

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION  
DIVISION OF HIGHWAYS  
MATERIALS CONTROL, SOILS AND TESTING DIVISION

INFORMATIONAL MEMORANDUM

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QUALITY ASSURANCE PROCEDURES

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- 1.0 PLANT AND EQUIPMENT INSPECTION STICKERS
- 1.1 Physical plants and equipment which prepare materials for or deliver materials to State project shall be regularly inspected and approved by an authorized representative of the Division when such inspections are necessary to insure conformance with Division specifications and directives.
- 1.2 The inspections and approval shall be witnessed, where applicable, by an inspection sticker supplies by the Materials Control, Soils and Testing Division. The inspection sticker will indicate the following:
1. Name of inspector
  2. Date of inspection and
  3. Date of expiration of approval
- 1.3 Inspections may be made at any time at the option of the Division and the status of the inspected facility shall be determined by the latest inspection. The date of expiration of approval, as noted on latest inspection sticker, shall be the last day on which the facility is considered to be approved by Division, and such facility must have an approved status at time of preparing materials for or delivering materials to State projects.
- 1.4 The sole purpose of the inspection sticker is to inform all concerned that a plant, or portion thereof, or a singular piece of equipment has been inspected and found to meet, substantially, all requirements of the specifications and is, therefore, approved to supply materials to State projects. Said inspection sticker shall therefore be affixed to the equipment or displayed in other manners so that the purpose as above stated will be fulfilled.

1.5 Each District will be supplied with inspection stickers numbered consecutively. The first digit of the sticker numbers issued to a District will correspond to the number of that District. The stickers shall be applied, insofar as practicable, in numerical order, and records shall be maintained by each District which will indicate the following:

1. Plant or portion thereof, or singular piece of equipment inspected.
2. Date of inspection.
3. Expiration date of inspection sticker.
4. Number of inspection sticker.

1.6 A plant or portion thereof, or a singular piece of equipment, shall be approved for a period not to exceed six (6) months. The period of approval shall be determined, in general, by the age, physical condition, or durability of the plant or equipment, and the inspection interval shall be such that the Division will have reasonable assurance that the plant or equipment is maintained in an acceptable manner.

1.7 Additional information regarding inspections and a sample of an inspection sticker is contained on FLOW DIAGRAM NO. 1, copy attached.

## 2.0 QUALITY ASSURANCE IN PORTLAND CEMENT CONCRETE

### 2.1 PURPOSE

The purpose of this procedure is to establish guidelines which will aid Division personnel in implementing in a prescribed and uniform manner the Division's Quality Assurance Program for portland cement concrete, said program being directed primarily to maintaining a predetermined and acceptable level of assurance that portland cement concretes do conform to their governing specification.

## 2.2 DEFINITION OF TERMS

### 2.2.1 QUALITY ASSURANCE

Quality Assurance is an expression of confidence which the Division has in its program of acceptance testing and inspection which determines conformance of materials and construction to governing specification. A Quality Assurance Program is a planned program of acceptance testing and inspection which is conducted by the Division for the express purpose of maintaining a predetermined and acceptable level of assurance that construction materials do conform to governing specifications. Part of any Quality Assurance Program, of course, is an awareness and knowledge of the producer's Quality Control Program and the level of Quality Control which he maintains.

### 2.2.2 QUALITY CONTROL

Quality Control is a planned program of testing, inspection and related activities conducted by a concrete producer for the purpose of measuring the various properties of concrete and its component materials which are governed by the specification and controlling these properties within the limits of the specification. Quality Control of portland cement concrete is discussed in detail in CD-318.

## 2.3 GENERAL DISCUSSION

During the past several years, the Division and the Contractor-Supplier industry have jointly participated in a program whose primary objective is to improve the quality of concrete in highway construction. When this program is fully implemented and effective, then the Division will run a smaller risk of having non-conforming materials incorporated into the work, and the Contractor-Supplier industry will run a smaller risk of having suitable materials rejected.

