APPENDIX

Specifications for Testing Aggregate

ASTM	AASHTO Test	AASHTO Part	Materials Procedures	Test Name
C123	T113	2	MP 702.01.20	*Lightweight Pieces in Aggregate
C566	T255	2		Moisture Content, Total of Aggregate by Drying
C702	R76	2		Reducing Samples of Aggregate to Testing Size
C29	T19	2		Unit Weight of Aggregate
C136	T27	2		Sieve or Screen Analysis of Fine and Coarse Aggregate
D75	T2	2	MP 700.00.06	Sampling Aggregates
C88	T104	2	MP 703.00.22	*Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
C127	T85	2		Specific Gravity and Absorption of Coarse Aggregate
C128	T84	2		Specific Gravity and Absorption of Fine Aggregate
C117	T11	2		Test for Materials Finer than No. 200 (75 µm) Sieve in Mineral Aggregates by Washing
D448	M43	1		Standard Sizes of Coarse Aggregates for Highway Construction
C142	T112	2	MP 703.01.20	*Test for Clay Lumps and Friable Particles in Aggregate
C131	T96	2		*Resistance to Abrasion of Small Size Coarse Aggregate by use of the Los Angeles Machine

* Not required to know in detail

Tests To Be Performed

Tests to be performed for completion of the Aggregate Technician Certification Program practical examination are as follows:

1. Amount of Material Finer than the No. 200 (0.075 mm)
   Sieve in Aggregate
   AASHTO T-11
2. Gradation Analysis - coarse and fine
   AASHTO T-27
3. Specific Gravity and Absorption of Fine Aggregate
   AASHTO T-84
4. Specific Gravity and Absorption of Coarse Aggregate
   AASHTO T-85
5. Unit Weight of Aggregate
   AASHTO T-19
6. Determining the Liquid Limit of Soils
   Three Point Method
   AASHTO T-89
7. Determining the Plastic Limit and Plasticity
   Index of Soils
   AASHTO T-90
8. Standard Method of Test for Percent Crushed Particles
   West Virginia Division of Highways Procedures
   MP 703.00.21

As stated in the West Virginia Department of Transportation Standard Specifications Book, Section 106.3, AASHTO test methods are preferred, therefore all written and practical testing will be done in accordance with these methods. If ASTM methods are compatible with AASHTO methods, they may also be used.

CONVERSION DATA

Pounds x 0.4536 = Kilograms

Pounds ÷ 2.205 = Kilograms

Kilograms ÷ 0.4536 = Pounds

Kilograms x 2.205 = Pounds

Pounds x 453.6 = Grams

Pounds ÷ 0.002205 = Grams

Grams ÷ 453.6 = Pounds

Grams x 0.002205 = Pounds

Grams x 0.001 = Kilograms

Grams ÷ 1000.0 = Kilograms

Kilograms x 1000.0 = Grams

Kilograms ÷ 0.001 = Grams

°F = (9/5) °C + 32

°C = 5/9 (°F - 32)

EXAMPLE GUIDE FOR QUALITY CONTROL

PLAN FOR ACCEPTANCE

Mr./ _____
West Virginia Division of Highways
District _____Engineer
_____Street
_____, West Virginia

Dear Mr./ _____:

Base Course Aggregate
Quality Control Plan
Project _____

We are submitting our base course aggregate quality control plan developed in accordance with Section 307 of the _____ Standard Specifications, the _____ Special Provisions, and MP 307.00.50.

1. The quality control program is under the direction of _____ who can be contacted at telephone number_____.

2. Sampling and testing will be performed by _____, certified aggregate technician number _____, compaction testing will be performed by _____, certified compaction technician number _____.

3. The items to be incorporated controlled, and tests to be conducted are _____.

4. During the production and placement operation of the base course aggregate, our responsible people will perform the following quality control tests in accordance with _____ Standard Specifications and MP 307.00.50. (See Attachment #1 for Breakdown of Activities.)

5. All testing, evaluation and documentation will be completed within 72 consecutive hours from the time of sampling or production will be halted until all work is current.

6. Material found to be non-complying shall not be incorporated into the roadway. In the event that nonspecification material is incorporated into the project, the Division of Highways Project Engineer and District Materials Supervisor will be notified immediately. Disposition of failing material shall be in accordance with directives from the Division of Highways.

7. We will notify all appropriate Division of Highways personnel at least 24 hours before scheduled work is to begin.

Very truly yours,

_____

Attachment #1

TEST OR ACTION	FREQUENCY	METHOD DOCUMENTATION	METHOD OF
Samples from Roadway	One (1) per each half day of operation	MP 700.00.06	Daily log
Sieve Analysis	One (1) per each half day of operation (Small quantity exception see Note 1 in MP 307.00.50)	AASHTO T-11 AASHTO T-27	T300, Plant Control Charts
(Completed gradation samples will be retained in sealed bags with plastic liners at _____ laboratory until notified by the Division of Highways to dispose of them.)			
Atterberg Limits	One (1) test before start of operations and every 10,000 tons thereafter	AASHTO T-89 AASHTO T-90	WVDOH Form T307
Face Fracture	One (1) test before start of operations and every 10,000 tons thereafter	MP 703.00.21	WVDOH Form T302
Unit Weight (Slag only)	One (1) test before start of operations and every 10,000 tons thereafter	AASHTO T-19	WVDOH Form T304
Control Charts (The charts will be maintained by our _____ laboratory, until project completion. They will then be given to the Division of Highways.)	Results plotted at same frequency as sieve analysis	MP 300.00.51 Section 307 of Standard Specifications	As instructed in MP 300.00.51
Compaction Test	Five (5) density test per lot of 2000 LF	MP 700.00.24 MP 717.04.21 Section 717 of the Standard Specifications and _____ special provisions	T313 and T317 See separate quality control plan for compaction
Surface Tolerance		Section 307.6.1, 308.3.3 Diary Standard Specifications	
Thickness Tolerance		Section 307.6.2 Diary Standard Specifications	

ML-25
ORIGINAL ISSUANCE: JUNE 1968
REISSUED: JANUARY 1995

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

MATERIALS PROCEDURE

PROCEDURE FOR MONITORING THE ACTIVITIES RELATED TO SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

1.0 PURPOSE

1.1 To provide for management a means for checking the adequacy of equipment, procedures and testing techniques employed in the conduct of Sieve Analysis of Fine and Coarse Aggregate. For further emphasis, it is restated that this procedure is designed solely to provide a method for monitoring activities relative to sieve analysis and shall not be used in a manner that would revise or modify acceptance testing procedures for aggregate as set forth in other procedures and instructions.

2.0 SCOPE

2.1 This procedure shall be applied to the extent that all activities related to the sieve analysis of fine and coarse aggregate which are regularly conducted outside the District Central Laboratory shall be monitored. These activities are frequently performed at project sites, Portland cement concrete batch plants and central mix plants, bituminous concrete plants and district sublabs.

3.0 PROCEDURE

3.1 All aggregate samples which have been tested for sieve analysis at locations other than the District Central Laboratory shall be retained until further disposition is determined by the District Materials Engineer/Supervisor. Care shall be taken to prevent loss of material when placing the weighed portions of the original sample into a clean, leak proof bag. If the original sample bag is used for this purpose, it should be leak proof and clean. Each sample shall be positively identified with a District Laboratory Number or a field sample

number or both, whichever is available and other information as necessary for complete identification. The gradation work sheet should completely identify the sample and a copy of this document placed in the sample bag would be quite adequate.

3.2 Approximately once each week, the District Materials Engineer/Supervisor or his authorized representative shall visit each location at which sieve analyses of fine and coarse aggregates have been conducted, and he shall select from the total LOT of samples which have been tested and accumulated since his last visit, at least one sample to be tested in the District Central Laboratory. It is most important that the sample selection be made by the District Materials Engineer/Supervisor or his authorized representative in as random a manner as possible and without influences that would tend to give particular samples a greater chance of being selected. To aid in accomplishing the foregoing, all aggregate samples from which the selection is to be made should be prominently displayed, and a frequent check should be made to ascertain that the collection of displayed samples is complete.

3.3 Each aggregate sample shall be tested in the District Central Laboratory using the sieves and test procedures set out in the governing specification for the item represented by the sample.

The following statement shall be written on the work sheets:

"MONITOR" test made to check lab. no. _____ where the District Laboratory Number for the original test is written in the blank space. Obtain a copy of the original gradation test report and keep it with the MONITOR test work sheets. No formal reporting of the MONITOR test work sheets. No formal reporting of the MONITOR test data need be done. Testing should be done at the earliest practical time in order to expedite the evaluation.

NOTE: If the MONITOR sample has previously been washed in conformance with the AASHTO T-11 test procedure, then this procedure need not be employed in the District Central Laboratory. Accordingly, the quantity lost in the initial application of the AASHTO T-11 shall be considered the total minus #200 sought and this quantity shall be added to the weight of the MONITOR sample prior to making test computations.

3.4 The MONITOR test data shall be compared with the original test data in the following manner:

3.4.1 Determine the differences in test values for each of the specification sieves by subtracting the smaller test value from the larger test value.

3.4.2 Obtain the sum of the differences in test values.

3.4.3 Determine the average difference in test values by dividing the sum of the differences as described in 3.4.2 above by a whole number corresponding to the number of sieves used in the gradation test. The value thus obtained will be called the AVERAGE TEST DIFFERENCE (ATD).

3.5 The following guide shall be used as an aid in evaluating the ATD and determining appropriate actions to be taken.

3.5.1 If the value of the ATD is equal to or less than 2.5 (ATD ≤ 2.5), the comparison would probably be considered favorable and no further investigation would be made. As a consequence, the testing technician should be instructed to discard the LOT of samples from which the MONITOR sample was selected.

3.5.2 If the value of the ATD is greater than 2.5 but equal to or less than 4 (2.5 < ATD ≤ 4), the comparison would probably be considered questionable and approximately one third of the remaining samples in the LOT from which the MONITOR sample was selected should be tested and they should each comply with the requirement set out in 3.5.1 above. If each of the latter tests does comply, then the action set out in 3.5.1 should be taken. If each of the latter tests does not comply, then all remaining samples should be tested and the action set out in 3.5.3 below should be taken.

3.5.3 If the value of the ATD is greater than 4 (ATD > 4), all remaining samples in the LOT from which the MONITOR sample was selected should be tested. A sufficiently thorough investigation should be made by the District Materials Engineer/Supervisor to allow him to make a judgment regarding the cause for the unfavorable test comparison. The results of this investigation and all pertinent test data will be reported in a District Materials Inspection Report (DMIR). The investigation and reporting shall be accomplished at the earliest practicable time so that the situation may be most expeditiously resolved. The Materials Control, Soils and Testing Division should be consulted when the action set out in this article is to be taken.

3.6 At the end of each fourth evaluation period, approximately four weeks, the District Materials Engineer/Supervisor shall prepare a report entitled "Implementation of Procedures for Monitoring Activities Related to the Sieve Analysis of Fine and Coarse Aggregate". The report will generally consist of a single page on which six columns of information or data is recorded as follows:

3.6.1 Column 1 shall be headed "Test Location". Give job location or plant or sublab location where tests were conducted.

3.6.2 Column 2 shall be headed "Date of last Monitor Sample Selection".

3.6.3 Column 3 shall be headed "Date of this Monitor Sample Selection".

3.6.4 Column 4 shall be headed "Number of Samples in LOT". Give the number of samples in LOT from which the Monitor sample was selected.

3.6.5 Column 5 shall be headed "Standard Aggregate Size". Give item number for base course materials.

3.6.6 Column 6 shall be headed "Average Test Difference". Report value of ATD to nearest 0.1. The reports shall be identified as having been issued in accordance with this memorandum, ML-25.

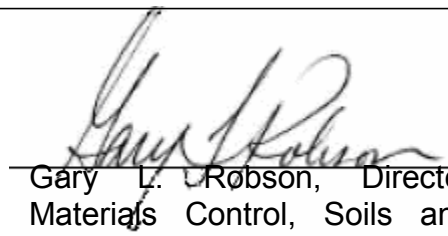
3.7 The reports described in article 3.5.3 and subsection 3.6 shall be distributed as follows:

3.7.1 District Materials Inspection Report::

1 copy to District Materials File
1 copy to MCS&T Division
1 copy to Construction Division
1 copy to District Engineer, if requested

3.7.2 Four-Week Reports:

1 copy to District Materials File
1 copy to MCS&T Division
1 copy to Construction Division
1 copy to District Engineer



Gary L. Robson, Director
Materials Control, Soils and
Testing Division

GLR:k

MP 106.03.50
ISSUED: FEBRUARY 1998
1ST REVISION: APRIL 2000
2ND REVISION:AUG 2008
PAGE 1 OF 8

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

GENERAL INFORMATION GUIDE FOR QUALITY ASSURANCE TESTING

1.0 PURPOSE

1.1 The purpose of the West Virginia Division of Highways (WVDOH) Technician and Inspector Certification Program is to improve the quality assurance of embankments, subgrades, base course, asphalt and Portland cement concrete by the certification of industry and Division of Highways personnel. This procedure is to establish guidelines for this purpose.

2.0 GENERAL

2.1 It is the Division's intent to conduct a cooperative program of training, study, and examination so that personnel of the producer, contractor, and the Division of Highways will be able to better assure, by their increased technical knowledge, the level of quality required by the governing specifications.

3.0 SCOPE

3.1 This procedure is applicable to all requirements, guidelines, and other support documents of the Division of Highways that reference conditions, methods, and levels of qualification specific to the Division of Highways training and certification program.

4.0 POLICIES AND ADMINISTRATION

4.1 Board of Certification - The Certification Program will be carried out in accordance with general policy guidelines established or approved by the State Highway Engineer. The State Highway Engineer will be advised by a Board composed of the following members:

1. Director of Materials Control, Soils and Testing Division
2. Director of Contract Administration Division
3. Director of Maintenance Division
4. Director Human Resources Division
5. Representatives of the Contractors Association of West Virginia
6. Representatives of West Virginia Hot-Mix Asphalt Materials Producers
7. Representatives of the West Virginia Aggregate Producers

8. Representatives of the West Virginia Cement Concrete Materials Producers

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4.1.1 The Certification Board will meet upon call of the State Highway Engineer.

