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METHOD OF TEST FOR PERFORMANCE OF SCREED BOARD CONCRETE VIBRATORS

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0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 22 March 1973, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The vibration characteristics for screed board concrete vibrators are indicated in IS : 2506-1964* which also recommends the methods for measuring these characteristics. While specifying these vibration characteristics, the committee had appreciated that even the requirements in regard to amplitude, frequency and acceleration could considerably vary from case to case and, therefore, the attempt in the specification had been to lay down only the limiting values of the vibration characteristics and the physical dimensions of vibrators on the basis of available technical literature, experience and the manufacturing practices in the country. A mere measurement of amplitude, frequency and acceleration of vibration may not yield a firm basis for judging the efficiency of a screed board vibrator and, therefore, a direct measurement of the amount and uniformity of compaction of concrete achieved with a vibrator would alone give a more convincing and fairer appreciation of its quality.

0.3 In this standard an attempt has been made to arrive at a method of test for direct measurement of compacting characteristics of screed board concrete vibrators to assess their performance in terms of compaction of concrete. The requirements have been suggested on the basis of available literature and will be reviewed further with the availability of more data in the light of experience gained with the use of this standard.

0.4 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

1. SCOPE

1.1 This standard covers the method of test for performance of screed board concrete vibrators in terms of compaction of concrete.

*Specification for screed board concrete vibrators.

†Rules for rounding off numerical values (*revised*).

2. PRINCIPLE OF TEST

2.1 The vibrator, when tested in accordance with the procedure laid down in **4** for compaction of concrete, shall be capable of compacting fully in one pass of the screed board, a 180 mm thick cement concrete slab of mix 1 : 2 : 4 (cement : fine aggregates : coarse aggregates by weight, size of the coarse aggregate 20 mm and below) and having a workability of compacting factor 0·78 ± 0·01 laid over 75 mm thick stable base of fully hardened 1 : 3 : 6 concrete (cement : fine aggregates : coarse aggregates by weight, size of the coarse aggregates 20 mm and below).

2.2 The degree of compaction of slab shall be observed by measurement of density from top to bottom of nine 100 mm diameter cores cut from the compacted slab cured and hardened for 14 days. The slab shall be considered to be fully compacted, if the density of concrete anywhere on the depth of each of the core is not less than 93 percent of the maximum wet density of the mix as calculated theoretically (*see* **4.4**) or determined experimentally (*see* **4.4.1**).

3. MATERIALS

3.1 Cement shall conform to IS : 269-1967*.

3.2 Aggregates shall conform to IS : 383-1970†.

3.3 Concrete shall be prepared in accordance with the requirements of IS : 456-1964‡.

4. METHOD OF TEST

4.1 The base of 1 : 3 : 6 concrete shall be laid and compacted to the required thickness to suit over all dimensions of test slab as indicated in Fig. 1. The base slab shall be cured for at least seven days and the test slab shall be laid on it after another seven days.

4.2 The forms shall be laid on the lean concrete base to the required thickness of compacted test slab and to suit the dimensions given in Fig. 1. The concrete shall be laid evenly in the forms so that the surcharge above the top of the forms is between 25 to 30 mm (*see* Note on page 5). The vibrator shall be started and the vibrating beam shall be moved forward over the concrete surface at an approximate speed of 300 mm/min in steps equal to three fourth of the width of the vibrating beam and lifted on to the uncompacted concrete at each step along the length of slab. The slab shall be compacted by one

