Test Procedure for

WORK PLAN, TRIAL BATCH, AND PILOT TEST PROCEDURES FOR PRECAST CONCRETE MIX DESIGNS

TxDOT Designation: Tex-703-I


1. SCOPE

1.1 This test method outlines the procedures and requirements for submitting a work plan and performing trial batches and pilot tests for precast concrete mix designs.

2. APPARATUS

2.1 The following Department and ASTM test methods list the apparatus required for performing trial batches and pilot tests for precast concrete mix designs.

- Tex-409-A or Tex-425-A
- Tex-414-A or Tex-416-A
- Tex-415-A
- Tex-417-A
- Tex-418-A
- Tex-422-A
- Tex-440-A (if applicable)
- Tex-447-A
- Tex-471-A (if applicable)
- ASTM C 1567 (if applicable)

3. PROCEDURES

3.1 Provide the following general information:

- fabricator name and plant location,
- list of all materials proposed for use in all concrete mixtures (with all materials appearing on the appropriate Material Producer List), and
- completed D9-342-R concrete mix design worksheets (Excel file) for all mix designs currently in use. Concrete mix design worksheets should include design
characteristics and material proportions. Attach ASTM C 1567 or Tex-471-A test results to the mix design worksheet if applicable. Proportion, batch, mix, and test new concrete mix designs according to the approved work plan and the pilot test procedures.

3.2  

**Work Plan:**

3.2.1  

Submit a work plan covering all concrete mix designs that includes at a minimum the following information.

3.2.1.1  

**Mix Proportions**—State which method will be used to proportion all mix designs. When water-reducing admixtures are used, include the target slump per product if different from the recommended slump listed in Item 421. Do not proportion the concrete materials to have a water-to-cementitious materials (w/cm) ratio lower than 0.28 unless approved by the Engineer.

3.2.1.2  

**Alkali-Silica Reaction (ASR) Mitigation**—State which mix design option(s) will be used to mitigate for ASR.

3.2.1.3  

**Temperature Control Measures**—State what measures will be taken to ensure that the fresh concrete temperature at the time of placement is 50°F or above and does not exceed 95°F.

3.2.1.4  

**Batching Procedure**—Provide a detailed narrative of the batching sequence for all mix designs. Include actual charging and mixing times. Describe the method of monitoring aggregate moisture content. Include frequency of testing for aggregate moisture content. State the minimum batch size, which may not be less than 25% of mixer capacity or 1 cu. yd., whichever is greater, unless approved by the Engineer.

**Quality Control**—Explain how the initial batch of concrete per casting will be deemed acceptable. Explain how all subsequent concrete batches during casting operations will be monitored to ensure that the concrete is uniform, able to be properly placed, consolidated and finished, and does not exceed the maximum allowed slump or temperature limits. Include what type of testing will be performed to ensure that the mix designs meet all pertinent concrete specifications. Explain how concrete hauling equipment will be monitored to ensure the correct load is placed in the product when multiple lines or lots are being cast simultaneously. Explain how the QC will monitor daily the batch plant and hauling equipment operations including but not limited to:

- the initial target weights,
- aggregate moisture content,
- batch weight tolerances,
- concrete temperature limits, and
- accelerated curing requirements (if applicable).
3.3 **Trial Batches:**

3.3.1 Before performing the pilot test, perform trial batches and testing necessary to substantiate the proposed mix design. Provide documentation including:

- mix design worksheet D9-342-R (Excel file),
- list of product(s) to be cast using the mix design,
- corrected and actual batch weights,
- aggregate moisture content,
- compressive strength values (target and actual results for release and design),
- initial concrete slump and slump retention (target and actual results),
- concrete and ambient temperature,
- proper consolidation and finishing,
- entrained air content values (target and actual results), if necessary,
- ASTM C 1567 test results, if applicable, and
- Tex-471-A test results for proper lithium dosage, if applicable.

3.3.2 Do not use concrete with a slump, temperature, or material batch weights that exceed the allowable limits. Target compressive strength is defined as a target compressive strength achieved by a predetermined age. Entrained air content is not required for trial batches if an air-entraining agent is not used.

