AGGREGATE INSPECTION
FIELD SECTION 1001

1001.1 SCOPE. To establish the duties responsibilities and procedures for aggregate inspection and reporting and to establish requirements for acceptance of dust suppressant additives. The following index lists information included in this Section.

NOTE: Sample weights [masses] shown herein are to be considered as minimum weights

[masses].

NOTE: References to Laboratory contained herein are references to Central Laboratory.

1001.2 DUTIES.

1001.2.1 The duty of an aggregate plant inspector is to make daily observations of the plant, stockpiling, and producing operations; and perform such tests and obtain such samples as may be required to insure that the final product will meet the specification requirements. The plant inspector must understand the problems of the contractor and producer and cooperate to help solve these problems. The inspector may suggest methods or corrective action to the producer only if the producer solicits the inspector's advice. The inspector shall insure that only materials with initial and source approval are incorporated into the final product.

1001.2.2 The frequency of all necessary tests and observations during production depend on the daily rate and difficulties of production. The district Operations Engineer shall determine the frequency required to assure delivery of materials within the limits of the specifications. Additional tests should be made as the material is removed as required, to insure that it still fully complies with the requirements of the specifications.

1001.2.3 The inspector shall complete various forms and reports requiring aggregate inspection and production as required in paragraph 1001.6 of this Section.

1001.2.4 Diary. The inspector shall maintain a bound diary describing the daily activities in accordance with General Sec 4 of this Manual.

1001.3 SAMPLING PROCEDURES.

1001.3.1 General. Samples shall be obtained in a manner to insure positive representative sampling. A representative sample of coarsely graded material from a stockpile or loaded car is extremely difficult to obtain, particularly one intended for sieve analysis.

1001.3.1.1 When taken at the plant during production, a sample should be obtained from the stream at a location to best insure that samples are representative of the material being produced. A sufficient amount of material shall be permitted to flow to insure normal production before sampling is begun. In sampling from the selected location, portions should be taken at regular intervals by passing a pan or other approved sampling device under the full cross section of the stream. These portions are then combined and reduced by use of a sample splitter or other approved method to the proper size for testing.

1001.3.1.2 For conveyor belt sampling, a pan or other approved sampling device may be used to obtain portions from the belt at random intervals by removing a selected portion of material from the belt or by taking portions of the material from the belt discharge as described above.

1001.3.1.3 When sampling a loaded car, the sampler must procure not less than three well-distributed samples to obtain portions to be combined to represent the material in the car. In case of fine aggregate, a sample thief may be used at not less than three well-distributed locations.

1001.3.1.4 When sampling a stockpile, it is recommended that separate samples be taken from different parts of the pile, care being taken to avoid any segregated areas and bearing in mind that the material near the base of the pile is likely to be segregated and coarser than the average of the material in the pile.

1001.3.1.5 Suggested field sample sizes are as follows:

SIZE OF SAMPLES (Original Field Sample)

Nominal Particles	Max. Size of Passing Sieve	Min. Weight [Mass] Field Samples[a]	
mm	Alternate	lb.	kg
	Fine Aggregate		
4.75	No. 4	10	5
	Coarse Aggregate		
9.5	3/8 in	10	5
12.5	1/2 in.	20	10
19.0	3/4 in.	30	15
25.0	1 in.	50	25
37.5	1-1/2 in.	70	30
50.0	2 in.	90	40
63	2-1/2 in.	100	45
75	3 in.	125	60
90	3-1/2 in.	150	65

[a] The samples prepared for tests shall be obtained from the field sample by quartering or other suitable means to insure a representative portion.

NOTE: Nominal maximum size of particle is the largest sieve upon which any material is retained.

1001.4 TYPES OF SAMPLES.

1001.4.1 Initial Approval. Sampling for initial approval shall be done by, or under the supervision of, experienced personnel familiar with this type of work.

1001.4.1.1 Mines and Quarries. Producers should be reminded that all quarries will be sampled initially on a "ledge" basis regardless of intended use. The Initial Sample will be obtained for Laboratory testing from each ledge of stone which varies from the adjacent material. Sampling shall be in compliance with all federal, state and local safety requirements. It is suggested the sample be obtained from the pile after each ledge has been excavated.

1004.4.1.2 New Formations or Special Investigations for Portland Cement Concrete Pavement Aggregates. The District is to consult with Materials, prior to sampling.

1001.4.1.2.1 A new formation is defined as one the department has not previously tested and approved for PCCP. It shall also apply to a new source of a previously tested formation if an examination of the new source indicated the material may have different properties.

1001.4.1.2.2 Special investigations are instances such as testing a previously rejected ledge in combination with approved ledges or other situations the department chooses to investigate.

1001.4.1.2.3 Initial approval for new formations or special investigations for use in PCCP shall start with a review of the service performance of concrete pavement utilizing aggregate from that formation and source (or nearby source). The paving could be city, county, commercial, etc. As much documentation as possible on age, mix design, etc. should be collected and a field review of the installations performed. If service performance is poor, the review may stop at this point and no testing be done. If service performance is satisfactory, sampling and testing may proceed.

1001.4.1.3 Gravel and Sand Sources. A representative sample shall be obtained from the deposit. However, initial approval samples from the deposit will not be required provided plant produced material can be obtained meeting specification requirements, in which case the material may be submitted to the Laboratory for source approval (see source approval).

1001.4.1.4 Lightweight [Low Mass Density] Aggregates. Manufactured lightweight [low mass density] aggregates prepared by expanding, calcining or sintering argillaceous materials such as clay, shales and slates shall be sampled. Care shall be exercised to obtain a representative sample. However, initial approval samples will not be required provided plant produced material meeting specification requirements can be obtained, in which case the material shall be submitted to the Laboratory for source approval.

1001.4.1.5 Other Mineral Aggregates. Other mineral aggregates such as previously produced material, chat, slag, or other manufacturing by-products shall be treated as special cases. The District shall obtain instructions from Materials, prior to sampling these materials.

1001.4.1.6 Sampling. The mine or quarry site should be examined thoroughly, with care taken to obtain samples that represent each of the various ledges exposed in the mine or quarry face being sampled. A ledge stone sample shall include only those materials which indicate the inherent quality of the stone. Any materials which are identifiable as being deleterious shall not be included in the sample of the stone, since the Specifications will control the amount of such material that can be tolerated in the finished product. Any deviation from the above procedure

must be approved by the State Project Operations Engineer.

1001.4.1.6.1 Size of Sample. New formation or special investigation samples for use in PCCP or PCCM when required, shall consist of approximately 2000 pounds [1000 kg] of material for each single ledge of stone. All other samples for the initial approval sample, representing a single ledge of stone, shall consist of 150 pounds [70 kg] of material.

1001.4.1.7 Producer Identification. It is important for historical tracking reasons to keep good records of changes in operators and locations. Facility codes assigned to producers indicate business relationships, not physical locations, which change over time. While it is normally not important as to who owns the physical property (although note when known), it is important as to who is producing the material and where the physical location is. The exact name and location along with the facility number is to be used when referencing a particular source. If either the name and/or location are changed, subsequent reports, samples, and correspondence should use the new name/location with a footnote * (* previously named or located) until enough permanent file records are established for a record. The changes should also be noted in the comments when the facility codes are changed.

1001.4.1.8 Identification of Sample. A SiteManager record, for initial approval samples, is to be filled out in accordance with Automation Section 3510 of this Manual. Ledge numbering instructions are in Automation Section 3900. The record shall indicate that the sample type is Gen Appr Initial.

1001.4.1.9 Columnar Sections. A columnar section, or sketch shall accompany all ledge stone samples, and shall be placed with the original copy of the identification sheet in the shipping envelope, Form T-658. One copy shall also be placed inside the bag.

1001.4.1.10 Time Required for Laboratory Tests. Individual times required to complete the tests may be longer than listed below, depending on the number of samples undergoing tests in the Laboratory.

1001.4.1.10.1 Coarse aggregate from a previously approved source or formation intended for use in portland cement concrete requires a minimum of 16 working days after receipt of the sample in the Laboratory.

1001.4.1.10.2 Coarse aggregate from new formations intended for use in portland cement concrete requires a minimum of 5 months after receipt of the sample in the Laboratory. As an option the producer may hire an independent laboratory to perform the tests. The independent laboratory must be approved by the department, and the test results submitted to the department for interpretation and verification.

1001.4.1.10.3 Coarse aggregates intended for other uses require a minimum of four working days.

1001.4.1.11 Approval of Material. Free Form and Approved Use templates on SiteManager test reports for initial approval samples will indicate the uses for which the material may be suitable, subject to the results obtained on the source approval samples.

1001.4.1.11.1 Approval granted for “all types of highway construction” (Product Code 1005CACP.) constitutes approval for all uses. Approval granted for “all types except PCCP” (Product Code 1005CACM.) comprises approval for all uses except portland cement concrete

pavement. Approval obtained for “all types except PCCP & PCCM” (Product Code 1002CAAC.) is considered to be approval for all uses except portland cement concrete.