The following major developments are outgrowths of the program just mentioned:

- 2.3.1 Portland cement concrete technicians have now been certified and are available in the Contractor-Supplier industry to implement a program of Quality Control (See definition of PORTLAND CONCRETE TECHNICIAN in Subsection 3.2 of CD-318).
- 2.3.2 The requirement for a Contractor (or his authorized representative, a subcontractor or a commercial supplier) to do Quality Control of portland cement concrete and to have in his service a Certified Portland Cement Concrete Technician is specified in Subarticles 501.3.2.2 and 601.3.2.2 of the Standard Specifications (1968) entitled QUALITY CONTROL TESTING (See CD-318 for interpretation).
- 2.3.3 The requirement for a Contractor (or his authorized representative, a subcontractor or a commercial supplier) to have a field laboratory which is equipped and maintained in specified manner so as to aid in the conduct of a Quality Control Program is specified in Subarticles 501.3.3.1 and 601.3.3.1 of the Standard Specification (1968).
- 2.3.4 Concrete batch plants and hauling equipment are regularly inspected by the Division and approval of same as conforming to requirements of governing specification is attested to by an inspection sticker (See Section 1 of this memorandum for details).
- 2.3.5 The requirement to do concrete design, using the particular sources of materials which are to be used in the work, is specified in articles 501.3.1 and 601.3.1 of the Standard Specifications (1968). This requirement will allow commercial concrete suppliers to have laboratory design work done just once a year for the various classes of concrete to be supplied, but this procedure guards against the possibility of source materials changing appreciable from one construction season to the next and affecting the quality of subsequent concrete work.

The foregoing is a significant measure of the Contractor-Supplier (producer) potential to do Quality Control of portland cement concrete. It is expected that this potential will not be utilized with the same effectiveness by all producers.

Although all producers will probably maintain an acceptable level of Quality Control, it is reasonable to assume that a number of producers will maintain a level of Quality Control well above the minimum accepted level.

It is generally agreed that an acceptable level of Quality Assurance may be maintained with less acceptance testing and inspection when the level of Quality Control is increased. This knowledge was not acted on in the past because the elements which are essential to Quality Control were not generally available then. Additionally, a minimum acceptable level of Quality Control could not have been practically established in the past because the producer industry, generally, was not equipped to maintain a positive and sustained level of Quality Control.

The capability to perform a positive and sustained level of Quality Control in practically all producer plants today is now well established (See CD-318 for interpretation). Also, the Division has the means for measuring the level of Quality Control maintained by each producing plant. Accordingly, it would be desirable to pursue a Quality Assurance Program which takes into account the level of Quality Control in a producer's plant so that an acceptable level of Quality Assurance could be maintained with a minimum cost (man-hours and dollars) to the Department. As previously stated the purpose of this procedure is to establish guidelines which will aid Department personnel in implementing in a prescribed and uniform manner such a Quality Assurance Program.

## 2.4

### DIRECTIVE

Concrete plants will be inspected in accordance with Section 1 of this memorandum and the condition of conformance will be determined. Those plants which are found to conform to the specifications will be identified as Class A plants and those which do not conform will be identified as Class B plants. The level of Quality Control at each concrete plant will also be evaluated.

Those plants which have a high level of Quality Control will be considered to have a Level 1 Quality Control, and those plants which have a lower level of Quality Control will be considered to have a Level 2. All concrete plants will then be rated with one of the following classification numbers A1, A2 or B.

#### 2.4.1 LEVEL 1 QUALITY CONTROL

All plants producing concrete which reasonably conforms to the specification requirements, and which satisfies the following additional requirements will be considered to have LEVEL 1 Quality Control:

2.4.1.1 The compressive strength of the concrete produced by the plant shall have a coefficient of variation of 0.15 or less and the average, compressive strength shall be equal to or greater than the specified requirement plus 2 1/2 standard deviations.

2.4.1.2 The air content of the concrete produced by the plant shall have a coefficient of variation of 0.18 or less, and the average air content shall not differ from the specified optimum value by more than one standard deviation.

