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RULE NO. R161-26.32

NOTICE OF PROPOSED RULE **POSTING DATE: November 9, 2026**

The Director of Austin Transportation and Public Works proposes to adopt the following rule on or after December 11, 2026

EFFECTIVE DATE OF PROPOSED RULE

A rule proposed in this notice may not become effective before the effective date established by a separate notice of rule adoption. A notice of rule adoption may not be posted before December 11, 2026, or after January 18, 2027 (the 70th day after the date of this notice).

If a proposed rule is not adopted on or before the 70th day, it is automatically withdrawn and cannot be adopted without first posting a new notice of proposed rule.

REQUEST FOR COMMENTS ON PROPOSED RULES

The City requests comments from the public with respect to the proposed rules included in this Notice. Comments must be submitted in writing to the contact person below no later than December 10, 2026. A summary of the written comments received will be included in the notice of rule adoption that must be posted for the rule to become effective.

Contact Person:

Amber Hutchens, Capital Program Consultant
Austin Transportation and Public Works
Amber.Hutchens@austintexas.gov
512-947-5646

TEXT OF PROPOSED RULE

The text of the proposed rule indicating changes from the current text is attached to this notice.

BRIEF EXPLANATION OF PROPOSED RULE

Rule R161-26.32 proposes a substantial rewrite of Item 403, Concrete for Structures, of the Standard Specifications Manual. The rule proposes an updated review and acceptance process to approve alternative mix designs that are more environmentally friendly and updates concrete standards and specifications for a more sustainable concrete mix design.

An affordability impact statement regarding the proposed rule is available by contacting Amber Hutchens, amber.hutchens@austintexas.gov, or 512-974-5646.

AUTHORITY FOR ADOPTION OF PROPOSED RULE

The authority and procedure for adoption of a rule to assist in the implementation, administration, or enforcement of a provision of the City Code is provided in City Code Chapter 1-2 (*Adoption of Rules*). The authority to regulate design and construction of streets is established in City Code Section 25-6-171 (*Standards for Design and Construction*).

CERTIFICATION BY CITY ATTORNEY

By signing this Notice of Proposed Rule R161-26.32, the City Attorney certifies the City Attorney has reviewed the rule and finds that adoption of the rule is a valid exercise of the Director's administrative authority.

REVIEWED AND APPROVED:

Richard Mendoza, P.E., Director
Austin Transportation and Public Works

Date: 11-6-26

Deborah Thomas, City Attorney

Date: 11/9/24

ITEM NO. 403 CONCRETE FOR STRUCTURES XX-XX-XX

403.1 Description

This item shall govern the quality, storage, handling, proportioning and mixing of materials for concrete used in construction of pavements, buildings, bridges, culverts, slabs, prestressed concrete and incidental appurtenances. This is a performance-based specification intended to encourage material producer innovation to foster increasingly more sustainable, lower embodied-carbon concrete mixtures meeting the established thresholds for the specific mixes. The GWP targets will be published separately.

403.2 Submittals

The submittal requirements of this specification item shall include the following for all concrete quantities (no exceptions):

Concrete mixture designs and testing results for each class of concrete reviewed, signed and sealed by a licensed engineer in the State of Texas. Mix design shall include:

1. Cement type and quantity
2. Supplementary cementing materials (SCMs) type and quantity
3. Aggregate type and quantity
4. Water source and quantity
5. Admixture dosage range, and reference to approved admixture
6. Gate settings and meter counts if concrete mixtures are produced from volumetric trucks

A. Environmental Product Declarations (EPD) – A Type III product specific EPD in accordance with ISO 14025 is required for each unique mixture design. This shall include but is not limited to changes in cementitious material type/content, aggregate source, or other EPD-declared parameters change beyond the EPD variation rules. Normal production adjustments within the previously approved mixture tolerances or specified allowable ranges shall not be considered a unique mixture design nor require a new EPD.

B. Mixture Design Variance Requests – documentation for substantially changed mixtures must be submitted in writing and must include the new mix design, and associated, revised trial batch verification test data.

C. Plant and Equipment certification by NRMCA or any other approved agency. Include NRMCA checklist completion and certification for plant and trucks likely to be used on the project

D. Larger Concrete Placements – For total project concrete quantities greater than 250 CY, the following additional submittals are required:

1. Project specific schedule of different classes of concrete mixtures - The Engineer of Record shall provide a schedule of the different classes of concrete mixtures for each location or structural member. The schedule shall consider the exposures and intended use of elements and members and shall avoid overly broad grouping.
2. Contractor’s estimate of actual concrete volumes for different classes during construction
3. Calculation of total project embodied carbon based on actual concrete estimated to be used on a mixture volume-weighted basis using Global Warming Potential (GWP) from corresponding mixtures’ EPDs. Carbon accounting shall be the responsibility of the project design or delivery team such as the project engineer or project manager. Requirements for this reporting will be detailed elsewhere within other criteria documents.

4. Contractor's Quality Control Plan (QCP), including any available certifications

E. Hot Weather Concrete Plans

Ice may be used during hot weather concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures") to lower the concrete temperature; however, the Contractor shall furnish a proposed temperature control strategy that will be acceptable to the Engineer of Record or designated representative for the class of concrete specified. The addition of ice shall not exceed 50% of the total mix water by mass. Liquid nitrogen or other chilling methods may also be used, provided the cooling method is submitted with the concrete mix design for review and approval by the Engineer of Record. Use of hot weather placement strategies shall be considered a normal production adjustment provided the concrete stays within the previously approved mixture tolerances or specified allowable ranges. As such, this shall not be considered a new mixture design nor require a new EPD.

403.3 Materials

Concrete shall be composed of cementitious materials, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

A. Cementitious Materials

Cementitious materials include the cement and Supplementary Cementitious Materials (SCMs) used in concrete. All cementitious materials shall comply with current Texas Department of Transportation (TXDOT) Material Specification, Item 421. All references to coal ash in TXDOT Material Specification shall be interpreted as Class F or Class C fly ash.

B. Mixing Water

Water shall comply with TXDOT Material Specification Item 421.

C. Coarse Aggregate

Coarse and fine aggregates shall comply with TXDOT Material Specification Item 421.

D. Mineral Filler

Mineral filler shall comply with TXDOT Material Specification Item 421.

E. Admixtures

All chemical admixtures, including water-reducing agents, plasticizers, and air-entraining agents, shall conform to Standard Specification Item 405, "Concrete Admixtures."

403.4 Storage of Materials

A. Cement, Supplementary Cementitous Materials and Mineral Filler

All cement, supplementary cementitious materials and mineral filler shall be stored in accordance with TXDOT requirement. Any cement, which has become partially set or which contains hard lumps or cakes, or cement salvaged from discarded or used bags, shall not be used. The Engineer or designated representative may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

B. Aggregates

Aggregates shall be stored in accordance with TXDOT requirements.

C. Admixtures

Admixtures shall be stored in accordance with manufacturers' recommendations and shall be protected against freezing.

D. Hot Weather Concrete Mixes

Ice may be used during hot weather concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures") to lower the concrete temperature; however, the Contractor shall furnish a proposed temperature control strategy that will be acceptable to the Engineer of Record or designated representative for the class of concrete specified. The addition of ice shall not exceed 50% of the total mix water by mass. Liquid nitrogen or other chilling methods may also be used, provided the cooling method is submitted with the concrete mix design for review and approval by the Engineer of Record.

403.5 Measurement of Materials

Materials shall be measured per NRMCA guidelines and within the following allowable variances. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates. Measurement of materials shall conform to Section 4.5 of TxDOT Specification Item 421, "Hydraulic Cement Concrete".

403.6 Performance Characteristics

A. General Characteristics

Most of the performance characteristics listed in section 403.6 (C) for concretes mixture will be tested and documented under the mixture approval process. However, a limited number of the performance characteristics stated below in section 403.6 (C) are requirements that will be tested to assure performance of concrete in-place.

1. Overall water/cement (w/cm) ratio shall comply with regulatory requirements, including latest version of American Concrete Institute (ACI) PRC-211.1 standards
2. Permeability shall be measured to evaluate durability of the concrete. Permeability shall be measured surface resistivity (AASHTO T358)

B. Class of Concrete

Concrete shall be produced in specific classes based on intended use, structural requirements, and exposure conditions. Each class shall meet the performance characteristics, strength requirements, and durability criteria specified in Table 2 below:

C. Required Tests for Mixture Design

Candidate laboratory trial mixtures should consider the following critical design criteria in their development. And at a minimum, results from the following tests for these design criteria shall be submitted for approval of the final proposed mix design. Historical data may be accepted for characteristics that can be shown to be stable over time and seldom change with respect to the proposed mixtures.

