CRD-C 44-63

METHOD FOR CALCULATION OF THERMAL CONDUCTIVITY OF CONCRETE

Scope

1. This method is suitable for calculating the thermal conductivity of concrete from results of tests for diffusivity and specific heat.

Calculation

2. (a) The thermal conductivity of concrete shall be calculated from the following equation:

$$k = \alpha s W$$

where:
k = thermal conductivity, Btu/ft-hr-deg F,
α = thermal diffusivity, ft^2/hr,
s = specific heat, Btu/lb-deg F,
W = actual unit weight, lb/ft^3.

The thermal diffusivity of concrete shall be determined using either Method CRD-C 36 or CRD-C 37. The specific heat of the concrete shall be determined according to the procedure of Method CRD-C 124. The unit weight of concrete shall be determined using the procedures of Method CRD-C 7.

(b) The thermal conductivity of lightweight concrete and similar materials at various moisture contents shall be calculated from the following equation:[1]

$$k = \alpha C$$

where:
k = thermal conductivity, Btu/ft-hr-deg F,
α = thermal diffusivity, ft^2/hr,
C = volumetric heat capacity, Btu/ft^3-deg F.

The thermal diffusivity shall be determined using method of test for thermal diffusivity of lightweight concrete and similar materials. A curve shall be made of diffusivity versus moisture content for the range used. The volumetric heat capacity shall be calculated from the following equation:

$$C = \gamma\left(c_1 \div \frac{w}{100}\right)$$

where:
C = volumetric heat capacity, Btu/ft^3-deg F,
γ = dry unit weight, lb/ft^3,
c_1 = specific heat of dry sample,
w = moisture content, percent dry weight.

The specific heat of material removed from diffusivity specimen shall be determined according to the procedure of Method CRD-C 242.

Report

3. The calculated value for thermal conductivity shall be reported to two decimal places, e.g., k = 1.35 Btu/ft-hr-deg F.

[1] Procedure based on paper: "Tests for Thermal Diffusivity of Granular Materials" by William L. Shannon and Winthrop A. Wells, published in *Proceedings* of the American Society for Testing Materials, Vol 47, 1947.