

Section 1000

1 State on Form 312U the intended use of the material. Accompany Form 312U with a listing
2 of compressive strength of at least three 4" x 8" cylinders at the age of 28 or 56 days,
3 depending on whether the mix is to be excavated or not. Air cure the cylinders during the
4 entire period before testing. The Engineer will advise the Contractor in writing of the
5 acceptability of the mix design.

6 **1000-7 LATEX MODIFIED CONCRETE**

7 **(A) Materials**

8 Refer to Division 10.

Item	Section
Coarse Aggregate, standard size No. 78M	1014-2
Fine Aggregate	1014-1
Portland Cement	1024-1
Type IP Blended Cement	1024-1
Type IS Blended Cement	1024-1
Type IT Blended Cement	1024-1
Water	1024-4

9 Do not use Type III high early strength cement.

10 Use a formulated latex admixture that is a non-hazardous, film forming and polymeric
11 emulsion in water and is homogeneous and uniform in composition. Add all stabilizers at
12 the point of manufacture.

13 Use a latex modifier conforming to Table 1000-4.

Property	Requirement
Polymer Type	Styrene Butadiene: 68 ± 4% Styrene 32 ± 4% Butadiene
Average Polymer Particle Size	1500 to 2500 Angstroms
Emulsion Stabilizers	Anionic and non-ionic surfactants
Percent Solids	46.5% to 49.0%
Weight per gallon at 75°F	8.40 to 8.60 lb
pH	9.5 to 11.0
Shelf Life	2 Years
Color	White

14 Provide a Type 5 material certification for each load of latex emulsion admixture in
15 accordance with Article 106-3. Test admixture samples to verify compliance with the
16 requirements before use. Allow 7 days for sampling and testing after delivery to the
17 project.

18 Do not allow the temperature of latex emulsion admixture to fall below 35°F at any time
19 or exceed 85°F after delivery to the project.

20 For latex emulsion that has been in storage, use a transfer pump and lines to recirculate it
21 before using.

22 For latex modified concrete, use a workable mixture that meets Table 1000-5.

23 Measure the slump 4 to 5 minutes after discharge from the mixer.

24 Submit the latex modified concrete mix design, completed by the latex emulsion
25 manufacturer, to the Engineer for review.

TABLE 1000-5 PROPERTIES OF LATEX MODIFIED CONCRETE	
Property	Requirement
Cement Content, lb/cy	658 min.
Latex Emulsion Admixture, gal/cy	24.5 min.
Air Content of Plastic Mix, %	3.5 - 6.5
Slump, inches	3 - 6
% Fine Aggregate as percent of total aggregate by weight	50 - 55
7 day Compressive Strength, psi	3,000 min.
Water-Cement Ratio by weight	0.40 max.

1 **(B) Equipment**

2 Before beginning any work, obtain approval for all equipment to be used for deck
3 preparation, mixing, placing, finishing and curing the latex modified concrete.

4 Use sandblasting equipment capable of removing all clay, salt deposits, oil and grease
5 deposits and all other foreign matter. Provide traps or separators to remove oil and water
6 from the compressed air. Use traps or separators of adequate size and drain them
7 periodically during operations. For proportioning and mixing, use self-contained, mobile
8 and continuously mixing equipment that meets the following requirements:

9 Use a self-propelled mixer that is capable of carrying sufficient unmixed dry, bulk
10 cement, sand, coarse aggregate, latex modifier and water to produce at least 6 cy of
11 concrete on site.

12 Use a mixer that is capable of positive measurement of cement introduced into the mix.
13 Use a recording meter that is visible at all times and equipped with a ticket printout to
14 indicate the quantity of cement.

15 Calibrate the mixers to accurately proportion the specified mix. Before placing latex
16 modified concrete, perform calibration and yield tests under the Engineer's supervision in
17 accordance with the Department's written instructions. Copies of these written
18 instructions are available from the Materials and Tests Unit. Perform the calibration and
19 yield tests using the material to be used on the project. Recalibrate the mixer after any
20 major maintenance operation on the mixer, anytime the source of materials changes or as
21 directed. Furnish all materials and equipment necessary to perform the calibrations and
22 yield tests.

