https://shine-aeb.uz

ISA

International Shine-AEB scientific journal

INTERNATIONAL SHINE-AEB SCIENTIFIC JOURNAL (ISA)

INTERNATIONAL SHINE-AEB: ilmiy jurnali.-№1 (4) 2025. Jurnal elektron ko’rinishda chiqariladi. Ta'sischi va noshir: SHINE-AEB MCHJ. https://shine-aeb.uz

TAHRIRIYATNING JOYLASHGAN JOYI: Toshkent viloyati, Chinoz tumani, B. G’ofurov ko’chasi 32-uy. Telefon: 99 837 91 18 Email: elyorbek.begaliyevich@mail.ru

NEW TYPES OF CULVERTS ON THE RAILWAY TRACK

Abdualiyev Elyorbek Begali o’g’li
Mirxanova Mavjuda Mixayilovna
Umaraliyev Shohjahon Muhammadro’zi o’g’li

Abstract: This article discusses new types of culverts are one of the most numerous categories of artificial structures on roads of both regional significance. These engineering structures are located in the body of the embankment of the road or railway and provide a safe drainage of water entering the roadbed. Thanks to culverts, the road drainage system provides a constant favorable humidity regime of the ground bases of road clothes and prevents the erosion of the road embankment.

In modern road construction, the most common are two types of culverts: made of corrugated metal and reinforced concrete from prefabricated elements. To increase throughput without increasing the height of the embankment, multi-point pipes are arranged from small pipes laid next to each other.

Key words: Artificial structures, waterproofing pipes, small bridges, reinforced concrete, concrete and iron pipes.

Introductions. Development of the country's economy, increase in export potential and the role of Railways in the supply of goods to consumers is incomparable. It is no accident that the railways are called the blood vessels of the country's economy it is not. Reforms carried out on the Railways of Uzbekistan sharply increase the load carrying capacity of Express Railways and passenger trains are aimed at raising the speed. Therefore, the design of rail repair in operation a great axamity is earned [1.2.3.4]. In addition, the waterproofing pipes on the railway are the most common artificial structures. Culverts located under the road are something of an alternative to bridges, so if there is no need for the latter, you can use this replacement. In addition, in some situations, it is simply not possible to build a bridge – for example, if the road is located too low [5.6.7.8.9.10].

The design of a culvert is a channel that passes through a road embankment. For the construction of a culvert, pipes of such a diameter are used that it is sufficient to transport a large volume of atmospheric precipitation. In addition, such pipes are often used in the creation of large drainage systems and underground passages. This article will focus on culverts and their application features [11.12.13.14].

In the modern market of building materials, culverts are represented in a very diverse way. The main parameter by which such pipes are classified is the material of manufacture.

According to this method of classification, the following types of culverts are distinguished:

- Reinforced concrete;
- Plastic;
- Metal corrugated.

Each material has its own characteristics. One of the main advantages of reinforced concrete structures for water drainage is the ability to create them in the place where they will be installed. The construction process in this case involves the installation of reinforced formwork, which will be filled with a concrete solution.

Figure-1. Reinforced concrete structures for water drainage.

The quality described above can be called quite useful, but it has a serious drawback – a reinforced concrete culvert under the road is installed for a very long time. Of course, there is a solution to this problem, which is to purchase ready-made reinforced concrete structures and deliver them to the installation site. The main quality of such material is its ability to withstand the influence of various external factors.

Various options of polymer products for the arrangement of culverts are a good solution. Plastic pipes withstand external loads well, but for this purpose they have to be further strengthened with the help of a concrete arch, which is filled along the outer edge of the pipe, and the weak resistance of concrete to ground movement in this case does not matter[15.16.17].

Culverts made of metal – this is a good solution to the problem of water diversion, but only if you consider it, on the one hand. Metal structures have better strength indicators compared to analogues, but this advantage is completely offset by weak resistance to corrosion. Because of this, metal pipes are only used temporarily for the construction of culverts.

Figure-2. Plastic culverts[5].

However, there is another use for metal products. They are often used for punctures of the roadbed. The fact is that it is not always possible to repair the water pipe that passes under the road, so the pipe is cleared using an external drainage system, which allows for repairs or high-quality cleaning of the system[18.19.20].

Figure-3. Culverts made of corrugated metal.

To create a reliable and high-quality culvert, it is best to use SMGK-prefabricated metal corrugated structures. According to the General classification, such structures are not ordinary pipes – the whole system becomes such only in the place where it is necessary to install culverts.

SMGK have a lot of positive qualities that are lacking in simple pipes. The main advantage of the prefabricated structure is the ability to arrange complex structures that can serve for several decades and at the same time calmly survive the impact of seismic shifts. Corrugated road pipe, among other things, is almost a third cheaper than alternative options [7].

Corrugated pipe is a natural geotechnical structure. Together with the surrounding backfill, it forms a coupled structure that accepts the loads acting on it. The corrugated pipe has elasticity, so that a uniform passive pressure is formed in the backfill. Along the pipe contour, the pressure is also uniform. At the same time, normal forces act on it, and there are no bending moments. Working together with the soil, the pipe retains its shape as a result of the stable state formed in the soil. At the same time, longitudinal displacements and deformations are possible, provided by the corrugated shape of the metal. The stabilizing effect of the soil reduces the loads acting on the pipe, compared to the calculated ones [8]. This is evidenced by the diagram of the load factor dependence on the density of the surrounding soil (Fig. 4).

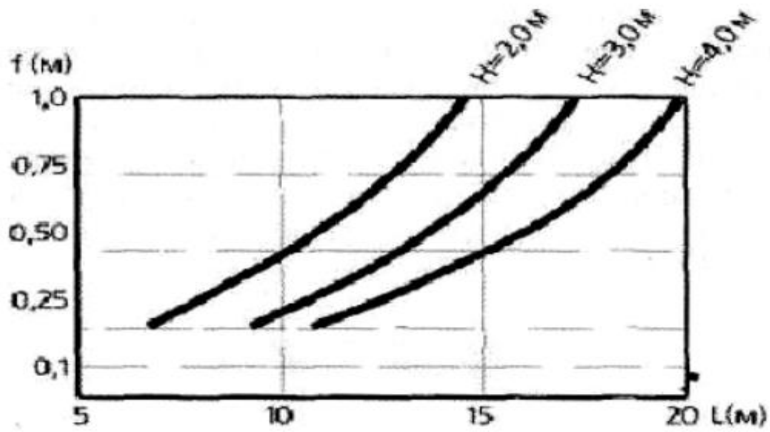

Figure-4. Diagram of the load factor dependence on the density of the surrounding soil.

Based on the analysis of the studies of culverts tubular structures made of corrugated you can do the following for the metal conclusions.

Conclusion. Using culverts allows you to move moisture under the roadbed. Of course, such systems are not relevant in all situations, but sometimes they are the only option for water diversion. A good solution is to use metal pipes as an external protective casing that protects the main pipeline. Usually for these purposes, pipes used for reinforcing the walls of drilling wells are used.

References

1. Джаббаров, Саидбурхан Тўлаганович. "8.27" ЎЗБЕКИСТОН ТЕМИР ЙЎЛЛАРИ" АЖ ТЕМИР ЙЎЛ ТАРМОҒИДА ЖОЙЛАШГАН СУВ ЎТКАЗУВЧИ ҚУВУРЛАРНИНГ ТЕХНИК ҲОЛАТИНИ БАҲОЛАШ." *Innovative technologies in construction Scientific Journal* 8.1 (2024): 100-106.
2. Begali, Mirxanova Mavjuda Mikhaylovna Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Normurodov Shahboz Ulug'bekovich. "1.4 INNOVATIVE TECHNOLOGY FOR CONDUCTING ENGINEERING AND GEODETIC SURVEYS OF RAILWAY AND AUTOMOBILE ROAD LINES." *SHINE-AEB GROUP* 1.1 (2023): 17-22.
3. Abdualiyev, E. B. "Research of surface condition of the rails rollingon sections of high-speed and high-speed train traffic." *Journal of Tashkent Institute of Railway Engineers* 15.3 (2019): 21-25.
4. Begali o’g’li, Abdualiyev Elyorbek. "Basalt armaturasi xozirgi kunda xavfsizlik, qulaylik va innovatsiyon yechimga ega bo’lgan maxsulot."
5. Abdualiyev, Elyorbek, Ozoda Mirzahidova, and Akmal Uralov. "ELIMINATION OF IMPULSE IRREGULARITIES ON THE RAIL HEAD WITH THE HELP OF GRINDING." *Academic research in educational sciences* 2.2 (2021): 1220-1225.
6. Abdualiyev, Elyorbek Begaliyevich, and Auezmurat Bekmuratovich Embergenov. "Hydraulic calculations of culverts on the high-speed section of the Tashkent-Sirdarya railway line." *Academic research in educational sciences* 2.4 (2021): 1964-1968.
7. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." (2023).
8. Begaliyevich, Abdualiev Elyorbek, Mirzahidova Ozoda Mirzabdulayebna, and Khamidov Mahsud Kamolovich. "STUDIES OF THE MODE OF OPERATION OF CULVERTS ON RAILWAY LINES." *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI* (2022): 307-310.
9. Abdualiyev, Elyorbek Begaliyevich, Movjuda Mikhaliyovna Mirkhanova, and Shukhrat Shavkatovich Makhamadjonov. "CONDITION OF CULVERTS ON THE HIGH-SPEED SECTION OF THE TASHKENT-SYRDARYA RAILWAY LINE." *Academic research in educational sciences* 2.2 (2021): 1096-1101.
10. Abdualiyev, E. B., and M. M. Mirxanova. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE PATH." *Results of National Scientific Research International Journal* 1.9 (2022): 479-483.
11. BEGALIYEVICH, ABDUALIEV ELYORBEK, MIRZAHID OVAOZODA MIRZABDULAYEBNA, and KHAMIDOV MAHSUD KAMOLOVICH. "TO EXAMINE THE IMPACT OF THE FORCES FALLING FROM THE STRUCTURE OF THE MOVEMENT ON THE WATERPROOFING PIPES IN HIGH-SPEED AND HIGH-SPEED RAILWAYS." *International Journal of Philosophical Studies and Social Sciences* (2022): 1-4.
12. Abdualiev, E. B., M. K. Khamidov, and F. F. Eshonov. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE TRACK ON THE SECTIONS OF HIGH-SPEED AND HIGH-SPEED TRAIN TRAFFIC OF JSC" UZBEKISTON TEMIR YOʼ LLARI." *Results of National Scientific Research International Journal* 1.9 (2022): 484-488.
13. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." *International Journal of Human Computing Studies* 3.2 (2021): 18-22.
14. Abdualiyev, E. B., and F. F. Eshonov. "New uses of culvert Construction." *Design Taxi* 2 (2020).
15. Begali o'g'li, Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Rakhmatov Islom Normurodov Shahboz Ulug'bekovich. "1.1 MEASURES TO STRENGTHEN THE HIGH-SPEED RAIL LINE LAND BASE." *SHINE-AEB GROUP* 1.1 (2023): 3-6.

16. Muhammadrozi o'g'li, Umaraliyev Shahjahan, et al. "1.2 DIAGNOSTICS OF THE ROADBED IN THE RAILWAY TRACK IN UZBEKISTAN." *International Shine-AEB Scientific Journal* 1.1 (2023): 7-11.

17. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.5 THE INNOVATIVE TECHNOLOGY OF USING DRONES IN MODERN CONSTRUCTION IN THE WORLD." *SHINE-AEB GROUP* 1.1 (2023): 19-22.

18. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.4 STRENGTHENING THE SLOPES OF THE ROADBED DURING PATH FLUCTUATIONS IN THE RAILWAY TRACK IN UZBEKISTAN." *SHINE-AEB GROUP* 1.1 (2023): 16-18.

19. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.8 TOPOGRAPHIC SURVEY USING SATELLITE TECHNOLOGIES IN THE." *International Shine-AEB Scientific Journal* 1.1 (2023): 29-33.

20. Abdualiev, E. B., and A. M. Abdukarimov. "Increase of productivity and reliability of control of rails." *Architectural and construction science and period materials of the Republican scientific and practical conference part*. No. 2.

A NEW GROUND FLOOR DIAGNOSTIC DEVICE

Umaraliev Shokhzhakhon Mukhammadruzi ugli
Tashkent State University of Transport, Assistant.
Embergenov Avezmurat Bekmuratovich
Tashkent State University of Transport, Senior lecturer.
Eshonov Farhad Fayzullakhuzhaevich
Tashkent State University of Transport, Senior lecturer.

Abstract: In this article, the concept of a diagnostic system using geophysical methods for specific railway track conditions, the elements of the diagnostic system are: the object of research; methods and technical means of diagnosis; classification of diagnostic signs (criteria for identifying deformations); trained technical personnel interacting with the object of research according to the rules established by the relevant regulatory and methodological documentation; expert opinion on the technical condition of the roadbed with an indication of the location, type and cause of deformations.

Keywords: Diagnostics, roadbed, soil properties, georadar, diagnostics of the main site, deformation, deep ground reference points, inclinometers, strain gauges, stresses.

Introduction. The roadbed diagnostics system is based on the use of both traditional and new geophysical methods, modern measuring equipment and computer technologies. The diagnostic system also uses specially designed mobile diagnostic laboratories. The basis of the diagnostic system of the roadbed is made up of geophysical methods, which are based on the study of anomalies of physical fields caused by changes in the lithological structure of the roadbed, the difference in physical and mechanical.

Physical fields in the roadbed arise from impacts:

• — direct or alternating electric current through electrodes driven into the ground (electrometric method and electrocontact dynamic sensing method);

• — emission of electromagnetic high-frequency signals (radar method);

• — hammer-type impact loads on the ground (seismic method);

• — moving rolling stock (vibration method).

A brief description of the geophysical methods is given below.

Electrometric method. It is based on the study of the resistance of various soils to the electric current passing through them. As a diagnostic feature, the electrical resistivity p, Ohm m is accepted. The dependence of p on the composition, properties and condition of various soils serves as the physical basis for the application of the electrometric method. The most widely used observation schemes are vertical electrical sounding (VEZ) and electrical profiling (EP)[1,2,3,4,5,6,7,8,9].

The method of electrocontact dynamic sensing (EDS). Combines two methods of simultaneous soil investigation: dynamic probing and current logging. For research, an EMF installation is used, with the help of which the depth of various layers of soil is determined by changing the magnitude of the current, and their strength characteristics are determined based on the results of dynamic probing.

Radar method. It is based on the study of the parameters of electromagnetic waves (propagation velocity and absorption coefficient) arising in soils from the pulsed action of a high-frequency generator.

The radar method does not require antenna contact with the ground surface, as in other geophysical methods, so it can be performed from mobile units (Fig.1), which provides high-speed diagnostics of extended sections of the roadbed. Georadar can diagnose the structure of the main site of the roadbed (the presence of ballast depressions), study the structure of the slope parts of the embankments (determining the size and location of ballast loops.

