

## Section 9.2

### CONCRETE PRODUCTION FACILITIES GUIDELINE

#### 9.2.1 General

The State Materials Office, in conjunction with the District Materials Offices, are responsible to verify that all concrete production facilities meet the requirements of the Specifications and guidelines herein. Concrete production facilities that supply concrete to Department projects must be approved by the Department in accordance with Standard Specification for Road and Bridge Construction **Section 6-8**. Concrete produced in accordance with Department specifications and this guideline shall be accepted upon proper certification of concrete production through an approved quality control plan and verification of job site acceptance criteria.

Notify the District Concrete Engineer prior to mixing and delivering concrete to a Department project. Identify the plant number, project number, mix number, and the cubic yards to be batched.

#### 9.2.2 Scope

This guideline establishes the Department's policies governing the production of concrete for Department use. The concrete production facility shall certify compliance with project specifications.

The following provides the Concrete Production Facility with information related to the methods and the minimum requirements for Quality Control programs, and the criteria by which the Department will maintain that approval. The Department will maintain the list of qualified plants that meet the requirements of these guidelines.

#### 9.2.3 Applicable Standards

Methods of sampling and testing materials shall be in accordance with **Standard Specification 346-5**. Reference to the above standards shall be construed to mean the most current issuance, including interims or addenda thereto at the time of advertisement for bids.

## 9.2.4 Materials Requirements

### 9.2.4.1 General

Meet the following requirements found in the Standard Specifications:

Coarse Aggregate	Section 901
Fine Aggregate*	Section 902
Portland Cement	Section 921
Water	Section 923
Admixtures	Section 924
Pozzolans and Slag	Section 929

\*Use only silica sand except as provided in **Section 902-5.2.3**.

Use materials containing no hard lumps, crusts, frozen matter, or that are not contaminated with dissimilar material.

### 9.2.4.2 Cementitious Material

Acceptance at the plant shall be based upon certified mill analyses. As a check on current quality, samples may be obtained and tested by the Producer or the Department.

Each plant must provide a separate and clearly labeled weatherproof facility to store each brand or type of cementitious material available during production. Each storage facility shall provide a suitable, safe and convenient means of collecting cementitious material samples.

Measure the cementitious materials by mass within an accuracy of 1% of the required total amount, except that for concrete batches of 3 yd<sup>3</sup> [3 m<sup>3</sup>] or less, accuracy of 2% is allowed. Weigh the cementitious materials separately from other materials. When weighing cementitious materials in a cumulative weigh hopper, weigh the cement first. Measure silica fume slurry as an admixture.

If bagged cementitious material is permitted, proportion the batch to use only whole bags. Store silica fume and metakaolin in accordance with the manufacture's recommendation.

### 9.2.4.3 Aggregates

All Aggregate shall be obtained from Department approved sources. A list of approved sources will be maintained by the Department and made available from the State Materials Office.

As a minimum, each plant must provide suitable bins, stockpiles or silos to store and identify aggregates without mixing, segregating or contaminating the different sources or grades. Identification shall include DOT designated, approved pit number and aggregate grade. Measure aggregates by mass or volume within an accuracy of 1% of the required amount. Apply aggregate surface moisture corrections.

The Producer shall be responsible for handling the aggregates so as to minimize segregation and recover material from the stockpile for use in the mix so it will remain within specification limits. Stockpiles shall be maintained in a well drained condition to minimize free water content and to not promote algae/fungal growth. The Producer shall make available to the Department, from the recovery side of the stockpile where feasible, the quantities of aggregate necessary for sampling and testing to ensure compliance with project specifications.

#### 9.2.4.3.1 Wetting Coarse Aggregate Stockpiles, Storage Bins And Silos

The entire surface of the coarse aggregate shall be continuously and uniformly sprinkled with water for a period of 24-hours immediately preceding introduction into the concrete. Any request for deviations from the 24-hour sprinkling requirement should be addressed in the Producer's Quality Control Program for consideration by the District Materials Engineer.

#### 9.2.4.4 Admixtures

Only admixtures approved by the Department shall be used in concrete mixes. A certification from the admixture supplier that the admixture proposed meets the requirements of **Standard Specification 924** is required. Ensure that the certification also includes an additional statement from the admixtures' supplier or an approved independent testing laboratory that the proposed admixture is compatible with all other admixture to be included in the concrete design mix. Admixture dosage rate shall be within the range of the manufacturers technical data sheet for the product to be used.

Measure admixtures by mass or volume. Use measuring equipment that has an accuracy, under all operating conditions, within 3% of the quantity of admixture required for the batch. Measure silica fume slurry to an accuracy of 1%. Measure each admixture separately, and add it to the mixing water in a separate sequence as the mixing water is introduced into the mix.

Store admixtures in accordance with the manufacture's recommendation.

## 9.2.4.5 Scales And Meters

All scales, meters and other weighing or measuring devices, excluding admixture dispensers, shall be checked for accuracy by a qualified representative of a scale company registered with the Bureau of Weights and Measures of the Florida Department of Agriculture prior to production of concrete. Scales, meters and other weighing or measuring devices, excluding admixture dispensers, shall be checked quarterly at a minimum. The Department reserves the right to be present during all scale checks.

### 9.2.4.5.1 Water Measuring Devices

Water measuring devices used during batching operations at concrete plants are to be checked for accuracy at least quarterly. Accuracy of these devices is checked by weight or volume. Any container used for accuracy verification must be capable of holding the maximum quantity of water normally used during batching sequence.