23 Use a mixer that controls the flow of water and latex emulsion into the mix. Measure the
24 flow rate of water and the latex emulsion with a calibrated flowmeter coordinated with
25 both the cement and aggregate feeding mechanisms and the mixer. Adjust the flow rate,
26 as necessary, to control the slump and ensure that the water-cement ratios are met. In
27 addition to flowmeters, use mixers with accumulative water and latex meters capable of
28 indicating the number of gallons, to the nearest 0.1 gallon, introduced into the mixer.
29 Filter water and latex with a suitable mesh filter before it flows through the accumulative
30 water and latex meters.

31 Calibrate the mixer to automatically proportion and blend all components of the indicated
32 composition on a continuous or intermittent basis as the finishing operation requires.
33 Provide a mixer that discharges mixed material through a conventional chute and is
34 capable of spraying water over the placement width as it moves ahead to ensure that the
35 surface to be overlaid is wet before receiving the modified material.

36 Mount a tachometer on the unit to indicate the drive shaft speed.

37 Use adequate hand tools for placing and leveling concrete down to approximately the
38 correct level for striking off with the screed.

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1 Use a finishing machine that meets the approval of the Engineer and the requirements of
2 the contract. Use a self-propelled finishing machine capable of forward and reverse
3 movement under positive control. Use a machine with at least 2 finishing devices, one
4 that is a vibrating screed and the other either a vibrating screed, oscillating screed, or one
5 or more rotating cylindrical drums 48" long or less and operating between 1,500 and
6 2,500 vpm. Make certain the finishing machine can finish the surface to within one foot
7 of the edges of the area being placed. Raise all screeds when the finishing machine is
8 moving backwards over the screeded surface.

9 Use screeds with a vibration frequency that is variable between 3,000 and 6,000 vpm
10 with positive controls. Use screeds with a metal covered bottom face not less than
11 4" wide. Provide screeds with positive control of the vertical position.

12 Use supporting rails for travelling of the finishing machine rigid enough to eliminate
13 deflection from the weight of the machine.

14 (C) Proportioning and Mixing of Modified Compositions

15 Meet the following requirements when proportioning and mixing modified materials:

16 Use mobile continuous mixers that accurately proportion all materials for the specified
17 mixture. Operate the proportioning equipment at the manufacturer's recommended speed
18 verified with the tachometer during calibration and normal operations.

19 Yield checks and other checks are permitted.

20 1000-8 MEASURING MATERIALS

21 (A) Weighing Cement

22 Measure cement by weight on scales separate from those used for other materials and in
23 a hopper that is entirely free and independent of the hoppers used for weighing the
24 aggregates. When the quantity of cement in a batch exceeds 30% of the full capacity of
25 the scale, ensure the quantity of cement as indicated by the scale is within $\pm 1\%$ of the
26 required weight. For smaller batches, ensure the quantity of cement as indicated by the
27 scale be not less than the required amount or more than 4% in excess. Equip all beam
28 type scales with a tare beam.

29 (B) Weighing Aggregates

30 Measure aggregates by weight. Base batch weights on saturated surface dry materials
31 and which are the required weights plus the total weight of surface moisture contained in
32 the aggregates. Ensure the individual aggregates, as weighed, are within $\pm 2\%$ of the
33 required weights.

34 (C) Water

35 Measure water by volume or by weight. Ensure the quantity of water measured is
36 within $\pm 1\%$ of the required amount.

37 (D) Admixture Dispensing Systems

38 Provide a separate dispensing system with separate fill and discharge lines for each type
39 of admixture to be used, except that admixtures may be measured and introduced into the
40 mix manually if approval has been obtained. Ensure each system is capable of
41 measuring, displaying and discharging the required amount of admixture into the mix.
42 Keep dispensing systems clean and in good operating condition. Use a dispensing system
43 that is either:

44 (1) Manually operated, self contained; or

45 (2) Semi-automatic or automatic, self-contained; or

46 (3) Interfaced to operate automatically with the concrete batching control panel.

1 Have the admixture dispenser dispense the required quantity of admixture for each
 2 concrete batch within an accuracy of $\pm 3\%$. Check the accuracy of the dispenser as
 3 provided below. Check the accuracy at the point of discharge, or through a bypass valve
 4 suitable for obtaining a calibrated sample of admixture and at the volumes normally used
 5 for one half mixer capacity and for full mixer capacity. Determine the accuracy at the
 6 time of installation and check daily during the early part of each day's operation.

