

**GLASS COMPOSITE REINFORCEMENT FOR  
STRENGTHENING COMPRESSIVE COLUMNS**

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***Аннотация:*** Колонна является важнейшим элементом конструкции, передающим нагрузку от перекрытий на фундамент, и ее надлежащая прочность имеет первостепенное значение. Выход из строя колонны может привести к обрушению всей каркасной конструкции. Целью данного исследования является проверка эффективности метода укрепления колонны.

***Ключевые слова:*** несущая конструкция, композиционные материалы, методы усиления, технология, железобетонные колонны, внешние композитные стержни.

***Annotatsiya:*** Ustun orayopma konstruksiyasidan tushayotgan yuklarni poydevorga uzatuvchi eng muhim konstruktiv element bo'lib, uning mustahkamligi katta ahamiyatga ega. Ustunning shkastlanishi binoni tashkil etuvchi konstruksiyalarning qulashiga olib kelishi mumkin. Ushbu tadqiqotning maqsadi ustunni mustahkamlash usulining samaradorligini tekshirishdir.

*Kalit so‘zlar: yuk ko‘taruvchi konstruksiya, kompozit materiallar, kuchaytirish usullari, texnologiya, temirbeton ustunlar, tashqi kompozit sterjenlar.*

***Abstract:** The column is the most important structural element transmitting floor loads to the foundation, and its proper strength is of paramount importance. Failure of a column can lead to the collapse of the entire frame structure. The purpose of this study is to test the effectiveness of the column strengthening method.*

***Key words:** bearing structure, composite materials, reinforcement methods, technology, reinforced concrete columns, external composite rods.*

**1. Introduction.** Reinforcement is used in a structural system to increase its seismic resistance by increasing strength or ductility. There are many methods of reinforcement. Currently, the most commonly used methods include the application of ferrocement, external reinforcement, and the central core technique. Reconstruction of a weak building is not a reasonable approach and can create a huge burden on the national economy. Many existing reinforced concrete (reinforced concrete) structures need to be reinforced due to increased demand, corrosion of steel rods, insufficient maintenance, changes in structural functions, changes in the rulebook and the impact of adverse circumstances such as earthquakes and explosions. Reinforcement of the column may also be required due to an increase in the number of floors, the difference in the strength of concrete in the field, the discrepancy between the percentage and type of reinforcement to the requirements of standards, the slope of the column and the draft. the foundation exceeds the permissible design limits. If proper attention is not paid to strengthening the building, it will lead to huge losses in terms of lives and wealth. Strengthening a building or its components is the best alternative approach to improving its seismic characteristics [1] [8].

**2. Methods.** In this study, two square columns were constructed, one control column and one reinforced column, as shown in Figure 1. Both the control and reinforced columns were subjected to the same axial load setting to test the

effectiveness of the reinforcement method. The columns were reinforced with external composite rods attached to the existing main rods. They were designed for a minimum area of steel (4pcs Ø6AIII). Concrete with a strength of B20 was used. All samples were tested under axial loading. The dimensions of the columns are shown in Table 1.

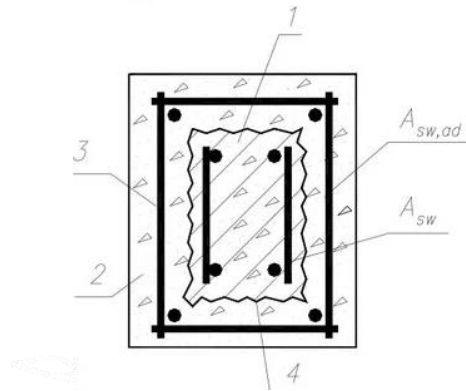


Figure 1. Visual representation of a reinforced column  
 1-reinforced structure, 2-monolithic concrete, 3-additional composite reinforcement, 4-surface notch



Figure 2. The process of

The dimensions of the columns.

Table 1.

|                                      |           |
|--------------------------------------|-----------|
| Reinforced square column             |           |
| Cross section                        | 200x200mm |
| Height                               | 1500mm    |
| Reinforcement. Main rods 4pcs Ø6AIII |           |

In order to strengthen, the transparent cover was first removed from the column. The outer rods were used for reinforcement and then attached to the existing main rods, as shown in Figure 2. To protect the outer rods, concrete was poured again to provide a transparent coating, which led to a slight increase in the diameter of the column. After applying the transparent coating, it was cured for 28 days. Load cells were connected to the column to measure displacement and

load, respectively. Grout concrete was designed to strengthen the bond between old and new concrete [2] [7].