4.2 Administration - The program will be administered by the Director of the Materials Control, Soils and Testing Division (hereafter referred to as "Director"). The Director will have the assistance of an Implementation Committee appointed by the State Highway Engineer as follows:

1. Director of Materials Control, Soils and Testing Division
2. One senior representative of the Contract Administration Division
3. One senior representative of the Maintenance Division
4. A representative of the Human Resources Division of the Division of Highways

4.2.1 In addition to the above, the non-Division of Highways members (Section 4.1) of the Certification Board may jointly select representatives of producers and contractors to work with the Implementation Committee at such times and on such matters as the Director and the representatives mutually agree. These representatives shall not be candidates for certification.

4.2.2 The Implementation Committee will meet upon call of the Director, or person authorized by the Director.

4.2.3 A Program Coordinator is to be recommended by the Implementation Committee and selected by the State Highway Engineer. The Committee will be assigned to assist the Director in administering the program and to handle planning, administration, and coordinating functions as may be delegated within the scope of appropriate Division of Highways directives.

5.0 REQUIREMENTS

5.1 Where applicable, quality control representatives of a contractor or producer will be certified in one (or more) of the certifications listed in Section 6.0 depending upon the individual’s duties or responsibilities. Responsibilities and qualification requirements are listed in appropriate support documents such as Materials Procedures, Quality Control Plans and others.

5.2 For purposes of the Division's Quality Assurance program, a non-Highways Division certified technician/inspector represents the company of which he/she is a full-time employee on the project, owner, or partner (as defined by the Federal Wage and Hour Legislation). If said company has subsidiary or

affiliated organizations, each organization will be required to have its own certified technicians/inspectors where applicable unless the State Highway Engineer makes an exception. Exceptions will be granted only when it can be proven that the certified technician/inspector actually performs the duties of the technician/inspector for all of the subsidiary or affiliated organizations.

5.3 Designated Highways Division personnel will be certified where applicable in one (or more) of the certifications listed in Section 6.0 depending upon the individual's duties or responsibilities.

6.0 CERTIFICATIONS

6.1 All certifications listed in the sections below require written examinations. Some of the listed certifications require a practical examination after successful completion of the written examination. It is the responsibility of the applicant to determine which certification is applicable to his/her assignment. Following is a description of the certifications listing relevant information about each:

6.2 AGGREGATE CERTIFICATIONS

6.2.1 Aggregate Technician - The written examination for an Aggregate Technician consists of the following areas:

- Aggregate Specifications and Procedures
- Aggregate Fundamentals
- Sampling, Control, and Inspection of Aggregates
- Aggregate Testing

After successful completion of the written examination, the applicant will be required to pass a practical examination consisting of his/her demonstration of testing common to normal aggregate quality requirements. Certification as an Aggregate Technician qualifies the employee, either Industry or Division, to perform sampling and/or testing of aggregates relevant to the quality control program or acceptance program respectively.

6.2.2 Aggregate Sampling Technician - The written examination for an Aggregate Sampling Technician consists of the following areas:

- Sampling Fundamentals
- Sampling Methods and Equipment

The Aggregate Sampling Technician requires only the successful completion of the written examination; no practical examination is required. Certification

as an Aggregate Sampling Technician qualifies the employee, either Industry or Division, to perform sampling of aggregates relevant to the quality control program or acceptance program respectively.

6.3 COMPACTION CERTIFICATIONS

6.3.1 Compaction Technician - The written examination for a Compaction Technician consists of the following areas:

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- Specifications
- Compaction Test Procedures
- Radiation Safety and Nuclear Gauge
- Test Procedure Problems

After successful completion of the written examination, the applicant will be required to pass a practical examination demonstrating his/her proficiency in using the testing equipment. Certification of the Compaction Technician qualifies the employee, either Industry or Division, to conduct tests on all construction materials that require compaction testing.

6.4 CONCRETE CERTIFICATIONS

6.4.1 Concrete Technician - The written examination for a Concrete Technician consists of the following areas:

- Fundamentals
- Sampling and Testing
- Control and Inspection
- Mix Proportioning and Adjustment

The Concrete Technician requires only the successful completion of the written examination; no practical examination test is required. Certification of the Concrete Technician qualifies the employee, either Industry or Division, to make plant and mix adjustments, proportioning, and other duties.

6.4.2 Concrete Technician - The written examination for a Concrete Technician consists of the following areas:

- Fundamentals
- Sampling and Testing
- Control and Inspection
- Specifications

After successful completion of the written examination, the applicant will be required to pass a practical examination demonstrating his/her proficiency in conducting tests common to concrete quality control. Certification as a Concrete Technician qualifies the employee, either Industry or Division, to perform sampling and/or testing of concrete relevant to the quality control program or acceptance program respectively.

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6.5 HOT-MIX ASPHALT CERTIFICATIONS

6.5.1 Hot-Mix Asphalt Technician - The written examination for a Hot-Mix Asphalt Technician consists of the following areas:

- Fundamentals
- Sampling and Testing
- Control and Inspection
- Mix Proportioning and Adjustment

After successful completion of the written examination, the applicant will be required to pass a practical examination demonstrating their proficiency in conducting tests common to Hot-Mix Asphalt quality control. Those persons, who have already completed certification requirements for the Hot-Mix Asphalt Technician program (see Section 6.5.3), and have kept their certification updated, will not be required to retake the practical examination. Certification of the Hot-Mix Asphalt Technician qualifies the employee, either Industry or Division, to take HMA samples, perform quality control or quality assurance testing on plant produced HMA, make plant and mix adjustments, aggregate proportioning, and other duties.

6.5.2 Asphalt Field Technician – The written examination for an Asphalt Field consists of the following areas:

- Surface Preparation
- Mix Delivery and Placement
- Joint Construction
- Pavement Compaction and Compaction Testing

The successful completion of the written examination is the only mandatory requirement for the Asphalt Field Technician. No practical examination test is required; however, see Section 6.5.2.1 for additional information regarding asphalt pavement density testing. Certification as an Asphalt Field

Technician qualifies the employee, either Industry or Division, to oversee or inspect asphalt pavement construction. In addition, the class hand-out material is a valuable reference tool for each stage of the construction process. The required radiation safety training is not included in this class.

6.5.2.1 For those Asphalt Field Technicians that wish to become certified to perform nuclear density testing of asphalt pavements, they must be evaluated by qualified District personnel on the first WVDOH paving project in which they perform this testing. The District personnel will make the decision as to whether or not the technician is correctly conducting the nuclear density tests in accordance with Division specifications. The District will also complete an evaluation form and send it to the Materials Control, Soils & Testing Division for

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processing. A technician that does not demonstrate proper nuclear density testing techniques shall not be allowed to continue testing on the project. They must be replaced by another qualified technician. Anyone who does not meet the evaluation standards must provide proof of Division approved training before another evaluation will be conducted.

6.5.3 Hot-Mix Asphalt Technician – The Hot-Mix Asphalt Technician certification will no longer be offered by the WVDOH. Those persons who have the Asphalt Technician certification, but do not have the Hot-Mix Asphalt Technician certification, will be allowed to continue HMA sampling and testing activities for the WVDOH, and their certification will be renewable on a regular basis. For those who have both of these certifications, the Hot-Mix Asphalt Technician certification will not be renewed since it will no longer be required.

7.0 TRAINING

7.1 Training - The Division of Highways, contractors, and producers will sponsor courses of instruction consisting of schools and seminars to help prepare personnel for certification under one or more of these certification programs. To the extent possible, these courses of instruction will be joint efforts of the industry and WVDOH. Nothing in this document shall be interpreted to prohibit any party from conducting courses of instruction for their personnel to assist in preparation for these exams.

7.2 The purpose of the schools is to provide helpful information and instruction for persons preparing to take the technician/inspector examinations. These courses are designed to provide instruction for persons with a basic foundation in the subject matter.

8.0 EXAMINATIONS

8.1 Examinations, both written and practical, will be coordinated by the Materials Control, Soils & Testing Division of the Division of Highways. The locations and dates of the examinations will be announced at least two weeks prior to being given. The examinations may be held on a regional basis when feasible. All written examinations will be a one-part, 'open-book' type, with a maximum time limit of three hours. Practical examinations require performance of the tests required by the specifications for the material type involved.

8.2 To pass the written examinations, the applicant must obtain a score of at least 70 percent. There will be two written examinations per certification topic each year prior to May.

8.3 After the applicant passes the written examination, they will have two attempts within a 12 month period to pass the practical exam.

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8.3.1 A third written examination shall be offered per certification in July for a fee of $250.00. This examination is limited to applicants who have not previously taken the written examination more than once within the calendar year. An applicant may only test twice per certification in a calendar year. A practical examination will be offered for those individuals who pass the third examination.

8.4 Certificate Non-Transferable - The status of the certification for a technician or an inspector is not transferable and is valid only for the quality control procedures designated by the bearer's certificate.

8.5 Revocation of Certificate - If at any time a Division of Highways, contractor's, producer's, or supplier's technician or inspector is found to have altered or falsified test reports or is found to have improperly performed tests or reported their results, the individual's certification may be rendered invalid by the State Highway Engineer upon recommendation of the Implementation Committee and/or the Board.

8.6 Renewal and Certification - Certification will be renewed every five (5) years. General guidance and information for renewal will be recommended by the Board as required by the State Highway Engineer. All renewals of certification shall be for a five-year period, and shall terminate on December 31 of the fifth-calendar year after renewal has been made.

8.6.1 The responsibility for applying for re-certification shall lie with the certified individual. The Division of Highways will attempt to contact a person by mail at their last known address. Such contact will be made within sufficient time to notify a person that their certification is about to expire. It is, however, the responsibility of the individual to inform the Division of Highways Human

Resources Division of his/her current address.

8.6.2 Applications for re-certification shall be on a standard form prepared by the Division of Highways and should include a chronological history of the candidates work within the area in which certification has been made. Such history will include only those assignments pertinent to this field during the five-year period for which the person was certified. The purpose of including this work history within this field is to permit the Implementation Committee or other party so designated by the State Highway Engineer to determine if the applicant for renewal had sufficient contact within the area in order to obtain renewal without having to retake the examination.

8.6.3 The above application will be notarized (Section 8.6.3).

8.6.4 The Implementation Committee or other designated party shall establish internal criteria for renewal and shall recommend to the State Highway Engineer disposition of each applicant. The State Highway Engineer may request the Board

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to review applications as required.

8.6.5 Upon obtaining renewal of certification, a renewal card shall be issued.

8.7 Application for Certification - Applications for certification will be directed to the Human Resources Division of the Division of Highways.

9.0 FUNCTIONS AND RESPONSIBILITIES

9.1 Contractor or Producer - The producer and contractor will be responsible for product control of all materials during the handling, blending, and mixing operations. The contractor and producer also will be responsible for the formulation of a design mix that will be submitted to the Division of Highways for approval.

9.1.1 Technician/Inspector - A Quality Control representative of a contractor or producer should be a certified technician/inspector as outlined in Section 5.0 and whose responsibilities may include such duties as proportioning and adjusting the mix, sampling and testing the product, and preparing control charts.

9.2 The Division of Highways - The Division of Highways is responsible for all acceptance decisions.

9.2.1 District Materials Supervisor - District Materials activities are the responsibility of the District Materials Supervisor.

9.2.2 Division Technicians and Inspectors - Division of Highways technicians and inspectors will be assigned as necessary to carry out the required acceptance decision activities. These employees will not issue instructions to the contractor or producer regarding process control activities. However, the Division of Highways representatives have the responsibility to question, and where necessary to reject, any operation or sequence of operations, which are not performed in accordance with the contract documents.

Aaron C. Gillispie, P.E., Director
Materials Control, Soils and Testing Division

ACG:w

MP 300.00.51
ISSUED: NOVEMBER 1976
REVISED: February 2001
PAGE 1 OF 6

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CONTRACT ADMINISTRATION DIVISION

MATERIALS PROCEDURE

PROCEDURAL GUIDELINES FOR MAINTAINING CONTROL CHARTS FOR AGGREGATE GRADATIONS

1.1.1 PURPOSE

1.1 To provide a standard method for developing and maintaining control charts to evaluate the grading characteristics of mineral aggregates.

2.0 SCOPE

2.1 Control charts shall be maintained where specified for sized aggregates, for bases and sub-bases, aggregates for Portland Cement and hot-mix asphalt, etc.

3.0 INTENT

3.1 It is the intent to have the procedure outlined hereinafter used in instances in which it can be reasonably and logically applied. The applicability of the procedure will normally depend on circumstances such as the number of samples, the continuity of delivery, etc. The moving average may not necessarily be continuous for the entire project. A new moving average series may be started after periods of inactivity, changes in materials or processes, change in job mix formula, resuming operations after correcting deficiencies, etc.

4.0 GENERAL

4.1 Paper Charts

4.1.1 Control charts should be prepared on 10 x 10 cross section paper approximately 25 inches wide. A chart length of approximately 30 inches should be displayed at all times. When standard cross section sheets are used, the most recent sheet must be displayed and all the previous sheets placed chronologically in a holder.

4.1.2 The item number and/or description of the material should be noted on the top of the chart and visible at all times.

4.1.3 Control charts will be maintained at the project office or at the testing site where applicable.

4.1.4 Scale – The control chart should have a vertical scale of one division equal to one percentage point (or one inch equal to 10 percent), except in the following cases: (a) a vertical scale of two divisions equal to one percentage point (or one inch equals five percent) should be used for any sieve which has a specification tolerance range less than ten percent, and (b) in the case of coarse aggregates used in Portland Cement concrete, a vertical scale of one division equal to 0.1 percentage point (or one inch equal to one percent) should be used for the #200 sieve.

4.1.5 On the horizontal scale the test values will be plotted on the heavy, vertical lines (one inch apart), progressing from the left to the right.

