


TO: SUPERSEDED BY EB 97-020 EFFECTIVE 4/4/97	ENGINEERING INSTRUCTION NEW YORK STATE DEPARTMENT OF TRANSPORTATION
	SUBJECT: REVISED SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS Subject Code: 7.27-1-584
Distribution: 30 Main Office 32 Regions 34 Special APPROVED:  ARUN M. SHIROLE, Deputy Chief Engineer, Structures Division	Code: EI 89-10 Date: 4/6/89 Supersedes: EI 87-026

Effective with the letting of 7/13/89 (PS&E 4/20/89), the specification requirements for High Density Concrete Overlay, Item 584.0101, Latex Modified Concrete Overlay, Item 584.1101, and Micro-Silica Concrete Overlay, Item 19584.12, will be modified and new item numbers issued as follows:

<u>Item No.</u>	<u>Description</u>	<u>Pay Unit</u>
584.0102	High Density Concrete Overlay	Sq. Ft.
584.1102	Latex Modified Concrete Overlay	Sq. Ft.
584.1201	Micro-Silica Concrete Overlay	Sq. Ft.

These changes are expected to improve the quality of specialized concrete overlays. The changes are listed below:

1. Micro-Silica Concrete is allowed as a third specialized concrete overlay option. Changes have been made to each subsection of section 584 to reflect the addition of this material. This item should be included in proposals by Designers as a third option. The minimum thickness of the Micro-Silica Concrete Overlay shall be 1-1/2" and the minimum total cover shall be 2-1/4".
2. There is now a deck surface temperature requirement. The maximum deck surface temperature allowed before concrete placement is 85°F.
3. A one-half inch minimum slump requirement for High Density Concrete has been instituted.
4. The lower limit of the air content range for High Density Concrete has been raised from 4.0% to 5.0%.
5. A minimum density of 100% of the theoretical project unit weight of High Density Concrete is now required. This was previously 98%.
6. Structural slab surfaces shall be prewet prior to the application of bonding grout on High Density Concrete overlays. However, the surfaces shall be free of standing water and dry to the touch prior to grout placement.
7. The wet cure period for High Density Concrete has been extended from 72 curing hours to 96 curing hours. The use of white-pigmented curing compound is no longer allowed.

SECTION 584 - SPECIALIZED CONCRETE OVERLAYS FOR STRUCTURAL SLABS

584-1 DESCRIPTION. The work shall consist of furnishing and placing a specialized concrete overlay on top of a structural slab. Unless otherwise indicated on the plans, the Contractor may place any one of the specialized overlays allowed by the terms of this section. Only one type of overlay will be allowed on any one structure.

584-1.01 Other Work. The following work will also be done under the terms of this section:

- A. Clean the structural slab.
- B. Clean exposed reinforcing steel.*
- C. Support and tie reinforcing steel.*
- D. Place slab reconstruction concrete.*
- E. Coat all surfaces to be in contact with the overlay with portland cement grout.

* Done only when required by the nature of the project.

584-1.02 Definitions.

A. Specialized Concrete Overlay Type. There are three allowable types of specialized concrete overlay. They are:

1. High Density Concrete. This is a portland cement concrete of very high density made from standard concreting materials. After manufacture it exhibits a slump of one inch (1") or less.

2. Latex Modified Concrete. This is a portland cement concrete to which an approved styrene butadiene latex admixture has been added.

3. Micro-Silica Concrete. This is a portland cement concrete to which an approved micro-silica admixture has been added.

B. Slab Reconstruction Concrete. For the purposes of this section, slab reconstruction concrete is that concrete, placed completely around exposed reinforcing bars. Refer to the CONSTRUCTION DETAILS for particulars regarding placement.

C. Curing Hour. A curing hour is defined as any hour, beginning with the hour of placement, during which the ambient air temperature at the concrete surface remains at, or above, 45°F as measured by a recording thermometer.

D. Curing Temperature. This shall be the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering.

584-2 MATERIALS

584-2.01 General. The following materials are to be used in the manufacture of any specialized concrete overlay, as required herein:

- A. Portland Cement. Portland Cement shall be Type 2. It shall meet the requirements of §701-01.
- B. Fine Aggregate.* Fine aggregate shall be either a natural sand or a sand manufactured from gravel. It shall meet the requirements of §703-07, except that the percent passing by weight for the No. 200 sieve shall be 2% maximum.
- C. Coarse Aggregate.* The coarse aggregate shall be crushed stone, or crushed gravel - Size Designation No. 1. It shall meet the requirements of §703-02, with the following exception: For Table 703-3, the maximum percent by weight (No. 2 size and smaller) of material passing the No. 200 sieve shall be 0.7%. In addition to the foregoing the coarse aggregate shall also meet the requirements of any one of the following:
1. Coarse aggregate shall be crushed limestone, or dolomite, that has an acid insoluble content of not less than ten percent (10%), excluding particles of chert and similar siliceous rocks.
 2. Coarse aggregate shall be crushed sandstone, granite, chert, traprock, ore tailings, or similar material.
 3. Coarse aggregates shall be crushed gravel or natural blends of two or more of the following types of materials: limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, or other similar materials. Not less than 20% (by weight, with adjustments to equivalent volumes for materials of different specific gravities), of the total coarse aggregate particles shall be non-carbonate. Non-carbonate particles are defined as those having an acid insoluble content of not less than 80%.

