



To: n-30-1-87728- Design Quality Assurance Bureau <b>SUPERSEDED</b> BY EI 00-019 EFFECTIVE 1/11/99		New York State Department of Transportation <b>ENGINEERING          INSTRUCTION</b>	<b>EI</b> <b>99-002</b>
<b>Title: SPECIFICATION REVISIONS- CLASS HP CONCRETE FOR SUBSTRUCTURES AND STRUCTURAL SLABS</b>			
Distribution: <input type="checkbox"/> Manufacturers (18) <input type="checkbox"/> Surveyors (33) <input checked="" type="checkbox"/> Main Office (30) <input checked="" type="checkbox"/> Consultants (34) <input type="checkbox"/> Local Govt. (31) <input checked="" type="checkbox"/> Contractors (39) <input checked="" type="checkbox"/> Regions/Agencies (32) <input type="checkbox"/> _____ ( )	Approved:  Paul J. Mack, Deputy Chief Engineer, Technical Services Division Date: 1/14/99		

This Engineering Instruction supersedes EI 96-024.

**EFFECTIVE DATE.** This Engineering Instruction will be effective on all Department contracts submitted for letting on or after May 6, 1999. Additionally, these specifications shall be substituted on all ongoing projects, by Order-on-Contract, to accommodate the material handling and placement improvements, at no additional cost to the State.

**PURPOSE.** To establish revised specifications for the use of Class HP concrete. Class HP concrete is the Departments standard class of concrete for bridge deck construction and may be used in substructure applications.

**BACKGROUND.** NYSDOT developed Class HP concrete in 1994 as part of a continuous improvement effort to produce longer lasting bridge decks. In 1996 Class HP was implemented as the standard class of concrete for bridge decks. Revised specifications have been developed to implement changes in allowable materials, handling and batching procedures, and concrete testing and acceptance procedures. Additionally, new specifications for applications other than bridge decks have been developed.

**IMPLEMENTATION.** All Class HP specifications now contain the following:

- The use of blended cements from the Department's Approved list will be allowed. The benefit of using a blended cement is that an allowable batching tolerance of 1% can be used rather than the tighter ½% tolerance required when a densified microsilica powder is added separately to the concrete.
- The use of Ground Granulated Blast Furnace Slag (GGBFS) appearing on the Department's Approved list will be allowed as a substitution for fly ash.
- The use of a water-reducing admixture, rather than a set-retarding water-reducing admixture, is allowed for substructure applications using Class HP concrete. This is to allow greater flexibility and control of set time in those instances where hydraulic pressure of the concrete on the forms is a concern.
- Mix criteria has been changed relating to allowable slump.

These revised specifications will be inserted into contract proposals by the Main Office Design Quality Assurance Bureau.

**DISAPPROVED SPECIFICATIONS.** The following specifications are superseded and disapproved for use.

ITEM 16555.0496      STRUCTURAL SLAB CONCRETE, CLASS HP (Optional Forming System)

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ITEM 18555.96	CONCRETE FOR STRUCTURES, CLASS HP
ITEM 18555.9601	CONCRETE FOR STRUCTURES, CLASS HP (Structural Slab with Integral Wearing Surface - Bottom Formwork Required)
ITEM 18555.9602	CONCRETE FOR STRUCTURES, CLASS HP (Structural Slab with Integral Wearing Surface - Bottom Formwork Not Required)
ITEM 18555.9603	CONCRETE FOR STRUCTURES, CLASS HP (Structural Slab with Separate Wearing Surface)
ITEM 18555.9604	CONCRETE FOR STRUCTURES, CLASS HP (Structural Approach Slab with Integral Wearing Surface)
ITEM 18555.9605	CONCRETE FOR STRUCTURES, CLASS HP (Structural Approach Slab with Separate Wearing Surface)
ITEM 11555.96M	CONCRETE FOR FOOTINGS, CLASS HP
ITEM 18555.96 M	CONCRETE FOR STRUCTURES, CLASS HP
ITEM 18557.0196M	SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE, BOTTOM FORMWORK REQUIRED
ITEM 18557.0596M	SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE, BOTTOM FORMWORK NOT REQUIRED
ITEM 18557.0796M	SUPERSTRUCTURE SLAB WITH SEPARATE WEARING SURFACE, BOTTOM FORMWORK REQUIRED
ITEM 18557.0996M	SUPERSTRUCTURE SLAB WITH SEPARATE WEARING SURFACE, BOTTOM FORMWORK NOT REQUIRED
ITEM 18557.2096M	STRUCTURAL APPROACH SLAB WITH INTEGRAL WEARING SURFACE
ITEM 18557.2296M	STRUCTURAL APPROACH SLAB WITH SEPARATE WEARING SURFACE

