

**ITEM 25555.9601 M - CONCRETE FOR STRUCTURES, CLASS HP (GALVANIZED STEEL REINFORCEMENT INCLUDED)**

**DESCRIPTION:**

This work shall consist of furnishing and placing Class HP concrete for structures, including galvanized steel reinforcement, as indicated on the plans or as directed by the Engineer.

**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.

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

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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.

Galvanized Steel Reinforcement shall meet the following requirements:

Bar Reinforcement. Steel reinforcing bars shall be billet steel bars (ASTM A615M, Grade 400) ONLY, conforming to the requirements of Subsection 709-01, Bar Reinforcement, Grade 400.

Galvanizing. The bar reinforcement shall be class 1 galvanized after bar fabrication, in accordance with ASTM A767M, Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement, including Supplemental Requirements S1 and S3, and as modified by "Bar Reinforcement", above.

In accordance with ASTM A767M, the average coating thickness, of a minimum of 3 tests, shall be 1070 g/m<sup>2</sup> or 0.15 mm.

The requirements of Section 5.3 (Chromating) of ASTM A767M shall be waived.

Bending of reinforcing bars after galvanizing as provided for in Section 7.2 of ASTM A767M shall not be allowed except as provided for in the subsection Field Bending in the "Construction Details" section of this specification.

Prior to galvanizing, the material shall have all grease, dirt, mortar, mill scale, injurious rust, or any other foreign substance removed.

For the purpose of this specification, the term "injurious rust" shall be interpreted to mean rust which is not firmly bonded to the steel. Rust which is difficult to remove, even by vigorous scrubbing with a wire brush, shall be considered firmly bonded to the steel.

The galvanized threads of nuts and mechanical connectors used for assembly with galvanized bolts and reinforcement shall be tapped oversize prior to coating and need not be retapped afterwards. The minimum additional diameter for Class-2A threads galvanized to Class C is as follows:

<u>Class-2A Thread Diameter (mm)</u>	<u>Additional Diameter (mm)*</u>
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11 mm and smaller	0.40
Over 11 to 25	0.53
Over 25	0.79

\* applied to both pitch and minor diameters, minimum and maximum limits.

Material galvanized in accordance with these specifications shall be free from any buildup of unadhered wet storage stains (white rust). These corrosion deposits, if present, shall be removed in a manner satisfactory to the Authority prior to incorporation of the material in the work. After removal of these deposits, the coating shall have a uniform appearance free from uncoated spots, lumps, blister, gritty areas, acid flux and black spots. Materials with these defects, or not meeting the finish and adherence of coating requirements as defined in the above ASTM specification, will be rejected and immediately removed from the work site. Acceptable material will be provided to replace rejected material at no additional costs to the Authority.

Zinc-Rich Paint. Zinc-rich paint used for the field repair of galvanized coatings shall meet the following requirements:

- A. One application of the material shall provide a dry coating thickness of at least 0.05 mm.
- B. The applied coating shall provide barrier protection and shall preferably be anodic to steel.
- C. Application of the coating material shall be possible under shop or field conditions.
- D. The dried film shall be a minimum zinc dust content equal to 94% (by weight)
- E. The brand of material used shall be approved by the galvanizer, and shall be compatible with the galvanizing, and inert in concrete.

Miscellaneous Hardware. Chairs, tie wires, nuts, bolts, washers, other devices, and miscellaneous hardware used to support, position, or fasten the reinforcement shall be made of or coated with, a non-conducting material, or galvanized. The specific hardware that the contractor proposes to use shall be approved by the Engineer. If the specific hardware is galvanized, the hardware shall be prepared and galvanized in accordance with the requirements of both ASTM A153M and the subsection Galvanizing in the "Materials" section of this specification.

Mechanical Connectors. Mechanical connectors used for galvanized bar reinforcement shall be galvanized in accordance with the requirements of ASTM A153M, Zinc Coating (Hot Dip) on Iron and Steel Hardware prior to installation.

The thread shall be taped oversize prior to being coated per the subsection, Galvanizing in the "Materials" section of this specification.

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The assembled connection on the galvanized reinforcing bars shall have no exposed uncoated steel. Any damage to the galvanized coating or uncoated area shall be repaired as indicated in subsection.

The manufacturer of the mechanical connectors shall certify, in writing to the Engineer, that the mechanical connectors, with oversize threads (if applicable), meet the following three parameters:

- A. The maximum slip, at 50% of the yield strength of the reinforcing bar, shall be 0.25 mm. At least 70% of the maximum slip shall be occurred on the first cycle.
- B. The maximum slip, at 90% of the yield strength of the reinforcing bar, shall be 0.46 mm.
- C. The tensile strength of the splice shall be at least 100% of the specified minimum tensile strength of the reinforcing bar.

**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 (liters, nearest half liter)
- 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 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.

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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.

The contractor shall leave all burlap in place for 14 curing days and provide continuous, uniform wetting for the entire curing period. Superstructure slabs, during the curing period, may be subjected to a vehicle load not to exceed nine metric tons, or a wheel not to exceed three metric tons no sooner than seven calendar days after placement. Full legal loading may commence no sooner than 14 calendar days after completion of the curing period.

Construction details for Galvanized Steel Reinforcement shall meet the following requirements:

Placing and Fastening Galvanized Steel Reinforcement. Prior to placing galvanized reinforcement, all grease, dirt, mortar and any other foreign substances shall be removed.

Galvanized reinforcement shall be placed in the position indicated and within the allowable tolerances specified. Before concrete is placed, all reinforcement shall be securely fastened and supported with approved chairs or other approved devices.

