Revised: 4/27/04 Laboratory: _____ Inspector(s): _____ Date: _____

S___F___

ORGANIC IMPURITIES IN FINE AGGREGATE
ASTM C 40-99 **(REQUIRED PER ASTM C 1077-98)**

4. Apparatus
4.1. Glass graduated bottles
Approximately 350 to 470-ml (12 to 16-oz capacity) ___
Colorless ___
User Scribed graduated marks @;
4.1.1. Standard color solution level – 75 ml (2 ½ fluid oz) ___
4.1.2. Fine aggregate level – 130 ml (4 ½ fluid oz) ___
4.1.3. NaOH solution level – 200 ml (7 fluid oz) ___
4.2. Glass color standard ___

5. Reagent and Reference Standard Color Solution
5.1. Reagent NaOH - 3% by mass ___
5.2. Reference Standard Color Solution (**Optional, if Glass Color Standard Procedure Used**)
0.250-g $K_2Cr_2O_7$ /100-ml concentrated H_2SO_4 ___
Freshly made ___

6.1. Sampling in accordance with ASTM-D 75 ___
7.1. Sample size 450-g (1-lb) ___

8. Procedure
8.1. Fill bottle with sample to 130-ml (4½-fluid oz) ___
8.2. Add NaOH solution to 200-ml (7-fluid oz) ___
8.3. Stop, shake, and let stand 24-hr ___

9. Determination of Color Value ___
9.1. Standard Color Solution Procedure ___
Glass bottle filled to 75-ml (2½-fluid oz) ___
9.2. Glass Color Standard Procedure ___
Gardner Color Standard No. (5,8,11 (standard),14,16) ___
Organic Plate No. (1, 2, 3 (standard), 4, 5) ___

10. Interpretation of Results
10.1. Darker than standard color needs further testing with ASTM C 87 ___

Data Sheet ___

S___F___

MATERIAL FINER THAN 75-µm (NO. 200) SIEVE IN AGGREGATE
ASTM C 117-03 **(REQUIRED PER ASTM C 1077-98)**

5. Apparatus
5.1. Balance accurate to 0.1-g or 0.1% ___
5.2. Sieves. 75-µm (No. 200) and 1.18-mm (No. 16) ___
5.3. Container. Size sufficient to agitate ___
5.4. Oven. 110 ± 5°C (230 ± 9°F) ___
5.5. Wetting agent. Dispersal agent such as liquid dishwashing detergent ___

6.1. Sampling in accordance with ASTM D 75 ___
6.2. Sample size (reduce in accordance w/ ASTM C 702) ___

NMSA, mm (in.)	Min Mass, g
4.75 (No. 4)	300
9.5 (3/8)	1,000
19.0 (5/8)	2,500
37.5 (1½)	5,000

8. Procedure A – Washing with plain water ___
8.1. Dry to constant mass, (B) ___
8.3. Add water, agitate, and decant over nest of sieves ___
8.4. Repeat decant until wash water is clear ___
8.5. Return material to washed sample and dry to constant mass ___

9. Procedure B – Washing with wetting agent ___
9.1. Dry to constant mass, (B) ___
9.2. Add water and wetting agent, agitate and decant over nest of sieves ___
9.3. Repeat decant w/o wetting agent until water is clear ___
9.4. Return material to washed sample and dry to constant mass ___

10. Calculation. A, % Loss = [(B - C) / B] x 100 ___

Data Sheet ___

S___F___

DENSITY, RELATIVE DENSITY (SPECIFIC GRAVITY), AND ABSORPTION OF COARSE AGGREGATE
ASTM C 127-01 **(REQUIRED PER ASTM C 1077-98)**

6. Apparatus
6.1. Balance accurate to 0.05% of test load or 0.5-g ___
6.2. Sample container. 3.35-mm (No. 6) wire basket ___
6.3. Water tank for suspending below balance ___
6.4. Sieve. 4.75-µm (No. 4) ___

7.1. Sample in accordance with ASTM D 75 ____
7.2. Reduce to test size in accordance with ASTM C 702 ___
7.3. Min. test size ___

NMSA, mm (in.)	Min Mass, kg (lb)
12.5 (½)	2 (4.4)
19.0 (¾)	3 (6.6)
25.0 (1)	4 (8.8)
37.5 (1½)	5 (11)

8. Procedure:
8.1. Dry to constant mass and immerse 24 ± 4 hr ___
8.2. For concrete mixture proportioning eliminate paragraph 8.1 ___
8.3. Sample to SSD condition by towel or air dry and weigh, (B) ___
8.4. Weigh SSD sample in water at 23 ± 1.7°C (73.4 ± 3°F), (C) ___
8.5. Dry to constant mass at 110 ± 5°C (230 ± 9°F), (A) ___

9. Calculations:
9.1.1. Rel density (Sp Gr) (OD) = A/(B - C) ___
9.1.2. Rel density (Sp Gr (SSD) = B/(B - C) ___
9.1.3. Apparent rel density (Apparent Sp Gr) = A/(A - C) ___
9.2.1. Density (OD), lb/ft^3, = 62.27 A/(B – C) ___
9.2.2. Density (SSD), lb/ft^3, = 62.27 B/(B – C) ___
9.2.3. Apparent density, lb/ft^3, = 62.27 A/(A – C) ___
9.4. Absorption, % = [(B - A)/A] x 100 ___

10. Report:
10.1. Density to nearest 0.5 lb/ft^3 & rel density (Sp Gr) to nearest 0.01 ___
10.2. Report absorption to nearest 0.1 % ___

Data Sheet ___

S___F___

DENSITY, RELATIVE DENSITY (SPECIFIC GRAVITY), AND ABSORPTION OF FINE AGGREGATE
ASTM C 128-01 **(REQUIRED PER ASTM C 1077-98)**

6.1. Balance, 1-kg capacity and accurate to 0.1% of test load and sensitive to ≤ 0.1-g ___
6.2. Pycnometer ___
Flask of 500-cm^3 or fruit jar w/pycnometer top (500-g sample) ___
6.3. Le Chatelier flask (55-g sample) ___
6.4. Mold & tamper ___
Frustum metal cone ___
ID: top, 40 ± 3-mm, ID: bottom 90 ± 3-mm ___
Height, 75 ± 3-mm, thickness, min. 0.8-mm ___
Tamper- mass, 340 ± 15-g, diameter, 25 ± 3-mm ___

7.1. Sample in accordance with D 75m mix & reduce to ~ 1-kg in accordance w/ C 702 ___

8.1. Dry to constant mass at 110 ± 5°C (230 ± 9°F), then cover with water for 24 ± 4 hr ___
8.1.1. Eliminate 24-hr soaking if surface has been kept wet ___
8.2. Bring to SSD by air dry w/ tumbling and stirring ___
8.3. Cone test. 25 tamps from 5-mm (0.2-in.) height ___
SSD achieved when sand slump slightly when cone is raised ___

9.2.1. Determine mass to 0.1-g ___
9.2.1. Partially fill pycnometer flask ___
Introduce 500 ± 10-g sample, (S) ___
Add water to 90% flask capacity ___
9.2.1.1 Manually roll, invert, and agitate ___
9.2.1.2. Mechanically agitate ___
9.2.2. Adjust temperature to 23 ± 1.7°C (73.4 ± 3°F) ___
Determine mass of flask, water, and sample, (C) ___
9.2.3. Remove sample and dry to constant mass, (A) ___
9.2.4. Determine mass of flask filled with water, (B) ___
9.3.1. Le Chatelier flask ___
Add water between 0 to 1-ml mark, record (R_1) ___
Add 55 ± 5-g sample, (S_1) ___
Roll or whirl flask ___
Adjust temperature back to 23 ± 1.7°C (73.4 ± 3°F) ___
Record water level, (R_2) ___
9.3.2. For determination of absorption use separate 500 ± 10-g of SSD mat'l, oven dry & weigh ___
10. Calculations:
10.2.1.1. Grav proc – (rel density) (OD) = A/(B + S - C) ___
10.2.1.2. Vol proc - (rel density) (OD) = $[S_1 (A/S)]/[0.9975 (R_2 – R_1)]$ ___
10.2.2.1. Grav proc - rel density (Sp Gr) (SSD) = S/(B + S – C) ___
10.2.2.2. Vol proc - rel density (Sp Gr) (SSD) = $S_1/[0.9975 (R_2 – R_1)]$ ___
10.2.3.1. Grav proc – apparent rel density (app Sp Gr) = A/(B + A - C) ___
10.2.3.2. Vol proc – apparent rel density (app Sp Gr) = $S_1 (A/S) / 0.9975 (R_2 – R_1) – [(S_1/S)(S – A)]$ ___
10.3.1.1. Grav proc – density (OD), lb/ft^3, = 62.27 A/(B + S – C) ___
10.3.1.2. Vol proc – density (OD), lb/ft^3, = 62.27 $S_1 (A/S)/[0.9975 (R_2 – R_1)]$ ___
10.3.2.1. Grav proc – density (SSD), lb/ft^3, = 62.27 S/(B + S – C) ___
10.3.2.2. Vol proc – density (SSD), lb/ft^3, = 62.27 $S_1/[0.9975 (R_2 – R_1)]$ ___
10.3.3.1. Grav proc – apparent density (SSD), lb/ft^3, = 62.27 A/(B + A – C) ___
10.3.3.2. Vol proc – app density (SSD), lb/ft^3, = 62.27 $S_1 (A/S) / 0.9975 (R_2 – R_1) – [(S_1/S)(S – A)]$ ___
10.4. Absorption, % = 100[(S – A//A] ___
11. Report:
11.1. Density to nearest 0.5 lb/ft^3 & rel density (Sp Gr) to nearest 0.01 ___
11.2. Report absorption to nearest 0.1 % ___

Data Sheet ___

S___F___

SIEVE ANALYSIS AND FINENESS MODULUS
OF FINE AND COARSE AGGREGATES
ASTM C 136-01 **(REQUIRED PER ASTM C 1077-98)**, CRD-C 104-80

6. Apparatus
6.1. Balances ___
6.1.1. Fine, accurate to 0.1-g or 0.1% ___
6.1.2. Coarse, accurate to 0.5-g or 0.1% ___
6.2. Sieves. ASTM E 11 ___
6.3. Mechanical sieve shaker shall impart vertical or vertical and lateral motion ___
6.4. Oven. 110 ± 5°C (230 ± 9°F) ___

