Spectrum Journal of Innovation, Reforms and Development
Volume 10, Dec., 2022 | **ISSN (E): 2751-1731**
Website: www.sjird.journalspark.org

SHRINKAGE DEFORMATIONS BETONA IN A DRY HOT CLIMATE

Bakhodir Rizayev, Islombek Akhmedov, Shavkat Yusupov, Isroiljon Umarov,
Aleksandir Kazadayev, Farrukh Dadakhanov
Namangan Engineering-Construction Institute, Islom Karimov Avenue, 12, Namangan, Uzbekistan, 160103

Abstract
The article provides an analysis of the deformation of concrete in dry and hot climates. Concrete shrinkage deformations under conditions of dry hot climate have pronounced periodic character depending on seasonal variation of air temperature and humidity.

Keywords: shrinkage, stresses, deformation, humidity, temperature, temperature expansion, wet storage, solar radiation, moisture release of concrete, seasonal change, normal condition.

The climatic conditions of the Republic of Uzbekistan are sharply continental. In summer, the air temperature can exceed + 400 C, while the relative humidity drops to 10-15% and below. In such klimaticheskikh conditions, from direct exposure to solar radiation, the surface of reinforced concrete and concrete structures is heated to 70-800 C. At the same time, significant deformations of concrete shrinkage appear, leading to the formation and opening of cracks on the surface of reinforced concrete and betonnykh structures.

One of the most important factors in improving the reliability and durability of structures of buildings and structures, especially for the Republic of Uzbekistan, is the further improvement of methods for their rascheta taking into account real operating conditions. When concrete hardens in a dry hot climate, the two opposite structural and destructive processes take place. The more structural processes prevail, the deeper and denser the hydration of cement will be, the physical and chemical hardening processes are more intensive, the strength of concrete is gained faster, and concrete is more resistant in hot climates. In the absence of proper care for concrete, dehydration of fresh concrete occurs. Concrete in dry weather during the first day loses 50... 70% of the water of consolidation.

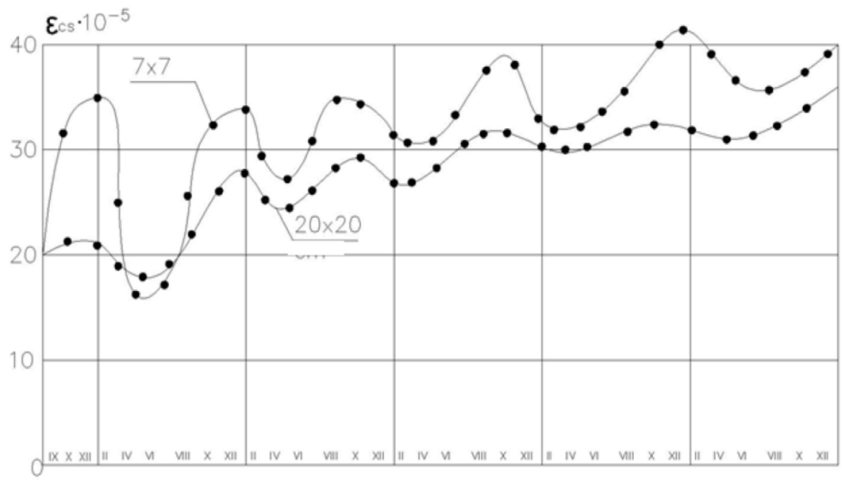
Intensive evaporation of moisture from the surface of freshly laid concrete causes plastic and moisture shrinkage of concrete. Plastic shrinkage of concrete occurs immediately after the formation of the concrete mixture, when it has not yet fully hardened. Plastic shrinkage of concrete causes the formation of surface cracks. Therefore, in order to prevent the evaporation of water from concrete, immediately after molding, moisture care of the concrete should be carried out. Any delay from the beginning of concrete care over 20 ... 30 minutes already contributes to the development of plastic shrinkage of concrete. Humid care of concrete immediately after the completion of the molding of a product or structure reduces the possibility of plastic shrinkage and cracking of exposed surfaces of concrete. The minimum duration of the initial care of freshly laid concrete in order to obtain the least plastic shrinkage in hot dry weather is 6 ... 7 hours.