7 Include in each system a graduated measuring unit into which the admixture is batched to
 8 permit a quick visual check of accuracy before its discharge. Ensure the measuring unit
 9 is clearly graduated and be of sufficient size to hold the maximum anticipated dose for
 10 one batch. Clearly mark the measuring unit for the type of admixture to be used.

11 Control the discharge sequence so an admixture will not be brought into contact with raw
 12 cement or another admixture before being diluted through contact with the mixing water
 13 in the mixer. Where 2 types of admixtures are being used, do not discharge them into the
 14 mix simultaneously. Add the air entraining agent with the first addition of water and add
 15 any other chemical admixture with the final addition of water, unless otherwise
 16 permitted.

17 Construct the discharge lines to completely empty after each cycle. Locate the admixture
 18 dispensing systems so the batching plant operator will have a visual verification of the
 19 actual quantity of admixture batched.

20 Use air entraining admixtures in accordance with the manufacturer's recommendations
 21 and in such quantity to provide the specified air content in freshly mixed concrete. Use
 22 a quantity of set retarding admixture and of water reducing admixture per 100 lb of
 23 cement that is within the range recommended on the current list of approved admixtures
 24 issued by the Materials and Tests Unit.

25 **1000-9 BATCHING PLANT**

26 **(A) General**

27 Plants located on the Department rights of way shall conform to Article 107-3.

28 Have ready mixed concrete plants inspected and approved by the Department before they
 29 are used to produce concrete, either paving, structural or incidental, for the project.
 30 Plants shall meet all the applicable requirements of these *Standard Specifications*, and in
 31 addition, ensure each ready mix plant provides at least 3 acceptable truck mixers or truck
 32 agitators available for use. Use trucks that have an identifying number. Plants approved
 33 by the Department will be placed on a list of approved plants available to the Contractor.
 34 All plants will be subject to reinspection at intervals selected by the Engineer.
 35 Reapproval after each inspection will be contingent on continuing compliance with the
 36 *Standard Specifications*.

37 **(B) Bins and Hoppers**

38 Provide bins with separate compartments for fine aggregates and for each required size of
 39 coarse aggregate in the batching plant. Design each compartment to discharge efficiently
 40 and freely into the weighing hopper. Provide control so, as the quantity desired is being
 41 approached, the material may be added slowly and shut off with precision. Construct
 42 weighing hoppers to eliminate accumulation of tare materials and to discharge fully
 43 unless otherwise permitted. Provide a port or other opening for removing an overload of
 44 any one of the several materials from the hopper.

45 **(C) Scales**

46 Use either the beam type, load cell type or the springless dial type scales for weighing
 47 aggregates and cement. Ensure the minimum graduation on beam or dial is not more than
 48 0.1% of the total capacity of the scale. Methods of weighing, other than beam or
 49 springless dial scales, may be approved by the Engineer provided they meet the required

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1 weighing tolerances. Ensure the scales are accurate within 0.5% under operating
2 conditions. Make available ten 50 lb test weights at the plant for checking accuracy. Use
3 test weights which meet the U.S. Bureau of Standards requirements for calibrating and
4 testing equipment. Keep all exposed fulcrums, clevises and similar working parts of
5 scales clean. When beam type scales are used, make provisions for indicating to the
6 operator that the required load in the weighing hopper is being approached. Ensure the
7 device indicates at least the last 50 lb of load and design it to give a positive indication of
8 overload of the scales. During charging of the hopper, have all indicating devices in full
9 view of the operator and provide convenient access to all controls. Ensure the indicating
10 devices are in the immediate vicinity of the operator and easily readable by the operator.

11 (D) Water Measuring Devices

12 Use devices for measurement of the water which are readily adjustable and are capable of
13 being set to deliver the required amount and cut off the flow automatically when this
14 amount has been discharged. Under all operating conditions the device shall have
15 accuracy within 1% of the quantity of water required for the batch. Arrange the device so
16 variable pressures in the water supply line will not affect the measurements. Use
17 measuring tanks of adequate capacity to furnish the maximum mixing water required and
18 equip them with outside taps and valves to provide for checking their calibration unless
19 other means are provided for readily and accurately determining the amounts in the tank.