7.1. Sample in accordance with ASTM D 75 ___
7.2. Thoroughly mix the sample ___
7.2. Split to testing size in accordance with ASTM C 702 ___
7.3. Fine aggregate, minimum of 300-g ___
7.4. Sample size, coarse aggregate

NMSA, mm (in.)	Min Mass, kg (lb)
9.5 (3/8)	1 (2)
12.5 (½)	2 (4)
19.0 (¾)	5 (11)
25.0 (1)	10 (22)
37.5 (1½)	15 (33)

8. Procedure:
8.1. Dry to constant mass ___
8.2. Nest sieves in decreasing sizes; agitate by hand or mechanical means ___
8.3. Limit material on sieve not to overload ___
8.3.1.1. Insert additional sieve above sieve that may be overloaded ___
8.3.1.2. Split sample into two or more portions and combine after sieving ___
8.3.1.3. Use larger framed sieves ___
8.4. Sieve for sufficient period ___
8.4. Check sieve time by hand sieving, not more than 1% after 1 minute ___
8.7. Determine mass retained on each sieve ___

9.1. Calculate % passing each sieve size ___

9.2. Calculate fineness modulus:
Cumulative % retained divided by 100 ___
Sieves required up to maximum size particle, 150-µm (No. 100), 300-µm (No. 50), 600-µm (No. 30), 1.18-mm (No. 16), 2.36-mm (No. 8), 4.75-mm (No. 4), 9.5-mm (3/8-in.), 19.0-mm (3/4-in.), 38.1-mm (1½-in.), and larger by 2:1 ratio ___
Calculation:
1. FM = Sum of total % retained / 100 ___
2. FM = [(No. of sieves involved) (100) - Sum total of % passing] / 100 (CRD-C 104-80) ___

Data Sheet ___

S___F___N/A___

UNIT MASS AND VOIDS IN AGGREGATE
ASTM C 29-97 (03)

5. Apparatus:
5.1. Balance accurate to 0.1% of test load ___
5.2. Tamping rod ___
5/8-in. (16-mm) diameter ___
Approximately 24-in. (600-mm) long ___
Hemispherical tip ___
5.3. Measure ___
Water-tight metal measure ___
Top rim plane to 0.01-in. (0.25-mm) ___
Interior wall smooth and continuous surface ___
5.4. Shovel or scoop ___
5.5. Plate glass ___
Minimum ¼-in. (6-mm) thick ___
Minimum 1-in. (25-mm) larger than measure ___
Grease to prevent leakage between glass and measure ___

6.1. Sample in accordance with ASTM D 75, reduce in accordance w/ ASTM C 702 ___

7.1. Sample size approximately 125 to 200% of measure volume ___
Dry to constant mass in oven at 110 ± 5°C (230 ± 9°F) ___

8. Calibration of measure ___
8.1. Fill measure with water and cover with glass ___
8.2. Determine mass of water ___
8.3. Measure temperature and determine water density (W) ___
8.4. Calculate measure volume by dividing water mass by density (V) ___
8.5. Calibrate annually ___
9.1. Selection of procedure for loose bulk density:
9.1. Shoveling procedure only if specifically stipulated otherwise determine by rodding or jigging

10. Rodding procedure: Rod aggregate $\leq$ 1½-in. ___
10.1. 3 equal lifts by volume ___
Surface level w/fingers ___
25 rods/layer ___
Level final surface with fingers or straightedge ___
10.2. Do not strike bottom forcibly ___
10.3. Determine mass of measure (T) and total mass to 0.05-kg (0.1-lb) (G) ___
11. Jigging aggregate > 1½-in. ___
11.1. Three equal layers on firm or concrete floor ___
Raise opposite side about 2-in. and drop ___
Alternate sides ___
50 drops/lift with 25 drops/side ___
Level final surface with fingers or straightedge ___
11.2. Determine mass of measure (T) and total mass to 0.05-kg (0.1-lb) (G) ___
12. Shovel when specified ___
12.1. Fill from shovel $\leq$ 2-in. above top of measure ___
Level surface with fingers or straightedge ___
12.2. Determine mass of measure (T) and total mass to 0.05-kg (0.1-lb) (G) ___
13. Calculations:
13.1. Bulk Density (unit mass), $M = (G - T) / V$ ___
13.2. Void Content, %, $= 100[(S \times W) - M] / (S \times W)$ ___
S = Bulk specific gravity ___

Data Sheet ___

S___F___N/A___

SURFACE MOISTURE IN FINE AGGREGATE
ASTM C 70-94 (01)

4. Apparatus:
4.1. Balance, capacity of 2 kg or more & sensitive to 0.5 g or less ___
4.2. Flask, suitable container or flask (pycnometer, volumetric flask, graduated volumetric flask, or other suitable measuring device) glass or noncorrosive metal ___
Volume to be 2 – 3 times loose volume of sample ___
Designed so can be filled to the mark, or volume of its contents read, within .05 ml or less ___

5. Sample, representative of fine aggregate to be tested, not to weigh less than 200 g ___

6. Procedure:
6.1. Surface water content determined either by weight or volume @ temp. range 18 - 29°C (65 - 85°F) ___
6.2. Determination by weight, get wt. of container, (g) , filled to mark w/ only water ___
Before placing spl in container, adjust water so sample sufficiently covered w/o going over original mark ___
Put sample in container & remove entrained air ___
Fill container to original mark & get wt., (g) ___
Calculate amount of water displaced using formula in C 70 para. 6.2 ___
6.3. Determination by volume, measure volume of water, (ml), sufficient to cover sample & put in container ___
Put sample in container & remove entrained air ___
Determine combined volume of sample & water by direct reading when graduated flask used ___
Pycnometer or volumetric flask of known volume, fill to known mark with additional measured volume of water ___
Pycnometer or flask volume is equal to combined volume of sample & water ___
Calculate amount of water displaced using formula in C 70 pare. 6.3 ___

Data Sheet ___

S___F___N/A___

EFFECT OF ORGANIC IMPURITIES IN FINE AGGREGATE
ON STRENGTH OF MORTAR
ASTM C 87-03

5. Apparatus:
5.1. Flow table, flow mold, & caliper according to ASTM C 230 ___
5.2. Tamper, trowel, cube molds, & testing machine according to ASTM C 109 ___
5.3. Mixer, bowl, & paddle according to ASTM C 305 ___
5.4. Curing apparatus in accordance w/ ASTM C 511 ___

6. Reagents & materials:
6.1. Type I or II Portland cement meeting requirements in ASTM C 150 ___
6.2. Sodium hydroxide solution (3 %), 3 parts by weight sodium hydroxide (NaOH) in 97 parts water ___

7. Sampling:
7.1. Sample portions of fine aggregate obtained by method in ASTM C 40 ___
Reduction of samples in accordance with ASTM C 702 ___
7.2. Additional field sample from aggregate supply in accordance with ASTM D 75 & D 3665 ___
8. Temperature of mixing water, moist closet, & storage tank maintained at 23 ± 1.7°C (73.4 ± 3°F) ___
9. Preparation of mortar:
9.1. Prepare in mechanical mixer in accordance with ASTM C 305, as modified below:
9.1.1. Mortar proportioned to produce consistency or 100 ± 5 as determined by flow test ___
9.1.2. If large particles so large the adjustment bracket (C 305) can't provide adequate clearance, remove oversize particles by sieving on No. 4 or No. 8 sieve & quantity removed recorded ___
9.2. H_2O & cement to get water-cement ratio of 0.6 by mass (600 g cement to 360 ml H_2O is) ___
9.3. Fine aggregate brought to saturated surface dry condition in accordance with ASTM C 128 ___
9.4. H_2O in mixing bowl, add cement to the H_2O, start mixer & mix @ (140 ± 5 rpm) for 30 sec. ___
9.5. While the 30 sec. Add measured quantity of aggregate estimated to get proper consistency ___
9.6. Stop mixer, change to medium speed (285 ± 10 rpm), mix 30 sec. ___
9.7. Stop mixer, let stand for 1 ½ min., 1st 15 sec. quickly scrape mortar from sides into the batch ___
9.8. Mix 1 min. at medium speed ___
If flow appears too high, after 1st 30 sec. stop mixer, add sand, mix additional 30 sec. ___
9.9. If remixing, quickly scrape mortar from sides into batch ___
9.10. Determine flow ___
10. Procedure:
10.1. Flow test:
10.1.1. Wipe flow table clean & dry & place flow mold at center ___
Immediately after mixing, place layer mortar about 1 in. (25 mm) thick in mold, tamp 20 times ___
Tamping pressure sufficient to ensure uniform filling of mold ___
Fill mold w/ mortar, tamp as specified in 1st layer, cut off mortar to plane surface, flush w/ top of mold by drawing straight edge of trowel (held nearly ⊥ to the mold) w/ sawing motion across top of mold ___
Wipe table top clean & dry, removing any water from edge of flow mold ___
Lift mold away from mortar 1 min. after mixing, immediately drop table through a height of ½ in. (12.7 mm) 10 times in 6 sec. ___
Flow is resulting increase in avg. dia. of mortar spec, measured on at least 4 diameters at approx. equal angles, expressed as percentage of original dia. ___
10.1.2. If flow too great, return to mixer vessel, add sand, mix 30 sec. (med. speed) & determine flow, if more than 2 trials needed to get flow of 100 ± 5, consider this a trial, & prepare new specs. ___
10.1.3. If mortar too dry, discard ___
10.1.4. To determine quantity of sand used, subtract wt. of portion left after mixing from initial wt. ___
10.2. Molding test specimens, immediately after acceptable flow test, return to mixing bowl, scrape down bowl, remix for 15 sec. (med. Speed), shake excess mortar from paddle into bowl, place in mortar cube in 2 layers in accordance w/ ASTM C 109 ___
10.3. Store test specimens in moist cabinet or moist room 24 ± 0.5 hr, ___
Additional curing by immersion in saturated lime water ___
10.4. Determine compressive strength in accordance w/ ASTM C 109 ___
Data Sheet ___