* Fine and coarse aggregates shall be stockpiled in accordance with the requirements of the CONSTRUCTION DETAILS.

- D. Water. Water shall meet the requirements of §712-01.
- E. Latex Admixture. The latex admixture shall be a non-hazardous, film forming polymeric emulsion to which all stabilizers have been added at the point of manufacture. It shall be homogeneous, uniform in composition and have less than 1000 ppm of total chloride ions. When tested in accordance with the Department's test method for Total Weight Percent Solids in the Latex, the admixture shall have a solids content of not less than 46%.

The latex admixture shall be accepted at the work site provided it meets all of the following requirements:

1. It shall be one of the products on the Department's Approved List. Only one brand shall be supplied.

2. Manufacturer's written certification that the material supplied is identical in composition to that prequalified in accordance with procedural directives of FHWA RD 78-35. This certification shall also list particle size, surface tension and infra red fingerprint information for the lot supplied.

3. Written certification that the material supplied has been tested and meets the requirements of the procedural directives of the Materials Bureau.

The latex admixture shall be agitated as necessary to prevent separation of the emulsion. It shall be maintained in storage within the temperature range of 32°F to 85°F. Admixture exposed to temperatures outside the foregoing limits shall be removed and replaced at no cost to the Department.

Field samples, for testing by the Department, will be taken. Refer to the CONSTRUCTION DETAILS, \$584-3.09B.

F. Micro-Silica Admixture. The microsilica admixture shall meet the procedural directives of the Materials Bureau. It shall be accepted at the job site based on its appearance on the Department's Approved List. Only one brand shall be supplied.

In addition, if the micro-silica admixture is supplied in the form of an emulsion, it shall be agitated as necessary to prevent separation.

G. Admixtures. All admixtures shall meet the requirements of \$711-08, except as noted herein. In addition, only vinsol resin-based air entraining agents appearing on the Approved List shall be allowed.

H. Bonding Grout. This shall consist of equal parts, by volume, of portland cement and concrete sand, mixed with sufficient water to form a slurry. The consistency of the slurry shall be such that it can be applied with a stiff, synthetic bristle brush or broom to the prepared concrete surfaces in a thin, even coating that will not run or puddle. No retempering will be permitted.

I. Class D Concrete. This shall meet the requirements of section 501.

J. Curing Materials.

1. Burlap. This shall meet the requirements of \$711-06.

2. Quilted Covers. These shall meet the requirements of \$711-02.

3. Polyethylene Curing Covers. These shall be white and meet the requirements of \$711-04.

4. Plastic Coated Fiber Blankets. These shall meet the requirements of \$711-03.

584-2.02 Manufacture of High Density Concrete.

1. High density concrete shall be proportioned as follows:

SOLID VOLUMES

Cement	Fine Aggregate	Coarse Aggregate	Total Aggregate
1.000	2.006	2.006	4.012

NOTES:

The proportions are based upon the following criteria:

1. Bulk specific gravities (saturated surface dry for aggregate).
2. CAI coarse aggregate gradation.
3. Fine aggregate fineness modulus: 2.80.
4. Air content: 6.0 percent.
5. Slump: 3/4 inch.
6. Water/cement ratio (by weight): 0.327.

No adjustments shall be made to the proportions without the approval of the Director, Materials Bureau.

2. Slump and air content placement limits shall be:

(a)	Min.	Desired	Max.
Slump (inches)	1/2	3/4	1
Air Content (%)	5.0	6.0	8.0

Note a. Slump shall be measured 5 minutes after discharge from the mobile mixer. The sample shall not be disturbed during the waiting period.

3. A water-reducing admixture shall be required to improve workability. It shall be added to a measured quantity of the mix water at a dosage rate established by the Director, Materials Bureau, before the water is introduced into the mixer. The mixture shall be handled and dispensed in a manner that will ensure uniform distribution of the admixture.

4. The Contractor shall supply the Regional Materials Engineer with sufficient quantities of cement, fine aggregate, coarse aggregate and all admixtures for laboratory test batches. The actual proportions of aggregates will be determined by the Department based upon aggregate properties. The material submitted shall be the same type and size and from the same source as that used to produce the concrete. The material supplied for test batches shall be submitted at least three (3) weeks in advance of mixer calibration testing. Fine and coarse aggregate samples shall be from stockpiles established and approved at the project site unless otherwise approved by the Regional Director.

The fine and coarse aggregate and all bulk cement shall be placed in Department furnished, moisture retaining, burlap bags. The admixtures shall be placed in Department furnished, one quart jars.

