AMERICAN JOURNAL OF MULTIDISCIPLINARY BULLETIN
ISSN: 2996-511X (online) | ResearchBib (IF) = 9.512 IMPACT FACTOR
Volume-4| Issue-3| 2026 Published: |30-03-2026|

INCREASING THE ENERGY EFFICIENCY OF RESIDENTIAL BUILDINGS' EXTERIOR WALLS MADE OF GASO-CONCRETE BLOCKS.

https://doi.org/10.5281/zenodo.19276276

Kulmirzayev Jaxongir Ilxomiddinovich
Basic doctoral student of the Samarkand State University of Architecture and Construction named after Mirzo Ulugbek (SamSACU).
mrjoxa1993@gmail.com +99893-998-19-93
Scientific supervisor: candidate of technical sciences, professor **G'.Shukurov.**

Abstract

This article presents the results of theoretical and practical studies conducted on a sample of external walls made of aerated concrete blocks in order to improve the operational characteristics and energy efficiency of external walls of residential buildings made of aerated concrete blocks. As a result of the studies, the total heat transfer resistance of the sample of external walls of residential buildings made of thermally improved aerated concrete blocks, the coefficient of thermal conductivity of wall layers, the heat flow passing through the wall, the temperature in the wall layers and the heat resistance of the wall for the summer season were determined. The conducted theoretical thermal-physical studies were compared with practical studies conducted on the wall model, and recommendations were developed to increase the thermal protection of external walls of buildings being built based on modern projects.

Keywords

Aerated concrete, external walls, heat transfer resistance, thermal conductivity coefficient, heat flow.

Introduction. The future of our country is closely related to the development of construction and construction equipment. That is why this area is always in the government's attention. In recent years, the production of aerated concrete and brick, small wall blocks has increased somewhat in our republic. These materials are widely used by the population in individual housing construction, along with pakhsa, raw brick, sinch and guvala. An increase in the number of floors in the construction of individual houses, an increase in the level of amenities created in houses is observed. Currently, public, residential and agricultural buildings made of aerated concrete blocks are being used in good condition. Most of such buildings are frame, and their long-term durability is designed for more than 100 years. However, since these buildings do not meet the thermal protection requirements of

BR 2.01.04-97*, it is necessary to increase their thermal protection. As a result of the research, it was possible to provide practical recommendations on improving the thermal physical properties of the external walls of residential buildings during the overhaul and increase their energy efficiency. Therefore, for conducting thermal-physical experiments, a sample of aerated concrete blocks measuring 600x400x300 mm was installed in the laboratory of the Department of “Buildings and Structures” of SamSACI, and thermal-physical experimental research was carried out.

Methods. By increasing the thermal insulation of external envelopes, it is possible to increase the energy efficiency of buildings. Therefore, it is important to use energy-efficient external envelopes in the design and construction of buildings and structures. Therefore, in order to increase the energy efficiency of buildings, various structural solutions for external walls have been recommended. The construction of low-energy buildings mainly depends on the following criteria. This can be achieved by the following methods:

1. By increasing the thermal insulation of external envelopes;
2. Through energy-efficient structural solutions for external envelopes;
3. By using solar energy in the process of heating buildings;
4. By using non-conventional energy sources;
5. By using geothermal heat sources;
6. By using wind energy;
7. By using river and sea water.

The experiments conducted in the field of heat physics are as follows:

1. Increasing the thermal protection of external barrier structures, that is, increasing the thermal insulation of their external walls in the process of reconstruction and major repairs of buildings;

2. Increasing energy efficiency by improving the thermal insulation of the external walls of buildings. As a result of the conducted theoretical and practical studies, it became known that often when a thermal insulation layer is installed on the inner surface of some external barrier structures, condensation moisture forms in certain layers of the structure. This situation does not meet the requirements of BR 2.01.04-97*. As is known, in accordance with the requirements of BR 2.01.04.-97*, it is required to increase the thermal protection of the external walls of residential buildings, medical treatment, children's institutions, schools, boarding schools, colleges, lyceums, educational institutions, as well as public and industrial buildings during construction, reconstruction and major repairs. To theoretically substantiate this issue, it is necessary to determine the total heat transfer resistance

of the external walls of residential buildings made of aerated concrete blocks under repair.