2.4.1.3 The consistency of the concrete produced by the plant shall have a coefficient of variation of 0.20 or less, and the average consistency shall not differ from the specified optimum value by more than two standard deviations.

2.4.1.4 The plant shall maintain an adequate Quality Control Program for aggregate gradation.

#### 2.4.2 LEVEL 2 QUALITY CONTROL

All plants which fail to meet one or more of the requirements specified in 2.4.1 will be considered to have LEVEL 2 Quality Control.

#### 2.4.3 PHYSICAL PLANT-EVALUATION

District personnel will inspect and evaluate concrete plants in conformance with Section 1 of this memorandum. A copy of the inspection data, which is specified in Subsection 1.5, will be transmitted to the Materials Division immediately after the inspection is completed.

#### 2.4.4 LEVEL OF QUALITY CONTROL - EVALUATION

The evaluation of the level of Quality Control maintained by concrete plants will be performed and maintained current by the Materials Division. The initial evaluation of the level of Quality Control will be based on an analysis of historical data. There after, tests for strength, entrained air, and consistency will be made by District personnel on random samples taken from plant production, and these test data will be used by the Materials Division to update the statistical parameters and maintain a current and valid evaluation of each plant's Quality Control level. The Materials Division will publish a list of concrete plants with their rating numbers, said publication to be updated monthly.

#### 2.4.5 CLASS AI PLANTS - TEST AND INSPECTION REQUIREMENTS

Concrete from Class AI concrete plant shall be sampled and tested by District personnel on a random basis with the frequency specified in Subsection 700.03 of the Construction Manual.

Plant inspection at Class AI concrete plants shall be performed by District personnel on a random basis with the frequency specified in Subsection 700.03 of the Construction Manual.

A concrete delivery ticket (Form HL-411) shall be initiated and signed at the plant and accompany each delivery to the project.

#### 2.4.6 CLASS A2 PLANTS - TEST AND INSPECTION REQUIREMENTS

Concrete for major Items from Class concrete plants shall be sampled and tested by District personnel on a project- by-project basis with the frequency specified in Subsection 700.03 of the Construction Manual.

Plant inspection at Class A2 concrete plants shall be performed by District personnel on a continual basis during the time that concrete for major items is being produced for State projects. Concrete for miscellaneous items (See 2.4.8) shall be sampled and tested with the same frequency required in 2.4.5, Class A1 plants.

#### 2.4.7 CLASS B PLANTS

Concretes purchased by a Contractor for use on State projects shall be supplied from Class A1 or A2 plants. Concretes purchased through competitive bidding with Purchase order contracts shall be supplied from Class A1 or A2 plants. (Class B plants are not considered to be eligible to compete with Class A plants in the furnishing of concrete to State projects).

In the event it is not practical to obtain small quantities of concrete for miscellaneous items (See 2.4.8) from a Class A1 or A2 plant and a survey reveals that a Class B plant is conveniently situated with respect to the construction site, then a direct purchase of concrete by the Division from the Class B plant may be accomplished in conformance with standard procedures of the Purchasing Division of the Department of Finance and Administration. The direct purchase of concrete from Class B plants shall also be made to conform to the requirements set out in Subsection 2.5 entitled Quality Assurance OF DIRECT PURCHASE CONCRETES FROM CLASS B PLANTS. Plant inspection at Class B plants and the sampling, testing and documentation of concretes from Class B plants shall also conform to the requirements set out in Subsection 2.5.



## 2.4.8 SMALL QUANTITIES FOR MISCELLANEOUS ITEMS

Miscellaneous concrete shall be defined as relatively small quantities incorporated into items that will not adversely affect the traffic carrying capacity of a completed facility. Such items would not include any concrete intended for major structures permanent mainline or ramp pavements, or other structurally critical items.