584-2.03 Manufacture of Latex Modified Concrete. Latex modified concrete shall consist of a homogeneous mixture of cement, fine aggregate, coarse aggregate, latex admixture and water mixed in accordance with the requirements of the MIX CRITERIA TABLE, given in this subsection. Any proposed concrete mix which does not meet the requirements of that table shall be subject to the approval of the Director, Materials Bureau.

The actual proportions of aggregates will be determined by the Department based upon aggregate properties. The Contractor shall inform the Engineer, in writing, of the sources of coarse and fine aggregate. This notification shall be given at least ten (10) working days prior to concrete placement.

The Contractor shall inform the Engineer, in writing, of which brand of latex is to be used. Notification shall be given at least ten (10) working days prior to concrete placement.

MIX CRITERIA (a)

Cement content (Sacks/c.y.)	7.0
Sand content (% Total Aggregate by Volume)	60.0
Latex Admixture (Gal./Sack)	3.5
Air Content (% Max.)	6.5
Water (Gal./Sack) (b)	2.5
Slump Desired (Inches) (c)	2.0-4.0
Slump Maximum (Inches) (c)	6.0

NOTE (a) The criteria are given for design information and the data is based on a fine aggregate modulus of 2.80 and a CA1 coarse aggregate gradation. The initial mix design shall be based on an expected air content range of 3 to 6 percent. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregates). The proportions shall be computed according to Department written instructions.

NOTE (b) The amount of added water shall be adjusted to provide slump at or below the prescribed limit.

NOTE (c) Concrete for the slump test shall be deposited in a clean container and allowed to stand covered without disturbance for 5 minutes prior to performing the slump test. Care shall be taken during the test to exclude the effects of vibrations caused by traffic and concrete placement operations.

584-2.04 Manufacture of Micro-Silica Concrete.

1. Micro-Silica concrete shall be proportioned as follows:

SOLID VOLUMES			
Cement	Micro-Silica	Fine Aggregate	Coarse Aggregate
1.000	0.183	2.593	2.299

NOTES:

The proportions are based upon the following criteria:

1. Bulk specific gravities (saturated surface dry for aggregate).
2. CAI coarse aggregate gradation.
3. Fine aggregate fineness modulus: 2.80.
4. Air content: 6%.
5. Slump: 6 inches.
6. Water/cement ratio (by weight): 0.40.

No adjustments shall be made to the proportions without the approval of the Director, Materials Bureau.

2. Slump and air content placement limits shall be:

(a)	Min.	Desired	Max.
Slump (inches)	5	6	8
Air Content (%)	5.0	6.0	8.0

Note a. When using a mobile mixer, the concrete for the slump test shall be deposited in a clean container and allowed to stand without disturbance for 5 minutes prior to performing the slump test.

3. A super-plasticizer admixture shall be required to improve workability. It shall be added to a measured quantity of the mix water at a dosage rate established by the Director, Materials Bureau, before the water is introduced into the mixer. The mixture shall be handled and dispensed in a manner that will ensure uniform distribution of the mixture.

4. The Contractor shall supply the Regional Materials Engineer with sufficient quantities of cement, fine aggregate, coarse aggregate and all admixtures for laboratory test batches. The actual proportions of aggregate will be determined by the Department based upon aggregate properties. The material submitted shall be the same type and size and from the same source as that used to produce the concrete. The material supplied for test batches shall be submitted at least three (3) weeks in advance of mixer calibration testing or concrete placement, whichever is earlier. Fine and coarse aggregate samples shall be from stockpiles established and approved at the project site unless otherwise approved by the Regional Director.

The fine and coarse aggregate and all bulk cement shall be placed in Department furnished, moisture retaining, burlap bags. The admixtures shall be placed in Department furnished, one quart plastic jars.

5. The criteria given are for design information. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities. The proportions shall be computed according to Department written instructions.

584-2.05 Equipment - General. All equipment proposed for use shall have the Engineer's approval prior to the start of the work. The finishing machine shall either appear on the Department's Approved List or be approved by the Regional Construction Engineer prior to the start of the work.

A. Cutting Equipment. This shall be capable of cutting concrete to the specified depth.

B. Blastcleaning Equipment. This shall be capable of removing rust from reinforcing bars and small chips of partially loosened concrete. Certain qualities of rust are not necessary to be removed. These will be designated by the Engineer. (Refer to §584-3.04).

C. Proportioning and Mixing Equipment.

1. High Density Concrete. Self-contained, continuous mixing and proportioning mobile units shall be used. A minimum of two units shall be supplied. The requirements of §584-2.05D shall apply.

2. Latex Modified Concrete. The requirements of §584-2.05C1 shall apply.

3. Micro-Silica Concrete. The contractor has the option of producing the micro-silica concrete in a mobile mixing unit or concrete batch plant. If a mobile mixing unit is used, the requirements of §584-2.05C1 shall apply. If a concrete batch plant is used, it shall meet the requirements of §501-3.02.