Further care of concrete does not significantly affect the subsequent development of concrete plastic shrinkage deformation, but it is necessary for the formation of a dense concrete structure and a set of 50 ... 70% compressive strength. Concrete is carefully covered with moisture-proof or damp materials for 8 ... 10 days, the concrete is constantly kept in wet conditions, preventing it from drying out. Under natural conditions of a dry hot climate, humidity deformations of concrete shrinkage develop along a certain cyclic curve damped from seasonal changes in the humidity of the outside air.

In the warm dry season, the greatest development of shrinkage deformations is observed in concrete, which gradually stops its development in the cold wet season and turns into swelling deformations of concrete. However, the swelling deformation is less than the shrinkage deformation of concrete. The amplitude of the cycle of moisture shrinkage and swelling deformations decreases with time, but eventually moisture shrinkage deformations remain in the concrete. The deformations of moisture shrinkage of concrete are the greater, the smaller the section of the element and the lower the relative humidity of the air. The influence of the dimensions of the section of elements on the deformation of concrete shrinkage is most pronounced in the initial periods of operation of the structure. The maximum values of deformation of moisture shrinkage of concrete are observed during the manufacture of the element in the warm dry season. The calculated values of the concrete shrinkage deformation for a given operating time are calculated using a hyperbolic dependence.

$$\varepsilon_{cs} = \varepsilon_{cs1}\frac{\Delta\tau}{\alpha_{cs}+\Delta\tau} \qquad (1.1)$$

Where $\Delta\tau$- time per day. from the end of the wet storage of concrete to the specified service life. Parameter α_cs - growth rate of concrete shrinkage strains, the value of which is taken from Table. 1.4 /2.3/ depending on the season of manufacture and the reduced section height.



Rice. 1.1. Time development of concrete shrinkage deformations in prisms of cross section 7x7 and 20x20 sm in a dry hot climate.

Table 1.4
Time of year of construction Parameter values for element α_csc with reduced section height

Time of year of construction	Parameter values for element $\alpha_{cs}c$ with reduced section height h_{red}, (sm) (						
	3,5	5,0	10,0	20,0	30,0	40	50
Warm /summer /	15	20	40	80	120	160	200
Cold /winter/	40	60	120	240	360	480	600

Note. In the manufacture of structures other than those indicated in Table. 1.4, the values of the parameter α_cs are taken by linear interpolation.

The calculated limit values of concrete shrinkage deformations are calculated based on the relative seasonal (average monthly) air humidity during the construction period. The limiting design values of concrete shrinkage deformations, corresponding to the water consumption of mixing the concrete mixture and the actual operating conditions of the structures, are calculated by the formula.

$$\varepsilon_{cs_1} = \varepsilon_{cs} \cdot \varphi_n \cdot \varphi_w \ (1.2)$$

The value of the coefficient φn is found in Table. 1.3 depending on the season of manufacture of the structure and the reduced sectional height. The value of the calculated concrete shrinkage deformation εcs for concrete of the compressive strength class B25 ... B65 and standard cone draft up to 7 cm is taken equal to (270 ... 400). 10-5. The values of the coefficient φw, which takes into account the relative humidity of the outside air by the beginning of concrete drying, are determined in the same way as in the calculation of concrete creep deformations.

The values of concrete shrinkage deformations are calculated by the formula

$$\varepsilon_{cs} = 0.125 \cdot 10^{-6} \cdot w \cdot \sqrt{w} \qquad (1.3)$$

Humidity deformation of concrete shrinkage in a cold, more humid season, taking into account the reversible moisture swelling deformation, if necessary, can be considered as the difference between concrete shrinkage deformation εcs determined by formula (1.3) and swelling deformations calculated by the formula:

$$\varepsilon_w = \propto_w \cdot \Delta w \cdot \varphi \quad (1.4)$$

where ∝w - seasonal moisture deformations of concrete swelling,

φ - coefficient, taking into account the scale factor, for seasonal moisture deformations of concrete swelling, is taken according to Table. 1.5 /2.3/.

Table 1.5

The values of the coefficient φ depending on the reduced element section height h_{red}						
3,5	5,0	10,0	20,0	30,0	40	50
1,1	1,0	0,9	0,75	0,55	0,40	0,35

The limiting values of deformations of moisture shrinkage of concrete can also be taken from Table. 1.6 depending on the relative humidity of the outside air and the reduced section height.

