CHAPTER 5
INSPECTION OF PLANT AND EQUIPMENT

The District Materials Engineer or representative will be responsible for the initial inspection and approval of the plant and trucks.

MIX DESIGN

Before any concrete is batched, it is the responsibility of the producers technician to prepare and submit a mix design for approval. The approved design must be at the plant prior to the beginning of the batching operations. The approved mix design controls the amount of water and other materials used in the batching. A sample design (form TL-27) is shown on Page 5 - 3.

AGGREGATES

Aggregates should be handled and stored to minimize segregation and to prevent contamination with deleterious substances. Stockpiles should be built in layers of uniform thickness. Stockpiles should not be built in high cone-shaped piles; this results in segregation. To minimize segregation, aggregates should be removed from stockpiles in horizontal layers.

Stockpiles are checked to determine that they are free from foreign matter, separated by space or bulkheads so that aggregates will not intermingle while loading, and kept in at least a saturated surface-dry (SSD) condition. In order to keep stockpiles in an SSD condition, they should be sprinkled, using an approved method, the night before batching. If aggregates are in less than SSD condition, there will be no surface moisture and only partial or no absorbed moisture, resulting in the loss of part of the mixing water to the aggregates. If stockpiles are built on the ground, the loader should remain at least twelve inches from the ground while removing the material. A check is made to see that the aggregates have been tested. When material comes from a local source, the delivery ticket is to have a certification stating that this material has come from a previously tested and approved stockpile, and the certification is to be signed by the producer or representative. In the case of rail shipments, each shipment should be accompanied by a seal or other evidence of inspection. If no evidence is found, or the material does not arrive at the plant in satisfactory condition, whether previously tested or not, the District Materials Engineer should be notified promptly. He will then decide whether or not the material must be resampled and tested before it is accepted for use.

CEMENT

Cement storage structures should be checked to determine if they are weatherproof. Any moistening of the cement prior to its use, creating lumpy and partially hydrated material, shall be cause for rejection. Since there are many different types and brands of cement used, the producer’s technician should make sure the type and brand used is the same as that shown on the mix design. Some silos have more than one compartment, and are capable of storing more than one type of cement. If more than one type is stored in one silo, the producer’s technician should make sure that the correct type is being used.

Before any concrete is batched, the producer’s technician should determine that there is a certification stating the cement meets the requirements of the VDOT Specifications.
SCALES

Scales used for weighing aggregates and cement shall be approved and sealed in accordance with the requirements of Section 109 of the Specifications. Before weighing aggregates and cement, the technician should be sure the scales have been serviced within the past 6 months by a private scale service company certifying that all concrete hopper scales meet Handbook 44 Regulations. Scales should be checked and certified whenever the scales are moved, whenever there is reason to believe they are inaccurate, or at the request of the Engineer. Before the weigh hopper is loaded, the scales are to be on the zero mark. If scales are not on zero, weighing operations cannot begin. It is the duty of the Certified Concrete Plant Technician to see that the correct batch weights are used. The batch weights are to be shown on the TL-28A form which is the producers batch weight certification. Cement and aggregates are to be weighed within the following tolerances:

<table>
<thead>
<tr>
<th>Material</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>+ 1%</td>
</tr>
<tr>
<td>Coarse &amp; Fine Aggregate</td>
<td>± 2%</td>
</tr>
</tbody>
</table>
VIRGINIA DEPARTMENT OF TRANSPORTATION
MATERIALS DIVISION

STATEMENT OF HYDRAULIC CEMENT CONCRETE MIX DESIGN

Submit one copy to the District Administrator, Virginia Department of Transportation. Approval must be received by the contractor from the Materials Division before work is begun. This mix design is approved for all projects of the Department for the class of concrete shown:

Calendar Year: 2007  Mix Design No.: 4-9907-07

Producer: GENERAL READY MIX  Plant Location: RICHMOND, VA
Type of Mix: Ready Mix  Phone: 804-555-2000

Date: 02/15/2007

Mix Design - One Cubic Yard (Meter) Based on SSD Condition

Class of Concrete  A-4 GENERAL  (E)  Slump/  2 TO 4  In.  mm  Air Content  6.50%  %