D. Mobile Mixer Units. Mobile mixing units shall appear on the Department's Approved List and be subject to the following requirements:

1. Each unit shall be self-propelled. Each unit shall be capable of carrying sufficient unmixed material to produce on site, no less than six (6) cubic yards of specialized concrete.

2. Each unit will be inspected by the Engineer. Units not functioning in a manner the Engineer considers acceptable shall be repaired. If repair is impractical, the unit shall be replaced. All costs associated with delays attributable to mobile mixer replacement shall be borne by the contractor. No extensions of time, for the purpose of replacing unacceptable mixers, will be granted. Conditions which will automatically designate a unit unacceptable are: hydrated cement deposits; broken, bent, loose or scalloped mixing paddles; mixing paddles worn 20 percent in any dimension; mixing paddles heavily caked with mortar; and admixture or water delivery system out of tolerance.

3. Proportioning devices shall deliver the materials within the following tolerances (by weight):

Coarse Aggregate	±2%
Fine Aggregate	±2%
Cement	0% to +4%
Water	±2%
Latex Admixture	±1%
Micro-Silica Admixture	±1%
Other Admixtures	±3%

The quantity of cement introduced into the mix shall be measured by a meter which is clearly visible and kept clean at all times. The quantity of cement shall be recorded by a ticket printer. The recordation may consist of a print of the number of revolution counts of the cement feeder.

4. There shall be positive control of the flow of water into the mixing chamber. Water flow shall be indicated by a flowmeter and readily adjustable to provide for minor variations in aggregate moisture. The system shall be equipped with a bypass valve, or hose, for determining proportioning accuracy.

a. High Density Concrete. There shall be positive control of the flow of air-entraining admixtures into the unit's water mix system. Flowmeters shall be used to control the quantity of admixtures added. Admixtures shall be dispensed in a manner that will ensure uniform distribution of the material. The system shall be capable of adding admixture in the amounts necessary to achieve the required air content. The system shall be equipped with a bypass valve suitable for obtaining a calibrated sample of admixture to determine batching accuracy.

b. Latex Modified Concrete. There shall be positive control of the flow of latex admixture into the mixing chamber. The latex admixture discharge pipe shall be readily accessible for determining proportioning accuracy.

c. Micro-Silica Concrete. The requirements of §584-2.05D4a shall apply. Also, there shall be positive control of the flow of micro-silica admixture into the mixing chamber. The micro-silica admixture discharge pipe shall be readily accessible for determining proportioning accuracy.

5. The units shall be capable of combining aggregates, cement, admixtures and water into a thoroughly mixed and uniform mass. Discharging the mixture shall be accomplished without segregation.

6. The units shall be made available to the Regional Materials Engineer for calibration tests in accordance with Department written instructions. The Materials Engineer shall have at least two working days for the calibration of each unit the Contractor proposes to use. The Contractor shall notify the Engineer-in-Charge and Materials Engineer, in writing, at least one week in advance of the dates each unit will be available for calibration. No calibration shall be performed while it is raining.

Note a. Additional mobile mixer units may be required under the provisions of §584-3.09D. All additional mixer units shall meet the requirements of this subsection.

E. Mixer Unit - Testing. Calibration and yield tests shall be performed by the Regional Materials Engineer according to the Department's written instructions, with the cooperation of the Contractor as required:

1. The Contractor shall supply sufficient quantities of cement, fine aggregate, coarse aggregate, water and admixture for the tests. Materials supplied shall be of the same type and size as well as from the same source as those materials which will be used to produce the concrete.

The Contractor shall supply a 36" x 36" x 9" container to be used for a yield test.

The Contractor shall supply a portable scale of at least 500-pound capacity, and two (2) containers of sufficient capacity to obtain cement samples of as much as 188 pounds each. Two fifty pound (50 lb.) weights for determining scale accuracy shall also be supplied.

2. The Materials Engineer will supervise proportioning and yield tests as part of the calibration tests. The proportioning test will consist of weighing each component to verify the proposed gate settings and the implementing of any necessary adjustments.

F. Placing and Finishing Equipment. This shall include adequate hand tools for the placement of plastic concrete and for working down to approximately the correct level for the auger strike-off. A self-propelled finishing machine will be required to place and finish all concrete, except in areas inaccessible to the machine. The specific method and equipment the Contractor proposes to use for finishing will be subject to the approval of the Regional Construction Engineer. The Contractor shall provide access to the finishing machine at the work site, for inspection by the Engineer. A qualified Finishing Machine Operator shall be available during the inspection. The Engineer shall have one working day for the inspection of the finishing machine. The Contractor shall provide, to the Engineer two weeks prior to the inspection date, a legible copy of the operating manual for his exclusive use.

The finishing machine shall be capable of forward and reverse motion under positive control. Provisions shall be made for raising the screeds to clear the screeded surface, if traveling in reverse.