1001.4.1.12 Producer Notification. The producer is to be notified in writing of the aggregate uses for which each ledge is suitable. The letter is to explain that tests for initial approval are performed on each ledge in order to determine the inherent quality of the stone for the use intended for the individual ledges. The notification is to state that samples of crushed aggregates produced to comply with Specification Sec 1005 or 1002 will have to be submitted to the Central Laboratory for source approval. The producer is also to be reminded that any produced aggregate must meet all other requirements of the specifications for the intended use. A copy of the letter shall be forwarded to Materials.

1001.4.1.12.1 All correspondence to aggregate producers concerning initial approval is to be addressed using information from the materials producers file as shown in SiteManager as follows:

Contact Person
Facility Full Name or short Name (either)
P. O. Box or Street Address (Address part 2)
City, State, Zip Code

The producer supplier name and producer supplier number is to be shown at the bottom of the page as a filing reference in the manner indicated in the external correspondence standards, e.g.:

City Wide #1, Sugar Cr. Quarry
3003000114

1001.4.2 Source Approval. Source approval based on Laboratory test results will be required on aggregates produced for use to meet the quality requirements of Specifications Sec 1002 and 1005. Source approval is not required for other uses. No produced material of this type is to be accepted for use until a source approval sample has been tested and approved by the Laboratory unless the material is from an operating quarry which previously had source approval. Note that Sec 1009 specifications require a minimum of Sec 1002 source approval.

1001.4.2.1 Sampling. Samples are to represent the final product which has been produced under department inspection to meet a definite specification and intended specific use. Source approval samples will be required every two years. Source samples, submitted to the Laboratory for testing, shall not be used for combination purposes such as production sample, trial mix or any purpose other than Source Approval. If the same ledge or combination of ledges are to be used for products as stated in 1001.12.5 of the Standard Specifications, only one Source Approval Sample will be needed. These samples will be obtained from production of the aggregate with district personnel verifying the ledge(s) for the product. Ledges used shall be approved for the intended use. Under no circumstances will a ledge of lower quality be accepted in combination for a higher quality product, except as outlined in Section 1005.1.1.1 of the Standard Specifications. If multiple ledges are involved, representative samples shall be secured by obtaining three or more approximately equal increments, selected at random from the unit being sampled. The increments shall be gathered over a period time sufficient to ensure the sample is representative of all ledges being combined. The increments shall be combined to form a field sample whose mass equals or exceeds the minimum recommended.

1001.4.2.2 Size of Sample. Source approval samples of coarse aggregate submitted to the

Laboratory shall consist of 150 pounds [70 kg] of any fraction of material produced with the maximum size no smaller than 1/2 inch [12.5 mm] nor larger than 1-1/2 inch [37.5 mm]. Source approval of fine aggregate from natural deposits (i.e.; natural sand) shall consist of 150 pounds.

1001.4.2.3 Identification of Sample. A SiteManager sample record, for source approval samples, is to be filled out in accordance with Automation Section 3510 of this Manual. The record shall indicate that the sample type is "Gen Appr Source (All General Items)." The Sample I.D. number(s) under which the ledge(s) or deposit was tested, and given initial approval, shall be shown under the Other Tab with the type set to “Initial Approval Sample ID #”. Use successive rows with multiple initial approvals and enter ID # in corresponding column.

1001.4.2.4 Time Required for Laboratory Tests. The actual tests conducted in the Laboratory on source approval samples will depend on the uses for which the produced aggregate is intended.

1001.4.2.4.1 Previously approved formation and member sources for coarse aggregate for portland cement concrete requires a minimum of 16 working days from the date received in the Laboratory.

1001.4.2.4.2 Source approval samples of fine aggregate for portland cement concrete require a minimum period of ten working days for complete tests.

1001.4.2.4.3 Coarse and fine aggregate for uses other than portland cement concrete will require a minimum of four working days for the completion of tests.

1001.4.2.5 Approval of Material. Remarks on test reports for source approval samples will state that the sample does or does not comply with specifications for the particular use intended. When compliance is indicated, this constitutes approval of the produced aggregate represented by the sample for the uses shown.

1001.4.2.5.1 When ledges are being resampled in accordance with paragraph 1001.4.3 of this section, production may continue to be accepted providing preliminary test results indicate specification compliance for the material. However, source approval samples should be submitted as soon as possible for the evaluation of future production.

1001.4.2.5.3 If a producer elects to produce material before source approval is granted, the District shall notify the producer by letter that the producer is producing without approval and at risk of rejection. A copy of the letter shall be forwarded to the State Project Operations Engineer.

1001.4.2.6 Producer Notification. The producer is also to be notified in writing of the results of tests on source approval samples of material produced to meet the requirements of Specification Sec 1002 and 1005. The letter is to list the ledges represented by each source sample and reiterate that crushed aggregate must meet all other requirements of the specifications for which it is specifically being produced. A copy of the letter shall be forwarded to the State Project Operations Engineer.

1001.4.2.6.1 All correspondence to aggregate producers concerning source approval is to be addressed using information from the materials producers file as shown in SiteManager as follows:

Contact Person

Facility Full Name or Short Name (either)
P. O. Box or Street Address (Address part 2)
City, State, Zip Code

The producer supplier name and producer supplier number is to be shown at the bottom of the page as a filing reference in the manner indicated in the external correspondence standards, e.g.:

City Wide #1, Sugar Cr. Quarry
3003000114

1001.4.3 Resampling of Approved Ledges.

1001.4.3.1 An approved ledge may be re-sampled any time aggregate produced from the ledge has a significant change in color, texture, characteristics or performance in the approved use. A new initial sample can be requested by either the producer or the department. If requested by the producer, the district must concur. This sample is intended to serve as a quality check sample on material in the ledge. When sampling is performed, the same procedure as outlined for initial approval sampling is to be followed. Produced material previously approved prior to resampling and that produced during Laboratory testing, shall be accepted. The sample record shall indicate reasons for resampling in the remarks. The preceding initial approval Laboratory number shall be listed under the Other Tab, with the Type set to “Initial Approval Sample ID #”.

1001.4.4 Absorption as Received and Rodded Unit Weight [Mass] Samples.

1001.4.4.1 Sampling. Samples of aggregate for portland cement concrete from various sources for rodded unit weight [mass] and absorption as received tests shall be submitted by the District. Generally, two samples per year from a source are sufficient.

1001.4.4.1.1 Samples should not be obtained from each of several plants located on the following sources: the Kansas, Missouri, Mississippi, and Arkansas Rivers. Two samples per year, per stream, per District will be satisfactory for these sources.

1001.4.4.1.2 From the results of these tests, that will be maintained in the Materials Field Office, a tabulation of "Physical Characteristics of Principal Portland Cement Concrete Aggregates Used in Missouri" will be periodically updated and furnished for concrete mix design purposes. When a new source, or a source shown with an asterisk on the current characteristic tabulation, is going to be used, it is desirable to submit a minimum of three and preferably five samples for rodded unit weight [mass] and absorption as received tests, to establish aggregate characteristics for that source.

1001.4.4.2 Size of Sample.

(a) 50 pounds [25 kg] of material or 50 pounds [25 kg] of each fraction in the case of split paving stone) is sufficient for a rodded unit weight [mass] test. It is not necessary to submit special samples for rodded unit weight [mass] of fine aggregate as this will be determined on routine production samples.

(b) A one gallon [4 liter] friction top metal can completely filled with aggregate (one gallon [4 liter] can of each fraction in the case of split paving stone) is sufficient for the absorption as received test. The lid of the container is to be secured immediately after filling, so that moisture

cannot escape from the aggregate. The sample should be submitted to the Laboratory as soon as possible after being obtained.

(c) Samples for both tests should be obtained from current production, if possible, and should comply with all requirements of the Specifications. In order to obtain representative samples of the material produced, the samples should be obtained at intervals throughout the production period. A SiteManager sample record shall be completed in accordance with Automation Section 3510 of this Manual and submitted with the sample. Representative field gradations and quality determinations are to be shown and submitted with each sample marked "Production Sample" and indicating "–Unit Weight [Mass]" or "–Absorption". The ratio of fine to coarse fraction for Gradation A paving aggregate is to be shown on the identification sheet and cross referenced to the companion sample.

1001.4.5 Trial Mix Samples for Bituminous Mixtures. Samples of raw materials for use in bituminous mixtures are required by the Laboratory in order to determine the suitability of the proposed bituminous mixtures.

1001.4.5.1 Sampling. The district's Operations Engineer shall request the contractor to furnish the name and location of the supplier or producer for each of the various materials proposed for use in the trial mixtures. This can be done at or through the Pre-Construction Conference. Where sources of materials are from a District other than the project location, the Contractor should be advised to contact the district's Operations Engineer in that District for necessary inspection. It is the responsibility of the inspecting District to determine if the proposed aggregate sources have initial and source approval, before submitting the trial mix samples.

1001.4.5.1.1 With the contractor's concurrence, the District Geologist or designated representative shall be responsible for obtaining the necessary samples of mineral aggregates to be submitted to the Laboratory for use in trial mixtures. However, the gradations being submitted should first be approved by either the contractor or representative and it is their responsibility to submit the proposed trial mix formula to the District Engineer. The district's Operations Engineer should make every effort to expedite this so the Laboratory will have sufficient time for testing.

