

Standard Recommended Practice for Estimating Scratch Hardness of Coarse Aggregate Particles

1. Scope

1.1 This recommended practice describes a method of estimating the quantity of soft particles in coarse aggregates on the basis of scratch hardness. It is intended to be used to identify materials that are soft, particularly those which are so poorly bonded that the separate particles in the piece are easily detached from the mass. The test is not intended to identify other types of deleterious materials in aggregates, separate mention of which should be made in specifications. Neither is it intended to imply that certain types of aggregate such as limestone, whose mineral constituents may be relatively soft but well bonded together, will not perform quite adequately in concrete or other end products even though it may be possible to produce a groove in the particles by the scratch hardness apparatus.

1.2 This recommended practice is intended primarily for field use in estimating the quality of a deposit of coarse aggregate. It will be helpful in the laboratory, and when used with visual inspection will afford a fast, convenient means of determining the amount of soft particles in aggregate. The test may be useful for preliminary screening of aggregate sources, but should not be considered for specification enforcement.

1.3 In case of question, the scratch test should be made on a freshly broken surface of the aggregate particle. If the particle contains more than one type of rock and is partly hard and partly soft, it should be classed as “soft” only if the soft portion is one third or more of the volume of the particle. Scratch hardness tests can be made on the exposed surface of a particle provided consideration is given to softening of the surface due to weathering. A particle with a thin, soft, and weathered surface and a hard core should normally be classed as “soft.”

2. Apparatus

2.1 *Brass Rod*, 1/16 in. (1.6 mm) in diameter, with a rounded point, mounted in a device so that a force of 2 ± 0.1 lbf (8.9 ± 0.4 N) is applied to the specimen tested. A suitable design for this apparatus is shown in Fig. 1. The brass rod shall be of suitable hardness so that when filed to a sharp point, it will scratch a copper penny (U. S. Lincoln design) but fail to scratch a nickel (U. S. Jefferson design). For use in the field, a brass rod of the specified size and hardness can be mounted into the wooden shaft of an ordinary lead pencil.

3. Samples

3.1 Coarse aggregate for the test shall consist of material from which the sizes finer than the 3/8-in. (9.5-mm) sieve have been removed. The sample tested shall be of such size that it will yield not less than the amounts of the different sizes prescribed in Table 1, which shall be available in amounts of 10 % or more.

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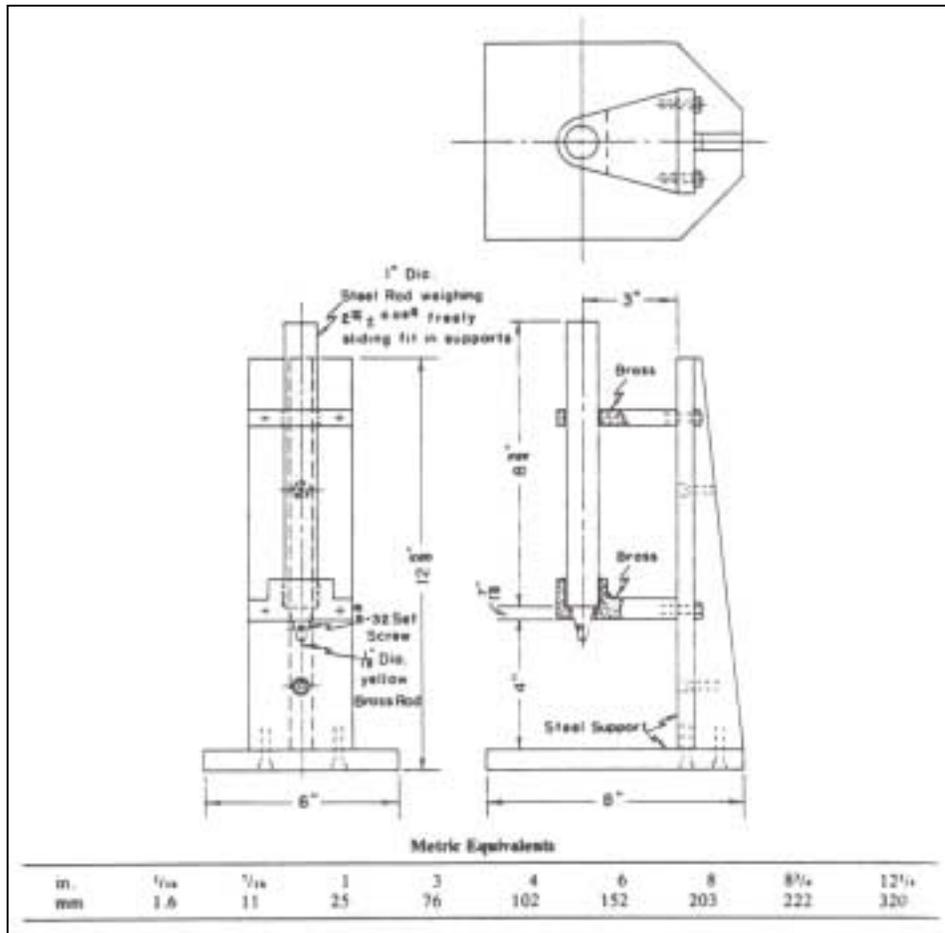


Fig. 1. Apparatus for Scratch Hardness Test

3.2 Should the sample contain less than 10 % of any of the sizes prescribed in Table 1, that size shall not be tested; but for the purpose of calculating the test results, it shall be considered to contain the same percentage of soft particles as the average of the next larger and next smaller size; or if one of these sizes is absent, it shall be considered to have the same loss as the next larger or next smaller size, whichever is present.

3.3 The requirements given in 3.1 cover aggregates composed of a mixture of different types of rock. When the aggregate is composed of only one type of rock, the weight of the sample tested may be reduced to an amount considered appropriate by the engineer.

4. Procedure

4.1 Subject each particle of aggregate under test to a scratching motion of the brass rod, using a force of 2 lbf (8.9 N). Particles are considered to be soft if, during the scratching process, a groove is made in them without deposition of metal from the brass rod, or if separate particles are detached from the rock mass.

NOTE—In the case of some sandstones, brass fragments may be deposited on hard individual grains, while at the same time separate particles are detached from the mass due to a weak-binding medium. Such particles are to be considered as soft.

5. Calculation and Report

5.1 The report shall include the following:

5.1.1 Weight and number particles of each size of each sample classified as soft in the test,

5.1.2 Weight and number of particles of each size of each sample classified as soft in the test,

5.1.3 Percentage of test sample classified as soft by weight and by number of particles, and

5.1.4 Weighted average percentage of soft particles calculated from percentages in 5.1.3 and based on the grading of the sample of aggregate received for examination or, preferably, the average grading of the material from that portion of the supply of which the sample is representative. In these calculations, sizes finer than the 3/8-in. (9.5-mm) sieve shall not be included.

Table 1 Minimum Size of Sample to be Tested (Square Opening Sieves)

Sieve Size, in. (mm)	Sample Weight, g
3/4 to 1/2 (9.5 to 12.5)	200
1/2 to 3/4 (12.5 to 19.0)	600
3/4 to 1 (19.0 to 25.0)	1,500
1 to 1-1/2 (25.0 to 37.5)	4,500
1-1/2 to 2 (37.5 to 50)	12,000