S___F___N/A___

SOUNDNESS OF AGGREGATE BY SODIUM OR MAGNESIUM SULFATE
ASTM C 88-99

4. Apparatus:
4.1. Sieves in compliance with ASTM E 11 ___
4.2. Perforated sample containers ___
4.3. Temperature regulation of sulfate solution ___
4.4. Balance accurate to 0.1-g for fine aggregate ___
Balance accurate to 0.1% or 1-g for coarse aggregate ___
4.5. Drying oven at 110 ± 5°C (230 ± 9°F) ___
Evaporation rate of 25-g/h for 4-hr ___
4.6. Hydrometer or graduated glassware ___

5.1. Volume of sulfate solutions shall be ≥ 5 times sample volume ___
5.1.1. Na_2SO_4 Sp Gr 1.151 to 1.174 ___
5.1.2. $MgSO_4$ Sp Gr 1.295 to 1.308 ___
5.1.3. $BaCl_2$ ___

6.1. Sample in accordance with ASTM D 75, reduce in accordance w/ ASTM C 702 ___
6.2. Fine aggregate with ≥ 100-g for sieves ≥ 5% retained ___
6.3. Coarse aggregate with amounts ≥ 5% retained ___
7.1. Wash sample and dry to constant mass, (B) ___
Separate into containers by size ___
8.1. Immerse in solution at 70 ± 2°F (21 ± 1°C) at least ½-in. for 16 to 18-hr ___
8.2. Drain sample for 15 ± 5 min ___
Dry to constant mass ___
Constant mass is < 0.1% loss in 4-hr drying ___
Cool to room temperature ___
8.3. Repeat cycle to total of five cycle in accordance with ASTM C 33 ___
8.4. Wash with warm water (43 ± 6°C (110 ± 10°F)) till clean ___
$BaCl_2$ test on wash water ___
9.1.1. Dry to constant mass at 110 ± 5°C (230 ± 9°F) ___
Sieve fine aggregate on the original retained sieve ___
Sieve coarse aggregate
63 to 37.5-mm (2½ to 1½-in.) on 31.5-mm (1¼-in.) ___
37.5 to 19.0-mm (1½ to ¾-in.) on 16.0-mm (5/8-in.) ___
19 to 9.5-mm (¾ to 3/8-in.) on 8.0-mm (5/16-in.) ___
9.5 to 4.75-mm (3/8-in to No. 4) on 4.0-mm (No. 5) ___
Determine mass retained on each sieve, (C) ___
10.1.1. Classify by failure type, splitting, crumbling, cracking, disintegration, flaking ___

11.1.4. Calculate weighted percentage loss, A, % loss = [(B - C) / B] x 100 x grading ___

Data Sheet ___

S___F___N/A___

LIGHTWEIGHT PIECES IN AGGREGATE
ASTM C 123-03

5. Apparatus
5.1. Balances ___
FA: 500-g capacity, sensitive to 0.1-g ___
CA: 5000-g capacity, sensitive to 1-g ___
5.2. Containers ___
Drying pans ___
Heavy liquid pans ___
5.3. Skimmer. 300-µm (No. 50) sieve cloth ___
5.4. Hot plate or oven. 110 ± 5°C (230 ± 9°F) ___
5.5. Sieves. 4.75-µm (No. 4), 300-µm (No. 50) ___
5.6. Hydrometer or graduated glassware to measure to ± 0.01 SpGr ___

6. Heavy liquid ___
6.1.1. $ZnCl_4$ in H_2O (2.0 SpGr) ___
6.1.2. Kerosene with 1,1,2,2 tetrabromoethane ___
6.1.3. $ZnBr_4$ in H_2O (2.4 SpGr) ___

7.1. Sample in accordance with ASTM D 75 & D 3665; Reduce according to ASTM C 702 ___
7.2. Dry test specimen to 110 ± 5°C (230 ± 9°F); sieve to remove undersize portion as specified in 8.1 & 8.2 below.
Minimum specimen according to the following;

NMSA, mm (in.)	Min Mass, g (lb)
4.75 (No. 4)	200 (0.44)
19.0 (¾)	3,000 (6.6)
37.5 (1½)	5,000 (11)
75 (3 in.)	10,000 (22)

8.1. Fine aggregate:
Sieve over 300-µm (No. 50) ___
Determine mass of material coarser than the No. 50 sieve, ___
Bring to SSD in accordance with ASTM C-128 ___
Introduce into heavy liquid with volume 3 times that of aggregate ___
Decant liquid and floaters over skimmer ___
Repeat decant to no floaters remain ___
Wash skimmed pieces with H_2O ($ZnCl_4$ and $ZnBr_4$) or Alcohol (1,1,2,2 Tetrabromoethane) ___
Air dry floaters in hood or outdoors (oven dry under hood @ <115°C) ___
8.2. Coarse aggregate:
Determine mass coarser than No 4, ___
Bring to SSD in accordance with ASTM C-127 ___
Introduce into heavy liquid with volume 3 times that of aggregate ___
Decant liquid and floaters over skimmer ___
Repeat decant to no floaters remain ___
Wash skimmed pieces with H_2O ($ZnCl_4$ and $ZnBr_4$) or Alcohol (1,1,2,2 Tetrabromoethane) ___
Air dry floaters in hood or outdoors (oven dry under hood @ <115°C) ___

9. Calculation:
9.1. Lightweight fine aggregate particles, L, % = $(W_1/W_2) \times 100$ ___
9.1. Lightweight coarse aggregate particles, L, % = $(W_1/W_3) \times 100$ ___

Data Sheet ___

S___F___N/A___

LOS ANGELES ABRASION AND IMPACT RESISTANCE
ASTM C 131-03, ASTM C 535-03

6. Apparatus
6.1. Los Angeles Machine ___
ID - 711 ± 5-mm (28 ± 0.2-in.) ___
IL - 508 ± 5-mm (20 ± 0.2-in.) ___
Dust-tight cover w/ID contour, bolt-able ___
Removable full-length steel shelf ___
89 ± 2-mm (3.5 ± 0.1-in.) ___
1270-mm (50-in.) to outside circumference opening ___
6.2. Sieves including 1.70-mm (No. 12) ___
6.3. Balance accurate to 0.1% of test load ___
6.4. Charge ___
Steel spheres ___
46.8-mm (1-27/32-in.) average diameter ___
Mass between 390 to 445-g ___
6.4.1. Up to 12 spheres depending on grading ___

7.1. Sample in accordance with ASTM D 75, reduce in accordance w/ ASTM C 702 ___

8. Test sample preparation:
8.1. Wash and dry to constant mass at 110 ± 5°C (230 ± 9°F) ___
8.1. Sample size of 5,000 ± 10-g in required grading in Table 1 (C 131) ___
8.1. Sample size of 10,000 ± 50-g in required grading in Table 1 (C 535) ___
9.1. Place sample and charge in LA Machine ___
Rotate at 30 to 33-rpm ___
Rotate for 500 or 1000- (ASTM C 535) revolutions ___
Sieve over 1.70-mm (No. 12) ___
Wash and dry to constant mass ___

10. Calculate loss, % = [(O - F)/O] x 100 ___

11. Report:
11.1.1. ID of source, type, & nominal max size of aggregate ___
11.1.2. Grading designation from Table 1 (C 131 or C 535) ___
11.1.3. Loss by abrasion & impact to nearest 1 % ___

Data Sheet ___

S___F___N/A___

CLAY LUMPS AND FRIABLE PARTICLES IN AGGREGATES
ASTM C 142-97

4. Apparatus
4.1. Balance accurate to 0.1% of the test load ___
4.2. Rust resistant containers with capacity to spread sample out ___
4.3. Sieves conforming to ASTM E 11 ___
4.4. Drying oven maintaining 110 ± 5°C (230 ± 9°F) ___
5. Samples:
5.1. Sample consist of material remaining from ASTM C 117 (minus No. 200) ___
5.2. Dry to constant mass (M) at 110 ± 5°C (230 ± 9°F) ___
5.3. Fine aggregate sample consist of ≥ 25-g of particles coarser than 1.18-mm (No. 16) ___
5.4. Coarse aggregate sample size ___

NMSA, mm (in.)	Min Mass, g (lb)
9.5 (3/8)	1000 (2.2)
19.0 (¾)	2000 (4.4)
37.5 (1½)	3000 (6.6)
Over 37.5 (1 1/2)	5000 (11)

6. Procedure:
6.1. Determine mass of sample
Soak in distilled water for 24 ± 4 hr ___
Roll and squeeze particles between thumb & forefinger ___
Wet sieve fines on specified sieves ___
6.2. Dry particles to constant mass at 110 ± 5°C (230 ± 9°F) (R) ___

7. Calculation:
7.1. Clay lumps & friable particles, % = [(M - R)/M] x 100

Data Sheet ___

S___F___N/A___

POTENTIAL ALKILI REACTIVITY OF CEMENT-AGGREGATE COMBINATIONS (MORTAR-BAR METHOD)
ASTM C 227-03

4. Apparatus:
4.1. Apparatus conform to ASTM C 490 ___; except as follows;
4.2. Sieves, square hole, woven-wire cloth sieves in accordance with ASTM E 11 ___
4.3. Mixer, paddle, & mixing bowl in accordance with ASTM C 305, except clearance between lower end of paddle & bottom of bowl is 5 – 6 mm (0.20 – 0.24 in.) ___
4.4. Tamper & trowel in accordance with ASTM C 109 ___
4.5. Containers (covered storage) made of material resistant to corrosion ___
Wall thickness less than 6 mm (3/16 in.) ___
Cover to maintain tight seal ___
Container arranged to provide every surface of spec. w/ approx. equal exposure to absorbent wicking material, spec. not in direct contact w/ wicking material but every surface within approx. 30 mm (1 1/4 in.) or less of wicking ___
Inner sides & core lined w/ absorbent material such as blotting paper or filter paper & will extend into top of water in bottom of container & above tops of specimens ___

5. Temperature & Humidity:
5.1. Temp molding room & dry materials not < 20°C (68°F), not > 27.5°C (81.5°F) ___
Temp mixing water molding room, moist room, & room measurements made 23°C ±2°C (73.4°F ± 3°F) ___
5.2. Rel. Humidity molding room not < 50 % ___
Moist room conform to ASTM C 511 ___
5.3. Storage room where specimens in containers stored temp. 38°C ± 2°C (100°F ± 3°F) ___