If accuracy is checked by volume, the maximum capacity of the container used must be known in gallons [liters]. Graduation marks must be readily visible on the container at each level checked, ensuring accurate volume determination to the nearest 0.5 gallon [2 L]. Accuracy of these graduation marks must be documented by a scale company registered with the Bureau of Weights and Measurements, Florida Department of Agriculture and Consumer Services.

Use of a flow meter mounted in series is acceptable provided the accuracy of the flow meter is traceable to the National Institute of Standards and Technology. The accuracy of the calibration device should be checked annually.

Measure water by volume or weight. Whichever method is used, construct the equipment so that the accuracy of measurement is not affected by variations in pressure in the water supply line. Use a meter or weighing device capable of being set to deliver the required quantity and to automatically cut off the flow when the required quantity has been discharged. Ensure that the measuring equipment has accuracy, under all operating conditions, within 1% of the quantity of water required for the batch.

Regardless of the method used, the following guidelines will be followed when measuring devices are checked for conformity with accuracy

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requirements of the specification or accuracy requirements as specified herein:

- (1) Devices will be checked up to the maximum quantity normally required for a batch.
- (2) At least four step - checks will be made at approximately equal intervals, including the maximum quantity normally required for a batch.
- (3) The report supplied by the qualified agency performing the check shall include the date of inspection, signature of the agency representative, observed deviations for each quantity checked and a statement that the device conforms to Department specifications. A copy of the report corresponding with the current certificate of inspection shall be available at the plant where the device is located.
- (4) A certificate of inspection bearing the date of certification and signed by a representative of the qualified agency shall be affixed to the measuring device.
- (5) Methods not specifically detailed above are considered acceptable if District Materials Personnel verify compliance with conditions and guidelines stated in the specifications, or other written authority.

#### 9.2.4.5.2 Admixture Measuring Dispensers

Admixture measuring dispenser accuracy shall be certified annually by the admixture supplier. Calibrate the dispensing equipment for calcium nitrite and silica fume slurry quarterly.

#### 9.2.4.5.3 Recorders

Plants equipped with recording mechanisms must provide records that are clear, complete and permanent indications of plant performance. Where necessary, recorder information may be supplemented by the batcher during the batching operation. The Department shall be allowed to review recorder history at any time.

#### 9.2.4.6 Batching Accuracy

Failure to maintain batching operations of the plastic concrete within the tolerance for each component material requires immediate investigation and corrective action by the concrete producer, and automatically places the plant

on conditional approved status. Failure to implement corrective measures will be cause for placing the plant on non-approved status and suspension of the Quality Control Plan.

#### 9.2.4.7 Batch Adjustments For Materials

Permissible adjustments to previously approved design mixes that may be made without a new design mix request are as follows:

- (1) Coarse or Fine Aggregate:  $\pm 75$  lbs/yd<sup>3</sup> [ $\pm 45$  kg/m<sup>3</sup>] of concrete.
- (2) Admixtures: Shall be within the manufacturer's technical data sheet range. Adjustments falling outside the technical data sheet range shall require design mix re-verification.
- (3) Cementitious Materials:  $\pm 6.5\%$  per cubic yard [cubic meter], but not less than the specified minimum for that class of concrete.

The Adjusted mix must meet the theoretical yield requirements of the approved mix design.

The Producer shall inform the District Materials Engineer of any adjustments to the mix. Batch adjustments shall be noted on the concrete delivery tickets.

#### 9.2.4.8 Batch Adjustments For Moisture

Within two hours prior to each day's batching, free moisture shall be determined for the coarse and fine aggregates. On continuous concrete placements expected to exceed three hours, an additional moisture test shall be required approximately half way through the batching operations. The concrete producer shall use these values for adjustment of batch proportions.

One or more of the following methods shall determine aggregate free moisture:

- (1) By using moisture probe readings, speedy moisture tester or Chapman flask for fine aggregate moisture. The accuracy of the moisture probe shall be verified at least weekly by the manufacturer's recommended method and by method (2) below. The Chapman flask and speedy moisture tester shall be verified at least weekly by method (2) below.
- (2) By calculating both coarse and fine aggregate free moisture based upon dry sample weights and adjusting for absorption.

- (3) By towel drying coarse aggregate to calculate free moisture on saturated surface dry aggregate. The accuracy of towel drying shall be verified weekly by method (2) above.

#### 9.2.4.9 Substitution of Materials

Obtain Department approval for any material substitutions before production of that design mix. Any substitution of materials must meet the requirements in ***Standard Specification 346***.

#### 9.2.4.10 Equipment

Use equipment for handling ingredients, mixing concrete, handling the mixed concrete, transporting and depositing the mixed concrete that has no detrimental effect on the plastic concrete. Do not use equipment with aluminum surfaces in physical contact with the mixed product.

### 9.2.5 Design Mixes

Design mixes shall meet the requirements of Standard Specification 346. Form 675-010-03, Concrete Design Mix [Form 675-010-04 for metric projects] shall be used for design mix submittals.

Plants furnishing concrete to multiple projects may use approved concrete mix designs on different projects, provided component materials and project requirements of the approved mix design remain the same. The concrete production facility shall submit mix design requests directly to the District Materials Engineer in the District that the concrete production facility is located. If a concrete producer is located out-of-state, then the mix design submission will be to the nearest District Materials Engineer.

The District Materials Engineer will monitor or otherwise review the proportioning, mixing and testing of the proposed mix. When the mix properties and components have been verified, the District Materials Office will so advise the State Materials Office, who will issue approval for the mix design. Those mix designs that cannot be verified regarding final properties or components will be returned to the concrete producer as unacceptable for use on Department projects. Make a separate submittal for each class of concrete and each particular combination of component materials to be used at trial mix temperatures of 70 to 85°F [20 to 30°C], and for hot weather mixes at a minimum temperature of 94°F [35°C]. Use only design mixes approved by the State Materials Office for Department use. The approved concrete mix design will

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remain in effect until the District Materials Office authorizes a change in writing.

