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TEMPERATURE DEFORMATIONS OF FIBROCONCRETE

Kholmirzaev Sattor Abdujabborovich
PhD. Professor, Namangan Engineering-Building Institute

Gulamiddinov Sarvarjon Gayratjonovich
PhD Student, Namangan Engineering-Building Institute
E-mail: gsarvarjon@mail.ru

ANNOTATION
The types of temperature deformations of concrete are studied and analyzed in the article. According to the results of the analysis, the penetration deformations increase in the hot season, and in the cold and high humidity periods, the growth decreases and gradually turns into the expansion deformation. The influence of the dimensions of the concrete section on the initial deformation plays a major role in the initial periods of construction operation.

Keywords: temperature, value of deformations, Reinforced concrete structures, formation of cracks in concrete

In dry hot climates, the temperature varies during the day and during the season. When concrete heats up, thermal deformation consists of two types of deformation: reversible deformation - expansion of concrete under the influence of temperature, and volume reduction under the influence of irreversible temperature. The thermal expansion of concrete depends mainly on the aggregate and the moisture content of the concrete. The aggregate expands when the concrete heats up. With an increase in temperature, the wet cement stone expands less than the filler, and this process stops due to the exit of adsorbed moisture in the gel and thermal volume reduction. Volume shrinkage of concrete as a result of temperature occurs mainly as a result of shrinkage of cement stone [1-5]. When concrete heats up, thermal expansion and volume shrinkage deformations occur at the same time. Temperature deformation of concrete ε_{bt} from its temperature expansion to temperature shrinkage ε_{cs} is small in value:

$$\varepsilon_{bt} = \varepsilon_{tt} - \varepsilon_{cs} = (\alpha_{tt} - \alpha_{cs})t = \alpha_{bt} \cdot t \quad (1)$$

The value of temperature deformations ε_{bt} wet concrete is more than dry concrete. Coefficient of linear deformation of concrete α_{bt} depends on the type of filler and the average density of concrete in the first heating.

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As the temperature increases, the reinforcement expands, its temperature deformations are greater than those of concrete, which is 11.5-12·10-6 0S-1. A reinforced concrete element expands to a lesser value than concrete with more reinforcement. Until the formation of cracks, the thermal deformation of reinforced concrete is close to the thermal deformation of concrete.

Because it expands more than concrete, it sometimes causes cracks to form in concrete. After the formation of cracks, the tension of reinforcement with concrete decreases and the reinforced concrete element begins to stretch more. Its elongation approaches the elongation of the armature.

It is recommended to calculate reinforced concrete elements for the formation of cracks under the influence of temperature only if their section differs by 300C in static uncertain constructions and by 500C in static concrete constructions.

In hot, dry climates, there is little chance of such temperature differences, so such structures are considered as concrete structures.

Elongation of the element along the axis during the first stage of operation of reinforced concrete structures ε_t and its curvature due to temperature $(\frac{1}{r})t$ determined by the following formulas for the hot season of the year:

$$\varepsilon_t = \Delta tw \cdot \alpha_{bt}\gamma_t \quad (2)$$

$$(\frac{1}{r})t = \frac{\vartheta_W \alpha_{bt}}{h}\gamma \quad (3)$$

Change of element axis when calculating reinforced concrete structures according to the second stage ε_t, cs and curvature $(\frac{1}{r})tcs$ Temperature and volumetric shrinkage under the influence of temperature are determined by the following formulas:

For the warm season of the year:

$$\varepsilon_{t,cs} = (\Delta t_w \alpha_{bt} - \varepsilon_{cs})\gamma_t \quad (4)$$

$$(\frac{1}{r})t,cs = \left[\frac{\vartheta_W \alpha_{bt}}{h} \pm (\frac{1}{r})cs\right]\gamma_t \quad (5)$$

For the cold season of the year:

$$\varepsilon_{t,cs} = (\Delta t_C \alpha_{bt} + \varepsilon_{cs})\gamma_t \quad (6)$$

$$(\frac{1}{r})t,cs = \left[\frac{\vartheta_W \alpha_{bt}}{h} \pm (\frac{1}{r})cs\right]\gamma_t \quad (7)$$

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Reliability coefficient on temperature γ_t 1.1 is accepted when calculating the first group of limit states, and 1.0 when calculating the second group of limit states.

Axial shrinkage for concrete elements $\varepsilon_{cs} = \varepsilon_{s_1}$ and curvature $(\frac{1}{r})cs = 0$ is accepted as [6-10].

In static reinforced concrete elements, the axial shrinkage and curvature of the element is determined by the following formula, when the input deformation is evenly distributed along the cross-section height.

$$\varepsilon_{cs} = \frac{\varepsilon_{cs_1}}{1+\frac{\alpha}{\bar{v}}(M-\mu^1)} \qquad (8)$$

$$(\frac{1}{r})cs = \frac{(0{,}5\cdot h - y)\varepsilon_{cs_1}}{0{,}083h^3 + \frac{\alpha}{\bar{V}}\left[\mu(y-a)^2 + \mu^1(h-y-0^1)^2\right]} \qquad (9)$$

The distance from the center of gravity of the given section to the stretching limit is determined by the following formula:

$$y = \frac{0{,}5h + \frac{\alpha}{\bar{v}}\left[M\alpha + \mu^1(h-a^1)\right]}{1+\frac{\alpha}{\bar{v}}(M+\mu^1)} \qquad (10)$$

$$\alpha = \frac{E_s}{E_{b\beta b}} \qquad (11)$$

Here E_s and E_b - modulus of elasticity of concrete and reinforcement.

βb - coefficient taking into account the effect of dry hot climate on the modulus of elasticity,

$\bar{v}$ - coefficient of elasticity of concrete,

h - element cross-sectional height

a and a^1 – respectively S and S^1 protective layer of concrete for reinforcements.

$$\mu = \frac{A_S}{b\cdot h_0} \qquad (12)$$

$$\mu^1 = \frac{A^1{}_S}{b\cdot h_0} \qquad (13)$$

In a dry hot climate, the above-mentioned changes cannot affect the formation of the structure of slag concrete, as well as its physical and mechanical characteristics.

Deterioration of the concrete structure due to changes in temperature and humidity prevents the subsequent increase in concrete strength. The amount of these negative effects on lightweight concrete is less.

The main reason for this is that the moisture absorbed by the porous filler reduces the harmful effects of dry hot climates. Such conclusions can be found in the works of Uzbekistan, CIS countries (8,29,49) and foreign researchers [11-17].

In order to ensure the durability of slag concrete, it is important to ensure its crack resistance. A. According to studies conducted by Fedorov, the coefficient of resistance of slag concrete varies between 0.4 and 0.8, and its average value is 0.55.

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