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantities</th>
<th>Code</th>
<th>Source</th>
<th>Plant/Quarry Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>Type II</td>
<td>476  lbs.</td>
<td>kg.</td>
<td>10 / LEHIGH CEMENT CO. UNION BRIDGE, MD</td>
</tr>
<tr>
<td>Min. Admix. 1</td>
<td></td>
<td>159  lbs.</td>
<td>kg.</td>
<td>114 / PROASH ROXBORO, MD</td>
</tr>
<tr>
<td>Min. Admix. 2</td>
<td></td>
<td></td>
<td></td>
<td>1 / TARMAC KINGSLAND, VA</td>
</tr>
<tr>
<td>Sand (1)</td>
<td></td>
<td>1166  lbs.</td>
<td>kg.</td>
<td>4017 / VULCAN MATERIALS HYLAS, VA</td>
</tr>
<tr>
<td>No. 57</td>
<td>Stone (1)</td>
<td>1748  lbs.</td>
<td>kg.</td>
<td>4027 / DEEPWELL RICHMOND, VA</td>
</tr>
<tr>
<td>Gr./No.</td>
<td>Aggr. (1)</td>
<td>267  lbs.</td>
<td>gal.</td>
<td>49 / SIKA AEA 15 LYNDHURST, NJ</td>
</tr>
<tr>
<td>Water (2)</td>
<td></td>
<td>32    gal.</td>
<td>L.</td>
<td>6 / SIKA PLASTIMENT LYNDHURST, NJ</td>
</tr>
<tr>
<td>Admixture (AE) (3)</td>
<td>2.5  oz.</td>
<td>ml.</td>
<td></td>
<td>12.7 / ml.</td>
</tr>
<tr>
<td>Admixture (Retarder) (3)</td>
<td>12.7  oz.</td>
<td>ml.</td>
<td></td>
<td>12.7 / ml.</td>
</tr>
</tbody>
</table>

NOTES:

(1) The quantities of fine and coarse aggregates necessary to conform to specifications in regard to consistency and workability shall be determined by the method described in "Recommended Practice for Selecting Proportions for Normal Weight Concrete" (ACI-211.1) and the actual quantities used shall not deviate more than plus or minus 5 percent from such quantities.

(2) To provide minimum slump permissible in Table II-17 while satisfying placement and finishing requirements. A separate design shall be submitted for each slump desired.

(3) The quantity of admixture will not be approved or disapproved since it varies considerably and must be initially established by trial and error by the producer or contractor with subsequent adjustment during batching to maintain the desired results within the range specified.

Mineral Admixture #1 - sp.gr. 2.63
Mineral Admixture #2 - sp.gr. 2.45
Sand - Abs. 0.6
Sand - F.M. 2.9
Sand - sp.gr. 2.62
C.A. #1 - Abs. 0.5
C.A. #1 - sp.gr. 2.69
C.A. #1 Unit mass 98.1 / lb. t.

Aggr. #2 - Abs. 2
Aggr. #2 - sp.gr. 2.69
2nd F.A./C.A.-F/M./w/wt. 1 / M

Design W/C Ratio 0.42

Contractor: GENERAL READY MIX
Producer Technician's Expiration Date 12/31/2012

By: B. L. SMITH

FOR DEPARTMENT USE ONLY

Remarks:

Copies: District Materials Engineer
Project Inspector
Plant Inspector
Sub-Contractor and / or R.M. Producer

2015 v.1.0

Approved tentatively subject to the production of material meeting the requirements of the Specifications and Special Provisions.
CORRECT AND INCORRECT METHODS OF HANDLING AND STORING AGGREGATES

Incorrect methods of stockpiling aggregates cause segregation and breakage.

PREFERABLE
Crane or other means of placing material in pile in units not larger than a truckload which remain where placed and do not run down slope.

OBJECTIONABLE
Methods which permit the aggregate to roll down the slope as it is added to the pile or permit hauling equipment to operate over the same level repeatedly.