Include the following with the mix design submittal:

- (1) The Department approved source identification number for coarse and fine aggregates, specific gravity, along with the size of coarse aggregate and target Fineness Modulus for fine aggregate. Identify other component materials by manufacturer, brand name, and type.
- (2) The actual proportions of raw materials intended to be combined to produce the concrete.
- (3) Historical or trial mix data:
  - (a) Historical data from a minimum of 15 consecutive Department acceptance tests of production concrete, made in accordance with the proposed mix design, which demonstrates that the proposed mix has met all applicable plastic and hardened concrete specification criteria without failure. For drilled-shaft concrete to be placed in (1) a wet shaft, or (2) a dry shaft requiring a temporary removable casing, provide slump loss test results. The Department will not approve hot weather mixes based on historical data.
  - (b) Alternatively, test data from a single trial mix which demonstrates that the produced concrete using the proposed mix, designated ingredients and designated water to cementitious materials ratio will have a slump within  $\pm 0.5$  inch [ $\pm 15$  mm] of the target value (or for mixes utilizing HRWR, within  $\pm 1$  inch [ $\pm 25$  mm] of the target value), air content of 2.5% to 5% and strength required to meet an over design which is the minimum required strength plus 1.6 standard deviations.
- (4) The chloride content of the proposed design mix. The Department will not approve mix designs when the chloride content of the trial mix exceeds the limits shown in **Standard Specification Section 346-4.2.1**.
- (5) For design mixes developed for use under hot weather concreting conditions: Hold the trial mix in the mixer for 90 minutes after completion of initial mixing. During the extended mixing period, turn the drum intermittently for 30 seconds every five minutes. Cover the drum with wet burlap or an impermeable cover material during the rest periods. At the end of the 90-minute period, remix the trial mix for a minimum of one minute and make a slump test to verify that the concrete is within the specified range for slump.



On completion of the extended mixing period, ensure that the trial mix concrete has a slump within  $\pm 0.75$  inch [ $\pm 20$  mm] of the target value ( $\pm 1$  inch [ $\pm 25$  mm] for mixes utilizing HRWR), and an air content between 2% and 5%. If below the target range, the producer may adjust the slump by a water addition. After the water addition, remix the concrete for a minimum of two minutes. Ensure that the mix temperature is not less than 94°F [ $34^{\circ}\text{C}$ ] at any time.

The total water used in initial mixing and the final slump adjustment constitutes the design mix water content. Ensure that the total water to cementitious materials ratio does not exceed the maximum water to cementitious ratio of Table 3 in the **Standard Specification 346-4**, for the respective class of concrete. The Department may require extended mixing for precast/prestressed concrete when centrally mixed at the placement site.

- (6) For design mixes proposed for use in wet drilled shafts, demonstrate the additional requirements in **Standard Specification Section 346-3.2**.

Submit strength test data for establishing the standard deviation of the plant to meet the specified strength of the mix submitted for approval within 1,000 psi [7 MPa]. The strength test data shall represent either a group of at least 30 consecutive tests or a statistical average for two groups totaling 30 or more tests. When the Department cannot determine the plant standard deviation from historical data, apply an over design requirement, based on a singular trial mix, that is the minimum required strength plus 1,200 psi [8 MPa] for minimum required concrete strengths of 5,000 psi [35 MPa] or less. For minimum required concrete strengths above 5,000 psi [35 MPa], apply an over design requirement that is the minimum required strength plus 1,400 psi [10 MPa].

Ensure that preparation and testing of the trial mixes is performed by a laboratory acceptable to the Department which (A) has been inspected by the CCRL on a regular basis, with all deficiencies corrected, and under the supervision of a Specialty Engineer, Engineer's representative or a professional Engineer, or (B) meets all the requirements of ASTM C 1077. The Department may give consideration to approval of laboratories operating under other independent inspection programs demonstrated to be equivalent to the programs recognized in (A) and (B). Ensure that the 28-day strength (or strength at any other designated age) of trial mixes meets the above stated over design requirements to ensure that concrete sampled and tested at the point of placement has a strength exceeding the specified minimum strength.

## 9.2.6 Batching Production Facility Requirements

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#### 9.2.6.1 Bins

Provide bins of adequate capacity for the required concrete production. Support the bins upon a rigid framework founded upon a stable foundation capable of holding them in a safe and secure position. Design each compartment to discharge efficiently and freely into the weigh hopper. Provide positive means of control so that as the quantity desired in the weigh hopper is approached, the material can be added slowly and the addition of further material can be stopped precisely. Use a discharging mechanism that prevents loss of material when it is closed. Construct aggregate storage bins sufficiently tight to prevent leakage of material, and divide them into at least one compartment for the fine aggregate and one compartment for each size of coarse aggregate to be used. Provide compartment partitions that are sufficiently tight and high enough to prevent intermingling of the different materials. Construct leak-proof and moisture-proof cementitious bins, and provide them with vibrators or other means to aid the flow of cement from the bin.

#### 9.2.6.2 Weigh Hoppers

Provide weigh hoppers consisting of suitable containers freely suspended from scales and protected from the elements so that accuracy is not adversely affected. Equip the hoppers with a discharge mechanism that prevents leakage or loss of material when closed. Vent hoppers to permit air to escape and equip them with vibrators or other equipment that ensures complete and efficient discharge of materials.

