МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

ПРИДНІПРОВСЬКА ДЕРЖАВНА АКАДЕМІЯ
БУДІВНИЦТВА ТА АРХІТЕКТУРИ

КАФЕДРА ІНОЗЕМНИХ МОВ

НАУКА І ТЕХНІКА: ПЕРСПЕКТИВИ XXI СТОЛІТТЯ

SCIENCE AND TECHNOLOGY: PERSPECTIVES OF THE XXI CENTURY

SCIENCE ET TECHNIQUE: PERSPECTIVES DU XXI SIÈCLE

МАТЕРІАЛИ II ДИСТАНЦІЙНОЇ НАУКОВО-ПРАКТИЧНОЇ КОНФЕРЕНЦІЇ
СТУДЕНТІВ І МОЛОДИХ ВЧЕНИХ

ДНІПРО
2024

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Матеріали

II дистанційної науково-практичної конференції студентів і молодих вчених
англійською та французькою мовами.

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Матеріали дистанційної науково-практичної конференції студентів і молодих вчених «Наука і техніка: перспективи XXI століття» (Дніпро, 4 квітня 2024 р.). Дніпро. ПДАБА, 2024. – 209 с.

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О.В. Саєнко, провідний фахівець кафедри іноземних мов

У збірнику матеріалів дистанційної науково-практичної конференції студентів і молодих вчених розглядаються питання будівництва та архітектури, матеріалознавства та машинобудування, людини та довкілля, охорони праці, економіки, новітніх тенденцій в розвитку науки і техніки, лінгвістики та методики викладання іноземних мов. Робочі мови конференції – англійська, французька.

Для викладачів, вчених, аспірантів, магістрів, студентів технічних та гуманітарних факультетів, а також для широкого кола читачів, які цікавляться динамічними змінами, які відбуваються у сучасному світі.

Затверджено на засіданні кафедри іноземних мов ПДАБА (протокол № 8 від 26.03.2024).

БУДІВНИЦТВО

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ENERGY EFFICIENCY IMPROVEMENT OF RESIDENTIAL AND PUBLIC BUILDINGS

Wall insulation is one of the most effective ways to reduce heat loss. But even there are reasons that can significantly reduce the effectiveness of using this technology. Modern insulating facade surfaces usually consist of polystyrene foam or mineral wool. Both the first and the second material have individual features that affect the scope of their application [1, 2].

Mineral wool, used to insulate enclosing structures, is a material with increased resistance to high temperatures, with excellent sound insulation properties, and good vapor permeability. It should be taken into account that the fire resistance of different grades of mineral wool is different. The use of combustible polymeric materials as binders in some of them, which support the burning process, defines their flammability groups as G1 and G2 - low and moderate. The obvious disadvantages of mineral wool are its hygroscopicity (moisture accumulates in it later) and significant weight compared to polystyrene foam. In addition, insulation of the external walls of the building with mineral wool requires special qualifications from employees, and accordingly, is time-consuming [2].

Styrofoam plates look more preferable compared to mineral wool. They are light, waterproof and have good thermal insulation performance. In addition, it is very simple and easy to work with them, which positively affects the quality and time of work. But the disadvantages of foam plastic are significant. The first is its flammability. In this regard, insulation of the facades of multi-story buildings with foam plates is allowed only up to the 9th floor. In accordance with the technological requirements, the installation of such plates requires additional processing of window and door openings, as well as the device of safety belts made of non-combustible heat-insulating materials every three floors. The material for thermal insulation of facades should also be chosen very carefully, because instead of the necessary material with flammability group G1 and G2 with moderate or high density, packaging foam can be used, which is less dense and has flammability G3 or G4 - medium or high [2].

To preserve heat-insulating properties in any insulation, certain requirements [3] should be met, where the value of the minimum permissible value of heat transfer resistance for the outer walls of the II temperature zone of the building area is defined as 4,0 m^2 ·K/W. In other words, if there are brick walls in the room and their thickness is about 52 cm, then the insulation layer - foam or mineral wool - should be at least 16 cm. For panel walls with a thickness of 30 cm, the insulation layer is chosen at least 18 cm.

REFERENCES

1. V.T. Semenova, I.E. Lynnyk Praktyka innovatsiynykh rozrobok u sferi terytorial′no-prostorovoho rozvytku mist i rehioniv: monohrafiya / pid zah. red. Kharkiv. nats.. un-t mis′k. hosp-va im. O.M. Beketova. Kharkiv: KHNUMH i. O.M. Beketova, 2016. 300 p. (in Ukrainian)

2. Provedennya pokazovoyi kompleksnoyi renovatsiya budivli Minrehionu [Elektronnyy resurs] URL: https://eeplatform.org.ua/prezentaciyi/provedennya-pokazovoyi-kompleksnoyi-renovaciya-budivli-minregionu/

3. DBN V.2.6-31:2021 Heat insulation and energy-efficiency of buildings.

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RESTORATION AND STRENGTHENING OF BEARING BRICK COLUMNS USING TM MAPEI MATERIALS

Today, many industrial and civil objects of Ukraine have damaged load-bearing structures, which make their safe and project operation impossible. The main reasons for this can be conditionally as follows:

-the life span of a lot of buildings, built in times of the Soviet Union, have already completed;
-buildings did not operate for a long time and receive any proper maintenance and repair, which caused their destruction;
-buildings were damaged as a result of hostilities or being hit by missiles.
-a combination of all the above-mentioned factors.

All this leads to the emergency stop of the technological process, long-term repair and restoration works and repeated, rather expensive, production start-up.

The purpose of the study is to provide the technology for performing repair and restoration works of brick structures using modern technological solutions and materials, in order to achieve the optimal result in terms of quality, speed of work, cost and warranty period of operation of the restored structure.

Restoration of load-bearing structures should be carried out only after identifying the cause of destruction and determining the current state of the structures by conducting an examination of their current state, bearing capacity, and, if necessary, diagnostic laboratory analysis. Only this approach makes it possible to ensure the correct selection of materials and technology for the repair, restoration and strengthening of structures, which allows ensuring durability and their integrity after carrying out repair and restoration works.

Restoration of brick structures is carried out in several stages:

- surface preparation [5];
- base consolidation;
- repair of cracks, peeling areas and missing elements of the masonry;
- strengthening of structures using Mapei FRG System composite materials;
- equipment of the restored structure.

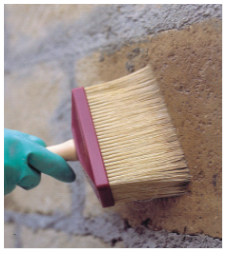
According to the CNR DT 200/2004 norm, before starting the restoration process, brick structures must be cleaned of dirt, mold, salts and other contaminants that impair the adhesion of repair solutions to the base.

In the second stage, it is necessary to consolidate the base by saturating it with a deep penetration primer that strengthens the base, reduces its absorption capacity and improves the adhesion of subsequent repair layers.

After that, cracks in the masonry are repaired, includeing the following stages:

1.Filling the opening of the crack with solution from one or both sides of the structure to prevent the injection solution from leaking out of the crack.

2.Injection of high-flow cement-based mortar (or pozzolana-based for historic buildings).

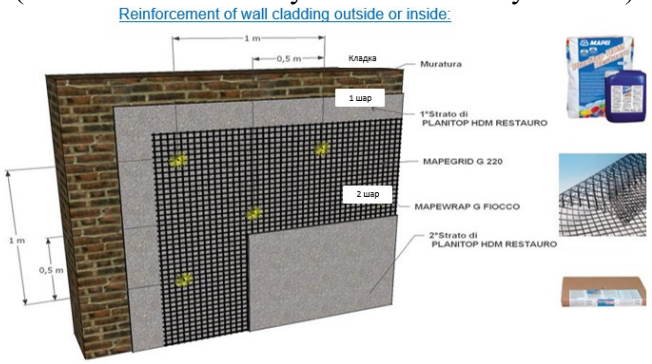


Pic 1. Consolidation of the base

Pic 2.Technology of crack repair and injection.