Results. This resistance is determined in the following manner:

1. First of all, the initial data is accepted, namely the type of building and the constructive solution of the energy-efficient external wall with aerated concrete blocks, as well as its calculation scheme;

2. Based on BR 02.01.04-97*, the required heat transfer resistance of the external walls of buildings that meet the minimum sanitary and hygienic requirements is determined using the following formula [3]:

$$R_u^{zar} = \frac{n(t_i - t_t)}{\Delta t^m \cdot \alpha_i}; \quad (1.1)$$

where: n - is the coefficient indicating the position of the outer surface of the external barrier structure relative to the outside air. Taken from Table 3 of BR 02.01.04-97*; t_u - indoor air temperature, this indicator is accepted from the QMQs for the suitability of buildings, °C. t_t - estimated outdoor temperature (average coldest 5-day outdoor temperature is taken), °C. This size is adopted from QMQ 02.01.01-94; Δt^m - The standard difference between the internal surface temperature of an external barrier structure and the internal air temperature, °C. This value is taken from Table 4 of QMQ 02.01.04-97* and this difference is written as follows:

$$\Delta t^m = t_i - \tau_i; \quad (1.2)$$

Depending on the type of barrier structure and its surfaces, the heat transfer coefficient of the internal and external surfaces of the external barrier structure is determined from Tables 5 and 6 of QMQ 02.01.04-97*. α_i *and* α_t $Vt/(m^2 \cdot °C)$.

Discussion. The total heat transfer resistance of the external wall is determined.

The total heat transfer resistance of the external barrier structure consists of three types of resistance:

1) The resistance to the transfer of heat from the internal air to the internal surface of the structure. This heat transfer resistance is called ($\mathbf{R_i}$) and is due to the difference between the internal air temperature and the internal surface temperature of the structure, and this difference is written as $\boldsymbol{\tau_i - \tau_n}$.

2) The resistance to the passage of heat through the body of the structure. This is called the thermal resistance (R) of the structure and is the difference between the temperature of the inner surface of the structure and the temperature of the outer surface, i.e. $\boldsymbol{\tau_i - \tau_t}$;

3) The resistance to the transfer of heat from the outer surface of the structure to the outside air. This heat transfer resistance is called ($\mathbf{R}_t$) and is caused by the

difference between the temperature of the outer surface of the structure and the outside air temperature, i.e. $\tau_i - \tau_t$.

Therefore, the total heat transfer resistance of the external barrier structure is the sum of three different resistances:

$R_y = R_i + R + R_m$ (1.3)

The resistances to heat absorption and release are often expressed in the same way and are called the heat transfer resistance of the internal and external surfaces of the structure.

The inverse value of the heat transfer resistance is called the heat transfer coefficient.

The heat transfer coefficient of the internal surface of the structure is denoted by $\alpha_и$ and is found from the following expression:

$$\alpha_и = \frac{1}{R_и} \quad (1.4)$$

The heat transfer coefficient of the external surface of the structure is represented by $\alpha_т$ and is found from the following formula:

$$\alpha_т = \frac{1}{R_T} \quad (1.5)$$

The transfer of heat from the inner surface of the structure to the air or from the outer surface occurs through thermal radiation and convection.

Therefore, the heat transfer coefficient is equal to the sum of the heat transfer coefficients by thermal radiation and convection.

$$\alpha = \alpha_и + \alpha_к ; \quad (1.6)$$

Heat is transferred to the inner surface of the external barrier structure by radiation from the inner walls, ceiling, and floor surfaces of the room, since their temperature is always higher than the temperature of the inner surface of the external barrier structure. The outer surface of the external barrier structure, in turn, gives off heat to the external environment (air) by radiation.

The coefficient of heat transfer by thermal radiation is determined by the following formula:

$$\alpha_н = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} - \frac{1}{C_0}} \cdot \frac{\left[\frac{t_1 + 273}{100}\right]^4 - \left[\frac{t_2 + 273}{100}\right]^4}{t_1 - t_2} \quad (1.7)$$

where, C_1 and C_2 - are the radiation coefficients of the surfaces;

S_0 - the emissivity of a black body;

t_1, t_2 - the temperature of the surfaces.

