

**DISTRIBUTION OF TEMPERATURE AND HUMIDITY IN  
CONCRETE OVER THE CROSS SECTION OF COLUMNS IN A DRY HOT  
CLIMATE**

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***Abstract:*** *The article studies the features of temperature and humidity changes in the outdoor air and establishes the temperature distribution over the cross section of reinforced concrete elements in natural conditions of a dry hot climate.*

***Key words:*** *climate, temperature, dry climate, concrete, reinforced concrete.*

In the most unfavorable climatic conditions of a dry, hot climate, there are structures that are directly exposed to solar radiation. Observations of the kinetics of changes in the temperature of concrete in a reinforced concrete element showed that at an ambient temperature of 37 °C the temperature of concrete under the influence of solar radiation reaches 48 °C at a minimum humidity of 20%. With an increase in air temperature in summer, the temperature on the concrete surface especially exposed to direct solar radiation increases. Starting from 11-13 hours, the air temperature rises faster, and the temperature of the concrete in the section is lower than the outside air temperature. On the surface of the element facing the sun, the concrete heats up faster than on the shady surface. At 2 pm this difference is 8 ... 16 due to solar radiation from 2 pm to 9 pm, heating of the inner layers of concrete is observed (Fig. 3. 4-3.6).

With an increase in air temperature, the temperature of concrete rises, and, starting from 13.00, the temperature of concrete on the surface of the columns begins to exceed the air temperature by 13 ... 17, especially from the side exposed to direct solar radiation. The maximum recorded temperature on the concrete surface in July at 2 pm was 45...48, which exceeds the air temperature by 12...18. (fig. 3. 7-3. 9).

There is a uniform heating with an increase in air temperature from 7.00 to 12.00. Starting from 13.00 hours, the increase in the temperature of the concrete

surface of the concrete is ahead of the increase in the temperature of the concrete in the middle of the section by 10 ... 12 .

Starting from 18:00, the temperature of the concrete decreases; by 20:00, the temperature of the concrete in the cross section becomes even. From 10:00 p.m., the decrease in the temperature of the concrete of the columns begins to lag behind the decrease in the air temperature, and the cooling of the concrete proceeds faster on the concrete surface than in the middle of the section. (Fig. 3.7-3.9).

On fig. 3.10 shows data on the change in the temperature of air and concrete in the section of the column at 15.00 hours for 1 year in a dry hot climate. Changes in concrete temperature follow changes in air temperature and are sinusoidal in nature. Starting from May and until October, the temperature of concrete in the section of the columns fluctuates between 30-48 with differences in the section of 8-11. In the autumn period, the concrete surface of the element facing the sun also turns out to be the most heated. This can be explained by the low horizon of the sun in autumn.

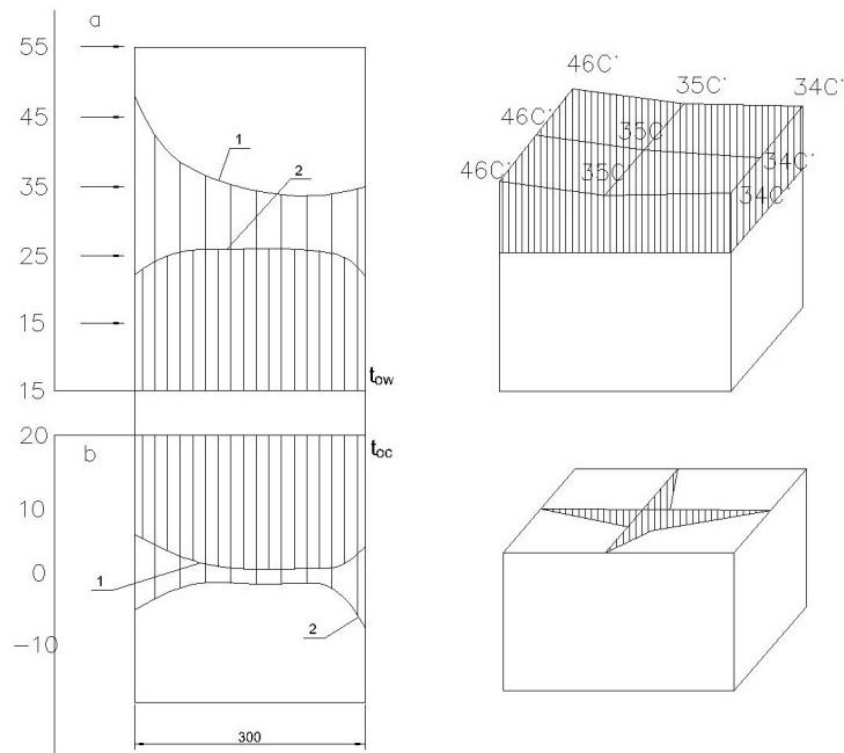


Fig. 3.4. Temperature distribution over the cross section in the hottest /a/ and most /b/ seasons under the influence of solar radiation on the stretched zone of the columns.

