8.2 Setting Time of Cement

8.2.1 Introduction

The setting times of cement give an indication of how long the cement will remain workable when used in a concrete mix. If the cement has deteriorated or was originally defective, it may take an excessive time to set.

8.2.2 Apparatus

The apparatus used for the test is the standard Vicat apparatus as shown in Figure 8.2.1. The apparatus is essentially a simple penetrometer, the sample of cement paste being placed in the mould below the sliding weight. The weight may be varied by placing calibrated weights within the stem and three different penetration devices may be fitted to the underside of the weight. The total sliding weight including the penetration attachments should be 300 ± 1g.

8.2.3 Sample preparation

a) The sample must be mixed with the correct amount of water to give a standard consistency. The standard consistence is determined by means of the Vicat apparatus fitted with the plunger, a 10mm diameter blunt-ended, metal cylinder weighing 9.0 ± 0.5 g.

b) The freshly mixed cement paste is placed in the mould and levelled off with a trowel. The plunger is brought into contact with the surface of the paste and then released.

c) The paste is at the correct consistence when the plunger penetrates to a point 5 ± 1 mm. from the bottom of the mould. The depth of penetration is shown on the scale. Fresh samples of paste with varying water contents should be tested until the desired consistence is achieved.

d) Normally, a weight of water between 26 and 33 percent of the weight of the dry cement is required to obtain the standard consistence.

Note. Note that the procedure of determining consistence should not take longer than about 5 minutes.

8.2.4 Test procedure

a) A fresh sample of cement paste of standard consistence should be placed in the mould and levelled off using a trowel.

b) The initial set needle should be fitted to the apparatus, this needle is a blunt-ended cylinder of diameter 1.13 mm. and weighing 9.0 ± 0.5 g. with the needle in position the sliding portion of the apparatus should weight 300 grams. The weight should be checked prior to the start of the test.

c) To determine the initial setting time the needle is brought into contact with the surface of the cement paste and released. Initially the needle will penetrate completely through the paste to the base of the mould, but the test is repeated at regular intervals at different points on the surface until the needle only penetrates to within 5 ± 1 mm. of the base of the mould. The time elapsed from initially mixing the cement with water until the desired penetration is reached is the initial setting time.
Figure 8.2.1 Vicat apparatus for determining the standard consistence and setting time of cement.
d) To determine the final setting time the final set needle is fitted to the apparatus. The final set needle is a cylindrical blunt-ended needle which is fitted with a metal collar which is hollowed out to leave a 5 mm. diameter cutting edge 0.5 mm. behind the tip of the needle. The weight should be 9.0 ± 0.5 g.

e) The needle is brought gently into contact with the surface of the paste and released. This operation is repeated at intervals until the tip of the needle marks the paste but the cutting edge does not come into contact with the paste. The time elapsed from initial mixing of the cement and water until this stage is reached is the final setting time.

Note 1. For ordinary Portland cement the initial time of setting is not less than 45 minutes and the final time of setting is not more than 375 minutes by Vicat test.

Note 2. It should be noted that the setting times will be reduced as the temperature of the paste increases, and the temperature of the test should be maintained at 30 ± 2°C to give consistent results. To prevent premature hardening of the surface of the paste, the humidity should exceed 90%; this may be achieved by covering the apparatus with a damp, but not dripping, towel between determinations.

8.2.5 Reporting of results

The initial setting time should be reported to the nearest 5 minutes and the final setting time should be reported to the nearest 30 minutes. The temperature of the test should be stated.