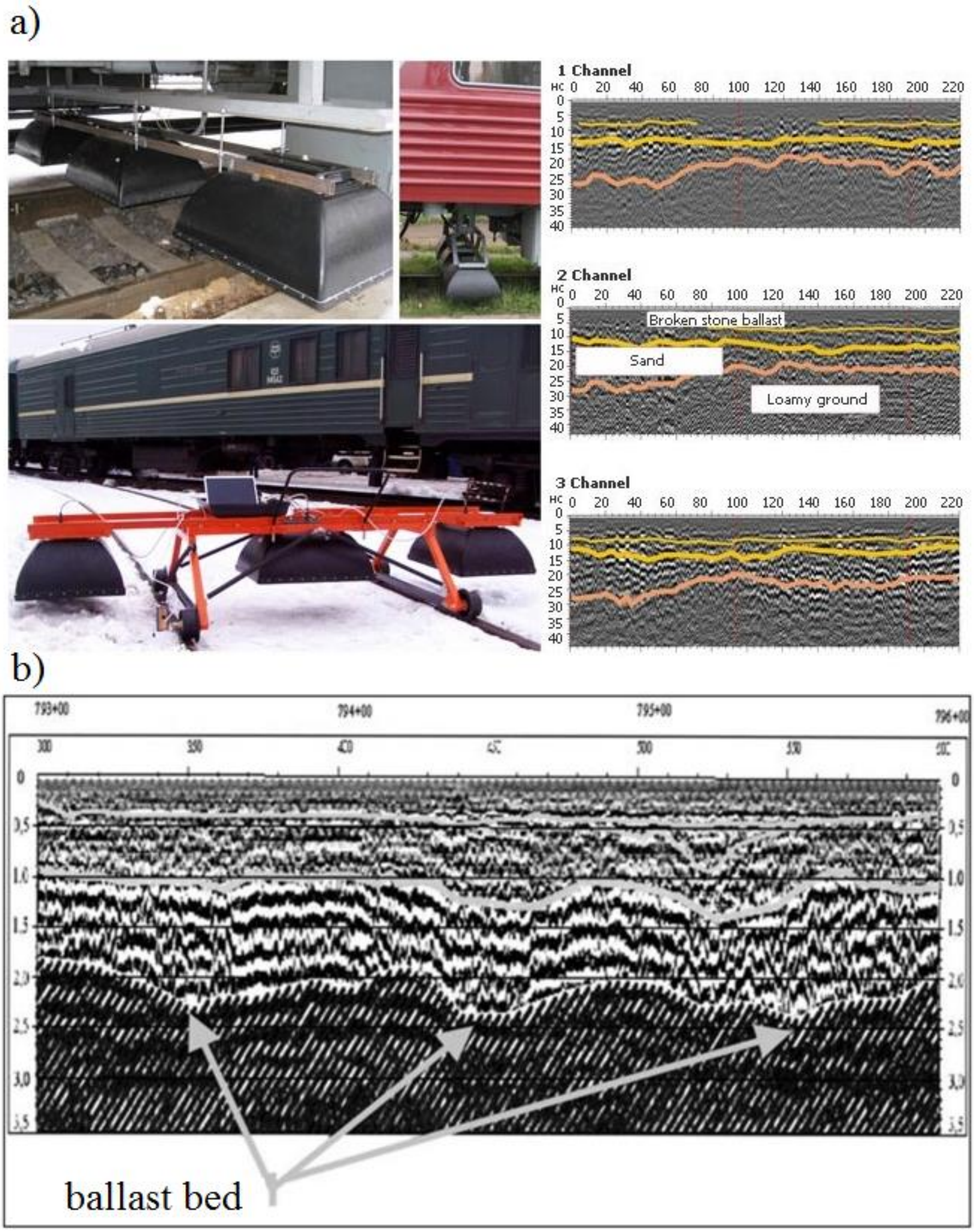

Fig. 1. Radar of the ground of the roadbed: a — the placement of the ground radar on the track trolley; b — the radar image of the fov), the determination of the boundaries of peat soils in the foundations of embankments in swamps, as well as the boundaries of the location of frozen soils. Diagnostics of the main site of the roadbed with the allocation of ballast depressions by georadar is shown in Fig. 2, b.

Seismic method. The physical prerequisite for the application of this method is the difference in the propagation velocities of longitudinal Vp and transverse Vs elastic waves associated with the presence of lithological boundaries in the earth bed and the difference in the properties and condition of the soil. Two observation methods are used: longitudinal seismic profiling and transverse seismic transmission. The seismic method is the most informative among other geophysical methods in terms of its capabilities and the range of diagnostic tasks to be solved. Vibration method. It is based on the use of soil vibrations of embankments arising from the impact of rolling stock. A group of diagnostic signs of a dynamic process corresponds to a certain condition of the operated embankments, which is a prerequisite for the use of the vibration method[10,11].

Traditional methods can be used, if necessary, at various stages of diagnosing the roadbed. Mobile diagnostic complexes (PNCs) in the form of reference load laboratories, track-measuring laboratory wagons (VP), including with radar complexes, are used for preliminary diagnostics and routine observations. Diagnostic studies of the listed complexes are carried out from the rail track and cover only the working area of the roadbed to a depth of no more than 3-4 m. Geophysical methods are usually used for detailed diagnostics, when it is necessary to obtain the most complete and specific information about the condition of the roadbed, indicating the type and size of existing deformations. Diagnostics of the main site. By the seismic method and in separate areas for a more detailed separation of soil layers by the method of electrocontact dynamic sounding, the following are determined: depressions in the main site in the form of ballast troughs, beds, bags, and also water-saturated and weakened soil zones are isolated[12.13.14.15.16.17.18.19.20].

Diagnostics of mounds of clay soils. By seismic and electrometric methods, the power of ballast plumes is established on the slopes of embankments; by the method of electrocontact dynamic sounding, separate layers of soil weakened in strength are isolated on the slopes, along which deformations of the embankment are possible. Seismic and electrometric methods and, in some cases, the method of electrocontact dynamic sounding separate the soils of the body of the embankment according to their appearance and condition, identify and outline the zones weakened in strength in the body of the embankments. The vibration method makes it possible to assess the dynamic state of embankments and predict the appearance of their sudden deformations under trains.

Diagnostics of the foundation of the roadbed. As the main methods, it is recommended to use seismic and electrometric methods; additionally, radar and the method of electrocontact dynamic sensing. When diagnosing embankments erected in swamps, using the electrometric method, the amount of immersion of the embankment into the thickness of silty sediments is determined and the sections of the path where the embankment has settled on the mineral bottom are identified.

On the landslide slopes on which the roadbed is constructed, using the seismic method, the boundaries between the landslide (or prone to landslide) and stable rocks are determined; the morphology of the landslide bed is established; the geometry of the landslide blocks in the plan and sometimes the number of floors of the landslide are clarified; the nature of the fracturing of the landslide massif and the predominant direction of landslide cracks are estimated. In areas of rock recesses, the seismic method can be used: to establish the thickness of loose cover deposits of rock massifs; the thickness of the weathered zone of bedrock; identification and delineation of vertical weakened zones in rocks; determination of azimuths of vertical and steeply falling cracks or layers of vertically layered strata; determination of the coefficient of volumetric fracture voidness.

In areas where karst processes are spreading, karst cavities may be located under the roadbed or in the immediate vicinity of its bases, which, under certain conditions, pose a real threat to the safety of train traffic. The use of seismic and electrometric methods makes it possible to identify the location, depth of occurrence and thickness of the karst rocks. In areas of permafrost, where the roadbed is exploited, electrometric and seismic methods are used to determine: the depth of the upper and lower boundaries of frozen rocks; the thickness of loose deposits; thawed and talic zones in the frozen rock massif; physical and mechanical properties of frozen soils in their natural occurrence.

Thus, geophysical methods have great opportunities for detailed diagnostics of the roadbed and its base. The choice of a single geophysical method or a rational set of methods depends on the effectiveness and accuracy of the methods in specific geoseismic and geoelectric conditions of the object and their technical and economic feasibility. For the successful application of geophysical methods, a small volume (10-15% of the total amount of work) of reference drilling wells is required for a more reliable interpretation of the obtained geophysical data.

Routine observations consist in measuring the time-varying parameters of the roadbed. First of all, various deformations of the roadbed are subject to measurement at the initial stage, until they have reached large values. In addition, the parameters of the humidity and temperature regimes of the roadbed are effective for regime observations. Methods and means of regime observations should promptly provide information on changes in the main parameters of the roadbed with sufficient regularity. Methods and means of regime observations can be divided into two large groups: stationary and mobile. The first include various sensors and control and notification systems installed at the facility, the removal of information from which can be carried out on portable devices or obtained by transmitting a signal in automatic mode. These methods and means are used to measure: deformations (deep ground reference points, inclinometers, strain gauges); stresses (messdoses, strain gauges and pore pressure sensors); temperature (thermal pumps and electric thermometers, thermal imagers); humidity (strain gauges, sorption sensors); groundwater level (hydrometric wells, etc.).

Mobile vehicles include: track measuring wagons; loading devices; georadar complexes. The stability of the track gauge geometry determined by track measuring cars depends on the condition of the track elements, including the roadbed. The transition of the roadbed to an unstable state causes increased disorders of the geometry of the rail track.

Another diagnostic mobile means for identifying areas with increased deformability of the sleeper base are load complexes. These complexes perform continuous measurement along the length of the track of the elastic precipitation of the rail and sleeper under the reference load when the complex is moving at a speed of 5-10 km / h. It is desirable to carry out the passages of the complex during the unfavorable period of spring thawing of the soil of the roadbed or prolonged rains. The complex consists of a load unit mounted on a special wagon, which provides a given reference load on the track and a measuring and computing complex that fixes and processes elastic deformations (precipitation) of the track that occur during load tests.

Conclusion. With a high degree of probability of exogenous geological hazards such as landslide, karst, landslide, scree and mudslide in areas adjacent to the roadbed, alarm systems or control and notification systems should be arranged. As such alarms, separate sensors can be used (for example, such as GPS, Glonas), allowing in real time to provide information about the movements of specially installed deformation reference points, or a barrier whose sensors are triggered when the barrier is deformed or destroyed, which in their magnitude exceed the systems established by the project.

Literatura

1. Джаббаров, Саидбурхан Тўлаганович. "8.27" ЎЗБЕКИСТОН ТЕМИР ЙЎЛЛАРИ" АЖ ТЕМИР ЙЎЛ ТАРМОҒИДА ЖОЙЛАШГАН СУВ ЎТКАЗУВЧИ ҚУВУРЛАРНИНГ ТЕХНИК ҲОЛАТИНИ БАҲОЛАШ." *Innovative technologies in construction Scientific Journal* 8.1 (2024): 100-106.
2. Begali, Mirxanova Mavjuda Mikhaylovna Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Normurodov Shahboz Ulug'bekovich. "1.4 INNOVATIVE TECHNOLOGY FOR CONDUCTING ENGINEERING AND GEODETIC SURVEYS OF RAILWAY AND AUTOMOBILE ROAD LINES." *SHINE-AEB GROUP* 1.1 (2023): 17-22.
3. Abdualiyev, E. B. "Research of surface condition of the rails rollingon sections of high-speed and high-speed train traffic." *Journal of Tashkent Institute of Railway Engineers* 15.3 (2019): 21-25.
4. Begali o’g’li, Abdualiyev Elyorbek. "Basalt armaturasi xozirgi kunda xavfsizlik, qulaylik va innovatsiyon yechimga ega bo’lgan maxsulot."
5. Abdualiyev, Elyorbek, Ozoda Mirzahidova, and Akmal Uralov. "ELIMINATION OF IMPULSE IRREGULARITIES ON THE RAIL HEAD WITH THE HELP OF GRINDING." *Academic research in educational sciences* 2.2 (2021): 1220-1225.
6. Abdualiyev, Elyorbek Begaliyevich, and Auezmurat Bekmuratovich Embergenov. "Hydraulic calculations of culverts on the high-speed section of the Tashkent-Sirdarya railway line." *Academic research in educational sciences* 2.4 (2021): 1964-1968.
7. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." (2023).
8. Begaliyevich, Abdualiev Elyorbek, Mirzahidova Ozoda Mirzabdulayebna, and Khamidov Mahsud Kamolovich. "STUDIES OF THE MODE OF OPERATION OF CULVERTS ON RAILWAY LINES." *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI* (2022): 307-310.
9. Abdualiyev, Elyorbek Begaliyevich, Movjuda Mikhaliyovna Mirkhanova, and Shukhrat Shavkatovich Makhamadjonov. "CONDITION OF CULVERTS ON THE HIGH-SPEED SECTION OF THE TASHKENT-SYRDARYA RAILWAY LINE." *Academic research in educational sciences* 2.2 (2021): 1096-1101.
10. Abdualiyev, E. B., and M. M. Mirxanova. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE PATH." *Results of National Scientific Research International Journal* 1.9 (2022): 479-483.
11. BEGALIYEVICH, ABDUALIEV ELYORBEK, MIRZAHID OVAOZODA MIRZABDULAYEBNA, and KHAMIDOV MAHSUD KAMOLOVICH. "TO EXAMINE THE IMPACT OF THE FORCES FALLING FROM THE STRUCTURE OF THE MOVEMENT ON THE WATERPROOFING PIPES IN HIGH-SPEED AND HIGH-SPEED RAILWAYS." *International Journal of Philosophical Studies and Social Sciences* (2022): 1-4.
12. Abdualiev, E. B., M. K. Khamidov, and F. F. Eshonov. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE TRACK ON THE SECTIONS OF

HIGH-SPEED AND HIGH-SPEED TRAIN TRAFFIC OF JSC" UZBEKISTON TEMIR YO′ LLARI." *Results of National Scientific Research International Journal* 1.9 (2022): 484-488.

13. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." *International Journal of Human Computing Studies* 3.2 (2021): 18-22.

14. Abdualiyev, E. B., and F. F. Eshonov. "New uses of culvert Construction." *Design Taxi* 2 (2020).

15. Begali o'g'li, Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Rakhmatov Islom Normurodov Shahboz Ulug'bekovich. "1.1 MEASURES TO STRENGTHEN THE HIGH-SPEED RAIL LINE LAND BASE." *SHINE-AEB GROUP* 1.1 (2023): 3-6.

16. Muhammadrozi o'g'li, Umaraliyev Shahjahan, et al. "1.2 DIAGNOSTICS OF THE ROADBED IN THE RAILWAY TRACK IN UZBEKISTAN." *International Shine-AEB Scientific Journal* 1.1 (2023): 7-11.

17. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.5 THE INNOVATIVE TECHNOLOGY OF USING DRONES IN MODERN CONSTRUCTION IN THE WORLD." *SHINE-AEB GROUP* 1.1 (2023): 19-22.

18. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.4 STRENGTHENING THE SLOPES OF THE ROADBED DURING PATH FLUCTUATIONS IN THE RAILWAY TRACK IN UZBEKISTAN." *SHINE-AEB GROUP* 1.1 (2023): 16-18.

19. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.8 TOPOGRAPHIC SURVEY USING SATELLITE TECHNOLOGIES IN THE." *International Shine-AEB Scientific Journal* 1.1 (2023): 29-33.

20. Abdualiev, E. B., and A. M. Abdukarimov. "Increase of productivity and reliability of control of rails." *Architectural and construction science and period materials of the Republican scientific and practical conference part*. No. 2.

THE USE OF UNMANNED AERIAL VEHICLES IN ENGINEERING RESEARCH

Eshonov Farhad Fayzullakhuzhaevich
Tashkent State University of Transport, Senior lecturer.
Umaraliev Shokhzhakhon Mukhammadruzi ugli
Tashkent State University of Transport, Assistant.
Embergenov Avezmurat Bekmuratovich
Tashkent State University of Transport, Senior lecturer.

Abstract: In this article, karsts, avalanches, landslides, flooding and mudflows are dangerous because they develop rarely, rapidly and pose a serious threat to people's lives. To prevent such situations, it is necessary to take appropriate engineering protection measures to find out what features the territory has and whether it is prone to such processes. And this requires geodetic surveys.