Supporting rails shall be required. They shall exhibit no bends or kinks. Rail supports shall be fully adjustable (not shimmed), to obtain the correct profile. Rail supports shall be spaced at a maximum of 2'-0" on center.

When placing concrete on a lane abutting a previously completed lane, the side of the finishing machine adjacent to the completed lane shall be equipped to travel on the completed lane.

1. High Density Concrete Overlay

a. Hand tools shall be adequate to place and work concrete which exhibits a slump of 3/4", or less.

b. The self-propelled finishing machine shall be a type which appears on the Department's Approved List, or an equal approved by the Regional Construction Engineer.

It shall be equipped with at least two (2) oscillating screeds, and an auger strike-off. The auger strike-off shall be capable of, and be required to, provide a uniform thickness of concrete in front of the forward oscillating screed.

The forward oscillating screed shall be designed to consolidate the concrete by vibration. A sufficient number of identical vibrators shall be installed such that at least one vibrator is provided for each five (5) feet of screed length. The bottom face of each screed shall be at least five (5) inches wide and with a turned-up, or rounded, leading edge to minimize tearing of the plastic concrete surface. Each screed shall have an effective weight of at least 75 pounds for each square foot of bottom face area. Each screed shall be provided with positive control of the vertical position and the angle of tilt.

Design of the finishing machine, together with appurtenant equipment, shall be such that positive machine screeding of the plastic concrete will be obtained within six inches (6") of the face of the existing curbs. The screed length shall be sufficient to extend at least six inches (6") beyond the line designated to form the edge of a subsequent placement section, and shall overlay the edge of a previous placement by at least six inches. The auger strike-off shall be adjusted to operate within six inches (6") of the placement edges.

2. Latex Modified Concrete.

a. The self-propelled finishing machine shall be a type approved by the Regional Construction Engineer.

b. The finishing machine shall be equipped with a vibrating pan to consolidate the concrete, a power driven strike-off auger, a power driven finishing roller, and a pan float. The vibrating pan shall vibrate at a frequency between 2500 and 7000 vpm.

3. Micro-Silica Concrete. The requirements of 584-2.05F2 shall apply.

4. Small Inaccessible Areas. Manual type screeds, which appear on the Department's Approved List, metal plates equipped with electric vibrators, or hand vibrators, shall be used to consolidate and finish these areas. The Engineer shall approve the equipment used for any specific area.

5. Bonding Grout.

a. The mixer shall be the type known as a mortar mixer which is designed for mixing mortar. It shall have a minimum capacity of 4.0 cubic feet. The mixer shall be approved by the Engineer, prior to use.

b. At least two (2) batching boxes of one (1) cubic foot capacity each shall be provided at the site for the proportioning of sand and cement.

c. A sufficient number of stiff nylon-bristle push brooms, nylon-bristle straight brooms, and pails for grout application, shall be provided.

6. Slab Reconstruction Concrete. Slab reconstruction concrete shall be finished with equipment meeting the requirements of §584-2.05F4.

G. Recording Thermometer. The Contractor shall supply a continuous recording thermometer capable of recording temperatures in the 30 - 100°F range. It shall likewise provide a recording capability over a 24 hour continuous period, minimum. The Contractor shall provide any ancillary equipment, supplies and labor necessary for calibration of this equipment. The cost of calibration shall be included in the unit price bid.

584-3 CONSTRUCTION DETAILS

584-3.01 Stockpiling Aggregates. The requirements of §501-3.03A - Stockpiles shall apply with the following modifications:

A. Unless otherwise approved by the Regional Director, fine and coarse aggregates shall be stockpiled at the work site.

B. Stockpiles shall be completely covered and no additions to approved stockpiles are permitted.

C. The free moisture content of each aggregate type, at the time of batching, shall not exceed seven percent (7%) of the saturated-surface dry weight of the fine or coarse aggregate or 8% total for both aggregates.

584-3.02 Vehicular and Equipment Restrictions. The operation of vehicles and equipment on, or over, the structural slab area where concrete removal operations have been completed is subject to the following restrictions:

A. Vehicular traffic is limited to necessary construction equipment. No vehicle, or construction equipment, weighing in excess of 4000 pounds fully loaded, shall be allowed to operate on, or over, any area of structural slab which exhibits exposed reinforcing steel. (Refer to §584-3.09A)

B. Runways shall be provided when concrete transporting devices are expected to operate over exposed reinforcing steel.

584-3.03 Placement Preconditions. Slab reconstruction concrete, or overlay concrete, shall be placed only after all of the following preconditions are satisfied:

A. The Contractor has submitted to the Engineer, in writing, the proposed sequence of operations, equipment, number of personnel, and category of personnel to be used during the concrete placement.

B. First stage blastcleaning has been completed on an area large enough to require one working day for concrete overlay placement. In no case shall this be less than one span length.

C. The Engineer has approved first stage blastcleaning.

D. Second stage blastcleaning, if required, has been completed and approved on an area large enough to require one working day for concrete overlay placement. In no case shall this be less than one span length.