6. Selection & preparation of materials:
6.1. Selection of aggregate – Crush ___, process & have same grading as described in 6.2. ___
6.2. Preparation of aggregate – test in grading req'ments of specs. for project w/+ No. 4 removed ___
Fine aggregates to Table 1 ___
Crush if not enough to obtain amount in Table 1 ___
6.3. Selection & preparation of cement:
6.3.1. Job cement, cement(s) from expected source(s) for job ___
If several cements used desirably test each ___
Cement(s) w/ alkali content exceeding 0.60 %, calculated as Na_2O should be used ___
6.3.2. Reference cements – evaluate agg's. general use or compare agg's. for investigational purposes use highest alkali content ___
6.3.3. Preparation of cement – pass No. 20 sieve ___

7. Procedure: (7.1. – 7.2.6.)

8. Calculation:
8.1. Difference between initial length & length at each period of measurement to the nearest 0.0001 % of effective gage length & record as expansion of spec. for period ___
Report avg. expansion of the 4 spec. to nearest 0.01 % as expansion for given period ___

9. Examination at end of test:
9.1.1. Warping ___
9.1.2. Examination:
9.1.2.1. Presence, location, & type of pattern of cracking ___
9.1.2.2. Appearance of surfaces & surface mottling ___
9.1.2.3. Surficial deposits or exudations, nature, thickness & continuity ___

10. Report ___

Data Sheet ___

S___F___N/A___

POTENTIAL ALKILI-SILICA REACTIVITY OF AGGREGATES
CHEMICAL METHOD
ASTM C 289-03

4. Apparatus:
4.1. Scales & weights in accordance with ASTM C 1005 ___
4.2. Analytical balance & weights in accordance with ASTM C 114 ___
4.3. Crushing & grinding equipment to crush & grind to pass No. 50 sieve ___
4.4.
4.4.1. No. 50 & 100 sieve conforming to ASTM E 11 ___
4.4.2. No. 4 sieve ___
4.5. Reaction containers, corrosion-resistant steel or other material w/ airtight covers ___
4.6. Constant temperature 80 ± 1°C for 24 hr ___
4.7. Spectrophotometer or photometer to measure wavelength of approx. 410 nm ___
4.8. Glassware appropriate for tests ___

5. Reagents
5.1. Purity of reagents, reagent grade ___
5.2. Purity of water, reagent water conforming to Type IV of ASTM D 1193 ___
5.3. Ammonium molybdate solution, 10 g ammonium molybdate ($(NH_4)_6\ Mo_7O_{24}*4H_2O$)) in 100 ml water ___, filter fine-texture paper if solution not clear stored in polyethylene container ___
5.4. Concentrated hydrochloric acid (HCL) 1.19 kg/L stored in chemically resistant container ___
5.5. Standard HCL (0.05 N) standardized to ± 0.0001 N, stored in chemically resistant container ___
5.6. HCL (1 + 1) - equal vol. concentrated HCL (1.19 kg/L) & water, stored in chemically resistant container ___
5.7. Concentrated hydrofluoric acid (approx. 50 % HF), stored in polyethylene bottle ___
5.7.1. Precaution – before use HF, review safety precautions, first aid for burns, & emergency response for spills ___, protective equipment (full-face shields, rubber aprons, gloves impervious to HF ___
5.8. Oxalic acid solution, dissolve 10 g in 100 ml water stored in chemically resistant container ___
5.9. Phenolphthalein indicator solution, dissolve 1 g phenolphthalein in 100 ml ethanol (1 + 1) stored in chemically resistant container ___
5.10. Silica standard solution < 1 yr. old, 10 mmol (SiO_2)/L by dissolving sodium metasilicate in water stored in polyethylene bottle ___, Use 100-ml aliquot solution to determine SiO_2 content ___
5.11. Standard sodium hydroxide solution, 1.000 ± 0.010 N standardized to ± 0.001 N stored in polyethylene bottle ___
5.12. Concentrated sulfuric acid (G_s 1.84) stored in chemically resistant container ___

6. Selection & preparation of test samples ___

7. Reaction procedure ___

8. Dissolved silica by gravimetric method ___

9. Dissolved silica by photometric method ___

10. Preparation of calibration curve ___

11. Determination of dissolved silica ___

12. Calculation:
12.1. Calculate SiO_2 concentration of NaOH solution filtered form aggregate ___

13. Reduction in alkalinity:
13.1.1. Transfer 20-ml aliquot of dilute solution to flask, add 2-3 drops phenolphthalein solution, titrate w/ 0.05-N HCL to phenolphthalein end point ___
13.1.2.1. Calculate reduction in alkalinity ___

Data Sheet ___

S___F___N/A___

PETROGRAPHIC EXAMINATION OF AGGREGATES FOR CONCRETE AND FOR HARDENED CONCRETE
ASTM C 295-03

5. Apparatus & supplies:
5.1. Following list permits test to be performed, but petrographer may use or substitute other items deemed needed. Minimum equipment needed marked w/ asterisk (*).
5.1.1. Apparatus & supplies for preparation of specimens:
5.1.1.1. Rock-cutting saw* preferably 350-mm (14-in.) or larger diameter ___
5.1.1.2. Horizontal grinding wheel* preferably 400-mm (16-in.) or larger diameter ___
5.1.1.3. Polishing wheel preferably 200 to 300-mm (8 to 12-in.) diameter ___
5.1.1.4. Abrasives* ___
Grits of No. 100, 220, 320, 600, 800 (122, 63, 31, 16, 12-μm) ___
Alumina of M-305 (5μm) ___
5.1.1.5. Geologist's pick or hammer ___
5.1.1.6. Microscope slides* - clear, noncorrosive, 25 x 45 mm ___
5.1.1.7. Mounting medium for powder mounts* - Canada balsam, neutral, in xylene; low-viscosity epoxy; or Lakeside 70 ___
5.1.1.8. Xylene* ___
5.1.1.9. Mounting medium* ___
5.1.1.10. Laboratory oven* ___
5.1.1.11. Plate-glass squares* - 300-mm (12-in.) on edge ___
5.1.1.12. Sample splitter* ___
5.1.1.13. Micro cover glasses* - noncorrosive, square ___
5.1.1.14. Plattner mortar ___
5.1.2. Apparatus & supplies for examination of specimens:
5.1.2.1. Polarizing microscope* - oculars & objective lenses up to 600 x ___
Objective-centering devices; full & quartering-wave compensators; quartz wedge; micrometer eyepiece; & Bertrand lens ___
5.1.2.2. Microscope lamps* ___
5.1.2.3. Stereoscopic microscope* 6 to 150-power ___
5.1.2.4. Magnet* ___
5.1.2.5. Needleholder & points* ___
5.1.2.6. Dropping bottle, 60-ml ___
5.1.2.7. Petri culture dishes ___
5.1.2.8. Forceps ___
5.1.2.9. Lens paper* ___
5.1.2.10. Immersion media* indexes 1.410 to 1.785 @ 0.005 steps ___
5.1.2.11. Counter ___
5.1.2.12. Photomicrographic camera & accessories ___

6. Sampling ___
7. Procedure for selection of samples for natural gravel & sand ___
8. Procedure for examination of natural gravel ___
9. Procedure for examination of natural sand ___
10. Procedure for examination of drilled core ___
11. Procedure for examination of ledge rock ___
12. Procedure for examination of crushed stone ___
13. Procedure for examination of manufactured sand ___
14. Calculation ___
15. Report ___

Data Sheet ___

S___F___N/A___

EFFECTIVENESS OF MINERAL ADMIXTURES OR GBFS IN PREVENTING EXPANSION OF CONCRETE DUE TO ALKALI-SILICA REACTION
ASTM C 441-02

5. Apparatus:
5.1. Apparatus conform to ASTM C 227 ___
Apparatus conform to ASTM C 490 ___; except as follows;
Sieves, square hole, woven-wire cloth sieves in accordance with ASTM E 11 ___
Mixer, paddle, & mixing bowl in accordance with ASTM C 305, except clearance between lower end of paddle & bottom of bowl is 5 – 6 mm (0.20 – 0.24 in.) ___
Tamper & trowel in accordance with ASTM C 109 ___
Containers (covered storage) made of material resistant to corrosion ___
Wall thickness less than 6 mm (3/16 in.) ___
Cover to maintain tight seal ___
Container arranged to provide every surface of spec. w/ approx. equal exposure to absorbent wicking material, spec. not in direct contact w/ wicking material but every surface within approx. 30 mm (1 1/4 in.) or less of wicking ___
Inner sides & core lined w/ absorbent material such as blotting paper or filter paper & will extend into top of water in bottom of container & above tops of specimens ___

5. Materials:
6.1. Pyrex glass, crushes Pyrex glass No. 7740 cullet or solid glass rod crushed, graded to Table 1 ___
6.2. High-alkali cement ___

7. Proportioning & consistency of mortar:
7.1. Control mixture, 400 g high-alkali cement & 900 g Pyrex glass aggregate recombined to Table 1 ___
7.2. Test mixture using Pozzolans – 300 g high-alkali cement, (100 g Portland cement X density of Pozzolans /3.15), & 900 g Pyrex glass aggregate as described in 7.1. ___
7.3. Test mixture using slag - 200 g high-alkali cement, (200 g Portland cement X density of slag/3.15), & 900 g Pyrex glass aggregate as described in 7.1. ___
7.5. Job mixture, same as 7.1. – 7.1.3. except cement(s) for job used ___
7.6. Flow, mixing water (ml) produce flow between 100 & 115 in accordance w/ C 1347 ___

8. Temperature & humidity:
8.1. Temp. of materials, H_2O, molding room, moist cabinet & humidity of lab & moist cabinet in accordance w/ C 227 ___

9. Preparation of test specimens:
9.1. Preparation of molds – in accordance w/ C 227 ___
9.2. Mixing of mortar, in accordance w/ C 227, except add admixture or slag ___
9.3. Molding test specimens – in accordance w/ C 227 ___
9.4. Dimensions & No. test specimens – 3 1 x 1 x 11 ¼-in. (25 x 25 x 285-mm) w/ gage length 10 $\pm$ 0.1 in. (254 $\pm$ 2.5 mm) ___

10. Procedure:
10.1. Store & measure specimens in accordance w/ C 227 ___

11. Calculation:
11.1. Reduction of mortar expansion resulting from use of mineral admixture or slag & report to nearest 0.1 % ___

