Lab Work No. 7

Determination of concrete compressive strength

The compressive strength of concrete is usually determined on cubic samples with face sizes of 70, 100, 150, 200, 300 mm; as well as on samples of cylindrical shape with a diameter of 70, 100, 150, 200 mm and a height of $h=d$ or $2d$. Sizes of the samples are selected depending on the maximum grain size of the aggregate. The maximum grain size of the filler should be no more than 1/4 of the size of the face of the cube or the diameter of the cylinder. Samples are tested in series of three samples.

Before molding, the inner surface of the metal molds is lubricated with a thin layer of machine oil. Compaction of the concrete mixture in the manufacture of samples is carried out by the method adopted in the technology of production. If it is impossible to fulfill this condition, the samples are formed as follows. The concrete mixture is laid and compacted by bayonet using a metal rod with a diameter of 16 mm. The number of bayings is determined at the rate of 10 bayings for every 100 cm^2 of sample area.

When compacting a concrete mixture with a mobility of less than 10 cm or a stiffness of up to 11 s, the form is fixed on a laboratory vibrating table with metal clamps. The form is filled with concrete mixture in excess and include a vibrating table. Vibration is continued until the mixture completely fills the mold to form cement milk on the surface. In the manufacture of samples from concrete mix with a hardness of 11 s or more, a nozzle is fixed on the mold. A mold with a nozzle is rigidly fixed on a vibrating platform and a load is installed on the surface of the mixture providing pressure (4 ± 0.5) kPa, and vibrate until the subsidence of the load ceases, plus an additional 5-10 s.

Then the excess concrete mixture is cut with a metal ruler, and the surface of the sample is smoothed with a trowel. When determining the compressive strength limits of ready-mixed concrete, the surface of the samples is closed with a damp cloth, kept in a room at an air temperature of (20 ± 3) °C for at least 24 hours, and then redistributed and placed in a normal hardening chamber. If heat and moisture

accelerated hardening of concrete is provided, then the samples in the molds are placed in a steaming chamber and subjected to heat and moisture treatment according to a given mode. Most often, the samples are hardened together with the products under identical conditions.

Before testing the samples are subjected to visual inspection (defective samples are not subject to testing), weighed, determine the average density. The average value of the average density of concrete is rounded to ten kg/m^3. The test sample is mounted on the bottom plate of the hydraulic press so that the direction of the breaking force is parallel to the concrete mixture layers when it is being compacted. The increase in load on the sample should be gradual. The rate of rise of the load should be within (0.6 ± 0.4) MPa per second.

The strength of concrete in MPa (kgf/cm^2) is calculated by the formula

$$R = \alpha \cdot \frac{P}{F}, \qquad (4)$$

where P – destructive force, N (kgf); F – cross-sectional area of the sample, mm^2 (cm^2); α – scale factor.

The values of the scale factors are selected from Table 6, depending on the size of the test samples.

Table 6

Values of Scale Factors to Bring the Strength of Heavy Concrete to the Strength of Concrete in Samples of the Basic Size

Cube Side Length, mm	Coefficient α
70	0.85
100	0.95
150	1.00
200	1.05
300	1.10

After calculating the tensile strength of individual samples, the arithmetic mean value of the tensile strength in this series of samples is calculated: from two samples ─ for two samples; of the three samples ─ the two highest strength samples.

The results of the experiments are entered in table.7.

Table 7

The Results of Determining the Strength of Concrete in Compression

Name of Defined Indicators	Values for Individual Samples			The Average Value of the Determined Indicator
Breaking load during compression test, kN (kgf)				
Strength at Compression, MPa (kgf/cm^2)				