E. Slab surface temperature and wetting requirements are met.

F. Bonding grout placement work has begun.

584-3.04 First Stage Blastcleaning.

A. First stage blastcleaning shall be done to thoroughly clean all receiving surfaces. All reinforcing steel, or other steel, which will be in contact with the new concrete shall be cleaned of all grease, dirt, concrete mortar and injurious rust. Injurious rust shall include all scale, loose rust deposits, or all rust not firmly bonded to the steel. Rust and concrete deposits, which in the Engineer's opinion, cannot be removed by blastcleaning, shall be considered firmly bonded and may remain. All concrete surfaces which will be in contact with new concrete, shall have laitance and partially loosened chips of concrete removed by blastcleaning.

B. All debris from the blastcleaning operation shall be removed. After removal, the exposed reinforcing steel shall be supported and tied. Rustproof chairs shall be provided in conformance with §556-2.01. If a continuous length of six feet (6'-0") or more, of reinforcing bar is exposed, the Engineer may require supports and positive tie-downs at a maximum spacing of 4'-0". Positive tie-downs shall consist of anchors drilled into the structural slab and connected to the reinforcing bars.

C. First stage blastcleaning operations may be commenced in an area after all necessary concrete removal has been completed there. The Contractor is forewarned however, that should more than 48 hours elapse from the termination of first stage blastcleaning operations, second stage blastcleaning will be required regardless of the apparent condition of the receiving surfaces.

D. The Engineer shall be allowed one working day to inspect the work after the supporting and tying of the reinforcing steel has been completed.

584-3.05 Second Stage Blastcleaning. If in the Engineer's opinion, contaminants, which might interfere with bond, are present on the prepared surface, second stage blastcleaning shall be performed. It shall be done where the Engineer directs. A light coating of orange colored rust, that forms on the reinforcing steel after first stage blastcleaning, is not considered detrimental to bond and may remain unless the time limit that follows is exceeded, or if ordered to be removed by the Engineer.

Second stage blastcleaning shall also be performed if more than 48 hours have elapsed from the time of termination of first stage blastcleaning operations.

584-3.06 Structural Slab Wetting. Structural slab wetting shall be governed by the following:

- A. High Density Concrete. Structural slab surfaces, prior to the application of bonding grout, shall be prewetted and free of standing water. The surfaces shall be dry to the touch.
- B. Latex Modified Concrete. The structural slab surface and any other porous surface which will be in contact with latex modified concrete shall be thoroughly wetted for 1 hour with water (§712-01), prior to the placement of bonding grout. The surface shall be visibly moist when bonding grout placement begins. All standing water in depressions, or areas of concrete removal shall be blown out with oil-free compressed air.
- C. Micro-Silica Concrete. The requirements of 584-3.06A shall apply.

584-3.07 Bonding Grout

A. Type. The bonding grout used shall meet the requirements of §584-2.01H.

B. Bonding Grout Mixing.

1. No bonding grout mixing, or placement, will be permitted until the Engineer has approved all blastcleaning operations.
2. Bonding grout shall be thoroughly mixed at the site, in a well-lit area, in an approved mechanical mixer. The fine aggregate and cement shall be deposited into separate one cubic foot batch boxes. The fine aggregate shall be deposited in the mixer prior to the addition of cement. The fine aggregate and cement shall be dry mixed for one minute and then water shall be added to produce a slurry. After the water is added, the bonding grout shall be mixed for a minimum of three minutes.
3. The Engineer may require that the mixer be thoroughly cleaned and rinsed before mixing a fresh batch of bonding grout.
4. Bonding grout that has dried, or become unworkable, as determined by the Engineer, shall not be incorporated in the work. No retempering will be permitted.

C. Bonding Grout Placement - High Density Concrete.

1. After the surface has been cleaned, prewetted, and immediately before placing concrete, a thin (approximately 1/8 inch) coating of bonding grout shall be vigorously and thoroughly broomed or brushed into the dry prepared surface. All surfaces to be in contact with new concrete, including the slab, curb, longitudinal and transverse joints shall be coated with bonding grout.

2. Bonding grout shall be broomed with a stiff, synthetic, bristle brush or broom. At all joints, and in areas around or below reinforcing steel, brooming shall be done with straight brooms. Care shall be exercised to ensure that all prepared surface areas receive a thorough, even coating, and that no excess bonding grout be permitted to collect in pockets. This shall be done to ensure that the bonding grout is evenly absorbed into the prepared surface.

3. The rate of bonding grout application shall be limited to that surface area which can be covered with new concrete before the bonding grout begins to dry out. Time limits will depend on atmospheric conditions and will be determined by the Contractor at the site. In the event drying does occur as evidenced by a light grey color the Contractor shall remove the bonding grout and place new bonding grout. Bonding grout removal shall be by blastcleaning, or other means approved by the Engineer.

D. Bonding Grout Placement - Latex Modified Concrete. The requirements of §584-3.07C shall apply except that the prepared surface, and any other porous surface to be in contact with concrete, shall be thoroughly wetted with water according to the requirements of §584-3.06B.