4.1.6 General Arrangement – Control charts are to be arranged on the cross section paper in the manner described below; an example of the arrangement is shown on Attachment I. [Note on the attachment the 10 X 10 squares are “stretched” vertically to allow the graph to fit the 8 1/2 by 11 paper]

4.1.7 The largest sieve size will be located toward the top of the chart and the smallest sieve size toward the bottom of the chart. The spacing between the lower limit of one sieve and the upper limit of the adjacent sieve should be a minimum of one inch.

4.1.8 The vertical scale for each sieve will be arranged so that the heavy lines will have a value of zero or a value which is a multiple of five. For instance, zero, five, ten, fifteen, etc.

4.1.9 Lines corresponding to the upper and lower limits of the specification will be drawn in red (pen or pencil) across the graph. At the beginning and end of each sheet (or length of the displayed portion) a vertical red line will be drawn between the specifications limits of each sieve, an arrow will be placed at the end of each vertical line. The specification limits will be indicated above and below the arrows, and the sieve size and scale will be indicated between the limits on the outside of the displayed portion of the chart.

4.1.10 Inside the solid red lines, that define the specification limits, two green dashed lines will be drawn. (Note exception in Section 4.1.11). These lines will be located parallel to the specification lines and at a distance from each specification line equal to approximately twenty (20) percent of the specification range. The band (area) between the green dashed lines and the specification line will be known as the caution band. This band may be shaded a light yellow or amber to symbolize the caution which the contractor should exercise to prevent the quality of his/her work from going outside the specification limits.

4.1.11 For screens specifying only 100 percent passing, plotting of caution band is not applicable. Also when the lower specification limit is zero, plotting of the lower caution band is not necessary.

4.1.12 Plotting of Test Data – Individual test values will be plotted with a blue color pen, or pencil, using the symbol O. [For paper charts the circle should be approximately 1/10 (0.1) inch in diameter]

4.1.13 Averages of consecutive test values will be plotted with a red color pen, or pencil, using the symbol ⊡. [For paper charts the square should be approximately 1/10 (0.1) inch on either side]

4.2 Computer Generated Charts

4.2.1 Computer generated charts using any standard variable control charting program may be used that allow hand plotting or computer plotting of the individual data and in a sequence that displays the applicable sieve sizes vertically from largest sieve size at the top of the display to smallest sieve size toward the bottom of the display in the least number of pages as practical when printed. The screen display should show horizontally on any given sieve at least eight potential data areas.

4.2.2 The item number and/or description of the material should be noted on the top of the chart and visible at all times.

4.2.3 Control charts will be maintained at the project office or at the testing site where applicable. These charts must be kept current, printed daily when applicable, and prominently displayed vertically in the specified sieve sequence (from largest sieve to smallest sieve). When printed, the most recent sheet(s) should be displayed and the previous sheets shall be placed chronologically in a holder.

4.2.4 Scale – To the extent possible, the control chart should have a vertical scale which visualizes the differences in tolerances limits between the specified sieves.

4.2.5 On the horizontal scale the test values should be plotted on heavy, vertical lines, progressing from the left to the right.

4.2.6 General Arrangement – Control charts are to be arranged on the computer screen (and when printed and displayed) in the manner described hereinafter.

4.2.7 The largest sieve size will be located toward the top of the chart and the smallest sieve size toward the bottom of the chart. The spacing between the lower limit of one sieve and the upper limit of the bordering sieve should be such that a clear demarcation between sieves is provided.

4.2.8 The vertical scale for each sieve will be arranged so that the heavy lines will have a value of zero or a value which is a multiple of five. For instance zero, five, ten, fifteen, etc.

4.2.9 General construction of the control chart should be the same as described in Sections 4.1.9 through 4.1.13 as applicable.

5.0 PLOTTING TEST DATA

5.1 Symbols and Color Code

5.1.1 Individual test values will be plotted in a blue color using the symbol described in Section 4.1.12.

5.1.2 Averages of consecutive test values will be plotted with a red color using the symbol described in Section 4.1.13.

5.2 Individual Test Values and Moving Average

5.2.1 Test values will be rounded to the nearest whole percentage point and plotted, except the No. 200 sieve will be rounded to the nearest one tenth (0.1) percentage point then plotted.

5.2.2 The average at the start of the job begins with the second sample result. This average will be plotted on the appropriate line on the control chart. Likewise the average is continued for the third through forth result, averaging all previous results and plotting each of these averages on the appropriate line on the control chart. The moving average will be considered to be the average of five

consecutive test values and is determined by starting with the fifth test value and averaging it with the four preceding test values. Thereafter only the last consecutive five sample result will be averaged, i.e., second test value through sixth test value, third test value through seventh test value, and so forth. All averages will be plotted on the control chart in the manner described in Section 4.1.13 and rounded in the manner described in Section 5.2.1.

5.2.3 As successive symbols are plotted across the control chart, from left to right, the blue symbol ⊙ (individual value) will be connected with a dashed blue line as depicted in Attachment 1, and the red ⊡ symbols will be connected with a solid red line as depicted in Attachment 1.

5.2.4 All additional samples, if taken, will be plotted on successive heavy vertical lines and treated in the same manner as above.

5.2.5 At the bottom of the cross section paper, or below the last (smallest) represented sieve size printed from the computer, and immediately left of the vertical line on which test data is plotted, the following information will be written:

1) The laboratory number assigned to the test.

2) The initials of the person plotting the test data.

3) The date the sample was taken.

6.0 INDIVIDUAL OR MOVING AVERAGE TEST VALUES OUTSIDE THE SPECIFICATIONS

6.1 Individual Test Values

6.1.1 When the individual test value on a sieve is outside the specification limits, or differs markedly from those preceding it, the Project Engineer/Supervisor and the contractor will be promptly advised. The contractor will immediately take any steps that may be necessary to bring the production under control.

6.2 Moving Average

6.2.1 When an average value of consecutive tests falls in the caution zone the contractor will be advised that the material is, or is becoming, borderline, and the following notation will be made in the plant or project diary:

"Contractor advised that _____ material is borderline". (Write item number for base course or aggregate size and item number for other material in the blank space).

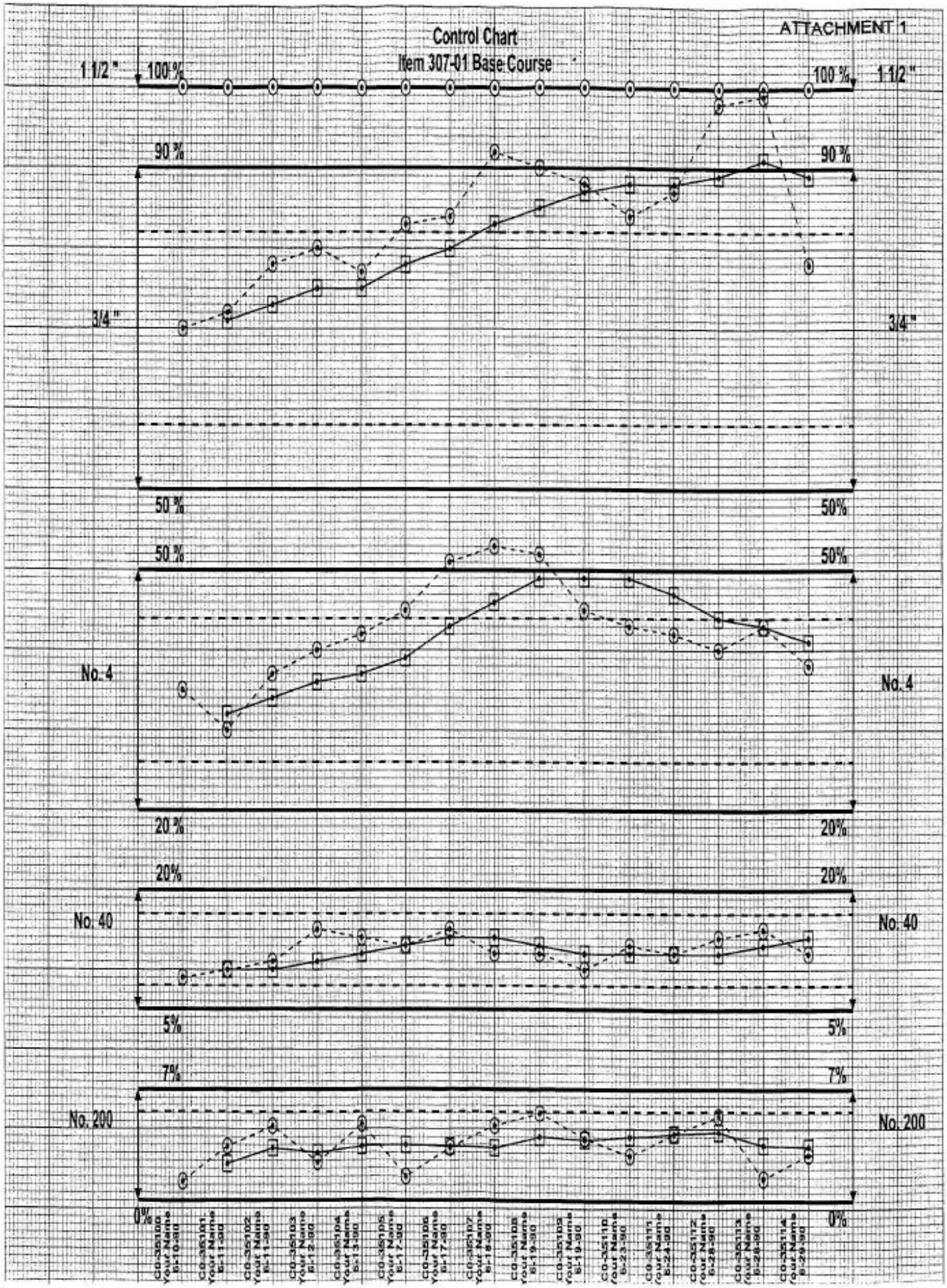
6.3 Material Outside Specification Limits

6.3.1 When three consecutive individual test values are outside the specification limits or when an average of consecutive tests falls outside the specification limits the contractor will be promptly advised that the material is nonconforming, and the contractor will immediately take any necessary steps to correct the deficiencies. When an average falls outside of the specification limits and the two immediately following individual test values are also outside the specification limits, operations will be discontinued until the contractor gives reasonable assurance that the deficiency has been corrected. After the contractor has taken significant steps to correct the deficiency the next individual sample that meets the specifications after production is resumed will be used to start a new average.

Barney C. Stinnett, Acting Director
Materials Control, Soils and Testing
Division

BCS:bk

Attachment


ATTACHMENT 1
Control Chart
Item 307-01 Base Course
1 1/2"
100 %
100 %
1 1/2"
90 %
90 %
3/4"
3/4"
50 %
50%
50 %
50%
No. 4
No. 4
20 %
20%
20%
20%
No. 40
No. 40
5%
5%
7%
7%
No. 200
No. 200
0%
0%
C0-35100 Your Name 8-10-90
C0-35101 Your Name 8-11-90
C0-35102 Your Name 8-11-90
C0-35103 Your Name 8-12-90
C0-35104 Your Name 8-13-90
C0-35105 Your Name 8-17-90
C0-35106 Your Name 8-17-90
C0-35107 Your Name 8-18-90
C0-35108 Your Name 8-19-90
C0-35109 Your Name 8-19-90
C0-35110 Your Name 8-23-90
C0-35111 Your Name 8-24-90
C0-35112 Your Name 8-28-90
C0-35113 Your Name 8-28-90
C0-35114 Your Name 8-29-90

8-17

MP 307.00.50
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WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

GUIDE FOR QUALITY CONTROL AND ACCEPTANCE PLANS FOR SUBGRADE, BASE COURSE, AND AGGREGATE ITEMS

---

1. PURPOSE

1.1 Testing of highway construction materials has traditionally been a two-phased activity; that done by industry in their Quality Control Program and that done by the purchaser to determine the acceptability of the material. In the case of crushed aggregate base course, and other aggregate items, the contractor (whether or not he/she is actually the manufacturer) is by positive statement in the specifications responsible for quality control, and the Division of Highways, as purchaser, is responsible for acceptance (verification) testing. The purpose of this Materials Procedure (MP) is to present guidelines for adequate Quality Control and Acceptance Plans.

2. SCOPE

2.1 This procedure is intended to apply to aggregate products as listed on Attachment 1.

3. REFERENCED DOCUMENTS

3.1 *Material Procedures:*

- MP 300.00.51, Procedural Guidelines for Maintaining Control charts for Aggregate Gradation
- MP 700.00.54, Procedure for Evaluating Quality Control Sample Test Results with Verification Sample Test Results

3.2 *Materials Letter*:

- ML-25, Procedure for Monitoring the Activities Related to Sieve Analysis of Fine and Coarse Aggregate

4. QUALITY CONTROL PLAN

4.1 As stated in the specifications, a Quality Control Plan must be designed by the contractor and submitted to the Engineer at the Pre-Construction Conference. The plan must clearly describe the methods by which the Quality Control Program will be conducted. A Quality Control Plan must include the following:

4.1.1 Name of company official responsible for quality control.

4.1.2 Name of person(s) actually conducting the sampling and testing. These should be Certified Aggregate Sampling Inspectors or Certified Aggregate Inspectors depending upon their assigned responsibilities. If they are not certified, a clear and complete resume of their qualifications should be included for review prior to approval. All persons sampling and testing on National Highway System (NHS) projects will be a Certified Aggregate Sampling Inspector or a Certified Aggregate Inspector depending upon their assigned responsibilities. The Inspector's certification identification number should be included along with any other supporting information.

4.1.3 Items to be controlled and the tests to be performed. Each test should be listed separately.

4.1.4 Sampling and Testing Plan: As a minimum, the sampling and testing plan should detail sampling locations, test methods, and test frequencies to be used (*see* Attachment 1). To facilitate the Division of Highways' monitoring activities, which are described in Section 4.1, all completed gradation samples must be retained by the contractor until further disposition is designated by the District Materials Supervisor. The Quality Control Plan should state where and how these samples will be maintained. Applicable sections of Materials Letter (ML) 25 should be used for guidance.