#### 9.2.6.3 Scales

Provide either beam type or springless dial type scales, or electronic devices such as load cells. Where using beam type scales, provide suitable means to hold poises securely in position after they are set. Keep scales clean and in good operating condition. Provide the scale operator with an unobstructed view of all indicating devices and convenient access to all controls. Use graduated weigh beam or dials to permit reading to 0.1% of the capacity of the scales.

All scales and other weighing devices used in batching shall be checked for accuracy by a representative of a scale company registered with the Bureau of Weights and Measures of the Florida Department of Agriculture. All scales and other weighing devices shall be checked prior to beginning any work for the Department and at least once every three months. Any scale can be required to be rechecked if deemed necessary by the Department. Check

scales up to at least the maximum load normally handled on each respective scale.

Maintain cement scales, pozzolan scales, and coarse and fine aggregate scales to an accuracy of 0.5% of the maximum load normally handled.

Affix a certificate of inspection bearing the date of the certification showing signature of the scale company representative to each weighing device. Make available at the plant a copy of the scale company's report corresponding with the current certificate of inspection showing the date of inspection, signature of the scale company representative, the observed scale deviations for the loads checked, and a statement that the scale meets the requirements of **Chapter 531 of the Florida Statutes (F.S.)**, pertaining to specifications, tolerances and regulations, as administered by the Bureau of Weights and Measures of the Florida Department of Agriculture.

## 9.2.7 Mixers

### 9.2.7.1 General Requirements

Provide mixers of an approved type that are capable of combining the components of the concrete into a thoroughly mixed and uniform mass, free from balls or lumps, which are capable of discharging the concrete with a satisfactory degree of uniformity.

### 9.2.7.2 Design

Use truck mixers of the inclined axis revolving drum type, or concrete plant central mixers of the non-tilting, tilting, vertical shaft or horizontal shaft types.

Make available at the batching plant at all times a copy of the manufacturer's design, showing dimensions and arrangement of blades. The concrete producer may use mixers that have been altered from such design in respect to blade design and arrangement, or to drum volume, when concurred by the manufacturer and approved by the Department.

Ensure that metal rating plates are attached to each mixer specifying its mixing speed, agitating speed, rated capacity and unit serial number.

### 9.2.7.3 Truck Mixers

Use truck mixers with a drum that is actuated by a power source independent of the truck engine or by a suitable power take-off. Ensure that either system

provides control of the rotation of the drum within the limits specified on the manufacturer's rating plate, regardless of the speed of the truck. Use truck mixers of the revolving drum type that are equipped with a hatch in the periphery of the drum shell which permits access to the inside of the drum for inspection, cleaning and repair of the blades.

Use truck mixers equipped with revolution counters of an approved type and mounting, by which the number of revolutions of the drum may be readily verified.

Ensure that the water supply system mounted on truck mixers is equipped with a volumetric water gauge or approved water meter in operating condition. Annually calibrate water measuring devices on truck mixers or other water sources used for concrete water adjustments.

Where a truck mixer volumetric gauge controls job site water additions, ensure the truck mixer is parked in a level condition during on-site water adjustments so that the gauge is indicating a specific tank volume before and after the concrete adjustment. When water additions exceed 4 gal/yd<sup>3</sup> [20 L/m<sup>3</sup>] of concrete, ensure that the water measuring equipment has an accuracy of within 3% of the indicated quantity.

Truck mixers meeting these requirements and **Standard Specification Section 346** will be issued an identification card by the District Materials Engineer upon request from the concrete producer. Identification cards shall be displayed in the truck cab when delivering concrete for Department use. Failure to display the identification card in the truck cab shall be cause for rejection of the delivered concrete. The Department may remove the identification cards when a truck mixer is discovered to be in noncompliance.

As an exception to the above, when the deficiency involves only an inoperable revolution counter, the truck mixer identification card will not be removed. However, the Department will note the deficiency on the card. The Producer will be allowed to deposit the concrete in the mixer, and the truck mixer will then be removed from use until the revolution counter is repaired or replaced. On the next delivery to any Department project, after repair or replacement of the counter, the truck mixer operator shall make known that the revolution counter is operable and obtain the Department's initial on the truck mixer identification card. Without such inspection and documentation of corrective action, the Department may reject the truck mixer at any time it is again found to have an inoperable revolution counter. The revolution counter will be set to zero prior to mixing.

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The Producer shall inspect all truck mixers at least once each week for changes due to accumulation of hardened concrete or to wear of blades. The blades shall be repaired as necessary to meet the requirements. Any appreciable accumulation of hardened concrete shall be removed before any mixer may be used.

Copies of the most recent water measuring equipment calibration shall be kept in the truck cab and available upon request.

#### 9.2.7.4 Central Mixers

Use stationary type mixers equipped with an approved timing device which will automatically lock the discharge lever when the drum is charged and release it at the end of the mixing period. In the event of failure of the timing device, the Department may allow operations to continue during the day that failure was noticed for the first time. Do not extend such operations beyond the end of that working day. The mixer shall be operated at the speed recommended by the manufacturer.

The Producer shall inspect all mixers at least once each week for changes due to accumulation of hardened concrete or to wear of blades.

#### 9.2.7.5 Cleaning and Maintenance of Mixers

Repair or replace mixer blades of revolving drum type mixers when the radial height of the blade at the point of maximum drum diameter is less than 90% of the design radial height. Repair or adjust mixers of other designs per manufacturer's instructions. Resolve questions of performance through mixer uniformity tests as described in ASTM C 94.

### 9.2.8 Mixing and Delivering Concrete

#### 9.2.8.1 General Requirements

Operate all concrete plant mixers at speeds per the manufacturer's design or recommendation. Do not allow the volume of mixed batch material to exceed the manufacturers rated mixing capacity. Mix concrete containing metakaolin or silica fume in accordance with their supplier's recommendations.