Inspection. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by the Engineer. All concrete placed in violation of this provision shall be rejected and removed.

Hazardous Materials. The galvanizer's and contractor's operations shall conform with all OSHA regulations that apply to working with zinc based materials. Contractor's operations which may be affected by these regulations include, but are not limited to, welding splices and coating repair.

Reinforcement.

- A. Ordering Bar Reinforcement. Prior to ordering bar reinforcement, the contractor shall carefully check all bar lists, and assume full responsibility for their accuracy.

No change in the bar list shall be made by the contractor unless approved by the Chief Engineer - Engineering Services.

- B. Field Bending. Galvanized bars shall not be bent in the field more than 10 degrees, regardless of the diameter of the bend.

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- C. Bar Splices. Bar Splices shall be permitted only where shown on the contract plans. Should the contractor desire to splice bars at locations other than those shown on the contract plans, written permission to do so shall first be obtained from the Chief Engineer - Engineering Services. Such permitted splices shall be well distributed, or located at points of low tensile stress. Splices shall not be permitted unless a minimum of 50 mm can be provided between the spliced bar and the nearest adjacent bar.

Splices for bar sizes No. 36, or smaller, shall be made by means of a mechanical connector or by placing the bars in contact and wiring them together for the length of the splice.

Splices for bars larger than No. 36 shall be made by arc welding, or by use of a mechanical connector.

Splices made with mechanical connectors shall be installed in accordance with the manufacturer's written requirements.

Arc welded splices shall be made and inspected in accordance with the provisions of the NYSSCM, Section 7, Part D. Prior to welding of reinforcing bars, the galvanized coating shall be removed for the length of the bar to be welded plus 150 mm on each side of the weld. After welding, all slag, weld spatter, and other foreign material shall be removed and the spliced area shall be cleaned and regalvanized in accordance with the field repair procedure described in subsection Field Repair - Galvanized Coating in the "Construction Details" section of this specification.

- D. Placement in Structural Slabs. Supports shall be spaced no farther apart than 1.2 meters center-to-center, nor shall any support be closer than 150 mm from the edge of any future concrete surface. Bridge slab reinforcement shall be placed in accordance with the following tolerances:

Vertical	+/- 6 mm
Horizontal	+/- 12 mm

The structural slab reinforcement mats (top and bottom) shall be securely connected together. This connection may be accomplished by wiring or other means approved by the Engineer. Connections shall be placed no farther apart than 1.2 meters on center. The supports may be utilized for this purpose. Connecting devices shall neither deflect the reinforcement nor interfere with the smooth flow of concrete.

Chairs, tie wires and other similar devices used for galvanized reinforcement shall meet the requirements of Miscellaneous Hardware in the "Materials" section of this specification.

Immediately prior to placement of concrete, the Engineer shall verify that the reinforcing steel is positioned within the above stated tolerances. If the allowable tolerances are

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exceeded, the Engineer shall order that the position of the reinforcing steel be corrected before he grants permission for placing concrete.

Subsequent to placement of concrete, the Engineer shall verify, at random that the vertical clear distance from the top of the structural slab to the top mat of main reinforcing, as shown on the contract plans, is correct within a tolerance of plus or minus 12 mm. If the tolerance is exceeded, the Engineer shall reject the work and so advise the contractor and the Chief Engineer in writing, stating the deficiencies upon which the rejection is based. The Chief Engineer shall review the nature and extent of the deficiencies and shall designate one or more of the following alternatives:

1. The affected concrete placement shall be removed and replaced in whole or in part.
2. The contractor shall provide special corrective measures as directed by the Chief Engineer - Engineering Services.
3. The concrete placement shall be accepted without corrective action.

The removal of the concrete placement and its subsequent replacement, or other corrective work which the contractor is directed to perform, shall be accomplished at no additional cost to the Authority.

Field Repair - Galvanized Coating. The contractor shall be required to field repair any damage to the galvanized coating done during shipping and handling, and to replace bars exhibiting severely damaged coatings. Repairable damage is defined as any bare or loose spots, or breaks in the coating which affect an area smaller than 100 cm<sup>2</sup>.

Field repair shall be allowed only when the total number of repairable damaged areas in any 3 m length of bar is less than 6. Any material with a total number of damaged areas greater than the amount specified above, or material with any damaged area greater than 100 square cm, shall be rejected, immediately removed from the work site, and replaced by the contractor at no cost to the Authority.

The galvanized coating is to be repaired with a zinc-rich paint by the following method:

- A. Clean the damaged area by power disk, wire brushing, sand or grit blasting, or any other suitable method approved by the Engineer to a near-white metal condition in accordance with SSPC-SP10 (0.25 mm to 0.50 mm anchor pattern), as a minimum. The surface shall also be clean, dry and free of oil, grease, flux residue, corrosion products, and any other foreign substance.
- B. Using a minimum of two coats, and the methods recommended by the manufacturer of the zinc-rich paint, spray or brush apply the zinc-rich paint to the area in a manner to achieve the applicable ASTM adherence and quality requirements of the original coating, and a minimum dry film thickness of 0.10 mm.

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These repair procedures are allowed only for those field repairs directed by the Engineer. This method shall not be allowed for shop repairs. All repairs shall be made at no cost to the Authority.

In addition, the contractor shall submit a bar list and schematic showing the bar locations to the Engineer at least one week prior to the placement of the reinforcement.

**METHOD OF MEASUREMENT:**

All the provisions of §555-4 shall apply. Separate measurement of the bar reinforcement shall not be made.

**BASIS OF PAYMENT:**

All the provisions of §555-5 shall apply, except that bar reinforcement shall be included. No separate payment will be made for steel bar reinforcement.