The Peerian Journal

Open Access | Peer Reviewed

Volume 27, February, 2024 **ISSN (E): 2788-0303**

Website: www.peerianjournal.com **Email:** editor@peerianjournal.com

Basics Of Studying The Temperature Field In Structures Under The Climate Conditions Of Uzbekistan

Rustamova.D.B., Khaitov.M.B., Fazilov F.X.

Teacher of Samarkand State Architecture and Construction University named after Mirzo Ulugbek (SamSACU).

nurmatovpanji017@gmail.com

Abstract: In order to develop the use of non-traditional energy resources as an alternative to natural fuel and energy sources in the country, practical work has begun in some regions to create powerful energy complexes using solar and wind energy.

Keywords: climate, external wall, structural diagram, air temperature, amplitude, heat transfer, thermal conductivity, heat transfer resistance, energy resources, energy efficiency.

Although the climate in Uzbekistan is short-lived, it is characterized by winters with temperatures of -20 ° C and below in the open air and summers with prolonged temperatures above + 40 ° C. In such conditions, both external heat resistance and thermal resistance requirements are applied to the external enclosing walls of building structures. priority. Thermal dominance of an exterior wall means that the temperature on the interior surface of the structure changes quickly or slowly when the temperature of the indoor air or outdoor air in the room changes. The smaller the amplitude of the temperature change occurring on the surface of the structure under the influence of changes in air temperature with a known and constant amplitude, the higher the thermal dominance of the structure or vice versa. Less heat is lost through the external enclosing structures, which have sufficient resistance to heat transfer, and condensation does not form on the internal surface of the structure during periods when the outside air temperature drops. To test the resistance to heat transfer and the predominance of heat, a sample of an external wall made of a cement sandwich panel was taken, a fragment 1.2 m long and 1.15 m wide, prepared at the factory. The structural diagram of a wall fragment is shown in Figure 2.1.

The thickness of the outer layer of the sandwich panel is 10 mm, volumetric weight $\gamma_0 = 1800\,кг/м^3$, thermal conductivity $\lambda = 0{,}76\,Bm/(м.{}^0C)$, heat absorption coefficient $S = 9{,}6\,Bm/(м^2.{}^0C)$ made from cement mixture. This layer is lined with glass fittings. Inner layer - thermal insulation density 40 кг/м3, thermal conductivity $\lambda = 0{,}041\,Bm/(м.{}^0C)$,
heat absorption coefficient $S = 0{,}49\,Bm/(м^2.{}^0C)$ made of foam [33].

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

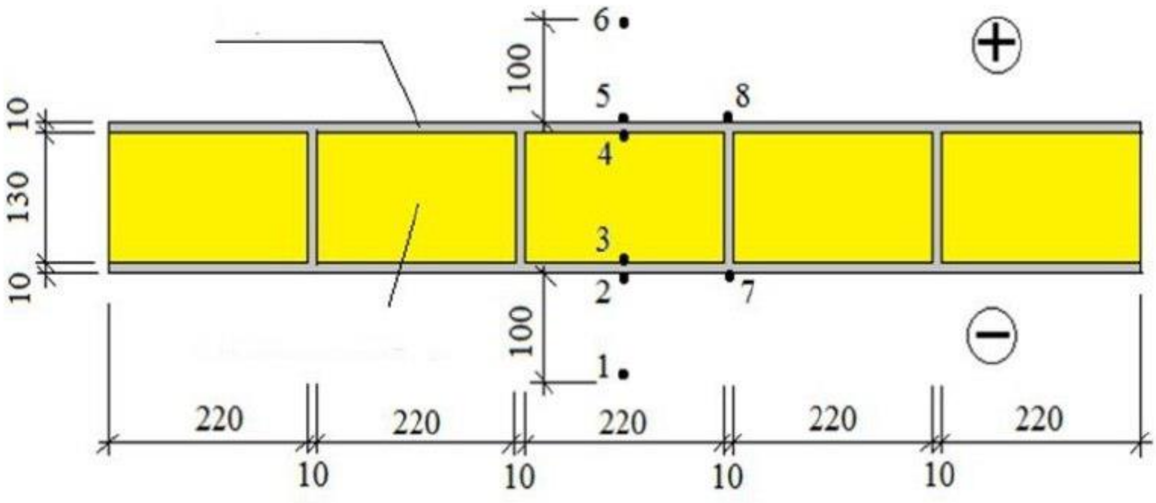

Figure 2.1. Layout of thermocouples on a cement sandwich wall panel: 1 ... 8 thermocouples.

