The contractor shall keep the Street Lighting Construction Supervisors informed of the status of the roadway construction. Contact:

Mr. George Berdine	(414) 286-5943/ office	(414) 708-4245/ cell
Mr. Dennis Miller	(414) 286-5942/ office	(414) 708-4251/ cell

If neither Mr. Berdine nor Mr. Miller are available, contact the lighting dispatcher at (414) 286-5944.

The contractor must keep the area behind the curb free from over pour and other debris. The contractor will be held responsible for costs incurred by Street Lighting Forces for cleaning debris from behind the curb.

If the contractor requests the relocation of any street lighting facilities, permanent or temporary, for mere convenience, the contractor will be responsible for all costs incurred by Street Lighting personnel fulfilling the relocation request.

Any questions regarding the design of the lighting system are to be directed to Street Lighting Engineering, contact Mr. Tom Manzke at (414) 286-3265.

28. High Performance Concrete Masonry Superstructure, Item SPV.0035.01.

A. Description.

High Performance Concrete Masonry, Superstructure shall consist of a mixture of cement, fine aggregate, coarse aggregate and water, proportioned, mixed, placed and protected in accordance with these specifications. Fly ash, ground granulated blast furnace slag and admixtures may constitute a portion of the designated job mix.

Complete all work as specified herein and in accordance with the applicable portions of sections 501 and 502 of the standard specifications.

B. Materials.

Performance Criteria.

Table 1 - HPC Mix Performance Criteria

Property	Required Value	Test Method
Initial set time, minimum	3 hours	ASTM C403
Slump, maximum after HRWR addition	8 inches	ASTM C143
Slump, minimum after 45 minutes	4 inches	ASTM C143
Pumpability (optional)	Plastic viscosity < 300 Pa-s	Modified slump test
Total air content, plastic concrete	6 +/- 1.5%	AASHTO T152
28-day compressive strength, minimum	6,000 psi	AASHTO T22

28-day compressive strength, maximum	9,000 psi	AASHTO T22
Total air content, hardened concrete	6 +/- 1.5%	ASTM C457
Max air void spacing factor	0.010 in	ASTM C457
Min air void specific surface	500 in (-1)	ASTM C457

REQUIREMENTS OF TABLE 2 ARE WAIVED

Table 2 - Testing for Durability and Material Properties of HPC

Property	Required Values	Test Methods
Freeze/thaw resistance	DF>90% at 300 cycles DF>85% at 500 cycles	ASTM C666A or B
Chloride permeability resistance	<2000 coulombs at 28 days	ASTM C1202
Chloride penetration resistance	1/2 – 1 inch, <0.03% Cl by wt. of concrete at 90 days 1/2 - 1 inch, <0.06% Cl by wt. of concrete at 4 months	AASHTO T259/T260
Salt scaling resistance	Rating of 0-1 at 50 cycles	ASTM C672
Shrinkage	$<600 \times 10^{-6}$ at 90 days	ASTM C157
Cracking resistance	Comparative test	AASHTO Cracking Tendency Test
Creep Behavior	N/A	ASTM C512
Elastic Modulus	N/A	ASTM C469
Flexural Strength	N/A	ASTM C78

The addition of Type F HRWR will be allowed in the field at the point of delivery. Type G HRWR admixtures shall only be added at the batch plant. The maximum haul time for concrete transported in truck mixers or truck agitators shall be in accordance with the standard specifications, and concrete shall be discharged before 300 revolutions of the drum or blades. The concrete temperature at placement shall be in accordance with the standard specifications under the field and plant conditions.

B.2 Raw Material Requirements

Raw materials shall be in accordance t section 501.2 of the standard specifications and be from department approved sources. These sources shall also meet the requirements of these special provisions as detailed below:

Requirements for Raw Materials:

1. Portland cement, Type I or II, (conforming to the standard specifications, section 501.3)
   ASTM C-150 chemical and physical requirements
   Additional Raw Material Requirements:
   - ~~$SO_3 < 3.5\%$~~ DELETED
   - Blame fineness <400 m^2/kg
   - Equivalent alkalis ($Na_2O + 0.658\ K_2O$), max., 0.060%

Coarse and fine aggregates shall be tan, cream, or buff colored.