Table 1.6

Humidity of the hottest month %	Values of limiting shrinkage strains ε_{cs} 1 ⟦·10⟧^(-6) of heavy concrete (OK-1-2 cm) for a structure not protected from solar radiation during alternate heating and cooling at, cm						
	3,5	5	10	20	30	50	100
0	800	720	630	585	570	560	550
20	710	630	540	490	475	460	445
40	615	540	450	400	380	365	340
60	530	450	360	310	290	270	240
75	460	380	290	240	220	200	160
90	390	310	220	170	160	155	150

Note.1.hred - the reduced height of the section of the element, which characterizes the massiveness of the structures and is equal to the sectional area divided by 1/2 of its diameter in contact with air.

2. Shrinkage deformations should be multiplied by: 0.85 - for structures made of concrete of a class below B 25.

REFERENCES

1. Akhmedov, I., Khamidov, A., Shavkat, Y., Jalalov, Z., Umarov, I., & Kazadayev, A. (2022). RESEARCH OF ASH-SLAG MIXTURES FOR PRODUCTION OF CONSTRUCTION MATERIALS. Spectrum Journal of Innovation, Reforms and Development, 10, 85-91.
2. Akhmedov, I., Khamidov, A., Shavkat, Y., Umarov, I., & Kazadayev, A. (2022). DISTRIBUTION OF SEDIMENTS IN THE MOUNTAIN RIVER BED. Spectrum Journal of Innovation, Reforms and Development, 10, 101-106.
3. Khamidov, A., Akhmedov, I., Shavkat, Y., Jalalov, Z., Umarov, I., Xakimov, S., & Aleksandr, K. (2022). APPLICATION OF HEAT-INSULATING COMPOSITE GYPSUM FOR ENERGY-EFFICIENT CONSTRUCTION. Spectrum Journal of Innovation, Reforms and Development, 10, 77-84.
4. Akhmedov, I., Khamidov, A., Kholmirzayev, S., Umarov, I., Dedakhanov, F., & Hakimov, S. (2022). ASSESSMENT OF THE EFFECT OF SEDIBLES FROM SOKHSOY RIVER TO KOKAND HYDROELECTRIC STATION. Science and innovation, 1(A8), 1086-1092.

5. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Umarov, I., Dedakhanov, F., & Hakimov, S. (2022). USE OF SULFUR CONCRETE IN REINFORCED CONCRETE STRUCTURES. Science and innovation, 1(A8), 985-990.
6. Kholmirzayev, S., Akhmedov, I., Yusupov, S., Umarov, I., Akhmedov, A., & Kazadayev, A. (2022). THE ROLE OF INTEGRATION OF SCIENCE, EDUCATION AND DEVELOPMENT IN STAFF PREPARATION FOR CONSTRUCTION. Science and innovation, 1(B8), 2237-2241.
7. Akhmedov, I., Khamidov, A., Kholmirzayev, S., Yusupov, S., & Umarov, I. (2022). IMPROVING RIVER SEDIMENT DISTRIBUTION CALCULATION IN MOUNTAIN RIVERS. Science and innovation, 1(A8), 1014-1019.
8. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Akhmedov, A., Dedakhanov, F., & Muydinova, N. (2022). CALCULATION OF REINFORCED CONCRETE STRUCTURES OF BUILDINGS BASED ON THE THEORY OF RELIABILITY. Science and innovation, 1(A8), 1027-1032.
9. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Yusupov, S., Umarov, I., & Hakimov, S. (2022). ANALYSIS OF THE EFFECT OF DRY HOT CLIMATE ON THE WORK OF REINFORCED CONCRETE ELEMENTS. Science and innovation, 1(A8), 1033-1039.
10. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Jalalov, Z., Yusupov, S., & Umarov, I. (2022). THE ROLE OF THE INTEGRATION OF SCIENCE, EDUCATION AND PRODUCTION IN THE TRAINING OF PERSONNEL FOR CONSTRUCTION EDUCATIONAL AREAS. Science and innovation, 1(A8), 1040-1045.
11. Khamidov, A., Akhmedov, I., Kholmirzayev, S., Jalalov, Z., Yusupov, S., & Umarov, I. (2022). EFFECTIVENESS OF MODERN METHODS OF TESTING BUILDING STRUCTURES. Science and innovation, 1(A8), 1046-1051.
12. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Umarov, I., Axmedov, A., & Abdunazarov, A. (2022). PROSPECTS FOR THE DEVELOPMENT OF REINFORCED CONCRETE STRUCTURES IN UZBEKISTAN. Science and innovation, 1(A8), 1052-1057.
13. Xamidov, A., Kholmirzayev, S., Rizayev, B., Umarov, I., Dadaxanov, F., & Muhtoraliyeva, M. (2022). THE EFFECTIVENESS OF THE USE OF MONOLITHIC REINFORCED CONCRETE IN THE CONSTRUCTION OF RESIDENTIAL BUILDINGS. Science and innovation, 1(A8), 991-996.
14. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Jalalov, Z., Yusupov, S., & Akhmedov, A. (2022). THE USE OF MONOLITHIC REINFORCED CONCRETE STRUCTURES ON THE TERRITORY OF THE REPUBLIC OF UZBEKISTAN. Science and innovation, 1(A8), 997-1003.
15. Kholmirzayev, S., Akhmedov, I., Khamidov, A., Umarov, I., Dedakhanov, F., & Kazadayev, A. (2022). ANALYSIS OF METHODS FOR PROCESSING SERA RAW MATERIALS AND MAKING SEROBETON. Science and innovation, 1(A8), 1004-1008.
16. Kholmirzayev, S., Akhmedov, I., Rizayev, B., Akhmedov, A., Dedakhanov, F., & Khakimov, S. (2022). RESEARCH OF THE PHYSICAL AND MECHANICAL PROPERTIES OF MODIFIED SEROBETON. Science and innovation, 1(A8), 1009-1013.