The study of heat resistance and heat transfer of the wall sample prepared for the experiment was carried out using a device created at the Department of Design of Buildings, Structures and Services. The schematic diagram of this device is shown in Figure 2.2. Using the device allows you to create a temperature difference of about 20-22 oC on opposite surfaces of the walls to be tested. This device for thermal testing is located in the laboratory of the department. During the experiments, the amplitude of daily changes in air temperature in the room did not exceed 10 ° C, and the average air temperature changed only about 20-22 ° C.

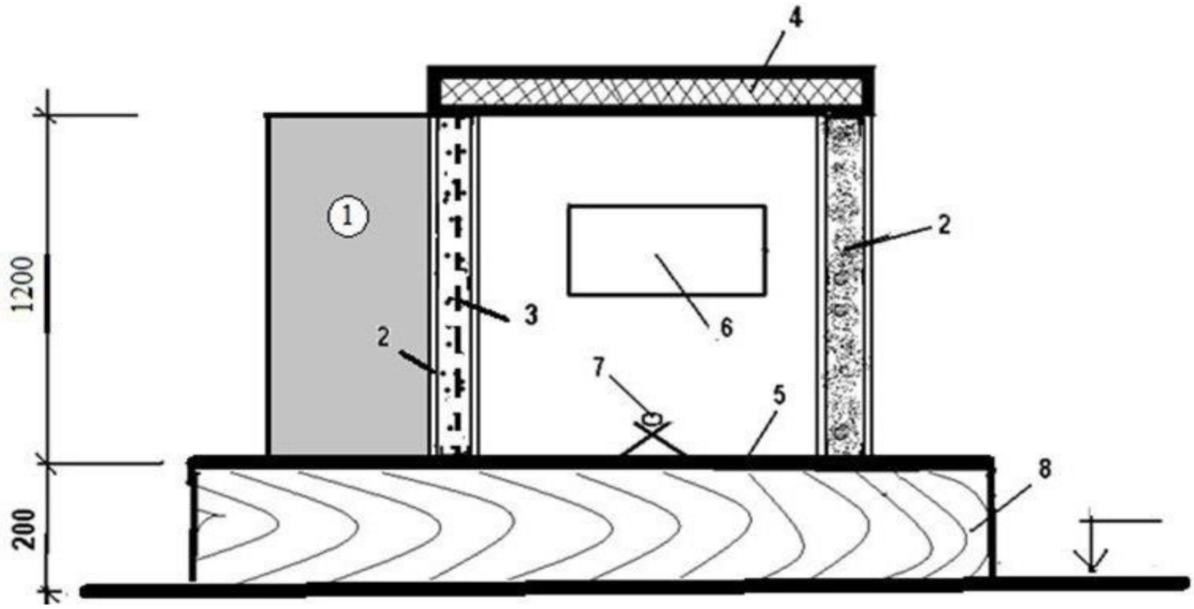

Figure 2.2. Schematic diagram of a device for conducting thermal tests on samples of cement sandwich wall panels:

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

1 - fragment of an internal wall made of a cement sandwich panel (installed perpendicular to the external wall panel); 2 - fragments of external walls made of cement sandwich panels; 3 - boundary of part of the frame profile entering the wall at the junction of the internal and external wall panels; 6 - cooling battery; 7 - heater chamber in the device; 4 - insulated chamber roof; 5 - linoleum floor of the chamber; 8 - load-bearing structure of the chamber floor (made of wooden beams).

When determining the resistance to heat transfer and the predominance of heat, temperature values were measured in two sections of the wall sample. The first section of the wall is located in the middle of the cell formed by cement ribs, 60 cm above the floor of the chamber. The following temperatures were measured in this section:

- air temperature in the device chamber at a distance of 10 cm from the wall surface (thermocouple 1);
- temperature of the wall surface from the chamber side (thermocouple 2);
- temperature at the boundary of the sandwich panel chamber and the polystyrene foam coating - thermal insulation (thermocouple 3);
- temperature at the boundary of the thermal insulation and the external cement coating on the room side (thermocouple 4);
- temperature of the outer surface of the cement coating from the room side (thermocouple 5);
- air temperature in the laboratory room (at a distance of 10 cm from the wall surface).

The second section of the wall where temperatures were measured was marked 60 cm above the chamber floor along the cemented edge of the wall fragment. The following measurements were made in this section:

- temperature of the surface of the cement coating from the chamber side (thermocouple 7);
- temperature of the surface of the cement coating from the room side (thermocouple 8).

During the experiment, the heat flow was measured using an ITP-11 thermometer. In experiments to determine the thermal dominance of cement sandwich panel walls, the air in the chamber was heated using 3 incandescent electric lamps with a total power of 350 W to create diurnal changes in outside air temperature.

