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METHOD OF TEST FOR SIEVE ANALYSIS OF FINE AND COARSE AGGREGATES

A. SCOPE

This method, which includes modifications of AASHTO Designations T 11, T 27, T 30, and T 37, specifies the procedures for determining the particle-size distribution of fine and coarse aggregates.

Special procedures for testing aggregate from extracted bituminous mixtures, supplemental fine aggregate, glass spheres, and granular quicklime are included in Appendices A, B, C, and D, respectively. A procedure for expediting testing and providing an approximate particle-size distribution for processed fine aggregate is included in Appendix E.

B. REFERENCES

California Test 201- Soil and Aggregate Sample Preparation
AASHTO M 92 - Standard Specification for Wire-Cloth Sieves for Testing Purposes
AASHTO T 11 - Test for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
AASHTO T 27 - Test for Sieve Analysis of Fine and Coarse Aggregates
AASHTO T 30 - Test for Mechanical Analysis of Extracted Aggregate
AASHTO T 37 - Test for Sieve Analysis of Mineral Filler for Hot Mix Asphalt (HMA)

C. APPARATUS

1. Balance: A balance or scale reading to 1 g for samples weighing less than approximately 1,000 g. For samples weighing more than 1,000 g the balance or scale should read to 0.2 % of the test sample's mass.

2. Sieves: Woven-wire cloth sieves of 3 in., 2 ½ in., 2 in., 1 ½ in., 1 in., ¾ in., ½ in., 3/8 in., ¼ in., No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200 designations with square openings conforming to AASHTO Designation M 92.

   a. Each sieve shall be inspected visually for bent or distorted wires after each use. Replace any damaged or nonconforming sieves.

3. Sieve shaker: Any mechanical sieve-shaking device that accomplishes the same thoroughness of sieving as the hand-sieving procedure described in F.1.a of this method.

   a. It is essential that the sieve shaker be designed so that its motion includes a bumping or bouncing action sufficient to keep the aggregate particles in motion on the surface of the sieves.

b. Refer to Section F.1.b of this method for procedures to verify shaker efficiency.

4. Agitator (Figure 1): A mechanical device designed to hold the wash vessel in an upright position while subjecting it to a lateral reciprocating motion at a rate of 285 ± 10 complete cycles per minute. The reciprocating motion shall be produced by means of an eccentric located in the base of the carrier, and the length of the stroke shall be 1.75 in. ± 0.025 in. The clearance between the cam and follower of the eccentric shall be between 0.001 in. and 0.004 in. Other types of agitators may be used provided the length of time and other factors are adjusted to produce the same results as those obtained using the agitator described above.

5. A combination sieve shaker-agitator is allowable when it meets the above requirements for shaking (3.a & b) while in the shaking mode and agitation (4) while in the agitation mode. A Tyler portable sieve shaker meets the above requirements when modified according to TL drawing No. D536.

6. Mechanical Washing Vessel: A flat-bottom, straight-sided, cylindrical vessel conforming to the specifications and dimensions shown in Figure 2.

7. An oven or other suitable thermo-statically controlled heating device capable of maintaining a temperature of 230˚F ± 9˚F.

D. MATERIALS

Distilled, deionized, or good-quality tap water shall be used for washing the fine-aggregate test sample.

E. SIZE OF SAMPLE

1. The sample to be tested shall be of sufficient size to ensure representation of the material. The exact amount of material required will vary according to the nominal size of the aggregate and the particle-size distribution.

2. Recommended sample mass for each aggregate size of processed aggregates (such as sized aggregates for PCC and AC) or composite aggregates (such as AB and CTB) that are comprised of approximately 40 % or more of aggregate retained on the No. 4 sieve, are listed in Table 1.

TABLE 1

Maximum Nominal Aggregate Size	Recommended Mass of Portion Retained on No. 4 Sieve
Over 2 ½ in.	30,000 g
2 ½ in.	25,000 g
2 in.	20,000 g
1 ½ in.	15,000 g
1 in.	10,000 g
3/4 in.	5,000 g
½ in.	2,500 g
3/8 in.	1,000 g

3. Sample size, for materials not adaptable to the recommendations in paragraph 2, should be sufficient to yield the amounts noted below for each coarse-size fraction that makes up 5 % or more of the total sample.

    a. At least 1,000 g of coarse-size fractions equal to or larger than ¾ in.

    b. At least 500 g of coarse-size fractions smaller than ¾ in.