3. If necessary, perform the technology of "stitching" the crack using the "dry" or "wet" method.
4. Filling and repair of process holes after performing the above-mentioned types of work.

Reinforcement of the brick structure is carried out after restoring its integrity, meeting the requirements for roughness, shape, rounding of corners and other requirements for the base. Amplification is performed by MAPEI FRG System [1, 6] technology which is made of a two-component cement mortar - Planitop HDM Maxiand Mapegrid G120 alkali-resistant glass fiber mesh that is immersed in the mass of the mortar. This system has shown its effectiveness during laboratory tests on strengthening brick columns (conducted in Lviv Polytechnic University in 2018) and in practice.



Pic 3. Scheme of MAPEI FRG amplification system [3,4, 6]

The installation of this reinforcement system does not require any special equipment and mechanisms, the additional weight of the reinforcement system is 21 kg per 1 sq.m. surface, while "cold bridges" are not formed, which has a positive effect on the energy efficiency of the building as a whole.

Conclusion. The use of modern technical solutions using Mapei FRP System and Mapei FRG System composite materials allows to performing repair and restoration works:

-in the shortest time;

-minimum additional load of structures (the weight of the system is approximately 21 kg/sq.m.)

-without any large-sized equipment and lifting mechanisms;

-without additional "bridges" of cold, without disturbing the thermal insulation of the building;

-the linear expansion of the materials of the reinforcement system is similar to the linear expansion of the structure itself, due to which the system works simultaneously with the base and does not require additional anchoring;

-unlike repair work during sheathing with steel plates, there is no corrosion problem when applying the reinforcement system;

-the system meets the requirements of CNR DT 200/2004: 'Instructions for the design, implementation and control of stationary reinforcement systems using fiber-reinforced composites'.

REFERENCES

1.Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening ExistingStructures.URL:https://www.cnr.it/sites/default/files/public/media/norme_tecniche_costruzioni/GuidelinesCNR_DT200_2004.pdf

2.Experimental Study of Compressed Ceramic Hollow Brick Masonry Structures Strengthening with GFRP Meshes. In Serhiy Bula and Mariana Kholod. Lviv National University.

3.Bula S., Kholod P., Bogdan S., Sadlovska M. I., 2018 Strengthening Of Subjected To Fire Masonry Structures With Gfrp Mashes (Tm "Mapei")

4.Копейка А. Е., Бондаренко Ю. В., Сушко Е. Н. "Досвід використання склопластиків для відновлення кам'яних конструкцій". Науковий вісник будівництва. Вип. 23. Харків: ХДТУБА, ХОТВ АБУ, 2003. С. 161–165.

5. ДБН В.2.6-162:2010. “Конструкції будинків і споруд. Кам’яні та армокам’яні конструкції. Основні положення”. Чинний від 09.01.2011. Київ: МінрегіонбудУкраїни, 2011. 94 с.

6. С. С. Була, П. Ф. Холод, С. М. Богдан, М. І. Садловська Підсилення GFRP сітками (Тм “Марei”) цегляних конструкцій, що зазнали вогневого впливую Національний університет “Львівська політехніка”.

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ANALYSIS OF 3D PRINTING TECHNOLOGIES IN THE CONSTRUCTION OF COMMERCIAL FACILITIES

3D printing technologies have gained significant attention in the construction industry due to their potential to revolutionize the way buildings are designed and constructed. By using additive manufacturing techniques, 3D printing can offer advantages such as reduced costs, decreased construction time, and minimized environmental impact. Here is an analysis of the available information on 3D printing technologies in the construction of commercial facilities:

According to a systematic literature review conducted by Ali et al., 3D printing technologies have been extensively studied in architectural design and construction. The review identified various research topics, including printing techniques analysis, material analysis, control system, data analysis, architectural design, literature review, concept analysis, and cost-benefit analysis [1].

One promising 3D printing technique mentioned in the literature is Contour Crafting. It has the potential to revolutionize the construction industry by offering almost unlimited possibilities for geometric complexity realizations. Contour Crafting has been associated with numerous advantages, such as cost reduction, time savings, environmental pollution reduction, and improved safety on construction sites [2].

The application of 3D printing in construction has also been investigated in terms of its efficiency and feasibility. Researchers have studied different types of 3D printers, materials, and construction procedures to advance this technique. For example, Bos et al. described the development of additive manufacturing of concrete and presented the 3D concrete printing facility at the Eindhoven University of Technology [1].

However, despite the potential benefits and advancements in 3D printing technology, its adoption in commercial construction has been limited. Building codes and regulations have been identified as a significant barrier to the widespread implementation of 3D printing in nonresidential construction. Incorporating new technologies and building innovations into existing building codes takes time, which slows down the adoption process [3].

In conclusion, 3D printing technologies have shown great potential in the construction industry, particularly in the design and construction of commercial facilities. The use of additive manufacturing techniques, such as Contour Crafting, can offer advantages such as cost reduction, time savings, and improved safety. However, the adoption of 3D printing in commercial construction is hindered by existing building codes and regulations. Further research and collaboration between industry stakeholders and regulatory bodies are needed to overcome these barriers and fully realize the benefits of 3D printing in the construction sector.

REFERENCES

1.3D Printing Technologies in Architectural Design and Construction: A Systematic Literature Review / M. Žujović та ін. // MDPI (Architectural Design, Urban Science, and Real Estate). 2022. № 12 (9). C.1319 URL: https://www.mdpi.com/2075-5309/12/9/1319

2.Hager I., Golonka A., Putanowicz R. 3D Printing of Buildings and Building Components as the Future of Sustainable Construction? // Procedia Engineering. 2016. № 151. С.292-299 URL: https://www.sciencedirect.com/science/article/pii/S1877705816317453

3.Allouzi R., Al-Azhari W., Allouzi R. Conventional Construction and 3D Printing: A Comparison Study on Material Cost in Jordan // Hindawi. 2020. URL: https://www.hindawi.com/journals/je/2020/1424682/

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SUSTAINABLE MATERIALS IN CONSTRUCTION IN THE 21ST CENTURY

Sustainable materials in construction have gained significant attention in the 21st century due to the need for environmentally friendly and resource-efficient building practices. These materials aim to reduce the environmental impact of construction, conserve natural resources, minimize waste, and promote energy efficiency. Here are some key sustainable materials that have revolutionized home construction:

Straw bale construction is an ancient technique that has been updated for the 21st century. Straw bales, made from agricultural waste, serve as a substitute for lumber and have excellent insulation properties. Despite their thickness, straw bale homes are resistant to fire and can provide a high R-value for energy efficiency [1].

Bamboo is considered one of the best eco-friendly building materials. It is a fast-growing plant with a high self-generation rate, making it a sustainable alternative to traditional timber. Bamboo is lightweight, strong, and flexible, making it suitable for various construction applications [2].

Biocomposites are materials made from natural fibers, such as hemp, flax, or jute, combined with a matrix material, often a bio-based polymer. These materials offer a sustainable alternative to conventional composites and can be used in various construction applications.

Earth bricks and adobe are sustainable materials made from a mixture of earth, clay, straw, and other organic materials. These materials have been used for centuries and provide excellent thermal properties. They are cheap, easily available, and environmentally friendly [3].

Using recycled steel in construction helps reduce the demand for virgin steel production, which has a significant environmental impact. Recycled steel retains its strength and durability and can be used in various structural applications.

Hempcrete is a sustainable construction material made from the stalks of the hemp plant, lime, and water. It offers excellent insulation properties, is fire-resistant, and has a low carbon footprint. Hempcrete is increasingly being used in building homes and other structures [4].

These sustainable materials offer numerous benefits, including reduced environmental impact, improved energy efficiency, and the conservation of natural resources. Incorporating these materials into construction practices can contribute to a greener and more sustainable future.

It should be noted that the search results provided valuable insights into the topic of sustainable materials in construction. However, for a more comprehensive understanding, it is recommended to consult additional sources.