The increase in temperature of the outer surface of the wall under the influence of solar radiation was taken into account as follows. The average temperature in July in Samarkand is $t_н = 25{,}9^0 C$. The maximum amplitude of daily changes in outdoor air temperature is $A_{t_н} = 25{,}2^0 C$ [24]. Maximum outdoor temperature excluding solar radiation $t_{н_{макс}} = t_н + 0{,}5A_{t_н} = 25{,}9 + 0{,}5 \cdot 25{,}2 = 38{,}5^0 C$,

Повышение температуры наружной поверхности стенки под воздействием солнечного излучения учитывалось следующим образом. Средняя температура в июле по Самарканду $t_н = 25{,}9^0 C$ равно. Максимальная амплитуда суточных изменений температуры наружного воздуха $A_{t_н} = 25{,}2^0 C$ [24]. Максимальная температура наружного воздуха, исключая солнечную радиацию $t_{н_{макс}} = t_н + 0{,}5A_{t_н} = 25{,}9 + 0{,}5 \cdot 25{,}2 = 38{,}5^0 C$,

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024
ISSN (E): 2788-0303
Website: www.peerianjournal.com
Email: editor@peerianjournal.com

minimum temperature

$$t_{н_{мин}} = t_н - 0,5A_{t_н} = 25,9 - 0,5 \cdot 25,2 = 13,3^0 C$$

would be equal.

The amount of solar radiation incident on the western wall is shown in Table 8 in [29]:

maximum radiation $J_{макс} = 740\, Bm / м^2$;

average radiation $J_{ср} = 169\, Bm / м^2$.

For Samarkand, the minimum value of average wind speed with a frequency of 16% or more per rum is $\vartheta = 2,4 м / сек$.

The effect of solar radiation was calculated using the equivalent temperature determined by the following formula [23]:

$$t_{экв} = \frac{\rho \cdot (J_{макс} - J_{ср})}{\alpha_н} \qquad (2.1)$$

Considering the absence of wind in the test chamber, the heat transfer coefficient of the outer surface of the wall for summer conditions in formula (2.1) $\alpha_н$ the value of the average wind speed was taken to be 1 m/s. In this case $\alpha_н = 1,16 \cdot (5 + 10\sqrt{1}) = 17,4 Bm / м^2 . {}^0C$.

Equivalent temperature

$$t_{экв} = \frac{0,7 \cdot (740 - 169)}{17,4} = 23^0 C.$$

Maximum temperature on the outer surface of the wall taking into account exposure to solar radiation: $t_{н_{макс}} = t_н + 0,5 \cdot A_{t_н} + t_{экв} = 25,9 + 12,6 + 23 = 61,5^0 C$

accepted. Two 100 W bulbs were turned on at 6 a.m. and one 150 W bulb was turned on at 9 a.m. to uniformly heat the air in the chamber. When the maximum temperature was reached, the light bulbs were turned off and the air in the chamber was naturally cooled for 3 hours. After this, the cooling unit was started. After the air temperature in the chamber dropped to a minimum value (at 000 o'clock at night), the refrigerator was turned off, and the air in the chamber was heated naturally for 6 hours.

References

1. Egamova, M., & Matyokubov, B. (2023). WAYS TO INCREASE THE ENERGY EFFICIENCY OF BUILDINGS AND THEIR EXTERNAL BARRIER STRUCTURES. *Evraziyskiy jurnal akademicheskix issledovaniy*, *3*(1 Part 1), 186-191.
2. Nosirova, S., & Matyokubov, B. (2023). WAYS TO INCREASE THE eNERGY eFFICIENCY OF eXTERNAL BARRIER CONSTRUCTIONS OF BUILDINGS. *Evraziyskiy jurnal akademicheskix issledovaniy*, *3*(3), 145-149.