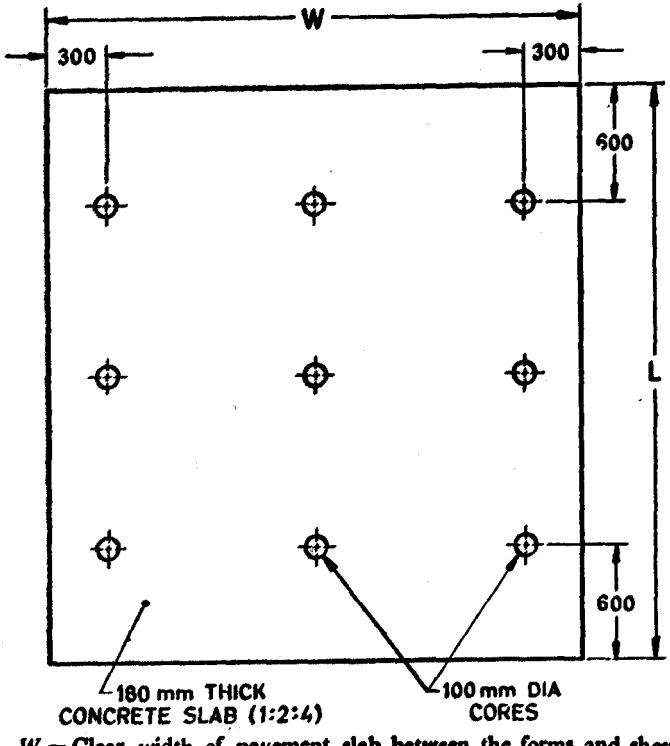
*Specification for ordinary, rapid-hardening and low heat Portland cement (*second revision*).

†Specification for coarse and fine aggregates from natural sources for concrete (*second revision*).

‡Code of practice for plain and reinforced concrete (*second revision*).

pass of the vibrating beam as indicated. Compaction slab shall be suitably cured for seven days and the cores shall be cut for density determination after allowing the slab to mature for another seven days.

NOTE — It is essential to judge the correct surcharge at the start of the test, because for a concrete of given workability, the amount of compaction is related to the change in the level of the surface of concrete during the passage of the vibrator. Too small a surcharge (that is too small a height of the concrete above the level of the tops of the forms before compaction) will result in poor compaction at the bottom of the slab, even though the surface is sealed and the compaction at the top appears good. Too great a surcharge will cause concrete to pile up in front of the beam until it reduces the speed of the machine and ultimately stops its forward motion. Correct surcharge may be judged before the start of the experiment, by adding material until no more can be compacted into the finished thickness of the slab.



W = Clear width of pavement slab between the forms and should suit the length of vibrating beam (*see* IS : 2506-1964 'Specification for screed board concrete vibrators')

L = Clear length of pavement between the forms

All dimensions in millimetres.

FIG. 1 DIAGRAM ILLUSTRATING THE POSITION OF CORES TO BE CUT FROM CONCRETE SLAB

4.3 Nine cores of 100 mm dia shall be drilled from the full depth of the hardened concrete as indicated in Fig. 1 and each core shall be sliced into sections about 45 mm thick. These sections shall be dried to constant weight to remove internal moisture, cooled in a desiccator and weighed. To determine the volume each section shall then be placed in molten paraffin wax and allowed to cool until the wax is in plastic condition. The excess wax shall be scraped off, leaving the surface voids filled and the concrete waterproofed. The wax-covered section shall then be weighed in air and in water. From the weight and volume the average dry density shall be determined for each slice.

4.4 Knowing the mix proportions of concrete and the specific gravities of different constituents, the theoretical maximum wet density of the freshly mixed concrete shall be determined from the following equation:

$$dc = \frac{(w + c + s + a)\ 1\,000}{\left(w + \frac{c}{S_c} + \frac{s}{S_s} + \frac{a}{S_a}\right)\frac{100}{100 - p}}$$

where

dc = theoretical maximum wet density of concrete in kg/m^3,

w = quantity of water in l,

c = weight of cement in kg,

s = weight of sand in kg,

a = weight of coarse aggregate in kg,

S_c = specific gravity of cement,

S_s = specific gravity of sand,

S_a = specific gravity of coarse aggregate, and

p = permissible percentage of voids in concrete to be taken as 2 for the purpose of this test.

4.4.1 Alternatively maximum wet density may be obtained by filling cube or cylinder moulds with the concrete in shallow layers and applying table vibration for at least one minute to ensure expulsion of all air. The weight of the compacted concrete divided by the volume will give the maximum wet density.

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