- 1) -at the hottest time of the day;
- 2) -to the coldest;
- 3) -direction of solar radiation.

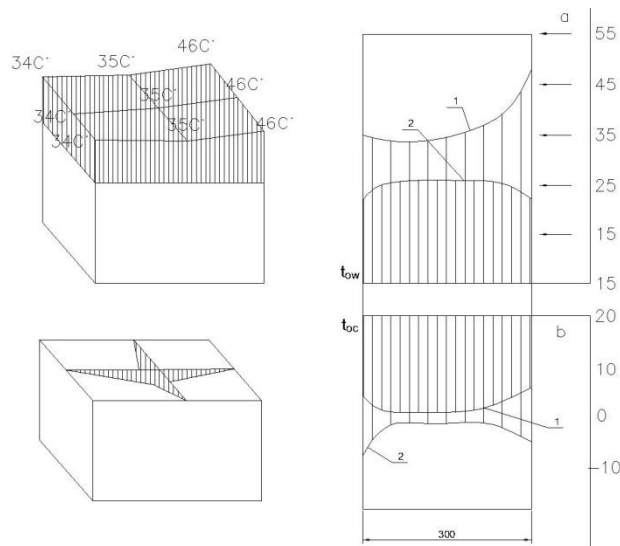
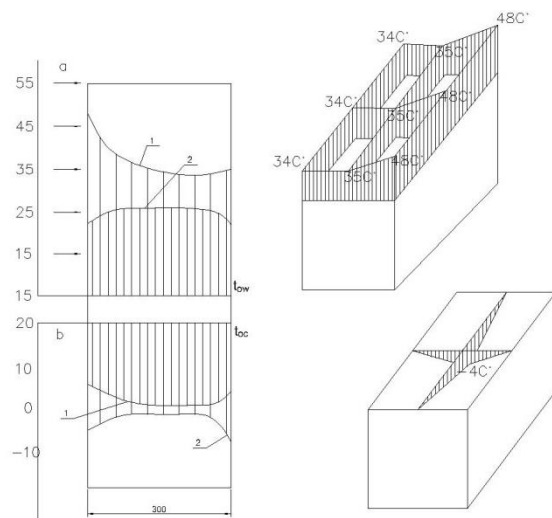


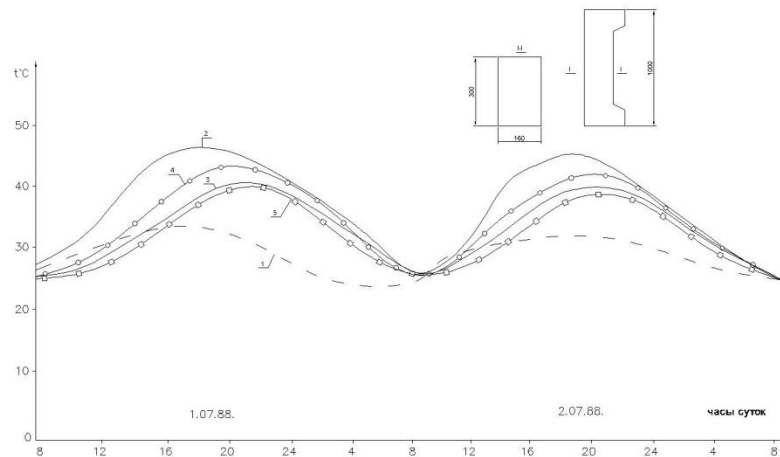
Fig.3.5 Temperature distribution over the cross section in the hottest /a/ and most /b/ seasons under the influence of solar radiation on the compressed zone of the columns.

- 1-at the hottest time of the day;
- 2-to the coldest;
- 3-direction of solar radiation.