REFERENCES

1.Elemental Green. 10 Eco Building Materials Revolutionizing Home Construction. Elemental Green. 2022. URL: https://en.wikipedia.org/wiki/Trade_and_development

2.Rinkesh . 17+ Sustainable and Green Building Construction Materials. Conserve energy future. 2021. URL: https://www.conserve-energy-future.com/sustainable-construction-materials.php

3.Sahni E. 10 Sustainable Materials Every Architect Must Know. Rethinking the future. 2022. URL: https://www.re-thinkingthefuture.com/rtf-fresh-perspectives/a1322-10-sustainable-materials-every-architect-must-know/

4.BigRentz. 20 Sustainable Building Materials for a Greener Future. BigRentz. 2023. URL: https://www.bigrentz.com/blog/sustainable-construction

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BENEFITS OF USING TREATED WATER IN CIVIL ENGINEERING

Today, water is at the centre of economic and social development, and its role is important in many areas of life. It is a precious and scarce resource that needs to be conserved and reused as much as possible. However, most of the water used for domestic and industrial purposes ends up as wastewater, which is often released into the environment without proper treatment. As humanity pays more and more attention to environmental issues and sustainable development, the use of treated water in civil engineering is becoming increasingly important. Purified water obtained from renewable sources or after wastewater treatment has a number of advantages that should be taken into account when planning and implementing construction projects. [1]

Therefore, let us consider the main advantages to understand the importance of the water purification process as one of the factors that will preserve the planet's water resources. The main idea of this process is to conserve freshwater resources. This will be most relevant in regions with limited or nonexistent water supply networks. Additionally, the use of purified water contributes to the reduction of emissions and environmental pollution. Instead of discharging wastewater directly into rivers or oceans, purified water can be reused for irrigation, road cleaning, or other industrial purposes. It should be noted that the use of purified water helps to reduce expenses for water supply and wastewater services. Instead of using precious freshwater from municipal water supply systems, construction projects can utilize purified water, which is advantageous from a financial standpoint. [4]

Concrete is one of the most common materials in the construction industry, but it also consumes a lot of water during its production and application. According to some estimates, approximately 150 liters of water are required to produce one cubic meter of concrete. Additionally, concrete curing requires constant surface moisture for several days to ensure its strength and durability. This can result in a significant amount of water consumption and wastage in the construction sector. [1]

Several studies have shown that treated wastewater can be used as a substitute for potable water in concrete production, without affecting its workability, compressive strength, or durability. Moreover, using treated wastewater can also reduce the cement content and improve the sustainability of concrete. Compared to conventional tap water, the incorporation of recycled water enhances the consistency and workability of reclaimed water concrete by 12–14%, and it increases concrete viscosity by 11% and yield stress by 25%. [1]

Having considered the benefits of using purified water, a logical question arises: "What is the best method of water purification?"

Reverse osmosis (RO) is a water purification technology that has gained widespread attention due to its effectiveness in removing impurities from water. In an RO system, water is forced through a semi-permeable membrane, which allows only water molecules to pass through while blocking contaminants such as salts, minerals, and other particles. This process produces clean, purified water suitable for various applications. One of the primary advantages of reverse osmosis is its ability to remove a wide range of impurities from water, including bacteria, viruses, heavy metals, and dissolved solids. As a result, RO systems are commonly used in residential, commercial, and industrial settings to provide clean

and safe drinking water. In residential applications, RO systems are often installed under the sink or connected to the household water supply to provide purified water for drinking and cooking. These systems typically consist of multiple filtration stages, including pre-filters to remove sediment and activated carbon filters to remove chlorine and other organic compounds, followed by the RO membrane for final purification. In commercial and industrial settings, RO systems are used for various purposes, including desalination of seawater, production of ultrapure water for pharmaceutical and electronics manufacturing, and treatment of wastewater for reuse or disposal. Despite its effectiveness, the use of reverse osmosis systems has some environmental implications. RO systems require energy to operate, and the production of purified water generates a significant amount of wastewater, known as brine, which contains concentrated levels of contaminants removed from the water. Proper disposal of brine is essential to minimize its environmental impact. [2, 3]

In conclusion, the advantages of using purified water in civil construction are manifold and significant. Firstly, purified water helps preserve freshwater resources, especially in regions with limited or absent municipal water supplies. Secondly, it contributes to environmental conservation by reducing wastewater discharge and pollution. Furthermore, it promotes sustainable construction practices by minimizing the environmental footprint associated with water consumption. Overall, incorporating purified water into civil construction projects offers numerous benefits for both the environment and the economy, making it a valuable investment for the future of sustainable development. In terms of purification, reverse osmosis systems offer an efficient and reliable solution for water purification, providing clean and safe drinking water for residential, commercial, and industrial applications. However, it is essential to consider the environmental consequences and implement proper management practices to ensure sustainable use of this technology.

REFERENCES

1. Chen, L., Chen, Z., Liu, Y. et al. Benefits and limitations of recycled water systems in the building sector: a review. Environ Chem Lett 22, 785–814 (2024).

2.Moslehyani A., Goh P.S. Membrane Separation Principles and Applications. Elsevier; Amsterdam, The Netherlands: 2019. Recent Progresses of Ultrafiltration (UF) Membranes and Processes in Water Treatment; pp. 85–110.

3. Puretetec Industrial Water | Deionized Water Services and Reverse Osmosis Systems.
URL: https://puretecwater.com/reverse-osmosis/what-is-reverse-osmosis

4. Shetty P. The Hidden Power of Treated Water: Fueling Construction and Domestic Activities using MBR STP like Huliot Clear Black STP [Електронний ресурс] / Prasanna Shetty. 2023.
URL: https://www.linkedin.com/pulse/hidden-power-treated-water-fueling-construction-domestic-shetty.

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ASSESSMENT OF THE EFFECTIVENESS OF TRENCH FASTENING USE WHEN PERFORMING CONSTRUCTION AND RECONSTRUCTION WORKS

The growth of civil and industrial construction in Ukraine depends not least on the works completed in advance to provide water supply and drainage to construction sites. For the construction and reconstruction of water management networks and hydrotechnical structures it is necessary to use safe and cost-effective methods, taking into account all possible requirements for environmental protection.

One of these methods is the use of trench fastening. Trench fastening is a process of ensuring the stability of deep trenches, which is used in the world's practice of construction, urban planning, road construction and other industries. Trench fastening can be effective when laying pipelines and building hydraulic structures in dense urban areas [1].

The advantages of trench fastening include the reduced environmental impact during construction, high efficiency, safety and cost-effectiveness. Another important advantage is that the use of this technology requires less space. Of course, this method also has disadvantages, which should be taken into account when designing and using this technology in specific conditions.

Let's consider the main stages of using trench fastening:

1. Preparatory stage: determining the expediency of using trench fastening based on such parameters as the size of the trench, the depth and nature of the soil, the presence of groundwater, and the saturation of the construction site with communications. Under favorable conditions, trench anchoring is more efficient than other methods because it allows you to reduce the time to perform the work, to minimize the volume of soil moved and to reduce the number of problems with blocking streets and roads;

2. Arrangement of the construction site works: organization of their safe execution, carrying out work on the installation of fastenings in the trench;

3. Operational stage: ensuring safety during work in the trench space using fastenings in accordance with the requirements of occupational health and safety rules, project documentation, and regulatory documents on environmental protection;

4. Dismantling of fastenings after completion of work in the trench.

These stages may vary depending on the conditions and the nature of the work, but in general, they are standard for the use of trench fastening in an urban environment.

The disadvantages of using this method are the need for additional research and detailed planning, which may take additional time and resources. The presence of restrictions can also be considered as disadvantage: in connection with dense construction trench fastening may have restrictions on the availability of space and depth, which can limit the possibilities for performing works on laying pipelines and installing hydraulic structures.

