RESEARCH REQUEST FOR PROPOSALS (RRFP) 23-01 and 23-02

QUESTIONS: The Tollway has received the following questions to RRFP 23-01 and 23-02 via the research@getipass.com mailbox. The Tollway offers the following responses:

Question 1: Are there any specific areas that Illinois Tollway expects to utilize Ultra-Light Foamed Glass Aggregate (ULFGA)?

Answer: Material properties of the foamed recycled glass indicate that the material is ideal for usage as a lightweight construction material in engineering applications such as nonstructural fills in embankments, retaining wall backfill, select fill for mechanically stabilized earth (MSE) retaining walls, and pipe bedding. Each of these application types are used on the Tollway system.

Question 2: For 23-02, does Illinois Tollway expect bench-scale lab testing or field-testing type proposals?

Answer: The Tollway is open to either.

Question 3: For the testing program to be developed and executed for evaluating Foam Glass Aggregates (FGA), are there specific tests targeted for FGA applications considering the climate and traffic conditions of Illinois Tollway? Can you please list and elaborate?

Answer: No specific tests are targeted. Proposals should detail what tests would be appropriate to prove the material is appropriate for interstate structures in a wet freeze-thaw climate.

Question 4: For 23-01, the RFP state that the required deliverable will be to perform testing on at least 2 representative concrete mixtures that include a new SCM. Is there an expected amount of SCMs that Illinois Tollway would like tested? Or is the expectation to only test one SCM for the entire project in these two mix design options?

Answer: The minimum requirement is to test one SCM for the entire project in two concrete mixtures designed to meet the Illinois Tollway's Class TL and HP mix requirements. These mix requirements are in the Tollway's Portland Cement Concrete special provision. The special provision is attached for reference. Additional testing can be proposed as value added.

Question 5: For 23-01, the RFP states that "laboratory testing" will be performed. Is there specific testing that Illinois Tollway would like to have done beyond basic fresh and hardened properties? For example, are there durability tests that they would like to have performed?

Answer: At a minimum, laboratory testing should include slump, slump loss, air content, temperature, compressive strength, time to cracking (ASTM C1581), length change (AASHTO T 160), hardened air (ASTM C457 method B), freeze-thaw (AASHTO T 161 procedure A), rapid chloride permeability test (AASHTO T 277 accelerated), and surface resistivity. Additional testing may be proposed as value added.

Question 6: The proposal guidelines state that the proposal should be limited to 5 pages. Does the length only apply to the Research Plan section or the proposal entirely not including the Cover/Summary page?

Answer: Only to the research plan.

Question 7: Cost share is mentioned on page 6 of the RFP. However, can you clarify if cost share is required or voluntary? If required, what is the rate of cost share?

Answer: Cost sharing is voluntary and can be proposed as value added.

PORTLAND CEMENT CONCRETE (Illinois Tollway)

Effective: March 11, 2022

Table of Contents.

1. Description. This item shall consist of the materials, mixture design, production, testing, curing, low air temperature protection, and temperature control of concrete. This item shall be in accordance with Section 1020 of the Standard Specifications and the IDOT Special Provision for Quality Control/Quality Assurance of Concrete Mixtures, except as modified herein, and shall apply to IDOT classes of concrete and the following portland cement concrete (PCC) mixtures for the Illinois Tollway:

- Class AX - high early strength patching of pavements and structures
- Class HP - high performance concrete
- Class MC - mass concrete structures including drilled shafts
- Class TL - ternary cementitious with an optimized aggregate gradation for pavement

The objective of this special provision is to provide the Illinois Tollway with a methodology to assure high quality concrete while simultaneously allowing the Contractor the maximum freedom in deciding how to develop the mixture design and place the concrete to achieve this objective.

2. **Reference Standards.** The current versions of following documents are referenced in the Portland Cement Concrete Special Provision and shall be followed, except as modified herein.