2. Coarse aggregate, Size No.1 (conforming to the standard specifications, section 501.2.5.4.4, ASTM No. 67 (nominal maximum size 3/4 inches) crushed stone only. Crushed gravel, crushed concrete, crushed slag or crushed sandstone shall not be allowed.
   - Department approved
   - ASTM C-33-67 requirements, class 5S

3. Fine aggregate, natural siliceous sand or stone sand, conforming to the standard specifications, section 501.2.5.3
   - Department approved
   - Gradation in accordance with standard specification, section 501.2.5.3.4

4. Fly ash, Class "C"
   - ASTM C-618 and the standard specifications, section 501.2.6
   - Department approved
   - Maximum SO3 content of 3.5 percent
   - ~~Maximum available Na2O equivalent content of 1.5 percent.~~ DELETED
   - Autoclave soundness test (AS1'M C151) on a combination of the job fly ash with the job cement (0.8% maximum expansion or contraction)

5. Slag (GGBFS)
   - Grade 100 or 120 ASTM C989 and the standard specifications, subsection 501.3.8
   - Department approved

6. Silica Fume
   - AASHTO M307 requirements
   - Department approved
   - Optional chemical and physical requirements of AASHTO M307 apply

7. Air-entraining agent
   - AASHTO Ml 54 requirements
   - Department approved
   - Standard specifications, section 501.3.3

8. High-range, water-reducing admixture
   - AASHTO M194 requirements, Type F or Type G
   - Care shall be taken that water contents are not reduced to levels which will restrict cement hydration. Water-cement rations shall not be lower than ~~0.480~~ 0.320. The liquid admixture shall be counted as water in the calculation of the water-cement ratio. CHANGED TO
   - An initial slump of 1 1/2 inches to 2 inches is recommended prior to addition of the high range admixture. Final slump shall be no greater than

is necessary for proper placement and compaction on in no case shall exceed 7 inches after addition of the high range admixture.
- Air tests will be performed after the addition of the admixture.
- Naphthalene sulfonate condensate or melamine sulfonate condensate type

B.3 Mix Design

Design and be responsible for the performance of the concrete mix. The mix proportions selected shall produce concrete that is sufficiently workable and finishable.

The trial batch test, such as described in American Concrete Institute Publication 211.2, shall be used in selecting mix proportions.

The mix design shall be based upon obtaining an average concrete strength sufficiently above the specified strength so that, considering the expected variability of the concrete and test procedures, no more than 1 in 10 strength tests will be expected to fall below the specified strength. Mix designs shall be modified during the course of the work when necessary to ensure compliance with strength and consistency requirements.

Satisfactory performance of the proposed mix design shall be verified by laboratory tests on trial batches. The results of such tests shall be furnished to the engineer at the time the proposed mix design is submitted. For mix design approval, the strengths of a minimum of five test cylinders taken from a trial batch shall average at least 800 psi greater than the specified strength.

If materials and a mix design identical to those proposed for use have been used on other work within the previous year, certified copies of concrete test results from this work, which indicate full compliance with these specifications, may be substituted for such laboratory tests. If the results of more than 10 such strength tests are available from historical records for the past year, average strength for these tests shall be at least 1.28 standard deviations above the specified strength.

All mix designs, and any other modifications thereto, shall be approved by the engineer prior to use. Mix design data provided to the engineer for each class of concrete required shall include the name, source, type and brand of each of the materials proposed for use and the quantity to be used per cubic yard of concrete.

The following two tables consist of two mix designs that may result in a concrete that satisfies the performance criteria specified herein. It shall be the contractor's responsibility to modify or adapt the mix design or develop a new mix design to satisfy the performance criteria

Table 3 - Proposed HPC Mix Design No. 1

Concrete Component	Amount
Portland cement content	525-575 lb/yd^3, Type I or I/II
Fly Ash	Class "C", 10% addition (by weight of cement)
Silica Fume	5% addition (by weight of cement)
Ground granulated blast furnace slag (GGBFS)	15% addition (by weight of cement)
Coarse aggregate	3/4 inch Maximum size (No. 67/CA 11), crushed stone
Water/cementitious material ratio	0.320 ~~0.480-0~~.560
Air entraining agent	0.36-0.38 (including water from HRWR) Approximately 1-2 oz/lb. Portland cement (the actual amount should be adjusted to provide the specified air content system; it could be outside this range)
HRWR, AASHTO M194 Type f (normal setting naphthalene Sulfonate condensate or melamine Sulfonate condensate)*	Approximately 100-128 ozlyd3 (the actual amount should be adjusted to provide the specified slump; it could be outside this range)

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* Alternate HRWR admixture types must be submitted for approval. Corrosion inhibitors and accelerating admixtures (Types C or E) shall not be allowed. Retarding admixtures (Type B or D) shall not be allowed for precast concrete.