Data Sheet ___

S___F___N/A___

TOTAL MOISTURE CONTENT OF AGGREGATE BY DRYING
ASTM C 566-97

5. Apparatus:
5.1. Balance accurate to 0.1% of test load ___
5.2. Source of heat ___
Oven, 110 ± 5°C (230 ± 9°F) ___
Hot plate ___
Heat lamp ___
Microwave ___
5.3. Sample container, heat resistant and sufficient volume ___
5.4. Stirrer, metal spoon or spatula ___

6.1. Sample in accordance with ASTM D 75 ___
6.2. Sample size ___

NMSA, mm (in.)	Min Mass, kg (lb)
4.75 (No. 4)	0.5 (1.1)
9.5 (3/8)	1.5 (3.3)
12.5 (½)	2 (4.4)
19.0 (¾)	3 (6.6)
25.0 (1)	4 (8.8)

7.1. Determine sample mass (W) ___
7.2. Dry to constant mass ___
7.2. Stir while heating to avoid local heat ___
7.2.1. With microwave, particles may explode ___
7.3. With hot plate, use alcohol to expedite ___
7.3. Decant alcohol before igniting ___
7.4. Test constant mass by < 0.1% additional loss with further heating ___
7.5. Determine dried sample mass (D) ___

8.1. Calculate total evaporable moisture content, % = 100 x (W - D) / D

Data Sheet ___

S___F___N/A___

POTENTIAL ALKALI REACTIVITY OF CARBONATE ROCKS FOR CONCRETE AGGREGATES
ASTM C 586-99

5. Apparatus & reagents:

5.1. 1 *N* sodium hydroxide solution, 40 ± 1 g reagent grade NaOH in distilled H_2O, dilute to 1 L stored in polyethylene bottle ___

5.2. Sawing, drilling, & grinding equipment ___

5.3. Storage bottles, 50 to 100-ml ___

5.4. Length comparator to allow the following;

5.4.1. Positive means of contact w/ conical ends of specimen ___

5.4.2. High-grade barrel or dial micrometer readable to 0.0001-in. (0.0025-mm), accurate within 0.0001 in. (0.0025 mm) in any 0.0010-in. (0.025-mm) range & 0.0002 in. (0.0050 mm) in any 0.0100-in. (0.25-mm) range ___, calibrated throughout range ___

5.4.3. Sufficient range to allow small differences among gage lengths ___

5.4.4. Standard for checking measuring device – fused silica or steel alloy bar w/ coefficient of thermal expansion not > 1.0 X 10^{-6}/°C w/ overall length 1.38 ± 0.08 in. (35 ± 2 mm) ___

6.1. Sample in accordance with ASTM D 75 ___

6.2. Distinguish differences in lithology ___

7.1. Right circular cylinders w/ conical ends ___

7.2. 1.38 ± 0.20 in. (35 ± 5 mm) long & 0.35 ± 0.04 in. (9 ± 1 mm) diameter ___

7.3. Included angle of conical ends approximately 120° ___

8.1. Position mark on specimen ___

8.2. Measure length ___

8.3. Immerse in distilled water @ room temperature ___

8.4. Remove, blot, measure until change in length for 24 hr. immersion not exceed 0.02 % ___

8.5. Immerse in bottle w/ 35^{+} ml 1 *N* NaOH @ room temperature & seal ___

8.6. Measure length @ 7, 14, 21, & 28 days, then 4-wk, & 12-wk if tests longer than 1 yr. ___

8.7. When measuring remove from bottle, rinse, blot, & determine length in same position ___

8.8. Immediately place back in bottle & reseal ___

8.9. Replace solution every 6 mo. ___

9. Calculation:

9.1. Calculate length change to nearest 0.01 % of reference length ($\Delta l - [(l_1 - l_0)/ l_0]$ x 100 ___

Data Sheet ___

S___F___N/A___

IRON STAINING MATERIALS IN LIGHTWEIGHT CONCRETE AGGREGATES
ASTM C 641-98

4. Apparatus:
4.1. Balance accurate to 0.1 % of test load ___
4.2. Sieves, 3/8-in. & No. 30, conforming to ASTM E 11 ___
4.3. Filter paper, 250 ± 10-mm diameter ___
4.4. Cheesecloth wrapping, 2 thickness, reagent grade ~ 457 mm (18 in.) square ___
4.5. Steam bath w/ iron-free or distilled water ___

5. Reagents:
5.1. Purity of reagents, reagent grade ___
5.2. Purity of water, distilled water or water of equal purity ___
5.3. Concentration of reagents:
5.3.1. Concentrated acid & ammonium hydroxide, HCl sp. gr. 1.19, NH_4OH sp. gr. 0.90 ___
5.3.2. Diluted acid, HCl (1 + 2) ___

6.1. Sample in accordance w/ ASTM D 75 ___
6.2. Reduce field sample in accordance w/ ASTM C 702 ___, dry & sieve on 3/8-in. & No. 30 sieves ___

7.1 2 portions of 100 g ___
7.2 Form cup-shaped filter paper, place 100-g specimen, fold sides of cup & press ___
7.3 Wrap prepared sample in cheesecloth, saturate w/ distilled water, & steam for 16 hr. ___
7.4 Remove papers, wash papers, put on watch glass, oven dry ___
7.5 Rate staining by Visual Classification Method ___
7.5.1. Evaluate extent & intensity of stains using photographic stain index standards ___
7.6. When required by ASTM C 330 & 331 follow Chemical Analysis Method ___
7.6.1. Chemical Analysis Method, dissolve iron from papers with HCl & rinse w/ hot distilled water ___

8. Calculation:
8.1. Calculate the determined Fe_2O_3 to nearest 0.01 mg (reported to nearest 0.1) ___

9. Report:

Data Sheet ___

S___F___N/A___

EVALUATION OF FROST RESISTANCE OF COURSE AGGREGATES IN
AIR-ENTRAINED CONCRETE BY CRITICAL DILATION
ASTM C 682-94

4. Apparatus:
4.1. Cooling bath, sufficient size & depth ___
lower temperature from 1.7 to –9.4°C (35 to 15°F) at rate of 2.8 ± 0.5°C/hr. (5 ± 1°F) ___
4.2. Constant-temperature water bath, refrigerated, sufficient capacity, temp. 1.7 ± 0.9°C (35 ± 2°F) ___
4.3. Strain-measuring & recording facilities & supply of strain frames, measure 2 millionths or less ___
4.4. Room or cabinet, temp. & humidity control, constant air circulation ___
4.5. Miscellaneous equipment, molds & specified apparatus ASTM C 192 ___

5. Coarse aggregate preparation:
5.1. Sample in accordance w/ ASTM C295 ___
5.2. Grading, in accordance w/ Table 2 in ASTM C 33 ___
5.3. Conditioning, condition representative of expected in field ___

6. Concrete mixture:
6.1. Ingredients, cement to ASTM C 150, fine aggregate to C 33, air-entraining admixture to C 260 ___
6.2. Proportions, using ACI Recommended Practice 211.1, concrete to following requirements:
6.2.1. Cement content 517 ± 5 lb/yd^3 (307 ± 2.8 kg/m^3) ___
6.2.2. Air content to Table 1, air-entraining admixture to Table 1 ±1% in ASTM C 231 or C173 ___
6.2.3. Adjust water content & fine agg. content to get slump 2 ½ ± ½ in. (63.5 ± 12.7 mm) in accordance w/ ASTM C 143 ___
6.3. Machine mix to ASTM C 192, mix 3 min., rest 2 min., mix 2min., discharge ___
6.4. Replication, minimum of 2 batches ___

7. Specimen preparation & conditioning:
7.1. Number of specimens, 12 ea. batch ___, 6 if conditioning not practical ___
7.2. Specimen preparation in accordance w/ ASTM C 671 ___
7.3. Curing, cover & seal according to ASTM C 171, >24 hr. @ 65-75°F (18-24°C) remove mold & store in limewater @ 73 ± 3°C (23 ± 1.7 °C) 13 days ___
7.4. Conditioning, moisture condition as expected in field @ time of initial freezing ___, if not use following:
7.4.1. After 14 days, 3 from ea. batch 3 wks @ 35°F (1.7°C) prior to testing ___, 3 others 1 wk @ 75 % rel. humidity & 73 ± 3°F (23 ± 1.7 °C), then 2 wks in 35°F water ___

8. Method of test:
8.1. After conditioning, test in accordance w/ ASTM C 671 ___

9. Interpretation of results:

10. Report:

Data Sheet ___

S___F___N/A___

REDUCING SAMPLES OF AGGREGATE TO TESTING SIZE
ASTM C 702-98 (03)

Method A - Mechanical Splitter
7. Apparatus:
7.1. Sample Splitter ___
Even number of chutes, not less than 8 for CA ___ or 12 for FA ___
Equal width chutes ___
For CA and mixed aggregate, chutes 50% wider than NMSA ___
For dry FA, chutes 12.5 to 20-mm (½ to ¾-in.) width ___
Alternating side discharge ___
Two receptacles ___
Hopper or straight-edged pan with width ≤ overall assembly of chutes ___

8. Procedure:
8.1. Distribute uniformly from edge to edge ___
8.1. Free flowing ___
8.1. Reintroduce until test size is obtained ___

Method B - Quartering
9. Apparatus:
9.1. Straight-edged scoop, shovel, or trowel ___
Broom or brush ___
Canvas blanket, approximately 2 x 2.5-m (6 x 8-ft) ___

10. Procedure:
10.1.1. Place sample on hard, clean, level surface or blanket ___
Turn sample over 3 times with shovel or lifting blanket corners ___
Form conical pile ___
Flatten pile at apex ___
Divide into equal quarters ___
Remove diagonally opposite quarters including fines ___
Continue mixing and quartering to obtain desired test size ___

Method C - Miniature Stockpile (damp fine aggregate only) ___
11. Apparatus:
11.1. Straight-edged scoop, shovel, or trowel ___
Small sampling thief ___
Small scoop or spoon ___

12. Procedure:
12.1. Place sample on hard clean, level surface ___
Turn sample over three times ___
Form conical pile ___
Obtain ≥ 5 increments randomly from the stockpile with device ___

Data Sheet ___

S___F___N/A___

LENGTH CHANGE OF CONCRETE DUE TO ALKALI-CARBONATE ROCK REACTION
ASTM C 1105-95 (02)

