing tree and stump for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
13	1 L.S.	Remove and dispose of existing wooden platform and railing for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
14	307 S.F.	Construct reinforced concrete driveway for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
15	1 L.S.	Construct reinforced concrete landing with ramp and steps for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
16	76 L.F.	Install metal handrailing at landing with ramp and steps for the sum of _____ dollars and _____ cents per linear foot.	$_____	$_____
17	1 L.S.	Relocate electrical ground rod and adjust conduit at wireway for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
18	1 L.S.	Relocate hose bib at ramp for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
19	1 L.S.	Install air vent tube and screen at landing for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____

20	1 L.S.	Adjust sewer cleanout covers and fittings at proposed ramp and sidewalk for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
21	1 L.S.	Adjust electrical pull box at proposed sidewalk for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
22	1 L.S.	Extend gutter downspout drain to driveway for the sum of _____ dollars and _____ cents per lump sum.	$_____	$_____
23	1,000 S.F.	Demolish and dispose of sidewalk and curb in unspecified areas for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
24	1,000 S.F.	Construct reinforced concrete sidewalk in unspecified areas for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____
25	50 L.F.	Construct reinforced concrete curb in unspecified areas for the sum of _____ dollars and _____ cents per linear foot.	$_____	$_____
26	100 S.F.	Install detectable warning surface unspecified areas for the sum of _____ dollars and _____ cents per square foot.	$_____	$_____

TOTAL PROPOSAL **$ _____**

The above prices shall include all labor, materials, overhead, profit, insurance, etc. to cover the finished work of the kinds called for.

The work proposed to be done shall be accepted when fully completed and finished in accordance with the plans and specifications to the satisfaction of the City Engineer.

The undersigned Bidder hereby declares that he has visited the site of the work and has carefully examined the contract documents pertaining to the work covered in the above bid, and that the bid prices contained in the proposal have been carefully checked and are submitted as correct and final.

The Contractor agrees to complete the project on which he has bid, as specified and shown on the plans, within __60__ consecutive calendar days.

The Bidder agrees that this bid shall be good and may not be withdrawn for a period of ninety (90) calendar days after the scheduled closing time for receiving bids.

Enclosed with this proposal is a Proposal Bond in the sum of 5% of total proposal, which it is agreed shall be collected and retained by the Owner as liquidated damages in the event his proposal is accepted by the Owner within ninety (90) days after the bids are received and the undersigned fails to execute the contract for the Owner within ten (10) days after date said proposal is accepted, otherwise said check or bond shall be returned to the undersigned upon demand.

_____	_____
Business Name	Authorized Signature
_____	_____
Address	Printed Name
_____	_____
City, State, Zip Code	Title
Phone No._____	_____
	Date
Fax No._____	
Email Address:	
_____	

BIDDER'S EXCEPTION FORM
Bid #TF-2016-03

This form must be completed and signed by an authorized representative of the company. Failure to do so may cause total bid to be rejected. If no exceptions are to proposed, indicate by stating "No Exceptions to Specifications" and sign in the appropriate space.

STATEMENT OF BIDDER: WE PROPOSE THE FOLLOWING EXCEPTIONS TO THE SPECIFICATIONS

SECTION	PAGE/ PARAGRAPH #	EXCEPTION

NOTE: If additional pages are needed, attach to the back of this page and note "See Page 2- Deviations" on this page.

Company Name

Authorized Signature

00300

EXPERIENCE RECORD

Contractor shall list in the spaces provided below, similar projects of equal or greater dollar amount that have been installed and are in operation within the past five (5) years. Separate sheets may be attached.

NO.	LOCATION	DESCRIPTION (Size, Type, Length)	CONTACT PERSON PHONE NUMBER	DATE OF INSTALLATION
1				
2				
3				
4				
5				
6				
7				
8				
10				

00400

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

Name of Bidder: _____

Address: _____

Date Organized: _____ Date Incorporated_____

Number of Years in contracting business under present name:_____

List Names of Owners, Partners, or Shareholders:

_____

_____

_____

_____

CONTRACTS ON HAND

Contract	Dollar Amount	Anticipated Completion Date

Type of work performed by your company:_____

Have you ever failed to complete any work awarded to you?_____

Have you ever defaulted on a contract?_____

List the projects most recently completed by your firm (include project of similar importance):

Project	Dollar Amount	Mo/Yr Completed

Major equipment available for this contract:

_____

_____

_____

Attach resume(s) for the principal member(s) of your organization, including the officers as well as the proposed superintendent for the project.

Credit available: $_____

Bank reference and bank officer:_____

The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the _____in verification of the recitals comprising this Statement of Bidder's Qualifications.

Executed this _____ day of _____, 2013.

By:_____ _____

(Signature) (Title)

STANDARD FORM OF AGREEMENT

STATE OF TEXAS §

COUNTY OF §

THIS AGREEMENT, made and entered into this ___day of _____ A.D. 2015, by and between the _____, TEXAS, a municipal corporation, of the County of _____ and State of _____, acting through _____ thereunto duly authorized so to do, Party of the First Part, hereinafter termed OWNER, and _____ of the City of _____, County of _____ _____, and State of _____, Party of the Second Part, hereinafter termed CONTRACTOR.

WITNESSETH: That for and in consideration of the payments and agreements hereinafter mentioned, to be made and performed by the OWNER, and under the conditions expressed in the bond bearing even date herewith, the said CONTRACTOR hereby agrees with the said OWNER to commence and complete the construction of certain improvements generally described as follows:

Construction of sidewalks on select segments of S. Austin St, E. Court St. and W. Nolte St. in the City of Seguin. The work effort includes removal of existing concrete sidewalk and curb, construction of new curb, sidewalks, ramps, handrailing and other miscellaneous items.

,and all extra work in connection therewith, under the terms as stated in the General Conditions of the Agreement and at his (or their) own proper cost and expenses to furnish all the materials, supplies, machinery, equipment, tools, superintendence, labor, insurance, and other accessories and services necessary to complete the said construction, in accordance with the Advertisement for Proposals, General and Special Conditions of Agreement, Plans and other drawings and printed or written explanatory matter thereof, and the Specifications and addenda therefore, as prepared by M&S Engineering, LLC, P.O. Box 970, Spring Branch, Texas 78070, herein entitled the ENGINEER, each of which has been identified by the CONTRACTOR and the ENGINEER, together with the CONTRACTOR'S written Proposal, and the performance and Payment Bonds hereto attached; all of which are made a part hereof and collectively evidence and constitute the entire contract (hereinafter collectively called the "Contract Documents" or the "Contract").

The CONTRACTOR hereby agrees to commence work within ten (10) days after the date written notice to do so shall have been given to him, and to substantially complete the same by **60** calendar days, subject to such extensions of time as are provided by the General and Specific Conditions.

The OWNER agrees to pay the CONTRACTOR in current funds the price or prices shown in the proposal, which forms a part of this contract, such payments to be subject to the General and Special Conditions of the contract.

IN WITNESS WHEREOF, the parties to these presents have executed this Agreement in the year and day first above written.

Party of the First Part (OWNER)	Party of the Second Part (CONTRACTOR)
By: _____	By: _____
ATTEST:	ATTEST:
_____	_____

Executed ____ originals.

00600

Performance Bond

STATE OF _____

COUNTY OF _____

We, _____(Contractor name) ,
_____(address),
as Principal, and_____
(bond company name), as Surety, are held and firmly bound unto the City of Seguin, Texas, as Owner, in the penal sum of_____
_____dollars ($_____), for the payment of which the Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, by this bond:

The Principal has entered into a written Contract with the Owner dated _____for the _____ ("Project"), which is fully incorporated into this bond by reference.

The condition of this obligation is that if the Principal faithfully and promptly performs all work for the Project in accordance with the Contract Documents, and faithfully and promptly observes and performs all of its covenants, conditions, duties and obligations under the Contract Documents according to their true intent and meaning, then this obligation will be satisfied; otherwise it will remain in full force and effect.

If the Owner declares the Principal to be in default under the Contract, the Surety agrees to either 1) promptly remedy the default, or 2) faithfully and promptly perform and complete the Project in accordance with the Contract Documents.

The Surety, for value received, agrees that no modification, change order, extension of time, amendment or addition to the Contract, or to the plans, specifications, drawings or other Contract Documents, will in any way affect the Surety's obligation on this bond, and the Surety waives notice of any such modification, change order, extension of time, amendment or addition.

The Surety certifies that it is authorized and admitted to write surety bonds in Texas. If this bond exceeds $100,000.00 the surety certifies that it either 1) holds a certificate of authority from the United States Secretary of the Treasury to qualify as a surety on obligations permitted or required under federal law, or 2) has obtained qualified reinsurance for any liability in excess of $100,000.00 from a reinsurer that is authorized and admitted as a reinsurer in the State of Texas, and is the holder of a certificate of authority from the United States Secretary of the Treasury to qualify as a surety or reinsurer on obligations permitted or required under federal law. This bond is governed by Chapter 2253 of the Texas Government Code, and it is provided solely for the protection of the Owner.

This bond is filed with the Owner in Guadalupe County, Texas, and the Principal and Surety agree that mandatory venue for any legal action filed upon this bond is in the District Courts of Guadalupe County, Texas.

Executed and sealed by the Principal and Surety on_____.

_____ Principal	_____ Surety
By: _____	By:_____
Title:_____	Title:_____
Address:_____	Address:_____
_____	_____
_____	_____
	Telephone Number:_____
	Facsimile Number:_____
(SEAL)	(SEAL)

The name and address of the Resident Agent of Surety is:

_____

_____

THIS BOND MUST BE ISSUED AFTER EXECUTION OF OWNER-CONTRACTOR AGREEMENT BY BOTH PARTIES. ATTACH ORIGINAL POWER OF ATTORNEY FOR THE SURETY'S REPRESENTATIVE TO THIS BOND.

THE ADDRESS OF THE SURETY COMPANY TO WHICH ANY NOTICE OF CLAIM SHOULD BE SENT MAY BE OBTAINED FROM THE TEXAS DEPARTMENT OF INSURANCE BY CALLING 1-800-252-3439.

00700

Payment Bond

STATE OF _____

COUNTY OF _____

_____(Contractor name), of _____(address), as Principal, and _____ (bond company name), as Surety, are held and firmly bound unto the City of Seguin, Texas, as Owner, in the penal sum of_____ dollars ($ _____) for the payment of which the Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, by this bond.

The Principal has entered into a Contract with the Owner dated_____ for the _____ ("Project"), which is fully incorporated into this bond by reference.

The condition of this obligation is that if the Principal pays all persons who supply public work labor or material for the Project, then this obligation will be satisfied; otherwise this bond will remain in full force and effect.

This bond is provided under the provisions of Chapter 2253 of the Texas Government Code, as amended and all liabilities on this bond shall be determined in accordance with the provisions of that statute to the same extent as if it were copied at length in this document.

The Surety, for value received, stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or the plans, specifications, drawings or other Contract Documents, or to the work performed under the Contract Documents, shall in any way affect its obligation on this bond, and the Surety waives notice of any such change, extension of time, alteration or addition.

The Surety certifies that it is authorized and admitted to write surety bonds in Texas. If this bond exceeds $100,000.00 the surety certifies that it either 1) holds a certificate of authority from the United States Secretary of the Treasury to qualify as a surety on obligations permitted or required under federal law, or 2) has obtained qualified reinsurance for any liability in excess of $100,000.00 from a reinsurer that is authorized and admitted as a reinsurer in the State of Texas, and is the holder of a certificate of authority from the United States Secretary of the Treasury to qualify as a surety or reinsurer on obligations permitted or required under federal law. This bond is governed by Chapter 2253 of the Texas Government Code, and it is provided solely for the protection of the Owner.

Mandatory venue for any legal action filed upon this bond is in the District Courts of Guadalupe County, Texas.

Executed and sealed by the Principal and Surety on_____.

Principal	Surety
By: _____	By:_____
Title:_____	Title:_____
Address:_____	Address:_____
_____	_____
_____	_____
	Telephone Number:_____
	Facsimile Number:_____
(SEAL)	(SEAL)

The name and address of the Resident Agent of the Surety is:

_____

THIS BOND MUST BE ISSUED AFTER EXECUTION OF OWNER-CONTRACTOR AGREEMENT BY BOTH PARTIES. ATTACH ORIGINAL POWER OF ATTORNEY FOR THE SURETY'S REPRESENTATIVE TO THIS BOND.

THE ADDRESS OF THE SURETY COMPANY TO WHICH ANY NOTICE OF CLAIM SHOULD BE SENT MAY BE OBTAINED FROM THE TEXAS DEPARTMENT OF INSURANCE BY CALLING 1-800-252-3439.

00800
GENERAL CONDITIONS OF AGREEMENT

1.0 DEFINITION OF TERMS

1.01 OWNER, CONTRACTOR AND ENGINEER. The Owner, the Contractor and the Engineer are those persons or organizations identified as such in the Agreement and are referred to throughout the Contract Documents as if singular in number and masculine in gender.

The term Engineer means the City of Seguin CITY Engineer or his duly authorized representative. The Engineer shall be understood to be the Engineer of the Owner, and nothing contained in the Contract Documents shall create any contractual or agency relationship between the Engineer and the Contractor.

The Owner may include any authorized representative of Owner as may be set forth in the SPECIAL CONDITIONS.

1.02 CONTRACT DOCUMENTS. The Contract Documents shall consist of the Advertisement for Proposals, Special Instructions, Proposal, Signed Agreement, Performance and Payment Bonds, Special Bonds (when required), General Conditions of the Agreement, Technical Specifications, Plans, and all modifications thereof incorporated in any of the documents before the execution of the Agreement.

The Contract Documents are complementary, and what is called for by any one shall be as binding as if called for by all. In case of conflict between any of the Contract Documents, priority of interpretation shall be in the following order: signed Agreement, Performance and Payment Bonds, Special Bonds (if any), Proposal, Advertisement for Proposals, Special Instructions, Technical Specifications, Plans, and General Conditions of Agreement.

1.03 SUB-CONTRACTOR. The term Sub-Contractor, as employed herein , includes only those having a direct contract with the Contractor and it includes one who furnishes material worked to a special design according to the plans or specifications of this work, but does not include one who merely furnishes material not so worked.

1.04. WRITTEN NOTICE. Written notice shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, return receipt requested, to the last business address known to him who gives the notice.

1.05. WORK. The Contractor shall provide and pay for all materials, supplies, machinery, equipment, tools, superintendence, labor, services, insurance, permits, certificates, licenses, and all water, light, power, fuel, transportation and other facilities necessary for the execution and completion of the work covered by the contract documents. Unless otherwise specified, all materials shall be new and both workmanship and materials shall be of a good quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials. Materials of work described in words which so applied have a well known technical or trade meaning shall be held to refer to such recognized standards.

1.06. EXTRA WORK. The term "Extra Work' as used in this contract shall be understood to mean and include all work that may be required by the Engineer or Owner to be done by the Contractor to accomplish any change, alteration or addition to the work shown upon the plans, or reasonable implied by the specifications, and not covered by the Contractor's proposal.

1.07. CALENDAR DAY. "Calendar Day" is any day of the week or month, no days being excepted.

1.08. SUBSTANTIALLY COMPLETED. By the term "substantially completed, is meant that the structure has been made suitable for use or occupancy or the facility is in condition to serve its intended purpose, but still may require minor miscellaneous work and adjustment.

2. RESPONSIBILITIES OF THE ENGINEER AND THE CONTRACTOR

2.01. OWNER-ENGINEER RELATIONSHIP. The Engineer will be the Owner's representative during construction. The duties, responsibilities and limitations of authority of the Engineer as the Owner's representative during construction are as set forth in the CONTRACT Documents and shall not be extended or limited without written consent of the Owner and Engineer. The Engineer will advise and consult with the OWNNER'S instructions to the Contractor shall be issued through the Engineer.

2.02. PROFESSIONAL INSPECTION BY ENGINEER. The Engineer shall make periodic visits to the site to familiarize himself generally with the progress of the executed work and to determine if such work generally meets the essential performance and design features and the technical and functional engineering requirements of the Contract Documents; provided and except, however, that the Engineer shall not be responsible for making any detailed, exhaustive, comprehensive or continuous on-site inspection of the quality or quantity of the work or be in any way responsible, directly or indirectly. For the construction means, methods, techniques, sequences, quality, procedures, programs, safety precautions or lack of same incident thereto on in connection therewith. Notwithstanding any other provision of this agreement or any other Contract Document, the Engineer shall not be any way responsible or liable for any acts, errors, omissions or negligence of the Contractor, any subcontractor or any of the Contractor's or subcontractor's agents, servants, or employees or any other person, firm or corporation performing or attempting to perform any of the work.

2.03. PAYMENTS FOR WORK. The Engineer shall review Contractor's applications for payment and supporting data, determine the amount owed to the Contractor and approve, in writing, payment to Contractor in such amounts; such approval of payment to Contractor constitutes a representation to the Owner or Engineer's professional judgment that the work has progressed to the point indicated to the made any examination to determine how or for what purpose Contractor has used the moneys paid on account of the Contract price.

2.04. OBJECTIONS AND DETERMINATIONS. The Engineer shall determine all claims disputes and other matters in question between the Contractor and the Owner relating to the execution or progress of the work or the interpretation of the Contract Documents. The Engineer's decision shall be rendered in writing within a reasonable time and shall be binding.

2.05. **CONTRACTOR'S DUTY AND SUPERINTENDENCE.** The Contractor shall give adequate attention to the faithful prosecution and completion of this contract and shall keep on the work, during its progress, a competent superintendent and necessary assistants. The Superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor.

The Contractor is and at all times shall remain an independent contractor, solely responsible for the manner and method of completing his work under this contract with full power and authority to select the means, method and manner of performing such work, so long as such methods do not adversely affect the completed improvements, the Owner, and Engineer being interested only in the result obtained and conformity of such completed improvements to the Contract Documents.

Likewise, the Contractor shall be solely responsible for the safety of himself, his employees and other persons, as well as for the protection of the safety of the improvements being erected and the property of himself or any other person, as a result of his work hereunder. Shop or working construction drawings and any specifications shown in relation thereto, as well as any additional information concerning the work to be performed, passing from or through the Engineer, shall not be interpreted as requiring or allowing Contractor to deviate from the plans and specifications, the intent of such drawings, specifications and any other such instructions being to define with particularity the agreement of the parties as to the work the Contractor is to perform. Contractor shall be fully and completely liable at his own expense, for design, construction, installation and use, or non-use, of all items and methods incident to performance of the contract, and for all loss, damage or injury incident thereto, either to person or property, including, without limitation, the adequacy of all temporary supports, shoring, bracing, scaffolding, machinery or equipment, safety precautions or devices, and similar items or devices used by him during construction.

Any review of work in process, or any visit or observation during construction, or any clarification of plans and specifications, by the Owner or Engineer, or any agent, employee, or representative of either of them, whether through personal observation on the project site or by means of approval of shop drawings for temporary construction or construction processes, or by other means or method, is agreed by the Contractor to be for the purpose of observing the extent and nature of work completed or being performed, as measured against the drawings and specifications constituting the contract, or for the purpose of enabling Contractor to more fully understand the plans and specifications so that the completed construction work will conform thereto, and shall in no way relieve the Contractor from full and complete responsibility for the proper performance of his work on the project, including but without limitation the propriety of means and methods of the Contractor in performing said contract, and the adequacy of any designs, plans or other facilities for accomplishing such performance. Deviation by the Contractor from plans and specifications that may have been in evidence during any such visitations or observation by Engineer, or any of his representatives whether called too the Contractor's attention or not, shall in no way relieve Contractor from his responsibility to complete all work in accordance with said plans and specifications.

2.06 CONTRACTOR'S UNDERSTANDING. It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the character of equipment and facilities needed preliminary to and during

the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this contract. No verbal agreement or conversation with any officer, agent or employee of the Owner or Engineer, either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained.

2.07 CHARACTER OF WORKMEN. The Contractor agrees to employ only orderly and competent men, skillful in the performance of the type or work required under this contract, to do the work; and agrees that whenever the Engineer shall inform him in writing that any man or men on the work are, in his opinion, incompetent, unfaithful or disorderly, such man or men shall be discharged from the work and shall not again be employed on the work without the Engineer's written consent.

2.08 CONTRACTOR'S BUILDINGS. The building of structures for housing men, or the erection of tents or other forms of protection, will be permitted only at such places as the Engineer shall direct, and the sanitary conditions of the grounds in or about such structures shall at all times be maintained in a manner satisfactory to the Engineer.

2.09 SANITATION. Necessary sanitary conveniences for the use of laborers on the work, properly secluded from public observation, shall be constructed and maintained by the Contractor in such manner and at such points as shall be approved by the Engineer, and their use shall be strictly enforced.

2.10 SHOP DRAWINGS. The Contractor shall submit to the Engineer, with such promptness as to cause no delay in his own work or in that of any other contractor, four checked copies, unless otherwise specified, of all shop and/or setting drawings and schedules required for the work of the various trades, and the Engineer shall pass upon them with reasonable promptness, noting desired corrections. The Contractor shall make any corrections required by the Engineer, file with him two corrected copies and furnish such other copies as may be needed. The Engineer's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing called the Engineer's attention to such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in ship drawings or schedules. It shall be the Contractor's responsibility to fully and completely review all shop drawings to ascertain their effect on his ability to perform the required contract work in accordance with the plans and specifications and within the contract time.

Such review by the Engineer shall be for the sole purpose of determining the sufficiency of said drawings or schedules to result in finished improvements in conformity with the plans and specifications, and shall not relieve the Contractor of his duty as an independent contractor as previously set forth, it being expressly understood and agreed that the Engineer does not assume any duty to pass upon the propriety or adequacy of such drawings or schedules, or any means or methods reflected thereby, in relation to the safety of either person or property during Contractor's performance hereunder.

2.11 PRELIMINARY APPROVAL. The Engineer shall not have the power to waive the obligations of this contract for the furnishing by the Contractor of good material, and of his performing good work as herein described, in full accordance with the plans and specifications. No failure or omission of the Engineer to discover, object to or condemn any defective work or material shall release the Contractor from the obligations to fully and

properly perform the contract, including without limitation, the obligation to at once tear out, remove and properly replace the same at any time prior to final acceptance upon the discovery of said defective work or material; provided, however, that the Engineer shall, upon request of the Contractor, inspect and accept or reject any material furnished, and in event the material has been once accepted by the Engineer, such acceptance shall be binding on the Owner, unless it can be clearly shown that such materials furnished does not meet the specifications for this work.

Any questioned work may be ordered taken up or removed for re-examination by the Engineer prior to final acceptance, and if found not in accordance with the specifications for said work, all expense of removing, re-examination and replacement shall be borne by the Contractor, otherwise the expense thus incurred shall be allowed as EXTRA WORK, and shall be paid for by the Owner; provided that, where inspection or approval is specifically required by the specifications prior to performance of certain work, should the Contractor proceed with such work without requesting in writing prior inspection or approval, he shall bear all expense of taking up, removing, and replacing this work if so directed by the Engineer.

2.12 DEFECTS AND THEIR REMEDIES. It is further agreed that if the work or any part thereof, or any material brought on the site of the work for use in the work or selected for the same, shall be deemed by the Engineer as unsuitable or not in conformity with the specifications, the Contractor shall, after receipt of written notice thereof from the Engineer, forthwith remove such material and rebuild or otherwise remedy such work so that it shall be in full accordance with this contract.

2.13 CHANGES AND ALTERATIONS. The Contractor further agrees that the Owner may make such changes and alterations as the Owner may see fit, in the line, grade, form, dimensions, plans or materials for the work herein contemplated, or any part thereof, either before or after the beginning of the construction, without affecting the validity of this contract and the accompanying Performance and Payment bonds.

If such changes or alterations diminish the quantity of the work to be done, they shall not constitute the basis for a claim for damages for anticipated profits on the work that may be dispensed with. If the amount of work is increased, such additional work shall be paid for as provided under Extra Work. In case the Owner shall make such changes or alterations as shall make useless any work already done or material already furnished or used in said work, then the Owner shall recompense the Contractor for any material or labor so used, and for any actual loss occasioned by such change, due to actual expenses incurred in preparation for the work as originally planned.

3. GENERAL OBLIGATIONS AND RESPONSIBILITIES

3.01 KEEPING PLANS AND SPECIFICATIONS ACCESSIBLE. The Contractor will be supplied with two (2) copies of the plans, specifications and special provisions, and he shall have available at the work site at all times one copy of each. He shall give the work his constant attention to facilitate the progress thereof and shall cooperate with the Engineer in every way possible. He shall have at all times a satisfactory and competent English-speaking Superintendent at the work site, authorized to receive orders and to act for him. The Contractor shall designate to the Engineer in writing the name of such

Superintendent, and he shall be furnished by the Contractor regardless of how much of the work may be sublet.

3.02 AUTHORITY AND DUTY OF INSPECTORS. Inspectors will be authorized to inspect all work done and all materials furnished. Such inspections may extend to all or to any part of the work and to the preparation or manufacture of the materials to be used. An Inspector will be assigned to the work by the Engineer and will report to the Engineer as to the progress of the work and the manner in which it is being performed; also to report whenever it appears that the materials furnished and the work performed by the Contractor fail to fulfill the requirements of the specifications and contract; and to call the attention of the Contractor to any such failure or other infringement. Such inspection will not relieve the Contractor from any obligation to perform the work in accordance with the requirements of the specifications.

In case of any dispute arising between the Contractor and the Inspector as to materials furnished or the manner of performing the work, the Inspector will have the authority to reject materials or suspend work until the questions at issue can be referred to and decided by the Engineer. The Inspector will not be authorized to revoke, alter, enlarge, or release any requirement of these specifications, or to approve or accept any portion of work, or to issue instructions contrary to the plans and specifications. He will in no case act as foreman or perform other duties for the Contractor nor interfere with the management of the work.

3.02 OWNERSHIP OF DRAWINGS. All drawings, specifications and copies thereof furnished by the Engineer shall not be reused on other work, and, with the exception of signed contract sets, are to be returned to him on request, at the completion of the work. All models are the property of the Owner.

3.03 ADEQUACY OF DESIGN. It is understood that the Owner believes it has employed competent engineers and designers. It is, therefore, agreed that, as to the Contractor only, the Owner shall be responsible for the adequacy of the design, sufficiency of the Contract Documents, and the practicability of the operations of the completed project; provided the Contractor has complied with the requirements of the said Contract Documents, all approved modifications thereof, and additions and alterations thereto approved in writing by the Owner. The burden of proof of such compliance shall be upon the Contractor to show that he has complied with the said requirements of the Contract Documents, approved modifications thereof and all approved additions and alterations thereto.

3.04 RIGHT OF ENTRY. The Owner reserves the right to enter the property or location on the works herein contracted for are to be constructed or installed, by such agent or agents as he may elect, for the purpose of inspecting the work, or for the purpose of constructing or installing such collateral work as said Owner may desire.

3.05 COLLATERAL CONTRACTS. The Owner agrees to provide by separate contract or otherwise, all labor and material essential to the completion of the work specifically excluded from this contract, in such manner as not to delay the progress of the work or damage said Contractor, except where such delays are specifically mentioned elsewhere in the Contract Documents.

3.06 DISCREPANCIES AND OMISSIONS. It is further agreed that it is the intent of this contract that all work must be done and all material must be furnished in accordance with the generally accepted practice, and in the event of any discrepancies between the separate contracts documents, the priority of interpretation defined under "Contract Documents" shall govern. In the event that there is still any doubt as to the meaning and intent of any portion of the contract, specifications or drawings, the Engineer shall define which is intended to apply to the work.

3.07 EQUIPMENT, MATERIALS AND CONSTRUCTION PLANT. The Contractor shall be responsible for the care, preservation, conservation, protection and replacement of all materials, supplies, machinery, equipment, tools, apparatus, accessories, facilities, all means of construction, and any and all parts of the work, whether the Contractor has been paid, partially paid, or not paid for such work, or whether Owner has taken possession of completed portions of such work, until the entire work is completed and accepted.

3.08 PROTECTION AGAINST ACCIDENT TO EMPLOYEES AND THE PUBLIC. The Contractor shall at all times exercise reasonable precautions for the safety of employees and others on or near the work and shall comply with all applicable provisions of Federal, State, and Municipal safety laws and building and construction codes. All machinery and equipment and other physical hazards shall be guarded in accordance with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America except where incompatible Federal, State, or Municipal laws or regulations. The Contractor shall provide such machinery guards, safe walkways, ladders, bridges, gangplanks, and other safety devices. The safety precautions actually taken and their adequacy shall be the sole responsibility of the Contractor, acting at his discretion as an independent contractor.

3.09 PERFORMANCE AND PAYMENT BONDS. Unless otherwise specified, it is further agreed by the parties to this Contract that the Contractor will execute separate performance and payment bonds, each in the sum of one hundred (100) percent of the total contract price, in standard forms for this purpose, guaranteeing faithful performance of the work and the fulfillment of any guarantees required, and further guaranteeing payment to all persons supplying labor and materials or furnishing him any equipment in the execution of the Contract, and it is agreed that this contract shall not be in effect until such performance and payment bonds are furnished and approved by the Owner.

Unless otherwise approved in writing by the Owner, the surety company underwriting the bonds shall be acceptable according to the latest list of companies holding certificates of authority from the appropriate authority of the State of Texas.

Unless otherwise stated, the cost of the premium for the performance and payment bonds shall be included in the Contractor's proposal.

3.10 LOSSES FROM NATURAL CAUSES. Unless otherwise specified, all loss or damage to the Contractor arising out of the nature of the work to be done, or from the action of the elements, or from any unforeseen circumstance in the prosecution of the same, or from unusual obstructions or difficulties which may be encountered in the prosecution of the work, shall be sustained and borne by the Contractor at his own cost and expense.

3.11 PROTECTION OF ADJOINING PROPERTY. The Contractor shall take proper means to protect the adjacent or adjoining property or properties in any wan encountered, which might be injured or seriously affected by any process of construction to be undertaken under this Agreement, from any damage or injury by reason of said process of construction; and he shall be liable for any and all claims for such damage on account of his failure to fully protect all adjoining property. The Contractor agrees to indemnify, save and hold harmless the Owner and Engineer against any claim or claims for damages due to any injury to any adjacent or adjoining property, arising or growing out of the performance of the contract.

3.12 PROTECTION AGAINST CLAIMS OF SUB-CONTRACTORS, LABORERS, MATERIALMEN, AND FURNISHERS OF MACHINERY, EQUIPMENT AND SUPPLIES. The Contractor agrees that he will indemnify and save the Owner and Engineer harmless from all claims growing out of the demands of sub-contractors, laborers, workmen, mechanics, material men and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in the furtherance of the performance of this contract, regardless whether caused wholly or in part by the negligence or gross negligence of any party indemnified hereunder and regardless of the application of any worker's compensation or similar statute which might apply to any employees or agents of the Contractor or any Subcontractor. When so desired by the Owner, the Contractor shall furnish satisfactory evidence that all obligations of the nature hereinabove designated have been paid, discharged or waived. If the Contractor fails so to do, then the Owner may, at its sole option, either pay directly any unpaid bills of which the Owner has written notice and deduct such amount from the next partial payment due to Contractor, or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to liquidate any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged, whereupon payments to the Contractor shall be resumed in full in accordance with the terms of this contract; but in no event shall the provisions of the sentence be construed to impose any obligation upon the Owner by either the Contractor or his Surety.

3.13 PROTECTION AGAINST ROYALTIES OR PATENTED INVENTION. Contractor shall pay all royalties and license fees, and shall provide for the use of any design, device, material or process covered by letters patent or copyright by suitable legal agreement with the patentee or owner. The Contractor shall defend all suits or claims for infringement of any patent or copyright rights and shall indemnify and save the Owner and Engineer harmless from any loss on account thereof, except that the Owner shall defend all such suites and claims and shall be responsible for all such loss when a particular design, device, material or process or the product of a particular manufacturer or manufacturers is specified or required by the Owner; provided, however, if choice of alternate design, device, material or process is allowed to the Contractor, then Contractor shall indemnify and save Owner harmless from any loss on account thereof. If the material or process specified or required by the Owner is an infringement, the Contractor shall be responsible for such loss unless he promptly gives such information to the Owner.

3.14 LAWS AND ORDINANCES. The Contractor shall at all times observe and comply with all Federal, State and local laws, ordinances and regulations, which any manner affect the contract or the work, and shall indemnify and save harmless the Owner and Engineer against any claim arising from the violation of any such laws, ordinances, and regulations whether by the Contractor or his employees, except where such violations are called for by the

provisions of the Contract Documents. If the Contractor observes that the plans and specifications are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he shall bear all costs arising there from. In case the Owner is a body politic and corporate, the law from which it derives its powers, insofar as the same regulates the objects for which, or the manner in which, or the conditions under which the Owner may enter into contract, shall be controlling, and shall be considered as part of this contract, to the same effect as thought embodied herein.

3.15 ASSIGNMENT AND SUBLETTING. The Contractor further agrees that he will retain personal control and will give his personal attention to the fulfillment of this contract and that he will not assign by Power of Attorney, or otherwise, or sublet said contract without the written consent of the Owner, and that no part or feature of the work will be sublet to anyone objectionable to the Engineer or the Owner. The Contractor further agrees that the subletting of any portion or feature of the work, or materials required in the performance of this contract, shall not relieve the Contractor from his full obligations to the Owner, as provided by this Agreement.

3.16 INDEMNIFICATION. The Contractor shall defend, indemnify and hold harmless the Owner and the Engineer and their respective officers, agents and employees, from and against all damages, claims, losses, demands, suits, judgments and costs, including reasonable attorneys' fees and expenses, arising out of or resulting from the performance of the work, provided that any such damages, claim, loss, demand, suit, judgment, cost or expense:

(1) Is attributable to bodily injury, sickness, disease or death or to injury or destruction or tangible property (other than the work itself) including the loss of use resulting there from; and,

(2) Is caused in whole or in part by any negligent act or omission of the Contractor, any Subcontractor, the Owner, anyone directly or indirectly employed by any one of them, or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

The obligation of the Contractor under this Paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, drawings, reports, surveys, Change Orders, designs or specifications, or the giving of or the failure to give directions or instructions by the Engineer, his agents or employees, provided such giving or failure to give is the primary cause of the injury or damage.

3.17 INSURANCE. The Contractor at his own expense shall purchase, maintain and keep in force such insurance as will protect him from claims set forth below which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by any one of them or by anyone for whose acts any of them may be liable, including the acts of Owner:

(1) Workmen's compensation claims, disability benefits and other similar employee benefit acts;

(2) Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees, and claims insured by usual bodily injury liability coverages;

(3) Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees, and claims insured by usual bodily injury liability coverages; and

(4) Claims for damages because of injury to or destruction of tangible property, including loss of use resulting there from.

3.17.1 POLICIES OF INSURANCE. Before commencing any of the work, Contractor shall file with the Owner valid Policies of Insurance acceptable to the Owner and Engineer. Such Policies shall contain a provision that coverages afforded under the Policies will not be canceled until at least thirty days' prior written notice has been given to the Owner.

The Contractor shall also file with the Owner valid Policies of Insurance covering all sub-contractors.

3.17.2 WAIVER OF SUBROGATION. Contractor, its agents, employees and subcontractors, hereby waive any and all rights of subrogation against Owner or Engineer arising out of any claim or incident for which insurance coverage or indemnification is required under the Contract Documents.

4. PROSECUTION AND PROGRESS

4.01 TIME AND ORDER OF COMPLETION. It is the meaning and intent of this contract, unless otherwise herein specifically provided, that the Contractor shall be allowed to prosecute his work at such times and seasons, in such order of precedence, and in such manner as shall be most conducive to economy of construction; provided however, that the order and the time of prosecution shall be such that the work shall be substantially completed as a whole and in part in accordance with this contract, the plans and specifications, and within the time of completion designated in the Proposal; provided, also that when the Owner is having other work done, either by contract or by his own force, the Engineer may direct the time and manner of constructing the work done under this contract, so that conflict will be avoided and the construction of the various works being done for the Owner shall be harmonized.

The Contractor shall submit, at such times as may reasonably be requested by the Engineer, schedules which shall show the order in which the Contractor proposes to carry on the work, with dates at which the Contractor will start the several parts of the work, and estimated dates of completion of the several parts.

4.02 EXTENSION OF TIME. Should the Contractor be delayed in the completion of the work by any act or neglect of the Owner or Engineer, or of any employee of either, or by other contractors employed by the Owner, or by changes ordered in the work, or by strikes, lockouts, fires, and unusual delays by common carriers, or by uncontrollable cause or causes beyond the Contractor's control, and the Engineer decides such cause justifies the delay, then an extension of time sufficient to compensate for the delay as determined by the Engineer shall be allowed for completing the work; provided, however, that the Contractor shall give the Engineer prompt notice in writing of the cause of such delay.

4.03 HINDRANCES AND DELAYS. No clams shall be made by the Contractor for damages resulting from hindrances or delays from any cause (except where the work is stopped by order of the Owner) during the progress of any portion of the work embraced in this contract. In case said work shall be stopped by the act of the Owner, then such expense as in the judgment of the Engineer is caused by such stoppage of said work shall be paid by the Owner to the Contractor.

5. MEASUREMENT AND PAYMENT

5.01 QUANTITIES AND MEASUREMENTS. No extra or customary measurements of any kind will be allowed, but the actual measured and/or computed length, area, solid contents, number and weight only shall be considered, unless otherwise specifically provided.

5.02 ESTIMATED QUANTITIES. This agreement, including the specifications and plans, is intended to show clearly all work to be done and material to be furnished hereunder. Where the estimated quantities are shown for the various classes of work to be done and material to furnished under this contract, they are approximate and are to be used only as a basis for estimating the probable cost of the work and for comparing the proposals offered for the work. It is understood and agreed that the actual amount of work to be done and material to be furnished under this contract may differ somewhat from these estimates.

5.03 PRICE OF WORK. In consideration of the furnishing of all the necessary labor, equipment and material, and the completion of all work by the Contractor, and on the completion of all work and of the delivery of all material embraced in this Contract in full conformity with the specifications and stipulations herein contained, the Owner agrees to pay the CONTRCTOR the prices set forth in the Proposal hereto attached, which has been made a part of this contract. The Contractor hereby agrees to receive such prices in full payment for furnishing all material and all labor required for the aforesaid work, also for all expense incurred by him, and for well and truly performing the same and the whole thereof in the manner and according to this Agreement.

5.04 PARTIAL PAYMENTS. On or before the 25th day or each month, the Contractor shall prepare and submit to the Engineer an application for payment showing as completely as practicable the total value of the work done by the Contractor up to and including the last day immediately preceding the date of such application and the value of all sound materials delivered on the site of the work that are to be fabricated into the work.

The Engineer shall verify Contractor's application, shall either approve or modify the total value of the work done by Contractor and the value of materials delivered on the site, and shall submit to Owner such application for payment as approved or modified with Engineer's verification affixed thereto on or before the 5th days of the month following the receipt of the application from Contractor.

The Owner shall pay the Contractor on or before the 25th day of the month in which the Owner receives the approved application from the Engineer the total amount of the approved and verified application, less five (5) percent of the amount thereof, which five (5) percent shall be retained until final payment, and further less all previous payments and all further sums that may be retained by the Owner under the terms of this Agreement. It is understood, however,

that in case the whole work be near to completion and some unexpected and unusual delay occurs due to no fault or neglect on the part of the Contractor, the Owner may, upon written recommendation of the Engineer, pay a reasonable and equitable portion of the retainage to the Contractor, or the Contractor, at the Owner's option, may be relieved of the obligation to fully complete the work and, thereupon, the Contractor shall receive payment of the balance due him under the contract subject only to the conditions stated under "Final Payment." Any such payments of retainage by Owner to Contractor prior to final payment must be agreed to in writing by the surety or sureties on Contractor's payment and performance bonds.

The Contractor shall submit to the Engineer, copies of the material invoices with the application for payment. No payment will be made to the Contractor until the quantities or work submitted have been checked and verified by the Engineer.

5.05 USE OF COMPLETED PORTIONS. The Owner shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding the time for completing the entire work or such portions may not have expired. Such taking possession and use shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents, nor shall the risk of loss change from Contractor to Owner. If such prior use increases the cost of or delays the work, the Contractor shall be entitled to such extra compensation, or extension of time, or both, as the Engineer may determine.

5.07 FINAL COMPLETION AND ACCEPTANCE. The Contractor shall notify the Engineer when, in the Contractor's opinion, the contract is "substantially completed" and when so notifying the Engineer, the Contractor shall furnish to the Engineer in writing a detailed list of unfinished work. The Engineer will review the Contractor's list of unfinished work and will add thereto such items as the Contractor has failed to include. The substantial completion of the structure or facility shall not excuse the Contractor from performing all of the work undertaken, whether of a minor or major nature, and thereby completing the structure of the facility if accordance with the Contract Documents.

Within ten (10) days after the Contractor has given the Engineer written notice that the work has been completed, or substantially completed, the Engineer and the Owner shall inspect the work and within said time, if the work be found to be completed or substantially completed in accordance with the Contract Documents, the Engineer shall issue to the Owner and the Contractor his Certificate of Completion, and thereupon it shall be the duty of the Owner within ten (10) days to issue a Certificate of Acceptance of the work to the Contractor or to advise the Contractor in writing of the reason for the non-acceptance.

Where the work consists of concrete pavements or concrete base, the "Final Acceptance" will not release the Contractor from responsibility for the thickness of the concrete, which will be determined by means of taking cores from the pavement. The coring of the pavement will be done within 90 days from completion of the pavement.

Final acceptance will not relieve the Contractor from any obligation for replacement or repair of any work or materials due to latent defects of materials or workmanship.

5.08 AFFIDAVIT OF BILLS PAID. Upon completion of the project and final acceptance by the Owner and Engineer, the Contractor shall furnish the Owner with an

affidavit certifying that all suppliers and subcontractors have been paid, before final payment will be made by Owner.

5.09 FINAL PAYMENT. Upon the issuance of the Certificate of Completion, the Engineer shall proceed to make final measurements and prepare a final statement of the value of all work performed and materials furnished under the terms of the Agreement and shall certify same to the Owner. Thereafter, Owner shall pay to the Contractor, on or after the 30th day and before the 35th day, the balance due the Contractor under the terms of this Agreement, provided he has fully performed his contractual obligations under the terms of this contract and provided the Contractor has delivered to the Owner the affidavit of bills paid, and a surety release. Neither the Certificate of Acceptance nor the final payment, nor any provision in the Contract Documents, shall relieve the Contractor of the obligation for fulfillment of any warranty which may be required.

5.10 GUARANTEE AGAINST DEFECTIVE WORK Contractor warrants materials and workmanship and that the work is in conformance with Project Manual and Plans included in this Contract for a period of one year from date of Certificate of Final Acceptance of entire project. Said warranty binds Contractor to correct any work that does not conform to such Project Manual and Plans or defects in workmanship or materials furnished under this Contract which may be discovered within said one-year period. Contractor shall at his own expense correct such defect within 30 days after receiving written notice of such defect from Owner by repairing same to condition called for in the Contract. Should Contractor fail or refuse to repair such defect within said 30 day period or to provide acceptable assurances that such repair work will be completed within a reasonable time thereafter, Owner may repair or cause to be repaired any such defect by calling Contractor's "Performance Bond".

5.10 PAYMENTS WITHHELD. The Owner may, on account of subsequently discovered evidence, withhold or nullify the whole or part of any certificate to such extent as may be necessary to protect him from loss on account of:

(a) Defective work not remedied.
(b) Claims filed or reasonable evidence indicating probable filing of claims.
(c) Failure of the Contractor to make payments properly to subcontractors or for material or labor.
(d) Damage to another contractor.
(e) Reasonable doubt that the work can be completed for the unpaid balance for the contract amount.
(f) Reasonable indication the work will not be completed within the contract time.
(g) Failure to submit "as built" drawings as required by the Contract Documents.

When the above grounds are removed or the Contractor provides a surety bond satisfactory to the Owner, which will protect the Owner in the amount withheld payment shall be made for amounts withheld because of them.

5.11 DELAYED PAYMENTS. Should the Owner fail to make payment to the Contractor of the sum named in any approved partial or final statement, when payment is due, the Owner shall pay to the Contractor, in addition to the sum shown as due by such statement, interest thereon at the rate of six (6) percent per annum, unless otherwise specified, from date due as provided under "Partial Payments" and "Final Payments," until fully paid, which shall

fully liquidate any injury to the Contractor growing out of such delay in payment, but the right is expressly reserved to the Contractor in the event payments be not promptly made, as provided under "Partial Payments." To at any time thereafter treat the contract as abandoned by the Owner and recover compensation, as provided under "Abandonment of Contract," unless such payments are withheld in accordance with the provisions of "Payments Withheld."

6. EXTRA WORK AND CLAIMS

6.01 CHANGE ORDERS. Without invalidating this Agreement, the Owner may, at any time or from time to time, order additions, deletions or revisions to the work; such changes will be authorized by written Change Order prepared by the Engineer for execution by the Owner and the Contractor. The Change Order shall set forth the basis for any change in contract price, as hereinafter set forth for Extra Work, and any change in contract time which may result from the change.

In the event the Contractor shall refuse to execute a Change Order which has been prepared by the Engineer and executed by the Owner, the Engineer may in writing instruct the Contractor to proceed with the work as set forth in the Change Order and the Contractor may make claim against the Owner for Extra Work involved therein, as hereinafter provided.

6.02 MINOR CHANGES. The Engineer may authorize minor changes in the work not inconsistent with the overall intent of the Contract Documents and not involving an increase in Contract Price. If the Contractor believes that any minor change or alteration authorized by the Engineer involves Extra Work and entitles him to an increase in the Contract Price, the Contractor shall make written request to the Engineer for a written Field Order. In such case, the Contractor by copy of his communication to the Engineer or otherwise in writing shall advise the Owner of his request to the Engineer for a written Field Order and that the work involved may result in an increase in the Contract Price.

Any request by the Contractor for a change in Contract Price shall be made in writing in accordance with the provisions of this section prior to beginning g the work covered by the proposed change.

6.03 EXTRA WORK. It is agreed that the basis of compensation to the Contractor for work either added or deleted by a Change Order or for which a claim for Extra Work is made shall be determined by one or more of the following methods:

Method (A) – By agreed unit prices; or
Method (B) – By agreed lump sum; or
Method (C) – If neither method (A) or (B) be agreed upon before the Extra Work is commenced, then the Contractor shall be paid the "actual field cost" of the work, plus fifteen (15) percent.

In the event said Extra Work be performed and paid for under Method (C), then the provisions of this paragraph shall apply and the "actual field cost" is hereby defined to include the cost to the Contractor of all workmen, such as foreman, timekeepers, mechanics and laborers, and materials, supplies, teams, trucks, rentals on machinery and equipment, for the time actually employed or used on such Extra Work, plus actual transportation charges necessarily incurred, together with all power, fuel, lubricants, water and similar operating

expenses, also all necessary incidental expenses incurred directly on account of such Extra Work, including Social Security Old Age Benefits and other payroll taxes, and a ratable proportion of premiums on Performance and Payment Bonds and Maintenance Bonds, Public Liability and Property Damage and Workmen's Compensation, and all other insurance as may be required by any law or ordinance, or directed by the Owner, or by them agreed to. The Engineer may direct the form in which accounts of the "actual field cost" shall be kept and the records of these accounts shall be made available to the Engineer. The Engineer or Owner may also specify in writing, before the work commences, the method of doing the work and the type and kind of machinery and equipment to be used; otherwise these matters shall be determined by the Contractor. Unless otherwise agreed upon, the prices for the use of machinery and equipment shall be determined by using 100 percent, unless otherwise specified, of the latest schedule of Equipment Ownership Expense adopted by the Associated General Contractors of America. Where practicable the terms and prices for the use of machinery and equipment shall be incorporated in the written Change Order. The fifteen percent (15%) of the "actual field cost" to be paid the Contractor shall cover and compensate him for his profit, overhead, general superintendence and field office expense and all other elements of cost and expense not embraced within the "actual field cost" as herein defined; save that where the Contractor's Camp or Field Office must be maintained primarily on account of such Extra Work, then the cost to maintain and operate the same shall be included in the "actual field cost."

No claim for Extra Work of any kind will be allowed unless ordered in writing by the Engineer. In case any orders or instructions, either oral or written, appear to the Contractor to involve Extra Work for which he should receive compensation or an adjustment in the construction time, he shall make written request to the Engineer for written order authorizing such Extra Work. Should a difference of opinion arise as to what does or does not constitute Extra Work, or ass to the payment therefore, and the Engineer insists upon its performance, the Contractor shall proceed with the work after making written request for written order and shall keep an accurate account of the "actual field cost" thereof, as provided under Method (C). The Contractor will thereby preserve the right to submit the matter of payment to a court of general jurisdiction to decide the matter, otherwise the Contractor shall waive all claims for payment for EXTRA WORK.

7. ABANDONMENT OF CONTRACT

7.01 ABANDONMENT BY CONTRACTOR. In case the Contractor should abandon and fail or refuse to resume work within ten (10) days after written notification from the Owner, or the Engineer, or if the Contractor fails to comply with the orders of the Engineer, when such orders are consistent with the Contract Documents, then, and in that case, where performance and payment bonds exist, the Sureties on these bonds shall be notified in writing and directed to complete the work, and a copy of said notice shall be delivered to the Contractor.

After receiving said notice of abandonment, the Contractor shall not remove from the work any machinery, equipment, tools, materials or supplies then on the job, but the same, together with any materials and equipment under contract for the work, may be held for use on the work by the Owner or the Surety on the performance bond, or another contractor in completion of the work; and the Contractor shall not receive any rental or credit therefore (except when used in connection with Extra Work, where credit shall be allowed as provided for under Section 6, Extra Work and Claims), it being understood that the use of such

equipment and materials will ultimately reduce the cost to complete the work and be reflected in the final settlement.

In case the Surety should fail to commence compliance with the notice for completion hereinbefore provided for, within ten (10) days after service of such notice, then the Owner may provide for completion of the work in either of the following elective manners:

7.01.1 The Owner may employ such force of men and use such machinery, equipment, tools, materials and supplies as said Owner may deem necessary to complete the work and charge the expense of such labor, machinery, equipment, tools, materials and supplies to said Contractor, and expense so charged shall be deducted and paid by the Owner out of such moneys as may be due, or that may thereafter at any time become due to the Contractor under and by virtue of this Agreement. In case such expense is less than the sum which would have been payable under this contract, if the same had been completed by the contractor, then said Contractor shall receive the difference. In case such expense is greater than the sum which would have been payable under this contract, if the same had been completed by said Contractor, then the Contractor and/or his Surety shall pay the amount of such excess to the Owner; or

7.01.2 The Owner under sealed bids, after five (5) days notice published one or more times in a newspaper having general circulation in the county of the location of the work, may let the contract for the completion of the work under substantially the same terms and conditions which are provided in this contract. In the case of any increase in cost to the Owner under the new contract as compared to what would have been the cost under this contract, such increase shall be charged to the Contractor and the Surety shall be and remain bound therefore. However, should the cost to complete any such new contract prove to be less than what would have been the cost to complete under this contract, the Contractor and/or his Surety shall be credited therewith.

When the work shall have been substantially completed the Contractor and his Surety shall be so notified and Certificates of Completion and Acceptance, as provided in Paragraph 5.06 hereinabove, shall be issued. A complete itemized statement of the contract accounts, certified to by the Engineer as being correct, shall then be prepared and delivered to the Contractor and his Surety, whereupon the Contractor and/or his Surety, or the Owner as the case may be, shall pay the balance due as reflected by said statement, within fifteen (15) days after the date of such Certificate of Completion.

After final completion of the work and in the event the statement of accounts shows that the cost to complete the work is less than that which would have been the cost to the Owner had the work been completed by the Contractor under the terms of this contract; or when the Contractor and/or his Surety shall pay the balance shown to be due by them to the Owner, then all machinery, equipment, tools, materials or supplies left on the site of the work shall be turned over to the Contractor and/or his Surety. Should the cost to complete the work exceed the contract price, and the Contractor and/or his Surety fail to pay the amount due the Owner within the time designated hereinabove, and there remains any machinery, equipment, tools, materials or supplies on the site of the work, notice thereof, together with an itemized list of such equipment and materials, shall be mailed to the Contractor and his Surety at the respective addresses designated in this contract; provided, however, that actual written notice given in any manner will satisfy this condition. After mailing or other giving of such notice, such property

shall be held at the risk of the Contractor and his Surety subject only to the duty of the Owner to exercise ordinary care to protect such property. After fifteen (15) days from the date of said notice the Owner may sell such machinery, equipment, tools, materials or supplies and apply the net sum derived from such sale to the credit of the Contractor and his Surety. Such sale may be made at either public or private sale, with or without notice, as the Owner may elect. The Owner shall release any machinery, equipment, tools, materials, or supplies, which remain on the work, and belong to persons other than the Contractor or his Surety, to their proper owners.

7.02. ABANDONMENT BY OWNER. In case the Owner shall fail to comply with the terms of this contract within ten (10) days after written notification by the Contractor, then the Contractor may suspend or wholly abandon the work, and may remove there from all machinery, tools and equipment, and all materials on the site of the work that have not been included in payments to the Contractor and have not been wrought into the work. Thereupon the Engineer shall make an estimate of the total amount earned by the Contractor, which estimate shall include the value of all work actually completed by said Contractor, the value of all partially completed work at a fair and equitable price, and the amount of all Extra Work performed at the prices agreed upon, or provided for by the items of this contract, and a reasonable sum to cover the cost of any provisions made by the Contractor to carry the whole work to completion and which cannot be utilized. The Engineer shall then make a final statement of the balance due the Contractor by deducting from the above estimate all previous payments by the Owner and all other sums that may be retained by the Owner under the terms of this Agreement and shall certify same to the Owner who shall pay to the Contractor on or before thirty (30) days after the date of delivery to Owner of such certified final statement.

00900

PREVAILING WAGE DECISION

General Decision Number: TX150016 01/02/2015 TX16

Superseded General Decision Number: TX20140016

State: Texas

Construction Types: Heavy and Highway

Counties: Atascosa, Bandera, Bastrop, Bell, Bexar, Brazos, Burleson, Caldwell, Comal, Coryell, Guadalupe, Hays, Kendall, Lampasas, McLennan, Medina, Robertson, Travis, Williamson and Wilson Counties in Texas.

HEAVY (excluding tunnels and dams, not to be used for work on Sewage or Water Treatment Plants or Lift / Pump Stations in Bell, Coryell, McClennon and Williamson Counties) and HIGHWAY Construction Projects

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of $10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015

* SUTX2011-006 08/03/2011

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER (Paving and Structures)	$ 12.56	
ELECTRICIAN	$ 26.35	
FORM BUILDER/FORM SETTER		
Paving & Curb	$ 12.94	
Structures	$ 12.87	
LABORER		
Asphalt Raker	$ 12.12	
Flagger	$ 9.45	
Laborer, Common	$ 10.50	
Laborer, Utility	$ 12.27	
Pipelayer	$ 12.79	
Work Zone Barricade		

Servicer.....$ 11.85

PAINTER (Structures).....$ 18.34

POWER EQUIPMENT OPERATOR:
Agricultural Tractor.....$ 12.69
Asphalt Distributor.....$ 15.55
Asphalt Paving Machine.....$ 14.36
Boom Truck.....$ 18.36
Broom or Sweeper.....$ 11.04
Concrete Pavement
Finishing Machine.....$ 15.48
Crane, Hydraulic 80 tons
or less.....$ 18.36
Crane, Lattice Boom 80
tons or less.....$ 15.87
Crane, Lattice Boom over
80 tons.....$ 19.38
Crawler Tractor.....$ 15.67
Directional Drilling
Locator.....$ 11.67
Directional Drilling
Operator.....$ 17.24
Excavator 50,000 lbs or
Less.....$ 12.88
Excavator over 50,000 lbs...$ 17.71
Foundation Drill, Truck
Mounted.....$ 16.93
Front End Loader, 3 CY or
Less.....$ 13.04
Front End Loader, Over 3 CY.$ 13.21
Loader/Backhoe.....$ 14.12
Mechanic.....$ 17.10
Milling Machine.....$ 14.18
Motor Grader, Fine Grade....$ 18.51
Motor Grader, Rough.....$ 14.63
Pavement Marking Machine....$ 19.17
Reclaimer/Pulverizer.....$ 12.88
Roller, Asphalt.....$ 12.78
Roller, Other.....$ 10.50
Scraper.....$ 12.27
Spreader Box.....$ 14.04
Trenching Machine, Heavy....$ 18.48

Servicer.....$ 14.51

Steel Worker
Reinforcing.....$ 14.00
Structural.....$ 19.29

TRAFFIC SIGNAL INSTALLER
Traffic Signal/Light Pole
Worker.....$ 16.00

TRUCK DRIVER
Lowboy-Float.....$ 15.66

Off Road Hauler.....$ 11.88
Single Axle.....$ 11.79
Single or Tandem Axle Dump Truck.....$ 11.68
Tandem Axle Tractor w/Semi Trailer.....$ 12.81

WELDER.....$ 15.97

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.)

and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

General Contract Conditions

DEFINITIONS

Whenever used in any of the contract Documents, the following meanings shall be given to the terms here in defined:

A. The term "Contract" means the Contract executed between the (Name of City of Seguin), hereinafter called the City of Seguin and (Name of Construction Co.), hereinafter called Contractor, of which these GENERAL CONDITIONS, form a part.

B. The term "Project Area" means the area within which is the specified Contract limits of the improvements contemplated to be constructed in whole or in part under this contract.

C. The term "Engineer" means the City Engineer or his designated staff.

D. The term "Contract Documents" means and shall include the following: Advertisement for Proposals, Special Instructions, Proposal, signed Agreement, Performance and Payment Bonds, Special Bonds (when required), General Conditions of the Agreement, Technical Specifications, Plans, and al modifications thereof incorporated in any of the documents before the execution of the Agreement.

SUPERVISION BY CONTRACTOR

A. Expect where the Contractor is an individual and gives his personal supervision to the work, the Contractor shall provide a competent superintendent, satisfactory to the City of Seguin and the Engineer, on the work at all times during working hours with full authority to act for him. The contractor shall also provide an adequate staff for the proper coordination and expediting of his work.

B. The Contractor shall lay out his own work and he shall be responsible for all work executed by him under the Contract. He shall verify all figures and elevations before proceeding with the work and will be held responsible for any error resulting from his failure to do so.

SUBCONTRACTS

A. No proposed subcontractor shall be disapproved by the city/county except for cause.

B. The Contractor shall be as fully responsible to the city/county for the acts and omissions of his subcontractors, and of persons either directly or indirectly employed by them.

C. The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work and required compliance by each subcontractor with the applicable provisions of the Contract.

D. Nothing contained in the Contract shall create any contractual relation between any subcontractor and the City of Seguin.

FITTING AND COORDINATION OF WORK

The Contractor shall be responsible for the proper fitting of all work and for the coordination of the operations of all trades, subcontractors, or material suppliers engaged upon this Contract.

PAYMENTS TO CONTRACTOR

A. Partial Payments

1. On or before the 25th day or each month, the Contractor shall prepare and submit to the Engineer an application for payment showing as completely as practicable the total value of the work done by the Contractor up to and including the last day immediately preceding the date of such application and the value of all sound materials delivered on the site of the work that are to be fabricated into work.

   The Engineer shall verify Contractor's application, shall either approve or modify the total value of the work done by the Contractor and the value of Materials delivered to the site, and shall submit to Owner such application for payment as approved or modified with Engineer's verification affixed thereto on or before the 5th days of the month following the receipt of the application from Contractor.

   The Owner shall pay the Contractor on or before the 25th day of the month in which the Owner receives the approved application from the Engineer the total amount of the approved and verified application, less five (5) percent of the amount thereof, which five (5) percent shall be retained until final payment, and further less all previous payments and all further sums that may be retained by the Owner under the terms of this Agreement. It is understood, however, that in case the whole work be near to completion and some unexpected and unusual delay occurs due to no fault or neglect on the part of the Contractor, the Owner may, upon written recommendation of the Engineer, pay a reasonable and equitable portion of the retainage to the Contractor, or the Contractor, at the Owner's option, may be relieved of the obligation to fully complete the work and, thereupon, the Contractor shall receive payment of the balance due him under the contract subject only to the conditions stated under "Final Payment." Any such payments of retainage by Owner to Contractor prior to final payment must be agreed to in writing by the surety or sureties on Contractor's payment and performance bonds.

   The Contractor shall submit to the Engineer, copies of the material invoices with the application for payment. No payment will be made to the Contractor until the quantities or work submitted have been checked and verified by the Engineer.

2. Monthly or partial payments made by the City of Seguin to the Contractor are moneys advanced for the purpose of assisting the contractor to expedite the work of construction. The Contractor shall be responsible for the care and protection of all materials and work upon which payments have been made until final acceptance of such work and materials by the City of Seguin. Such payments shall not constitute a waiver of the right of the City of Seguin to require the fulfillment of all terms of the Contract and the delivery of all improvements embraced in this Contract complete and satisfactory to the City of Seguin in all details.

B. Final Payment

1. After final inspection and acceptance by the City of Seguin of all work under the Contract, the Contractor shall prepare his requisition for final payment which shall be based upon the careful inspection of each item of work at the applicable unit prices stipulated in the Agreement. The total amount of the final payment due the Contractor under this contract shall be the amount computed as described above less all-previous payments.

2. The City of Seguin before paying the final estimate, shall require the Contractor to furnish releases or receipts from all subcontractors having preformed any work and all persons having supplied materials, equipment (installed on the Project) and services to the Contractor, if the City of Seguin deems such action advisable, make payment in part or in full to the Contractor without requiring the furnishing of such releases or receipts and any payments made shall in no way impair the obligations of any surety or sureties furnished under this Contract.

3. Any amount due the City of Seguin under Liquidated Damages shall be deducted from the final payment due the contractor.

C. Payments Subject to Submission of Certificates

Each payment to the Contractor by the City of Seguin shall be made subject to submission by the Contractor or all written certifications required of him and his subcontractors.

D. Withholding Payments

The City of Seguin may withhold from any payment due the Contractor whatever is deemed necessary to protect the City of Seguin, and if so elects, may also withhold any amounts due the Contractor to any subcontractors or material dealers, for work performed or material furnished by them. The foregoing provisions shall be construed solely for the benefit of the City of Seguin and will not require the City of Seguin to determine or adjust any claims or disputes between the Contractor and his subcontractors or material dealers, or to withhold any moneys for their protection unless the City of Seguin elects to do so. The failure or refusal of the City of Seguin to withhold any moneys from the Contractor shall in no way impair the obligations of any surety or sureties under any bond or bonds furnished under this Contract.

CHANGES IN THE WORK

A. The City of Seguin may make changes in the scope of work required to be performed by the Contractor under the Contract without relieving or releasing the Contractor from any of his obligations under the Contract or any guarantee given by him pursuant to the Contract provisions, and without affecting the validity of the guaranty bonds, and without relieving or releasing the surety or sureties of said bonds. All such work shall be executed under the terms of the original Contract unless it is expressly provided otherwise.

B. Except for the purpose of affording protection against any emergency endangering health, life, limb or property, the Contractor shall make no change in the materials used or in the specified manner of constructing and/or installing the improvements or supply additional labor, services or materials beyond that actually required for the execution of the Contract, unless in pursuance of a written order form the City of Seguin authorizing the Contractor to proceed with the change. No claim for an adjustment of the Contract Price will be valid unless so ordered.

C. If applicable unit prices are contained in the Agreement, the City of Seguin may order the Contractor to proceed with desired unit prices specified in the Contract; provided that in case of a unit price contract the net value of all changes does not increase the original total amount of the agreement by more than twenty-five percent (25%) or decrease the original the total amount by eighteen percent (18%) for counties or twenty-five percent (25%) for cities.

D. Each change order shall include in its final form:

1. A detailed description of the change in the work.

2. The Contractor's proposal (if any) or a confirmed copy thereof.

3. A definite statement as to the resulting change in the contract price and/or time.

4. The statement that all work involved in the change shall be performed in accordance with contract requirements except as modified by the change order.

5. The procedures as outlined in this Section for a unit price contract also apply in any lump sum contract.

CLAIMS FOR EXTRA COST

A. If the Contractor claims that any instructions by Drawings or otherwise involve extra cost or extension of time, he shall, within ten days after the receipt of such instructions, and in any event before proceeding to execute the work, submit his protest thereto in writing to the City of Seguin, stating clearly and in detail the basis of his objections. No such claim will be considered unless so made.

B. Claims for additional compensation for extra work, due to alleged errors in ground elevations, contour lines, or bench marks, will not be recognized unless accompanied by certified survey data, made prior to the time the original ground was disturbed, clearly showing that errors exist which resulted, or would result, in handling more material, or performing more work, than would be reasonably estimated from the Drawings and maps issued.