When necessary and in order to produce concrete of the specified temperature during cold weather conditions, heat either the mix water or the aggregates or both prior to batching. Apply the heating uniformly in a manner, which is not detrimental to the mix. Do not heat the aggregates

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directly by gas or oil flame or on sheet metal over fire. Do not heat the aggregates or water to a temperature of over 150° F (66° C). If either is heated to over 100° F (38° C), mix them together prior to the addition of the cement so that the cement does not come in contact with the materials, which are in excess of 100° F (38° C). Include in the Quality Control Plan measures to maintain free moisture in a well drained condition when heating aggregates.

#### 9.2.8.2 Central Mixing:

After all materials are in the mixer, mix the concrete a minimum of two minutes or the manufacturer's recommended minimum, whichever is longer, unless the Department authorizes a reduced mixing time.

#### 9.2.8.3 Transit Mixing:

Initially mix each batch between 70 and 100 revolutions of the drum at mixing speed. When water is added at the job site, mix the concrete 30 additional mixing revolutions. When mixing for the purpose of adjusting consistency, do not allow the total number of revolutions at mixing speed to exceed 160. Discharge all concrete from truck mixers before total drum revolutions exceed 300. All revolutions of the drum shall be counted in the total number of revolutions.

Do not haul concrete in mixer trucks loaded with more than the rated capacity shown on their attached plates.

#### 9.2.8.4 Charging the Mixer

Charge each batch into the drum so that some water enters both in advance of and after the cementitious material and aggregates. If using fly ash in the mix, charge it into the drum over approximately the same interval as the cement. The concrete producer may use other time intervals for the introduction of materials into the mix when the concrete producer demonstrates, using test requirements specified in ASTM C 94, that he can achieve uniformity of the concrete mix.

For concrete mixes containing specialty ingredients (silica fume, metakaolin, corrosion inhibitor calcium nitrite, accelerators, high range water reducers, etc.), charge the batch materials into the mixer in a sequence recommended by the supplier. Adjust the weight of mixing water for a concrete mix containing a corrosion inhibitor admixture or silica fume slurry. Account for water in the corrosion inhibitor or silica fume slurry as described in the

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manufacture's technical data sheet.

## 9.2.9 Quality Control Plan

The quality control plan of any concrete production facility shall meet the requirements of **Standard Specification Section 6**. The quality control plan is used to maintain the properties of concrete to the point of discharge at the project site. The quality control plan shall address how the water to cementitious materials ratio and the plastic properties tests of concrete will be controlled to meet specification requirements. The quality control plan shall address the qualification of personnel, source of materials, and equipment used to produce concrete. Quality control of the concrete shall be achieved through statistical evaluation of test results. The Producer shall use a Department approved laboratory and qualified personnel.

The production facility shall be on the Department's approved list prior to production of concrete for Department projects. The approved Quality Control Plan shall be the minimum required control of concrete on all Department projects. The State Materials Office will assign a Concrete Plant Number for each facility.

## 9.2.10 Personnel

Concrete production facilities supplying concrete to Department projects shall have adequate qualified personnel. Batch Plant operator, certified technicians and manager of quality control are required positions for an approved concrete production facility. At the discretion of the Department, certain functions of the above positions may be combined when it can be demonstrated that the plant operation and quality of the concrete will not be detrimentally affected. CTQP Qualified Technicians utilizing equipment with a valid calibration/verification will perform Quality Control sampling and testing. This qualification of any technician shall be made available upon request.

### 9.2.10.1 Batch Plant Operator

Personnel who have quality control functions or who sign concrete certification/delivery tickets must demonstrate, through examination, adequate concrete related knowledge. Plant Operators shall be present during batching operations. The Plant Operator shall be qualified by the Department's Construction Training and Qualification Program (CTQP).

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9.2.10.2 Certified Technicians

Personnel who perform the tests on the plastic properties of concrete, such as slump, temperature, air content, making/curing concrete cylinders and calculating the water to cementitious materials ratio, shall be qualified as a Concrete Field Inspector – Level I by the Department’s Construction Training and Qualification Program (CTQP).

Personnel who perform the tests on the hardened properties of concrete, such as strength of cylinders, shall be qualified as a Concrete Laboratory Technician – Level I by the Department’s Construction Training and Qualification Program (CTQP).

9.2.10.3 Mix Design Technician

Personnel who have quality control functions of designing a concrete mix must demonstrate, through examination, adequate concrete related knowledge. Such examinations will deal with Department specifications and concrete quality control procedures. The Mix Design Technician shall be qualified as a Concrete Laboratory Technician – Level II by the Department’s Construction Training and Qualification Program (CTQP).

9.2.10.4 Manager of Quality Control

Personnel who perform the duties of managing the quality control of the plant shall be qualified as a Concrete Laboratory Technician – Level II by the Department’s Construction Training and Qualification Program (CTQP). The personnel shall also have the following qualifications:

- (1) Three years of quality control experience directly related to cement concrete production.
- (2) Demonstrated proficiency in implementing, supervising and maintaining surveillance over a quality control program.
- (3) Experience or certification in performance of required quality control tests and in organization and statistical evaluation of quality control test results.

The personnel who perform the duties of managing the quality control of the production facility shall have the following duties and responsibilities:

- (1) Implement policies and procedures of the quality control program.



- (2) Maintain liaison with Project Manager and the Department on all activities related to quality control.
- (3) Supervise the activities of all quality control technicians, ensuring sufficient manpower in all areas related to quality control testing and inspection.
- (4) Review all quality control procedures to ensure compliance with project specifications.
- (5) Ensure all quality control records are properly prepared and reviewed.
- (6) Ensure that quality control activities are performed in accordance with documented instructions and procedures.
- (7) Develop and maintain a filing, storage and retrieval system for quality control records.