4.1.5 Testing Facility: The plan should state the specific location where the samples(s) will be tested and retained.

4.1.6 Documentation Plan: The method by which the contractor will document and distribute test results must be described.

4.2 Forms and Distribution: Approved processing forms furnished by the Division will be used to record the test data. Gradation tests will be recorded on Form T300. The laboratory number will always start with a "C" for all quality control samples taken and tested by the contractor. One copy of each completed form should be retained by the contractor until the work is completed and accepted. The original signed copy is to be delivered to the District Materials Supervisor. To be an effective quality control function, tests must be completed and results distributed in a regular and timely manner. The plan, therefore, must state what action will be taken in the event that testing and reporting are not completed in a reasonable period of time – preferably within72 hours after the sample is taken.

4.3 Control Charts: The specifications require the plotting of gradation test results on control charts using the moving average concept as described in MP 300.00.51. The Quality Control Plan should state where and how the charts will be maintained and made available to Division personnel. These charts are part of the Division's acceptance procedures and must be available to the Division when the project is completed. At the contractor's request, the requirement of Control Charts may be waived. The contractor will submit a written request to the Materials Control, Soils and Testing Division asking that Control Charts be waived. Materials Control, Soils and Testing Division will make a determination based on the size of the project and the number of gradation tests required.

4.4 Disposition of Non-Specification Material: A detailed plan of action providing for the immediate notification of all parties involved in the event that nonconforming situations are detected.

5. ACCEPTANCE PLAN

5.1 The specifications state that acceptance (verification) sampling and testing is the responsibility of the Division. Quality control tests are the responsibility of the contractor. Acceptance activities (sampled and tested at the frequency given in Section 4.1.2) may be accomplished by conducting verification sampling and testing completely independent of the contractor and, in some cases, by witnessing tests performed by the contractor, or by a combination of the two. The following guidelines provide a system which should result in sufficient confidence in the contractor's documentation of his quality control operations to permit acceptance of the material in accordance with the procedure set forth in the specifications.

5.1.1 Review all information supplied by the contractor on the Quality Control Plan. Note in particular the qualifications of the sampler and tester and the location and other qualifying statements about the testing facility. In the event the testing facility is such that little qualifying information is supplied or known, this facility should be visited prior to the work and reviewed relative to the availability, type, and suitability (including applicable calibration checks) of the testing equipment. This information should be documented and kept available at the District Materials Section.

5.1.2 Sample and test for applicable items completely independent of the contractor at a frequency equal to or greater than ten (10) percent of the frequency for testing given in the approved Quality Control Plan. Witnessing the contractor's sampling and testing activities may also be a part of the acceptance procedure, but only to the extent that such tests are considered "in addition to" the ten (10) percent independent tests.

5.1.3 Plot the results of gradation tests performed by the Division on the contractor's quality control charts with a red circle, but do not include these values in the moving average. When the contractor's tests are witnessed, circle the contractor's test result on the control chart with red. These values are used in the moving

average calculations. The laboratory number will always start with an "M" for all acceptance (verification) samples taken and tested in this manner by the Division, and will always start with an "O" for all of the contractor's tests which are witnessed by the Division.

5.1.4 Evaluate the results of acceptance (verification) tests, whether performed or witnessed by the Division, in accordance with MP 700.00.54.

5.1.5 If the evaluation indicates similarity with the quality control test, the control chart will be considered acceptable to that point.

5.1.6 If dissimilarity is determined, an immediate investigation will be conducted in an effort to determine the cause. Until the situation is resolved, any samples held in accordance with ML 25 will be retained and may be used in whatever manner deemed appropriate during the investigation.

5.2 Implement ML 25 for aggregate gradations.

Aaron C. Gillispie, P. E.
Director
Materials Control, Soils and Testing Division

ACG:Mw

Attachments

ATTACHMENT 1

MP 307.00.50
ORIGINAL ISSUANCE: NOVEMBER 1976
REVISED: APRIL 2010

GUIDELINES FOR CONTRACTOR'S QUALITY CONTROL

Item Description	Property	Minimum Frequency
207 Subgrade	Gradation	One (1) sample per day of placement. Note 1
	Atterburg Limits	From an approved aggregate source: one (1) test at the beginning of placement and then each 10,000 tons. Not from an approved aggregate source: a minimum of one (1) test per 6 days of placement.
212 Select Material for Backfilling	Gradation	Minimum of one (1) sample per day of production, shipment, or stockpiling.
307 Crushed Aggregate	Gradation	One (1) sample per each one-half (1/2) day of placement. Note 1
	Other tests required by the Contract documents: percent crushed particles, unit weight, Atterburg limits, etc.	One (1) test at the beginning of placement and then each 10,000 tons thereafter (this includes one or more projects)
307 Crushed Aggregate Shoulder Course for Resurfacing Projects	Gradation	One (1) sample per day of placement. Note 1
	Other tests required by the Contract documents: percent crushed particles, unit weight, Atterburg limits, etc.	One (1) test at the beginning of placement and then each 10,000 tons thereafter (this includes one or more projects)
604 Class 1 Aggregate	Gradation	Minimum of one (1) sample per day of production, stockpiling, or placement
606 Aggregate for Underdrain	Gradation	Minimum one (1) sample per day of placement.

ATTACHMENT 1

MP 307.00.50
ORIGINAL ISSUANCE: NOVEMBER 1976
REVISED: APRIL 2010

GUIDELINES FOR CONTRACTOR'S QUALITY CONTROL

Item Description	Property	Minimum Frequency
609 Bed Course Material	Gradation	Minimum of one (1) sample per day of production, stockpiling or placement.
626 Aggregate	Gradation	One (1) Sample per day of placement. Note 1
	Atterburg Limits	From an approved aggregate source: one (1) test at the beginning of placement and then each 10,000 tons. Not from an approved aggregate source: a minimum of one (1) test per 6 days of placement.
636 Aggregate	Gradation	One (1) sample per each one-half (1/2) day of placement. Note 1
	Atterburg Limits	One (1) test at the beginning of placement and then each 10,000 tons thereafter.

Note 1 - In the event project activities are such that relatively small quantities of material are being placed per placement date, and to prevent over sampling, the Engineer may approve the following alternate sampling method: A minimum of one (1) sample per 6 consecutive days shall be taken to represent up to each 170 cubic yards(250 tons). Sampling is to be done on the first day of aggregate placement. In this case the sample shall be taken at a random time and place, represent the same material and production, and shall represent material placed in a reasonable time period.

MP 601.03.51
ORIGINAL ISSUANCE: JULY 1976
1st REVISION: APRIL 2005

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

MATERIALS PROCEDURE

STANDARD METHOD FOR DETERMINATION OF Ā OF THE TOTAL SOLIDS IN PORTLAND CEMENT CONCRETE

1.0 PURPOSE

1.1 To establish a procedure for determining the Ā of the total solids contained in Portland cement concrete.

1.2 To establish a uniform definition of Ā.

2.0 SCOPE

2.1 This procedure shall apply in all cases where the specification requires the determination of Ā of the total solids in Portland cement concrete.

3.0 DEFINITIONS

3.1 Ā (A-Bar) – A factor that characterizes the gradation of an aggregate. The size of the factor is very highly correlated with the aggregate surface area. The Ā factor is used as a control in concrete mix designs.

40 PROCEDURE

4.1 Since the solids contained in a portland cement concrete mix consist of coarse aggregate, fine aggregate, and portland cement, this procedure will address the determination of Ā of these solids in combination.

4.1.1 The mass of the solid materials used in the mix proportions shall be used to determine the percent of each constituent material in the total solids.

4.1.1.1 Determine the total mass of solids:

$$M_{ca} + M_{fa} + M_c = M_t$$

Where:

M_{ca} = mass of coarse aggregate (SSD) used in one cubic yard (meter) of concrete.

M_{fa} = mass of fine aggregate (SSD) used in one cubic yard (meter) of concrete.

M_c = mass of cement used in one cubic yard (meter) of concrete.

M_t = total mass of solids in one cubic yard (meter) of concrete.

4.1.1.2 Determine the fractional part of each solid (solid fraction):

$\frac{Mca}{M_t}$ = fractional part of coarse aggregate in the mix

$\frac{Mfa}{M_t}$ = fractional part of fine aggregate in the mix

$\frac{Mc}{M_t}$ = fractional part of cement in the mix

4.1.2 Determine the gradation of each of the individual materials using standard procedures with the following modifications.

4.1.2.1 When determining the fine aggregate gradation, include Standard Sieve sizes 3/8 inch (9.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 16 (1.18 mm), No. 30 (600 µm), No. 50 (300 µm), No. 100 (150 µm), and No. 200 (75 µm).

4.1.2.2 When determining the coarse aggregate gradation, all material passing the smallest specification sieve shall be sieved through either eight or twelve inch sieves. Only a minor amount of material will be retained on any sieves above the No. 200. This amount of material is considered to be insignificant and is added to the amount retained on the No. 200 sieve.

4.1.3 Determine the Solid Ā's. The Solid Ā of each constituent shall be determined by adding the cumulative percentages by mass of material passing each of Standard Sieve sizes 1 1/2 inch (37.5 mm), 3/4 inch (19 mm), 3/8 inch (9.5 mm), No. 4 (4.75 mm), No. 8 (2.36 mm), No. 16 (1.18 mm), No. 30 (600 µm), No. 50 (300 µm), No. 100 (150 µm), and No. 200 (75 µm) and dividing by 100.

4.1.4 Determine the Ā of each of the solids using the fractional parts (solid fractions) from 4.1.1.2 and the Solid Ā of each constituent from 4.1.3.

$\bar{A}_{ca}$ = fractional part of coarse aggregate x Solid Ā of coarse aggregate

$\bar{A}_{fa}$ = fractional part of fine aggregate x Solid Ā of fine aggregate

$\bar{A}_{c}$ = fractional part of cement x Solid Ā of cement

Where:

$\bar{A}_{ca}$ = Ā of coarse aggregate
$\bar{A}_{fa}$ = Ā of fine aggregate
$\bar{A}_{c}$ = Ā of cement

4.1.5 Determine the Ā of the Total Solids:

$$\bar{A}_{\text{Total Solids}} = \bar{A}_{ca} + \bar{A}_{fa} + \bar{A}_{c}$$

Richard D. Genthner, P.E.
Director
Materials Control, Soils and Testing Division

RDG:Mb

Attachments

EXAMPLE OF CALCULATIONS
Ā TOTAL SOLIDS

1. Total mass of solids in one cubic yard (meter) of concrete:

   M_{ca} = Mass of SSD Coarse Aggregate = 1800 lb. (816 kg)

   M_{fa} = Mass of SSD Fine Aggregate = 1100 lb. (499 kg)

   M_c = Mass of cement = 600 lb. (272 kg)

   M_t = Total mass of Solids

   $M_t = M_{ca} + M_{fa} + M_c$

   M_t = 1800 lb. (816 kg) + 1100 lb. (499 kg) + 600 lb. (272 kg) = 3500 lb. (1587 kg)

2. Fractional part of each solid:

   $\frac{M_{ca}}{M_t} = \frac{1800 \text{ lb. } (816 \text{ kg})}{3500 \text{ lb. } (1587 \text{ kg})} = 0.514$

   $\frac{M_{fa}}{M_t} = \frac{1100 \text{ lb. } (499 \text{ kg})}{3500 \text{ lb. } (1587 \text{ kg})} = 0.314$

   $\frac{M_c}{M_t} = \frac{600 \text{ lb. } (272 \text{ kg})}{3500 \text{lb.} (1587 \text{kg})} = 0.171$

3. Determination of the Solid Ā of each constituent:

	PERCENT PASSING		
Sieve Size	Coarse Aggregate	Fine Aggregate	Cement
1 1/2 in. (37.5 mm)	100	100	100
3/4 in. (19.0 mm)	84	100	100
3/8 in. (9.5 mm)	21	100	100
No. 4 (4.75 mm)	2	98	100
No. 8 (2.36 mm)	1	83	100
No. 16 (1.18 mm)	0	65	100
No. 30 (600 µm)	0	48	100
No. 50 (300 µm)	0	13	100
No. 100 (150 µm)	0	3	100
No. 200 (75 µm)	0.5	1.5	100
Totals	208.5	611.5	1000
Solid Ā's	2.08	6.12	10

4. Determine the Ā of each of the solids:

$\bar{A}_{ca}$ = 0.514 x 2.08 = 1.07
$\bar{A}_{fa}$ = 0.314 x 6.12 = 1.92
$\bar{A}_{c}$ = 0.171 x 10 = 1.71

5. Determine the Ā of the Total Solids:

Ā Total Solids = 1.07 + 1.92 + 1.71 = 4.70

MP 700.00.06
REPLACES: ML-26
ORIGINAL ISSUANCE: MARCH 1968
REVISED: DECEMBER 1988
REISSUED: JANUARY 1995
AMENDED FOR MANUAL 10/04

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

MATERIALS PROCEDURE

AGGREGATE SAMPLING PROCEDURES

1.0 PURPOSE

1.1 To provide a uniform procedure for obtaining aggregate samples.

2.0 SCOPE

2.1 This procedure shall apply to the following:

(a) Process Control sampling by the Contractor.

(b) Acceptance Sampling by the Division.

(c) Independent Assurance Sampling by the Division.

(d) Record Sampling by the Division.