**3. The results and their discussion.** The results are shown in Table 2 and graphically shown in Figure 3. The column of the control square has been tested and the behavior of the column is shown in the graph. The control column failed with an applied load of 209 kN, as well as with some cracks in the middle of the column, which corresponds to the line of the deformation graph 0.04–0.07, as shown in Figure 5. The maximum lateral deformation is approximately 2.03 mm, which is very small in magnitude, and the load is within the core section [9] [10].

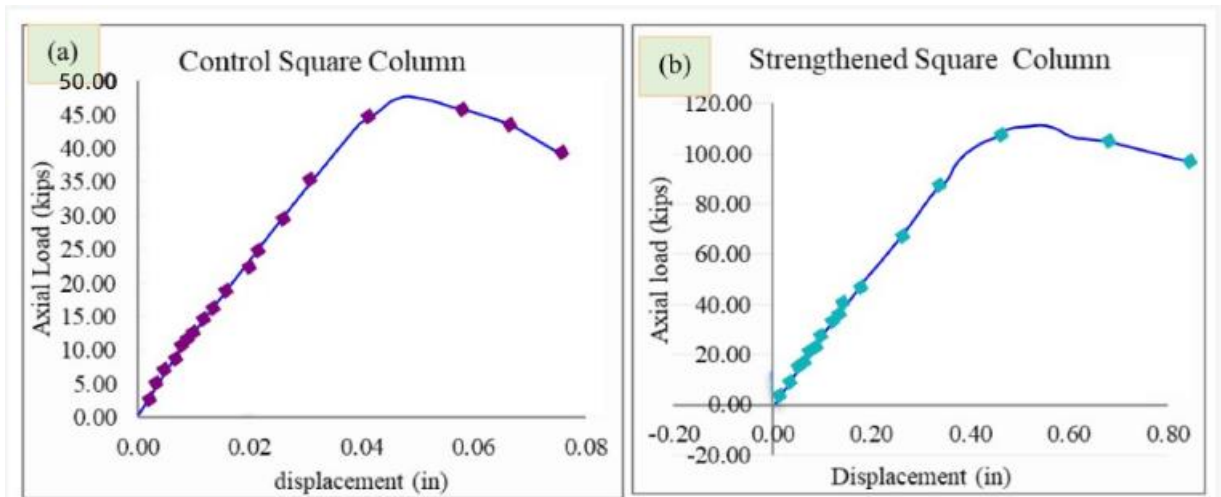


Figure 3. Graphs of the dependence of axial load on deformation for the control SC (a) and reinforced SC (b).



Figure 4. Reinforced square column.

Test results

Table 2.

| Power             | Design pressure (kN) | Test value(kN) |
|-------------------|----------------------|----------------|
| Control sample    | 254                  | 209            |
| Reinforced sample | 421                  | 501            |

The reinforced square column collapsed right in the middle in the form of buckling at an applied load of 501 kN. This strength is almost 2 times higher than the calculated strength of the steering column [12]. The column shows some deformation at the beginning of 0.51mm without load, and then the deformation returns to zero with increasing load, which is due to surface irregularities and self-adjustment for proper adhesion. Columns are destroyed due to shear (crumpling), due to which the lateral deformation suddenly increases without increasing the load. The maximum lateral deformation is approximately 2.29 mm, which is very small in magnitude and is located within the core of the section [3][11].

**4. Conclusions.** The load-bearing capacity of reinforced square columns increases by 58%, respectively, compared with control columns. This method can be effectively used to strengthen columns, as it leads to a significant increase in the bearing capacity and plasticity of structural elements. The calculated load is slightly less than the test load due to the use of rational reduction coefficients. The deformation capacity of reinforced square columns has been improved by 20%, respectively.

#### **List of used literature**

1. M.Mamadaliyev “ANALYTICAL CALCULATION OF BENDING ELEMENTS WITH BASALT FIBER REINFORCEMENT AND GLASS COMPOSITE ROD UNDER SHORT-TERM DYNAMIC LOADING” (Spectrum Journal of Innovation, Reforms and Development Volume 21, Nov., 2023) <https://sjird.journalspark.org/index.php/sjird/article/view/855/821>
2. Dusmatov, A., Nabiyev, M., Baxromov, M., & Azamjonov, A. (2023). Influence of two-layer axisymmetric cylindrical shells on their physical and mechanical characteristics. In E3S Web of Conferences (Vol. 452, p. 06010). EDP Sciences.