Thus, it is proposed to study the world experience of using and implementing the technology of trench fastening during the design and execution of works on the construction and reconstruction of hydraulic structures in the conditions of dense urban development. This allows us to significantly reduce the time and cost of these works. Using the example of the reconstruction of the storm sewer section during the reconstruction of Sobornosti Avenue in Kyiv, the effectiveness and universality of this method had been proven in practice, because it was not only the process of laying a new pipeline with an internal diameter of 1200 mm, but it was also the process of dismantling the old one with an internal diameter of 900 mm. Also, the use of trench fastening by LTW-VERBAU allowed it to complete the technical task in record time (700 meters of rain collector were installed in 50 days). The work was carried out in rather difficult conditions and there were intersections with various communications, cable routes and pipelines. But thanks to the versatility of the equipment and its ease of use, the reconstruction period was reduced by approximately 1.5 times.

Taking into account all of the above, the following conclusions can be drawn:

Trench fastening is an effective way to ensure the stability of deep trenches in the construction and reconstruction of hydraulic structures;

The use of trench fastening allows to reduce the risk of emergency situations and increases the safety of workers on the construction site;

Trench fastening helps to reduce the time of work and the costs of their implementation, which makes it economically beneficial;

The use of trench fastening allows to maintain the stability of soil and to prevent damage to neighboring structures during construction work;

Trench fastening can be used in any conditions, including work in water and in the polluted areas.

In connection with the increase in the volume of construction works and reconstruction of hydraulic structures, the use of trench fastening is becoming increasingly relevant and necessary to ensure the safety and the efficiency of work.

REFERENCES

1.N. M. Zolotova. Outline of lectures from the course "Organization and technology of construction works". Kharkiv: XNUMX, 2018. 74 p.

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HOUSING STOCK

Residential buildings, as well as residential premises in other buildings located on the territory of Ukraine, form the housing fund of our state according to Article 4 of the Housing Code [2].

Housing stock is a set of all residential premises, regardless of the form of ownership, including residential buildings, specialized buildings (dormitories, shelter hotels, houses of maneuvering fund, residential premises from the housing fund for temporary settlement of citizens, special homes for lonely elderly people, boarding houses for disabled people, veterans, and others), apartments, service living quarters, and other residential premises in other buildings suitable for living [3].

The housing stock is a complicated engineering complex, which consists of residential buildings, water supply and sewerage systems, heat and power equipment. It includes automatic means of control and operation, various communication networks, fire-fighting, elevator, sanitary and other equipment.

Categories of housing stock by purpose are as follows:

1.General purpose housing stock is a set of housing of all forms of ownership, intended for the residence of citizens;

2.The social housing stock is housing intended for the residence of citizens in need of social protection. This category of citizens includes disabled people, veterans, single elderly citizens. They are provided with housing in nursing homes;

3.Special purpose housing stock includes serving housing which is provided for employees of enterprises, institutions and organizations and for citizens who, by the nature of their labor relations, must live at or near their place of work. Workers, employees, students, pupils, as well as other citizens are provided with dormitories for an appropriate period. Places in boarding schools are given to disabled people, veterans, lonely elderly citizens. The special purpose fund includes flexible housing stock for temporary residence of displaced citizens and shelter hotels for refugees, homeless and internally displaced persons. The special purpose housing stock is formed by constructing apartments of new buildings, reconstructing existing houses and apartments of other categories of housing stock, reconstructing non-residential buildings and by including them in the housing stock, as well as by transferring one housing stock to the fund of another purpose.

The housing stock of Ukraine includes the following types of buildings:

1)residential buildings are the buildings that are intended for human habitation, have one or more apartments, as well as all necessary auxiliary premises.

Residential buildings are characterized as buildings with such features as:

• compliance of buildings with architectural, construction, sanitary, hygienic, fire and other norms and standards, which makes these buildings suitable for permanent residence of citizens;

• acceptance of buildings by designers and specialists of the completed building that meets the specified conditions;

• registration of building as residential by local governments.

It is necessary to distinguish auxiliary rooms premises and utility rooms of residential building.

Auxiliary rooms in residential buildings are rooms for the provision and maintenance of the house, and for consumer services for the population at the place of residence (lobby, staircase, transition gateway, inter-apartment corridor, wheelchair, basements, attics, etc.);

2) apartments are parts of residential buildings for single persons or for one or more families with comfortable living rooms, utility rooms, a separate exit to the staircase, gallery, corridor or street;

3) part of an apartment (single-family house) is a living room in an apartment (single-apartment house), which is suitable for permanent residence of a single person or family, and utility rooms of an apartment (one-room house) [1,3].

Utility rooms are kitchen, bathroom or shower room, toilet, apartment corridor or hallway, storage rooms or closets built into the apartment. They cannot be the subject of a separate lease agreement.

The above mentioned information provides a classification of the housing stock of Ukraine in accordance with the current legislation in the field of real estate. Each category of the housing stock category is given a concise definition.

REFERENCES

1. Державні будівельні норми України. Будинки і споруди. Житлові будинки. Основні положення ДБН В.2.2-15-2005, затверджені Наказом Держбуду України від 18 травня 2005 р. № 80 (v0080509-05), набрали чинності з 1 січня 2006 р. згідно з наказом Держбуду України від 28 вересня 2005 р. № 175.

2. Цивільний кодекс України від 16.01.2003 р. / Відомості Верх. Ради України. 2003 р. № 40 – 44. с. 356.

3. Сліпченко, С.О. Житлове право України : Наук. - практ. посібник / Сліпченко, Є.О. Мічурін, О.В. Соболєв. Х. : Еспада, 2013. 344 с.

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A RISE OF CONSTRUCTION EFFICACY BASED ON SMART APPROACH TO ACTIVITY ANALYSIS OF WORKERS

It is common knowledge that workers activity on the building site is very important because directly influences general efficacy of any construction. Irrational workers' behavior and time spending can lead to low production, discrepancies in project's schedule, constructional defects, extra expenses etc. That is exactly the point why workers' activity monitoring is so important for managers who can estimate labor efficacy better and construction progress with it. However, activity analysis of workers is mostly carried out by using method of manual observation nowadays, which is time-consuming, labor-intensive and expensive. And the reliability of such observation is under the question. The researchers have developed various automatic technologies to monitor construction sites basing on mentioned issues. They have come to nonvisual and visual methods of workers' activity analysis. [1]

Nonvisual methods are based on electronic sensors that continuously collect workers' speed, acceleration, direction etc. to classify the activities by using the global positioning system (GPS), inertial measurement unit (IMU) system, radio-frequency identification (RFID) system, and ultrawideband (UWB) system. [2-4] One of key advantages of this methods is that we can very simply identify each construction worker and his activity during working day. However we need him to wear these sensors what may cause negative reaction beside affect conventional working process.

When it comes to visual methods these systems can analyze construction progress onsite by using computer algorithms which can process camera data (pictures and videos), extract the contour map of the humans and obtain key point data about the workers' activity. (Fig. 1.)

The general scheme how it works is shown on a framework below.