5. Apparatus:
5.1. Mold, items for molding, & length comparator conform to ASTM C 157 & C 490 ___

6. Materials:
6.1. Max. size coarse agg., nothing > ¾-in. sieve ___,
If petrographic exam or tests made to ASTM C 586, use one of the 2 following procedures:
6.1.1. Proportional testing, crush to pass ¾-in. sieve, replace to keep same as original % on No. 4 ___
6.1.2. Separated size testing, crush to pass ¾-in. sieve & use as aggregate ___
6.2. Job cement, cement meet requirement in sufficient quantity ___
6.3. Reference cements, highest alkali, comply w/ ASTM C 150 & C 595 ___
6.4. Substitute fine agg., not reactive w/ alkalies ___

7. Sampling:
7.1. Sample in accordance w/ ASTM D 75, reduce in accordance w/ ASTM C 702 ___

8. Test specimens:
8.1. Prepare in accordance w/ ASTM C 157 ___, cross-sections 75.0 ± 0.7 mm (3.00 ± 0.03 in.) ___
8.2. Control or comparison mixtures made as described in 8.1. ___

9. Conditioning:
9.1. Cure, store, & remove molds in accordance w/ ASTM C 157 ___, keep moist storage to ASTM C 511, but not immerse in water ___

10. Procedure:
10.1. Procedure in ASTM C 157, except measure length @ 7, 28, & 56 days, 3, 6, 9, & 12 mo. ___

11. Calculation:
11.1. Calculate Δ length at ea. age as % change of length @ time of removal from mold ___
Calculate average Δ length in % for group ___
11.2. Data at least 3 to be valid test for that age ___

12. Report:

Data Sheet ___

S___F___N/A___

DEGRADATION OF FINE AGGREGATE DUE TO ATTRITION
ASTM C 1137-97

5. Apparatus:
5.1. Sieves, No. 200, 100, 50, 30, 16, 8, 4, & 3/8-in. conforming to ASTM E 11 ___
5.2. Balance readable & accurate to 0.1 g or 0.1 % test load ___
5.3. Drying oven, 110 ± 5°C (230 ± 9°F) ___
5.4. Attrition device, stainless steel octagonal tank 140 mm (5 ½ in.) high, 110 mm (4 ½ in.) inside width, motor-driven 19-mm (3/4-in.) vertical shaft w/ 3 blades rotating @ 850 rpm ___
5.5. Rotating device, electric motor-driven, drive impeller clockwise @ 850 rpm ___

6. Sample preparation:
6.1. Sample in accordance w/ ASTM D 75, reduce in accordance w/ ASTM C 702 ___
6.2. 2 portions 500 ± 5 g to specified grade ___, Table 1 5 alternative gradings ___
6.3. Table 1, wash fines in accordance w/ ASTM C 117, oven dry, sieve (ASTM C 136), reblend ___
6.4. Test on standard grading, use nearest to as-received sample ___

7. Procedure:
7.1. Oven-dry mass to nearest 0.1 g ___
7.2. Bottom of impeller shaft 3 ± 1mm (1/8 ± 1/32 in.) above bottom of container ___
W/ funnel place sample, add 175 ± 5 g water ___
7.3. 6 ± 1/10 min @ 850 rpm ___
7.4. Wash sample from container into pan ___
7.5. Settle until clear, decant ___
7.6. Oven dry to constant mass, if loss 3 g or > test invalid, if loss 3 g or < proceed w/ following:
7.7. Test sample in accordance w/ ASTM C 117, test rest in accordance w/ ASTM C 136 ___
7.8. Repeat w/ duplicate sample ___

8. Report:

Data Sheet ___

S___F___N/A___

ABRASION RESISTANCE OF CONCRETE (UNDERWATER METHOD)
ASTM C 1138-97

4. Apparatus:
4.1. Rotating device, drill press rotate to 1200 ± 100 rpm ___
4.2. Test container, steel pipe 305 ± 6-mm (12 ± ¼-in.) dia., 450 ± 25-mm (18 ± 1-in.) high ___
4.3. Agitation paddle, as shown in Fig. 2 ___
4.4. Abrasive charges, 70 grade 1000 chrome steel balls, nominal size in Table 1 ___
4.5. Scales, platform, 45 kg (100 lb.), accurate to 5.0 g, equipped to suspend sample in water ___
4.6. Weighing basket, wire basket or suitable container, prevent entrapping air ___
4.7. Water tank ___
4.8. Seating block, 3 steel blocks, 25 x 25 x 25 mm (1 x 1 x 1 in.) ___

5. Test specimens:
5.1. Cylindrical, dia. ~ 6-mm (1/4-in.) < inside dia. of container, 100 ± 13 mm (4 ± ½ in.) high ___
5.2. Remove membrane ___
5.3. Soak, lime-saturated water or water concrete to be in for minimum 48 hr. ___
5.4. Average dia. top surface nearest 2 mm (1/16 in.) ___
5.5. Surface dry, mass in air to 25.0 g, apparent mass in water to 25.0 g ___

6. Procedure:
6.1. Place in container testing surface up & seating blocks placed ___
6.2. Position surface normal to drill shaft, center coincides w/ drill shaft ___
6.3. Mount paddle 38 ± 5 mm (1 ½ ± ¼ in.) above surface of specimen ___
6.4. Mass of charge to 10 g, place on specimen, add water to 165 ± 5 mm(6 ½ ± ¼ in.) above spec. ___
6.5. Rotate paddle at required speed ___
6.6. Remove after 12 hr., flush abraded material & surface dry, get mass in air & water ___
6.7. 6 12-hr. periods, total 72 hr. ___

7. Calculation:
7.1.1. Calculate volume of specimen ___
7.1.2. Calculate volume of concrete lost at end of time increment ___

8. Report:

Data Sheet ___

S___F___N/A___

UNCOMPACTED VOID CONTENT OF FINE AGGREGATE (AS INFLUENCED BY PARTICLE SHAPE, SURFACE TEXTURE, AND GRADING
ASTM C 1252-03

6. Apparatus:
6.1. Cylindrical measure, 39 mm x 86 mm, 6 mm thick bottom, approx 100 ml ___
6.2. Funnel, 60 ± 4° slope from horizontal, 12.7 ± 0.6 mm dia., 38 mm high, vol at least 200 ml ___
6.3. Funnel stand,3 or 4 legs that allows funnel opening 115 ± 2 mm above top of cylinder ___
6.4. Glass plate, 60 x 60 x 4 mm ___
6.5. Pan, to contain funnel stand, prevent loss of material ___
6.6. Metal spatula, 100 mm long, 20 mm wide ___
6.7. Scale or balance, accurate & readable to ± 0.1 g ___

7. Sampling:
7.1. Sample in accordance w/ ASTM D 75 & C 702 ___
Or spls from ASTM C 136 ___
Or from agg extracted from bit concrete spec ___

8. Calibration of cylindrical measure:
8.1. Calibrate using water-filling method ___

9. Preparation of test samples:
9.1. Test method A, dry & sieve in accordance w/ ASTM C 136 to following quantities:

Individual Size Fraction	Mass, g
No. 8 to No. 16	44 ___
No. 16 to No. 30	57 ___
No. 30 to No. 50	72 ___
No. 50 to No. 100	17___
	190 ___

Tolerance ea. amount ± 0.2 g
9.2. Test method B, dry & sieve in accordance w/ ASTM C 136 to following quantities:

Individual Size Fraction	Mass, g
No. 8 to No. 16	190 ___
No. 16 to No. 30	190 ___
No. 30 to No. 50	190 ___

Tolerance ea. amount ± 1 g
9.3. Test method C, pass No. 4 sieve, 190 ± 1 g ___
9.4. Specific gravity of fine aggregate, bulk gr. – No. 4 in accordance w/ ASTM C 128 ___

10. Procedure:
10.1. Fill measure w/ funnel ___
10.2. Strike off heaped material w/ single pass, brush adhering fines, weigh to 0.1 g ___
10.3. Repeat & average 2 trials ___
10.4. Mass of empty measure ___

11. Calculations:
11.1. Calculate uncompacted voids ___
11.2. Test method A, calculate avg. uncompacted voids, U_s ___
11.3. Calculate test method B as follows:
11.3.1. Avg. uncompacted voids for ea. of 3 size-fraction samples ___
11.3.2. Mean uncompacted voids U_m ___
11.4.Test method C calculate avg. uncompacted voids, U_R ___

12. Report ___

Data Sheet ___

S___F___N/A___

POTENTIAL ALKILI REACTIVITY OF AGGREGATE (MORTAR-BAR METHOD)
ASTM C 1260-01

4.1. Apparatus conform to C 490 ___; except as follows:
4.2. Sieves, square hole, woven-wire cloth sieves in accordance with ASTM E 11 ___
4.3. Mixer, paddle, & mixing bowl in accordance with ASTM C 305, except clearance between lower end of paddle & bottom of bowl is 5.1 ± 0.3 mm (0.20 ± 0..01 in.) ___
4.4. Containers – such that bars totally immersed in H_2O or 1N NaOH solution ___
Made of mat'l to w/ stand prolonged exposure to 80°C (176°F) & resistant to 1N NaOH ___
Prevent moisture change by tight-fitting lids, sealing, or both ___
Specs do not touch sides of container or ea other ___
If specs stood upright, specs not supported by the metal gage stud ___
4.5. Oven or H_2O bath – convection oven or H_2O bath @ 80.0 ± 2.0°C (176 ± 3.6°F) ___

4.6. Sod Hydroxide – USP or tech grade, Na^+ & OH^- between 0.99N & 1.01N ___
4.7. Purity of H_2O – reagent H_2O conform to Type IV of D 1193 ___
4.8. Sod Hydroxide solution – 40.0 g NaOH/ 900ml H_2O & additional distilled or deionized H_2O to make 1.0 L of solution ___
Vol NaOH sol 4 ± 0.5 vols to 1 vol of mortar bars ___

6.1. Temp molding room & dry materials not < 20°C (68°F), not > 27.5°C (81.5°F) ___
Temp mixing water molding room, moist room, & room measurements made 23°C ±2°C (73.4°F ± 3°F) ___
6.2. Rel. Humidity molding room not < 50 % ___; Moist room conform to ASTM C 511 ___
6.3. Maintain storage oven or H_2O bath @ 80.0 ± 2.0°C (176 ± 3.6°F) ___