3. Azamjonov Asadbek Tursunali o'g'li. "COMPUTER PROGRAMS FOR DESIGNING BUILDING STRUCTURES." *Spectrum Journal of Innovation, Reforms and Development* 21 (2023): 178-184.
4. Abdukarimov, B. A., Tillaboyeva F. Sh, and A. T. Azamjonov. "CALCULATION OF HYDRAULIC PROCESSES IN SOLAR WATER HEATER COLLECTOR HEAT PIPES." *Экономика и социум* 4-1 (107) (2023): 4-10.
5. Onorboyev Shavkat, and Azamjonov Asadbek Tursunali o'g'li. "IMPACT OF THE CONSTRUCTION INDUSTRY ON ECOLOGY." *Miasto Przyszłości* 44 (2024): 394-399.
6. Сотволдиев, Ф., & Азамжонов, А. (2023). Анализ солнечных водонагревателей. Тенденции и перспективы развития городов, 1(1), 320-323.
7. Davlyatov , S. M., & Solijonov , F. S. o'g'li. (2023). O'ZBEKISTONDA YETISHTIRILAYOTGAN MAHALLIY YOG'UCH MATERIALLARINING XUSUSIYATLARI. *GOLDEN BRAIN*, 1(1), 263–265. Retrieved from <https://researchedu.org/index.php/goldenbrain/article/view/4568>
8. Абобакирова, З. А., Эркабоев, А. А. У., & Солижонов, Ф. С. У. (2022). ИССЛЕДОВАНИЕ СОСТОЯНИЯ ДЕФОРМАЦИИ ПРИ РАСТЯЖЕНИИ С ИСПОЛЬЗОВАНИЕМ СТЕКЛОВОЛОКОННОЙ АРМАТУРЫ В БАЛКАХ. *Talqin va tadqiqotlar ilmiy-uslubiy jurnali*, 4(4), 47-55.
9. Asrorovna, A. Z., Abdug'ofurovich, U. S., & Sodiqjon o'g'li, S. F. (2022). ISSUES OF IMPROVING THE ECONOMY OF BUILDING MATERIAL-WOOD PRODUCTION. *Spectrum Journal of Innovation, Reforms and Development*, 8, 336-340.
10. Abdug'Ofurovich, U. S., O'G'Li, S. F. S., & O'G'Li, E. A. A. (2022). KOMPOZIT ARMATURALI EGILUVCHI BETON ELEMENTLARNING KUCHLANIB-DEFORMATSIYALANGANLIK HOLATINI EKSPERIMENTAL TADQIQ ETISH. *Talqin va tadqiqotlar ilmiy-uslubiy jurnali*, 4(4), 41-46.

11. Abdukarimov B. A., Sh T. F., Azamjonov A. T. CALCULATION OF HYDRAULIC PROCESSES IN SOLAR WATER HEATER COLLECTOR HEAT PIPES //Экономика и социум. – 2023. – №. 4-1 (107). – С. 4-10.
12. Azamjonov Asadbek Tursunali o'g'li, Use of Solar Battery Batteries Research Parks Publishing LLC (2023) С. 76-83.
13. Obidovich A. T. Architecture And Urban Planning In Uzbekistan //Texas Journal of Engineering and Technology. – 2022. – Т. 9. – С. 62-64.
14. Muxammadovich A. A. et al. IMPROVING SUPPORT FOR THE PROCESS OF THE THERMAL CONVECTION PROCESS BY INSTALLING REFLECTIVE PANELS IN EXISTING RADIATORS IN PLACES //CENTRAL ASIAN JOURNAL OF MATHEMATICAL THEORY AND COMPUTER SCIENCES. – 2022. – Т. 3. – №. 12. – С. 179-183.
15. Obidovich A. T. et al. ROMAN STYLE QUALITY CHANGES IN EUROPEAN ARCHITECTURE IN X-XII CENTURIES //Spectrum Journal of Innovation, Reforms and Development. – 2022. – Т. 10. – С. 121-126.
16. BEAMS, D. I. B. R. C. Spectrum Journal of Innovation, Reforms and Development Volume 22, December, 2023 ISSN (E): 2751-1731 Website: www.sjird. journalspark. org DEVELOPMENT OF COMPOSITE REINFORCEMENTS AND CONCRETE DEFORMATIONS IN BASALT REINFORCED CONCRETE BEAMS.
17. Солижонов, Ф., & Курбонов, К. (2023). Расчет бетонных конструкций с композитной арматурой методом предельных состояний. *Тенденции и перспективы развития городов*, 1(1), 481-485.
18. Sodiqjon o'g'li, S. F. (2023). BAZALT KOMPOZIT ARMATURALI BETON TO 'SINLARNI NORMAL KESIMLAR BO 'YICHA MUSTAHKAMLIGINI TADQIQ ETISH.: BAZALT KOMPOZIT ARMATURALI BETON TO 'SINLARNI NORMAL KESIMLAR BO 'YICHA MUSTAHKAMLIGINI TADQIQ ETISH.
19. Akramov Kh.A, Davlyatov Sh.M, Kimsanov B.I, Nazirov A.S "APPLICATION AND CLASSIFICATION OF COMPOSITE