### **NEW SPECIFICATIONS.** The attached new and revised specifications include:

ITEM 16555.0498	STRUCTURAL SLAB CONCRETE, CLASS HP (Optional Forming System)
ITEM 18555.9804	FOOTING CONCRETE, CLASS HP
ITEM 18555.9805	CONCRETE FOR STRUCTURES, CLASS HP
ITEM 18555.0198	CONCRETE FOR STRUCTURES, CLASS HP (Structural Slab with Integral Wearing Surface - Bottom Formwork Required)
ITEM 18555.0298	CONCRETE FOR STRUCTURES, CLASS HP (Structural Slab with Integral Wearing Surface - Bottom Formwork Not Required)
ITEM 18555.0398	CONCRETE FOR STRUCTURES, CLASS HP (Structural Slab with Separate Wearing Surface)
ITEM 18555.0498	CONCRETE FOR STRUCTURES, CLASS HP (Structural Approach Slab with Integral Wearing Surface)
ITEM 18555.0598	CONCRETE FOR STRUCTURES, CLASS HP (Structural Approach Slab with Separate Wearing Surface)
ITEM 18555.9804M	FOOTING CONCRETE, CLASS HP
ITEM 18555.9805M	CONCRETE FOR STRUCTURES, CLASS HP
ITEM 18557.0198M	SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE, BOTTOM FORMWORK REQUIRED
ITEM 18557.0598M	SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE, BOTTOM FORMWORK NOT REQUIRED
ITEM 18557.0798M	SUPERSTRUCTURE SLAB WITH SEPARATE WEARING SURFACE, BOTTOM FORMWORK REQUIRED

- ITEM 18557.0998M SUPERSTRUCTURE SLAB WITH SEPARATE WEARING SURFACE,  
BOTTOM FORMWORK NOT REQUIRED
- ITEM 18557.2098M STRUCTURAL APPROACH SLAB WITH INTEGRAL WEARING SURFACE
- ITEM 18557.2298M STRUCTURAL APPROACH SLAB WITH SEPARATE WEARING SURFACE

**COST IMPACT.** The cost of producing Class HP concrete containing both fly ash and microsilica continues to vary depending on concrete plant capabilities and regional location. The changes initiated by these specifications will not result in any increased costs to the Department. The allowance for use of blended cements, developed at the request of industry, as well as allowing the use of GGBFS, will provide the producer with more flexibility in material selection and should not have an impact on cost. Mix criteria change is based on the Departments experiences using Class HP concrete. This change provides greater latitude for the use of this concrete and is not expected to influence costs.

**CONTACT PERSON.** Any questions regarding this Instruction should be directed to Field Engineering II, Materials Bureau at (518) 457-4582.

**ITEM 16555.0498- STRUCTURAL SLAB CONCRETE, CLASS HP  
(OPTIONAL FORMING SYSTEMS)**

**DESCRIPTION.** The work shall consist of furnishing and placing portland cement concrete and reinforcing steel to construct a structural slab.

Unless otherwise noted on the plans, the contractor may use any of the following forming systems to form the underside of the structural slab:

1. Removable forms
2. Permanent corrugated metal forms
3. Prestressed concrete form units.

The following restrictions shall apply:

- A. Fascia overhangs shall be formed with removable forms. The forms used shall leave the resulting concrete flat surfaced.
- B. A bay, constructed in stages such that a longitudinal joint is required, shall be formed with removable forms.
- C. A haunch which rests upon an end diaphragm shall be formed with removable, or permanent corrugated metal, forms.
- D. Prestressed concrete form units shall not be used where the design span is less than 5'-0" nor greater than 10'-9". The design span is equal to the beam spacing minus one-half the top flange width.
- E. Prestressed concrete form units may be restricted at the ends of some skewed spans. Refer to the plans for details.

The furnishing and installing of reinforcing steel will be part of this work.

**MATERIALS.**

1. **Concrete.** All the material requirements of §555-2 shall apply with the following additions:

A microsilica admixture shall be supplied in slurry form or as a densified powder, added either independently or as part of a blended cement. The Producer shall provide the Regional Materials Engineer with a minimum sample of one quart of microsilica directly from a storage container, for each days placement of Class HP concrete, for testing by the Department. This sample shall be obtained in the presence of a Department representative.