7.1. Selection of aggregate, coarse – Crush, fine – minimum crushing; process & have same grading as described in 6.2. ___
7.2. Preparation of aggregate – test in grading req'ments of specs. for project w/+ No. 4 removed ___
Fine aggregates to Table 1 ___
Crush if not enough to obtain amount in Table 1 ___
7.3. Selection & preparation of cement:
7.3.1. Portland cement to C 150 ___
7.3.2. Pass cement thru No. 20 sieve ___
7.4. Preparation of test specs:
7.4.1. At least 3 specs for ea cement-aggregate combination ___
7.4.2. Prepare molds to C 490, except interior surfaces covered w/ release agent ___
7.4.3. Mix 1 part cement to 2.25 parts graded aggregate ___
Mix enough for 3 specs @ 440 g cement & 990 g agg ret'd on sieves in Table 1 ___
H_2O to cement ratio = 0.47 by mass ___
7.4.4. Mix mortar to C 305 ___
7.4.5. Mold not > 2 min & 15 sec after finishing original mixing ___
Fill 2 = layers compacted w/ tamper, trim flush w/ top of mold ___

8.1. Put in moist cabinet or room for 24 ± 2 hr, de-mold, take rdgs, put on oven or H_2O bath ___
8.2. Remove from oven or bath, dry, take 0-rdg w/ in 15 ± 2 sec ___
Totally immerse in 1N NaOH @ 80.0 ± 2.0°C (176 ± 3.6°F), seal, put in oven or bath ___
8.3. Take rdgs (at least 3) for 14 days, then 1/ wk after 14 days ___

9. Calculation ___

10. Report ___

Data Sheet ___

S___F___N/A___

CONCRETE AGGRAGATES BY CETERMINATION OF LENGTH CHANGE OF CONCRETE
DUE TO ALKALI-SILICA REACTION
ASTM C 1293-01

5. Apparatus:
5.1. Molds, items for molding specimens comparator in accordance w/ ASTM C 157 & C 490 ___,
cross sections of 75.0 ± 0.7 mm (3.00 ± 0.03 in.) ___
5.2.1. Recommended container, 22-L (5.8-gal) polyethylene w/ airtight lids ___
5.2.2. Alternative containers, meeting expansion efficiency requirements ___
5.3.1. Recommended environment, sealed space, insulated ___
Air circulation, max temp variation w/ in 250 mm (9.8 in.) of top & bottom NTE 2.0°C (3.6°F) ___
Maintain temp. @ 38.0 ± 2.0°C (100.4 ± 3.6°F) ___
5.3.2. Alternative storage environment, meeting expansion efficiency requirements ___
:
6.1. USP or tech. Grade sodium hydroxide (NaOH) ___
6.3.1. Potable tap water, unless otherwise indicated ___

7.1. Cement, type I as specified in C 150, alkali content 0.9 ± 0.1 % Na_2O equivalent ___
7.2. Aggregates:
7.2.1. Nonreactive fine aggregate as specified in C 33, w/ fineness modulus of 2.7 ± 0.2 ___
7.2.2. Nonreactive course aggregate as specified in C 33 ___
7.2.3. Sieve coarse agg & grade according to Table 1 ___
7.2.3.1. Proportional testing, crush > 1-in. to pass ¾-in. sieve, grade to Table 1, add proportionally to original minus ¾-in. material ___
7.2.3.2. Separated size testing, crush > 1-in. to pass ¾-in. sieve, grade to Table 1, test in concrete as separate aggregate ___
7.3. Concrete mixture proportions:
7.3.1. Cement content, 420 ± 10 kg/m^3 (708 ± 17 lb/yd^3) ___
7.3.2. Volume of coarse concrete, oven-dry-rodded volume of 0.70 ± 0.2 % ___
7.3.3. Water to cement ratio of 0.42 to 0.45 by mass ___
7.3.4. Admixture (NaOH), bring alkali content, expressed as Na_2Oeq, to 1.25 % by mass of cement ___

10.1. Sample in accordance w/ ASTM D 75, reduce sample accordance w/ ASTM C 702 ___

9.1. Mixing concrete:
9.1.1. General, mix in accordance w/ ASTM C 192 ___
9.1.2. Slump, measure in accordance w/ ASTM C 143 ___
9.1.3. Yield & air content, in accordance w/ ASTM C 138 ___
9.2. Prepare 3 spec of type required in ASTM C 157 ___
9.3. Initial conditioning, cure, store, & remove molds in accordance w/ ASTM C 157 ___

10.1. Initial comparator reading in accordance w/ ASTM C 157, initial rdg. @ removal of mold @ age of 23.5 ± 0.5 hr., store @ 38.0 ± 2°C (100.4 ± 3.6°F) ___
10.2. Subsequent comparator readings, stand on end, not in contact w/ water ___
10.2.1. Read @ 7, 28, 56 days & 3, 6, 9, & 12 mos. ___
10.2.2. Remove containers from temp. room, place in moist room for 16 ± 4 hr. before reading ___
10.3. Make all specimens @ same time, so comparator readings done @ same time ___
10.4. Mark specimens so same end uppermost each reading, alternate ends in storage ___

11. Calculation:
11.1. Change in length to 0.001 %, average length change in % for group of prisms ___
11.2. At least 3 bars to be valid test at that age ___

12. Report:

Data Sheet ___

S___F___N/A___

SAMPLING AGGREGATES
ASTM D 75-03

5.3. Flowing stream, bin, or belt ___
5.3.1. Obtain 3 increments ___
Take entire cross section of material ___
Should use special device to intercept stream ___

5.3.2. Conveyor belt ___
Obtain 3 increments ___
Stop conveyor belt ___
Insert two templates shaped to the belt ___
Scoop all material including fines ___
Use brush and dust pan ___

5.3.3. Stock piles or transportation units ___
Coarse aggregate:
Least desirable sampling procedure ___
Insert board shoved vertically into pile above sampling point ___
Fine aggregate:
Optional 30-mm (1¼-in.) diameter sampling tube ___
Obtain 5 increments with tube at random locations ___

4.3.4. Roadway (base, sub-base) ___
Obtain 3 increments ___
Sample from full depth ___
Mark specific area (a metal template is useful) ___

4.4. Sample size:

NMSA, mm (in.)	Min Mass, kg (lb)
2.36 (No. 8)	10 (22)
4.75 (No. 4)	10 (22)
9.5 (3/8)	10 (22)
12.5 (½)	15 (33)
19.0 (¾)	25 (55)
25.0 (1)	50 (110)
37.5 (1½)	75 (165)
50 (2)	100 (220)
63 (2.5(	125 (276)
75 (3)	150 (331)
90 (3.5)	175 (386)

Data Sheet ___

S___F___N/A___

SIEVE ANALYSIS OF MINERAL FILLER FOR ROAD & PAVING MATERIALS
ASTM D 546-99

4. Apparatus:
4.1. Balance, 200 g capacity, sensitive to 0.05 g, accurate to ± 0.05 g ___
4.2. Sieves, No. 200, 50, & 30 conforming to ASTM E 11 ___
4.3. Drying oven, 110 ± 5°C (230 ± 9°F) ___

5. Test sample:
5.1. Sample in accordance w/ ASTM D 242, reduce in accordance w/ ASTM S 702 ___

6. Procedure:
6.1. Oven-dry @ 110 ± 5°C (230 ± 9°F) ___
6.2. Wash on nest of sieves, oven-dry material on ea. sieve, calculate ea. as % of original sample ___

7. Report:
7.1. Report results as total % passing ea. sieve to nearest 0.5 % ___

Data Sheet ___

S___F___N/A___

SAND EQUIVALENT VALUE OF SOILS AND FINE AGGREGATE
ASTM D 2419-02

6. Interferences:
6.1. Temp. solution 72 ± 5°F (22 ± 3°C) ___
6.2. Location free from vibration ___
6.3. Keep plastic cylinders from direct sunlight ___
6.4. Remove fungus as needed ___
6.4.1. Remove w/ diluted chlorine bleach ___
6.4.2. Fill w/ bleach, let stand overnight ___
6.4.3. Allow bleach to flow through siphon & irrigator tube ___
6.4.4. Rinse w/ clear water ___
6.5. Clear clogged sand from holes of irrigator __
6.6. Working solution > 2 wks. discard ___
6.7. Clean containers before mixing new solution ___
6.8. Fresh solution not added to old solution ___

7. Apparatus:
7.1. Transparent plastic graduate, stopper, irrigator tube, weighted foot, & siphon ___
7.2. Measuring tin, cylindrical, ~ 2 ¼-in. (57 mm) dia., capacity 85 ± 5 ml ___
7.3. No. 4 sieve conforming to ASTM E 11 ___
7.4. Wide-mouth funnel ___
7.5. 2 1.0 gal bottles ___
7.6. Flat pan ___
7.7. Clock or watch in min. & sec. ___
7.8. Mechanical sand equivalent shaker, hold graduate hor., throw 8 ± 0.04 in., operate 175 ± 2 cpm ___
7.9. Manual sand equivalent shaker, 100 cycles in 45 ± 5 sec, ½ stroke 5 ± 0.2 in. ___
7.10. Drying oven, 110 ± 5°C (230 ± 9°F) ___
7.11. Filter paper, Whatman No. 2V or equivalent ___

8. Reagents & materials:
8.1. Stock solution:
8.1.1. Stock solution w/ formaldehyde.
8.1.1.1. Anhydrous calcium chloride, 454 g, technical grade ___
8.1.1.2. USP glycerin, 2050 g ___
8.1.1.3. Formaldehyde, (40 volume % solution) 47 g ___
8.1.1.4. Dissolve 454 g calc. chlor. in 1.89 L distilled water, cool, filter, add 2050 g glycerin & 47 g formaldehyde, mix, dilute to 3.78 L ___
8.1.2. Stock solution w/ glutaraldehyde.
8.1.2.1. Calcium chloride dihydrate, 577 g, A.C.S. grade ___
8.1.2.2. USP glycerin, 2050 g ___
8.1.2.3. 1,5-pentanedial (glutaraldehyde), 50 % solution in 59 g water ___
8.1.2.4. Dissolve 577 g calc. chlor. dihydrate in 1.89 L distilled water, cool, add 2050 g glycerin, & 59 g glutaraldehyde, mix, dilute to 3.78 L ___
8.1.3. Stock solution w/ Kathon CG/ICP.
8.1.3.1. Calcium chloride dihydrate, 577g, A.C.S. grade ___
8.1.3.2. USP glycerin, 2050 g ___
8.1.3.3. Kathon CG/ICP, 63 g ___
8.1.3.4. Dissolve 577 g calc. chlor. dihydrate in 1.89 L distilled water, cool, add 2050 g glycerin, 63 g Kathon CG/ICP, mix, dilute to 3.78 L ___
8.2. Working calcium chloride solution, dilute 1 measuring tin (85 ± 5 ml) calc. chlor. to 1.0 gal water ___