20 1000-10 MIXERS AND AGITATORS

21 (A) General

22 Mixers are defined as equipment to mix concrete and may be stationary or truck
23 mounted. Agitators are defined as equipment used to haul central mixed concrete and
24 may be truck mixers or truck agitators. Provide a metal plate or plates attached to each
25 mixer and agitator in a prominent place on which the manufacturer has plainly marked
26 the mixing speed of the drum or paddles and the maximum capacity of the drum or
27 container in terms of volume of mixed concrete. On truck mixers and agitators, show the
28 manufacturer's recommended agitating and mixing speed of rotation of the mixing drum
29 or blades. Equip stationary mixers with an acceptable timing device that will not permit
30 the batch to be discharged until the specified mixing time has elapsed. Equip truck
31 mixers with counters to verify the number of revolutions of the drum or blades. Actuate
32 the counters at the initial time the drums have reached mixing speed.

33 Examine mixers and agitators periodically for changes in condition due to accumulation
34 of hard concrete or mortar, wear of blades or any other condition which decreases mixing
35 efficiency. Mixers are unacceptable when the radial height or other dimension of the
36 blade has worn below 90% of the original dimension. This radial height excludes any
37 lips on the blade and is the height of the blade running perpendicular to the shell of the
38 drum. Where such conditions are found, do not use the units until they are corrected.

39 Also examine mixers and agitators periodically for general mechanical condition,
40 including water measuring and discharge apparatus, identifying number on trucks,
41 condition of the blades, speed of rotation of the drum and condition of the drum.

42 (B) Mixer Capacity

43 Do not load truck mixers with concrete with more than 63% of the gross volume of the
44 drum. Use mixers capable of combining the ingredients of the concrete into a thoroughly
45 mixed and uniform mass and of discharging the concrete with a satisfactory degree of
46 uniformity. Use stationary mixers, when loaded at the manufacturer's guaranteed mixing
47 capacity and the concrete mixed for the prescribed mixing time, capable of combining the
48 ingredients of the concrete into a thoroughly mixed and uniform mass and discharging
49 the concrete with satisfactory uniformity.

1 Use at least 20% of the rated mixing capacity as the minimum quantity of concrete
2 permitted to be mixed or agitated in any mixer.

3 **(C) Agitator Capacity**

4 Load the agitator to not exceed 80% of the gross drum volume and have it be capable of
5 maintaining the concrete in a thoroughly mixed and uniform mass and of discharging the
6 concrete with a satisfactory degree of uniformity.

7 **(D) Consistency Tests**

8 The Engineer may, from time to time, make slump tests to measure consistency of the
9 concrete. Take individual samples at approximately the 1/5th point, the midpoint and the
10 4/5th point of the load, using AASHTO T 119. Such tests will be made within
11 20 minutes of discharge of that portion of the load. If the results vary by more than 1" in
12 slump, do not use the mixer or agitator unless the condition is corrected.

13 **1000-11 MIXING AND DELIVERY**

14 **(A) General**

15 Mix and deliver concrete to the site of the work by one of the following methods, except
16 where other methods are approved. Maintain responsibility for controlling the materials
17 and operations as to produce uniform concrete meeting Specifications requirements.

18 When concrete is being produced for structures and incidental construction in accordance
19 with Article 1000-4, have present during all batching operations a Certified Concrete
20 Batch Technician employed by the Contractor or concrete supplier. During batching and
21 delivery, the sole duty of this employee is to supervise the production and control of the
22 concrete. Perform moisture tests, adjust mix proportions of aggregates for free moisture,
23 complete and sign Batch Tickets (Materials and Tests Form 903) or approved delivery
24 tickets and assure quality control of the batching. Delivery tickets will be permitted
25 instead of batch tickets (Materials and Tests Form 903) provided they have been
26 reviewed and approved by the Materials and Tests Unit. The Department certifies
27 technicians who satisfactorily complete examinations prepared and administered by the
28 Department.

29 **(1) Central Mixed Concrete**

30 Concrete that is mixed completely in a stationary mixer and the mixed concrete
31 transported to the point of delivery in a truck agitator or in a truck mixer operating at
32 agitating speed or in non agitating equipment approved by the Engineer. Perform
33 mixing within the capacity and at the mixing speeds recommended by the
34 manufacturer.