Keywords: Drones, karsts, avalanches, landslides, flooding, total station survey, UAV, point cloud, 3D model, terrain elevation map.

Introduction. The use of modern geodetic equipment allows us to develop the most effective measures in a short time. About what results can be achieved thanks to laser scanning and drones. Traditional methods of geodetic surveying include classical (total station survey) and satellite technologies. The methods are reliable and time-tested, but they have a number of significant drawbacks.

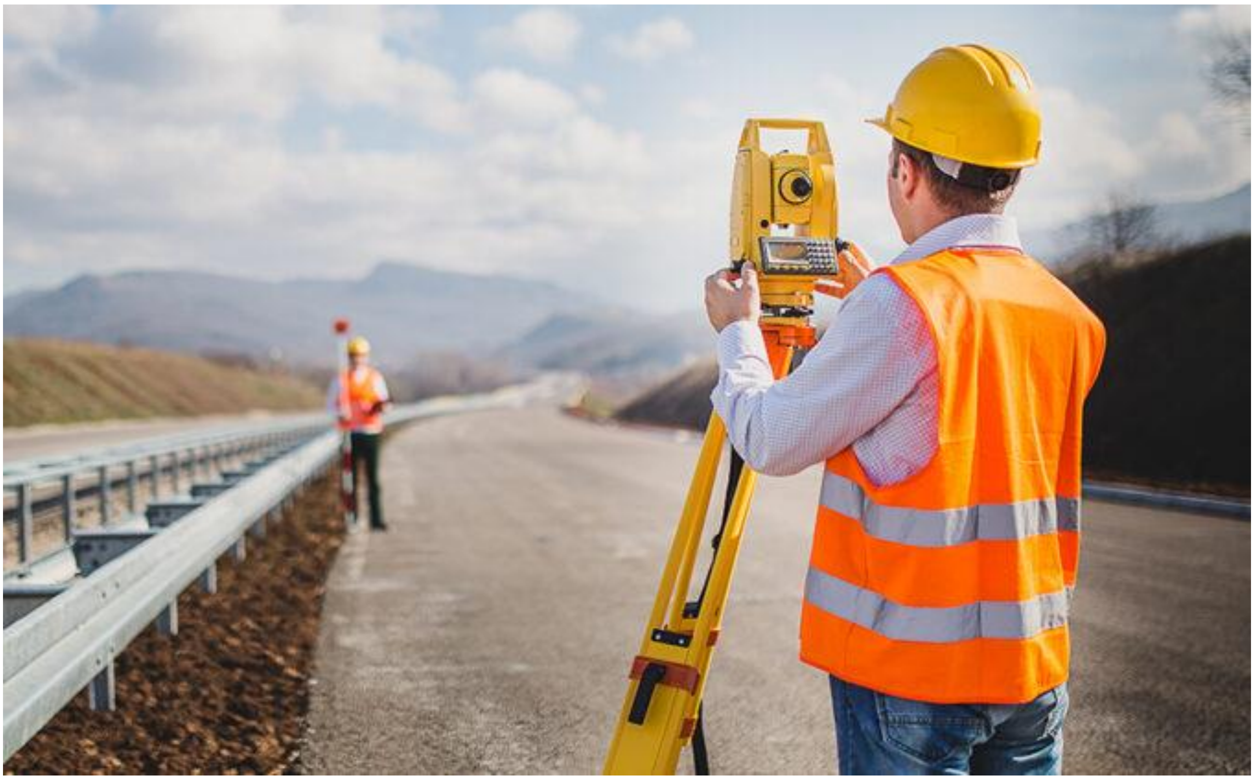

Fig. 1.Total station survey.

So, after the survey, a topographic plan is obtained that does not cover the entire territory under consideration as a whole, but only individual characteristic points, the density of which on the ground corresponds to the selected accuracy class and the scale of the survey. As a result, important terrain features may be unfixed, and this is of critical importance when designing engineering protection measures. And in the future it may lead to the development of a dangerous geological phenomenon[1,2,3,4,5,6,7].

The second disadvantage of the results of classical methods is the difficulty in interpreting the information received, since the image turns out to be flat. Another disadvantage of performing a total station survey or shooting using satellite receivers is the need to travel long distances on foot. For this reason, carrying out surveys on vast territories (several hectares) takes a lot of time, and the relevance of the information may be lost even before the survey is completed.

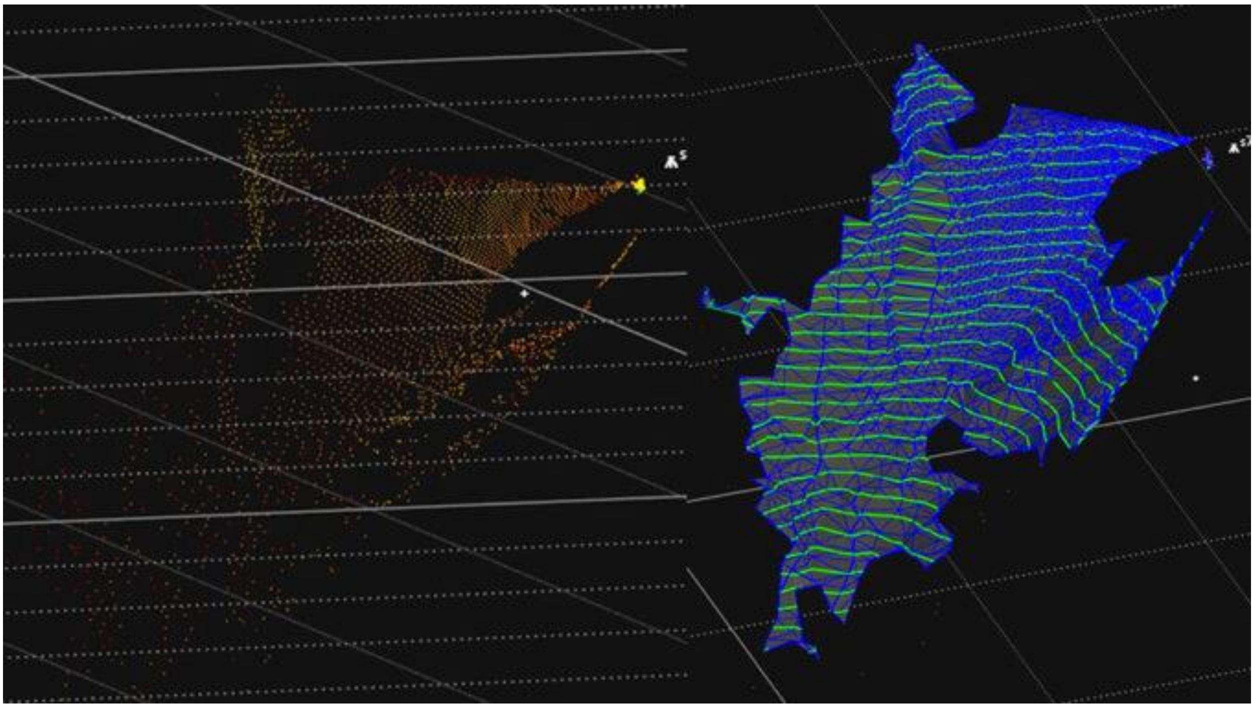

Fig. 2. Scan and surface with horizontal landslide slope near the wall ST-3.

The main advantage of laser scanning is the ability to create a three—dimensional point model of an object. The result is achieved with the help of laser scanners working on the principle of measuring the distance to the object and fixing the directions to these segments. With one scanner installation, you can form an entire point cloud of a given area of space. The array of received data is processed on a computer — surface models, elevation maps are created, horizontals are isolated. All this serves as the basis for the development of plans, sections and drawings. When aerial photography from a UAV is used, a digital camera with high resolution is used. This makes it possible to obtain a stereo image, assign the exact coordinates of the centers to the images, and also in most cases exclude the marking of ground markings. The information received is processed in a special computer program: the photos are scaled, the necessary corrections are made to them. As a result, a large-scale surface plan is formed [8,9,10,11].

The equipment set consists of several components. The first is a UAV that serves as a carrier of equipment for aerial photography and transmission of satellite signal reception. The second is a satellite receiver, which is used to determine the positions of control points or identification signs. It can also be used as a base station if there are no permanent ones available in the district. The third is a digital camera. The fourth is smartphones and PCs for performing preparatory work and desk processing of field materials. UAVs can also be equipped with multispectral, thermal imaging cameras, lidars and other devices. Aerial photography is performed according to a proven algorithm. First, the territory or object is studied, the appropriate equipment is selected. It is being prepared for operation and checked (verified, calibrated and configured). Next, flight tasks are developed: the boundaries and height, the speed of the UAV movement, the overlap of images, and so on are determined. The presence of the initial terrestrial or satellite geodetic networks is checked, solutions for connecting and linking devices to them are determined. Identification marks or control points are marked and coordinated. The UAV receiver is connected to a permanent station or to a specially installed one at points whose coordinates are known. The camera is calibrated, flight characteristics are checked[12.13.14.15.16.17.18.19.20].

Aerial photography is being performed. Then the data from the UAV is transferred to a computer, processed with the assignment of exact coordinates and heights to the centers of the images. Photogrammetric processing is carried out. A geo-linked orthophotoplane, a point cloud, a 3D model, and a horizontal elevation map are created. If additional equipment is used, thermal imaging, multispectral images and other information are prepared. In the process of work, the Institute's staff performed aerial photography from the BLPA of a section about 1.5 km long. Periodic geodetic control of the geometric parameters of the body of the embankment was carried out and geodetic control of deformations of the soil mass was carried out. The information received was analyzed, a conclusion was drawn up on the progress of construction.This made it possible to assess the condition of the embankment relative to the design solutions, as well as to analyze and control the situation with the volume of dumping and deformations of the soil massif.

The area of aerial photography was 50 hectares. An orthophotoplan, a 3D model and a height map (with horizontals) have been prepared for each measurement cycle. The analysis of materials was carried out both independently (in the current cycle) and in comparison with previous cycles. This made it possible to trace various slope and erosion processes, changes in the geometric characteristics of the embankment during construction work. It was also possible to identify some errors in the production of filling works. Then a preliminary design was developed, where solutions to the problems that arose during the construction of the embankment were proposed.

Fig. 3. Preparing drones for shooting the track.

Engineering and geological surveys as part of scientific and technical support during the construction of ski slopes and upper slopes of the cable car. The aerial photography was intended to reflect the actual situation on the site of the projected routes and supplement the archival engineering and geological materials with new data. This was necessary for the development of engineering protection measures, since, according to the design materials, most of the slopes were in an unstable state and required strengthening.

Fig. 4. Photo from the UAV.

The area of aerial photography of the territory of the future ski slopes was 224 hectares. As a result, an orthophotoplan, a 3D model and an elevation map (with horizontals) of the terrain were formed. They were used to develop topographic plans of 1:2,000 scale of hazardous geological processes and geocryological engineering zoning, and also facilitated the analysis of new and archival materials.

Conclusion. In the course of the work, the outcrops of rocky soils to the surface in areas with a slope of more than 40° were redefined. In the previous survey, performed by the classical method for a scale of 1:2,000, these areas were marked as non-rocky sandy and lumpy soil. Aerial photography from UAVs made it possible to reduce the volume of protective measures, reduce the cost of construction of trails. The relevance of new survey technologies for mining enterprises is the ability to speed up the process of obtaining extensive information about an object or territory. At the same time, in terms of accuracy of the result, such techniques are not inferior to traditional ones, and the level of safety for a person when performing laser scanning and aerial photography with BLPA is much higher.

This allows you to design engineering protection measures for an object in the shortest possible time or optimize ready-made solutions.

Literatura

1. Джаббаров, Саидбурхан Тўлаганович. "8.27" ЎЗБЕКИСТОН ТЕМИР ЙЎЛЛАРИ" АЖ ТЕМИР ЙЎЛ ТАРМОҒИДА ЖОЙЛАШГАН СУВ ЎТКАЗУВЧИ ҚУВУРЛАРНИНГ ТЕХНИК ҲОЛАТИНИ БАҲОЛАШ." *Innovative technologies in construction Scientific Journal* 8.1 (2024): 100-106.
2. Begali, Mirxanova Mavjuda Mikhaylovna Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Normurodov Shahboz Ulug'bekovich. "1.4 INNOVATIVE TECHNOLOGY FOR CONDUCTING ENGINEERING AND GEODETIC SURVEYS OF RAILWAY AND AUTOMOBILE ROAD LINES." *SHINE-AEB GROUP* 1.1 (2023): 17-22.
3. Abdualiyev, E. B. "Research of surface condition of the rails rollingon sections of high-speed and high-speed train traffic." *Journal of Tashkent Institute of Railway Engineers* 15.3 (2019): 21-25.
4. Begali o’g’li, Abdualiyev Elyorbek. "Basalt armaturasi xozirgi kunda xavfsizlik, qulaylik va innovatsiyon yechimga ega bo’lgan maxsulot."
5. Abdualiyev, Elyorbek, Ozoda Mirzahidova, and Akmal Uralov. "ELIMINATION OF IMPULSE IRREGULARITIES ON THE RAIL HEAD WITH THE HELP OF GRINDING." *Academic research in educational sciences* 2.2 (2021): 1220-1225.
6. Abdualiyev, Elyorbek Begaliyevich, and Auezmurat Bekmuratovich Embergenov. "Hydraulic calculations of culverts on the high-speed section of the Tashkent-Sirdarya railway line." *Academic research in educational sciences* 2.4 (2021): 1964-1968.
7. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." (2023).
8. Begaliyevich, Abdualiev Elyorbek, Mirzahidova Ozoda Mirzabdulayebna, and Khamidov Mahsud Kamolovich. "STUDIES OF THE MODE OF OPERATION OF CULVERTS ON RAILWAY LINES." *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI* (2022): 307-310.
9. Abdualiyev, Elyorbek Begaliyevich, Movjuda Mikhaliyovna Mirkhanova, and Shukhrat Shavkatovich Makhamadjonov. "CONDITION OF CULVERTS ON THE HIGH-SPEED SECTION OF THE TASHKENT-SYRDARYA RAILWAY LINE." *Academic research in educational sciences* 2.2 (2021): 1096-1101.
10. Abdualiyev, E. B., and M. M. Mirxanova. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE PATH." *Results of National Scientific Research International Journal* 1.9 (2022): 479-483.
11. BEGALIYEVICH, ABDUALIEV ELYORBEK, MIRZAHID OVAOZODA MIRZABDULAYEBNA, and KHAMIDOV MAHSUD KAMOLOVICH. "TO EXAMINE THE IMPACT OF THE FORCES FALLING FROM THE STRUCTURE OF THE MOVEMENT ON THE WATERPROOFING PIPES IN HIGH-SPEED AND HIGH-SPEED RAILWAYS." *International Journal of Philosophical Studies and Social Sciences* (2022): 1-4.
12. Abdualiev, E. B., M. K. Khamidov, and F. F. Eshonov. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE TRACK ON THE SECTIONS OF HIGH-SPEED AND HIGH-SPEED TRAIN TRAFFIC OF JSC" UZBEKISTON TEMIR YOʻ LLARI." *Results of National Scientific Research International Journal* 1.9 (2022): 484-488.

13. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." *International Journal of Human Computing Studies* 3.2 (2021): 18-22.