- REINFORCEMENT IN CONSTRUCTION” Spectrum Journal of Innovation, Reforms and Development Volume 09, Nov., 2022 Page 95-100
20. Akramov Kh.A, Davlyatov Sh.M, Kimsanov B.I, Nazirov A.S “CONSTRUCTION FEATURES OF PERFORMING EXTERNAL REINFORCEMENT FROM COMPOSITE MATERIALS” Spectrum Journal of Innovation, Reforms and Development Volume 09, Nov., 2022 Page 110-115
21. Akramov Kh.A, Davlyatov Sh.M, Kimsanov B.I, Nazirov A.S “THE ROLE OF ROD STAYED-SHELL SYSTEMS IN STUDIES OF INNOVATIVE STRUCTURES IN CONSTRUCTION” Spectrum Journal of Innovation, Reforms and Development Volume 09, Nov., 2022 Page 116-123
22. Ravshanbek o‘g‘li, R. R. (2023). BAZALT FIBRALARI ORQALI BETON TARKIBNI OPTIMALLASHTIRISH. SO ‘NGI ILMIY TADQIQOTLAR NAZARIYASI, 6(7), 37-44.
23. Ravshanbek o‘g‘li, R. R., & Zuxriddinovna, M. S. (2023). TO ‘RT QAVATLI BINONI SEYSMIK KUCHLAR TA’SIRIGA LIRA 9.6 DASTUR YORDAMIDA HISOBLASH.: TO ‘RT QAVATLI BINONI SEYSMIK KUCHLAR TA’SIRIGA LIRA 9.6 DASTUR YORDAMIDA HISOBLASH.
24. Nabiyeu, M., Salimov, O., Khotamov, A., Akhmedov, T., Nasriddinov, K., Abdurakhmanov, U., ... & Abobakirov, A. (2024). Effect of external air temperature on buildings and structures and monuments. In E3S Web of Conferences (Vol. 474, p. 03011). EDP Sciences.
25. Umarov, S. A. O. (2023). UCH QAVATLI BINONI SEYSMIK KUCHLAR TA’SIRIGA LIRA 9.6 DASTUR YORDAMIDA HISOBLASH. GOLDEN BRAIN, 1(1), 224-230.
26. Ashurov, M., & Ravshanbek o‘g‘li, R. R. (2023). RESEARCH OF PHYSICAL AND MECHANICAL PROPERTIES OF BASALT FIBER CONCRETE. European Journal of Interdisciplinary Research and Development, 17, 12-18.
27. Numanovich, A. I., & Ravshanbek o'g'li, R. R. (2022). BASALT FIBER CONCRETE PROPERTIES AND APPLICATIONS. Spectrum Journal of Innovation, Reforms and Development, 9, 188-195.



28. Abobakirova, Z., Umarov, S., & Raximov, R. (2023). Enclosing structures of a porous structure with polymeric reagents. In E3S Web of Conferences (Vol. 452, p. 06027). EDP Sciences.
29. Dusmatov, A., Nabiyev, M., Baxromov, M., & Azamjonov, A. (2023). Influence of two-layer axisymmetric cylindrical shells on their physical and mechanical characteristics. In E3S Web of Conferences (Vol. 452, p. 06010). EDP Sciences.
30. . Бахромов, М. М. (2020). Исследование сил негативного трения оттаивающих грунтов в полевых условиях. Молодой ученый, (38), 24-34.
31. 2. Бахромов, М. М., Отакулов, Б. А., & Рахимов, Э. Х. У. (2019). Определение сил негативного трения при оттаивании околосвайного грунта. European science, (1 (43)), 22-25.
32. 3. Бахромов, М. М., & Рахманов, У. Ж. (2020). Проблемы строительства на просадочных лессовых и слабых грунтах и их решение. Интернаука, (37-1), 5-7.
33. Бахромов, М., & Хасанов, Д. (2022). ТЎКМА ГРУНТЛАРДА ЗАМИН ВА ПОЙДЕВОРЛАР ҚУРИЛИШИ. Евразийский журнал академических исследований, 2(6), 353-360.
34. Бахромов, М. М., & Рахронов, У. Ж. (2019). Дефекты при проектировании и строительстве оснований и фундаментов. Проблемы современной науки и образования, (3 (136)), 76-79.
35. Бахромов, М. М., & Рахронов, У. Ж. (2019). Закономерности воздействия сил негативного трения по боковой поверхности сваи. Проблемы современной науки и образования, (12-2 (145)), 62-65.
36. Бахромов, М. М., Рахронов, У. Ж., & Отабоев, А. Б. У. (2019). Воздействие сил негативного трения на сваю при просадке грунтов. Проблемы современной науки и образования, (12-2 (145)), 24-35.
37. Бахромов, М. М. (2022). Механические характеристики грунта и погноз закономерности воздействия сил негативного трения по боковой поверхности сваи. PEDAGOGS journali, 10(3), 162-167.