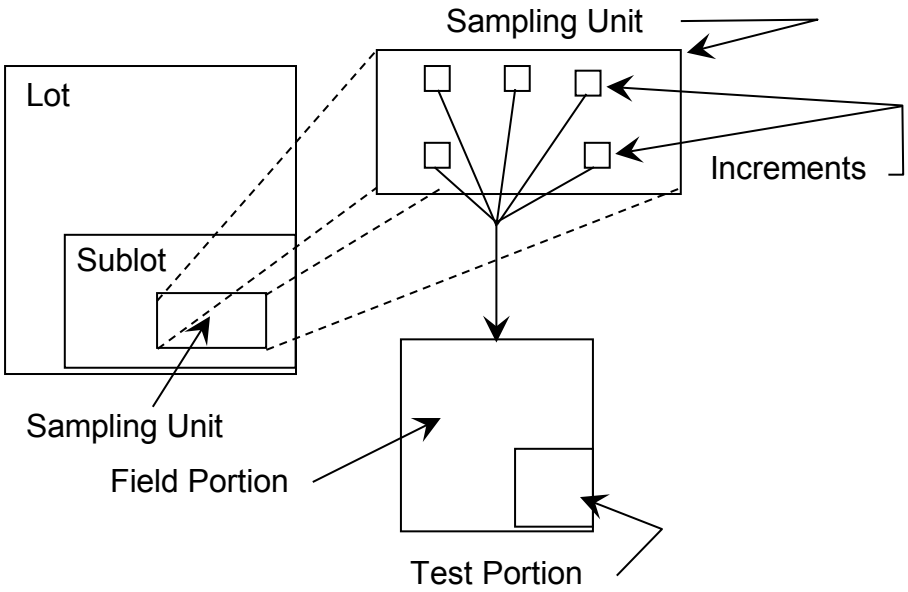
3.0 GENERAL

3.1 Taking a good sample is just as important as conducting a good test. The sampler must use every precaution to obtain samples that will show the true nature and condition of the material they represent.

3.2 Most aggregates are mixtures of various particle sizes, which tend to separate, or segregate, during transporting or stockpiling. For this reason aggregate samples should be obtained at the last practical point before the material is incorporated into the finished product or before compaction.

3.3 Frequency of sampling will be in accordance with the applicable directives for the type sample being procured.

4.0 DEFINITION OF TERMS



4.1 Lot: The quantity of material represented by an average test value, not to exceed five individual test values, calculated in accordance with MP 300.00.51

4.2 Sublot: The quantity of material represented by a single test value. In the case where only one sample is needed for the total plan quantity, the sublot may be considered the Lot.

4.3 Sampling Unit: The quantity of material within the sublot from which increments are obtained to be combined into a field sample.

4.4 Increment: The portion of material removed from the sampling unit to be combined into a field sample.

4.5 Field Sample: A composite of increments.

4.6 Test Portion: The material split from the field sample to be used in performing a specific test.

4.7 Random Location: A location whose position depends entirely on chance. In other words, one location has as good a chance being selected as any other.

5.0 CONTRACTOR RESPONSIBILITY

5.1 The Contractor shall provide suitable equipment needed for proper inspection and sampling, including required access and any special equipment necessary to comply with the appropriate sampling techniques outlined herein. (See Section 105.5 (5th Paragraph) and Section 105.11 (1st Paragraph) of the 2010 Standard Specifications for Roads and Bridges.)

6.0 SAMPLING PROCEDURES

6.1 There are four general areas from which aggregate samples are usually obtained. These include (1) Sampling from the roadway after the aggregate has been placed, but prior to compaction, (2) Sampling from a conveyor belt, (3) Sampling from a flowing stream of aggregate, and (4) Sampling from stockpiles.

6.1.1 Sampling from the roadway (e.g., bases and subbases). The first step in obtaining a roadway sample is to locate the sublot. This is usually the quantity of material that will be represented by the one sample and is defined as a section of roadway of given width and length. The next step is to randomly locate a sampling unit within the sublot. A sampling unit is defined as an area having dimensions of approximately12 feet by 12 feet, or an area of approximately 144 $feet^2$ in locations having any dimension less than 12 feet. Locating the sampling unit is accomplished by use of random numbers contained in Attachment I. Any pair of numbers (decimals) may be used to locate a sampling unit within the sublot. To locate the sampling unit in a sublot defined by area, the length of the area, in feet, is multiplied by one decimal of the pair, and width is multiplied by the other decimal. The resulting distances are to be measured from one end and one side of the area. For example, a sublot of material consists of base course aggregate 26 feet wide from Station 956+00 to 965+00. The total length in feet is thus 96500 minus 95600, or 900 feet. A pencil tossed on Attachment I points to the pair of decimals 0.115 and 0.447. To locate the sampling unit, the first decimal is multiplied by the length of the sublot, and the companion decimal is multiplied by the width.

The length value will be measured from Station 956+00 and the width value from the left-hand edge of the base. Thus, 900 times 0.115 equals 104, and 26 times 0.447 equals 12, so the sampling unit would be located at Station 956+00 plus 1+04, or 957+04 at 12 feet from the left edge. This point could define the center or any corner of the sampling unit. If we use the center, a 12 foot by 12 foot sampling unit would fall between Stations 956+98 and 957+l0 with longitudinal boundaries 6 feet and 18 feet from the left edge of the base. Five approximately equal increments are then located within the sampling unit. This is also best accomplished by means of the random numbers in Attachment 1. Procedures to follow are essentially the same as those set forth for locating the sample unit. The five increments are taken from the sampling unit and combined to form a field sample whose weight equals or exceeds the minimum recommended in Table 1. All increments shall be taken from the roadway for the full depth of the material being sampled, care being taken to exclude any foreign material which may have been incorporated during the normal construction process. The specific areas from which each increment is to be removed shall be clearly marked; a metal template placed over the area is a definite aid in securing approximately equal increment weights.

6.1.2 Sampling from a Conveyor Belt. The first step in obtaining a sample from the conveyor belt is to define the sublot. This is generally defined as a unit of time, i.e., a half-day or a day's production. The next step is to randomly locate a sampling unit within the sublot. A sampling unit in this case is generally considered to be the material contained within the length of the conveyor. Locating the sampling unit is accomplished by use of the random numbers contained in Attachment I. Any number may be used to locate a sampling unit within the sublot. To locate the sampling unit in a sublot defined by time, the length of time, usually in minutes, is multiplied by the random decimal obtained from Attachment I. For example, a sublot of material consists of concrete aggregate used in a half-day's production estimated to be between 8:00 a.m. and 12:00 noon. A pencil tossed on Attachment I points to decimal 0.279. Thus, the sampling unit would be located somewhere within the four hour period (8:00 a.m. to 12:00 noon). Four (hours) times 60 (minutes per hour) times 0.279 equals 67 minutes. The sampling unit would be located 67 minutes after the 8:00 a.m. startup; or at 9:07 a.m. (or as soon thereafter as practical). Five randomly located, approximately equal increments are obtained from the sampling unit and

combined to form a field sample whose weight equals or exceeds the minimum recommended in Table 1. The location of the five increments is determined by multiplying the length of the belt by five random numbers. The conveyor belt is stopped while the increments are being obtained. Two templates, conforming to the shape of the belt and spaced such that the material contained between them will yield an increment of the required size, are inserted into the aggregate stream on the belt. All material between the templates is carefully scooped into a suitable container, including all fines on the belt collected with a brush and dustpan.

6.1.3 Sampling from a Flowing Aggregate Stream (bin or belt discharge). Definition of the sublot and location of the sampling unit is generally identical with sampling from a conveyor belt, with the exception that the sampling unit in this case is defined as that material which will flow during a five minute period. Once the sampling unit is located, five approximately equal increments, randomly spaced, are obtained and combined to form a field sample whose weight equals or exceeds the minimum recommended in Table 1. Each increment is taken from the entire cross-section of the material as it is being discharged. It is usually necessary to have a special device constructed for use at each particular plant. This device will consist of a pan of sufficient size to intercept the entire cross-section of the discharge stream and hold the required quantity of material. A set of rails may be necessary to support the pan as it is passed under the discharge stream. If the sampling pan overflows, it should be struck level so that only material that is within the pan is retained.

6.1.4 Sampling from a Stockpile. If possible, stockpile sampling should be avoided when sampling to determine the gradation of an aggregate. However, circumstances sometimes make it necessary, and when this occurs a sampling plan and the number of samples to be taken must be considered for each specific case. Stockpiled aggregates tend to segregate with the coarser particles rolling to the outside base of the pile, which makes gradation representation difficult. Because of this, every effort should be made to enlist the services of power equipment (such as a front-end loader) to develop a separate small sampling pile composed of material taken from various levels and depths in the main pile. Increments from this pile may be combined, thoroughly mixed, and reduced by quartering and/or sample

splitter to obtain the field sample. Methods for quartering and splitting samples are given in AASHTO R76. If power equipment is not available, hand sampling may be employed to obtain at least three increments per sample: One increment taken from the top one third of the pile, one from the middle and one from the bottom third. When hand sampling, the outer layer of the pile should be removed (scraped away with the shovel) at the point prior to sampling.

7.0 WEIGHTS REQUIRED

7.1 Field Sample Weights

Field sample weights as listed in Table I are minimum values. Actual weights required must be predicated on the type and number of tests to which the material is to be subjected. Generally speaking, the amounts specified in Table I will provide adequate material for routine gradation and quality analysis.

7.2 Test Portion Weight

The weight of the test portion to be obtained from the field sample for a particular test will be defined in the Standard Procedures of the test involved. Reduction of the field sample into test portions is done with a sample splitter. The weight of test portion recommended for gradation testing is given in Table II.

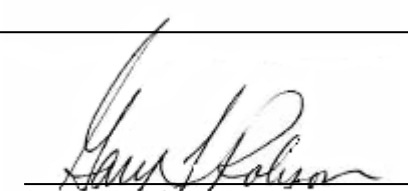
8.0 TRANSPORTING SAMPLES

8.1 Testing at Site of Sampling

Samples taken for testing In the field may be placed in any suitable clean container of appropriate size which is secure enough to prevent loss of material when transporting the sample to the testing location.

8.2 Samples to be Shipped from Site of Sampling

Samples to be shipped should be placed in standard sampling sacks. If the sample contains an appreciable quantity of fine material, a plastic liner should be put in the sack to prevent loss of the fines. Each sack must be securely tied to prevent loss of material in transit. It is also essential that sample identification be maintained from the field to the testing site. Each sack must have appropriate indelible identification attached and enclosed so that field reporting, laboratory logging, and test reporting may be facilitated.



Gary L. Robson, Director
Materials Control, Soils
and Testing Division

GLR:w
Attachments

MP 700.00.06
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ATTACHMENT NUMBER: 1
AMENDED FOR MANUAL 10/04

TABLE I

WEIGHT OF SAMPLES

NOMINAL MAXIMUM SIZE OF PARTICLES*	MINIMUM WEIGHT OF FIELD SAMPLES	
Sieve Size	Kilo	lb
No. 8	10	25
No. 4	10	25
3/8 in.	10	25
1/2 in.	15	35
3/4 in.	25	55
1 in.	50	110
1 1/2 in.	75	165
2 in.	100	220
2 1/2 in.	125	275
3 in.	150	330
3 1/2 in.	175	385

*The nominal maximum size of particles is defined as the largest sieve size listed in the applicable specifications upon which any material is permitted to be retained. Exception: If the specification tolerances are such that no sieve listed has a range of X-100 percent passing, then the next smallest standard sieve, as listed in Table I, and below that sieve which 100 percent must past will be considered the nominal maximum size.

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TABLE II

TEST PORTION FOR GRADATION

NOMINAL MAXIMUM SIZE OF PARTICLES	MINIMUM WEIGHT OF TEST PORTION	
Sieve Size	kg	lb.
No. 8	0.3	0.7
No. 4	0.3	0.7
3/8 in.	1.0	2.0
1/2 in.	2.0	4.0
3/4 in.	5.0	11.0
1 in.	10.0	22.0
1 1/2 in.	15.0	33.0
2 in.	20.0	44.0
2 1/2 in.	35.0	77.0
3 in.	60.0	130.0
3 1/2 in.	100.0	220.0

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ATTACHMENT I

RANDOM NUMBERS

.858	.082	.886	.125	.263	.176	.551	.711	.355	.698
.576	.417	.242	.316	.960	.879	.444	.323	.331	.179
.587	.288	.835	.636	.596	.174	.866	.685	.066	.170
.068	.391	.139	.002	.159	.423	.629	.631	.979	.399
.140	.324	.215	.358	.663	.193	.215	.667	.627	.595
.574	.601	.623	.855	.339	.486	.065	.627	.458	.137
.966	.589	.751	.308	.025	.836	.200	.055	.510	.656
.608	.910	.944	.281	.539	.371	.217	.882	.324	.284
.215	.355	.645	.450	.719	.057	.287	.146	.135	.903
.761	.883	.711	.388	.928	.654	.815	.570	.539	.600
.869	.222	.115	.447	.658	.989	.921	.924	.560	.447
.562	.036	.302	.673	.911	.512	.972	.576	.838	.014
.481	.791	.454	.731	.770	.500	.980	.183	.385	.012
.599	.966	.356	.183	.797	.503	.180	.657	.077	.165
.464	.747	.299	.530	.675	.646	.385	.109	.780	.699
.675	.654	.221	.777	.172	.738	.324	.669	.079	.587
.269	.707	.372	.486	.340	.680	.928	.397	.337	.564
.338	.917	.942	.985	.838	.805	.278	.898	.906	.939
.130	.575	.195	.887	.142	.488	.316	.935	.403	.629
.011	.283	.762	.988	.102	.068	.902	.850	.569	.977
.683	.441	.572	.486	.732	.721	.275	.023	.088	.402
.493	.155	.530	.125	.841	.171	.794	.850	.797	.367
.059	.502	.963	.055	.128	.655	.043	.293	.792	.739
.996	.729	.370	.139	.306	.858	.183	.464	.457	.863
.240	.972	.495	.696	.350	.642	.188	.135	.470	.765

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PAGE 1 OF 6

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
CONTRACT ADMINISTRATION DIVISION

MATERIALS PROCEDURE

PROCEDURE FOR EVALUATING QUALITY CONTROL SAMPLE TEST RESULTS WITH VERIFICATION SAMPLE TEST RESULTS

1.0 PURPOSE

1.1 To provide a procedure for the comparison of quality control sample test results with verification sample test results.

2.0 SCOPE

2.1 This procedure is primarily applicable to the contractor's test results when used in the acceptance process. Other tests, not necessarily applicable to the acceptance process but used for control of materials, may also apply.