14. Abdualiyev, E. B., and F. F. Eshonov. "New uses of culvert Construction." *Design Taxi* 2 (2020).

15. Begali o'g'li, Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Rakhmatov Islom Normurodov Shahboz Ulug'bekovich. "1.1 MEASURES TO STRENGTHEN THE HIGH-SPEED RAIL LINE LAND BASE." *SHINE-AEB GROUP* 1.1 (2023): 3-6.

16. Muhammadrozi o'g'li, Umaraliyev Shahjahan, et al. "1.2 DIAGNOSTICS OF THE ROADBED IN THE RAILWAY TRACK IN UZBEKISTAN." *International Shine-AEB Scientific Journal* 1.1 (2023): 7-11.

17. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.5 THE INNOVATIVE TECHNOLOGY OF USING DRONES IN MODERN CONSTRUCTION IN THE WORLD." *SHINE-AEB GROUP* 1.1 (2023): 19-22.

18. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.4 STRENGTHENING THE SLOPES OF THE ROADBED DURING PATH FLUCTUATIONS IN THE RAILWAY TRACK IN UZBEKISTAN." *SHINE-AEB GROUP* 1.1 (2023): 16-18.

19. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.8 TOPOGRAPHIC SURVEY USING SATELLITE TECHNOLOGIES IN THE." *International Shine-AEB Scientific Journal* 1.1 (2023): 29-33.

20. Abdualiev, E. B., and A. M. Abdukarimov. "Increase of productivity and reliability of control of rails." *Architectural and construction science and period materials of the Republican scientific and practical conference part*. No. 2.

TOPOGRAPHIC SURVEY USING A QUADCOPTER

Umaraliev Shokhzhakhon Mukhammadruzi ugli
Tashkent State University of Transport, Assistant.
Embergenov Avezmurat Bekmuratovich
Tashkent State University of Transport, Senior lecturer.
Eshonov Farhad Fayzullakhuzhaevich
Tashkent State University of Transport, Senior lecturer.

Abstract: The article considers the justification of the possibility of using aerial photography by geodetic quadcopter in order to obtain a topographic basis for the design of highways. The topographic basis is obtained in the form of an orthophotoplan of the terrain with accuracy corresponding to regulatory requirements.

Keywords: railway design, digital terrain model, quadcopter, unmannedaerial vehicle (UAV), point cloud, identification mark, orthophotoplane.

Introduction. Drones are used to build images, create maps and spatial analysis in areas such as topographic aerial photography of the area. Today, it is no exaggeration to say that quadrocopters are the fastest and most effective method of aerial photography. In addition, unlike shooting from manned aircraft, the use of drones is much cheaper, and also makes it possible to get better results. The main advantages quadrocopters for geodesy: reduction of time costs, simplification of work, the ability to shoot in hard-to-reach places.The survey of the terrain by a quadcopter for the purpose of further designing a highway can be attributed to such a type of survey as topographic and geodetic surveys (TGI). According to the results of the TGI, topographic and geodetic data and materials should be obtained to compare options for highway routes and prepare documentation for territory planning under the placement of the selected railway option. The design documentation should substantiate the design needs for the chosen route direction, provide materials for choosing the location of sections of crossings over natural and artificial obstacles, comparison and evaluation of route options, recommendations for choosing the optimal railway route option for subsequent stages of design and survey work (PIR) [1,2,3,4].

Aerial photography is one from methods of drawing up topographic maps and plans large scale. The results of the work are orthophotoplans, topographic maps and plans, digital models of terrain and relief (CMR and CMR), which can be used to solve the problems of design, construction and reconstruction of railways. The use of aerial photography from UAVs is due to economic feasibility or lack of other technical and practical possibilities for obtaining reliable topographic materials, however, the use of UAVs in construction is currently not legally fixed, there are no methods and recommendations for the use of geodetic quadrocopters in obtaining a topographic basis for design. The kit for aerial photography should include a UAV with an on-board and / or ground-based GNSS receiver of geodetic accuracy, an on-board complex control, avionics, payload and ground control station. According to I. 5.1.1.16 SP 47.13330.2012, the average errors in determining the planned position of objects and terrain contours with clear, easily recognizable outlines (boundaries) relative to the nearest points (points) of the geodetic basis should not exceed 0.5 mm for open areas and 0.7 mm for mountainous and forested areas on the scale of the plan in undeveloped territories. Following these requirements, the error in determining the planned coordinates is presented in Table 1 [5,6,7,8,9,10].

Table 1. Errors in determining the contours of objects

The scale of the plan	Errors, m	
	open country	mountainous and forested areas
1:500	0,25	0,35
1:1000	0,5	0,7
1:2000	1,0	1,4
1:5000	2,5	3,5

When aerial photography with UAVs, it is necessary to take into account factors that hinder the work (the presence of vegetation, terrain fractures, the inability to decipher individual elements of the survey, seasonality, the presence of shadows, clouds, industrial smoke and atmospheric haze, complicating or excluding the process of decoding, the presence of objects with high reflectivity, the presence and height of buildings). The technical equipment of the UAV should ensure the safe performance of flights, taking into account the geographical features of the territory of the Republic of Uzbekistan. The purpose of this work is to substantiate the possibility of conducting topographic surveys using a quadrocopter during engineering and geodetic surveys of railways. The assessment was carried out on the basis of aerial photography data from a quadrocopter DJI Mavic 2 Pro and their subsequent processing.

Source data: aerial photography results (527 photos from the camera of the DJI Mavic 2 quadcopter Pro), the first part of the images has a nadir view, the other part is perspective; the coordinates of the terrain, 5 pieces. The data was loaded into photogrammetric processing software, in our case — AgisoZ Metashape. After uploading the images, the program aligns the photos and builds a sparse point cloud. The entire assessment of the accuracy of the reconstructed scene and the output results is evaluated on it. After its construction, the coordinates of the ground identification signs are loaded to control the accuracy on them[11,12.13.14.15.16.17.18.19.20].

If necessary, they can be used to fit the model as a support. The tasks that we will solve with the helpof the Metashape program are carried out in four stages:

1. Determination of the parameters of the external and internal orientation of the cameras. At the first stage, Metashape finds common points of photos and uses them to determine all camera parameters: position, orientation, internal geometry (focal length, distortion parameters, etc.). The results are a sparse cloud of common points in the 3D model space and data on the position and orientation of cameras. The data on the position and orientation of the cameras is used in further processing stages.

2. Building a dense point cloud. Before proceeding to the next stage of creating a 3D model or beforeby exporting the model, a dense point cloud can be edited and classified.

3. Construction of a three-dimensional surface: a polygonal model and/or CMM. A three-dimensional polygonal model describes the shape of an object based on a dense point cloud.

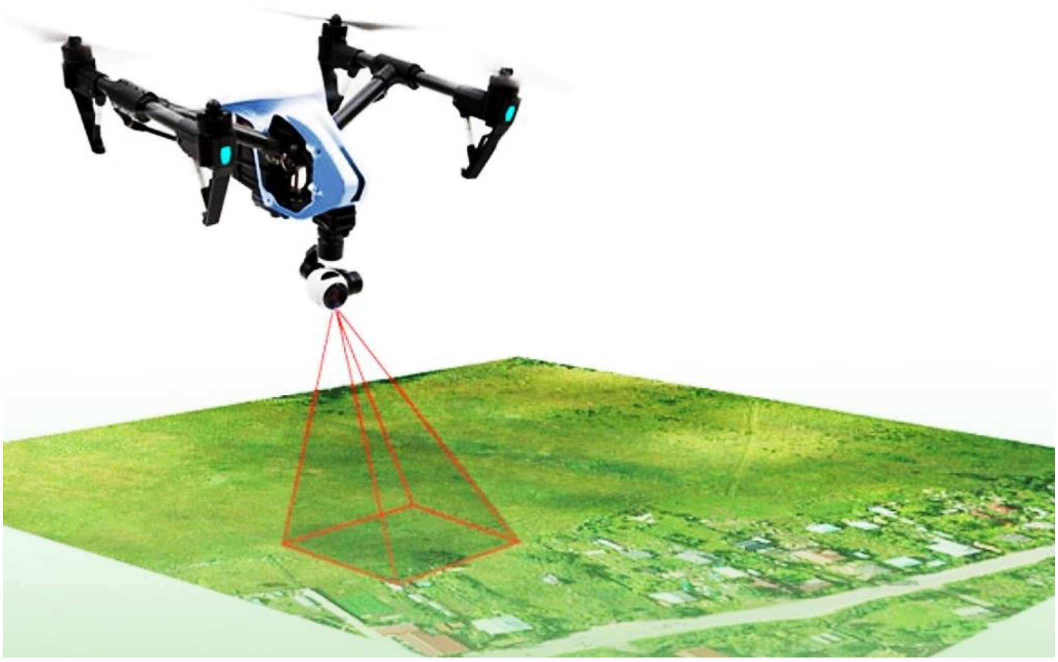

Fig. 1. Digital terrain model (the size of the CMM is 10590x10140, at 6.73 cm / pixels)

4. Building a texture for a polygonal model (if it was built), as well as building an orthophotoplane. The finished orthophotoplane is shown in Figure 2.

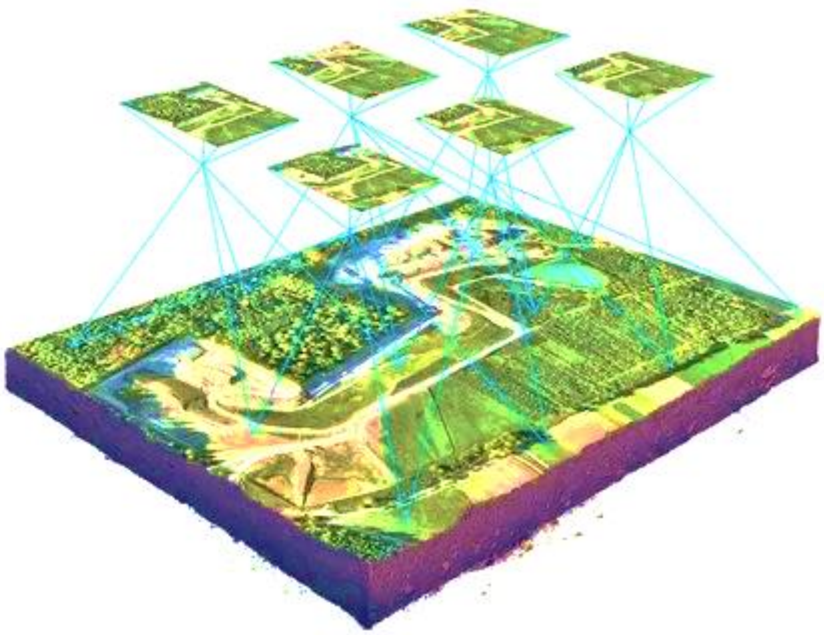

Fig. 2. Orthophotoplane.

The orthophotoplane we have obtained has the size 36006x34329 pixels, at 1.76 cm/ pixels. The standard error does not exceed 3.7 cm, which, according to Table 1, may correspond to a 1:500 scale plan. According to the results of the work, it becomes obvious that the use of quadrocopters in conducting engineering and geodetic surveys is no longer the technology of the future, but the technology of the present. Accordingly, the problem of the lack of regulatory documentation on this topic was a significant gap in the organization of work.

Conclusion. In addition to everything, it is worth adding that, using quadrocopter, it is not necessary to dwell only on engineering and geodetic surveys, since the darkening of the quadrocopter opens up wide opportunities in such areas as:

— monitoring of the condition of the roadway;

— control over construction and repair works;

— obtaining information about the condition of the roadway (detection of defects of the roadway and their parameters);

— determination of transport flow parameters.

Literatura

1. Джаббаров, Саидбурхан Тўлаганович. "8.27" ЎЗБЕКИСТОН ТЕМИР ЙЎЛЛАРИ" АЖ ТЕМИР ЙЎЛ ТАРМОҒИДА ЖОЙЛАШГАН СУВ ЎТКАЗУВЧИ ҚУВУРЛАРНИНГ ТЕХНИК ҲОЛАТИНИ БАҲОЛАШ." *Innovative technologies in construction Scientific Journal* 8.1 (2024): 100-106.
2. Begali, Mirxanova Mavjuda Mikhaylovna Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Normurodov Shahboz Ulug'bekovich. "1.4 INNOVATIVE TECHNOLOGY FOR CONDUCTING ENGINEERING AND GEODETIC SURVEYS OF RAILWAY AND AUTOMOBILE ROAD LINES." *SHINE-AEB GROUP* 1.1 (2023): 17-22.
3. Abdualiyev, E. B. "Research of surface condition of the rails rollingon sections of high-speed and high-speed train traffic." *Journal of Tashkent Institute of Railway Engineers* 15.3 (2019): 21-25.
4. Begali o’g’li, Abdualiyev Elyorbek. "Basalt armaturasi xozirgi kunda xavfsizlik, qulaylik va innovatsiyon yechimga ega bo’lgan maxsulot."
5. Abdualiyev, Elyorbek, Ozoda Mirzahidova, and Akmal Uralov. "ELIMINATION OF IMPULSE IRREGULARITIES ON THE RAIL HEAD WITH THE HELP OF GRINDING." *Academic research in educational sciences* 2.2 (2021): 1220-1225.
6. Abdualiyev, Elyorbek Begaliyevich, and Auezmurat Bekmuratovich Embergenov. "Hydraulic calculations of culverts on the high-speed section of the Tashkent-Sirdarya railway line." *Academic research in educational sciences* 2.4 (2021): 1964-1968.
7. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." (2023).
8. Begaliyevich, Abdualiev Elyorbek, Mirzahidova Ozoda Mirzabdulayebna, and Khamidov Mahsud Kamolovich. "STUDIES OF THE MODE OF OPERATION OF CULVERTS ON RAILWAY LINES." *BARQARORLIK VA YETAKCHI TADQIQOTLAR ONLAYN ILMIY JURNALI* (2022): 307-310.
9. Abdualiyev, Elyorbek Begaliyevich, Movjuda Mikhaliyovna Mirkhanova, and Shukhrat Shavkatovich Makhamadjonov. "CONDITION OF CULVERTS ON THE HIGH-SPEED SECTION OF THE TASHKENT-SYRDARYA RAILWAY LINE." *Academic research in educational sciences* 2.2 (2021): 1096-1101.
10. Abdualiyev, E. B., and M. M. Mirxanova. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE PATH." *Results of National Scientific Research International Journal* 1.9 (2022): 479-483.
11. BEGALIYEVICH, ABDUALIEV ELYORBEK, MIRZAHID OVAOZODA MIRZABDULAYEBNA, and KHAMIDOV MAHSUD KAMOLOVICH. "TO EXAMINE THE IMPACT OF THE FORCES FALLING FROM THE STRUCTURE OF THE MOVEMENT ON THE WATERPROOFING PIPES IN HIGH-SPEED AND HIGH-SPEED RAILWAYS." *International Journal of Philosophical Studies and Social Sciences* (2022): 1-4.

12. Abdualiev, E. B., M. K. Khamidov, and F. F. Eshonov. "STUDIES OF THE INFLUENCE OF CULVERTS ON THE UPPER STRUCTURE OF THE TRACK ON THE SECTIONS OF HIGH-SPEED AND HIGH-SPEED TRAIN TRAFFIC OF JSC" UZBEKISTON TEMIR YOʻ LLARI." *Results of National Scientific Research International Journal* 1.9 (2022): 484-488.