If the microsilica is to be added independently, it shall be one appearing on the Department's Approved List. Only one brand shall be allowed for any structural element. The Manufacturer shall provide written certification for each shipment supplied that the material meets the requirements of the procedural directives of the Materials Bureau. This certification shall list fineness, silica content,

**ITEM 16555.0498- STRUCTURAL SLAB CONCRETE, CLASS HP  
(OPTIONAL FORMING SYSTEMS)**

total chloride ion content, solids content for slurries, and moisture content for densified powders.

If the microsilica admixture is supplied in the slurry form it shall be maintained in storage above the temperature of 32°F. Slurries exposed to temperatures of 32°F or less shall be removed and replaced at no cost to the Department. The slurry shall be homogeneous and agitated as necessary to prevent separation.

If the microsilica admixture is supplied as a densified powder as part of a blended cement, the blended cement shall meet the requirements of Item 701-03 - BLENDED PORTLAND CEMENT, and shall appear on the Departments Approved List.

Item 711-12- GROUND GRANULATED BLAST FURNACE SLAG (GGBFS) may be substituted, in total, for fly ash and shall appear on the Departments Approved List.

Class HP concrete shall consist of a homogeneous mixture of cement, fly ash, microsilica admixture, fine aggregate, coarse aggregate, air entraining agent, set retarding water reducer and/or water reducing admixture and water. In addition, all Class HP concrete for superstructure slabs and structural approach slabs must contain a set retarding water reducing admixture as per §555-2.02. Class HP concrete shall meet the requirements of TABLE 1- MIX CRITERIA given below.

**MIX CRITERIA**

Cement content (lbs./c.y.)	500
Fly ash content (lbs./c.y.)	135
Microsilica content (lbs./c.y.)	40
Sand percent total aggregate (solid volume)	40
Designed water/total cementitious content	0.40
Desired air content (%)	6.5
Allowable air content (%)	5.0 - 8.0
Desired slump (inches)	4
Allowable slump (inches)	3 -5
Type of coarse aggregate gradation	CA 2

**NOTE:** The criteria are given for design information and the data is based on a fine aggregate fineness modulus of 2.80. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregate). The proportions shall be computed according to Department written instructions.

**ITEM 16555.0498- STRUCTURAL SLAB CONCRETE, CLASS HP  
(OPTIONAL FORMING SYSTEMS)**

2. **Other Materials.** These shall meet the following requirements:

Epoxy coated bar reinforcement	§ 709-04
Prestressed concrete form units	§ 718-05
Chairs, tie wires, and other devices used to position reinforcing steel	§ 556-2.01 § 556-2.02

**CONSTRUCTION DETAILS.**

1. **Concrete Manufacturing and Transportation.** The requirements of subsection 555-3 shall apply as modified herein.

Microsilica admixture addition shall be as follows:

A. If a microsilica slurry is used, the slurry shall be added using proportioning equipment approved by the Regional Materials Engineer. The microsilica slurry admixture shall be added through an existing automation system or a two stop off-line automated batching system. The automated batching system shall meet the following requirements:

- Delivery accuracy of  $\pm 1\%$  (by volume)
- Program quantity (gallons, 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 (gallons, nearest tenth)

B. If a densified powder is used, the densified powder shall be weighed cumulatively with the cement and fly ash. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus fly ash plus densified powder. The batching tolerance for the cement plus fly ash plus densified powder shall be  $\pm \frac{1}{2}\%$  by weight.

C. If a densified powder is used as part of a blended cement, The blended cement shall be weighed cumulatively with the fly ash. The blended cement shall be first in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of blended cement plus fly ash. The batching tolerance for the blended cement plus fly ash shall be  $\pm 1\%$  by weight.

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(OPTIONAL FORMING SYSTEMS)**

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

Calibration shall be in accordance with the procedures approved by the Regional Materials Engineer. Whenever any part or all of the off-line system is moved the entire system shall be recalibrated.

2. **Falsework.** The requirements of subsection 555-3.02 shall apply.

3. **Forms.**

A. **Removable Forms:** The requirements of 555-3.03A and 555-3.03B shall apply.

B. **Permanent Corrugated Metal Forms:** The requirements of 555-3.03A and 555-3.03C shall apply.

C. **Prestressed Concrete Form Units:** The requirements of 555-3.03A; 557-3.01; 557-3.02; 557-3.03A and 557-3.03B shall apply.