C. Any discrepancies, which may be discovered between actual conditions and those, represented by the Drawings and maps shall be reported at once to the City of Seguin and work shall not proceed except at the Contractor's risk, until written instructions have been received by him from the City of Seguin.

D. If, on the basis of the available evidence, the City of Seguin determines that an adjustment of the Contract Price and/or time is justifiable, a change order shall be executed.

TERMINATION, DELAYS, AND LIQUIDATED DAMAGES

A. Right of the City of Seguin to Terminate Contract.

In the event that any of the provisions of this contract are violated by the Contractor, or by any of his subcontractors, the City of Seguin may serve written notice upon the Contractor and the Surety of its intention to terminate the contract. The notices shall contain the reasons for such intention to terminate the contract, and unless such violation or delay shall cease and satisfactory arrangement of correction be made within ten days, the contract shall, upon the expiration of said ten (10) days, cease and terminate. In the event of any such termination, the City of Seguin shall immediately serve notice thereof upon the Surety and the Contractor. The Surety shall have the right to take over and perform the contract. Provided, however, that is the Surety does not commence performance thereof within ten (10) days from the date of the mailing to such Surety of notice of termination, the City of Seguin may take over the work and complete the project by bid/contract or by force account at the expense of the Contractor and his Surety shall be liable to the City of Seguin for any excess cost incurred. In such event the City of Seguin may take possession of and utilize in completing the work, such materials, appliances, and plant as may be on the site of the work and necessary therefore.

B. Liquidated Damages for Delays.

If the work is not completed within the time stipulated in the applicable bid for Lump Sum or Unit Price Contract provided, the Contractor shall pay to the City of Seguin as fixed, agreed, and liquidated damages (it being impossible to determine the actual damages occasioned by the delay) the amount of ($500.00) for each calendar day of delay, until the work is completed. The Contractor and his sureties shall be liable to the City of Seguin for the amount thereof.

C. Excusable Delays.

The right of the Contractor to proceed shall not be terminated nor shall the Contractor be charged with liquidated damages for any delays in the completion of the work due to:

(1) Any acts of the Government, including controls or restrictions upon or requisitioning of materials, equipment, tools, or labor by reason of war, national defense, or any other national emergency:

(2) Any acts of the City of Seguin:

(3) Causes not reasonably foreseeable by the parties to this Contract at the time of the execution of the Contract which are beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God or of the public enemy, acts of another Contractor in the performance of some other contract with the City of Seguin, fires, floods, epidemics, quarantine, restrictions, strikes, freight embargoes, and weather of unusual severity such as hurricanes, tornadoes, cyclones and other extreme weather conditions.

Provided, however, that the Contractor promptly notifies the City of Seguin within then (10) days in writing of the cause of the delay. Upon receipt of such notification, the City of Seguin shall ascertain the facts and the cause and extent of delay. If, upon the basis of the facts and the terms of this contract, the delay is properly excusable, the City of Seguin shall extend the time for completing the work for a period of time commensurate with the period of excusable delay.

ASSIGNMENT OR NOVATION

The Contractor shall not assign or transfer, whether by an assignment or novation, any of its rights, duties, benefits, obligations, liabilities, or responsibilities under this Contract without the written consent of the City of Seguin; provided, however, that assignment to banks or other financial institutions may be made without the consent of the City of Seguin. No assignment or notation of this Contract shall be valid unless the assignment or notation expressly provides that the assignment of any of the Contractor's rights or benefits under the Contract is subject to a prior lien for labor performed, services rendered, and materials, tools, and equipment supplied for the performance of the work under this Contract in favor of all persons, firms, or corporations rendering such labor or services or supplying such materials, tools, or equipment.

DISPUTES

A. All disputes arising under this Contract or its interpretation except those disputes covered by **FEDERAL LABOR STANDARDS PROVISIONS** whether involving law or fact or both, or extra work, and all claims for alleged breach of contract shall, within ten (10) days of commencement of the dispute, be presented by the Contractor to the City of Seguin for decision. Any claim not presented within the time limit specified in this paragraph shall be deemed to have been waived, except that if the claim is of a continuing character and notice of the claim is not given within ten (10) days of its commencement, the claim will be considered only for a period commencing then (10) days prior to the receipt of the City of Seguin.

B. The Contractor shall submit in detail his claim and his proof thereof.

C. If the Contractor does not agree with any decision of the City of Seguin, he shall in no case allow the dispute to delay the work but shall notify the City of Seguin promptly that he is proceeding with the work under protest.

TECHNICAL SPECIFICATIONS AND DRAWINGS

Anything mentioned in the Technical Specifications and not shown on the Drawings or vice versa, shall be of like effect as if shown on or mentioned in both. In case of difference between Drawings and Technical Specifications, the Technical Specifications shall govern. In case of any discrepancy in Drawings, or Technical Specifications, the matter shall be immediately submitted to the City of Seguin, without whose decision, said discrepancy shall not be adjusted by the Contractor, save only at his own risk and expense.

SHOP DRAWINGS

A. All required shop drawings, machinery details, layout drawings, etc. shall be submitted to the Engineer in six (6) copies for approval sufficiently in advance of requirements to afford ample time for checking, including time for correcting, resubmitting and rechecking if necessary. The Contractor may proceed, only at his own risk, with manufacture or installation of any equipment or work covered by said shop drawings, etc. until they are approved and no claim, by the Contractor, for extension of the contract time shall be granted by reason of his failure in this respect.

B. Any drawings submitted without the Contractor's stamp of approval will not be considered and will be returned to him for proper resubmission. If any drawings show variations from the requirements of the Contract because of standard shop practice or other reason, the Contractor shall make specific mention of such variation in his letter of transmittal in order that, if acceptable, suitable action may be taken for proper adjustment of contract price and/or time, otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract even though the drawings have been approved.

C. If a shop drawing is in accordance with the contract or involves only a minor adjustment in the interest of the City of Seguin not involving a change in contract price or time; the engineer may approve the drawing. The approval shall not relieve the Contractor from his responsibility for adherence to the contract or for any error in the drawing.

REQUESTS FOR SUPPLEMENTARY INFORMATION

It shall be the responsibility of the Contractor to make timely requests of the City of Seguin for any additional information not already in his possession which should be furnished by the City of Seguin under the terms of this Contract, and which he will require in the planning and execution of the work. Such requests may be submitted from time to time as the need approaches, but each shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay. Each request shall be in writing, and list the various items and the latest date by which each will be required by the Contractor. The first list shall be submitted within two weeks after Contract award and shall be as complete as possible at this time. The Contractor shall, if requested, furnish promptly any assistance and information the Engineer may require in responding to these requests of the Contractor. The Contractor shall be fully responsible for any delay in his work or to others arising from his failure to comply fully with the provision of this section.

MATERIALS AND WORKMANSHIP

A. Unless otherwise specifically provided for in the technical specifications, all workmanship, equipment, materials and articles incorporated in the work shall be new and the best grade of the respective kinds for the purpose. Where equipment, materials, articles or workmanship are referred to in the technical specifications as "equal to" any particular standard, the Engineer shall decide the question of equality.

B. The Contractor shall furnish to the City of Seguin for approval the manufacturer's detailed specifications for all machinery, mechanical and other special equipment, which he contemplates installing together with full information as to type, performance characteristics, and all other pertinent information as required, and shall likewise submit for

approval full information concerning all other materials or articles which he proposes to incorporate.

C. Machinery, mechanical and other equipment, materials or articles installed or used without such prior approval shall be at the risk of subsequent rejection.

D. Materials specified by reference to the number or symbol of a specific standard, shall comply with requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Invitation for Bids, except as limited to type, class or grade, or modified in the technical specifications shall have full force and effect as though printed therein.

E. The City of Seguin may require the Contractor to dismiss from the work such employee or employees as the City of Seguin or the Engineer may deem incompetent, or careless, or insubordinate.

SAMPLES, CERTIFICATES AND TESTS

A. The Contractor shall submit all material or equipment samples, certificates, affidavits, etc., as called for in the contract documents or required by the Engineer, promptly after award of the contract and acceptance of the Contractor's bond. No such material or equipment shall be manufactured or delivered to the site, except at the Contractor's own risk, until the required samples or certificates have been approved in writing by the Engineer. Any delay in the work caused by late or improper submission of samples or certificates for approval shall not be considered just cause for an extension of the contract time.

B. Each sample submitted by the Contractor shall carry a label giving the name of the Contractor, the project for which it is intended, and the name of the producer. The accompanying certificate or letter from the Contractor shall state that the sample complies with contract requirements, shall give the name and brand of the product, its place of origin, the name and address of the producer and all specifications or other detailed information which will assist the Engineer in making a prompt decision regarding the acceptability of the sample. It shall also include the statement that all materials or equipment furnished for use in the project will comply with the samples and/or certified statements.

C. Approval of any materials shall be general only and shall not constitute a waiver of the City of Seguin's right to demand full compliance with Contract requirements. After actual deliveries, the Engineer will have such check tests made as he deems necessary in each instance and may reject materials and equipment and accessories for cause, even though such materials and articles have been given general approval. If materials, equipment or accessories which fail to meet check tests have been incorporated in the work, the Engineer will have the right to cause their removal and replacement by proper materials or to demand and secure such reparation by the Contractor as is equitable.

D. All testing of materials required under these specifications shall be performed by an approved agency for testing materials. The Contractor shall make the nomination of the laboratory and the payment for such services. The Contractor will pay for any retest required because of failure of the initial test.

PERMITS AND CODES

A. The Contractor shall give all notices required by and comply with all applicable laws, ordinances, and codes of the local Governments. All construction work and/or utility installations shall comply with all applicable ordinances, and codes including all written waivers. Before installing any work, the Contractor shall examine the drawings and technical specifications for compliance with applicable ordinances and codes and shall immediately report any discrepancy to the City of Seguin. Where the requirements of the drawings and technical specifications fail to comply with such applicable ordinances or codes, the City of Seguin will adjust the Contract by Change Order to conform to such ordinances or codes (unless waivers in writing covering the difference have been granted by the governing body or department) and make appropriate adjustment in the Contract Price or stipulated unit prices.

   Should the Contractor fail to observe the foregoing provisions and proceed with the construction and/or install any utility at variance with any applicable ordinance or code, including any written waivers (notwithstanding the fact that such installation is in compliance with the drawings and technical specifications), the Contractor shall remove such work without cost to the City of Seguin.

B. The Contractor shall at his own expense, secure and pay for all permits for street pavement, sidewalks, shed, removal of abandoned water taps, sealing of house connection drains, pavement cuts, buildings, electrical, plumbing, water, gas and sewer permits required by the local regulatory body or any of its agencies.

C. The Contractor shall comply with applicable local laws and ordinances governing the disposal of surplus excavation, materials, debris and rubbish on or off the Project Area and commit no trespass on any public or private property in any operation due to or connected with the improvements contained in this Contract.

CARE OF WORK

A. The Contractor shall be responsible for all damages to person or property that occur as a result of his fault or negligence in connection with the prosecution of the work and shall be responsible for the proper care and protection of all materials delivered and work performed until completion and final acceptance.

B. The Contractor shall provide sufficient competent watchmen, both day and night, including Saturdays, Sundays, and holidays, from the time the work is commenced until final completion and acceptance.

C. In an emergency affecting the safety of life, limb or property, including adjoining property, the Contractor, without special instructions or authorization from the City of Seguin is authorized to act at his discretion to prevent such threatened loss or injury, and he shall so act. He shall likewise act if instructed to do so by the City of Seguin.

D. The Contractor shall avoid damage as a result of his operations to existing sidewalks, streets, curbs, pavements, utilities (except those which are to be replaced or removed),

adjoining property, etc., and he shall at his own expense completely repair any damage thereto caused by his operations.

E. The Contractor shall shore up, brace, underpin, secure, and protect as maybe necessary, all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be in any way affected by the excavations or other operations connected with the construction of the improvements included in this Contract. The Contractor shall be responsible for the giving of any and all required notices to any adjoining or adjacent property owner or other party before the commencement of any work. The Contractor shall indemnify and save harmless the City of Seguin from any damages on account settlements or the loss of lateral support of adjoining property and from all loss or expense and all damages for which the City of Seguin may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

ACCIDENT PREVENTION

A. No laborer or mechanic employed in the performance of this Contract shall be required to work in surroundings or under working conditions, which are unsanitary, hazardous, or dangerous to his health or safety, are determined under construction safety and health standards promulgated by the Secretary of Labor.

B. The Contractor shall exercise proper precaution at all times for the protection of persons and property and shall be responsible for all damages to persons or property, either on or off the site, which occur as a result of his prosecution of the work.

C. The Contractor shall maintain an accurate record of all cases of death, occupational disease, or injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract. The Contractor shall promptly furnish the City of Seguin with reports concerning these matters.

D. The Contractor shall indemnify and save harmless the City of Seguin from any claims for damages resulting from property damage, personal injury and/or death suffered or alleged to have been suffered by any person as a result of any work conducted under this contract.

E. The Contractor shall provide trench protection for all trenches in an excess of a depth of five (5) feet, in the manner specified in the technical specifications and drawings.

F. The Contractor shall at all times conduct his work in such a manner as to insure the least possible inconvenience to vehicular and pedestrian traffic. At the close of the work each day, all streets where possible in the opinion of the City of Seguin, shall be opened to the public in order that persons living in the area may have access to their homes or businesses by the use of streets. Barricades, warning signs, and necessary lighting shall be provided to the satisfaction of the City of Seguin at the expense of the Contractor.

SANITARY FACILITIES

The Contractor shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, a sufficient number of enclosed temporary toilets shall be conveniently placed as required. Drinking water shall be provided from an approved source, so piped or transported as to keep it safe

and fresh and served from single service containers or satisfactory types of sanitary drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing and governing health regulations.

USE OF PREMISES

A. The Contractor shall confine his equipment, storage of materials, and construction operations to the contract limits as shown on the drawings and as prescribed by ordinances or permits, or as may be desired by the City of Seguin, and shall not unreasonably encumber the site or public rights of way with his materials and construction equipment.

B. The Contractor shall comply with all reasonable instructions of the City of Seguin and all existing state and local regulations regarding signs, advertising, traffic, fires, explosives, danger signals, and barricades.

REMOVAL OF DEBRIS, CLEANING, ETC.

The Contractor shall, periodically or as directed during the progress of the work, remove and legally dispose of all surplus excavated material and debris, and keep the Project Area and public rights of way reasonably clear. Upon completion of the work, he shall remove all temporary construction facilities, debris and unused materials provided for work, and put the whole site of the work and public rights of way in a neat and clean condition.

INSPECTION

A. All materials and workmanship shall be subject to inspection, examination, or test by the City of Seguin and Engineer at any and all times during manufacture or construction and at any and all places where such manufacture or construction occurs. The City of Seguin shall have the right to reject defective material and workmanship or require its correction. Unacceptable workmanship shall be satisfactorily corrected. Rejected material shall be promptly segregated and removed from the Project Area and replaced with material of specified quality without charge. If the Contractor fails to proceed at once with the correction of rejected workmanship or defective material, the City of Seguin may be contract or otherwise have the defects remedied or rejected materials removed from the Project Area and charge the cost of the same against any Monies which may be due the Contractor, without prejudice to any other rights or remedies of the City of Seguin.

B. The Contractor shall furnish promptly all materials reasonably necessary for any tests, which may be required. All tests by the City of Seguin will be performed in such manner as not to delay the work unnecessarily and will be made in accordance with the provisions of the technical specifications.

C. The Contractor shall notify the City of Seguin sufficiently in advance of back filling or concealing any facilities to permit proper inspection. If any facilities are concealed without approval or consent of the City of Seguin, the Contractor shall uncover for inspection and recover such facilities at his own expense, when so requested by the City of Seguin.

D. Should it be considered necessary or advisable by the City of Seguin at any time before final acceptance of the entire work to make an examination of work already completed by uncovering the same, the Contractor shall on request promptly furnish all necessary facilities, labor, and material. If such work is found to be defective in any important or essential respect, due to fault of the Contractor or his subcontractors, the Contractor shall defray all the expenses of such examination and of satisfactory reconstruction. If, however, such work if found to meet the requirements of the Contract, the actual cost of labor and material necessarily involved in the examination and replacements, shall be allowed the Contractor and he shall, in addition, if completion of the work of the entire Contract has been delayed thereby, be granted a suitable extension of time on account of the additional work involved.

E. Inspection of materials and appurtenances to be incorporated in the improvements included in this Contract may be made at the place of production, manufacture or shipment, whenever the quantity justifies it, and such inspection and acceptance, unless otherwise stated in the technical specifications, shall be final, except as regards (1) latent defects, (2) departures from specific requirements of the Contract, (3) damage or loss in transit, or (4) fraud or such gross mistakes as amount to fraud. Subject to the requirements contained in the preceding sentence, the inspection of materials as a whole or in part will be made at the Project Site.

F. Neither inspection, testing, approval nor acceptance of the work in whole or in part, by the City of Seguin or its agents shall relieve the Contractor or his sureties of full responsibility for materials furnished or work performed not in strict accordance with the Contract.

REVIEW BY CITY OF SEGUIN

The City of Seguin and its authorized representatives and agents shall have access to and be permitted to observe and review all work, materials, equipment, payrolls, personnel records, employment conditions, material invoices, and other relevant data and records pertaining to this Contract, provided, however that all instructions and approval with respect to the work will be given to the Contractor only by the City of Seguin through its authorized representatives or agents.

FINAL INSPECTION

When the improvements included in this Contract are substantially completed, the Contractor shall notify the City of Seguin in writing that the work will be ready for final inspection on a definite date, which shall be stated in the notice. The City of Seguin will make the arrangements necessary to have final inspection commenced on the date stated in the notice, or as soon thereafter as is practicable.

DEDUCTION FOR UNCORRECTED WORK

If the City of Seguin deems it not expedient to require the Contractor to correct work not done in accordance with the Contract Documents, an equitable deduction from the Contract Price will be made by agreement between the Contractor and the City of Seguin and subject to settlement, in case of dispute, as herein provided.

INSURANCE

The Contractor shall not commence work under this contract until he has obtained all the insurance required as described in Attachment A.

The Vendor will procure and maintain at its expense insurance with insurance companies authorized to do business in the State of Texas, covering all operations under this Agreement, whether performed by the Vendor or its agents, subcontractors or employees. Before commencing the work the Vendor will furnish to the City an original certificate or certificates in a form satisfactory to the City.

The Vendor shall not cause any insurance policy to be cancelled or permit it to lapse, and all insurance policies shall include an endorsement to the effect that the insurance policy shall not be subject to cancellation or to a reduction in the required limits of liability or amounts of insurance until notice has been mailed to the City of Seguin, ATTN: Purchasing Manager, P.O. Box 591, Seguin, TX 78156-0591. The notice shall state the date when such cancellation or reduction shall be effective. The cancellation date shall not be less than thirty (30) days after such notice.

Commercial general liability and motor vehicle insurance will be written with the City as an additional insured and will be endorsed to provide a waiver of the carrier's right of subrogation against the City. The types and amounts of insurance required are set forth in Attachment A.

WARRANTY OF WORKMANSHIP AND MATERIALS

Neither the final certificate of payment nor any provision in the Contract nor partial or entire use of the improvements included in this Contract by the City of Seguin or the public shall constitute an acceptance of work not done in accordance with the Contract or relieve the Contractor of liability in respect to any express warranties or responsibility for faulty materials or workmanship. The Contractor shall promptly remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within a period of 12 months from the date of final acceptance of the work.

COMPLIANCE WITH AIR AND WATER ACTS

In compliance with the Clean Air Act, as amended, 41 U.S.C. Sec. 7401 et. seq., and the regulations of the Environmental Protection Agency with respect thereto, the Contractor agrees that:

1. Any facility to be utilized in the performance of this contract or any subcontract shall not be a facility listed on the EPA List of Violating Facilities pursuant to 40 CFR 15.20.

2. He will comply with all requirements of Section 114 of the Clean Air Act, as amended.

EQUAL EMPLOYMENT OPPORTUNITY

A. The Contractor will not discriminate against any employee or the applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such

action shall include, but not be limited to the following: employment, promotion, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms or compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Owner.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

C. The Contractor will cause the foregoing provisions to be inserted in all subcontracts for any work covered by this contract so that such provisions will be binding upon each subcontractor, provided that the foregoing provisions shall not apply to contracts or subcontracts for standard commercial supplies or raw materials.

D. The Contractor shall take affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions.

E. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts.

F. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents.

AFFIRMATIVE ACTION FOR HANDICAPPED WORKERS

The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise threat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, promotion, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

NON SEGREGATED FACILITIES

The Contractor certifies that he does not and will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not and will not permit his employees any segregated facilities at any of his establishments, or permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. As used in this paragraph the term "segregated facilities" means any waiting rooms, work areas, rest rooms and washrooms, restaurants and other eating areas, time clocks, locker room and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise.

JOB OFFICES

A. The Contractor and his subcontractors may maintain such office and storage facilities on the site as are necessary for the proper conduct of the work. These shall be located so as to cause no interference to any work to be performed on the site. The City of Seguin shall be consulted with regard to locations.

B. Upon completion of the improvements, or as directed by the City of Seguin, the Contractors shall remove all such temporary structures and facilities from the site, and leave the site of the work in the condition required by the Contract.

PARTIAL USE OF SITE IMPROVEMENTS

The City of Seguin may give notice to the Contractor and place in use those sections of the improvements which have been completed, inspected and can be accepted as complying with the technical specifications and if in its opinion, each such section is reasonably safe, fit, and convenient for the use and accommodation for which it was intended, provided:

A. The use of such sections of the improvements shall in no way impede the completion of the remainder of the work by the Contractor.

B. The Contractor shall not be responsible for any damages or maintenance costs due directly to the use of such sections.

C. The period of guarantee stipulated in the Section 132 hereof shall not begin to run until the date of the final acceptance of all work which the Contractor is required to construct under this Contract.

CONTRACT DOCUMENTS AND DRAWINGS

The City of Seguin will furnish the Contractor without charge 2 copies of the Contract Documents, including Technical Specifications and Drawings. Additional copies requested by the Contractor will be furnished at cost.

CONTRACT PERIOD

The work to be performed under this contract shall commence within the time stipulated by the City of Seguin in the Notice to Proceed, and shall be fully completed within 60 calendar days thereafter.

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor or other person doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 1491, 80th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code by a person who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the person meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. *See* Section 176.006, Local Government Code.

A person commits an offense if the person knowingly violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

OFFICE USE ONLY

Date Received

1 **Name of person who has a business relationship with local governmental entity.**

2 ☐ **Check this box if you are filing an update to a previously filed questionnaire.**

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

3 **Name of local government officer with whom filer has employment or business relationship.**

_____

Name of Officer

This section (item 3 including subparts A, B, C & D) must be completed for each officer with whom the filer has an employment or other business relationship as defined by Section 176.001(1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the filer of the questionnaire?

☐ Yes ☐ No

B. Is the filer of the questionnaire receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer named in this section AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

C. Is the filer of this questionnaire employed by a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership of 10 percent or more?

☐ Yes ☐ No

D. Describe each employment or business relationship with the local government officer named in this section.

4

_____ _____

Signature of person doing business with the governmental entity **Date**

Adopted 06/29/2007

ATTACHMENT A
(Revised 2/18/14)

INSURANCE

SECTION A. Prior to the approval of this contract by the City, CONTRACTOR shall furnish a completed Insurance Certificate to the Purchasing office. The certificate shall be completed by an agent authorized to bind the named underwriter(s) to the coverages, limits, and termination provisions shown thereon, and shall furnish and contain all required information referenced or indicated thereon. CITY SHALL HAVE NO DUTY TO PAY OR PERFORM UNDER THIS CONTRACT UNTIL SUCH CERTIFICATE IS RECEIVED BY THE CITY OF SEGUIN'S PURCHASING DEPARTMENT, and no officer or employee of the City shall have authority to waive this requirement.

INSURANCE COVERAGE REQUIRED

SECTION B. CITY reserves the right to review the insurance requirements of this section during the effective period of the contract and to adjust insurance coverages and their limits when deemed necessary and prudent by CITY, based upon changes in statutory law, court decisions, or the claims history of the industry as well as the CONTRACTOR.

SECTION C. Subject to CONTRACTOR'S right to maintain reasonable deductibles in such amounts as are approved by CITY, CONTRACTOR shall obtain and maintain in full force and effect for the duration of this contract, and any extension hereof, at CONTRACTOR'S sole expense, insurance coverage written by companies approved by the State of Texas and acceptable to CITY, in the following type(s) and amount(s):

	TYPE	AMOUNT
1.	**Workers' Compensation and Employer's Liability**	Statutory

NOTE: For building or construction projects, and services provided at City-owned facilities, the successful Contractor shall meet the minimum requirements defined in the Texas Workers' Compensation Commission Rule 28 TAC §110.110 which follows this insurance attachment.

2. **Commercial General (public) Liability** including coverage for the following:

a.	Premises operations	Combined single limit for bodily injury and and property damage of $500,000 per occurrence or its equivalent with an aggregate limit of $1,000,000.
b.	Independent contractors	
c.	Products/completed operations	
d.	Personal injury	
e.	Advertising injury	
f.	Contractual liability	
g.	Medical payments	
h.	Professional liability*	
i.	Underground hazard*	
j.	Explosion and collapse hazard*	
k.	Liquor liability*	
l.	Fire legal liability*	
m.	City's property in Contractor's* care, custody, or control	
n.	Asbestos specific liability*	

* **Not required for this contract**

3. **Comprehensive Automobile Liability** insurance, including coverage for loading and unloading hazards, for: — Combined single limit for bodily injury and property damage of $500,000 per occurrence or equivalent.

a. Owned/leased vehicles
b. Non-owned vehicles
c. Hired vehicles

4.	**Errors and Omissions** insurance policy (when applicable)	Provide a prudent amount of coverage for the willful or negligent acts or omissions of any officers, employees or agents thereof.

ADDITIONAL POLICY ENDORSEMENTS

CITY shall be entitled, upon request, and without expense, to receive copies of the policies and all endorsements thereto and may make any reasonable request for deletion, revision, or modification of particular policy terms, conditions, limitations, or exclusions (except where policy provisions are established by law or regulation binding upon either of the parties hereto or the underwriter of any of such policies). Upon such request by CITY, CONTRACTOR shall exercise reasonable efforts to accomplish such changes in policy coverages, and shall pay the cost thereof.

REQUIRED PROVISIONS

CONTRACTOR agrees with respect to the above required insurance, all insurance contracts and certificate(s) of insurance will contain and state, in writing, on the certificate or its attachment, the following required provisions.

a. Name the City of Seguin and its officers, employees, and elected representatives as an Additional Insured(s), (as the interest of each insured may appear) to all applicable coverage.

b. Provide for 30 days notice to City for cancellation, non-renewal, or material change.

c. Provide for notice to City at the address shown below by registered mail.

d. CONTRACTOR agrees to waive subrogation against the City of Seguin, its officers, employees, and elected representatives for injuries, including death, property damage, or any other loss to the extent same may be covered by the proceeds of insurance.

e. Provide that all provisions of this agreement concerning liability, duty, and standard of care together shall be underwritten by contractual liability coverage sufficient to include such obligations within applicable policies.

f. For coverages that are **only** available with claims made policies, the required period of coverage will be determined by the following formula: Continuous coverage for the life of the contract, plus one year (to provide coverage for the warranty period) and an extended discovery period for a minimum of five years which shall begin at the end of the warranty period.

NOTICES

CONTRACTOR shall notify CITY in the event of any change in coverage and shall give such notices not less than thirty (30) days prior to the change, which notice must be accompanied by a replacement CERTIFICATE OF INSURANCE. All notices shall be given to CITY at the following address:

Purchasing Department
City of Seguin
P.O. Box 591
Seguin, Texas 78156

SECTION D. Approval, disapproval, or failure to act by CITY regarding any insurance supplied by CONTRACTOR shall not relieve CONTRACTOR of full responsibility or liability for damages and accidents as set forth in the contract documents. Neither shall the bankruptcy, insolvency, or denial of liability by the insurance company exonerate CONTRACTOR from liability.

WORKERS COMPENSATION INSURANCE
for
Building or Construction Projects and Services Provided at City-Owned Facilities

TEXAS WORKERS' COMPENSATION COMMISSION RULE 28 § 110.110

****

As required by the Texas Workers' Compensation Rule 28, §110.110, the Contractor shall accept the following definitions and comply with the following provisions:

Workers' Compensation Insurance Coverage

A. Definitions:

1. Certificate of coverage ("certificate")-A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

2. Duration of the project-includes the time from the beginning of the work on the project until the Contractor's/person's work on the project has been completed and accepted by the City of Seguin.

3. Persons providing services on the project ("subcontractor" in Section 406.096) - includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent Contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

B. The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

C. The Contractor must provide a certificate of coverage to the City of Seguin prior to being awarded the contract.

D. If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the City of Seguin showing that coverage has been extended.

E. The Contractor shall obtain from each person providing services on a project, and provide to the City of Seguin:

1. A certificate of coverage, prior to that person beginning work on the project, so the City of Seguin will have on file certificates of coverage showing coverage for all persons providing services on the project; and

2. No later than seven (7) days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

F. The Contractor shall retain all required certificates of coverage for the duration of the project and for one (1) year thereafter.

G. The Contractor shall notify the City of Seguin in writing by certified mail or personal delivery, within ten (10) days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

H. The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and

stating how a person may verify coverage and report lack of coverage.

I. The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

1. Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;

2. Provide to the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.

3. Provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

4. Obtain from each other person with whom it contracts, and provide to the Contractor:

   a. A certificate of coverage, prior to the other person beginning work on the project; and

   b. A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

5. Retain all required certificates of coverage on file for the duration of the project and for one (1) year thereafter;

6. Notify the City of Seguin in writing by certified mail or personal delivery, within ten (10) days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

7. Contractually require each person with whom it contracts, to perform as required by paragraphs (1) - (7), with the certificates of coverage to be provided to the person for whom they are providing services.

J. By signing this contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the City of Seguin that all employees of the Contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

K. The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the City of Seguin to declare the contract void if the Contractor does not remedy the breach within ten (10) days after receipt of notice of breach from the City of Seguin.

As defined by the Texas Labor Code, Chapter 269, Section 406.096(e), building or construction is defined as:

1. Erecting or preparing to erect a structure, including a building, bridge, roadway, public utility facility, or related appurtenance;

2. Remodeling, extending, repairing, or demolishing a structure; or

3. Otherwise improving real property or an appurtenance to real property through similar activities.

The employment of a maintenance employee who is not engaging in building or construction as the employer's primary business does not constitute engaging in building or construction.

CITY OF SEGUIN
INSURANCE REQUIREMENT AFFIDAVIT

To be Completed By Appropriate Insurance Agent

and submitted with bid proposal.

I, the undersigned Agent/Broker, certify that the insurance requirements contained in this bid document have been reviewed by me with the below identified Contractor. If the below identified Contractor is awarded this contract by the City of Seguin, I will be able to, within ten (10) days after being notified of such award, furnish a valid insurance certificate to the City meeting all of the requirements defined in this bid.

_____ _____

Agent (Signature) Agent (Print)

Name of Agency/Broker: _____

Address of Agent/Broker: _____

City/State/Zip: _____

Agent/Broker Telephone #: (_____) _____

CONTRACTOR'S NAME: _____
(Print or Type)

NOTE TO AGENT/BROKER

If this time requirement is not met, the City has the right to invalidate the bid award and award the contract to the next lowest bidder meeting specifications. Should an awarded bid be invalidated the Contractor may be liable for breach of contract. If you have any questions concerning these requirements, please contact the Purchasing Manager for the City of Seguin at (830) 401-2451

GENERAL CONDITIONS OF BIDDING

These general conditions apply to any procurement of products or services by the City of Seguin. Failure to comply with these General Conditions of Bidding may result in the bid being disqualified.

1. **DEFINITION OF TERMS**

A. "Bid documents" mean the entire packet of documents provided to bidders, including, but not limited to the General Conditions of Bidding, General and/or Technical Specifications, Special and Supplementary Conditions, Information to Bidders, Bid Form(s) and any Addendum.

B. "Bidder" means a person or firm submitting a bid, proposal, or quote to provide equipment, material, and/or services necessary in the performance of these specifications, and competing for award of a contract.

C. "Bid" or "Proposal" means an offer to perform or provide the requirements specified herein. "Furnish" or "provide" means to supply, equip, and deliver the specified equipment, material and/or services to the Purchaser.

D. "Formal Bid" is a formally advertised solicitation for acquiring goods, services, and construction that requires a public opening of sealed bids or proposals, generally $50,000 or more.

E. "Informal Bid" is a competitive bid or price quotation for supplies or services under $50,000 that is conveyed by letter, telephone, or other means and does not require a sealed bid, public opening, or public reading of bids.

F. "City", "Purchaser", or" Owner" shall refer to the City of Seguin, PO Box 591, Seguin, Texas 78156-0591.

G. "Contract" means the contract awarded pursuant to this solicitation.

H. "Contractor" or "Vendor" means the bidder to which a contract award has been made by the City.

I. "Purchase Order" means the document issued by the City that creates a legal binding contract between the City and the Contractor and authorizes the Contractor to ship goods pursuant to the contract.

2. **SUBMISSION OF BIDS**

A. All bids must be on blank forms furnished by the Purchasing Department and must be written in ink or typed. Pencil quotations will not be considered. Proposals must be submitted on the forms or in the format called for in specifications. Each must be executed personally by the bidder, or if executed by an agent, a power of attorney or other evidence of his authority to act on behalf of the bidder must accompany the bid. If the bidder is a corporation, the certificate of corporate bidder must be executed under the corporate seal by some duly authorized officer of the corporation other than the officers signing the bid. By execution of the bid, the bidder accepts all general and special conditions of the contract and the specifications.

B. Formal sealed bids and proposals must be received at the date, time, and place specified in the bid document packaged in a sealed envelope (8 1/2" x 11" minimum) clearly marked with the bid or project name, bid number, and date/time of opening, unless otherwise specified. An early postmark will not suffice. Bids and proposals will be publicly opened and read followed by evaluation and award at a later

date. **Formal bids and proposals ($50,000 or higher) may NOT be faxed or submitted via e-mail.**

C. Informal bids are due at the date, time, and place stated in the bid document. **Informal bids (less than $50,000) may be faxed or submitted via e-mail.**

D. Each Bidder agrees that its price will remain firm and subject to acceptance by the City for a period of sixty (60) calendar days from the bid opening date. The prices quoted in the bid shall not be subject to escalation except where otherwise clearly indicated by the Bidder or by the City in bid documents. The basis for the escalation shall be clearly indicated in either case.

E. All information required by the bid documents will be furnished. The bidder will print or type its name, in ink, and manually sign the bid sheet. The bid sheet, with original signatures, must be submitted.

F. All prices shall be quoted as required in the specifications. Unit prices will be shown when called for on the bid sheet, and where there is a conflict between the unit price show and the total price shown, the unit price will govern.

G. No change in price will be considered after bids have been opened. The City reserves the right to negotiate prices as submitted by proposal as allowed by state statute.

H. In case of ambiguity or lack of clarity in stating prices in the bid, Purchaser reserves the right to adopt the price written in words or reject the bid. Any ambiguity in the bid as a result of omission, error, unintelligible or illegible wording shall be construed in the favor of the City.

I. If this bid is altered, any erasure or alteration of figures on the item on which the erasure or alteration is made must be initialed by signee of this bid.

J. The City reserves the right to extend the bid closing time and date. Notification will be made by addendum.

K. The City reserves the right to increase or decrease the quantity specified, unless the bidder specified otherwise.

3. WITHDRAWAL OF BIDS

A. A Bidder may withdraw a bid before Council acceptance of the bid without prejudice to himself by a written request addressed to the Purchasing Manager.

B. If there is an honest mistake in the bid, due to clerical errors, and the bidder calls attention thereto promptly, the bidder will not be bound by the bid.

C. When the mistake was a result of a bidder's negligence, and City has no knowledge of the mistake when bids were opened, and awarded a contract based on the bid, bidder will not be released and shall be bound by the bid.

D. If a mistake is not discoverable and verifiable by the City, bidder's incorrect interpretation of Engineering specifications set forth in a construction contract will not release him from his obligations, once a contract has been awarded by City Council and bidder has received notice of such award.

4. GENERAL CONDITIONS

Bidders will submit their bids or proposals upon the following express conditions:

A. Bidders shall thoroughly examine all drawings, specifications, plans, schedules, instructions, and all other contract documents pertaining to this bid.

B. Bidders shall make all investigations necessary to thoroughly inform themselves regarding plant and facilities for delivery of materials or equipment as required by the bid conditions. No plea of ignorance by the Bidder of conditions that exist or that may hereafter exist as a result of failure or omission on the part of the Bidder to make the necessary examinations and investigations will be accepted as a basis for varying the requirements of the City or the compensation to the vendor.

C. If any bidder is in doubt as to the true meaning of the specifications, other bid documents, or any part thereof, they may submit a written request for clarification to the Purchasing Manager. A request for clarification should be submitted by the deadline, if any, indicated in the specifications.

D. All materials, equipment, supplies which are new, non-standard to the City of Seguin, and/or items which are to be listed as an alternate or exception must be pre-approved PRIOR to placing them on a bid proposal. In order to fairly evaluate all bids, sufficient time requirements for possible field testing or demonstrations should be allowed.

E. Bidders are advised that City contracts are subject to all legal requirements under Local, State and Federal statutes, ordinances, and regulations. Any bid, after being opened, becomes subject to the Public Information Act, Government Code Chapter 552; therefore bidders must clearly indicate any portion of the submitted bid that the bidder claims is not subject to public inspection under the Public Information Act.

F. No officer or employee of the City shall have a financial interest, direct or indirect, in any contract with the City, or shall benefit financially, directly or indirectly, in the sale to the City of any materials, supplies or services, except on behalf of the City as an officer or employee.

G. The City of Seguin is committed to maintaining fair and open competition as required by local, state, and federal laws and statutes. Every effort is made to maintain the highest level of ethical conduct in every aspect of the procurement process. Sharp business practices or high-pressure tactics will not be tolerated. Qualification and selection of vendors is based on those vendors who share the same high standards of ethical conduct.

5. DESCRIPTION OF GOODS

A. Any catalog or manufacturer's reference in this bid is merely descriptive, and not restrictive, unless otherwise noted, and is used only to indicate type and quality of material. Any such references are made a part of these contract documents as if incorporated verbatim herein.

B. The term "Or Equal", if used, is intended to allow substitution of a brand which has all the essential performance, features, reliability, and other salient characteristics as the brand name and model stated in the item description. "Or Equal" is intended to establish a level of quality and function and is not to be interpreted as a preference for a particular brand. Other brands meeting these minimum requirements will be accepted. Bid submitted on an "Or Equal" item must clearly identify the proposed product, the quantity of the product, model, and type, as applicable.

C. Alternate bids will not be considered unless expressly authorized by the bid documents.

6. PREPARATION OF BID

Bidders will prepare bids in accordance with the following:

A. Specifications are written to encourage competition. The specifications herein shall be the basis of comparison between bidders. There is no intent to discriminate against any supplier or vendor but rather, to set a definite standard of performance. Bidders are required to quote services and/or equipment that will meet or exceed the minimum or maximum specifications herein.

B. Any omission in the specifications of any minor requirement necessary to make each unit complete and functional shall not relieve the Supplier of responsibility to furnish any material or equipment necessary.

C. The City reserves the right to request clarification to assist in evaluating the bidder's response when the bid response is unclear with respect to product pricing, packaging or other factors. The information provided is not intended to change the bid response in any fashion and such information must be provided within two days from request.

D. Bidders shall not include federal taxes nor State of Texas limited sales, excise and use taxes in bid prices since the City of Seguin is exempt from payment of such taxes under section 151.309 of the Texas Tax Code.

E. By submitting a bid, each bidder certifies that it is a duly qualified, capable, and bondable business entity, that it is not in or contemplating bankruptcy or receivership and that it is not currently delinquent with respect to payment of taxes assessed by any political subdivision.

F. By submitting a bid, each bidder certifies that it does not currently owe any money to the City.

G. The City is exempt from the Federal Excise and Transportation Tax, and the Limited Sales and Use Tax. Unless the bid form or specification specifically indicates otherwise, the price bid must be net exclusive of the above mentioned taxes, and will be so construed.

H. Prompt payment discounts will not be considered in determining low bids and making awards.

7. BID DEPOSIT

No bid deposit will be expected of bidder UNLESS specifications expressly provide otherwise. If a bid bond is required, the submitted bond may be in the form of a cashier's check, cash, a certified check made payable to the City of Seguin or an original bond submitted in the form required by the City in the Bid Documents. The bond shall be executed by a surety authorized by the Texas State Insurance Commission and must be signed by both the surety and the bidder. Should a bid deposit be presented in a form not acceptable to the City, the bid will not be considered.

8. EXCEPTIONS

If Bidder takes exceptions to any provisions of the specifications, the exceptions must be specifically and clearly identified by section in Bidder's bid, and Bidder's proposed alternative must also be provided in the bid. Bidders cannot take a 'blanket exception' to the entire bid document.

9. ADDENDA

Any clarification or interpretation of the bid, if made, will be made only by written addendum issued through the Purchasing Department and signed by the City of Seguin Purchasing Manager. A copy of such Addendum will be mailed or delivered to each person receiving bids. Addenda to the bid documents may be issued in response to a request for clarification or objection, or for any other reason the City considers advisable. Once issued, an addendum becomes a part of the bid documents. All addenda can be viewed and downloaded at the City's website: www.seguintexas.gov. It is the bidder's responsibility to check this site to determine if the City has issued any addenda. The City will not be

responsible for any other explanation or interpretation of the bid made or given prior to the award of the contract.

10. REJECTION OF BIDS

A. The City of Seguin reserves the right to accept or reject any or all bids, and to waive any informalities and technicalities. The City of Seguin shall consider all factors it believes to be relevant in selecting the offer that provides the best value for the City including, but not limited to, the offered price. Causes for bidder disqualification and rejection of bids may include, but shall not be limited to:

1. Bidder's current inability to satisfactorily perform the work or service, or the bidder's previous failure to properly and timely perform its obligations under a contract with the City. Purchaser may make such investigation as is deemed necessary to determine the ability of the Bidder to provide the equipment, material, and/or services as required by this specification and to determine the adequacy of the proposed equipment, material, and/or services. The Bidder shall furnish, upon request, all such data and information requested for this purpose. The information provided is not intended to change the bid response in any fashion and such information must be provided within two days from request.

2. Bidder's current violation of any City ordinance.

3. Bidder's misstatement or concealment of any material fact in the bid.

4. Bid or proposal's nonconformance to law or the requirements of the bid specifications.

5. Failure to use or properly complete the bid/proposal form furnished by the City of Seguin.

6. Lack of signature by an authorized representative on the proposal form.

7. Alteration of bid form.

8. Evidence of collusion among proposers.

9. Omission of proposal guarantee (if required).

10. In the event that a bidder is, or subsequently becomes, delinquent in the payment of his, her or its City taxes, including state and local sales taxes, or any other City financial obligation, such fact shall constitute grounds for rejection of the bid, or if awarded the bid, for cancellation of the contract.

11. AWARD

A. The City reserves the right to award a bid or contract to the lowest responsible bidder or to the bidder who provides goods or services at the "best value" for the City. Factors to be considered in the evaluation of the bids are price, quality, reputation and experience of Bidder, past relationship with City, long term cost, safety record, operating history of equipment, conformance to specifications, delivery, and other factors as deemed appropriate by the Purchaser.

B. The City reserves the right to reject or accept all or any combination of bids deemed advantageous to the City.

C. The City reserves the right to reject or accept all or any combination of base bid plus alternative bids when alternate bids are called for in bid documents, subject to available funding.

D. Contractor is an independent contractor. Award of a contract does not create a joint venture between the Contractor and the City.

12. CONTRACT

A. City's Bid Documents combined with the Vendor's response (bid or proposal) submitted to and accepted by the City, constitutes a contract between the City of Seguin and the selected vendor at the time the Seguin City Council awards the contract to such vendor.

B. No further documentation is required, although the contracting parties may supplement the

contract with further documentation. By submitting a bid or proposal, the vendor agrees to comply with the Terms and Conditions and other requirements set forth in the Bid Documents and to be further bound to the representations and information the vendor provides in the response.

C. Acceptance of bidder's offer may be in the form of a "Notice of Award", a Purchase Order (P.O.) or a "Contract".

13. RESERVATIONS

THE CITY EXPRESSLY RESERVES THE RIGHT TO ACCEPT, REJECT OR CANCEL ANY AND ALL BIDS and:

A. Waive any defect, irregularity, or informality in any bid or bidding procedure;

B. Reissue a bid invitation or proposal;

C. Procure any item by other allowable means;

D. Waive minor deviations from the specifications when a bid meets the intent of the specifications and consider such bid if it is determined the bid's total cost is lower, the purpose for the bid is improved or not impaired, the bid amounts to the best value for the City, and/or the waiver otherwise results in a measurable benefit on behalf of the City.

E. Extend any contract when most advantageous to the City as provided by original contract conditions.

14. WARRANTIES

A. WARRANTY FOR PRODUCT: The Contractor warrants to the City that all goods delivered will conform to the specifications, drawings, or other descriptions furnished or incorporated by reference, will be of merchantable quality, good workmanship, free from defects, and fit for all purposes specified in this contract. The Contractor shall not Limit or exclude any implied warranties, and any attempt to do so shall render this contract voidable at the option of the City. The Contractor will provide copies of applicable warranties or guarantees to the Purchasing Manager. The City may return goods not meeting applicable warranties to the Contractor at the Contractor's expense.

B. WARRANTY FOR PRICE: The City will pay the price for goods specified by the Contractor's bid. The Contractor warrants its price to be no higher than the Contractor's current prices or charges on orders by others for products or services of the kind and specification covered by this bid contract for similar quantities under similar or like conditions and methods of purchase. In the event Contractor breaches this warranty, the prices or charges shall be reduced to Contractor's current prices or charges on orders by others, or in the alternative, City may cancel this contract without liability to Contractor for breach or Contractor's actual expense.

C. SAFETY WARRANTY: Contractor warrants that the goods sold to the City conform to the standards promulgated by the U.S. Department of Labor under the Occupational Safety and Health Act (OSHA) as amended. In the event the goods do not so conform, the Contractor must correct or replace the goods at the Contractor's expense. If the Contractor fails to do so within a reasonable time, the City, at its discretion, may cause the correction to be made at the Contractor's expense, or may return the goods at the Contractor's expense and terminate this contract.

15. PROTESTS

A. The City Council is the final authority on issues relating to this contract. The Purchasing Manager is the City's representative in the award and administration of this contract, and will issue and receive

all documents, notices, and correspondence.

B. Any protest to the City's consideration of any bid must be submitted in writing and delivered to the City of Seguin, ATTN: Purchasing Manager.

C. The protest may be delivered in person to the Purchasing office located at 816 Fred Byrd Drive, Seguin, Texas, or by certified mail, return receipt requested, to the following address: City of Seguin, Purchasing Department, ATTN: Purchasing Manager, PO Box 591, Seguin, Texas 78156-0591.

D. The written protest must include the following information before it may be considered by the City:

1. Name, mailing address, and business phone number of the protesting party;
2. Identification of the bid or proposal being protested;
3. A precise and concise statement of the reason/reasons for the protest which should provide enough factual information to enable the City to determine the basis of the protest;
4. Any documentation or other evidence supporting the protest.

E. The Purchasing Department, in conjunction with the department responsible for the bid or proposal solicitation, will attempt to resolve the protest, including, at the City's option, meeting with the protesting party. If the protest is successfully resolved by mutual agreement, written verification of the resolution of each ground addressed in the protest will be provided to the City Manager. If the Purchasing Department is unable to resolve the protest, the protesting party may request the protest be reviewed and resolved by the City Manager.

F. A request for the City Manager's review must be in writing and received by the Purchasing Department within three (3) business days from the date the Purchasing Department informs the protesting party the protest cannot be resolved. The request for review must be delivered in person to the Purchasing Department at the address stated above or by certified mail, return receipt requested, to the mailing address stated above. If the protesting party fails or refuses to request a review by the City Manager within the three (3) days, the protest is deemed finalized and no further review by the City is required. Applicable documentation and other information applying to the protest may be submitted by the protesting party to the Purchasing Department before review by the City Manager. If the protesting party requests a review by the City Manager, such documentation will be forwarded to the City Manager for consideration. The City Manager may likewise notify the protesting party or any City department to provide additional information.

G. The decision reached by the City Manager will be final, but the protesting party may still appear before the City Council during the hearing of citizens' session.

16. SHIPMENT & DELIVERY

A. Bidder is to quote its lowest and best price F.O.B. Destination on each item to shipping location in Seguin, Texas unless otherwise specified in the bid documents. Pricing shall include packaging, transportation, unloading, and any trade and cash discounts, which may be taken if earned.

B. The bidder certifies all materials, parts, and equipment supplied or represented in response to this bid shall be new and unused unless noted elsewhere in the bid documents.

C. The title and risk of loss of the goods will not pass to the City until receipt and acceptance takes place at the FOB point. The City department receiving deliveries or issuing purchase orders under this contract will inspect and accept any and all deliveries made and may reject those items which are

damaged or which do not conform to the specifications. The Contractor is responsible for the proper labeling, packing, and delivery to final destination, including replacement of rejected deliveries at no additional cost.

D. Delivery dates pertaining to this specification must be clearly stated in the bid form where required. The bidder will clearly state in the bid the time required for delivery upon receipt of contract or purchase order. Failure to specify delivery date or state unrealistically short or long delivery dates may cause the bid to be disqualified. Proposed delivery time must be specific and such phrases "as required", "as soon as possible", or "prompt" may result in disqualification of the bid.

E. Vendor must keep the City advised as to the status of the delivery. When delivery delay can be foreseen, the Vendor shall give prior notice to the City.

F. Default in promised delivery, without acceptable reasons, or failure to meet specifications without remedy shall cause the City to purchase the goods elsewhere, and charge any increase in cost and handling to the defaulting vendor. This does not limit any other remedies to the City for damage entitled under the Uniform Commercial Code.

17. REJECTIONS

A. Delivered articles not in accordance with samples and specifications must be removed by the bidder at his expense. All disputes concerning quality of supplies delivered under this proposal will be determined by the City's Purchasing Manager or his/her designated representative.

B. All articles enumerated in the proposal shall be subject to inspection or delivery by an officer designated for the purpose and if found inferior to the quality called for, or not equal in value to the department's samples, or deficient in weight, measurements, workmanship or otherwise, this fact shall be reported to the Purchasing Manager who shall have the right to reject the whole or any part of the same.

18. PAYMENTS

A. Payment of invoices by the City shall be made thirty (30) days after receipt and acceptance of all equipment or performance of services covered by each purchase order or following the receipt of an accurate invoice, whichever is later, in compliance with state statute. Bidder shall state his bid in accordance with the standard payment terms and conditions of the City of Seguin of Net 30 days. All bids must be stated in terms of dollars and cents, the bidder's lowest, best, and final price.

B. Invoices submitted or otherwise used pursuant to the bid awarded under this IFB shall be presented to the City in the following form and content:

1. Each invoice must reference the City of Seguin contract, agreement, or P.O. number;
2. Only one contract, agreement, or project shall be billed on a particular invoice;
3. Each invoice must have a billing or invoice number and an Invoice Total.

C. The invoice requirements stated herein shall not be read to disallow or exclude other information that may be otherwise required or requested by the City. Such information required herein must be submitted only on an invoice and not in any other non-invoice form or document.

19. ASSIGNMENT

No right or interest in the contract shall be assigned, nor delegation of any obligation made by Vendor without the written permission of the City. Any attempted assignment or delegation by Vendor shall be wholly void and totally ineffective for all purposes unless made in conformity with this paragraph.

20. WAIVER

No claim or right arising out of a breach of this contract can be discharged in whole or in part by a waiver or renunciation of the claim or right unless the waiver or renunciation is supported by consideration and is in writing signed by the aggrieved party.

21. FORCE MAJEURE

In the event that the performance by either party of any of its obligations under this contract is interrupted or delayed by events outside of their control such as acts of God, war, riot, or civil commotion, then the party is excused from such performance for the period of time reasonably necessary to remedy the effects of the events.

22. GRATUITIES

The City may, by written notice to the Vendor, cancel this contract without liability to the City if it is determined by the City that gratuities have been offered to any officer or employee of the City with a view toward securing a contract, securing favorable treatment with respect to the awarding, amending, or the making of any determinations in respect to the performance of such a contract. In the event City, as set forth in this paragraph, cancels this contract the City shall be entitled to recover from the Vendor all additional costs incurred by City as a result of the cancellation.

23. TERMINATION

A. DEFAULT: Failure by either party to perform any of its provisions will constitute a default and breach of contract, in which case, the other party may require corrective action within 10 days from the date the defaulting party receives written notice citing the nature of the breach. Failure of the defaulting party to take corrective action or to provide a satisfactory written reply excusing such failure within the prescribed 10 days will authorize the other party to terminate this agreement by written notice.

B. CONVENIENCE: The City reserves the right to terminate this contract upon 30 days written notice for any reason deemed by the City Council to serve the public interest. Termination for convenience will not be made when termination is authorized under any other provisions of this contract. In the event of such termination the City will pay the Contractor those costs directly attributable to supplies obtained in compliance with the contract prior to termination. Provided, however, that no costs will be paid to the Contractor which are recoverable in the normal course of doing business. The City is not liable for loss of any profits anticipated to be made hereunder.

C. FUNDING: The City retains the right to terminate this contract at the expiration of each of City's budget periods. This contract is conditioned on a best efforts attempt by City to obtain and appropriate funds for payment of any debt due by City herein.

D. FUNDING OUT: The State of Texas statutes prohibit the obligation and expenditure of public funds beyond the fiscal year for which a budget has been approved. Should, during the term of this contract, funds be withdrawn by the funding authority, a Force Majeur shall be deemed to exist, and this contract may be terminated without penalty or recourse by either party.

24. ENTIRETY OF AGREEMENT/AMENDMENTS

This represents the entire agreement between the parties relating to the subject matter of this contract. Any prior agreements, promises, negotiations, or representations between the parties are not binding unless included in this contract. All amendments to this contract must be in writing and executed by both parties.

25. SEVERABILITY

In case any one or more of the provisions contained in this contract is held to be invalid or unenforceable in any respect by a court of proper jurisdiction, the invalidity, illegality or unenforceability will not affect any other provision of this contract, and this contract will be construed as if the invalid or unenforceable provision was not contained herein.

26. INSURANCE

If required, specific insurance provisions will be included in bid specifications. An original, certified copy of an insurance certificate must be submitted within ten days from request. The successful vendor will be required to maintain, at all times during performance of the contract, the insurance detailed in bid specifications. Failure to provide this document may result in disqualification of bid.

27. INDEMNITY

The Vendor will indemnify, hold harmless and defend the City and its employees, agents, officers and servants from any and all lawsuits, claims, demands and causes of action of any kind arising from the negligent or intentional acts errors or omissions of the Vendor, its officers, employees or agents. This will include, but not be limited to, the amounts of judgments, penalties, interest, court costs, reasonable legal fees, and all other expenses incurred by the City arising in favor of any party, including the amounts of any damages or awards resulting from claims demands and causes of action for personal injuries, death or damages to property alleged or actual infringement of patents, copyrights, and trademarks and without limitation by enumeration, all other claims, demands, or causes of action of every character occurring, resulting, or arising from any negligent or intentional wrongful act, error or omission of the Vendor or its agents or employees. This obligation by the Vendor will not be limited by reason of the specification of any particular insurance coverage required under this Agreement.

28. PATENTS

The bidder agrees to indemnify and save harmless the City, the Purchasing Manager, and his/her assistants from all suits and actions of every nature and description brought against it or any of them, for or on account of the use of patented appliances, products or processes, and he shall pay all royalties and charges which are legal and equitable. Evidence of such payment or satisfaction shall be submitted, upon request of the Purchasing Manager, as a necessary requirement in connection with the final estimate for payment in which such patented appliances, products or processes are used.

29. CONFIDENTIALITY

The City of Seguin is governed by the Public Information Act ("The Act"), Chapter 552 of the Texas Government Code. All information submitted by prospective bidders during the bidding process is subject to release under The Act. On each page where proprietary information appears, information considered confidential must be labeled. Failure to so label the proprietary or confidential information shall be considered as a waiver of any confidentiality rights or interests. Disclosure of requested information will be determined in accordance with the Texas Public Information Act. You are not encouraged to submit such data and information unless it is absolutely required to understand and evaluate your response. If such data and information is submitted, you agree that the City shall not be liable for disclosure of such data and information and hereby release the City from any liability. In the event a request for public information is filed with the City which involves information labeled as confidential, you will be notified by the City of the request so that you will have an opportunity to contact the Attorney General as to why such information should not be released.

30. ANTI-LOBBYING PROVISION

Bidders are prohibited from directly or indirectly communicating with City Council members regarding the Bidder's qualifications or any other matter related to the eventual award of a contract for the

services requested under this Invitation for Bids. Bidders are prohibited from contacting City staff members regarding their qualifications or the award of a contract, unless in response to an inquiry from a staff member. Any violation will result in immediate disqualification of the Bidder from the selection process.

Upon issuance of the Invitation for Bids, all bidder communications and requests for clarification or objections shall be directed in writing to the Purchasing Manager for response, determination and dissemination to all bidders. Any communication by bidders or their representatives toward other city officers or employees regarding this Invitation for Bids or the award of a contract are prohibited and will constitute grounds for disqualification of a proponent. A lobbyist or a proponent or any of their agents may not do any act or refrain from any act for the express purpose and intent of placing any City official under personal obligation to the lobbyist or proponent.

31. CONFLICT OF INTEREST

A person or vendor seeking to contract with the City must file a Conflict of Interest Questionnaire (CIQ) if the person has a business relationship with the City, and either: has a business relationship with a city official or a city official's family member; or has given a gift worth more than $250 to a city official or city official's family member within the previous 12-month period. A vendor required to file a CIQ must do so with the City Secretary within seven business days of: (1) beginning contract discussions with the city; (2) submitting to the City an application, response to a request for proposals or bid; or (3) learning of the existence of the applicable business relationship. Vendors should see Texas Local Government Code Chapter 176 in an effort to determine its applicability. The conflict of interest questionnaire form is included herein and is available from the Texas Ethics Commission at www.ethics.state.tx.us.

32. LOCAL VENDOR PREFERENCE POLICY

Texas Local Government Code, Sections 271.905(a) and 271.9051 allow the City to consider a vendor's principal place of business in awarding certain contracts by way of competitive bids. This consideration is in effect to promote economic development opportunities through the contract by employing local residents and increasing tax revenue. The City of Seguin applies a local vendor preference to bids in compliance with state statute.

33. NOTICES

All notices called for or required by this agreement will be addressed to Purchasing Manager, City of Seguin, 205 N. River Street, Seguin, Texas 78155, or such other party or address as either party designates in writing, by certified mail, postage pre-paid, or by hand delivery, and will be effective five days after mailing.

34. QUESTIONS

Questions regarding interpretation of specifications, bids, bid results or bid awards should be directed in writing to the Buyer or Purchasing Technician indicated in the General and/or Technical Specifications, or the Purchasing Manager, twood@seguintexas.gov and be referenced by bid number.

TECHNICAL SPECIFICATIONS
GENERAL INFORMATION

1.1 SCOPE AND SEQUENCE OF WORK. This project consists of old sidewalk and curb removal, new sidewalk and curb construction, and construction of a commercial driveway. It is the intent of the plans and specifications to describe a completed work to be performed under the contract. Unless otherwise provided, the Contractor shall furnish all materials, supplies, tools, equipment, supervision and labor necessary for the proper prosecution and completion of the work.

General Sequence of Work:

- **A.** Barricades, traffic handling and lane closures.
- **B.** SWPPP Installation.
- **C.** Removal of existing concrete sidewalk, curb, ramps, etc.
- **D.** Excavation/grading.
- **E.** Valve, sewer clean out, and meter box adjustments.
- **F.** Install new sidewalks, ramps, driveways, railing, etc.
- **G.** Clean up.

Note: No Demolition or construction work along West Nolte Street shall begin before January 2nd, 2016. This work schedule requirement is intended to avoid any potential conflicts with vehicular or pedestrian traffic within the construction zone during the Christmas holiday shopping season.

1.2 PERMITS, CERTIFICATES, LAWS AND ORDINANCES. The Contractor shall, at his own expense, procure any and all permits, certificates and licenses required of him by law for the execution of his work. The Owner will furnish permits from the Texas Department of Highways and Public Transportation and railroad companies for crossing their properties with utility extensions if such are required.

1.3 MANUFACTURER'S CERTIFICATES. All manufacturers' certificates required herein are to be furnished by the Contractor at his own expense.

1.4 BOUNDARIES OF WORK. The Owner will provide land and rights-of-way for the work specified in this contract and make suitable provisions for ingress and egress and the Contractor shall not enter on or occupy with men, tools, equipment, or materials, any ground outside the property of the Owner without the written permission of the Owner of such ground. Other contractors and employees or agents of the Owner may for all necessary purposes enter upon the work and premises used by the Contractor, and the Contractor shall conduct his work so as not to impede unnecessarily any work being done by others on or adjacent to the site.

1.5 PROTECTION OF THE SITE. The Contractor shall protect all structures, walks, pipelines, trees, shrubbery, lawns and other improvements during the progress of his work and shall remove from the site all debris and unused materials.

1.6 TESTING OF MATERIALS. All testing of materials required under these specifications shall be performed by an approved agency for testing materials. The Contractor shall make the nomination of the laboratory and the payment for such services. The Contractor will pay for any retest required because of failure of the initial test.

1.7 REJECTED/DEFECTIVE MATERIALS. All materials not conforming to the requirements of these specifications will be rejected and shall be removed immediately from the site of the work..

1.8 HAULING OF MATERALS. Any vehicle, truck, truck-tractor, trailer or semi-trailer or combination of such vehicles, when used to deliver materials to a project shall comply with the State laws concerning the gross weight of such vehicle or combinations of vehicles and load and the allowable axle weights, unless authorized by permit to exceed the legal weight.

1.9 DETAIL PLANS. Detail plans for construction are furnished herewith and make a part of these specifications, the same as if they were written herein.

1.10 EXAMINATION OF SITE OF THE PROJECT. Prospective bidders shall make a careful examination of the site of the project, soil and water conditions to be encountered, improvements to be protected, disposal sites for surplus material not designated to be salvage materials, and as to methods of providing ingress and egress to private properties.

1.11 QUANTITIES. The quantities of each item on the bid proposal blank represent the approximate amount of work to be done. Final quantities actually completed will be determined and paid for by actual measurements on the ground of the final work completed. No incidental items or work will be paid for unless there appears an item in the proposal for such work. It must be strictly understood that the prices bid are for complete and acceptable work.

1.12 FAILURE TO COMPLETE ON TIME. The time of completion is the essence of the contract. For each calendar day that any work shall remain uncompleted after the time specified in the proposal and the contract, or the increased time granted by the Owner, or as automatically increased by additional work or materials ordered after the contract is signed, the sum of $500.00 per day will be deducted from the monies due the Contractor, not as a penalty but as liquidated damages.

This sum of money thus deducted for such delay, failure or non-completion is not to be considered as a penalty, but it shall be deemed, taken and treated as reasonable liquidated damages, since it would be impractical and extremely difficult to fix the actual damages and the Owner may withhold from the Contractor's compensation such sum as liquidated damages.

Prior to commencing construction of the project, the Contractor shall furnish for approval to the Engineer and Owner a tentative construction schedule showing the Contractor's intended sequence of work together with approximate dates for commencing and completing the principle units of work.

1.13 TREE DAMAGES. The protection of existing trees within the right-of-way and on private property is the essence of the contract. For each tree that any work shall damage or

destroy, the amount per tree shall be $500.00. This will be deducted from the monies due the Contractor, not as a penalty but as liquidated damages. In addition the Contractor shall replace the tree with a caliper-inch to caliper-inch replacement.

This sum of money thus deducted for such failure to protect the trees is not to be considered as a penalty, but it shall be deemed, taken and treated as reasonable liquidated damages, since it would be impractical and extremely difficult to fix the actual damages and the Owner may withhold from the Contractor's compensation such sum as liquidated damages.

1.14 MATERIALS. The Contractor shall furnish all materials for a complete job as shown on the plans and as required by the specifications.

1.15 EXISTING STRUCTURES. The plans show the locations of all known surface and subsurface structures. However, the Engineer assumes no responsibility for failure to show any or all of the structures on the plans or to show them in their exact location. It is mutually agreed that such failure to show these structures will not be considered sufficient basis for claims for additional compensation for extra work or for increasing the pay quantities in any manner whatsoever, unless the obstruction encountered is such as to necessitate changes in the lines or grades, or requires the building of special work, provisions for which are not made in the plans and proposal, in which case the provisions in these specifications for extra work shall apply

1.16. COMPETENT WORKERS. The Contractor shall employ only competent workers for the execution of this work and all such work shall be performed under the direct supervision of an experiences superintendent.