Pose estimation network is used to obtain human key point information from the video. Then the multiperson tracking algorithm is adopted and the boundary frame of workers is extracted by using the key points to complete the extraction of motion and appearance information, thus effectively tracking workers and key points. Eventually multilayer fully connected neural networks and stacked long short-term memory are designed to classify the key point information of each worker, complete action recognition, and analyze the construction efficiency. [1]

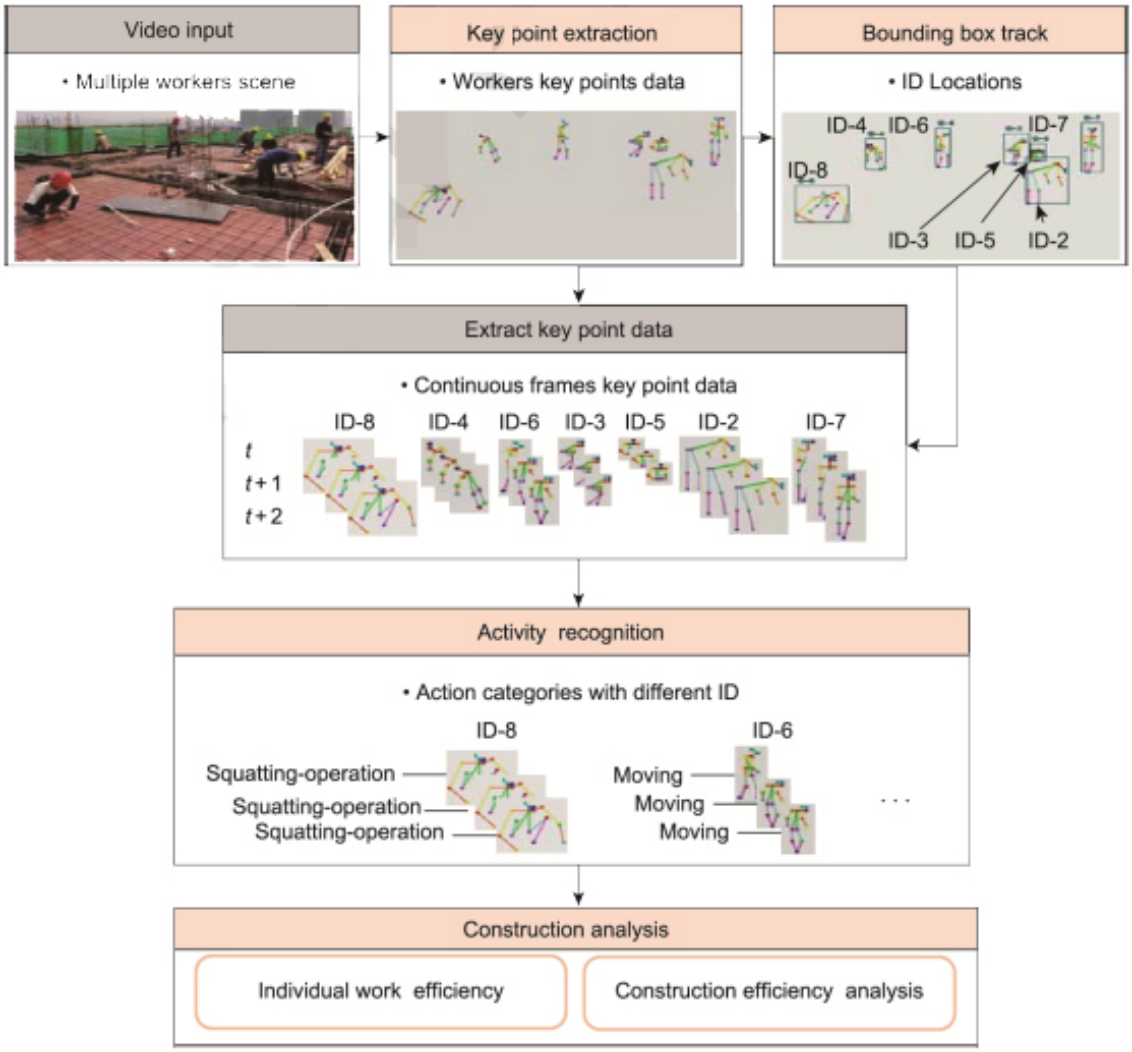

Figure 1. The framework of multiple worker construction actions and working efficiency recognition.

Developed systems of control and monitoring of worker's activity analysis mentioned above are not perfect in comparison with chronometry. However they are very perspective and may bring significant economic effect. Such a smart approach to onsite construction process control allows to monitor workers' activitywithout psychological discomfort insuring quality and motivation of the working process.

REFERENCES

1. Construction Activity Analysis of Workers Based on Human Posture Estimation Information Xuhong Zhou, Shuai Li, Jiepeng Liu, Zhou Wu, Yohchia Frank Chen
2. Slaton T, Hernandez C, Akhavian R. Construction activity recognition with convolutional recurrent networks. Autom Constr 2020;113:103138.
3. Kelm A, Laußat L, Meins-Becker A, Platz D, Khazaee MJ, Costin AM, et al. Mobie passive radio frequency identification (RFID) portal for automated and rapid control of personal protective equipment (PPE) on construction sites. Autom Constr 2013;36:38–52.
4. Cheng T, Teizer J, Migliaccio GC, Gatti UC. Automated task-level activity analysis through fusion of real time location sensors and worker'sthoracic posture data. Autom Constr 2013;29:24–39.

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APPLICATION OF INNOVATIVE CONSTRUCTION TECHNOLOGIES IN THE RESTORATION AND RECONSTRUCTION OF HISTORICAL BUILDINGS

In the restoration and reconstruction of historical buildings, the application of innovative construction technologies plays a crucial role in preserving the nation's history and ensuring the efficient preservation of these valuable structures.

The integration of innovative technologies such as HBIM (Historic Building Information Modeling), IOT (Internet of Things), and digital technologies is essential for achieving resilience and sustainability in the preservation process [1]. The main purpose of restoration projects is to carry cultural heritage monuments into the future with minimum changes to their structures and characteristics. This presents a significant challenge, as these unique buildings require innovative construction ideas for restoration that minimize alterations to their original form and characteristics [2].

In the practical techniques for restoration of architectural formation elements, various methods such as architectural simulation, reconstruction, disassembly & reassembly, reinforcement, and cleaning are utilized, demonstrating the significant role of new technology in restoring old buildings [3].

The application of digital technologies for the restoration of historic buildings has been emphasized, with the aim of optimizing the restoration process and identifying new possible applications of such techniques. This includes the use of 3D stereoscopic technology and virtual reality for the digital restoration of ancient buildings, providing viewers with an immersive experience of roaming through the disappearance of ancient buildings and experiencing their construction style, history, and culture [4].

Furthermore, the application of BIM (Building Information Modeling) technology has been highlighted for its significance in promoting information integration and collaboration in historical reconstruction, emphasizing the importance of information technology for modeling, design, and archive in historical restoration projects [5].

In conclusion, the application of innovative construction technologies such as HBIM, IOT, digital technologies, 3D stereoscopic technology, virtual reality, and BIM plays a crucial role in the restoration and reconstruction of historical buildings, ensuring the preservation of the nation's history and cultural heritage while embracing resilience, sustainability, and efficient preservation processes.

REFERENCES

1.N.M. Elabd, Y.M. Mansour, L.M. Khodier Developments in the Built Environment. Volume 8, September 2021, 100058. Utilizing innovative technologies to achieve resilience in heritage buildings preservation. URL: https://www.sciencedirect.com/science/article/pii/S266616592100017X

2.B. Okten, M. Okten. The Need for Innovation in Historical Building Restoration Projects. June 2018.URL:https://www.researchgate.net/publication/326993420_The_Need_for_Innovation_in_Historical_Building_Restoration_Projects

3.M. Anwar. World Journal of Engineering and Technology. Practical Techniques for Restoration of Architectural Formation Elements in Historical Buildings. January 2019. URL: https://www.researchgate.net/publication/331093869_Practical_Techniques_for_Restoration_of_Architectural_Formation_Elements_in_Historical_Buildings

4.Marinos Ioannides, Eleanor Fink, Antonia Moropoulou, Monika Hagedorn-Saupe, Antonella Fresa, Gunnar Liestøl, Vlatka Rajcic, Pierre Grussenmeyer. Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection. Application of Digital Technologies in the Restoration of Historic Buildings and Heritage Objects. 2016.
URL: https://link.springer.com/chapter/10.1007/978-3-319-48974-2_16

5.Le Yan, Dong Kai, Li guang fan. Applied Mechanics and Materials - Details. The Application of BIM in the Restoration of Historical Buildings. 2014. URL: https://www.scientific.net/AMM.638-640.1627

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SAFETY AND POTENTIAL HAZARDS IN HYDROTECHNICAL STRUCTURES

Hydrotechnical structures play a crucial role in managing water resources, providing flood protection, and supporting various industrial and agricultural activities. However, ensuring the safety of these structures is paramount to prevent potential hazards and safeguard both human lives and the environment.