1001.4.5.1.2 Extreme care should be used, when obtaining trial mix samples to assure the gradations are representative of the material being produced for that particular bituminous mixture. Trial mix samples may be obtained by accumulating representative portions of routine job control samples over a period of several days' production until a sufficient quantity has been saved. This quantity should then be mixed thoroughly and reduced to the desired sample size to obtain the gradation for use in the trial mix formula. If there is insufficient time to use the above method then the gradation of the trial mix samples, however obtained, should be compared for compatibility with prior job control gradations. Good judgment should be exercised as to whether the trial mix sample gradation is representative of production and should be submitted for trial mix.

1001.4.5.1.3 Material produced for trial mix samples shall be obtained from specific ledge combinations. This ledge combination represented by the sample must be maintained throughout production of the stockpile being produced.

1001.4.5.2 Size of Sample. Minimum sizes of samples for these materials shall be as follows:

TRIAL MIX SAMPLE SIZE

Type of Mixture Desired	* Minimum Total Pounds [kg] of Material
Recycled Asphaltic Concrete	150 [75] RAP 200 [100] coarse aggregate 150 [75] sand
Other Asphaltic Concrete	250[125] coarse aggregate 150 [75] each, natural and/or manufactured sand
Two (2) Asphaltic Concrete Mixes Submitted in Combination**	400 [200] coarse aggregate 200 [100] each, natural and/or manufactured sand
Plant Mix Bituminous Pavement or Surface Leveling Plant Mix	200 [100] coarse aggregate 100 [50] sand or screenings
Plant Mix Bituminous Base	250 [125] coarse aggregate 100 [50] sand or screenings (if used)

* If the coarse aggregate is furnished in more than one fraction, a minimum of 150 pounds [75 kg] of each fraction should be submitted.

** If mixes are being submitted in combination and only two fractions are used, 200 pounds [100 kg] of each should be submitted.

To avoid delays, good judgment should be exercised. It is better to send too much material than too little. Each sample shall be properly identified to correspond with the SiteManager sample record, which shall be filled out to show all of the necessary information concerning the sample.

1001.4.5.3 After obtaining the required quantity of aggregate, the following procedures are recommended to ensure the gradation of the aggregate in each bag is as nearly the same as possible.

(a) 100 pounds [50 kg] (2 bags) Required:

Split 50 pounds [25 kg] (one bag) into 1/2 portions and place into two bags. Repeat with second bag adding to material in bags containing material split from first bag.

(b) 200 pounds [100 kg] (4 bags) Required:

Combine 100 pounds [50 kg] (2 bags) using 100 pounds [50 kg] (2 bags) method. Repeat with remaining 100 pounds [50 kg] (2 bags). Take 50 pounds [25 kg] (one bag) from each group and combine using 100 pounds [50 kg] (2 bags) method. Repeat with remaining bags.

(c) 400 pounds [200 kg] (8 bags) Required:

Combine 200 pounds [100 kg] (4 bags) using 200 pounds [100 kg] (4 bags) method. Repeat with remaining 200 pounds [100 kg] (4 bags). Take 50 pounds [25 kg] (one bag) from each group and combine using 100 pound [50 kg] (2 bags) method. Repeat with remaining bags.

(d) 800 pounds [400 kg] (16 bags) Required:

Combine 400 pounds [200 kg] (8 bags) using 400 pounds [200 kg] (8 bags) method. Repeat with remaining 400 pounds [200 kg] (8 bags). Take 50 pounds [25 kg] (one bag) from each group and combine using 100 pound [50 kg] (2 bags) method.

Repeat with remaining bags.

(e) Comments: A "Gilson Splitter" with a bag attachment is recommended for this procedure.

(f) If an odd number of bags is required, prepare the trial mix sample with the next larger number of bags in the above method and throw away surplus bags. For example, if 250 pounds [125 kg] (5 bags) is required, prepare 400 pounds [200 kg] (8 bags), select 50 pounds [25 kg] (one bag) for the field gradation, throw 100 pounds [50 kg] (2 bags) away and submit 250 pounds [125 kg] (5 bags) to the Central Laboratory.

1001.4.5.4 Identification of Sample. A SiteManager sample record for trial mix samples is to be filled out in accordance with Automation Sec 3510 of this Manual. The record shall indicate that the sample type is “Trial Mix”. The Sample ID number(s) under which the ledge(s) or deposit was tested and given source approval, shall be shown under the Other Tab. Select Source Approval and enter ID # in corresponding column.

1001.4.6 Production Samples.

1001.4.6.1 Sampling. Production samples are those samples submitted to the Laboratory to check the accuracy of field analysis and the characteristics of the product.

1001.4.6.1.1 Production samples of aggregates produced to meet the quality requirements of portland cement concrete and asphaltic concrete shall be submitted to the Laboratory no less than twice per year. The first sample shall be obtained within 3 days of the beginning of production and the second with 30 days. Production samples shall be submitted at least every 30 days from plants supplying 1,000 tons [Mg] or more of the aggregate per month. Production samples may be submitted on other types of aggregate material at the discretion of the District. Samples are to represent the final product which has been produced under department inspection to meet a definite specification and intended specific use. Production samples may be obtained by retaining half of the final split for gradation samples until the required amount is obtained. This is one method that may be used to ensure a representative sample is obtained. Production samples, submitted to the Laboratory for testing, shall not be used for combination purposes such as source sample, trial mix or any purpose other than production samples. Production samples may be submitted on other types of aggregate material at the discretion of the district.

1001.4.6.2 Size of Sample. Production samples shall be submitted to the Central Laboratory for each product produced from a unique combination of ledges. These samples shall consist of 50 pounds [25 kg] of any fraction of material produced with the maximum size no smaller than 1/2 inch [12.5 mm] nor larger than 1 1/2 inch [37.5 mm]. A SiteManager sample record shall be completed in accordance with Automation Section 3510 of this Manual and shall accompany the sample submitted to the Central Laboratory.

1001.4.6.3 Identification of Sample. A SiteManager sample record for production samples

is to be filled out in accordance with Automation Sec 3510 of this Manual. The record shall indicate that the sample type is "Production". The Laboratory number(s) under which the ledge(s) or deposit was tested, and given source approval, shall be shown under the Other Tab. Select Source Approval and enter ID # in corresponding column, with the Type set to "Production Sample ID #".

1001.4.7 Compaction Standard Samples

1001.4.7.1 Sampling. Compaction Samples are those samples submitted to the Laboratory to determine compaction characteristics of aggregate used for base in construction projects.

1001.4.7.1.1 Compaction samples produced to meet the quality requirements of aggregate for base shall be submitted to laboratory no less than once per year. The sample shall be submitted from production and represent the product incorporated into the project. Samples for compaction characteristics may be submitted any time a question of the composition of material used for compaction is questioned.

1001.4.7.2 Size of Sample. A sample shall represent a unique combination of ledges. Sample shall consist of 100 pounds of material (2 bags).

1001.4.7.3 Identification of Sample. A SiteManager record for Compaction Standard samples is to be filled out in accordance with Automation Sec 3510 of this Manual. The record shall indicate that the sample type is "Compaction Standard". The ledge source should also be noted under "Plant ID" on the **Addtl Sample Data Tab**. The Sample ID # under which the ledges(s) were tested and given source approval, shall be shown under the **Other Tab**, by selecting "Source Approval Sample ID#" and entering the ID # in the corresponding column.

1001.4.8 Absorption Samples for Bituminous Surfacing

1001.4.8.1 Sampling. Absorption samples for bituminous surfacing may be submitted to the Laboratory to determine absorption of material produced for use as graded aggregate for bituminous surfacing.

1001.4.8.1.1 Absorption samples for bituminous surfacing represent aggregate produced to meet the quality requirements of graded aggregate for bituminous surface. These samples may be submitted to the Laboratory as needed to determine absorption. The samples shall be submitted from production and represent the product incorporated into the project.

1001.4.8.2 Size of Sample. A sample shall represent a unique combination of ledges or deposit location. Sample shall consist of 50 pounds of material (1 bag).

1001.4.8.3 Identification of Sample. A SiteManager record for Absorption samples is to be filled out in accordance with Automation Sec 3510 of this Manual. The record shall indicate that the sample type is "General Prod Absorption". The ledge source should also be noted under "Plant ID" on the **Addtl Sample Data Tab**. The Sample ID# under which the ledge(s) were tested and given source approval, shall be shown under the **Other Tab**, by selecting "Source Approval Sample ID#" and entering the ID# in the corresponding column.

1001.5 FIELD TESTING PROCEDURES.

1001.5.1 Sieve Analysis. Sieve analysis of mineral filler shall be in accordance with AASHTO

T37. Sieve analysis for the determination of particle size distribution of coarse and fine aggregate shall be performed in accordance with the following procedures:

1001.5.1.1 Apparatus.

(a) Balance or Scale - The balance or scale shall be accurate to within 0.5 percent of the weight [mass] of the sample to be weighed (determined).