LIMITED ACCEPTABILITY
Pile built radially in horizontal layers by dozer or front end loader working from materials as dropped from conveyor belt. A rock ladder may be needed in setup.

GENERALLY OBJECTIONABLE
Dozer or front end loader stacking progressive layers on slope not flatter than 3:1 is objectionable unless materials strongly resist breakage.

FIGURE 13
CORRECT

Chimney surrounding material falling from end of conveyor belt to prevent wind from separating fine and coarse materials. Openings provided as required to discharge materials at various elevations on the pile.

INCORRECT

Free fall of material from high end of stacker permitting wind to separate fine from coarse material. When stockpiling large sized aggregates from elevated conveyors, breakage is minimized by use of a rock ladder.

UNFINISHED OR FINE AGGREGATE    FINISHED AGGREGATE STORAGE (DRY MATERIALS)

Stockpiling of Coarse Aggregate When Permitted: Stockpiled aggregate should be finish-screened at batch plant. When this is done no restrictions on stockpiling are required.

FIGURE 13
WATER

Water must be previously approved and may be measured by either volume or weight. Means of dispensing water into the batch are by: meter, holding tank, or scales. Water is to be dispensed within an accuracy of ± 1%.

ADMIxTURES

There are several types of admixtures used in highway concrete. Examples are: air entraining agents, set retarders, water reducers, and accelerators. The Department of Transportation publishes an approved list of admixtures periodically. Admixtures must be used and dispensed according to manufacturer recommendations by means of an approved, graduated, transparent, measuring device before they are introduced into the mixer. (Page 5 - 8). If more than one admixture is to be used, they shall be released in sequence rather than at the same instant as there may be a chemical reaction between the admixtures. Liquid admixtures should be agitated prior to their use. Admixtures must be dispensed within an accuracy of ± 3%. Admixtures must be stored and handled to prevent freezing, contamination, and deterioration.

TRUCKS

Before a transit mix truck leaves the plant, the producers technician should see that the required mixing revolutions are obtained. The correct speed can be obtained from the manufacturer’s rating plate on the truck. Truck mixers are to be equipped with the following devices: revolution counter, manufacturer’s rating plate which shows the mixing capacity (specifications require a maximum and minimum that can be mixed), and agitating speed of the mixer, and a properly calibrated water measuring device. (See Page 5 - 9). Periodically, the technician should make a visual inspection of the trucks to see that the blades are in good condition and there is no excessive buildup of hardened concrete in the drum. Before any truck is used for VDOT concrete, the technician should make sure the truck has a current VDOT strap tag - a change has occurred regard this requirement as of February 2015 (please see page 11-18 of this chapter).

The volume of concrete mixed per batch shall not be less than 15 percent nor more than 110 percent of the mixer’s rated capacity.

CONCRETE BATCH REPORT - FORM TL-28A

Before the truck leaves the plant, the upper half of Form TL-28A, should be filled out by the producer. He should send the original to the project with the truck driver and retain the carbon copy for his records. An example of Form TL-28A is shown on Page 10 - 9.
FIGURE 14 BATCH PLANT DIAGRAM

12A - SCALES
12B - WATER MEASURING DEVICE
12C - ADMIXTURE DISPENSER
FIGURE 15 ADMIXTURE DISPENSER

TRANSPARENT GRADUATED TUBE

DISCHARGE VALVE

TO MIXER

RETURN TO SUPPLY

FILL VALVE

SUPPLY
FIGURE 16  TRUCK MIXER

13A  Drum and Blades
13B  Water Tank
13C  Manufacturer Plates
13D  Revolution counter
FIGURE 17 MANUFACTURER PLATES
VDOT Materials Division Manual of Instructions, Chapter IV, Section 416.01(e) to harmonize with the VDOT Road and Bridge Specifications, Section 217.05. An important feature is that VDOT truck tags will no longer be used to demonstrate truck approval. All trucks coming to a VDOT project are certified by the HCC producers VDOT Certified Plant Technician as meeting the requirements for all items listed in the VDOT Hydraulic Cement Concrete Plant Inspection Report and the VDOT Truck Inspection Report. Full compliance with this Memorandum is required by February 1, 2015.

