Adaptation of the exterior wall construction of the industrial building located in the city of Jizzah to the requirements of building codes 2.01.04 - 2018 “Thermal technique in construction”

Dilshod Orziqul o’g’li Ziyaviddinov
Behruz Aziz o’g’li Yunusov
Akbarxon Qahramon o’g’li Abdunabiyev
Chinora Ahmadjon qizi Xudoyberdiyeva
Jizzax politexnika instituti

Abstract: This article shows the calculation work and its solution for increasing the overall heat transfer resistance of the external wall constructions of the industrial building designed for the production of natural materials, built of low-rise brick, located in the city of Jizzakh. This solution is aimed at increasing thermal protection for winter conditions in accordance with the requirements of BUILDING CODES 2.01.04-18 “Construction thermal engineering”.

Keyword: industrial building, brick, thermal insulation material, mineral plate, energy-saving, levels of heat protection

After our country gained independence, many changes took place in our country. Many constructions and construction works were carried out. In particular, many industrial buildings, agricultural buildings and residential buildings have been built and are being built for our population. The demand for the use of natural gas and electricity for heating and lighting these buildings has also increased noticeably. In accordance with the decision of the head of state No. PQ-4779 dated 10.07.2020, the funds of the Fund (Energy Savings Fund) will be used to increase the energy efficiency of buildings and multi-apartment buildings by introducing energy-efficient technologies and devices from renewable energy sources , including financing the preparation of the technical-economic justification of projects for improving thermal protection, as well as conducting an energy audit, and similar decisions were made. Also, the Cabinet of Ministers adopted the decision No. 640 dated 9.10.2020 "On approval of the regulation on the off-budget intersectoral energy saving fund under the Ministry of Energy of the Republic of Uzbekistan". The number of operational residential and industrial buildings in our republic is greater than the number of newly built residential and industrial buildings. Taking this into account, it is appropriate to design newly constructed and operated industrial and residential buildings on the basis of BUILDING CODES . There are also a number of operating industrial buildings in the city of Jizzakh, which do not meet the requirements of BUILDING CODES 2.01.04-2018. In this article, calculation works for the winter season and one of its solutions for increasing the energy efficiency of the external wall structure of a low-rise industrial building intended for the production of yarn and materials, located in the territory of the Olmazor Square of Jizzakh city, are shown. For heat-physical calculations, we determine the necessary information provided by BUILDING CODES 2.01.01 - 22 and 2.01.04 - 18.

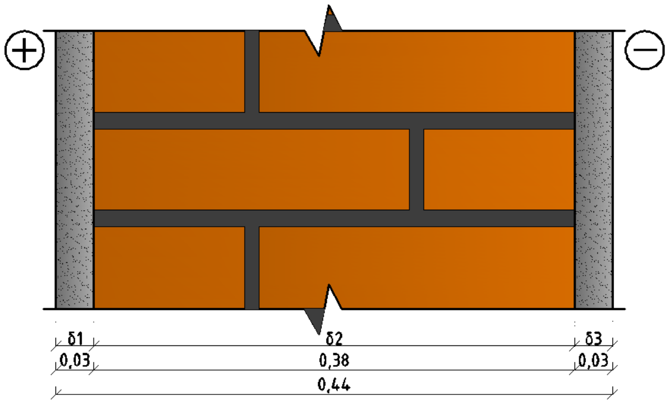
The construction area of the city of Jizzakh, the city is located in the dry zone in terms of humidity, the average temperature of the city's coldest sotka is 0.98 as the calculated outdoor air temperature t_H^1 = - 22, the coldest sotka is provided (average temperature of 0.92 = t_H^1 -19 , the coldest five-day supply (coldest) average temperature of 0.92 = t_H^5 -19 , the coldest three-day supply (coldest) 0.92 We determine the average temperature t_H^3 by the following formule: $t_H^3 = t_H^1 + t_H^5$/2= -19-19/2=-19°C, average temperature of July t_H=+28,6°C, the maximum amplitude of daily fluctuations of the outdoor air temperature of the city in July A_{tH}=24,9 °C, Maximum and average solar radiation for vertical surfaces facing west from the guide as the structure is a wall $_{\text{мах}}$=746 Vt/м^2, $J_{o'rt}$=172 Vt/м^2, The minimum value of the average wind speed for the month of July with a repetition of 16% and more in terms of directions for the city is V=2.6m/s, for the development room that is being designed from the application in accordance with the function of the room of the industrial building, where the external barrier construction is considered the relative temperature and relative humidity of the indoor air $t_и$ = 30; $\varphi_и$ = 45 %.