17. Khamidov, A., Akhmedov, I., Kholmirzayev, S., Qodirova, F., Nomonova, S., & Kazadayev, A. (2022). RESEARCH OF ASH-SLAG MIXTURES FOR THE PRODUCTION OF BUILDING MATERIALS. Science and innovation, 1(A8), 1020-1026.
18. Adhamjon, K., Islombek, A., Sattor, K., Shavkat, Y., Aleksandir, K., & Begyor, S. (2022). APPLICATION OF HEAT-INSULATING COMPOSITE GYPSUM FOR ENERGY EFFICIENT CONSTRUCTIO. Science and Innovation, 1(8), 1058-1064.
19. Khamidov, A., Akhmedov, I., Kholmirzayev, S., Qodirova, F., Nomonova, S., Sharopov, B., & Kazadayev, A. (2022). INVESTIGATION OF THE PROPERTIES OF CONCRETE BASED ON NON-FIRING ALKALINE BINDERS. Science and innovation, 1(A8), 1065-1073.
20. Khamidov, A., Akhmedov, I., Rizayev, B., Kholmirzayev, S., Jalalov, Z., Kazadayev, A., & Sharopov, B. (2022). THERMAL INSULATION MATERIALS BASED ON GYPSUM AND AGRICULTURAL WASTE. Science and innovation, 1(A8), 1074-1080.
21. Khamidov, A., Akhmedov, I., Kholmirzayev, S., Qodirova, F., Nomonova, S., Sharopov, B., & Kazadayev, A. (2022). INVESTIGATION OF THE PROPERTIES OF CONCRETE BASED ON NON-FIRING ALKALINE BINDERS. Science and innovation, 1(A8), 1065-1073.
22. Абдуназаров, А., Хакимов, С., Умаров, И., Мухторалиева, М., Дедаханов, Ф., & Шаропов, Б. (2022). МЕРОПРИЯТИЯ ПО ПОВЫШЕНИЮ ЭНЕРГОЭФФЕКТИВНОСТИ СОВРЕМЕННЫХ И РЕКОНСТРУИРУЕМЫХ ЗДАНИЙ. Journal of new century innovations, 18(1), 130-134.
23. Hakimov, S., Sharopov, B., Umarov, I., Muxtoraliyeva, M., Dadaxanov, F., & Abdunazarov, A. (2022). URILISH MATERIALLARI SANOATIDA INNOVATSION MATERIALLAR ISHLAB CHIQARISHNING ISTIQBOLLI TOMONLARI. Journal of new century innovations, 18(1), 149-156.
24. Sharopov, B., Hakimov, S., Umarov, I., Muxtoraliyeva, M., Dadaxanov, F., & Abdunazarov, A. (2022). QUYOSH ENERGIYASIDAN FOYDALANIB TURAR JOY BINOLARI QURISHNING ISTIQBOLI TOMONLARI. Journal of new century innovations, 18(1), 135-141.
25. Kazadayev, A., Sharopov, B., Hakimov, S., Umarov, I., Muxtoraliyeva, M., Dadaxanov, F., & Abdunazarov, A. (2022). MAMLAKATIMIZDA NEMIS TA'LIM TIZIMINI JORIY QILISHNING SAMARADORLIGI TAHLILI. Journal of new century innovations, 18(1), 124-129.
26. Sodiqjon, K., Begyor, S., Aleksandr, K., Farrukh, D., Mukhtasar, M., & Akbarjon, A. (2022). PROSPECTIVE ASPECTS OF USING SOLAR ENERGY. Journal of new century innovations, 18(1), 142-148.
27. Mukhtasar, M., Begyor, S., Aleksandr, K., Farrukh, D., Isroil, U., Sodiqjon, K., & Akbarjon, A. (2022). ANALYSIS OF THE EFFECTIVENESS OF THE DEVELOPMENT OF THE GERMAN EDUCATION SYSTEM IN OUR COUNTRY. Journal of new century innovations, 18(1), 168-173.