4. Samples containing more than 15 % passing the No. 4 sieve shall be of sufficient size to yield at least 1,000 g of material passing the No. 4 sieve.

F. SIEVING PROCEDURE

1. Separate the test sample into a series of sizes using such sieves as are necessary to determine compliance with the specifications for the material being tested. Either the hand or mechanical sieving method may be used.

    a. Perform the hand method of sieving by means of a lateral and vertical motion of the sieve, accompanied by a jarring action, so as to keep the sample moving continuously over the surface of the sieve. Do not turn or manipulate particles through the sieve by hand. Continue sieving until not more than 0.5 % by mass of the total sample will pass any sieve during one additional minute of hand sieving.

    b. Mechanical sieving may be used only after it has been demonstrated that the shaker will separate a test sample with the same effectiveness as the hand method. The effectiveness of the mechanical shaker and the minimum shaking time shall be determined for each shaker by comparison with the hand-sieving method using the procedure described below.

        (1) Obtain a test sample of all crushed, clean, durable aggregate with a relatively uniform size distribution over the range of sieves to be included.

        (2) Determine the total mass of the test sample and the tare mass of each sieve.

        (3) Separate the sample into its various sieve sizes using the mechanical shaker operated for a trial period.

        (4) At the end of the trial period, determine the amount of material retained on each sieve by weighing the sieves and retained material and subtracting the mass of the sieve.

        (5) Reassemble the sieves in the mechanical shaker, and shake for an additional period of time of not less than 1 min.

        (6) Determine the amount of material on each sieve as in step (4).

        (7) Repeat steps (4) through (6) until not more than 0.5 % by mass of the total sample passes through any of the sieves during the additional shaking time.

        (8) Sieve each size fraction for one additional minute using the hand-sieving procedure.

(9) If more than 0.5 % by mass of the total sample passes through any sieve during the hand sieving, the mechanical shaker is not performing effectively, and it shall not be used.

(10) The required shaking time for the shaker shall be at least 125 % of the minimum time required to accomplish the thoroughness of sieving described above. In no case shall the shaking time for any shaker be less than 5 min.

c. When sieving, limit the amount of material retained on the No. 4 and coarser sieves to a single layer of aggregate. If necessary, sieve the test sample in portions; then combine all respective portions retained on the sieves before weighing.

d. In no case, when sieving fine aggregate (material passing the No. 4 sieve), shall the material retained on any sieve at the completion of the sieving operation exceed that mass specified in Table 2. To reduce the amount of material retained on a sieve, either use a sieve with openings slightly larger than the overloaded sieve, or split the entire sample into smaller portions prior to sieving, and then combine respective fractions prior to weighing.

TABLE 2

MAXIMUM MASS IN GRAMS OF MATERIAL ALLOWED ON SIEVE* AT COMPLETION OF SIEVING OPERATION

Sieve Size	Wt. Per sq. in.	Total Mass for 8 in. Diameter Sieve
No. 8	4.0	200
16	3.0	150
30	2.5	125
50	2.0	100
100	1.5	75
200	1.0	50

*For intermediate sieve sizes not listed in this table, the mass specified for the next smaller sieve size shall apply.

G. DETERMINATION OF COARSE-AGGREGATE PARTICLE-SIZE DISTRIBUTION

1. Prepare all materials as prescribed in California Test 201. Be sure to clean all coatings from the coarse aggregate and break clods sufficiently to pass the No. 4 sieve.

2. If the coarse-aggregate particles contained in a sample are clean or are coated lightly with fines, which can be removed easily by sieving, it will not be necessary to subject the coarse portion to a cleaning process prior to performing the coarse-sieve separation.

3. Separate the sample on the following sieves: 3 in., 2½ in., 2 in., 1½ in., 1 in., ¾ in., 3/8 in., and No. 4. Other sieves may be added as required to determine compliance with specifications or to reduce the amount of material retained on certain sieves. It is permissible to include the No. 8 sieve with the coarse-sieve separation when it is not necessary to determine the distribution of material finer than the No. 8 sieve.

4. Place each coarse-size fraction in a separate container.

    a. When a sample has been divided into two or more portions to facilitate sieving, recombine all portions of the same size.

    b. Combine all portions of the material passing the No. 4 sieve obtained from the sample preparation and sieving phases.