(b) Sieves - The sieves with square openings shall be mounted on substantial frames constructed in a manner that will prevent loss of material during sieving. Suitable sieve sizes shall be selected to furnish the information required by the Specifications covering the material to be tested. The woven wire cloth sieves shall conform to AASHTO M 92 and be checked for conformance prior to use.

(c) Stove - Electric, natural gas, propane, or other suitable burner capable of maintaining a controlled temperature.

(d) Pans - Pans of sufficient size and quantity for washing and drying samples and for holding separated fractions of material.

(e) Brass sieve brush.

(f) Large spoon or trowel.

(g) Sample splitter.

1001.5.1.2 Sample Preparation. Samples of aggregate for sieve analysis shall be taken in accordance with paragraph 1001.3 of this section and reduced to the proper size for testing by the use of a sample splitter, quartering cloth, or other approved method. The sample for testing shall be approximately the size shown below and shall be the end result of the sampling method. It may be necessary to deviate somewhat from the recommended quantity for certain non-uniformly graded aggregates. For example, a smaller sample may be desirable for Type 3 base containing a small amount of 1-1/2 in. [37.5 mm] size material, in order to avoid having to sieve an excessive amount of fine material. The district's Operations Engineer should be consulted when in doubt as to the size of the sample to use. The selection of samples of an exact predetermined weight [mass] shall not be attempted.

COARSE AGGREGATE

Maximum Size of Particle(1)	Recommended Weight [Mass] of Sample (kg)
2" [50 mm]	9
1-1/2" [37.5 mm]	6
1" [25.0 mm]	4
3/4" [19.0 mm]	2.5
1/2" [12.5 mm]	1.5
3/8" [9.5 mm]	1

(1) Max. size is defined as the smallest sieve through which 100 percent of the material will pass.

FINE AGGREGATE

Concrete Sand (Specification Sec 1005.2)	400 grams
Asphalt Sand (Specification Sec 1001.2)	150 grams
Manufactured Fines (Specification Sec 1002.2) Aggregate with at least 95 percent passing a No. 8 [2.36 mm] sieve	100 grams
Aggregate with at least 85 percent passing a No. 4 [4.75 mm] sieve and more than 5 percent retained on a No. 8 [2.36 mm] sieve	500 grams

1001.5.1.3 Procedure. The sieve analysis shall be performed in accordance with paragraph 1001.5.1.3.1 or 1001.5.1.3.2 depending on whether a dry or washed gradation is desired. A dry gradation may be run on any material where the accuracy of the sieve analysis does not require washing. The district's Operations Engineer should be consulted when there is a question as to whether a dry or washed gradation should be run.

1001.5.1.3.1 Washed gradation.

(a) The test sample shall be dried to a constant weight [mass] at a moderate temperature. The sample shall then be weighed to the nearest minimum scale increment and the weight [mass] recorded under original dry weight [mass] in the plant inspector's workbook Form T-630R. The test sample, after being dried and weighed, shall be placed in a pan and covered with water. The content shall be stirred thoroughly to assure a complete separation of the material finer than a No. 200 sieve [75 µm] from the coarser particles. The use of a large spoon to stir and agitate the aggregate in the wash water has been found satisfactory. Care should be taken to avoid spilling any of the wash water. The contents of the pan should be agitated vigorously and the wash water poured immediately over the smallest sieve called for in the Specification. A larger sieve shall be nested over the small sieve to prevent damage. Agitation should be sufficiently vigorous to result in the complete separation of all particles finer than a No. 200 [75 ? m] sieve from the coarse particles and to bring the fine material into suspension in order that it will be removed by decantation of the wash water. Care shall be taken to avoid, as much as possible, the decantation of the coarse particles of the sample. The operation shall be repeated until the wash water is clear. All material retained on the nested sieves shall be returned to the washed sample. The washed aggregate shall then be dried to a constant weight [mass] at a moderate temperature. The sample shall be weighed to the nearest minimum scale increment and the weight [mass] recorded under washed dry weight [mass] in the plant inspector's workbook Form T-630R.

(b) The sample shall be separated into a series of sizes using such sieves as are necessary to determine compliance with the specification for the material under test. The sieving operation shall be conducted by means of a lateral and vertical motion so as to keep the sample moving continuously over the surface of the sieve. In no case shall fragments in the sample be turned or manipulated through the sieve by hand. Sieving shall be continued until not more than 1 percent by weight [mass] of the residue passes any sieve during 1 minute. When performing the sieving operation, it may be necessary to divide the aggregate into two or more portions for some of the sieves in order to avoid the overloading of the sieve (4 g per sq.in. [6 kg/m^2] of

sieve surface) that would occur if the entire amount were placed on the sieve at one time. When mechanical sieving is used, the thoroughness of sieving shall be tested by using the hand method of sieving as described above.

1001.5.1.3.2 Dry Gradation.

(a) A dry gradation may be used if it has been established that the accuracy of the desired results will not be affected. All samples of aggregate, where the percent of absorbed moisture changes for different particle sizes, shall be dried to substantially constant weight [mass] at a moderate temperature. Samples of aggregate, where the percent of absorbed moisture is essentially constant for different particle sizes, may be sieved as sampled, if sufficiently dry.

(b) The sieving operation for a dry gradation is the same as for a washed gradation as described herein.

1001.5.1.4 Worksheet Form T-630R and Calculations.

1001.5.1.4.1 Passing Basis. One method for calculating gradation on a passing basis is as follows: The material which has been separated by the sieving operation shall be weighed starting with the largest size retained. This weight [mass] shall be recorded in the plant inspector's workbook on the line corresponding to the sieve on which the material is retained. An example is given in Exhibit 1001-B of this section. The second largest sized material is then added to the largest size in the weigh pan and the accumulated total is recorded on the line corresponding to the sieve on which the material is retained. This operation is continued with the accumulated total being recorded on the line corresponding to the sieve on which the material is retained down to the smallest sieve, in this example, the No. 200**?** ? ? **?** m] size sieve. The final quantity of material remaining in the pan (in this instance, minus No. 200 [75 ? m] material) should be recorded on the line designated as "PAN." The "PAN + LOSS" is the sum of the "LOSS" from washing over a No. 200 [75 µm] sieve plus the amount retained in the "PAN". The quantity retained on the smallest sieve is then added to the quantity in the "PAN + LOSS" and is to be recorded on the line designated as "TOTAL". The "TOTAL" should equal the original dry weight [mass] within a tolerance of one gram for each sieve that the material passed through. The difference between the "TOTAL" and the "ORIGINAL DRY WEIGHT [MASS] is recorded on the line designated "DIFFERENCE". Tolerance for the sieving is plus or minis 1 gram per sieve. In the example in Exhibit 1001-B, the tolerance should be equal to or less than plus or minus 5 grams (Five sieves were used, beginning with the smallest sieve through which 100 percent passed). This tolerance is to be recorded on the line designated as "SIEVE ACCURACY".

The total amount of material finer than the smallest sieve shall be determined by adding the weight [mass] of material passing the smallest sieve obtained by dry sieving to that lost by washing. In the example, the amount lost by washing as recorded on the "LOSS" line was found to be 442 grams. The 7 on the "PAN" line shows that 7 additional grams were obtained in the dry sieving operation. This total quantity, 449 grams, is recorded on the "PAN + LOSS" line.

Except for the smallest sieve used, the percent passing is determined by dividing the quantity shown for each sieve by the original dry weight [mass] and subtracting the percentage from 100. The percentage passing the smallest sieve is found by dividing the quantity shown on the "PAN + LOSS" line by the original dry weight [mass]. The percentage for the smallest sieve is shown on the line for that sieve.

After entering information from Form T-630R in the computer, the box at the bottom of the column may be checked and the database "RECORD NO." entered at the top of the column. (NOTE: The record number may change due to deletion of files, therefore this could only be used as a short-term reference for recalling a gradation. After this number becomes invalid, the gradation would have to be located in the database by using the date of testing.

Exhibit 1001-C shows Form T-630R being used to record the gradation of a material produced to meet Section 1003 specifications.

1001.5.2 Plasticity Index.

1001.5.2.1 The plasticity index is defined as the numerical difference between the liquid limit and the plastic limit. The liquid limit is that moisture content, expressed as a percentage of the weight [mass] of the oven-dried material, at which the soil will just begin to flow when lightly jarred. The plastic limit is the minimum moisture content, expressed as a percentage of the weight [mass] of the oven dried material, at which soil threads rolled to 1/8 in. [3 mm] diameter will just begin to break in pieces. All original weights [masses] and calculations shall be recorded on Form T-630R. If the material is such that the plastic limit cannot be determined, the material is to be considered non-plastic. The inspector shall determine the plasticity index, when required, in accordance with the following method.

1001.5.2.2 Apparatus.

(a) Dish - a porcelain evaporating dish or similar mixing dish, about 4-1/2 in. [115 mm] in diameter.

(b) Spatula - a spatula or pill knife having a blade about 3 in. [75 mm] in length and approximately 3/4 in. [19 mm] in width.

(c) Surface for rolling - a ground glass plate on which to roll the sample.