13. Begaliyevich, Abdualiyev Elyorbek, Maxamadjonov Shuxrat Shavkatovich, and Uralov Akmal Shakarovich. "Studies of culverts on the high-speed section of the Tashkent-Sirdarya Railway Line." *International Journal of Human Computing Studies* 3.2 (2021): 18-22.

14. Abdualiyev, E. B., and F. F. Eshonov. "New uses of culvert Construction." *Design Taxi* 2 (2020).

15. Begali o'g'li, Abdualiyev Elyorbek, Umaraliyev Shahjahan Muhammadrozi o'g'li, and Rakhmatov Islom Normurodov Shahboz Ulug'bekovich. "1.1 MEASURES TO STRENGTHEN THE HIGH-SPEED RAIL LINE LAND BASE." *SHINE-AEB GROUP* 1.1 (2023): 3-6.

16. Muhammadrozi o'g'li, Umaraliyev Shahjahan, et al. "1.2 DIAGNOSTICS OF THE ROADBED IN THE RAILWAY TRACK IN UZBEKISTAN." *International Shine-AEB Scientific Journal* 1.1 (2023): 7-11.

17. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.5 THE INNOVATIVE TECHNOLOGY OF USING DRONES IN MODERN CONSTRUCTION IN THE WORLD." *SHINE-AEB GROUP* 1.1 (2023): 19-22.

18. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.4 STRENGTHENING THE SLOPES OF THE ROADBED DURING PATH FLUCTUATIONS IN THE RAILWAY TRACK IN UZBEKISTAN." *SHINE-AEB GROUP* 1.1 (2023): 16-18.

19. Begali o'g'li, Abdualiyev Elyorbek, et al. "1.8 TOPOGRAPHIC SURVEY USING SATELLITE TECHNOLOGIES IN THE." *International Shine-AEB Scientific Journal* 1.1 (2023): 29-33.

20. Abdualiev, E. B., and A. M. Abdukarimov. "Increase of productivity and reliability of control of rails." *Architectural and construction science and period materials of the Republican scientific and practical conference part*. No. 2.

DIAGNOSTIC DEVICES FOR MONITORING THE TECHNICAL CONDITION OF A RAILWAY TRACK

Makhamajanov Shukhratjon Shavkat ugli. Assistant Professor at Tashkent State Transport University

Annotation. This article contains materials on diagnostics and monitoring of structures of the upper structure of the railway track. Information about the observation of the technical condition of railway track elements is described.

Keywords: diagnostics, track pattern, track gauge, monitoring, profilograph, MCC, PRS, APSH-3.

The main task of monitoring the condition of the rail track is the timely detection of deviations of the track parameters from the established standards to prevent these deviations from exceeding the tolerance limits for the current track content. The measurement of the parameters of the rail track, carried out systematically, makes it possible to assess the influence of various operational factors on the stability of the track, the appearance of its characteristic disorders. The measurement results are also used to assess the condition of the path. In the course of work on the current maintenance and repair of the track, such track parameters as its width, the relative position of the rail heads along the level, and the bending boom of the rail threads on curved sections of the track are monitored [2]. The frequency of monitoring the track parameters depends on the operating conditions, the track structure and its condition, the engineering and geological conditions of the area and the characteristics of the existing natural and climatic factors. Under normal (favorable) conditions, the track width and the relative position of the rail heads along the level are monitored at least once a week by the track foreman and at least twice a month by the road foreman together with the track foreman; at the same time, a track control template is used as a measuring tool. According to the schedule approved by the head of the track distance, the above-mentioned track parameters are measured continuously throughout its entire length using track measuring trolleys at least once a month. In addition, all controlled gauge parameters are measured monthly when the track gauge car passes (on high-speed train lines, the track gauge car is passed at least twice a month) [3]. The automated track template (APSH-3) (Fig. 1) is designed to determine the track width (template) and the relative position of the rail threads in height (level). The APSH-3 can be used as an autonomous measuring instrument, as well as as part of a computerized carriage of the track measuring laboratory (KVLP) during adjustment and calibration work. Provides: - measurement of parameters (template and level); - digitally displaying the measured values on a bright synth-synthesizing display; - storage of measurement results in the non-volatile memory of the APSH; - work as part of the KVL-P in the automatic information exchange mode with the on-board automated system (receiving and transmitting data via the ZigBee radio channel during alignment and calibration).

Fig. 1. Automated travel template (APSH-3)

The profilograph of the transverse profile of the track and switches of the PRS-02 (Fig. 2) provides reliable information about the rolling surface, track width, rail elevation, slope, and cross-section of the switch elements. This device replaces a number of removable devices: control center, travel caliper, needle profilometers, templates, etc. The universal profiler in combination with rail grinding and rail milling machines ensures efficient maintenance and repair of rails and switches. The measurement concept incorporated in the PRS-02 makes it possible to quickly and accurately record various parameters of the transverse profile of rails and tracks, as well as the parameters of switches, including crosspieces, wags and counter rails.

Fig. 2. Universal profiler PRS-02. PRS-02 provides the following functions [1]: •automated acquisition of information on the dimensions of the transverse profile of the track and various cross-sections of the switch; •measuring the track width (at a given depth) and the elevation of the rails at any location, including the switch; •measurement of the slope and inclination of the rolling surface of the rails, determination of head wear; •automatic calculation of the profile of rails and crosspieces and cross-section display on the screen of a portable personal computer (PCC); •saving information about the measured section in a database with comments and its coordinate reference;

•viewing, analyzing and processing measurement results in post-processing mode using special software tools. • the width of the chutes; the pitch of the wit (the distance between the working face of the frame rail head and the non-working edge of the wit) opposite the first rod; the distance between the retracted wit and the frame rail; • the distance between the front ends of the movable cores of the blunt crosspieces; • fitting of quills and movable (pivoting) cores; • attachment of the wits to the frame rails, as well as movable (pivoting) cores to the guardrails of the crosspiece; • ordinates of transfer curves; • wear of frame rails, crosspieces and crosspieces, including vertical wear of the core of prefabricated and solid-cast crosspieces, vertical wear of guardrails of prefabricated and solid-cast crosspieces, vertical wear of movable (pivoting) cores of sharp and blunt crosspieces, lateral wear of frame rails, relative position of the crosspieces and frame rails, lateral wear of the crosspiece.

LITERATURE

1. E.V. Nepomnyashchikh and K.A. Kirpichnikov. Diagnostics of the condition of the railway track and its elements. A study guide for students. Cheat. Zabizht, 2012. 109 p.
2. Omarov A.D., Zakirov R.S. Fundamentals of technical diagnostics of track facilities and devices. The training manual. 2002.
3. Kreinis Z.L., Korshikova N.P. Maintenance and repair of railway tracks. Textbook. 2012.

METHODS OF PROTECTING RAILWAYS IN DESERT CONDITIONS

Begmatov Pardaboy Abdurakhimovich, PhD, Associate Professor
Tadjibayev Sherzod Amirkulovich, PhD, Associate Professor
Yuldashaliev Jamshid, Assistant

Abstract: This article discusses methods for protecting railways in desert areas with sandy soils. It also examines techniques for reinforcing the railway subgrade using various types of grass seeds.

Keywords: railway subgrade, ballast prism, sleepers, rails, protective layer, subgrade protection, soil.

The development and improvement of railway transport operations, as well as the enhancement of its efficiency, can be ensured through a high level of reliability of the railway track and the operational stability of its load-bearing foundation – the railway subgrade, which is a complex engineering structure constructed from sandy soils of diverse origin.

The existing railways in Uzbekistan pass through three main natural and climatic zones – irrigated areas, deserts, and mountainous regions. The total length of Uzbekistan's railway network exceeds 7.4 thousand kilometers, of which about 80% pass through sandy deserts and semi-deserts [2,3], including areas with shifting sands. Any damage or threat to the safety of train operations in these sections can lead to disruptions in the functioning of the entire railway network. After the construction of the railways, the destruction of previously stabilized sands led to the emergence of shifting sands along railway lines and near stations.

Shifting and partially stabilized sands in Uzbekistan cover more than 13 million hectares. Large areas of land adjacent to desert zones have historically been under threat from shifting sands (the Amu Darya Delta, parts of the Kyzylkum Desert, and the Alat, Karakul, Jandar, Kagan, Romitan, and Karaulbazar districts of the Bukhara region bordering the Sundukli sands; the Mubarek, Bahoristan, Nishan, and other districts of the Kashkadarya region; and lands in the Jizzakh region bordering the Kyzylkum Desert and Surkhandarya region) [2,4].

To reinforce the railway subgrade, both traditional anti-deformation structures based on proven technologies [5] and new structural solutions and implementation technologies are currently being used.

In combination with biological reinforcement methods, such as grass seeding by various means (mechanized seeding over a previously applied vegetation soil layer of at least 10–15 cm containing no less than 2% humus, or hydroseeding with mulching), geosynthetic materials (GMs) are laid directly on the slope surface beneath the applied vegetation soil, with grass seeds sown on top to create a denser grass cover and to stabilize the moisture regime. In such cases, geomats are typically used [6].

The formation of biological types of slope reinforcement is also possible using GMs that contain grass seeds, fertilizers, and mineral fibers. The strength of these materials must be at least 0.5 kN/m. The service life requirements are similar to those for GMs used as temporary elements on slopes [6].

In sandy deserts, several factors negatively affect plant development: low atmospheric precipitation, high summer air and soil surface temperatures, mobility of the sandy substrate, poor nutrient content in the sand, and sometimes strong salinity in the upper sand layers. As a result of long-term exposure to these factors, plants have developed various forms of adaptation, which allow vegetation to establish itself on sand and help stabilize it.

The long process of plant adaptation has led to the development of various life forms. The most characteristic among them are:

a) Shrubs;

b) Semi-shrubs;

c) Perennial herbaceous plants with long growing seasons;

d) Herbaceous perennials – ephemeroids;

e) Annual herbaceous plants with long growing seasons;

f) Annual plants – ephemerals [7].

Fig. 1. Protection of the railway subgrade in sandy areas through grass seeding.

The methods of planting, seeding, and caring for sand-fixing shrubs are as follows: Large shrub species of *Kandym*, which are among the main sand-fixing plants in deserts, are cultivated using cuttings, seedlings, and seeds. Cuttings and seedlings are planted at a rate of up to 3,300 units per hectare (spacing: 3 m × 1 m). Planting time is from January to March. Depending on habitat conditions, the survival rate of *Kandym* ranges from 60% to 80%. Seeds are sown using pre-germinated seeds placed into the soil with a spade. The seeding rate is 10–12 kg for 10,000 planting spots per hectare. All seeding is done in November–December, after heavy rains.

Small shrub species of *Kandym* are cultivated using seedlings and seeds; using cuttings is ineffective. Sowing is done with pre-germinated seeds placed with a spade at spacing of 3 m × 0.5 m or 1.5 m × 1 m. The seed rate is 6–8 kg per hectare. Seeding time is in autumn, before the sand surface freezes. Around 3,300 seedlings per hectare are planted with 3 m × 1 m spacing. Planting depth is 30–40 cm. Seedlings are trimmed immediately after planting. Planting is done in autumn (after the first rains) or in spring after the sand has thawed. The survival rate is usually high—up to 80%.

Cultivation of *Haloxylon* (saxaul) in saline areas is successful in sandy areas with good moisture and shallow groundwater. The sandy type of saxaul is more suitable for drier environments. Seeding saxaul gives good results in sandy areas with shallow groundwater. The seed rate is 7–8 kg per hectare. Saxaul is only planted using seedlings and cuttings, spaced 3 m × 1 m, which amounts to around 3,300 planting spots per hectare. Seedling survival rates vary depending on habitat and range from 30% to 60%.

Tamarix (Cherkez) is cultivated using seedlings and cuttings; seed sowing is less effective. The planting material rate is around 3,300 units per hectare with 3 m × 1 m spacing. Planting is done from January to March. The survival rate of seedlings is higher (around 80%) compared to cuttings (30%).

References

1. Presidential Decree of the Republic of Uzbekistan No. PQ-2827 dated March 13, 2017, “On measures for the construction of the Bukhara-Miskin railway line.”
2. Anti-deformation structures for railway subgrades: Illustrated textbook for university, technical school, and railway college students. – Moscow: Marshrut, 2003. – 96 p.
3. Fazilov T.I. Organomineral anti-deflation coatings obtained by impregnating shifting sands. Abstract of dissertation for the degree of Doctor of Technical Sciences – Kharkov, KhISI, 1991. – 350 p.
4. Mirakhmedov M.M., Muzaffarova M.K. Expansion of the application range of methods for fixing shifting sands. Collection of articles for the 80th anniversary of TashIIT, 2011.
5. Zakirov R.S., Omarov A.D. Anti-deformation reinforcement of railway subgrades made from sandy soil in Kazakhstan. Almaty: “Gylym”, 1999. – 164 p.
6. Blazhko L.S. Reinforcement of the railway subgrade using geomaterials // Track and Track Facilities. 2003. – No. 11. – Pp. 16–17.
7. Lesov K.S., Tadzhibaev Sh.A., Mavlanov A.M., Kenzhaliev M.K. Stability calculation of embankments and reinforcement of railway subgrade slopes using geosynthetic materials // Transport of the Silk Road (International Scientific Electronic Journal), Tashkent, 2021, No. 1, pp. 78–83.

ANTI-DEFLATION AND ANTI-DEFORMATION TECHNOLOGIES FOR STRENGTHENING ROADBED SLOPES

Tadjibayev Sherzod Amirkulovich
Tashkent,Uzbekistan

Abstract. *This article provides an analysis of the state of work in the deformation of the slopes of the roadbed in sandy soils. And also considered to ensure the stability of the ADAD strengthening of the slopes of the roadbed of railways.*

Key words: *technology, sand, method, deformation, soil, reinforcement, efficiency, slope, roadbed.*

The existing railways in Uzbekistan pass through three main natural and climatic zones - irrigated, desert and mountainous areas. The total length of the railways of Uzbekistan is more than 7.4 thousand km, of which about 80% pass through sandy deserts and semi-deserts [1,2,5], including through shifting sands. Failure, a threat to the safety of train traffic in these areas will lead to disruptions in the operation of the entire railway network. After the construction of the railways, as a result of the destruction of overgrown sands, shifting sands began to appear along the railway lines and near stations.

Shifting and partially overgrown sands in Uzbekistan occupy an area of over 13 million hectares. Significant areas of Uzbekistan adjacent to desert zones have historically been under threat from shifting sands (the Amu Darya delta, part of the Kyzylkum desert, Alat, Karakul, Jandar, Kagan, Rometan, Karaul-Bazar districts of the Bukhara region bordering the Sundukli sands; Mubarek, Bahoristan, Nishan and other districts of the Kashkadarya region; lands of the Jizzakh region bordering the Kyzylkum desert and the Surkhandarya region [3,5,7,9].

The ability of sand to perform its structural function and to withstand the load from rolling stock, including a vibrodynamic component, largely depends on its physical and mechanical properties [2,4,6,8].

In terms of granulometric sandy soils include loose mineral particles containing less than 50% by weight of particles larger than 2 mm, and it is assumed that the plasticity number for these soils is $W_n < 1$ [7].

Considering that sandy soils have different grain compositions, it is customary to characterize them by the heterogeneity coefficient η, which is the ratio

$$\eta = d_{60}/d_{10}\,, \qquad (1.1)$$

where: d_{60} is the diameter of sand particles, less than which 60% of particles are contained by weight in a given soil;

d_{10} is the diameter of particles, less than which 10% of particles are contained by weight in a given sand.