Table 4- Proposed HPC Mix Design No.2

Concrete Component	Amount
Portland cement	520 lb/yd3, Type I or I/II
Fly Ash	Class "C", 180 lb/yd^3
Fine aggregate (Sand)	1259 lb/yd^3
Coarse aggregate (Stone)	1754 lb/yd^3
Water	266 lb/yd^3
Water reducer	0.36 gal./yd^3
Superplasticizer	0.64 gal./yd^3
Air entrainment	as required

B.4 Suggested Mixing Procedure

The Contractor is responsible for ensuring that a proper mixing sequence is used to ensure good distribution of the cementitious materials without balling. The following mixing sequence is provided for information purposes only and has been used to achieve proper mixing of HPC concrete:

1. Turbine mixer. — The mixing action of a turbine mixer is good and the order of adding ingredients is generally not critical. The suggested order of addition is as follows:

Add sand and coarse aggregate to the rotating mixer
Add approximately half the water and half the AEA
Add the cementitious materials (Portland cement, fly ash, and silica fume)
Add the remaining water and AEA
Mix for 3 minutes

2. Tilting drum mixer or ready-mix truck. - The sequence of addition of ingredients is more critical when these mixers are used. The suggested sequence of material addition is as follows:

Add the silica fume to the drum with approximately 1/3 of the coarse aggregate and mix well
Add 70 percent of the mix water containing the air entraining admixture to the rotating drum

After a several second delay (5-7 seconds) introduce the remaining aggregates

As the aggregates are discharging (7 to 10 seconds delay) add cementitious materials (in any order, Portland cement, fly ash)
Add the rest of the mix water
Mix for 70 revolutions

Add the HRWR. HRWA (Type F) is to be added at the job site.
Alternatively, a Type G HRWA may be used at the plant to achieve the required slump.

If Type F HRWR is added at the job site, the concrete must be mixed for 70 revolutions after its addition (about 7 minutes at mixing speed, assuming 9-10 revolutions per minute).

B.5 Curing Requirements

The cast-in-place concrete shall be moist cured (wetted burlap method) according to the standard specifications, section 502.3.8. Additionally, special curing techniques will be required such as continuous application of water to insure proper hydration. These requirements will be included in the final material specifications based upon testing performed under this LIQ. Moist curing of the test samples will be performed by application of wet burlap and plastic for 4 days and cured in accordance with AASHTO requirements for test samples curing for 28-day strength and the standard specifications, section 502.3.10.1.3. Cold weather concrete procedures shall be in accordance with section 501.3.9 of the standard specifications.

B.6 Required Contractor Testing

B.6.1 Aggregate Testing During Concrete Production

(1) Perform the following tests on aggregate used for the production of this HPC mix:

Gradations	AASHTO T-11 & T-27*
P-200 (75um)	AASHTO T-11*

Aggregate Moisture	AASHTO T-255*

*As modified in CMM 4-25-50

(2) Perform the tests required in B.6.1.(1) at a frequency of one (1) test per day during concrete production.

B.6.2 Required Concrete Testing

(1) Perform the following tests on this HPC mix:

Compressive Strength	AASHTO T-22, T-23, T-141, M-201
Temperature	AASHTO T-309
Slump	AASHTO T-119*
Air Content	AASHTO T-152*

*As modified in CMM 4-25-70

(2) Perform all of the tests required in B.6.2.(1) at a frequency of once per 50 cubic yards or fraction thereof placed.

C. Construction.

Concrete shall be placed as shown on plans for superstructure. Apply a sack rubbed finish to top of curbs and all exposed side, sloped and underside surfaces of superstructure, and all exposed surfaces of the pier in accordance with subsection 502.3.7.5 of the standard specifications.

D. Measurement.

The department will measure High Performance Concrete Masonry Superstructure by the cubic yard acceptably completed.

E. Payment.

The department will pay for the measured quantity at the contract unit price under the following bid item:

Item Number	Description	Unit
SPV.0035.01	High Performance Concrete Masonry Superstructure	CY

Payment is full compensation for furnishing and placing all materials; preparing the mix design; performing testing; finishing and curing the concrete; and for furnishing all labor, tools, equipment and incidentals necessary to complete the contract work.

29. Cellular Concrete, item SPV.0035.02.

A Description.

This work consists of furnishing and installing cellular concrete backfill (lightweight embankment material) at the locations shown on the plans.

Work and materials shall be in accordance with the applicable provisions of sections 209 and 501 of the standard specifications and as hereinafter provided.