1.17 TERMINATION OF CONTRACT IN CASE OF NATIONAL EMERGENCY. Whenever, because of a national emergency so declared by the President of the United States or other lawful authority, it becomes impossible for the Contractor to obtain al of the necessary labor, material and equipment for the prosecution of the work with reasonable continuity for a period of two months, the Contractor shall within seven days notify the Owner in writing, giving a detailed statement of the efforts which have been made and listing all necessary items of labor, material and equipment not obtainable. If after investigation, the Owner finds that such conditions exist and that the inability of the Contractor to proceed is not attributable in whole or in part to the fault or neglect of the Contractor, then in the Owner cannot after reasonable effort assist the Contractor in procuring and making available the necessary labor, materials, and equipment within thirty days, the Contractor may request the Owner to terminate the contract and the Owner shall within thirty days comply with the request, and the termination shall be based on a final settlement, which shall include, but not be limited to , the payment for all work executed.

1.18 COPIES OF PLANS AND SPECIFICATIONS Four (4) sets of the Plans and Specifications shall be furnished to the Contractor, without charge, for construction purposes. Additional copies may be obtained from the Engineer at actual reproduction cost. One (1) additional set of plans shall be marked and returned to the Engineer as "RECORD" drawings.

1.19 MATERIALS AND WORKMANSHIP. The Contractor shall furnish all materials for a complete job as shown on the plans and as required by the specifications.

Where materials or equipment are specified by a trade or brand name, it is not the intention of the Owner to discriminate against an equal produce or another manufacturer, but rather to set a definite standard of performance and to establish an equal basis for the evaluation of bids. Where the words "equivalent", "proper", or "equal to" are used, they shall be understood to mean that the article or process is equal, in the opinion or judgment of the Engineer, to the article or process specified by name. Unless otherwise specified, all materials shall be the best of their respective kinds and shall be in all cases fully equal to approved samples. Notwithstanding that the words "or equal to" or other such expressions are used in the specifications, the material, manufactured article or process specifically designated shall be used unless a substitute shall be approved in writing by the Engineer, and the Engineer shall have the right to require the use of such specifically designated material, article or process.

The Contractor should note that his bid will be based on the material, manufactured article or process specifically designated in the specificatons.

1.20 CONTRACTOR'S INSURANCE

1.20.1 Contractor's Liability Insurance

Without limiting any of the other obligations or liabilities of the Contractor, the Contractor and each subcontractor, at their own expense, shall, during the term of the contract, purchase and maintain the hereinafter stipulated minimum insurance with companies duly authorized to do business in the State of Texas and satisfactory to the Owner. Certificates of each policy, together with a statement by the issuing company to the extent policy shall not be cancelled without thirty (30) days' prior notice being given the Owner, shall be delivered to the Owner before any work is started:

(a) Employers liability insurance a minimum of $1,000,000 combined single limit,

(a) Comprehensive General Liability Insurance, including independent contractor's liability, completed operations and contractual liability, covering, but not limited to, the liability assumed under the indemnification provisions of this contract, fully insuring Contractor's (or subcontractor's) liability for injury to or death of Owner's employees and third parties, extended to include personal injury liability coverage, and for damage to property of third parties, with the following limits for each occurrence:

Injury or Death	$1,000,000
Property Damage	$1,000,000

The policy shall include broad form property damage coverage extended to apply to completed operations, XCU exclusions removed. The completed operations coverage must be maintained for a minimum of one (1) year after final completion and acceptance of the work, with evidence of same filed with the Owner. Where work is being performed in connection with an existing facility owned or leased by the Owner, the policy shall include fire legal liability of not less than $100,000 per occurrence.

(b) Comprehensive automobile and truck liability insurance, covering owned, hired, and non-owned vehicles, with minimum limits of $1,000,000 each occurrence, for bodily

injury and $1,000,000 each occurrence for property damage, such insurance to include coverage for loading and unloading hazards.

1.20.2 "Umbrella" Excess Liability Insurance

The Contractor shall obtain, pay and maintain this policy during the contract term, insuring the Contractor for an amount of not less than $1,000,000 combined single limit bodily injury and property damage liability insurance, including death, in excess of the primary coverage required hereinabove, Owner to be named as additional insured.

1.20.3 Policy Endorsements and Special Conditions

Each insurance policy to be furnished by the Contractor shall include the following conditions by endorsement to the policy:

(a) Each policy shall require that thirty (30) days prior to the cancellation or any material change in coverage, a notice thereof shall be given the Owner by certified mail.

(b) The term "Owner" shall include all authorities, boards, bureaus, commissions, divisions, departments, and offices of the Owner and the individual members, employees, and agents thereof in their official capacities, and/or while acting on behalf of the Owner; and

(c) The policy phrase "other insurance" shall not apply to the Owner where the Owner is an additional insured on the policy.

Concerning insurance to be furnished by the Contractor, is a condition precedent to acceptability thereof that:

(a) Any policy submitted shall not be subject to limitations, conditions, or restrictions deemed inconsistent with the intent of the insurance requirements to be fulfilled by the Contractor. The Owner's s decision thereon shall be final; and

(b) Companies issuing the insurance policies and Contractor shall have no recourse against the Owner for payment of any premiums and deductibles are the sole responsibility and risk of the Contractor;

(c) Approval, disapproval, or failure to act by the Owner regarding any insurance supplied by the Contractor (or any subcontractor) shall not relieve the Contractor of full responsibility or liability for damages and accidents as set forth in the contract documents. Neither shall the bankruptcy, insolvency, or denial of liability by the insurance company exonerate the Contractor from liability; and

(d) No special payments shall be made for any insurance that the Contractor and subcontractors are required to carry; all are included in the contract price and the contract unit prices.

Any of such insurance policies required under this section may be written in combination with any of the others, where legally permitted, but none of the specified limits may be lowered thereby.

1.20.4 Proof of Insurance Coverage. The Contractor shall furnish the Owner with certificates showing type, amount, class of operations covered, effective dates, and dates of expiration or policies.

1.21 CONTRACTOR'S RESPONSIBILITY FOR WORKERS' COMPENSATION INSURANCE COVERAGE. Without limiting any of the other obligations or liabilities of the Contractor, the Contractor and each subcontractor, at their own expense, shall, during the term of the contract, purchase and maintain the hereinafter stipulated Workers' Compensation Insurance with Companies duly authorized to do business in the State of Texas and satisfactory to the Owner. Workers' Compensation is to be as required by Texas Law, with the policy endorsed to provide a waiver of subrogation as to the Owner. Certificates of each policy, together with a statement by the issuing company to the extent policy shall not be cancelled without thirty (30) days' prior notice being given the Owner, shall be delivered to the Owner before any work is started. The Contractor shall post a notice on each project site in the text, form, and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered and stating how a person may verify coverage and report lack of coverage. All Workers' Compensation policies shall adhere to the following:

A. Definitions.

Certificate of coverage ("certificate") – A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

Duration of the project – includes the time from the beginning of the work on the project until the Contractor's/person's work on the project has been completed and accepted by the governmental entity.

Persons providing services on the project – includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of such an entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

B. The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011 (44) for all employees of the contractor providing services on the project, for the duration of the project.

C. The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

D. If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

E. The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

(1) a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and

(2) no later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

F. The Contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

G. The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

H. The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

I. The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

(1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;

(2) provide to the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;

(3) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(4) obtain from each person with whom it contracts, and provide to the Contractor;

(a) A certificate of coverage, prior to the other person beginning work on the project; and

(b) A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(5) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(6) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

(7) contractually require each person with whom it contracts, to perform as required by paragraphs (1) – (7), with the certificates of coverage to be provided to the person for whom they are providing services.

J. By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

K. The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

1.22 REFERENCE SPECIFICATIONS. Where reference is made in these specifications to specifications compiled by other agencies, organizations, or departments, such reference is made for expediency and standardization from the material suppliers' point of view, and such specifications referred to are hereby made a part of these specifications.

Whenever reference is made to the furnishing of materials or testing thereof to conform to the Standards of any technical society, organization, or body, it shall be construed to mean the latest standard, code, specification, or tentative specification adopted and published at the time of advertisement for bids, even though reference has been made to an earlier standard, and such standards are made a part hereof to the extent which is indicated or intended.

The following are names and abbreviations of such groups:

AASHO	American Association of State Highway Officials

ACI	American Concrete Institute
AGMA	American Gear Manufacturers Association
AIEE	American Institute of Electrical Engineers
AISC	American Institute of Steel Construction
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASCE	American Society of Civil Engineers
ASA	American Standards Association
ASHE	American Society of Heating & Ventilating Engineers
ASTM	American Society for Testing Materials
ASME	America Society of Mechanical Engineers
AWSC	American Welding Society Code
AWPA	American Wood Preservers Association
AWWA	American Water Works Association
FED.SPEC.	Federal Specification
NAVY SPEC.	Navy Department Specification
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
SAE	Society of Automotive Engineers Standards
SHBI	Steel Heating Boiler Institute
U.L., INC.	Underwriters' Laboratories, Incorporated

Where no reference is made to a code, standard, or specification, the Standard Specifications of the ASTM, the ASA, the ASME, the AIEE, or the NEMA shall govern.

1.23 ABBREVIATIONS. Wherever the abbreviations defined herein occur on the plans, in the specifications, contract, bonds, advertisement, proposal, or in any other document or instrument herein contemplated or to which the specifications apply or may apply, the intent and meaning shall be as follows:

Asph.	Asphalt
Ave.	Avenue
Blvd.	Boulevard
D.I.	Ductile Iron
C.L.	Centerline
C.O.	Cleanout
Conc.	Concrete
Cond.	Conduit
Corr.	Corrugated
Cu.	Cubic
Culv.	Culvert
Dia.	Diameter
Dr.	Drive or Driveway
Elev.	Elevation
F.	Farenheit
Ft. of '	Foot or feet
Gal.	Gallon
Lb.	Pound
Lin.	Linear
M.H.	Manhole
Max.	Maximum
Min.	Minimum
Mono.	Monolithic
No.	Number
%	Percent
P.S.I.	Pounds per square inch
P.V.C.	Polyvinyl Chloride
Reinf.	Reinforced
Rem.	Remove
Rep.	Replace
R/W or R of W	Right-of-Way
Sani.	Sanitary
Sq.	Square
Std.	Standard
St.	Street or Storm
Str.	Strength
Vol.	Volume
Yd.	Yard

In reference to such abbreviations where a specification number is referred to, the latest revision of said specification shall apply.

1.24 ENGINEER. The "Engineer" in these specifications shall be understood as referring to the City Engineer or his designated representative.

1.25 PREVAILING WAGE RATES The Contractor shall pay to all laborers, workmen and mechanics employed by him in the execution of the contract, not less than the rate as determined by the US Department of Labor in accordance with the Davis-Bacon Act. For

reference purposes, a copy of the US Department of Labor wage decision in included herein these specifications.

1.26 INCIDENTAL ITEMS Bidders are especially notified that no incidental items of work will be paid for unless there appears an item in the proposal for such work. It must be strictly understood that the prices bid are for complete and acceptable work.

1.27 PROTECTION AGAINST ACCIDENT TO EMPLOYEES AND THE PUBLIC The Contractor and his sureties shall indemnify and save harmless the Engineer, the Owner, and all their officers, agents, and employees from all suits, actions, or claims of any character, name and description brought for or on account of any injuries or damages received or sustained by any person or persons or property, on account of any negligent act or fault of Contractor, his agents or employees in the execution of said contract; or on account of the failure of the Contractor to provide necessary barricades, warning lights or signs, or the failure to take any other necessary precautions to prevent injury to persons or damage to property, and will be required to pay any judgment, with costs and attorney fees, which may be obtained against the Engineer and/or Owner growing out of such injury or damage.

1.28 PUBLIC UTILITIES AND OTHER PROPERTY. In case it is necessary to change or move the property of Owner or of a public utility, such property shall not be moved or interfered with until ordered to do so by the Engineer and Owner. The light is reserved to the Engineer of public utilities to enter upon the limits of the project for the purposed of making such changes or repairs of their property that may be made necessary by performance of this contract.

1.29 POWER FOR CONSTRUCTION. The electrical service to the site will be provided by the Contractor. The Contractor shall furnish and install all necessary temporary wiling, and furnish and install area distribution boxes so located that the individual trades may use their own construction type extension cords to obtain adequate power and artificial lighting at all points where required by inspectors and for safety. All necessary permits shall be acquired by the Contractor.

1.30 USE OF EXPLOSIVES. Use of explosives will not be allowed.

1.31 MANUFACTURED PRODUCTS. All equipment of standard manufacture specified herein shall be the manufacturer's latest and proven design. Specifications and drawings call attention to certain features but do not purport to cover all details entering into the design of the products or systems. The completed product or system shall be compatible with the functions required and the equipment furnished by the Contractor.

1.32 PATENTED DEVICES. If the manufacturer of any material, process, or manufactured product used in the construction of this project is required or desires to use any design, device, materials, or process covered by letters, patent, or copyright, the manufacturer shall provide for such use by suitable legal agreement with the patentee or Engineer and Owner and the prices bid hereunder shall, without exception, indemnify and save the Engineer and Owner harmless from any and all claims for infringement by reason of the use of any such patented design, device, material, or process, or trade mark or

copyright used in connection with any equipment to be furnished under this contract.

1.33 TOOLS AND ACCESSORIES. The Contractor shall, unless otherwise stated in the detailed specifications, furnish with each type, kind, or size of equipment, one (1) complete set of suitably marked high grade tools and appliances which may be needed to adjust, operate, maintain, or repair the equipment.

Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

Spare parts shall be furnished as specified in the specific provisions or contract items.

Each piece of equipment shall be provided with a substantial name plate securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, and principal rating data.

1.34 COORDINATION WITH OTHERS In the event other contractors are doing work in the same area simultaneously with this project, the Contractor shall coordinate his proposed construction with that of the other contractors.

Likewise, the operations of the Owner must continue without undue interruption, and the Contractor shall schedule and coordinate his work to provide for the least possible inconvenience to the Owner.

1.35 LAND FOR CONSTRUCTION PURPOSES. The Contractor will be permitted to use available land belonging to the Owner, on or near the site of the Work, for construction purposes and for storage of materials and equipment.

The Contractor shall immediately move stored materials or equipment if any occasion arises, as determined by the Owner, requiring access to the storage area. Materials or equipment shall not be placed on the property of the Owner until the Engineer or Owner has agreed to the location to be used for storage.

1.36 REFERENCE STANDARDS. Reference to standards, specifications, manuals or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual code, or laws or regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated. However, no provision of any referenced standard, specification, manual, or code, (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of the Owner, Contractor, or Engineer, or any of their Consultants, agents, or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Engineer and Owner, or any of the their consultants, agents, or employees, any duty or auth0lity to supervise or direct the furnishing or performance of the Work.

1.37 SITE ADMINISTRATION. The Contractor shall be responsible for all areas of

the site used by it, and by all Subcontractors in the performance of the Work. The Contractor will exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically .reserved to the Owner or others. The Contractor has the right to exclude from the site all persons who have no purpose related to the Work or its inspection, and may require all persons on the site (except Owner's employees) to observe the same regulations as the Contractor requires of its employees.

1.38 SUBSTITUTE EQUIPMENT AND "OR EQUAL" ITEMS. The technical specifications specify equipment brands, which have been used as the basis of design for this project.

Allowance of substitute equipment does not constitute a waiver of the specifications. The Engineer reserves the right to decide whether or not the proposed substitution will be accepted.

In order that the Engineer may determine if the proposed substitute item is a satisfactory alternate to that specified, three (3) sets of drawings, specifications, full descriptive material, installation list and a detailed list of the equipment proposed shall be submitted to the Engineer for approval. The following shall also be submitted:

1. Name, address, contact and phone number of similar projects on which product was used and date of installation.
2. For construction methods:

    a. Detailed description of proposed methods including required modifications to structures (concrete, piping, etc.).
    b. Drawings illustrating methods.

3. Itemized comparison of proposed substitution with product or method specified to include a list of all deviations from product or method specified.
4. Data relating to changes in construction schedule.

In making request for substitution, Contractor represents:

1. He has personally investigated proposed product or method and determined that it is equal or superior in all respects to the specified product or method.
2. He will provide the same guarantee for substitution as for product or method specified.
3. He will coordinate installation of accepted substitution into work, making such changes as may be required for work to be complete in all respects.
4. He waives all claims for additional costs related to substitution, which consequently becomes apparent.

Substitutions will not be considered if:

1. They are indicated or implied on Shop Drawings or project data submittals without a formal request being first submitted and approved.
2. Acceptance will require substantial revision of Contract Documents.

Should the Contractor furnish an approved substitute unit, he shall notify in writing the Engineer office of **all dimensional, mechanical, electrical and structural changes and/or requirements for the unit's use and shall reimburse the Engineer for any associated redesign and/or construction drawings.** He shall include in his bid, the additional construction costs of mechanical, architectural, structural, electrical and engineering costs of that unit. Redesign and drawing revisions will be prepared by the Engineer. The Contractor (Supplier) shall pay the Engineer for such redesign cost. The bid shall also include any paid-up licenses necessary for the use of the equipment, if required by the manufacturer.

Reimbursement shall be based on engineering direct labor cost plus indirect labor cost plus any direct non-labor expenses such as travel or per diem plus profit of the above total.

Whenever a material or article is specified or described by using the name of a proplietary product or the name of a particular manufacturer or vendor, the specified item shall be understood as establishing the type, function, and quality desired. Unless the specification states that no equivalent or "or equal" item is permitted, other manufacturers' products will be accepted, provided sufficient information is submitted to allow the Engineer to determine that the products proposed are equivalent to those named. Such items shall be submitted for review by the procedure set forth in the submittals section.

Requests for review of equivalency will not be accepted from anyone except the Contractor.

1.39 PROJECT ACCESS. Access to the project is limited to the boundaries shown on the plans. If additional access is required or desired it shall be acquired by the Contractor, with written approval from the affected property owners being provided to the Owner. Such approval shall be received by the Owner prior to use of additional access areas. Contractor shall be responsible for all street repairs necessary for use of unapproved streets.

1.40 LINES AND GRADES. Horizontal control and established benchmarks are provided on the Plans. The Engineer shall provide a base line and a benchmark for the Contractor.

The Contractor will be responsible for all field and construction staking. The Contractor shall provide construction staking at such intervals as necessary to control the grade and alignment of the work. Any work performed without being properly located may be ordered removed and replaced at the Contractor's expense.

The cost of replacing any stakes or iron pipes which were disturbed by the Contractor shall be charged against the Contractor and deducted from the payment for the work.

1.41 PUBLIC UTILITIES AND OTHER PROPERTY

In case it is necessary to change or move the property of the Owner or of a public utility, such property shall not be moved or interfered with until authorized by the utility company, Owner, or Engineer.

It will be the Contractor's responsibility to contact the proper authority, and set up a field meeting to verify by uncovering of the utility and determine the location and elevation of each major utility described above, at least two weeks prior to crossing the utility. If field conditions vary from those shown on the contract plans, the Contractor shall notify the Engineer immediately of field conditions to be encountered, so sufficient time exists to make any necessary adjustments in line or grade. Failure by the Contractor to make proper and timely verification of the above described utilities shall be justification for rejection of claim for extra cost by the Contractor.

If, after field verification, it is necessary to change or move the property of a property owner or of a public utility, seven (7) days' notice shall be given before such change, and such property shall not be moved or interfered with until authorized by the property owner or the utility compm1y. The right is reserved to the property owner or public utilities to enter upon the limits of the project for the purpose of making such changes or repairs of their property that may be made necessary by the performance of this contract/

1.42 POLLUTION CONTROL. Contractor shall prevent the release of sanitary wastes, sediment, debris alld other substar1ces resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris or other substance will be permitted to enter sanitary sewers and reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

1.43 CONTRACTOR'S WARRANTY OF TITLE. Contractor warrants and guarantees that title to all work, materials, and equipment covered by any Application for Payment, whether incorporated in the project or not, will pass to Owner at the time of payment free and clear of all liens, claims, security interests, and encumbrances.

1.44 CONTRACTOR'S CONTINUING OBLIGATION. Contractor's obligation to perform the work and complete the Project in accordance with the Contract documents shall be absolute. Neither recommendations of any progress or final payment by Owner, nor the issuance of a certificate of Substantial Completion, nor any payment by Owner to Contractor under the Contract Documents nor any use or occupancy of the project or any part thereof by Owner, nor any act of acceptance by Owner nor any failure to do so, nor any correction of defective work by Owner shall constitute an acceptance of work not in accordance with the Contract Documents.

1.45 QUALITY CONTROL

General

Contractor shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents. The Contractor is solely responsible for maintaining that the quality of work is in accordm1ce with the Contract Documents. The Contractor shall be responsible for the notification and scheduling required to ensure that a certified technicim1 from the testing laboratory is present during all sampling and testing procedures required in the Contract Documents. The

Contractor shall not proceed with construction work requiring such testing without the presence of the laboratory's certified technician. The Owner, at his option, may perform additional tests as quality monitoring. Quality monitoring activities of the Owner and Engineer, or failure on the part of the Owner or Engineer to perform tests on constructed works, in no way relieves the Contractor of the obligation to perform work and furnish materials conforming to the Contract Documents.

Contractor's Responsibilities

1. Control the quality of work produced and verify that the work performed meets the standards of quality established in the Contract Documents.

    a. Inspect and verify conformance of all materials furnished and work performed, whether by the Contractor, its subcontractors or its suppliers.

    b. Provide and pay for the services of a testing laboratory approved by Engineer to insure that products proposed for use fully comply with the Contract Documents.

    c. Perform tests as indicated in this and other sections of the specifications. Schedule the time and sequence of testing with the Owner and Engineer. Testing is to be observed by the Engineer or Owner.

    d. Promptly replace any defective materials and/or construction work incorporating defective materials or workmanship.

    e. Provide Certified Test Reports as required. Reports are to indicate that materials and construction are in compliance with the Contract Documents.

2. Assist the Owner and Owner's testing organization to perform quality monitoring activities.

Quality Monitoring Activities by Engineer

1. Quality Monitoring activities of the Owner through their own forces or through contracts with materials testing laboratories and survey crews are for the Owner's use in monitoring the results of the Contractor's work and quality control activities, if deemed necessary by the Owner.

2. The Quality Monitoring activities of the Owner DO NOT relieve the Contractor of its responsibility to provide testing in accordance with the requirements of the Contract Documents or to provide materials and construction work complying with the Contract Documents.

Submittals

1. Submittals shall be in accordance with Section B — SPECIAL INSTRUCTIONS and shall include:

    a. The name of the proposed primary and secondary testing laboratories along with

documentation of qualifications, a list of tests that can be performed, and a list of the certified laboratory technicians and the licensed engineers who will be performing the sampling and testing for the Construction Work along with their certifications and licenses.

b. Test reports per Test Reports paragraph of this supplementary condition.

Standards

1. Provide a testing laboratory that complies with the ASTM (American Society of Testing Materials) and/or ACIL (American Council of Independent Laboratories) "Recommended Requirements for Independent Laboratory Qualifications", or other specified testing organizations.

2. Perform tests listed in the specifications.

Delivery and Storage

1. Handle and protect test specimens of products and construction materials at the construction site in accordance with ASTM or other applicable testing procedures.

Verification Testing

1. Provide verification testing when tests performed by the Owner indicate that materials or the results of construction activities are not in conformance with Contract Documents.

2. Verification testing is to be provided at the Contractor's expense to verify products or constructed works are in compliance after corrections have been made.

3. Tests must comply with recognized methods or with methods recommended by the Engineer's testing laboratory and approved by the Engineer and Owner.

Test Reports

1. Test reports are to be prepared for all tests. Tests performed by testing laboratories may be submitted on their standard test report forms. These reports must include the following:

   i. Name of the Owner, project title and number, equipment installer and general contractor.
   ii. Name of the laboratory, address, and telephone number.
   iii. Name and signature of the certified laboratory personnel performing the sampling and testing.
   iv. Date and time of sampling, inspection, and testing.
   v. Date the report was issued.
   vi. Description of the test performed.
   vii. Weather conditions and temperature at time of test or sampling.
   viii. Location at the site or structure where the test was taken.
   ix. Standard or test procedure used in making the test.
   x. A description of the results of the test.
   xi. Statement of compliance or non-compliance with Contract Documents.

xii. Interpretations of test results, if appropriate.

2. Distribute copies of the test reports to:

	No. of Copies
Owner	2
Engineer	1
Contractor	1

Non-Conforming Work

1. Contractor shall promptly correct any work that is not in compliance with the Contract Documents and shall immediately notify the Engineer and Owner when the corrective work will be performed.

2. Payment for non-conforming work shall be withheld until such work is corrected or replaced with work complying with the Contract Documents.

1.46. DOCUMENTATIONS TO ACCOMPANY APPLICATIONS FOR PAYMENT.

Contractor's Applications for Payment shall be accompanied by the documentation specified herein:

1. Materials and Equipment:

   a. If payment is required for materials and equipment not incorporated in the work but delivered and suitably stored at the site, the Application for Progress Payment shall be accompanied by invoices and such data, satisfactory to Engineer, as will establish Owner's title to the material and equipment and protect his interest therein, including applicable insurance.

   b. Payments for such materials and equipment shall be based only upon the actual cost of the materials and equipment to Contractor and shall not include any overhead or profit to Contractor.

   c. Failure to properly store materials and equipment will be cause to withhold payment for those materials and pieces of equipment.

   d. Non-receipt of operation and maintenance manuals, as required, will be cause for Owner to withhold partial payment for that particular piece of equipment. See individual specifications for required operation and maintenance manuals.

2. Schedules and Data:

   Each Application for Progress Payment shall be accompanied by Contractor's updated schedule of operations, or progress report, with such shop drawings schedules, procurement schedules, value of material on hand included in application, and other data specified or reasonably required by Engineer. An updated cash flow schedule shall accompany each partial payment request.

1.47 CONSTRUCTION IN PUBLIC ROADS. Contractor will be responsible for complying with all federal, State, County and City regulations pertaining to construction in public roadway and traffic safety. No public road shall be entirely closed overnight. It shall be the responsibility of the Contractor to build and maintain all weather bypasses and detours, if necessary, and to properly light, barricade mark all bypasses and detours that might be required on an across the roads involved in the work included in this contract.

The Contractor shall make every effort to complete construction and allow immediate access to adjacent property at driveway entrances located along the roads. Owners or tenants of improvements where access and/or entrance drives are located shall be notified at least twenty-four (24) hours prior to the time the construction will be started at their drive-ins or entrances, and the Contractor shall provide temporary ingress to entrance drives where necessary. The Contractor shall be responsible for all road and entrance reconstruction and repairs and maintenance for same for a period of one year from the date of acceptance of the project.

In addition to roads and entrances cut by construction excavation, if any other roads or streets in the area are used by the Contractor or Subcontractors during the progress of construction and are damaged by the Contractor in the opinion of the Engineer, the Contractor, when directed by the Owner, shall immediately repair such damage. In the event the repairs and maintenance are not made in a reasonable period of time and it becomes necessary for the County, City or Engineer to make such repairs, the Contractor shall reimburse the County, City or Engineer for the cost of such repairs.

The Contractor shall, at all times, keep a sufficient width of the roadway clear of dirt and other materials to allow the free flow of traffic on the project site. The Contractor shall assume any and all responsibility for damage, personal or otherwise, that may be caused by the construction along roads or private drives.

1.48 FENCES, IMPROVEMENTS, AND DRAINAGE CHANNELS. Fences or other improvements removed to permit construction shall be replaced in the same location and left in a condition as good as, or better, than that in which they were found. There shall be no separate pay item for fences removed or damaged beyond the limits shown in the plans.

Temporary fencing for maintenance of site security shall be provided by the Contractor at his expense. Temporary fencing, with gates, to restrain livestock shall be provided through areas where livestock are pastured, unless the Contractor makes satisfactory arrangements with the land owner and/or tenant. The temporary fence shall be installed on the easement lines and shall be removed after the trench has been backfilled.

Where surface drainage channels or drainage structures are disturbed or altered during construction, they shall be restored to their original condition of grade and cross section as soon as possible.

Temporary channels required to provide adequate drainage during construction shall be provided and maintained by the Contractor. No separate payment shall be allowed.

1.49 SUPERINTENDENCE BY CONTRACTOR. The Contractor shall have on the

project at all times, as his agent, a competent Superintendent capable of reading and thoroughly understanding the plans and specifications and thoroughly experienced in the type of work being performed. The Superintendent must be capable reading, speaking and comprehending English. The Superintendent shall have full authority to execute orders or directions and to promptly supply such materials, equipment, tools, labor and incidentals as may be required. Such superintendence shall be furnished irrespective of the amount of work subcontracted.

The Contractor shall be responsible for supervision of all work performed by the subcontractor at all times during construction.

1.50 HANDLING MATERIALS NOT APPROVED. The Contractor shall remove from the site any materials found to be damaged, and any materials not meeting the specifications. These materials shall be removed promptly, unless the Engineer and Owner will accept the materials after repairing. Materials found to be damaged, or not acceptable to the Engineer or Owner after installation, shall be removed or replaced as directed. Inspection before installation shall not relieve the Contractor from any responsibility to furnish materials meeting the specifications.

1.51 DUST CONTROL. Contractor shall take responsible measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. Dusty materials in piles or in transit shall be covered when practical to prevent blowing.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels or similar equipment, shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

1.52 APPLICATION FOR FINAL PAYMENT. In addition to the requirements of Article 5.09, GENERAL CONDITIONS, the final Application for Payment shall be accompanied by all other documentation called for in the Contract Documents, including Affidavit of Bills Paid, Waiver of Lien, Consent of Surety to Final Payment, complete record drawings and such other data and schedules as Owner may reasonably require.

1.53. CORRECTION PERIOD. If, prior to two years after date of final payment or such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents, any work is found to be defective, Contractor shall within seven (7) days of notification by Owner, without cost to Owner and in accordance with Owner's written instructions, either correct such defective work or, if it has been rejected by Owner, remove it from the site and replace it with non-defective work. If Contractor does not promptly comply with the terms of such instructions, Owner may have the defective work corrected or the rejected work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by Contractor.

Nothing in these Contract Documents concerning the correction period shall establish a period of limitation with respect to any other obligation which Contractor has under the

Contract Documents. The establishment of time periods relates only to the specific obligations of Contractor to correct tile work, and has no relationship to the time within which his obligations under the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish his liability with respect to his obligations other than to specifically correct the work.

All special guarantees and manufacturers' warranties that extend beyond the two (2) year correction period shall be issued directly to tile Owner without continued involvement by tile Contractor.

1.54 ENVIRONMENTAL PROTECTION REQUIREMENTS. The Contractor shall provide and maintain, during the life of the contract, environmental protection as defined herein:

1. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice.

2. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project.

3. Comply with Federal, State, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution. Obtain all construction and disposal permits as required.

1.55. ENVIRONMENTAL PROTECTION PLAN. All of the Contractor's employees shall be trained on tile site Environmental Protection Plan requirements. The Contractor shall meet all requirements of tile Owner's Environmental Protection Plan described herein.

1. Land Resources: Except in areas to be cleared, DO NOT remove, cut, deface, injure, or destroy trees or shrubs without the Owner's permission. DO NOT fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Owner. Where such use of attached ropes, cables, or guys is authorized, the Contractor shall be responsible for any resultant damage.

2. Replacement: Trees and other landscape features scarred or damaged by equipment operations, and replace with equivalent, undamaged trees and landscape features. Obtain Owner approval before replacement.

3. Oily and Hazardous Substances: Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. In accordance with 40 CFR §112, surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus ten percent (10%) freeboard for precipitation. The berm shall be impervious to oil for seventy-two (72) hours and be constructed so that any discharge will not permeate, drain, infiltrate, or otherwise escape before cleanup occurs.

4. Storm Water Drainage: There shall be no discharge of excavation groundwater to

the sanitary sewer, storm drains, or to drainage ditches without prior specific authorization by required regulatory agencies and Owner in writing. Discharge of hazardous substances will not be permitted under any circumstances. Construction site runoff shall be prevented from entering any storm drain or the drainage ditch directly by the use of straw bales or other method suitable to the Engineer. Contractor shall provide erosion protection of the surrounding soils. Contractor shall be responsible for payment and receipt of a stormwater permit if necessary. Contractor shall maintain stormwater controls of said permit per state, local agencies or Engineer and Owner.

5. Fish and Wildlife Resources: DO NOT disturb fish and wildlife. DO NOT alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

6. Bum-off: Bum-off of the ground cover is not permitted.

7. Protection of Erodible Soils: Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

8. Temporary Protection of Erodible Soils: Use the following methods to prevent erosion and control sedimentation:

a. Mechanical Retardation and Control of Runoff: Mechanically retard and control the rate of runoff from the construction site. This includes construction of diversion ditches, benches, berms, and use of silt fences and straw bales to retard and divert runoff to protected drainage courses.

b. Vegetation and Mulch: Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydro-seeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

c. Provide new seeding where ground is disturbed. Include topsoil or nutrients during the seeding operation necessary to establish a suitable stand of grass.

9. Control And Disposal Of Solid Wastes: Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Remove all solid waste (including non-hazardous debris) from the property and dispose off-site at an approved landfill. Solid waste disposal off-site must comply with most stringent local, State, and Federal requirements including 40 CFR §241, 40 CFR §243, and 40 CFR §258.

10. Dust Control: Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas

disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will not be permitted.

11. Noise: Make the maximum use of low-noise emission products, as certified by the EPA. Confine soil placement operations to the period between 7 A.M. and 5 P.M., Monday through Friday, exclusive of holidays, unless otherwise specified.

12. Spill Control: In the event of a spill or release of a hazardous substance (as designated in 40 CFR §302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), the Contractor shall notify the Owner immediately. Immediate containment actions shall be taken to minimize the effect of any spill or leak. Cleanup shall be in accordance with applicable federal, state, and local regulations. As directed by the Owner, additional sampling and testing shall be performed to verity spills have been cleaned up. Spill cleanup and testing shall be done at no additional cost to the Owner.

13. Spill Response Materials:

a. The Contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

b. Within five days after the award of contract, the Contractor shall meet with the Owner to discuss the project and verify a mutual understanding relative to the details of environmental protection, including measures for protecting natural resources, required reports, and other measures to be taken.

c. The Engineer must receive from the Contractor a letter signed by an officer of the firm appointing a project Environmental Manager and stating that he/she is responsible for managing and implementing the Environmental Program as described in this contract. The Environmental Manager must have authority to direct the removal and replacement of non-conforming work, and the letter shall include a statement of this authority.

Item 104
Removing Concrete

1. DESCRIPTION

Break, remove, and salvage or dispose of existing hydraulic cement concrete.

2. CONSTRUCTION

Remove existing hydraulic cement concrete from locations shown on the plans. Avoid damaging concrete that will remain in place. Saw-cut and remove the existing concrete to neat lines. Replace any concrete damaged by the Contractor at no expense to the Department. Accept ownership and properly dispose of broken concrete in accordance with federal, state, and local regulations unless otherwise shown on the plans.

3. MEASUREMENT

Removing concrete pavement, floors, porches, patios, riprap, medians, foundations, sidewalks, driveways, and other appurtenances will be measured by the square yard (regardless of thickness) or by the cubic yard of calculated volume, in its original position.

Removing curb, curb and gutter, and concrete traffic barrier will be measured by the foot in its original position. The removal of monolithic concrete curb or dowelled concrete curb will be included in the concrete pavement measurement.

Removing retaining walls will be measured by the square yard along the front face from the top of the wall to the top of the footing.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

4. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Removing Concrete" of the type specified. This price is full compensation for breaking the concrete; loading, hauling, and salvaging or disposing of the material; and equipment, labor, tools, and incidentals.

Removing retaining wall footings will not be paid for directly but will be considered subsidiary to this Item.

Item 105

Removing Treated and Untreated Base and Asphalt Pavement

1. DESCRIPTION

Break, remove, and store or dispose of existing asphalt pavement, including surface treatments, and treated or untreated base materials.

2. CONSTRUCTION

Break material retained by the Department into pieces not larger than 24 in. unless otherwise shown on the plans. Remove existing asphalt pavement before disturbing stabilized base. Avoid contamination of the asphalt materials and damage to adjacent areas. Repair material damaged by operations outside the designated locations.

Stockpile materials designated salvageable at designated sites when shown on the plans or as directed. Prepare stockpile site by removing vegetation and trash and by providing for proper drainage. Material not designated to be salvaged will become the property of the Contractor. When this material is disposed of, do so in accordance with federal, state, and local regulations.

3. MEASUREMENT

This Item will be measured by the 100-ft. station along the baseline of each roadbed, by the square yard of existing treated or untreated base and asphalt pavement in its original position, or by the cubic yard of existing treated or untreated base and asphalt pavement in its original position, as calculated by the average end area method. Square yard and cubic yard measurement will be established by the widths and depths shown on the plans and the lengths measured in the field.

4. PAYMENT

The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Removing Treated and Untreated Base and Asphalt Pavement" of the depth specified. This price is full compensation for breaking the material, loading, hauling, unloading, stockpiling or disposing; repair to areas outside designated locations for removal; and equipment, labor, tools, and incidentals.

Item 247
Flexible Base

1. DESCRIPTION

Construct a foundation course composed of flexible base.

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications. Notify the Engineer of the proposed material sources and of changes to material sources. The Engineer may sample and test project materials at any time before compaction throughout the duration of the project to assure specification compliance. Use Tex-100-E material definitions.

2.1. **Aggregate.** Furnish aggregate of the type and grade shown on the plans and meeting the requirements of Table 1. Each source must meet Table 1 requirements for liquid limit, plasticity index, and wet ball mill for the grade specified. Do not use additives, such as but not limited to lime, cement, or fly ash to modify aggregates to meet the requirements of Table 1 unless shown on the plans.

Table 1
Material Requirements

Property	Test Method	Grade 1–2	Grade 3	Grade 4[2]	Grade 5
Sampling	Tex-400-A				
Master gradation sieve size (cumulative % retained)	Tex-110-E				
2-1/2"		0	0	As shown on the plans	0
1-3/4"		0–10	0–10		0–5
7/8"		10–35	–		10–35
3/8"		30–65	–		35–65
#4		45–75	45–75		45–75
#40		65–90	50–85		70–90
Liquid Limit, % Max	Tex-104-E	40	40	As shown on the plans	35
Plasticity Index, Max[1]	Tex-106-E	10	12	As shown on the plans	10
Plasticity index, Min[1]		As shown on the plans	As shown on the plans	As shown on the plans	As shown on the plans
Wet ball mill, % Max	Tex-116-E	40	–	As shown on the plans	40
Wet ball mill, % Max increase passing the #40 sieve		20	–	As shown on the plans	20
Min compressive strength, psi	Tex-117-E			As shown on the plans	
lateral pressure 0 psi		35	–		–
lateral pressure 3 psi		–	–		90
lateral pressure 15 psi		175	–		175

1. Determine plastic index in accordance with Tex-107-E (linear shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
2. Grade 4 may be further designated as Grade 4A, Grade 4B, etc.

2.1.1. **Material Tolerances.** The Engineer may accept material if no more than 1 of the 5 most recent gradation tests has an individual sieve outside the specified limits of the gradation.

When target grading is required by the plans, no single failing test may exceed the master grading by more than 5 percentage points on sieves No. 4 and larger or 3 percentage points on sieves smaller than No. 4.

The Engineer may accept material if no more than 1 of the 5 most recent plasticity index tests is outside the specified limit. No single failing test may exceed the allowable limit by more than 2 points.

2.1.2. **Material Types**. Do not use fillers or binders unless approved. Furnish the type specified on the plans in accordance with the following:

2.1.2.1. **Type A**. Crushed stone produced and graded from oversize quarried aggregate that originates from a single, naturally occurring source. Do not use gravel or multiple sources.

2.1.2.2. **Type B**. Crushed or uncrushed gravel. Blending of 2 or more sources is allowed.

2.1.2.3. **Type C**. Crushed gravel with a minimum of 60% of the particles retained on a No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I. Blending of 2 or more sources is allowed.

2.1.2.4. **Type D**. Type A material or crushed concrete. Crushed concrete containing gravel will be considered Type D material. Crushed concrete must meet the requirements in Section 247.2.1.3.2., "Recycled Material (Including Crushed Concrete) Requirements," and be managed in a way to provide for uniform quality. The Engineer may require separate dedicated stockpiles in order to verify compliance.

2.1.2.5. **Type E**. Caliche, iron ore or as otherwise shown on the plans.

2.1.3. **Recycled Material**. Reclaimed asphalt pavement (RAP) and other recycled materials may be used when shown on the plans. Request approval to blend 2 or more sources of recycled materials.

2.1.3.1. **Limits on Percentage**. Do not exceed 20% RAP by weight, when RAP is allowed, unless otherwise shown on the plans. The percentage limitations for other recycled materials will be as shown on the plans.

2.1.3.2. **Recycled Material (Including Crushed Concrete) Requirements**.

2.1.3.2.1. **Contractor-Furnished Recycled Materials**. Provide recycled materials, other than RAP, that have a maximum sulfate content of 3,000 ppm when tested in accordance with Tex-145-E. When the Contractor furnishes the recycled materials, including crushed concrete, the final product will be subject to the requirements of Table 1 for the grade specified. Certify compliance with DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines," for Contractor furnished recycled materials. In addition, recycled materials must be free from reinforcing steel and other objectionable material and have at most 1.5% deleterious material when tested in accordance with Tex-413-A. For RAP, do not exceed a maximum percent loss from decantation of 5.0% when tested in accordance with Tex-406-A. Test RAP without removing the asphalt.

2.1.3.2.2. **Department-Furnished Required Recycled Materials**. When the Department furnishes and requires the use of recycled materials, unless otherwise shown on the plans:

- Department-required recycled material will not be subject to the requirements in Table 1,
- Contractor-furnished materials are subject to the requirements in Table 1 and this Item,
- the final product, blended, will be subject to the requirements in Table 1, and
- for final product, unblended (100% Department-furnished required recycled material), the liquid limit, plasticity index, wet ball mill, and compressive strength is waived.

Crush Department-furnished RAP so that 100% passes the 2 in. sieve. The Contractor is responsible for uniformly blending to meet the percentage required.

2.1.3.2.3. **Department-Furnished and Allowed Recycled Materials**. When the Department furnishes and allows the use of recycled materials or allows the Contractor to furnish recycled materials, the final blended product is subject to the requirements of Table 1 and the plans.

2.1.3.3. **Recycled Material Sources**. Department-owned recycled material is available to the Contractor only when shown on the plans. Return unused Department-owned recycled materials to the Department stockpile location designated by the Engineer unless otherwise shown on the plans.

The use of Contractor-owned recycled materials is allowed when shown on the plans. Contractor-owned surplus recycled materials remain the property of the Contractor. Remove Contractor-owned recycled materials from the project and dispose of them in accordance with federal, state, and local regulations before project acceptance. Do not intermingle Contractor-owned recycled material with Department-owned recycled material unless approved.

2.2. **Water**. Furnish water free of industrial wastes and other objectionable matter.

2.3. **Material Sources**. Expose the vertical faces of all strata of material proposed for use when non-commercial sources are used. Secure and process the material by successive vertical cuts extending through all exposed strata, when directed.

3. EQUIPMENT

Provide machinery, tools, and equipment necessary for proper execution of the work.

3.1. Provide rollers in accordance with Item 210, "Rolling." Provide proof rollers in accordance with Item 216, "Proof Rolling," when required.

3.2. When ride quality measurement is required, provide a high speed or lightweight inertial profiler certified at the Texas A&M Transportation Institute. Provide equipment certification documentation. Display a current decal on the equipment indicating the certification expiration date.

4. CONSTRUCTION

Construct each layer uniformly, free of loose or segregated areas, and with the required density and moisture content. Provide a smooth surface that conforms to the typical sections, lines, and grades shown on the plans or as directed.

Stockpile base material temporarily at an approved location before delivery to the roadway. Build stockpiles in layers no greater than 2 ft. thick. Stockpiles must have a total height between 10 and 16 ft. unless otherwise approved. After construction and acceptance of the stockpile, loading from the stockpile for delivery is allowed. Load by making successive vertical cuts through the entire depth of the stockpile.

Do not add or remove material from temporary stockpiles that require sampling and testing before delivery unless otherwise approved. Charges for additional sampling and testing required as a result of adding or removing material will be deducted from the Contractor's estimates.

Haul approved flexible base in clean trucks. Deliver the required quantity to each 100-ft. station or designated stockpile site as shown on the plans. Prepare stockpile sites as directed. When delivery is to the 100-ft. station, manipulate in accordance with the applicable Items.

4.1. **Preparation of Subgrade or Existing Base**. Remove or scarify existing asphalt concrete pavement in accordance with Item 105, "Removing Treated and Untreated Base and Asphalt Pavement," when shown on the plans or as directed. Shape the subgrade or existing base to conform to the typical sections shown on the plans or as directed.

When new base is required to be mixed with existing base, deliver, place, and spread the new flexible base in the required amount per station. Manipulate and thoroughly mix the new base with existing material to provide a uniform mixture to the specified depth before shaping.

Proof roll the roadbed in accordance with Item 216, "Proof Rolling," before pulverizing or scarifying when shown on the plans or directed. Correct soft spots as directed.

4.2. **Placing.** Spread and shape flexible base into a uniform layer with an approved spreader the same day as delivered unless otherwise approved. Construct layers to the thickness shown on the plans. Maintain the shape of the course. Control dust by sprinkling, as directed. Correct or replace segregated areas as directed, at no additional expense to the Department.

Place successive base courses and finish courses using the same construction methods required for the first course.

4.3. **Compaction.** Compact using density control unless otherwise shown on the plans. Multiple lifts are permitted when shown on the plans or approved. Bring each layer to the moisture content directed. When necessary, sprinkle the material in accordance with Item 204, "Sprinkling."

Begin rolling longitudinally at the sides and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the roller unit. Begin rolling at the low side and progress toward the high side on superelevated curves. Offset alternate trips of the roller. Operate rollers at a speed between 2 and 6 mph as directed.

Rework, recompact, and refinish material that fails to meet or that loses required moisture, density, stability, or finish requirements before the next course is placed or the project is accepted. Continue work until specification requirements are met. Perform the work at no additional expense to the Department.

Before final acceptance, the Engineer will select the locations of tests and measure the flexible base depth in accordance with Tex-140-E. Correct areas deficient by more than 1/2 in. in thickness by scarifying, adding material as required, reshaping, recompacting, and refinishing at the Contractor's expense.

4.3.1. **Ordinary Compaction.** Roll with approved compaction equipment as directed. Correct irregularities, depressions, and weak spots immediately by scarifying the areas affected, adding or removing approved material as required, reshaping, and recompacting.

4.3.2. **Density Control.** Compact to at least 100% of the maximum dry density determined by Tex-113-E, unless otherwise shown on the plans. Maintain moisture during compaction within ±2 percentage points of the optimum moisture content as determined by Tex-113-E. Measure the moisture content of the material in accordance with Tex-115-E or Tex-103-E during compaction daily and report the results the same day to the Engineer, unless otherwise shown on the plans or directed. Do not achieve density by drying the material after compaction.

The Engineer will determine roadway density and moisture content of completed sections in accordance with Tex-115-E. The Engineer may accept the section if no more than 1 of the 5 most recent density tests is below the specified density and the failing test is no more than 3 pcf below the specified density.

4.4. **Finishing.** After completing compaction, clip, skin, or tight-blade the surface with a maintainer or subgrade trimmer to a depth of approximately 1/4 in. Remove loosened material and dispose of it at an approved location. Seal the clipped surface immediately by rolling with a pneumatic tire roller until a smooth surface is attained. Add small increments of water as needed during rolling. Shape and maintain the course and surface in conformity with the typical sections, lines, and grades as shown on the plans or as directed.

Correct grade deviations greater than 1/4 in. in 16 feet measured longitudinally or greater than 1/4 in. over the entire width of the cross-section in areas where surfacing is to be placed. Correct by loosening and adding, or removing material. Reshape and re-compact in accordance with Section 247.4.3., "Compaction."

4.5. **Curing.** Cure the finished section until the moisture content is at least 2 percentage points below optimum or as directed before applying the next successive course or prime coat.

4.6. **Ride Quality**. This section applies to the final travel lanes that receive a 1 or 2 course surface treatment for the final surface, unless otherwise shown on the plans. Measure ride quality of the base course after placement of the prime coat and before placement of the surface treatment, unless otherwise approved. Use a certified profiler operator from the Department's MPL. When requested, furnish the Engineer documentation for the person certified to operate the profiler.

Provide all profile measurements to the Engineer in electronic data files within 3 days after placement of the prime coat using the format specified in Tex-1001-S. The Engineer will use Department software to evaluate longitudinal profiles to determine areas requiring corrective action. Correct 0.1-mi.sections having an average international roughness index (IRI) value greater than 100.0 in. per mile to an IRI value of 100.0 in. per mile or less for each wheel path, unless otherwise shown on the plans.

Re-profile and correct sections that fail to maintain ride quality until placement of the next course, as directed. Correct re-profiled sections until specification requirements are met, as approved. Perform this work at no additional expense to the Department.

5. MEASUREMENT

Flexible base will be measured as follows:

- **Flexible Base (Complete In Place)**. The ton, square yard, or any cubic yard method.
- **Flexible Base (Roadway Delivery)**. The ton or any cubic yard method.
- **Flexible Base (Stockpile Delivery)**. The ton, cubic yard in vehicle, or cubic yard in stockpile.

Measurement by the cubic yard in final position and square yard is a plans quantity measurement. The quantity to be paid for is the quantity shown in the proposal unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Measurement is further defined for payment as follows.

5.1. **Cubic Yard in Vehicle**. By the cubic yard in vehicles of uniform capacity at the point of delivery.

5.2. **Cubic Yard in Stockpile**. By the cubic yard in the final stockpile position by the method of average end areas.

5.3. **Cubic Yard in Final Position**. By the cubic yard in the completed and accepted final position. The volume of base course is computed in place by the method of average end areas between the original subgrade or existing base surfaces and the lines, grades, and slopes of the accepted base course as shown on the plans.

5.4. **Square Yard**. By the square yard of surface area in the completed and accepted final position. The surface area of the base course is based on the width of flexible base as shown on the plans.

5.5. **Ton**. By the ton of dry weight in vehicles as delivered. The dry weight is determined by deducting the weight of the moisture in the material at the time of weighing from the gross weight of the material. The Engineer will determine the moisture content in the material in accordance with Tex-103-E from samples taken at the time of weighing.

When material is measured in trucks, the weight of the material will be determined on certified scales, or the Contractor must provide a set of standard platform truck scales at a location approved by the Engineer. Scales must conform to the requirements of Item 520, "Weighing and Measuring Equipment."

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the types of work shown below. No additional payment

will be made for thickness or width exceeding that shown on the typical section or provided on the plans for cubic yard in the final position or square yard measurement.

Sprinkling and rolling, except proof rolling, will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans. When proof rolling is shown on the plans or directed, it will be paid for in accordance with Item 216, "Proof Rolling."

Where subgrade is constructed under this Contract, correction of soft spots in the subgrade will be at the Contractor's expense. Where subgrade is not constructed under this Contract, correction of soft spots in the subgrade will be paid in accordance with pertinent Items or Article 4.4., "Changes in the Work."

6.1. **Flexible Base (Complete In Place)**. Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. For square yard measurement, a depth will be specified. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, spreading, blading, mixing, shaping, placing, compacting, reworking, finishing, correcting locations where thickness is deficient, curing, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

6.2. **Flexible Base (Roadway Delivery)**. Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle," "In Stockpile," or "In Final Position" will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing materials, temporary stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

6.3. **Flexible Base (Stockpile Delivery)**. Payment will be made for the type and grade specified. For cubic yard measurement, "In Vehicle" or "In Stockpile" will be specified. The unit price bid will not include processing at the roadway. This price is full compensation for furnishing and disposing of materials, preparing the stockpile area, temporary or permanent stockpiling, assistance provided in stockpile sampling and operations to level stockpiles for measurement, loading, hauling, delivery of materials to the stockpile, furnishing scales and labor for weighing and measuring, and equipment, labor, tools, and incidentals.

Item 300
Asphalts, Oils, and Emulsions

1. DESCRIPTION

Provide asphalt cements, cutback and emulsified asphalts, performance-graded asphalt binders, and other miscellaneous asphalt materials as specified on the plans.

2. MATERIALS

Provide asphalt materials that meet the stated requirements when tested in accordance with the referenced Department, AASHTO, and ASTM test methods. Use asphalt containing recycled materials only if the recycled components meet the requirements of Article 6.9, "Recycled Materials." Provide asphalt materials that have been preapproved for use by the Construction Division in accordance with Tex-545-C, "Asphalt Binder Quality Program."

Acronyms used in this Item are defined in Table 1.

Table 1
Acronyms

Acronym	Definition
Test Procedure Designations	
Tex	Department
T or R	AASHTO
D	ASTM
Polymer Modifier Designations	
P	polymer-modified
SBR or L	styrene-butadiene rubber (latex)
SBS	styrene-butadiene-styrene block co-polymer
TR	tire rubber (from ambient temperature grinding of truck and passenger tires)
AC	asphalt cement
AE	asphalt emulsion
AE-P	asphalt emulsion prime
A-R	asphalt-rubber
C	cationic
EAP&T	emulsified asphalt prime and tack
H-suffix	harder residue (lower penetration)
HF	high float
MC	medium-curing
MS	medium-setting
PCE	prime, cure, and erosion control
PG	performance grade
RC	rapid-curing
RS	rapid-setting
S-suffix	stockpile usage
SCM	special cutback material
SS	slow-setting

2.1. **Asphalt Cement**. Provide asphalt cement that is homogeneous, water-free, and nonfoaming when heated to 347°F, and meets the requirements in Table 2.

Table 2
Asphalt Cement

Property	Test Procedure	Viscosity Grade									
		AC-0.6		AC-1.5		AC-3		AC-5		AC-10	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity	T 202										
140°F, poise		40	80	100	200	250	350	400	600	800	1,200
275°F, poise		0.4	–	0.7	–	1.1	–	1.4	–	1.9	–
Penetration, 77°F, 100g, 5 sec.	T 49	350	–	250	–	210	–	135	–	85	–
Flash point, C.O.C., °F	T 48	425	–	425	–	425	–	425	–	450	–
Solubility in trichloroethylene, %	T 44	99.0	–	99.0	–	99.0	–	99.0	–	99.0	–
Spot test	Tex-509-C	Neg.		Neg.		Neg.		Neg.		Neg.	
Tests on residue from Thin-Film Oven Test:	T 179										
Viscosity, 140°F, poise	T 202	–	180	–	450	–	900	–	1,500	–	3,000
Ductility,[1] 77°F 5 cm/min., cm	T 51	100	–	100	–	100	–	100	–	100	–

1. If AC-0.6 or AC-1.5 ductility at 77°F is less than 100 cm, material is acceptable if ductility at 60°F is more than 100 cm.

2.2. **Polymer-Modified Asphalt Cement**. Provide polymer-modified asphalt cement that is smooth, homogeneous, and meets the requirements of Table 3. Supply samples of the base asphalt cement and polymer additives if requested.

Table 3
Polymer-Modified Asphalt Cement

Property	Test Procedure	Polymer-Modified Viscosity Grade											
		AC-5 w/2% SBR		AC-10 w/2% SBR		AC-15P		AC-20XP		AC-10-2TR		AC-20-5TR	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Polymer		SBR		SBR		SBS		SBS		TR		TR	
Polymer content, % (solids basis)	Tex-533-C	2.0	–	2.0	–	3.0	–	–	–	2.0	–	5.0	–
Dynamic shear, G*/sin δ, 64°C, 10 rad/s, kPa	T 315	–	–	–	–	–	–	1.0	–	–	–	1.0	–
Dynamic shear, G*/sin δ, 58°C, 10 rad/s, kPa	T 315	–	–	–	–	–	–	–	–	1.0	–	–	–
Viscosity													
140°F, poise	T 202	700	–	1,300	–	1,500	–	2,000	–	1,000	–	2,000	–
275°F, poise	T 202	–	7.0	–	8.0	–	8.0	–	–	–	8.0	–	10.0
Penetration, 77°F, 100 g, 5 sec.	T 49	120	–	80	–	100	150	75	115	95	130	75	115
Ductility, 5cm/min., 39.2°F, cm	T 51	70	–	60	–	–	–	–	–	–	–	–	–
Elastic recovery, 50°F, %	Tex-539-C	–	–	–	–	55	–	55	–	30	–	55	–
Softening point, °F	T 53	–	–	–	–	–	–	120	–	110	–	120	–
Polymer separation, 48 hr.	Tex-540-C	None		None		None		None		None		None	
Flash point, C.O.C., °F	T 48	425	–	425	–	425	–	425	–	425	–	425	–
Tests on residue from RTFOT aging and pressure aging:	Tex-541-C and R 28 T 313												
Creep stiffness													
S, -18°C, MPa		–	–	–	–	–	300	–	300	–	300	–	300
m-value, -18°C		–	–	–	–	0.300	–	0.300	–	0.300	–	0.300	–

2.3. **Cutback Asphalt.** Provide cutback asphalt that meets the requirements of Tables 4, 5, and 6 for the specified type and grade. Supply samples of the base asphalt cement and polymer additives if requested.

Table 4
Rapid-Curing Cutback Asphalt

Property	Test Procedure	Type–Grade					
		RC-250		RC-800		RC-3000	
		Min	Max	Min	Max	Min	Max
Kinematic viscosity, 140°F, cSt	T 201	250	400	800	1,600	3,000	6,000
Water, %	D95	–	0.2	–	0.2	–	0.2
Flash point, T.O.C., °F	T 79	80	–	80	–	80	–
Distillation test:	T 78						
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:							
Viscosity, 140°F, poise	T 202	600	2400	600	2400	600	2400
Ductility, 5 cm/min., 77°F, cm	T 51	100	–	100	–	100	–
Solubility in trichloroethylene, %	T 44	99.0	–	99.0	–	99.0	–
Spot test	Tex-509-C	Neg.		Neg.		Neg.	

Table 5
Medium-Curing Cutback Asphalt

Property	Test Procedure	Type–Grade							
		MC-30		MC-250		MC-800		MC-3000	
		Min	Max	Min	Max	Min	Max	Min	Max
Kinematic viscosity, 140°F, cSt	T 201	30	60	250	500	800	1,600	3,000	6,000
Water, %	D95	–	0.2	–	0.2	–	0.2	–	0.2
Flash point, T.O.C., °F	T 79	95	–	122	–	140	–	149	–
Distillation test:	T 78								
Distillate, percentage by volume of total distillate to 680°F									
to 437°F		–	35	–	20	–	–	–	–
to 500°F		30	75	5	55	–	40	–	15
to 600°F		75	95	60	90	45	85	15	75
Residue from distillation, volume %		50	–	67	–	75	–	80	–
Tests on distillation residue:									
Viscosity, 140°F, poise	T 202	300	1200	300	1200	300	1200	300	1200
Ductility, 5 cm/min., 77°F, cm	T 51	100	–	100	–	100	–	100	–
Solubility in trichloroethylene, %	T 44	99.0	–	99.0	–	99.0	–	99.0	–
Spot test	Tex-509-C	Neg.		Neg.		Neg.		Neg.	

Table 6
Special-Use Cutback Asphalt

Property	Test Procedure	Type–Grade					
		MC-2400L		SCM I		SCM II	
		Min	Max	Min	Max	Min	Max
Kinematic viscosity, 140°F, cSt	T 201	2,400	4,800	500	1,000	1,000	2,000
Water, %	D95	–	0.2	–	0.2	–	0.2
Flash point, T.O.C., °F	T 79	150	–	175	–	175	–
Distillation test:	T 78						
Distillate, percentage by volume of total distillate to 680°F							
to 437°F		–	–	–	–	–	–
to 500°F		–	35	–	0.5	–	0.5
to 600°F		35	80	20	60	15	50
Residue from distillation, volume %		78	–	76	–	82	–
Tests on distillation residue:							
Polymer		SBR		–		–	
Polymer content, % (solids basis)	Tex-533-C	2.0	–	–	–	–	–
Penetration, 100 g, 5 sec., 77°F	T 49	150	300	180	–	180	–
Ductility, 5 cm/min., 39.2°F, cm	T 51	50	–	–	–	–	–
Solubility in trichloroethylene, %	T 44	99.0	–	99.0	–	99.0	–

2.4. **Emulsified Asphalt.** Provide emulsified asphalt that is homogeneous, does not separate after thorough mixing, and meets the requirements for the specified type and grade in Tables 7, 8, 9, and 10.

Table 7
Emulsified Asphalt

Property	Test Procedure	Type–Grade									
		Rapid-Setting		Medium-Setting				Slow-Setting			
		HFRS-2		MS-2		AES-300		SS-1		SS-1H	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72										
77°F, sec.		–	–	–	–	75	400	20	100	20	100
122°F, sec.		150	400	100	300	–	–	–	–	–	–
Sieve test, %	T 59	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1
Miscibility	T 59	–		–		–		Pass		Pass	
Cement mixing, %	T 59	–	–	–	–	–	–	–	2.0	–	2.0
Coating ability and water resistance:	T 59										
Dry aggregate/after spray		–		–		Good/Fair		–		–	
Wet aggregate/after spray		–		–		Fair/Fair		–		–	
Demulsibility, 35 ml of 0.02 N $CaCl_2$, %	T 59	50	–	–	30	–	–	–	–	–	–
Storage stability, 1 day, %	T 59	–	1	–	1	–	1	–	1	–	1
Freezing test, 3 cycles[1]	T 59	–		Pass		–		Pass		Pass	
Distillation test:	T 59										
Residue by distillation, % by wt.		65	–	65	–	65	–	60	–	60	–
Oil distillate, % by volume of emulsion		–	0.5	–	0.5	–	5	–	0.5	–	0.5
Tests on residue from distillation:											
Penetration, 77°F, 100 g, 5 sec.	T 49	100	140	120	160	300	–	120	160	70	100
Solubility in trichloroethylene, %	T 44	97.5	–	97.5		97.5	–	97.5	–	97.5	–
Ductility, 77°F, 5 cm/min., cm	T 51	100	–	100		–	–	100	–	80	–
Float test, 140°F, sec.	T 50	1,200	–	–		1,200	–	–	–	–	–

1. Applies only when the Engineer designates material for winter use.

Table 8
Cationic Emulsified Asphalt

Property	Test Procedure	Type–Grade											
		Rapid-Setting				Medium-Setting				Slow-Setting			
		CRS-2		CRS-2H		CMS-2		CMS-2S		CSS-1		CSS-1H	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol													
77°F, sec.	T 72	–	–	–	–	–	–	–	–	20	100	20	100
122°F, sec.		150	400	150	400	100	300	100	300	–	–	–	–
Sieve test, %	T 59	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1
Cement mixing, %	T 59	–	–	–	–	–	–	–	–	–	2.0	–	2.0
Coating ability and water resistance:													
Dry aggregate/after spray	T 59	–		–		Good/Fair		Good/Fair		–		–	
Wet aggregate/after spray		–		–		Fair/Fair		Fair/Fair		–		–	
Demulsibility, 35 ml of 0.8% Sodium dioctyl sulfosuccinate, %	T 59	70	–	70	–	–	–	–	–	–	–	–	–
Storage stability, 1 day, %	T 59	–	1	–	1	–	1	–	1	–	1	–	1
Particle charge	T 59	Positive		Positive		Positive		Positive		Positive		Positive	
Distillation test:													
Residue by distillation, % by wt.	T 59	65	–	65	–	65	–	65	–	60	–	60	–
Oil distillate, % by volume of emulsion		–	0.5	–	0.5	–	7	–	5	–	0.5	–	0.5
Tests on residue from distillation:													
Penetration, 77°F, 100 g, 5 sec.	T 49	120	160	70	110	120	200	300	–	120	160	70	110
Solubility in trichloroethylene, %	T 44	97.5	–	97.5	–	97.5	–	97.5	–	97.5	–	97.5	–
Ductility, 77°F, 5 cm/min., cm	T 51	100	–	80	–	100	–	–	–	100	–	80	–

Table 9
Polymer-Modified Emulsified Asphalt

Property	Test Procedure	Type–Grade											
		Rapid-Setting				Medium-Setting				Slow-Setting			
		RS-1P		HFRS-2P		AES-150P		AES-300P		AES-300S		SS-1P	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72												
77°F, sec.		–	–	–	–	75	400	75	400	75	400	30	100
122°F, sec.		50	200	150	400	–	–	–	–	–	–	–	–
Sieve test, %	T 59	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1
Miscibility	T 59	–		–		–		–		–		Pass	
Coating ability and water resistance:	T 59												
Dry aggregate/after spray		–		–		Good/Fair		Good/Fair		Good/Fair		–	
Wet aggregate/after spray		–		–		Fair/Fair		Fair/Fair		Fair/Fair		–	
Demulsibility, 35 ml of 0.02 N $CaCl_2$, %	T 59	60	–	50	–	–	–	–	–	–	–	–	–
Storage stability, 1 day, %	T 59	–	1	–	1	–	1	–	1	–	1	–	1
Breaking index, g	Tex-542-C	–	80	–	–	–	–	–	–	–	–	–	–
Distillation test:[1]	T 59												
Residue by distillation, % by wt.		65	–	65	–	65	–	65	–	65	–	60	–
Oil distillate, % by volume of emulsion		–	3	–	0.5	–	3	–	5	–	7	–	0.5
Tests on residue from distillation:													
Polymer content, wt. % (solids basis)	Tex-533-C	–	–	3.0	–	–	–	–	–	–	–	3.0	–
Penetration, 77°F, 100 g, 5 sec.	T 49	225	300	90	140	150	300	300	–	300	–	100	140
Solubility in trichloroethylene, %	T 44	97.0	–	97.0	–	97.0	–	97.0	–	97.0	–	97.0	–
Viscosity, 140°F, poise	T 202	–	–	1,500	–	–	–	–	–	–	–	1,300	–
Float test, 140°F, sec.	T 50	–	–	1,200	–	1,200	–	1,200	–	1,200	–	–	–
Ductility,[2] 39.2°F, 5 cm/min., cm	T 51	–	–	50	–	–	–	–	–	–	–	50	–
Elastic recovery,[2] 50°F, %	Tex-539-C	55	–	55	–	–	–	–	–	–	–	–	–
Tests on RTFO curing of distillation residue	Tex-541-C												
Elastic recovery, 50°F, %	Tex-539-C	–	–	–	–	50	–	50	–	30	–	–	–

1. Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F ±10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 min. (±5 min.) from the first application of heat.
2. HFRS-2P must meet one of either the ductility or elastic recovery requirements.