If the soil approaches a theoretically homogeneous composition, i.e. when all particles have the same diameter, then $\eta = 1$. However, in practice, it is customary to consider sandy soils homogeneous when $\eta < 3$, and in other cases the degree of heterogeneity is determined by formula (1.1).

A common feature of desert sands is a noticeable or sharp predominance of particles smaller than 0.25 mm and up to 0.1 mm. Single-peak and double-peak distribution of sand grains by granulometric composition is observed (Figure 1).

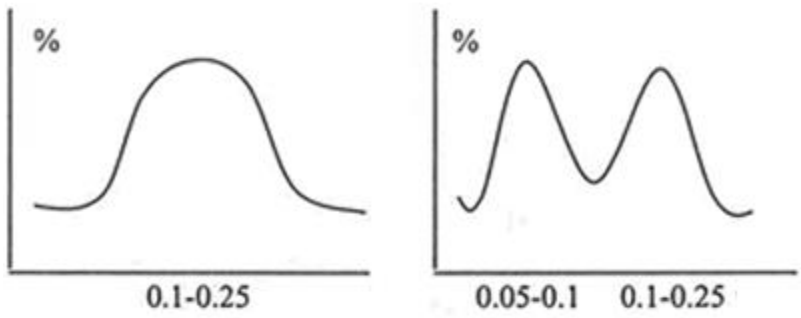

Figure 1. Types of distribution of sand grains by granulometric composition

The results of laboratory tests to determine the strength characteristics of dune sands under static conditions and under vibrodynamic loads are presented in Table 1. [1,2,4,7].

Table 1.

Strength characteristics of dune sands under static load

Humidity, %	*c*, t/m^2	*φ*, degree
6	0,4	35
8	0,58	33
10	0,67	31
12	0,62	29

Changes in the strength characteristics of dune sands under the influence of vibrodynamic loading were studied by Sh.Sh.Abdukamilov.

According to the results of studies [2,6,9], it follows that in order to prevent a decrease in the strength of dune sands under the influence of vibrodynamic loading, it is necessary to compact the soil as much as possible during the construction of the roadbed, and subsequently ensure the constancy of the density of dune sands, protecting it from precipitation, as well as such phenomena as sand drifts and sand blowing. (monograph)

Anti-deflation and anti-deformation strengthening of the roadbed

The durability, reliability and operational performance of the railways of Uzbekistan depend in general on the roadbed laid in the desert and steppe subzones, including anti-deflation and anti-deformation (ADAD) strengthening of the roadbed from fluttering.

The technical policy in the railway transport of Uzbekistan, aimed at maintaining the achieved weight of the train and static load leads to an increase in the force impact on the track. This also leads to an increase in train speeds. In modern track designs, the main platform and slopes of the trackbed primarily need to be strengthened. In the CIS and especially in the far abroad, there is an active search for economical and technological means, ways to strengthen the roadbed in difficult natural and climatic areas. In Uzbekistan, an old traditional means can be used for these purposes - non-blown clay soil, which is relatively cheap and can be mechanized to perform ADAD reinforcement of the roadbed, but the scope of application and the new technology for creating ADAD reinforcement during the construction or widening of the roadbed in subzones have not been studied until recently. Research conducted in recent years has created the prerequisites for the possibility of using environmentally friendly chemical binders for processing sandy soil and geosynthetics for the purpose of using ADAD reinforcement of seasonally frozen roadbeds. However, their use in ADAD reinforcement has not been studied to date [1,4,6,7,9].

The need and feasibility of ADAD reinforcement of slopes of seasonally frozen roadbeds should be established only on the basis of calculating the layer thickness and assessing the stability of ADAD reinforcement. It is necessary to consider a qualitative and quantitative assessment of the stability of ADAD reinforcement of roadbed slopes. In order to conduct a qualitative and quantitative assessment of the stability of the ADAD strengthening, design organizations must have data on the physical and mechanical properties of the materials used for the ADAD strengthening of slopes. For a qualitative assessment of the ADAD strengthening, the thickness of the layer exposed to weather and climate factors and the thickness of the ADAD strengthening layer must be determined [5,7,9].

To ensure and improve the local stability of the ADAD strengthening of slopes, it is necessary to choose the most reliable and also the most economical option for specific conditions. In the general number of measures to improve the durability and operational reliability, the stability of the ADAD strengthening of slopes of seasonally frozen roadbed is of particular importance. This is due to the fact that in subzones with unfavorable climatic and hydrometeorological conditions, which in combination characterize the degree of complexity of the engineering and geological situation, the main share of the roadbed is usually made up of ADAD reinforced slope parts. At the same time, along with general issues that require appropriate solutions from the point of view of roadbed stability during the specified service life, slopes with ADAD reinforcement should be given special attention as special engineering structures [4,6,8].

As practice shows, as well as the studies carried out, it is confirmed that in cases where the issues of choosing the type and ensuring the stability of ADAD reinforcement of slopes are not given due importance, deformations occur within the entire roadbed (shoulders, main platform, slopes), as well as beyond it (drainage ditches), the elimination of which requires costs. At the same time, the choice of the type, assessment and ensuring the stability of ADAD reinforcement of roadbed slopes requires a comprehensive approach.

Economic analysis of the completed and experimental ADAD strengthening works allows us to state that the economic efficiency of ADAD strengthening structures is determined by [1,5,7,9]:

- rational area of application of the selected options;
- comparable comparison with operational measures for repair of the slope and the main area of the seasonally frozen roadbed;
- reduced comparable costs, as well as labor costs;
- service life of the selected ADAD strengthening structure;
- volume of PDPD strengthening works.
- The determining factors influencing the values of reduced comparable costs in this case should be:
- degree of ensuring local stability;
- degree of increasing local stability by one or another type of structure;
- cost of machine operation (under specific conditions);
- speed of ADAD strengthening works with the effect of immediate protection of slopes from the manifestation of local deformations;
- cost of materials taking into account their movement;
- labor costs.

Literatures

1. Saginovich, Lesov Kuvandik, and Tadjibayev Sherzod Amirkulovich. "Calculation of the reserve coefficient of local stability of the slopes of the roadbed reinforced with a volumetric geogrid." *ACADEMICIA: An International Multidisciplinary Research Journal* 11.11 (2021): 115-120.

2. Lesov, K. S. (2021). Tadjibaev Sh. A., Kenjaliev MK Experimental researches on strengthening the slopes of the roadbed with geomaterials on the experimental section of the Bukhara–Misken railway line. *Journal NX*, *7*(2).

3. Lesov, K. S. (2019). Tadjibaev Sh. A. and Kenjaliyev MK, Technology for strengthening slopes of the subgrade of railroads made of sandy soils using geosynthetic materials. *Problems of architecture and construction*, 15-18.

4. Таджибаев Шерзод Амиркулович, Бегматов Пардабой Абдурахимович, Мехмонов Машхурбек Хусен угли. (2024). 8.3 СПОСОБЫ РЕЗЕРВИРОВАНИЯ ДЛЯ ПОВЫШЕНИЯ НАДЕЖНОСТИ. *Innovative Technologies in Construction Scientific Journal*, *8*(1), 10–11.

5. Таджибаев Шерзод Амиркулович Бегматов Пардабой Абдурахимович Мехмонов Машхур Хесейн угли. (2024). 8.8 Базовые требование земляного полотно магистральных железных дорог. *Innovative Technologies in Construction Scientific Journal*, *8*(1), 27–28

6. Begmatov, P. A., Sulaymanov, S., & Tadjibayev, S. A. (2020). SUBSTANTIATION OF TECHNICAL AND ECONOMIC INDICATORS OF MODERN TECHNOLOGIES WITH THE CURRENT MAINTENANCE OF THE SUBGRADE OF RAILWAYS. *Journal of Tashkent Institute of Railway Engineers*, *16*(2), 9-13.

7. Лесов, К. С., Кенжалиев, М. К., & Таджибаев, Ш. А. (2019, November). Определение устойчивости насыпи земляного полотна железных дорог, возведенного из мелких песков. In *Международная научно-техническая конференция «Глобальное партнерство-как условие и гарантия устойчивого развития» II том. Ташкент* (pp. 248-252).

8. Лесов К. С., Таджибаев Ш., Кенжалиев М. К. Технология укрепление откосов земляного полотна железных дорог из песчаных грунтов с применением геосинтетических материалов Проблемы архитектуры и строительства (научно-технический журнал). № 4, 2019 //Самарканд, СамГАСИ. – 2019. – №. 4. – С. 15.

9. Лесов К. С., Мирахмедов М. М., Таджибаев Ш. А. Мировой опыт применения геосинтетических материалов в конструкциях земляного полотна //Архитектура. Строительство. Дизайн. Научно-практический журнал. – 2019. – №. 2. – С. 194-197.

COMPARATIVE ANALYSIS OF TECHNOLOGY OF ANTI-EROSION PROTECTION OF EARTH STRUCTURES USING GEOSYNTHETIC MATERIALS

Tadjibayev Sherzod Amirkulovich
Tashkent,Uzbekistan

Abstract. *This article examines a wide range of different polymeric materials used in geotechnical, hydraulic engineering and transport construction. It also presents an analysis of the technology of anti-erosion protection of earth structures using geosynthetic materials.*

Key words: *geosynthetic materials, roadbed, technology, analysis, reserve coefficient of stability, reinforcement, strengthening, anchor.*

The use of synthetic materials does not introduce significant complications into the traditional technology of production works, which is determined by the convenient form of their delivery - rolls of sufficiently large width. The length of the web is usually assigned depending on the weight of the web in such a way as to allow its manual laying. And in some cases, technological advantages are created associated with the improvement of backfill and compaction of the soil layer or building materials. Only operations for transportation, laying and connecting webs are added. In addition, changes are made to the preparation of the base and backfill of the material of the overlying layer [1,2,3,4,6].

The preparation of the base is carried out in accordance with current standards, with special attention paid to the need to profile it with the required slope if synthetic materials perform drainage functions in the body or upper part of the roadbed. Preparation of a weak embankment base may not be carried out if there is no risk of damage to the webs; otherwise, it consists of filling in deep holes, ruts, cutting down bushes and dumping a protective layer from local soil if there is surface water on the construction site [5].

Laying of roadbeds to create layers in the body or upper part of the roadbed is usually carried out by rolling out rolls along the axis of the route, if there is no need to ensure equal strength of the layer across the width; when laying roadbeds directly on a weak embankment base, transverse rolling of the rolls is usually carried out. Depending on the construction conditions and the width of the synthetic materials, the productivity of work when performing this operation manually varies from 1 thousand m2 / shift to 10 thousand m2 / shift, i.e., as a rule, it exceeds the productivity of work in subsequent operations and does not delay them.

Laying of roadbeds is usually carried out manually, implementing the simplest mechanization of these works. In the USA, a bracket fixed to the front of a vehicle with a telescopic axle for installing a roll is used to mechanize this operation. In Germany, a support with an axis above it for installing the roll is used, reinforced on load-bearing elements mounted on the vehicle frame. The support can rotate around the axis by 90°; in the transport position, it coincides with the longitudinal axis of the vehicle, and before the start of rolling, it is rotated to the working position - across its axis [6].

Synthetic material sheets are connected with anchors, stitching, fusing, gluing. The most common connection is with anchors. Due to the need to increase the overlap of the edges of the sheets, the value of which is 15-20 cm, and when laying sheets on a weak base, it is selected depending on the settlement of the embankment S (0.15 + 0.2 S, m), but not less than 30 cm - this causes an overconsumption of synthetic materials. Anchors are rods with a diameter of 3-5 mm with a pointed lower end and a bent upper end, or U-shaped brackets with a length of 15-20 cm. They are usually installed every 10-15 m, and when laying sheets on a weak base, every 1.5-2 m.

Fusion jointing is performed using blowtorches [6] or a device designed by Giprodornia (Russia). The device is a two-wheeled trolley with a gas cylinder, in the rear part of which there is a movable support with a cone that lifts the edge of the web. The flame of the gas burner installed on this support is directed under the edge of the web, melting its surface. During the movement of the trolley, the upper web is pressed against the previously laid lower web [6].

The most common method of joining webs of synthetic materials in foreign practice is sewing them with synthetic threads. For this, special portable machines of various designs are used. This method allows to reduce labor costs and increase productivity in comparison with other methods [6].

In difficult soil conditions, in order to facilitate the work and improve their quality, it is advisable to join the webs partially or completely outside the construction site. In order to avoid complications associated with the transportation of sheets of increased width, the following method of joining is used: the sheets are laid one on top of the other, connected along one of the longitudinal sides, rolled into a roll, and at the work site the roll is unrolled and the resulting block of sheets is laid out. After joining the sheets, the material of the overlying layer is poured in a "away from you" manner without driving construction vehicles onto the sheets. Due to the poor lightfastness of most synthetic materials, the period between their laying and backfilling should not exceed 5-6 hours. The thickness of the poured layer should be at least 15-20 cm, and in the case of arranging an interlayer on a weak foundation - 20-25 cm with a single passage of construction vehicles [6].

Synthetic materials laid in a slope with an intersection of the expected sliding surface absorb part of the tensile stresses. This increases the overall stability of the slopes, which is especially important during construction in difficult conditions (embankments on a weak foundation); increases the steepness of the slopes. This allows to reduce the volume of excavation works, the area of land allocated for construction [6,7,8]. To simultaneously increase local stability, synthetic materials are placed on the slope and combined into clips. Since the main function of the materials in this case is reinforcement, it is preferable to use rigid high-strength meshes and fabrics. Figure 1.3 d shows the embankment profiles of sections of the Bratislava highway with reinforced slopes and their position according to the initial design solution (without reinforcement) [6, 8]. The stability of such slopes is calculated in the traditional way, introducing the strength of synthetic materials into the number of holding forces [6], or, which seems more correct, the permissible force in synthetic materials [6,7], corresponding to the value of the load perceived by it at a certain value of the final relative deformation (5-10%), in some cases (for layers laid directly on a weak base) corresponding to the long-term strength of synthetic materials.

In Gidrodorniya, a method for calculating reinforced slopes has been developed taking into account the occurrence of tensile stresses in the sliding surface zone [7]. In accordance with it, the safety factor of a reinforced slope is determined by the formula

$$К_{rez} = \frac{\sum_{l}^{n}(\sigma_{pi} \cdot L_i \cdot B_i) + n \cdot \sigma_g \cdot \delta_i}{0{,}5 \sum_{i=1}^{n} P_i(cos\beta_i - \sqrt{cos^2}\beta_i + 4sin^2\beta_i)} \quad (1.1)$$

where $P_i = \gamma_i \cdot F_i \cdot B_i$- _i- mass of each of the blocks into which the slope above the slip surface is divided (the position of the slip line is determined by any known method);

F_i, B_i, γ_i, L_i -- respectively, the area, thickness, average density of the blocks and the length of the slip surface within them;

n, δ - the number of reinforcement layers, their thickness;

σ_g- - permissible force in the reinforcement;

β_i- angle of inclination of the slip surface to the horizon within the block;

σ_{pi}- - limit value of tensile stresses for the soil.