$t_и$ = 30 °C and $\varphi_и$ = 45 % based on the values, the humidity regime of the house is moderate, taking into account the moderate humidity regime of the house and the location of the city of Jizzakh in the dry zone, the operating conditions of the wall are A. Since the outer wall construction is made of solid bricks, this construction is considered homogeneous. The external wall structure is plastered with a 30 mm thick lime-sand mixture from the inside and a 30 mm cement-sand mixture from the outside. We determine their volumetric weight, heat transfer coefficient λ and heat absorption coefficient S.

Small ceramic brick: $\gamma = 1600 kg/m^3$, $\lambda = 0{,}58\, Vt/(м \cdot °C)$, S=7,91 $Vt/(м^2 \cdot °C)$;

Lime sand mixture; $\gamma = 1600 kg/m^3$, $\lambda = 0{,}7\, Vt/(м \cdot °C)$, $S = 8{,}08\, Vt/(м^2 \cdot °C)$

Cement-sand mixture; $\gamma = 1800 kg/m^3$, $\lambda = 0{,}76\, Vt/(м \cdot °C)$, $S = 9{,}60\, Vt/(м^2 \cdot °C)$



1-picture. Scheme of the external wall construction made of aerated brick. a-layer (δ_1) plaster made of cement-sand-lime mixture, b-layer (δ_2) small ceramic brick, v-layer (δ_3) plaster made of cement-sand mixture.

Normative temperature difference according to the function and type of construction of the furnace $\Delta tH = 4°C$, heat transfer coefficient of internal and external surfaces, depending on the type of construction and the nature of its surfaces $\alpha_i = 8{,}7 \frac{Vt}{m^2} * °C$ va $\alpha_t = 23 \frac{Vt}{m^2} * °C$, coefficient that takes into account the position of the outer surface in relation to the outside air, depending on the type of barrier construction n=1, coefficient that takes into account the position of the outer surface in relation to the outside air, depending on the type of barrier construction $\rho = 0{,}4$.

Thermal-physical calculation of the external wall structure restored from small-sized (ceramic) bricks for winter conditions.

Using the collected data, we determine the total heat transfer resistance of the external wall structure reconstructed from small ceramic bricks using the following formula:

$$R_{um} = R_i + R_k + R_t = \frac{1}{\alpha_i} + \frac{\delta_1}{\lambda_1} + \frac{\delta_2}{\lambda_2} + \frac{\delta_3}{\lambda_3} + \frac{1}{\alpha_t} = \frac{1}{8{,}7} + \frac{0{,}03}{0{,}7} + \frac{0{,}38}{0{,}58} + \frac{0{,}03}{0{,}76} + \frac{1}{23} =$$

$$= 0{,}114 + 0{,}042 + 0{,}655 + 0{,}039 + 0{,}043 = 0{,}893 \text{ м}^2\text{х°C}/Vt$$

We determine the thermal inertia of the structure using the following formula:

$$D = \frac{\delta_1}{\lambda_1} \cdot S_1 + \frac{\delta_2}{\lambda_2} \cdot S_2 + \frac{\delta_3}{\lambda_3} S_3 = \frac{0{,}03}{0{,}7} \cdot 8{,}69 + \frac{0{,}38}{0{,}58} \cdot 8{,}08 + \frac{0{,}03}{0{,}76} \cdot 9{,}60 = 6{,}04$$

4<D=6,04 because, according to the instructions, we take $t_{\text{H}}^{3} = -19{,}0\,^0$C determined in point 3 as the calculation temperature of the outside air.

We determine the required value of resistance to heat transfer for the structure using the following formula:

$$R_{um}^{T.E} = \frac{(t_{\text{B}} - t_{\text{H}}) \cdot n}{\Delta t^{\text{H}} \cdot \alpha_{\text{B}}} = \frac{(30+19) \cdot 1}{4 \cdot 8{,}7} = 1{,}12 m^2 \cdot {}^\circ C / Vt$$

$R_{um} \geq R_{um}^{T.E}$ Let's check if the condition is fulfilled:

$R_{um} = 0{,}893 > R_{um}^{T.E} = 1{,}12 m^2 \cdot {}^\circ C / Vt$ the condition was not met.