2.2 Materials and Tests

2.2.1 Aggregate Gradations

2.2.2 Hot Mix Asphalt

1. Asphalt Content
2. Air Voids
3. Stability
4. Flow

2.2.3 Portland Cement Concrete

1. Air Content
2. Consistency

3.0 PROCEDURE

3.1 The following procedure will be implemented by the District Materials Engineer/Supervisor.

3.2 Immediately after completion of the verification sample, it will be compared to applicable quality control sample test results for the same item. Note that all samples being compared must be taken from the same sampling location, e.g., stockpile, roadway, etc., and sampled and tested in the same manner. The comparison will be made in the following manner (also see sample computation sheets in the attachments).

3.2.1 If there are more than ten quality control samples available, determine the average of the ten consecutive quality control samples ($X\ (bar)_{10}$) whose midpoint is nearest chronologically to the verification sample. Should there only be five to ten quality control samples available, determine the average of all the available consecutive quality control test results. When comparing the grading characteristics of an aggregate, the average (X (bar)) for each sieve will be determined.

3.2.2 In the event there are less than five quality control samples available when the verification sample is complete, the District Materials Engineer/Supervisor will make an informal review of the data. If the data is such that a dissimilarity appears obvious (even without a formal comparison) then Section 4.1 of this procedure would apply. If, however, the verification sample results appear to be similar to the quality control sample results then the verification sample would be judged at this point by the District Materials Engineer/Supervisor to be similar, and the applicable portions of Section 5.1 of this procedure would apply with the following statement: "This verification sample (verification sample number recorded here) has been judged to be similar in accordance with Section 3.2.2 of MP 700.00.54."

3.2.3 Determine the range (R) of the quality control samples used in Section 3.2.1 by subtracting the smallest test value from the largest test value. When comparing the grading characteristics of aggregate, the range (R) for each sieve will be determined.

3.2.4 Compute the interval (I) by substituting the values calculated in Sections 3.2.1 and 3.2.3 into the proper equation below. When comparing the grading characteristics of aggregate, the interval (I) for each sieve will be determined.

No. of Samples Used in Calculating the Average in Section 3.2.1	Equation for Computing the Interval (I)
10	$I = X(bar)_{10} \pm 0.91R$
9	$I = X(bar)_{9} \pm 0.97R$
8	$I = X(bar)_{8} \pm 1.05R$
7	$I = X(bar)_{7} \pm 1.17R$
6	$I = X(bar)_{6} \pm 1.33R$
5	$I = X(bar)_{5} \pm 1.61R$

3.2.5 The interval (I) is determined by first adding the average ($X(bar)_n$) to the product of the range (R) times the given constant (This determines the upper limit of the interval). Note that for gradings, if the result obtained is greater than 100, it will be recorded as 100. And second, subtract the product of the range (R) times the given constant from the average ($X(bar)_n$). This determines the lower limit of the interval. Note here that if the result is less than zero, it will be recorded as zero.

3.2.6 Compare the verification sample test result with the calculated interval. When comparing the grading characteristics of aggregates, a comparison for each sieve will be determined.

3.3 If the verification sample is an aggregate and all sieve results coincide with or lie between the upper and lower limits of the interval, the quality control sample test results will be considered similar to the verification sample test results.

3.4 If the verification sample is an aggregate and any one of the compared values (on any sieve) is not similar to the quality control data, the quality control samples will be considered dissimilar to the verification sample.

3.5 If the verification sample is an asphalt mix, and the asphalt content and air voids coincide with or lie between the upper and lower limits of their interval, the quality control samples will be considered to be similar to the verification sample.

3.6 If the verification sample is an asphalt mix, and any one of the compared values is not similar to the quality control data, the quality control samples will be considered to be dissimilar to the verification sample.

3.7 If the verification sample (test) is Portland Cement concrete, and both the air content and consistency coincide with or lie between the upper and lower limits of their interval, the quality control samples (tests) will be considered to be similar to the verification sample.

4.0 EVALUATION

4.1 If the quality control sample data is dissimilar to the verification sample the following action will be taken where appropriate.

4.1.1 Review the quality control sampling procedure.

4.1.2 Review the quality control testing procedures.

4.1.3 Check testing equipment

4.1.4 Review computations.

4.1.5 Review documentation.

4.1.6 Perform any additional investigations that may clarify the dissimilarity.

5.0 REPORTING

5.1 If the quality control samples are found to be similar to the verification sample, proof of the similarity will be shown on the back of, or attached to, the original verification sample test report. The proof will include all of the calculations specified in Section 3.2.1 through 3.2.6 using the format similar to that shown on the appropriate sample computation sheet (attached). The report should be signed by the District Materials Engineer/Supervisor and distributed as specified in Sections 5.5 and 5.6.

5.2 If the quality control samples are dissimilar to the verification sample, the investigation described in Section 4.0 will be documented on the reverse side, or attached to, the original verification sample test report as described below, omitting the words in parenthesis which do not apply. A copy of all calculations specified in Section 3.2.1 to 3.2.6 using the format similar to that shown on the appropriate sample computation sheet will also accompany the test report.

1. Quality control sampling procedures (are, are not) in accordance with applicable directives.
2. Quality control testing procedures (are, are not) in accordance with applicable directives.
3. Testing equipment (is, is not) in proper working order.
4. Computations (are, are not) correctly performed.
5. Documentation (is, is not) properly performed.
6. Report any other information that may have been determined in accordance with Section 4.1.6.

5.3 All negative replies noted above will be explained. This will include a brief statement of the action taken to correct the deficiency. In the event other documentation is needed, such as a District Materials Inspection Report, to explain and/or support the final resolution of the dissimilarity, the dissimilar verification sample number should be referenced therein.

5.4 Results of the investigation as reported will be signed by the District Materials Engineer/Supervisor.

5.5 On the test report at the bottom will be typed the following: "Issued by District (Number) per MP 700.00.54, (Date)."

5.6 The signed, issued report should be prepared in duplicate and distributed as follows:

5.6.1 The original copy will be submitted to the Contract Administration Division, Materials Section.

5.6.2 On copy should be maintained in the District Materials file.

Robert K. Tinney, Director
Contract Administration Division

RKT:bk

ATTACHMENTS

MP 700.00.54
REPLACES ML27 AND ML31
ISSUED: JULY 1991
REISSUED: JANUARY 1995
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ATTACHMENT NO. 1

COMPUTATION SAMPLE SHEET
ASPHALT

Quality Control Lab. Number	Date	Asphalt Content (%)	Air Voids (%)	Stability Newton's	Flow (0.25mm)
C7-68439	9-15-98	3.8	3.7	9586	11.3
C7-68676	9-16-98	4.3	3.2	9512	9.8
C7-68922	9-16-98	3.5	4.1	9688	10.6
C7-69314	9-17-98	4.0	4.4	9450	11.5
C7-69658	9-17-98	4.2	3.8	9498	10.2
C7-69770	9-18-98	4.0	5.0	9725	9.1
C7-69879	9-22-98	4.0	4.6	9531	10.3
C7-69891	9-22-98	4.0	3.7	9706	11.1
C7-70126	9-23-98	4.5	3.0	9825	11.6
C7-70245	9-24-98	4.3	4.6	9412	10.8
X(bar)	=	4.06	4.01	9593.3	10.63

Property	Average $X(bar)_{10}$	±	Constant (0.91)	x	Range (R)	Interval (I)	V.S.[1] Result	Similar Yes/No
Asphalt Content	4.06		0.91		1.0	5.0/3.2[2]	4.5	Yes
Air Voids	4.01		0.91		3.0	6.7/1.3[2]	3.9	Yes
Flow	10.63		0.91		2.5	12.9/8.4[2]	10.3	Yes
Stability	9593.3		0.91		413	9969/9217[3]	9650	Yes

Note: All four of these tests may not apply to any one sample. For those tests that do apply and all replies in the "Similar" column are "Yes", take action specified in Section 5.1. If one or more of the applicable test replies in the "Similar" column are "No", take action specified in Section 5.2.

1 - Verification Sample.

2 - Round calculated intervals to nearest 0.1 percent.

3 - Round calculated interval to nearest whole Newton.

MP 700.00.54
REPLACES ML27 AND ML31
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ATTACHMENT NO. 2

COMPUTATION SAMPLE SHEET
PORTLAND CEMENT CONCRETE

Quality Control ID or Lab. Number	Date	Air Content (%)	Consistency (Slump) (inches)
01	9-15-98	6.2	2.50
02	9-16-98	7.0	2.75
03	9-16-98	5.2	2.50
04	9-17-98	6.4	3.00
05	9-17-98	5.0	2.75
06	9-18-98	5.8	2.25
07	9-22-98	5.4	2.50
08	9-22-98	4.4	2.75
09	9-23-98	6.0	3.00
10	9-24-98	6.0	2.50
	X(bar) =	5.74	2.65

Property	Average $X(bar)_{10}$ ±	Constant (0.91) x	Range (R)	Interval (I)	V.S.[1] Result	Similar Yes/No
Air Content	5.74	0.91	2.6	8.1/3.4[2]	7.6	Yes
Consistency (Slump)	2.65	0.91	0.75	3.25/2.00[3]	3.00	Yes

Note: If all replies in the “Similar” column are “Yes”, take action Specified in Section 5.1. If one or both of the replies in the “Similar” column are “No”, take action specified in Section 5.2.

1 - Verification Sample

2 - Round calculated interval to nearest 0.1 percent.

3 - Round calculated interval to nearest 0.25 inches.

MP 700.00.54
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ATTACHMENT NO. 3

COMPUTATION SAMPLE SHEET
AGGREGATE GRADATIONS

Quality Control Lab. Number	Date	1 ½"	1"	½"	#4	#8	#200
C7-57698	08-10-98	100	100	25	4	2	0.6
C7-57972	08-10-98	100	100	30	2	2	0.6
C7-58793	08-11-98	100	99	28	2	1	0.4
C7-58845	08-11-98	100	99	49	8	2	1.0
C7-76068	08-12-98	100	100	32	2	1	0.5
C7-76271	08-12-98	100	100	36	1	1	0.6
C7-78174	08-13-98	100	100	42	2	2	0.7
C7-78232	08-13-98	100	100	19	1	1	0.5
C7-78496	08-14-98	100	100	36	2	2	0.3
C7-78541	08-15-98	100	100	43	1	1	0.5
X(bar)	=	100	99.8	34.0	2.5	1.5	0.57

Sieve Size	Average X $(bar)_{10}$	±	Constant (0.91)	x	Range (R)	Interval (I)	V.S.[1] Result	Similar Yes/No
1 ½"	100		0.91		0	100/100	100	Yes
1"	99.8		0.91		1	100/99	100	Yes
½"	34.0		0.91		30	61/7	24	Yes
#4	2.5		0.91		7	9/0	2	Yes
#8	1.5		0.91		1	2/0	1	Yes
#200	0.57		0.91		0.7	1.2/0	0.4	Yes

Note: If all replies in the "Similar" column are "Yes", take action Specified in Section 5.1. If one or more of the replies in this column are "No", take action specified in Section 5.2. All calculated intervals are to be rounded to the nearest whole number except the #200 sieve which is rounded to the nearest 0.1.

* Verification Sample

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PAGE 1 OF 4

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

MATERIALS PROCEDURE

STANDARD METHOD OF TEST FOR PERCENT CRUSHED PARTICLES

1.0 PURPOSE

1.1 To set forth a standard method of test for determining the percent of crushed particles in coarse aggregate (gravel).

2.0 SCOPE

2.1 This method of test is applicable to that portion of crushed gravel which is retained on the No. 4 (4.75 mm) sieve when that material is being used for applications where the standard specifications place a requirement on the percent of crushed particles.

3.0 EQUIPMENT

3.1 A balance or scale with a minimum capacity of 5000 grams and an accuracy of one gram.

3.2 A No. 4 (4.75 mm) sieve meeting the requirements of AASHTO M-92.

3.1 Pans or suitable containers in which to place the aggregate particles as they are separated.

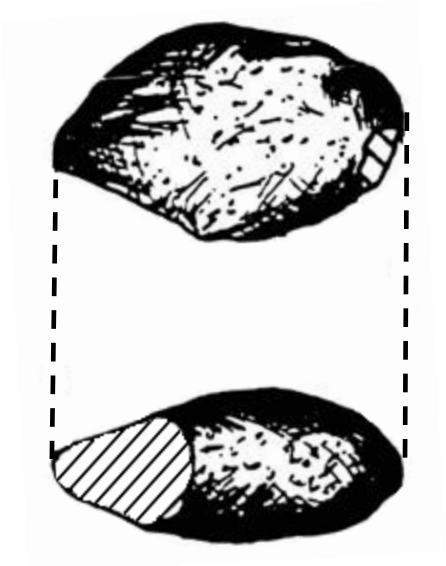
4.0 DEFINITIONS

4.1 Crushed Particle - A particle of aggregate which has at least one fractured face where face fracture is defined as set forth below:

4.2 Face Fracture - A face fracture is defined as a break that has resulted from the production process (crushing operation) and which constitutes an area of at least 25 percent of the largest two dimensional area of the particle remaining.

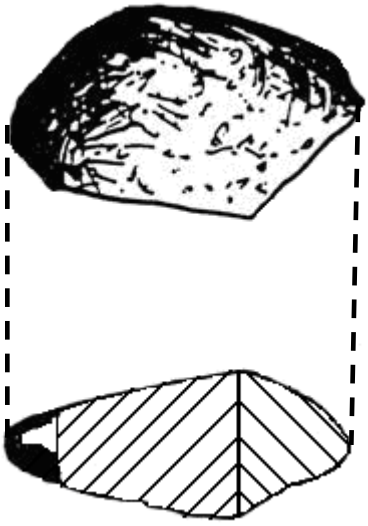
4.3 Single Face Fracture - A particle which has only one exposed break in a single plane meeting the requirements set forth in Paragraph 4.2. An example is shown by Figure 1.