Form supports shall be placed in direct contact with the flange of the stringer. All attachments shall be made by permissible welds, bolts, or other means approved by the Engineer. The welding of form supports to steel not considered weldable, or to portions of flanges subject to tensile stresses will not be permitted. Welds and welding shall be in accordance with those portions of the New York State Steel Construction Manual concerned with fillet weld design, fillet weld details, general workmanship and technique, except that 1/8 inch fillet welds will be permitted. All welding shall be performed by a New York State Department of Transportation Certified Welder whose qualifications permit him to do the work.

4. **Placing and Fastening Reinforcing Steel.**

A. **Removable Forms and Permanent Corrugated Metal Forms.** The requirements of subsection 556-3.01 and 556-3.02 shall apply.

B. **Prestressed Concrete Form Units.** The requirements of subsections 556-3.01 and 556-3.02 shall apply, except that the second paragraph of 556-3.02E which begins with "The structural..." and ends with "...of concrete." shall not apply. The following shall apply instead: "The top reinforcing steel mat shall be securely connected to the forms and the stud shear connectors. Connections shall be placed no farther apart than 4'-0" on centers. Connections to the forms may be made to the form lifting devices, reinforcing steel projecting from the forms, or devices in the form supplied for this purpose. Hold down devices shot into the form will not be permitted. Connections shall neither deflect the reinforcing steel, nor interfere with the smooth flow of concrete."

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(OPTIONAL FORMING SYSTEMS)**

5. **Handling and Placing Structural Slab Concrete.** The requirements of 555-3.04 shall apply.
6. **Provisions for Concreting in Cold Weather.** The requirements of 555-3.06A and 555-3.06B shall apply.
7. **Cold Joints.** "Cold Jointing," that is, the bonding of fresh concrete to set concrete, will be allowed only where indicated on the plans, or where approved by the DCES. For the purpose of this specification, the plane formed between prestressed concrete form units, and subsequent portland cement concrete placements, is not considered a cold joint.

When cold jointing, the concrete in place shall have its surface cut over with a suitable tool to remove all loose and foreign materials. This surface shall be scrubbed with wire brooms and kept clean. Immediately before placing the new concrete, the forms shall be drawn tightly against the concrete in place. The existing concrete surface shall be coated thoroughly with a thin coating of 1:1 mortar, or neat cement paste, thoroughly brushed into the surface.

The mortar shall be worked into the prepared surface by means of stiff brushes, or other methods acceptable to the Engineer. Mortar shall not be allowed to begin to dry. If drying does begin to occur, as evidenced by a light grey color, prior to concrete placement, the Engineer shall order the mortar to be completely removed and new mortar placed at no additional cost to the State.

8. **Finishing Integral Wearing Surfaces:** The requirements of subsection 555-3.08D shall apply.
9. **Finishing Surfaces to be Overlaid with Portland Cement, or Asphalt, Concrete:** Finishing of these surfaces shall be done by mechanical means except in areas which are inaccessible to a mechanical screeding operation. The equipment shall be approved by the Engineer prior to use.

Surfaces shall be screeded to a surface tolerance of 3/8 of an inch in ten (10) feet. The surface tolerance shall be verified by the Engineer with an approved straight edge not less than ten (10) feet long. The straight edge shall be furnished by the Contractor who shall maintain it in good condition at the paving site at all times.

Hand screeding, when required, shall be performed in such a manner as to produce the same surface quality and uniformity as that produced by mechanical screeding. Finishing screeds shall be 10 inches, or more, in width and the contacting surfaces shall be steel. Hand-operated equipment shall be used in such a manner as to duplicate the action of a mechanical screed. Hand-screeding shall be performed in the same sequence and manner as mechanical screeding unless otherwise directed by the Engineer.

10. **Curing:** The requirements and allowances of subsection 555-3.09 shall apply.
11. **Damaged or Defective Concrete:** Damaged, or defective, concrete shall be defined by, and repaired in accordance with, the requirements of Section 502, Portland Cement Concrete Pavement, and subsection 502-3.15, Defective or Damaged Concrete. Epoxy mortar made from Item 721-05, Epoxy Repair Paste, shall be used for patching vertical or overhead surfaces.