Therefore, it is necessary to increase the thermal protection of the external wall structure of the industrial building made of bricks. In buildings under construction and repair, the total heat transfer resistance of external barrier structures should correspond to the heat transfer resistance listed in Table 2-a, b and c in accordance with the requirements of BUILDING CODES 2.01.04-18. In order to accept the quoted heat transfer resistance from BUILDING CODES 2.01.04-18, the heating period is determined first. When accepting the value of heat transfer resistance, it is necessary to determine the degree per day for the heating period. This quantity is determined using the following formula.

$$\boldsymbol{D_d} = (\boldsymbol{t_i} - \boldsymbol{t}_{o'rt.sut.harorat}) \cdot \boldsymbol{Z}_{is.\text{davri}}$$

We determine the average daily temperature of the heating period:

$$t_{o'rt.sut.harorat} = \frac{1{,}7 + 3{,}6 + 9{,}1 + 8{,}3 + 3{,}0}{5} = 5{,}14°\text{C};$$

We determine the degree day for the heating period:

$$D_d = (30°\text{C} - 5{,}14\ °\text{C}) \cdot 143{,}5 = 3567{,}41\ °\ sutka;$$

Based on this, we determine the heat transfer resistance given by the specified level of thermal protection for the external wall structure:

For level 1: $R_{um}^{T.E} = 1{,}26 м^2 \cdot^o C/Vt$, For level 2: $R_{um}^{T.E} = 1{,}6 м^2 \cdot^o C/Vt$, For level 3: $R_{um}^{T.E} = 2{,}2 м^2 \cdot^o C/Vt$

Now we will check the fulfillment of the condition stated in BUILDING CODES 2.01.04-18.

$R_{um} = 0{,}893 > R_{um}^{T.E} = 1{,}26 м^2 \cdot^o C/Bt$, $R_{um} = 0{,}893 > R_{um}^{T.E} = 1{,}6 м^2 \cdot^o C/Bt$,

$R_{um} = 0{,}893 > R_{um}^{T.E} = 2{,}2 м^2 \cdot^o C/Bt$ conditions were not met.

For this reason, we increase its thermal protection by covering the residential building with mineral boron (mineral plate) with a density of γ =100kg/m^3 (λ =0.061 °C/W) from the outside. Its calculated thickness for three levels is determined by the following formula:

$$\delta_4 = \left(R_{um}^{T.E} - \frac{1}{\alpha_i} - \frac{\delta_1}{\lambda_1} - \frac{\delta_2}{\lambda_2} - \frac{\delta_3}{\lambda_3} - \frac{1}{\alpha_t}\right) x \lambda_4$$

For level 1: $\delta_4 = (1{,}26 - 0{,}114 - 0{,}042 - 0{,}655 - 0{,}039 - 0{,}043)x0{,}061 = 0{,}022\ m.$

Constructively, we accept 0,03 m (3 cm).

For level 2: $\delta_4 = (1{,}6 - 0{,}114 - 0{,}042 - 0{,}655 - 0{,}039 - 0{,}043)x0{,}061 = 0{,}043\ m.$

Constructively, we accept 0,05 m (5 cm).

For level 3: $\delta_4 = (2{,}2 - 0{,}114 - 0{,}042 - 0{,}655 - 0{,}039 - 0{,}043)x0{,}061 = 0{,}079\ m.$

Constructively, we accept 0,05 m (5 cm).

Now we recalculate the total heat transfer resistance of all three layers:

$R_{1.um} = 0{,}114 + 0{,}042 + 0{,}655 + 0{,}491 + 0{,}039 + 0{,}043 = 1{,}38\ м^2 x°C/Vt$

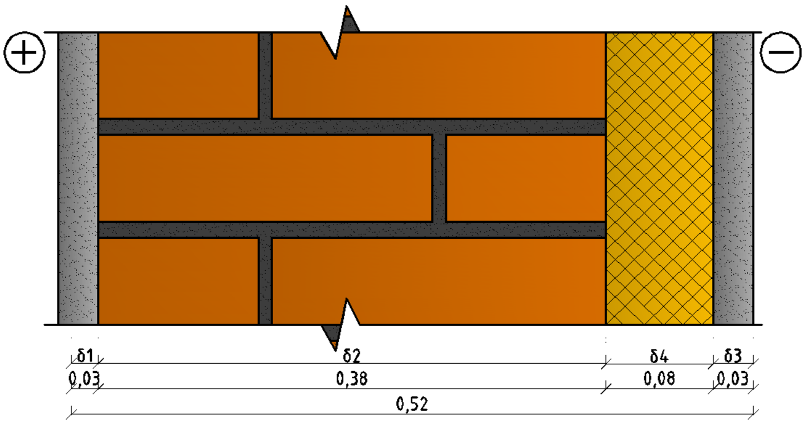
$R_{2.um} = 0{,}114 + 0{,}042 + 0{,}655 + 0{,}819 + 0{,}039 + 0{,}043 = 1{,}71\ м^2 x°C/Vt$