   2.1. Illinois Department of Transportation (IDOT) – Standard Specifications for Road and Bridge Construction

   2.2. Illinois Department of Transportation (IDOT) – Supplemental Specifications and Recurring Special Provisions

   2.3. Illinois Department of Transportation (IDOT) – Manual of Test Procedures for Materials

   2.4. Illinois Department of Transportation (IDOT) – Manual of Aggregate Quality Test Procedures

   2.5. Illinois Tollway – Illinois Tollway Manual of Modified Test Procedures

   2.6. Illinois Tollway – Approved List of Shrinkage Reducing Admixtures (SRA)

   2.7. Indiana Department of Transportation (INDOT) ITM 222 – Specific Gravity Factor and Absorption of Lightweight Fine Aggregate

   2.8. Applicable American Association of State Highway and Transportation Officials (AASHTO) Test Methods

   2.9. Applicable American Society for Testing and Materials (ASTM) Test Methods

3. **Requirements.**

   3.1. Laboratory. Contractor and Consultant laboratories performing testing for mixture qualification shall be AASHTO re:source accredited. Laboratories performing testing for field acceptance shall be either AASHTO re:source accredited or meet the minimum requirements specified in the current version of IDOT policy memorandum 6-08 “Minimum Private Laboratory Requirements for Construction Materials Testing or Mix Design.”

   3.2. Equipment. Compression Machine Requirements. All laboratories reporting compressive strength results for all PCC items shall utilize compressive testing machines capable of storing results digitally for the duration of the contract and producing those results on request. This requirement extends to Quality Control laboratories furnished by the Contractor or their subcontractors, Quality Assurance laboratories representing the Engineer, or Independent Assurance laboratories reporting directly to the Tollway. The digital readouts shall be provided to the Engineer upon request and shall display the following:

   - Specimen identification number
   - Diameter and cross-sectional area of specimen
   - Specimen age at time of test
   - Date and time of test
   - Rate of loading to the nearest pound per second and maximum load achieved to the nearest pound of applied load
   - Compressive strength calculated to nearest pounds per square inch
   - Type of fracture and any length/diameter corrections applied
   - Test equipment and technician identification
   - Laboratory name and location

   3.3. Personnel. Personnel conducting strength testing for mixture qualification and field acceptance shall be certified as an American Concrete Institute (ACI) Concrete Strength Testing Technician**.**

4. Materials. Portland cement, water, fine and coarse aggregates, supplementary cementitious materials, and concrete admixtures shall conform to the requirements of Division 1000 of Standard Specifications with exceptions as noted. Specific references are as follows:

Table 1 – Materials for Concrete Mixtures

Material	**Section**
Portland Cement	1001
Water	1002
Fine Aggregates	1003
Coarse Aggregates	1004 & Section 4.1 below
Supplementary Cementitious Materials	1010 & Section 4.2 below
Concrete Admixtures	1021 & Section 4.3 below
Other Materials	Section 4.4 below

4.1. Coarse Aggregate.

Table 2 – Coarse Aggregate Requirements

Mixture Class	**Section**
AX	1004
HP	1004 & Section 4.1.1
MC	1004
TL	1004 & Section 4.1.2

4.1.1. For Class HP mixtures, aggregates shall contain no more than two percent by weight of deleterious materials. Deleterious materials shall include substances whose disintegration is accompanied by an increase in volume which may cause spalling of the concrete.

4.1.2. For Class TL mixtures, all coarse aggregate gradations and sources used in the mixture design shall be on the IDOT Freeze-Thaw Rating List for 30 Year Extended Life Pavement Design.

Revise footnote 6/ of Article 1004.01(b) of the Standard Specifications to read as follows:

"6/ For crushed aggregate, if the material finer than the No. 200 sieve consists of the dust from fracture, essentially free from clay or silt, this percentage may be increased to 3.5."

4.2. Supplementary Cementitious Materials (SCM).

Table 3 – SCM Requirements

Mixture Class	Section
AX	1010 & Section 4.2.1
HP	1010, Section 4.2.1 & Section 4.2.2
MC	
TL	1010 & Section 4.2.1

4.2.1. The limestone in a portland-limestone cement is not classified as an SCM.

4.2.2. For Class HP and MC mixtures, SCM's shall have an alkali content less than 3.5 percent (Na_2O_{eq}).

4.3. Concrete Admixtures.

Table 4 – Concrete Admixtures

Mixture Class	Section
AX	1021, Section 4.3.1 & Section 4.3.2
HP	
MC	
TL	1021 & Section 4.3.2

4.3.1. Shrinkage reducing admixtures (SRA) shall be per the Illinois Tollway Approved List of Shrinkage Reducing Admixtures (SRA).