(d) Liquid limit device - a mechanical device consisting of a brass dish and carriage conforming to AASHTO T 89.

(e) Grooving tool - a combined grooving tool and gauge conforming to AASHTO T 89. This tool should be frequently checked for compliance to dimensions.

(f) Miscellaneous containers - containers suitable for mixing, setting and drying the material.

(g) Balance - a balance accurate to 0.01 g.

(h) Oven - an oven, sand bath, or improvised drying unit capable of maintaining a controlled temperature.

(i) Mortar and pestle.

(j) Desicator if available.

1001.5.2.3 Sample Preparation. Minus No. 40 [425 µm] material should be prepared in the following manner, starting with a representative 30 to 40-lb. [15 to 20 kg] sample, in the "as

received" or "as obtained" condition.

(a) Reduce the sample down to 500-2500 g depending on the maximum size of the material.

(b) Sieve through the No. 40 [425 µm] sieve and save both fractions.

(c) Place the plus No. 40 [425 µm] portion in a pan, cover with water and scrub the material between the hands, breaking up all lumps.

(d) Wash the material on the No. 40 [425 µm] sieve until the water is clear, retaining the water and material washed through.

(e) The plus No. 40 [425 µm] material should be dried sufficiently to allow the minus No. 40 [425 µm] particles to be removed by sieving, with care being taken to avoid splattering and loss of material from the sample. Retain all minus No. 40 [425 µm] material.

(f) All of the minus No. 40 [425 µm] material that was washed from the coarse portion is allowed to settle out. It is suggested that a small quantity of vinegar (a bottle-cap full should be sufficient) be added to the water to reduce surface tension and aid settlement of the particles. Most of the liquid may then be siphoned off after one or two hours, depending on the type of material being tested.

(g) The remaining material should be dried in an oven, sand bath, or improvised drying unit with a maximum temperature of 140 F. Care should be taken to prevent splattering and loss of material from the pan. Care shall also be taken to clean the pan thoroughly so that all material will be recovered. Break the material down to pass a No. 40 [425 µm] sieve using a mortar and pestle.

(h) Combine all three portions of minus No. 40 [425 µm] material from (b), (e), and (g); mix thoroughly; and select a sample for test.

1001.5.3 Liquid Limit (Quick Method). The liquid limit apparatus is identical, and the test procedure is similar, to that used in the standard liquid limit method.

(a) About 50 g of dry minus No. 40 [425 µm] material should be thoroughly mixed with water. This need not be weighed accurately. It is not important whether the material actually weighs 50 g or 200 g, except that 50 g is sufficient and the extra volume involves more time and effort to obtain an intimate mixture on material that is not needed or used. The first increment of water can be about 5 to 8 grams, but subsequent additions of water should be in smaller amounts (1 to 3 grams), with each addition accomplished by thorough mixing.

(b) Adjust the liquid limit cup to make certain the drop is exactly 10 mm. The end of the grooving tool handle is 10 mm in diameter.

(c) When the mixture attains the consistency of a thick paste or when the operator considers it to be near the liquid limit, at least 30 g of the mixture should be placed in the cup of the liquid limit machine above the spot where the cup rests on the base. The mixture should be leveled with a spatula with as few strokes as possible so that the maximum thickness is 10 mm (the thickness of the curved section of the grooving tool is 10 mm). The material in the cup should be divided by a firm stroke of the grooving tool along the diameter through the centerline

of the cam follower so that a clean sharp groove is formed. Exhibit 1001-E, of this section, depicts the position of the material in the brass cup. The cup is then attached to the carriage and dropped 10 mm by turning the crank at the rate of two revolutions per second until the two sides of the sample come in contact at the bottom of the groove along a distance of about 1/2 in. [13 mm]. Don't use more material than necessary because the weight [mass] of the extra material will tend to make the groove close at less than the actual liquid limit. The closure at the bottom of a groove may be rather deceptive. Try to judge 1/2 in. [13 mm] accurately. The spatula is usually 3/4 in. [19 mm] wide and will serve as a check on the amount of closure obtained. It does make a difference whether the groove closes 1/8 in. [3 mm], 1/2 in. [13 mm], or 1-1/4 in. [32 mm]

(d) A watch may be used to determine the proper rate for turning the crank, which is two times per second. Much slower or much faster will affect the results. Try to calibrate the time element accurately, so that the crank will be turned at the required rate with reasonable consistency.

(e) The combination of granular material and low moisture at the liquid limit may cause difficulty in cutting the groove. Trying to cut a groove with one continuous motion will probably accomplish nothing except tear the material and pull it out of the cup. Rocking the grooving tool as it moves through the material will give better results. It is permissible to repair any slight tears by light pressure with the spatula, if care is taken not to widen the groove or disturb the mass.

(f) When smoothing the liquid limit sample in the cup, try to avoid entrapment of air since the air pocket will affect the flow and consequently the test result. This is very important.

(g) Before attaching the cup to the machine, wipe the bottom of the cup and the top of the hard rubber block to avoid any cushioning effect and to obtain the proper impact. The acceptable number of blows for groove closure must be within the range of 22 to 28. If the number of blows required to close the groove is less than 22, the sample shall be removed from the brass cup and the material manipulated to reduce the moisture content. Then it shall be returned to the brass cup and the sample rerun. Under no circumstances is dry material to be added to reduce the moisture content. If the number of blows is greater than 28, more water shall be added to the mixture.

(h) The moisture sample should be sliced from the cake of material for about 3/4 in. [19 mm] width extending from edge to edge of the cake of material at right angles to the groove and including that portion of the groove which flowed together. The moisture sample shall be placed into a tarred container with lid and weighed immediately. The sample shall be dried to constant weight [mass] in an oven, sand bath, or improvised drying unit with a maximum temperature of 140 F; allowed to cool in a desicator, if available, and weighed. The loss in weight [mass] shall be recorded as the weight [mass] of water.

1001.5.3.1 Calculations. The liquid limit value is obtained by dividing the moisture percentage by the factor corresponding to the number of blows used to close the groove. The factors to be used for the range of 22 to 28 blows are tabulated below:

Blows	Factor
22	1.017
23	1.011
24	1.005

25	1.000
26	0.995
27	0.990
28	0.985

The liquid limit is expressed as the moisture content in percentage of the weight [mass] of the oven-dried material and shall be calculated as follows:

$$\text{Liquid Limit} = \frac{\text{wt. [mass] of water}}{\text{wt. [mass] of oven-dried soil}} \times 100$$

An example of the liquid limit calculation is as follows:

Number of blows to close groove = 23
Percent moisture content at closure = 41.2 percent
Liquid Limit = 41.2 / 1.011 = 40.7

Report the liquid limit to the nearest whole number which would be 41.

1001.5.4 Plastic Limit.

1001.5.4.1 If the liquid limit test has been performed, a portion of the sample remaining in the cup immediately after completion shall be used as a plastic limit sample.

(a) The plastic limit sample shall consist of approximately 15-20 g of minus No. 40 [425 µm] material. Small increments of water should be added, if necessary, with thorough mixing, kneading, mashing, and cutting action with the spatula following the addition of each increment, making sure that the material and water are mixed thoroughly and uniformly.

(b) Take a portion of the material weighing approximately 4 g, form it into a mass roughly ellipsoidal (egg shaped) in shape and roll it to a 1/8 in. [3 mm] uniform diameter thread approximately 6 in. [150 mm] in length, on a standard glass. Should the thread elongate at any time to a length greater than 6 in. [150 mm], with a diameter greater than 1/8 in. [3 mm], the ends of the thread should be cut off and discarded, leaving a length of 6 in. [150 mm]. The 6 in. [150 mm] thread shall then be cut into six pieces approximately 1 in. [25 mm] in length, the pieces gathered together on the surface of the glass, formed into an ellipsoidal mass, and rolled as before. This alternate rolling to a thread 1/8 in. [3 mm] in diameter, gathering together and rerolling, shall be continued until the thread crumbles under the slight pressure required for rolling and the material can no longer be rolled into a thread. The crumbling may occur when the thread has a diameter greater than 1/8 in. [3 mm]. This shall be considered a satisfactory end point provided the material has been previously rolled into a thread 1/8 in. [3 mm] in diameter. An example of the crumbling of the thread is shown in Exhibit 1001-D, of this Section.

(c) As to the rolling operation, some operators use the heel of the hand to apply the pressure, some the palm, and some the meaty part of the base of the thumb. It makes no difference what part of the hand is used, as long as the technique can be calibrated and the results checked. Probably each material will demand a different pressure to form a 1/8 in. [3 mm] thread. Only experience will help to determine the proper pressure to apply. Varying the distance through which the thread is rolled may also help to reach the plastic limit on different materials.

(d) The portions of the crumbled material shall then be gathered together and placed in an aluminum container with a lid. The container and material shall be weighed immediately and the weight [mass] recorded. The material in the container shall then be dried to constant [mass] in an oven, sand batch, or improvised drying unit; allowed to cool; and then weighed. This weight [mass] shall be recorded and the loss in weight [mass] shall be recorded as the weight [mass] of water. The plastic limit value is the percentage of moisture in the sample at the completion of the test.

