THERMAL CONDUCTIVITY OF CONCRETE

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The cylinder method was used. A long cylinder had a circular hole along the axis in which there was an electric heating coil. By preliminary tests it was shown that the flow of heat in the middle of the cylinder was radial. The heat generated in the coil in this middle part could be calculated directly from the electric current and e. m. f. per unit length of the coil. The temperature gradient was measured by thermocouples which were placed in holes parallel to the axis at different distances from the axis. The thermal conductivity was then calculated from the formula

$$K = \frac{Q}{2\pi L\,(T_1 - T_2)} \log\left(\frac{R_2}{R_1}\right)$$

In this formula, Q is the quantity of heat generated in unit length at the middle, t_1 and t_2 are temperatures at radial distances r_1 and r_2 when a steady flow is reached.

Over fifty cylinders of various standard concrete mixtures have been tested at temperatures ranging from 50°C to 300°C. The cylinders were made of various standard concrete mixtures, the ratios of the mixture to the aggregate being 1:2, 1:3, 1:4, 1:5, 1:7, 1;9, and different proportions of the mixing water were also used. The thermal conductivity in c. g. s. physical units for "neat" cement was found to be .00147 and that for mixtures of different aggregates was about .00344 to .00384. The thermal conductivity of "neat" cement is thus about 1/2 of that for any concrete mixture. The thermal conductivity of concrete mixtures did not vary much with the richness in cement of the mixtures.

The above values are for temperatures ranging from 100°C to 200°C, but the effect of temperatures on thermal conductivity below 300°C was not marked. All the above concretes were thoroughly dried and had an age of from 28 days to 120 days.

These experiments are to be described in detail in a bulletin of the Engineering Experiment Station of the University of Illinois.

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