38. Mamatkhanovich, B. M., & Malikov, S. S. (2022). Strength And Deformability Of Metal GlassPlastic Shells Taking Into Account Shear Rigidity. *The Peerian Journal*, 12, 79-86.
39. Dusmatov, A., Bakhramov, M., & Malikov, S. (2023). Interlaminar shifts of two-layer aggressive-resistant combined plates based on metal and fiberglass. In *E3S Web of Conferences* (Vol. 389, p. 01030). EDP Sciences.
40. Mamatkhanovich, B. M. (2022). CONSTRUCTION OF FOUNDATIONS IN GRUNTS WITH VARIABLE STRUCTURES. *Spectrum Journal of Innovation, Reforms and Development*, 10, 115-120.
41. Mamathanovich, B. M. (2023). CONSTRUCTION OF FOUNDATIONS ON DRY SOILS. *Spectrum Journal of Innovation, Reforms and Development*, 21, 294-297.
42. Mamatkhanovich, B. M. (2022). Construction of Grounds and Foundations on Bulk Soil. *Miasto Przyszłości*, 201-205.
43. Bakhromov, M. M., Rakmanov, U. J., & Otaboev, A. B. U. (2021). Problems of construction on insulated forest and weak soils and their solution. *Asian Journal of Multidimensional Research*, 10(10), 604-607.
44. Dusmatov, A., Nabiyev, M., Baxromov, M., & Azamjonov, A. (2023). Influence of two-layer axisymmetric cylindrical shells on their physical and mechanical characteristics. In *E3S Web of Conferences* (Vol. 452, p. 06010). EDP Sciences.
45. Дилшоджон оглы, З. Н. (2023). ПРИМЕНЕНИЕ КОМПОЗИТНЫХ МАТЕРИАЛОВ ДЛЯ УСИЛЕНИЯ ЖЕЛЕЗОБЕТОННЫХ КОНСТРУКЦИЙ. Журнал «Спектр» об инновациях, реформах и развитии, 22, 148-154.
46. Набиев, М. Н., Насриддинов, Х. Ш., & Кодиров, Г. М. (2021). Влияние Водорастворимых Солей На Эксплуатационные Свойства Наружные Стен. *Ta'lim va rivojlanish tahlili onlayn ilmiy jurnali*, 1(6), 44-47.
47. Shavkatovich, N. K. (2022). SYSTEMS OF ARTIFICIAL REGULATION OF THE AIR ENVIRONMENT OF APARTMENTS AND HOUSES. *Spectrum Journal of Innovation, Reforms and Development*, 9, 169-174.