5. Determine the total mass of material retained on each coarse sieve and the total amount of fine material passing the No. 4 sieve. The total mass retained on a given sieve is the sum of the material retained on the sieve plus the material retained on all larger sieves.

    a. Accumulate the mass of material retained on each successive sieve beginning with the coarsest size.

    b. When it is not necessary to keep the aggregate's size fractions separated, the sized portions may be combined in succession, and the accumulated mass may be determined directly.

H. DETERMINATION OF THE FINE-AGGREGATE PARTICLE-SIZE DISTRIBUTION

1. Sieve the entire test sample according to Section F.

2. Split or quarter a fine-aggregate test sample weighing 500 g ± 25 g from the material passing the No. 4 sieve.

    a. If there is insufficient material passing the No. 4 sieve to obtain the required 500 g ± 25 g, use all of the material passing the No. 4 sieve for the fine-aggregate test sample.

    b. If less than 10 % of the submitted sample is retained on the No. 30 sieve, it is permissible to reduce the fine-aggregate test sample's mass to approximately 125 g. Obtain this smaller test sample by carefully splitting the prepared 500 g portion into four quarters. Do not make any adjustments for mass during this splitting operation.

3. Oven dry the fine-aggregate test sample to constant mass at a temperature of 230˚F ± 9˚F, and then cool it to room temperature. Weigh and record the mass of oven-dried material as the test sample's mass.

    a. Oven-drying the test sample prior to washing may be eliminated provided the moisture content is determined by drying a duplicate sample and the mass is corrected to establish the dry mass of the test sample.

    b. When testing reclaimed aggregates containing traces of asphalt or asphalt concrete, the oven-drying temperature shall not exceed 100˚F.

4. Place the fine-aggregate test sample in the mechanical washing vessel, add 1000 mL ± 5 mL of water, and clamp the lid in place. Secure the vessel in the mechanical agitator. After 10 min ± 30 s have elapsed from the introduction of the wash water, agitate the vessel and contents for 2 min ± 5 s.

5. Following agitation, remove the vessel from the shaker, unclamp the lid, and pour the contents into a No. 200 sieve. Rinse any remaining fines from the vessel into the sieve. Direct water from a flexible hose attached to a faucet onto the sample until the water passing through the sieve comes out clear. It may be necessary to flood clayey or silty samples while it is still in the vessel to prevent clogging the No. 200 sieve. Repeated flooding may be necessary before all of the contents can be poured from the vessel into the sieve.

6. After rinsing, wash the material from the sieve into a drying pan; then place the drying pan in a slanting position until the free water that drains to the lower edge is clear. Pour this water off taking care not to lose any material from the test sample.

7. Oven-dry the washed test sample to constant mass at a temperature of 230˚F ± 9˚F and cool it to room temperature. Spreading the sample as thin as possible in large, shallow drying pans will decrease the drying time.

   a. When testing reclaimed aggregate containing traces of asphalt concrete, the oven-drying temperature shall not exceed 100˚F.

8. Separate the sample on the Nos. 8, 16, 30, 50, 100, and 200 sieves. Other sieves may be added as required to determine compliance with specifications or to reduce the amount of material retained on certain sieves.

9. Determine and record the mass of material retained on each sieve. The following procedure normally is used for the fine-aggregate test sample.

   a. Weigh the material retained on the coarsest sieve, and record this mass on the appropriate work card. Do not remove the material from the scale or balance.

   b. Add the material retained on the next finer sieve, and record this mass on the appropriate work card. Do not remove the material from the scale or balance.

   c. Continue accumulating mass until the material in the sieve pan is weighed.

I. CALCULATIONS

1. Convert mass to percentages as follows:

   a. Compute the percentage of material retained on each sieve by the following formula:

$$R = 100\ M_c/M_t$$

   Where:

   R = Percentage of test sample retained on the sieve.

   M_c = Cumulative mass of material retained on the sieve.

   M_t = Oven-dried mass of test sample prior to washing.

b. Compute the percentage of material passing each sieve as follows:

$$P = 100 - R$$

Where:

P = Percentage of test sample passing the sieve.

R = Percentage of test sample retained on the sieve.