### **9.2.11 Records**

All records shall be kept on file at each plant and made available upon request by the Department. The following updated information shall be available at each plant:

- (1) Producer Quality Control program and plant approval status.
- (2) Approved concrete design mixes.
- (3) Materials source/specification compliance (delivery tickets, certifications, certified mill test reports, miscellaneous test reports).
- (4) Quality Control data (gradation and absorption worksheets, fresh and hardened concrete test results, sample frequency data, and any additional information required by the District Materials Engineer).
- (5) Plant and mixer design data as required by project specifications.
- (6) Federal poster.
- (7) Contract documents, as determined necessary by the District Materials Engineer.

- (8) A copy of the scale company or testing agency report showing the observed deviations from quantities checked during calibration of scales or meters. Certification documents for admixture weighing and measuring dispensers.
- (9) Chloride test data. Ensure that testing for chlorides is performed by a laboratory meeting the requirements of **Standard Specification Section 6-9**.
- (10) Weekly mixer inspection certification (a copy of the truck mixer certification shall be located in the truck cab and in the plant).
- (11) Moisture Control records including date and time of test.
- (12) Daily records of all concrete batched for delivery to Department projects, including respective design mix numbers and quantities of batched concrete.

### 9.2.12 **Sampling and Testing of Materials**

Sampling and Testing of materials and concrete for quality control purposes is the responsibility of the concrete production facility. Frequency of sampling must be designed to provide adequate data to operate the quality control program for each design mix. Table 1 designates the minimum sampling and testing frequencies that will be accepted in a well controlled production facility. The quality control plan shall indicate an increased sampling rate when any quality control plan limit is reached. All sampling and testing shall be conducted in accordance with current ASTM sampling and testing methods.

<b>TABLE 1</b>	
Material and Required Tests	Minimum Sampling Frequency For Each Source and Grade
Coarse Aggregate*	
Gradation	1 per month
Absorption	1 per month
Total Minus 200	1 per month
Fine Aggregate*	
Gradation	1 per month
Absorption	1 per month
(Screenings only)	
Total Minus 200	1 per month
Cementitious Materials	Certification
Admixtures	Certification
Water	1/30 days: Open bodies of water & recycled water
Chemical Analysis**	1/3 months: Wells and treated water
Chlorides	As required in Specification 346-4.2

\*Materials certifications must be kept on file for three years.

\*\*Water approved by a Public Health Department does not need to be tested.

### 9.2.13 Delivery Ticket/Certification

The following information is required information for each delivery ticket/certification. All information shown on the delivery ticket/certification must be furnished with each load. The information contained within **Standard Specification Section 346-6.3** is required information on each delivery ticket/certification. The original signature on the delivery ticket shall certify to the accuracy of the recorded information and compliance with the approved design mix including the chloride content requirements. A sample of a delivery ticket is provided in Attachment "B".

- (1) Serial number of delivery ticket.
- (2) Plant number assigned by the Department.
- (3) Date of batching.
- (4) Contractor's name.
- (5) A description of the delivery location.
- (6) FDOT Financial Project Number.

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- (7) Truck number making the concrete delivery.
  - (8) Class of concrete.
  - (9) Design mix number.
  - (10) Time all materials are introduced into mixer.
  - (11) Cubic yards [cubic meters] in this load.
  - (12) Cumulative total cubic yards [cubic meters] batched for job on date of delivery.
  - (13) Maximum allowable water addition at the job site.
  - (14) Number of revolutions at mixing speed before leaving for job site.
  - (15) Amount of mixing time for central mixer.
  - (16) Coarse and fine aggregate sources (Department assigned Pit No.).
  - (17) Actual weight of coarse and fine aggregates batched in pounds [kilograms].
  - (18) Percent of free moisture in coarse and fine aggregates.
  - (19) Cement producer and type.
  - (20) Total weight of cement batched in pounds [kilograms].
  - (21) Producer, brand name and class (whichever might apply) of Pozzolan or Slag.
  - (22) Total amount of Pozzolan or Slag batched in pounds [kilograms].
  - (23) Producer, supplier, type and total amount of air entraining agent used.
  - (24) Producer, supplier, type and total amount of admixtures used.
  - (25) Total amount of water batched at the plant in gallons [liters] or pounds [kilograms].
  - (26) Statement of compliance with Department specifications.
  - (27) Original signature of Plant Operator and Technician Identification Number.