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(OPTIONAL FORMING SYSTEMS)**

**METHOD OF MEASUREMENT.** The requirements of subsection 555-4.02 shall apply.

**BASIS OF PAYMENT.** The terms of subsection 555-5.03 shall apply with the following modifications:

1. The cost of furnishing and placing bar reinforcement will be paid for under this item.
2. Partial payment, in accordance with the terms of subsection 109-04, may be made for bar reinforcement in the cast-in-place concrete portion of the structural slab. Partial payment may be made for Precast concrete form units, provided they have received the Inspector's stamp of approval, as required under "Basis of Acceptance" under subsection 718-01.
3. Progress payments will be made on a per-span basis as follows:
  - A. Forty (40) percent of the estimated square footage (less the cost of partial payments made for materials) will be paid for after all reinforcing is properly placed, to the satisfaction of the Engineer.
  - B. An additional fifty (50) percent of the estimated square footage (less the cost of partial payments made for materials) will be paid for after the concrete has been placed and curing applications have been instituted. Both placement and curing operations shall meet with the approval of the Engineer prior to payment authorization.
  - C. The remainder will be paid for after completion of all curing, and necessary corrective work.

- ITEM 18555.9804- FOOTING CONCRETE, CLASS HP**
- ITEM 18555.9805- CONCRETE FOR STRUCTURES, CLASS HP**
- ITEM 18555.0198- CONCRETE FOR STRUCTURES, CLASS HP**  
(Structural Slab with Integral Wearing Surface- Bottom Formwork Required)
- ITEM 18555.0298- CONCRETE FOR STRUCTURES, CLASS HP**  
(Structural Slab with Integral Wearing Surface- Bottom Formwork not Required)
- ITEM 18555.0398- CONCRETE FOR STRUCTURES, CLASS HP**  
(Structural Slab- Separate Wearing Surface)
- ITEM 18555.0498- CONCRETE FOR STRUCTURES, CLASS HP**  
(Structural Approach Slab with Integral Wearing Surface)
- ITEM 18555.0598- CONCRETE FOR STRUCTURES, CLASS HP**  
(Structural Approach Slab-Separate Wearing Surface)

**DESCRIPTION.** This work shall consist of furnishing and placing Class HP concrete for structures.

**MATERIALS.** All the material requirements of §555-2 shall apply with the following additions:

A microsilica admixture shall be supplied in slurry form or as a densified powder, added either independently or as part of a blended cement. The Producer shall provide the Regional Materials Engineer with a minimum sample of one quart of microsilica directly from a storage container, for each days placement of Class HP concrete, for testing by the Department. This sample shall be obtained in the presence of a Department representative.

If the microsilica is to be added independently, it shall be one appearing on the Department's Approved List. Only one brand shall be allowed for any structural element. The Manufacturer shall provide written certification for each shipment supplied that the material meets the requirements of the procedural directives of the Materials Bureau. This certification shall list fineness, silica content, total chloride ion content, solids content for slurries, and moisture content for densified powders.

If the microsilica admixture is supplied in the slurry form it shall be maintained in storage above the temperature of 32°F. Slurries exposed to temperatures of 32°F or less shall be removed and replaced at no cost to the Department. The slurry shall be homogeneous and agitated as necessary to prevent separation.

If the microsilica admixture is supplied as a densified powder as part of a blended cement, the blended cement shall meet the requirements of Item 701-03 - BLENDED PORTLAND CEMENT, and shall appear on the Departments Approved List.

Item 711-12- GROUND GRANULATED BLAST FURNACE SLAG (GGBFS) may be substituted, in total, for fly ash and shall appear on the Departments Approved List.

Class HP concrete shall consist of a homogeneous mixture of cement, fly ash, microsilica admixture, fine aggregate, coarse aggregate, air entraining agent, set retarding water reducer and/or water reducing admixture and water. In addition, Class HP concrete for superstructure slabs and structural approach slabs must contain a set retarding water reducing admixture as per §555-2.02. Class HP concrete shall meet the requirements of TABLE 1- MIX CRITERIA given below.

**ITEM 18555.98XX- SUBSTRUCTURE AND FOOTING CONCRETE, CLASS HP**  
**ITEM 18555.XX98- CONCRETE FOR STRUCTURES, CLASS HP**

**TABLE 1 - MIX CRITERIA**

Cement content (lbs./c.y.)	500
Fly ash content (lbs./c.y.)	135
Microsilica content (lbs./c.y.)	40
Sand percent total aggregate (solid volume)	40
Designed water/total cementitious content	0.40
Desired air content (%)	6.5
Allowable air content (%)	5.0-8.0
Desired slump (inches)	4
Allowable slump (inches)	3 -5
Type of coarse aggregate gradation	CA 2

**NOTE** The criteria are given for design information and the data is based on a fine aggregate fineness modulus of 2.80. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregate). The proportions shall be computed according to Department written instructions.