4.3.2. Replace Article 1020.05(b)(9) with the following:

(9) When a Type F admixture is used, retempering with water will not be allowed. When a Type G admixture is used, retempering with water or with Type G admixture will not be allowed.

4.4. Other Materials.

4.4.1. Fiber reinforcement may be permitted provided the material is used in accordance with the product manufacturer's recommendations and it is demonstrated that the concrete complies with the herein established performance requirements.

4.4.2. Lightweight aggregate shall meet the requirements of ASTM C1761. The surface moisture and absorption capacity shall be determined in accordance with INDOT Procedure ITM 222.

5. Mixture Design.

5.1. Proportioning.

5.1.1. **Supplementary Cementitious Materials (SCM).**

5.1.1.1. For Class AX, HP, and MC mixtures, a portion of the portland cement shall be replaced with at least one SCM to meet the performance parameters in section 5.2.

5.1.1.2. For Class TL mixtures, ternary concrete incorporates portland cement, slag cement, fly ash and other SCM's to produce a mix with three cementitious

constituent materials. Slag, fly ash, and any other SCM's combined as constituent materials in a ternary mix or as part of a blended cement shall consist of no less than 35% and no more than 50% of the total cementitious material.

5.1.2. **Alkali Silica Reactivity.** Concrete shall be proportioned such that the maximum total alkali content (Na_2O_{eq}) contributed by portland cement (as determined in accordance with AASHTO T 105) does not exceed the requirements in Table 5.

Table 5: Alkali Content

Mixture Class	AX	HP	MC	TL
Maximum Alkali Content contributed by Portland Cement (lb/yd^3)	5.0	4.0	4.0	5.0

For all mixtures, the requirements in Table 5 shall be waived, if one of the following two requirements are met.

5.1.2.1. Each aggregate shall be evaluated individually in accordance with ASTM C1260 and must have a measured expansion no greater than 0.10 percent after 16 days.

Each aggregate that does not meet this limit when tested with portland cement alone may demonstrate acceptance using a blended cement or a combination of portland cement and supplementary cementitious materials proposed for the mixture. The supplementary cementitious replacement content needed to pass the ASTM C1260 requirement shall become the minimum required replacement percentage of the concrete mixture.

5.1.2.2. The aggregate has been evaluated in accordance with ASTM C1293 within the last 12 months and has an average expansion of three concrete specimens equal to or less than 0.04 % at one year.

5.1.3. **Estimated Concrete Temperature and Equivalent Cement Ratio (w/c_{eq}) for Class MC Mixtures.**

5.1.3.1. Estimated temperature rise of the proposed concrete mixture shall be less than 80°F when calculated according to the following equation:

Temperature Rise = $0.16 \times C_{eq}$, where C_{eq} is the equivalent cement content given by

$C_{eq} = C + 0.5 \times F_{ClassF} + 0.8 \times (F_{ClassC} + S_{100}) + 0.9 \times S_{120} + 1.25 \times (SF + MK)$,

and C represents portland cement, F_{ClassF} is Class F fly ash, F_{ClassC} is Class C fly ash, S_{100} is Grade 100 slag, S_{120} is Grade 120 slag, SF is silica fume, and MK is metakaolin. These values are in pounds per cubic yard of concrete.

Other proposed cementitious contents may be submitted if testing is performed to demonstrate the actual temperature rise of the concrete will be less than 80°F or if the approved thermal control plan demonstrates the maximum temperature limit and the maximum temperature difference limits

won't be exceeded. Several different possible methods may be utilized to demonstrate the actual temperature rise, including a super insulated 3'x3'x3' test block (ATR cube method), Quadrel Q-drum, or other similar measurement that evaluates the semi-adiabatic temperature rise of concrete. The testing procedure must be approved by the Illinois Tollway.

5.1.3.2. The equivalent w/c_{eq} shall not be greater than 0.45 when calculated using the equivalent cement content used for calculation of temperature rise.