**ATTACHMENT "A"**

**CONCRETE Production Facility inspection checklist**

<b>PLANT NUMBER:</b> _____						
<b>INSPECTION DATE:</b> ____ / ____ / ____						
Inspected for: 346 _____, 347 _____, Both _____						
Today's Inspection: Initial _____, Routine _____, Reinspection _____						
Concrete Supplier:		Plant Inspected By:				
Plant Address:		Plant Location:				
Plant Telephone No.:		Plant Fax Number:				
<b>QUALITY CONTROL PERSONNEL</b>						
Quality Control Manager:		CTQP Batch Plant Certification Date:				
QC Manager Location:		Quality Control Telephone No.:				
Quality Control Mobile No.:		Quality Control Fax. No.:				
<b>PLANT PERSONNEL</b>				<b>Y</b>	<b>N</b>	
1	The plant personnel are certified through the CTQP program.					
2	The plant personnel are indicated in the Quality Control Plan.					
Batch Operator:		CTQP TIN:	Expiration Date:			
QC Manager:		CTQP TIN:	Expiration Date:			
Other:		CTQP TIN:	Expiration Date:			
Other:		CTQP TIN:	Expiration Date:			
Based on today's inspection, this plant is placed on the following status:						
APPROVED _____		CONDITIONALLY APPROVED _____		NON-APPROVED _____		
<div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span>_____ FDOT PLANT INSPECTOR</span> <span>_____ PLANT REPRESENTATIVE</span> </div> <p style="font-size: small; text-align: center; margin-top: 5px;">Plant Representative signature does not indicate agreement or disagreement with inspector findings.</p>						
<b>AREA</b>	<b>REMARK OR DEFFICIENCY</b>			<b>Y</b>	<b>N</b>	<b>N/A</b>
<b>CEMENT</b>						
<b>POZZOLANS / SLAG</b>						
<b>COARSE AGGREGATE</b>						
<b>FINE AGGREGATE</b>						
<b>ADMIXTURES</b>						
<b>WATER</b>						
<b>PLANT RECORDS</b>						
<b>SCALES</b>						
<b>MIXING CONCRETE</b>						
<b>RAW MATERIALS</b>						
<b>MIXERS</b>						

**THIS INFORMATION IS COLLECTED INSIDE THE BATCH HOUSE**

No.	Item	Y	N	N/A	
<b>CEMENT</b>					
1	The certification for cement complies with AASHTO M-85 & FDOT specification.				
2	The cement is identified in the Quality Control Plan.				
<b>POZZOLANS / SLAG</b>					
3	The certification for Fly Ash complies with ASTM C-618 (Class F) or ASTM C-311 (Class C) and FDOT specification.				
4	The certification for Blast Furnace Slag complies with ASTM C-989 and FDOT specification.				
5	The fly ash and slag are identified in the Quality Control Plan.				
Material	Type	Brand	Source	Delivery Date	Mill Cert. Date

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>COARSE AGGREGATE</b>				
1	The coarse aggregates are indicated in the Quality Control Plan.			
2	The coarse aggregates meet all specification requirements.			
3	The Gradation / Absorption tests is being performed by approved personnel or lab. Technician Identification Number (TIN) _____			
4	The Gradation / Absorption tests is being performed in a timely manner (at least once per 30 days).			
5	The free moisture test is being performed by an approved method. (cook out or towel drying)			
6	The plant is verifying the accuracy weekly if the towel method is being used.			
Pit No.	Grade	FDOT Code	Delivery Date	Date Certified

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>FINE AGGREGATE</b>				
1	The fine aggregates are indicated in the Quality Control Plan.			
2	The fine aggregates meet all specification requirements.			
3	The Gradation / Absorption tests is being performed by approved personnel or lab. Technician Identification Number (TIN) _____			
4	The Gradation / Absorption tests is being performed in a timely manner (at least once per 30 days).			
5	The free moisture test is being performed by an approved method. (cook out, moisture probe reading, speedy moisture tester or Chapman flask)			
6	The plant is verifying the accuracy weekly if the speedy moisture tester or Chapman flask method is being used.			
7	The plant is verifying the accuracy at least weekly if the moisture probe is being used by the recommendation of the manufacture.			
Pit No.	Grade	FDOT Code	Delivery Date	Date Certified

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>ADMIXTURES</b>				
1	All admixtures are indicated in the Quality Control Plan.			
2	All admixtures are on the Qualified Products List as approved for FDOT.			
3	The number of measuring devices is sufficient.			
<b>Material Identification (Brand)</b>		<b>Delivery Date</b>	<b>Dispenser Calibration Date</b>	

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>WATER</b>				
1	The source of the water is indicated in the Quality Control Plan.			
2a	The source of water is from the city. (no testing needed)			
2b	The source of water is from a well and tested once every three months, unless the past eight consecutive tests pass in which only require once every six months. (last test date of: _____)			
2c	The source of water is from a stream or lake and tested once every thirty days. (last test date of: _____)			
2d	The source of water is recycled and tested once every thirty days. (last test date of: _____)			
2e	The source of water is reclaimed wash water and tested once every thirty days. (last test date of: _____)			
3	The source of water was tested at an approved laboratory. (name of laboratory: _____)			

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>PLANT RECORDS</b>				
1	The various Applicable Specifications on File (both English and Metric if applicable).			
2	The Plant Quality Control Plan on file.			
3	A copy of the Federal Poster posted.			
4	A daily record of concrete batched for the Department on file.			
5	Copies of the manufacturers design showing dimensions and arrangements of blades for each mixer available.			
6	All approved Design Mixes are on file.			
7	The records for the Coarse Aggregates are available.			
8	The records for the Fine Aggregates are available.			
9	The records for moisture probe and other methods of determining the free moisture being verified at least once per 7 days.			
10	The plant deviated from the standard 24-hour aggregate watering.			
11	If the plant deviated from the standard 24-hour aggregate watering, the deviation is shown in their quality control plan and approved by the District Materials Engineer.			
12	Project information was recorded (fill in below).			
13	Concrete test data was recorded (fill in below).			

Concrete Test Data:

FIN Project #	Mix # (Mix Class)	Date Cast	Plastic Property	Strength 28-Day	Chloride Results

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>SCALES</b>				
1	A company registered with the Bureau of Weights and Measures of the Department of Agriculture calibrated the scales and water meters for accuracy.			
2	Company Name & Registration #:			
3	Cement scale was calibrated (date: _____).			
4	Course & Fine Aggregates scale was calibrated (date : _____).			
5	Water measuring device was calibrated (date : _____).			
6	There is an automatic cutoff for water measuring device.			
7	The scale company report includes observed scale deviations.			
8	The scale deviations were checked within 0.5% of maximum load.			
9	Suitable means were provided to hold poises on beam type scales.			
10	Scales permit reading to 0.1% of capacity.			
11	A device to indicate the required load is being reached is provided.			
12	All weighing devices are in view of the operator.			
13	Cementitious materials are measured within an accuracy of 1% of the required amounts.			
14	Aggregates are measured within an accuracy of 1% of the required amounts.			
15	Water is measured within an accuracy of 1% of the required amounts.			