Replace Section 416.01(e) with the following:

(e) Inspection of Plant and Equipment

1) Approval

Hydraulic cement concrete (HCC) plants and trucks are approved by one of the two following programs:

(a) National Ready Mixed Concrete Association (NRMCA) Certification

Producers electing to use NRMCA Certification for inspection of plant and trucks for VDOT approval are required to complete and sign the form in the Appendix, page, IV-A-1.

(b) Self-certification

HCC producers electing to perform self-certification for inspection of both plant and trucks are required to complete and sign all of the forms supplied in the Appendix, pages IV-A-1 thru IV-A-6.

Failure to comply with VDOT requirements for plant and truck certification may result in removal of the plant as an approved HCC supplier, deletion of trucks for use on VDOT projects and/or decertification of the producer’s VDOT HCC Certified Plant Technician. Documentation must be available to the District Materials Section that demonstrates compliance with one of the two approval programs. Material source code numbers for plant locations will be obtained through the Materials Division/Physical Laboratory. The frequency of self-inspection shall be at a minimum the same as the NRMCA inspection frequency.

2) Documentation Requirements

Documentation consists of submitting a Certificate of Compliance to the District Materials Section. This Certificate of Compliance must be signed by the HCC producer’s VDOT HCC Certified Plant Technician. The following documentation shall be retained by the HCC producer and be available to the District Materials Engineer (DME) upon request:

1. A current List of Approved Trucks for use on VDOT projects
2. VDOT HCC Plant Technician Certification(s)
3. Approved HCC mix designs shall be kept on file
4. A current Truck Inspection Report for each approved truck
5. A current Hydraulic Cement Concrete Plant Inspection Report
3) **Plant/Truck Monitoring**

Before HCC is provided to a project, the District Concrete Technician may arrange for a visit to the plant. Based upon the Technician’s experience and knowledge of the District’s projects/workload and understanding of potential risks, the Technician may elect to examine any or all of the following:

- The inspection reports for the plant and transit mixing trucks (herein referred to as Trucks).

  The District Concrete Technician verifies the HCC producer’s inspection reports, both those features that are reported as compliant and those that are problematic with particular attention to the most critical concerns at the plant for producing quality concrete. Regardless of what is found in the reports, the Technician may decide to inspect any or all plant operations and trucks.

- Checking any number of trucks for drum cleanliness and blade wear. If a truck is found to be out of compliance, the District Concrete Technician will draw a line through the truck listed on the HCC producer’s List of Approved Trucks, date and sign the deletion. To reapprove the truck a new Truck Inspection Report must be completed demonstrating compliance to all items on the inspection report. The District Concrete Technician may choose to be present for the re-inspection of non-compliant trucks.

- Plant batching operations. If any areas of non-compliance are noted while inspecting the plant, the District Concrete Technician will fill out a new *Virginia Department of Transportation/Materials Division Hydraulic Cement Concrete Plant Inspection Report* denoting areas of non-compliance, signing and dating the report at the time of the review. On a follow-up visit, the areas of non-compliance will be inspected to ensure proper action was taken by the producer to correct the problems.

Also, it is advantageous that an inspection take place as early as possible before HCC is delivered to the project site. If batch testing is part of the contract requirements, additional portions of the report may be monitored at that time. While the entire inspection of both plant and trucks may be performed, the District Concrete Technician will determine how much verification is needed. In the case where the District Concrete Technician has verified the HCC producer’s inspection report within the last few months, less verification may be justified. A VDOT HCC Plant Certified Technician shall be available during production for VDOT projects. HCC production shall be in accordance with approved HCC Mix Designs. The intent is for some portion of the inspection process to be verified by the District Concrete Technician during each plant visit.