1001.5.4.2 Calculations. Calculate the plastic limit expressed as the water content in percentage of the weight [mass] oven dry soil, as follows:

$$\text{Plastic Limit} = \frac{\text{wt. [mass] of water}}{\text{wt. [mass] of oven-dried soil}} \times 100$$

Record the plastic limit to the nearest whole number.

1001.5.5 Percent Deleterious Substances in Coarse Aggregate.

1001.5.5.1 The inspector shall determine the percent of deleterious substances in coarse aggregate, when required, in accordance with MoDOT Test Method T71. The following procedure is a descriptive detail of the test method.

1001.5.5.2 Apparatus.

(a) Containers - containers of such a size and shape to contain the sample.
(b) Sieve - one No. 4 [4.75 mm] sieve to divide the sample.
(c) Water source to wet sample for observation.
(d) Balance - balance accurate to within 0.5 percent of the weight [mass] of sample to be weighed.

1001.5.5.3 Procedure. The sample shall be tested in an "as obtained" condition. The original sample obtained shall be sieved over a No. 4 [4.75 mm] sieve and the material passing shall be discarded. The material remaining shall be used to determine the percent of deleterious substances based on the weight [mass] of plus No. 4 [4.75 mm] materials. The samples may be rinsed at the time of examination but should not be soaked or allowed to stand in water. The individual particles comprising the sample shall be examined piece by piece and separated into the various constituents in accordance with the descriptions shown in Annex A of this Section. Recommended minimum sample sizes of plus No. 4 [4.75 mm] material are shown in the following tabulation:

Maximum Size (1)		Sample Size
(inches)	[mm]	(grams)
2	50	10,000
1-1/2	37.5	9,000
1	25.0	5,000
3/4	19.0	3,000
1/2	12.5	2,000
3/8	9.5	1,000

(1) Maximum size is defined as the smallest sieve through which 100 percent of the material will pass.

1001.5.5.4 Calculations. The percentage of deleterious substances in coarse aggregate shall be calculated as follows:

$$P = \frac{C}{W} \times 100$$

Where:

P = Percentage of deleterious substances.

W = Weight [Mass] of test sample for the portion retained on the No 4 [4.75 mm] sieve.

C = Actual weight [mass] of deleterious substance.

1001.5.6 Lightweight [Low Mass Density] Particle Content including Coal and Lignite in Fine Aggregate.

1001.5.6.1 The inspector shall determine the lightweight particle content in accordance with MoDOT Test Method T71.

1001.5.6.2 The inspector shall determine the percent lightweight [low mass density] particles in fine aggregate when required. Lightweight [low mass density] sand particles are not considered deleterious lightweight [low mass density] particles. The test shall be in accordance with AASHTO T 113.

1001.5.7 Percent Other Deleterious Substances, Clay Lumps and Shale in Fine Aggregate.

1001.5.7.1 The inspector shall determine the percent other deleterious substances, clay lumps and shale in accordance with MoDOT Test Method T71.

1001.5.7.2 Preparation. Recommended test sample size is approximately 200 grams, before sample is sieved over the No. 16 sieve.

1001.5.7.3 Sample Size. The sample shall be tested in a dry condition (dried to a constant weight). Sample shall be sieved over a No. 16 sieve, discarding material passing the sieve. The material retained shall be the test sample used to determine the clay lumps and shale.

1001.5.7.4 Procedure. The test sample shall be visually examined for shale, clay lumps and other deleterious substances. Particles may be lightly rinsed at the time of examination, but shall not be soaked in water. The deleterious substances shall be separated out into the constituents required by specification.

Shale is determined by using a non-glazed ceramic bowl (Plastic Index bowl). If particles leave a black mark on the bowl when pressure is applied to the material while moving it across the bottom of the bowl, this material is considered shale.

1001.5.7.5 Calculations for deleterious content. The percentage of a deleterious substance shall be calculated as follows:

$$P = \frac{C}{W} \times 100$$

Where:

P = Percentage of each deleterious substance component.
C = Actual weight [mass] of deleterious substance for that component.
W = Weight [mass] of test sample.

1001.5.8 Thin or Elongated Pieces. The inspector shall determine the percent thin or elongated pieces when required. The test shall be in accordance with ASTM D4791.

1001.6 RECORDS AND REPORTS.

1001.6.1 Plant Inspection Aggregate Worksheet Form T-630R. Form T-630R is bound in workbook form entitled "Plant Inspection of Aggregates". Form T-630R is provided to record original test results performed at an aggregate plant. All original data and test results will be entered directly into the workbook. Recording on a scratch sheet for later entry is not permitted. No erasures are permitted. If errors are made, they shall be lined out but not obliterated and corrections noted.

1001.6.1.1 Form T-630R is basically a self-explanatory form; however, a few items to note are as follows. If the book is to be used only for one material at one plant, the basic plant information need only be shown on the first page. If more than one material or plant is recorded in the same book, the plant information may be required on other pages. The inspector should sign or initial the sheet filled out for that day or in the provided spaces if more than one day's tests are listed on a sheet.

1001.6.1.2 Any test results indicating out of specification material shall be circled and a notation made as to the corrective action taken or disposition of rejected materials. Test results representing samples submitted to the Laboratory shall be identified. Other items shall be recorded as required by local conditions.

1001.6.1.3 When a book has been completed, it shall be maintained as required at the District's discretion; however, the books shall be retained for a minimum of five years.

1001.6.2 Reporting Accuracy. Aggregates graded on a passing basis are to be reported to the same number of places shown in the specifications. Note that minus No. 200 [75 µm] material in portland cement concrete aggregates is specified to 0.1 percent.

1001.7 ROUNDING-OFF-PROCEDURES. The actual rounding-off procedures shall be as follows:

(a) Test values should be calculated to only one place beyond the last place to be retained and then rounded to the number of places to be reported.

(b) When the figure next beyond the last place to be retained is less than five, retain unchanged the figure in the last place retained.

(c) When the figure next beyond the last place to be retained is greater than five, increase by one the figure in the last place retained.

(d) When the figure next beyond the last place to be retained is five, increase by one the figure in the last place retained if it is odd, leave the figure unchanged if it is even.

(e) This rounding-off procedure may be restated simply as follows: when rounding off a number to one having a specified number of significant places, choose that which is nearest. If two choices are possible, as when the digit dropped is exactly five, choose the one ending in an even digit.

An example of applying these rules to a "Passing" gradation is as follows:

(Inch-pound Units)

Sec 1005.1.5	Percent	Calculated Gradation	Reported Gradation	Conformance
Pass 1 in.	100	99.5	100	Yes
Pass 3/4 in.	90-100	94.5	94	Yes
Pass 3/8 in.	15-45	34.6	35	Yes
Pass No. 4	0-5	5.5	6	No
Pass No. 200	0-2.0	1.57	1.6	Yes (deleterious)

(SI Units)

Sec 1005.1.5	Percent	Calculated Gradation	Reported Gradation	Conformance
Pass 25.0 mm	100	99.5	100	Yes
Pass 19.0 mm	90-100	94.5	94	Yes
Pass 9. 5 mm	15-45	34.6	35	Yes
Pass 4.75 mm	0-5	5.5	6	No
Pass 75 µm	0-2.0	1.57	1.6	Yes (deleterious)

Individual deleterious substances for all aggregates are to be reported to the same number of places shown in the specifications. The following is an example of how to compare the sum of the individual deleterious substances with the specified total of all deleterious substances.

	Individual Reported Value	Specified Value	Conformance
Deleterious Rock	5.3	6.0	Yes
Shale	0.8	1.0	Yes
Chert in Limestone	0.0	4.0	Yes
Other Foreign Material	0.1	0.5	Yes
Sum of Percentages	6.2	6.0	No

Plasticity index and liquid limit are to be reported to the nearest whole number. To achieve this, the liquid limit and plastic limit are each calculated to one decimal place and then rounded off to a whole number. The plasticity index would be the difference between these two whole numbers.

1001.8 SAMPLE IDENTIFICATION. It is extremely important a sample be properly identified and that complete and accurate information relative to it and the material represented be furnished to the Laboratory. A sample record must be completed in SiteManager, on which all pertinent data regarding the sample is shown. This is essential in order to have the proper tests made in the Laboratory and the results properly reported to the field.

1001.8.1 A sample record shall be completed in accordance with Automation Section 3510 of

this Manual.

The sampler should assign an identification number to each sample (see AS-3510.3.2). This number is to be shown on the sample tag, one tag attached to the bag and one tag placed inside the bag, accompanying the sample. Show the identification number on the second shipping tag or separate piece of paper and place inside each sample bag. This procedure provides a simplified reference to the sample should the shipping tag become lost and it becomes necessary for the Laboratory to contact the sampler.

1001.8.2 Classification of Sample. Sample type is selected on the Basic Sample Data tab in SiteManager (AS-3510.3.9.)

1001.8.3 In addition, the following data should be shown in Remarks on the SiteManager record when applicable to the material being sampled:

(a) If the material represented has been sampled and tested previously, show this on the record and also give the previous Laboratory numbers.