5.1.4. **Aggregate Gradation.**

5.1.4.1. For Class AX mixtures, the coarse aggregate gradation shall be CA 13, CA 14, CA 16, or a blend of these gradations, except CA 11 may be used for full-depth patching.

5.1.4.2. For Class HP and MC mixtures, CA 11, CA 13, CA 14, CA 16 or a blend of these gradations shall be used. The combined coarse aggregate gradation shall have a minimum of 45 percent passing the ½ in. sieve.

5.1.4.3. For Class TL mixtures, the coarse aggregate shall be a combination of two or more gradations specified in Article 1004.01(c) of the Standard Specifications and shall be combined with the fine aggregate during batching at the concrete plant to produce a combined aggregate gradation that complies with Table 6. Each of the individual aggregate gradations used in the mixture design shall be an average of a minimum of 5 stockpile gradations from existing stockpiles at the plant.

Table 6 – Tarantula Curve Gradation Requirements

Sieve Size	Tarantula Curve Limits *% Retained by Weight*
1 in.	0
¾ in.	≤ 20
½ in.	4 - 20
⅜ in.	4 - 20
# 4	4 - 20
# 8	≤ 12
# 16	≤ 12
# 30	4 - 20
# 50	4 - 20
#100	≤ 10
#200	≤ 2
Coarse Sand % Retained (No. 8 to No. 30 Sieve)	> 15
Fine Sand % Retained (No. 30 to No. 200 Sieve)	24 - 34

5.2. Laboratory Performance Parameters. Class AX, HP, and MC mixtures require a laboratory trial batch to demonstrate the following requirements. A laboratory trial batch is not required for Class TL mixtures.

5.2.1. **Slump Loss.** For HP and MC mixtures, unless otherwise approved by the Illinois Tollway, the initial slump (measured within 10 minutes after the addition of water) shall be between 3 and 8 inches. The slump shall be no less than 3 inches for at least 45 minutes after the addition of water as measured by Illinois Modified AASHTO T 119. The change in slump shall be no greater than 2 inches in 20 minutes and no greater than 4 inches from the initial measurement (measured within 10 minutes after the addition of water). The concrete temperature during testing shall be greater than 70°F. Specimens for compressive strength and hardened air void analysis shall be cast after the final slump measurement.

5.2.2. **Compressive Strength.** Compressive strength shall be no less than the values in Table 7 when determined in accordance with Illinois Modified AASHTO T 22. Test cylinders shall be made and cured in accordance with Illinois Modified AASHTO R 39. Strength shall be defined as the average of two 6 x 12 in. cylinder breaks.

Table 7: Minimum Compressive Strength Requirements

Mixture Class	Age	AX	HP	MC
		(psi)		
Interim Strength	16 hours	2,500[1]	-	-
Ultimate Strength	36 hours	4,000[2]	-	-
	14 days	3,500[1]	4,000[4]	3,500[2&4]
	28 days	-	-	4,000[3&4]

[1] Pavement
[2] Structures
[3] Drilled shaft. The time to obtain the specified strength may be increased to a maximum 56 days.
[4] The compressive strength determined in the laboratory shall be designated as f'_{target} for future acceptance of the mixture

5.2.3. **Plastic Air Content.** Plastic air content shall meet the requirements in Table 8 when determined in accordance with Illinois Modified AASHTO T 152.

Table 8 – Plastic Air Content Requirements

Mixture Class	AX	HP	MC
Air Content (%) Range	5.0 – 8.0		

5.2.4. **Time to Cracking.** Net time to cracking shall be no less than the values in Table 9 when determined in accordance with ASTM C1581. Prior to batching for a test sample, all coarse aggregate particles exceeding ¾-inch shall be removed and replaced with an equal volume of minus ¾-inch graded material.

Table 9 – Minimum Time to Cracking Requirements

Mixture Class	AX	HP	MC
Time to Cracking (days)	10	28	-

5.2.4.1. For Class HP mixtures, this test shall be waived if the concrete mixture contains 605 lb/yd^3 or less total cementitious material and a minimum dosage of 1.5 gal/yd^3 of approved SRA.