48. Nabiyeu, M., Salimov, O., Khotamov, A., Akhmedov, T., Nasriddinov, K., Abdurakhmanov, U., ... & Abobakirov, A. (2024). Effect of external air temperature on buildings and structures and monuments. In *E3S Web of Conferences* (Vol. 474, p. 03011). EDP Sciences.
49. Khasan, N. (2024). Calculation of Cast Reinforced Concrete Frames of Multi-Story Buildings Taking into Account Dry-Hot Climate Conditions. *Miasto Przyszłości*, 49, 1215-1219.
50. Shavkatovich, N. X. (2022). ESTABLISHMENT OF TEMPERATURE AND HUMIDITY IN APARTMENTS AND HOUSES WITH THE HELP OF ARTIFICIAL PHASE ARTIFICIAL REGULATORY SYSTEMS. *Spectrum Journal of Innovation, Reforms and Development*, 10, 107-114.
51. Қодиров, F. M., & Мирзабабаева, С. М. (2022). Бетон ва темирбетон конструкциялар бузилишининг турлари ва уларнинг олдини олиш. *INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING*, 1(6), 91-95.
52. Mirzajonovich, Q. G., & ToychiboyQizi, J. X. (2021). The determination of condensation precipitation on the inner surfaces of the limitation during the action of aerosols. *Asian Journal of Multidimensional Research*, 10(10), 132-137.
53. Sagdiev, K. S., Yuvmitov, A. S., & Qodirov, G. M. (2020). Assessment Of Seismic Resistance Of Existing Preschool Educational Institutions And Recommendations For Their Provision Seismic Safety. *The American Journal of Applied sciences*, 2(12), 90-99.
54. Mirzajonovich, Q. G., & Qizi, J. X. T. Y. (2021). Influence Of Hydrophobizing Additives On Thermal Properties Of Ceramzito Concrete In Agressive Environment. *The American Journal of Engineering and Technology*, 3(12), 26-33.
55. Mirzajonovich, Q. G., & Qizi, M. Z. A. (2021). Determination Of Condensation On The Inner Surface Of The Walls Of Canoe Buildings Under The Influence Of Aerosols. *The American Journal of Engineering and Technology*, 3(12), 14-19.

56. Қодиров, Ф. М., & Мирзабабаева, С. М. (2022). Бетон ва темирбетон конструкциялар бузилишининг турлари ва уларнинг олдини олиш. *INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING*, 1(6), 91-95.
57. Ogli, A. U. A., Ogli, X. A. M., & Mirzajonovich, Q. G. (2020). Hazrati Imam Architecture The Complex Is A Holiday Of Our People. *The American Journal of Engineering and Technology*, 2(11), 46-49.
58. Gayradjonovich, G. S., Mirzajonovich, Q. G., Tursunalievich, S. B., & Ogli, X. A. M. (2021). Corrosion State Of Reinforced Concrete Structures. *The American Journal of Engineering and Technology*, 3(06), 88-91.
59. Momin, N., Mirzajonovich, Q. G., Tursunalievich, S. B., & Gayradjonovich, G. S. (2021). Reception of improving the microclimate in the houses of the fergana valley. *The American Journal of Engineering and Technology*, 3(06), 92-96.
60. Ogli, X. A. M., Ogli, A. U. A., & Mirzajonovich, Q. G. (2020). Ways Of Implementation Of Environmental Emergency Situations In Engineering Preparation Works In Cities. *The American Journal of Engineering and Technology*, 2(11), 108-112.
61. Мирзабабаева, С. М., & Қодиров, Ф. М. (2022). Биноларни ўровчи конструкцияларини тузлар таъсиридаги сорбцион хусусиятини яхшилаш. *INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING*, 1(6), 86-90.
62. Mirzajonovich, Q. G., Ogli, A. U. A., & Ogli, X. AM (2020). Influence Of Hydro Phobizing Additives On Thermophysical Properties And Long-Term Life Of Keramzit0betona In An Aggressive Medium. *The American Journal of Engineering and Technology*, 2(11), 101-107.
63. Кодиров, Г. М., Набиев, М. Н., & Умаров, Ш. А. (2021). Микроклимат В Помещениях Общественных Зданиях. *TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI*, 1(6), 36-39.
64. BINO TOM QISMIGA VERTALYOT QO'NISHI NATIJASIDA BINONING KONSTRUKSIYALARIDAGI O'ZGARISHLARI" 2023/10/5,

"SCIENTIFIC BASIS OF APPLICATION OF INNOVATION AND ENERGY-SAVING TECHNOLOGIES IN THE CONSTRUCTION OF ENGINEERING COMMUNICATIONS" Authors: D.G'. G'ulomov, A.R. G'ulomov

65. Xasanjon, X. R. (2024). Review and Analysis of the Operation of Monolithic Biaxial Ceilings With Void Generators in Dry and Hot Climates. *Miasto Przyszłości*, 49, 896-901.

66. Abduxodi o'g'li, A. A. (2024). TEMIRBETON KARKAS TIZIMLI XIZMAT KO 'RSATISH BINOSINI SEYSMIK KUCHLAR TA'SIRIGA HISOBLASH VA ULARNI SOLISHTIRMA TAHLILI. *Miasto Przyszłości*, 49, 627-630.

67. Davlyatov, S., Jakhongirov, I., Abdurakhmonov, A., Solijonov, F., & Abobakirova, Z. (2024, November). Determination of the stress-strain state of models of steel cylindrical tanks using the "ANSYS" program. In *E3S Web of Conferences* (Vol. 508, p. 04002). EDP Sciences.