Mixture Design Performance Property	ASTM Test #	Requirements

Cast-in-place cylinders (strength)	C 39/Tex-418-A	Min. Strength per class
Surface Resistivity (durability)	AASHTO T358	Minimum Surface Resistivity per class
Density Absorption	C 642	≤ 12%
Density (Unit Weight) Yield	C 138/Tex-417-A	result may be used as baseline for Contractor's daily QC
ASR (evaluate aggregates)	C 1260/1567	< 0.10% @ 16 days
ASR (evaluate aggregates)	C 1293	< 0.04% @ 1 year – only required if results of short- term test using C 1260/1567 exceeds allowable limits.
Sulfate Resistance (mortar only)	C 1012	< 0.10% @ 6 months (moderate)
Shrinkage	C 157	< 0.05% @ 35 days (7 days in lime water + 28 days air dry)

D. Required Performance Tests for Acceptance

In-Place Performance Property	**ASTM Test #**	**Requirements**
Cast-in-place cylinders (strength)	C 39/Tex-418-A	Minimum Strength per class
Surface Resistivity (durability)	AASHTO T358	Minimum Surface Resistivity per class

Class	General Usage	Description	Regular Concrete (28 days mix design)		Slow Strength Gain (56 days mix design)		Minimum Acceptance Surface Resistivity (kΩ-cm)
			Expected Strength, (psi)	Required Minimum Strength, (psi)	Expected Strength, (psi)	Required Minimum Strength, (psi)	
			7 Days	28 Days	7 Days	56 Days	28 or 56 Days
A	General Use	Inlets, manholes, curb, gutter, curb & gutter, concrete retards, sidewalks, Type I driveways, backup walls and anchors	2100	3000	1930	3000	16
B	Low Strength	Riprap, small roadside signs and anchors	1400	2000	1290	2000	16
C^{Str}	Standard Items	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, and cast-in-place concrete traffic barrier, traffic-rated multi-use path	2520	3600	2310	3600	20
D	Riprap	Riprap	1750	2500	1610	2500	16
H^{Str}	Prestressed/ Precast High Strength	Prestressed concrete beams, boxes, piling and precast concrete traffic barrier	As indicated on plans	As indicated on plans	n/a	n/a	26
I	Slip Forming	Machine extruded mixes for slip forming machines	2450	3500	2250	3500	16
J	Utility Repair	Utility trench repair	560	800	n/a	n/a	n/a
S^{Str}	General Structural	General structural, top slabs of direct traffic culverts and building elements including columns, beams, footings, elevated slabs, shear walls and walls	2800	4000	2570	4000	20
*	Project Specific	Project Specific High Strength mixtures with outdoor exposure conditions	As indicated	As indicated	As indicated	As indicated	26

E. Concrete mix designs and adjustments to approved mix designs shall be prepared by individuals qualified through appropriate industry-recognized concrete mix design credentials. Additionally, the designs shall be reviewed and sealed by a Professional Engineer currently holding an active license by the State of Texas attesting that the design meets specification requirements.

F. Concrete Admixture

Unless otherwise specified in the contract, concrete admixtures shall conform to Standard Specification Item No. 405, "Concrete Admixtures." Any change in admixtures from outside the design range submitted for the approved mix design shall require written approval from the Engineer of Record prior to use.

Stamped and colored concrete may be used to provide aesthetic and/or visual cues. The addition of powder dye or other visual modifiers placed per the manufacturer's recommendations to the concrete surface and approved by the Engineer of Record will not be considered as a change to the overall cementitious materials or w/c ratio.

G. Consistency and Quality of Concrete

Ideally, concrete shall be workable, cohesive, and possess satisfactory finishing qualities, and shall be of the stiffest consistency that can be placed and vibrated into a homogeneous mass without the development of segregation or honeycombing. Further, the City encourages consistency and quality of concrete that will allow efficient placement and completion of finishing operations before initial set.

The final surface of the concrete shall be free of defects, including but not limited to plastic shrinkage, crazing or map cracking that could reduce durability. Re-tempering after initial set shall not be allowed. When field conditions require additional moisture for final concrete surface finishing operations, the required water shall be applied to surface by fog spray only and shall be held to a minimum. Alternatively, approved finishing aids may be used and are preferred over water. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing.

Unless otherwise specified or shown on the drawings, the temperature of fresh concrete at the time of placement shall not exceed 95°F per ACI 305R. Alternatively, a maximum fresh concrete temperature of 100°F may be allowed when a hot weather concreting plan, including approved temperature control measures, is submitted and approved by the Engineer of Record per the requirements in 403.2.E Hot Weather Concrete Mixes above. Concrete temperature shall be measured at the point of placement.

403.7 Mixing and Mixing Equipment

Provide proportioning and mixing equipment that meets the current certification requirements of the National Ready Mixed Concrete Association (NRMCA). All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to ensure completion of the work without excessive delays for repairs and/or replacement. Mixing equipment must produce uniform distribution of materials and be capable of producing concrete meeting requirements of the most current version of ASTM C 94 *Standard Specification for Ready-Mixed Concrete* and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities.

A. Volumetric Batching

Use of volumetric batched concrete will be permitted provided the batching and continuous mixing operations conform to the most current version of ASTM C 685 *Concrete Made by Volumetric Batching and Continuous Mixing*. The concrete shall be made from materials continuously batched by volume, mixed in a continuous mixer and delivered to the site in a freshly mixed and unhardened state. Tests and criteria for batching accuracy and mixing efficiency shall be as specified in ASTM C 685.

1. A ticket system will be used that includes a copy for the Inspector. Ticket will have time/date of concrete batch, a mix design designation, weight of cement, SCM, aggregate, and batched quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.
2. Each batching or mixing unit, or both, shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator. The mixer shall produce a thoroughly mixed and uniform concrete.
3. The batcher-mixer unit shall have separate compartments for all necessary ingredients needed for the manufacture of concrete. The unit shall be equipped with calibrated proportioning devices to vary the mix proportions, and it shall produce concrete as required by the Work and ASTM C 685.

B. Truck-mixed Concrete

Water or approved chemical admixture additions at the jobsite may be made only in accordance with ASTM C94, the approved mixture design limits, and the maximum approved w/cm. Additions shall be documented on the delivery ticket or electronic record and mixed for the required revolutions before sampling or discharge.

When the concrete contains silica fume, mixing times and batching operations shall be adjusted as necessary to ensure that the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix shall be verified in trial batches.

C. Hand-mixed Concrete

Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer or designated representative. Hand-mixed batches shall not exceed a 4 cubic foot batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches. Admixtures shall not be used unless specifically approved by the Engineer or designated representative.

403.8 Concrete Production Equipment and Facilities

A. Certified Batching Plants

Provide concrete from certified portable and stationary concrete batch plant facilities that meet current requirements of the National Ready Mixed Concrete Association (NRMCA). The NRMCA plant certification is valid for two years from the date of the successful inspection. Re-certification and re-inspection shall be performed every two years. Delivery vehicle certification is valid for 12 months.

B. Mixing Concrete

Provide concrete in a thoroughly mixed and uniform mass with a satisfactory degree of uniformity when tested in accordance with C94.

1. Additional water at Placement Site: Concrete producers may add water to concrete in truck mixers or agitators one time prior to discharge or placement as needed. The total water added remain within the approved COA-reviewed mix design water-cement ratio. Water addition shall not cause the truck to exceed rated mixing capacity.

   After adding water, rotate the drum at least 30 additional revolutions at mixing speed before discharging. The producer shall document all water added after batching and the corresponding adjusted water-cement ratio and provide this documentation to the Engineer or designated COA representative and Purchaser. Do not add water to the concrete during or after discharge or placement. Do not add water for the purpose of retempering the concrete. Do not add water in truck chutes or pump or slipform hoppers beyond the minimum necessary to wet the surfaces for lubrication.

2. Concrete Temperature Requirements at the Point of Placement: Produce concrete so that at the time of concrete placement, concrete temperature is between 45°F to 95°F as measured via ASTM C1064 unless otherwise approved by the Engineer of Record with a project-specific hot-weather or cold-weather plan. If heating is required, adjust the temperature of water, aggregates, or both to meet the minimum required placement temperature. Do not heat aggregate to more than 150°F.

   Use aggregates free of ice and frozen lumps at time of batching. Heat aggregates in stockpiles or bins using steam or hot water coils or live steam or by indirect hot air. Do not use direct flame to heat coarse aggregate. During batching operations, compensate for accumulated condensation from heating.

403.9 Guidance for Quality Control

Quality Control is defined as activities performed by the producer, manufacturer, and/or contractor to assure that products and services meet all contract specification requirements during production, manufacturing, and/or placement.