5.2.5. **Length Change.** Measured shrinkage shall be no greater than the values in Table 10 after 21 days of air drying when determined in accordance with AASHTO T 160. Specimens shall be wet cured for 7 days prior to air drying. The initial reading for calculation of shrinkage shall be taken at the initiation of drying.

Table 10: Measured Shrinkage

Mixture Class	AX	HP	MC
Length Change	0.05%	0.03%	0.04%[1]

[1] The length change requirement will be waived if the mixture will only be used for drilled shaft construction.

5.2.6. **Freeze Thaw Durability.**

5.2.6.1. Class AX, HP, and MC mixtures shall possess an air-void system having the following characteristics as determined by ASTM C457 (Method B):

- Spacing factor not exceeding 0.008-in.
- Specific surface not less than 600 in^2/in^3
- Total air content not less than 4.0 percent

5.2.6.2. For Class AX, HP, and MC mixtures, the durability factor shall be no less than 80 percent after 300 cycles of freezing and thawing as determined in accordance with AASHTO T 161 (Procedure A) with the following modifications: the 14-day curing period prior to freeze-thaw cycling shall consist of 7 days immersion, in saturated lime water at 73.4 ± 3 °F followed by 7 days of storage in air at 73.4 ± 2 °F and at a relative humidity of 50 ± 4%. The freeze-thaw testing in accordance with AASHTO T 161 (Illinois Tollway modified) shall be waived if the air-void system parameters are met.

5.2.7. **Resistance to Penetration of Chloride Ions.**

5.2.7.1. The total charge passed shall not exceed the values in Table 11 when determined in accordance with AASHTO T 277 using the accelerated curing procedure. Test specimens shall be made in accordance with Illinois Modified AASHTO R 39. Specimens shall be cured for one week at 73 °F and the following three weeks at 100 °F. An interim test result can be provided at the option of the contractor. A test shall consist of three specimens.

Table 11: Chloride Penetrability

Mixture Class	AX	HP	MC
	Total Charge Passed (coulombs)		
28 days	2000	1250	-

5.2.7.2. For Class AX and HP mixtures, electrical surface resistivity shall be determined in accordance with Tollway Modified AASHTO T 358 and be reported for information. 4 x 8 in. cylinder specimens shall be used and shall be made in accordance with Illinois Modified AASHTO R 39 and moist-cured in lime-water for 28 days prior to testing.

5.3. Field Trial Batch Performance Parameters. Class AX, HP, MC, and TL mixtures require a field trial batch, witnessed by the Tollway, to demonstrate the following

requirements. The Contractor shall schedule the field trial batch with Tollway Materials a minimum of 7 days before the proposed date of the trial batch.

5.3.1. **Slump.** Slump shall meet the requirements of Table 12 when determined in accordance Illinois Modified AASHTO T 119.

Table 12 – Trial Batch Slump Requirements

Mixture Class	AX	HP	MC	TL
Slump (inches)	3-8	3-8[1]	3-8[1]	2-4[2]

[1] Slump loss shall be tested in accordance with section 5.2.1.
[2] Slump less than 2 inches will be permitted if the mixture is intended for slipform placement.

5.3.2. **Compressive Strength.** Compressive strength shall be no less than the values in Table 13 when determined in accordance with Illinois Modified AASHTO T 22. Test cylinders shall be made and cured in accordance with Illinois Modified AASHTO T 23. Strength shall be defined as the average of two 6 x 12 in. cylinder breaks.

Table 13 – Trial Batch Compressive Strength Requirements

Type of Strength	Age	AX	HP	MC	TL
		(psi)			
	16 hours	2,500[1]	-	-	-
	3 days	-	-	-	2,500
Ultimate	36 hours	4,000[2]	-	-	-
	7 days	-	-	-	3,500
	14 days	3,500[1]	$4000 \le fc \le [f'_{target} +1500]$[3]	$3,500 \le fc \le [f'_{target} +1500]$[2&3]	-
	28 days	-	-	$4,000 \le fc \le [f'_{target} +1500]$[3&4]	-

[1] Pavement
[2] Structures
[3] f'_{target} and fc are defined as the strength obtained in the laboratory and field trial batches, respectively.
[4] Drilled Shaft. The 7 and 14-day compressive strength results shall also be provided. The time to obtain the specified strength may be increased to a maximum 56 days.