$R_{3.um} = 0{,}114 + 0{,}042 + 0{,}655 + 1{,}311 + 0{,}039 + 0{,}043 = 2{,}204\ м^2 x°C/Vt$

Now let's check the fulfillment of the 3 levels of condition stated in BUILDING CODES 2.01.04-18:

$R_{um} > R_{um}^{T.e} = 1{,}38 > R_{um}^{T.e} = 1{,}2 м^2 \cdot^o C/Vt$, $R_{um} > R_{um}^{T.e} = 1{,}71 > R_{um}^{T.e} = 1{,}6 м^2 \cdot^o C/Vt$,

$R_{um} > R_{um}^{T.e} = 2{,}204 > R_{um}^{T.e} = 2{,}2 м^2 \cdot^o C/Vt$ conditions are met.



Pic 2. The scheme of the external wall construction made of bricks covered with heat-insulating material. a-layer (δ_1) plaster made of cement-sand-lime mixture, b-layer (δ_2) small ceramic brick, g-layer (δ_3) thermal insulation material (mineral plate), v-layer (δ_4) plaster made of cement-sand mixture.

From the results of the above-mentioned theoretical thermal-physical calculations, it can be concluded that during the repair of the external wall structure of the industrial building built of low-floor bricks in operation at Almazor MFY, Jizzah city, its total heat transfer was reduced by covering it with an 8 cm thick mineral plate from the outside. increasing its resistance while fully meeting the requirements of 3 levels of thermal protection specified in BUILDING CODES 2.01.04-18.

References

1. G'ayrat Shukurov, Dilnoza Islamova « Qurilish fizikasi » darslik Toshkent «Yangi asr avlodi" 2018 - yil.

2. Ziyaviddinov, D. O. O. G. L., & Qurbonov, J. (2023). Jizzax shahrida eksplutatsiya qilinayotgan g'ishtli turar-joy binosining tashqi devor konstruksiyasining energiya samaradorligini oshirish. Science and Education, 4(4), 553-559

3. www.lex.uz. 2020 - yil 10 - iyuldagi «Iqtisodiyotning energiya samaradorligini oshirish va mavjud resurslardan foydalanish orqali iqtisodiyot tarmoqlarining yoqilg'i-energetika mahsulotlariga bog'liqligini kamaytirish bo'yicha qo'shimcha chora - tadbirlar to'g'risida"gi PQ - 4779 - son qarori.

4. BUILDING CODES 2.01.01-22 « Climatic and physical-geological data for planning", Tashkent 2022 - year.

5. BUILDING CODES 2.01.04 - 18 « Construction heat engineering", Tashkent 2018

6. Алиев, М. Р. (2020). Экспериментальное определение динамических характеристик кирпичных школьных зданий. Academy, (11 (62)), 66-70.

7. Rakhmonkulovich, A. M., & Abdumalikovich, A. S. (2019). Increase seismic resistance of individual houses with the use of reeds. Modern Scientific Challenges And Trends, 189.

8. Юсупов, У. Т., Алиев, М. Р., & Рузматов, И. И. (2021). Энергоэффективность новых жилых домов. Science and Education, 2(5), 131-143.

9. Юсупов, У. Т., Алиев, М. Р., & Илҳомов, Р. (2021). Архитектурное решение энергоэффективных многоэтажных жилых домов. Science and Education, 2(5), 276-287.

10. Алиев, М. Р. (2022). Характерные повреждения индивидуальных домов со стенами из сырцового кирпича. Eurasian Journal of Academic Research, 2(3), 264-268.

11. Aliyev, M. R. (2022). Bino va inshootlarning konstruksiyalarini tekshirishning asosiy bosqichlari. Science and Education, 3(2), 98-102.

12. Asatov, N., Tillayev, M., & Raxmonov, N. (2019). Parameters of heat treatment increased concrete strength at its watertightness. In E3S Web of Conferences (Vol. 97, p. 02021). EDP Sciences.

13. Рахмонов, Н. Э. (2020). Проблемы разработки отечественного синтетического пенообразователя. Academy, (11 (62)), 93-95.