Table 10
Polymer-Modified Cationic Emulsified Asphalt

Property	Test Procedure	Type-Grade											
		Rapid-Setting						Medium-Setting				Slow-Setting	
		CRS-1P		CRS-2P		CHFRS-2P		CMS-1P[3]		CMS-2P[3]		CSS-1P	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72												
77°F, sec.		–	–	–	–	–	–	20	100	–	–	20	100
122°F, sec.		50	150	150	400	100	400	–	–	50	400	–	–
Sieve test, %	T 59	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1	–	0.1
Demulsibility, 35 ml of 0.8% Sodium dioctyl sulfosuccinate, %	T 59	60	–	70	–	60	–	–	–	–	–	–	–
Storage stability, 1 day, %	T 59	–	1	–	1	–	1	–	–	–	–	–	1
Breaking index, g	Tex-542-C	–	80	–	–	–	–	–	–	–	–	–	–
Particle charge	T 59	Positive		Positive		Positive		Positive		Positive		Positive	
Distillation test:[1]	T 59												
Residue by distillation, % by weight		65	–	65	–	65	–	65	–	65	–	62	–
Oil distillate, % by volume of emulsion		–	3	–	0.5	–	0.5	–	0.5	–	0.5	–	0.5
Tests on residue from distillation:													
Polymer content, wt. % (solids basis)	Tex-533-C	–	–	3.0	–	3.0	–	–	–	–	–	3.0	–
Penetration, 77°F, 100 g, 5 sec.	T 49	225	300	90	150	80	130	40	–	40	–	55	90
Viscosity, 140°F, poise	T 202	–	–	1,300	–	1,300	–	–	5,000	–	5,000	–	–
Solubility in trichloroethylene, %	T 44	97.0	–	97.0	–	95.0	–	–	–	–	–	97.0	–
Softening point, °F	T 53	–	–	–	–	130	–	–	–	–	–	135	–
Ductility, 77°F, 5 cm/min., cm	T 51	–	–	–	–	–	–	–	–	–	–	70	–
Float test, 140°F, sec.	T 50	–	–	–	–	1,800	–	–	–	–	–		
Ductility,[2] 39.2°F, 5 cm/min., cm	T 51	–	–	50	–	–	–	–	–	–	–	–	–
Elastic recovery,[2] 50°F, %	Tex-539-C	45	–	55	–	55	–	45	–	45	–	–	–
Tests on rejuvenating agent:													
Viscosity, 140°F, cSt	T 201	–	–	–	–	–	–	50	175	50	175	–	–
Flash point, C.O.C., °F	T 48	–	–	–	–	–	–	380	–	380	–	–	–
Saturates, % by weight	D2007	–	–	–	–	–	–	–	30	–	30	–	–
Solubility in n-pentane, % by weight	D2007	–	–	–	–	–	–	99	–	99	–	–	–
Tests on rejuvenating agent after TFO or RTFO:	T 240 or T 179												
Weight Change, %		–	–	–	–	–	–	–	6.5	–	6.5	–	–
Viscosity Ratio		–	–	–	–	–	–	–	3.0	–	3.0	–	–
Tests on latex:[4]													
Tensile strength, die C dumbbell, psi	D412[5]	–	–	–	–	–	–	500	–	500	–	–	–
Change in mass after immersion in rejuvenating agent, %	D471	–	–	–	–	–	–	–	40[6]	–	40[6]	–	–

1. Exception to T 59: Bring the temperature on the lower thermometer slowly to 350°F (±0°F). Maintain at this temperature for 20 min. Complete total distillation in 60 min. (±5 min.) from the first application of heat.
2. CRS-2P must meet one of either the ductility or elastic recovery requirements.
3. With all precertification samples of CMS-1P or CMS-2P, submit certified test reports showing that the rejuvenating agent and latex meet the stated requirements. Submit samples of these raw materials if requested by the Engineer.
4. Preparation of latex films: Use any substrate which produces a film of uniform cross-section. Apply latex using a drawdown tool that will deliver enough material to achieve desired residual thickness. Cure films for 14 days at 75°F and 50% relative humidity.
5. Cut samples for tensile strength determination using a crosshead speed of 20 in./min.
6. Specimen must remain intact after exposure and removal of excess rejuvenating agent.

2.5. **Specialty Emulsions.** Provide specialty emulsion that is either asphalt-based or resin-based and meets the requirements of Table 11.

Table 11
Specialty Emulsions

Property	Test Procedure	Type–Grade					
		Medium-Setting				Slow-Setting	
		AE–P		EAP&T		PCE[1]	
		Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72						
77°F, sec.		–	–	–	–	10	100
122°F, sec.		15	150	–	–	–	–
Sieve test, %	T 59	–	0.1	–	0.1	–	0.1
Miscibility[2]	T 59	–		Pass		Pass	
Demulsibility, 35 ml of 0.10 N $CaCl_2$, %	T 59	–	70	–	–	–	–
Storage stability, 1 day, %	T 59	–	1	–	1	–	–
Particle size,[5] % by volume < 2.5 µm	Tex-238-F[3]	–	–	90	–	90	–
Asphalt emulsion distillation to 500°F followed by Cutback asphalt distillation of residue to 680°F:	T 59 & T 78						
Residue after both distillations, % by wt.		40	–	–	–	–	–
Total oil distillate from both distillations, % by volume of emulsion		25	40	–	–	–	–
Residue by distillation, % by wt.	T 59	–	–	60	–	–	–
Residue by evaporation,[4] % by wt.	T 59	–	–	–	–	60	–
Tests on residue after all distillation(s):							
Viscosity, 140°F, poise	T 202	–	–	800	–	–	–
Kinematic viscosity,[5] 140°F, cSt	T 201	–	–	–	–	100	350
Flash point C.O.C., °F	T 48	–	–	–	–	400	–
Solubility in trichloroethylene, %	T 44	97.5	–	–	–	–	–
Float test, 122°F, sec.	T 50	50	200	–	–	–	–

Supply with each shipment of PCE:

- a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;
- a certification from the producer that the formulation supplied does not differ from the one tested and that no listed RCRA hazardous wastes or Polychlorinated Biphenyls (PCBs) have been mixed with the product; and
- a Material Safety Data Sheet.

Exception to T 59: In dilution, use 350 ml of distilled or deionized water and a 1,000-ml beaker.
Use Tex-238-F, beginning at "Particle Size Analysis by Laser Diffraction," with distilled or deionized water as a medium and no dispersant, or use another approved method.
Exception to T 59: Leave sample in the oven until foaming ceases, then cool and weigh.
PCE must meet either the kinematic viscosity requirement or the particle size requirement.

2.6. **Recycling Agent.** Recycling agent and emulsified recycling agent must meet the requirements in Table 12. Additionally, recycling agent and residue from emulsified recycling agent, when added in the specified proportions to the recycled asphalt, must meet the properties specified on the plans.

Table 12
Recycling Agent and Emulsified Recycling Agent

Property	Test Procedure	Recycling Agent		Emulsified Recycling Agent	
		Min	Max	Min	Max
Viscosity, Saybolt Furol, 77°F, sec.	T 72	–	–	15	100
Sieve test, %	T 59	–	–	–	0.1
Miscibility[1]	T 59	–		No coagulation	
Residue by evaporation,[2] % by wt.	T 59	–	–	60	–
Tests on recycling agent or residue from evaporation:					
Flash point, C.O.C., °F	T 48	400	–	400	–
Kinematic viscosity,	T 201				
140°F, cSt		75	200	75	200
275°F, cSt		–	10.0	–	10.0

1. Exception to T 59: Use 0.02 N CaCl2 solution in place of water.
2. Exception to T 59: Maintain sample at 300°F until foaming ceases, then cool and weigh.

2.7. **Crumb Rubber Modifier**. Crumb rubber modifier (CRM) consists of automobile and truck tires processed by ambient temperature grinding.

CRM must be:

- free from contaminants including fabric, metal, and mineral and other nonrubber substances;
- free-flowing; and
- nonfoaming when added to hot asphalt binder.

Ensure rubber gradation meets the requirements of the grades in Table 13 when tested in accordance with Tex-200-F, Part I, using a 50-g sample.

Table 13
CRM Gradations

Sieve Size (% Passing)	Grade A		Grade B		Grade C		Grade D	Grade E
	Min	Max	Min	Max	Min	Max		
#8	100	–	–	–	–	–	As shown on the plans	As approved
#10	95	100	100	–	–	–		
#16	–	–	70	100	100	–		
#30	–	–	25	60	90	100		
#40	–	–	–	–	45	100		
#50	0	10	–	–	–	–		
#200	–	–	0	5	–	–		

2.8. **Crack Sealer**. Provide polymer-modified asphalt-emulsion crack sealer meeting the requirements of Table 14. Provide rubber-asphalt crack sealer meeting the requirements of Table 15.

Table 14
Polymer-Modified Asphalt-Emulsion Crack Sealer

Property	Test Procedure	Min	Max
Rotational viscosity, 77°F, cP	D2196, Method A	10,000	25,000
Sieve test, %	T 59	–	0.1
Storage stability, 1 day, %	T 59	–	1
Evaporation	Tex-543-C		
Residue by evaporation, % by wt.		65	–
Tests on residue from evaporation:			
Penetration, 77°F, 100 g, 5 sec.	T 49	35	75
Softening point, °F	T 53	140	–
Ductility, 39.2°F, 5 cm/min., cm	T 51	100	–

Table 15
Rubber-Asphalt Crack Sealer

Property	Test Procedure	Class A		Class B	
		Min	Max	Min	Max
CRM content, Grade A or B, % by wt.	Tex-544-C	22	26	–	–
CRM content, Grade B, % by wt.	Tex-544-C	–	–	13	17
Virgin rubber content,[1] % by wt.		–	–	2	–
Flash point,[2] C.O.C., °F	T 48	400	–	400	–
Penetration,[3] 77°F, 150 g, 5 sec.	T 49	30	50	30	50
Penetration,[3] 32°F, 200 g, 60 sec.	T 49	12	–	12	–
Softening point, °F	T 53	–	–	170	–
Bond Test, non-immersed, 0.5 in specimen, 50% extension, 20°F[4]	D5329	–		Pass	

1. Provide certification that the Min % virgin rubber was added.
2. Agitate the sealing compound with a 3/8- to 1/2-in. (9.5- to 12.7-mm) wide, square-end metal spatula to bring the material on the bottom of the cup to the surface (i.e., turn the material over) before passing the test flame over the cup. Start at one side of the thermometer, move around to the other, and then return to the starting point using 8 to 10 rapid circular strokes. Accomplish agitation in 3 to 4 sec. Pass the test flame over the cup immediately after stirring is completed.
3. Exception to T 49: Substitute the cone specified in D217 for the penetration needle.
4. Allow no crack in the crack sealing materials or break in the bond between the sealer and the mortar blocks over 1/4 in. deep for any specimen after completion of the test.

2.9. **Asphalt-Rubber Binders.** Provide asphalt-rubber (A-R) binders that are mixtures of asphalt binder and CRM, which have been reacted at elevated temperatures. Provide A-R binders meeting D6114 and containing a minimum of 15% CRM by weight. Provide Types I or II, containing CRM Grade C, for use in hot-mixed aggregate mixtures. Provide Types II or III, containing CRM Grade B, for use in surface treatment binder. Ensure binder properties meet the requirements of Table 16.

Table 16
A-R Binders

Property	Test Procedure	Binder Type					
		Type I		Type II		Type III	
		Min	Max	Min	Max	Min	Max
Apparent viscosity, 347°F, cP	D2196, Method A	1,500	5,000	1,500	5,000	1,500	5,000
Penetration, 77°F, 100 g, 5 sec.	T 49	25	75	25	75	50	100
Penetration, 39.2°F, 200 g, 60 sec.	T 49	10	–	15	–	25	–
Softening point, °F	T 53	135	–	130	–	125	–
Resilience, 77°F, %	D5329	25	–	20	–	10	–
Flash point, C.O.C., °F	T 48	450	–	450	–	450	–
Tests on residue from Thin-Film Oven Test:	T 179						
Retained penetration ratio, 39.2°F, 200 g, 60 sec., % of original	T 49	75	–	75	–	75	–

2.10. **Performance-Graded Binders.** Provide PG binders that are smooth and homogeneous, show no separation when tested in accordance with Tex-540-C, and meet the requirements of Table 17.

Separation testing is not required if:

- a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer,
- the binder is blended on site in continuously agitated tanks, or
- binder acceptance is based on field samples taken from an in-line sampling port at the hot-mix plant after the addition of modifiers.

Table 17
Performance-Graded Binders

Property and Test Method	Performance Grade																		
	PG 58			PG 64				PG 70				PG 76				PG 82		
	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28
Average 7-day max pavement design temperature, °C[1]	< 58			< 64				< 70				< 76				< 82		
Min pavement design temperature, °C[1]	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28	>-34	>-16	>-22	>-28
Original Binder																		
Flash point, T 48, Min, °C	230																	
Viscosity, T 316:[2,3] Max, 3.0 Pa·s, test temperature, °C	135																	
Dynamic shear, T 315:[4] G*/sin(δ), Min, 1.00 kPa, Max, 2.00 kPa,[7] Test temperature @ 10 rad/sec., °C	58			64				70				76				82		
Elastic recovery, D6084, 50°F, % Min	–	–	30	–	–	30	50	–	30	50	60	30	50	60	70	50	60	70
Rolling Thin-Film Oven (Tex-541-C)																		
Mass loss, Tex-541-C, Max, %	1.0																	
Dynamic shear, T 315: G*/sin(δ), Min, 2.20 kPa, Max, 5.00 kPa,[7] Test temperature @ 10 rad/sec., °C	58			64				70				76				82		
Pressure Aging Vessel (PAV) Residue (R 28)																		
PAV aging temperature, °C	100																	
Dynamic shear, T 315: G*sin(δ), Max, 5,000 kPa Test temperature @ 10 rad/sec., °C	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22
Creep stiffness, T 313:[5,6] S, max, 300 MPa, *m*-value, Min, 0.300 Test temperature @ 60 sec., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18
Direct tension, T 314:[6] Failure strain, Min, 1.0% Test temperature @ 1.0 mm/min., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18

1. Pavement temperatures are estimated from air temperatures using an algorithm contained in a Department-supplied computer program, may be provided by the Department, or by following the procedures outlined in AASHTO MP 2 and PP 28.
2. This requirement may be waived at the Department's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed, and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).
3. Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.
4. For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G*/sin(δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (T 201 or T 202) or rotational viscometry (T 316).
5. Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.
6. If creep stiffness is below 300 MPa, direct tension test is not required. If creep stiffness is between 300 and 600 MPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.
7. Maximum values for unaged and RTFO aged dynamic shear apply only to materials used as substitute binders, as described in specification items, 340, "Dense-Graded Hot-Mix Asphalt (Small Quantity)," 341, "Dense-Graded Hot-Mix Asphalt," and 344, "Superpave Mixtures."

3. EQUIPMENT

Provide all equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils, and emulsions.

4. CONSTRUCTION

Typical Material Use. Use materials shown in Table 18, unless otherwise determined by the Engineer.

Table 18
Typical Material Use

Material Application	Typically Used Materials
Hot-mixed, hot-laid asphalt mixtures	PG binders, A-R binders Types I and II
Surface treatment	AC-5, AC-10, AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-20XP, AC-10-2TR, AC-20-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P,CRS-2P, CHFRS-2P, A-R binders Types II and III
Surface treatment (cool weather)	RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L
Precoating	AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H
Tack coat	PG Binders, SS-1H, CSS-1H, EAP&T
Fog seal	SS-1, SS-1H, CSS-1, CSS-1H
Hot-mixed, cold-laid asphalt mixtures	AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S
Patching mix	MC-800, SCM I, SCM II, AES-300S
Recycling	AC-0.6, AC-1.5, AC-3, AES-150P, AES-300P, recycling agent, emulsified recycling agent
Crack sealing	SS-1P, polymer mod AE crack sealant, rubber asphalt crack sealers (Class A, Class B)
Microsurfacing	CSS-1P
Prime	MC-30, AE-P, EAP&T, PCE
Curing membrane	SS-1, SS-1H, CSS-1, CSS-1H, PCE
Erosion control	SS-1, SS-1H, CSS-1, CSS-1H, PCE

4.1. **Storage and Application Temperatures.** Use storage and application temperatures in accordance with Table 19. Store and apply materials at the lowest temperature yielding satisfactory results. Follow the manufacturer's instructions for any agitation requirements in storage. Manufacturer's instructions regarding recommended application and storage temperatures supersede those of Table 19.

Table 19
Storage and Application Temperatures

Type–Grade	Application		Storage
	Recommended Range (°F)	Maximum Allowable (°F)	Maximum (°F)
AC-0.6, AC-1.5, AC-3	200–300	350	350
AC-5, AC-10	275–350	350	350
AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-20-5TR	300–375	375	360
RC-250	125–180	200	200
RC-800	170–230	260	260
RC-3000	215–275	285	285
MC-30, AE-P	70–150	175	175
MC-250	125–210	240	240
MC-800, SCM I, SCM II	175–260	275	275
MC-3000, MC-2400L	225–275	290	290
HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, CMS-2, CMS-2S, AES-300, AES-300S, AES-150P, AES-300P	120–160	180	180
SS-1, SS-1H, CSS-1, CSS-1H, PCE, EAP&T, SS-1P, RS-1P, CRS-1P, CSS-1P, recycling agent, emulsified recycling agent, polymer mod AE crack sealant	50–130	140	140
PG binders	275–350	350	350
Rubber asphalt crack sealers (Class A, Class B)	350–375	400	–
A-R binders Types I, II, and III	325–425	425	425

5. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but is subsidiary or is included in payment for other pertinent items.

Item 320
Equipment for Asphalt Concrete Pavement

1. DESCRIPTION

Provide equipment to produce, haul, place, compact, and core asphalt concrete pavement.

2. EQUIPMENT

Ensure weighing and measuring equipment complies with Item 520, "Weighing and Measuring Equipment." Synchronize equipment to produce a mixture meeting the required proportions.

2.1. **Production Equipment.** Provide:

- drum-mix type, weigh-batch, or modified weigh-batch mixing plants that ensure a uniform, continuous production;
- automatic proportioning and measuring devices with interlock cut-off circuits that stop operations if the control system malfunctions;
- visible readouts indicating the weight or volume of asphalt and aggregate proportions;
- safe and accurate means to take required samples by inspection forces;
- permanent means to check the output of metering devices and to perform calibration and weight checks; and
- additive-feed systems to ensure a uniform, continuous material flow in the desired proportion.

2.1.1. **Drum-Mix Plants.** Provide a mixing plant that complies with the requirements below.

2.1.1.1. **Aggregate Feed System.** Provide:

- a minimum of one cold aggregate bin for each stockpile of individual materials used to produce the mix;
- bins designed to prevent overflow of material;
- scalping screens or other approved methods to remove any oversized material, roots, or other objectionable materials;
- a feed system to ensure a uniform, continuous material flow in the desired proportion to the dryer;
- an integrated means for moisture compensation;
- belt scales, weigh box, or other approved devices to measure the weight of the combined aggregate; and
- cold aggregate bin flow indicators that automatically signal interrupted material flow.

2.1.1.2. **Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS) Feed Systems.** Provide a minimum of one bin for each stockpile of RAP and RAS to weigh and feed the recycled material into the hot-mix plant.

2.1.1.3. **Mineral Filler Feed System.** Provide a closed system for mineral filler that maintains a constant supply with minimal loss of material through the exhaust system. Interlock the measuring device into the automatic plant controls to automatically adjust the supply of mineral filler to plant production and provide a consistent percentage to the mixture.

2.1.1.4. **Heating, Drying, and Mixing Systems.** Provide:

- a dryer or mixing system to agitate the aggregate during heating;
- a heating system that controls the temperature during production to prevent aggregate and asphalt binder damage;

- a heating system that completely burns fuel and leaves no residue; and
- a recording thermometer that continuously measures and records the mixture discharge temperature.

2.1.1.5. **Dust Collection System**. Provide a dust collection system to collect fines generated by the drying and mixing process and reintroduce them into the mixing drum.

2.1.1.6. **Asphalt Binder Equipment**. Supply equipment to heat binder to the required temperature. Equip the heating apparatus with a continuously recording thermometer located at the highest temperature point. Produce a 24-hr. chart of the recorded temperature. Place a device with automatic temperature compensation that accurately meters the binder in the line leading to the mixer.

Furnish a sampling port on the line between the storage tank and mixer. Supply an additional sampling port between any additive blending device and mixer.

Supply an in-line viscosity-measuring device located between the blending unit and the mixing drum when A-R binder is specified. Provide a means to calibrate the meter on site when an asphalt mass flow meter is used.

2.1.1.7. **Mixture Storage and Discharge**. Provide a surge-storage system to minimize interruptions during operations unless otherwise approved. Furnish a gob hopper or other device to minimize segregation in the bin. Provide an automated system that weighs the mixture upon discharge and produces a ticket showing:

- date,
- project identification number,
- plant identification,
- mix identification,
- vehicle identification,
- total weight of the load,
- tare weight of the vehicle,
- weight of mixture in each load, and
- load number or sequential ticket number for the day.

2.1.1.8. **Truck Scales**. Provide standard platform scales at an approved location.

2.1.2. **Weigh-Batch Plants**. Provide a mixing plant that complies with Section 320.2.1.1., "Drum-Mix Plants," except as required below.

2.1.2.1. **Screening and Proportioning**. Provide enough hot bins to separate the aggregate and to control proportioning of the mixture type specified. Supply bins that discard excessive and oversized material through overflow chutes. Provide safe access for inspectors to obtain samples from the hot bins.

2.1.2.2. **Aggregate Weigh Box and Batching Scales**. Provide a weigh box and batching scales to hold and weigh a complete batch of aggregate. Provide an automatic proportioning system with low bin indicators that automatically stop when material level in any bin is not enough to complete the batch.

2.1.2.3. **Asphalt Binder Measuring System**. Provide bucket and scales with enough capacity to hold and weigh binder for one batch.

2.1.2.4. **Mixer**. Equip mixers with an adjustable automatic timer that controls the dry and wet mixing period and locks the discharge doors for the required mixing period. Furnish a pug mill with a mixing chamber large enough to prevent spillage.

2.1.3. **Modified Weigh-Batch Plants**. Provide a mixing plant that complies with Section 320.2.1.2., "Weigh-Batch Plants," except as specifically described below.

2.1.3.1. **Aggregate Feeds**. Aggregate control is required at the cold feeds. Hot bin screens are not required.

2.1.3.2. **Surge Bins**. Provide one or more bins large enough to produce 1 complete batch of mixture.

2.2. **Hauling Equipment**. Provide trucks with enclosed sides to prevent asphalt mixture loss. Cover each load of mixture with waterproof tarpaulins when shown on the plans or required by the Engineer. Clean all truck beds before use to ensure the mixture is not contaminated. Coat the inside truck beds, when necessary, with an approved release agent from the Department's MPL.

2.3. **Placement and Compaction Equipment**. Provide equipment that does not damage underlying pavement. Comply with laws and regulations concerning overweight vehicles. Use other equipment that will consistently produce satisfactory results, when approved.

2.3.1. **Asphalt Paver**. Furnish a paver that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements. Ensure the paver does not support the weight of any portion of hauling equipment other than the connection. Provide loading equipment that does not transmit vibrations or other motions to the paver that adversely affect the finished pavement quality. Equip the paver with an automatic, dual, longitudinal-grade control system and an automatic, transverse-grade control system.

2.3.1.1. **Tractor Unit**. Supply a tractor unit that can push or propel vehicles, dumping directly into the finishing machine to obtain the desired lines and grades to eliminate any hand finishing. Equip the unit with a hitch able to maintain contact between the hauling equipment's rear wheels and the finishing machine's pusher rollers while mixture is unloaded.

2.3.1.2. **Screed**. Provide a heated compacting screed that will produce a finished surface that meets longitudinal and transverse profile, typical section, and placement requirements. Screed extensions must provide the same compacting action and heating as the main unit unless otherwise approved.

2.3.1.3. **Grade Reference**. Provide a grade reference with enough support that the maximum deflection does not exceed 1/16 in. between supports. Ensure that the longitudinal controls can operate from any longitudinal grade reference including a string line, ski, mobile reference, or joint matching shoes.

2.3.2. **Material Transfer Devices**. Provide the specified type of device when shown on the plans. Ensure the devices provide a continuous, uniform mixture flow to the asphalt paver. Provide windrow pick-up equipment, when used, constructed to pick up substantially all roadway mixture placed in the windrow.

2.3.3. **Remixing Equipment**. Provide equipment, when required, that includes a pug mill, variable pitch augers, or variable diameter augers operating under a storage unit with a minimum capacity of 8 tons.

2.3.4. **Motor Grader**. Provide a self-propelled grader, when allowed, with a blade length of at least 12 ft. and a wheelbase of at least 16 ft.

2.3.5. **Thermal Imaging System or Hand-Held Thermal Camera**. Provide a thermal imaging system or hand-held thermal camera meeting the requirements of Tex-244-F.

2.3.6. **Rollers**. Provide rollers meeting the requirements of Item 210, "Rolling," for each type of roller required for compaction.

2.3.7. **Straightedges and Templates**. Furnish 10-ft. straightedges and other templates as required or approved.

2.4. **Field Laboratory**. Provide and maintain a Type D Structure (Asphalt Mix Control Laboratory) unless otherwise shown on the plans in accordance with Item 504, "Field Office and Laboratory," and details shown on the plans.

2.5. **Coring Equipment**. Provide equipment suitable to obtain a pavement specimen meeting the dimensions for testing when coring is required.

3. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.

Item 341
Dense-Graded Hot-Mix Asphalt

1. DESCRIPTION

Construct a hot-mix asphalt (HMA) pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder mixed hot in a mixing plant. Payment adjustments will apply to HMA placed under this specification unless the HMA is deemed exempt in accordance with Section 341.4.9.4., "Exempt Production."

2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate.** Furnish aggregates from sources that conform to the requirements shown in Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse, intermediate, or fine aggregate. Aggregate from reclaimed asphalt pavement (RAP) is not required to meet Table 1 requirements unless otherwise shown on the plans. Supply aggregates that meet the definitions in Tex-100-E for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex-200-F, Part II.

2.1.1. **Coarse Aggregate.** Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance; and
- once approved, do not add material to the stockpile unless otherwise approved.

Provide aggregate from non-listed sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes. SAC requirements apply to aggregates used on surfaces

other than travel lanes when shown on the plans. The SAC for sources on the Department's *Aggregate Quality Monitoring Program* (AQMP) (Tex-499-A) is listed in the BRSQC.

2.1.1.1. **Blending Class A and Class B Aggregates.** Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate to meet requirements for Class A materials. Ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source when blending Class A and B aggregates to meet a Class A requirement. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Coarse aggregate from RAP and Recycled Asphalt Shingles (RAS) will be considered as Class B aggregate for blending purposes.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

2.1.1.2. **Micro-Deval Abrasion.** The Engineer will perform a minimum of one Micro-Deval abrasion test in accordance with Tex-461-A for each coarse aggregate source used in the mixture design that has a Rated Source Soundness Magnesium (RSSM) loss value greater than 15 as listed in the BRSQC. The Engineer will perform testing before the start of production and may perform additional testing at any time during production. The Engineer may obtain the coarse aggregate samples from each coarse aggregate source or may require the Contractor to obtain the samples. The Engineer may waive all Micro-Deval testing based on a satisfactory test history of the same aggregate source.

The Engineer will estimate the magnesium sulfate soundness loss for each coarse aggregate source, when tested, using the following formula:

$$Mg_{est.} = (RSSM)(MD_{act}/RSMD)$$

where:
$Mg_{est.}$ = magnesium sulfate soundness loss
$MD_{act.}$ = actual Micro-Deval percent loss
$RSMD$ = Rated Source Micro-Deval

When the estimated magnesium sulfate soundness loss is greater than the maximum magnesium sulfate soundness loss specified, the coarse aggregate source will not be allowed for use unless otherwise approved. The Engineer will consult the Geotechnical, Soils, and Aggregates Branch of the Construction Division, and additional testing may be required before granting approval.

2.1.2. **Intermediate Aggregate.** Aggregates not meeting the definition of coarse or fine aggregate will be defined as intermediate aggregate. Supply intermediate aggregates, when used that are free from organic impurities. The Engineer may test the intermediate aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. Supply intermediate aggregate from coarse aggregate sources, when used that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve, and verify that it meets the requirements in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

2.1.3. **Fine Aggregate.** Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with Tex-408-A to verify the

material is free from organic impurities. No more than 15% of the total aggregate may be field sand or other uncrushed fine aggregate. Use fine aggregate, with the exception of field sand, from coarse aggregate sources that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve and verify that it meets the requirements in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

Table 1
Aggregate Quality Requirements

Property	Test Method	Requirement
Coarse Aggregate		
SAC	Tex-499-A (AQMP)	As shown on the plans
Deleterious material, %, Max	Tex-217-F, Part I	1.5
Decantation, %, Max	Tex-217-F, Part II	1.5
Micro-Deval abrasion, %	Tex-461-A	Note[1]
Los Angeles abrasion, %, Max	Tex-410-A	40
Magnesium sulfate soundness, 5 cycles, %, Max	Tex-411-A	30
Crushed face count,[2] %, Min	Tex-460-A, Part I	85
Flat and elongated particles @ 5:1, %, Max	Tex-280-F	10
Fine Aggregate		
Linear shrinkage, %, Max	Tex-107-E	3
Combined Aggregate[3]		
Sand equivalent, %, Min	Tex-203-F	45

1. Used to estimate the magnesium sulfate soundness loss in accordance with Section 341.2.1.1.2., "Micro-Deval Abrasion."
2. Only applies to crushed gravel.
3. Aggregates, without mineral filler, RAP, RAS, or additives, combined as used in the job-mix formula (JMF).

Table 2
Gradation Requirements for Fine Aggregate

Sieve Size	% Passing by Weight or Volume
3/8"	100
#8	70–100
#200	0–30

2.2. **Mineral Filler.** Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime or fly ash unless otherwise shown on the plans. Use no more than 1% hydrated lime if a substitute binder is used unless otherwise shown on the plans or allowed. Test all mineral fillers except hydrated lime and fly ash in accordance with Tex-107-E to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:

- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
- does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
- meets the gradation requirements in Table 3.

Table 3
Gradation Requirements for Mineral Filler

Sieve Size	% Passing by Weight or Volume
#8	100
#200	55–100

2.3. **Baghouse Fines.** Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.

2.4. **Asphalt Binder.** Furnish the type and grade of performance-graded (PG) asphalt specified on the plans.

2.5. **Tack Coat.** Furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized or preferred tack

coat materials may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

The Engineer will obtain at least one sample of the tack coat binder per project in accordance with Tex-500-C, Part III, and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will obtain the sample from the asphalt distributor immediately before use.

2.6. **Additives**. Use the type and rate of additive specified when shown on the plans. Additives that facilitate mixing, compaction, or improve the quality of the mixture are allowed when approved. Provide the Engineer with documentation such as the bill of lading showing the quantity of additives used in the project unless otherwise directed.

2.6.1. **Lime and Liquid Antistripping Agent**. When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.

2.6.2. **Warm Mix Asphalt (WMA)**. Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215°F and 275°F using approved WMA additives or processes from the Department's MPL.

WMA is allowed for use on all projects and is required when shown on the plans. When WMA is required, the maximum placement or target discharge temperature for WMA will be set at a value below 275°F.

Department-approved WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures above 275°F; however, such mixtures will not be defined as WMA.

2.7. **Recycled Materials**. Use of RAP and RAS is permitted unless otherwise shown on the plans. Do not exceed the maximum allowable percentages of RAP and RAS shown in Table 4. The allowable percentages shown in Table 4 may be decreased or increased when shown on the plans. Determine asphalt binder content and gradation of the RAP and RAS stockpiles for mixture design purposes in accordance with Tex-236-F. The Engineer may verify the asphalt binder content of the stockpiles at any time during production. Perform other tests on RAP and RAS when shown on the plans. Asphalt binder from RAP and RAS is designated as recycled asphalt binder. Calculate and ensure that the ratio of the recycled asphalt binder to total binder does not exceed the percentages shown in Table 5 during mixture design and HMA production when RAP or RAS is used. Use a separate cold feed bin for each stockpile of RAP and RAS during HMA production.

Surface, intermediate, and base mixes referenced in Tables 4 and 5 are defined as follows:

- **Surface**. The final HMA lift placed at or near the top of the pavement structure;
- **Intermediate**. Mixtures placed below an HMA surface mix and less than or equal to 8.0 in. from the riding surface; and
- **Base**. Mixtures placed greater than 8.0 in. from the riding surface.

2.7.1. **RAP**. RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Crush or break RAP so that 100% of the particles pass the 2 in. sieve. Fractionated RAP is defined as 2 or more RAP stockpiles, divided into coarse and fine fractions.

Use of Contractor-owned RAP including HMA plant waste is permitted unless otherwise shown on the plans. Department-owned RAP stockpiles are available for the Contractor's use when the stockpile locations are shown on the plans. If Department-owned RAP is available for the Contractor's use, the Contractor may use Contractor-owned fractionated RAP and replace it with an equal quantity of Department-owned RAP. This allowance does not apply to a Contractor using unfractionated RAP. Department-owned RAP generated through required work on the Contract is available for the Contractor's use when shown on the plans. Perform any necessary tests to ensure Contractor- or Department-owned RAP is appropriate for use. The Department will not perform any tests or assume any liability for the quality of the Department-owned RAP

unless otherwise shown on the plans. The Contractor will retain ownership of RAP generated on the project when shown on the plans.

The coarse RAP stockpile will contain only material retained by processing over a 3/8-in. or 1/2-in. screen unless otherwise approved. The fine RAP stockpile will contain only material passing the 3/8-in. or 1/2-in. screen unless otherwise approved. The Engineer may allow the Contractor to use an alternate to the 3/8-in. or 1/2-in. screen to fractionate the RAP. The maximum percentages of fractionated RAP may be comprised of coarse or fine fractionated RAP or the combination of both coarse and fine fractionated RAP.

Do not use Department- or Contractor-owned RAP contaminated with dirt or other objectionable materials. Do not use Department- or Contractor-owned RAP if the decantation value exceeds 5% and the plasticity index is greater than 8. Test the stockpiled RAP for decantation in accordance with Tex-406-A, Part I. Determine the plasticity index in accordance with Tex-106-E if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction or ignition.

Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles. Remove unused Contractor-owned RAP material from the project site upon completion of the project. Return unused Department-owned RAP to the designated stockpile location.

Table 4
Maximum Allowable Amounts of RAP[1]

Maximum Allowable Fractionated RAP[2] (%)			Maximum Allowable Unfractionated RAP[3] (%)		
Surface	Intermediate	Base	Surface	Intermediate	Base
20.0	30.0	40.0	10.0	10.0	10.0

1. Must also meet the recycled binder to total binder ratio shown in Table 5.
2. Up to 5% RAS may be used separately or as a replacement for fractionated RAP.
3. Unfractionated RAP may not be combined with fractionated RAP or RAS.

2.7.2. **RAS**. Use of post-manufactured RAS or post-consumer RAS (tear-offs) is permitted unless otherwise shown on the plans. Up to 5% RAS may be used separately or as a replacement for fractionated RAP in accordance with Table 4 and Table 5. RAS is defined as processed asphalt shingle material from manufacturing of asphalt roofing shingles or from re-roofing residential structures. Post-manufactured RAS is processed manufacturer's shingle scrap by-product. Post-consumer RAS is processed shingle scrap removed from residential structures. Comply with all regulatory requirements stipulated for RAS by the TCEQ. RAS may be used separately or in conjunction with RAP.

Process the RAS by ambient grinding or granulating such that 100% of the particles pass the 3/8 in. sieve when tested in accordance with Tex-200-F, Part I. Perform a sieve analysis on processed RAS material before extraction (or ignition) of the asphalt binder.

Add sand meeting the requirements of Table 1 and Table 2 or fine RAP to RAS stockpiles if needed to keep the processed material workable. Any stockpile that contains RAS will be considered a RAS stockpile and be limited to no more than 5.0% of the HMA mixture in accordance with Table 4.

Certify compliance of the RAS with DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines." Treat RAS as an established nonhazardous recyclable material if it has not come into contact with any hazardous materials. Use RAS from shingle sources on the Department's MPL. Remove substantially all materials before use that are not part of the shingle, such as wood, paper, metal, plastic, and felt paper. Determine the deleterious content of RAS material for mixture design purposes in accordance with Tex-217-F, Part III. Do not use RAS if deleterious materials are more than 0.5% of the stockpiled RAS unless otherwise approved. Submit a sample for approval before submitting the mixture design. The Department will perform the testing for deleterious material of RAS to determine specification compliance.

2.8. **Substitute Binders**. Unless otherwise shown on the plans, the Contractor may use a substitute PG binder listed in Table 5 instead of the PG binder originally specified, if the substitute PG binder and mixture made with the substitute PG binder meet the following:

- the substitute binder meets the specification requirements for the substitute binder grade in accordance with Section 300.2.10., "Performance-Graded Binders;" and
- the mixture has less than 10.0 mm of rutting on the Hamburg Wheel test (Tex-242-F) after the number of passes required for the originally specified binder. Use of substitute PG binders may only be allowed at the discretion of the Engineer if the Hamburg Wheel test results are between 10.0 mm and 12.5 mm.

Table 5
Allowable Substitute PG Binders and Maximum Recycled Binder Ratios

Originally Specified PG Binder	Allowable Substitute PG Binder	Maximum Ratio of Recycled Binder[1] to Total Binder (%)		
		Surface	Intermediate	Base
HMA				
76-22[2]	70-22 or 64-22	20.0	20.0	20.0
	70-28 or 64-28	30.0	35.0	40.0
70-22[2]	64-22	20.0	20.0	20.0
	64-28 or 58-28	30.0	35.0	40.0
64-22[2]	58-28	30.0	35.0	40.0
76-28[2]	70-28 or 64-28	20.0	20.0	20.0
	64-34	30.0	35.0	40.0
70-28[2]	64-28 or 58-28	20.0	20.0	20.0
	64-34 or 58-34	30.0	35.0	40.0
64-28[2]	58-28	20.0	20.0	20.0
	58-34	30.0	35.0	40.0
WMA[3]				
76-22[2]	70-22 or 64-22	30.0	35.0	40.0
70-22[2]	64-22 or 58-28	30.0	35.0	40.0
64-22[4]	58-28	30.0	35.0	40.0
76-28[2]	70-28 or 64-28	30.0	35.0	40.0
70-28[2]	64-28 or 58-28	30.0	35.0	40.0
64-28[4]	58-28	30.0	35.0	40.0

1. Combined recycled binder from RAP and RAS.
2. Use no more than 20.0% recycled binder when using this originally specified PG binder.
3. WMA as defined in Section 341.2.6.2., "Warm Mix Asphalt (WMA)."
4. When used with WMA, this originally specified PG binder is allowed for use at the maximum recycled binder ratios shown in this table.

3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a mandatory pre-paving meeting with the Engineer on or before the first day of paving unless otherwise shown on the plans.

4.1. **Certification.** Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 6. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist. Provide Level 1A certified specialists at the plant during production operations. Provide Level 1B certified specialists to conduct placement tests.

Table 6
Test Methods, Test Responsibility, and Minimum Certification Levels

Test Description	Test Method	Contractor	Engineer	Level[1]
1. Aggregate and Recycled Material Testing				
Sampling	Tex-221-F	✓	✓	1A
Dry sieve	Tex-200-F, Part I	✓	✓	1A
Washed sieve	Tex-200-F, Part II	✓	✓	1A
Deleterious material	Tex-217-F, Parts I & III	✓	✓	1A
Decantation	Tex-217-F, Part II	✓	✓	1A
Los Angeles abrasion	Tex-410-A		✓	TxDOT
Magnesium sulfate soundness	Tex-411-A		✓	TxDOT
Micro-Deval abrasion	Tex-461-A		✓	2
Crushed face count	Tex-460-A	✓	✓	2
Flat and elongated particles	Tex-280-F	✓	✓	2
Linear shrinkage	Tex-107-E	✓	✓	2
Sand equivalent	Tex-203-F	✓	✓	2
Organic impurities	Tex-408-A	✓	✓	2
2. Asphalt Binder & Tack Coat Sampling				
Asphalt binder sampling	Tex-500-C, Part II	✓	✓	1A/1B
Tack coat sampling	Tex-500-C, Part III	✓	✓	1A/1B
3. Mix Design & Verification				
Design and JMF changes	Tex-204-F	✓	✓	2
Mixing	Tex-205-F	✓	✓	2
Molding (TGC)	Tex-206-F	✓	✓	1A
Molding (SGC)	Tex-241-F	✓	✓	1A
Laboratory-molded density	Tex-207-F	✓	✓	1A
VMA[2] (calculation only)	Tex-204-F	✓	✓	2
Rice gravity	Tex-227-F	✓	✓	1A
Ignition oven correction factors[3]	Tex-236-F	✓	✓	2
Indirect tensile strength	Tex-226-F	✓	✓	2
Hamburg Wheel test	Tex-242-F	✓	✓	2
Boil test	Tex-530-C	✓	✓	1A
4. Production Testing				
Selecting production random numbers	Tex-225-F, Part I		✓	1A
Mixture sampling	Tex-222-F	✓	✓	1A
Molding (TGC)	Tex-206-F	✓	✓	1A
Molding (SGC)	Tex-241-F	✓	✓	1A
Laboratory-molded density	Tex-207-F	✓	✓	1A
VMA[2] (calculation only)	Tex-204-F	✓	✓	1A
Rice gravity	Tex-227-F	✓	✓	1A
Gradation & asphalt binder content[3]	Tex-236-F	✓	✓	1A
Control charts	Tex-233-F	✓	✓	1A
Moisture content	Tex-212-F	✓	✓	1A
Hamburg Wheel test	Tex-242-F	✓	✓	2
Micro-Deval abrasion	Tex-461-A		✓	2
Boil test	Tex-530-C	✓	✓	1A
Abson recovery	Tex-211-F		✓	TxDOT
Overlay test	Tex-248-F		✓	TxDOT
Cantabro loss	Tex-245-F		✓	2
5. Placement Testing				
Selecting placement random numbers	Tex-225-F, Part II		✓	1A/1B
Trimming roadway cores	Tex-207-F	✓	✓	1A/1B
In-place air voids	Tex-207-F	✓	✓	1A/1B
Establish rolling pattern	Tex-207-F	✓		1B
Control charts	Tex-233-F	✓	✓	1A
Ride quality measurement	Tex-1001-S	✓	✓	Note[4]
Segregation (density profile)	Tex-207-F, Part V	✓	✓	1B
Longitudinal joint density	Tex-207-F, Part VII	✓	✓	1B
Thermal profile	Tex-244-F	✓	✓	1B

1. Level 1A, 1B, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
2. Voids in mineral aggregates.
3. Refer to Section 341.4.9.2.3., "Production Testing," for exceptions to using an ignition oven.
4. Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.

4.2. **Reporting and Responsibilities.** Use Department-provided templates to record and calculate all test data, including mixture design, production and placement QC/QA, control charts, thermal profiles, segregation density profiles, and longitudinal joint density. Obtain the current version of the templates at http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. The maximum allowable time for the Contractor and Engineer to exchange test data is as given in Table 7 unless otherwise approved. The Engineer and the Contractor will immediately report to the other party any test result that requires suspension of production or placement, a payment adjustment less than 1.000, or that fails to meet the specification requirements. Record and electronically submit all test results and pertinent information on Department-provided templates.

Subsequent sublots placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Article 5.3., "Conformity with Plans, Specifications, and Special Provisions."

Table 7
Reporting Schedule

Description	Reported By	Reported To	To Be Reported Within
Production Quality Control			
Gradation[1]	Contractor	Engineer	1 working day of completion of the sublot
Asphalt binder content[1]			
Laboratory-molded density[2]			
Moisture content[3]			
Boil test[3]			
Production Quality Assurance			
Gradation[3]	Engineer	Contractor	1 working day of completion of the sublot
Asphalt binder content[3]			
Laboratory-molded density[1]			
Hamburg Wheel test[2]			
Boil test[3]			
Binder tests[2]			
Placement Quality Control			
In-place air voids[2]	Contractor	Engineer	1 working day of completion of the lot
Segregation[1]			
Longitudinal joint density[1]			
Thermal profile[1]			
Placement Quality Assurance			
In-place air voids[1]	Engineer	Contractor	1 working day of receipt of the trimmed cores for in-place air voids[4]
Segregation[2]			
Longitudinal joint density[2]			
Thermal profile[2]			
Aging ratio[2]			
Payment adjustment summary	Engineer	Contractor	2 working days of performing all required tests and receiving Contractor test data

1. These tests are required on every sublot.
2. Optional test. To be reported as soon as results become available.
3. To be performed at the frequency specified on the plans.
4. 2 days are allowed if cores cannot be dried to constant weight within 1 day.

The Engineer will use the Department-provided template to calculate all payment adjustment factors for the lot. Sublot samples may be discarded after the Engineer and Contractor sign off on the payment adjustment summary documentation for the lot.

Use the procedures described in Tex-233-F to plot the results of all quality control (QC) and quality assurance (QA) testing. Update the control charts as soon as test results for each sublot become available. Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

4.3. **Quality Control Plan (QCP).** Develop and follow the QCP in detail. Obtain approval for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP before the mandatory pre-paving meeting. Receive approval of the QCP before beginning production. Include the following items in the QCP:

4.3.1. **Project Personnel.** For project personnel, include:

- a list of individuals responsible for QC with authority to take corrective action;
- current contact information for each individual listed; and
- current copies of certification documents for individuals performing specified QC functions.

4.3.2. **Material Delivery and Storage.** For material delivery and storage, include:

- the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
- aggregate stockpiling procedures to avoid contamination and segregation;
- frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
- procedure for monitoring the quality and variability of asphalt binder.

4.3.3. **Production.** For production, include:

- loader operation procedures to avoid contamination in cold bins;
- procedures for calibrating and controlling cold feeds;
- procedures to eliminate debris or oversized material;
- procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, RAP, RAS, lime, liquid antistrip, WMA);
- procedures for reporting job control test results; and
- procedures to avoid segregation and drain-down in the silo.

4.3.4. **Loading and Transporting.** For loading and transporting, include:

- type and application method for release agents; and
- truck loading procedures to avoid segregation.

4.3.5. **Placement and Compaction.** For placement and compaction, include:

- proposed agenda for mandatory pre-paving meeting, including date and location;
- proposed paving plan (e.g., paving widths, joint offsets, and lift thicknesses);
- type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
- procedures for the transfer of mixture into the paver, while avoiding segregation and preventing material spillage;
- process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality;
- paver operations (e.g., operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
- procedures to construct quality longitudinal and transverse joints.

4.4. **Mixture Design.**

4.4.1. **Design Requirements.** The Contractor may design the mixture using a Texas Gyratory Compactor (TGC) or a Superpave Gyratory Compactor (SGC) unless otherwise shown on the plans. Use the dense-graded

design procedure provided in Tex-204-F. Design the mixture to meet the requirements listed in Tables 1, 2, 3, 4, 5, 8, 9, and 10.

4.4.1.1. **Target Laboratory-Molded Density When The TGC Is Used.** Design the mixture at a 96.5% target laboratory-molded density. Increase the target laboratory-molded density to 97.0% or 97.5% at the Contractor's discretion or when shown on the plans or specification.

4.4.1.2. **Design Number of Gyrations (Ndesign) When The SGC Is Used.** Design the mixture at 50 gyrations (Ndesign). Use a target laboratory-molded density of 96.0% to design the mixture; however, adjustments can be made to the Ndesign value as noted in Table 9. The Ndesign level may be reduced to no less than 35 gyrations at the Contractor's discretion.

Use an approved laboratory from the Department's MPL to perform the Hamburg Wheel test, and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the laboratory mixture design.

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- asphalt binder content and aggregate gradation of RAP and RAS stockpiles;
- the target laboratory-molded density (or Ndesign level when using the SGC);
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

Table 8
Master Gradation Limits (% Passing by Weight or Volume) and VMA Requirements

Sieve Size	A Coarse Base	B Fine Base	C Coarse Surface	D Fine Surface	F Fine Mixture
2"	100.0[1]	–	–	–	–
1-1/2"	98.0–100.0	100.0[1]	–	–	–
1"	78.0–94.0	98.0–100.0	100.0[1]	–	–
3/4"	64.0–85.0	84.0–98.0	95.0–100.0	100.0[1]	–
1/2"	50.0–70.0	–	–	98.0–100.0	100.0[1]
3/8"	–	60.0–80.0	70.0–85.0	85.0–100.0	98.0–100.0
#4	30.0–50.0	40.0–60.0	43.0–63.0	50.0–70.0	70.0–90.0
#8	22.0–36.0	29.0–43.0	32.0–44.0	35.0–46.0	38.0–48.0
#30	8.0–23.0	13.0–28.0	14.0–28.0	15.0–29.0	12.0–27.0
#50	3.0–19.0	6.0–20.0	7.0–21.0	7.0–20.0	6.0–19.0
#200	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0	2.0–7.0
Design VMA, % Minimum					
–	12.0	13.0	14.0	15.0	16.0
Production (Plant-Produced) VMA, % Minimum					
–	11.5	12.5	13.5	14.5	15.5

1. Defined as maximum sieve size. No tolerance allowed.

Table 9
Laboratory Mixture Design Properties

Mixture Property	Test Method	Requirement
Target laboratory-molded density, % (TGC)	Tex-207-F	96.5[1]
Design gyrations (Ndesign for SGC)	Tex-241-F	50[2]
Indirect tensile strength (dry), psi	Tex-226-F	85–200[3]
Boil test[4]	Tex-530-C	–

1. Increase to 97.0% or 97.5% at the Contractor's discretion or when shown on the plans or specification.
2. Adjust within a range of 35–100 gyrations when shown on the plans or specification or when mutually agreed between the Engineer and Contractor.
3. The Engineer may allow the IDT strength to exceed 200 psi if the corresponding Hamburg Wheel rut depth is greater than 3.0 mm and less than 12.5 mm.
4. Used to establish baseline for comparison to production results. May be waived when approved.

Table 10
Hamburg Wheel Test Requirements

High-Temperature Binder Grade	Test Method	Minimum # of Passes @ 12.5 mm[1] Rut Depth, Tested @ 50°C
PG 64 or lower	Tex-242-F	10,000[2]
PG 70		15,000[3]
PG 76 or higher		20,000

1. When the rut depth at the required minimum number of passes is less than 3 mm, the Engineer may require the Contractor to increase the target laboratory-molded density (TGC) by 0.5% to no more than 97.5% or lower the Ndesign level (SGC) to no less than 35 gyrations.
2. May be decreased to no less than 5,000 passes when shown on the plans.
3. May be decreased to no less than 10,000 passes when shown on the plans.

4.4.2. **Job-Mix Formula Approval.** The job-mix formula (JMF) is the combined aggregate gradation, target laboratory-molded density (or Ndesign level), and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When WMA is used, JMF1 may be designed and submitted to the Engineer without including the WMA additive. When WMA is used, document the additive or process used and recommended rate on the JMF1 submittal. The Engineer and the Contractor will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. The Department may require the Contractor to reimburse the Department for verification tests if more than 2 trial batches per design are required.

4.4.2.1. **Contractor's Responsibilities.**

4.4.2.1.1. **Providing Gyratory Compactor.** Use a TGC calibrated in accordance with Tex-914-K when electing or required to design the mixture in accordance with Tex-204-F, Part I, for molding production samples. Furnish an SGC calibrated in accordance with Tex-241-F when electing or required to design the mixture in accordance with Tex-204-F, Part IV, for molding production samples. Locate the SGC, if used, at the Engineer's field laboratory and make the SGC available to the Engineer for use in molding production samples.

4.4.2.1.2. **Gyratory Compactor Correlation Factors.** Use Tex-206-F, Part II, to perform a gyratory compactor correlation when the Engineer uses a different gyratory compactor. Apply the correlation factor to all subsequent production test results.

4.4.2.1.3. **Submitting JMF1.** Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide approximately 10,000 g of the design mixture if opting to have the Department perform the Hamburg Wheel test on the laboratory mixture, and request that the Department perform the test.

4.4.2.1.4. **Supplying Aggregates.** Provide approximately 40 lb. of each aggregate stockpile unless otherwise directed.

4.4.2.1.5. **Supplying Asphalt**. Provide at least 1 gal. of the asphalt material and sufficient quantities of any additives proposed for use.

4.4.2.1.6. **Ignition Oven Correction Factors**. Determine the aggregate and asphalt correction factors from the ignition oven in accordance with Tex-236-F. Provide the Engineer with split samples of the mixtures before the trial batch production, including all additives (except water), and blank samples used to determine the correction factors for the ignition oven used for QA testing during production. Correction factors established from a previously approved mixture design may be used for the current mixture design if the mixture design and ignition oven are the same as previously used, unless otherwise directed.

4.4.2.1.7. **Boil Test**. Perform the test and retain the tested sample from Tex-530-C until completion of the project or as directed. Use this sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.

4.4.2.1.8. **Trial Batch Production**. Provide a plant-produced trial batch upon receiving conditional approval of JMF1 and authorization to produce a trial batch, including the WMA additive or process if applicable, for verification testing of JMF1 and development of JMF2. Produce a trial batch mixture that meets the requirements in Table 4, Table 5, and Table 11. The Engineer may accept test results from recent production of the same mixture instead of a new trial batch.

4.4.2.1.9. **Trial Batch Production Equipment**. Use only equipment and materials proposed for use on the project to produce the trial batch.

4.4.2.1.10. **Trial Batch Quantity**. Produce enough quantity of the trial batch to ensure that the mixture meets the specification requirements.

4.4.2.1.11. **Number of Trial Batches**. Produce trial batches as necessary to obtain a mixture that meets the specification requirements.

4.4.2.1.12. **Trial Batch Sampling**. Obtain a representative sample of the trial batch and split it into 3 equal portions in accordance with Tex-222-F. Label these portions as "Contractor," "Engineer," and "Referee." Deliver samples to the appropriate laboratory as directed.

4.4.2.1.13. **Trial Batch Testing**. Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the mixture requirements in Table 11. Ensure the trial batch mixture is also in compliance with the Hamburg Wheel requirement in Table 10. Use a Department-approved laboratory to perform the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.

4.4.2.1.14. **Development of JMF2**. Evaluate the trial batch test results after the Engineer grants full approval of JMF1 based on results from the trial batch, determine the optimum mixture proportions, and submit as JMF2. Adjust the asphalt binder content or gradation to achieve the specified target laboratory-molded density. The asphalt binder content established for JMF2 is not required to be within any tolerance of the optimum asphalt binder content established for JMF1; however, mixture produced using JMF2 must meet the voids in mineral aggregates (VMA) requirements for production shown in Table 8. If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform Tex-226-F on Lot 1 production to confirm the indirect tensile strength does not exceed 200 psi. Verify that JMF2 meets the mixture requirements in Table 5.

4.4.2.1.15. **Mixture Production**. Use JMF2 to produce Lot 1 as described in Section 341.4.9.3.1.1., "Lot 1 Placement," after receiving approval for JMF2 and a passing result from the Department's or a Department-approved laboratory's Hamburg Wheel test on the trial batch. If desired, proceed to Lot 1 production, once JMF2 is approved, at the Contractor's risk without receiving the results from the Department's Hamburg Wheel test on the trial batch.

Notify the Engineer if electing to proceed without Hamburg Wheel test results from the trial batch. Note that the Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.

4.4.2.1.16. **Development of JMF3.** Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.

4.4.2.1.17. **JMF Adjustments.** If JMF adjustments are necessary to achieve the specified requirements, make the adjustments before beginning a new lot. The adjusted JMF must:

- be provided to the Engineer in writing before the start of a new lot;
- be numbered in sequence to the previous JMF;
- meet the mixture requirements in Table 4 and Table 5;
- meet the master gradation limits shown in Table 8; and
- be within the operational tolerances of JMF2 listed in Table 11.

4.4.2.1.18. **Requesting Referee Testing.** Use referee testing, if needed, in accordance with Section 341.4.9.1., "Referee Testing," to resolve testing differences with the Engineer.

Table 11
Operational Tolerances

Description	Test Method	Allowable Difference Between Trial Batch and JMF1 Target	Allowable Difference from Current JMF Target	Allowable Difference between Contractor and Engineer[1]
Individual % retained for #8 sieve and larger	Tex-200-F or Tex-236-F	Must be Within Master Grading Limits in Table 8	±5.0[2,3]	±5.0
Individual % retained for sieves smaller than #8 and larger than #200			±3.0[2,3]	±3.0
% passing the #200 sieve			±2.0[2,3]	±1.6
Asphalt binder content, %	Tex-236-F	±0.5	±0.3[3]	±0.3
Laboratory-molded density, %	Tex-207-F	±1.0	±1.0	±1.0
In-place air voids, %		N/A	N/A	±1.0
Laboratory-molded bulk specific gravity		N/A	N/A	±0.020
VMA, %, min	Tex-204-F	Note[4]	Note[4]	N/A
Theoretical maximum specific (Rice) gravity	Tex-227-F	N/A	N/A	±0.020

1. Contractor may request referee testing only when values exceed these tolerances.
2. When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 will be considered out of tolerance when outside the master grading limits.
3. Only applies to mixture produced for Lot 1 and higher.
4. Test and verify that Table 8 requirements are met.

4.4.2.2. **Engineer's Responsibilities.**

4.4.2.2.1. **Gyratory Compactor.** For mixtures designed in accordance with Tex-204-F, Part I, the Engineer will use a Department TGC, calibrated in accordance with Tex-914-K, to mold samples for trial batch and production testing. The Engineer will make the Department TGC and the Department field laboratory available to the Contractor for molding verification samples, if requested by the Contractor.

For mixtures designed in accordance with Tex-204-F, Part IV, the Engineer will use a Department SGC, calibrated in accordance with Tex-241-F, to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the field laboratory or provide and use a Department SGC at an alternate location. The Engineer will make the Contractor-provided SGC in the Department field laboratory available to the Contractor for molding verification samples.

4.4.2.2.2. **Conditional Approval of JMF1 and Authorizing Trial Batch.** The Engineer will review and verify conformance of the following information within 2 working days of receipt:

- the Contractor's mix design report (JMF1);
- the Contractor-provided Hamburg Wheel test results;

- all required materials including aggregates, asphalt, additives, and recycled materials; and
- the mixture specifications.

The Engineer will grant the Contractor conditional approval of JMF1 if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test results with laboratory mixture design, 10 working days are allowed for conditional approval of JMF1. The Engineer will base full approval of JMF1 on the test results on mixture from the trial batch.

Unless waived, the Engineer will determine the Micro-Deval abrasion loss in accordance with Section 341.2.1.1.2., "Micro-Deval Abrasion." If the Engineer's test results are pending after 2 working days, conditional approval of JMF1 will still be granted within 2 working days of receiving JMF1. When the Engineer's test results become available, they will be used for specification compliance.

After conditionally approving JMF1, including either Contractor- or Department-supplied Hamburg Wheel test results, the Contractor is authorized to produce a trial batch.

4.4.2.2.3. **Hamburg Wheel Testing of JMF1**. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the laboratory mixture, the Engineer will mold samples in accordance with Tex-242-F to verify compliance with the Hamburg Wheel test requirement in Table 10.

4.4.2.2.4. **Ignition Oven Correction Factors**. The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven used for QA testing during production in accordance with Tex-236-F.

4.4.2.2.5. **Testing the Trial Batch**. Within 1 full working day, the Engineer will sample and test the trial batch to ensure that the mixture meets the requirements in Table 11. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture, the Engineer will mold samples in accordance with Tex-242-F to verify compliance with the Hamburg Wheel test requirement in Table 10.

The Engineer will have the option to perform the following tests on the trial batch:

- Tex-226-F, to verify that the indirect tensile strength meets the requirement shown in Table 9; and
- Tex-530-C, to retain and use for comparison purposes during production.

4.4.2.2.6. **Full Approval of JMF1**. The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for the trial batch meet the requirements in Table 11. The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet these requirements.

4.4.2.2.7. **Approval of JMF2**. The Engineer will approve JMF2 within one working day if the mixture meets the requirements in Table 5 and the gradation meets the master grading limits shown in Table 8. The asphalt binder content established for JMF2 is not required to be within any tolerance of the optimum asphalt binder content established for JMF1; however, mixture produced using JMF2 must meet the VMA requirements shown in Table 8. If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform Tex-226-F on Lot 1 production to confirm the indirect tensile strength does not exceed 200 psi.

4.4.2.2.8. **Approval of Lot 1 Production**. The Engineer will authorize the Contractor to proceed with Lot 1 production (using JMF2) as soon as a passing result is achieved from the Department's or a Department-approved laboratory's Hamburg Wheel test on the trial batch. The Contractor may proceed at its own risk with Lot 1 production without the results from the Hamburg Wheel test on the trial batch.

If the Department's or Department-approved laboratory's sample from the trial batch fails the Hamburg Wheel test, the Engineer will suspend production until further Hamburg Wheel tests meet the specified values. The Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel test be removed and replaced at the Contractor's expense.

4.4.2.2.9. **Approval of JMF3 and Subsequent JMF Changes.** JMF3 and subsequent JMF changes are approved if they meet the mixture requirements shown in Table 4, Table 5, and the master grading limits shown in Table 8, and are within the operational tolerances of JMF2 shown in Table 11.

4.5. **Production Operations.** Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification. Submit a new mix design and perform a new trial batch when the asphalt binder content of:

- any RAP stockpile used in the mix is more than 0.5% higher than the value shown on the mixture design report; or
- RAS stockpile used in the mix is more than 2.0% higher than the value shown on the mixture design report.

4.5.1. **Storage and Heating of Materials.** Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.

4.5.2. **Mixing and Discharge of Materials.** Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F (or 275°F for WMA) and is not lower than 215°F. The Department will not pay for or allow placement of any mixture produced above 350°F.

Produce WMA within the target discharge temperature range of 215°F and 275°F when WMA is required. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor's corrective action is not successful at controlling the production temperature within the target discharge range. Note that when WMA is produced, it may be necessary to adjust burners to ensure complete combustion such that no burner fuel residue remains in the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. Determine the moisture content, if requested, by oven-drying in accordance with Tex-212-F, Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck, and perform the test promptly.

4.6. **Hauling Operations.** Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary.

Use equipment for hauling as defined in Section 341.4.7.3.3., "Hauling Equipment." Use other hauling equipment only when allowed.

4.7. **Placement Operations.** Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed. Use a hand-held thermal camera or infrared thermometer, when a thermal imaging system is not used, to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as

directed. Ensure that all finished surfaces will drain properly. Place the mixture at the rate or thickness shown on the plans. The Engineer will use the guidelines in Table 12 to determine the compacted lift thickness of each layer when multiple lifts are required. The thickness determined is based on the rate of 110 lb./sq. yd. for each inch of pavement unless otherwise shown on the plans.