**CONSTRUCTION DETAILS.** All the provisions of §555-3 shall apply as modified herein.

Microsilica admixture addition shall be as follows:

1. **If a microsilica slurry is used** - Batch cement and fly ash independently of the microsilica slurry. The tolerance for cement and fly ash draw weights shall be based upon the total weight of cement plus fly ash, and shall be  $\pm 1\%$  by weight. The slurry shall be added using proportioning equipment approved by the Regional Materials Engineer. The microsilica slurry admixture shall be added either through an existing automation system or a two stop off-line automated batching system. The automated batching system shall meet the following requirements:

- Meter accuracy of  $\pm 1\%$  (by volume)
- Program quantity (gallons, 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 (gallons, nearest tenth)

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

Calibration shall be in accordance with the procedures approved by the Regional Materials Engineer. Whenever any part or all of the off-line system is moved the entire system shall be recalibrated.

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2. **If a densified powder is used and added independently** - The densified powder shall be weighed cumulatively with the cement and fly ash. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus fly ash plus densified powder. The batching tolerance for the cement plus fly ash plus densified powder shall be  $\pm\frac{1}{2}\%$  by weight.
3. **If a densified powder is used as part of a blended cement** - The blended cement shall be weighed cumulatively with the fly ash. The blended cement shall be first in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of blended cement plus fly ash. The batching tolerance for the blended cement plus fly ash shall be  $\pm 1\%$  by weight.

**METHOD OF MEASUREMENT.** All the provisions of §555-4 shall apply.

**BASIS OF PAYMENT.** All the provisions of §555-5 shall apply.

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
18555.9804	Footing Concrete, Class HP	Cubic Yard
18555.9805	Concrete for Structures, Class HP	Cubic Yard
18555.0198	Concrete for Structures, Class HP (Structural Slab with Integral Wearing Surface, Bottom Formwork Required)	Square Foot
18555.0298	Concrete for Structures, Class HP (Structural Slab with Integral Wearing Surface, Bottom Formwork not Required)	Square Foot
18555.0398	Concrete for Structures, Class HP (Structural Slab, Separate Wearing Surface)	Square Foot
18555.0498	Concrete for Structures, Class HP (Structural Approach Slab with Integral Wearing Surface)	Square Foot
18555.0598	Concrete for Structures, Class HP (Structural Approach Slab- Separate Wearing Surface)	Square Foot

**ITEM 18555.9804M - FOOTING CONCRETE, CLASS HP**  
**ITEM 18555.9805M - CONCRETE FOR STRUCTURES, CLASS HP**

**DESCRIPTION.** This work shall consist of furnishing and placing Class HP concrete for structures.

**MATERIALS.** All the material requirements of §555-2 shall apply with the following additions:

A microsilica admixture shall be supplied in slurry form or as a densified powder, added either independently or as part of a blended cement. The Producer shall provide the Regional Materials Engineer with a minimum sample of one quart of microsilica directly from a storage container, for each days placement of Class HP concrete, for testing by the Department. This sample shall be obtained in the presence of a Department representative.

If the microsilica is to be added independently, it shall be one appearing on the Department's Approved List. Only one brand shall be allowed for any structural element. The Manufacturer shall provide written certification for each shipment supplied that the material meets the requirements of the procedural directives of the Materials Bureau. This certification shall list fineness, silica content, total chloride ion content, solids content for slurries, and moisture content for densified powders.

If the microsilica admixture is supplied in the slurry form it shall be maintained in storage above the temperature of 0°C. Slurries exposed to temperatures of 0°C or less shall be removed and replaced at no cost to the Department. The slurry shall be homogeneous and agitated as necessary to prevent separation.

If the microsilica admixture is supplied as a densified powder as part of a blended cement, the blended cement shall meet the requirements of Item 701-03 - BLENDED PORTLAND CEMENT, and shall appear on the Departments Approved List.

Item 711-12- GROUND GRANULATED BLAST FURNACE SLAG (GGBFS) may be substituted, in total, for fly ash and shall appear on the Departments Approved List.

Class HP concrete shall consist of a homogeneous mixture of cement, fly ash, microsilica admixture, fine aggregate, coarse aggregate, air entraining agent, set retarding water reducer and/or water reducing admixture and water. In addition, Class HP concrete for superstructure slabs and structural approach slabs must contain a set retarding water reducing admixture as per §555-2.02. Class HP concrete shall meet the requirements of TABLE 1- MIX CRITERIA given below.