35 **(2) Transit Mixed Concrete**

36 Concrete that is mixed completely in a truck mixer while at the batching plant, in
37 transit, or at the work site.

38 **(3) Shrink Mixed Concrete**

39 Concrete that is mixed partially in a stationary mixer at a central mixing plant and
40 completed as transit mixed concrete. Place all ingredients for a batch in the
41 stationary mixer, partially mix before any concrete is discharged to the truck mixer
42 and do not exceed the rated capacity of the equipment for the batch size. The mixing
43 time at the stationary mixer may be reduced to the minimum necessary to
44 intermingle the ingredients, and the mixing may be completed in the truck mixer.
45 Use the number of mixing revolutions in the truck mixer as specified for transit
46 mixed concrete or reduce as indicated by mixer performance tests.

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1 (B) Mixing Time for Central Mixed Concrete

2 Mixing time begins when all solid materials are in the mixing compartment and ends
3 when any part of the concrete begins to discharge. In charging the mixer, water will enter
4 in advance of cement and aggregate. Ensure all the water is substantially in the drum
5 before 1/3 of the specified mixing time has elapsed. Count transfer time in multiple drum
6 mixers as part of the mixing time.

7 Where mixer performance tests are not made, use a minimum mixing time of 90 seconds,
8 providing that blending of materials during charging is achieved to the satisfaction of the
9 Engineer. The minimum mixing time for an individual mixer is that which, as shown by
10 mixer performance tests, will produce concrete in accordance with Table 1000-6, except
11 that the mixing time shall not be less than 50 seconds under any circumstances.
12 Maximum mixing time excluding discharge time is 150 seconds.

13 Sampling and testing for mixer performance tests will be done as provided below.
14 Charge the mixer to its rated capacity with the materials and proportions to be used in the
15 work and mixed at the recommended mixing speed to the target time. Stop mixing and
16 begin discharging. Two samples of sufficient size to make the required tests will be
17 taken after discharge of approximately 15% and 85% of the load.

Property	Requirement	Test Method
Difference in Test Samples Air Content, percent by volume of concrete	1.0%	AASHTO T 152
Slump	1.0"	AASHTO T 119
Coarse aggregate content, portion by weight of each sample retained on the No. 4 sieve	6.0%	AASHTO M 157
Weight	1.0 lb	AASHTO T 121
Average Compressive Strength at 7 days, percent of average	10.0% ^A	AASHTO T 22 AASHTO T 23

18 **A.** Tentative approval may be granted pending 7 day compressive strength tests.

19 Each of the 2 samples of concrete will be separately tested for the properties listed in
20 Table 1000-6. Tests will be conducted in accordance with the test procedures specified
21 in Table 1000-6 or procedures established by the Materials and Tests Unit.

22 The mixer performance test described above will be performed on at least 2 batches of
23 concrete. For the performance test to be acceptable, have all tests in each batch tested
24 meet the requirements listed above.

25 The Engineer may recheck mixer performance at any time when, in his opinion,
26 satisfactory mixing is not being accomplished.

27 Where satisfactory mixing cannot be accomplished in 90 seconds, the Engineer may
28 increase the mixing time or require that the mixer be repaired or replaced before any
29 further mixing can be done.

30 (C) Truck Mixers and Truck Agitators

31 When a truck mixer is used for complete mixing, mix each batch of concrete for at least
32 70 revolutions of the drum or blades at the rate of rotation designated by the
33 manufacturer of the equipment as mixing speed, unless otherwise directed by the
34 Engineer. Unless the mixer is equipped with a counter which will distinguish between
35 mixing and agitating speeds, perform the minimum required number of revolutions of the
36 drum at mixing speed as directed, either at the batching plant before the mixer leaves
37 for the work site and/or at the work site before the concrete is discharged.

1 Perform any additional mixing at the speed designated by the manufacturer of the
2 equipment as agitating speed. Put all materials including mixing water in the drum
3 before actuating the revolution counter for determining the number of revolutions of the
4 drum.

5 When a truck mixer or truck agitator is used to transport concrete that has been
6 completely mixed in a stationary mixer, perform mixing during transport at agitating
7 speed.