2. If a composite or sized sample has been separated into two or more aggregate-size fractions for testing, compute the grading of the entire sample by the following method:

a. Compute the percentage, by mass, represented by each aggregate-size fraction based on the total sample mass as received.

Example:

Fraction	Aggregate Size		Mass in Grams	Percent of Total Sample
	Pass	Retained		
A	1 in.	No. 4	6,600	66 %
B	No. 4	--	3,400	34 %
Total Sample	--	--	10,000	100 %

b. Then, take each aggregate size in turn and multiply the percent passing each sieve (as determined by the sieve analysis on the test sample) by the percentage of that aggregate size found to be present in the "as-received" sample.

Example:

Sieve Size	1 Grading of Aggregate Size Fraction "A"	2 Percent of Total Sample	3 Products of Items 1 and 2
1 in.	100	66 %	66
in.	94	66 %	62
3/8 in.	24	66 %	16
No. 4	3	66 %	2
No. 8	3	66 %	2
No. 16	3	66 %	2
No. 30	2	66 %	1
No. 50	2	66 %	1
No. 100	1	66 %	1
No. 200	0	66 %	0

c. Add the products thus obtained on corresponding sieve sizes as shown in the following example. These sums, as shown in the last column of the example, constitute the "as received" grading of the original sample.

Example:

Sieve Size	Grading of Aggregate Size Fractions						"As Received" Grading of Original	
	A 1 in. x No. 4 % Passing	B No. 4 x 0 % Passing	A 66 %		B 34 %		Sample A + B Percent Passing	
1 in.	100	100	66	+	34	=	100	
¾ in.	94	100	62	+	34	=	96	
3/8 in.	24	100	16	+	34	=	50	
No. 4	3	100	2	+	34	=	36	
No. 8	3	70	2	+	24	=	26	
No. 16	3	56	2	+	19	=	21	
No. 30	2	41	1	+	14	=	15	
No. 50	2	27	1	+	9	=	10	
No. 100	1	17	1	+	6	=	7	
No.200	0	8	0	+	3	=	3	

J. PRECAUTIONS

1. Proper care of the sieves is necessary for accurate sieving. Use the following procedure in removing particles stuck in the mesh of the fine sieves:

   a. No. 4 and No. 8 sieves: Clean by brushing with a brass wire brush. A rounded piece of wood, such as a brush handle, can be used if one hand is placed on the opposite side when pushing against the sieve in order to avoid stretching the sieve out of shape.

   b. No. 16, No. 30 and No. 50 sieves: Clean by brushing with a brass wire brush.

   c. No. 100 sieves: Clean by brushing with a stiff, short bristle brush such as a stencil brush.

   d. No. 200 sieves: Clean only by brushing with a small paintbrush. These sieves are damaged easily.

   e. Do not use a sharp object to push out particles, which are stuck in the mesh of the sieves because this will result in enlarging the openings.

2. Examine sieves each day for broken wires, and solder any breaks. Discard any sieve that develops a break in the main body of the screen. Soldering decreases effective sieving area; therefore, sieves with large breaks or several small breaks should be discarded.

3. Check all sieves from No. 4 through No. 200 biannually with a standard sample of known grading made up from hard, clean aggregate that does not degrade from the sieve-shaking procedure. This is especially useful for checking No. 100 and No. 200 sieves, as small breaks and distortions are missed easily in these fine-mesh sieves.

4. Never sieve hot samples, as hot aggregate will distort the fine meshes of the No. 100 and No. 200 sieves.

1. Take care to avoid loss of material during transfer of sample from wash pot to sieves and also during rinsing.

6. Always run the sieve shaker for the time specified in the mechanical agitation washing procedure. Aggregate will not be cleaned properly in less than the specified time, and particle breakdown will result from excessive agitation.

K. REPORTING OF RESULTS

Report the total percentage passing each sieve to the nearest whole number. Calculate percentage on the basis of the oven-dry mass of the test sample prior to washing and/or sieving.

L. SAFETY AND HEALTH

Soils and aggregates may contain bacteria and/or organisms, which can be harmful to one's health. The wearing of dust masks and protective gloves when handling materials is advised.

Use of heat resistant gloves/mitts or potholders is required for removing samples from the ovens.

Dust, noise, lifting and the operation of equipment are encountered in this testing procedure. It is not possible to completely eliminate these risks, but steps should be taken to minimize them as much as possible.