A. Standard Reference Procedure

   The following test methods apply to the COA's established procedures for sampling and testing:

   1. ASTM C31/C31M/Tex-447-A – Standard Practice for Making and Curing Concrete Test Specimens in the Field
   2. ASTM C39/C39M/Tex-418-A – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   3. ASTM C1202 – Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
   4. ASTM C138/C138M/Tex-417-A – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
   5. ASTM C172/C172M/Tex-407-A – Standard Practice for Sampling Freshly Mixed Concrete
   6. ASTM C1064/C1064M/Tex-422-A – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

B. Quality Control Plan (QCP)

   Concrete producer shall annually submit the most recent version of their active Quality Control Plan (QCP) along with their annual mix design approvals. The NRMCA QCP template found at the following site may used:

https://www.nrmca.org/wp-content/uploads/2022/04/Quality_Guide.pdf

may be used. For any project using a concrete producer not having an annual QCP on file with the City, Contractor must submit the concrete producer's QCP during the project submittal process. Project-specific items required in the QC plan include, but are not limited to, the following:

1. Organizational chart
2. QC Administrator and contact information
3. The name(s), credentials, and contact information of the on-site QC staff responsible for QC testing and QC plan enforcement
4. Methods for interaction between production and QC personnel to implement timely corrective action including suspension of work
5. Coordination of activities
6. Documentation, procedures, and submittals
7. Project specifics
8. Sampling, testing, and initial curing facilities for QC and quality assurance (QA) strength test specimens
9. Corrective action plan when a process is determined or suspected to be out of tolerance and specify the actions required to restore the process in control and compliance with the defined requirements. Corrective action plan shall include both general requirements for operations of QCP as a whole, and for individual items of work contained in the technical specification. The QCP shall specify how the results of quality control inspections and tests will be utilized to determine the need for corrective action. It shall contain well defined set of rules and the type of correction to be taken to regain the process control
10. Hot and cold weather protection considerations and methods
11. Control charts or other documented producer process-control records shall be maintained by the producer and made available upon request. Project-specific control charts may be required for projects with defined statistical acceptance requirements or high-volume/critical placements identified in the contract documents.
12. Mix design and supporting documentation
13. Handling, protection, initial curing, and transporting of strength test specimens
14. Methods to monitor construction equipment loading and open-to-traffic strengths
15. Finishing and curing procedure
16. List of QC records to be submitted to the Engineer of Record or designated representative
17. Adjustment of aggregate and admixtures proportions within an approved mix design may be made to maintain optimized aggregate gradation without resubmittal of the mix design, provided the approved water-cement ratio, cementitious material types and contents, admixture, and required performance characteristics are not exceeded. All such adjustments shall be documented in the Quality Control records including the reason for the change.

C. Personnel Requirements

Individuals performing Quality Control (QC) tests shall demonstrate that they are proficient and capable of performing such work in accordance with the applicable test procedure and specification requirement prior to the beginning of related work.

D. Quality Control (QC) Laboratory Requirements

Laboratories, including field laboratories and all associated testing equipment that prepare concrete mixes or perform QC testing, must demonstrate to the Engineer of Record or COA designated representative that they are properly equipped, staffed, calibrated, and managed to perform batching and testing of concrete in accordance with the applicable test methods and procedures and meet ASTM C1077 requirements. Mix designs and their accompanying documentation must include a statement signed by an ACI certified Concrete Laboratory Testing Technician - Level II or a Professional Engineer certifying that all applicable standard test methods were properly performed to verify the quality and performance of the concrete. Laboratories must maintain records demonstrating equipment calibration, testing procedures, and verification of results, and make these records available to the Engineer or designated representative upon request.

E. QC Sampling and Testing

Contractor shall not continue production of nonconforming work. Perform sampling, testing, and initial curing shall be according to ASTM C31/C31M. Deviations from the procedures outlined in ASTM C31, including initial curing, will invalidate the test results. QC testing laboratory shall be responsible for QC test samples and maintain custody and control of samples during curing period until testing using the accommodations provided by Contractor.

403.10 Quality Assurance (QA) During Concrete Placement/ Project Implementation (Acceptance)

Quality Assurance (QA) is activities performed by the City and designated representatives necessary to provide adequate confidence and assurances to be able to accept in-place products and services which exhibit compliance with the given specification requirements.

This section shall apply to project specific concrete mixes. Any concrete mix not previously approved by the City of Austin shall be submitted to the Engineer of Record for review prior to use on the project. The City or Engineer of Record review of documentation does not relieve the contractor of its Quality control responsibilities or imply that city perform independent testing.

A. Mixture Design Submittal & Approval

The concrete mixtures shall be designed to meet the requirements of 403.6 Performance Requirements. The class of concrete shall be provided as specified in Table 2, or as specified in the contract.

Variance requests must be submitted in writing and must include the mix design, associated trial batch verification test data. Do not use a grade of concrete with a specified and required compressive strength different from what is designated for the application.

The Producer shall perform all work required to substantiate and submit the concrete mix design per ACI PRC-211.1 and any special specifications, including trial batch testing. Complete concrete design data shall be submitted via the Contractor to the Engineer of Record or designated representative for review. The mix design will be valid for a period of one (1) year provided that there are no significant changes to the performance test results.

The Producer-submitted concrete mix design shall include the following information, not limited to:

1. Results of all tests required in accordance with 403.6.C
2. Description of individual coarse aggregate stockpiles, original source, bulk specific gravity, absorption, gradation, and alkali-silica reactivity test results. A combined coarse aggregate blended gradation shall be provided, including the percentage of each coarse aggregate used
3. Description of fine aggregate, original source, bulk specific gravity, absorption, gradation, Fineness Modulus, base Fineness Modulus, alkali-silica reactivity, and sand equivalent test
4. Description and original source and amount of cement and supplementary cementitious materials
5. Target water-cementitious material ratio
6. Target water content by volume or mass
7. Target compressive strength at a specific time period.
8. Target concrete density and slump where applicable
9. Type, manufacturer, and dosage rates and ranges of air-entraining and chemical admixtures
10. Target Surface Resistivity Value (tested per AASHTO T358)

When there are changes that results in changes to the performance properties of the concrete by changing the aggregates or in type, brand or source of cement, supplementary cementitious material or chemical admixtures, the mix shall be evaluated as a new mix design.

At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that no substantial change in the performance test results and that test results confirming the adequacy of the mix designs have been acquired during the previous year. The resubmittal analysis must be reviewed, signed and sealed by a registered Professional Engineer holding a current and active license in the state of Texas. Updated cement, SCM, and admixture certifications shall accompany the resubmittal.

Approved admixtures that are included in the prequalified concrete admixtures list maintained by TxDOT's Construction Division may be used with all classes of concrete at the option of the Contractor provided that specific requirements of the governing concrete structure specification are met. Water reducing and retarding agents shall be required for hot weather, large mass, and continuous slab placements.

B. Quality Assurance

1. QA Considerations: The Engineer of Record is responsible for administering the quality assurance for acceptance and will institute any actions necessary toward its successful implementation. Concrete that meets performance requirements as specified in Section 403.6.D and will be paid at full price. Acceptance of concrete not meeting these performance criteria will be subject to payment adjustment factors stated in Section 403.12 Payment.
2. Personnel Requirements:

   Individuals performing Quality tests shall demonstrate that they are proficient and capable of performing such work in accordance with the applicable test procedures and specification requirements prior to the beginning of related work. Quality testing personnel performing field sampling and testing of fresh concrete shall hold a current ACI Concrete Field-Testing Technician Grade I certification or an equivalent TxDOT-approved certification. Quality testing personnel

performing laboratory testing, including but not limited to compressive strength, density, air content, temperature, and other specified performance tests, shall hold appropriate ACI or TxDOT laboratory testing certifications applicable to the tests being performed, or equivalent certifications acceptable to the City Engineer or designated representative.

C. QA Laboratory Requirements

The testing laboratory with responsibility for acceptance testing on the project must be a City of Austin qualified laboratory facility. Laboratory shall generally be accredited by AASHTO resource and the Cement and Concrete Reference Laboratory (CCRL) with an audit that covers ASTM C1077 *Standard Practice for Agencies Testing Concrete and Concrete Aggregates*.

D. Concrete Placement Preconstruction Meeting

Contractor shall hold a concrete preconstruction meeting prior placement. including City Project Manager, City Inspector, Contractor, Concrete subcontractor, Concrete Supplier, QA Laboratory, and Engineer of Record. Meeting invitation shall be sent out a minimum of 14-days in advance to allow ample time for acceptance and scheduling.

E. QA Sampling and Testing

City of Austin or its designated representative will conduct QA sampling and testing; monitor Contractor adherence to the QC plan; and inspect field-placed materials to ensure all concrete for the project is represented. Any material test data gathered by the City of Austin and provided to the contractor will also be made available to the material producer upon request.

Samples for acceptance will be taken at the point of placement in accordance with ASTM C172. Mix adjustments to the materials selected for QA sampling and testing are not permitted following QA sampling and testing. QA sampling will take place without prior notification. It is the contractor's responsibility to provide space, water, power, and security for laboratory field testing per ASTM C31. QA testing laboratory shall be responsible for test samples and maintain custody and control of QA samples during curing period until testing using the accommodations provided by Contractor.

