

**ITEM 05557.41 M - LIGHTWEIGHT HIGH-PERFORMANCE CONCRETE FOR
STRUCTURAL SLABS - BOTTOM FORMWORK REQUIRED**

DESCRIPTION.

Furnish and place reinforcing steel and lightweight high-performance concrete to construct superstructure slabs as shown in the contract plans.

MATERIALS.

Use materials meeting §557-2. Perform additional work as follows:

Manufacture lightweight high-performance concrete according to §501, and the following modifications:

1. Design a lightweight high-performance concrete mixture, proportioned according to the American Concrete Institute Manual of Concrete Practice, ACI 211.2, Standard Practice for Selecting Proportions for Structural Lightweight Concrete. Produce a homogeneous mixture of cement, fly ash, microsilica, fine aggregate, lightweight coarse aggregate, air entraining agent, normal range set-retarding water-reducing admixture, and water as designed.
2. Use Type 2 cement. Use a minimum cementitious content of 360 kg/m³.
3. Use lightweight coarse aggregate conforming to §703-10, with a gradation in the 25mm to 4.75 mm size designation in Table 1, ASTM C330.
4. Construct lightweight aggregate stockpile(s) so as to maintain uniform moisture throughout the pile. Continuously and uniformly sprinkle the stockpile(s) with water for a minimum of 24 hours using a sprinkler system approved by the Materials Engineer. If a steady rain of comparable intensity occurs, turn off the sprinkler system at the direction of the Materials Engineer, until the rain ceases. At the end of the wetting period, or after the rain ceases, allow stockpiles to drain for 12 to 15 hours immediately prior to use, unless otherwise directed by the Materials Engineer.
5. Supply either a densified powder or slurry form of microsilica admixture whose brand name appears on the Department's Approved List. Use only one brand for any structural element. Provide written certification from the Supplier that the microsilica meets the requirements of the Materials Bureau. Include the following data: fineness, silica content, total chloride ion content, solids content for slurries, and moisture content for densified powders.

Agitate the slurry as necessary to prevent separation. Remove and replace slurry that reaches a temperature less than 0°C., at no cost to the Department.

The Materials Engineer will take a ½ - 1 liter microsilica sample directly from the storage container, for each days placement, for testing by the Department.

If densified powder is used, and added independently - weigh cumulatively in the following order: cement, fly ash and microsilica. Base the batching tolerance of ±½% on the total mass of cementitious material, for each material draw mass.

If densified powder is used as part of a blended cement - weigh cumulatively in the following order: blended cement and fly ash. Base the batching tolerance of ±1% on the total mass of cementitious material, for each material draw mass.

If microsilica slurry is used - use proportioning equipment approved by the Materials Engineer. Add through an existing automation system or a two stop, off-line automated, batching system meeting the following requirements:

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- Delivery accuracy - $\pm 1\%$ (by volume)
- Program quantity - liters (nearest tenth)
- Batching tolerance - $\pm 2.0\%$ (by volume)
- System interlocks
- Print requirements:
 - a. Date and time
 - b. Truck number (or alternate method relating microsilica to batch ticket)
 - c. Delivered quantity (liters, nearest tenth)

Locate the control box/printer for a two stop, off-line batching system at the batch plant operator's work station unless otherwise approved by the Materials Engineer.

Calibrate in accordance with procedures approved by the Materials Engineer. Recalibrate the entire system if part or all of the off-line system is moved.

6. After the materials have been accepted for this work, determine the proportions for concrete and equivalent batch masses based on trials made with materials to be used in the work.
 - a. Determine the cement content for each trial batch by means of a yield test according to ASTM C138.
 - b. At least 1 week prior to concrete placement provide the Materials Engineer with a copy of the trial mix design with the following data.
 - i. Fine and coarse aggregate (saturated surface dry condition) content in kg/m^3 .
 - ii. Cement content in kg/m^3 .
 - iii. Water content in kg/m^3 .
 - iv. Dry unit mass in accordance with ASTM C567.
 - v. 28 day compressive strengths.
 - vi. Batch masses.

The Materials Engineer will approve the batch weights prior to use. Use these values to manufacture all lightweight concrete for this project, and periodically correct the batch masses to account for changes in the fine aggregate fineness modulus and aggregate moisture contents.

7. Achieve an average compression strength of 25.00 MPa, or greater, with no individual cylinder compressive strength less than 21.00 MPa.
8. Produce concrete with an average dry unit mass ranging from 1750 to 1850 kg/m^3 when tested in accordance with ASTM C567.

CONSTRUCTION DETAILS.

Apply the provisions of §557-3 and the following modifications:

1. Install epoxy coated reinforcing steel and Uncoated Bar Reinforcement for Concrete Structures in accordance with Section 556 - Reinforcing Steel for Concrete Structures and as shown on the plans.
2. Add the following to §557-3.01, Concrete Manufacturing and Transporting:

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- a. Use slump and air tests as a control measure to maintain a suitable consistency. Perform slump and air tests according to NYSDOT Materials Method 9.2. Determine air content by the volumetric method described in ASTM C173. Air content and slump placement limits are:

	Minimum	Desired	Maximum
Air Content (Volumetric Method)	5.0%	6.5%	8.0%
Slump (mm)	----	65-90	100

- b. If the lightweight coarse aggregate moisture content at the time of batching is less than saturated surface dry (SSD), introduce lightweight coarse aggregate, along with approximately 2/3 of the total mixing water, into the mixer and mix for a minimum of 10 minutes. Otherwise, batch the coarse aggregate routinely with the fine aggregate, admixtures, cement, fly ash, microsilica, and remaining mixing water and mix completely.
- c. Have the lightweight aggregate manufacturer supply a service representative at the site for the first two days of lightweight concrete placement operations to assist in the control of lightweight concrete mixing and placement operations.
3. Handle and place concrete according to §557-3.06, Handling and Placing, except that pumping is not permitted. No waivers will be granted.

Test the concrete according to written Department procedural directives. Fabricate and cure cylinders for compressive strength testing according to NYSDOT Materials Method 9.2 procedures. The Engineer will cast cylinders, in sets of 2 individual cylinders, at a frequency of 1 set for each 50 m³, or fraction thereof actually placed. A minimum of 1 set will represent each day's concrete placement.

4. Cure concrete according to §557-3.12, Curing, except that only continuous wetting is allowed.
5. Make any repairs as per the provisions of §557-3.13, Damaged or Defective Concrete. In addition, the Engineer will reject any concrete represented by a cylinder set with an average compressive strength less than 25.00 MPa, or an individual cylinder with a compressive strength less than 21.00 MPa. Proposed repairs require Deputy Chief Engineer, Structures approval.
6. The loading limitations of §557-3.14 apply, except that concrete cylinder sets designated for early loading must attain an average compression strength of 25.00 MPa, or greater, with no individual cylinder less than 21.00 MPa.

METHOD OF MEASUREMENT.

Payment will be made at the unit price bid per square meter for the number of square meters of structural slabs stated in the Estimate of Quantities shown on the contract plans.

BASIS OF PAYMENT.

Include the cost of all labor, materials and equipment necessary to complete the work in the square meter bid price.

Progress payments will be made on a per span basis as follows:

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1. 40 percent of the estimate area after all reinforcing is properly placed.
2. 40 percent of the estimate area after concrete placement, and curing initiated.
3. The remainder after curing and necessary corrective work is complete.