Data Sheet ___

S___F___N/A___

AGGREGATE DURABILITY INDEX
ASTM D 3744-03

5. Apparatus:
5.1. Mechanical washing vessel, flat-bottom, straight-sided ___
5.2. Collection pan, round, 9 in. dia., 4 in. deep ___
5.3. Agitator, mechanical, reciprocating 285 ± 10 cpm, stroke length 1.75 ± 0.025 in. ___
5.4. Equipment required in ASTM D 2419 ___
5.5. Sieves conforming to ASTM E 11 ___
5.6. Balance, minimum capacity 500 g, meet requirements in ASTM D 4753, Class GP5 ___

6. Reagents & materials:
6.1. Calcium chloride solutions as specified in ASTM D 2419 ___
6.2. Distilled or demineralized water ___

8.1 Sample in Accordance w/ ASTM D 75 ___

9. Initial sample preparation:
9.1. Dry not > 140°F (60°C), separate on No. 4 sieve ___
9.3. Break clods & remove fines from aggregates ___
9.4. Sieve in accordance w/ ASTM C 136 on ¾, ½, 3/8-in. & No. 4,8, & 16 sieves (discard + ¾-in.) ___
9.5. Determine procedures based on sieve test (Par 9.4) ___
9.5.1. < 10 % pass No. 4, use Procedure A ___
9.5.2. < 10 % coarser No. 4, use Procedure B ___
9.5.3. Coarse & fine fractions present ≥ 10 % & % pass No. 16 > 10 %, use Procedures A & B ___
9.5.4. If 75 to 80 % between 3/8-in. & no. 16, use Procedure C ___

Procedure A – coarse aggregate:
10. Test sample preparation ___
11. Procedure for coarse aggregate ___

Procedure B – fine aggregate
12. Test sample preparation ___
13. Procedure for fine aggregate ---
Procedure C – agg. too fine to be tested as coarse agg. & too coarse to be tested as fine agg.:
14. Test sample preparation ___
15. Procedure ___
Calculation:
16. Procedure A – coarse aggregate ___
17. Procedure B – fine aggregate ___
18. Procedure C – agg. too fine to be tested as coarse agg. & too coarse to be tested as fine agg. ___

20. Report ___

Data Sheet ___

S___F___N/A___

FLAT OR ELONGATED PARTICLES
ASTM D 4791-99, CRD-C 119-91

6. Apparatus:
6.1.1. Proportional caliper ___
Base w/ 2 fixed post and swinging arm ___
Ratios of 1:2, 1:3, and 1:5 ___
6.1.2. Balance accurate to 0.5% of test load ___

7.1. Sample in accordance with ASTM D 75 ___

NMSA, mm (in.)	Min Mass, kg (lb)
9.5 (3/8)	1 (2)
12.5 (½)	2 (4)
19.0 (¾)	5 (11)
25.0 (1)	10 (22)
37.5 (1½)	15 (33)
50 (2)	20 (44)
63 (2.5)	35 (77)
75 (3)	60 (130)
90 (3.5)	100 (220)
100 (4)	150 (330)
112 (4.5)	200 (440)
125 (5)	300 (660)
150 (6)	500 (1100)

7.2. Reduce to test size ___

8. Procedure:
8.2. Each sieve size w/>10% of sample ___
100 particles for each sieve size ___
8.3. Test each particle in caliper ___
8.3.1. Segregate into groups ___
(1) Flat (F) ___
(2) Elongated (E) ___
(3) Not flat or elongated ___
8.3.2. Group test ___
8.3.1.1. Flatness - set large opening to width, test with smaller opening ___
8.3.1.2. Elongate - set large opening to length, test with smaller opening ___

9. Calculation:
9.1. Calculate weighted averages ___
Weighted Mass = % mass (F or E) x % mass retained > 3/8-in. ___
Weighted Number = % number (F or E) x % mass retained > 3/8-in. ___
Percent by mass ___
Percent by number ___

Data Sheet ___

S___F___N/A___

DETERMINING THE PERCENTAGE OF FRACTURED PARTICLES IN COARSE AGGREGATE
ASTM D 5821-01

5. Apparatus:
5.1. Balance accurate & readable to w/in 0.1 % of test spl mass @ any pt w/in range of use ___
5.2. Sieves, conforming to ASTM E-11 ___
5.3. Sample splitter in accordance w/ ASTM C 702 ___
5.4. Spatula ___

6.1. Sample in accordance w/ ASTM D 75 ___

7. Sample preparation:
7.1. Dry spl sufficiently to get clean separation of fine & coarse mat'l ___
Sieve on # 4 or specified sieve in accordance w/ ASTM C 136 ___
Reduce portion retained on the sieve in accordance w/ ASTM C 702 ___
7.2. Sample size:

NMSA, mm (in.)	Min Mass, g (lb)
9.5 (3/8)	200 (0.5)
12.5 (½)	500 (1)
19.0 (¾)	1500 (3)
25.0 (1)	3000 (6.5)
37.5 (1½)	7500 (16.5)

8. Procedure:
8.1. Wash over designated sieve, dry to constant weight, weigh to 0.1 % of original dry weight ___
8.2. Inspect ea. particle ___
Hold particle so face is viewed directly ___
If face is at least ¼ of max cross-sectional area, consider it a fractured face ___
8.3. Use spatula & separate into 3 categories ___
Fractured based on whether particle has required No. of fractured faces ___
Particles not meeting specified criteria ___
Questionable or border-line particles ___
8.4. Determine weight or count for ea. category ___
8.5. If > one No. of fractured faces is specified, repeat proc. on same spl for ea. requirement ___

9. Report:
9.1. Mass % or count % of part w/ specified Nos. of fractured faces to nearest 1 % as follows:

$$P = [F/(F + N)] \times 100$$ ___

Where:
P = % particles w/ specified No. of fractured faces
F = Mass or count of fractured particles w/ at least the specified No. of fractured faces
N = Mass or count of particles in the non-fractured category not meeting the fractured particle criteria
9.2. Specified fracture criteria against which the spl was evaluated ___
9.3. Total mass in grams of the coarse aggregate tested ___
9.4. The sieve on which test spl ret'd @ start of test ___
9.5. Whether the % of fractured faces was determined by mass or count ___

Data Sheet ___

S___F___N/A___

SCRATCH HARDNESS OF COARSE AGGREGATE
CRD-C 130-89

2. Apparatus:
2.1. Brass rod, 1.6-mm (1/16-in.) diameter w/rounded point ___
Force device mount, 8.9 ± 0.4-N (2 ± 0.1-lbf) when mounted ___
Scratch copper penny but not a nickel ___

3. Sample in accordance with ASTM D 75 ___
3.1. Sample size ___

NMSA, mm (in.)	Min Mass, kg (lb)
12.5 (½)	0.2 (0.4)
19.0 (¾)	0.6 (1.3)
25.0 (1)	1.5 (3.3)

Material coarser than 9.5-mm (3/8-in.) ___
Size > 10% of sample ___

4. Procedure:
4.1. Scratch each particle ___
Separate into group of scratched or not ___

5. Calculation:
5.1. Calculate % soft particles by mass ___
Calculate % soft particles by number ___
5.1.4. Weighted average, % = % soft particle x sample grading ___

Data Sheet ___

S___F___N/A___

PERCENTAGE OF CRUSHED PARTICLES IN AGGREGATE
CRD-C 171-94

6. Apparatus:
6.1. Balance, minimum capacity 6 kg, sensitive to 0.1 g ___
6.2. Stereoscopic microscope, 6 to 150X ___
6.3. Sieves conforming to ASTM E 11 ___
6.4. Drying oven, 110 ± 5°C (230 ± 9°F) ___
6.5. Spatula ___
6.6. Sample splitter ___

7. Sampling:
7.1. Sample in accordance w/ ASTM D 75 & D 3665, wash, oven-dry @ 110 ± 5°C (230 ± 9°F) ___
7.2. Sieve in accordance w/ ASTM C 136 ___
7.3. Select amount in accordance w/ ASTM C 702 in amounts in Table 1, except if < amount in column, use all sample ___

8. Procedure:
8.1. Mass to 0.1 g ___
8.2. Spread fraction on clean flat surface to inspect each particle ___
8.3. Inspect ea. particle for fractures, microscope on minus No. 4 fractions ___
8.4. Separate crushed from not crushed ___
8.5. Mass crushed particles from ea. fraction ___

9. Calculations:
9.1. Calculate % of crushed particles in ea. fraction as follows:
Percentage crushed particles (%) = (mass crushed particles/mass fraction) X 100 ___

10. Report:
10.1 % retained on ea. sieve ___
10.2 Mass ea. fraction ___
10.3 Mass crushed particles ea. fraction ___
10.4 Percentage crushed particles ea. fraction ___

Data Sheet ___

S___F___N/A___

Sieves

Check for holes, looseness, tears, cracks, etc. (ASTM E 11 section 5.1):

Sieve Size	200-mm (8-in.)	300-mm (12-in.)	Gilson
150-mm (6-in.)			
125-mm (5-in.)			
100-mm (4-in.)			
90-mm (3½-in.)			
75-mm (3-in.)			
63-mm (2½-in.)			
50-mm (2-in.)			
37.5-mm (1½-in.)			
31.5-mm (1¼-in.)			
25.0-mm (1-in.)			
19.0-mm (3/4-in.)			
16.0-mm (5/8-in.)			
12.5-mm (1/2-in.)			
9.5-mm (3/8-in.)			
8.0-mm (5/16-in.)			
6.3-mm (1/4-in.)			
4.75-mm (No. 4)			
4.00-mm (No. 5)			
3.35-mm (No. 6)			
2.36-mm (No. 8)			
2.00-mm (No. 10)			
1.70-mm (No. 12)			
1.16-mm (No. 16)			
850-μm (No. 20)			
600-μm (No. 30)			
425-μm (No. 40)			
300-μm (No. 50)			
250-μm (No. 60)			
180-μm (No. 80)			
150-μm (No. 100)			
106-μm (No. 140)			
75-μm (No. 200)			