F. The COA or designated representative may perform additional testing on concrete that is pumped whenever the pump is relocated or whenever there is a significant change in the boom configuration, line length, pump system, mixture, or observed concrete properties. Results of these tests may be used by the Engineer or designated representative to determine acceptance of the pumped concrete.

G. Stop Production Criteria

Production must be stopped by Contractor if one or more of the following occur:

A. The QA testing shows that one or more of the suspension limits for material quality characteristics defined in section 403.06 are in non-compliance

B. The material production QC plan is not being followed

C. Segregation, excessive slumping of unsupported slip formed edges, or other notable changes in the fresh concrete properties as delivered is or are observed that may prevent proper placement or consolidation and finishing of the finished product

The Engineer of Record or designated representative will issue a Notice to Resume Work only after all necessary adjustments have been made to restore conformance with all applicable specifications and the appropriate documentation has been added to the QC records.

H. Production Acceptance Testing

Testing will be required for small placements such as manholes, inlets, culverts, wing walls, etc. The City of Austin or Engineer of Record or designated representative will determine number of tests to a minimum of 1 set (2 cylinders) for each 30 cubic yards placed over a several days period.

Compressive strength test cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer of Record or designated representative for design compressive strength confirmation or early form removal. Compressive strength test cylinders made for early form removal or for consideration of use of structure will be at Contractor's expense, except when required by Engineer or Record or designated representative.

A compressive strength test shall be defined as the average breaking strength of 2 cylinders. A minimum of six compressive strength test cylinders shall be prepared; two each to be tested at 7 and 28 days or for slower strength gain mixtures at 7 and 56 days as noted by class leaving two extras remaining for acceptance or referee testing as needed. Specimens will be tested conforming to TxDOT Test Method TEX-418-A. Early age (7-day) and referee test cylinders may be eliminated by the EOR if deemed unnecessary.

The City of Austin primarily uses 6x12 inch and 4x8 inch cylinders for concrete strength testing, depending on the aggregate size, with the cylinder diameter needing to be at least three times the nominal maximum aggregate size. Aggregate greater than 1.25-inch sizes require the bigger 6x12 inch cylinders to accurately represent the concrete, while smaller aggregates allow for the 4x8 inch size.

Design strength cylinders shall be cured conforming to ACI or TxDOT Bulletin C-11 (and supplements thereto). QA testing laboratory shall be responsible for these test samples and maintain custody and control of QA samples during curing period until testing using the accommodation provided by Contractor per ASTM C31.

I. Acceptance of Concrete

Concrete failing to meet the required compressive strength or permeability will be evaluated in accordance with Article 403.13 Payment.

403.11 - Excavation, Placing of Concrete, Finishing, Curing and Backfill

Excavation, placing of concrete, finishing, curing and backfill shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill", Standard Specification Item No. 410S, "Concrete Structures" and Standard Specification Item No. 411S, "Surface Finishes for Concrete".

403.12 Measurement

Where measurement of concrete for a structure is not provided by another governing pay item, measurement shall be made under this specification in accordance with the following:

The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard, each, square yard or linear foot as indicated in the Contract Documents. Measurement will be as follows:

A. General

1. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the drawings or as may have been directed by the Engineer or designated representative in writing.

2. No deductions shall be made for chamfers less than 2 inches in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches or less in width.

3. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.

4. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.

5. No measurement shall be made for inlet and junction box invert concrete.

6. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

B. Plan Quantity. For those items measured for plan quantity payment, adequate calculations have been made. If no adjustment is required by Article 403.11, additional measurements or calculations will not be required or made.

C. Measured in Place. For those items not measured for Plan Quantity payment, measurement will be made in place, subject to the requirements of Article 403.6 above.

403.13 Payment

The work performed and materials furnished as prescribed by this item and measured in accordance with the applicable provisions of "Measurement" above will be paid for as follows:

The quantity to be paid for will be that quantity indicated in the contract documents and/or shown on the drawings, regardless of errors in calculations, except as may be modified by the following.

A. Plan Quantities will be adjusted:

I. When a complete structure element has been erroneously included or omitted from the drawings, the quantity shown on the drawings for that element will be added to or deducted from the plan quantity and included for payment. A complete structure element will be the smallest portion of a total structure for which a quantity is included on the drawings. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

II. When the plan quantity for a complete structure element is in error by 5 percent or more, a recalculation will be made and the corrected quantity included for payment. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

III. When quantities are revised by a change in design, the "plan quantity" will be increased or decreased by the amount involved in the design change. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The party to the contract requesting the adjustment shall present to the other a copy of the description and location, together with calculations of the quantity for the structure element involved. When this quantity is certified correct by the Engineer or designated representative, it will become the revised plan quantity.

Payment for increased or decreased costs due to a change in design on those items measured as "Cubic Yard", "Each", "Square Foot", "Square Yard" or "Linear Foot" will be determined by Change Order. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The unit prices bid for the various classes of concrete shown shall include full compensation for furnishing, hauling, and mixing all concrete material; placing, finishing and curing all concrete; all grouting, pointing and finishing; furnishing and placing drains; furnishing and placing metal flashing strips; furnishing and placing expansion joint material required by this item; and for all forms and false work, labor, tools, equipment and incidentals necessary to complete the work.

Pay Item No. 403-CY:	(Structure or Structural Component)	Per Cubic Yard.
Pay Item No. 403-EA:	(Structure or Structural Component)	Per Each.
Pay Item No. 403-SY:	(Structure or Structural Component)	Per Square Yard.
Pay Item No. 403-LF:	(Structure or Structural Component)	Per Lineal Foot.

B. Payment Adjustment Factors:

The following procedure will be used to evaluate concrete where one or more project acceptance test specimens fail to meet the required design strength or permeability specified in this Item or shown on the plans.

I. The concrete for a given placement will be considered structurally adequate and accepted at full price if the average of 28-day or 56-day set of specimens made at the time of placement meets the required design strength and permeability, provided no single specimen test result is less than 85% of the required design strength or permeability.

II. The Engineer will perform a structural review of the concrete to determine its adequacy to remain in service if the average 28-day or 56-day set of specimens made at the time of placement is less than the required design strength and permeability or if any single specimen test result is less than 85% of the required design strength or permeability. If the concrete is determined to be structurally adequate, the Engineer will determine the limits of the payment adjustment using the formula below.

a. If the in-situ concrete strength or permeability is needed for the structural review, take cores at locations designated by the Engineer in accordance with Tex-424-A. Engineer of Record will test the cores. The coring and testing will be at the Contractor's expense.

b. If all the tested cores meet the required design strength and permeability, the concrete will be paid for at full price. Cores are considered structurally adequate if they follow ACI 301 in that the average of three cores in the area tested must be 85% of design strength with no core less than 75% of design strength. Project specific mixtures may have alternative criteria based on requirements enforced by the Engineer of Record.

c. If any of the tested cores do not meet the required design strength or permeability, but the average strength or permeability attained is determined to be structurally adequate, the Engineer will determine the limits of the payment adjustment using the following formula for strength deficiency.

$$A = B_p \times [1.75 \times (S_a/S_s) -$$

where:

A = Amount to be paid per unit of measure for the entire placement in question.

S_a = Actual average strength or permeability from cylinders or cores. Use values from cores, if taken.

S_s = Minimum required strength or permeability (specified).

B_p = Unit bid price.

d. Where a high probably of significant errors are suspected within QA laboratory testing, failing test results can be appealed using a referee process as follows. Tests cores shall be drilled from the area in question in accordance with ASTM C42 *Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams in Concrete* and ACI 214.4R. Testing from these cores shall be permitted to more accurately determine the strength and durability of the in-place concrete. These new test results will be evaluated by criteria 403.12 (B) (II) (a), (b), and (c) above.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 403, "Concrete For Structures"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 401S	Structural Excavation and Backfill
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finishes for Concrete
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4610	Coal Ash
DMS-4620	Ground Granulated Blast-Furnace Slag
DMS-4630	Silica Fume
DMS-4635	Metakaolin
DMS-4640	Chemical Admixtures for Concrete
American Association of State Highway & Transportation Officials, AASHTO Standard Method of Test for	
Designation	Description
Method T 26	Quality of Water to be Used in Concrete
American Concrete Institute, ACI	
Designation	Description
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C 78	Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C 94	Specification For Ready-Mixed Concrete
ASTM C 150	Specification For Portland Cement
ASTM C 138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 150	Specification For Portland Cement
ASTM C 157	Standard Test Method for Length Change of Hardened Cement Mortar And Concrete
ASTM C 403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C 469	Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C 496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C 595	Standard Specification for Blended Hydraulic Cements
ASTM C 618	Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C 642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C 685	Concrete Made By Volumetric Batching and Continuous Mixing
ASTM C 845	Standard Specification for Expansive Hydraulic Cement