The use of dust collection units and the spraying of workroom floors with dust palliatives are very effective methods of reducing dust conditions.

The use of earplugs or earmuffs is recommended when operating noisy equipment. Enclosures built around noisy equipment can eliminate much of the noise. The use of sound deadening material should be utilized when appropriate.

Guards or shields shall be provided around dangerously exposed moving parts of machinery. Also, personnel will be instructed in the proper operation of each machine and in proper lifting methods. The use of back support braces will be made available to all employees. Table-high carts to move materials can eliminate much of the lifting.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

End of Text
(California Test 202 contains 20 pages)

Figure 1
Standard Mechanical Agitator

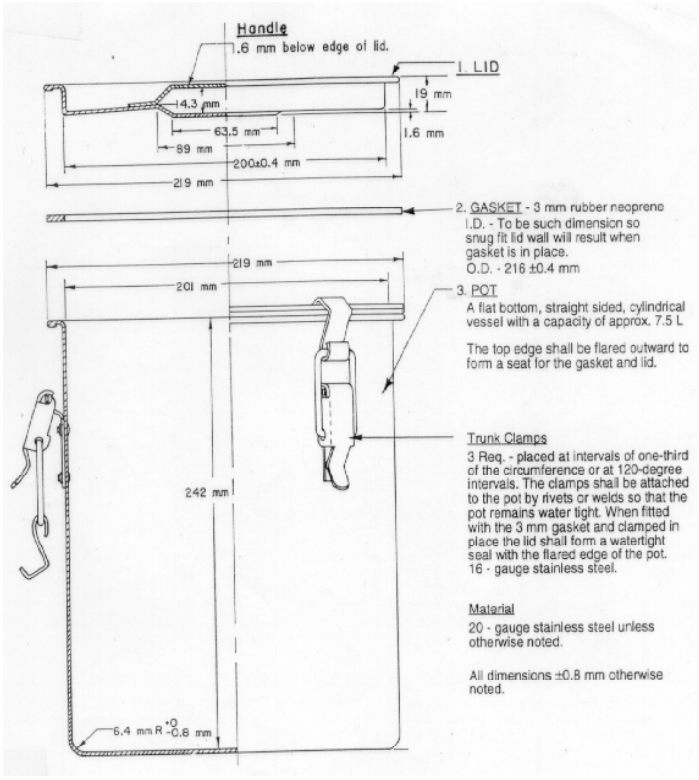

Figure 2
Mechanical Washing Vessel

APPENDIX A

SIEVE ANALYSIS OF AGGREGATE FROM EXTRACTED BITUMINOUS MIXTURES

A. SCOPE

This appendix specifies modifications, which must be made to the basic California Test 202 when determining the particle-size distribution of aggregate from extracted bituminous mixtures.

B. APPARATUS

Use the apparatus described in the basic test method.

C. MATERIALS

1. Use distilled, deionized, or good-quality tap water for washing the sample.

2. Wetting Agent: any dispersing agent, such as Calgon, Joy, or other detergent, that will promote separation of the fine materials can also be used.

D. PROCEDURE

1. The sample to be tested by sieve analysis shall be the entire aggregate sample recovered from the asphalt extraction test (California Test 310 or 362).

2. Weigh the oven-dried test sample, and record this as the test sample's mass.

3. Place the test sample in the mechanical washing vessel and add enough water to cover the sample. Add a sufficient amount of wetting agent to assure a thorough separation of the material finer than No. 200 sieve from the coarser particles. There should be enough wetting agent to produce a small amount of suds when the sample is agitated. Clamp the lid in place. Secure the vessel in the mechanical agitator. After 1 min ± 10 s have elapsed from the introduction of the washing solution, agitate the vessel and contents for 2 min ± 5 s.

   Note: Sudsing will depend on the hardness of the water and the detergent. Excessive suds may overflow the sieves and carry some materials with them.

4. Following agitation, remove the vessel from the shaker, unclamp the lid, and pour the contents into No. 8 and No. 200 sieves nested together with the No. 8 sieve on top. Rinse any remaining fines from the vessel into the sieves. Direct water from a flexible hose attached to a faucet onto the aggregate until the water passing through the sieves comes out clear.