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>MIXING CONCRETE</b>				
1	The batching sequence is in accordance with the specifications.			
2	The mixing is at proper drum speed.			
3	If a truck mixer is used, the drum revolutions are according to specifications.			
4	The maximum mixer volume is not exceeded.			
5	All water going into the mixer is metered or weighed.			
6	If a central mixer is used, the concrete is mixed a minimum of two minutes or as approved in the quality control plan.			
7	The central mixer is equipped with an approved timing device.			
8	Admixtures are measured separately.			
9	Admixtures are added with the mixing water.			
10	Cement is weighed independently from other materials.			
11	Cement is weighed first when using a cumulative weigh hopper.			
12	Cementitious materials are being protected from loss in handling after weighing.			

REMARKS OR DEFFICIENCY:

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**THIS INFORMATION IS COLLECTED OUTSIDE THE BATCH HOUSE**

No.	Item	Y	N	N/A
<b>RAW MATERIALS</b>				
1	The cement is stored in a weatherproof facility that is labeled.			
2	For the cementitious materials there is a suitable, safe and convenient means of collecting samples.			
3	Aggregates are handled and stored in silos, ground storage, or batch bins, free of contamination & segregation, and clearly labeled.			
4	Aggregates are in a well-drained condition.			
5	Aggregates stockpiles are formed properly.			
6	Aggregate silos are kept in a reasonably full condition.			
7	The entire surface of the coarse aggregate is continuously and uniformly sprinkled with fresh water 24-hours immediately preceding introduction into the concrete mix (unless otherwise identified in the Quality Control Plan).			
8	All scales have adequate protection from the elements.			
9	All scales are clean to assure accurate and efficient operation.			

REMARKS OR DEFFICIENCY:

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No.	Item	Y	N	N/A
<b>MIXERS / MAINTENANCE OF MIXERS</b>				
1	Mixers are free of hardened concrete.			
2	All Blades are greater than 90% of design height.			
3	The supplier examines the mixers weekly for hardened concrete and blade wear and a record of the truck inspection being kept (both in the cab of the truck mixer and in the plant).			
4	The manufacturer metal rating plate (consisting of mixing speed, agitation speed, rated capacity and unit serial number) of the drum is available, attached, and legible on each truck mixer.			
5	The mixer is equipped with a hatch in the periphery of the drum, revolution counter, and a clean operating water gauge (calibrated annually) that are all in good operation.			
6	Either <b>central</b> or <b>truck</b> (circle one) mixers demonstrate the capability to combine the concrete component materials into a thoroughly mixed and uniform mass.			
7	Either <b>central</b> or <b>truck</b> (circle one) mixers demonstrate the capability to discharge the concrete with a satisfactory degree of uniformity.			
8	Mixers were inspected and recorded (fill in below).			

Mixer Inspection:

Truck Number	Counter Condition	Blade Condition	Drum Condition	Rating Plates	Water Gauge	Remarks

\*Superficial Inspection, hatch need not be open (E) English (M) Metric (B) Both

REMARKS OR DEFFICIENCY:

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**ATTACHMENT "B"**

**Sample Delivery Ticket for Structural Concrete**

Financial Project No.: \_\_\_\_\_

Serial No.: \_\_\_\_\_

Plant No.: \_\_\_\_\_

Date: \_\_\_\_\_

Concrete Supplier: \_\_\_\_\_

Delivered to: \_\_\_\_\_

Phone Number: \_\_\_\_\_

Phone Number: \_\_\_\_\_

Address: \_\_\_\_\_

Address: \_\_\_\_\_

Truck No.	DOT Class	DOT Mix No.	Cubic Yards This Load
Allowable Jobsite Water Addition	Time Loaded	Mixing revolutions	Cubic Yards Total Today
Cement _____ Source      _____ Type      _____ Amount		Fly Ash or Slag _____ Source      _____ Type      _____ Amount	
Coarse Agg. _____ Pit Num.      _____ % Moisture      _____ Amount		Air Entrainment Admixture _____ Source      _____ Brand      _____ Type      _____ Amount	
Fine Agg. _____ Pit Num.      _____ % Moisture      _____ Amount		Admixture _____ Source      _____ Brand      _____ Type      _____ Amount	
Batch Water (gals. or lbs.) _____ Amount		Admixture _____ Source      _____ Brand      _____ Type      _____ Amount	

Issuance of this ticket constitutes certification that the concrete batched was produced and information recorded in compliance with Department specification requirements for Structural Concrete.

\_\_\_\_\_  
 CTQP Technician Identification Number

\_\_\_\_\_  
 Signature of Batcher Plant Operator

Arrival time at job site		Number of revolutions upon arrival at job site	
Water added at job site (gal. or lbs.)		Additional mixing revolutions with added water	
Time concrete completely discharged		Total number of revolutions	
Initial Slump	Initial Air	Initial Concrete Temp.	Initial w/c Ratio
Acceptance Slump	Acceptance Air	Acceptance Concrete Temp.	Acceptance w/c Ratio

Issuance of this ticket constitutes certification that the maximum specified water cementitious ratio was not exceeded and the batch was delivered and placed in compliance with Department specification requirements.

\_\_\_\_\_  
 CTQP Technician Identification Number

\_\_\_\_\_  
 Signature of Contractor's Representative