ASTM C 873	Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds
ASTM C 989	Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C 1012	Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution
ASTM C 1157	Standard Performance Specification for Hydraulic Cement
ASTM C 1202	Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration
ASTM C 1240	Standard Specification for Silica Fume Used in Cementitious Mixtures
ASTM C 1260	Standard Test Method for Potential Alkali Reactivity of Aggregates
ASTM C 1293	Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction
ASTM C 1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM D-512	Test Methods for Chloride Ion in Water
ASTM D-516	Test Methods for Sulfate Ion in Water
ASTM D-4191	Test Method for Sodium in Water by Atomic Absorption
ASTM D-4192	Test Method for Potassium Water by Atomic Absorption
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
TEX-203-F	Sand Equivalent Test
TEX-401-A	Sieve Analysis of Fine and Coarse Aggregate
TEX-406-A	Mineral Finer than (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
TEX-408-A	Organic Impurities in Fine Aggregate for Concrete
TEX-410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
TEX-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
TEX-413-A	Determination of Deleterious Materials in Mineral Aggregate
TEX-416-A	Air Content of Freshly-Mixed Concrete by the Pressure Method
TEX-417-A	Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
TEX-418-A	Compressive Strength of Cylindrical Concrete Specimens
TEX-421-A	Splitting Tensile Strength of Cylindrical Concrete Specimens
TEX-422-A	Measuring Temperature of Freshly Mixed Portland Cement Concrete
TEX-448-A	Flexural Strength of Concrete Using Simple Beam Third-Point Loading
TEX-470-A	Optimized Aggregate Gradation for Hydraulic Cement Concrete Mix Designs
TEX-612-J	Acid Insoluble Residue
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4610	Fly Ash
DMS-4620	Ground Granulated Blast-Furnace Slag
DMS-4630	Silica Fume
DMS-4635	Metakaolin

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 403, "Concrete For Structures"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Hydraulic Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 520	Weighing and Measuring Equipment
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4635	Metakaolin
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
DMS-6100	Epoxy and Adhesives

ITEM NO. 403 CONCRETE FOR STRUCTURES 04-14-25

403.1 Description

This item shall govern quality, storage, handling, proportioning and mixing of materials for hydraulic cement concrete construction of buildings, bridges, culverts, slabs, prestressed concrete and incidental appurtenances.

Source: Rule No. R161-25.04, 4-14-25.

403.2 Submittals

The submittal requirements of this specification item may include:

A. Mix design option(s) of the class of concrete required on the project,

B. The supplier of the concrete mix design(s) and type of mixing equipment, and

C. Type of admixtures to be used with the concrete mixes. Source: Rule No. R161-25.04, 4-14-25.

403.3 Materials

Concrete shall be composed of hydraulic cement or hydraulic cement and supplementary cementing materials, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

A. Cementitious Materials

Hydraulic cement shall conform to ASTM C 150, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) and Type III (High Early Strength). Type I shall be used when none is specified or indicated on the drawings. Type I and Type III cements shall not be used when a Type II cement is specified or indicated on the drawings. Type III cement may be used in lieu of a Type I cement, when the anticipated air temperature for the succeeding 12 hours will not exceed 60°F (15.6°C). A Type III cement shall only be used in precast concrete or when otherwise specified or allowed. All cement shall be of the same type and from the same source for a monolithic placement.

Unless otherwise specified the cementitious material content shall be limited to no more than 700 lbs. per cubic yard. When supplementary cementing materials are used, cement is defined as "cement plus supplementary cementing material." Supplementary cementing materials include fly ash (DMS-4610), ultra-fine fly ash (DMS-4610), ground granulated blast furnace slag grade 100 or 120 (DMS-4620), silica fume (DMS-4630) and metakaolin (DMS-4635).

Supplementary cementing materials shall not be used when white hydraulic cement is specified.

Class C fly ash shall not be used in sulfate-resistant concrete.

~~Hydraulic cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.~~

When sulfate-resistant concrete is required for a project, mix design options 1, 2, 3 or 4 presented in Section 403.8, "Mix Design Options" shall be used to develop appropriate mix design utilizing Type I/II, II, V, IP or IS cement.

B. Mixing Water

Water for use in concrete and for curing shall be potable water free of oils, acids, organic matter or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl or sulfates as SO4.

Water from the City of Austin will not require testing. Contractor may request approval of water from other sources. Contractor shall arrange for samples to be taken from the source and tested at the Contractor's expense. When water from other sources is proposed, test reports shall be provided that indicates compliance with Table 1 before use.

Table 1: Chemical Limits for Mix Water

Contaminant	**Test Method**	**Maximum Concentration (ppm)**
Chloride (CL) Prestressed concrete Bridge decks & superstructure All other concrete	ASTM D-512	 500 500 1,000
Sulfate (SO_4)	ASTM D-516	1,000
Alkalies ($NA_2O + 0.658 K_2O$)	ASTM D-4191 & D-4192	600
Total Solids	AASHTO T-26	50,000

Water that has an adverse effect on the air-entraining agent or any other chemical admixture or on strength or time of set of the concrete shall not be used. Water used in white Portland cement concrete shall be free from iron and other impurities, which may cause staining, or discoloration.

C. Coarse Aggregate

Coarse aggregate shall consist of durable particles of crushed or uncrushed gravel, crushed blast furnace slag, crushed stone or combinations thereof; free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. When white hydraulic cement is specified, the coarse aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout.

The coarse aggregate from each source shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TXDOT Test Method TEX-413-A. The coarse aggregate from each source shall have a wear of not more than 40 percent when tested in accordance with TXDOT Test Method TEX-410-A.

Unless otherwise indicated on the drawings, the coarse aggregate from each source shall be subjected to 5 cycles of the soundness test conforming to TXDOT Test Method TEX-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

Coarse aggregate shall be washed. The Loss by Decantation (TXDOT Test Method TEX-406-A), plus allowable weight of clay lumps, shall not exceed 1 percent or the value indicated on the drawings or in the project manual, whichever is less. If material finer than the #200 sieve is definitely established to be dust of fracture of aggregates made primarily from crushing of stone, essentially free from clay or shale as established by Part III of TXDOT Test Method TEX-406-A, the percent may be increased to 1.5. When crushed limestone coarse aggregate is used in concrete pavements, the decant may exceed 1% but not more than 3% if the

material finer than the #200 sieve is determined to be at least 67% calcium carbonate in accordance with TxDoT Test Method Tex-406-A, Part III.

The coarse aggregate factor may not be more than 0.82; however, when voids in the coarse aggregate exceed 48 percent of the total rodded volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor may not be less than 0.68 except for a Class I machine extruded mix that shall not have a coarse aggregate factor lower than 0.61.

When exposed aggregate surfaces are required, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable for exposed aggregate finishes.

When tested by approved methods, the coarse aggregate including combinations of aggregates when used, shall conform to the grading requirements shown in Table 2.

Table 2: Coarse Aggregate Gradation Chart (Percent Passing)

Grade	Nom. Size	2½"	2"	1½"	1"	¾"	½"	⅜"	No. 4	No. 8
1	2"	100	80—100	50—85		20—40			0—5	
2 (467)*	1½"		100	95—100		35—70		10—30	0—5	
3	1"		100	95—100		60—90	25—60		0—5	
4 (57)*	1"			100	95—100		25—60		0—10	0—5
5 (67)*	¾"				100	90—100		20—55	0—10	0—5
6 (7)*	½"					100	90—100	40—70	0—15	0—5
7	⅜"						100	70—95	0—25	
8	⅜"						100	95—100	20—65	0—10

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.

2. The use of recycled crushed hydraulic cement concrete as a coarse aggregate shall be limited to Concrete Classes A, B and D (see Table 5).

D. Fine Aggregate

Fine aggregate shall be washed and consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. When white hydraulic cement is specified, the fine aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps in accordance with TEX-413-A. When subjected to color test for organic impurities per TXDOT Test Method TEX-408-A, it shall not show a color darker than standard.

Unless indicated otherwise on the drawings the acid insoluble residue of fine aggregate used in slab concrete subject to direct traffic shall not be less than 60 percent by weight (mass) when tested conforming to TXDOT Test Method TEX-612-J.

Unless indicated otherwise on the Drawings, fine aggregate shall be blended, when necessary, to meet the acid insoluble residue requirement.

When blending the following equation shall be used:

Acid Insoluble (%) = {(A1)(P1)+(A2)(P2)}/100

Where:

A1 = acid insoluble (%) of aggregate 1,

A2 = acid insoluble (%) of aggregate 2,

P1 = % by weight of A1 of the fine aggregate blend, and

P2 = % by weight of A2 of the fine aggregate blend.

When tested in accordance with TxDoT Test Method Tex-401-A, the fine aggregate, including mineral filler and combinations of aggregates, when used, shall conform to the grading requirements shown in Table 3.