5.3.3. **Plastic Air Content**. Plastic air content shall meet the requirements of Table 14 when determined in accordance with Illinois Modified AASHTO T 152.

Table 14 – Trial Batch Plastic Air Requirements

Mixture Class	AX	HP	MC	TL
Air Content (%)	+/- 1.5 from design, Minimum of 4.0	5.0 – 8.0%	5.0 – 8.0%	5.0 – 8.0%, 5.5 - 8.0% for slipform

5.3.4. **Freeze Thaw Durability.**

5.3.4.1. Class AX, HP, MC, and TL mixtures shall possess an air-void system having the following characteristics as determined by ASTM C457 (Method B):

- Spacing factor not exceeding 0.008-in.
- Specific surface not less than 600 in^2/in^3
- Total air content not less than 4.0 percent

5.3.4.2. The air-void system requirement in Section 5.3.4.1 shall be waived if the mixture has a system air metric (SAM) number no greater than 0.20 and an air content no less than 5.0% when determined in accordance with AASHTO TP 118. In addition, the difference between the QC and Tollway Materials representative's SAM number and air content shall be no greater than 0.1 and 0.9%, respectively.

5.3.5. **Water / Cementitious Materials Ratio**. For AX, HP, MC and TL mixtures, water / cementitious materials ratio shall be design -0.03, +0.00.

5.3.6. **Resistance to Penetration of Chloride Ions.**

5.3.6.1. The total charge passed shall not exceed the values in Table 15 when determined in accordance with AASHTO T 277 using the accelerated curing procedure. Test specimens shall be made in accordance with Illinois Modified AASHTO T 23. Specimens shall be cured for one week at 73 °F and the following three weeks at 100 °F. An interim test result can be provided at the option of the contractor. A test shall consist of three specimens.

Table 15: Chloride Penetrability

Mixture Class	AX	HP	MC	TL
	Total Charge Passed (coulombs)			
28 days	2000	1500	-	-

5.3.6.2. For Class AX, HP, and TL mixtures, electrical surface resistivity shall be determined in accordance with Tollway Modified AASHTO T 358 and be reported for information. 4 x 8 in. cylinder specimens shall be used and shall be made in accordance with Illinois Modified AASHTO T 23 and moist-cured in lime-water for 28 days prior to testing.

5.3.7. **Maturity.** For Class AX, HP, MC, and TL mixtures, a strength-maturity relationship shall be developed in accordance with Illinois Tollway Test Procedure (TTP) 014 Estimating Concrete Strength by Maturity. If the maturity verification fails during use, then the Contractor shall be responsible for developing a new maturity-strength relationship according to TTP 014.

5.4. Mixture Qualification Submittal. The concrete mixture design shall be submitted using the Tollway A-70 form, and a mixture submittal shall include the following items:

5.4.1. Mixture design showing:

- Quantities, description, sources and mill certifications of all mixture ingredients

- Design water-cementitious materials ratio (w/cm)
- Design Slump
- Design Air content
- Gradation and absorption of all aggregates
- Bulk specific gravity (SSD) of all cementitious materials and aggregates
- Theoretical mass and fresh density
- Admixture dosage

5.4.2. A trial batch report demonstrating that the concrete complies with the performance requirements herein specified.

5.4.3. A strength-maturity relationship in accordance with Illinois Tollway Test Procedure (TTP) 014 Estimating Concrete Strength by Maturity.

5.5. Mixture Design Approval. Once verified, a mixture design will be approved for use for a three-year period. In addition, any change in aggregate or cement source; cement/supplementary cementitious type, grade or classification; or admixture brand or manufacturer; must be approved by Tollway Materials and will require a resubmittal and additional testing.

6. Field Production

6.1. Quality Plan.

6.1.1. At least 14 days prior to the first concrete placement, the Contractor shall submit the Tollway A-71 form, Quality Control Plan for Concrete Production at the Jobsite.