Figure 1



4.4 Multi-Face or Two Face Fracture - A particle which has at least two exposed breaks in two or more different planes meeting the requirements set forth in Paragraph 4.2. An example is shown by Figure 2.

Figure 2



5.0 TEST PROCEDURE

5.1 Obtain from the field sample a test portion of appropriate size by use of a sample splitter.

5.2 Approximate weight of test portion of crushed gravel

MAXIMUM NOMINAL SIZE OF PARTICLE		WEIGHT OF TEST PORTION
3/8 in.	(9.5 mm)	500 grams
3/4 in.	(19 mm)	1500 grams
1 in.	(25 mm)	2000 grams **
1 1/2 in.	(38 mm)	3000 grams
Over 1 1/2 in.	(>38 mm)	5000 grams

**Note: table amended for aggregate manual

5.3 Dry test portion to a constant weight in an oven maintained at 230 ± 9° F (110 ± 5°C).

5.4 Separate the test portion on a No. 4 (4.75 mm) sieve discarding all minus No. 4 (4.75 mm) material.

5.5 Weigh the plus No. 4 material and enter weight on work sheet.

5.6 Place the test portion on a workbench or other suitable workspace arranged in a manner convenient for separating the sample into single-face, multi-face, and no-face fractures.

5.7 Pick up each particle and inspect it to determine the number of face fractures then place it in the appropriate pan or container.

5.8 After the entire test portion has been separated, weigh each fraction and record the weight on the work sheet.

5.9 The entire test portion will be re-combined and the test conducted by a second technician following the steps as set forth in Paragraphs 5.5 through 5.8.

5.10 When the results obtained by two technicians vary more than two percent, it is necessary for both technicians to review the test procedure and re-conduct the test beginning at Paragraph 5.5.

6.0 CALCULATIONS

6.1 Let W_1 = the weight of all particles which meet the definition of two or more face fractures.

W_2 = the weight of all particles which have only one fractured face.

W_3 = the weight of all particles which have no fractured faces.

$W_4 = W_1 + W_2$ = Total weight of all particles which exhibit at least one face fracture or more, namely all crushed particles.

W_5 = Total sample weight

6.2 Percent Crushed Particles (Single-Face or More) =

$$\frac{W_4}{W_5} X 100$$

6.3 Percent Multi-face Fractures =

$$\frac{W_1}{W_5} X 100$$

6.4 When the final two results have been obtained, they shall be averaged and the average reported to the nearest whole percent.

Gary L. Robison, Director
Materials Control, Soils
And Testing Division

GLR:b

T300E
Rev 2017-06-23

WEST VIRGINIA DIVISION OF HIGHWAYS

SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE (AASHTO T-27)
MATERIALS FINER THAN No. 200 SIEVE BY WASHING (AASHTO T-11)

Click To Begin

Site Manager I.D.#:		Aggregate Size:	Class 1	Spec Sieve Sizes	% Pass	Pass /Fail
		Sieve Type Coarse:	12 Inch			
Lab Reference Number:		Sieve Type Fine:	12 Inch			
Technician:		Material Type:	Lime Stone			
Producer / Supplier Code:		Contract #:				
Producer / Supplier Name:		Project #:				
Site Manager Material Code:		Auth #:				
Date Sampled:		Item #:				
Date Tested:		Tons / CY				

(A) Initial Oven Dry Mass of Total Sample	(A)	
(B) Oven Dry mass of Total Sample After T-11	(B)	
(C) Oven Dry Mass of Plus No. 4 Material	(C)	
(D) Oven Dry Mass of Plus No. 4 Material After T-11	(D)	
(E) Oven Dry Mass of Minus No. 4 Material Used in Split	(E)	
(F) Combination Gradation Coarse Fraction Pan Material After Dry Sieving (K)	(F)	
(G) Total Oven Dry Mass of Minus No. 4 Material (E+F)	(G)	
(H) Initial Oven Dry Mass of Total Fine Sample or Mass of Minus No. 4 Material	(H)	
(I) Oven Dry Mass of Total Fine Sample or Mass of Minus No. 4 Material After T-11	(I)	

Sieve Analysis of Coarse Aggregate

Sieve Size	Mass Retained M_R Regular	Mass Retained M_R Combination	Over Loading	% Retained (M_R/A)x100	Percent Passing	Reported Percent Passing	Material Specifications Low	Material Specifications High
(J) Pan								
(K) Combination Grad. Pan								
(L) Loss By T-11								
(M) Final Total (ΣM_R)								

C. F. = (G) ÷ (P)
C. F. = ÷
C. F. =

Sieve Analysis of Fine Aggregate

Sieve Size	Mass Retained M_R Regular	Mass Retained M_R Combination	Over Loading	% Retained (M_R/(HorA) x100	Percent Passing	Reported Percent Passing	Material Specifications Low	Material Specifications High
(N) Pan								

(O) Loss By T-11		Coarse - No. 200 Dry		Fine - No. 200 Dry	
(P) Final Total Fine Sample (ΣM_R)		Coarse - No. 200 Wet		Fine - No. 200 Wet	
(Q) Final Total - No. 4 (ΣM_R)		Total - No. 200		÷ Init. Mass (A) or (H)	
(R) Combined Total (M+Q)			x 100 =		%

(S) Sample Loss or Gain	(A-M) or (M-A)	
	(H-P) or (P-H)	
	(A-R) or (R-A)	
(T) Percentage of Initial OD Mass ((S/A)x100) or ((S/H)x100)		

Name:	
Signature:	
Date:	

Remarks: **Pass/Fail** Lab Info Only:

T-301
Rev. 12-01

WEST VIRGINIA DEPARTMENT OF HIGHWAYS
MATERIALS CONTROL SOILS & TESTING
Ā CALCULATION WORKSHEET

F. S. # _____
Tech. _____
Date _____

Lab Number		Project and Contract C			Date Sampled		Transmit Date
Test Sequence	Material Code	Quantity			Item Number	Plant Source Code	Aggregate Source Code
Sieves:	1st	2nd	3rd	4th	5th	6th	7th	8th	No. 200
Design Number				Unit Weight	Face Fracture % One	% Two	LL	PL	PI
AASHTO Size		Smallest Sieve 100%	Target A-bar	Actual A-bar	FA A-bar	CA No. 200	FA No. 200	Total No. 200	P/F/N

Plant Name _____ Source Coarse Agg. _____

Technician _____ Date _____ Source Fine Agg. _____

Class of Concrete _____ Cmnt Fact _____ Field Sample # _____

Sieves	CA	FA	Cement
1 1/2 in. % pass			100
3/4 in. % pass			100
3/8 in. % pass			100
No. 4 % pass			100
No. 8 % pass			100
No. 16 % pass			100
No. 30 % pass			100
No. 50 % pass			100
No. 100 % pass			100
No. 200 % pass			100
Total			1000.0
Solid Ā s			10.00

Total Mass of Each Solid at SSD in One yd^3 of Concrete From Mix Design

M_{ca} _____ lb

M_{fa} _____ lb

$M_{ca} + M_{fa}$ _____ lb

$*M_c$ _____ lb

M_t _____ lb

Fractional Part of Each Solid (0.001)

$\frac{M_{ca}}{M_t}$ = _____ = _____ :

$\frac{M_{fa}}{M_t}$ = _____ = _____ :

$\frac{*M_c}{M_t}$ = _____ = _____ :

* Include Mass of Fly Ash When Used.

Solid Fraction x Each Solid Ā

Coarse Agg _____ x _____ = _____ $Ā_{ca}$

Fine Agg _____ x _____ = _____ $Ā_{fa}$

Cement _____ x 10.00 = _____ $Ā_c$

Fractional Part of Coarse and Fine Agg. (0.001)

$F_{ca} = \frac{M_{ca}}{M_{ca} + M_{fa}}$ = _____ = _____

$F_{fa} = \frac{M_{fa}}{M_{ca} + M_{fa}}$ = _____ = _____

Adjusted and Maximum Minus No. -200 Based on Fractional Part of Total Aggregate (0.01)

	-No. 200 % pass x F_{ca} or F_{fa} =			Adjusted Total -200 CA + FA
Ā Total Solids	$Ā_{ca} + Ā_{fa} + Ā_c$ _____	CA	_____ x _____ = _____	
Target Ā	_____	FA	_____ x _____ = _____	_____
Ā Tolerance ±	_____	-No. 200 Spec Limit x F_{ca} or F_{fa} =		Max. Allowed Total -.200 CA + FA
Total Ā P/F	_____	CA	_____ x _____ = _____	
		FA	_____ x _____ = _____	_____

T302
Rev. 12-01

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL SOILS & TESTING DIVISION
FACE FRACTURE
MP 703.00.21

Lab Number		Project and Contract			Date Sampled			Transmit Date
		C						
Test Sequence	Material Code		Quantity		Item Number	Plant Source Code		Aggregate Source Code
Sieves:	1st	2nd	3rd	4th	5th	6th	7th	8th	No. 200
Design Number		Bitumen Content Target	Actual	Unit Weight	Face Fracture %One	%Two	LL	PL	PI
AASHTO Size	Smallest Sieve 100%	Target A-bar		Actual A-bar	FA A-bar	CA No. 200	FA No. 200	Total No. 200		P/F/N

Technician 1: _____ Technician 2: _____

Source _____ Date _____ Field Sample # _____

Technician 1. Initial Mass _____

	Mass (Nearest 1g)	Percent of Sample (Nearest 0.1 %)
0 Face		
1 Face		
2 or More Face		
Final Mass		
Total Crushed Particles		

Technician 2. Initial Mass _____

	Mass (Nearest 1g)	Percent of Sample (Nearest 0.1 %)
0 Face		
1 Face		
2 or More Face		
Final Mass		
Total Crushed Particles		

Final Results	Tech 1	Tech 2	Difference (Must be 2% or less)	Tech 1 & Tech 2 Average to Nearest 1 %
0 Face				
1 Face				
2 or More Face				
Total Crushed Particles				

T303E
Rev. 12-00

UNIT WEIGHT OF AGGREGATE

AASHTO T-19

ASTM C-29

CALIBRATION OF UNIT WEIGHT MEASURE

DATE _____

CALIBRATED BY _____

MEASURE SIZE _____

A. Weight of Measure, Glass, Grease, and Water _____

B. Weight of Measure, Glass, and Grease _____

C. Weight of Water in Measure _____

D. Convert g to lb if necessary _____

E. Temperature of Water (Nearest 0.2^{o}F or 0.1^{o}C) _____

F. Weight of Water at Temperature E (from Tables in _____

Aggregate Manual Chap. 5, AASHTO T19, or ASTM C29)

G. Factor for Measure (Round to the nearest thousandth) _____

All Weights rounded to the nearest 0.1 lb or 50 g (0.05 kg)

C = A-B

D = C ÷ 453.6 (If C measured in g)

D = C (If C measured in lb)

G = F ÷ D

T304E
Rev. 12-01

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL SOILS & TESTING DIVISION

UNIT WEIGHT OF AGGREGATE

Lab Number		Project and Contract			Date Sampled			Transmit Date
		C						
Test Sequence	Material Code		Quantity		Item Number	Plant Source Code		Aggregate Source Code

Sieves:	1st	2nd	3rd	4th	5th	6th	7th	8th	No. 200

Design Number	Bitumen Content Target	Bitumen Content Actual	Unit Weight	Face Fracture %One	Face Fracture %Two	LL	PL	PI

AASHTO Size	Smallest Sieve 100%	Target A-bar	Actual A-bar	FA A-bar	CA No. 200	FA No. 200	Total No. 200	P/F/N

Technician _____ Rodded _____ Loose _____ Jigged _____

Source _____ Date _____ Field Sample # _____

	1st Trial	2nd Trial
A. Weight of Measure and Aggregate		
B. Weight of Measure		
C. Weight of Aggregate		
D. Convert Wt. of Aggregate from g to lbs if necessary.		
E. Correction Factor of Measure (Report to the nearest 0.001)		
F. Weight per Cubic Foot (Reported to nearest lb/ft^3)		

G. Average Wt. per Cubic Foot (Reported to nearest lb/ft^3) _____

H. Average Tons/yd^3 (Report to the nearest 0.01 ton/yd^3) _____

All weights measured to the nearest 0.1 lb or 50 g (0.05 kg)

C = A - B

D = C ÷ 453.6g (if C is measured in g)

F = D x E

$G = (F_{1st} + F_{2nd}) \div 2$

H = G X 27 ÷ 2000

T305
Rev. 12-01

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL SOILS & TESTING DIVISION

BULK SPECIFIC GRAVITY AND ABSORPTION FINE AGGREGATE

Laboratory No. _____

Field Sample No. _____

Date _____

Source _____

Tested By _____

(Record masses to 0.1 g)

A = Mass of oven-dry sample in air, grams ((a)-(b)) _____

(a) Mass of oven-dry sample and drying pan in air, grams _____

(b) Mass of drying pan, grams _____

B = Mass of pycnometer filled to calibration mark with distilled water, grams _____

C = Mass of pycnometer, sample, and water to calibration mark, grams _____

D = Mass of saturated-surface-dry sample in air, grams _____

Bulk Specific Gravity (Oven Dry Basis) $= \frac{A}{B+D-C} =$ _____

Bulk Specific Gravity (Saturated-Surface-Dry Basis) $= \frac{D}{B+D-C} =$ _____

Apparent Specific Gravity $= \frac{A}{B+A-C} =$ _____

Absorption, percent $= \frac{D-A}{A} \times 100 =$ _____

Report Specific Gravities to the nearest 0.01
Report Absorption to the nearest 0.1%

T306
Rev. 12-01

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL SOILS & TESTING DIVISION

BULK SPECIFIC GRAVITY AND ABSORPTION COARSE AGGREGATE

Laboratory No. _____

Field Sample No. _____

Date _____

Source _____

Tested By _____

(Record masses to 1 g)

A = Mass of oven-dry sample in air, grams _____

B = Mass of saturated-surface-dry sample in air, grams _____

C = Mass of saturated sample in water, grams _____

Bulk Specific Gravity (Oven Dry Basis) = $\frac{A}{B-C}$ = _____

Bulk Specific Gravity (Saturated-Surface-Dry Basis) = $\frac{B}{B-C}$ = _____

Apparent Specific Gravity = $\frac{A}{A-C}$ = _____

Absorption, percent = $\frac{B-A}{A} \times 100$ = _____

Report Specific Gravities to the nearest 0.01
Report Absorption to the nearest 0.1%

T307
Rev. 12-01

WEST VIRGINIA DIVISION OF HIGHWAYS
MATERIALS CONTROL SOILS & TESTING DIVISION

LIQUID / PLASTIC LIMIT AND PLASTICITY INDEX

Lab Number	Project and Contract	Date Sampled	Transmit Date
	C		

Test Sequence	Material Code	Quantity	Item Number	Plant Source Code	Aggregate Source Code

Sieves:	1st	2nd	3rd	4th	5th	6th	7th	8th	No. 200

Design Number	Bitumen Content Target	Bitumen Content Actual	Unit Weight	Face Fracture %One	Face Fracture %Two	LL	PL	PI
							0	

AASHTO Size	Smallest Sieve 100%	Target A-bar	Actual A-bar	FA A-bar	CA No. 200	FA No. 200	Total No. 200	P/F/N

Technician _____ Date _____ Field Sample # _____

Source _____

Report all masses to nearest 0.01 g.
Calculate % of Water to nearest 0.1%.