Table 3: Fine Aggregate Gradation Chart[1](Grade 1 - Percent Passing)

⅜	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200
100	95—100	80—100	50—85	25—65	10—351	0—10	0—32

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.

2. The use of recycled crushed hydraulic cement concrete as a fine aggregate shall be limited to Concrete Classes A, B and D (see Table 5).

3. 6 to 35 when sand equivalent value is greater than 85.

4. 0 to 6 for manufactured sand.

Sand equivalent per TXDOT Test Method TEX-203-F shall not be less than 80 nor less than otherwise indicated on the drawings, whichever is greater.

The fineness modulus will be determined by adding the percentages by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 and dividing the sum of the six sieves by 100. For all classes of concrete except K (see Table 5), the fineness modulus shall be between 2.30 and 3.10. For Class K concrete, the fineness modulus shall be between 2.40 and 2.90, unless indicated otherwise on the Drawings.

E. Mineral Filler

Mineral filler shall consist of stone dust, clean crushed sand or other approved inert material. When tested in accordance with TxDoT Test Method Tex-401-A, it shall conform to the following gradation:

Passing the No. 30 Sieve	100 percent
Passing the No. 200 Sieve	65 to 100 percent

F. Mortar and Grout

Unless otherwise specified, indicated on the drawings or approved by the Engineer or designated representative mortar and grout shall consist of 1 part cement, 2 parts finely graded sand and enough water

to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce color required. When required by the Engineer or designated representative, approved latex adhesive may be added to the mortar. Mortar shall be provided with a consistency such that the mortar can be easily handled and spread by trowel. Grout shall be provided of a consistency that will flow into and completely fill all voids.

G. Admixtures

All chemical admixtures including water reducing, placticizers and air entrainment shall conform to TxDoT DMS-4640, "Chemical Admixtures for Concrete". Calcium chloride-based admixtures shall not be approved. Admixtures shall be included in the prequalified concrete admixtures list maintained by TxDot's Construction Division. High-range water-reducing admixtures (TxDoT Type F or G) and accelerating admixtures (TxDoT Type C or E) shall not be used in bridge deck concrete.

H. Air Entrainment

Unless indicated otherwise on the drawings, all concrete classes with the exception of Class B shall be air entrained in accordance with Table 8. If the air content is more than 1½ percentage points below or 3 percentage points above the required air, the load of concrete will be rejected. If the air content is more than 1½ but less than 3 percentage points above the required air, the concrete may be accepted based on strength test results.

Source: Rule No. R161-25.04, 4-14-25.

403.4 Storage of Materials

A. Cement, Supplementary Cementing Materials and Mineral Filler

All cement, supplementary cementing materials and mineral filler shall be stored in separate and well ventilated, weatherproof buildings or approved bins, which will protect the material from dampness or absorption of moisture. Storage facilities shall be easily accessible and each shipment of packaged cement shall be kept separated to provide for identification and inspection. The Engineer or designated representative may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

B. Aggregates

The method of handling and storing concrete aggregates shall prevent contamination with foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be clear of all vegetation and shall be level. Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch layer of the stockpile shall not be used without recleaning the aggregate.

When conditions require the use of 2 or more grades of coarse aggregates, separate stockpiles shall be maintained to prevent intermixing. Where space is limited, stockpiles shall be separated by walls or other appropriate barriers.

Aggregate shall be stockpiled and protected from the weather a minimum of 24 hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Engineer or designated representative shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

The stockpiles shall be sprinkled to control moisture and temperature as necessary. A reasonably uniform moisture content shall be maintained in aggregate stockpiles.

C. Admixtures

Admixtures shall be stored in accordance with manufacturer's recommendations and shall be protected against freezing.

D. Hot Weather Concrete Mixes

Ice may be used during hot weather concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures") to lower the concrete temperature; however, the Contractor shall furnish a mix design acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50% of the total mix water weight.

Source: Rule No. R161-25.04, 4-14-25.

403.5 Measurement of Materials

Water shall be accurately metered. Fine and coarse aggregates, mineral filler, bulk cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to the Engineer or designated representative. Measurement of materials in non-volumetric and volumetric mixers shall conform to Section 421.4.D of TxDot Specification Item 421, "Hydraulic Cement Concrete".

Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

Source: Rule No. R161-25.04, 4-14-25.

403.6 Mix Design

The Contractor shall furnish a mix design acceptable to the Engineer or designated representative for the class of concrete required in accordance with Table 5. The mix shall be designed by a qualified commercial laboratory and signed/sealed by a registered Professional Engineer, licensed in the State of Texas to conform with requirements contained herein, to ACI 211.1 or TXDOT Bulletin C-11 (and supplements thereto). The maximum water-to-cementitious material ratio identified in Table 5 for specific classes of concrete shall not be exceeded.

A higher strength class of concrete with equal or lower water-to-cementituous material ratio may be substituted for the specified class of concrete.

The mix design shall be over-designed in accordance with Table 5 in order to account for production variability and to ensure minimum compressive strength requirements are met.

Allowable mix design options are presented in Section 403.8.

The Contractor shall perform, at the Contractor's expense, the work required to substantiate the design, including testing of strength specimens. Complete concrete design data shall be submitted to the Engineer or designated representative for approval. The mix design will be valid for a period of one (1) year provided that there are no changes to the component materials.

When there are changes in aggregates or in type, brand or source of cement, supplementary cementing material or chemical admixtures, the mix shall be evaluated as a new mix design. A change in vendor does not necessarily constitute a change in materials or source. When only the brand or source of cement is changed and there is a prior record of satisfactory performance of the cement with the ingredients, the submittal of new trial batches may be waived by the Engineer or designated representative.

At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that substantial change in the component materials has occurred and that test results confirming the adequacy of the mix designs have been acquired during the previous year. The resubmittal analysis must be reviewed, signed and sealed by a registered Professional Engineer, licensed in the State of Texas. This resubmittal shall include a reanalysis of specific gravity, absorption, fineness modulus, sand equivalent, soundness, wear and unit weights of the aggregates. Provided that the fineness modulus did not deviate by more than 0.20 or that the re-proportioned total mixing water, aggregate and cement (or cement plus fly ash) are within 1, 2, and 3 percent, respectively, of pre-approved quantities, a one-year extension on the approval of the mix may be granted by the Engineer or designated representative. Updated cement, fly ash, and admixture certifications shall accompany the resubmittal.

Approved admixtures that are included in the prequalified concrete admixtures list maintained by TxDot's Construction Division may be used with all classes of concrete at the option of the Contractor provided that specific requirements of the governing concrete structure specification are met. Water reducing and retarding agents shall be required for hot weather, large mass, and continuous slab placements. Air entraining agents may be used in all mixes but must be used in the classes indicated on Table 5. Unless approved by the Engineer or designated representative, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1 for the various aggregate grades.

Source: Rule No. R161-25.04, 4-14-25.

403.7 Consistency and Quality of Concrete

Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 4 without the development of segregation or honeycombing. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Concrete that exceeds the maximum acceptable placement slump at time of delivery will be rejected. Slump values shall be conducted in accordance with TXDOT Test Method TEX-415-A.

Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Re-tempering (i.e. addition of water and reworking concrete after initial set) shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, the required water shall be applied to surface by fog spray only and shall be held to a minimum. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder.

Table 4: Slump Requirements

	Slump[1], inches	
Type of Construction	**Maximum**	**Minimum**
Cased Drilled Shafts	4	3
Reinforced Foundation Caissons and Footings	3	1
Reinforced Footings and Substructure Walls	3	1
Uncased Drilled Shafts	6	5
Thin-walled Sections; 9 inches (225 mm) or less	6½	4
Prestressed Concrete Members[1]	6½	4
Precast Drainage Structures	6	4
Wall Sections over 9 inches (225 mm)	5	3
Reinforced Building Slabs, Beams, Columns and Walls	4	1
Bridge Decks	4	2
Pavements, Fixed-form	6½	4
Pavements, Slip-form	3	1½

Sidewalks, Driveways and Slabs on Ground	4	2
Curb & Gutter, Hand-vibrated	3	1
Curb & Gutter, Hand-tamped or spaded	4	2
Curb & Gutter, Slip-form/extrusion machine	2	½
Heavy Mass Construction	2	1
High Strength Concrete	4	3
Riprap and Other Miscellaneous Concrete	6	1
Under Water or Seal Concrete	8½	6

1. Slump values when a high range water reducer (HRWR) is not used.

2. When a high range water reducer (HRWR) is used, maximum acceptable placement slump will be 9 in.

During progress of the work, the Engineer or designated representative shall cast test cylinders as a check on compressive strength of concrete actually placed. The Engineer or designated representative will perform slump tests, entrained air tests and temperature checks to ensure compliance with specifications.