8 Provide concrete, when discharged from truck mixers or truck agitators, of the
9 consistency and workability required for the work. Control the rate of discharge of the
10 plastic concrete from the mixer drum by the speed or rotation of the drum in the
11 discharge direction with the discharge gate fully open. If additional mixing water is
12 necessary to produce the slump necessary for proper placement, add it only with
13 permission and rotate the truck mixer drum at least 25 revolutions at mixing speed before
14 discharge of any concrete. Additional mixing water will be allowed only if the maximum
15 specified water content per cubic yard is not exceeded.

16 **(D) Delivery**

17 Use a ticket system for recording the transportation of batches from the proportioning
18 plant to the site of the work. Use tickets furnished by the Engineer and fill it out in
19 accordance with instructions issued by the Engineer. Issue the tickets to the truck
20 operator at the proportioning plant for each load and have them signed by the plant
21 inspector, which will signify that the concrete in the truck has been inspected before
22 departure. Ensure each ticket shows the time batching was completed and if transit
23 mixed, the number of revolutions at mixing speed, if any, at the plant. Deliver the tickets
24 to the inspector at the site of the work. Do not use loads which do not carry such tickets
25 and loads which do not arrive in satisfactory condition within the time limits specified in
26 the work.

27 **1000-12 VOLUMETRIC MIXED CONCRETE**

28 Upon written request by the contractor, the Department may approve the use of concrete
29 proportioned by volume. The volumetric producer must submit and have approved a process
30 control plan and product quality control plan by the Materials and Tests Unit. If concrete is
31 proportioned by volume, the other requirements of these specifications with the following
32 modifications will apply. Unless otherwise approved by the Department, use of concrete
33 proportioned by volume shall be limited to Class B concrete and no more than 30 cy per unit
34 per day.

35 **(A) Materials**

36 Use materials that meet the requirements for the respective items except that they will be
37 measured by a calibrated volume-weight relationship.

38 Storage facilities for all material shall be designed to permit the Department to make
39 necessary inspections before the batching operations. The facilities shall permit
40 identification of approved material at all times and shall be designed to avoid mixing
41 with, or contaminating by, unapproved material. Coarse and fine aggregate shall be
42 furnished and handled so variations in the moisture content affecting the uniform
43 consistency of the concrete is avoided.

44 Moisture content of the coarse and fine aggregate will be made available onsite for the
45 Engineer's review for each load. The frequency of moisture testing will be dependent on
46 certain variables such as weather, season and source; however, moisture tests should be
47 performed at least once at the beginning of the work day for each source material.
48 Additional daily moisture tests for the coarse and fine aggregate shall be performed if
49 requested by the Engineer.

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1 Unused materials should be emptied from hopper daily. Concrete should not be mixed
2 with materials left in the hopper overnight.

3 **(B) Equipment**

4 Provide volumetric mixers with rating plates indicating that the performance of the mixer
5 is in accordance with the Volumetric Mixer Manufacturer Bureau or equivalent. Mixers
6 must comply with ASTM C685. Unless otherwise specified, all mixing operations must
7 be in strict accordance with the manufacturer's recommended procedures. Such
8 procedures shall be provided to the Department for review upon request.

9 The volumetric mixer shall be capable of carrying sufficient unmixed dry bulk cement,
10 pozzolan (if required), fine aggregate, coarse aggregate, admixtures and water, in
11 separate compartments and accurately proportioning the specified mix. Each batching or
12 mixing unit (or both) shall carry in a prominent place a metal plate or plates on which are
13 plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed
14 and the weight-calibrated constant of the machine in terms of a revolution counter or
15 other output indicator.

16 The concrete mixing device shall be an auger-type continuous mixer used in conjunction
17 with volumetric proportioning. The mixer shall produce concrete, uniform in color and
18 appearance, with homogeneous distribution of the material throughout the mixture.
19 Mixing time necessary to produce uniform concrete shall be established by the contractor
20 and shall comply with other requirements of these specifications. Only equipment found
21 acceptable in every respect and capable of producing uniform results will be permitted.