With known (according to laboratory tests) strength characteristics of the soil - the angle of internal friction (φ) and adhesion (C), the value of σ_{pi}, MPa, can be calculated using the formula

$$\sigma_{pi} = 0{,}5(0.1 - \sqrt{0.01 + 4[0{,}1 \cdot tg\varphi + C]^2} \quad (1.2)$$

Reinforced soil retaining structures have become widespread abroad, reducing construction costs by 10-50% compared to conventional solutions (construction of powerful concrete retaining walls). They are a lightweight outer wall connected by reinforcement strips (usually steel), clamped in the soil. Almost the entire load is supported by reinforcement made of rigid high-strength synthetic materials. Fig. 1.3.e shows the cross-section of a structure of the type with a nearly vertical slope without cladding (sheets of synthetic materials form a collar), constructed in the USA [6].

In Italy and France, this method was used to restore landslide areas [5,6,7,8]. When eliminating a large landslide (32 m wide) in Italy, non-woven polyester material Dre-novo was used. Its surface density is 480 g/m2, strength is 370 N/cm, elongation at break is 50%, width is 8 m and roll length is 30 m. A package of mats, each 50 cm thick, was laid on a pre-prepared area, forming a destroyed slope. Each mat was a layer of crushed stone-clay soil wrapped in non-woven material. The mats were laid with a slope of 18° towards the slope body. It is noted that the costs of strengthening slopes using synthetic materials are 1/10 of the costs of strengthening using traditional methods [8].

Increasing demands for more economical use of land necessitate the use of new methods for strengthening the slopes of embankments and cuttings. Depending on the physical properties of the soil and the steepness of the slopes, grass seeding, turfing, slope paving, as well as various structures, such as gravity retaining walls, backfill walls, and reinforced soil structures, are used for this purpose. Various combinations of the listed methods are often used to strengthen slopes and improve water drainage. Some of them are based on the use of a volumetric geogrid structure. Separating or filtering geosynthetics can replace multi-layer backfill made of fractionated material. Stabilizing geosynthetics, in turn, strengthen the underlying soil layers, providing a sufficiently strong foundation for retaining walls Some types of slope strengthening are intended to ensure their temporary stabilization for a period sufficient for the development of the root system of planted plants. So-called "soft" systems disintegrate after a pre-calculated period of time under the influence of microorganisms or solar radiation . In addition, in recent years, the production of new special biologically unstable types of geotextiles has begun (for example, AKZO Industrial Systems), which are used to form a protective turf layer on slopes. Such protective coatings are similar to the straw mats used previously [6,7,8].

The Nicolon Corporation has proposed the Armoform system for protecting slopes from erosion, the basis of which is a shell of high-strength textiles filled with concrete using a pump. The thickness of the protective structure formed in this way is 2.2 - 8 inches (5.5-20.3 cm). This design can be made in three versions. The proposed slope protection system is inexpensive and simple to install, including in the case of floodable slopes.

LITERATURE

1. Лесов, К., Таджибаев, Ш., Мавланов, А., & Кенжалиев, М. (2021). Расчет устойчивости насыпи и укрепление откосов земляного полотна с использованием геосинтетических материалов. *Транспорт шелкового пути*, (1), 78-83. Лесов, К., Таджибаев, Ш., Мавланов, А., & Кенжалиев, М. (2021). Расчет устойчивости насыпи и укрепление откосов земляного полотна с использованием геосинтетических материалов. *Транспорт шелкового пути*, (1), 78-83.

2. Лесов, К. С., Таджибаев, Ш. А., & Кенжалиев, М. К. У. (2022). ПОВЫШЕНИЯ УСТОЙЧИВОСТИ ОТКОСОВ НАСЫПИ ЗЕМЛЯНОГО ПОЛОТНА С ПРИМЕНЕНИЕМ ОБЪЕМНЫХ ГЕОРЕШЕТОК. *Central Asian Research Journal for Interdisciplinary Studies (CARJIS)*, *2*(10), 229-236.

3. ЛЕСОВ, К., ТАДЖИБАЕВ, Ш., МАВЛАНОВ, А., & КЕНЖАЛИЕВ, М. ТРАНСПОРТ ШЁЛКОВОГО ПУТИ. *ТРАНСПОРТ ШЁЛКОВОГО ПУТИ Учредители: ННО" Научно-исследовательский информатизационный центр"*, (1), 78-83.

4. Лесов, К. С., Таджибаев, Ш. А., & угли Кенжалиев, М. К. (2023, May). ПРОТИВОЭРОЗИОННАЯ ЗАЩИТА ЗЕМЛЯНЫХ СООРУЖЕНИЙ НА УЧАСТКЕ ЖЕЛЕЗНОДОРОЖНОЙ ЛИНИИ БУХАРА–МИСКЕН. In *International Conference" Technical and technological sciences in the modern world"*. (Vol. 1, No. 1, pp. 34-37).

5. Лесов, К. С., Таджибаев, Ш. А., Кенжалиев, М. К. У., & Мирханова, М. М. (2022). ТЕХНИКО-ЭКОНОМИЧЕСКАЯ ОЦЕНКА ЭФФЕКТИВНОСТИ УКРЕПЛЕНИЯ И ПОВЫШЕНИЯ УСТОЙЧИВОСТИ ОТКОСОВ ЗЕМЛЯНОГО ПОЛОТНА. *Universum: технические науки*, (11-3 (104)), 39-42.

6. Лесов, К. С., & Таджибаев, Ш. А. (2022). ИССЛЕДОВАНИЕ УСТОЙЧИВОСТИ ОТКОСОВ ЗЕМЛЯНОГО ПОЛОТНА ЖЕЛЕЗНЫХ ДОРОГ ПРИ УКРЕПЛЕНИИ ГЕОСИНТЕТИЧЕСКИМИ МАТЕРИАЛАМИ. *Universum: технические науки*, (8-1 (101)), 57-61.

7. Лесов, К. С., Таджибаев, Ш. А., & угли Кенжалиев, М. К. (2023, May). ПРОТИВОЭРОЗИОННАЯ ЗАЩИТА ЗЕМЛЯНЫХ СООРУЖЕНИЙ НА УЧАСТКЕ ЖЕЛЕЗНОДОРОЖНОЙ ЛИНИИ БУХАРА–МИСКЕН. In *International Conference" Technical and technological sciences in the modern world"*. (Vol. 1, No. 1, pp. 34-37).

8. Таджибаев Шерзод Амиркулович (2023). ИССЛЕДОВАНИЕ УСТОЙЧИВОСТИ ОТКОСОВ НАСЫПИ ЗЕМЛЯНОГО ПОЛОТНА ПРИ УКРЕПЛЕНИИ ОБЪЕМНЫХ ГЕОРЕШЕТОК. Universum: технические науки, (9-3 (114)), 5-9.

CURRENT STATE OF TECHNOLOGY AND RATIONAL METHODS OF STRENGTHENING THE ROADBED OF RAILWAYS ON SOFT SOILS IN DEVELOPED COUNTRIES OF THE WORLD.

Tadjibayev Sherzod Amirkulovich
Bozorov Dovudbek Rizamat o'g'li
Tashkent,Uzbekistan

Abstract: *This article discusses methods for strengthening the roadbed of railways using modern geosynthetic materials. It also presents the main types and functions of geotextiles and volumetric geogrids.*

Key words: *method, way, weak soil, reinforcement of roadbed, technology, geotextile, volumetric geogrid, reinforcements, woven, non-woven.*

The development and improvement of railway transport, increasing its efficiency can be ensured with a high level of reliability of the railway track, operational stability of its supporting base - the roadbed, which is a complex technical structure erected and being erected from sandy soils of complex origin.

Analysis of existing works shows that the stress state of the roadbed has not been studied widely enough, and little attention has been paid to studies of the deformability of soil structures reinforced with geosynthetic materials. There is no developed methodology for calculating the stress-strain state of the roadbed reinforced with geosynthetic materials, which will not make it possible to reasonably recommend certain structures for strengthening the slopes of the roadbed using geosynthetic materials in the construction and reconstruction of railways [1,2,3,4].

The relevance of developing such a methodology is increasing in connection with the tightening of the resource-saving policy carried out on railways. Calculations of the stress-strain state of the roadbed reinforced with geosynthetics can be used by design organizations when selecting and justifying the method of strengthening the roadbed with insufficient bearing capacity and increased deformability on reconstructed railway lines. The developed method allows calculating the change in the stress state of the roadbed of railways under construction and reconstruction when reinforced with geosynthetics, which can be used to assess the possibility of using the considered reinforcement method from the point of view of ensuring the bearing capacity calculated within the framework of the classical theory of limit equilibrium [5,6,7,8]

To strengthen the roadbed, both traditional anti-deformation structures using proven technologies [3,5,7,8] and new design solutions and technologies for their implementation are currently used.

Thus, when strengthening the roadbed, the following measures are provided:

– the installation of vertical sand drains and cuts; – filling the embankment to the value determined by calculation, strengthening the base to prevent settlements (usually more than 5 mm) of the embankment on a weak base, causing overstrain in the elements of the track superstructure;

– filling retaining berms and counter-benches, anchoring the slope part, sequential cutting of benches on the main core of the embankment to prevent sliding of sand plumes along the embankment core;

– strengthening works, water drainage to prevent erosion of poorly protected slopes of embankments and cuttings;

– lateral backfill to embankments, widening due to strengthening works (retaining walls, rock backfill, etc.) of the main area for placing the ballast prism, constructed according to new standards, and creating conditions for repair work;

– ensuring normal water drainage from the ballast prism and shoulders, sealing cracks;

– positioning of slopes of excavations, filling of embankments to eliminate snow-drift areas (excavations up to 2 m deep and embankments less than the height of the snow cover) [7,8].

In order to ensure timely commissioning of the railway line with a high level of reliability of the roadbed, it is necessary to interconnect the implementation of scientific research, experiments and excavation work into a single complex. Preventive experiments allow for the introduction and testing of new designs and technologies for subsequent construction, timely acquisition of new equipment, and the organization of monitoring and scientific support. Types of sites may differ in sets of climatic and engineering-geological conditions, work technology, implementation periods and materials used [3,5,7].

In accordance with the standards, checks of the stability of embankment slopes and the stability of foundation soils must be carried out, and the intensity of foundation settlement must be determined. If these checks are not ensured, anti-deformation measures are designed. To strengthen a weak foundation, considerable experience has been accumulated in the implementation of design and technological solutions, including cutting and replacing weak soils, sand, crushed stone, cement-sand piles, ballast berms, etc. [5,7,8]. Projects of enormous complexity, volume of work and investment can be implemented only with the appropriate construction potential, scientific, design and production support.

Design, technological and organizational solutions in earthworks projects are always interconnected, and their selection is a relevant and complex task in the complex of construction of communication routes, in which at each stage of design and especially, production of works, engineering-geological and climatic characteristics are constantly changing. The methodology for solving this problem is based on continuous monitoring of characteristics in order to determine their combined influence on the resulting indicators [7,8].

One of the promising and widely used methods of strengthening the roadbed in transport construction has become the use of various types of geosynthetic materials (geotextiles, geogrids, geocells, geomembranes, geomats, geocomposites of various types). Geosynthetic materials are used in transport and civil construction in many leading countries of the world (Great Britain, Germany, France, Switzerland, Austria, France, Italy, USA, Russia) and have proven themselves in solving various engineering problems [5,6,8].

Geosynthetics are a wide range of different polymeric materials used in geotechnical, hydraulic engineering and transport construction, the use of which in roadbed structures can be divided according to the following criteria:

Geotextile is a synthetic material that is used in construction and landscape design for separation, filtration, drainage, reinforcement and protection of soil layers. It is made of polypropylene or polyester and can be woven, non-woven or knitted-stitched.

The main types of geotextiles:

Non-woven needle-punched - used most often, allows water to pass through well and is used for drainage, slope reinforcement, road construction.

Woven - durable, allows less water to pass through, suitable for reinforcement and stabilization of the base.

Heat-bonded - less durable, but cheaper, used for less loaded areas.

Geotextile functions in railway construction:

Separation of layers: prevents mixing of ballast (crushed stone) and soil.

Reinforcement: increases the bearing capacity of the base.

Drainage: ensures water drainage and prevents erosion.

Filtration: retains soil particles, allowing water to pass through.

Figure -1. Geosynthetic materials

Geogrid -is a three-dimensional geosynthetic material, which is a cellular structure that is stretched on the site and filled with crushed stone, sand, soil or concrete. It is used to reinforce and stabilize embankments, slopes, embankments and foundations for highly loaded structures, including railway tracks.

Geogrid functions in railway construction:

- Strengthening and stabilizing the foundation under the rails and ballast.
- Reducing pressure on weak foundations (clay, peat) - redistributes the load over a larger area.
- Preventing subsidence and shifting of crushed stone - especially important under high loads and vibration.
- Strengthening slopes and embankments - especially at steep angles or unstable soils.

Figure 2. Volumetric geogrids

Literatures

1. Lesov, K. S. (2021). Tadjibaev Sh. A., Kenjaliev MK Experimental researches on strengthening the slopes of the roadbed with geomaterials on the experimental section of the Bukhara–Misken railway line. *Journal NX*, *7*(2).
2. Lesov, K. S. (2019). Tadjibaev Sh. A. and Kenjaliyev MK, Technology for strengthening slopes of the subgrade of railroads made of sandy soils using geosynthetic materials. *Problems of architecture and construction*, 15-18.
3. Таджибаев Шерзод Амиркулович, Бегматов Пардабой Абдурахимович, Мехмонов Машхурбек Хусен угли. (2024). 8.3 СПОСОБЫ РЕЗЕРВИРОВАНИЯ ДЛЯ ПОВЫШЕНИЯ НАДЕЖНОСТИ. *Innovative Technologies in Construction Scientific Journal*, *8*(1), 10–11.
4. Таджибаев Шерзод Амиркулович Бегматов Пардабой Абдурахимович Мехмонов Машхур Хесейн угли. (2024). 8.8 Базовые требование земляного полотно магистральных железных дорог. *Innovative Technologies in Construction Scientific Journal*, *8*(1), 27–28
5. Begmatov, P. A., Sulaymanov, S., & Tadjibayev, S. A. (2020). SUBSTANTIATION OF TECHNICAL AND ECONOMIC INDICATORS OF MODERN TECHNOLOGIES WITH THE CURRENT MAINTENANCE OF THE SUBGRADE OF RAILWAYS. *Journal of Tashkent Institute of Railway Engineers*, *16*(2), 9-13.
6. Лесов, К. С., Кенжалиев, М. К., & Таджибаев, Ш. А. (2019, November). Определение устойчивости насыпи земляного полотна железных дорог, возведенного из мелких песков. In *Международная научно-техническая конференция «Глобальное партнерство-как условие и гарантия устойчивого развития» II том. Ташкент* (pp. 248-252).
7. Лесов К. С., Таджибаев Ш., Кенжалиев М. К. Технология укрепление откосов земляного полотна железных дорог из песчаных грунтов с применением геосинтетических материалов Проблемы архитектуры и строительства (научно-технический журнал). № 4, 2019 //Самарканд, СамГАСИ. – 2019. – №. 4. – С. 15.
8. Лесов К. С., Мирахмедов М. М., Таджибаев Ш. А. Мировой опыт применения геосинтетических материалов в конструкциях земляного полотна //Архитектура. Строительство. Дизайн. Научно-практический журнал. – 2019. – №. 2. – С. 194-197.

THE CURRENT STATE OF THE RAILWAY DIAGNOSTICS AND MONITORING SYSTEM IN DEVELOPED COUNTRIES.

Tadjibayev Sherzod Amirkulovich
Shodiyev Umidjon G'ulom o'g'li
Tashkent,Uzbekistan

Abstract: In this article, diagnostics and monitoring of the status of the disease and symptoms are discussed.They were also introduced to modern railway control equipment and methods in developed countries.