The following items are suggested as a guideline in establishing miscellaneous concrete:

- 2.4.8.1 Sidewalks - not to exceed approximately 50 square meters per day.
- 2.4.8.2 Curb and gutter - Not to exceed approximately 150 lineal meters per day.
- 2.4.8.3 Concrete base course and concrete base course widening - Not to exceed approximately 50 square meters per day.
- 2.4.8.4 Paving, patching and temporary pavements.
- 2.4.8.5 Building floors and foundations.
- 2.4.8.6 Slope paving and headers.
- 2.4.8.7 Paved ditch.
- 2.4.8.8 Guardrail anchorages.
- 2.4.8.9 Metal pile shells.
- 2.4.8.10 Small culvert headwalls.
- 2.4.8.11 Fence posts.
- 2.4.8.12 Catch basins, manhole bases and inlets.
- 2.4.8.13 Sign, signal and light bases.

FLOW DIAGRAM NO. 2 is made a part of this memorandum and gives detailed information on the organization and operation of the Quality Assurance procedures.

2.5           QUALITY ASSURANCE OF DIRECT PURCHASE CONCRETES FROM CLASS B PLANTS

2.5.1         PURPOSE

The purpose of this instruction is to provide guidance in specifying direct purchase concretes and for inspection and testing direct purchase concretes from Class B plants so that a predetermined and acceptable level of Quality Assurance may be maintained by Division personnel. This instruction is set apart from the main directive in Subsection 2.4 because it is the intent to have concretes from Class B plants used in highway work only when it is not practical or economical to obtain concretes from Class A1 or A2 plants.

2.5.2         DEFINITION OF TERMS

2.5.2.1       Direct Purchase - Direct purchase is a formal procedure used by the Purchasing Division of Department of Finance and Administration to purchase supplies and equipment for government agencies (including the Division of Highways) when it is not practical or economical to use the procedure of competitive bidding. Direct purchase requisitions will always specify the name of the proposed supplier as well as product name, quantity, specifications, etc.

2.5.3         GENERAL DISCUSSION

When highway work requiring portland cement concrete is let to contract, the contract will normally allow for the Contractor to produce or procure the concrete in which event the concrete shall be supplied by a Class A1 or A2 plant. If the Division should determine prior to letting work to contract that it would be impractical or uneconomical to obtain concrete from a Class A1 or A2 plant but that it would be practical to obtain it from a Class B plant, then the Division may stipulate in the contract documents that the concrete will be supplied to the Contractor by the Division FOB site of work. In this event the purchase of concrete from a Class B plant shall conform to the requirements specified in Article 2.5.4.

When highway work requiring portland cement concrete is being done by Division forces and it is found to be impractical or uneconomical to obtain concrete from a Class A1 or A2 plant but that it would be practical to obtain it from a Class B plant, then the purchase of concrete from a Class B plant shall be made to conform to the requirements of article 2.5.4.

#### 2.5.4 INSTRUCTION

The purchase of portland cement concrete from a Class B plant will be permitted only after a field condition survey has been conducted and properly documented which indicates that it would be impractical and uneconomical to obtain concrete from a Class A1 or A2 plant, and that a Class B plant does exist from which a direct purchase of concrete could practically and economically be made.

Procedures for making direct purchases of concrete shall be as prescribed by the Department of Finance and Administration. The method of specifying direct purchase concrete shall be as follows:

- (1) Specify the class of concrete.
- (2) Specify that the concrete mix design will be furnished by the Division.
- (3) Specify that a Division inspector will be at the plant during the full time that concrete is being batched to direct the batching operation, and that batching shall not commence until the inspector is present.
- (4) Specify that the inspector shall execute FORM OC-411 which will accompany each load of concrete to the site of the work.


In addition to the Quality Assurance activity performed at the plant, the Division will sample and test as deemed necessary all direct purchase order LOTS of concrete used in highway maintenance work.

IM-18  
1ST REVISION: JUNE 1971  
2ND REVISION: APRIL 1972  
REISSUED: JANUARY 1995  
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Gary L. Robson, Director  
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Attachments