ITEM 18555.9804M - FOOTING CONCRETE, CLASS HP  
 ITEM 18555.9805M - CONCRETE FOR STRUCTURES, CLASS HP

TABLE 1 - MIX CRITERIA

Cement content (kg/m <sup>3</sup> )	300
Fly ash content (kg/m <sup>3</sup> )	80
Microsilica content (kg/m <sup>3</sup> )	25
Sand percent total aggregate (solid volume)	40
Designed water/total cementitious content	0.40
Desired air content (%)	6.5
Allowable air content (%)	5.0 - 8.0
Desired slump (mm)	100
Allowable slump (mm)	75-125
Type of coarse aggregate gradation	CA 2

NOTE The criteria are given for design information and the data is based on a fine aggregate fineness modulus of 2.80. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregate). The proportions shall be computed according to Department written instructions.

**CONSTRUCTION DETAILS.** All the provisions of §555-3 shall apply as modified herein.

Microsilica admixture addition shall be as follows:

1. **If a microsilica slurry is used** - Batch cement and fly ash independently of the microsilica slurry. The tolerance for cement and fly ash draw weights shall be based upon the total weight of cement plus fly ash, and shall be ±1% by weight. The slurry shall be added using proportioning equipment approved by the Regional Materials Engineer. The microsilica slurry admixture shall be added either through an existing automation system or a two stop off-line automated batching system. The automated batching system shall meet the following requirements:

- Meter accuracy of ±1% (by volume)
- Program quantity (liters, nearest half liter)
- Batching tolerance ±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 half liter)

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

Calibration shall be in accordance with the procedures approved by the Regional Materials Engineer. Whenever any part or all of the off-line system is moved the entire system shall be recalibrated.

**ITEM 18555.9804M - FOOTING CONCRETE, CLASS HP**  
**ITEM 18555.9805M - CONCRETE FOR STRUCTURES, CLASS HP**

2. **If a densified powder is used and added independently** - The densified powder shall be weighed cumulatively with the cement and fly ash. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus fly ash plus densified powder. The batching tolerance for the cement plus fly ash plus densified powder shall be  $\pm 1/2\%$  by weight.
3. **If a densified powder is used as part of a blended cement** - The blended cement shall be weighed cumulatively with the fly ash. The blended cement shall be first in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of blended cement plus fly ash. The batching tolerance for the blended cement plus fly ash shall be  $\pm 1\%$  by weight.

**METHOD OF MEASUREMENT.** All the provisions of §555-4 shall apply.

**BASIS OF PAYMENT.** All the provisions of §555-5 shall apply.

**Payment will be made under:**

<b>Item No.</b>	<b>Item</b>	<b>Pay Unit</b>
18555.9804M	Footing Concrete, Class HP	Cubic Meter
18555.9805M	Concrete for Structures, Class HP	Cubic Meter

ITEM 18557.0198M -SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE, BOTTOM FORMWORK REQUIRED, CLASS HP  
ITEM 18557.0598M -SUPERSTRUCTURE SLAB WITH INTEGRAL WEARING SURFACE, BOTTOM FORMWORK NOT REQUIRED, CLASS HP  
ITEM 18557.0798M -SUPERSTRUCTURE SLAB WITH SEPARATE WEARING SURFACE, BOTTOM FORMWORK REQUIRED, CLASS HP  
ITEM 18557.0998M -SUPERSTRUCTURE SLAB WITH SEPARATE WEARING SURFACE, BOTTOM FORMWORK NOT REQUIRED, CLASS HP  
ITEM 18557.2098M -STRUCTURAL APPROACH SLAB WITH INTEGRAL WEARING SURFACE, CLASS HP  
ITEM 18557.2298M -STRUCTURAL APPROACH SLAB WITH SEPARATE WEARING SURFACE, CLASS HP

**DESCRIPTION.** This work shall consist of furnishing and placing Class HP concrete for structures.

**MATERIALS.** All the material requirements of §557-2 shall apply with the following additions:

A microsilica admixture shall be supplied in slurry form or as a densified powder, added either independently or as part of a blended cement. The Producer shall provide the Regional Materials Engineer with a minimum sample of one quart of microsilica directly from a storage container, for each days placement of Class HP concrete, for testing by the Department. This sample shall be obtained in the presence of a Department representative.

If the microsilica is to be added independently, it shall be one appearing on the Department's Approved List. Only one brand shall be allowed for any structural element. The Manufacturer shall provide written certification for each shipment supplied that the material meets the requirements of the procedural directives of the Materials Bureau. This certification shall list fineness, silica content, total chloride ion content, solids content for slurries, and moisture content for densified powders.