22 Each volumetric mixer shall be equipped with an onboard ticketing system that will
23 electronically produce a record of all material used and their respective weights and the
24 total volume of concrete placed. Alternate methods of recordation may be used if
25 approved by the Engineer. Tickets shall identify at least the following information:

- 26 (1) Contractor Name
- 27 (2) Contractor Phone Number
- 28 (3) NCDOT Project No. and TIP No.
- 29 (4) Date
- 30 (5) Truck No.
- 31 (6) Ticket No.
- 32 (7) Time Start/End of Pour
- 33 (8) Mix ID and Description (Strength)
- 34 (9) Aggregate Moisture Before Mixing

35 **(C) Proportioning Devices**

36 Volume proportioning devices, such as counters, calibrated gate openings or flow meters,
37 shall be easily accessible for controlling and determining the quantities of the ingredients
38 discharged. All indicating devices that affect the accuracy of proportioning and mixing
39 of concrete shall be in full view of and near enough to be read by the operator and
40 Engineer while concrete is being produced. In operation, the entire measuring and
41 dispensing mechanism shall produce the specified proportions of each ingredient.

42 Provide positive control of the flow of water and admixtures into the mixing chamber
43 with a volumetric mixer. Indicate water flow by a flow meter and be readily adjustable to
44 provide for slump control and/or minor variations in aggregate moisture. Provide a mixer
45 capable of continuously circulating or mechanically agitating the admixtures.

46 Dispense liquid admixtures through a controlled, calibrated flow meter. A positive
47 means to observe the continuous flow of material shall be provided. If an admixture
48 requires diluting, the admixture shall be diluted and thoroughly mixed before introducing
49 the admixture into the dispenser. When admixtures are diluted, the ratio of dilution and
50 the mixing shall be approved by and performed in the presence of the Department.

1 The volumetric mixer shall be capable of measurement of cement, pozzolan (if required),
2 liquids and aggregate being introduced into the mix.

3 (D) Calibration

4 Volume-weight relationships will be based on calibration. The proportioning devices
5 shall be calibrated by the contractor before the start of each NCDOT job and
6 subsequently at intervals recommended by the equipment manufacturer. Calibrations
7 will be performed in the presence of the Department and subject to approval from the
8 Department. Calibration of the cement and aggregate proportioning devices shall be
9 accomplished by weighing (determining the mass of) each component. Calibration of the
10 admixture and water proportioning devices shall be accomplished by weight (mass) or
11 volume. Tolerances in proportioning the individual components will be as follows:

TABLE 1000-7 VOLUMETRIC MIXED CONCRETE CALIBRATION TOLERANCES	
Item	Tolerance
Cement, Weight (Mass) percent	0 to +4
Fine Aggregate, Weight (Mass) percent	± 2
Coarse Aggregate, Weight (Mass) percent	± 2
Admixtures, Weight (Mass) or Volume percent	± 3
Water, Weight (Mass) or Volume percent	± 1

12 Each volumetric mixer must be accompanied at all times by completed calibration
13 worksheets and they shall be made available to the Department upon request.

14 (E) Verification of Yield

15 Verification of the proportioning devices may be required at any time by the Department.
16 Verification shall be accomplished by proportioning the rock and sand based on the
17 cement meter count for each concrete mobile mixer. Once the count (revolutions) for
18 94 lb of cement has been determined then delivery of the correct amount of rock and sand
19 can be verified.

20 (F) Uniformity

21 When concrete is produced, have present during all batching operations a Certified
22 Concrete Batch Technician. During batching and placement, the sole duty of this
23 employee is to supervise the production and control of the concrete, perform moisture
24 tests, adjust mix proportions of aggregates for free moisture, complete and sign approved
25 delivery tickets and assure quality control of the batching.

26 Two samples of sufficient size to make the required tests will be taken after discharge of
27 approximately 15% and 85% of the load. Each of the 2 samples of concrete will be
28 separately tested for the properties listed in Table 1000-7. Tests will be conducted in
29 accordance with the test procedures specified in Table 1000-7 or procedures established
30 by the Materials and Tests Unit. The Engineer may recheck mixer performance at any
31 time when, in his opinion, satisfactory mixing is not being accomplished.

32 SECTION 1002 33 SHOTCRETE PRODUCTION AND DELIVERY

34 1002-1 DESCRIPTION

35 This section addresses shotcrete to be used for temporary support of excavations and other
36 applications in accordance with the contract. Produce shotcrete by either the dry-mix or
37 wet-mix process composed of Portland cement, fine and/or coarse aggregates, water and at the
38 Contractor's option, pozzolans. Include chemical admixtures as required or needed for
39 shotcrete produced by the wet-mix process. Ground granulated blast furnace slag, fly ash or