28. Dadakhanov, F., Sharopov, B., Umarov, I., Mukhtoraliyeva, M., Hakimov, S., Abdunazarov, A., & Kazadayev, A. (2022). PROSPECTS OF INNOVATIVE MATERIALS PRODUCTION IN THE BUILDING MATERIALS INDUSTRY. Journal of new century innovations, 18(1), 162-167.
29. Begyor, S., Isroil, U., Aleksandr, K., Farrukh, D., Mukhtasar, M., Sodiqjon, K., & Akbarjon, A. (2022). MEASURES TO IMPROVE THE ENERGY EFFICIENCY OF MODERN AND RECONSTRUCTED BUILDINGS. Journal of new century innovations, 18(1), 157-161.
30. Fathulloev A.M., Eshev S.S., Samiev L.N., Ahmedov I.G'., Jumaboyev X., Arifjanov S. Boglanmagan gruntlardan tashkil topgan uzanlarda yuvilmaslik tezliklarini aniklash [To the determination of non-effective speed in the beds containing from unconnected soils] //Journal "Irrigatsiya va melioratsiya". Tashkent. – 2019. – C. 27-32.
31. Arifjanov A., Akmalov Sh., Akhmedov I., Atakulov D. Evaluation of deformation procedure in waterbed of rivers //IOP Conference Series: Earth and Environmental Science. – IOP Publishing, 2019. – T. 403. – №. 1. – C. 012155.
32. Arifjanov A., Samiyev L., Akhmedov I., Atakulov D. Innovative Technologies In The Assessment Of Accumulation And Erosion Processes In The Channels //Turkish Journal of Computer and Mathematics Education (TURCOMAT). – 2021. – T. 12. – №. 4. – Pp. 110-114.
33. Axmedov I.G'., Muxitdinov M., Umarov I., Ibragimova Z. Assessment of the effect of sedibles from sokhsoy river to kokand hydroelectric power station //InterConf. – 2020.
34. Arifjanov A.M., Ibragimova Z.I., Axmedov I.G'. Analysis Of Natural Field Research In The Assessment Of Processes In The Foothills The American Journal of Applied sciences. – 2020. – T. 2. – №. 09. – Pp. 293-298.
35. Арифжанов А.М., Самиев, Л.Н., Абдураимова, Д.А., Ахмедов, И.Г. Ирригационное значение речных наносов [Irrigation value of river sediments] //Актуальные проблемы гуманитарных и естественных наук. – 2013. – №. 6.
36. Ахмедов И.Ғ., Ортиқов И.А., Умаров И.И. Дарё ўзанидаги деформацион жараёнлаарни баҳолашда инновацион технологиялар [Innovative technologies in the assessment of deformation processes in the riverbed] // Фарғона политехника институти илмий-техника журнали. – Фарғона. – 2021. – Т.25, №.1. – С. 139-142.
37. Tadjiboyev S., Qurbonov X., Akhmedov I., Voxidova U., Babajanov F., Tursunova E., Xodjakulova D. Selection of Electric Motors Power for Lifting a Flat Survey in Hydraulic Structures // AIP Conference Proceedings 2432, 030114 (2022); https://doi.org/10.1063/5.0089643
38. Abduraimova D., Rakhmonov R., Akhmedov I., Xoshimov S., Eshmatova B. Efficiency of use of resource-saving technology in reducing irrigation erosion // AIP Conference Proceedings 2432, 040001 (2022); https://doi.org/10.1063/5.0089645
39. Холмирзаев С. А., Комилова Н. Х. Влияние сухого жаркого климата на ширину раскрытия трещин внецентренно-сжатых железобетонных элементов //Приволжский научный вестник. – 2015. – №. 4-1 (44).