Safety in hydrotechnical structures is a multifaceted concern that involves the careful consideration of design, construction, maintenance, and emergency response. The consequences of failure in these structures can be catastrophic, leading to loss of life, property damage, and environmental degradation.

Understanding and recognizing potential risks associated with hydrotechnical facilities is a critical step in ensuring their safety. These risks may include structural failures, overtopping, erosion, seismic events, and environmental impacts. Thorough risk assessments are essential to identify vulnerabilities and implement effective mitigation measures.

Adherence to international safety standards and regulations is a cornerstone of ensuring the safety of hydrotechnical structures. Compliance with established guidelines helps engineers and stakeholders navigate the complexities of designing and managing these facilities while minimizing risks [1].

Regular inspection and maintenance are vital for ensuring the structural integrity of hydrotechnical structures. Neglecting routine checks and necessary repairs can lead to gradual deterioration, compromising the overall safety of the facility. Case studies illustrating the consequences of inadequate maintenance underscore the importance of proactive care.

Developing comprehensive emergency preparedness plans is essential to respond effectively to unforeseen events. Training programs for personnel, simulation exercises, and the establishment of communication protocols contribute to a swift and coordinated response in times of crisis.

Hydrotechnical projects often have environmental implications. It is crucial to mitigate negative impacts on ecosystems and biodiversity. Incorporating eco-friendly practices, such as habitat restoration and sustainable water management, ensures a harmonious coexistence between hydrotechnical structures and the environment [2].

The integration of emerging technologies can significantly enhance safety in hydrotechnical structures. Monitoring systems, advanced materials, and data analytics contribute to real-time risk assessment and early detection of potential issues, allowing for timely intervention.

Safety in hydrotechnical structures requires collaboration among various stakeholders, including government agencies, engineers, and local communities. Public engagement initiatives foster a culture of safety awareness and enable collective efforts to address potential risks.

Analyzing historical incidents related to hydrotechnical structures provides valuable insights into improving safety practices. By learning from past failures, the industry can implement measures to prevent similar incidents and continuously enhance safety protocols.

Ensuring the safety of hydrotechnical structures is a shared responsibility that requires a holistic approach. By prioritizing compliance with regulations, embracing technological innovations, and learning from past incidents, the industry can create a safer environment for both the infrastructure and the communities it serves. Continuous vigilance, collaboration, and innovation are key to mitigating potential hazards and ensuring the long-term sustainability of hydrotechnical projects [1,2,3].

REFERENCES

1.Sargand SM, Masada T, White K, Altarawneh B. Profile-wall high-density polyethylene pipes 1050 mm in diameter under deep soil cover: comparisons of field performance data and analytical predictions. In: Transportation Research Record: Journal of the Transportation Research Board No. 1814. TRB. National Research Council; 2002. p. 186 — 196.

2.Navid H. Jafari, H. Omar Ulloa. Literature Search on Use of Flexible Pipes in Highway Engineering for DOTD's Needs. FHWA/LA.17/638. Dept. of Civil and Environmental Engineering Louisiana State University. 2020 p. 63.

3.Suleiman, Muhannad Taher, The structural performance of flexible pipes (2002). Retrospective Theses and Dissertations. 1033. P.143. URL: https://lib.dr.iastate.edu/rtd/1033.

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LATTICE MASTS AND TOWERS - DESIGN FEATURES

With the development of cellular communications, there is a need for reliable high-rise equipment supports.The classic variant of supports are lattice towers and masts. Towers are high-rise structures rigidly fixed in the base. The main difference between a mast and a tower is the presence of ties that provide stability. [1]

A tower and a mast consist of sections having a lattice structure. The main elements of masts and towers are belts, struts, struts and diaphragms. This system is adopted similarly to trusses. A girdle is a longitudinal element of the structure that takes the main part of the load. The strut is the horizontal element of the lattice and the strut is the inclined element. The frame is made of pipes or angles. Tubes have higher aerodynamic characteristics than profiles, but are more complex and expensive to manufacture.

Towers can be classified in three ways:

1. By the number of faces (type of cross-section):	2. By configuration:	3. By lattice pattern:
- trihedral;	- with fractures	-triangular lattice;
- tetrahedral;	- without fractures.	-rhombic lattice
- polyhedral.		

If the number of faces is increased, the metal consumption increases. To ensure stability and more uniform distribution of forces in the girders, towers are designed widened at the bottom. Three-sided towers are used for small heights and insignificant loads. For taller structures with significant loads, multifaceted towers are used. The most rational are tetrahedral pyramidal towers [2].

Similarly to towers, masts are classified:
- by the number of faces (type of cross-section);
- by the lattice scheme.

Fig. 1 shows general types of towers and masts (distinction by external features).

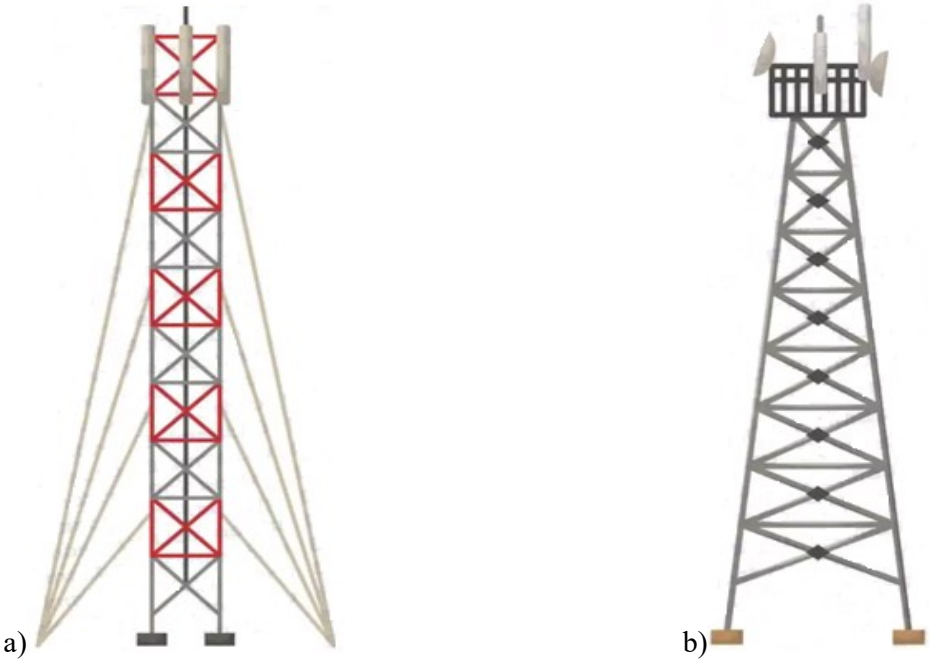

Figure 1. Appearance of towers and masts.
a) mast b) tower

Thus, the main difference between towers and masts is the way of providing stability:

for towers - the stability is provided only by the structural elements of the trunk (towers are mainly widened downwards); for masts - stability is ensured by ties (masts are mostly of the same cross-sectional height).

REFERENCES

1. Беленя Е.И. Металлические конструкции..Стройиздат, 1986, 560 с.

2. Пичугин С.Ф. До оцінки надійності сталевих ґратчастих баштових опор зв'язку як складних стержневих систем. // Коммунальное хозяйство городов. 2009. №. 86. с.27-40.

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CONSTRUCTION OF NON-STANDARD BRIDGE STRUCTURES

Non-standard bridge structures, also known as unique-design bridges, offer greater technical, economic, and aesthetic interest compared to standard overpass bridges. These bridges are typically built over rivers, chasms, or estuaries and require specialized design and construction approaches. Here are some key aspects related to the construction of non-standard bridge structures:

Basic Bridge Forms: There are six basic forms of bridges: beam, truss, arch, suspension, cantilever, and cable-stay. Each form has its own structural characteristics and is suitable for different types of non-standard bridge designs.