5. After rinsing, wash the material from the sieves into a drying pan; then place the drying pan in a slanting position until the free water that drains to the lower edge is clear. Pour this water off taking care not to lose any material from the test sample.

6. Oven dry the washed test sample to a constant mass at a temperature of 230˚F ± 9˚F and cool it to room temperature. Spreading the material as thin as possible in large, shallow drying pans will decrease the drying time.

7. Perform the sieving and determine the mass retained on each sieve as prescribed in the basic test method.

E. CALCULATIONS

Determine the grading of the test sample as prescribed in the basic test method.

F. PRECAUTIONS

Observe the precautions listed in the basic test method.

G. REPORTING OF RESULTS

Report as prescribed in the basic test method.

APPENDIX B

SIEVE ANALYSIS OF SUPPLEMENTAL FINE AGGREGATE FOR ASPHALT CONCRETE

A. SCOPE

This appendix specifies modifications, which must be made to the basic California Test 202 when determining the particle-size distribution of supplemental fine aggregate.

B. APPARATUS

Use the apparatus described in the basic test method.

C. MATERIALS

Use distilled, deionized, or good-quality tap water for washing the test sample.

D. PROCEDURE

1. From the submitted sample, split or quarter the material to a mass of 500 ± 25 g. Without further adjustments, split or quarter the portion, in two operations, to obtain a test sample of approximately 125 g.

2. Oven dry the test sample to constant mass at a temperature of 230˚F ± 9˚F and cool it to room temperature. Weigh the oven-dried material and record as the test sample's mass.

3. Place the test sample on the No. 200 sieve, and direct water from a flexible hose attached to a faucet onto the sample until the water passing through the sieve comes out clear.

4. After rinsing, wash the material from the sieve into a drying pan; then place the drying pan in a slanting position until the free water that drains to the lower edge is clear. Pour this water off taking care not to lose any material from the test sample.

5. Oven dry the washed test sample to constant mass at a temperature of 230˚F ± 9˚F, and cool it to room temperature.

6. Perform the sieving using the No. 30 and No. 200 sieves. Determine the mass retained on each sieve as prescribed in the basic test method.

E. CALCULATIONS

Determine the sieve analysis as prescribed in the basic test method.

F. PRECAUTIONS

Observe the precautions listed in the basic test method.

G. REPORTING OF RESULTS

Report the total percentages passing the No. 30 and No. 200 sieves to the nearest whole number.

APPENDIX C

SIEVE ANALYSIS OF GLASS SPHERES

A. SCOPE

This appendix specifies the modifications, which must be made to the basic California Test 202 when determining the particle-size distribution of glass spheres (beads), for reflectorizing paint markings on pavements.

B. APPARATUS

Use the apparatus described in the basic test method, except that the balance shall read to 0.1 g.

C. MATERIALS

No special materials are required for this test.

D. SIZE OF SAMPLE

1. Initial samples supplied by the prospective vendor shall weigh approximately 5 lb.

2. When testing to determine acceptance of shipment, one test sample shall be obtained from each container submitted for testing.

E. PROCEDURE

1. From the submitted sample, split or quarter the material to a mass of 400 g ± 20 g. Without further adjustments, split or quarter the portion, in three operations, to obtain a test sample of approximately 50 g.

2. Oven dry the test sample at a temperature of 230˚F ± 9˚F to a constant mass, and cool it to room temperature. Weigh and record the oven-dried material as the test mass.

    a. Do not wash glass spheres.

3. Perform the sieving as prescribed in the basic test method.

F. CALCULATIONS

Determine the grading of the test sample as prescribed in the basic test method.

G. PRECAUTIONS

Observe the precautions listed in the basic test method.

H. REPORTING OF RESULTS

Report as prescribed in the basic test method.

APPENDIX D

SIEVE ANALYSIS OF GRANULAR QUICKLIME

A. SCOPE

This appendix specifies modifications that must be made to the basic California Test 202 when determining the particle-size distribution of granular quicklime.

B. APPARATUS

1. Use the apparatus described in the basic test method.

2. An immediate supply of tap water for emergency washing of eyes or skin.

C. MATERIALS

No special materials are required for this test.

D. SIZE OF SAMPLE

The total mass of quicklime submitted for testing shall be not less than 5 lb.

E. PROCEDURE

1. From the submitted sample, split or quarter the material to a mass of 2000 g ± 100 g. Without further adjustments, split or quarter the portion, in three operations, to obtain a test sample of approximately 250 g.