3.3.3 Make enough compressive strength cylinders in accordance with Tex-447-A to substantiate the target release (handling strength for non-stressed products, if necessary) and design strengths. Test the cylinders in accordance with Tex-418-A:

- at the desired release of tension age (stressed) or at 24 hours (non-stressed),
- at 3 days (if target design strength was not previously achieved), and
- at 7 days (if target design strength was not previously achieved).

3.3.4 QC will electronically submit initial trial batch documentation to the TxDOT Area Supervisor for review and proposed scheduling of the pilot test. The TxDOT QA inspector will witness the pilot test if the initial mix design and trial batch results meet all specification requirements and if the initial slump, slump retention, compressive strength, entrained air content, and other properties are reasonably close to the proposed target values or weights.

3.4 **Pilot Test:**

3.4.1 The pilot test requires one batch, at least 50% of mixer capacity, using the same proposed ingredients from the trial batch, batched in accordance with the approved concrete Work Plan and using typical production equipment and personnel.

3.4.2 Do not use concrete with a slump, temperature, or material batch weights that exceed the allowable limits.
3.4.3 Properly certified QC will determine and record the following aggregate and concrete properties in accordance with the applicable test method:

- aggregate moisture content (Tex-409-A or Tex-425-A),
- compressive strength (Tex-418-A),
- initial concrete slump and slump retention (Tex-415-A),
- air content (Tex-414-A or Tex-416-A),
- concrete temperature (Tex-422-A),
- unit weight and yield (Tex-417-A),
- initial set of concrete, when applicable (Tex-440-A), and
- ambient temperature at the time of the pilot test.

3.4.4 Compression Strength—Make 10 compressive strength cylinders according to Tex-447-A and test according to Tex-418-A, at the desired release of tension age (stressed) or at 24 hr. (non-stressed), at 3, 7, 14, and 28 days.

3.4.5 Slump Retention—Determine the slump immediately after mixing and every 15 minutes thereafter during the projected casting period or until zero-slump is reached. Casting period is the estimated time to place, consolidate, and finish a member. The slump retention tests must encompass the range of anticipated fresh concrete temperatures (10°F intervals) for each mix design. Plot all the slump and time data per mix design on a single graph and use it to predict the acceptable casting period for any concrete temperature within the temperature range and set retarding chemical admixture dosage.

3.4.6 Unit Weight—Perform unit weight test and calculate yield of fresh concrete according to Tex-417-A for each mix design. The unit weight must be within ± 2 lb./cu. ft. of the trial batch unit weight result. The yield must be within ± 2% of the theoretical batch volume.

3.4.7 Initial Set of Concrete—Perform initial set tests according to Tex-440-A for each mix design that will be used with accelerated curing or as required by the Engineer. The tests must encompass the range of anticipated fresh concrete temperatures (10°F intervals) for each mix design. Plot all the initial set and time data per mix design on a single graph and use it to predict the initial time of set for any concrete temperature within the temperature range and set retarding chemical admixture dosage.

3.5 Changes to Precast Concrete Mix Designs:

3.5.1 Perform trial batches and pilot tests and submit results for new mix designs when any of the following changes have been made to existing mix designs:

- source of aggregate(s);
- amount, type, or brand of cement;
- amount, type, or brand of supplementary cementing material (SCM);
- water content;
- amount or brand of accelerating chemical admixture;
brand or type of retarding chemical admixture; (Amount may be adjusted within the manufacturer’s recommended dosage rates once it has been established that the admixture does not have an incompatibility with the other materials.) or

brand or type of high-range water reducing (HRWR) chemical admixture. (Amount may be adjusted with ±20% from the dosages used for pilot test batches.)

3.5.2 The Engineer may waive trial batches and pilot tests for changes in chemical admixture dosages greater than the above amounts if information is provided for approval showing proper usage of admixtures with changes in aggregate moisture conditions and ambient conditions.

3.5.3 Trial batches may not be used in TxDOT product. TxDOT QA inspectors must witness the pilot test batching and testing.

3.6 Pilot Test Documentation:

3.6.1 Electronically furnish the following information for each concrete mix design:

- concrete mix design worksheet D9-342-R (Excel file) and corrected batch weights used in pilot test,
- data collected from pilot test testing, and
- ASTM C 1567 and Tex-471-A test results, if applicable.