4) **Non-conformity Resolution Procedure**

The District Concrete Technician will work with the HCC producer making a resolute effort to resolve non-compliant inspection action items. The accumulation of one or more of the violations below (not all inclusive) may result in the removal of the approved status of an HCC producer.

a) Supplying HCC without using an approved HCC mix design

b) Inadequate maintenance of trucks/equipment (documented in the *Truck Inspection Report* and/or the *Hydraulic Cement Concrete Plant Inspection Report*)
c) Not performing the self-inspection or having a valid NRMCA inspection within the prescribed inspection frequency

d) Failing to comply with specification requirements

When an HCC producer fails to act within 5 business days on the notification(s) of non-compliance issued by the District Concrete Technician, the DME may begin the process of removing the approval status of an HCC producer. The DME will follow the steps below:

1. The DME will review the District Concrete Technician and HCC producer’s inspection documentation within 5 business days of notification by the District Concrete Technician. If the DME can resolve the matter with the HCC producer, there will be no need to proceed to step 2. If the matter is unresolved, then the DME will proceed to step 2.
2. The DME will issue a written notice of placing the HCC producer on probation.
3. The probation will continue until the inspection action items are resolved and the HCC producer has demonstrated for at least 3 months of providing HCC to VDOT projects that the inspection action items are not recurring issues.
4. If 5 business days after the date of being notified of being on probation and failing to resolve the inspection action items, the DME may remove the HCC producer, providing written notification of removal. The written notification will outline what actions the HCC producer needs to take to regain an approved HCC producer status.
5. When the HCC producer regains the approved status, the HCC producer will be on a probationary status for a 3 month period demonstrating continued inspection compliance.

Suspensions of HCC Concrete Plant Technician Certifications will be handled in accordance with the VDOT Materials Division Manual of Instructions, Sec. 115.07 Suspension of Certification.

**Appeal Process:** If the decision is to place the HCC producer on probation or remove the approval status of the HCC producer, the HCC producer has 5 business days to appeal the decision in writing to the VDOT Concrete Program Manager. The Concrete Program Manager or designated representative will review the matter and render a decision within 5 business days. If the HCC producer does not agree with the decision of the Concrete Program Manager or appointed representative, then the HCC producer may appeal to the State Materials Engineer or designated representative in writing within 5 business days after the Concrete Program Manager’s decision. The State Materials Engineer’s (or designated representative) decision is final and will be made within 5 business days after receiving the HCC producer’s written appeal. During the Appeal Process the decision by the DME stands until a ruling is made.
Hydraulic Cement Concrete (HCC) Producer Name - ________________________________

HCC Producer Location - ________________________________

_____________________________________________

This signed document certifies:

1. that the plant location above has either (please circle one):
   a. a current/valid NRMCA Certification for plant and/or trucks
   b. or completed VDOT Inspection Reports for plant and/or trucks

2. that all plant equipment and trucks used on VDOT projects meets or exceeds the requirements listed on the Truck Inspection Report and the Hydraulic Cement Concrete Plant Inspection Report.

3. a List of Approved Trucks is on file for this plant location.

If a truck is sent from another producer’s plant (either an approved source or not an approved source for HCC), the List of Approved Trucks must be updated for this plant location. Proof of current truck inspection must be on file at the plant location where the truck is being dispatched.

This documentation will be made available to VDOT upon request.

Signed by - ________________________________ (print name)

______________________________ (signature)
Date of Inspection - _____________

Truck Number - _________________

Inspected by - _________________ (signature)

__________________________________________ (print name)

Hydraulic Cement Concrete (HCC) Producer Name - ___________________________

HCC Producer Location - _________________________________________________

_________________________________________________

If the answer to any question below is “No”, then the truck is not approved for use of VDOT projects.

**Truck Number:**

Is it visible and legible? _________

**Water Meter/Dispensing Device:**

Does the water meter function properly? _________

Is the water dispensing device working properly? _________

**Drum Condition: (must open the inspection plate/hatch to verify)**

Is there abnormal wear on the blades? _________

Is there abnormal buildup of concrete in the drum and/or on the blades? _________

Is the condition of the drum satisfactory? _________

Does the drum rotate both clockwise and counterclockwise with variable speed? _________

Are the chutes non-aluminum and satisfactorily clean of hardened concrete? _________
Manufacturer’s Plate:

Is the manufacturer’s plate legible and the correct plate for the truck?  ___________

Revolution Counter:
Does the revolution counter work (verify 1 count per drum of rotation by rotating drum 5 times to ensure the counter reads 5)?  ___________

Back-up signal working properly?  ___________

Note: This document addresses the production of quality HCC and does not absolve the HCC producer from complying with the VDOT Work Area Protection Manual and other Federal and State regulations that govern the operation of HCC transit mix trucks.