3. Egamova, M., & Matyokubov, B. (2023). IMPROVING THE eNERGY EFFICIENCY OF THE EXTERNAL WALLS OF RESIDENTIAL BUILDINGS BEING BUILT ON THE BASIS OF A NEW MODEL PROJECT. *Evraziyskiy jurnal akademicheskix issledovaniy*, *3*(3), 150-155.
4. Matyokubov, B. P., & Rustamova, D. B. PERSPECTIVE CONSTRUCTIVE SOLUTIONS OF MODERN COMPOSITE EXTERNAL WALLS OF SANDWICH TYPE. *International Journal For Innovative engineering and Management Research*.
5. Salomovich, T. E., Samariddinovich, S. U., & Pulatovich, M. B. Improving the Heat Preservation Properties of the exterior Walls of Brick Buildings.
6. Tulakov, E. S., Bo‘ronov H, M. B., & Abdullaeva, S. A. (2020). Kam qavatli turar-joy binolari erto‘la devorlarining issiqlik izolyasiya qatlami qalinligini hisoblash. *Me’morchilik va qurilish muammolari Problemы arxitekturы i stroitelstva. Samarqand*, *2*, 41-45.
7. Norkulov, B. M., Khidirov, S. K., Suyunov, J. S., Nurmatov, P. A., Tadjieva, D. O., & Rustamova, D. B. (2023, March). Determination of dynamic forces affecting floating structure in pump station water supply channel. In AIP Conference Proceedings (Vol. 2612, No. 1, p. 020020). AIP Publishing LLC.
8. Norkulov, B. M., Khidirov, S. K., Tadjieva, D., Nurmatov, P., & Suyunov, J. (2023, March). Study of kinematic structure of low flood of water supply facilities. In AIP Conference Proceedings (Vol. 2612, No. 1). AIP Publishing.
9. Uralov, B., Choriev, R., Maksudova, L., Sapaeva, M., Shernaev, A., & Nurmatov, P. (2021). Substantiation of the influence of the channel shape and the roughness of machine canals on the pressure loss of irrigation pumping stations. In *IOP Conference Series: Materials Science and Engineering* (Vol. 1030, No. 1, p. 012148). IOP Publishing.
10. Musulmanovich, N. B. (2021). ANALYSIS OF CHANGE OF FLOW DYNAMICS IN LOW BENEFITS OF WATER SUPPLY FACILITIES. Journal of Advanced Scientific Research (ISSN: 0976-9595), 1(1).
11. Khidirov, S., Oymatov, R., Norkulov, B., Musulmanov, F., Rayimova, I., & Raimova, I. (2021). Exploration of the hydraulic structure of the water supply facilities operation mode and flow. In *E3S Web of Conferences* (Vol. 264, p. 03024). EDP Sciences.
12. Саидов, Б. М., & Рустамова, Д. Б. (2021). ГИДРОТЕХНИК ИНШООТЛАР ХАВФИНИ ТАҲЛИЛ ҚИЛИШ. *Журнал Технических исследований*, *4*(2).
13. Рустамова, Д. Б., & Носирова, С. А. (2020). СЭНДВИЧ ТИПИДАГИ ЗАМОНАВИЙ ЙИҒМА ТАШҚИ ДЕВОРЛАРНИНГ ИСТИҚБОЛЛИ КОНСТРУКТИВ ЕЧИМЛАРИ. *Журнал Технических исследований*, *3*(6).
14. Mahmudov, M., Rustamova, D., & SobiraNosirova, S. (2021). Empirical dependence of sorption humidity of keramzybeton concrete on relative humidity of air. *European Journal of Research Development and Sustainability*, *2*(6), 10-16.
15. Rustamova, D. B., & Egamova, M. T. (2022). THEORETICAL BASIS OF INCREASING ENERGY EFFICIENCY IN RESIDENTIAL BUILDINGS. *Journal of Advanced Scientific Research (ISSN: 0976-9595)*, *2*(1).
16. Makhmudov, M., & Rustamova, D. (2021). UNIFORMITY CHECK OF THE THERMAL CONDUCTIVITY COEFFICIENT OF BRICK AND PLASTER USED IN THE MANUFACTURE OF FRAGMENTS OF EXPERIMENTAL WALLS FOR STUDYING HEAT PROTECTIVE

The Peerian Journal
Open Access | Peer Reviewed
Volume 27, February, 2024 ISSN (E): 2788-0303
Website: www.peerianjournal.com Email: editor@peerianjournal.com

QUALITIES. *Journal of Advanced Scientific Research (ISSN: 0976-9595)*, *1*(1).
17. Носирова, С. А., Рустамова, Д. Б., & Эгамова, М. Т. (2021). ЭНЕРГИЯТЕЖАМКОР УЙЛАР-ЎЗБЕКИСТОННИНГ ЯҚИН ЙИЛЛАРДАГИ ЭНГ АСОСИЙ ШИОРИ. *Журнал Технических исследований*, *4*(2).
18. Norkulov, B. M., Khidirov, S. K., Suyunov, J. S., Nurmatov, P. A., Tadjieva, D. O., & Rustamova, D. B. (2023, March). Determination of dynamic forces affecting floating structure in pump station water supply channel. In *AIP Conference Proceedings* (Vol. 2612, No. 1, p. 020020). AIP Publishing LLC.
19. Saparboevich, Sattarov Ikramboy, and Sattarov Temur Ikramboevich. "Inspection and Assessment of the Technical Condition of Residential and Public Buildings." Central Asian Journal of Theoretical and Applied Science 4.4 (2023): 99-103.
20. Saparboyevich, Sattarov I., and Sattarov T. Ikramboyevich. "Process Of Designing And Constructing Brick Buildings For Energy Efficiency Measures." JournalNX, 2020, pp. 164-168.