6.1.2. Prior to placements requiring cold weather protection, the Contractor shall submit the Tollway A-72 form, QC Plan for Cold Weather Placement of Concrete.

6.2. Production Facility and Transportation Equipment. Production facilities and transportation equipment shall be in accordance with Section 1103, with the following additions:

The production facility and ready-mix trucks supplying portland cement concrete shall have a current Certification of Ready Mixed Concrete Production Facilities from the National Ready Mixed Concrete Association (NRMCA). The Contractor's Quality Control Plan shall include documentation of NRMCA certification.

6.3. Curing. Class AX, MC, and TL mixtures shall be in accordance with Article 1020.13 for the appropriate type of construction. For Class HP mixtures, curing shall be in accordance with Article 1020.13(a)(5) of the Standard Specifications for a 7-day period, with the following additions:

6.3.1. The temperature of the curing water shall not be more than 20 °F cooler than the surface temperature of the concrete at the time the water and concrete come in contact. The curing water temperature shall be measured in the storage tank. The surface temperature of the concrete shall be measured under the cotton mats placed for curing. Measuring the temperatures of the curing water and concrete surface, and any required heating or cooling of the curing water, shall be the responsibility of the contractor.

6.3.2. Use black or dark colored plastic sheets when the daily high ambient temperature is below 60 °F. Use white or similarly reflective plastic sheets when the daily high ambient temperature is above 85°F. Use any color or transparency of plastic sheet at temperatures between 60 and 85 °F.

6.3.3. Remove Article 1020.13(a)(6).

6.4. Protection of Concrete Other Than Structures from Low Air Temperatures

The Contractor shall protect the concrete in accordance with Article 1020.13(c), except as revised herein:

6.4.1. Replace the 3rd sentence of the 2nd paragraph of Article 1020.13(c) with the following.

The protective cover shall also extend a minimum of 1 ft. beyond the placed concrete and shall remain in place until the estimated in-place concrete strength as determined by Illinois Tollway Test Procedure (TTP) 014 Estimating Concrete Strength by Maturity meets the design strength of the item. This is intended to evaluate when removal of protection is allowed, or when concrete can be opened to traffic. Final acceptance of the strength of the item is based on standard laboratory cured cylinders.

6.4.2. Replace the 3rd paragraph of Article 1020.13(c) with the following.

The Contractor shall provide means for checking the temperature near the surface of the concrete during the protection period according to Article 1020.13(d)(1) and Section 6.5.2 of this special provision.

6.4.3. Replace the 4th paragraph of Article 1020.13(c) with the following.

The concrete temperature should be a minimum of 40 °F and a maximum of 90 °F, but shall not be less than 35 °F. The Contractor is advised the protection specified, including the insulation R value, is an approximation for meeting the 40 °F minimum within the first 48 hours of placement. Additional insulation during the protection period may be required to meet the requirements in Section 6.4.1 of this special provision. The Contractor shall implement corrective action, as detailed in the A-72 form, if temperature probe sensor readings are below 40°F.

6.5. Protection of Concrete Structures from Low Air Temperatures

The Contractor shall protect the concrete in accordance with Article 1020.13(d), except as revised herein:

6.5.1. Replace the 2nd sentence of the 1st paragraph of Article 1020.13(d) with the following.

This protection shall remain in place until the estimated in-place concrete strength as determined by Illinois Tollway Test Procedure (TTP) 014 Estimating Concrete Strength by Maturity meets the design strength of the item. This is intended to evaluate when removal of protection is allowed, or when concrete can be opened to traffic. Final acceptance of the strength of the item is based on standard laboratory cured cylinders.

6.5.2. Replace the 8th sentence of 5th paragraph of Article 1020.13(d)(1) with the following.

Temperature sensor readings shall be provided to the Engineer in the morning of each day for the duration of the required protection.

6.5.3. Replace the 6th paragraph of Article 1020.13(d)(1) with the following.

The concrete temperature should be a minimum of 45 °F and a maximum of 90 °F, but shall not be less than 40 °F. The Contractor is advised the protection specified, including the insulation R value, is an approximation for meeting the 45 °F minimum within the first 72 hours of placement. Additional insulation during the protection period may be required to meet the requirements in Section 6.5.1 of this special provision. The Contractor shall implement corrective action, as detailed in the A-72 form, if temperature probe sensor readings are below 45°F.