Comments: (Please comment on any features that are near borderline or may potentially be out-of-compliance for the next inspection that could lead to the production of objectionable concrete.)

________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
________________________________________________________________________________
Virginia Department of Transportation/Materials Division
Hydraulic Cement Concrete Plant Inspection Report

Date of Plant Inspection - ____________________
Inspected by - ________________________________ (signature)
____________________________________________ (print name)

Hydraulic Cement Concrete (HCC) Producer Name - ________________________________
HCC Producer Location - ________________________________________________
________________________________________________
________________________________________________

Personnel:
Is there at least one VDOT Certified Plant Technician on staff? ___________
The names and certification expiration dates should be verified as current.

Records:
Are the records stored in a location that prevents damage to the records? ___________
Are the records maintained for at least five years? ___________

Tickets:
Are the batching tickets legible and contain the sufficient information? ___________
The sufficient information should include the date/time of batching, batch weights and batcher name.

Bins and Weigh Hoppers:*
Are bins and weigh hoppers clean and in good operating condition? ___________
Are the bins and weight hoppers discharging freely and completely? ___________
Is there a separate hopper for the cement? ___________

Materials Source Verification:
Are the materials (admixtures, aggregates, cement, water, etc.) being used in the HCC VDOT approved (a current approved HCC mix design can be used as a proof of this requirement? ___________

Materials Storage:* 
Are systems in place and working so as to keep the aggregates in at least a saturated-surface dry condition? ___________
Are the aggregates segregated? ___________
Are the aggregate piles contaminated? ___________
Are the aggregate piles well-drained? ___________
Does the cement silo keep the cement dry and free of clumps? ___________
Are the admixtures stored in a non-freezing environment? ___________

IV-A-5
Accuracy of Scales and Dispensers:*  
Are the scales and dispensers capable of the accuracy required for the specification?  
Have the scales been checked for accuracy and have a current calibration certificate/sticker (within the last 6 months)?  
Are the dispensers working properly and checked for accuracy?  
Is the admixture measuring device transparent?  
Is the admixture dispensing device capable of manufacturer’s recommended procedures for dispensing admixture into the mix?

Moisture testing of Aggregates:  
Does the facility have the necessary equipment in good operating condition to perform moisture tests on the fine and coarse aggregate?

Equipment:  
Does the facility have equipment meeting the requirements of ASTM C 231 (C173 for lightweight concrete if applicable) and ASTM C143 for testing air content and slump?

Water:  
Is the water from an approved source?

Batchers:*  
Have the HCC batchers (if different from the HCC VDOT Certified Plant Technician) been properly trained to ensure the HCC produced meets the approved mix design requirements?

Comments:  (Please comment on any features that are near borderline or may potentially be out-of-compliance for the next inspection that could lead to the production of objectionable concrete.)

* These items will be filled out on the self-certification program, but are not required under a nationally recognized certification program. However, during the inspection all items on this list may be checked.
Chapter 5
Study Questions

1. Before any concrete is batched, the producer’s technician should determine that there is an approved __________ at the plant.

2. The required weighing accuracy for cement is __________.

3. Aggregates arriving at a plant by truck are acceptable for use if they are accompanied by a ____________.

4. Hopper and cement scales for batching concrete materials must be ____________.

5. Aggregates should be handled and stockpiled in such a manner as to minimize ____________.

6. The required weighing accuracy for aggregate is ____________.

7. The minimum and maximum limits of volume of concrete which can be mixed in a mixer are ____________.

8. The loader should remain ____________ from the ground while removing material if stockpiles are built on the ground.