E. Bonding Grout Placement - Micro-Silica Concrete. The requirements of §584-3.07C shall apply.

584-3.08 Placing, Finishing and Curing Slab Reconstruction Concrete.

A. Slab reconstruction concrete shall be preplaced separately from overlay concrete except when both of the following conditions are, in the opinion of the Engineer, demonstrably present:

1. Areas of exposed reinforcing steel do not exceed 5% of the total slab area from which concrete has been removed, regardless of the concrete removal method employed.
2. Individual areas of exposed reinforcing shall not exceed 25 square feet in area, nor shall any dimension of an individual area exceed six feet in length.

Where both of the foregoing conditions are present, slab reconstruction concrete may be placed integrally with overlay concrete.

The Contractor has the following choices of concrete placed as slab reconstruction concrete depending on overlay type:

Overlay Type	Slab Reconstruction Concrete
High Density*	High Density**, or Class D
Latex Modified*	Latex Modified, or Class D
Micro-Silica*	Micro-Silica, or Class D

* Slab reconstruction concrete placed integrally with overlay concrete shall be overlay concrete.

** If slab reconstruction concrete is placed separately from overlay concrete, the contractor may use High Density Concrete meeting §584-2.02, except that the maximum slump shall not exceed 4 inches.

B. Bonding grout shall be placed against all surfaces receiving slab reconstruction concrete. Bonding grout for Class D concrete shall be mixed and placed in accordance with §584-3.07B and §584-3.07C.

C. If Class D concrete is used, the requirements of section 501 shall apply. A self-contained mobile mixer may be used for batching the concrete. The mixer shall meet the requirements of §584-2.05D.

D. If concrete transporting devices are operated on the prepared surface, protection shall be provided to prevent contamination of the prepared surface. Exposed reinforcing steel shall be protected from concrete transporting devices such that no debonding, loosening, bending or breakage occurs.

E. After blastcleaning is completed, and bonding grout mixing and placement is progressing, the Contractor shall place slab reconstruction concrete in the locations where reinforcing bars have been exposed. The concrete shall be consolidated by internal vibration in accordance with §555-3.04B. It shall be screeded to the level of the surrounding concrete, or to 1/2 inch above the reinforcing steel, whichever is higher. The slab reconstruction concrete surface shall be intentionally roughened. The Engineer may require that a coarse textured drag be used on the surface of the plastic concrete.

F. Curing shall be accomplished in the following manner.

1. High Density, Micro-Silica and Class D Concrete. Curing shall be by means of quilted covers, or plastic coated fiber blankets. Quilted covers, if used, shall be kept wet for the entire curing period in accordance with §584-3.10A. The wet curing period shall be 72 curing hours.

2. Latex Modified Concrete. Curing shall be done in accordance with §584-3.10B, except that the air cure period shall be 48 curing hours.

Regardless of the type of concrete placed, the use of membrane curing compounds will not be allowed.

G. The slab reconstruction concrete shall be thoroughly blastcleaned after the curing period is over, but prior to the placement of bonding grout and overlay. The blastcleaning shall remove laitance, expose 50% of the surface coarse aggregate, and leave an irregular surface acceptable to the Engineer.

H. Placement of slab reconstruction concrete in accordance with this subsection shall not relieve the Contractor of the requirement to provide at least the minimum thickness of overlay material required by the plans. There will be no separate payment for any grade changes necessitated by this requirement.

584-3.09 Placing and Finishing Overlay.

A. General. The following requirements shall apply for high-density, micro-silica and latex modified concrete placements.

1. Minimum Overlay Thickness. This shall be in accordance with the following:

Type	Minimum Thickness of Overlay Concrete	Minimum Total Cover
High Density	2"	2-1/4"
Latex Modified	1-1/2"	2-1/4"
Micro-Silica	1-1/2"	2-1/4"

2. The prepared surface of the structural slab shall be protected from contamination by any source.

3. The concrete may be mixed at the point of deposition.

At areas where slab reconstruction concrete is to be placed integrally with overlay concrete as allowed by §584-3.08A, the following requirements shall also apply:

4. The concrete shall be mixed at the work site, but not on a prepared area of the structural slab. If this requirement creates a conflict with §584-3.09A3, then this requirement shall apply.

5. No construction equipment in excess of 4000 pounds, fully loaded, shall be allowed on the prepared surface of the structural slab. If this requirement creates a conflict with §584-3.09A3, then this requirement shall apply.

6. Exposed reinforcing steel shall be protected from concrete transporting devices, so that no debonding, loosening, bending, or breaking occurs.

If the Engineer deems §584-3.09A4, and §584-3.09A5 unnecessary, based upon his opinion of the structural slab integrity, he may waive them.