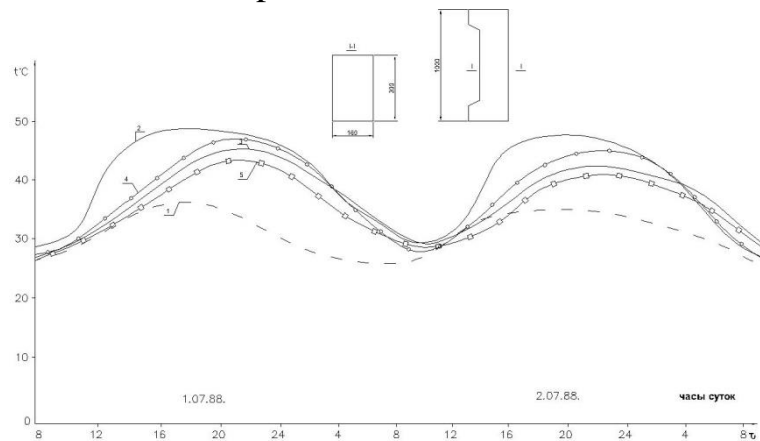
Pic. 3.6 Temperature distribution over the section in the hottest /a/ and the most /b/ season when exposed to solar radiation on the side surface of the columns.

- 1-at the hottest time of the day;
- 2-to the coldest;
- 3->направление солнечной радиации.



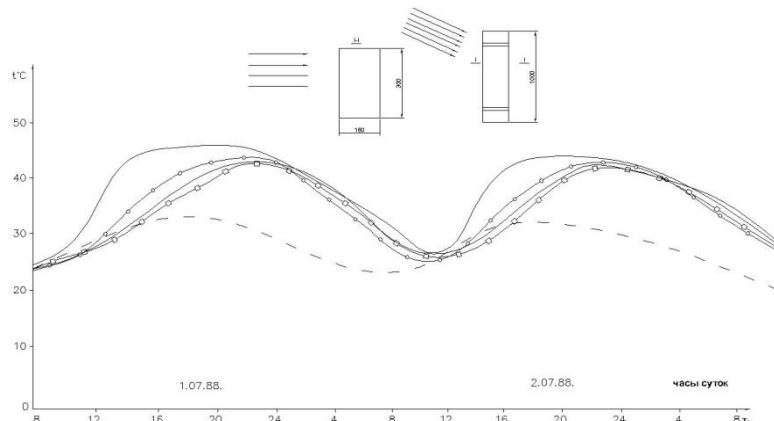
Pic. 3.7 Temperature change of concrete in a reinforced concrete element under the influence of solar radiation from the side of the stretched face during 2 days of the hottest month.

1-air temperature; 2-on the surface facing the sun;  
3- opposite surface; 4- at a depth of 30 mm; 5- in the middle of the section.



Picture. 3.8. The change in the temperature of concrete in a reinforced concrete element when exposed to solar radiation from the side of the compressed face for 2 days. 1 - air temperature; 2 - on the surface facing the sun;

3-opposite surface; 4-at a depth of 30mm; 5 - in the middle of the section.



Rice. 3.9. The change in the temperature of concrete in a reinforced concrete element when exposed to solar radiation from the side surface for 2 days. The numbers

on the curves are thermocouple numbers

X-location of thermocouples 1-5 thermocouple numbers

6-air temperature.

During the day during the day from 9 to 14 hours the temperature rises from 17 to 27 and the temperature difference is 10 respectively. From November to December and from March to May, the temperature of the concrete of the columns ranges from 5 to 25 with differences in the height of the section of 6 ... 8. In winter, the temperature of the concrete of the columns ranges from +4 to -4 at an air temperature of -7, and the temperature drops of the concrete in the cross section reaches 4 ... 7. Seasonal differences in concrete temperatures are 49 during the day and 22 at night. In samples, with an increase in temperature and a decrease in the relative humidity of the environment, by the age of one month, the humidity decreased by 5-6%, and after 3 months the humidity was 1-4%, which corresponded to the normal humidity of reinforced concrete structures in air-dry operating conditions. In the samples stored in the workshop in the shade, the same age, the humidity was 4%. Thus, the highest temperature in reinforced concrete elements in a dry hot climate, from the point of view of the influence of temperature and humidity conditions of the environment, is the summer period from July to August, and during the day - the period from 14 to 17 hours.

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