14. Rahmonov, N. E. (2022). Energiya samarador uylar qurilishini qishloq sharoitida ommalashtirish istiqbollari. Science and Education, 3(2), 169-174.

15. Асатов, Н. А., & Рахмонов, Н. Э. (2022). Пути уменьшения краевого эффекта при расчете конического купола с учетом влияния преднапряженного опорного контура. Eurasian Journal of Academic Research, 2(3), 260-263.

16. Ablayeva, U., & Normatova, N. (2019). Energy saving issues in the design of modern social buildings. Problems of Architecture and Construction, 2(1), 59-62.

17. Норматова, Н. А. (2020). Проектирование энергосберегающих зданий в условиях узбекистана. Academy, (11 (62)), 89-92.

18. Аблаева, Ў. Ш., & Норматова, Н. А. (2021). Тошкент: лойиҳалашнинг анъанавийликдан хозирги кунигача. Science and Education, 2(5), 206-216.

19. Аблаева, Ў. Ш., & Норматова, Н. А. (2021). Ўзбекистондаги мавжуд биноларнинг энергия тежамкор шамоллатиладиган тизимлари асосий системалари. Science and Education, 2(5), 193-205.

20. Норматова, Н. А. (2022). Саноат биноси ташқи деворининг иссиқлик самарадорлигини аниқлаш ва ечиш. Eurasian Journal of Academic Research, 2(3), 224-227.

21. Испандиярова, У. Э. К. (2020). Усиление мостовых железобетонных балок высокопрочными композиционными материалами. European science, (6 (55)), 63-67.

22. Асатов, Н. А., & Испандиярова, У. Э. К. (2021). Бетон с комплексной добавкой на основе суперпластификатора и кремнийорганического полимера. Academy, (5 (68)), 6-10.

23. Испандиярова, У. Э., & Исаев, Р. А. (2023). Рост промышленного и жилищного строительства в нашей республике, актуальные вопросы, стоящие перед строителями. Science and Education, 4(4), 413-420.

24. Карабеков, У. А., & Каримов, В. Ш. У. (2021). Использование ГИС-технологий в городах строителство. Science and Education, 2(5), 257-262.

25. Karabekov, U. A. (2022). Improve the use of gis in land management for agriculture and farmers. Eurasian Journal of Academic Research, 2(3), 256-259.

26. Karabekov, U. B. A. (2022). Qishloq xo’jaligi va landshaft kartalarini yaratishda GAT dasturlarini qo’llash texnologiyasini takomillashtirish. Science and Education, 3(2), 163-168.

27. Gayrat, S., Salimjon, M. K., & Dilshod, Z. (2022). The heat does not cover the roof of residential buildings increase protection. Galaxy International Interdisciplinary Research Journal, 10(2), 674-678.

28. Асатов, Н. А., & Саримсоков, С. Ш. (2022). Экспериментальные исследования динамических параметров висячих систем. Eurasian Journal of Academic Research, 2(3), 232-237.

29. Sarimsoqov, S. S. (2022). Armaturalangan ikki qiyali yog’och to’sinni loyihalash. Science and Education, 3(2), 175-183.

30. Sarimsoqov, S. (2019). The main characteristics of the situational method of teaching a foreign language. In science and practice: a new level of integration in the modern world (pp. 205-207).

31. Uktamovich, S. B., Yuldashevich, S. A., Rahmonqulovich, A. M., & Uralbayevich, D. U. (2016). Review of strengthening reinforced concrete beams using cfrp Laminate. European science review, (9-10), 213-215.

32. Asatov, N., Jurayev, U., & Sagatov, B. (2019). Strength of reinforced concrete beams hardenedwith high-strength polymers. Problems of Architecture and Construction, 2(2), 63-65.

33. Sagatov, B., & Rakhmanov, N. (2019). Strength of reinforced concrete elements strengthened with carbon fiber external reinforcement. Problems of Architecture and Construction, 2(1), 48-51.

34. Ашрабов, А. А., Сагатов, Б. У., & Алиев, М. Р. (2016). Усиление тканевыми полимерными композитами железобетонных балок с трещинами. Молодой ученый, (7-2), 37-41.

35. Sagatov, B. U. (2022). O’zbekistonda energiya tejamkor binolar qurilishining ahvoli. Science and Education, 3(1), 261-265.

36. Sagatov, B. U. (2022). Composite materials for reinforcing ferro-concrete elements. Eurasian Journal of Academic Research, 2(3), 281-285.