Table 12
Compacted Lift Thickness and Required Core Height

Mixture Type	Compacted Lift Thickness Guidelines		Minimum Untrimmed Core Height (in.) Eligible for Testing
	Minimum (in.)	Maximum (in.)	
A	3.00	6.00	2.00
B	2.50	5.00	1.75
C	2.00	4.00	1.50
D	1.50	3.00	1.25
F	1.25	2.50	1.25

4.7.1. **Weather Conditions.**

4.7.1.1. **When Using a Thermal Imaging System.** The Contractor may pave any time the roadway is dry and the roadway surface temperature is at least 32°F; however, the Engineer may restrict the Contractor from paving surface mixtures if the ambient temperature is likely to drop below 32°F within 12 hr. of paving. Provide output data from the thermal imaging system to demonstrate to the Engineer that no recurring severe thermal segregation exists in accordance with Section 341.4.7.3.1.2., "Thermal Imaging System."

4.7.1.2. **When Not Using a Thermal Imaging System.** Place mixture when the roadway surface temperature is at or above the temperatures listed in Table 13 unless otherwise approved or as shown on the plans. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. The Engineer may allow mixture placement to begin before the roadway surface reaches the required temperature if conditions are such that the roadway surface will reach the required temperature within 2 hr. of beginning placement operations. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the ambient temperature is likely to drop below 32°F within 12 hr. of paving.

Table 13
Minimum Pavement Surface Temperatures

Originally Specified High Temperature Binder Grade	Minimum Pavement Surface Temperatures (°F)	
	Subsurface Layers or Night Paving Operations	Surface Layers Placed in Daylight Operations
PG 64 or lower	45	50
PG 70	55[1]	60[1]
PG 76 or higher	60[1]	60[1]

1. Contractors may pave at temperatures 10°F lower than these values when utilizing a paving process including WMA or equipment that eliminates thermal segregation. In such cases, use a hand-held thermal camera operated in accordance with Tex-244-F to demonstrate to the satisfaction of the Engineer that the uncompacted mat has no more than 10°F of thermal segregation.

4.7.2. **Tack Coat.** Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller to remove streaks and other irregular patterns when directed.

4.7.3. **Lay-Down Operations.**

4.7.3.1. **Thermal Profile.** Use a hand-held thermal camera or a thermal imaging system to obtain a continuous thermal profile in accordance with Tex-244-F. Thermal profiles are not applicable in areas described in Section 341.4.9.3.1.4., "Miscellaneous Areas."

4.7.3.1.1. **Thermal Segregation.**

4.7.3.1.1.1. **Moderate.** Any areas that have a temperature differential greater than 25°F, but not exceeding 50°F, are deemed as having moderate thermal segregation.

4.7.3.1.1.2. **Severe.** Any areas that have a temperature differential greater than 50°F are deemed as having severe thermal segregation.

4.7.3.1.2. **Thermal Imaging System.** Review the output results when a thermal imaging system is used, and provide the automated report described in Tex-244-F to the Engineer daily unless otherwise directed. Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system. The Engineer may suspend paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe thermal segregation. Density profiles are not required and not applicable when using a thermal imaging system. Provide the Engineer with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots upon completion of the project or as requested by the Engineer.

4.7.3.1.3. **Thermal Camera.** Take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used. Evaluate areas with moderate thermal segregation by performing density profiles in accordance with Section 341.4.9.3.3.2., "Segregation (Density Profile)." Provide the Engineer with the thermal profile of every sublot within one working day of the completion of each lot. Report the results of each thermal profile in accordance with Section 341.4.2., "Reporting and Responsibilities." The Engineer will use a hand-held thermal camera to obtain a thermal profile at least once per project. No production or placement payment adjustments greater than 1.000 will be paid for any sublot that contains severe thermal segregation. Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise directed. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Section. Evaluate areas with severe thermal segregation by performing density profiles in accordance with Section 341.4.9.3.3.2., "Segregation (Density Profile)." Remove and replace the material in any areas that have both severe thermal segregation and a failing result for Segregation (Density Profile) unless otherwise directed. The sublot in question may receive a production and placement payment adjustment greater than 1.000, if applicable, when the defective material is successfully removed and replaced.

4.7.3.2. **Windrow Operations.** Operate windrow pickup equipment so that when hot-mix is placed in windrows, substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

4.7.3.3. **Hauling Equipment.** Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture; however, with exception of paving miscellaneous areas, end dump trucks are only allowed when used in conjunction with an MTD with remixing capability or when a thermal imaging system is used unless otherwise allowed.

4.7.3.4. **Screed Heaters.** Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 min. The Engineer may evaluate the suspect area in accordance with Section 341.4.9.3.3.4., "Recovered Asphalt Dynamic Shear Rheometer (DSR)," if the screed heater remains on for more than 5 min. while the paver is stopped.

4.8. **Compaction.** Compact the pavement uniformly to contain between 3.8% and 8.5% in-place air voids. Take immediate corrective action to bring the operation within 3.8% and 8.5% when the in-place air voids exceed the range of these tolerances. The Engineer will allow paving to resume when the proposed corrective action is likely to yield between 3.8% and 8.5% in-place air voids.

Obtain cores in areas placed under Exempt Production, as directed, at locations determined by the Engineer. The Engineer may test these cores and suspend operations or require removal and replacement if the in-place air voids are less than 2.7% or more than 9.9%. Areas defined in Section 341.4.9.3.1.4., "Miscellaneous Areas," are not subject to in-place air void determination.

Furnish the type, size, and number of rollers required for compaction as approved. Use a pneumatic-tire roller to seal the surface unless excessive pickup of fines occurs. Use additional rollers as required to remove any roller marks. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

Use the control strip method shown in Tex-207-F, Part IV, on the first day of production to establish the rolling pattern that will produce the desired in-place air voids unless otherwise directed.

Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Complete all compaction operations before the pavement temperature drops below 160°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 160°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

4.9. **Acceptance Plan**. Payment adjustments for the material will be in accordance with Article 341.6., "Payment."

Sample and test the hot-mix on a lot and sublot basis. Suspend production until test results or other information indicates to the satisfaction of the Engineer that the next material produced or placed will result in payment factors of at least 1.000, if the production payment factor given in Section 341.6.1., "Production Payment Adjustment Factors," for 2 consecutive lots or the placement pay factor given in Section 341.6.2., "Placement Payment Adjustment Factors," for 2 consecutive lots is below 1.000.

4.9.1. **Referee Testing**. The Construction Division is the referee laboratory. The Contractor may request referee testing if a "remove and replace" condition is determined based on the Engineer's test results, or if the differences between Contractor and Engineer test results exceed the maximum allowable difference shown in Table 11 and the differences cannot be resolved. The Contractor may also request referee testing if the Engineer's test results require suspension of production and the Contractor's test results are within specification limits. Make the request within 5 working days after receiving test results and cores from the Engineer. Referee tests will be performed only on the sublot in question and only for the particular tests in question. Allow 10 working days from the time the referee laboratory receives the samples for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than 3 referee tests per project are required and the Engineer's test results are closer to the referee test results than the Contractor's test results.

The Construction Division will determine the laboratory-molded density based on the molded specific gravity and the maximum theoretical specific gravity of the referee sample. The in-place air voids will be determined based on the bulk specific gravity of the cores, as determined by the referee laboratory and the Engineer's average maximum theoretical specific gravity for the lot. With the exception of "remove and replace" conditions, referee test results are final and will establish payment adjustment factors for the sublot in question. The Contractor may decline referee testing and accept the Engineer's test results when the placement payment adjustment factor for any sublot results in a "remove and replace" condition. Placement sublots subject to be removed and replaced will be further evaluated in accordance with Section 341.6.2.2., "Placement Sublots Subject to Removal and Replacement."

4.9.2. **Production Acceptance**.

4.9.2.1. **Production Lot**. A production lot consists of 4 equal sublots. The default quantity for Lot 1 is 1,000 tons; however, when requested by the Contractor, the Engineer may increase the quantity for Lot 1 to no more than 4,000 tons. The Engineer will select subsequent lot sizes based on the anticipated daily production such that approximately 3 to 4 sublots are produced each day. The lot size will be between 1,000 tons and 4,000 tons. The Engineer may change the lot size before the Contractor begins any lot.

If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform Tex-226-F on Lot 1 to confirm the indirect tensile strength does not exceed 200 psi. Take corrective action to bring the mixture within specification compliance if the indirect tensile strength exceeds 200 psi unless otherwise directed.

4.9.2.1.1. **Incomplete Production Lots.** If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot. Adjust the payment for the incomplete lot in accordance with Section 341.6.1., "Production Payment Adjustment Factors." Close all lots within 5 working days unless otherwise allowed.

4.9.2.2. **Production Sampling.**

4.9.2.2.1. **Mixture Sampling.** Obtain hot-mix samples from trucks at the plant in accordance with Tex-222-F. The sampler will split each sample into 3 equal portions in accordance with Tex-200-F and label these portions as "Contractor," "Engineer," and "Referee." The Engineer will perform or witness the sample splitting and take immediate possession of the samples labeled "Engineer" and "Referee." The Engineer will maintain the custody of the samples labeled "Engineer" and "Referee" until the Department's testing is completed.

4.9.2.2.1.1. **Random Sample.** At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with Tex-225-F. Take one sample for each sublot at the randomly selected location. The Engineer will perform or witness the sampling of production sublots.

4.9.2.2.1.2. **Blind Sample.** For one sublot per lot, the Engineer will obtain and test a "blind" sample instead of the random sample collected by the Contractor. Test either the "blind" or the random sample; however, referee testing (if applicable) will be based on a comparison of results from the "blind" sample. The location of the Engineer's "blind" sample will not be disclosed to the Contractor. The Engineer's "blind" sample may be randomly selected in accordance with Tex-225-F for any sublot or selected at the discretion of the Engineer. The Engineer will use the Contractor's split sample for sublots not sampled by the Engineer.

4.9.2.2.2. **Informational Cantabro and Overlay Testing.** When requested or shown on the plans, select one random sublot from Lot 2 or higher for Cantabro and Overlay testing during the first week of production. Obtain and provide the Engineer with approximately 90 lb. (40 kg) of mixture in sealed containers, boxes, or bags labeled with the Control-Section-Job (CSJ), mixture type, lot, and sublot number. The Engineer will ship the mixture to the Construction Division for Cantabro and Overlay testing. Results from these tests will not be used for specification compliance.

4.9.2.2.3. **Asphalt Binder Sampling.** Obtain a 1-qt. sample of the asphalt binder for each lot of mixture produced. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill in accordance with Tex-500-C, Part II. Label the can with the corresponding lot and sublot numbers and deliver the sample to the Engineer. The Engineer may also obtain independent samples. If obtaining an independent asphalt binder sample, the Engineer will split a sample of the asphalt binder with the Contractor. The Engineer will test at least one asphalt binder sample per project to verify compliance with Item 300, "Asphalts, Oils, and Emulsions."

4.9.2.3. **Production Testing.** The Contractor and Engineer must perform production tests in accordance with Table 14. The Contractor has the option to verify the Engineer's test results on split samples provided by the Engineer. Determine compliance with operational tolerances listed in Table 11 for all sublots.

Take immediate corrective action if the Engineer's laboratory-molded density on any sublot is less than 95.0% or greater than 98.0% to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

The Engineer may allow alternate methods for determining the asphalt binder content and aggregate gradation if the aggregate mineralogy is such that Tex-236-F does not yield reliable results. Provide evidence that results from Tex-236-F are not reliable before requesting permission to use an alternate method unless otherwise directed. Use the applicable test procedure as directed if an alternate test method is allowed.

Table 14
Production and Placement Testing Frequency

Description	Test Method	Minimum Contractor Testing Frequency	Minimum Engineer Testing Frequency
Individual % retained for #8 sieve and larger	Tex-200-F or Tex-236-F	1 per sublot	1 per 12 sublots[1]
Individual % retained for sieves smaller than #8 and larger than #200			
% passing the #200 sieve			
Laboratory-molded density	Tex-207-F	N/A	1 per sublot[1]
Laboratory-molded bulk specific gravity			
In-place air voids			
VMA	Tex-204-F		
Segregation (density profile)[2]	Tex-207-F, Part V	1 per sublot	1 per project
Longitudinal joint density	Tex-207-F, Part VII		
Moisture content	Tex-212-F, Part II	When directed	
Theoretical maximum specific (Rice) gravity	Tex-227-F	N/A	1 per sublot[1]
Asphalt binder content	Tex-236-F	1 per sublot	1 per lot[1]
Hamburg Wheel test	Tex-242-F	N/A	1 per project
Recycled Asphalt Shingles (RAS)[3]	Tex-217-F, Part III	N/A	
Thermal profile[2]	Tex-244-F	1 per sublot	
Asphalt binder sampling and testing	Tex-500-C	1 per lot (sample only)	
Tack coat sampling and testing	Tex-500-C, Part III	N/A	
Boil test[4]	Tex-530-C	1 per lot	
Cantabro loss[5]	Tex-245-F	1 per project (sample only)	
Overlay test[5]	Tex-248-F		

1. For production defined in Section 341.4.9.4., "Exempt Production," the Engineer will test one per day if 100 tons or more are produced. For Exempt Production, no testing is required when less than 100 tons are produced.
2. Not required when a thermal imaging system is used.
3. Testing performed by the Construction Division or designated laboratory.
4. The Engineer may reduce or waive the sampling and testing requirements based on a satisfactory test history.
5. Testing performed by the Construction Division and for informational purposes only.

4.9.2.4. **Operational Tolerances**. Control the production process within the operational tolerances listed in Table 11. When production is suspended, the Engineer will allow production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.

4.9.2.4.1. **Gradation**. Suspend operation and take corrective action if any aggregate is retained on the maximum sieve size shown in Table 8. A sublot is defined as out of tolerance if either the Engineer's or the Contractor's test results are out of operational tolerance. Suspend production when test results for gradation exceed the operational tolerances for 3 consecutive sublots on the same sieve or 4 consecutive sublots on any sieve unless otherwise directed. The consecutive sublots may be from more than one lot.

4.9.2.4.2. **Asphalt Binder Content**. A sublot is defined as out of operational tolerance if either the Engineer's or the Contractor's test results exceed the values listed in Table 11. No production or placement payment adjustments greater than 1.000 will be paid for any sublot that is out of operational tolerance for asphalt binder content. Suspend production and shipment of the mixture if the Engineer's or the Contractor's asphalt binder content deviates from the current JMF by more than 0.5% for any sublot.

4.9.2.4.3. **Voids in Mineral Aggregates (VMA)**. The Engineer will determine the VMA for every sublot. For sublots when the Engineer does not determine asphalt binder content, the Engineer will use the asphalt binder content results from QC testing performed by the Contractor to determine VMA.

Take immediate corrective action if the VMA value for any sublot is less than the minimum VMA requirement for production listed in Table 8. Suspend production and shipment of the mixture if the Engineer's VMA results on 2 consecutive sublots are below the minimum VMA requirement for production listed in Table 8. No production or placement payment adjustments greater than 1.000 will be paid for any sublot that does not meet the minimum VMA requirement for production listed in Table 8 based on the Engineer's VMA determination.

Suspend production and shipment of the mixture if the Engineer's VMA result is more than 0.5% below the minimum VMA requirement for production listed in Table 8. In addition to suspending production, the Engineer may require removal and replacement or may allow the sublot to be left in place without payment.

4.9.2.4.4. **Hamburg Wheel Test**. The Engineer may perform a Hamburg Wheel test at any time during production, including when the boil test indicates a change in quality from the materials submitted for JMF1. In addition to testing production samples, the Engineer may obtain cores and perform Hamburg Wheel tests on any areas of the roadway where rutting is observed. Suspend production until further Hamburg Wheel tests meet the specified values when the production or core samples fail the Hamburg Wheel test criteria in Table 10. Core samples, if taken, will be obtained from the center of the finished mat or other areas excluding the vehicle wheel paths. The Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.

If the Department's or Department approved laboratory's Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Department confirm the results by re-testing the failing material. The Construction Division will perform the Hamburg Wheel tests and determine the final disposition of the material in question based on the Department's test results.

4.9.2.5. **Individual Loads of Hot-Mix**. The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 11, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

4.9.3. **Placement Acceptance**.

4.9.3.1. **Placement Lot**. A placement lot consists of 4 placement sublots. A placement sublot consists of the area placed during a production sublot.

4.9.3.1.1. **Lot 1 Placement**. Placement payment adjustments greater than 1.000 for Lot 1 will be in accordance with Section 341.6.2., "Placement Payment Adjustment Factors"; however, no placement adjustment less than 1.000 will be assessed for any sublot placed in Lot 1 when the in-place air voids are greater than or equal to 2.7% and less than or equal to 9.9%. Remove and replace any sublot with in-place air voids less than 2.7% or greater than 9.9%.

4.9.3.1.2. **Incomplete Placement Lots**. An incomplete placement lot consists of the area placed as described in Section 341.4.9.2.1.1., "Incomplete Production Lots," excluding areas defined in Section 341.4.9.3.1.4., "Miscellaneous Areas." Placement sampling is required if the random sample plan for production resulted in a sample being obtained from an incomplete production sublot.

4.9.3.1.3. **Shoulders, Ramps, Etc**. Shoulders, ramps, intersections, acceleration lanes, deceleration lanes, and turn lanes are subject to in-place air void determination and payment adjustments unless designated on the plans as not eligible for in-place air void determination. Intersections may be considered miscellaneous areas when determined by the Engineer.

4.9.3.1.4. **Miscellaneous Areas**. Miscellaneous areas include areas that typically involve significant handwork or discontinuous paving operations, such as temporary detours, driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. Temporary detours are subject to in-place air void determination when shown on the plans. Miscellaneous areas also include level-ups and thin overlays when the layer thickness specified on the plans is less than the minimum untrimmed core height eligible for testing shown in Table 12. The specified layer thickness is based on the rate of 110 lb./sq. yd. for each inch of pavement unless another rate is shown on the plans. When "level up" is listed as part of the item bid description code, a payment adjustment factor of 1.000 will be assigned for all placement sublots as described in Article 341.6, "Payment." Miscellaneous areas are not eligible for random placement sampling locations. Compact miscellaneous areas in accordance with Section 341.4.8., "Compaction." Miscellaneous

areas are not subject to in-place air void determination, thermal profiles testing, segregation (density profiles), or longitudinal joint density evaluations.

4.9.3.2. **Placement Sampling.** The Engineer will select random numbers for all placement sublots at the beginning of the project. The Engineer will provide the Contractor with the placement random numbers immediately after the sublot is completed. Mark the roadway location at the completion of each sublot and record the station number. Determine one random sample location for each placement sublot in accordance with Tex-225-F. Adjust the random sample location by no more than necessary to achieve a 2-ft. clearance if the location is within 2 ft. of a joint or pavement edge.

Shoulders, ramps, intersections, acceleration lanes, deceleration lanes, and turn lanes are always eligible for selection as a random sample location; however, if a random sample location falls on one of these areas and the area is designated on the plans as not subject to in-place air void determination, cores will not be taken for the sublot and a 1.000 pay factor will be assigned to that sublot.

Provide the equipment and means to obtain and trim roadway cores on site. On-site is defined as in close proximity to where the cores are taken. Obtain the cores within one working day of the time the placement sublot is completed unless otherwise approved. Obtain two 6-in. diameter cores side-by-side from within 1 ft. of the random location provided for the placement sublot. For Type D and Type F mixtures, 4-in. diameter cores are allowed. Mark the cores for identification, measure and record the untrimmed core height, and provide the information to the Engineer. The Engineer will witness the coring operation and measurement of the core thickness. Visually inspect each core and verify that the current paving layer is bonded to the underlying layer. Take corrective action if an adequate bond does not exist between the current and underlying layer to ensure that an adequate bond will be achieved during subsequent placement operations.

Trim the cores immediately after obtaining the cores from the roadway in accordance with Tex-207-F if the core heights meet the minimum untrimmed value listed in Table 12. Trim the cores on site in the presence of the Engineer. Use a permanent marker or paint pen to record the lot and sublot numbers on each core as well as the designation as Core A or B. The Engineer may require additional information to be marked on the core and may choose to sign or initial the core. The Engineer will take custody of the cores immediately after they are trimmed and will retain custody of the cores until the Department's testing is completed. Before turning the trimmed cores over to the Engineer, the Contractor may wrap the trimmed cores or secure them in a manner that will reduce the risk of possible damage occurring during transport by the Engineer. After testing, the Engineer will return the cores to the Contractor.

The Engineer may have the cores transported back to the Department's laboratory at the HMA plant via the Contractor's haul truck or other designated vehicle. In such cases where the cores will be out of the Engineer's possession during transport, the Engineer will use Department-provided security bags and the Roadway Core Custody protocol located at http://www.txdot.gov/business/specifications.htm to provide a secure means and process that protects the integrity of the cores during transport.

Decide whether to include the pair of cores in the air void determination for that sublot if the core height before trimming is less than the minimum untrimmed value shown in Table 12. Trim the cores as described above before delivering to the Engineer if electing to have the cores included in the air void determination. Deliver untrimmed cores to the Engineer and inform the Engineer of the decision to not have the cores included in air void determination if electing to not have the cores included in air void determination. The placement pay factor for the sublot will be 1.000 if cores will not be included in air void determination.

Instead of the Contractor trimming the cores on site immediately after coring, the Engineer and the Contractor may mutually agree to have the trimming operations performed at an alternate location such as a field laboratory or other similar location. In such cases, the Engineer will take possession of the cores immediately after they are obtained from the roadway and will retain custody of the cores until testing is completed. Either the Department or Contractor representative may perform trimming of the cores. The Engineer will witness all trimming operations in cases where the Contractor representative performs the trimming operation.

Dry the core holes and tack the sides and bottom immediately after obtaining the cores. Fill the hole with the same type of mixture and properly compact the mixture. Repair core holes with other methods when approved.

4.9.3.3. **Placement Testing**. Perform placement tests in accordance with Table 14. After the Engineer returns the cores, the Contractor may test the cores to verify the Engineer's test results for in-place air voids. The allowable differences between the Contractor's and Engineer's test results are listed in Table 11.

4.9.3.3.1. **In-Place Air Voids**. The Engineer will measure in-place air voids in accordance with Tex-207-F and Tex-227-F. Before drying to a constant weight, cores may be pre-dried using a Corelok or similar vacuum device to remove excess moisture. The Engineer will average the values obtained for all sublots in the production lot to determine the theoretical maximum specific gravity. The Engineer will use the average air void content for in-place air voids.

The Engineer will use the vacuum method to seal the core if required by Tex-207-F. The Engineer will use the test results from the unsealed core to determine the placement payment adjustment factor if the sealed core yields a higher specific gravity than the unsealed core. After determining the in-place air void content, the Engineer will return the cores and provide test results to the Contractor.

4.9.3.3.2. **Segregation (Density Profile)**. Test for segregation using density profiles in accordance with Tex-207-F, Part V. Density profiles are not required and are not applicable when using a thermal imaging system. Density profiles are not applicable in areas described in Section 341.4.9.3.1.4., "Miscellaneous Areas."

Perform a density profile every time the paver stops for more than 60 sec. on areas that are identified by either the Contractor or the Engineer as having thermal segregation and on any visibly segregated areas unless otherwise approved. Perform a minimum of one profile per sublot if the paver does not stop for more than 60 sec. and there are no visibly segregated areas or areas that are identified as having thermal segregation.

Provide the Engineer with the density profile of every sublot in the lot within one working day of the completion of each lot. Report the results of each density profile in accordance with Section 341.4.2., "Reporting and Responsibilities."

The density profile is considered failing if it exceeds the tolerances in Table 15. No production or placement payment adjustments greater than 1.000 will be paid for any sublot that contains a failing density profile. When a hand-held thermal camera is used instead of a thermal imaging system, the Engineer will measure the density profile at least once per project. The Engineer's density profile results will be used when available. The Engineer may require the Contractor to remove and replace the area in question if the area fails the density profile and has surface irregularities as defined in Section 341.4.9.3.3.5., "Irregularities." The sublot in question may receive a production and placement payment adjustment greater than 1.000, if applicable, when the defective material is successfully removed and replaced.

Investigate density profile failures and take corrective actions during production and placement to eliminate the segregation. Suspend production if 2 consecutive density profiles fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

Table 15
Segregation (Density Profile) Acceptance Criteria

Mixture Type	Maximum Allowable Density Range (Highest to Lowest)	Maximum Allowable Density Range (Average to Lowest)
Type A & Type B	8.0 pcf	5.0 pcf
Type C, Type D & Type F	6.0 pcf	3.0 pcf

4.9.3.3.3. **Longitudinal Joint Density**.

4.9.3.3.3.1. **Informational Tests**. Perform joint density evaluations while establishing the rolling pattern and verify that the joint density is no more than 3.0 pcf below the density taken at or near the center of the mat. Adjust the

rolling pattern, if needed, to achieve the desired joint density. Perform additional joint density evaluations, at least once per sublot, unless otherwise directed.

4.9.3.3.3.2. **Record Tests**. Perform a joint density evaluation for each sublot at each pavement edge that is or will become a longitudinal joint. Joint density evaluations are not applicable in areas described in Section 341.4.9.3.1.4., "Miscellaneous Areas." Determine the joint density in accordance with Tex-207-F, Part VII. Record the joint density information and submit results on Department forms to the Engineer. The evaluation is considered failing if the joint density is more than 3.0 pcf below the density taken at the core random sample location and the correlated joint density is less than 90.0%. The Engineer will make independent joint density verification at least once per project and may make independent joint density verifications at the random sample locations. The Engineer's joint density test results will be used when available.

Provide the Engineer with the joint density of every sublot in the lot within one working day of the completion of each lot. Report the results of each joint density in accordance with Section 341.4.2., "Reporting and Responsibilities."

Investigate joint density failures and take corrective actions during production and placement to improve the joint density. Suspend production if the evaluations on 2 consecutive sublots fail unless otherwise approved. Resume production after the Engineer approves changes to production or placement methods.

4.9.3.3.4. **Recovered Asphalt Dynamic Shear Rheometer (DSR)**. The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Construction Division. The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder. Obtain DSR values in accordance with AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with Tex-211-F.

4.9.3.3.5. **Irregularities**. Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities and areas where the mixture does not bond to the existing pavement.

If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.4. **Exempt Production**. The Engineer may deem the mixture as exempt production for the following conditions:

- anticipated daily production is less than 1,000 tons;
- total production for the project is less than 5,000 tons;
- when mutually agreed between the Engineer and the Contractor; or
- when shown on the plans.

For exempt production, the Contractor is relieved of all production and placement sampling and testing requirements, and the production and placement pay factors are 1.000. All other specification requirements apply, and the Engineer will perform acceptance tests for production and placement listed in Table 14 when 100 tons or more per day are produced.

For exempt production:

- produce, haul, place, and compact the mixture in compliance with the specification and as directed;

- control mixture production to yield a laboratory-molded density that is within ±1.0% of the target laboratory-molded density as tested by the Engineer;
- compact the mixture in accordance with Section 341.4.8., "Compaction;" and
- when a thermal imaging system is not used, the Engineer may perform segregation (density profiles) and thermal profiles in accordance with the specification.

4.9.5. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

5. MEASUREMENT

Hot mix will be measured by the ton of composite hot-mix, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Section 341.5., "Measurement," will be paid for at the unit bid price for "Dense Graded Hot-Mix Asphalt" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, materials including tack coat, placement, equipment, labor, tools, and incidentals.

Payment adjustments will be applied as determined in this Item; however, a payment adjustment factor of 1.000 will be assigned for all placement sublots for "level ups" only when "level up" is listed as part of the item bid description code. A payment adjustment factor of 1.000 will be assigned to all production and placement sublots when "exempt" is listed as part of the item bid description code.

Payment for each sublot, including applicable payment adjustments greater than 1.000, will only be paid for sublots when the Contractor supplies the Engineer with the required documentation for production and placement QC/QA, thermal profiles, segregation density profiles, and longitudinal joint densities in accordance with Section 341.4.2., "Reporting and Responsibilities." When a thermal imaging system is used, documentation is not required for thermal profiles or segregation density profiles on individual sublots; however, the thermal imaging system automated reports described in Tex-244-F are required.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."

6.1. **Production Payment Adjustment Factors.** The production payment adjustment factor is based on the laboratory-molded density using the Engineer's test results. A payment adjustment factor will be determined from Table 16 for each sublot using the deviation from the target laboratory-molded density defined in Table 9. The production payment adjustment factor for completed lots will be the average of the payment adjustment factors for the 4 sublots sampled within that lot.

Table 16
Production Payment Adjustment Factors for Laboratory-Molded Density[1]

Absolute Deviation from Target Laboratory-Molded Density	Production Payment Adjustment Factor (Target Laboratory-Molded Density)
0.0	1.050
0.1	1.050
0.2	1.050
0.3	1.044
0.4	1.038
0.5	1.031
0.6	1.025
0.7	1.019
0.8	1.013
0.9	1.006
1.0	1.000
1.1	0.965
1.2	0.930
1.3	0.895
1.4	0.860
1.5	0.825
1.6	0.790
1.7	0.755
1.8	0.720
> 1.8	Remove and replace

1. If the Engineer's laboratory-molded density on any sublot is less than 95.0% or greater than 98.0%, take immediate corrective action to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

6.1.1. **Payment for Incomplete Production Lots.** Production payment adjustments for incomplete lots, described under Section 341.4.9.2.1.1., "Incomplete Production Lots," will be calculated using the average production payment factors from all sublots sampled. A production payment factor of 1.000 will be assigned to any lot when the random sampling plan did not result in collection of any samples.

6.1.2. **Production Sublots Subject to Removal and Replacement.** If after referee testing, the laboratory-molded density for any sublot results in a "remove and replace" condition as listed in Table 16, the Engineer may require removal and replacement or may allow the sublot to be left in place without payment. The Engineer may also accept the sublot in accordance with Section 5.3.1., "Acceptance of Defective or Unauthorized Work." Replacement material meeting the requirements of this Item will be paid for in accordance with this Section.

6.2. **Placement Payment Adjustment Factors.** The placement payment adjustment factor is based on in-place air voids using the Engineer's test results. A payment adjustment factor will be determined from Table 17 for each sublot that requires in-place air void measurement. A placement payment adjustment factor of 1.000 will be assigned to the entire sublot when the random sample location falls in an area designated on the plans as not subject to in-place air void determination. A placement payment adjustment factor of 1.000 will be assigned to quantities placed in areas described in Section 341.4.9.3.1.4., "Miscellaneous Areas." The placement payment adjustment factor for completed lots will be the average of the placement payment adjustment factors for up to 4 sublots within that lot.

Table 17
Placement Payment Adjustment Factors for In-Place Air Voids

In-Place Air Voids	Placement Pay Adjustment Factor	In-Place Air Voids	Placement Pay Adjustment Factor
< 2.7	Remove and Replace	6.4	1.042
2.7	0.710	6.5	1.040
2.8	0.740	6.6	1.038
2.9	0.770	6.7	1.036
3.0	0.800	6.8	1.034
3.1	0.830	6.9	1.032
3.2	0.860	7.0	1.030
3.3	0.890	7.1	1.028
3.4	0.920	7.2	1.026
3.5	0.950	7.3	1.024
3.6	0.980	7.4	1.022
3.7	0.998	7.5	1.020
3.8	1.002	7.6	1.018
3.9	1.006	7.7	1.016
4.0	1.010	7.8	1.014
4.1	1.014	7.9	1.012
4.2	1.018	8.0	1.010
4.3	1.022	8.1	1.008
4.4	1.026	8.2	1.006
4.5	1.030	8.3	1.004
4.6	1.034	8.4	1.002
4.7	1.038	8.5	1.000
4.8	1.042	8.6	0.998
4.9	1.046	8.7	0.996
5.0	1.050	8.8	0.994
5.1	1.050	8.9	0.992
5.2	1.050	9.0	0.990
5.3	1.050	9.1	0.960
5.4	1.050	9.2	0.930
5.5	1.050	9.3	0.900
5.6	1.050	9.4	0.870
5.7	1.050	9.5	0.840
5.8	1.050	9.6	0.810
5.9	1.050	9.7	0.780
6.0	1.050	9.8	0.750
6.1	1.048	9.9	0.720
6.2	1.046	> 9.9	Remove and Replace
6.3	1.044		

6.2.1. **Payment for Incomplete Placement Lots.** Payment adjustments for incomplete placement lots described under Section 341.4.9.3.1.2., "Incomplete Placement Lots," will be calculated using the average of the placement payment factors from all sublots sampled and sublots where the random location falls in an area designated on the plans as not eligible for in-place air void determination. A placement payment adjustment factor of 1.000 will be assigned to any lot when the random sampling plan did not result in collection of any samples.

6.2.2. **Placement Sublots Subject to Removal and Replacement.** If after referee testing, the placement payment adjustment factor for any sublot results in a "remove and replace" condition as listed in Table 17, the Engineer will choose the location of 2 cores to be taken within 3 ft. of the original failing core location. The Contractor will obtain the cores in the presence of the Engineer. The Engineer will take immediate possession of the untrimmed cores and submit the untrimmed cores to the Construction Division, where they will be trimmed if necessary and tested for bulk specific gravity within 10 working days of receipt.

The average bulk specific gravity of the cores will be divided by the Engineer's average maximum theoretical specific gravity for that lot to determine the new payment adjustment factor of the sublot in question. If the new payment adjustment factor is 0.700 or greater, the new payment adjustment factor will apply to that

sublot. If the new payment adjustment factor is less than 0.700, no payment will be made for the sublot. Remove and replace the failing sublot, or the Engineer may allow the sublot to be left in place without payment. The Engineer may also accept the sublot in accordance with Section 5.3.1., "Acceptance of Defective or Unauthorized Work." Replacement material meeting the requirements of this Item will be paid for in accordance with this Section.

6.3. **Total Adjusted Pay Calculation**. Total adjusted pay (TAP) will be based on the applicable payment adjustment factors for production and placement for each lot.

$TAP = (A+B)/2$

where:
A = Bid price × production lot quantity × average payment adjustment factor for the production lot
B = Bid price × placement lot quantity × average payment adjustment factor for the placement lot + (bid price × quantity placed in miscellaneous areas × 1.000)

Production lot quantity = Quantity actually placed - quantity left in place without payment

Placement lot quantity = Quantity actually placed - quantity left in place without payment - quantity placed in miscellaneous areas

Item 360
Concrete Pavement

1. DESCRIPTION

Construct hydraulic cement concrete pavement with or without curbs on the concrete pavement.

2. MATERIALS

2.1. **Hydraulic Cement Concrete.** Provide hydraulic cement concrete in accordance with Item 421, "Hydraulic Cement Concrete." Use compressive strength testing unless otherwise shown on the plans. Provide Class P concrete designed to meet a minimum average compressive strength of 3,200 psi or a minimum average flexural strength of 450 psi at 7 days or a minimum average compressive strength of 4,000 psi or a minimum average flexural strength of 570 psi at 28 days. Test in accordance with Tex-448-A or Tex-418-A.

Obtain written approval if the concrete mix design exceeds 520 lb. per cubic yard of cementitious material.

Use coarse aggregates for continuously reinforced concrete pavements to produce concrete with a coefficient of thermal expansion not more than 5.5×10^{-6} in./in./°F. Provide satisfactory Tex-428-A test data from an approved testing laboratory if the coarse aggregate coefficient of thermal expansion listed on the Department's *Concrete Rated Source Quality Catalog* is not equal to or less than 5.5×10^{-6} in./in./°F.

Provide Class HES concrete for very early opening of small pavement areas or leave-outs to traffic when shown on the plans or allowed. Design Class HES to meet the requirements of Class P and a minimum average compressive strength of 3,200 psi or a minimum average flexural strength of 450 psi in 24 hr., unless other early strength and time requirements are shown on the plans or allowed.

Use Class A or P concrete meeting the requirements of Item 421, "Hydraulic Cement Concrete," and this Item for curbs that are placed separately from the pavement.

2.2. **Reinforcing Steel.** Provide Grade 60 or above, deformed steel for bar reinforcement in accordance with Item 440, "Reinforcement for Concrete." Provide positioning and supporting devices (baskets and chairs) capable of securing and holding the reinforcing steel in proper position before and during paving. Provide corrosion protection when shown on the plans.

2.2.1. **Dowels.** Provide smooth, straight dowels of the size shown on the plans, free of burrs, and conforming to the requirements of Item 440, "Reinforcement for Concrete." Coat dowels with a thin film of grease, wax, silicone or other approved de-bonding material. Provide dowel caps on the lubricated end of each dowel bar used in an expansion joint. Provide dowel caps filled with a soft compressible material with enough range of movement to allow complete closure of the expansion joint.

2.2.2. **Tie Bars.** Provide straight deformed steel tie bars. Provide either multiple-piece tie bars or single-piece tie bars as shown on the plans. Furnish multiple piece tie bar assemblies from the list of approved multiple-piece tie bars that have been prequalified in accordance with DMS-4515 "Multiple Piece Tie Bars for Concrete Pavements," when used. Multiple-piece tie bars used on individual projects must be sampled in accordance with Tex-711-I, and tested in accordance with DMS-4515 "Multiple Piece Tie Bars for Concrete Pavements."

2.3. **Alternative Reinforcing Materials.** Provide reinforcement materials of the dimensions and with the physical properties specified when allowed or required by the plans. Provide manufacturer's certification of required material properties.

Assemble with milled ends of compression members in full bearing. Assemble non-bearing connections to the specified gap. Ream all subsize holes to the specified size while the connections are assembled, or drill full size while the connections are assembled. Notify the Engineer before shipping if fill plates or shims are added. Adding or increasing the thickness of shims or fill plates in bearing connections requires approval. Use drift pins and snug-tight bolts during the drilling process to ensure all planes of the connection (webs and flanges) can be assembled simultaneously. Do not use tack welds to secure plates while drilling.

Secure parts not completely bolted in the shop with temporary bolts to prevent damage in shipment and handling. Never use tack welds in place of temporary bolts.

Match-mark connecting parts in field connections using low-stress stencils in accordance with the diagram in the erection drawings.

3.7.3. **Welded Field Connections**. Mill or grind bevels for groove welds. Do not cut into the web when cutting the flange bevel adjacent to the web. End preparation, backing, and tolerances for girder splices must be in accordance with Item 448, "Structural Field Welding." Details for all other field-welds must conform to the applicable AWS code unless otherwise shown on the plans.

In the shop, prepare ends of beams or girders to be field-welded taking into account their relative positions in the finished structure due to grade, camber, and curvature. Completely shop-assemble and check each splice. Match-mark the splice while it is assembled with low-stress stencils in accordance with the diagram in the erection drawings.

3.8. **Finish and Painting**.

3.8.1. **Shop Painting**. Perform shop painting of bridge members as required in DMS-8104, "Paint, Shop Application for Steel Bridge Members." Grind corners on new steel items to be painted (except for the coatings on box and tub girder interiors) that are sharp or form essentially 90° angles to an approximately 1/16 in. flat surface before blast cleaning. (A corner is the intersection of 2 plane faces.) This requirement does not apply to punched or drilled holes. Do not omit shop paint to preserve original markings.

Ensure painted faying surfaces meet the required slip and creep coefficients for bolted connections as outlined in DMS-8104, "Paint, Shop Application for Steel Bridge Members."

Use a Class A slip (minimum slip coefficient of 0.33) if no slip coefficient or corresponding surface condition is specified Perform all required testing at no expense to the Department.

Surface preparation and painting the interiors of Tub Girders and Closed Boxes is in accordance with DMS-8104, "Paint, Shop Application for Steel Bridge Members."

3.8.2. **Weathering Steel**. Provide an SSPC-SP 6 blast in the shop to all fascia surfaces of unpainted weathering steel beams. Fascia surfaces include:

- exterior sides of outermost webs and undersides of bottom flanges of plate girders and rolled beams,
- all outer surfaces of tub girders and box girders,
- all surfaces of truss members,
- webs and undersides of bottom flanges of plate diaphragms,
- bottom surfaces of floor beams, and
- any other surfaces designated as "fascia" on the plans.

Do not mark fascia surfaces. Use one of the following methods as soon as possible to remove any markings or any other foreign material that adheres to the steel during fabrication and could inhibit the formation of oxide film:

- SSPC-SP 1, "Solvent Cleaning,"
- SSPC-SP 2, "Hand Tool Cleaning,"
- SSPC-SP 3, "Power Tool Cleaning," and

- SSPC-SP 7, "Brush-off Blast Cleaning."

Do not use acids to remove stains or scales. Feather out touched-up areas over several feet.

3.8.3. **Machined Surfaces**. Clean and coat machine-finished surfaces that are in sliding contact, particularly pins and pinholes, with a non-drying, water-repellent grease-type material containing rust-inhibitive compounds. Ensure the coating material contains no ingredients that might damage the steel. Protect machined surfaces from abrasive blasting.

3.9. **Handling and Storage of Materials**. Prevent damage when storing or handling girders or other materials. Remove or repair material damaged by handling devices or improper storage by acceptable means in accordance with ASTM A6 and the applicable AWS code.

Place stored materials on skids or acceptable dunnage above the ground. Keep materials clean. Shore girders and beams to keep them upright and free of standing water. Place support skids close enough to prevent excessive deflection in long members such as columns. Do not stack completed girders or beams at the jobsite.

Protect structural steel from salt water or other corrosive environments during storage and transit.

3.10. **Marking and Shipping**. Mark all structural members in accordance with the erection drawings. If a surface is painted, make the marks over the paint. Do not use impact-applied stencils to mark painted surfaces.

Mark the weight directly on all members weighing more than 3 tons.

Keep material clean and free from injury during loading, transportation, unloading, and storage. Pack bolts of each length and diameter, and loose nuts or washers of each size, separately and ship them in boxes, crates, kegs, or barrels. Plainly mark a list and description of the contents on the outside of each package.

3.11. **Field Erection.** Do not lift and place any steel member, including girders and diaphragms, over an open highway or other open travel way unless otherwise approved. Do not allow traffic to travel under erected members until sufficiently stable as shown on approved erection drawings.

3.11.1. **Pre-Erection Conference**. Schedule and attend a pre-erection conference with the Engineer at least 7 days before commencing steel erection operations. Do not install falsework or perform any erection operations before the meeting.

3.11.2. **Methods and Equipment**. Do not tack-weld parts instead of using erection bolts. Do not tack-weld parts to hold them in place for bolting. Provide falsework, tools, machinery, and appliances, including drift pins and erection bolts. Provide enough drift pins, 1/32 in. larger than the connection bolts, to fill at least 1/4 of the bolt holes for primary connections. Use erection bolts of the same diameter as the connection bolts.

Securely tie, brace, or shore steel beams or girders immediately after erection as shown on the erection drawings. Maintain bracing or shoring until the diaphragms are in place and as specified in the erection drawings. Protect railroad, roadway, and marine traffic underneath previously erected girders or beams from falling objects associated with other construction activities.

Only welders certified or working directly under the supervision of a foreman certified in accordance with Item 448, "Structural Field Welding," may handle torches when applying heat to permanent structural steel members.

3.11.3. **Falsework**. Construct falsework in accordance with the erection plan. Construct foundations for shore towers as shown on erection drawings. Do not use timber mats with deteriorated timbers or soil to construct shore tower foundations. Notify the Engineer of completed falsework to obtain approval before opening roadway to traffic or starting girder erection activities. Ensure falsework is protected from potential vehicle impact.

Inspect and maintain falsework daily. Use screw jacks or other approved methods to control vertical adjustment of falsework to minimize the use of shims.

3.11.4. **Handling and Assembly**. Accurately assemble all parts as shown on the plans and the approved shop drawings. Verify match-marks. Handle parts carefully to prevent bending or other damage. Do not hammer if doing so damages or distorts members. Do not weld any member for transportation or erection unless noted on the plans or approved by the Engineer.

3.11.4.1. **Welded Connections**. Weld flange splices to 50% of their thickness and meet the minimum erection bracing and support requirements before releasing the erection cranes, as shown on the plans and on the approved erection plans. Field-weld in accordance with Item 448, "Structural Field Welding."

3.11.4.2. **Bolted Connections**. Before releasing the erection cranes:

- install 50% of the bolts in the top and bottom flanges and the web with all nuts finger-tight,
- meet the minimum erection bracing and support requirements shown on the plans and on the approved erection plans, and
- install top lateral bracing across the connection for tub girders, and fully tension the bolts connecting the bracing to the top flanges.

Install high-strength bolts, including erection bolts, in accordance with Item 447, "Structural Bolting." Clean bearing and faying surfaces for bolted connections in accordance with Item 447, "Structural Bolting." Clean the areas of the outside ply under washers, nuts, and bolt heads before bolt installation. Ensure the required faying surface condition is present at the time of bolting.

3.11.5. **Misfits**. Correct minor misfits. Ream no more than 10% of the holes in a plate connection (flange or web), and ensure no single hole is more than 1/8 in. larger than the nominal bolt diameter. Submit proposed correction methods for members with defects that exceed these limits or prevent the proper assembly of parts. Straighten structural members in accordance with S2.1. Make all corrections in the presence of the Engineer at no expense to the Department. Do not remove and reweld gusset plates without approval.

3.11.6. **Bearing and Anchorage Devices**. Place all bearing devices such as elastomeric pads, castings, bearing plates, or shoes on properly finished bearing areas with full and even bearing on the concrete. Place metallic bearing devices on 1/4 in.-thick preformed fabric pads manufactured in accordance with DMS-6160, "Water Stops, Nylon-Reinforced Neoprene Sheet, and Elastomeric Pads," to the dimensions shown on the plans. Provide holes in the pad that are no more than 1/4 in. larger than the bolt diameter.

Build the concrete bearing area up to the correct elevation once it has been placed below grade using mortar that meets Item 420, "Concrete Substructures," and provide adequate curing. Use only mortar for build-ups between 1/8 in. and 3/8 in. thick. Use galvanized steel shims or other approved shim materials in conjunction with mortar if the bearing area must be raised more than 3/8 in.

Provide at least 75% contact of flange to shoe with no separation greater than 1/32 in. for beams and girders. Make corrections using heat or pressure in accordance with S2.1, or with galvanized shims. Correct small irregularities by grinding.

Provide at least 85% contact between the rocker plate and the base plate. Adjust the location of slotted holes in expansion bearings for the prevailing temperature. Adjust the nuts on the anchor bolts at the expansion ends of spans to permit free movement of the span. Provide lock nuts or burr the threads.

Remove all foreign matter from sliding or machine-finished surfaces before placing them in the structure.

Restore distorted bearing pads or expansion bearings to an equivalent 70°F position after completion of all welded or bolted splices, using an approved method of relieving the load on the bearing devices.

3.11.7. **Erecting Forms**. Do not erect forms until all welding or bolting is complete and the unit is positioned and properly set on the bearings unless otherwise noted on the plans.

3.11.8. **Field Finish.** Paint in accordance with Item 446, "Field Cleaning and Painting Steel." Restore weathering steel that will remain unpainted to a uniform appearance by solvent cleaning, hand cleaning, power brush, or blast cleaning after all welding and slab concrete placement has been completed. Remove from all unpainted weathering steel fascia surfaces (see Section 441.3.8.2., "Weathering Steel,") any foreign material, including markings, that adheres to the steel and could inhibit formation of oxide film as soon as possible. Feather out touched-up areas over several feet. Do not use acids to remove stains or scales.

4. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.

Item 442
Metal for Structures

1. DESCRIPTION

Provide structural steel, high-strength bolts, forgings, steel castings, iron castings, wrought iron, steel pipe and tubing, aluminum castings and tubing, or other metals used in structures, except reinforcing steel and metal culvert pipe.

2. MATERIALS

Furnish mill test reports (MTRs), supplemental test documentation, and certifications required by this and other pertinent Items.

2.1. **Structural Steel**. The Engineer may sample and test steel in accordance with ASTM A370.

2.1.1. **Bridge Structures**. Provide the grade of ASTM A709 steel shown on the plans. Grade 50W, 50S, or HPS 50W may be substituted for Grade 50 at no additional cost to the Department. Use Zone 1 if no AASHTO temperature zone is shown on the plans.

2.1.2. **Non-Bridge Structures**.

2.1.2.1. **Steel Classifications**. Provide the types and grades of steel listed in this Section unless otherwise shown on the plans.

2.1.2.1.1. **Carbon Steel**. Meet ASTM A36.

2.1.2.1.2. **Low-Alloy Steel**. Meet the requirements of one of the following standards:

- ASTM A529 Grade 50;
- ASTM A572 Grade 50 or 55;
- ASTM A588;
- ASTM A709 Grade 50, 50S, 50W, or HPS 50W; or
- ASTM A992.

Specify ASTM A6 supplemental requirement S18, "Maximum Tensile Strength," for material used for sign, signal, and luminaire supports.

2.1.2.2. **Impact Testing**. Tension members and components of the following structure types, if more than 1/2 in. thick. Other members designated on the plans must meet the Charpy V-notch (CVN) requirements of Table 1:

- base plates for roadway illumination assemblies, traffic signal pole assemblies, high mast illumination poles, camera poles, and overhead sign supports;
- pole mounting plates, arm mounting plates, and clamp-on plates for traffic signal pole assemblies;
- arm stiffeners, pole gussets, and stiffeners for traffic signal pole long mast arm assemblies (50 ft. to 65 ft.);
- pole shafts, ground sleeves, and handhole frames for high mast illumination poles;
- W-columns, tower pipes, multiple-sided shafts, tower pipe and multiple-sided shaft connection plates, chord angles, chord splice plates or angles, and truss bearing angles for truss type overhead sign supports; and

- pipe posts, pipe arms, post and arm flange plates, and handhole frames for monotube overhead sign supports.

Table 1
CVN Requirements for Non-Bridge Steel

Material	Thickness	Minimum CVN Toughness
ASTM A36, A53, A242, A500, A501, A709 Gr. 36, any other steel with minimum specified yield point below 40 ksi	up to 4"	15 ft.-lb. at 70°F
ASTM A572,[1] A588,[1] A633,[1] any other steel with minimum specified yield point between 40 and 65 ksi, inclusive	up to 2"	15 ft.-lb. at 70°F
	over 2" to 4", mechanically fastened	15 ft.-lb. at 70°F
	over 2" to 4", welded	20 ft.-lb. at 70°F
Any steel with minimum specified yield point over 65 ksi and under 90 ksi[2]	up to 2-1/2"	20 ft.-lb. at 50°F
	over 2-1/2" to 4", mechanically fastened	20 ft.-lb. at 50°F
	over 2-1/2" to 4", welded	25 ft.-lb. at 50°F

1. Reduce the testing temperature by 15°F for each 10-ksi increment or fraction thereof above 65 ksi if the yield point of the material given on the MTR exceeds 65 ksi.
2. Reduce the testing temperature by 15°F for each 10-ksi increment or fraction thereof above 85 ksi if the yield point of the material given on the MTR exceeds 85 ksi.

Use the (H) frequency of testing for material with minimum specified yield point up to 50 ksi. Use the (P) frequency of testing for material with minimum specified yield point over 50 ksi. Ensure steel is sampled and tested in accordance with ASTM A673.

2.1.3. **Other Components.**

2.1.3.1. **Miscellaneous Bridge Components**. Provide steel that meets ASTM A36, A709 Grade 36, or A500 Grade B for members such as steel bearing components not bid under other items, steel diaphragms for use with concrete bridges, and armor and finger joints, unless otherwise shown on the plans.

2.1.3.2. **Shear Connectors and Anchors**. Provide cold-drawn bars for stud shear connectors, slab anchors, and anchors on armor and finger joints that meet the requirements of ASTM A108, Grade 1010, 1015, 1018, or 1020, either semi-killed or killed, and have the tensile properties given in Table 2 after drawing or finishing. Determine tensile properties in accordance with ASTM A370.

Table 2
Minimum Tensile Properties for Bar Stock

Tensile strength	60 ksi
Yield strength	50 ksi
Elongation	20% (2")
Reduction of area	50%

Provide certification from the manufacturer that the studs or anchors as delivered have the required material properties.

2.1.3.3. **Fasteners**. Provide high-strength bolts that meet ASTM A325 or A490 as shown on the plans. The Department may sample high-strength bolts, nuts, and washers for structural connections in accordance with Tex-719-I.

Follow the requirements of Item 447, "Structural Bolting," for tests, test reports, and supplemental requirements for high-strength bolts, nuts, and washers.

Use bolts that meet ASTM A307 and nuts that meet ASTM A563 when ASTM A325 or A490 bolts are not shown on the plans.

2.1.3.4. **Slip-Resistant Deck Plates**. Furnish steel for deck plates that meets ASTM A786 and one of A242, A588, or A709 Gr. 50W. State the type and trade name of material to be used on the shop drawings.

2.1.3.5. **Rail Posts**. Provide material for rail posts that meets ASTM A36 or ASTM A709 Grade 36 unless otherwise shown on the plans.

2.2. **Steel Forgings**. Provide steel forgings for pins, rollers, trunnions, or other forged parts that meet ASTM A668, Class C, D, F, or G, as shown on the plans. For pins 4 in. or smaller in diameter for non-railroad structures, material that meets ASTM A108, Grades 1016 to 1030, with a minimum yield strength of 36 ksi, may be used instead.

2.3. **Steel Castings**. Provide steel castings that meet ASTM A27, Grade 70-36.

2.4. **Iron Castings**. Provide iron castings that are true to pattern in form and dimensions; free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended; and meet the standards shown in Table 3.

Table 3
Standards for Iron Castings

Casting Material	ASTM Standard	Grade or Class
Gray iron	A48	35B
Malleable iron	A47	32510
Ductile iron	A536	70-50-05

2.5. **Steel Tubing**. Provide steel tubing that meets ASTM A500, Grade B unless otherwise shown on the plans. Tubing that meets API Standard 5L, Grade X52 may be used if produced by a mill listed in the standard API specifications as authorized to produce pipe with the API monogram. Hydrostatic tests are not required for API 5L steel, and instead of an MTR, the manufacturer may furnish a certificate for each lot or shipment certifying the tubing meets the requirements of this Section.

2.6. **Pipe Rail**. "Pipe" includes special extruded and bent shapes. Provide pipe that is rolled, extruded, or cold-pressed from a round pipe or flat plate, and of the section shown on the plans.

Ensure the design of the cold press and dies results in a pipe of uniform section-free from die marks. Cut the pipe to the lengths required once it has been formed to the required section. Make the end cuts and notches at the angles to the axis of the pipe required to produce vertical end faces and plumb posts when required by the plans. Provide a neat and workmanlike finish when cutting and notching pipe.

2.7. **Aluminum**. Provide aluminum materials that meet the standards shown in Table 4 unless otherwise shown on the plans.

Table 4
Aluminum Standards

Material	ASTM Standard	Alloy-Temper
Castings	B108	A444.0-T4
Extrusions	B221	6061-T6
Sheet or plate	B209	6061-T6

When testing is required, cut test specimens from castings from the lower 14 in. of the tension flange, but not at the junction of the rib or base. Flatten the curved surfaces before machining. Provide standard test specimens in conformance with ASTM E8.

3. CONSTRUCTION

3.1. **Fabrication, Erection, and Painting**. Fabricate, weld, and erect structural metal in accordance with Item 441, "Steel Structures," Item 447, "Structural Bolting," Item 448, "Structural Field Welding," and the applicable AWS welding code. Paint in accordance with Item 446, "Field Cleaning and Painting Steel." Aluminum or galvanized steel members do not require painting unless otherwise shown on the plans.

3.2. **Galvanizing**. Galvanize fabricated steel items, steel castings, bolts, nuts, screws, washers, and other miscellaneous hardware in accordance with Item 445, "Galvanizing." Galvanizing is not required unless specified.

4. MEASUREMENT

This Item will be measured by the pound of structural metal furnished and placed in a complete structure not including the weight of erection bolts, paint, or weld metal.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

The maximum percent variance from the plans quantity will be as given in Table 5.

Table 5
Percent Variance

Quantity	Variance
Over 1,000,000 lb.	1/2%
100,000 through 1,000,000 lb.	1%
Under 100,000 lb.	1-1/2%

If the requests for increases in sizes or weights of members are approved, measurement will be made on the sizes or weights shown on the plans.

Castings, bearing plates, anchor bolts, drains, deck plates, armor and finger joints, and other metal for which no separate measurement is specified will be included in the total quantity of structural steel.

The weights of rolled materials (such as structural shapes and plate) will be computed on the basis of nominal weights and dimensions using measurements shown on the plans. Deductions will not be made for material that is removed for copes, clips, planing, or weld preparation. The weight of castings will be computed from the dimensions shown on the approved shop drawings. Shoes will be measured by the weights shown on the plans.

Weight of high-strength fasteners will be based on Table 6. Weight of other metal will be based on Table 7.

Splices will be measured as follows:

- No additional weight will be allowed for weld metal in a welded splice.
- Where a bolted splice is permitted as an alternate for a welded splice, measurement will be made on the basis of a welded splice.
- Where a bolted splice is required, the weight of the splice material, bolt heads, washers, and nuts will be measured with no deduction for holes.

Table 6
Pay Weight for High-Strength Fasteners, Pounds per Hundred Units

Diameter	Item		
	Bolt heads	Nuts	Washers
3/4"	15	19	4.8
7/8"	23	30	7.0
1"	32	43	9.4
1-1/8"	45	59	11
1-1/4"	64	79	14

Table 7
Pay Weight for Metals

Material	Weight (lb./cu. in.)
Steel	0.2836
Cast iron	0.2604
Wrought iron	0.2777

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Structural Steel" of the type (Rolled Beam, Plate Girder, Tub Girder, Box Girder, Railroad Through-Girder, Railroad Deck-Girder, Miscellaneous Bridge, Miscellaneous Non-Bridge) specified. This price is full compensation for materials, fabrication, transportation, erection, paint, painting, galvanizing, equipment, tools, labor, and incidentals.

Item 445
Galvanizing

1. DESCRIPTION

Galvanize or repair galvanizing on metal items.

2. MATERIALS

Provide galvanized metal items that meet the standards in Table 1.

Table 1
Galvanizing Standards

Item	Standard
Fabricated items, rolled, pressed, or forged steel shapes, plates, pipes, tubular items, and bars	ASTM A123
Steel or iron castings	ASTM A153, Class A
Bolts, nuts, screws, washers, and other miscellaneous hardware	ASTM A153, Class C or D or ASTM B695, Class 50
Miscellaneous fasteners	ASTM B633, Class Fe/Zn 8
Rail elements for metal beam guard fence or bridge railing	AASHTO M 180
Permanent metal deck forms, supporting angles, and incidental items	ASTM A653, Coating Designation G165

3. CONSTRUCTION

3.1. **General.** Provide for proper filling, venting, and draining during cleaning and galvanizing if fabricated members or assemblies are required to be hot-dip galvanized. Provide drain holes or slots as required, except where prohibited by the plans. Provide a surface finish on the thermal-cut drain holes or slots in accordance with AWS D1.1 requirements for base metal preparation. Drain to the small end of tapered sections that are assembled using slip-joint splices. Ensure cleaning and galvanizing does not produce hydrogen embrittlement.

Remove weld flux, weld slag, and any other weld residue or impurities before galvanizing. Before galvanizing material 1/4 in. or greater in thickness:

- remove all sharp burrs, and
- chamfer to approximately 1/16 in. all edges.

3.2. **Painting Galvanized Materials.** Provide a paint system if painting is specified on galvanized materials in accordance with DMS-8102 "Paint Systems for Galvanized Steel." Follow all manufacturer instructions for surface preparation and application including the following:

3.2.1. **Surface Preparation.** Do not water-quench or chromate-quench galvanized surfaces to be painted. Prepare the surface in accordance with ASTM D6386. Apply coating within 12 hr. of cleaning. Re-clean the surface if more than 12 hr. elapse before initial painting.

3.2.2. **Coating Application.** Ensure the coating is smooth, even, continuous, and free of drips, runs, sags, holidays, wrinkles, or other coating defects. Ensure the coating has a uniform appearance within all portions of the painted piece and all related pieces and components of a project. Ensure all repairs are smooth, even, and visually match the remainder of the coated piece by use of feathering and other appropriate techniques to avoid sharp transitions.

3.3. **Galvanizing Weldments**. If problems develop during galvanizing of welded material, the Engineer may require a compatibility test of the combined galvanizing and welding procedures in accordance with Section 441.3.2.6., "Testing of Galvanized Weldments," and may require modification of one or both of the galvanizing and welding procedures.

3.4. **Workmanship**.

3.4.1. **Coverage**. Bare spots no more than 1/8 in. across are acceptable unless numerous. Repair larger bare spots in accordance with Section 445.3.5., "Repairs." Local runs or drips of zinc coating are acceptable unless they interfere with the intended use of the product. Carefully remove plainly visible excessive zinc accumulations.

3.4.2. **Adhesion**. Tap the coated area with a small hammer to test coating adhesion. The coating is acceptable if it is not brittle and does not scale or flake.

3.4.3. **Appearance**.

3.4.3.1. **White Rust**. A white powdery residue indicates moisture. Remove heavy layers of white rust that have caused the coating to pit. Light coatings may remain unless the Engineer requires chemical removal. Remove white rust from articles that will be in direct contact with soil.

3.4.3.2. **Red Rust**. Red rust on galvanized items indicates uncoated areas. See Section 445.3.4.1., "Coverage," for acceptance criteria.

3.4.3.3. **Alligator Cracking or Spider Webbing**. The composition of the base metal may cause dark lines resembling alligator skin. See Section 445.3.4.2., "Adhesion," to determine whether the coating is acceptable.

3.4.3.4. **Dull Gray Coating**. The composition of the base metal can cause a dull gray color. See Section 445.3.4.2., "Adhesion," to determine whether the coating is acceptable.

3.4.4. **Coating Thickness**. Galvanize to the thickness specified. Use Tex-728-I to determine coating thickness.

3.5. **Repairs**. Use zinc-based solders, sprayed zinc, or zinc-rich paints for repairs in accordance with this Section.

3.5.1. **Materials**.

3.5.1.1. **Zinc-Based Solders**. Solders used in rod form or as powders:

- zinc-tin-lead alloys with liquidus temperatures in the range of 446°F to 500°F or
- zinc-cadmium alloys with liquidus temperatures in the range of 518°F to 527°F.

3.5.1.2. **Sprayed Zinc (Metallizing)**. Zinc coating applied by spraying with droplets of molten metal using wire, ribbon, or powder processes.

3.5.1.3. **Organic Zinc-Rich Paints**. Zinc-rich paints based on organic binders that meet the requirements of DMS-8103, "Galvanizing Repair Paints." The Department's MPL has a list of approved repair paints for galvanized coatings.

3.5.2. **Repair Processes**.

3.5.2.1. **Zinc-Based Solders**. Remove moisture, oil, grease, dirt, corrosion products, and welding slag or flux from surfaces to be repaired. Clean surface to white metal by wire-brushing, light grinding, or mild blasting extending into the surrounding undamaged galvanized coating. Preheat cleaned areas to at least 600°F, but not more than 750°F. Wire-brush while heating and evenly distribute a layer of zinc solder. Flush the repaired area with water or wipe with a damp cloth to remove flux residue when repair is completed.

3.5.2.2. **Sprayed Zinc (Metallizing).** Remove oil, grease, corrosion products, and any welding slag or flux from surfaces to be repaired, and ensure the surfaces are dry. Clean surface to white metal by wire-brushing, light grinding, or mild blasting extending into the surrounding undamaged galvanized coating. Apply coating by metal-spraying pistols fed with either zinc wire, ribbon, or powder. Provide a coating that is uniform and free of lumps, coarse areas, or loose particles.

3.5.2.3. **Organic Zinc-Rich Paints.** Remove oil, grease, corrosion products, and welding slag or flux from surfaces to be repaired, and ensure the surfaces are clean and dry. Clean surface to near-white metal by wire-brushing, light grinding, or mild blasting extending into the surrounding undamaged coating to provide a smooth repair. Spray or brush-apply the paint to the prepared area in accordance with the paint manufacturer's instructions to attain the required dry-film thickness. Provide multiple passes when using spray application.

3.6. **Repair Coating Thickness.** Measure thickness in the repaired area using Tex-728-I after completing repair and cooling or curing. The minimum thickness required is the same as that required for the specified galvanizing. However, if the repair uses zinc-rich paints, the minimum coating thickness is 50% higher than the specified galvanizing thickness but not greater than 4.0 mils.

4. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be considered subsidiary to pertinent Items.

Item 447
Structural Bolting

1. DESCRIPTION

Furnish and install high-strength bolts for structural connections.

2. MATERIALS

2.1. **General.** Use the same supplier for bolts and nuts to ensure proper fit. Have the manufacturer or distributor perform rotational-capacity (R-C) tests in accordance with Tex-452-A on all bolt, nut, and washer assemblies. Test each combination of bolt production lot, nut lot, and washer lot as an assembly and assign an R-C lot number to each lot tested. Test 2 samples from each assigned R-C lot.

Furnish a manufacturer's certified test report (MCTR) or a distributor's certified test report (DCTR) for each R-C lot supplied. Include in the MCTR or DCTR:

- results of the R-C tests,
- R-C lot number,
- manufacturing location for assembly components,
- date and location of tests, and
- a statement that the materials represented by the test report conform to the specifications.