68. Abdukholiq, A., & Golibjon, A. (2023). CALCULATION OF REINFORCED CONCRETE SLAB STRUCTURE UNPROTECTED FROM SUNLIGHT IN NATURAL CLIMATE IN LIRA PK PROGRAM. *Spectrum Journal of Innovation, Reforms and Development*, 21, 245-250.

69. Goncharova, N., Abobakirova, Z., Davlyatov, S., Umarov, S., & Mirzababayeva, S. (2023, September). Capillary permeability of concrete in aggressive dry hot climate. In *E3S Web of Conferences* (Vol. 452, p. 06021).

70. Y Karimov, I Musaev, S Mirzababayeva, Z Abobakirova, S Umarov, Land use and land cover change dynamics of Uzbekistan: a review, *E3S Web of Conferences* 421, 03007

71. Akramov, X., Davlyatov, S., Umarov, S., & Abobakirova, Z. (2023). Method of experimental research of concrete beams with fiberglass reinforcement for bending. In *E3S Web of Conferences* (Vol. 365, p. 02021). EDP Sciences.

72. Mirzababayeva, S., Abobakirova, Z., Umarov, S. Crack resistance of bent concrete structures with fiberglass reinforcement, *E3S Web of Conferences*, 2023, 452, 06023.

73. Strength and uniformity of composite reinforced columns, Akramov, K., Davlyatov, S., Kimsanov, B. E3S Web of Conferences, 2023, 452, 06012.
74. Comparison of current and expired norms for the development of methods for checking and monitoring the seismic resistance of buildings. Shodiljon Umarov, Khusnitdin Akramov, Zebuniso Abobakirova and Saxiba Mirzababayeva, E3S Web Conf., 474 (2024) 01020, DOI: <https://doi.org/10.1051/e3sconf/202447401020>.
75. Analytical calculation of bending elements with basalt fiber and glass composite rod reinforcement under short-term dynamic loading, Akramov, K., Davlyatov, S., Nazirov, A., E3S Web of Conferences, 2023, 452, 06006.
76. Abdulkhayev, Z., Madraximov, M., Abdujalilova, S., Mirzababayeva, S., Otakulov, B., Sattorov, A., & Umirzakov, Z. (2023, September). Flow trajectory analysis and velocity coefficients for fluid dynamics in tubes and holes. In E3S Web of Conferences (Vol. 452, p. 02010).
77. Goncharova N. I., Abobakirova Z. A., Mukhamedzanov A. R. Capillary permeability of concrete in salt media in dry hot climate //AIP Conference Proceedings. – AIP Publishing LLC, 2020. – Т. 2281. – №. 1. – С. 020028.
78. Comparability of estimates of the impact of gunpowder and gas-dynamic explosions on the stability of buildings and structures, Tojiev, R., Yunusaliev, E., Abdullaev, I., E3S Web of Conferences, 2021, 264, 02044
79. The Significant Technical Mantle of AI in the Field of Secular Engineering: An Innovative Design Akhmedov, J., Jurayev, U., Kosimova, S., Tursunov, Q., Kosimov, L. 2024 4th International Conference on Advance Computing and Innovative Technologies in Engineering, ICACITE 2024, 2024, страницы 601–606.
80. Aerodynamic study of the characteristics of the nest one skyscraper under wind load Akhmedov, J., Madaliev, M., Yunusova, M., Kurbonova, N., Fayziyev, A. E3S Web of Conferences, 2023, 452, 06018.
81. Methodology for checking the seismic strength of buildings based on existing norms Abobakirova, Z., Umarov, S., Davlyatov, S., Nasriddinov, H., Mahmudov, A. BIO Web of Conferences, 2024, 105, 05014.

Improving the thermal properties of lightweight concrete exterior walls.

82. Improving the thermal properties of lightweight concrete exterior walls  
Goncharova, N., Ababakirova, Z., Davlyatov, S., Umarov, S., Mirzababayeva, S.  
E3S Web of Conferences, 2024, 508, 05002.

83. Operation of reinforced concrete beams along an inclined section under conditions of one-sided heating, Umarov, S., Mirzababayeva, S., Abobakirova, Z., Goncharova, N., Davlyatov, S. E3S Web of Conferences, 2024, 508, 05001.

84. Mirzaakbarovna, M. S. (2023). INTEGRATION IS THE BASIS OF QUALIFIED PERSONNEL TRAINING. *Journal of Innovation in Education and Social Research*, 1(4), 233-239.