Design Criteria: The design of non-standard bridge structures involves considering various factors such as load distribution, construction materials, and the purpose of use. The selection of construction materials, such as steel, concrete, timber, or prestressing, depends on the specific requirements and constraints of the project.[1]

Structural Efficiency and Economy: Efficiency and economy are important considerations in bridge construction. Engineers strive to build structurally efficient and cost-effective bridges while meeting design requirements and financial constraints. Various studies and research have been conducted to explore the efficiency and economy of bridge structural systems. [2]

Hybrid Bridge Structures: In recent years, there has been a development of sophisticated hybrid bridge structures. These structures combine different materials, such as steel girders and composite materials, to achieve optimal performance and durability. Hybrid bridges are often used for medium and larger span bridges due to their vital functions in the transportation network. [3]

Enclosed Bridges and Decorative Features: In some cases, non-standard bridges may require enclosure for safety or aesthetic reasons. Enclosed bridges are designed to protect users from the environment or to prevent objects from being thrown from the bridge. The construction of enclosed bridges may involve through truss or Vierendeel construction methods. [4]

It's important to note that the construction of non-standard bridge structures requires careful planning, design, and adherence to specific engineering standards and regulations. The selection of appropriate construction methods, materials, and techniques depends on the unique characteristics and requirements of each project.

REFERENCES

1.Structural Guide. Different Types of Bridges. Structural Guide. 2020. URL: https://www.structuralguide.com/types-of-bridges/

2.Mladjov R. Efficiency and Economy in Bridge and Building Structures. STRUCTURE. 2016. URL: https://www.structuremag.org/?p=9973

3.Lin W., Yoda T. Bridge Structure. Bridge Engineering. 2017. URL: https://www.sciencedirect.com/topics/engineering/bridge-structure

4.Design of steel footbridges. Steel Construction.info. 2019. URL: https://www.steelconstruction.info/Design_of_steel_footbridges

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COMPARING THE RESULTS OF CALCULATION AND CROSS SECTION SELECTION OF CENTRALLY COMPRESSED FREESTANDING COLUMN ACCORDING TO UKRAINIAN AND EUROPEAN STANDARDS

Design of metal structures in Ukraine until 01.07.2013 was done according to national normative documents only. However, after this date, it became legal to design and calculate metal structures according to European norms - Eurocode 3 "Design of metal structures". [1]

In the realities of today, due to the processes of active European integration of Ukraine, there is a necessity to correct the current construction normative documents and adapt them to the European standard. To do this, it is important to identify the differences and details in the calculation algorithms of both normative documents, and to analyse the differences in the results of calculations. This is what determines the relevance of this research topic.

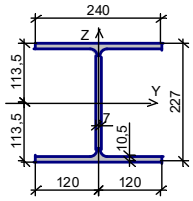
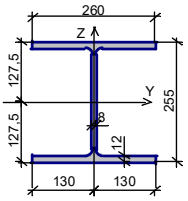
The topic of our investigation is to compare the results of calculation and cross section selection of a centrally compressed freestanding column according to DBN B.2.6-198:2014 "Steel structures. Design standards" and EN 1993-1-1 Eurocode 3: Design of steel structures - Part 1-1: General rules and regulations of buildings.

The purpose of the study is to calculate and select the section of a freestanding centrally compressed column according to DBN B.2.6-198:2014 and EN 1993-1-1 and to compare the results of the calculations and selected sections.

For the calculation the input data were taken as follows: Freestanding centrally compressed column with a height of 6 m, vertical constant force of 1000 kN, the force from its own weight is taken into account. The column is made of steel grade St3Gsp, which corresponds to steel C255 according to Ukrainian norms and S235 according to European norms.

The calculation was performed using SCAD Office Kristall 21.1.1.1.1 software. As a result of the calculation, we received the following results: [2,3]

- Results of cross section selection:

DBN B.2.6-198:2014	EN 1993-1-1
 Columnar I-beam 23K1	 Columnar I-beam 26K1

- Calculation results with selected cross sections:

According to DBN B.2.6-198:2014

Verification	Utilisation factor
Strength during combined action of longitudinal force and bending moments without considering plasticity	0,768
Stability in compression in the plane XOY (XOU)	0,884
Stability in compression in the plane XOZ (XOV)	0,813
Strength in central compression/tension	0,768
Ultimate flexibility in the plane XOY	0,265
Ultimate flexibility in the plane XOZ	0,163

Utilisation factor – 0,884

According to EN 1993-1-1

Verification	Utilisation factor
Plastically resistant to longitudinal compression	0,764
Total loss of stability about the axis Y	0,789
Total loss of stability about the axis Z	0,903
Shear strength about the axis Y	0,764
Resistance to bulging under the action of forces (N,My,Mz)	0,903
Stability of web	0,764

Utilisation factor – 0,903

According to the results of the work it can be seen that the calculations according to DBN B.2.6-198:2014 resulted in a smaller cross-section and utilisation factor, compared to the results of calculations according to EN 1993-1-1. This difference can be explained by the fact that in the process of inputting the initial data into the software, to perform the calculation according to the Ukrainian norms required more clarifying information about the responsibility level of the structure, the ultimate flexibility of the element, in contrast to the European ones.

Therefore, we can conclude that the calculation according to the European norms is more universal, giving a greater safety reserve in comparison with the Ukrainian norms. At the same time, the results of calculation according to DBN B.2.6-198:2014 are more favourable from the economic point of view.

REFERENCES

1.Білик А., Ковалевська Е. Розрахунок сталевих конструкцій будівель відповідно до Єврокоду 3 та Національних додатків України: практ. посіб. 2-ге вид. – К.: УЦСБ, 2019. – 232 с.

2.Державні будівельні норми України: Сталеві конструкції. Норми проектування. ДБН В.2.6-198:2014. – К.: Мінрегіон України, 2014. – 205с. Чинний з 1 січня 2015 р.

3. Національний стандарт України: Єврокод 3: Проектування сталевих конструкцій. Частина 1-1. Загальні правила і правила для споруд (EN 1993-1-1:2005, IDT). ДСТУ-Н Б EN 1993-1-1. – К.: Мінрегіон Уркаїни, 2010. – 154 с. Чинний з 1 липня 2013 р.

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RELIABILITY OF GEODETIC GROUNDING AS A GUARANTEE OF QUALITY GEODETIC CONSTRUCTION SUPPORT

Engineering and geodetic works are an important and integral part of the complex of works in the search, design, construction and operation of engineering structures. They are a component of the technology of engineering and construction works. The intensive level of development of scientific and technical progress in construction requires the introduction of modern highly effective geodetic technologies, which should ensure the performance of engineering and geodetic works.

The quality of engineering and geodetic support of construction at all its stages depends on the reliability of the results of geodetic measurements. The reliability of the results of geodetic measurements depends on the complex influence of factors: the influence of the external environment (the influence of refraction, the curvature of the Earth), the accuracy of geodetic instruments (high-precision, precise and technical precision instruments), the personal physical properties of the observer and the reliability of the points of survey justification. If it is impossible to completely get rid of the influence of the external environment, then with regard to other constituent factors, their influence can be reduced to a minimum.

Today, there is a wide range of geodetic instruments that allow you to perform angular measurements with an accuracy of up to tenths of seconds, linear measurements - up to tenths of a millimeter, and deviations up to half a millimeter per one kilometer of a double course. The availability of high professional training of geodesist specialists allows high-quality observations, and automated deduction systems completely eliminate the "human factor". However, unfortunately, the factor of reliability of geodetic justification is poorly studied. Reliability, in a general sense, is the ability to preserve over time within the established limits the values of all parameters that characterize the ability to perform the required functions in the specified modes and conditions of operation, maintenance, storage and transportation. [1] The reliability of geodetic points means their ability to maintain a stable spatial position during the entire period of operation, that is, to be durable and maintain the accuracy of their position according to the category of the geodetic network.