2.2. **Bolt Assemblies.** Provide bolts, nuts, and washers meeting the type, grade, and finish requirements in Table 1.

Use ASTM A325 or A490 Type 3 plain (uncoated) bolts for weathering steel as indicated and ASTM A325 Type 1 galvanized bolts for coated steel.

Provide bolts long enough for the installed bolt end to be flush with or outside the face of the nut.

Ensure galvanized nuts are lubricated with a lubricant containing a dye of a color that contrasts with the color of the galvanizing. Order ASTM A563 nuts with supplemental requirement S2 if they will be galvanized.

Table 1
ASTM Type, Finish, and Grade for Structural Bolts, Nuts, and Washers

	ASTM Designation	Bolt Type	Bolt Finish	ASTM A563 Nut Grade and Finish	ASTM F436 Washer Type and Finish
Heavy-Hex Bolts	A325	1	Galvanized	DH,[1] galvanized and lubricated	1; galvanized
	A325	3	Plain	C3 and DH3; plain	3; plain
	A490	3	Plain	DH3; plain	3; plain
Tension-Control Bolts			Galvanized	DH,[1] galvanized and lubricated	1; galvanized
		3	Plain	C3 and DH3; plain	3; plain
	F2280	3	Plain	DH3; plain	3; plain

1. ASTM A194 Heavy Hex Grade 2H nuts may be substituted.

2.3. **Washer-Type Indicating Devices.** Use compressible-washer-type direct tension indicators that meet ASTM F959 if allowed. Alternative washer-type indicating devices must be approved by Engineer. Provide detailed testing, installation, and inspection requirements prepared by the manufacturer.

2.4. **Storage.** Protect all bolts and nuts from dirt and moisture at the jobsite. Remove from protected storage only those bolts and nuts anticipated to be installed during a workday. Return unused fasteners to protected

storage at the end of the day. Do not clean fasteners of lubricant present in the as-delivered condition. Perform a field R-C test at the Contractor's expense in accordance with Tex-452-A on any lot of fasteners that shows signs of rust, dirt, or loss of lubrication as directed. Apply additional lubrication and rerun the R-C test before installing bolts if the fasteners fail the R-C test. Replace any fasteners that cannot be re-lubricated to pass the field R-C test. Tension control bolts may only be re-lubricated by the manufacturer.

2.5. **Sampling and Testing**. Sample high-strength bolts, nuts, and washers in accordance with Tex-719-I. Perform field R-C tests as directed in accordance with Tex-452-A. Perform installation verification tests required in Section 447.4.1., "Verification Testing."

2.6. **Fitup Bolts and Erection Pins**. Provide heavy-hex fitup bolts of the same diameter as the connection bolts. Do not use washer-type indicating devices for fitups. Do not reuse galvanized bolts or ASTM A490 bolts that have been used as fitup bolts. Provide a sufficient number of erection or drift pins, 1/32 in. larger than the bolt diameter.

2.7. **Paint Markers**. Provide white or yellow paint markers for marking bolts or nuts for wrench calibration, R-C Tests, and bolt installation.

3. EQUIPMENT

3.1. **Testing Equipment**. Provide a calibrated tension-measuring device (Skidmore-Wilhelm or equivalent), calibrated torque wrench, and other accessories necessary to perform the installation verification test and the R-C test and to calibrate hydraulic or electric torque wrenches.

3.2. **Wrenches**. Furnish either of the following types of wrenches.

3.2.1. **Air-Driven Impact Wrenches**. Furnish air-driven impact wrenches, air compressors, and related accessories of sufficient capacity to properly tension high-strength bolts. Impact wrenches should be of sufficient size and capacity to be able to tension fully a bolt in less than 15 sec. Repair or replace any wrenches that are unable to apply full tension to a bolt within this time.

3.2.2. **Calibrated Torque Wrenches**. Furnish calibrated hydraulic or electric torque wrench and related accessories capable of properly tensioning high-strength bolts. Calibrate the wrench to stall out or cut out completely when the bolt tension reaches 1.05 times the tension specified in Table 2. Calibrate the wrench by tensioning 3 bolts of each size in a calibrated tension-measuring device (Skidmore-Wilhelm or equivalent). Mark each bolt and verify the rotation from snug-tight when calibrating the wrench as specified in Section 447.4.5.3.1., "Turn-of-the-Nut Method." Calibrate the wrench at least once each working day or as directed. Recalibrate the wrench for changes in bolt diameter; changes in bolt length greater than 2 bolt diameters; significant differences in the surface condition of the bolts, threads, nuts, or washers; or changes in the equipment or hose length.

4. CONSTRUCTION

4.1. **Verification Testing**. Have each member of the bolting crew that will perform the actual work complete an acceptable pre-installation verification test in the presence of the Engineer. Only crewmembers that have demonstrated proper workmanship via verification testing may perform production bolting work.

4.1.1. **Air-Driven Impact Wrench**. Perform an installation verification test on 3 complete fastener assemblies of each combination of diameter, length, grade, and lot to be installed before beginning bolting. Follow the bolt-tensioning procedures in Section 447.4.5.3., "Tension Bolts." Use a calibrated tension-measuring device (Skidmore-Wilhelm or equivalent) to verify and demonstrate that the method for estimating the snug-tight condition and controlling the turns from snug-tight develops a tension greater than 1.05 times the tension specified in Table 2. The snug-tight condition is defined as the tightness that exists when the plies of the joint are in firm contact.

4.1.2. **Calibrated Torque Wrench.** Calibrate the wrench before beginning bolting in accordance with Section 447.3.2.2., "Calibrated Torque Wrenches." Use the bolting crew that will perform the actual work for the calibration and calibrate the wrench in the presence of the Engineer. Follow the bolt-tensioning procedures in Section 447.4.5.3., "Tension Bolts."

4.1.3. **Direct-Tension Indicator.** Use a calibrated tension-measuring device for compression-type indicators to verify the gap is not less than 0.015 in. or the job inspection gap specified by the manufacturer when tension in the bolt reaches 1.05 times the tension specified in Table 2.

Follow the manufacturer's instructions for pre-installation verification testing methods and frequency for alternative washer-type indicating devices deemed acceptable.

4.2. **Workmanship.** The Engineer will disqualify any crewmembers not adhering to proper installation methods during production work. Disqualified crew may not perform further bolting work until they complete an additional pre-installation verification test suitable to the Engineer.

4.3. **General.** Ensure all material within the grip of the bolt is steel. Do not allow any compressible material such as gaskets or insulation within the grip. Ensure the slope of parts in contact with the bolt head or nut does not exceed 1:20 with respect to a plane normal to the bolt axis. Prepare all joint surfaces, including those in contact with the bolt heads, nuts, or washers, so that the surfaces are free of dirt, loose rust, loose mill scale, burrs, and other matter that would prevent solid seating of the parts.

Replace any bolts and nuts installed for shipping purposes unless the shop drawings indicate the shop-installed bolts are to be fully tensioned in the shop. Do not tension bolts that have been installed snug-tight in the shop. Remove any bolts installed snug-tight in the shop and replace them with new bolts. Inspect and prepare the joint surfaces after removing shop-installed bolts that are not fully tensioned in the shop.

Provide a hardened washer for heavy-hex and tension-control bolts under either the nut or the bolt head, whichever is turned during tensioning. Install hardened washers under both the nut and bolt head of ASTM A490 bolts when the outer plies being fastened have a yield strength less than 40 ksi.

Install an ASTM F436 washer for direct tension indicators as follows:

- under the nut when the nut is turned and the direct tension indicator is located under the bolt head;
- between the nut and the direct tension indicator when the nut is turned and the direct tension indicator is located under the nut;
- under the bolt head when the bolt head is turned and the direct tension indicator is located under the nut; and
- between the bolt head and the direct tension indicator when the bolt head is turned and the direct tension indicator is located under the bolt head.

Tension all bolts to provide the minimum bolt tension values given in Table 2.

Erect steel in conformance with Item 441, "Steel Structures." Do not tack-weld any parts to eliminate fitup bolts or to hold parts together while bolting.

Remove lubricant from bolt assemblies on painted structures after tensioning and before coating the connections.

Re-tighten the nuts or tack weld the nuts to the bolts when bolts are used to temporarily support welded diaphragms after completing the welding operations if the diaphragms are over vehicular or pedestrian traffic.

Table 2
Bolt Tension

Nominal Bolt Size, in.	Minimum Tension (kips)	
	ASTM A325 Bolts	ASTM A490 Bolts
1/2	12	15
5/8	19	24
3/4	28	35
7/8	39	49
1	51	64
1-1/8	56	80
1-1/4	71	102
1-3/8	85	121
1-1/2	103	148

4.4. **Preparation of Faying Surfaces**. Perform blast cleaning or painting of faying surfaces in accordance with Item 441, "Steel Structures." Provide an SSPC-SP 10 blast cleaning before shipment for weathering steel. Do not wire-brush weathering steel faying surfaces.

Roughen galvanized faying surfaces by hand wire-brushing. Do not use power wire brushes to roughen galvanized faying surfaces.

4.5. **Bolt Installation**. Use the following procedure for bolt installation of a complete connection:

4.5.1. **Fair-Up Holes**. Use a minimum number of erection or drift pins, as directed, in the holes to "fair-up" all holes.

4.5.2. **Install Bolts**. Install bolts in all remaining holes of the connection. Do not use excessive force, which results in damage to the threads, to install the bolts. Increase the number of erection or drift pins as necessary to align the holes if force is required to install the bolts. Do not ream the holes unless approved. Ream the holes in accordance with Section 441.3.11.5., "Misfits," if approved. Remove the erection or drift pins and install bolts in these holes. Bring the connection to a full snug-tight condition by snugging systematically from the most rigid part of the connection to the free edges. The snug-tight condition is defined as the tightness that exists when the plies of the joint are in firm, full contact and all of the bolts in the joint have been tightened sufficiently to prevent the removal of the nuts without the use of a wrench. A snug-tight condition can usually be attained by a few impacts of an impact wrench or the full effort of a worker using an ordinary spud wrench as demonstrated in the installation verification test. As necessary, re-snug previously snugged bolts that may have relaxed as a result of the subsequent snugging of adjacent bolts to ensure all bolts are simultaneously snug-tight and the connection plates are in full contact.

Fully tighten a minimum number of bolts as directed until the plies are in full contact if snugging does not bring the plies of the joint into full contact. Mark these bolts as fitup bolts. Use a non-galvanized ASTM A325 bolt of the same diameter as a fitup bolt in connections requiring the use of galvanized ASTM A325 bolts. Re-snug all remaining bolts.

Do not use washer-type indicating devices to bring the connection to a snug-tight condition. Rather, install heavy-hex bolt assemblies in a sufficient number of holes (approximately 20%) to attain firm, full contact between plies. Remove the heavy-hex bolts and install the washer-type indicating device assemblies after firm contact is established by connections in surrounding bolt holes.

4.5.3. **Tension Bolts**. Loosen all fitup bolts after tensioning all the other bolts in the connection. Ungalvanized ASTM A325 bolts used as fitup bolts may be reused in a connection using this type of bolt. Replace all galvanized bolts and ASTM A490 bolts used as fitup bolts. Tension these remaining untensioned bolts in accordance with this paragraph. Ensure the element not turned by the wrench (bolt head or nut) does not rotate.

4.5.3.1. **Turn-of-the-Nut Method**. Match-mark the nuts and the protruding bolt ends after the bolts have been brought up to snug-tight condition and before final tensioning so that actual rotation can be determined.

Tension all bolts in the connection to their final tension by the amount of rotation specified in Table 3. Start final tensioning at the center or most rigid part of the connection and progress toward the free edges.

4.5.3.2. **Calibrated Wrench Method.** Use a calibrated hydraulic torque wrench to tension all bolts to 1.05 times the tension given in Table 1 after they have been brought to the snug-tight condition. Calibrate the wrench in accordance with Section 447.3.2.2., "Calibrated Torque Wrenches." Start tensioning at the most rigid part of the connection and proceed to the free edges. Return the wrench to re-tension previously tensioned bolts that may have relaxed as a result of the subsequent tensioning of adjacent bolts. Place marks on the socket at one-third points so the amount of rotation can be visually determined.

4.5.3.3. **Washer-Type Indicating Devices.**

4.5.3.3.1. **Compressible-Washer-Type Direct Tension Indicators.** Ensure the direct-tension indicator arches are oriented away from the work and that they bear against the hardened bearing surface. Confirm the appropriate feeler gage is 1) accepted in at least half the spaces between protrusions before tensioning, and 2) refused entry in at least half the spaces between protrusions after tensioning.

4.5.3.3.2. **Alternative Washer-Type Indicating Devices.** Follow the procedures prepared by the manufacturer and approved by the Engineer. Verify proper installation after tensioning.

4.5.4. **Bolt Reuse.** Do not reuse ASTM A490 or galvanized ASTM A325 bolts. Ungalvanized ASTM A325 bolts may be reused one time if the threads have not been damaged. Re-tensioning previously tensioned bolts loosened by the tensioning of adjacent bolts is not considered to be reuse.

Tension all bolts in a connection within 10 days of installation. Bolts not tensioned within 10 days of installation are subject to field R-C testing. Re-lubricate or replace any installed bolts that do not have sufficient lubrication as determined by the field R-C test.

Table 3
Nut Rotation from Snug-Tight Condition[1]

Bolt length (underside of head to end of bolt)	Disposition of Outer Face of Bolted Parts		
	Both faces normal to bolt axis	One face normal to bolt axis and other face sloped less than 1:20 (beveled washer not used)	Both faces sloped less than 1:20 from bolt axis (beveled washer not used)
Up to and including 4 bolt diameters	1/3 turn	1/2 turn	2/3 turn
Over 4 bolt diameters up to and including 8 diameters	1/2 turn	2/3 turn	5/6 turn
Over 8 bolt diameters up to and including 12 diameters[2]	2/3 turn	5/6 turn	1 turn

1. Nut rotation is relative regardless of the element (nut or bolt) being turned. The tolerance is –0°, +30° for bolts installed by 1/2 turn or less and –0°, +45° for bolts installed by 2/3 turn or more.
2. Determine the required rotation for bolt lengths greater than 12 diameters using the installation verification test in a simulated connection of solidly fitted steel.

5. MEASUREMENT AND PAYMENT

Installation and testing of bolts will not be paid for directly but will be subsidiary to the pertinent Items requiring the use of high-strength bolts.

When payment for the structure associated with the bolts is made under Item 442, "Metal for Structures," bolts, nuts, and washers will be paid for in accordance with Item 442, "Metal for Structures."

Item 450
Railing

1. DESCRIPTION

Construct railing of concrete, steel, aluminum, or a combination of these materials, including necessary anchorage for the railing on bridges, culverts, walls, or other structures as shown on the plans.

2. MATERIALS

Use materials that conform to requirements of the following Items.

- Item 421, "Hydraulic Cement Concrete,"
- Item 440, "Reinforcement for Concrete,"
- Item 441, "Steel Structures,"
- Item 442, "Metal for Structures,"
- Item 445, "Galvanizing," and
- Item 540, "Metal Beam Guard Fence."

Provide an approved Type III, Class C epoxy or an epoxy of the type and class stated on the plans where epoxy anchors are allowed or required for installing drilled and epoxied rail anchorage reinforcement or rail anchor bolts in accordance with DMS-6100, "Epoxies and Adhesives." Use other materials if shown on the plans. Provide only dual cartridge epoxy systems mixed with a static mixing nozzle supplied by the epoxy adhesive manufacturer and dispensed with a tool supplied by the epoxy adhesive manufacturer. Do not use bulk epoxies. Drill and install anchorage reinforcement or anchor bolts to the embedment depth shown on the plans or the depth the manufacturer recommends, whichever is deeper. No additional payment will be made for providing embedment deeper than shown on the plans. Select an embedment depth capable of developing the yield strength of the steel anchor based on the product literature for the epoxy and steel anchor being used if no resistance or embedment depth is specified on the plans. Use 60 ksi as the yield strength for reinforcing steel.

3. CONSTRUCTION

Construct railing in accordance with details, alignment, and grade designated on the plans. Do not place railing until falsework or formwork, if any, for the span has been released unless otherwise directed. Adhere to the schedule restrictions for Placing Bridge Rails and Opening to Construction Traffic in Item 422, "Concrete Superstructures." Notify the Engineer after completion of the following steps and obtain approval of work before proceeding to the next step: placing rail reinforcement and pre-pour clear cover checks.

Ensure expansion joints in the railing will function properly before placing concrete.

Furnish either steel or aluminum, but not both, for the entire Contract if the plans allow either steel or aluminum options for a particular railing type.

Install epoxy adhesive anchorages in accordance with the manufacturer's instructions including hole size, drilling equipment and method, hole cleaning equipment and method, mixing and dispensing epoxy, and anchor insertion. Do not alter the manufacturer's mixing nozzle or dispenser. Anchorage bars or bolts must be clean and free of grease, oil, or any other foreign material. Demonstrate hole cleaning method to the Engineer for approval and continue the approved process for all anchorage locations. Do not weld to an anchor bar or anchor bolt that is anchored with epoxy adhesive. Do not expose rail to traffic until epoxy adhesive has obtained full cure in accordance with manufacturer's specifications.

3.1. **Metal Railing.**

3.1.1. **General.** Furnish metal beam rail elements in accordance with Item 540, "Metal Beam Guard Fence."

Fabricate and erect metal railing according to the pertinent provisions of Item 441, "Steel Structures," and the requirements of this Item.

Prepare and submit for approval the required shop or erection drawings in accordance with Item 441, "Steel Structures," when the plans require. Show all splice locations and details on the shop or erection drawings. Splice members only as provided on the plans.

Field-weld when required in accordance with Item 448, "Structural Field Welding."

3.1.2. **Fabrication.** Fabricate metal railing and post panels in sections conforming to the details shown on the plans and field-verified lines and grades. Fabricate adjacent sections so they will accurately engage each other in the field. Match-mark each pair of sections so they can be erected in the same position they were fabricated.

Fabricate metal rail elements included as part of the railing system to the dimensions and cross-sections shown on the plans and within a tolerance of 1/4 in. per 10 feet in the straightness of either edge. Joint and connect metal rail elements to the rail posts as shown on the plans, lapping metal rail elements in the direction of traffic in the adjacent lane. Bolts and nuts for metal railing should meet requirements of ASTM A307 and be galvanized in accordance with Item 445, "Galvanizing," unless otherwise shown on the plans.

Fabricate aluminum in accordance with AWS D1.2.

Heat aluminum materials other than castings to a temperature up to 400°F for no more than 30 min. to facilitate bending or straightening.

3.1.3. **Castings.** Provide permanent mold castings of the materials specified that are true to pattern in form and dimensions and of uniform quality and condition. Castings must be free from cracks and defects such as blowholes, porosity, hard-spots, or shrinkage that could affect their suitability for use. Repair minor defects in aluminum castings by an approved inert gas-welding process. Ensure finished castings are free of burrs, fins, discoloration, and mold marks and that they have a uniform appearance and texture.

Produce castings under radiographic control sufficient to establish and verify a product free from harmful internal defects. Heat-treat the entire lot of castings to the specified temper when required.

Permanently mark the heat or lot number on the web or top of the base of all castings. Furnish mill test reports showing the heat or lot number, chemical composition, tensile strength, elongation, and number of pieces for each casting heat or lot. For aluminum castings, a heat or lot should consist of at least 1,000 lb. of trimmed castings when produced from batch type furnaces, or 2,000 lb. when produced from a continuous furnace during a period of no more than 8 consecutive hours. Furnish the entire number of acceptable posts cast from each heat or lot except when a portion is required to complete a project.

3.1.4. **Corrosion Protection.** Galvanize all portions of steel railing after fabrication in accordance with Item 445, "Galvanizing," unless otherwise noted on the plans. Apply appearance coat to galvanized surface in accordance with Item 445, "Galvanizing," when shown on the plans. When painting is specified in place of galvanizing, shop paint steel in accordance with Item 441, "Steel Structures." Repair any damage to galvanized or painted surfaces after erection in accordance with Items 445, "Galvanizing," and Item 446, "Field Cleaning and Painting Steel," respectively.

Before final acceptance, clean surfaces of aluminum and galvanized steel railing not shown to be painted to remove extrusion marks, grease, dirt, and all other surface contaminants.

3.1.5. **Storage**. Store railing materials above the ground on platforms, skids, or other supports, and keep them free from grease, dirt, and contact with dissimilar metals. Avoid scratching, marring, denting, discoloring, or otherwise damaging the railing.

3.2. **Concrete Railing**. Provide concrete portions of railing in accordance with the requirements of Item 420, "Concrete Substructures," and Item 422, "Concrete Superstructures." Construct forms so the railing line and grade can be checked after the concrete has been placed but before initial set. Do not disturb the form alignment during finish floating of the railing tops. Exercise particular care in other construction to avoid disturbing or vibrating the span with the newly placed railing.

Provide precast members conforming to Item 424, "Precast Concrete Structural Members (Fabrication)."

Slipform construction of railing is permitted unless otherwise shown on the plans. Demonstrate slipforming method showing line and grade of concrete surfaces can be consistently obtained and clear cover outside reinforcing steel be maintained at all times. Stop slipforming railing if specified concrete clear cover is not obtained or appearance of rail is off line and grade.

Do not slipform railing with cast-in-place anchor bolts unless noted otherwise.

Provide additional reinforcing as needed to prevent movement of the reinforcement cage. Clear cover and epoxy coating requirements for additional reinforcement are the same as shown for the rail reinforcement. The rail reinforcing cage may be tack welded to the rail anchorage reinforcement provided the rail and anchorage reinforcement are not epoxy coated and weld locations measured along the rail are no closer than 3 ft. Tie all bar intersections if epoxy coated reinforcement is required for the railing proposed to be slipformed. Provide a wire line to maintain vertical and horizontal alignment of the slipform machine. Attach a grade line gauge or pointer to the machine so a continuous comparison can be made between the rail being placed and the established grade line. Rails or supports at the required grade are allowed instead of sensor controls. Make one or more passes with the slipform over the rail segment to ensure proper operation and maintenance of grades and clearances before placing concrete. Provide slipformed rail within a vertical and horizontal alignment tolerance of ±1/4 in. per 10 feet. Construct rail with a smooth and uniform appearance. Consolidate concrete so it is free of honeycomb. Provide concrete with a consistency that will maintain the shape of the rail without support. Minimize starting and stopping of the slipform operation by ensuring a continuous supply of concrete.

Do not exceed the manufacturer's recommended speed for the slipform machine. Stop slipforming and take remedial action if slipforming causes movement of the reinforcement such that plan clearances are not achieved. Remove and replace unsatisfactory slipformed rail at the Contractor's expense.

3.3. **Tests**. The Engineer will sample cast aluminum posts for testing in accordance with Tex-731-I to verify the material requirements of Item 442, "Metal for Structures." Metal beam rail elements may be sampled in accordance with Tex-713-I. The Engineer may sample bolts and nuts in accordance with Tex-708-I for galvanized coating testing.

The Engineer will select 3 anchor bars or bolts from the first day's production to be tested after the epoxy has cured. Test the bars or bolts in the presence of the Engineer in accordance with ASTM E1512, using a restrained test, to evaluate the epoxy adhesive's bond strength. Verify the anchor bars or bolts develop the required pullout resistance on the plans or 75% of the yield strength of the bars or bolts, whichever is less, without a bond failure of the epoxy. The Engineer may require additional tests during production. Perform corrective measures to provide adequate capacity if any of the tests do not meet the required test load. Repair damage from testing.

4. MEASUREMENT

This Item will be measured by the foot.

This is a plans quantity measurement Item. The quantity to be paid for is the quantity shown in the proposal except as modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Railing" of the type specified. This price will be full compensation for furnishing, preparing, and placing concrete, expansion joint material, reinforcing steel, structural steel, aluminum, cast steel, pipe, anchor bolts or bars, testing of epoxy anchors, and all other materials required in the finished railing; removal and disposal of salvageable materials; and hardware, paint and painting of metal railing, galvanizing, equipment, labor, tools, and incidentals.

Item 502

Barricades, Signs, and Traffic Handling

1. DESCRIPTION

Provide, install, move, replace, maintain, clean, and remove all traffic control devices shown on the plans and as directed.

2. CONSTRUCTION

Comply with the requirements of Article 7.2., "Safety."

Implement the traffic control plan (TCP) shown on the plans.

Install traffic control devices straight and plumb. Make changes to the TCP only as approved. Minor adjustments to meet field conditions are allowed.

Submit Contractor-proposed TCP changes, signed and sealed by a licensed professional engineer, for approval. The Engineer may develop, sign, and seal Contractor-proposed changes. Changes must conform to guidelines established in the TMUTCD using approved products from the Department's Compliant Work Zone Traffic Control Device List.

Maintain traffic control devices by taking corrective action when notified. Corrective actions include, but are not limited to, cleaning, replacing, straightening, covering, and removing devices. Maintain the devices such that they are properly positioned and spaced, legible, and have retroreflective characteristics that meet requirements day or night and in all weather conditions.

The Engineer may authorize or direct in writing the removal or relocation of project limit advance warning signs. When project limit advance warning signs are removed before final acceptance, provide traffic control in accordance with the TMUTCD for minor operations as approved.

Remove all traffic control devices upon completion of the work as shown on the plans or as directed.

3. MEASUREMENT

Barricades, Signs, and Traffic Handling will be measured by the month. Law enforcement personnel with patrol vehicles will be measured by the hour for each person.

4. PAYMENT

4.1. **Barricades, Signs, and Traffic Handling**. Except for Contracts with callout work and work orders, the work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Barricades, Signs, and Traffic Handling." This price is full compensation for installation, maintenance, adjustments, replacements, removal, materials, equipment, labor, tools, and incidentals.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Barricades, Signs, and Traffic Handling." This price is full compensation for installation, maintenance, adjustments, replacements, removal, materials, equipment, labor, tools, and incidentals.

When the plans establish pay items for particular work in the TCP, that work will be measured and paid under pertinent Items.

4.1.1. **Initiation of Payment**. Payment for this Item will begin on the first estimate after barricades, signs, and traffic handling devices have been installed in accordance with the TCP and construction has begun.

4.1.2. **Paid Months**. Monthly payment will be made each succeeding month for this Item provided the barricades, signs, and traffic handling devices have been installed and maintained in accordance with the TCP until the Contract amount has been paid.

If, within the time frame established by the Engineer, the Contractor fails to provide or properly maintain signs and barricades in compliance with the Contract requirements, as determined by the Engineer, the Contractor will be considered in noncompliance with this Item. No payment will be made for the months in question, and the total final payment quantity will be reduced by the number of months the Contractor was in noncompliance.

4.1.3. **Maximum Total Payment Before Acceptance**. The total payment for this Item will not exceed 10% of the total Contract amount before final acceptance in accordance with Article 5.12., "Final Acceptance." The remaining balance will be paid in accordance with Section 502.4.1.5., "Balance Due."

4.1.4. **Total Payment Quantity**. The quantity paid under this Item will not exceed the total quantity shown on the plans except as modified by change order and as adjusted by Section 502.4.1.2., "Paid Months." An overrun of the plans quantity for this Item will not be allowed for approving designs; testing; material shortages; closed construction seasons; curing periods; establishment, performance, test, and maintenance periods; failure to complete the work in the number of months allotted; nor delays caused directly or indirectly by requirements of the Contract.

4.1.5. **Balance Due**. The remaining unpaid months of barricades less non-compliance months will be paid on final acceptance of the project, if all work is complete and accepted in accordance with Article 5.12., "Final Acceptance."

4.1.6. **Contracts with Callout Work and Work Orders**. The work performed and the materials furnished with this Item and measured as provided under "Measurement," will be considered subsidiary to pertinent Items, except for federally funded Contracts.

4.2. **Law Enforcement Personnel**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement," will be paid by Contractor force account for "Law Enforcement Personnel." This price is full compensation for furnishing all labor, materials, supplies, equipment, patrol vehicle, fees, and incidentals necessary to complete the work as directed.

Item 506

Temporary Erosion, Sedimentation, and Environmental Controls

1. DESCRIPTION

Install, maintain, and remove erosion, sedimentation, and environmental control measures to prevent or reduce the discharge of pollutants in accordance with the Storm Water Pollution Prevention Plan (SWP3) on the plans and the Texas Pollutant Discharge Elimination System (TPDES) General Permit TXR150000. Control measures are defined as Best Management Practices used to prevent or reduce the discharge of pollutants. Control measures include, but are not limited to, rock filter dams, temporary pipe slope drains, temporary paved flumes, construction exits, earthwork for erosion control, pipe, construction perimeter fence, sandbags, temporary sediment control fence, biodegradable erosion control logs, vertical tracking, temporary or permanent seeding, and other measures. Erosion and sediment control devices must be selected from the *Erosion Control Approved Products* or *Sediment Control Approved Products* lists. Perform work in a manner to prevent degradation of receiving waters, facilitate project construction, and comply with applicable federal, state, and local regulations. Ensure the installation and maintenance of control measures is performed in accordance with the manufacturer's or designer's specifications.

Provide the Contractor Certification of Compliance before performing SWP3 or soil disturbing activities. By signing the Contractor Certification of Compliance, the Contractor certifies they have read and understand the requirements applicable to this project pertaining to the SWP3, the plans, and the TPDES General Permit TXR150000. The Contractor is responsible for any penalties associated with non-performance of installation or maintenance activities required for compliance. Ensure the most current version of the certificate is executed for this project.

2. MATERIALS

Furnish materials in accordance with the following:

- Item 161, "Compost,"
- Item 432, "Riprap," and
- Item 556, "Pipe Underdrains."

2.1. **Rock Filter Dams.**

2.1.1. **Aggregate.** Furnish aggregate with approved hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding. Provide the following:

- Types 1, 2, and 4 Rock Filter Dams. Use 3 to 6 in. aggregate.
- Type 3 Rock Filter Dams. Use 4 to 8 in. aggregate.

2.1.2. **Wire.** Provide minimum 20 gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:

- a double-twisted, hexagonal weave with a nominal mesh opening of 2-1/2 × 3-1/4 in.;
- minimum 0.0866 in. steel wire for netting;
- minimum 0.1063 in. steel wire for selvages and corners; and
- minimum 0.0866 in. for binding or tie wire.

2.1.3. **Sandbag Material.** Furnish sandbags meeting Section 506.2.8., "Sandbags," except that any gradation of aggregate may be used to fill the sandbags.

2.2. **Temporary Pipe Slope Drains**. Provide corrugated metal pipe, polyvinyl chloride (PVC) pipe, flexible tubing, watertight connection bands, grommet materials, prefabricated fittings, and flared entrance sections that conform to the plans. Recycled and other materials meeting these requirements are allowed if approved.

Furnish concrete in accordance with Item 432, "Riprap."

2.3. **Temporary Paved Flumes**. Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material that conforms to the plans. Provide rock or rubble with a minimum diameter of 6 in. and a maximum volume of 1/2 cu. ft. for the construction of energy dissipaters.

2.4. **Construction Exits**. Provide materials that meet the details shown on the plans and this Section.

2.4.1. **Rock Construction Exit**. Provide crushed aggregate for long- and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft or flaky materials, and organic and injurious matter. Use 4- to 8-in. aggregate for Type 1. Use 2- to 4-in. aggregate for Type 3.

2.4.2. **Timber Construction Exit**. Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers with nuts and bolts or lag bolts, of at least 1/2 in. diameter, unless otherwise shown on the plans or allowed. Provide plywood or pressed wafer board at least 1/2 in. thick for short-term exits.

2.4.3. **Foundation Course**. Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the plans or directed.

2.5. **Embankment for Erosion Control**. Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.

2.6. **Pipe**. Provide pipe outlet material in accordance with Item 556, "Pipe Underdrains," and details shown on the plans.

2.7. **Construction Perimeter Fence**.

2.7.1. **Posts**. Provide essentially straight wood or steel posts that are at least 60 in. long. Furnish soft wood posts with a minimum diameter of 3 in., or use nominal 2 × 4 in. boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 × 1-1/5 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.25 lb. per foot.

2.7.2. **Fence**. Provide orange construction fencing as approved.

2.7.3. **Fence Wire**. Provide 14 gauge or larger galvanized smooth or twisted wire. Provide 16 gauge or larger tie wire.

2.7.4. **Flagging**. Provide brightly-colored flagging that is fade-resistant and at least 3/4 in. wide to provide maximum visibility both day and night.

2.7.5. **Staples**. Provide staples with a crown at least 1/2 in. wide and legs at least 1/2 in. long.

2.7.6. **Used Materials**. Previously used materials meeting the applicable requirements may be used if approved.

2.8. **Sandbags**. Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 oz. per square yard, a Mullen burst-strength exceeding 300 psi, and an ultraviolet stability exceeding 70%.

Use natural coarse sand or manufactured sand meeting the gradation given in Table 1 to fill sandbags. Filled sandbags must be 24 to 30 in. long, 16 to 18 in. wide, and 6 to 8 in. thick.

Table 1
Sand Gradation

Sieve Size	Retained (% by Weight)
#4	Maximum 3%
#100	Minimum 80%
#200	Minimum 95%

Aggregate may be used instead of sand for situations where sandbags are not adjacent to traffic. The aggregate size must not exceed 3/8 in.

2.9. **Temporary Sediment Control Fence**. Provide a net-reinforced fence using woven geo-textile fabric. Logos visible to the traveling public will not be allowed.

2.9.1. **Fabric**. Provide fabric materials in accordance with DMS-6230, "Temporary Sediment Control Fence Fabric."

2.9.2. **Posts**. Provide essentially straight wood or steel posts with a minimum length of 48 in., unless otherwise shown on the plans. Furnish soft wood posts at least 3 in. in diameter, or use nominal 2 × 4 in. boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 × 1-1/2 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.25 lb. per foot.

2.9.3. **Net Reinforcement**. Provide net reinforcement of at least 12.5 gauge (SWG) galvanized welded wire mesh, with a maximum opening size of 2 × 4 in., at least 24 in. wide, unless otherwise shown on the plans.

2.9.4. **Staples**. Provide staples with a crown at least 3/4 in. wide and legs 1/2 in. long.

2.9.5. **Used Materials**. Use recycled material meeting the applicable requirements if approved.

2.10. **Biodegradable Erosion Control Logs**.

2.10.1. **Core Material**. Furnish core material that is biodegradable or recyclable. Use compost, mulch, aspen excelsior wood fibers, chipped site vegetation, agricultural rice or wheat straw, coconut fiber, 100% recyclable fibers, or any other acceptable material unless specifically called out on the plans. Permit no more than 5% of the material to escape from the containment mesh. Furnish compost meeting the requirements of Item 161, "Compost."

2.10.2. **Containment Mesh**. Furnish containment mesh that is 100% biodegradable, photodegradable, or recyclable such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material.

Furnish biodegradable or photodegradable containment mesh when log will remain in place as part of a vegetative system.

Furnish recyclable containment mesh for temporary installations.

2.10.3. **Size**. Furnish biodegradable erosion control logs with diameters shown on the plans or as directed. Stuff containment mesh densely so logs do not deform.

3. QUALIFICATIONS, TRAINING, AND EMPLOYEE REQUIREMENTS

3.1. **Contractor Responsible Person Environmental (CRPE) Qualifications and Responsibilities**. Provide and designate in writing at the preconstruction conference a CRPE and alternate CRPE who have overall responsibility for the storm water management program. The CRPE will implement storm water and erosion control practices; will oversee and observe storm water control measure monitoring and management; will monitor the project site daily and produce daily monitoring reports as long as there are BMPs in place or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES General Permit TXR150000. During time suspensions when work is not occurring or on contract non-work days, daily inspections are not required unless a rain event has occurred. The CRPE will provide recommendations on

how to improve the effectiveness of control measures. Attend the Department's preconstruction conference for the project. Ensure training is completed as identified in Section 506.3.3., "Training," by all applicable personnel before employees work on the project. Document and submit a list, signed by the CRPE, of all applicable Contractor and subcontractor employees who have completed the training. Include the employee's name, the training course name, and date the employee completed the training. Provide the most current list at the preconstruction conference or before SWP3 or soil disturbing activities. Update the list as needed and provide the updated list when updated.

3.2. **Contractor Superintendent Qualifications and Responsibilities**. Provide a superintendent that is competent, has experience with and knowledge of storm water management, and is knowledgeable of the requirements and the conditions of the TPDES General Permit TXR150000. The superintendent will manage and oversee the day to day operations and activities at the project site; work with the CRPE to provide effective storm water management at the project site; represent and act on behalf of the Contractor; and attend the Department's preconstruction conference for the project.

3.3. **Training**. All Contractor and subcontractor employees involved in soil disturbing activities, small or large structures, storm water control measures, and seeding activities must complete training as prescribed by the Department.

4. CONSTRUCTION

4.1. **Contractor Responsibilities**. Implement the SWP3 for the project site in accordance with the plans and specifications, TPDES General Permit TXR150000, and as directed. Coordinate storm water management with all other work on the project. Develop and implement an SWP3 for project-specific material supply plants within and outside of the Department's right of way in accordance with the specific or general storm water permit requirements. Prevent water pollution from storm water associated with construction activity from entering any surface water or private property on or adjacent to the project site.

4.2. **Implementation**. The CRPE, or alternate CRPE, must be accessible by phone and able to respond to project-related storm water management or other environmental emergencies 24 hr. per day.

4.2.1. **Commencement**. Implement the SWP3 as shown and as directed. Contractor-proposed recommendations for changes will be allowed as approved. Conform to the established guidelines in the TPDES General Permit TXR150000 to make changes. Do not implement changes until approval has been received and changes have been incorporated into the plans. Minor adjustments to meet field conditions are allowed and will be recorded in the SWP3.

4.2.2. **Phasing**. Implement control measures before the commencement of activities that result in soil disturbance. Phase and minimize the soil disturbance to the areas shown on the plans. Coordinate temporary control measures with permanent control measures and all other work activities on the project to assure economical, effective, safe, and continuous water pollution prevention. Provide control measures that are appropriate to the construction means, methods, and sequencing allowed by the Contract. Exercise precaution throughout the life of the project to prevent pollution of ground waters and surface waters. Schedule and perform clearing and grubbing operations so that stabilization measures will follow immediately thereafter if project conditions permit. Bring all grading sections to final grade as soon as possible and implement temporary and permanent control measures at the earliest time possible. Implement temporary control measures when required by the TPDES General Permit TXR150000 or otherwise necessitated by project conditions.

Do not prolong final grading and shaping. Preserve vegetation where possible throughout the project, and minimize clearing, grubbing, and excavation within stream banks, bed, and approach sections.

4.3. **General**.

4.3.1. **Temporary Alterations or Control Measure Removal**. Altering or removal of control measures is allowed when control measures are restored within the same working day.

4.3.2. **Stabilization**. Initiate stabilization for disturbed areas no more than 14 days after the construction activities in that portion of the site have temporarily or permanently ceased. Establish a uniform vegetative cover or use another stabilization practice in accordance with the TPDES General Permit TXR150000.

4.3.3. **Finished Work**. Remove and dispose of all temporary control measures upon acceptance of vegetative cover or other stabilization practice unless otherwise directed. Complete soil disturbing activities and establish a uniform perennial vegetative cover. A project will not be considered for acceptance until a vegetative cover of 70% density of existing adjacent undisturbed areas is obtained or equivalent permanent stabilization is obtained in accordance with the TPDES General Permit TXR150000. An exception will be allowed in arid areas as defined in the TPDES General Permit TXR150000.

4.3.4. **Restricted Activities and Required Precautions**. Do not discharge onto the ground or surface waters any pollutants such as chemicals, raw sewage, fuels, lubricants, coolants, hydraulic fluids, bitumens, or any other petroleum product. Operate and maintain equipment on-site to prevent actual or potential water pollution. Manage, control, and dispose of litter on-site such that no adverse impacts to water quality occur. Prevent dust from creating a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property. Wash out concrete trucks only as described in the TPDES General Permit TXR150000. Use appropriate controls to minimize the offsite transport of suspended sediments and other pollutants if it is necessary to pump or channel standing water (i.e., dewatering). Prevent discharges that would contribute to a violation of Edwards Aquifer Rules, water quality standards, the impairment of a listed water body, or other state or federal law.

4.4. **Installation, Maintenance, and Removal Work**. Perform work in accordance with the SWP3, according to manufacturers' guidelines, and in accordance with the TPDES General Permit TXR150000. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until soil disturbing activities are completed and permanent erosion control features are in place or the disturbed area has been adequately stabilized as approved.

The Department will inspect and document the condition of the control measures at the frequency shown on the plans and will provide the Construction SWP3 Field Inspection and Maintenance Reports to the Contractor. Make corrections as soon as possible before the next anticipated rain event or within 7 calendar days after being able to enter the worksite for each control measure. The only acceptable reason for not accomplishing the corrections with the time frame specified is when site conditions are "Too Wet to Work." Take immediate action if a correction is deemed critical as directed. When corrections are not made within the established time frame, all work will cease on the project and time charges will continue while the control measures are brought into compliance. Commence work once the Engineer reviews and documents the project is in compliance. Commencing work does not release the Contractor of the liability for noncompliance of the SWP3, plans, or TPDES General Permit TXR150000.

The Engineer may limit the disturbed area if the Contractor cannot control soil erosion and sedimentation resulting from the Contractor's operations. Implement additional controls as directed.

Remove devices upon approval or as directed. Finish-grade and dress the area upon removal. Stabilize disturbed areas in accordance with the permit, and as shown on the plans or directed. Materials removed are considered consumed by the project. Retain ownership of stockpiled material and remove it from the project when new installations or replacements are no longer required.

4.4.1. **Rock Filter Dams for Erosion Control**. Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams. Place sandbags as a foundation when required or at the Contractor's option.

Place the aggregate to the lines, height, and slopes specified, without undue voids for Types 1, 2, 3, and 5. Place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side with wire ties, or hog rings for Types 2 and 3, or as directed. Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed. Construct filter dams according to the following criteria unless otherwise shown on the plans:

4.4.1.1. **Type 1 (Non-Reinforced).**

- **Height.** At least 18 in. measured vertically from existing ground to top of filter dam.
- **Top Width.** At least 2 ft.
- **Slopes.** No steeper than 2:1.

4.4.1.2. **Type 2 (Reinforced).**

- **Height.** At least 18 in. measured vertically from existing ground to top of filter dam.
- **Top Width.** At least 2 ft.
- **Slopes.** No steeper than 2:1.

4.4.1.3. **Type 3 (Reinforced).**

- **Height.** At least 36 in. measured vertically from existing ground to top of filter dam.
- **Top Width.** At least 2 ft.
- **Slopes.** No steeper than 2:1.

4.4.1.4. **Type 4 (Sack Gabions).** Unfold sack gabions and smooth out kinks and bends. Connect the sides by lacing in a single loop–double loop pattern on 4- to 5-in. spacing for vertical filling. Pull the end lacing rod at one end until tight, wrap around the end, and twist 4 times. Fill with stone at the filling end, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires 4 times.

Place the sack flat in a filling trough, fill with stone, connect sides, and secure ends as described above for horizontal filling.

Lift and place without damaging the gabion. Shape sack gabions to existing contours.

4.4.1.5. **Type 5.** Provide rock filter dams as shown on the plans.

4.4.2. **Temporary Pipe Slope Drains.** Install pipe with a slope as shown on the plans or as directed. Construct embankment for the drainage system in 8-in. lifts to the required elevations. Hand-tamp the soil around and under the entrance section to the top of the embankment as shown on the plans or as directed. Form the top of the embankment or earth dike over the pipe slope drain at least 1 ft. higher than the top of the inlet pipe at all points. Secure the pipe with hold-downs or hold-down grommets spaced a maximum of 10 ft. on center. Construct the energy dissipaters or sediment traps as shown on the plans or as directed. Construct the sediment trap using concrete or rubble riprap in accordance with Item 432, "Riprap," when designated on the plans.

4.4.3. **Temporary Paved Flumes.** Construct paved flumes as shown on the plans or as directed. Provide excavation and embankment (including compaction of the subgrade) of material to the dimensions shown on the plans unless otherwise indicated. Install a rock or rubble riprap energy dissipater, constructed from the materials specified above, to a minimum depth of 9 in. at the flume outlet to the limits shown on the plans or as directed.

4.4.4. **Construction Exits.** Prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits when tracking conditions exist. Construct exits for either long- or short-term use.

4.4.4.1. **Long-Term.** Place the exit over a foundation course as required. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the plans or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.

4.4.4.1.1. **Type 1.** Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.

4.4.4.1.2. **Type 2.** Construct using railroad ties and timbers as shown on the plans or as directed.

4.4.4.2. **Short-Term.**

4.4.4.2.1. **Type 3.** Construct using crushed aggregate, plywood, or wafer board. This type of exit may be used for daily operations where long-term exits are not practical.

4.4.4.2.2. **Type 4.** Construct as shown on the plans or as directed.

4.4.5. **Earthwork for Erosion Control.** Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.

4.4.5.1. **Excavation and Embankment for Erosion Control Features.** Place earth dikes, swales, or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover. Place swales and dikes at other locations as shown on the plans or as directed to prevent runoff spillover or to divert runoff. Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides. Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the plans or as directed.

Create a sediment basin, where required, providing 3,600 cu. ft. of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at one time, not including offsite areas.

4.4.5.2. **Excavation of Sediment and Debris.** Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.

4.4.6. **Construction Perimeter Fence.** Construct, align, and locate fencing as shown on the plans or as directed.

4.4.6.1. **Installation of Posts.** Embed posts 18 in. deep or adequately anchor in rock, with a spacing of 8 to 10 ft.

4.4.6.2. **Wire Attachment.** Attach the top wire to the posts at least 3 ft. from the ground. Attach the lower wire midway between the ground and the top wire.

4.4.6.3. **Flag Attachment.** Attach flagging to both wire strands midway between each post. Use flagging at least 18 in. long. Tie flagging to the wire using a square knot.

4.4.7. **Sandbags for Erosion Control.** Construct a berm or dam of sandbags that will intercept sediment-laden storm water runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Fill each bag with sand so that at least the top 6 in. of the bag is unfilled to allow for proper tying of the open end. Place the sandbags with their tied ends in the same direction. Offset subsequent rows of sandbags 1/2 the length of the preceding row. Place a single layer of sandbags downstream as a secondary debris trap. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.

4.4.8. **Temporary Sediment-Control Fence.** Provide temporary sediment-control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion-control measures used to control sediment in areas of higher flow. Install the fence as shown on the plans, as specified in this Section, or as directed.

4.4.8.1. **Installation of Posts.** Embed posts at least 18 in. deep, or adequately anchor, if in rock, with a spacing of 6 to 8 ft. and install on a slight angle toward the runoff source.

4.4.8.2. **Fabric Anchoring.** Dig trenches along the uphill side of the fence to anchor 6 to 8 in. of fabric. Provide a minimum trench cross-section of 6 × 6 in. Place the fabric against the side of the trench and align approximately 2 in. of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.

4.4.8.3. **Fabric and Net Reinforcement Attachment.** Attach the reinforcement to wooden posts with staples, or to steel posts with T-clips, in at least 4 places equally spaced unless otherwise shown on the plans. Sewn

vertical pockets may be used to attach reinforcement to end posts. Fasten the fabric to the top strand of reinforcement by hog rings or cord every 15 in. or less.

4.4.8.4. **Fabric and Net Splices**. Locate splices at a fence post with a minimum lap of 6 in. attached in at least 6 places equally spaced unless otherwise shown on the plans. Do not locate splices in concentrated flow areas.

Requirements for installation of used temporary sediment-control fence include the following:

- fabric with minimal or no visible signs of biodegradation (weak fibers),
- fabric without excessive patching (more than 1 patch every 15 to 20 ft.),
- posts without bends, and
- backing without holes.

4.4.9. **Biodegradable Erosion Control Logs**. Install biodegradable erosion control logs near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the biodegradable erosion control logs into the erosion measures used to control sediment in areas of higher flow. Install, align, and locate the biodegradable erosion control logs as specified below, as shown on the plans, or as directed.

Secure biodegradable erosion control logs in a method adequate to prevent displacement as a result of normal rain events, prevent damage to the logs, and as approved, such that flow is not allowed under the logs. Temporarily removing and replacing biodegradable erosion logs as to facilitate daily work is allowed at the Contractor's expense.

4.4.10. **Vertical Tracking**. Perform vertical tracking on slopes to temporarily stabilize soil. Provide equipment with a track undercarriage capable of producing a linear soil impression measuring a minimum of 12 in. long × 2 to 4 in. wide × 1/2 to 2 in. deep. Do not exceed 12 in. between track impressions. Install continuous linear track impressions where the 12 in. length impressions are perpendicular to the slope. Vertical tracking is required on projects where soil disturbing activities have occurred unless otherwise approved.

4.5. **Monitoring and Documentation**. Monitor the control measures on a daily basis as long as there are BMPs in place and/or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES General Permit TXR150000. During time suspensions when work is not occurring or contract non-work days, daily inspections are not required unless a rain event has occurred. Monitoring will consist of, but is not limited to, observing, inspecting, and documenting site locations with control measures and discharge points to provide maintenance and inspection of controls as described in the SWP3. Keep written records of daily monitoring. Document in the daily monitoring report the control measure condition, the date of inspection, required corrective actions, responsible person for making the corrections, and the date corrective actions were completed. Maintain records of all monitoring reports at the project site or at an approved place. Provide copies within 7 days. Together, the CRPE and an Engineer's representative will complete the Construction Stage Gate Checklist on a periodic basis as directed.

5. MEASUREMENT

5.1. **Rock Filter Dams**. Installation or removal of rock filter dams will be measured by the foot or by the cubic yard. The measured volume will include sandbags, when used.

5.1.1. **Linear Measurement**. When rock filter dams are measured by the foot, measurement will be along the centerline of the top of the dam.

5.1.2. **Volume Measurement**. When rock filter dams are measured by the cubic yard, measurement will be based on the volume of rock computed by the method of average end areas.

5.1.2.1. **Installation**. Measurement will be made in final position.

5.1.2.2. **Removal**. Measurement will be made at the point of removal.

5.2. **Temporary Pipe Slope Drains**. Temporary pipe slope drains will be measured by the foot.

5.3. **Temporary Paved Flumes**. Temporary paved flumes will be measured by the square yard of surface area. The measured area will include the energy dissipater at the flume outlet.

5.4. **Construction Exits**. Construction exits will be measured by the square yard of surface area.

5.5. **Earthwork for Erosion and Sediment Control**.

5.5.1. **Equipment and Labor Measurement**. Equipment and labor used will be measured by the actual number of hours the equipment is operated and the labor is engaged in the work.

5.5.2. **Volume Measurement**.

5.5.2.1. **In Place**.

5.5.2.1.1. **Excavation**. Excavation will be measured by the cubic yard in its original position and the volume computed by the method of average end areas.

5.5.2.1.2. **Embankment**. Embankment will be measured by the cubic yard in its final position by the method of average end areas. The volume of embankment will be determined between:

- the original ground surfaces or the surface upon that the embankment is to be constructed for the feature and
- the lines, grades and slopes of the accepted embankment for the feature.

5.5.2.2. **In Vehicles**. Excavation and embankment quantities will be combined and paid for under "Earthwork (Erosion and Sediment Control, In Vehicle)." Excavation will be measured by the cubic yard in vehicles at the point of removal. Embankment will be measured by the cubic yard in vehicles measured at the point of delivery. Shrinkage or swelling factors will not be considered in determining the calculated quantities.

5.6. **Construction Perimeter Fence**. Construction perimeter fence will be measured by the foot.

5.7. **Sandbags for Erosion Control**. Sandbags will be measured as each sandbag or by the foot along the top of sandbag berms or dams.

5.8. **Temporary Sediment-Control Fence**. Installation or removal of temporary sediment-control fence will be measured by the foot.

5.9. **Biodegradable Erosion Control Logs**. Installation or removal of biodegradable erosion control logs will be measured by the foot along the centerline of the top of the control logs.

5.10. **Vertical Tracking**. Vertical tracking will not be measured or paid for directly but is considered subsidiary to this Item.

6. PAYMENT

The following will not be paid for directly but are subsidiary to pertinent Items:

- erosion-control measures for Contractor project-specific locations (PSLs) inside and outside the right of way (such as construction and haul roads, field offices, equipment and supply areas, plants, and material sources);
- removal of litter, unless a separate pay item is shown on the plans;
- repair to devices and features damaged by Contractor operations;
- added measures and maintenance needed due to negligence, carelessness, lack of maintenance, and failure to install permanent controls;

- removal and reinstallation of devices and features needed for the convenience of the Contractor;
- finish grading and dressing upon removal of the device; and
- minor adjustments including but not limited to plumbing posts, reattaching fabric, minor grading to maintain slopes on an erosion embankment feature, or moving small numbers of sandbags.

Stabilization of disturbed areas will be paid for under pertinent Items except vertical tacking which is subsidiary.

Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly but is subsidiary to the excavation and embankment under this Item.

6.1. **Rock Filter Dams**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows:

6.1.1. **Installation**. Installation will be paid for as "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

6.1.2. **Removal**. Removal will be paid for as "Rock Filter Dams (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

When the Engineer directs that the rock filter dam installation or portions thereof be replaced, payment will be made at the unit price bid for "Rock Filter Dams (Remove)" and for "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

6.2. **Temporary Pipe Slope Drains**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Pipe Slope Drains" of the size specified. This price is full compensation for furnishing materials, removal and disposal, furnishing and operating equipment, labor, tools, and incidentals.

Removal of temporary pipe slope drains will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the pipe slope drain installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Pipe Slope Drains" of the size specified, which is full compensation for the removal and reinstallation of the pipe drain.

Earthwork required for the pipe slope drain installation, including construction of the sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."

Riprap concrete or stone, when used as an energy dissipater or as a stabilized sediment trap, will be measured and paid for in accordance with Item 432, "Riprap."

6.3. **Temporary Paved Flumes**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Paved Flume (Install)" or "Temporary Paved Flume (Remove)." This price is full compensation for furnishing and placing materials, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the paved flume installation or portions thereof be replaced, payment will be made at the unit prices bid for "Temporary Paved Flume (Remove)" and "Temporary Paved Flume (Install)." These prices are full compensation for the removal and replacement of the paved flume and for equipment, labor, tools, and incidentals.

Earthwork required for the paved flume installation, including construction of a sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."

6.4. **Construction Exits.** Contractor-required construction exits from off right of way locations or on-right of way PSLs will not be paid for directly but are subsidiary to pertinent Items.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" for construction exits needed on right of way access to work areas required by the Department will be paid for at the unit price bid for "Construction Exits (Install)" of the type specified or "Construction Exits (Remove)." This price is full compensation for furnishing and placing materials, excavating, removal and disposal, cleaning vehicles, labor, tools, and incidentals.

When the Engineer directs that a construction exit or portion thereof be removed and replaced, payment will be made at the unit prices bid for "Construction Exit (Remove)" and "Construction Exit (Install)" of the type specified. These prices are full compensation for the removal and replacement of the construction exit and for equipment, labor, tools, and incidentals.

Construction of sediment traps used in conjunction with the construction exit will be measured and paid for under "Earthwork for Erosion and Sediment Control."

6.5. **Earthwork for Erosion and Sediment Control.**

6.5.1. **Initial Earthwork for Erosion and Sediment Control.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Excavation (Erosion and Sediment Control, In Place)," "Embankment (Erosion and Sediment Control, In Place)," "Excavation (Erosion and Sediment Control, In Vehicle)," "Embankment (Erosion and Sediment Control, (In Vehicle)," or "Earthwork (Erosion and Sediment Control, In Vehicle)."

This price is full compensation for excavation and embankment including hauling, disposal of material not used elsewhere on the project; embankments including furnishing material from approved sources and construction of erosion-control features; and equipment, labor, tools, and incidentals.

Sprinkling and rolling required by this Item will not be paid for directly but will be subsidiary to this Item.

6.5.2. **Maintenance Earthwork for Erosion and Sediment Control for Cleaning and Restoring Control Measures.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid under a Contractor Force Account Item from invoice provided to the Engineer.

This price is full compensation for excavation, embankment, and re-grading including removal of accumulated sediment in various erosion control installations as directed, hauling, and disposal of material not used elsewhere on the project; excavation for construction of erosion-control features; embankments including furnishing material from approved sources and construction of erosion-control features; and equipment, labor, tools, and incidentals.

Earthwork needed to remove and obliterate erosion-control features will not be paid for directly but is subsidiary to pertinent Items unless otherwise shown on the plans.

Sprinkling and rolling required by this Item will not be paid for directly but will be subsidiary to this Item.

6.6. **Construction Perimeter Fence.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Construction Perimeter Fence." This price is full compensation for furnishing and placing the fence; digging, fence posts, wire, and flagging; removal and disposal; and materials, equipment, labor, tools, and incidentals.

Removal of construction perimeter fence will be not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the perimeter fence installation or portions thereof be removed and replaced, payment will be made at the unit price bid for "Construction Perimeter Fence," which is full compensation for the removal and reinstallation of the construction perimeter fence.

6.7. **Sandbags for Erosion Control**. Sandbags will be paid for at the unit price bid for "Sandbags for Erosion Control" (of the height specified when measurement is by the foot). This price is full compensation for materials, placing sandbags, removal and disposal, equipment, labor, tools, and incidentals.

Removal of sandbags will not be paid for directly but is subsidiary to the installation Item. When the Engineer directs that the sandbag installation or portions thereof be replaced, payment will be made at the unit price bid for "Sandbags for Erosion Control," which is full compensation for the reinstallation of the sandbags.

6.8. **Temporary Sediment-Control Fence**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows:

6.8.1. **Installation**. Installation will be paid for as "Temporary Sediment-Control Fence (Install)." This price is full compensation for furnishing and operating equipment finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

6.8.2. **Removal**. Removal will be paid for as "Temporary Sediment-Control Fence (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

6.9. **Biodegradable Erosion Control Logs**. The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows:

6.9.1. **Installation**. Installation will be paid for as "Biodegradable Erosion Control Logs (Install)" of the size specified. This price is full compensation for furnishing and operating equipment finish backfill and grading, staking, proper disposal, labor, materials, tools, and incidentals.

6.9.2. **Removal**. Removal will be paid for as "Biodegradable Erosion Control Logs (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

6.10. **Vertical Tracking**. Vertical tracking will not be measured or paid for directly but is considered subsidiary to this Item.

Item 520
Weighing and Measuring Equipment

1. DESCRIPTION

Provide weighing and measuring equipment for materials measured or proportioned by weight or volume.

2. EQUIPMENT

Provide certified scales, scale installations, and measuring equipment meeting the requirements of *NIST Handbook 44*, except that the required accuracy must be 0.4% of the material being weighed or measured.

Provide personnel, facilities, and equipment for checking the scales as approved. Check all weighing and measuring equipment after each move and at least once each 6 mo. or when requested.

Calibrate all scales using weights certified by the Texas Department of Agriculture (TDA) or an equivalent agency as approved. Provide a written calibration report from a scale mechanic for all calibrations. Cease plant operations during the checking operation. Do not use inaccurate or inadequate scales. Bring performance errors as close to zero as practicable when adjusting equipment.

Furnish enough certified weights to check the accuracy and sensitivity of the scales. Insulate scales against shock, vibrations, or movement of other operating equipment. Provide an automated ticket printout for each truckload of material on a daily basis where payment is determined by weight. Each loading ticket must show the ticket number, truck number, gross weight, tare weight, and net weight.

Provide a summary spreadsheet that lists separately the ticket number, truck number, gross weight, tare weight, net weight, overload weight, and payment weight amounts as shown in Table 1 if required on the plans for materials paid by the ton. Provide this spreadsheet:

- for each lot when materials are paid for in increments of sublots or lots, and
- daily for other materials.

Provide the totals for net weight and overload amounts to be deducted for all summary sheets within 2 days of delivery of materials. Include the overload deduction in the total amount reported for payment. Submissions are subject to verification.

Table 1
Example Spreadsheet

Ticket No.	Truck No.	Gross Wt.	Tare Wt.	Net Wt.	Overload Wt.	Payment Wt.
				Totals	Totals	Totals

Furnish leak-free weighing containers large enough to hold a complete batch of the material being measured.

2.1. **Truck Scales.** Furnish platform truck scales capable of weighing the entire truck or truck–trailer combination in a single draft.

2.2. **Aggregate Batching Scales**. Equip scales used for weighing aggregate with a quick adjustment at zero that provides for any change in tare. Provide a visual means that indicates the required weight for each aggregate.

2.3. **Suspended Hopper**. Provide a means for the addition or the removal of small amounts of material to adjust the quantity to the exact weight per batch. Ensure the scale equipment is level.

2.4. **Belt Scales**. Use belt scales for proportioning aggregate that are accurate to within 1.0% based on the average of 3 test runs, where no individual test run exceeds 2.0% when checked in accordance with Tex-920-K.

2.5. **Asphalt Material Meter**. Provide an asphalt material meter with an automatic digital display of the volume or weight of asphalt material. Verify the accuracy of the meter in accordance with Tex-921-K. Ensure the accuracy of the meter is within 0.4% when using the asphalt meter for payment purposes. Ensure the accuracy of the meter is within 1.0% when used to measure component materials only and not for payment.

2.6. **Liquid Asphalt Additive Meters**. Provide a means to check the accuracy of meter output for asphalt primer, fluxing material, and liquid additives. Furnish a meter that reads in increments of 0.1 gal. or less. Verify accuracy of the meter in accordance with Tex-923-K. Ensure the accuracy of the meter within 5.0%.

2.7. **Particulate Solid and Slurry Additive Meters**. Provide a means to check the accuracy of meter output for particulate solids (such as hydrated lime or mineral filler) and slurries (such as hydrated lime slurry). Ensure the accuracy of the meter within 5.0%.

3. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.

Item 530
Intersections, Driveways, and Turnouts

1. DESCRIPTION

Construct and pave intersections, driveways, and turnouts. Pave existing intersections, driveways, and turnouts.

Intersections are considered to be areas off the travel lanes and shoulders of the Contract highway on the intersecting highway on the state system. The intersecting on-system highway work will be paid for under this Item only when shown on the plans.

Driveways are defined as private (residential or commercial) and public (county road and city street) access areas off the travel lanes and shoulders.

Turnouts include but are not limited to mailbox and litter barrel widenings.

2. MATERIALS

Furnish materials that meet the following:

- Item 247, "Flexible Base"
- Item 260, "Lime Treatment (Road-Mixed)"
- Item 263, "Lime Treatment (Plant-Mixed)"
- Item 275, "Cement Treatment (Road-Mixed)"
- Item 276, "Cement Treatment (Plant-Mixed)"
- Item 292, "Asphalt Treatment (Plant-Mixed)"
- Item 316, "Seal Coat"
- Item 330, "Limestone Rock Asphalt Pavement"
- Item 334, "Hot-Mix Cold-Laid Asphalt Concrete Pavement"
- Item 340, "Dense-Graded Hot-Mix Asphalt (Small Quantity)"
- Item 360, "Concrete Pavement"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

3. CONSTRUCTION

Construct and pave intersections, driveways, and turnouts, and pave existing intersections, driveways, and turnouts as shown on the plans or as directed. Place materials in accordance with construction Articles of pertinent Items. Provide uninterrupted access to adjacent property unless otherwise directed. Ensure that abrupt elevation changes in driveway or turnout areas that serve as sidewalks do not exceed 1/4 in. and that the sidewalk area cross slope does not exceed 2%. Ready-mix concrete and hand finishing will be permitted when concrete pavement is specified unless otherwise shown on the plans for intersections.

4. MEASUREMENT

This Item will be measured by the square yard of the final pavement surface.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Intersections," "Driveways," "Turnouts," "Intersections, Driveways, and Turnouts," or "Driveways and Turnouts" of the surface specified.

This price is full compensation for furnishing and operating equipment; excavation and embankment; base and pavement materials; and labor, materials, tools and incidentals. Drainage structures will be measured and paid for in accordance with the pertinent bid items.

Item 531
Sidewalks

1. DESCRIPTION

Construct hydraulic cement concrete sidewalks.

2. MATERIALS

Furnish materials conforming to the following:

- Item 360, "Concrete Pavement"
- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

Use Class A concrete unless otherwise shown on the plans. Use Grade 8 course aggregate for extruded Class A concrete. Use other grades if approved.

3. CONSTRUCTION

Shape and compact subgrade, foundation, or pavement surface to the line, grade, and cross-section shown on the plans. Lightly sprinkle subgrade or foundation material immediately before concrete placement. Hand-tamp and sprinkle foundation when placement is directly on subgrade or foundation materials. Remove and dispose of existing concrete in accordance with Item 104, "Removing Concrete." Provide a clean surface for concrete placement directly on the surface material or pavement.