(b) Always show anything that appears unusual, from field observation, regarding the material being sampled. This is very important, especially if conditions are such that the sample, even though representative, may not reflect the prevailing condition. Such information is often helpful in arriving at a final decision regarding the material.

1001.9 DUST SUPPRESSANT ADDITIVES.

1001.9.1 Acceptance of dust suppressant additives will be based on an acceptable manufacturer and brand name approval in accordance with Sec 1001.14 of the Standard Specifications. A list of qualified dust suppressant additives is shown in Field Section FS-1001 Table 1 of this manual.

ANNEX A
DESCRIPTION OF CONSTITUENT MATERIALS COMPRISING THE CLASSIFICATION OF DELETERIOUS SUBSTANCES

A.1 Coarse aggregate for asphaltic concrete, plant mix bituminous pavement, plant mix bituminous leveling, plant mix bituminous base and for seal coats (Specification Sec 1002 and 1003).

A.1.1 Deleterious Rock.

(1) Shaly rock. A rock that is generally contaminated with shale to a high degree. Color may vary but the rock usually has a dull gray appearance and is reasonably uniform in appearance. Also may occur in the form of numerous shale lines or seams closely spaced throughout the particle, thus giving a laminated or streaked appearance.

(2) Cap plus 20 percent. A rock particle with a line of demarcation of a layer or "cap" of shale or shaly rock which usually occurs on one face, but may be found on two faces; in either case the summation of percent of "caps" exceeds 20 percent of the volume of the rock particle.

(3) Extremely soft rock. A rock which can be readily broken with the fingers. In some cases, due to size or shape of the rock it cannot be broken, however, small areas can be spalled or chipped off with the fingers.

(4) Chert. Chert which is soft and highly absorptive should be considered deleterious.

A.1.2 Shale. A fine-grained rock formed by the consolidation of clay, mud, or silt; generally having a finely stratified or laminated structure.

A.1.3 Other Foreign Material. Clay lumps, mud balls, lignite, coal, roots, sticks, and other foreign material not related to the inherent material being inspected.

A.2 Graded aggregate for bituminous surface (Specification Sec 1004).

A2.1 Deleterious Rock.

(1) Shaly rock. A rock that is generally contaminated with shale to a high degree. Color may vary, but the rock usually has a dull gray appearance and is reasonably uniform in appearance. Pieces of rock having shaly seams, skin shale, and pieces of rock which are not predominantly shaly are not to be considered as deleterious.

(2) Extremely soft rock. A rock which can be readily broken with fingers, or from which small areas can be spalled or chipped off readily with the fingers.

A.2.2 Mud balls and shale

(1) Mud balls. Balls of mud.

(2) Shale. A fine grained rock formed by the consolidation of clay, mud, or silt; generally having a finely stratified or laminated structure.

A.2.3 Clay. A clay material which is more or less uniformly dispersed throughout the

produced product.

A.2.4 Other Foreign Material. Any material not related to the inherent material being inspected.

A.3 Coarse Aggregate for Portland Cement Concrete (Specification Sec 1005).

A.3.1 Deleterious Rock.

(1) Shaly rock. A rock that is generally contaminated with shale to a high degree. Color may vary but the rock usually has a dull gray appearance and is reasonably uniform in appearance. Also may occur in the form of numerous shale lines or seams closely spaced throughout the particle, thus giving a laminated or streaked appearance.

(2) Cap plus 20 percent. A rock particle with a line of demarcation of a layer or "cap" of shale or shaly rock which usually occurs on one face, but may be found on two faces; in either case, the summation of the percent of "caps" exceeds 20 percent of the volume of the rock particle.

(3) Extremely soft and/or porous rock. A rock which can be readily broken with the fingers. In some cases, due to the size or shape of the rock it cannot be broken, however, small areas can be spalled or chipped off with the fingers. Porosity or high absorption may be detected by rapid disappearance of surface water or by breaking rock in half and observing the depth of penetration of moisture.

A.3.2 Shale. A fine-grained rock formed by the consolidation of clay, mud, or silt; generally having a finely stratified or laminated structure.

A.3.3 Chert in Limestone. A fine-grained rock consisting of silica minerals, sharp-edged and may be highly absorptive. May occur in the form of nodules, lenses, or layers in limestone formations; and may vary in color from white to black. Quartz-type material is excluded

A.3.4 Other Foreign Material. Clay lumps, mud balls, lignite, coal, roots, sticks, and other foreign material not related to the inherent material being inspected.

A.3.5 Material Passing No. 200 [75 µm] Sieve. The portion of material passing a No. 200 [75 µm] sieve as determined by a washed analysis.

A.3.6 Thin or Elongated Pieces. Rock particles that have a length greater than five times the maximum thickness. In case two sizes of coarse material are required to be combined into coarse aggregate, the limitation on “thin or elongated pieces” shall apply only to the coarser size so combined and shall only apply to particles retained on the 3/4 in. [19.0 mm] sieve. In the case of coarse aggregate produced without combining two sizes, the limitation on “thin or elongated pieces” shall apply only to particles retained on a 3/4 in. [19.0 mm] sieve.

A.4 Aggregate for Surfacing (Specification Sec 1006).

A.4.1 Deleterious Rock and Shale.

(1) Extremely soft rock. A rock which can be readily broken or spalled with the fingers.

(2) Shale. A fine-grained rock formed by the consolidation of clay, mud, or silt; generally having a finely stratified or laminated structure.

A.4.2 Mud Balls. Balls of mud.

A.4.3 Other Foreign Material. Any material not related to the inherent material being inspected.

A.5 Aggregate Base Material (Specification Sec 1007.1, 1007.2, 1007.3 and 1007.5).

A.5.1 Deleterious Rock.

(1) Extremely soft rock. A rock which can be readily broken or spalled with the fingers.

A.5.2 Shale. A fine-grained rock formed by the consolidated of clay, mud, or silt; generally having a finely stratified or laminated structure.

A.6 Aggregate Base Material (Specification Sec 1007.4).

A.6.1 Deleterious Rock.

(1) Extremely soft rock. A rock which can be readily broken or spalled with the fingers

A.6.2 Shale and Mud Balls.

(1) Shale. A fine-grained rock formed by the consolidation of clay, mud, or silt; generally having a finely stratified or laminated structure.

2) Mud balls. Balls of mud.

FORM T-630R PLANT INSPECTION AGGREGATE WORKSHEET

MATERIAL PRODUCT OR SPEC. NO

FACILITY CODE PRODUCER

PURCHASE ORDER NO. PLANT LOCATION

CONSIGNED TO LEDGE

DESGINATION

MECHANICAL SIEVE ANALYSIS

RECORD NO.											
DATE											
INSPECTOR											
ORIG/WET WT.		%		%		%		%		%	
ORIG.DRY WT.											
WASHED DRY WT.											
LOSS											
FIELD MOIST.											SPEC LIMIT
37.5 mm (1 ½")											
25 mm (1")											
19 mm (3/4")											
12.5 mm (1/2")											
9.5 mm (3/8")											
4.75 mm (# 4)											
2.36 mm (# 8)											
2.0 mm (#10)											
1.18 mm (#16)											
850 µm (# 20)											
600 µm (# 30)											
425 µm (# 40)											
300 µm (# 50)											
150 µm (#100)											
75 µm (#200)											
PAN											
PAN + LOSS											
TOTAL											
DIFFERENCE											
SIEVE ACCURACY											
TONS ACC/REJ.											
QUALITY DETERMINATION											
ORIG.WT.											
DELT											
SHALE											
CHERT											
OTHER											
TOTAL DELT											
PLASTICITY INDEX											
IN COMPUTER	☐		☐		☐		☐		☐		

REPORT DATA AND REMARKS

EXHIBIT 1001-A

PLASTIC INDEX DETERMINATION

MATERIAL PRODUCT OR SPEC NO.