If the microsilica admixture is supplied in the slurry form it shall be maintained in storage above the temperature of 0°C. Slurries exposed to temperatures of 0°C or less shall be removed and replaced at no cost to the Department. The slurry shall be homogeneous and agitated as necessary to prevent separation.

If the microsilica admixture is supplied as a densified powder as part of a blended cement, the blended cement shall meet the requirements of item 701-03 - BLENDED PORTLAND CEMENT, and shall appear on the Departments Approved List.

Item 711-12- GROUND GRANULATED BLAST FURNACE SLAG (GGBFS) may be substituted, in total, for fly ash and shall appear on the Departments Approved List.

Class HP concrete shall consist of a homogeneous mixture of cement, fly ash, microsilica admixture, fine aggregate, coarse aggregate, air entraining agent, set retarding water reducer and/or water reducing admixture and water. In addition, Class HP concrete for superstructure slabs and structural approach slabs must contain a set retarding water reducing admixture as per §557-2A. Class HP concrete shall meet the requirements of TABLE 1- MIX CRITERIA given below.

**ITEM 18557.XXM - CLASS HP CONCRETE FOR SUPERSTRUCTURE AND APPROACH SLABS**

**TABLE 1 - MIX CRITERIA**

Cement content (kg/m <sup>3</sup> )	300
Fly ash content (kg/m <sup>3</sup> )	80
Microsilica content (kg/m <sup>3</sup> )	25
Sand percent total aggregate (solid volume)	40
Designed water/total cementitious content	0.40
Desired air content (%)	6.5
Allowable air content (%)	5.0- 8.0
Desired slump (mm)	100
Allowable slump (mm)	75-125
Type of coarse aggregate gradation	CA 2

**NOTE** The criteria are given for design information and the data is based on a fine aggregate fineness modulus of 2.80. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregate). The proportions shall be computed according to Department written instructions.

**CONSTRUCTION DETAILS.** All the provisions of §555-3 shall apply as modified herein.

Microsilica admixture addition shall be as follows:

1. **If a microsilica slurry is used** - Batch cement and fly ash independently of the microsilica slurry. The tolerance for cement and fly ash draw weights shall be based upon the total weight of cement plus fly ash, and shall be ±1% by weight. The slurry shall be added using proportioning equipment approved by the Regional Materials Engineer. The microsilica slurry admixture shall be added either through an existing automation system or a two stop off-line automated batching system. The automated batching system shall meet the following requirements:

Meter accuracy of ±1% (by volume)

Program quantity (liters, nearest half liter)

Batching tolerance ±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 half liter)

**ITEM 18557.XXM - CLASS HP CONCRETE FOR SUPERSTRUCTURE AND APPROACH SLABS**

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

Calibration shall be in accordance with the procedures approved by the Regional Materials Engineer. Whenever any part or all of the off-line system is moved the entire system shall be recalibrated.

2. **If a densified powder is used and added independently** - The densified powder shall be weighed cumulatively with the cement and fly ash. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus fly ash plus densified powder. The batching tolerance for the cement plus fly ash plus densified powder shall be  $\pm\frac{1}{2}\%$  by weight.
3. **If a densified powder is used as part of a blended cement** - The blended cement shall be weighed cumulatively with the fly ash. The blended cement shall be first in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of blended cement plus fly ash. The batching tolerance for the blended cement plus fly ash shall be  $\pm 1\%$  by weight.

**METHOD OF MEASUREMENT.** All the provisions of §557-4 shall apply.

**BASIS OF PAYMENT.** All the provisions of §557-5 shall apply.

**Payment will be made under:**

Item No.	Item	Pay Unit
18557.0198M	Superstructure Slab with Integral Wearing Surface, Bottom Formwork Required, Class HP	Square Meter
18557.0598M	Superstructure Slab with Integral Wearing Surface, Bottom Formwork Not Required, Class HP	Square Meter
18557.0798M	Superstructure Slab with Separate Wearing Surface, Bottom Formwork Required, Class HP	Square Meter
18557.0998M	Superstructure Slab with Separate Wearing Surface, Bottom Formwork Not Required, Class HP	Square Meter
18557.2098M	Structural Approach Slab with Integral Wearing Surface, Class HP	Square Meter
18557.2298M	Structural Approach Slab with Separate Wearing Surface, Class HP	Square Meter