6.5.4. Add the following to Article 1020.13(d):

For Class HP mixtures, when protection is required, the temperature of water for curing shall be no less than 45°F.

6.5.5. Add the following to Article 1020.13(d)(1)

6.5.5.1. Protection Method IA. For superstructure and moment slabs, Protection Method I shall apply, with the following exception: The insulating material shall only cover the top and sides of the superstructure and moment slabs.

6.5.5.2. Protection Method IB. For superstructure and moment slabs, Protection Method I shall apply, with the following exceptions: The insulating material shall only cover the top and sides of the bridge deck. The Contractor shall place heating coils uniformly across the superstructure and moment slabs.

6.6. Temperature Control. Temperature control for concrete placement shall be in accordance with Article 1020.14, except as revised herein.

6.6.1. The temperature of the surfaces to receive concrete shall not be less than 40°F.

6.6.2. The temperature of the concrete at the point of placement shall not be less than 60°F for ternary mixtures or for any concrete with more than 20% fly ash or 35% slag replacement of Portland cement. This does not apply to Class MC mixtures.

6.6.3. Class HP mixtures shall not be placed when the ambient air temperature exceeds 90ºF without approval of the Engineer and the maximum concrete temperature shall be 85ºF at the point of placement, except when placement operations are conducted at night, when the maximum concrete temperature shall be 90ºF.

6.7. Field Acceptance.

6.7.1. Concrete mixtures shall be tested and evaluated according to the Illinois Department of Transportation Recurring Special Provision for Quality Control/Quality Assurance of Concrete Mixtures, except as revised herein.

6.7.1.1. Add the following to Article 1020.16(g) Schedule B Footnote 2/:

If a gap in the placement of a given mix design exceeds two hours, the procedure to determine testing frequency shall restart for slump, air content, temperature, and compressive strength.

6.7.1.2. Revise Article 1020.16(g) Schedule B Footnote 7/ to read:

The test of record for strength shall be the day indicated in Article 1020.04 and herein as ultimate strength. Compressive strength, as measured using Illinois Modified AASHTO T 22, shall be determined using only 6 x 12 in. cylinders. Estimated in-place concrete strength as determined by Illinois Tollway Test Procedure (TTP) 014 Estimating Concrete Strength by

Maturity shall be used to determine early falsework and form removal, early pavement or bridge opening to traffic, or to monitor strengths.

6.7.2. Acceptance to this specification shall be based on the key characteristics in Table 16 below:

Table 16 – Field Acceptance Requirements

Test	AX	HP	MC	TL
Strength (psi)	Interim: 2,500 at 16 hours[1] Ultimate: 3,500 at 14 days[1] Ultimate: 4,000 at 36 hours[2]	Ultimate: 4000 ≤ f_c ≤ [f'_{target} +1500]	Ultimate: 3,500 ≤ f_c ≤ [f'_{target} +1500] [2] Ultimate: 4,000 ≤ f_c ≤ [f'_{target} +1500] [3]	Interim: 2,500 at 3 days Ultimate: 3,500 at 7 days
Plastic Air Content (%)	Design ± 1.5%, Minimum of 4%	5.0 – 8.0%		5.0 – 8.0% 5.5 - 8.0% for slipform
Slump (in.)	3-8	3-8		2-4[4]
Water / cementitious materials ratio	Design -0.03, +0.00			

[1] Pavement

[2] Structures

[3] Drilled Shaft. The 7 and 14-day compressive strength results shall also be provided. The time to obtain the specified strength may be increased to a maximum 56 days, provided the curing period specified in Article 1020.13 is increased to a minimum of 14 days.

[4] For Slipform Placement - Maintain the concrete at a uniform consistency. The Engineer will not allow an edge slump greater than ½ inch where no additional concrete work is to be constructed immediately adjacent to the pavement being placed. The Engineer will not allow an edge slump greater than ¼ inch where additional concrete work is to be constructed immediately adjacent to the pavement being placed.