Proportioning of all material components shall be checked prior to discharging. Excluding mortar material for pre-coating of the mixer drum [see section 403.8.B] and adjustment for moisture content of admixtures and aggregates, material components shall fall within the range of + 1% for water, + 2% for aggregates, + 3% for cement, + 2% for fly ash and within manufacturer recommended dosage rates for admixtures except that air entrainment shall be within + 1½ percentage points of the mix design requirements.

Unless otherwise specified or indicated on the drawings, concrete mix temperature shall not exceed 90°F except in mixes with high range water reducers where a maximum mix temperature of 100°F will be allowed. Cooling an otherwise acceptable mix by addition of water or ice during agitation will not be allowed.

Test cylinders will be required for small placements such as manholes, inlets, culverts, wing walls, etc. The Engineer or designated representative will determine number of tests to a minimum of 1 for each 25 cubic yards placed over a several day period.

Test cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer or designated representative for design strength confirmation or early form removal. Test cylinders made for early form removal or for consideration of use of structure will be at Contractor's expense, except when required by Engineer or designated representative.

A strength test shall be defined as the average breaking strength of 2 cylinders. A minimum of four test cylinders shall be prepared; two each to be tested at 7 and 28 days. Specimens will be tested conforming to TXDOT Test Method TEX-418-A. If required strength or consistency of class of concrete being produced cannot be secured with minimum cementitious material specified or without exceeding maximum water/cementitious material ratio, Contractor will be required to furnish different aggregates, use a water reducing agent, an air entraining agent or increase the cement content in order to provide concrete meeting these specifications.

Slump tests will be performed in accordance with TxDoT Test Method Tex-415-A. Entrained air tests will be performed in accordance with TxDoT Test Method Tex-416-A.

Test specimens shall be cured using the same methods and under the same conditions as the concrete represented. Design strength cylinders shall be cured conforming to TXDOT Bulletin C-11 (and supplements thereto).

Concrete quality is by 28-day compressive tests, job control testing will be by 7-day compressive strength tests. Should the concrete fail to meet the 28-day required strength, the tolerance for acceptance shall follow ACI 301 and be acceptable to the Engineer of Record. The minimum strength requirement for seven (7) day test will be 70

percent of the specified minimum 28-day compressive strength. If the required 7-day strength is not secured the Engineer shall be notified within 3 days to determine how to proceed.

Table 5: Classes of Concrete

Class	Cement Sks Per CY	Minimum Strength, psi (MPa)		Maximum W/C Ratio[1]	Coarse Aggr. Grade[2,3,4]	Air Entrain.
		28 Days	7 Days			
A	5.0	3000	2100	0.6	1,2,3,4,8	Yes
B	4.0	2000	1400	0.6	2,3,4,5,6,7	No
C[5]	6.0	3600	2520	0.45	1,2,3,4,5,6	Yes
D	4.5	2500	1750	0.6	2,3,4,5,6,7	No
H[5]	6.0	As indicated	As Indicated	0.45	3,4,5,6	Yes
I	5.5	3500	2450	0.45	2,3,4,5	Yes
J	2.0	800	560	N/A	2,3,4,5	No
S[5]	6.0	4000	2800	0.45	2,3,4,5	Yes

Notes:

1. Maximum water-cement or water-cementitious ratio by weight.
2. Unless otherwise allowed, Grade 1 coarse aggregate shall only be used in massive foundations with 4-in minimum clear spacing between reinforcing steel bars.
3. Grade 1 coarse aggregate grading shall not be used in drilled shafts.
4. Unless otherwise allowed, Grade 8 coarse aggregate shall be used in extruded curbs.
5. Structural concrete classes. Concrete from volumetric concrete trucks is not allowed for City of Austin structural concrete classes.
6. When Type II cement is used in Class C, S or A concrete, the 7-day compressive strength requirement will be 2310 psi for Class C, 2570 psi for Class S and 1925 psi for Class A minimum.

Table 6: Over Design Required to Meet Compressive Strength Requirements[1]

Number Of Tests[2,3]	Standard Deviation, psi				
	300	400	500	600	700
15	470	620	850	1,120	1,390
20	430	580	760	1,010	1,260
30 or more	400	530	670	900	1,130

Notes:

1. When designing the mix, add the tabulated amounts to the minimum design strength in Table 5. Maximum water-cement or water-cementitious ratio by weight.
2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi of the specified strength may be used.
3. If less than 15 prior tests are available, the overdesign should be 1,000 psi for specified strength less than 3,000 psi, 1,200 psi for specified strengths from 3,000 to 5,000 psi and 1,400 psi for specified strengths greater than 5,000 psi.

Table 7: Expected Usage of Concrete Classes

Class	General Usage
A	Inlets, manholes, curb, gutter, curb & gutter, concrete retards, sidewalks, driveways, backup walls and anchors
B	Riprap, small roadside signs and anchors
C[5]	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, and cast-in-place concrete traffic barrier
D	Riprap
H[5]	Prestressed concrete beams, boxes, piling and precast concrete traffic barrier
J	Utility trench repair
S[5]	Bridge slabs and top slabs of direct traffic culverts

Table 8: Air Entrainment[1]		
Nominal Maximum Aggregate Size Inches	% Air Entrainment	
	Moderate Exposure	Severe Exposure
⅜ - Grades 7 & 8	6	7½
½ - Grade 6	5½	7
¾ - Grade 5	5	6
1 - Grade 4	4½	6
1½ - Grades 2 & 3	4½	5½
2 - Grade 2	4	5

1. For specified concrete strengths above 5,000 psi a reduction of 1 percentage point is allowed.

Source: Rule No. R161-22.01, 3-1-2022; Rule No. R161-25.04, 4-14-25.

403.8 Mix Design Options

For the structural concretes identified in Table 5 (Classes C, H and S) and any other class of concrete designed using more than 520 lbs. of cementitious material per cubic yard, one of the mix design options presented below shall be used.

For the non-structural concretes identified in Table 5 (Classes A, B, D and J) and any other class of concrete designed using less than 520 lbs. of cementitious material per cubic yard, one of the mix design options presented below will be used, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3 and 4 unless a sulfate-resistant concrete is required.

A. Option 1: Twenty (20) to thirty-five (35) percent of the cement may be replaced with Class F fly ash.

B. Option 2: Thirty-five (35) to fifty (50) percent of the cement may be replaced with ground granulated blast-furnace slag.

C. Option 3: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class F fly ash, ground granulated blast-furnace slag or silica fume. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.

D. Option 4: Type IP or Type IS will be used and up to ten (10) percent of the cement may be replaced with Class F fly ash, ground granulated blast-furnace slag or silica fume.

E. Option 5: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class C fly ash and at least six (6) percent of silica fume, ultra fine fly ash or metakaolin. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.

F. Option 6: A lithium nitrate admixture will be added at a minimum dosage of 0.55 gal. of thirty (30) percent lithium nitrate solution per pound of alkalis present in the hydraulic cement.

G. Option 7: When hydraulic cement only is used in the design, the total alkali contribution from the cement in the concrete does not exceed 4.0 lbs. per cubic yard, when calculated as follows:

alkali (lbs. per CY) = .01 (lbs. cement/CY) (% Na2O equivalent in cement).

where (% Na2O equivalent in cement) is assumed to be the maximum cement alkali content reported on the cement mill certificate.

H. Option 8: When there are deviations from Options 1 through 7, the following shall be performed:

1. Conduct tests on both coarse and fine aggregate separately in accordance with ASTM C 1260, using of the proposed cementitious in the same proportions of hydraulic cement to supplementary cementing material to be used in the mix.

2. Prior to use of the mix, a certified test report signed and sealed by a Professional Engineer, licensed in the State of Texas shall be submitted that demonstrates that ASTM C 1260 test results for each aggregate do not exceed 0.10 percent expansion.

Source: Rule No. R161-25.04, 4-14-25.

403.9 Mixing and Mixing Equipment

All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work without excessive delays for repairs and replacement. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass and shall be capable of producing concrete meeting requirements of ASTM C 94, Ready-mixed Concrete and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed in a structure. For all mixers an adequate water supply and an accurate method of measuring the water shall be provided.

The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when specified time of mixing has elapsed.

A. Proportioning and Mixing Equipment

For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used.

When approved by Engineer or designated representative in writing or when specified for use in other items, these mixers may be used for other types of concrete construction, including structural concrete, if the number of mixers furnished will supply the amount of concrete required for the particular operation in question.

These mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging.

For continuous volumetric mixers, the materials delivered during a revolution of the driving mechanism or in a selected interval, will be considered a batch and the proportion of each ingredient will be calculated in the same manner as for a batch type plant.

Mixing time shall conform to recommendations of manufacturer of mixer unless otherwise directed by Engineer or designated representative.