FACILITY CODE PRODUCER

BLOWS	FACTOR	BLOWS	FACTOR
22	1.02	25	1
23	1.01	26	1
24	1.01	27	0.99
		28	0.99

REC.NO./PAGE								
DATE								
INSPECTOR								
LOCATION								
	L.L.	P.L.	L.L.	P.L.	L.L.	P.L.	L.L.	P.L.
BLOWS								
CORR.FACTOR								
WET WT + CAN								
DRY WT + CAN								
MOISTURE								
DRY WT + CAN								
CAN WT								
DRY WT								
% MOISTURE								
PLASTIC INDEX								

REPORT DATA AND REMARKS

REC.NO./PAGE								
DATE								
INSPECTOR								
LOCATION								
	L.L.	P.L.	L.L.	P.L.	L.L.	P.L.	L.L.	P.L.
BLOWS								
CORR.FACTOR								
WET WT + CAN								
DRY WT + CAN								
MOISTURE								
DRY WT + CAN								
CAN WT								
DRY WT								
% MOISTURE								
PLASTIC INDEX								

REPORT DATA AND REMARKS

EXHIBIT 1001-A (PAGE 2)

FORM T-630R PLANT INSPECTION AGGREGATE WORKSHEET

MATERIAL CRUSHED WINTERSET LIMESTONE PRODUCT OR SPEC. NO TYPE 5 BASE

FACILITY CODE 3014902112 PRODUCER BIG STONE COMPANY

PURCHASE ORDER NO. PLANT LOCATION 0.6 MI. SW/O MID TOWN, MO

CONSIGNED TO LEDGE 1-4

DESGINATION QUARRY STOCKPILE

MECHANICAL SIEVE ANALYSIS

RECORD NO.	485		486								
DATE	3/19/96		3/20/96								
INSPECTOR	R.K.		R.K.								
ORIG/WET WT.	3215	%	3314	%		%		%		%	
ORIG.DRY WT.	3171		3252								
WASHED DRY WT.	2729		2981								
LOSS	442		271								
FIELD MOIST.	44	1.4	62	1.9							
	*										SPEC LIMIT
37.5 mm (1 ½")											100
25 mm (1")	0	100	0	100							
19 mm (3/4")											
12.5 mm (1/2")	378	88	350	89							60-90
9.5 mm (3/8")											
4.75 mm (# 4)	1537	52	1468	55							40-60
2.36 mm (# 8)											
2.0 mm (#10)											
1.18 mm (#16)											
850 µm (# 20)											
600 µm (# 30)	2458	22	2412	26							15-35
425 µm (# 40)											
300 µm (# 50)											
150 µm (#100)											
75 µm (#200)	2719	14	2971	8.5							0-15
PAN	7		6								
PAN + LOSS	449		277								
TOTAL	3168		3248								
DIFFERENCE	-3		-4								
SIEVE ACCURACY	±5		±5								
TONS ACC/REJ.	1380		925								
QUALITY DETERMINATION											
ORIG.WT.											
DELT											
SHALE											
CHERT											
OTHER											
TOTAL DELT											
PLASTICITY INDEX											
IN COMPUTER	☐		☐		☐		☐		☐		

REPORT DATA AND REMARKS

*Stockpile was originally tested for Type 1 Base. retested for Type 5.

EXHIBIT 1001-B

PLASTIC INDEX DETERMINATION

MATERIAL PRODUCT OR SPEC NO.

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FACILITY CODE PRODUCER

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BLOWS	FACTOR	BLOWS	FACTOR
22	1.02	25	1
23	1.01	26	1
24	1.01	27	0.99
		28	0.99

REC.NO./PAGE	485 / 1							
DATE	3/19/96							
INSPECTOR	R.K.							
LOCATION	BIG STONE@MIDTOWN							
	L.L.	P.L.	L.L.	P.I.	L.L.	P.I.	L.L.	P.I.
BLOWS	25							
CORR.FACTOR								
WET WT + CAN	17.89	11.64						
DRY WT + CAN	16.21	11.12						
MOISTURE	1.68	0.52						
DRY WT + CAN	16.21	11.12						
CAN WT	8.23	8.13						
DRY WT	7.98	2.99						
% MOISTURE	21	17						
PLASTIC INDEX	4							

REPORT DATA AND REMARKS

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REC.NO./PAGE								
DATE								
INSPECTOR								
LOCATION								
	L.L.	P.L.	L.L.	P.I.	L.L.	P.I.	L.L.	P.I.
BLOWS								
CORR.FACTOR								
WET WT + CAN								
DRY WT + CAN								
MOISTURE								
DRY WT + CAN								
CAN WT								
DRY WT								
% MOISTURE								
PLASTIC INDEX								

REPORT DATA AND REMARKS

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EXHIBIT 1001-B (PAGE 2)

FORM T-630R PLANT INSPECTION AGGREGATE WORKSHEET

MATERIAL CRUSHED WINTERSET LIMESTONE PRODUCT OR SPEC. NO 1003.1 GR. 3

FACILITY CODE 3014902112 PRODUCER BIG STONE COMPANY

PURCHASE ORDER NO. PLANT LOCATION 0.6 MI. SW/O MID TOWN, MO

CONSIGNED TO LEDGE 1-4

DESGINATION QUARRY STOCKPILE

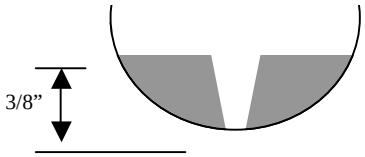
MECHANICAL SIEVE ANALYSIS

RECORD NO.	486										
DATE	3/28/96										
INSPECTOR	R.K.										
ORIG/WET WT.	1651	%		%		%		%		%	
ORIG.DRY WT.	1544										
WASHED DRY WT.											
LOSS											
FIELD MOIST.	107	6.9									SPEC
											LIMIT
37.5 mm (1 ½")											
25 mm (1")											
19 mm (3/4")											
12.5 mm (1/2")	0	100									100
9.5 mm (3/8")	281	82									80-100
4.75 mm (# 4)	1472	5									0-5
2.36 mm (# 8)											
2.0 mm (#10)											
1.18 mm (#16)											
850 µm (# 20)											
600 µm (# 30)											
425 µm (# 40)											
300 µm (# 50)											
150 µm (#100)											
75 µm (#200)											
PAN	70										
PAN + LOSS	70										
TOTAL	1542										
DIFFERENCE	-2										
SIEVE ACCURACY	±3										
TONS ACC/REJ.	1380	ACC.									
QUALITY DETERMINATION											
ORIG.WT.											
DELT											
SHALE											
CHERT											
OTHER											
TOTAL DELT											
PLASTICITY INDEX											
IN COMPUTER	☐		☐		☐		☐		☐		

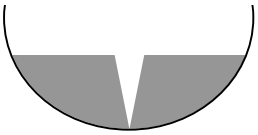
REPORT DATA AND REMARKS

*Stockpile was originally tested for Type 1 Base. retested for Type 5.

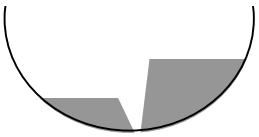
EXHIBIT 1001-C



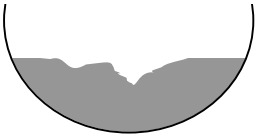
BEFORE THE TEST



AT THE LIQUID LIMIT



BELOW THE LIQUID LIMIT
Material slides on the dish



ABOVE THE LIQUID LIMIT

THE LIQUID LIMIT TEST

THREAD ABOVE THE PLASTIC LIMIT

THREAD AT THE PLASTIC LIMIT

THREAD BELOW THE PLASTIC LIMIT

THE PLASTIC LIMIT TEST

EXHIBIT 1001-D

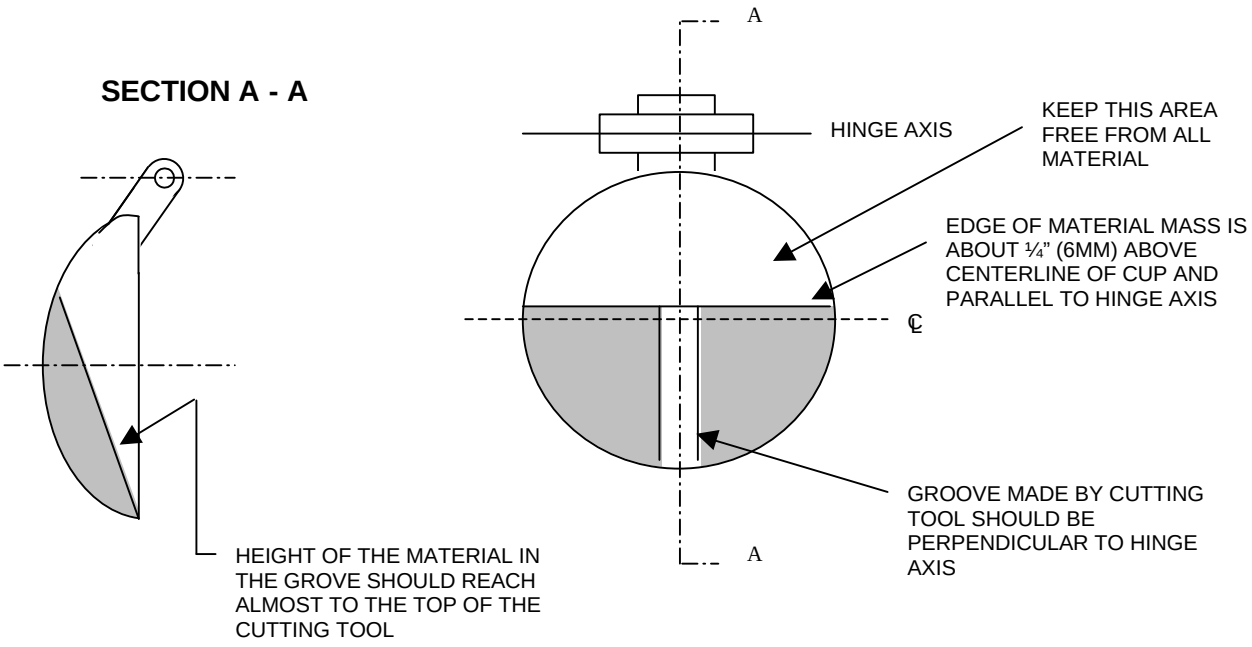


EXHIBIT 1001-E