85. Mirzababaeva, S. (2023). OPERATIONAL RELIABILITY OF RECONSTRUCTED BUILDINGS-STRUCTURES. *Spectrum Journal of Innovation, Reforms and Development*, 21, 235-239.

86. Mirzababaeva, S. M. (2021). The influence of elevated and high temperatures on the deformability of concrete. *Anal. Educ. Dev*, 1(6), 40-43.v

87. Mirzababayeva, S. M. (2023). DETERMINATION OF STRENGTH CHARACTERISTICS OF HEAT-RESISTANT CONCRETE ON ALUMINA CEMENT. *Web of Scholars: Multidimensional Research Journal*, 2(11), 34-38.

88. Asrorovna, A. Z., & Abdug‘ofurovich, U. S. (2023). ISSUES OF RATIONAL USE OF WASTE IN THE PRODUCTION OF BUILDING MATERIALS. *Spectrum Journal of Innovation, Reforms and Development*, 22, 94-100.

89. Abdug‘ofurovich, U. S. (2023). INVESTIGATION OF CROSSBARS WITH REINFORCED CONCRETE AND COMPOSITE REINFORCEMENT. *Spectrum Journal of Innovation, Reforms and Development*, 22, 77-84.

90. Abdug‘ofurovich, U. S., & Asrorovna, A. Z. (2023). THE ROLE OF BINDERS AND FILLERS IN THE STUDY OF CONCRETE PROPERTIES. *Spectrum Journal of Innovation, Reforms and Development*, 22, 101-109.

91. Madraximov, M., Abdulkhaev, Z., Ibrokhimov, A., & Mirababaeva, S. (2024, June). Numerical simulation of laminar symmetric flow of viscous fluids. In *AIP Conference Proceedings* (Vol. 3119, No. 1). AIP Publishing.
92. UMAROV, S. A. (2021). STRENGTHENING AND DEFORMATION OF GLASS COMPOSITE ARMATURES MANUFACTURED IN UZBEKISTAN. *THEORETICAL & APPLIED SCIENCE Учредители: Теоретическая и прикладная наука*, (11), 829-835.
93. Mirzaakbarovna, M. S. (2023). FACADE STUDY METHODS. *Journal of Innovation in Education and Social Research*, 1(4), 240-246
94. Abdugofurovich, U. S., & Asrorovna, A. Z. (2022). STRESS-STRAIN STATE OF THIN-WALL SPATIAL COATINGS UNDER VARIOUS DESIGN SOLUTIONS OF CONTOUR STRUCTURES AND SHELL PLATES. *Spectrum Journal of Innovation, Reforms and Development*, 8, 332-335.
95. Asrorovna, A. Z., Abdugofurovich, U. S., & Mirzaakbarovna, M. S. (2022). Optimization of corrosion-resistant concrete with chemical additives. *Spectrum Journal of Innovation, Reforms and Development*, 8, 296-303.
96. Mirzaev, I., Sagdiev, K., Yuvmitov, A., Turdiev, M., & Egamberdiev, B. (2024). EXPERIMENTAL DETERMINATION OF DYNAMIC COEFFICIENT OF AMONTON-COULOMB DRY FRICTION. *Facta Universitatis, Series: Mechanical Engineering*.
97. ўғли Холмирзаев, Қ. Р., & Умаров, Ш. А. (2022). ШИША ТОЛАЛИ АРМАТУРАЛАРНИ ТЎСИНЛАРДА ҚЎЛЛАШ ОРҚАЛИ МУСТАҲКАМЛИК ВА БУЗИЛИШ ҲОЛАТЛАРИ АНИҚЛАШ. *INTERNATIONAL CONFERENCE ON LEARNING AND TEACHING*, 1(6), 135-141.
98. Goncharova, N., Abobakirova, Z., Davlyatov, S., Umarov, S., & Mirzababayeva, S. (2023). Capillary permeability of concrete in aggressive dry hot climate. In *E3S Web of Conferences* (Vol. 452, p. 06021). EDP Sciences.
99. Мирзаахмедова, У. А., Мирзабабаева, С. М., Абобакирова, З. А., & Умаров, Ш. А. (2021). Надежности И Долговечности Энергоэффективные



100. Yuvmitov, A., Akhundjanov, D., Abdurakhmanov, U., Khasanova, N., & Egamberdiev, B. (2023). Study of stress-strain state of structures and assessment of seismic safety of Ismoil Somoni Mausoleum in Bukhara. In E3S Web of Conferences (Vol. 452, p. 06007). EDP Sciences.