Mix and place concrete in accordance with the pertinent Items. Hand-finishing is allowed for any method of construction. Finish exposed surfaces to a uniform transverse broom finish surface. Curb ramps must include a detectable warning surface and conform to details shown on the plans. Install joints as shown on the plans. Ensure that abrupt changes in sidewalk elevation do not exceed 1/4 in., sidewalk cross slope does not exceed 2%, curb ramp grade does not exceed 8.3%, and flares adjacent to the ramp do not exceed 10% slope. Ensure that the sidewalk depth and reinforcement are not less than the driveway cross-sectional details shown on the plans where a sidewalk crosses a concrete driveway.

Provide finished work with a well-compacted mass, a surface free from voids and honeycomb, and the required true-to-line shape and grade. Cure for at least 72 hr. in accordance with Item 420, "Concrete Substructures."

3.1. **Conventionally Formed Concrete.** Provide pre-molded or board expansion joints of the thickness shown on the plans for sidewalk section lengths greater than 8 ft. but less than 40 ft., unless otherwise directed. Terminate workday production at an expansion joint.

3.2. **Extruded or Slipformed Concrete.** Provide any additional surface finishing immediately after extrusion or slipforming as required on the plans. Construct joints at locations as shown on the plans or as directed.

4. MEASUREMENT

Sidewalks will be measured by the square yard of surface area. Curb ramps will be measured by the square yard of surface area or by each. A curb ramp consists of the ramp, landing, adjacent flares or side curb, and detectable warning surface as shown on the plans.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Sidewalks" of the depth specified and "Curb Ramps" of the type specified. This price is full compensation for surface preparation of sidewalk foundation; materials; removal and disposal of existing concrete; excavation, hauling and disposal of excavated material; drilling and doweling into existing concrete curb, sidewalk, and pavement; repair of adjacent street or pavement structure damaged by these operations; and equipment, labor, materials, tools, and incidentals.

Sidewalks that cross and connect to concrete driveways or turnouts will be measured and paid for in accordance with Item 530, "Intersections, Driveways, and Turnouts."

Item 618
Conduit

1. DESCRIPTION

Furnish and install conduit.

2. MATERIALS

Provide new materials that comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following Items:

- Item 400, "Excavation and Backfill for Structures"
- Item 476, "Jacking, Boring, or Tunneling Pipe or Box"

When specified on the plans, provide:

- rigid metal conduit (RMC);
- intermediate metal conduit (IMC);
- electrical metallic tubing (EMT);
- polyvinyl chloride (PVC) conduit;
- high density polyethylene (HDPE) conduit;
- liquidtight flexible metal conduit (LFMC); or
- liquidtight flexible nonmetallic conduit (LFNC).

Furnish conduit from new materials in accordance with DMS-11030, "Conduit."

Provide prequalified conduit from the Department's MPL. When required by the Engineer, notify the Department in writing of selected materials from the MPL intended for use on each project.

Provide other types of conduit not on the MPL that comply with the details shown on the plans and the NEC. Fabricate fittings such as junction boxes and expansion joints from a material similar to the connecting conduit, unless otherwise shown on the plans. Use watertight fittings. Do not use set screw and pressure-cast fittings. Steel compression fittings are permissible. When using HDPE conduit, provide fittings that are UL-listed as electrical conduit connectors or thermally fused using an electrically heated wound wire resistance welding method.

Use red 3-in. 4-mil polyethylene underground warning tape that continuously states "Caution Buried Electrical Line Below."

3. CONSTRUCTION

Perform work in accordance with the details shown on the plans and the requirements of this Item.

Use established industry and utility safety practices when installing conduit located near underground utilities. Consult with the appropriate utility company before beginning work.

Install conduit a minimum of 18 in. deep below finished grade unless otherwise shown on the plans. Meet the requirements of the NEC when installing conduit. Secure and support conduit placed for concrete encasement in such a manner that the alignment will not be disturbed during placement of the concrete. Cap ends of conduit and close box openings before concrete is placed.

Ream conduit to remove burrs and sharp edges. Use a standard conduit cutting die with a 3/4-in. taper per foot when conduit is threaded in the field. Fasten conduit placed on structures with conduit straps or hangers as shown on the plans or as directed. Fasten conduit within 3 ft. of each box or fitting and at other locations shown on the plans or as directed. Use metal conduit clamps that are galvanized malleable or stainless steel unless otherwise shown on the plans. Use 2-hole type clamps for 2-in. diameter or larger conduit.

Fit PVC and HDPE conduit terminations with bushings or bell ends. Fit metal conduit terminations with a grounding type bushing, except conduit used for duct cable casing that does not terminate in a ground box and is not exposed at any point. Conduit terminating in threaded bossed fittings does not need a bushing. Before installation of conductors or final acceptance, pull a properly sized mandrel or piston through the conduit to ensure that it is free from obstruction. Cap or plug empty conduit placed for future use.

Perform trench excavation and backfilling as shown on the plans or as directed, and in accordance with Item 400, "Excavation and Backfill for Structures." Excavation and backfilling will be subsidiary to the installation of the conduit.

Jack and bore as shown on the plans or as directed, and in accordance with Item 476, "Jacking, Boring, or Tunneling Pipe or Box."

Place warning tape approximately 10 in. above trenched conduit. Where existing surfacing is removed for placing conduit, repair by backfilling with material equal in composition and density to the surrounding areas and by replacing any removed surfacing, such as asphalt pavement or concrete riprap, with like material to equivalent condition. Mark conduit locations as directed.

4. MEASUREMENT

This Item will be measured by the foot of conduit.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Conduit" of the type and size specified and the installation method specified as applicable. This price is full compensation for furnishing and installing conduit; hanging, strapping, jacking, boring, tunneling, trenching, and furnishing and placing backfill; encasing in steel or concrete; replacing pavement structure, sod, riprap, curbs, or other surface; marking location of conduit (when required); furnishing and installing fittings, junction boxes, and expansion joints; and materials, equipment, labor, tools, and incidentals.

Flexible conduit will not be paid for directly but will be subsidiary to pertinent Items. Unless otherwise shown on the plans, no payment will be allowed under this Item for conduit used on electrical services or in foundations.

Item 620
Electrical Conductors

1. DESCRIPTION

Furnish and install electrical conductors, except conductors specifically covered by other Items.

2. MATERIALS

Provide new materials that comply with the details shown on the plans and the requirements of this Item. Use stranded insulated conductors that are rated for 600 volts; approved for wet locations; and marked in accordance with UL, NEC, and CSA requirements. Furnish electrical conductors in accordance with DMS-11040, "Electrical Conductors."

Provide prequalified electrical conductors from the Department's MPL. When required by the Engineer, notify the Department in writing of selected materials from the MPL intended for use on each project.

Ensure all grounding conductors size 8 AWG and larger are stranded, except for the grounding electrode conductor at the electrical service, which will be a solid conductor.

Use white insulation for grounded (neutral) conductors, except grounded conductors size 4 AWG and larger may be black with white tape marking at every accessible location. Do not use white insulation or marking for any other conductor except control wiring specifically shown on the plans.

Ensure insulated grounding conductors are green except insulated grounding conductors size 4 AWG and larger may be black with green tape marking at every accessible location. Do not use green insulation or marking for any other conductor except control wiring specifically shown on the plans.

3. CONSTRUCTION

Perform work in accordance with the details shown on the plans and the requirements of this Item.

Splice conductors only in junction boxes, ground boxes, and transformer bases, and in poles and structures at the handholes. Splice as shown on the plans. Do not exceed the manufacturer's recommended pulling tension. Use lubricant as recommended by the manufacturer. Install conductors in accordance with the NEC.

Make insulation resistance tests on the conductors before making final connections, and ensure each continuous run of insulated conductor has a minimum DC resistance of 5 megohms when tested at 1,000 volts DC. The Engineer may require verification testing of all or part of the conductor system. The Engineer will witness these verification tests. Replace conductors exhibiting an insulation resistance of less than 5 megohms at no additional cost to the Department.

4. MEASUREMENT

This Item will be measured by the foot of each single conductor.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Electrical Conductors" of the types and sizes specified. This price is full compensation for furnishing, installing, and testing electrical conductors; furnishing and installing breakaway connectors; and for materials, equipment, labor, tools, and incidentals, except:

- conductors used in connecting the components of electrical services will be paid for under Item 628, "Electrical Services";
- conductors inside roadway illumination assemblies will be paid for under Item 610, "Roadway Illumination Assemblies";
- conductors inside of traffic signal pole assemblies will be paid for under this Item; and
- conductors used for internal wiring of equipment will not be paid for directly but will be subsidiary to pertinent Items.

Item 624
Ground Boxes

1. DESCRIPTION

- **Installation.** Construct, furnish, and install ground boxes complete with lids.
- **Removal.** Remove existing ground boxes.

2. MATERIALS

Provide new materials that comply with the details shown on the plans, the requirements of this Item, and the pertinent requirements of the following items:

- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 432, "Riprap"
- Item 440, "Reinforcement for Concrete"
- Item 618, "Conduit"
- Item 620, "Electrical Conductors"

Provide fabricated precast polymer concrete ground boxes in accordance with DMS-11070, "Ground Boxes." Provide prequalified ground boxes from the Department's MPL. When required by the Engineer, notify the Department in writing of selected materials from the MPL intended for use on each project.

Provide other precast or cast-in-place ground boxes that comply with the details shown on the plans.

3. CONSTRUCTION

Perform work in accordance with the details shown on the plans and the requirements of this Item.

Use established industry and utility safety practices when installing or removing ground boxes located near underground utilities. Consult with the appropriate utility company before beginning work.

3.1. **Installation.** Fabricate and install ground boxes in accordance with the details, dimensions, and requirements shown on the plans. Install ground box to approved line and grade.

Construct precast and cast-in-place concrete ground boxes in accordance with Item 420, "Concrete Substructures," and Item 440, "Reinforcement for Concrete."

Construct concrete aprons as shown on the plans and in accordance with Item 432, "Riprap," and Item 440, "Reinforcement for Concrete."

3.2. **Removal.** Remove existing ground boxes and concrete aprons to at least 6 in. below the conduit level. Uncover conduit to a sufficient distance so that 90 degree bends can be removed and conduit reconnected. Clean the conduit in accordance with Item 618, "Conduit." Replace conduit within 5 ft. of the ground box. Remove old conductors and install new conductors as shown on the plans. Backfill area with material equal in composition and density to the surrounding area. Replace surfacing material with similar material to an equivalent condition.

4. MEASUREMENT

This Item will be measured by each ground box installed complete in place or each ground box removed.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Ground Box" of the types and sizes specified and for "Remove Ground Box."

5.1. **Installation**. This price is full compensation for excavating and backfilling; constructing, furnishing, and installing ground boxes and concrete aprons; and material, equipment, labor, tools, and incidentals. All wiring connections required inside the ground box will be considered subsidiary to this bid item. Conduit will be paid for under Item 618, "Conduit." Electrical conductors will be paid for under Item 620, "Electrical Conductors."

5.2. **Removal**. This price is full compensation for removing and disassembling ground boxes and concrete aprons; excavating, backfilling, and surface placement; removing old conductors; disposal of unsalvageable materials; and materials, equipment, labor, tools, and incidentals. Cleaning of conduit is subsidiary to this Item. Conduit replaced within 5 ft. of the ground box will be subsidiary to this Item. Additional conduit will be paid for under Item 618, "Conduit." Installation of conductors will be paid for under Item 620, "Electrical Conductors."

2.4. **Curing Materials**. Provide Type 2 membrane curing compound conforming to DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants." Provide SS-1 emulsified asphalt conforming to Item 300, "Asphalts, Oils, and Emulsions," for concrete pavement to be overlaid with asphalt concrete under this Contract unless otherwise shown on the plans or approved. Provide materials for other methods of curing conforming to the requirements of Item 422, "Concrete Superstructures." Provide insulating blankets for curing fast track concrete pavement with a minimum thermal resistance (R) rating of 0.5 hour-square foot F/BTU. Use insulating blankets that are free from tears and are in good condition.

2.5. **Epoxy**. Provide Type III, Class C epoxy in accordance with DMS-6100, "Epoxies and Adhesives," for installing all drilled-in reinforcing steel. Submit a work plan and request approval for the use of epoxy types other than Type III, Class C.

2.6. **Evaporation Retardant**. Provide evaporation retardant conforming to DMS-4650., "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants."

2.7. **Joint Sealants and Fillers**. Provide Class 5 or Class 8 joint-sealant materials and fillers unless otherwise shown on the plans or approved and other sealant materials of the size, shape, and type shown on the plans in accordance with DMS-6310, "Joint Sealants and Fillers."

3. EQUIPMENT

Furnish and maintain all equipment in good working condition. Use measuring, mixing, and delivery equipment conforming to the requirements of Item 421, "Hydraulic Cement Concrete." Obtain approval for other equipment used.

3.1. **Placing, Consolidating, and Finishing Equipment**. Provide approved self-propelled paving equipment that uniformly distributes the concrete with minimal segregation and provides a smooth machine-finished consolidated concrete pavement conforming to plan line and grade. Provide an approved automatic grade control system on slip-forming equipment. Provide approved mechanically-operated finishing floats capable of producing a uniformly smooth pavement surface. Provide equipment capable of providing a fine, light water fog mist.

When string-less paving equipment is used, use Section 5.9.3, "Method C," and establish control points at maximum intervals of 500 ft. Use these control points as reference to perform the work.

Provide mechanically-operated vibratory equipment capable of adequately consolidating the concrete. Provide immersion vibrators on the paving equipment at sufficiently close intervals to provide uniform vibration and consolidation of the concrete over the entire width and depth of the pavement and in accordance with the manufacturer's recommendations. Provide immersion vibrator units that operate at a frequency in air of at least 8,000 cycles per minute. Provide enough hand-operated immersion vibrators for timely and proper consolidation of the concrete along forms, at all joints and in areas not covered by other vibratory equipment. Surface vibrators may be used to supplement equipment-mounted immersion vibrators. Provide tachometers to verify the proper operation of all vibrators.

For small or irregular areas or when approved, the paving equipment described in this Section is not required.

3.2. **Forming Equipment**.

3.2.1. **Pavement Forms**. Provide metal side forms of sufficient cross-section, strength, and rigidity to support the paving equipment and resist the impact and vibration of the operation without visible springing or settlement. Use forms that are free from detrimental kinks, bends, or warps that could affect ride quality or alignment. Provide flexible or curved metal or wood forms for curves of 100-ft. radius or less.

3.2.2. **Curb Forms**. Provide curb forms for separately placed curbs that are not slipformed that conform to the requirements of Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."

3.3. **Reinforcing Steel Inserting Equipment.** Provide inserting equipment that accurately inserts and positions reinforcing steel in the plastic concrete parallel to the profile grade and horizontal alignment in accordance to plan details when approved.

3.4. **Texturing Equipment.**

3.4.1. **Carpet Drag.** Provide a carpet drag mounted on a work bridge or a manual moveable support system. Provide a single piece of carpet of sufficient transverse length to span the full width of the pavement being placed and adjustable so that a sufficient longitudinal length of carpet is in contact with the concrete being placed to produce the desired texture. Obtain approval to vary the length and width of the carpet to accommodate specific applications.

3.4.2. **Tining Equipment.** Provide a self-propelled metal tine device equipped with steel tines with cross-section approximately 1/32 in. thick × 1/12 in. wide. Provide tines for transverse tining equipment spaced at approximately 1 in., center-to-center, or provide tines for longitudinal tining equipment spaced at approximately 3/4 in., center-to-center. Manual methods that produce an equivalent texture may be used when it is impractical to use self-propelled equipment, such as for small areas, narrow width sections, and in emergencies due to equipment breakdown.

3.5. **Curing Equipment.** Provide a self-propelled machine for applying membrane curing compound using mechanically-pressurized spraying equipment with atomizing nozzles. Provide equipment and controls that maintain the required uniform rate of application over the entire paving area. Provide curing equipment that is independent of all other equipment when required to meet the requirements of Section 360.4.9., "Curing." Hand-operated pressurized spraying equipment with atomizing nozzles may only be used on small or irregular areas, narrow width sections, or in emergencies due to equipment breakdown.

3.6. **Sawing Equipment.** Provide power-driven concrete saws to saw the joints shown on the plans. Provide standby power-driven concrete saws during concrete sawing operations.

3.7. **Grinding Equipment.** Provide self-propelled powered grinding equipment that is specifically designed to smooth and texture concrete pavement using circular diamond blades when required. Provide equipment with automatic grade control capable of grinding at least a 3-ft. width longitudinally in each pass without damaging the concrete.

3.8. **Testing Equipment.** Provide testing equipment regardless of job-control testing responsibilities in accordance with Item 421, "Hydraulic Cement Concrete," unless otherwise shown on the plans or specified.

3.9. **Coring Equipment.** Provide coring equipment capable of extracting cores in accordance with the requirements of Tex-424-A when required.

3.10. **Miscellaneous Equipment.** Furnish both 10-ft. and 15-ft. steel or magnesium long-handled, standard straightedges. Furnish enough work bridges, long enough to span the pavement, for finishing and inspection operations.

4. CONSTRUCTION

Obtain approval for adjustments to plan grade-line to maintain thickness over minor subgrade or base high spots while maintaining clearances and drainage. Maintain subgrade or base in a smooth, clean, compacted condition in conformity with the required section and established grade until the pavement concrete is placed. Keep subgrade or base damp with water before placing pavement concrete.

Adequately light the active work areas for all nighttime operations. Provide and maintain tools and materials to perform testing.

4.1. **Paving and Quality Control Plan.** Submit a paving and quality control plan for approval before beginning pavement construction operations. Include details of all operations in the concrete paving process, including

methods to construct transverse joints, methods to consolidate concrete at joints, longitudinal construction joint layout, sequencing, curing, lighting, early opening, leave-outs, sawing, inspection, testing, construction methods, other details and description of all equipment. List certified personnel performing the testing. Submit revisions to the paving and quality control plan for approval.

4.2. **Job-Control Testing.** Perform all fresh and hardened concrete job-control testing at the specified frequency unless otherwise shown on the plans. Provide job-control testing personnel meeting the requirements of Item 421, "Hydraulic Cement Concrete." Provide and maintain testing equipment, including strength testing equipment at a location acceptable to the Engineer. Use of a commercial laboratory is acceptable. Maintain all testing equipment calibrated in accordance with pertinent test methods. Make strength-testing equipment available to the Engineer for verification testing.

Provide the Engineer the opportunity to witness all tests. The Engineer may require a retest if not given the opportunity to witness. Furnish a copy of all test results to the Engineer daily. Check the first few concrete loads for slump and temperature to verify concrete conformance and consistency on start-up production days. Sample and prepare strength-test specimens (2 specimens per test) on the first day of production and for each 3,000 sq. yd. or fraction thereof of concrete pavement thereafter. Prepare at least 1 set of strength-test specimens for each production day. Perform slump and temperature tests each time strength specimens are made. Monitor concrete temperature to ensure that concrete is consistently within the temperature requirements. The Engineer will direct random job-control sampling and testing. Immediately investigate and take corrective action as approved if any Contractor test result, including tests performed for verification purposes, does not meet specification requirements.

The Engineer will perform job-control testing when the testing by the Contractor is waived by the plans; however, this does not waive the Contractor's responsibility for providing materials and work in accordance with this Item.

4.2.1. **Job-Control Strength.** Use 7-day job-control concrete strength testing in accordance with Tex-448-A or Tex-418-A unless otherwise shown on the plans or permitted.

Use a compressive strength of 3,200 psi or a lower job-control strength value proven to meet a 28-day compressive strength of 4,000 psi as correlated in accordance with Tex-427-A for 7-day job-control by compressive strength. Use a flexural strength of 450 psi or a lower job-control strength value proven to meet a 28-day flexural strength of 570 psi as correlated in accordance with Tex-427-A for 7-day job-control by flexural strength.

Job control of concrete strength may be correlated to an age other than 7 days in accordance with Tex-427-A when approved. Job-control strength of Class HES concrete is based on the required strength and time.

Investigate the strength test procedures, the quality of materials, the concrete production operations, and other possible problem areas to determine the cause when a job-control concrete strength test value is more than 10% below the required job-control strength or when 3 consecutive job-control strength values fall below the required job-control strength. Take necessary action to correct the problem, including redesign of the concrete mix if needed. The Engineer may suspend concrete paving if the Contractor is unable to identify, document, and correct the cause of low-strength test values in a timely manner. The Engineer will evaluate the structural adequacy of the pavements if any job-control strength is more than 15% below the required job-control strength. Remove and replace pavements found to be structurally inadequate at no additional cost when directed.

4.2.2. **Split-Sample Verification Testing.** Perform split-sample verification testing with the Engineer on random samples taken and split by the Engineer at a rate of at least 1 for every 10 job-control samples. The Engineer will evaluate the results of split-sample verification testing. Immediately investigate and take corrective action as approved when results of split-sample verification testing differ more than the allowable differences shown in Table 1, or the average of 10 job-control strength results and the Engineer's split-sample strength result differ by more than 10%.

Table 1
Verification Testing Limits

Test Method	Allowable Differences
Temperature, Tex-422-A	2°F
Flexural strength, Tex-448-A	19%
Compressive strength, Tex-418-A	10%

4.3. **Reinforcing Steel and Joint Assemblies.** Accurately place and secure in position all reinforcing steel as shown on the plans. Place dowels at mid-depth of the pavement slab, parallel to the surface. Place dowels for transverse contraction joints parallel to the pavement edge. Tolerances for location and alignment of dowels will be shown on the plans. Stagger the lap locations so that no more than 1/3 of the longitudinal steel is spliced in any given 12-ft. width and 2-ft. length of the pavement. Use multiple-piece tie bars, drill and epoxy grout tie bars, or, if approved, mechanically-inserted single-piece tie bars at longitudinal construction joints. Verify that tie bars that are drilled and epoxied or mechanically inserted into concrete at longitudinal construction joints develop a pullout resistance equal to a minimum of 3/4 of the yield strength of the steel after 7 days. Test 15 bars using ASTM E488, except that alternate approved equipment may be used. All 15 tested bars must meet the required pullout strength. Perform corrective measures to provide equivalent pullout resistance if any of the test results do not meet the required minimum pullout strength. Repair damage from testing. Acceptable corrective measures include but are not limited to installation of additional or longer tie bars.

4.3.1. **Manual Placement.** Secure reinforcing bars at alternate intersections with wire ties or locking support chairs. Tie all splices with wire.

4.3.2. **Mechanical Placement.** Complete the work using manual placement methods described above if mechanical placement of reinforcement results in steel misalignment or improper location, poor concrete consolidation, or other inadequacies.

4.4. **Joints.** Install joints as shown on the plans. Joint sealants are not required on concrete pavement that is to be overlaid with asphaltic materials. Clean and seal joints in accordance with Item 438, "Cleaning and Sealing Joints." Repair excessive spalling of the joint saw groove using an approved method before installing the sealant. Seal all joints before opening the pavement to all traffic. Install a rigid transverse bulkhead, for the reinforcing steel, and shaped accurately to the cross-section of the pavement when placing of concrete is stopped.

4.4.1. **Placing Reinforcement at Joints.** Complete and place the assembly of parts at pavement joints at the required location and elevation, with all parts rigidly secured in the required position, when shown on the plans.

4.4.2. **Transverse Construction Joints.**

4.4.2.1. **Continuously Reinforced Concrete Pavement (CRCP).** Install additional longitudinal reinforcement through the bulkhead when shown on the plans. Protect the reinforcing steel immediately beyond the construction joint from damage, vibration, and impact.

4.4.2.2. **Concrete Pavement Contraction Design (CPCD).** Install and rigidly secure a complete joint assembly and bulkhead in the planned transverse contraction joint location when the placing of concrete is intentionally stopped. Install a transverse construction joint either at a planned transverse contraction joint location or mid-slab between planned transverse contraction joints when the placing of concrete is unintentionally stopped. Install tie bars of the size and spacing used in the longitudinal joints for mid-slab construction joints.

4.4.2.3. **Curb Joints.** Provide joints in the curb of the same type and location as the adjacent pavement. Use expansion joint material of the same thickness, type, and quality required for the pavement and of the section shown for the curb. Extend expansion joints through the curb. Construct curb joints at all transverse pavement joints. Place reinforcing steel into the plastic concrete pavement for non-monolithic curbs as shown on the plans unless otherwise approved. Form or saw the weakened plane joint across the full width

of concrete pavement and through the monolithic curbs. Construct curb joints in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."

4.5. **Placing and Removing Forms.** Use clean and oiled forms. Secure forms on a base or firm subgrade that is accurately graded and that provides stable support without deflection and movement by form riding equipment. Pin every form at least at the middle and near each end. Tightly join and key form sections together to prevent relative displacement.

Set side forms far enough in advance of concrete placement to permit inspection. Check conformity of the grade, alignment, and stability of forms immediately before placing concrete, and make all necessary corrections. Use a straightedge or other approved method to test the top of forms to ensure that the ride quality requirements for the completed pavement will be met. Stop paving operations if forms settle or deflect more than 1/8 in. under finishing operations. Reset forms to line and grade, and refinish the concrete surface to correct grade.

Avoid damage to the edge of the pavement when removing forms. Repair damage resulting from form removal and honeycombed areas with a mortar mix within 24 hr. after form removal unless otherwise approved. Clean joint face and repair honeycombed or damaged areas within 24 hr. after a bulkhead for a transverse construction joint has been removed unless otherwise approved. Promptly apply membrane curing compound to the edge of the concrete pavement when forms are removed before 72 hr. after concrete placement.

Forms that are not the same depth as the pavement, but are within 2 in. of that depth are permitted if the subbase is trenched or the full width and length of the form base is supported with a firm material to produce the required pavement thickness. Promptly repair the form trench after use. Use flexible or curved wood or metal forms for curves of 100-ft. radius or less.

4.6. **Concrete Delivery.** Clean delivery equipment as necessary to prevent accumulation of old concrete before loading fresh concrete. Use agitated delivery equipment for concrete designed to have a slump of more than 5 in. Segregated concrete is subject to rejection.

Begin the discharge of concrete delivered in agitated delivery equipment conforming to the requirements of Item 421, "Hydraulic Cement Concrete." Place non-agitated concrete within 45 min. after batching. Reduce times as directed when hot weather or other conditions cause quick setting of the concrete.

4.7. **Concrete Placement.** Do not allow the pavement edge to deviate from the established paving line by more than 1/2 in. at any point. Place the concrete as near as possible to its final location, and minimize segregation and rehandling. Distribute concrete using shovels where hand spreading is necessary. Do not use rakes or vibrators to distribute concrete.

4.7.1. **Consolidation.** Consolidate all concrete by approved mechanical vibrators operated on the front of the paving equipment. Use immersion-type vibrators that simultaneously consolidate the full width of the placement when machine finishing. Keep vibrators from dislodging reinforcement. Use hand-operated vibrators to consolidate concrete along forms, at all joints and in areas not accessible to the machine-mounted vibrators. Do not operate machine-mounted vibrators while the paving equipment is stationary. Vibrator operations are subject to review.

4.7.2. **Curbs.** Conform to the requirements of Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter" where curbs are placed separately.

4.7.3. **Temperature Restrictions.** Place concrete that is between 40°F and 95°F when measured in accordance with Tex-422-A at the time of discharge, except that concrete may be used if it was already in transit when the temperature was found to exceed the allowable maximum. Take immediate corrective action or cease concrete production when the concrete temperature exceeds 95°F.

Do not place concrete when the ambient temperature in the shade is below 40°F and falling unless approved. Concrete may be placed when the ambient temperature in the shade is above 35°F and rising or

above 40°F. Protect the pavement with an approved insulating material capable of protecting the concrete for the specified curing period when temperatures warrant protection against freezing. Submit for approval proposed measures to protect the concrete from anticipated freezing weather for the first 72 hr. after placement. Repair or replace all concrete damaged by freezing.

4.8. **Spreading and Finishing**. Finish all concrete pavement with approved self-propelled equipment. Use power-driven spreaders, power-driven vibrators, power-driven strike-off, screed, or approved alternate equipment. Use the transverse finishing equipment to compact and strike-off the concrete to the required section and grade without surface voids. Use float equipment for final finishing. Use concrete with a consistency that allows completion of all finishing operations without addition of water to the surface. Use the minimal amount of water fog mist necessary to maintain a moist surface. Reduce fogging if float or straightedge operations result in excess slurry.

4.8.1. **Finished Surface**. Perform sufficient checks with long-handled 10-ft. and 15-ft. straightedges on the plastic concrete to ensure the final surface is within the tolerances specified in Surface Test A in Item 585, "Ride Quality for Pavement Surfaces." Check with the straightedge parallel to the centerline.

4.8.2. **Maintenance of Surface Moisture**. Prevent surface drying of the pavement before application of the curing system by means that may include water fogging, the use of wind screens, and the use of evaporation retardants. Apply evaporation retardant at the manufacturer's recommended rate. Reapply the evaporation retardant as needed to maintain the concrete surface in a moist condition until curing system is applied. Do not use evaporation retardant as a finishing aid. Failure to take acceptable precautions to prevent surface drying of the pavement will be cause for shutdown of pavement operations.

4.8.3. **Surface Texturing**. Complete final texturing before the concrete has attained its initial set. Drag the carpet longitudinally along the pavement surface with the carpet contact surface area adjusted to provide a satisfactory coarsely textured surface. Prevent the carpet from getting plugged with grout. Do not perform carpet dragging operations while there is excessive bleed water.

A metal-tine texture finish is required unless otherwise shown on the plans. Provide transverse tining unless otherwise shown on the plans. Immediately following the carpet drag, apply a single coat of evaporation retardant, if needed, at the rate recommended by the manufacturer. Provide the metal-tine finish immediately after the concrete surface has set enough for consistent tining. Operate the metal-tine device to obtain grooves approximately 3/16 in. deep, with a minimum depth of 1/8 in., and approximately 1/12 in. wide. Do not overlap a previously tined area. Use manual methods to achieve similar results on ramps, small or irregular areas, and narrow width sections of pavements. Repair damage to the edge of the slab and joints immediately after texturing. Do not tine pavement that will be overlaid or that is scheduled for blanket diamond grinding or shot blasting.

Target a carpet drag texture of 0.04 in., as measured by Tex-436-A, when carpet drag is the only surface texture required on the plans. Ensure adequate and consistent macro-texture is achieved by applying enough weight to the carpet and by keeping the carpet from getting plugged with grout. Correct any location with a texture less than 0.03 in. by diamond grinding or shot blasting. The Engineer will determine the test locations at points located transversely to the direction of traffic in the outside wheel path.

4.8.4. **Small, Irregular Area, or Narrow Width Placements**. Use hand equipment and procedures that produce a consolidated and finished pavement section to the line and grade where machine placements and finishing of concrete pavement are not practical.

4.8.5. **Emergency Procedures**. Use hand-operated equipment for applying texture, evaporation retardant, and cure in the event of equipment breakdown.

4.9. **Curing**. Keep the concrete pavement surface from drying as described in Section 360.4.8.2., "Maintenance of Surface Moisture," until the curing material has been applied. Maintain and promptly repair damage to curing materials on exposed surfaces of concrete pavement continuously for at least 3 curing days. A curing day is defined as a 24-hr. period when either the temperature taken in the shade away from artificial heat is above 50°F for at least 19 hr. or the surface temperature of the concrete is maintained above 40°F for 24 hr.

Curing begins when the concrete curing system has been applied. Stop concrete paving if curing compound is not being applied promptly and maintained adequately. Other methods of curing in accordance with Item 422, "Concrete Superstructures," may be used when specified or approved.

4.9.1. **Membrane Curing**. Spray the concrete surface uniformly with 2 coats of membrane curing compound at an individual application rate of no more than 180 sq. ft. per gallon. Apply the curing compound before allowing the concrete surface to dry.

Manage finishing and texturing operations to ensure placement of curing compound on a moist concrete surface, relatively free of bleed water, to prevent any plastic shrinkage cracking. Time the application of curing compound to prevent plastic shrinkage cracking.

Maintain curing compounds in a uniformly agitated condition, free of settlement before and during application. Do not thin or dilute the curing compound.

Apply additional compound at the same rate of coverage to correct damage where the coating shows discontinuities or other defects or if rain falls on the newly coated surface before the film has dried enough to resist damage. Ensure that the curing compound coats the sides of the tining grooves.

4.9.2. **Asphalt Curing**. Apply a uniform coating of asphalt curing at a rate of 90 to 180 sq. ft. per gallon when an asphaltic concrete overlay is required. Apply curing immediately after texturing and once the free moisture (sheen) has disappeared. Obtain approval to add water to the emulsion to improve spray distribution. Maintain the asphalt application rate when using diluted emulsions. Maintain the emulsion in a mixed condition during application.

4.9.3. **Curing Class HES Concrete**. Provide membrane curing in accordance with Section 360.4.9.1., "Membrane Curing," for all Class HES concrete pavement. Promptly follow by wet mat curing in accordance with Section 422.4.8., "Final Curing," until opening strength is achieved but not less than 24 hr.

4.9.4. **Curing Fast-Track Concrete Pavement**. Provide wet mat curing unless otherwise shown on the plans or as directed. Cure in accordance with Section 422.4.8., "Final Curing." Apply a Type 1-D or Type 2 membrane cure instead of wet mat curing if the air temperature is below 65°F and insulating blankets are used.

4.10. **Sawing Joints**. Saw joints to the depth shown on the plans as soon as sawing can be accomplished without damage to the pavement regardless of time of day or weather conditions. Some minor raveling of the saw-cut is acceptable. Use a chalk line, string line, sawing template, or other approved method to provide a true joint alignment. Provide enough saws to match the paving production rate to ensure sawing completion at the earliest possible time to avoid uncontrolled cracking. Reduce paving production if necessary to ensure timely sawing of joints. Promptly restore membrane cure damaged within the first 72 hr. of curing.

4.11. **Protection of Pavement and Opening to Traffic**. Testing for early opening is the responsibility of the Contractor regardless of job-control testing responsibilities unless otherwise shown on the plans or as directed. Testing result interpretation for opening to traffic is subject to approval.

4.11.1. **Protection of Pavement**. Erect and maintain barricades and other standard and approved devices that will exclude all vehicles and equipment from the newly placed pavement for the periods specified. Protect the pavement from damage due to crossings using approved methods before opening to traffic. Where a detour is not readily available or economically feasible, an occasional crossing of the roadway with overweight equipment may be permitted for relocating equipment only but not for hauling material. When an occasional crossing of overweight equipment is permitted, temporary matting or other approved methods may be required.

Maintain an adequate supply of sheeting or other material to cover and protect fresh concrete surface from weather damage. Apply as needed to protect the pavement surface from weather.

4.11.2. **Opening Pavement to All Traffic.** Pavement that is 7 days old may be opened to all traffic. Clean pavement, place stable material against the pavement edges, seal joints, and perform all other traffic safety related work before opening to traffic.

4.11.3. **Opening Pavement to Construction Equipment.** Unless otherwise shown on the plans, concrete pavement may be opened early to concrete paving equipment and related delivery equipment after the concrete is at least 48 hr. old and opening strength has been demonstrated in accordance with Section 360.4.11.4., "Early Opening to All Traffic," before curing is complete. Keep delivery equipment at least 2 ft. from the edge of the concrete pavement. Keep tracks of the paving equipment at least 1 ft. from the pavement edge. Protect textured surfaces from the paving equipment. Restore damaged membrane curing as soon as possible. Repair pavement damaged by paving or delivery equipment before opening to all traffic.

4.11.4. **Early Opening to All Traffic.** Concrete pavement may be opened after curing is complete and the concrete has attained a flexural strength of 450 psi or a compressive strength of 3,200 psi, except that pavement using Class HES concrete may be opened after 24 hr. if the specified strength is achieved.

4.11.4.1. **Strength Testing.** Test concrete specimens cured under the same conditions as the portion of the pavement involved.

4.11.4.2. **Maturity Method.** Use the maturity method, Tex-426-A, to estimate concrete strength for early opening pavement to traffic unless otherwise shown on the plans. Install at least 2 maturity sensors for each day's placement in areas where the maturity method will be used for early opening. Maturity sensors, when used, will be installed near the day's final placement for areas being evaluated for early opening. Use test specimens to verify the strength–maturity relationship in accordance with Tex-426-A, starting with the first day's placement corresponding to the early opening pavement section.

Verify the strength–maturity relationship at least every 10 days of production after the first day. Establish a new strength–maturity relationship when the strength specimens deviate more than 10% from the maturity-estimated strengths. Suspend use of the maturity method for opening pavements to traffic when the strength–maturity relationship deviates by more than 10% until a new strength–maturity relationship is established.

The Engineer will determine the frequency of verification when the maturity method is used intermittently or for only specific areas.

4.11.5. **Fast Track Concrete Pavement.** Open the pavement after the concrete has been cured for at least 8 hr. and attained a minimum compressive strength of 1,800 psi or a minimum flexural strength of 255 psi when tested in accordance with Section 360.4.11.4.1., "Strength Testing," or Section 360.4.11.4.2., "Maturity Method," unless otherwise directed. Cover the pavement with insulating blankets when the air temperature is below 65°F until the pavement is opened to traffic.

4.11.6. **Emergency Opening to Traffic.** Open the pavement to traffic under emergency conditions, when the pavement is at least 72 hr. old when directed in writing. Remove all obstructing materials, place stable material against the pavement edges, and perform other work involved in providing for the safety of traffic as required for emergency opening.

4.12. **Pavement Thickness.** The Engineer will check the thickness in accordance with Tex-423-A unless other methods are shown on the plans. The Engineer will perform 1 thickness test consisting of 1 reading at approximately the center of the paving equipment every 500 ft. or fraction thereof. Core where directed, in accordance with Tex-424-A, to verify deficiencies of more than 0.2 in. from plan thickness and to determine the limits of deficiencies of more than 0.75 in. from plan thickness. Fill core holes using an approved concrete mixture and method.

4.12.1. **Thickness Deficiencies Greater than 0.2 in.** Take one 4-in. diameter core at that location to verify the measurement when any depth test measured in accordance with Tex-423-A is deficient by more than 0.2 in. from the plan thickness.

Take 2 additional cores from the unit (as defined in Section 360.4.12.3., "Pavement Units for Payment Adjustment" at intervals of at least 150 ft. and at selected locations if the core is deficient by more than 0.2 in., but not by more than 0.75 in. from the plan thickness, and determine the thickness of the unit for payment purposes by averaging the length of the 3 cores. In calculations of the average thickness of this unit of pavement, measurements in excess of the specified thickness by more than 0.2 in. will be considered as the specified thickness plus 0.2 in.

4.12.2. **Thickness Deficiencies Greater than 0.75 in.** Take additional cores at 10-ft. intervals in each direction parallel to the centerline to determine the boundary of the deficient area if a core is deficient by more than 0.75 in. The Engineer will evaluate any area of pavement found deficient in thickness by more than 0.75 in., but not more than 1 in. Remove and replace the deficient areas without additional compensation or retain deficient areas without compensation, as directed. Remove and replace any area of pavement found deficient in thickness by more than 1 in. without additional compensation.

4.12.3. **Pavement Units for Payment Adjustment.** Limits for applying a payment adjustment for deficient pavement thickness from 0.20 in. to not more than 0.75 in. are 500 ft. of pavement in each lane. Lane width will be as shown on typical sections and pavement design standards.

For greater than 0.75 in. deficient thickness, the limits for applying zero payment or requiring removal will be defined by coring or equivalent nondestructive means as determined by the Engineer. The remaining portion of the unit determined to be less than 0.75 in. deficient will be subject to the payment adjustment based on the average core thickness at each end of the 10-ft. interval investigation as determined by the Engineer.

Shoulders will be measured for thickness unless otherwise shown on the plans. Shoulders 6 ft. wide or wider will be considered as lanes. Shoulders less than 6 ft. wide will be considered part of the adjacent lane.

Limits for applying payment adjustment for deficient pavement thickness for ramps, widenings, acceleration and deceleration lanes, and other miscellaneous areas are 500 ft. in length. Areas less than 500 ft. in length will be individually evaluated for payment adjustment based on the plan area.

4.13. **Ride Quality.** Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

5. MEASUREMENT

This Item will be measured as follows:

5.1. **Concrete Pavement.** Concrete pavement will be measured by the square yard of surface area in place. The surface area includes the portion of the pavement slab extending beneath the curb.

5.2. **Curb.** Curb on concrete pavement will be measured by the foot in place.

6. PAYMENT

These prices are full compensation for materials, equipment, labor, tools, and incidentals.

6.1. **Concrete Pavement.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the adjusted unit price bid for "Concrete Pavement" of the type and depth specified as adjusted in accordance with Section 360.6.2., "Deficient Thickness Adjustment."

6.2. **Deficient Thickness Adjustment.** Where the average thickness of pavement is deficient in thickness by more than 0.2 in. but not more than 0.75 in., payment will be made using the adjustment factor as specified in Table 2 applied to the bid price for the deficient area for each unit as defined under Section 360.4.12.3., "Pavement Units for Payment Adjustment."

Table 2
Deficient Thickness Price Adjustment Factor

Deficiency in Thickness Determined by Cores (in.)	Proportional Part of Contract Price Allowed (Adjustment Factor)
Not deficient	1.00
Over 0.00 through 0.20	1.00
Over 0.20 through 0.30	0.80
Over 0.30 through 0.40	0.72
Over 0.40 through 0.50	0.68
Over 0.50 through 0.75	0.57

6.3. **Curb.** Work performed and furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Curb" of the type specified.

Item 421
Hydraulic Cement Concrete

1. DESCRIPTION

Furnish hydraulic cement concrete for concrete pavements, concrete structures, and other concrete construction.

2. MATERIALS

Use materials from prequalified sources listed on the Department website. Provide coarse and fine aggregates from sources listed in the Department's *Concrete Rated Source Quality Catalog* (CRSQC). Use materials from non-listed sources only when tested and approved by the Engineer before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources. Do not combine approved material with unapproved material.

2.1. **Cement**. Furnish cement conforming to DMS-4600, "Hydraulic Cement."

2.2. **Supplementary Cementing Materials (SCM)**.

- **Fly Ash**. Furnish fly ash, ultra-fine fly ash (UFFA), and modified Class F fly ash (MFFA) conforming to DMS-4610, "Fly Ash."
- **Slag Cement**. Furnish Slag Cement conforming to DMS-4620, "Slag Cement."
- **Silica Fume**. Furnish silica fume conforming to DMS-4630, "Silica Fume."
- **Metakaolin**. Furnish metakaolin conforming to DMS-4635, "Metakaolin."

2.3. **Cementitious Material**. Cementitious materials are the cement and supplementary cementing materials used in concrete.

2.4. **Chemical Admixtures**. Furnish admixtures conforming to DMS-4640, "Chemical Admixtures for Concrete."

2.5. **Water**. Furnish mixing and curing water that is free from oils, acids, organic matter, or other deleterious substances. Water from municipal supplies approved by the Texas Department of Health will not require testing. Provide test reports showing compliance with Table 1 before use when using water from other sources.

Water that is a blend of concrete wash water and other acceptable water sources, certified by the concrete producer as complying with the requirements of both Table 1 and Table 2, may be used as mix water. Test the blended water weekly for 4 weeks for compliance with Table 1 and Table 2 or provide previous test results. Then test every month for compliance. Provide water test results upon request.

Table 1
Chemical Limits for Mix Water

Contaminant	Test Method	Maximum Concentration (ppm or mg\L)
Chloride (Cl)	ASTM C114	
Prestressed concrete		500
Bridge decks & superstructure		500
All other concrete		1,000
Sulfate (SO4)	ASTM C114	2,000
Alkalies (Na2O + 0.658K2O)	ASTM C114	600
Total solids	ASTM C1603	50,000

Table 2
Acceptance Criteria for Questionable Water Supplies

Property	Test Method	Limits
Compressive strength, min % control at 7 days	ASTM C31, ASTM C39[1,2]	90
Time of set, deviation from control, h:min.	ASTM C403	From 1:00 early to 1:30 later

1. Base comparisons on fixed proportions and the same volume of test water compared to the control mix using 100% potable water or distilled water.
2. Base comparisons on sets consisting of at least 2 standard specimens made from a composite sample.

Do not use mix water that has an adverse effect on the air-entraining agent, on any other chemical admixture, or on strength or time of set of the concrete. Use mixing and curing water free of iron and other impurities that may cause staining or discoloration when using white hydraulic cement.

2.6. **Aggregate.**

2.6.1. **Coarse Aggregate.** Provide coarse aggregate consisting of durable particles of gravel, crushed blast furnace slag, recycled crushed hydraulic cement concrete, crushed stone, or combinations which are free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material, either free or as an adherent coating. Provide coarse aggregate of uniform quality throughout.

Provide coarse aggregate with the requirements listed in Table 3 unless otherwise shown on the plans.

Table 3
Coarse Aggregate Requirements

Description	Test Method	Limit
Weight of Clay Lumps, % Max	Tex-413-A	0.25
Weight of Shale, % Max		1.0
Weight of Laminate and Friable Particle, % Max		5.0
L.A. Abrasion Wear, % Max	Tex-410-A	40
5-Cycle Magnesium Sulfate Soundness,[1,2] non-air-entrained concrete, % Max	Tex-411-A	25
5-Cycle Magnesium Sulfate Soundness,[1,3] air-entrained concrete, % Max		18
Loss by Decantation, % Max	Tex-406-A	1.5

1. Recycled crushed hydraulic cement concrete is not subject to 5-cycle magnesium sulfate soundness requirements.
2. Allowed when air-entrained concrete is used at the Contractor's option.
3. Only when air-entrained concrete is required by the plans.

Increase the loss by decantation limit to 3.0% for all classes of concrete and 5.0% for Class A, B, and P if the material finer than the No. 200 sieve is determined to be at least 85% calcium carbonate in accordance with Tex-406-A, Part III, in the case of coarse aggregates made primarily from crushing stone unless otherwise shown on the plans. Provide test results upon request.

Provide coarse aggregate or combination of aggregates conforming to the gradation requirements shown in Table 4 when tested in accordance with Tex-401-A unless otherwise specified.

Table 4
Coarse Aggregate Gradation Chart

Aggregate Grade No.[1]	Maximum Nominal Size	Percent Passing on Each Sieve								
		2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	#4	#8
1	2"	100	80–100	50–85		20–40			0–10	
2	1-1/2"		100	95–100		35–70		10–30	0–10	
3	1-1/2"		100	95–100		60–90	25–60		0–10	
4 (57)	1"			100	95–100		25–60		0–10	0–5
5 (67)	3/4"				100	90–100		20–55	0–10	0–5
6 (7)	1/2"					100	90–100	40–70	0–15	0–5
7	3/8"						100	70–95	0–25	
8	3/8"						100	95–100	20–65	0–10

1. Corresponding ASTM C33 gradation shown in parentheses.

2.6.2. **Fine Aggregate.** Provide fine aggregate consisting of clean, hard, durable particles of natural, manufactured sand, recycled crushed hydraulic cement concrete, slag, lightweight aggregate, or a combination thereof. Provide fine aggregate free from frozen material and from injurious amounts of salt, alkali, vegetable matter, or other objectionable material.

Provide fine aggregates with the requirements in Table 5 unless otherwise shown on the plans.

Table 5
Fine Aggregate Requirements

Description	Test Method	Limit
Weight of Clay Lumps, % Max	Tex-413-A	0.50
Organic Impurities[1]	Tex-408-A	Color not darker than standard
Sand Equivalent	Tex-203-F	80
Fineness Modulus	Tex-402-A	2.3 to 3.1

1. Only when air-entrained concrete is specified.

Provide fine aggregate or combinations of aggregates conforming to the gradation requirements shown in Table 6 when tested in accordance with Tex-401-A unless otherwise specified.

Table 6
Fine Aggregate Gradation Chart (Grade 1)

Sieve Size	Percent Passing
3/8"	100
#4	95–100
#8	80–100
#16	50–85
#30	25–65
#50	10–35[1]
#100	0–10
#200	0–3[2]

1. 6–35 when sand equivalent value is greater than 85.
2. 0–6 for manufactured sand.

2.6.3. **Intermediate Aggregate.** Provide intermediate aggregate consisting of clean, hard, durable particles of natural, manufactured sand, slag, recycled crushed hydraulic cement concrete, lightweight aggregate, or a combination thereof when optimized aggregate gradation (OAG) concrete is specified or when used at the Contractor's option. Provide intermediate aggregate free from frozen material and injurious amounts of salt, alkali, vegetable matter, or other objectionable material.

Provide intermediate aggregate with the requirements in Table 7.

Table 7
Intermediate Aggregate Requirements

Description	Test Method	Limit
Weight of Clay Lumps, % Max	Tex-413-A	0.50
L.A. Abrasion Wear,[1] % Max	Tex-410-A	40
5-Cycle Magnesium Sulfate Soundness,[1,2,3] non-air-entrained concrete, % Max	Tex-411-A	25
5-Cycle Magnesium Sulfate Soundness,[1,2,4] air-entrained concrete, % Max		18
Organic Impurities[5]	Tex-408-A	Color not darker than standard
Loss by Decantation,[1] % Max	Tex-406-A	1.5

1. Only applies to the portion retained on the No. 4 sieve, if more than 30% of the intermediate aggregate is retained on the No. 4 sieve.
2. Recycled crushed hydraulic cement concrete is not subject to 5-cycle magnesium sulfate soundness requirements.
3. Allowed when air-entrained concrete is used at the Contractor's option.
4. Only when air-entrained concrete is required by the plans.
5. Only applies to the portion passing the 3/8 in. sieve, if more than 30% of the intermediate aggregate is passing the 3/8 in. sieve.

For the portion retained on the No. 4 sieve, if more than 30% of the intermediate aggregate is retained on the No. 4 sieve, and in the case of aggregates made primarily from crushing stone, unless otherwise shown on the plans, the loss by decantation may be increased to 3.0% for all classes of concrete and 5.0% for Class A, B, and P if the material finer than the No. 200 sieve is determined to be at least 85% calcium carbonate in accordance with Tex-406-A, Part III. Provide test results upon request.

2.7. **Mortar and Grout**. Furnish pre-packaged grouts conforming to DMS-4675, "Cementitious Grouts and Mortars for Miscellaneous Applications," when specified for applications other than post-tension grouting.

Section 421.4.2.6., "Mix Design Options," does not apply for mortar and grout.

2.8. **Storage of Materials**.

2.8.1. **Cement and Supplementary Cementing Materials**. Store all cement and supplementary cementing materials in weatherproof enclosures that will protect them from dampness or absorption of moisture.

When permitted, small quantities of packaged cementitious material may be stored in the open, on a raised platform, and under waterproof covering for up to 48 hr.

2.8.2. **Aggregates**. Handle and store concrete aggregates in a manner that prevents contamination with foreign materials. Clear and level the sites for the stockpiles of all vegetation if the aggregates are stored on the ground and do not use the bottom 6-in. layer of aggregate without cleaning the aggregate before use.

Maintain separate stockpiles and prevent intermixing when conditions require the use of 2 or more grades of coarse aggregates. Separate the stockpiles using physical barriers where space is limited. Store aggregates from different sources in different stockpiles unless the Engineer authorizes pre-blending of the aggregates. Minimize segregation in stockpiles. Remix and test stockpiles when segregation is apparent.

Sprinkle stockpiles to control moisture and temperature as necessary. Maintain reasonably uniform moisture content in aggregate stockpiles.

2.8.3. **Chemical Admixtures**. Store admixtures in accordance with manufacturer's recommendations and prevent admixtures from freezing.

3. EQUIPMENT

3.1. **Concrete Plants and Mixing Equipment**. Except for volumetric stationary plant or truck (auger) mixers, each plant and truck mixer must be currently certified by the National Ready Mixed Concrete Association (NRMCA) or have an inspection report signed and sealed by a licensed professional engineer showing concrete measuring, mixing, and delivery equipment meets all requirements of ASTM C94. A new

certification or signed and sealed report is required every time a plant is moved. Plants with a licensed professional engineer's inspection require re-inspection every 2 yr. Provide a copy of the certification or the signed and sealed inspection report to the Engineer. Remove equipment or facilities from service until corrected when they fail to meet specification requirements.

When allowed on the plans or by the Engineer, for concrete classes not identified as structural concrete in Table 8 or for Class C concrete not used for bridge-class structures, the Engineer may inspect and approve all plants and trucks instead of the NRMCA or non-Department engineer-sealed certifications. The criteria and frequency of Engineer approval of plants and trucks is the same used for NRMCA certification.

Inspect and furnish inspection reports on the condition of blades and fins and their percent wear from the original manufacturer's design for truck mixers and agitators annually. Repair mixing equipment exhibiting 10% or more wear before use. If an inspection within 12 mo. is not practical, a 2-mo. grace period (for a maximum of 14 mo. between inspections) is permitted.

3.1.1. **Scales**. Check all scales before beginning of operations, after each move, or whenever their accuracy or adequacy is questioned, and at least once every 6 mo. Immediately correct deficiencies, and recalibrate. Provide a record of calibration showing scales in compliance with ASTM C94 requirements. Check batching accuracy of volumetric water batching devices at least every 90 days. Check batching accuracy of chemical admixture dispensing devices at least every 6 mo. Perform daily checks as necessary to ensure measuring accuracy.

3.1.2. **Volumetric Mixers**. Provide volumetric mixers with rating plates defining the capacity and the performance of the mixer in accordance with the Volumetric Mixer Manufacturers Bureau or equivalent. Provide volumetric mixers that comply with ASTM C685. Provide test data showing mixers meet the uniformity test requirements of Tex-472-A.

Unless allowed on the plans or by the Engineer, volumetric truck (auger) mixers may not supply classes of concrete identified as structural concrete in Table 8.

3.1.3. **Agitators and Truck and Stationary Mixers**. Provide stationary and truck mixers capable of combining the ingredients of the concrete into a thoroughly mixed and uniform mass and capable of discharging the concrete so at least 5 of the 6 requirements of Tex-472-A are met.

Perform concrete uniformity tests on mixers or agitators in accordance with Tex-472-A as directed, to resolve issues of mix uniformity and mixer performance.

Perform the mixer or agitator uniformity test at the full rated capacity of the equipment. Remove all equipment that fails the uniformity test from service.

Inspect and maintain mixers and agitators. Keep them free of concrete buildup, and repair or replace worn or damaged blades or fins.

Ensure all mixers have a plate affixed showing manufacturer's recommended operating speed and rated capacity for mixing and agitating.

3.2. **Hauling Equipment**. Provide hauling equipment capable of maintaining the mixed concrete in a thoroughly mixed and uniform mass, and discharging the concrete with a satisfactory degree of uniformity.

Provide equipment with smooth, mortar-tight metal containers equipped with gates that prevent accidental discharge of the concrete when using non-agitating equipment for transporting concrete.

Maintain hauling equipment clean and free of built-up concrete.

3.3. **Testing Equipment**. Furnish and maintain the following in accordance with the pertinent test procedure unless otherwise shown on the plans or specified:

- sieves necessary to perform aggregate gradation analysis when optimized aggregate gradation is specified,
- equipment necessary to perform Tex-415-A and Tex-422-A,
- equipment necessary to perform Tex-409-A or Tex-425-A,
- test molds,
- curing facilities,
- maturity meters if used, and
- wheelbarrow or other container acceptable for the sampling of the concrete.

Provide strength-testing equipment when required in accordance with the Contract-controlling test unless shown otherwise.

4. CONSTRUCTION

4.1. **Classification of Concrete Mix Designs.** Provide classes of concrete meeting the requirements shown in Table 8.

A higher-strength class of concrete with equal or lower water-to-cementitious material (w/cm) ratio may be substituted for the specified class of concrete when approved.

4.2. **Mix Design Proportioning.** Furnish mix designs using ACI 211, Tex-470-A, or other approved procedures for the classes of concrete listed in Table 8 unless a design method is indicated on the plans. Perform mix design proportioning by absolute volume method unless otherwise approved. Perform cement replacement using equivalent weight method unless otherwise approved.

Do not exceed the maximum w/cm ratio listed in Table 8 when designing the mixture.

4.2.1. **Cementitious Materials.** Do not exceed 700 lb. of cementitious material per cubic yard of concrete unless otherwise specified or approved.

- Use cement of the same type and from the same source for monolithic placements.
- Do not use supplementary cementing materials when white hydraulic cement is specified.

Table 8
Concrete Classes

Class of Concrete	Design Strength,[1] Min f'_c (psi)	Max w/cm Ratio	Coarse Aggregate Grades[2,3,4]	Cement Types	Mix Design Options	Exceptions to Mix Design Options	General Usage[5]
A	3,000	0.60	1–4, 8	I, II, I/II, IL, IP, IS, IT, V	1, 2, 4, & 7	When the cementitious material content does not exceed 520 lb./cu. yd., Class C fly ash may be used instead of Class F fly ash.	Curb, gutter, curb & gutter, conc. retards, sidewalks, driveways, back-up walls, anchors, non-reinforced drilled shafts
B	2,000	0.60	2–7				Riprap, traffic signal controller foundations, small roadside signs, and anchors
C[6]	3,600	0.45	1–6	I, II, I/II, IP, IS, IT,[7] V	1–8		Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, inlets, manholes, concrete traffic barrier (cast-in-place)
E	3,000	0.50	2–5	I, II, I/II, IL, IP, IS, IT,[7] V	1–8	When the cementitious material content does not exceed 520 lb./cu. yd., Class C fly ash may be used instead of Class F fly ash.	Seal concrete

Table 8 (continued)

Concrete Classes

Class of Concrete	Design Strength,[1] Min f'_c (psi)	Max w/cm Ratio	Coarse Aggregate Grades[2,3,4]	Cement Types	Mix Design Options	Exceptions to Mix Design Options	General Usage[5]
F[6]	Note[8]	0.45	2–5	I, II, I/II, IP, IS, IT,[7] V			Railroad structures; occasionally for bridge piers, columns, or bents
H[6]	Note[8]	0.45	3–6	I, II, I/II, III, IP, IS, IT,[7] V	1–5	Do not use Type III cement in mass placement concrete. Up to 20% of blended cement may be replaced with listed SCMs when Option 4 is used for precast concrete.	Precast concrete, post-tension members
S[6]	4,000	0.45	2–5	I, II, I/II, IP, IS, IT,[7] V	1–8		Bridge slabs, top slabs of direct traffic culverts, approach slabs
P	See Item 360, "Concrete Pavement."	0.50	2–3	I, II, I/II, IL, IP, IS, IT, V	1–8	When the cementitious material content does not exceed 520 lb./cu. yd., Class C fly ash may be used instead of Class F fly ash.	Concrete pavement
CO[6]	4,600	0.40	6	I, II, I/II, IP, IS, IT,[7] V	1–8		Bridge deck concrete overlay
LMC[6]	4,000	0.40	6–8				Latex-modified concrete overlay
SS[6]	3,600	0.45	4–6			Use a minimum cementitious material content of 658 lb./cu. yd. of concrete.	Slurry displacement shafts, underwater drilled shafts
K[6]	Note[8]	0.40	Note[8]	I, II, I/II, III IP, IS, IT,[7] V			Note[5]
HES	Note[8]	0.45	Note[8]	I, IL, II, I/II, III		Mix design options do not apply. 700 lb. of cementitious material per cubic yard limit does not apply.	Concrete pavement, concrete pavement repair
"X" (HPC)[6,9,10]	Note[11]	0.45	Note[11]	I, II, I/II, III IP, IS, IT,[7] V	1–5, & 8	Maximum fly ash replacement for Options 1 and 3 may be increased to 45%. Up to 20% of a blended cement may be replaced with listed SCMs for Option 4. Do not use Option 8 for precast concrete.	
"X" (SRC)[6,9,10]	Note[11]	0.45	Note[11]	I/II, II, IP, IS, IT,[7] V	1–4 , & 7	Do not use Class C Fly Ash Type III-MS may be used where allowed. Type I and Type III cements may be used with Options 1–3, with a maximum w/cm of 0.40. Up to 20% of blended cement may be replaced with listed SCMs when Option 4 is used for precast concrete. Do not use Option 7 for precast concrete.	

1. Design strength must be attained within 56 days.
2. Do not use Grade 1 coarse aggregate except in massive foundations with 4 in. minimum clear spacing between reinforcing steel bars, unless otherwise permitted. Do not use Grade 1 aggregate in drilled shafts.
3. Use Grade 8 aggregate in extruded curbs unless otherwise approved.
4. Other grades of coarse aggregate maybe used in non-structural concrete classes when allowed by the Engineer.
5. For information only.
6. Structural concrete classes.
7. Do not use Type IT cements containing > 5% limestone.
8. As shown on the plans or specified.
9. "X" denotes class of concrete shown on the plans or specified.
10. (HPC): High Performance Concrete, (SRC): Sulfate Resistant Concrete.
11. Same as class of concrete shown on the plans.

4.2.2. **Aggregates.** Recycled crushed hydraulic cement concrete may be used as a coarse or fine aggregate in Class A, B, E, and P concrete. Limit recycled crushed concrete fine aggregate to a maximum of 20% of the fine aggregate.

Use light-colored aggregates when white hydraulic cement is specified.

Use fine aggregate with an acid insoluble residue of at least 60% by weight when tested in accordance with Tex-612-J in all concrete subject to direct traffic.

Use the following equation to determine if the aggregate combination meets the acid insoluble residue requirement when blending fine aggregate or using an intermediate aggregate:

$$\frac{(A_1 \times P_1)+(A_2 \times P_2)+(A_{ia} \times P_{ia})}{100} \geq 60\%$$

where:
A_1 = acid insoluble (%) of fine aggregate 1
A_2 = acid insoluble (%) of fine aggregate 2
A_{ia} = acid insoluble (%) of intermediate aggregate passing the 3/8 in. sieve
P_1 = percent by weight of fine aggregate 1 of the fine aggregate blend
P_2 = percent by weight of fine aggregate 2 of the fine aggregate blend
P_{ia} = percent by weight of intermediate aggregate passing the 3/8 in. sieve

Alternatively to the above equation, blend fine aggregate with a micro-deval loss of less than 12%, when tested in accordance with Tex-461-A, with at least 40% of a fine aggregate with an acid insoluble residue of at least 60%.

4.2.3. **Chemical Admixtures.** Do not use Type C, Type E, Type F, or Type G admixtures in Class S bridge deck concrete. Do not use chemical admixtures containing calcium chloride in any concrete.

Use a 30% calcium nitrite solution when a corrosion-inhibiting admixture is required. The corrosion-inhibiting admixture must be set neutral unless otherwise approved. Dose the admixture at the rate of gallons of admixture per cubic yard of concrete shown on the plans.

4.2.4. **Air Entrainment.** Use an approved air-entraining admixture when air-entrained concrete is specified, or when an air-entraining admixture is used at the Contractor's option, and do not exceed the manufacturer's recommended dosage. Ensure the minimum entrained air content is at least 3.0% for all classes of concrete except Class P when air-entrained concrete is specified, during trial batch, or when providing previous field data.

4.2.5. **Slump.** Provide concrete with a slump in accordance with Table 9 unless otherwise specified. When approved, the slump of a given concrete mix may be increased above the values shown in Table 9 using chemical admixtures, provided the admixture-treated concrete has the same or lower water-to-cementitious material ratio and does not exhibit segregation or excessive bleeding. Request approval to exceed the slump limits in Table 9 sufficiently in advance for proper evaluation by the Engineer.

Perform job-control testing of slump in accordance with Section 421.4.8.3.1., "Job-Control Testing."

Table 9
Placement Slump Requirements

General Usage[1]	Placement Slump Range,[2] in.
Walls (over 9 in. thick), caps, columns, piers, approach slabs, concrete overlays	3 to 5
Bridge slabs, top slabs of direct traffic culverts, latex-modified concrete for bridge deck overlays	3 to 5-1/2
Inlets, manholes, walls (less than 9 in. thick), bridge railing, culverts, concrete traffic barrier, concrete pavement (formed), seal concrete	4 to 5-1/2
Precast concrete	4 to 9
Underwater concrete placements	6 to 8-1/2
Drilled shafts, slurry displaced and underwater drilled shafts	See Item 416, "Drilled Shaft Foundations."
Curb, gutter, curb and gutter, concrete retards, sidewalk, driveways, anchors, riprap, small roadside sign foundations, concrete pavement repair, concrete repair	As approved

1. For information only.
2. For fiber reinforced concrete, perform slump before addition of fibers.

4.2.6. **Mix Design Options.**

4.2.6.1. **Option 1.** Replace 20% to 35% of the cement with Class F fly ash.

4.2.6.2. **Option 2.** Replace 35% to 50% of the cement with slag cement or MFFA.

4.2.6.3. **Option 3.** Replace 35% to 50% of the cement with a combination of Class F fly ash, slag cement, MFFA, UFFA, metakaolin, or silica fume; however, no more than 35% may be fly ash, and no more than 10% may be silica fume.

4.2.6.4. **Option 4.** Use Type IP, Type IS, or Type IT cement as allowed in Table 5 for each class of concrete. Up to 10% of a Type IP, Type IS, or Type IT cement may be replaced with Class F fly ash, slag cement, or silica fume. Use no more than 10% silica fume in the final cementitious material mixture if the Type IT cement contains silica fume, and silica fume is used to replace the cement.