40. Холмирзаев С. А. Температурные изменения в керамзитобетонных колоннах в условиях сухого жаркого климата //Журнал «Бетон и железобетон. – 2001. – №. 2.
41. Хамидов А. И. и др. Использование теплоизоляционного композиционного гипса в энергоэффективном строительстве. – 2021.
42. Хамидов А. И., Нуманова С. Э., Жураев Д. П. У. Прочность бетона на основе безобжиговых щёлочных вяжущих, твердеющего в условиях сухого и жаркого климата //Символ науки. – 2016. – №. 1-2. – С. 107-109.
43. Нуманова С. Э. Хамидов Адхамжон Иномжонович //ISSN 2410-700Х. – С. 107.
44. Хамидов А. И., Ахмедов И., Кузибаев Ш. Теплоизоляционные материалы на основе гипса и отходов сельского хозяйства. – 2020.
45. Хамидов А. И. Использование теплоизоляционных материалов для крыш в энергоэффективном строительстве //Научно–технический журнал ФерПИ. Спец. – №. 2018.
46. Хамидов А. И., Мухитдинов М. Б., Юсупов Ш. Р. Физико-механические свойства бетона на основе безобжиговых щелочных вяжущих, твердеющих в условиях сухого и жаркого климата. – 2020.
47. Нуриддинов А. О., Ахмедов И., Хамидов А. И. АВТОМОБИЛ ЙЎЛЛАРИНИ ҚУРИЛИШИДА ИННОВАЦИЯЛАР //Academic research in educational sciences. – 2022. – Т. 3. – №. TSTU Conference 1. – С. 73-77.
48. Нуманова С.Э. Хамидов Адхамжон Иномжонович //ISSN 2410-700Х. – С. 107.
49. Ризаев Б.Ш. Прочность, деформативность и трещиностойкость внецентренно-сжатых железобетонных элементов в условиях сухого жаркого климата. – 1993.
50. Yuvmitov A., Hakimov S. R. Influence of seismic isolation on the stress-strain state of buildings //Acta of Turin Polytechnic University in Tashkent. – 2021. – Т. 11. – №. 1. – С. 71-79.
51. Ювмитов А., Хакимов С. Исследование влияния сейсмоизоляции на динамические характеристики ЗДАНИЯ //Acta of Turin Polytechnic University in Tashkent. – 2020. – Т. 10. – №. 2. – С. 14.
52. Abdunazarov A., Soliev N. tudy of the performance of frameless construction structures under the influence of vertical stresses of ultra-submerged the lyoss soils //Студенческий вестник. – 2020. – Т. 28. – №. 126 часть 3. – С. 39.
53. Хошимов С. Н. У., Казадаев А. М. УСТАНОВКА ДООЧИСТКИ СТОЧНЫХ ВОД ОТ НЕФТЕПРОДУКТОВ //Вестник Науки и Творчества. – 2017. – №. 3 (15). – С. 147-150.
54. Ювмитов А. С., Казадаев А. М. ИССЛЕДОВАНИЕ РАСПРОСТРАНЕННЫХ ОШИБОК, ДОПУСКАЕМЫХ В ПРОЦЕССЕ СТРОИТЕЛСТВА ЗДАНИЙ И СООРУЖЕНИЙ, МЕРЫ ПО ИХ НЕДОПУЩЕНИЮ И УЛУЧШЕНИЮ КАЧЕСТВА СТРОИТЕЛЬСТВА //Central Asian Research Journal for Interdisciplinary Studies (CARJIS). – 2022. – №. Special issue. – С. 140-145.
55. Казадаев А. М., Обидинова Г.Ш., РОЛЬ МАЛОГО БИЗНЕСА И ЧАСТНОГО ПРЕДПРИНИМАТЕЛЬСТВА В РЕСПУБЛИКЕ УЗБЕКИСТАН // Теория и практика современной науки. – 2017. – №. 5 (23). – С. 1005-1008.