Conclusions. For all buildings, the thermal resistance and heat transfer coefficients of the internal and external surfaces of external enclosing structures are given in QMQ – 2.01.04-97*.

The thermal resistance (R) of external enclosing structures depends on the composition of the material from which the structure is made and the coefficient of thermal conductivity.

If the external wall consists of several layers, its thermal resistance is equal to the sum of the heat transfer resistances of the layers. Therefore, the thermal resistance of multi-layer structures is determined by the following formula

$$\mathbf{R} = \mathbf{R_1} + \mathbf{R_2} + \cdots + \mathbf{R_n} = \frac{\delta_1}{\lambda_1} + \frac{\delta_2}{\lambda_2} + \ldots + \frac{\delta_n}{\lambda_n} \qquad (1.8)$$

where, R_1, R_2, R_n - heat transfer resistance of individual layers, $m^2 \cdot {}^\circ C/Vt$;

δ_1, δ_2 va δ_n – thickness of individual layers, m.

λ_1, λ_2 va λ_n – thermal conductivity coefficient of individual layers, $Vt/m^2 \cdot {}^\circ C$;

n – number of layers that make up the structure.

The thermal resistance R_0 of external enclosing structures must not be lower than the values $R_0^{тр}$ indicated in Tables 2a, 2b or 2c, depending on the given level of thermal protection of the building.

LIST OF USED LITERATURE:

1. Shukurov G'.Sh., Boboev S.M. Arxitektura fizikasi. 1-qism. Qurilish issiqlik-fizikasi.Darslik – T.: Mehnat, 2005 y. 160s.

2. Shukurov G'.Sh., Islomova D. G'. Qurilish fizikasi. Darslik – Samarqand. 2015 y.226s.

3. Fokin. K.F. Stroitelьnaya teplotexnika ograjdayuщix chastey zdaniy. M. Stroyizdat, 1973g. 286s.

4. QMQ-2.01.04-18. Stroitelьnaya teplotexnika. – T., 2018 y.

5. Shukurov G'., Ne'matov B. Mayda blokdan iborat tashqi devor konstruktsiyasini issiqlik himosini oshirish. Obrazovanie nauka i innovatsionnыe idei v mire. Mejdunarodnыy nauchnыy elektronnыy jurnal. Rossiya-2023 y. http:/www.neviournal.org/

6. Shukurov, G., Bolikulovich, K. M., Holiyevich, F. F., Ilxomiddinovich, K. J., & Rizki, M. A. (2024, July). Innovative solutions for the use of aerated concrete blocks in residential buildings. In *AIP Conference Proceedings* (Vol. 3167, No. 1). AIP Publishing.

7. Ne'matov, B. (2023). TURAR-JOY BINOLARIDA GAZOBETON BLOKLARDAN FOYDALANISHNING INNOVATSION YECHIMLARI. *PROBLEMS OF ARCHITECTURE AND CONSTRUCTION (SCIENTIFIC TECHNICAL JOURNAL)*, *1*(2), 251-254.

8. Ziyaviddinov, D. O., Yunusboev, B. A., Dossaliyev, K. S., Kh, J. M., & Kulmirzayev, J. I. (2024). DESIGN OF A 4 FLOOR PUBLIC BUILDING MADE OF REINFORCED CONCRETE PANELS ON THE BASIS OF ENERGY EFFICIENCY REQUIREMENTS. *Экономика и социум*, (4-1 (119)), 710-714.

9. Shukurov, G., Sultonov, A. A., & Kulmirzayev, J. I. (2024). BINOLARNING ENERGIYA SAMARADORLIGINI OSHIRUVCHI QURILISH MATERIALLARINING ISSIQLIK-FIZIK XUSUSIYATLARINI TAJRIBADA ANIQLASH. In *Uz Conferences* (Vol. 1, No. 1).

10. Tulakov, E., Inoyatov, D., Kurbonov, A., Sirojiddinov, S., Abdullayeva, S., Matyokubov, B., & Kulmirzayev, J. (2024). Experimental analysis of moisture protection of buildings. In *E3S Web of Conferences* (Vol. 559, p. 04018). EDP Sciences.