4.2.6.5. **Option 5.** Replace 35% to 50% of the cement with a combination of Class C fly ash and at least 6% of silica fume, UFFA, or metakaolin. However, no more than 35% may be Class C fly ash, and no more than 10% may be silica fume.

4.2.6.6. **Option 6.** Use a lithium nitrate admixture at a minimum dosage determined by testing conducted in accordance with Tex-471-A, "Lithium Dosage Determination Using Accelerated Mortar Bar Testing." Before use of the mix, provide an annual certified test report signed and sealed by a licensed professional engineer, from a laboratory on the Department's MPL, certified by the Construction Division as being capable of testing according to Tex-471-A, "Lithium Dosage Determination Using Accelerated Mortar Bar Testing."

4.2.6.7. **Option 7.** Ensure the total alkali contribution from the cement in the concrete does not exceed 3.5 lb. per cubic yard of concrete when using hydraulic cement not containing SCMs calculated as follows:

$$\text{lb. alkali per cu. yd.} = \frac{(\text{lb. cement per cu. yd.}) \times (\%\ Na_2O \text{ equivalent in cement})}{100}$$

In the above calculation, use the maximum cement alkali content reported on the cement mill certificate.

4.2.6.8. **Option 8.** Perform annual testing as required for any deviations from Options 1–5 or use mix design options listed in Table 10. Laboratories performing ASTM C1260, ASTM C1567, and ASTM C1293 testing must be listed on the Department's MPL. Before use of the mix, provide a certified test report signed and sealed by a licensed professional engineer demonstrating the proposed mixture conforms to the requirements of Table 10.

Provide a certified test report signed and sealed by a licensed professional engineer, when HPC is required, and less than 20% of the cement is replaced with SCMs, demonstrating ASTM C1202 test results indicate the permeability of the concrete is less than 1,500 coulombs tested immediately after either of the following curing schedules:

- Moisture cure specimens 56 days at 73°F.
- Moisture cure specimens 7 days at 73°F followed by 21 days at 100°F.

Table 10
Option 8 Testing and Mix Design Requirements

Scenario	ASTM C1260 Result		Testing Requirements for Mix Design Materials or Prescriptive Mix Design Options[1]
	Mix Design Fine Aggregate	Mix Design Coarse Aggregate	
A	> 0.10%	> 0.10%	Determine the dosage of SCMs needed to limit the 14-day expansion of each aggregate[2] to 0.08% when tested individually in accordance with ASTM C1567; or Use a minimum of 40% Class C fly ash with a maximum CaO^3 content of 25%.
B	≤ 0.10%	≤ 0.10%	Use a minimum of 40% Class C fly ash with a maximum CaO^3 content of 25%; or Use any ternary combination which replaces 35% to 50% of cement.
	≤ 0.10%	ASTM C1293 1 yr. Expansion ≤ 0.04%	Use a minimum of 20% of any Class C fly ash; or Use any ternary combination which replaces 35% to 50% of cement.
C	≤ 0.10%	> 0.10%	Determine the dosage of SCMs needed to limit the 14-day expansion of coarse and intermediate[2] aggregate to 0.08% when tested individually in accordance with ASTM C1567; or Use a minimum of 40% Class C fly ash with a maximum CaO^3 content of 25%.
D	> 0.10%	≤ 0.10%	Use a minimum of 40% Class C fly ash with a maximum CaO^3 content of 25%; or Use any ternary combination which replaces 35% to 50% of cement.
	> 0.10%	ASTM C1293 1 yr. Expansion ≤ 0.04%	Determine the dosage of SCMs needed to limit the 14-day expansion of fine aggregate to 0.08% when tested in accordance with ASTM C1567.

1. Do not use Class C fly ash if the ASTM C1260 value of the fine, intermediate, or coarse aggregate is 0.30% or greater, unless the fly ash is used as part of a ternary system.
2. Intermediate size aggregates will fall under the requirements of mix design coarse aggregate.
3. Average the CaO content from the previous ten values as listed on the mill certificate.

4.2.7. **Optimized Aggregate Gradation (OAG) Concrete.** The gradation requirements in Table 3 and Table 4 do not apply when OAG concrete is specified or used by the Contractor unless otherwise shown on the plans. Use Tex-470-A to establish the optimized aggregate gradation. Use at least 420 lb. per cubic yard of cementitious material when OAG concrete is used unless otherwise approved. Use a coarse aggregate with a maximum nominal size of 1-1/2 in. for Class P concrete. Use a coarse aggregate for all other classes of concrete with a maximum nominal size not larger than:

- 1/5 the narrowest dimension between sides of forms, or
- 1/3 the depth of slabs, or
- 3/4 the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, bundled tendons, or ducts.

Make necessary adjustments to individual aggregate stockpile proportions during OAG concrete production when the gradation deviates from the optimized gradation requirements.

4.2.8. **Self-Consolidating Concrete (SCC).** Provide SCC meeting the following requirements shown in Table 11 when approved for use in precast concrete. Use concrete with a slump flow that can be placed without vibration and will not segregate or excessively bleed.

Request approval to exceed the slump flow limits sufficiently in advance for proper evaluation by the Engineer.

Table 11
Mix Design Requirements for SCC

Tests	Test Method	Acceptable Limits
Slump Flow for Precast Concrete	ASTM C1611	22 to 27[1]
T_{50}, sec	ASTM C1611	2 to 7
VSI Rating	ASTM C1611	0 or 1
Passing Ability, in.	ASTM C1621	≤ 2
Segregation Column, %	ASTM C1610	≤ 10
Bleeding, %	ASTM C232	≤ 2.5

1. These slump flow limits are generally acceptable for most applications. However, slump flow limits may be adjusted during mix design approval process and when approved by the Engineer.

4.3. **Concrete Trial Batches.** Perform preliminary and final trial batches when required by the plans, or when previous satisfactory field data is not available. Submit previous satisfactory field data to the Engineer showing the proposed mix design conforms to specification requirements when trial batches are not required and before concrete is placed.

Perform preliminary and final trial batches for all self-consolidating concrete mix designs.

4.3.1. **Preliminary Trial Batches.** Perform all necessary preliminary trial batch testing when required, and provide documentation including mix design, material proportions, and test results substantiating the mix design conforms to specification requirements.

4.3.2. **Final Trial batches.** Make all final trial batches using the proposed ingredients in a mixer that is representative of the mixers to be used on the job when required. Make the batch size at least 50% of the mixer's rated capacity. Perform fresh concrete tests for air content and slump, and make, cure, and test strength specimens for compliance with specification requirements. Test at least one set of design strength specimens, consisting of 2 specimens per set, at 7-day, 28-day, and at least one additional age unless otherwise directed. Before placing, provide the Engineer the option of witnessing final trial batches, including the testing of the concrete. If not provided this option, the Engineer may require additional trial batches, including testing, before the concrete is placed.

Conduct all testing listed in Table 11 when performing trial batches for self-consolidating concrete. Make an additional mixture with 3% more water than the preliminary trial batch. Make necessary adjustments to the mix design if this additional mixture does not meet requirements of Table 11. Cast and evaluate mock-ups for precast concrete that are representative of the actual product as directed. Provide the Engineer the option of witnessing final trial batches, including the testing of the concrete and the casting of the mock-ups before placement. If not provided this option, the Engineer may require additional trial batches, including testing and mock-ups, before the concrete is placed.

Establish 7-day compressive strength target values using the following formula for each Class A, B, and E concrete mix designs to be used:

$$\text{Target value} = \text{Minimum design strength} \times \frac{\text{7 - day avg. trial batch strength}}{\text{28 - day avg. trial batch strength}}$$

Submit previous satisfactory field data, data from a new trial batch, or other evidence showing the change will not adversely affect the relevant properties of the concrete when changes are made to the type, brand, or source of aggregates, cement, SCM, water, or chemical admixtures. Submit the data for approval before making changes to the mix design. A change in vendor does not necessarily constitute a change in materials or source. The Engineer may waive new trial batches when there is a prior record of satisfactory performance with the ingredients. During concrete production, dosage changes of chemical admixtures used in the trial batches will not require a re-evaluation of the mix design.

The Contractor has the option of performing trial batches in conjunction with concrete placements except for SCC mixtures, when new trial batches are required during the course of the project. If the concrete fails to meet any requirement, the Engineer will determine acceptability and payment adjustments.

Establish the strength–maturity relationship in accordance with Tex-426-A when the maturity method is specified or permitted. When using the maturity method, any changes in any of the ingredients, including changes in proportions, will require the development of a new strength–maturity relationship for the mix.

4.3.3. **Mix Design of Record.** Once a trial batch or previously satisfactory field data substantiates the mix design, the proportions and mixing methods used become the mix design of record. Do not exceed mix design water-to-cementitious material ratio.

4.4. **Production Testing.**

4.4.1. **Aggregate Moisture Testing.** Determine moisture content per Tex-409-A or Tex-425-A for coarse, intermediate, and fine aggregates at least twice a week, when there is an apparent change, or for new shipments of aggregate. When aggregate hoppers or storage bins are equipped with properly maintained electronic moisture probes for continuous moisture determination, moisture tests per Tex-409-A or Tex-425-A are not required. Electronic moisture probes, however, must be verified at least every 90 days against Tex-409-A and be accurate to within 1.0% of the actual moisture content.

When producing SCC, and when aggregate hoppers or storage bins are not equipped with electric moisture probes, determine the moisture content of the aggregates before producing the first concrete batch each day. Thereafter, determine the moisture content every 4 hr. or when there is an apparent change while SCC is being produced.

4.4.2. **Aggregate Gradation Testing.** Perform a sieve analysis in accordance with Tex-401-A on each stockpile used in the blend at least one day before producing OAG concrete when producing optimized aggregate gradation concrete. Perform sieve analysis on each stockpile after every 10,000 cubic yards of OAG concrete produced. Provide sieve analysis data to the Engineer.

4.5. **Measurement of Materials.**

4.5.1. **Non-Volumetric Mixers.** Measure aggregates by weight. Correct batch weight measurements for aggregate moisture content. Measure mixing water, consisting of water added to the batch, ice added to the batch, water occurring as surface moisture on the aggregates, and water introduced in the form of admixtures, by volume or weight. Measure ice by weight. Measure cement and supplementary cementing materials in a hopper and on a separate scale from those used for other materials. Measure the cement first when measuring the cumulative weight. Measure concrete chemical admixtures by weight or volume. Measure batch materials within the tolerances of Table 12.

Table 12
Mix Design Batching Tolerances—Non-Volumetric Mixers

Material	Tolerance (%)
Cement, wt.	-1 to +3
SCM, wt.	-1 to +3
Cement + SCM (cumulative weighing), wt.	-1 to +3
Water, wt. or volume	±3[1]
Fine aggregate, wt.	±2
Coarse aggregate, wt.	±2
Fine + coarse aggregate (cumulative weighing), wt.	±1
Chemical admixtures, wt. or volume	±3

1. Allowable deviation from target weight not including water withheld or moisture in the aggregate. The Engineer will verify the water-to-cementitious material ratio is within specified limits.

Ensure the quantity measured, when measuring cementitious materials at less than 30% of scale capacity, is accurate to not less than the required amount and not more than 4% in excess. Ensure the cumulative quantity, when measuring aggregates in a cumulative weigh batcher at less than 30% of the scale capacity,

is measured accurate to ±0.3% of scale capacity or ±3% of the required cumulative weight, whichever is less.

Measure cement in number of bags under special circumstances when approved. Use the weights listed on the packaging. Weighing bags of cement is not required. Ensure fractional bags are not used except for small hand-mixed batches of approximately 5 cu. ft. or less and when an approved method of volumetric or weight measurement is used.

4.5.2. **Volumetric Mixers.** Provide an accurate method of measuring all ingredients by volume, and calibrate equipment to assure correct measurement of materials within the specified tolerances. Base tolerances on volume–weight relationship established by calibration, and measure the various ingredients within the tolerances of Table 13. Correct batch measurements for aggregate moisture content.

Table 13
Mix Design Batching Tolerances—Volumetric Mixers

Material	Tolerance
Cement, wt. %	0 to +4
SCM, wt. %	0 to +4
Fine aggregate, wt. %	±2
Coarse aggregate, wt. %	±2
Admixtures, wt. or volume %	±3
Water, wt. or volume %	±1

4.6. **Mixing and Delivering Concrete.**

4.6.1. **Mixing Concrete.** Operate mixers and agitators within the limits of the rated capacity and speed of rotation for mixing and agitation as designated by the manufacturer of the equipment. Provide concrete in a thoroughly mixed and uniform mass with a satisfactory degree of uniformity when tested in accordance with Tex-472-A.

Do not top-load new concrete onto returned concrete.

Adjust mixing times and batching operations as necessary when the concrete contains silica fume to ensure the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix will be verified by the Construction Division, Materials and Pavements Section, using cylinders made from trial batches. Make necessary changes to the batching operations, if uniform dispersion is not achieved, until uniform and complete dispersion of the silica fume is achieved.

Mix concrete by hand methods or in a small motor-driven mixer when permitted, for small placements of less than 2 cu. yd. For such placements, proportion the mix by volume or weight.

4.6.2. **Delivering Concrete.** Deliver concrete to the project in a thoroughly mixed and uniform mass, and discharge the concrete with a satisfactory degree of uniformity. Conduct testing in accordance with Tex-472-A when there is a reason to suspect the uniformity of concrete and as directed.

Maintain concrete delivery and placement rates sufficient to prevent cold joints.

Adding chemical admixtures or the portion of water withheld is only permitted at the jobsite, under the supervision of the Engineer, to adjust the slump or slump flow of the concrete. Do not add water or chemical admixtures to the batch after more than an amount needed to conduct slump testing has been discharged. Turn the drum or blades at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete. When this water is added, do not exceed the approved mix design water-to-cementitious material ratio.

Before unloading, furnish the delivery ticket for the batch of concrete containing the information required on Department Form 596, "Concrete Batch Ticket." The Engineer will verify all required information is provided on the delivery tickets. The Engineer may suspend concrete operations until the corrective actions are

implemented if delivery tickets do not provide the required information. The Engineer will verify the design water-to-cementitious material ratio is not exceeded.

Begin the discharge of concrete delivered in truck mixers within the times listed in Table 14. Concrete may be discharged after these times provided the concrete temperature and slump meet the requirements listed in this Item and other pertinent Items. Perform these tests with certified testing personnel per Section 421.4.8.1., "Certification of Testing Personnel." Provide the Engineer the option of witnessing testing of the concrete. If not provided this option, the Engineer may require additional testing before the concrete is placed.

Table 14
Concrete Discharge Times

Fresh Concrete Temperature, °F	Max Time After Batching for Concrete Not Containing Type B or D Admixtures, min.	Max Time After Batching for Concrete Containing Type B or D Admixtures,[1] min.
90 and above	45	75
75 ≤ T < 90	60	90
T < 75	90	120

1. Concrete must contain at least the minimum manufacturer's recommended dosage of Type B or D admixture.

4.7. **Placing, Finishing, and Curing Concrete.** Place, finish, and cure concrete in accordance with the pertinent Items.

4.8. **Sampling and Testing of Concrete.** Unless otherwise specified, all fresh and hardened concrete is subject to testing as follows:

4.8.1. **Certification of Testing Personnel.** Contractor personnel performing testing must be either ACI-certified or qualified by a Department-recognized equivalent written and performance testing program for the tests being performed. Personnel performing these tests are subject to Department approval. Use of a commercial laboratory is permitted at the Contractor's option. All personnel performing testing using the maturity method must be qualified by a training program recognized by the Department before using this method on the job.

4.8.2. **Fresh Concrete.** Provide safe access and assistance to the Engineer during sampling. Fresh concrete will be sampled for testing at the discharge end if using belt conveyors or pumps. When it is impractical to sample at the discharge end, a sample will be taken at the time of discharge from the delivery equipment and correlation testing will be performed and documented to ensure specification requirements are met at the discharge end.

4.8.3. **Testing of Fresh Concrete.** Test for the fresh properties listed in Table 15.

Table 15
Fresh Concrete Tests

Tests	Test Methods
Slump[1]	Tex-415-A
Temperature[1]	Tex-422-A
Air Content[1,2]	Tex-414-A, Tex-416-A or ASTM C457

1. Job-control testing performed by the Contractor.
2. Only required when air-entrained concrete is specified on the plans.

Concrete with a slump lower than the minimum placement slump in Table 9 after the addition of all water withheld, or concrete exhibiting segregation and excessive bleeding will be rejected.

4.8.3.1. **Job-Control Testing.** Perform job-control testing as specified in Table 16 unless otherwise specified. Provide the Engineer the opportunity to witness the testing. The Engineer may require a retest if not given the opportunity to witness. Immediately notify the Engineer of any nonconformity issues. Furnish a copy of all test results to the Engineer daily.

Table 16
Job-Control Testing Frequencies

Concrete Placements	Frequency
Bridge Deck Placements	Test the first few loads, then every 60 cu. yd. or fraction thereof.
All Other Structural Class Concrete Placements	One test every 60 cu. yd. or fraction thereof per class per day.
Non-Structural Class Concrete Placements	One test every 180 cu. yd. or fraction thereof.

Immediately resample and retest the concrete slump when the concrete exceeds the slump range at time of placement. If the concrete exceeds the slump range after the retest, and is used at the Contractor's option, the Engineer will make strength specimens as specified in Article 421.5., "Acceptance of Concrete."

4.8.3.2. **Strength Specimen Handling.** Remove specimens from their molds and deliver Department test specimens to curing facilities within 24 to 48 hr. after molding, in accordance with pertinent test procedures unless otherwise shown on the plans or directed. Clean and prepare molds for reuse if necessary.

5. ACCEPTANCE OF CONCRETE

The Engineer will sample and test the fresh and hardened concrete for acceptance. The test results will be reported to the Contractor and the concrete supplier. Investigate the quality of the materials, the concrete production operations, and other possible problem areas to determine the cause for any concrete that fails to meet the required strengths as outlined below. Take necessary actions to correct the problem including redesign of the concrete mix. The Engineer may suspend all concrete operations under the pertinent Items if the Contractor is unable to identify, document, and correct the cause of the low strengths in a timely manner. Resume concrete operations only after obtaining approval for any proposed corrective actions. Concrete failing to meet the required strength as outlined below will be evaluated using the procedures listed in Article 421.6., "Measurement and Payment."

5.1. **Structural Class of Concrete.** For concrete classes identified as structural concrete in Table 8, the Engineer will make and test 7-day and 28-day specimens. Acceptance will be based on attaining the design strength given in Table 8.

5.2. **Class P and Class HES.** The Engineer will base acceptance in accordance with Item 360, "Concrete Pavement," and Item 361, "Repair of Concrete Pavement."

5.3. **All Other Classes of Concrete.** For concrete classes not identified as structural concrete in Table 8, the Engineer will make and test 7-day specimens. The Engineer will base acceptance on the 7-day target value established in accordance with Section 421.4.3., "Concrete Trial Batches."

6. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.

The following procedure will be used to evaluate concrete where one or more project acceptance test specimens fail to meet the required design strength specified in this Item or on the plans:

- The concrete for a given placement will be considered structurally adequate and accepted at full price if the average of all test results for specimens made at the time of placement meets the required design strength provided no single test result is less than 85% of the required design strength.
- The Engineer will perform a structural review of the concrete to determine its adequacy to remain in service if the average of all test results for specimens made at the time of placement is less than the required design strength or if any test results are less than 85% of the required design strength. If the in-situ concrete strength is needed for the structural review, take cores at locations designated by the

Engineer in accordance with Tex-424-A. The Engineer will test the cores. The coring and testing will be at the Contractor's expense.

- If all of the tested cores meet the required design strength, the concrete will be paid for at full price.
- If any of the tested cores do not meet the required design strength, but the average strength attained is determined to be structurally adequate, the Engineer will determine the limits of the payment adjustment using the following formula:

$$A = B_p\left[-5.37\left(\frac{S_a}{S_s}\right)^2 + 11.69\left(\frac{S_a}{S_s}\right) - 5.32\right]$$

where:
A = Amount to be paid per unit of measure for the entire placement in question
S_a = Actual average strength from cylinders or cores. Use values from cores, if taken.
S_s = Minimum required strength (specified)
B_p = Unit Bid Price

- If the structural review determines the concrete is not adequate to remain in service, the Engineer will determine the limits of the concrete to be removed.
- The decision to reject structurally inadequate concrete or to apply the payment adjustment factor will be made no later than 56 days after placement.

Item 440
Reinforcement for Concrete

1. DESCRIPTION

Furnish and place reinforcement of the type, size, and details shown on the plans.

2. MATERIALS

Use deformed steel bar reinforcement unless otherwise specified or allowed.

2.1. **Approved Mills.** Before furnishing steel, producing mills of reinforcing steel for the Department must be pre-approved in accordance with DMS-7320, "Qualification Procedure for Reinforcing Steel Producing Mills," by the Construction Division. The Department's MPL has a list of approved producing mills. Reinforcing steel obtained from unapproved sources will not be accepted.

Contact the Construction Division with the name and location of the producing mill for stainless reinforcing steel, low carbon/chromium reinforcing steel, or dual-coated reinforcing steel at least 4 weeks before ordering any material.

2.2. **Deformed Steel Bar Reinforcement.** Provide deformed reinforcing steel conforming to one of the following:

- ASTM A615, Grades 60, 75, or 80;
- ASTM A996, Type A, Grade 60;
- ASTM A996, Type R, Grade 60, permitted in concrete pavement only (Furnish ASTM A996, Type R bars as straight bars only and do not bend them. Bend tests are not required.); or
- ASTM A706, Grades 60 or 80.

Provide the grade of reinforcing steel shown on the plans. Provide Grade 60 if no grade is shown.

The nominal size, area, and weight of reinforcing steel bars this Item covers are shown in Table 1.

Table 1
Size, Area, and Weight of Reinforcing Steel Bars

Bar Size Number	Diameter (in.)	Area (sq. in.)	Weight per Foot (lbs.)
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	7.650
18	2.257	4.00	13.60

2.3. **Smooth Steel Bar Reinforcement.** Provide smooth bars for concrete pavement with a yield strength of at least 60 ksi and meeting ASTM A615. Provide steel conforming to ASTM A615 or meet the physical requirements of ASTM A36 for smooth bars that are larger than No. 3. Designate smooth bars by size number up to No. 4 and by diameter in inches above No. 4.

2.4. **Spiral Reinforcement**. Provide bars or wire for spiral reinforcement of the grade and minimum size or gauge shown on the plans.

Provide smooth or deformed wire conforming to ASTM A1064. Provide bars conforming to ASTM A615; ASTM A996, Type A; or ASTM A675, Grade 80, meeting dimensional requirements of ASTM A615.

2.5. **Weldable Reinforcing Steel**. Provide reinforcing steel conforming to ASTM A706 or with a maximum carbon equivalent (C.E.) of 0.55% if welding of reinforcing steel is required or desired. Provide a report showing the percentages of elements necessary to establish C.E. for reinforcing steel that does not meet ASTM A706, in order to be structurally welded. These requirements do not pertain to miscellaneous welds on reinforcing steel as defined in Section 448.4.2.1.1., "Miscellaneous Welding Applications."

Calculate C.E. using the following formula:

$$C.E. = \%C + \frac{\%Mn}{6} + \frac{\%Cu}{40} + \frac{\%Ni}{20} + \frac{\%Cr}{10} - \frac{\%Mo}{50} - \frac{\%V}{10}$$

Do not weld stainless reinforcing steel without permission from the Engineer. Provide stainless reinforcing steel suitable for welding, if required, and submit welding procedures and electrodes to the Engineer for approval.

2.6. **Welded Wire Reinforcement**. Provide welded wire reinforcement (WWR) conforming to ASTM A1064. Observe the relations shown in Table 2 among size number, diameter in inches, and area when ordering wire by size numbers, unless otherwise specified. Precede the size number for deformed wire with "D" and for smooth wire with "W."

Designate WWR as shown in the following example: 6 × 12 – W16 × W8 (indicating 6-in. longitudinal wire spacing and 12-in. transverse wire spacing with smooth No. 16 wire longitudinally and smooth No. 8 wire transversely).

Table 2
Wire Size Number, Diameter, and Area

Size Number (in.)	Diameter (in.)	Area (sq. in.)
31	0.628	0.310
30	0.618	0.300
28	0.597	0.280
26	0.575	0.260
24	0.553	0.240
22	0.529	0.220
20	0.505	0.200
18	0.479	0.180
16	0.451	0.160
14	0.422	0.140
12	0.391	0.120
10	0.357	0.100
8	0.319	0.080
7	0.299	0.070
6	0.276	0.060
5.5	0.265	0.055
5	0.252	0.050
4.5	0.239	0.045
4	0.226	0.040
3.5	0.211	0.035
2.9	0.192	0.035
2.5	0.178	0.025
2	0.160	0.020
1.4	0.134	0.014
1.2	0.124	0.012
0.5	0.080	0.005

Note—Size numbers (in.) are the nominal cross-sectional area of the wire in hundredths of a square inch. Fractional sizes between the sizes listed above are also available and acceptable for use.

2.7. **Epoxy Coating**. Provide epoxy coated reinforcing steel as shown on the plans. Before furnishing epoxy coated reinforcing steel, an epoxy applicator must be pre-approved in accordance with DMS-7330, "Qualification Procedure for Reinforcing Steel Epoxy Coating Applicators." The Department's MPL has a list of approved applicators.

Furnish coated reinforcing steel meeting the requirements in Table 3.

Table 3
Epoxy Coating Requirements for Reinforcing Steel

Material	Specification
Bar	ASTM A775 or A934
Wire or WWR	ASTM A884 Class A or B
Mechanical couplers	As shown on the plans
Hardware	As shown on the plans

Use epoxy coating material and coating repair material that complies with DMS-8130, "Epoxy Powder Coating for Reinforcing Steel." Patch no more than 1/4-in. total length in any foot at the applicator's plant.

Maintain identification of all reinforcing steel throughout the coating and fabrication process and until delivery to the project site.

Furnish 1 copy of a written certification verifying the coated reinforcing steel meets the requirements of this Item and 1 copy of the manufacturer's control tests.

2.8. **Mechanical Couplers**. Use couplers of the type specified in DMS-4510, "Mechanical Couplers for Reinforcing Steel," Article 4510.5.A, "General Requirements," when mechanical splices in reinforcing steel bars are shown on the plans.

Furnish only couplers pre-qualified in accordance with DMS-4510, "Mechanical Couplers for Reinforcing Steel." Ensure sleeve-wedge type couplers are not used on coated reinforcing. Sample and test couplers for use on individual projects in accordance with DMS-4510, "Mechanical Couplers for Reinforcing Steel." Furnish couplers only at locations shown on the plans.

Furnish couplers for stainless reinforcing steel with the same alloy designation as the reinforcing steel.

2.9. **Fibers.** Supply fibers conforming to DMS-4550 "Fibers for Concrete" at the minimum dosage listed in the Department's MPL, when allowed by the plans. Use non-metallic fibers when shown on the plans.

2.10. **Stainless Reinforcing Steel.** Provide deformed steel bars of the types listed in Table 4 and conforming to ASTM A955, Grade 60 or higher when stainless reinforcing steel is required on the plans.

Table 4
Acceptable Types of Deformed Stainless Steel Bar

UNS Designation	S31653	S31803	S24100	S32304
AISI Type	316LN	2205	XM-28	2304

2.11. **Low Carbon/Chromium Reinforcing Steel.** Provide deformed steel bars conforming to ASTM A1035, Grade 100 when low carbon/chromium reinforcing steel is required on the plans.

2.12. **Dual-Coated Reinforcing Steel.** Provide deformed bars conforming to ASTM A1055, Grade 60 or higher when dual-coated reinforcing steel is required on the plans.

2.13. **Glass Fiber Reinforced Polymer Bars (GFRP).** Provide bars conforming to the AASHTO LRFD *Bridge Design Guide Specifications for GFRP-Reinforced Concrete Bridge Decks and Traffic Railings*, Section 4, "Material Specifications" when GFRP bars are required on the plans. Provide sample certification demonstrating the GFRP bar supplier has produced bar that meets the Material Specifications 2 mo. before fabrication. Furnish certification upon shipment that the GFRP bar supplied meets the Material Specifications.

3. CONSTRUCTION

3.1. **Bending.** Fabricate reinforcing steel bars as prescribed in the CRSI *Manual of Standard Practice* to the shapes and dimensions shown on the plans. Fabricate in the shop if possible. Field-fabricate, if permitted, using a method approved by the Engineer. Replace improperly fabricated, damaged, or broken bars at no additional expense to the Department. Repair damaged or broken bars embedded in a previous concrete placement using a method approved by the Engineer.

Unless otherwise shown on the plans, the inside diameter of bar bends, in terms of the nominal bar diameter (d), must be as shown in Table 5.

Table 5
Minimum Inside Diameter of Bar Bends

Bend	Bar Size Number (in.)	Pin Diameter
Bends of 90° and greater in stirrups, ties, and other secondary bars that enclose another bar in the bend	3, 4, 5	4d
	6, 7, 8	6d
Bends in main bars and in secondary bars not covered above	3 through 8	6d
	9, 10, 11	8d
	14, 18	10d

Bend-test representative specimens as described for smaller bars in the applicable ASTM specification where bending No. 14 or No. 18 Grade 60 bars is required. Make the required 90° bend around a pin with a diameter of 10 times the nominal diameter of the bar.

Bend stainless reinforcing steel in accordance with ASTM A955.

3.2. **Tolerances.** Fabrication tolerances for bars are shown in Figure 1.

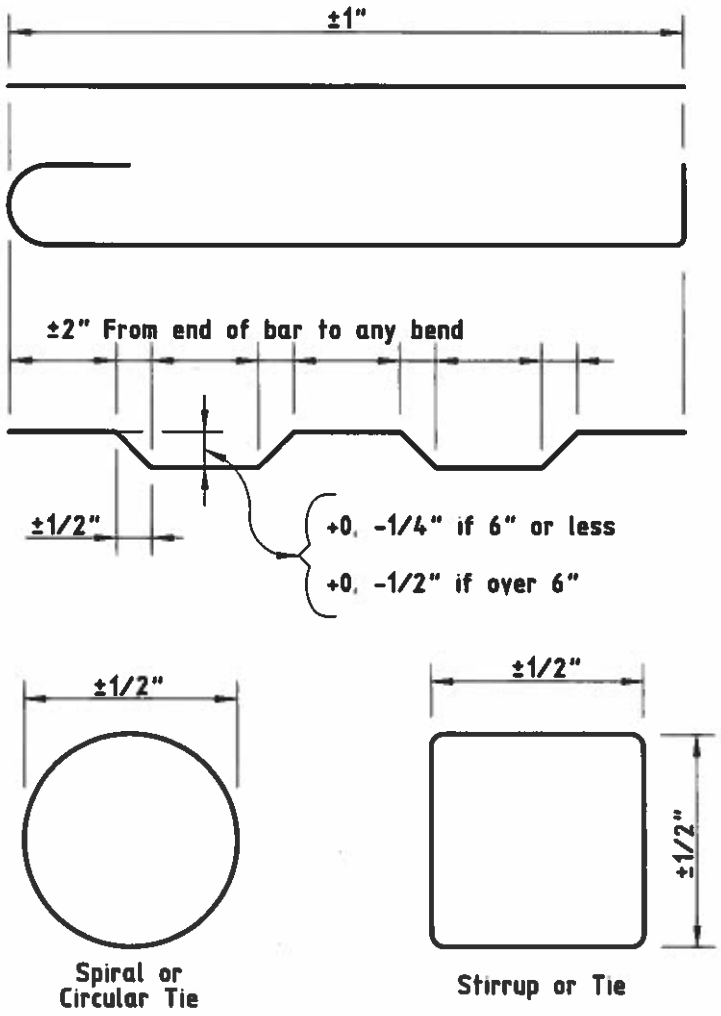

Figure 1
Fabrication Tolerances for Bars

3.3. **Storage.** Store reinforcement above the ground on platforms, skids, or other supports, and protect it from damage and deterioration. Ensure reinforcement is free from dirt, paint, grease, oil, and other foreign materials when it is placed in the work. Use reinforcement free from defects such as cracks and delaminations. Rust, surface seams, surface irregularities, or mill scale will not be cause for rejection if the minimum cross-sectional area of a hand wire-brushed specimen meets the requirements for the size of steel specified.

Do not allow stainless reinforcing steel to be in direct contact with uncoated reinforcing steel, nor with galvanized reinforcing steel. This does not apply to stainless steel wires and ties. Store stainless reinforcing steel separately, off the ground on wooden supports.

3.4. **Splices.** Lap-splice, weld-splice, or mechanically splice bars as shown on the plans. Additional splices not shown on the plans will require approval. Splices not shown on the plans will be permitted in slabs no more than 15 in. in thickness, columns, walls, and parapets.

- Do not splice bars less than 30 ft. in plan length unless otherwise approved. For bars exceeding 30 ft. in plan length, the distance center-to-center of splices must be at least 30 ft. minus 1 splice length, with no more than 1 individual bar length less than 10 ft. Make lap splices not shown on the plans, but otherwise

permitted, in accordance with Table 6. Maintain the specified concrete cover and spacing at splices, and place the lap-spliced bars in contact, securely tied together.

Table 6
Minimum Lap Requirements for Steel Bar Sizes through No. 11

Bar Size Number (in.)	Uncoated Lap Length	Coated Lap Length
3	1 ft. 4 in.	2 ft. 0 in.
4	1 ft. 9 in.	2 ft. 8 in.
5	2 ft. 2 in.	3 ft. 3 in.
6	2 ft. 7 in.	3 ft. 11 in.
7	3 ft. 5 in.	5 ft. 2 in.
8	4 ft. 6 in.	6 ft. 9 in.
9	5 ft. 8 in.	8 ft. 6 in.
10	7 ft. 3 in.	10 ft. 11 in.
11	8 ft. 11 in.	13 ft. 5 in.

- Do not lap No. 14 or No. 18 bars.
- Lap spiral steel at least 1 turn.
- Splice WWR using a lap length that includes the overlap of at least 2 cross wires plus 2 in. on each sheet or roll. Splices using bars that develop equivalent strength and are lapped in accordance with Table 6 are permitted.
- Lap the existing longitudinal bars with the new bars as shown in Table 6 for box culvert extensions with less than 1 ft. of fill. Lap at least 1 ft. 0 in. for extensions with more than 1 ft. of fill.
- Ensure welded splices conform to the requirements of the plans and of Item 448, "Structural Field Welding." Field-prepare ends of reinforcing bars if they will be butt-welded. Delivered bars must be long enough to permit weld preparation.
- Install mechanical coupling devices in accordance with the manufacturer's recommendations at locations shown on the plans. Protect threaded male or female connections, and ensure the threaded connections are clean when making the connection. Do not repair damaged threads.
- Mechanical coupler alternate equivalent strength arrangements, to be accomplished by substituting larger bar sizes or more bars, will be considered if approved in writing before fabrication of the systems.

3.5. **Placing.** Place reinforcement as near as possible to the position shown on the plans. Do not vary bars from plan placement by more than 1/12 of the spacing between bars in the plane of the bar parallel to the nearest surface of concrete. Do not vary bars from plan placement by more than 1/4 in in the plane of the bar perpendicular to the nearest surface of concrete. Provide a minimum 1-in. clear cover of concrete to the nearest surface of bar unless otherwise shown on the plans.

For bridge slabs, the clear cover tolerance for the top mat of reinforcement is −0, +1/2 in.

Locate the reinforcement accurately in the forms, and hold it firmly in place before and during concrete placement by means of bar supports that are adequate in strength and number to prevent displacement and keep the reinforcement at the proper distance from the forms. Provide bar supports in accordance with the CRSI *Manual of Standard Practice*. Use Class 1 supports, approved plastic bar supports, precast mortar, or concrete blocks when supports are in contact with removable or stay-in-place forms. Use Class 3 supports in slab overlays on concrete panels or on existing concrete slabs. Bar supports in contact with soil or subgrade must be approved.

Use Class 1A supports with epoxy coated reinforcing steel. Provide epoxy or plastic coated tie wires and clips for use with epoxy coated reinforcing steel.

Use mortar or concrete with a minimum compressive strength of 5,000 psi for precast bar supports. Provide a suitable tie wire in each block for anchoring to the bar.

Place individual bar supports in rows at 4-ft. maximum spacing in each direction. Place continuous type bar supports at 4-ft. maximum spacing. Use continuous bar supports with permanent metal deck forms.

The exposure of the ends of longitudinals, stirrups, and spacers used to position the reinforcement in concrete pipe and storm drains is not cause for rejection.

Tie reinforcement for bridge slabs and top slabs of direct traffic culverts at all intersections, except tie only alternate intersections where spacing is less than 1 ft. in each direction. Tie the bars at enough intersections to provide a rigid cage of reinforcement for reinforcement cages for other structural members. Fasten mats of WWR securely at the ends and edges.

Clean mortar, mud, dirt, debris, oil, and other foreign material from the reinforcement before concrete placement. Do not place concrete until authorized.

Stop placement until corrective measures are taken if reinforcement is not adequately supported or tied to resist settlement, reinforcement is floating upward, truss bars are overturning, or movement is detected in any direction during concrete placement.

3.6. **Handling, Placing, and Repairing Epoxy Coated Reinforcing Steel.**

3.6.1. **Handling.** Provide systems for handling coated reinforcing steel with padded contact areas. Pad bundling bands or use suitable banding to prevent damage to the coating. Lift bundles of coated reinforcement with a strongback, spreader bar, multiple supports, or a platform bridge. Transport the bundled reinforcement carefully, and store it on protective cribbing. Do not drop or drag the coated reinforcement.

3.6.2. **Placing.** Do not flame-cut coated reinforcement. Saw or shear-cut only when approved. Coat cut ends as specified in Section 440.3.6.3., "Repairing Coating."

Do not weld or mechanically couple coated reinforcing steel except where specifically shown on the plans. Remove the epoxy coating at least 6 in. beyond the weld limits before welding and 2 in. beyond the limits of the coupler before assembly. Clean the steel of oil, grease, moisture, dirt, welding contamination (slag or acid residue), and rust to a near-white finish after welding or coupling. Check the existing epoxy for damage. Remove any damaged or loose epoxy back to sound epoxy coating.

Coat the splice area after cleaning with epoxy repair material to a thickness of 7 to 17 mils after curing. Apply a second application of repair material to the bar and coupler interface to ensure complete sealing of the joint.

3.6.3. **Repairing Coating.** Use material that complies with the requirements of this Item and ASTM D3963 for repairing of the coating. Make repairs in accordance with procedures recommended by the manufacturer of the epoxy coating powder. Apply at least the same coating thickness as required for the original coating for areas to be patched. Repair all visible damage to the coating.

Repair sawed and sheared ends, cuts, breaks, and other damage promptly before additional oxidation occurs. Clean areas to be repaired to ensure they are free from surface contaminants. Make repairs in the shop or field as required.

3.7. **Handling and Placing Stainless Reinforcing Steel.** Handle, cut, and place stainless reinforcing steel bar using tools that are not used on carbon steel. Do not use carbon steel tools, chains, slings, etc. when handling stainless steel. Use only nylon or polypropylene slings. Cut stainless steel reinforcing using shears, saws, abrasive cutoff wheels, or torches. Remove any thermal oxidation using pickling paste. Do not field bend stainless steel reinforcing without approval.

Use 16 gauge fully annealed stainless steel tie wire conforming to the material properties listed in Section 440.2.10., "Stainless Reinforcing Steel." Support all stainless reinforcing steel on solid plastic, stainless steel, or epoxy coated steel chairs. Do not use uncoated carbon steel chairs in contact with stainless reinforcing steel.

3.8. **Bending, Handling, Repairing, and Placing GFRP Bars.** Fabricate, handle, repair, and place GFRP bars in accordance with the AASHTO LRFD Bridge Design Guide Specifications for GFRP-Reinforced Concrete Bridge Decks and Traffic Railings, Section 5, Construction Specifications.

4. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be considered subsidiary to pertinent Items.

Item 441
Steel Structures

1. DESCRIPTION

Fabricate and erect structural steel and other metals used for steel structures or for steel portions of structures.

2. MATERIALS

2.1. **Base Metal**. Use metal that meets Item 442, "Metal for Structures."

2.2. **Approved Electrodes and Flux-Electrode Combinations**. Use only electrodes and flux-electrode combinations found on the Department's MPL. To request a product be added to this list or to renew an expired approval, electronically submit a current Certificate of Conformance containing all tests required by the applicable AWS A5 specification according to the applicable welding code (for most construction, AASHTO/AWS D1.5, *Bridge Welding Code*, or AWS D1.1, *Structural Welding Code—Steel*) to the Construction Division.

2.3. **High-Strength Bolts**. Use fasteners that meet Item 447, "Structural Bolting." Use galvanized fasteners on field connections of bridge members when ASTM A325 bolts are specified and steel is painted.

2.4. **Paint Systems**. Provide the paint system (surface preparation, primer, intermediate, and appearance coats as required) shown on the plans. Provide System IV if no system is specified.

2.4.1. **Standard Paint Systems**. Standard paint systems for painting new steel include the following:

2.4.1.1. **System III-B**. Provide paint in accordance with DMS-8101, "Structural Steel Paints-Performance." Provide inorganic zinc (IOZ) prime coat, epoxy intermediate coat, and urethane appearance coat for all outer surfaces except those to be in contact with concrete. Provide epoxy zinc prime coat for touchup of IOZ.

2.4.1.2. **System IV**. Provide paint in accordance with DMS-8101, "Structural Steel Paints-Performance." Provide IOZ prime coat and acrylic latex appearance coat for all outer surfaces except those to be in contact with concrete. Provide epoxy zinc prime coat for touchup of IOZ.

2.4.2. **Paint Inside Tub Girders and Closed Boxes**. Provide a white polyamide cured epoxy for all interior surfaces, including splice plate but excluding the faying surfaces, unless otherwise shown on the plans. Provide IOZ primer meeting the requirements of DMS-8101, "Structural Steel Paints—Performance," to all interior faying surfaces and splice plates.

2.4.3. **Special Protection System**. Provide the type of paint system shown on the plans or in special provisions to this Item. Special Protection Systems must have completed NTPEP Structural Steel Coatings (SSC) testing regimen as a complete system, with full data available through NTPEP.

2.4.4. **Galvanizing**. Provide galvanizing, as required, in accordance with Item 445, "Galvanizing."

2.4.5. **Paint over Galvanizing**. Paint over galvanized surfaces, when required, in accordance with Item 445, "Galvanizing."

2.4.6. **Field Painting**. Provide field paint, as required, in accordance with Item 446, "Field Cleaning and Painting Steel."

3. CONSTRUCTION

3.1. General Requirements.

3.1.1. Applicable Codes. Perform all fabrication of bridge members in accordance with AASHTO/NSBA Steel Bridge Collaboration S2.1. Follow all applicable provisions of the appropriate AWS code (D1.5 or D1.1) except as otherwise noted on the plans or in this Item. Weld sheet steel (thinner than 1/8 in.) in accordance with ANSI/AWS D1.3, Structural Welding Code—Sheet Steel. Unless otherwise stated, requirements of this Item are in addition to the requirements of S2.1 for bridge members. Follow the more stringent requirement in case of a conflict between this Item and S2.1. Perform all bolting in accordance with Item 447, "Structural Bolting."

Fabricate railroad underpass structures in accordance with the latest AREMA *Manual for Railway Engineering* and this Item. In the case of a conflict between this Item and the AREMA manual, the more stringent requirements apply.

3.1.2. Notice of Fabrication. Give adequate notice before commencing fabrication work as specified in Table 1. Include a schedule for all major fabrication processes and dates when inspections are to occur.

Table 1
Notice of Beginning Work

Plant Location	Notice Required
In Texas	7 days
In the contiguous United States	21 days
Outside the contiguous United States	60 days

Perform no Department work in the plant before the Engineer authorizes fabrication. The Contractor must bear all Department travel costs when changes to their fabrication or inspection schedules are not adequately conveyed to the Department.

When any structural steel is fabricated outside of the contiguous 48 states, the additional cost of inspection will be in accordance with Article 6.4., "Sampling, Testing, and Inspection."

3.1.3. Bridge Members. Primary bridge members include:

- web and flanges of plate, tub, and box girders;
- rolled beams and cover plates;
- floor beam webs and flanges;
- arch ribs and arch tie beams or girders;
- truss members;
- diaphragm members for curved plate girders or beams;
- pier diaphragm members for tub girders;
- splice plates for primary members; and
- any other member designated as "primary" or "main" on the plans.

Secondary bridge members include:

- bracing (diaphragms, cross frames, and lateral bracing); and
- all other miscellaneous bridge items not considered primary bridge members.

3.1.4. Responsibility. The Contractor is responsible for the correctness and completeness of shop drawings and for the fit of shop and field connections.

3.1.5. **Qualification of Plants and Personnel.**

3.1.5.1. **Plants.** Fabrication plants that produce bridge members must be approved in accordance with DMS-7370, "Steel Bridge Member Fabrication Plant Qualification." The Department's MPL has a list of approved bridge member fabrication plants.

Fabrication plants that produce non-bridge steel members listed below must be approved in accordance with DMS-7380, "Steel Non-Bridge Member Fabrication Plant Qualification." The Construction Division maintains a list of approved non-bridge fabrication plants for the following items:

- Roadway Illumination Poles,
- High Mast Illumination Poles,
- High Mast Rings and Support Assemblies,
- Overhead Sign Support Structures,
- Traffic Signal Poles, and
- Intelligent Transportation System (ITS) Poles

The Department will evaluate non-bridge member fabrication plants for competence of the plant, equipment, organization, experience, knowledge, and personnel to produce acceptable work.

3.1.5.2. **Personnel.** Provide a QC staff qualified in accordance with the applicable AWS code. Provide an adequate number of qualified QC personnel for each specific production operation. QC must be on-site and independent of production personnel, as the Engineer determines. QC personnel must be proficient in utilizing the applicable plans, specifications, and test methods, and in verifying compliance with the plant QC and production procedures. Welding inspectors must be current AWS Certified Welding Inspectors for bridge member plants, and for non-bridge member plants requiring Department approval per DMS-7380, "Steel Non-Bridge Member Fabrication Plant Qualification." The QC staff must provide inspection of all materials and workmanship before the Department's inspection. Provide the Department inspector with adequate personnel and equipment needed to move material for inspection access. QC is solely the Contractor's responsibility.

3.1.5.3. **Nondestructive Testing (NDT).** Personnel performing NDT must be qualified in accordance with the applicable AWS code and the employer's Written Practice. Level III personnel who qualify AS Level I and Level II inspectors must be certified by ASNT for which the NDT Level III is qualified. Testing agencies and individual third-party contractors must also successfully complete periodic audits for compliance, performed by the Department. In addition, ultrasound technicians must pass a hands-on test the Construction Division administers. This will remain current provided they continue to perform testing on Department materials as evidenced by test reports requiring their signature. A technician who fails the hands-on test must wait 6 months before taking the test again. Qualification to perform ultrasonic testing will be revoked when the technician's employment is terminated or when the technician goes 6 months without performing a test on a Department project. The technician must pass a new hands-on test to be re-certified.

3.1.5.4. **Welding Procedure Specifications Qualification Testing.** For bridge member fabrication, laboratories performing welding procedure specifications (WPSs) qualified by testing must be approved in accordance with DMS-7360, "Qualification Procedure for Laboratories Performing Welding Procedure Qualification Testing." The Department's MPL has a list of laboratories approved to perform WPS qualification testing.

3.1.6. **Drawings.**

3.1.6.1. **Erection Drawings.** Submit erection drawings prepared by a licensed professional engineer, including calculations, for approval in accordance with Item 5, "Control of the Work," at least 4 weeks before erecting any portion of field-spliced (welded or bolted) girders, railroad underpasses, trusses, arches, or other members for which erection drawings are required on the plans. Include drawings and calculations for any temporary structures used to support partially erected members. Erection drawings are not required for rolled I-beam units unless otherwise noted on the plans.

Prepare erection drawings following the procedures outlined in Section 2.2 of the AASHTO/NSBA Steel Bridge Collaboration S10.1. As a minimum, include:

- plan of work area showing structure location relative to supports and all obstructions;
- equipment to be used including allowable load information;
- erection sequence for all pieces;
- member weights and center of gravity location of pieces to be lifted;
- locations of cranes, holding cranes, and temporary supports (falsework), including when to release load from temporary supports and holding cranes;
- details of falsework including specific bracing requirements with maximum allowable design wind speed clearly indicated;
- girder lifting points;
- diaphragm and bracing requirements; and
- minimum connection requirements when more than the standard requirements.

Perform girder erection analyses using UT-Lift and UT-Bridge software available on the Department's website or other suitable commercial software. Ensure temporary stresses in members being erected will not cause permanent damage and that stability is maintained throughout the erection operations. Provide actual input files and output results from UT-Lift and UT-Bridge, or graphical and hard copy results from commercial software programs.

Do not proceed if site conditions differing from those depicted on the approved erection drawings could affect temporary support stresses, erected girders, or public safety in any manner. Revise erection drawings and resubmit to the Engineer for approval before proceeding if site conditions could affect these things.

3.1.6.2. **Shop Drawings.** Prepare and electronically submit shop drawings before fabrication for each detail of the general plans requiring the use of structural steel, forgings, wrought iron, or castings as documented in the *Guide to Electronic Shop Drawing Submittal* available on the Bridge Division website and as directed for other items the standard specifications require.

Indicate joint details on shop drawings for all welds. Provide a title block on each sheet in the lower right corner that includes:

- project identification data including federal and state project numbers,
- sheet numbering for the shop drawings,
- name of the structure or stream for bridge structures,
- name of owner or developer,
- name of the fabricator or supplier, and
- name of the Contractor.

Provide one set of 11 × 17-in. approved shop drawings in hardcopy to the Department for the inspector at the fabrication plant.

3.1.6.2.1. **Bridge Members.** Prepare drawings in accordance with AASHTO/NSBA Steel Bridge Collaboration G1.3, "Shop Detail Drawing Presentation" unless otherwise approved. Print a bill of material on each sheet, including the Charpy V-Notch (CVN) and fracture-critical requirements, if any, for each piece. Indicate fracture-critical areas of members.

3.1.6.2.2. **Non-Bridge Members.** Furnish shop drawings for non-bridge members when required by the plans or pertinent Items.

3.1.7. **Welding Procedure Specifications (WPSs).** Submit WPSs and test reports in accordance with the applicable AWS code to the Construction Division before fabrication begins, and notify the Engineer which procedures will be used for each joint or joint type. Do not begin fabrication until the Engineer approves WPSs.

Post the approved WPSs for the welding being performed on each welding machine, or use another approved method of ensuring the welder has access to the procedure information at all times.

3.1.8. **Documentation**. Before beginning fabrication, provide a completed Material Statement Form 1818 (a.k.a. D-9-USA-1) with supporting documentation (such as mill test reports (MTRs)) that the producing mill issues and qualified personnel verifies. Ensure the documentation legibly reflects all information the applicable ASTM specifications require. Supply documents electronically to the Department.

Provide a copy of the shipping or storage invoice, as material is shipped or placed in approved storage that reflects:

- member piece mark identification and calculated weight per piece from the contract drawings,
- number of pieces shipped or in storage,
- total calculated weight for each invoice per bid item, and
- the unique identification number of the shipping or storage invoice.

The inspector's acceptance of material or finished members will not prohibit subsequent rejection if the material or members are found to be damaged or defective. Replace rejected material promptly.

3.1.9. **Material Identification**. Assembly-mark individual pieces and issue cutting instructions to the shop using a system that will maintain identity of the original piece.

Identify structural steel by standard and grade of steel. Also differentiate between material toughness requirements (CVN, fracture-critical) as well as any other special physical requirements. In addition, identify structural steel for primary members by mill identification numbers (heat numbers). Use an approved identification system. Use either paint or low-stress stencils to make identification markings on the metal. Mark the material as soon as it enters the shop and carry the markings on all pieces through final fabrication. Transfer the markings before cutting steel for primary members of bridge structures into smaller pieces. Loss of identification marking on any piece, with no other positive identification, or loss of heat number identification on any primary member piece will render the piece unacceptable for use. Unidentifiable material may be approved for use after testing to establish acceptability to the satisfaction of the Engineer. Have an approved testing facility perform testing and a licensed professional engineer sign and seal the results.

3.2. **Welding**.

3.2.1. **Details**.

3.2.1.1. **Rolled Edges**. Trim plates with rolled edges used for webs by thermal cutting.

3.2.1.2. **Weld Tabs**. Use weld tabs at least 2 in. long for manual and semi-automatic processes, at least 3 in. long for automatic processes, and in all cases at least as long as the thickness of the material being welded. Use longer weld tabs as required for satisfactory work.

3.2.1.3. **Weld Termination**. Terminate fillet welds approximately 1/4 in. from the end of the attachment except for galvanized structures and flange-to-web welds, for which the fillet weld must run the full length of the attachment, unless otherwise shown on the plans.

3.2.1.4. **No-Paint Areas at Field-Welded Connections**. Keep surfaces within 4 in. of groove welds or within 2 in. of fillet welds free from shop paint.

3.2.1.5. **Galvanized Assemblies**. Completely seal all edges of tightly contacting surfaces by welding before galvanizing.

3.2.1.6. **Submerged-Arc Welding (SAW)**. Do not use hand-held semiautomatic SAW for welding bridge members unless altered to provide automatic guidance or otherwise approved.

3.2.1.7. **Tubular Stiffeners for Bridge Members**. Weld in accordance with AWS D1.5, using WPSs qualified based on tests on ASTM A709 Gr. 50W or Gr. 50 steel for non-weathering applications and ASTM A709 Gr. 50W steel for weathering applications.

3.2.1.8. **Non-Bridge Member Weathering Steel Welds**. Provide weld metal with atmospheric corrosion resistance and coloring characteristics similar to that of the base metal for weathering steel structures fabricated per AWS D1.1.

3.2.2. **Shop Splices**.

3.2.2.1. **Shop Splice Locations**. Keep at least 6 in. between shop splices and stiffeners or cross-frames. Obtain approval for shop splices added after shop drawings are approved.

3.2.2.2. **Grinding Splice Welds**. Grind shop groove welds in flange plates smooth and flush with the base metal on all surfaces whether the joined parts are of equal or unequal thickness. Grind so the finished grinding marks run in the direction of stress, and keep the metal below the blue brittle range (below 350°F). Groove welds in web plates, except at locations of intersecting welds, need not be ground unless shown on the plans except as required to meet AWS welding code requirements.

3.2.3. **Joint Restraint**. Never restrain a joint on both sides when welding.

3.2.4. **Stiffener Installation**.

3.2.4.1. **Flange Tilt**. Members must meet combined tilt and warpage tolerances before the installation of stiffeners. Cut stiffeners to fit acceptable flange tilt and cupping. Minor jacking or hammering that does not permanently deform the material will be permitted.

3.2.4.2. **Stiffeners Near Field Splices**. Tack weld intermediate stiffeners within 12 in. of a welded field splice point in the shop. Weld the stiffeners in the field in accordance with Item 448, "Structural Field Welding," after the splice is made.

3.2.5. **Nondestructive Testing (NDT)**. Perform magnetic particle testing (MT), radiographic testing (RT), or ultrasonic testing (UT) at the Contractor's expense as specified in D1.5 for bridge structures. The Engineer will periodically witness, examine, verify, and interpret NDT. Additional welds may be designated for NDT on the plans. Retest repaired groove welds per the applicable AWS code after repairs are made and have cooled to ambient temperature. Complete NDT and repairs before assembly of parts into a member, but after any heat-correction of weld distortion.

3.2.5.1. **Radiographic Testing**. Radiographs must have a density of at least 2.5 and no more than 3.5, as a radiographer confirms. The density in any single radiograph showing a continuous area of constant thickness must not vary in this area by more than 0.5. Use only ASTM System Class I radiographic film as described in ASTM E1815. Use low-stress stencils to make radiograph location identification marks on the steel.

3.2.5.2. **Ultrasonic Testing**. Have UT equipment calibrated yearly by an authorized representative of the equipment manufacturer or by an approved testing laboratory.

3.2.5.3. **Magnetic Particle Testing**. Use half-wave rectified DC when using the yoke method unless otherwise approved. Welds may be further evaluated with prod method for detecting centerline cracking.

3.2.6. **Testing of Galvanized Weldments**. If problems develop during galvanizing of welded material, the Engineer may require a test of the compatibility of the combined galvanizing and welding procedures in accordance with this Section and may require modification of one or both of the galvanizing and welding procedures.

Prepare a test specimen with a minimum length of 12 in. using the same base material, with the same joint configuration, and using the welding procedure proposed for production work if testing is required. Clean and

galvanize this test specimen using the same conditions and procedure that will be applied to the production galvanizing.

Examine the test specimen after galvanizing. There must be no evidence of excessive buildup of zinc coating over the weld area. Excessive zinc coating buildup will require modification of the galvanizing procedure.

Remove the zinc from the weld area of the test specimen and visually examine the surface. There must be no evidence of loss of weld metal or any deterioration of the base metal due to the galvanizing or welding procedure. Modify the galvanizing or welding procedure as required if there is evidence of deterioration or loss of weld metal, and run a satisfactory retest on the modified procedures before production work. Report procedures and results on the galvanized weldment worksheet provided by the Department.

3.3. **Bolt Holes.** Detail holes on shop drawings 1/16 in. larger in diameter than the nominal bolt size shown on the plans unless another hole size is shown on the plans.

Thoroughly clean the contact surfaces of connection parts in accordance with Item 447, "Structural Bolting," before assembling them for hole fabrication. Make holes in primary members full-size (by reaming from a subsize hole, drilling full-size, or punching full-size where permissible) only in assembly unless otherwise approved.

Ream and drill with twist drills guided by mechanical means unless otherwise approved. If subpunching holes, punch them at least 3/16 in. smaller than the nominal bolt size. Submit the proposed procedures for approval to accomplish the work from initial drilling or punching through check assembly when numerically controlled (N/C) equipment is used. Use thermal cutting for holes only with permission of the Engineer. Permission for thermal cutting is not required for making slotted holes, when slotted holes are shown on the plans, by drilling or punching 2 holes and then thermally cutting the straight portion between them. Perform all thermal cutting in accordance with Section 441.3.5.1., "Thermal Cutting."

Slightly conical holes that naturally result from punching operations are acceptable provided they do not exceed the tolerances of S2.1. The tolerance for anchor bolt hole diameter for bridge bearing assemblies is +1/8 in., −0.

3.4. **Dimensional Tolerances.** Meet tolerances of the applicable AWS specifications and S2.1 except as modified in this Section.

3.4.1. **Rolled Sections.** Use ASTM A6 mill tolerances for rolled sections, except D1.5 camber tolerances apply to rolled sections with a specified camber.

3.4.2. **Flange Straightness.** Ensure flanges of completed girders are free of kinks, short bends, and waviness that depart from straightness or the specified camber by more than 1/8 in. in any 10 ft. along the flange. Rolled material must meet this straightness requirement before being laid out or worked. Plates must meet this requirement before assembly into a member. Inspect the surface of the metal for evidence of fracture after straightening a bend or buckle. The Engineer may require nondestructive testing.

3.4.3. **Alignment of Deep Webs in Welded Field Connections.** For girders 48 in. deep or deeper, the webs may be slightly restrained while checking compliance with tolerances of S2.1 for lateral alignment at field-welded connections. In the unrestrained condition, webs 48 in. deep or deeper must meet the tolerances of Table 2. Girders under 48 in. deep must meet the alignment tolerances of S2.1.

Table 2
Web Alignment Tolerances for Deep Girders

Web Depth (in.)	Maximum Web Misalignment (in.)
48	1/16
60	1/8
72	1/4
84	5/16
96	5/16
108	3/8
120	7/16
132	7/16
144	1/2

3.4.4. **Bearings**. Correct bearing areas of shoes, beams, and girders using heat, external pressure, or both. Grind or mill only if the actual thickness of the member is not reduced by more than 1/16 in. below the required thickness.

3.4.4.1. **I-Beams, Plate Girders, and Tub Girders**. The plane of the bearing area of beams and girders must be perpendicular to the vertical axis of the member within 1/16 in. in any 24 in.

3.4.4.2. **Closed Box Girders**. Meet these tolerances:

- The plane of the bearing areas of the box girder is perpendicular to the vertical axis of the girder within 1/16 in. across any horizontal dimension of the bearing.
- The planes of the beam supports on the box girder are true to the vertical axis of the supported beams or girders to 1/16 in. in any 24 in.

In the shop, verify the plane of all bearing areas with the box placed on its bearings to field grade, using an approved process for verification.

3.4.4.3. **Shoes**. Meet these tolerances:

- The top bolster has the center 75% of the long dimension (transverse to the girder) true to 1/32 in., with the remainder true to 1/16 in., and is true to 1/32 in. across its entire width in the short dimension (longitudinal to the girder).
- The bottom bolster is true to 1/16 in. across its diagonals.
- For a pin and rocker type expansion shoe, the axis of rotation coincides with the central axis of the pin.
- When the shoe is completely assembled, as the top bolster travels through its full anticipated range, no point in the top bolster plane changes elevation by more than 1/16 in. and the top bolster does not change inclination by more than 1 degree, for the full possible travel.

3.4.4.4. **Beam supports**. Fabricate beam support planes true to the box girder bearing to 1/16 in. in the short direction and true to the vertical axis of the nesting girders to 1/16 in.

3.4.5. **End Connection Angles**. For floor beams and girders with end connection angles, the tolerance for the length back to back of connection angles is ±1/32 in. Do not reduce the finished thickness of the angles below that shown on the shop drawings if end connections are faced.

3.5. **Other Fabrication Processes.**

3.5.1. **Thermal Cutting**. Use a mechanical guide to obtain a true profile. Hand-cut only where approved. Hand-cutting of radii for beam copes, weld access holes, and width transitions is permitted if acceptable profile and finish are produced by grinding. Provide a surface finish on thermal-cut surfaces, including holes, in accordance with D1.5 requirements for base metal preparation. Obtain approval before using other cutting processes.

3.5.2. **Oxygen-Gouging**. Do not oxygen-gouge quenched and tempered (Q&T), normalized, or thermo-mechanically controlled processed (TMCP) steel.

3.5.3. **Annealing and Normalizing**. Complete all annealing or normalizing (as defined in ASTM A941) before finished machining, boring, and straightening. Maintain the temperature uniformly throughout the furnace during heating and cooling so the range of temperatures at all points on the member is no more than 100°F.

3.5.4. **Machining**. Machine the surfaces of expansion bearings so the travel direction of the tool is in the direction of expansion.

3.5.5. **Camber**. Complete cambering in accordance with S2.1 before any heat-curving.

3.5.6. **Heat Curving**. Heat-curve in accordance with S2.1. The methods in the AASHTO bridge construction specifications are recommended. Attach cover plates to rolled beams before heat-curving only if the total thickness of one flange and cover plate is less than 2-1/2 in. and the radius of curvature is greater than 1,000 ft. Attach cover plates for other rolled beams only after heat-curving is completed. Locate and attach connection plates, diaphragm stiffeners, and bearing stiffeners after curving, unless girder shrinkage is accounted for.

3.5.7. **Bending of Quenched and Tempered Steels**. The cold-bending radius limitations for HPS 70W in S2.1 apply to all Q&T steels.

3.6. **Nonconformance Reports (NCRs)**. Submit an NCR to the Engineer for approval when the requirements of this Item are not met. Submit NCRs in accordance with the Construction Division's NCR guidelines document. Have readily available access to the services of a licensed professional engineer experienced in steel structures design and fabrication. This licensed professional engineer may be responsible for reviewing potentially structurally deficient members in accordance with the NCR guidelines document. Receive Department approval before beginning repairs. Perform all repair work in strict compliance with the approved NCR and repair procedure.

3.7. **Shop Assembly**.

3.7.1. **General Shop Assembly**. Shop-assemble field connections of primary members of trusses, arches, continuous beam spans, bents, towers (each face), plate girders, field connections of floor beams and stringers (including for railroad structures), field-bolted diaphragms for curved plate girders and railroad underpasses, and rigid frames. Field-bolted cross-frames and rolled-section diaphragms do not require shop assembly. Complete fabrication, welding (except for shear studs), and field splice preparation before members are removed from shop assembly. Obtain approval for any deviation from this procedure. The Contractor is responsible for accurate geometry.

Use a method and details of preassembly consistent with the erection procedure shown on the erection plans and camber diagrams. The sequence of assembly may start from any location in the structure and proceed in one or both directions. An approved method of sequential geometry control is required unless the full length of the structure is assembled.

Verify by shop assembly the fit of all bolted and welded field connections between bent cap girders and plate girders or between plate girders and floor beams.

Do not measure horizontal curvature and vertical camber for final acceptance until all welding and heating operations are completed and the steel has cooled to a uniform temperature. Check horizontal curvature and vertical camber in a no-load condition.

3.7.2. **Bolted Field Connections**. Each shop assembly, including camber, alignment, accuracy of holes, and fit of milled joints, must be approved before the assembly is dismantled.