56. Umarov, S. A. (2021). Development of deformations in the reinforcement of beams with composite reinforcement. Asian Journal of Multidimensional Research, 10(9), 511-517.
57. Умаров, Ш. А. (2021). Исследование Деформационного Состояния Композиционных Арматурных Балок. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 60-64.
58. Abdugofurovich, U. S. (2022). BONDING OF POLYMER COMPOSITE REINFORCEMENT WITH CEMENT CONCRETE. Gospodarka i Innowacje., 24, 457-464.
59. Абдуллаев, И. Н., Умирзаков, З. А., & Умаров, Ш. А. (2021). Анализ Тканей В Фильтрах Систем Пылегазоочистки Цементного Производства. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 16-22.
60. Davlyatov, S. M., & Kimsanov, B. I. U. (2021). Prospects For Application Of Non-Metal Composite Valves As Working Without Stress In Compressed Elements. The American Journal of Interdisciplinary Innovations Research, 3(09), 16-23.
61. Умаров, Ш. А., Мирзабабаева, С. М., & Абобакирова, З. А. (2021). Бетон Тўсинларда Шиша Толали Арматураларни Қўллаш Орқали Мустаҳкамлик Ва Бузилиш Ҳолатлари Аниқлаш. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 56-59.
62. Тошпулатов, С. У., & Умаров, Ш. А. (2021). ИНСТРУМЕНТАЛЬНО-УЧЕБНО-ДИНАМИЧЕСКИЕ ХАРАКТЕРИСТИКИ СРЕДНЕЙ ШКОЛЫ И КОНСТРУКТИВНЫЕ РЕШЕНИЯ СРЕДНЕЙ ШКОЛЫ№ 2 Г. ФЕРГАНЫ. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 10-15.
63. Mamazhonovich, M. Y., Abdugofurovich, U. S., & Mirzaakbarovna, M. S. (2021). The Development of Deformation in Concrete and Reinforcement in Concrete Beams Reinforced with Fiberglass Reinforcement. Middle European Scientific Bulletin, 18, 384-391.
64. 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.
65. Hasanboy o‘g‘li, A. A. (2022). Stress Deformation of Flexible Beams with Composite Reinforcement under Load. American Journal of Social and Humanitarian Research, 3(6), 247-254.
66. Hasanboy o‘g‘li, A. A. (2022). Stress Deformation of Flexible Beams with Composite Reinforcement under Load. American Journal of Social and Humanitarian Research, 3(6), 247-254.
67. угли Ахмадалиев, А. Х., & угли Халимов, А. О. (2022, May). КОМПОЗИТНОЕ УСИЛЕНИЕ ИЗГИБАЮЩИЙ БАЛК ПОД НАГРУЗКОЙ. In INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING (Vol. 1, No. 7, pp. 409-415).
68. Сон, Д. О., & Халимов, А. О. (2021). УПРАВЛЕНИЕ МЕТРОЛОГИЧЕСКИМИ РИСКАМИ КАК ОСНОВА ДЛЯ УВЕЛИЧЕНИЯ КАЧЕСТВА ПРОДУКЦИИ. Экономика и социум, (2-2), 202-210.

69. Бахромов, М. М. (2020). Исследование сил негативного трения оттаивающих грунтов в полевых условиях. Молодой ученый, (38), 24-34.
70. Бахромов, М. М., & Раҳманов, У. Ж. (2020). Проблемы строительства на просадочных лессовых и слабых грунтах и их решение. Интернаука, (37-1), 5-7.
71. Mirzaeva, Z. A. (2021). Improvement of technology technology manufacturing wood, wood with sulfur solution. Asian Journal of Multidimensional Research, 10(9), 549-555.
72. Мирзаева, З. А. К., & Рахмонов, У. Ж. (2018). Пути развития инженерного образования в Узбекистане. Достижения науки и образования, 2(8 (30)), 18-19.
73. Abdullayev, I., & Umirzakov, Z. (2020). Optimization of bag filter designs (on the example of cement plants in the fergana region of the republic of Uzbekistan). Збірник наукових праць ΛΌГOΣ, 31-34.
74. Abdullayev, I. N., & Umirzakov, Z. A. (2021). Efficiency of Fabric in The Systems of Dust and Gas Cleaning of Cement Production.
75. Абобакирова, З. А., & кизи Мирзаева, З. А. (2022, April). СЕЙСМИК ҲУДУДЛАРДА БИНОЛАРНИ ЭКСПЛУАТАЦИЯ ҚИЛИШНИНГ ЎЗИГА ХОС ХУСУСИЯТЛАРИ. In INTERNATIONAL CONFERENCES ON LEARNING AND TEACHING (Vol. 1, No. 6, pp. 147-151).