LIQUID LIMIT

		A	B	C	D	E	F	G
Dish No.	No. of Blows	Mass of Dish & Wet Soil	Mass of Dish & Dry Soil	Mass of Dish	Mass of Water	Mass of Dry Soil	% of Water	Liquid Limit
1								
2								
3								

PLASTIC LIMIT AND PLASTICITY INDEX

	H	K	L	M	N	P	R	S
Dish No.	Mass of Dish & Wet Soil	Mass of Dish & Dry Soil	Mass of Dish	Mass of Water	Mass of Dry Soil	% of Water	Plastic Limit	Plasticity Index

Liquid Limit

D = A - B

E = B - C

F = (D / E) X 100

G= VALUE FROM FLOW CURVE (Nearest Whole No.) (3 pt. method)
G = F X (CORR. FACTOR) (Nearest Whole No.) (1 pt. method)

Plasticity Index

S = G - R

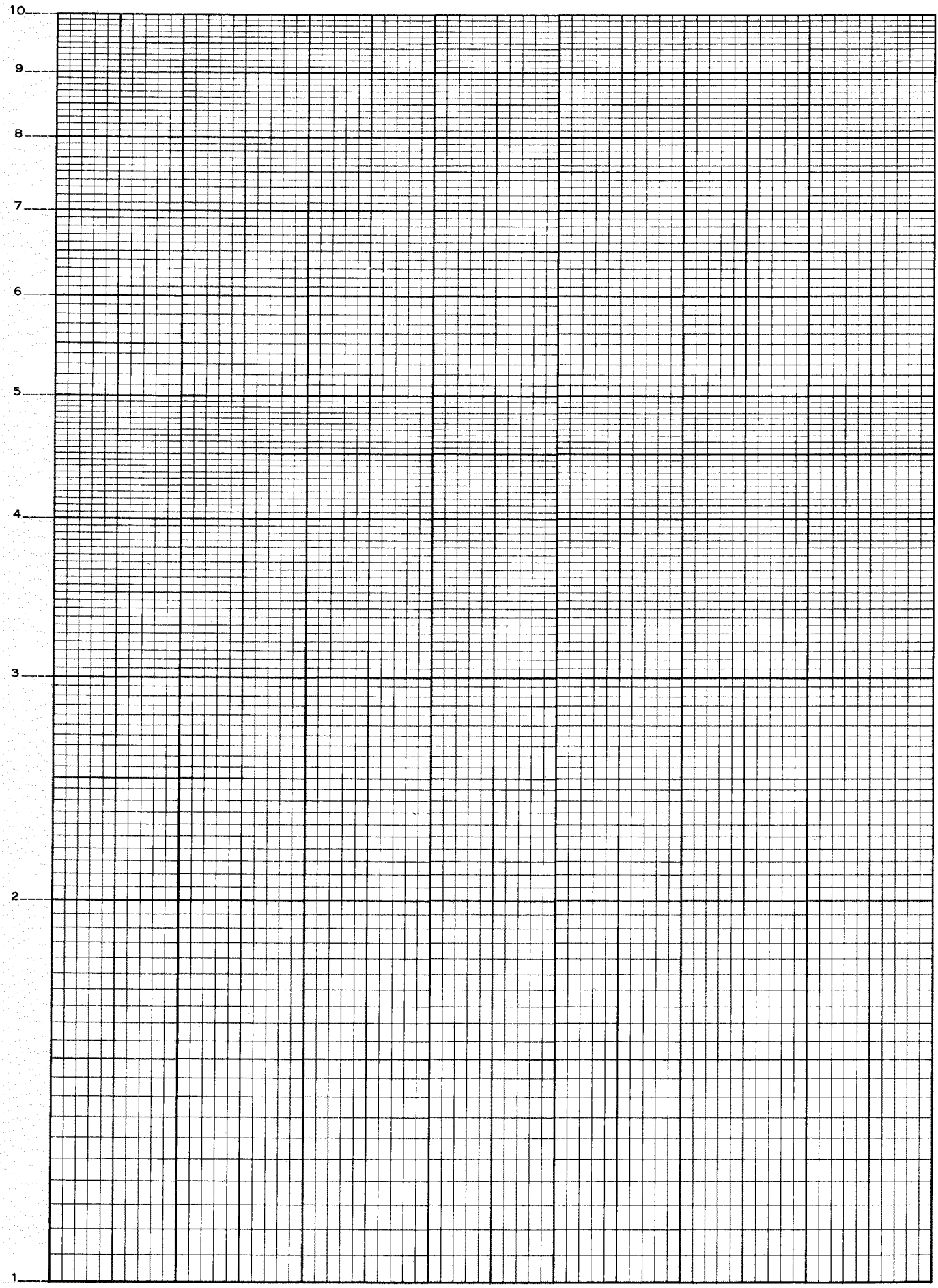
Plastic Limit

M = H - K

N = K - L

P= (M / N) X 100

R = P (Nearest Whole No.)



SEMI-LOGARITHMIC 1 CYCLE BY 10 DIVISIONS PER INCH
CONTROL COMPANY

T100
REV. 1-97

WEST VIRGINIA DIVISION OF HIGHWAYS

TEST SAMPLE DATA

Laboratory Number			
Material Description		Source Code	
Materials Code		Source	
Date Received		Item No. 1	
Project ALP		Item No. 2	
Project/Auth. Number		Quantity	
Date Sampled		Unit	
Sampled By		Station	
Field Sample Number		Elevation	
Bridge Number		Offset	
Test Required		CS Tag Number	
Other Identification			

REMARKS:

EXCERPTS FROM
WEST VIRGINIA DIVISION OF HIGHWAYS
CONSTRUCTION MANUAL 2002
DIVISION 700, MATERIALS CONTROL

MATERIAL	SAMPLE LOCATION	MINIMUM FREQUENCY	SAMPLE SIZE	SAMPLE TESTING	REMARKS
AGGREGATES (Quality Check)					
Commercial Sources	At Source (Sampled by MCS&T Division)	Sampled and tested annually.	75 – 125 lbs (35 – 60 kg)	Tests conducted by MCS&T Division (See Note 4).	For sampling method, see MP 700.00.06.
	At Intermediate or Final Destination (Sampled by field personnel.)	One sample per each 10,000 tons (10 000 Mg) or 5,000 yd_3 (4 000 m_3) of material used for project(s).	Refer to MP 700.00.06.	Tests conducted by field personnel. (See Note 3)	For sampling method, see MP 700.00.06.
Local Sources	At Production or Storage Site (Sampled by field personnel.)	One sample per each six days of production.	Refer to MP 700.00.06.	Tests conducted by MCS&T Division. (See Note 4)	For sampling method, see MP 700.00.06.
	At Production or Storage Site (Sampled by field personnel.)	One sample per each six days of production.	Refer to MP 700.00.06.	Tests conducted by field personnel. (See Note 3)	For sampling method, see MP 700.00.06.
AGGREGATES (Gradation Check)					
Base Course, Subbase and, Shoulders	Typically sampled from the roadway prior to compaction. (See Note 9)	One sample per each half day of operation or as specified in the Contractor's approved Quality Control Plan.	Refer MP 700.00.06.to	Gradation (See Note 1)	Refer to MP 700.00.06.
Portland Cement Concrete	See Remarks.	One sample per each day of operation.	Refer to MP 700.00.06.	Gradation and Total Solids (See Note 1)	Refer to MP 700.00.06 and MP 601.03.51
Misc. Items (bedding, backfill around pipe culverts, underdrains etc.)	Project Stockpile or Production Site	One sample per each half-day of operation or stockpiling.	Refer to MP 700.00.06.	Gradation(See Note 1)	Refer to MP 700.00.06.
Misc. Items (subgrade, select material for backfilling)	Project Stockpile or Production Site	One sample per each day of production or shipment unless otherwise specified.	Refer to MP 700.00.06.	Gradation (See Note 1)	Refer to MP 700.00.06.

MINIMUM SAMPLING AND TESTING CRITERIA
Figure 703A

MATERIAL	SAMPLE LOCATION	MINIMUM FREQUENCY	SAMPLE SIZE	SAMPLE TESTING	REMARKS
AGGREGATES (Density and Thickness Check)					
Base Course and Subbase	Roadway	DENSITY One sample per each working-width layer per 2,000 ft (600 m) (lot size).	As required by governing test procedures.	Conformity with 80% to specified target percent of dry density.	Divide the "lot" into five approximately equal size sublots and randomize location of density tests.
		THICKNESS: One sample per each working-width layer per 1,200 ft (350 m).	As required by governing test procedures.	(See Note 1)	Measure after all fine grading operations are completed and randomize location of thickness tests.

Notes:

1. Refer to the governing section of the contract documents.

2. Unless otherwise specified, take samples at the point of delivery if the material has not been previously sampled and tested by the WVDOH Materials Control, Soils and Testing Division. Certain material sources consistently demonstrate an ability to supply acceptable products. WVDOH periodically samples and tests products from selected material sources and, if acceptable, will designate the source as approved and certified. Contact the Materials Control, Soils and Testing Division for an updated list of approved and certified material sources (e.g., mills, terminals). Unless otherwise specified, if the Contractor provides sufficient documentation to substantiate that a material has been supplied by an approved and certified source, accept the material for use upon delivery to the project site (i.e., no further sampling and testing is required). Otherwise, further sampling and testing may be required. The Project Office should maintain an up-to-date list of all approved and certified material sources that are applicable to the project.

3. Conduct all tests required by the contract documents except for the following: Los Angeles Abrasion (LA), soundness, mortar strength, organic impurities, and deleterious content (analysis optional). The tests may include, but will not be limited to, the following: Atterberg Limits (liquid limit, plastic limit, and plasticity index), percent crushed particles (single-face and multiple-face fracture), unit weight, and others as specified.

4. The WVDOH Materials Control, Soils and Testing Division will test for the following: Los Angeles Abrasion (LA), soundness, deleterious content, mortar strength, and organic impurities.

5. Unless the shipment is certified or pre-tested, take one asphalt sample per shipment at its point of delivery. An asphalt shipment is considered certified if it is shipped from a WVDOH approved and certified material source. Contact the Project Office or Materials Control, Soils and Testing Division for an updated list of approved and certified material sources. A shipping document will accompany each pre-tested asphalt shipment. A laboratory number will appear on the shipping document from which the asphalt material's test results can be obtained. As needed, use this laboratory number to confirm the acceptability of the material.

MINIMUM SAMPLING AND TESTING CRITERIA
(Continued)
Figure 703A

6. The following procedures apply to all quantities of Portland cement concrete from A1 plants and all quantities of miscellaneous concrete, as defined by IM 18, from A2 plants. If sufficient plant production exists, the WVDOH Materials Control, Soils and Testing Division will obtain a minimum of ten randomly selected samples from plant production and test for compressive strength, air content, and consistency. Yield will be determined from one of the ten samples. For a minimum of four of these samples, the batching operation at the plant will be observed to check operational control and to obtain aggregate samples for gradation testing. If plant production is insufficient to fulfill these requirements, however, the Materials Control, Soils and Testing Division will obtain one sample per two days of operation, minimum, and test for compressive strength, air content, and consistency. One yield test will be conducted for every ten samples. For a minimum of 40% of the samples, but no more than four times per month, the batching operation at the plant will be observed to check operational control and to obtain aggregate samples for gradation testing. For testing in either A1 or A2 plants, project personnel may substitute observations of the Contractor's quality control tests in lieu of the testing normally required by Figure 703A, except that occasional testing may be performed on the project to monitor the Contractor's program. In the event that the Contractor's quality control testing does not provide sufficient data to meet the requirements of Figure 703A, additional testing will be performed by the Division to complete the minimum frequency required.

7. The sampling frequency and tests for structural concrete also apply to Portland cement concrete pavement, where coring is considered impractical, and to all structural items constructed with pavement concrete (e.g., approach slabs), if authorized in the contract specifications.

8. Do not accept material delivered to the job site unless the shipment has a corresponding WVDOH approval number. In such cases, contact the WVDOH Materials Control, Soils and Testing Division for resolution or disposition. Refer to the "Evidence of Inspection List," which is updated annually and available in each District office, for the contact person within the Materials Control, Soils and Testing Division and the material's required acceptance criteria.

9. Unless specified otherwise, the Project Engineer may approve sampling at an alternate point if the following conditions are met: a) The material is taken from a conveyor belt or pug mill and hauled directly to and incorporated into the job with samples taken from the conveyor belt or pug mill discharge; b) The sampling procedure is in accordance with MP 700.00.06; and c) Sufficient data is developed to assure that the test results of samples taken from the alternate point do not differ significantly from the test results of samples taken from the roadway.

MINIMUM SAMPLING AND TESTING CRITERIA
(Continued)
Figure 703A