B. Ready-mixed Concrete

Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet quality requirements specified herein. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum. Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

1. A ticket system will be used that includes a copy for the Inspector. Ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

2. Sufficient trucks will be available to support continuous placements. The Contractor will satisfy the Engineer or designated representative that adequate standby trucks are available to support monolithic concrete placement requirements.

3. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of the Engineer or designated representative and under the Inspector's observation. When water is added under these conditions, the concrete batch will be thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.

4. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and for agitating and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Engineer or designated representative.

5. The loading of the transit mixers shall not exceed capacity as shown on the manufacturer's plate attached to the mixer or 63 percent of the drum volume, whichever is the lesser volume. The loading of transit mixers to the extent of causing spill-out en route to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.

6. Excess concrete remaining in the drum after delivery and wash water after delivery shall not be dumped on the project site unless approval of the dump location is first secured from the Engineer or designated representative.

C. Volumetric Batching

Use of volumetric batched concrete will be permitted provided the batching and continuous mixing operations conform to ASTM C 685, "Concrete Made By Volumetric Batching and Continuous Mixing". This type concrete shall be made from materials continuously batched by volume, mixed in a continuous mixer and delivered to the site in a freshly mixed and unhardened state. Tests and criteria for batching accuracy and mixing efficiency shall be as specified in ASTM C 685.

1. A ticket system will be used that includes a copy for the Inspector. The ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

2. Each batching or mixing unit, or both, shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator. The mixer shall produce a thoroughly mixed and uniform concrete.

3. The batcher-mixer unit shall contain in separate compartments all the necessary ingredients needed for the manufacture of concrete. The unit shall be equipped with calibrated proportioning devices to vary the mix proportions and it shall produce concrete as required by the Work and ASTM C 685.

D. Truck-mixed Concrete

The concrete shall be mixed in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer that will produce a uniform concrete mix. The concrete shall be delivered to the project in a thoroughly mixed and uniform mass and shall be discharged with a satisfactory degree of uniformity. Additional mixing at the job site, at the mixing speed designated by the manufacturer, may be allowed by the Engineer or designated representative as long as the concrete is discharged before the drum has revolved a total of 300 revolutions after the introduction of the mixing water to the cement and the aggregates.

Re-tempering or adding concrete chemical admixtures is only permitted at the job site when concrete is delivered in a truck mixer. Water shall not be added after introduction of mixing water at the batch plant except on arrival at the job site with approval of the Engineer or designated representative, in order to adjust the slump of the concrete. When this water is added, the mix design water-cementitious material ratio shall not be exceeded. The drum or blades shall be turned at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete. Water or chemical admixtures shall not be added to the batch after any concrete has been discharged.

When the concrete contains silica fume, mixing times and batching operations shall be adjusted as necessary to ensure that the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix shall be verified in trial batches.

E. Hand-mixed Concrete

Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer or designated representative. Hand-mixed batches shall not exceed a 4 cubic foot batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches. Admixtures shall not be used unless specifically approved by the Engineer or designated representative.

Source: Rule No. R161-25.04, 4-14-25.

403.10 Excavation, Placing of Concrete, Finishing, Curing and Backfill

Excavation, placing of concrete, finishing, curing and backfill shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill", Standard Specification Item No. 410S, "Concrete Structures" and Standard Specification Item No. 411S, "Surface Finishes for Concrete".

Source: Rule No. R161-25.04, 4-14-25.

403.11 Measurement

Where measurement of concrete for a structure is not provided by another governing pay item, measurement shall be made under this specification in accordance with the following:

The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard, each, square yard or linear foot as indicated in the Contract Documents. Measurement will be as follows:

~~A. General~~

1. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the drawings or as may have been directed by the Engineer or designated representative in writing.

2. No deductions shall be made for chamfers less than 2 inches in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches or less in width.

3. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.

4. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.

5. No measurement shall be made for inlet and junction box invert concrete.

6. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

B. Plan Quantity. For those items measured for plan quantity payment, adequate calculations have been made. If no adjustment is required by Article 403.11, additional measurements or calculations will not be required or made.

C. Measured in Place. For those items not measured for Plan Quantity payment, measurement will be made in place, subject to the requirements of Article 403.10.A.1 above.

Source: Rule No. R161-25.04, 4-14-25.

403.12 Payment

The work performed and materials furnished as prescribed by this item and measured in accordance with the applicable provisions of "Measurement" above will be paid for as follows:

The quantity to be paid for will be that quantity indicated in the contract documents and/or shown on the drawings, regardless of errors in calculations, except as may be modified by the following.

Plan Quantities will be adjusted:

A. When a complete structure element has been erroneously included or omitted from the drawings, the quantity shown on the drawings for that element will be added to or deducted from the plan quantity and included for payment. A complete structure element will be the smallest portion of a total structure for which a quantity is included on the drawings. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

B. When the plan quantity for a complete structure element is in error by 5 percent or more, a recalculation will be made and the corrected quantity included for payment. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

C. When quantities are revised by a change in design, the "plan quantity" will be increased or decreased by the amount involved in the design change. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The party to the contract requesting the adjustment shall present to the other, a copy of the description and location, together with calculations of the quantity for the structure element involved. When this quantity is certified correct by the Engineer or designated representative, it will become the revised plan quantity.

Payment for increased or decreased costs due to a change in design on those items measured as "Cubic Yard", "Each", "Square Foot", "Square Yard" or "Linear Foot" will be determined by Change Order. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The unit prices bid for the various classes of concrete shown shall include full compensation for furnishing, hauling, and mixing all concrete material; placing, finishing and curing all concrete; all grouting, pointing and finishing; furnishing and placing drains; furnishing and placing metal flashing strips; furnishing and placing expansion joint material required by this item; and for all forms and false work, labor, tools, equipment and incidentals necessary to complete the work.

Pay Item No. 403-CY:	(Structure or Structural Component) (Structure or Structural Component)	Per Cubic Yard.
Pay Item No. 403-EA:		Per Each.
Pay Item No. 403-SY:		Per Square Yard.
Pay Item No. 403-LF:		Per Lineal Foot.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 403, "Concrete For Structures"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 401S	Structural Excavation and Backfill
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finishes for Concrete
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4640	Chemical Admixtures for Concrete
American Association of State Highway & Transportation Officials, AASHTO Standard Method of Test for	
Designation	Description
Method T 26	Quality of Water to be Used in Concrete
American Concrete Institute, ACI	
Designation	Description
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C 94	Specification For Ready-Mixed Concrete
ASTM C 150	Specification For Portland Cement
ASTM C 685	Concrete Made By Volumetric Batching and Continuous Mixing
ASTM C-1260	Standard Test Method for Potential Alkali Reactivity of Aggregates
ASTM D-512	Test Methods for Chloride Ion in Water
ASTM D-516	Test Methods for Sulfate Ion in Water
ASTM D-4191	Test Method for Sodium in Water by Atomic Absorption
ASTM D-4192	Test Method for Potassium Water by Atomic Absorption

~~Texas Department of Transportation: Manual of Testing Procedures~~	
~~Designation~~	~~Description~~
~~TEX-203-F~~	~~Sand Equivalent Test~~
~~TEX-401-A~~	~~Sieve Analysis of Fine and Coarse Aggregate~~
~~TEX-406-A~~	~~Mineral Finer than (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)~~
~~TEX-408-A~~	~~Organic Impurities in Fine Aggregate for Concrete~~
~~TEX-410-A~~	~~Abrasion of Coarse Aggregate Using The Los Angeles Machine~~
~~TEX-411-A~~	~~Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate~~
~~TEX-413-A~~	~~Determination of Deleterious Materials in Mineral Aggregate~~
~~TEX-415-A~~	~~Slump of Portland Cement Concrete~~
~~TEX-416-A~~	~~Air Content of Freshly-Mixed Concrete by the Pressure Method~~
~~TEX-418-A~~	~~Compressive Strength of Cylindrical Concrete Specimens~~
~~TEX-612-J~~	~~Acid Insoluble Residue~~
~~Texas Department of Transportation: Publications~~	
~~Designation~~	~~Description~~
~~Bulletin C-11~~	~~Construction Bulletin~~
~~Texas Department of Transportation: Departmental Material Specifications~~	
~~Designation~~	~~Description~~
~~DMS-4610~~	~~Fly Ash~~
~~DMS-4620~~	~~Ground Granulated Blast-Furnace Slag~~
DMS-4630	~~Silica Fume~~
DMS-4635	~~Metakaolin~~

RELATED CROSS REFERENCE MATERIALS	
Standard Specification Item 403, "Concrete For Structures"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 360	Concrete Pavement
	Concrete Structures
Item 420	Hydraulic Cement Concrete
Item 421	Surface Finishes for Concrete
	Pneumatically Placed Concrete
Item 427	Weighing and Measuring Equipment
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS 4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
	Epoxy and Adhesives
DMS 8900	Fly Ash

Source: Rule No. R161-25.04, 4-14-25.