2. Weigh and record the mass of the test sample.

    a. Test the granular quicklime in its "as-received" condition. Do not wash or oven dry.

3. Perform the sieving and determine the mass retained on each sieve as prescribed in the basic test method and the following instructions:

    a. Use the sieves necessary to determine compliance with the specifications and additional intermediate sieves as needed to prevent overloading.

    b. Sieving shall be accomplished by the mechanical sieving method. The sieving time shall be 10 min ± 30 s.

    c. Take care that the quicklime particles are not crushed or abraded by excessive handling.

F. CALCULATIONS

Determine the grading of the test sample as prescribed in the basic test method.

G. PRECAUTIONS

Observe the precautions listed in the basic test method and these special precautions:

1. A heat-producing chemical reaction occurs as water combines with quicklime. Burns can result from allowing quicklime to contact the body when it is wet from perspiration or other moisture.

2. If quicklime gets into the eyes, rinse them immediately with a heavy flow of water and seek medical assistance.

H. REPORTING

Report as prescribed in the basic test method.

APPENDIX E

APPROXIMATE SIEVE ANALYSIS OF PROCESSED FINE AGGREGATE

A. SCOPE

This appendix provides a procedure for expediting testing and determining an approximate particle-size distribution for processed fine aggregates. Washing the test sample is not required; however, the test results must be correlated with tests done according to the basic California Test 202.

B. APPARATUS

Use the apparatus described in the basic test method.

C. MATERIALS

Use the materials described in the basic test method.

D. PROCEDURE

1. Sieve the entire test sample according to Section F in the basic California Test 202.

2. From the material passing the No. 4 sieve, split or quarter the fine-aggregate to a mass of 500 g ± 25 g.

3. Aggregate sampled from a hot bin need not be dried further. Dry aggregate obtained from any other location in a forced draft oven at 230˚F ± 9˚F for 15 min or in a microwave oven for 5 min.

4. Weigh and record the mass of the test sample.

5. Separate the sample on the Nos. 8, 16, 30, 50, 100, and 200 sieves. Other sieves may be added as required to determine compliance with specifications or to reduce the amount of material retained on certain sieves.

6. Determine and record the cumulative mass of material retained on each sieve.

    a. Weigh the material retained on the coarsest sieve and record this mass on the appropriate work sheet. Do not remove the material from the balance.

    b. Add the material retained on the next finer sieve and record this mass on the appropriate work sheet. Do not remove the material from the balance.

    c. Continue accumulating mass until the material in the pan is weighed.

7. Save the entire test sample.

8. Calculate the percentage of material passing each sieve by following the procedures in Section H of the basic test and using the mass recorded in step 3 above as the total sample mass.

9. Retest selected samples for sieve analysis according to the procedure in the basic California Test 202.

   a. A sufficient number of samples shall be retested to establish the correlation between the washed and unwashed test samples.

   b. Additional retests should be performed whenever there is an indication that the previous correlation is no longer valid.

   c. Any material subject to rejection because of excessive material retained on any sieve, by the approximate method, shall be retested one time.

E. CALCULATIONS

1. Establish a correction factor for each sieve size by dividing the percent passing the sieve after washing by the percent passing the sieve before the sample was washed.

   Example:

Sieve Size	Washed Grading % Pass	Unwashed Grading % Pass	% By Wash / % Without Wash	=Correction Factor
No. 4	100	100	$^{100}/_{100}$	= 1.00
8	71	67	$^{71}/_{67}$	= 1.06
16	56	50	$^{56}/_{50}$	= 1.12
30	25	18	$^{25}/_{18}$	= 1.39
50	10	6	$^{10}/_{6}$	= 1.67
100	5	3	$^{5}/_{3}$	= 1.67
200	3	2	$^{3}/_{2}$	= 1.50

2. Determine the approximate washed sieve analyses of subsequent unwashed samples by multiplying the percent passing, as determined by the unwashed sample, by the correction factor for each respective sieve.

F. PRECAUTIONS

1. Observe the precautions listed in the basic test method.

2. If the source of material changes, new correction factors shall be established.

G. REPORTING OF RESULTS

Report the total percentages passing each sieve to the nearest whole number. Identify the reported results as being "approximate".