B. Latex Modified Concrete - Latex Sampling.

1. If the overlay placement is latex modified concrete, daily sampling of the latex admixture will be required. The sample shall be provided under the direction of the Engineer. The minimum sample size will be one quart of latex for each day's placement. The latex shall be taken from a bypass valve in the latex feed line on the mobile mixer, and placed directly in a Department furnished one quart plastic jar. The sample will be sent to the Materials Bureau for testing.

C. Micro-Silica Concrete - Micro-Silica Sampling.

1. If the overlay placement is micro-silica concrete, the sampling procedure found in §584-3.09B shall be followed, except the sample shall be the micro-silica admixture. In addition, if a batch plant is used, a minimum sample of one quart of micro-silica shall be taken directly from the storage container for each shipment of micro-silica concrete.

D. Maximum Widths. Maximum placement width shall be:

Type	Max. Width
High Density	24' - 0"*
Latex Modified	None
Micro-Silica	None

*Unless the contract plans specifically require a single placement of greater width. If a high density concrete is to be placed at a width in excess of the limit established above, the Contractor shall request approval of the Regional Construction Engineer in writing. The Contractor shall be required to supply additional mobile mixers to ensure continuous production by two mobile mixers operating simultaneously. He shall also supply sufficient equipment and personnel to ensure prompt placement of the concrete produced.

E. Finishing Equipment. An approved finishing machine will be required.

1. Supporting rails upon which the finishing machine travels shall be placed outside the area to be concreted. Said rails shall be supported at two feet on center maximum spacings. However, no deflection will be permitted. If deflections occur spacings shall be reduced, or rails shall be replaced by more resistant rail material. Plans for anchoring support rails shall be submitted in writing to the Engineer for approval. Provision for anchorage of supporting rails shall provide for horizontal and vertical stability and positive anchorage may be required by the Engineer. A hold-down device shot into the prepared surface, or new overlay, will not be permitted.

2. Immediately prior to the beginning of overlay operations, the finishing machine shall be operated over the full length of bridge segment to be overlaid. This test run shall be made with the screed adjustment set to its finishing position. While operating the finishing machine during the test, the screed rails shall be checked for deflection, the intended cover on exposed reinforcing steel verified, and the minimum overlay thickness confirmed. All necessary corrections shall be made before the concrete placement is begun.

F. Placement - High Density Concrete.

1. No concrete shall be placed unless surface slab temperature requirements of §584-3.12 and §584-3.13 are met. Concrete shall be deposited as nearly as possible in its final position, so that the use of hand tools will be kept to a minimum. Internal vibrators shall not be used for moving concrete into position.

2. In areas where the depth is three (3) inches or greater, the concrete shall be consolidated by internal vibration immediately before strike-off by the finishing machine auger. Internal vibration in all areas where the depth is three (3) inches or greater, shall be in accordance with the requirements of §555-3.04B.

3. The new concrete shall be placed slightly above final grade. It shall then be struck-off, screeded and finished to final grade.

4. The finished surface, before texturing, shall be uniformly smooth, dense and even. Variations in pavement surface in excess of 1/8 inch above, or below, the proper finished elevation, or surface irregularities of more than 1/8 inch in 10 feet, will not be accepted.

5. The concrete surface shall be checked at random by the Engineer with an approved straight-edge not less than 10 feet long. The straight-edge shall be furnished by the Contractor. It shall be maintained in good, usable condition by him at all times.

6. The concrete shall be placed, consolidated, and finished at final grade to a minimum density of 100% of the theoretical project unit weight. The measurement of percent consolidation shall be performed in accordance with Department instructions. The Contractor shall provide a construction bridge so the Engineer may perform the measurement.

7. All concrete not meeting the minimum requirement for percent consolidation shall be revibrated. Revibrated concrete shall be tested for percent consolidation. Revibrated concrete not meeting the requirement for percent consolidation shall be removed and replaced.

8. A construction dam, or bulkhead shall be installed in case of a delay in the placement operations exceeding 30 minutes duration. During any delays of 30 minutes or less, the placement shall be protected from drying with several layers of wet burlap. If the concrete placement is stopped, or delayed, for 90 minutes or more, further placement shall be discontinued and may be resumed only after 48 hours have elapsed. This restriction does not prohibit continuation of the placement provided a gap is left in the placement. This gap shall be sufficient in length to allow the finishing machine to clear the previously placed concrete.

9. Adequate precautions shall be taken to protect freshly placed concrete from rainfall. All placement operations shall stop when it starts to rain. The Engineer may order removal and replacement of material damaged by rainfall.

10. The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.

11. At transverse and longitudinal construction joints, the overlay material placement shall be continued beyond the joint location a distance at least equal to the placement depth, and shall be allowed to stand free, or shall be formed. After the overlay material has cured for a minimum of 48 curing hours, the concrete shall be sawed to a depth of $3/4" \pm 1/8"$. The overlay material beyond the saw cut shall be chipped out to the level of the original prepared surface, or to the level of the reinforcing bars, whichever is higher. The chipped face of the construction joints shall not undercut the saw cut and shall have a slope of approximately 45° .