37. Abdurakhmanov, A. M. (2020). Ventilated hinged view and its properties. in синтез науки и образования в решении глобальных проблем современности (pp. 37-43).

38. Асатов, Н. А., & Абдурахмонов, А. М. (2023). Исследование энергоаудита жилого здания для устойчивого развития с использованием возобновляемых источников энергии. актуальные проблемы научных исследований: теоретический, 16.

39. Асатов, Н. А., & Абдурахмонов, А. М. (2023). Исследование меры энергоэффективности и экономического анализа изоляционных материалов в строительном секторе. глобализация науки: история, современное состояние, 19.

40. Асатов, Н. А. (2023). Анализ исследования ультранизкого энергопотребления зданий из передовых материалов и необходимые условия для них. central asian journal of arts and design, 79-83.

41. Abdurakhmanov, A. M., & Pak, D. A. (2021). Analysis of a research of a technique of construction of reinforcing frameworks. Сборник статей подготовлен на основе докладов Международной научно-практической, 3.

42. Пармонов, Н. Н., & Абдурахманов, А. М. (2021). Новая энергоэффективная технология, применяемая в производственных процессах. In Технические и технологические основы инновационного развития (pp. 30-32).

43. Pak, D. A. (2021). TECHNIQUE INCREASE IN FIRE RESISTANCE METAL DESIGNS. In ИНТЕГРАЦИЯ НАУКИ, ОБЩЕСТВА, ПРОИЗВОДСТВА И ПРОМЫШЛЕННОСТИ: ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ (pp. 9-10).

44. Пармонов, Н. Н., & Абдурахманов, А. М. (2021). ИССЛЕДОВАНИЕ СПОСОБОВ РАСЧЕТА СТАТИЧНО НЕОПРЕДЕЛИМЫХ СИСТЕМ. In ФУНДАМЕНТАЛЬНЫЕ И ПРИКЛАДНЫЕ НАУЧНЫЕ ИССЛЕДОВАНИЯ: АКТУАЛЬНЫЕ ВОПРОСЫ, ДОСТИЖЕНИЯ И ИННОВАЦИИ (pp. 48-50).

45. Kobilov, B. U., & Abdurakhmanov, A. M. (2021). theoretical justification of criteria of capacity of Knots and components of the equipment. In концепции,

теория и методика фундаментальных и Прикладных научных исследований (pp. 136-137).

46. Inomovich, A. N. (2021). Principles of Reconstruction and Formation of Residential Buildings Typical of Historical City Centers. European journal of innovation in nonformal education, 1(2), 29-40.

47. Inomovich, A. N. (2021). CHARACTERISTICS OF HISTORICAL SAMARKAND CITY CENTERS. International Journal of Discoveries and Innovations in Applied Sciences, 1(5), 155-158.

48. Inomovich, A. N. (2022). Cement Hardening and its Kinetic Features. European Journal of Life Safety and Stability (2660-9630), 13, 54-57.

49. Асатов, Н. А., Сагатов, Б. У., & Нишонова, Д. И. (2023). Проектирование солнцезащитного устройства в условиях сухого жаркого климата. Science and Education, 4(4), 460-468.

50. Асатов, Н. А., Сагатов, Б. У., & Джавлонова, Ш. Г. К. (2023). Перспективы реконструкции производственных зданий. Science and Education, 4(4), 445-451.

51. Asatov, N. A., Sagatov, B. U., & Egamberdiyev, T. T. O. G. L. (2023). O'zbekiston Respublikasida 1970-2020 yillarda qurilgan turar-joy binolari. Science and Education, 4(4), 452-459.

52. Джураев, У. У. (2021). Влияние минеральных добавок в агрессивной среде на прочность керамзитобетона. Science and Education, 2(5), 144-154.

53. Dzhuraev, U. U. (2020). Improving the technical condition of buildings and structures on the basis of verification calculation.

54. Djurayev, U., & Mingyasharova, A. (2019). Determination of the technical condition of buildings and structures on the basis of verification calculations. Problems of Architecture and Construction, 1(4), 37-39.

55. Джураев, У. У. (2020). Повышение технического состояния зданий и сооружений на основе поверочного расчета. Academy, (11 (62)), 70-74.

56. Ziyaviddinov, D. O. O. G. L., & Qurbonov, J. (2023). Jizzax shahrida eksplutatsiya qilinayotgan g'ishtli turar-joy binosining tashqi devor konstruksiyasining energiya samaradorligini oshirish. Science and Education, 4(4), 553-559