Key words: diagnosis, indication, condition, result, monitoring, system, means, puteizmeritelnye instrumenty.

Diagnostics in general - is a comprehensive study, detection of defects, development and improvement of various methods and means of detecting defects, prediction of possible deviations.

Three components of diagnostics and monitoring of railway transport infrastructure can be distinguished.

Firstly, the "legislative" basis of diagnostics - regulatory and technical documentation, on the basis of which the functioning of the entire diagnostics and monitoring system is carried out (technical regulations for controlled parameters, instructions for their assessment, acceptable risks, test programs and methods, regulations for the interaction of elements of the diagnostics and infrastructure monitoring system, regulations for information interaction with other information and analytical systems of JSC Russian Railways, etc.) [1,2,3,4].

Secondly, the instrumental base of diagnostics, which carries out direct monitoring of the state of infrastructure facilities to the required extent:

- mobile means (specialized, multifunctional);
- manual means (removable);
- stationary.

Thirdly, the "intelligent" core of the diagnostics and monitoring system is the information and analytical subsystem that collects, controls the condition and reliability, standardizes and synchronizes the received information, accumulates and analyzes it in depth. The system should provide other information and analytical systems of JSC Russian Railways, systems of technical and economic analysis and management decision-making for the purpose of effective management of the railway transport infrastructure with objective information in the necessary and sufficient volume [1,2,3,5].

Speaking about regulatory and technical support, it is necessary to note the main, cornerstone principle of constructing the diagnostics and monitoring system as a whole, which should be reflected in the regulatory and technical documentation - the principle of uniformity of measurements. It is necessary to develop or clarify technical regulations for measuring the parameters of various objects of the railway infrastructure. These regulations should provide clear definitions of all parameters that need to be measured and assessed, the conditions for performing measurements and their frequency.

Now, when it is possible to calculate the spatial position of rail threads, measure the transverse profiles of rails and much more, it is simply necessary to give the most correct definition of parameters, based on the scientific and technical, physical description of the object, and not on the available measuring instruments. Not the normative and technical documentation should adapt to what and how the developers of diagnostic systems can measure, but the developers of diagnostic systems should measure what is required for an adequate representation of the state of technical objects of the railway infrastructure[6,7,8].

All diagnostic tools operating within the railway infrastructure diagnostic and monitoring system must ensure measurement of parameters in accordance with uniform technical regulations. Compliance with the developed requirements must be strictly ensured by all developers of diagnostic tools. All tools measuring certain parameters must generate them in an established, standard form, no matter what methods, sensors, measurement schemes and processing methods are used. Ensuring compliance with the principle of uniformity of measurements must become one of the main criteria when deciding on the possibility of using diagnostic tools on the railway network. Diagnostic tools may differ only in the list of measured parameters and the accuracy of their measurement. Acceptance of all diagnostic tools must also be carried out according to uniform testing programs and methods. Test programs and methods must be based on the requirements for ensuring the uniformity of measurements, checking the measurements for their repeatability, reproducibility and comparability.[4,5]

High-precision tool

The diagnostic tools used in the diagnostic and monitoring system must be optimized in terms of their composition, the list of parameters being diagnosed, and the frequency of operation in order to provide the diagnostic and monitoring system with information on the actual state of the infrastructure in the necessary and sufficient volume to predict its development and make timely effective management decisions.

Recently, there has been a constant increase in the functionality of diagnostic tools, an increase in the degree of automation of the processes of measurements, processing and analysis of the information received. This is especially evident in the latest diagnostic tools developed by the NPC INFOTRANS company. The wide range of monitored parameters of infrastructure objects determines the accuracy of the diagnosis and, consequently, the efficiency of using the resources invested in the maintenance of the infrastructure [1].

The real flagship that gave impetus to the expansion of the functionality of diagnostic tools was the ERA diagnostic complex, which monitors the widest possible range of track infrastructure parameters, including video monitoring of the track superstructure, spatial scanning, ground penetrating radar, etc., as well as contact network parameters, automation and communication systems. Such multifunctional tools not only allow obtaining a one-time "snapshot" of the infrastructure, but also reduce the traffic load and significantly reduce diagnostic costs. The functions proposed by the developer initially seemed redundant, but then, as the analytical apparatus developed, they became necessary and are now actively used in a variety of aspects.

A relevant area of diagnostic development is determining the behavior of the infrastructure in conditions of real interaction with circulating rolling stock. Within the framework of this area, multifunctional diagnostic laboratories based on locomotives (SPL-ChS200, SMDL-2TE116) are already successfully operating. The use of modern technical solutions made it possible to implement maximum functionality in the limited space of one locomotive section, similar to the two-car diagnostic complexes "ERA".

The joint project of Russian Railways, INFOTRANS and Siemens AG (the INFOTRANS-VELARO Rus project) opens a new class of diagnostic tools – the class of autonomous diagnostic tools. The project provides for equipping high-speed passenger electric trains Sapsan with the information and measuring system (IMS) INFOTRANS-VELARO Rus. Today, this project still has no analogues, although work in this direction is already underway, for example, in Korea[1,3,7].

The uniqueness of this system is that it operates completely autonomously, without requiring operator support. Measurements are taken in conditions of real interaction of the train with the track. All detected violations are immediately (in real time) automatically transferred to the servicing units for corrective measures.

Another unique feature of this project is that for the first time, diagnostic equipment of this range was installed on a regular passenger electric train. The equipment was installed without interfering with the regular train systems and with virtually no interference with the layout (all passenger seats are preserved). The installed high-precision measurement systems can operate in a wide range of weather and climate conditions at speeds up to and including 350 km/h. This approach allows for diagnostics without any load on the transportation process. At the same time, high frequency of monitoring of the condition of high-speed highways is ensured in conditions of real interaction of high-speed rolling stock with the infrastructure. All this together makes it possible to effectively monitor and forecast the development of the infrastructure of high-speed highways for the purpose of early warning and prevention of its transition to a dangerous state[6,7,8,9].

A wide range of diagnostic parameters, high accuracy and full automation of all processes of control, measurement, processing and analysis of information without operator participation ensure the completeness, objectivity and reliability of the data obtained, necessary for monitoring especially important high-speed routes.

This project was further developed in the IIS "INFOTRANS-Lastochka", installed on the high-speed electric train ES2G "Lastochka". This project significantly expands the list of controlled infrastructure parameters that determine its interaction with rolling stock. The Lastochka electric train equipped with the INFO-TRANS-Lastochka IIS is currently operating on the Moscow Central Circle.

This trend of increasing the functionality of the diagnostic tools in operation is currently maintained for the previously highly specialized track measuring cars. The track measuring cars manufactured this year are equipped with all the necessary systems for effective diagnostics of the continuous welded track condition, video monitoring of the upper track condition with automatic assessment of the condition of most elements of the upper track condition. Next year, a comprehensive laboratory car is planned to be developed and manufactured on the basis of one car, equipped with systems for full diagnostics of the entire infrastructure, including track infrastructure, contact network, automation and communication systems[1,3,5,7,9].

Technical innovations are successfully used today and ensure the safety of movement not only of railway lines, but also of such important structures as the metro. Thus, our company has created the first in Russia "Self-propelled multifunctional diagnostic complex" - SMDK-Mtr specifically for the metro. The complex ensures control of the widest possible range of parameters of metro infrastructure facilities: track, tunnels, railway automation devices, telemechanics, contact network and radio communication, and also monitors the environmental situation. Due to the synergistic effect of complex diagnostics, its information content is significantly increased, which allows to increase the level of safety and reliability of the infrastructure, reduce the costs of its maintenance.

Multifunctionality of systems and measuring instruments is now a global trend in the development of diagnostics.

INFOTRANS, by order of the German Railways (Deutsche Bahn - DB) for their new diagnostic train Miss-DVT, developed and supplied an innovative contactless system "MIBIS", which has been successfully used for several years. A distinctive feature of the MIBIS system is the ability to perform high-precision control of the track and rail geometry in the entire range of operating speeds, including low speeds, practically from zero. INFOTRANS has now begun equipping the second Miss-DVT diagnostic train with the well-proven MIBIS system.

In 2015, our company won the international tender of the Swiss Federal Railways (SBB) to create a multifunctional diagnostic complex (project gDFZ) in tough competition with foreign companies - leaders in the field of railway diagnostics. Currently, the international project to create a diagnostic train for the Swiss Federal Railways with a wide range of measuring systems for monitoring the condition of technical infrastructure facilities is nearing completion. In this project, INFOTRANS acts as a project integrator and manufacturer of control and measuring systems. To implement the project, an international cooperation was formed, which included companies from Germany, Switzerland and Italy.

LITERATURES

1. Тенденции мировой диагностики // Издательский центр транспортной газеты «Евразия Вести», 2017 г. VIII.
2. Лесов, К., Таджибаев, Ш., Мавланов, А., & Кенжалиев, М. (2021). Расчет устойчивости насыпи и укрепление откосов земляного полотна с использованием геосинтетических материалов. *Транспорт шелкового пути*, (1), 78-83. Лесов, К., Таджибаев, Ш., Мавланов, А., & Кенжалиев, М. (2021). Расчет устойчивости насыпи и укрепление откосов земляного полотна с использованием геосинтетических материалов. *Транспорт шелкового пути*, (1), 78-83.
3. Лесов, К. С., Таджибаев, Ш. А., & Кенжалиев, М. К. У. (2022). ПОВЫШЕНИЯ УСТОЙЧИВОСТИ ОТКОСОВ НАСЫПИ ЗЕМЛЯНОГО ПОЛОТНА С ПРИМЕНЕНИЕМ ОБЪЕМНЫХ ГЕОРЕШЕТОК. *Central Asian Research Journal for Interdisciplinary Studies (CARJIS)*, *2*(10), 229-236.
4. ЛЕСОВ, К., ТАДЖИБАЕВ, Ш., МАВЛАНОВ, А., & КЕНЖАЛИЕВ, М. ТРАНСПОРТ ШЁЛКОВОГО ПУТИ. *ТРАНСПОРТ ШЁЛКОВОГО ПУТИ Учредители: ННО" Научно-исследовательский информатизационный центр"*, (1), 78-83.
5. Лесов, К. С., Таджибаев, Ш. А., & угли Кенжалиев, М. К. (2023, May). ПРОТИВОЭРОЗИОННАЯ ЗАЩИТА ЗЕМЛЯНЫХ СООРУЖЕНИЙ НА УЧАСТКЕ ЖЕЛЕЗНОДОРОЖНОЙ ЛИНИИ БУХАРА–МИСКЕН. In *International Conference" Technical and technological sciences in the modern world"*. (Vol. 1, No. 1, pp. 34-37).
6. Лесов, К. С., Таджибаев, Ш. А., Кенжалиев, М. К. У., & Мирханова, М. М. (2022). ТЕХНИКО-ЭКОНОМИЧЕСКАЯ ОЦЕНКА ЭФФЕКТИВНОСТИ УКРЕПЛЕНИЯ И ПОВЫШЕНИЯ УСТОЙЧИВОСТИ ОТКОСОВ ЗЕМЛЯНОГО ПОЛОТНА. *Universum: технические науки*, (11-3 (104)), 39-42.
7. Лесов, К. С., & Таджибаев, Ш. А. (2022). ИССЛЕДОВАНИЕ УСТОЙЧИВОСТИ ОТКОСОВ ЗЕМЛЯНОГО ПОЛОТНА ЖЕЛЕЗНЫХ ДОРОГ ПРИ УКРЕПЛЕНИИ ГЕОСИНТЕТИЧЕСКИМИ МАТЕРИАЛАМИ. *Universum: технические науки*, (8-1 (101)), 57-61.
8. Таджибаев Шерзод Амиркулович (2023). ИССЛЕДОВАНИЕ УСТОЙЧИВОСТИ ОТКОСОВ НАСЫПИ ЗЕМЛЯНОГО ПОЛОТНА ПРИ УКРЕПЛЕНИИ ОБЪЕМНЫХ ГЕОРЕШЕТОК. Universum: технические науки, (9-3 (114)), 5-9.
9. Saginovich, Lesov Kuvandik, and Tadjibayev Sherzod Amirkulovich. "Calculation of the reserve coefficient of local stability of the slopes of the roadbed reinforced with a volumetric geogrid." *ACADEMICIA: An International Multidisciplinary Research Journal* 11.11 (2021): 115-120.

ANTIOXIDANT CAPACITY OF SERUM IN PATIENTS WITH CHRONIC VIRAL HEPATITIS C ON THE BACKGROUND OF CHRONIC RENAL FAILURE

Aripkhodzhaeva F.A.

ALFAGRANUS University, Tashkent, Uzbekistan

Introduction. As you know, the main line of defense against the aggressive action of free radicals is the human antioxidant system. Suppression of the activity of the antioxidant system can lead to excessive accumulation of reactive oxygen species and cell destruction. This, in turn, leads to an unfavorable course of diseases in the pathogenesis of which the state of the antioxidant system is of great importance.

The purpose of our work is to study the state of serum antioxidant capacity in patients with chronic viral hepatitis C on the background of chronic renal failure.

Materials and methods. 98 patients with chronic renal failure undergoing programmed hemodialysis were examined.between the ages of 20 and 60 and 20 practically healthy people with no markers of hepatitis. The control group consisted of 20 practically healthy people with no markers of hepatitis. In the patients of the studied groups, the indicators of antioxidant protection of blood serum were evaluated: total antioxidant capacity (AOS), a test system manufactured by Cayman Chemical, in millimolar equivalents by photometric method.

Research results. We studied the degree of endogenous intoxication and the overall antioxidant capacity of 32 patients with chronic kidney disease (main group), 36 patients with chronic kidney disease without underlying diseases (control group I) and 30 patients with chronic kidney disease without concomitant diseases (control group II). Studies have established an increase in serum SMP in patients of the main group (36.8±0.21 cu; healthy subjects (9.79±0.09 u/e) $p<0.05$ compared with the indicators of the I and II control groups (14.02±0.28 u/e, 27.3±0.20 u/e, respectively), which showed the greatest severity of endogenous intoxication in patients of the main group. The study of AOS in the blood of patients (study groups) showed a significant decrease ($p<0.05$) in AOS in patients with HCV without background diseases and HCV on the background of CRF (0.078±0.004 mmol/l, 0.061±0.008 mmol/l, respectively), compared with the indicators of healthy and patients with CRF without concomitant diseases (0.380±0.059 mmol/l, 0.096±0.005 mmol/L; respectively).

Conclusion. Chronic viral hepatitis C on the background of CRF is manifested by a decrease in AOS and the severity of endogenous intoxication, which is the basis for the introduction of antioxidant protection agents into pathogenetic therapy.

Literature

1. Афанасьев И.Б. Свободные радикалы в биомедицине. М.: Наука, 1989. 152 с.

2. Гриневич В.В., Пашков А.Н. Состояние антиоксидантной защиты при хронической почечной недостаточности. Нефрология, 2003, № 4.

3. Sies H. Oxidative stress: oxidants and antioxidants. Experimental Physiology, 1997, 82(2), 291-295.

4. Halliwell B., Gutteridge J.M. Free Radicals in Biology and Medicine. Oxford University Press, 2015.

5. Valko M., Leibfritz D., Moncol J., Cronin M.T., Mazur M., Telser J. Free radicals and antioxidants in normal physiological functions and human disease. The International Journal of Biochemistry & Cell Biology, 2007, 39(1), 44-84.

TABLE OF CONTENTS