To select reliable points of the geodetic network for their use as points of survey justification, we will perform a reliability assessment. Let's calculate the probability of the location of immutability of the geodetic points:

$$P(\mathrm{t}) = \frac{N_0 - n(t)}{N_0} \quad (1)$$

where N_0 is the number of geodetic network points with constant position;
n(t) is the number of points of the geodetic network that have shifted.

The influence of various man-made and natural factors that disrupt the natural balance of the soil massif, and as a result, cause displacement of geodetic marks, create conditions in which it is impossible to achieve 100% reliability. Taking into account the negative impact of the external environment, we will accept for urban areas with man-made and overloaded zones, with different engineering and geological conditions, the reliability criterion of the geodetic network is at least 90%, i.e. P(t)≥0.9.

Let's calculate the maximum allowable number of geodetic points that can undergo displacements and lose their position stability. Let the plan-altitude marking geodetic network include 10 points, then from formula (1) we determine n(t)=0.1*N0=0.1*10=1 point, i.e., to ensure the reliability of the survey network, the loss of stable position of only one is allowed point in the process of geodetic support of construction. Taking into account that the average duration of the construction of a multi-story building can be from 1 to 4 years depending on its area and construction technology, we will calculate the maximum allowable failure intensity of the geodetic network, provided that Δti=2 years:

$$\lambda(t) = \frac{n(\Delta t_i)}{N_{cpi} \cdot \Delta t_i} \quad (2)$$

n(Δti) –is the number of failures of geodetic points in the interval Δti=2 years;
Ncri – is the number of operational objects in the middle of the interval Δti.

$$N_{cpi} = \frac{N_i + N_{i+1}}{2} = (10+9)/2 = 9,$$

Ni – is the number of operational objects at the beginning of the interval Δti;
N_{i+1} is the number of operational objects at the end of the interval Δti.

Then, λ=1/(9,5*24)=0,004, therefore, with a higher value of the intensity, the condition of maintaining 90% reliability is violated (P(t)≥0.9).

To determine the periodicity of monitoring the state of the geodetic network output points, we derive the formula:

$$t = -\frac{\ln P(t)}{\lambda} \quad (3)$$

t=-ln0,9/0,004≈10 months is the maximum period until the next observation of the stability of the geodetic base points for the given conditions. If instead of 90% we accept 95%, then this term will be halved and will be t=-ln0.95/0.004≈5 months, and at 99% we will get t=-ln0.99/0.004≈1 month.

On the basis of the performed calculations, it is recommended to carry out observations once a month to ensure the reliability of the geodetic base, which is used in the geodetic support of construction.

REFERENCES

1. Reliability. URL:https://uk.wikipedia.org/wiki/%D0%9D%D0%B0%D0%B4%D1%96%D0%B9%D0%BD%D1%96%D1%81%D1%82%D1%8C

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RETROFITTING OF INDIVIDUAL HEATING POINTS

According to the Ministry of Regional Development, Construction and Housing and Communal Services, 80% of high-rise buildings in Ukraine need modernization. Experts advise to start the renovation of houses with the installation of an individual heating point, and not with insulation [1].

The introduction of innovative energy-saving technologies is currently the only solution for reducing heating costs. Without a coolant supply system into the heating system of the house, based on tracking of the real weather conditions and their constant changes, it makes no sense to consider significant cost savings. Therefore, the equipment of the automated individual heating point becomes the main task when solving the improvement of the energy efficiency of the system. Experts claim that it is quite possible to reduce heat consumption by up to 40% by installing a modern individual heating unit [2].

An individual heating unit is, in accordance with the requirements of Section 16 [3], a set of equipment that is designed to:

- to regulate the temperature of the coolant in accordance with weather conditions;
- to change and control the parameters of the coolant;
- to account for heat carrier and condensate costs, as well as heat load;
- to regulate the coolant flow rate;
- to protect the heating system from emergency exceeding of the coolant parameters;
- for additional cleaning of the coolant;
- to fill and feed the heating system;
- to create conditions for the use of combined heat supply using alternative energy sources.

Modern individual heating points are equipped with all the necessary automatic means that provide heat engineering control, accounting and regulation of quantitative and qualitative parameters of the heat carrier.

REFERENCES

1. Heating point. URL: https://ua-energy.org/uk/posts/indyvidualnyi-teplovyi-punkt-pershyi-krok-do-modernizatsii-bahatopoverkhivky

2. Feist, W. Gestaltungsgrundlagen Passivhauser / W. Feist // Verlag das Beispiel GmBH. 2001. 132 p.

3. ДБН В.2.5-39:2008 Інженерне обладнання будинків і споруд. Зовнішні мережі та споруди. Теплові мережі. Зі Зміною № 1.

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STABILITY ESTIMATION OF STEEL VERTICAL CYLINDRICAL TANKS UNDER WIND ACTION

Problem statement. Steel vertical cylindrical tanks are most commonly used in the oil and gas industry as storage tanks for petroleum products and gases. Currently, many of these structures have been seriously damaged or destroyed in Ukraine. This has created an urgent need for the construction of new tanks.

When diagnosing the tanks technical condition, it is necessary to perform an individual assessment of the technical condition of these structures. It should be taken into account specific loading conditions, geometry parameters, defects and damaging in order to identify reserves of the bearing capacity of a particular tank.

The cylindrical wall of tanks belongs to the class of thin-walled shells. The geometrical parameters of such shells are $r/t = 600 \div 3800$; $l/r = 0,6 \div 2,5$; here l, r, t are the length, radius and thickness of the cylindrical shell. The issue of stability for such structures comes to the fore.

The wind load is of great importance among the compressive loads. According to the design standards [1, 2],the wind load on a cylindrical structure is a pressure that is not evenly distributed around the circumference of the structure.

In the stability estimation, the nonuniform wind pressure is replaced by a uniform external pressure, which is called the equivalent vacuum [3]. The conversion is made by multiplying the nonuniform wind pressure amplitude by the coefficient k_w. The value of k_w is equal 0,5 for all geometrical parameters tanks.

The **aim** of the study is to clarify the validity of this approach and identify possible inaccuracies in the engineering estimation of tank stability.

Content of the research. The research was carried out using the finite element method. The calculations were performed at a wind pressure value that corresponds to the wind load on the territory of Ukraine. [1]

The static analysis has shown that the membrane circumferential stresses σ_{2M} are predominant for these shells. Their value reaches 17-20 MPa. The second for their value are the membrane meridional stresses σ_{1M}. The relationship $\sigma_{1M} = \mu \cdot \sigma_{2M}$ is observed; here μ is the Poisson's ratio. It corresponds to the basic dependencies of the shell theory.

Bending stresses in the shell are extremely low. The value of bending circumferential stresses is σ_{2B} = 0,12÷0,20 MPa. The highest bending stresses occur in the shell areas adjacent to the edges, that is, in the edge effect region.

It was found that the distribution of all stresses corresponds to the wind pressure distribution. The main peculiarity of the bending stress diagrams is the pronounced wave-like nature.

The nature of the stress diagrams corresponds to the radial displacement diagrams w and the deformed shell shapes. This wave-like nature of deformation was also observed in full-scale experiments [4].

Such wave deviations of the shell surface have already occurred at the beginning of deformation. As a result, the limit wind load will be lower than buckling wind load. And in this case, instead of solving the bifurcation problem of stability, it is necessary to solve the nonlinear problem of shell deformation.

Conclusions. The resulting wave-like nature of the bending stresses, radial displacements and deformed shell shapes indicate the complex actual behavior of shell structures under wind pressure. This fact is not considered in regulatory stability estimations. In order to obtain a reliable assessment of stability during the technical diagnosis of tanks in operation, it is desirable to perform a shell nonlinear deformation analysis in each specific case. At the same time, it is necessary to take into account the actual distribution of wind pressure and the real geometric shape of the cylindrical shell with existing geometry imperfections.

REFERENCES

1. ДБН В.1.2 - 2:2006. Навантаження і впливи. Норми проектування. Київ. Мінбуд України, 2006. 75 с.
2. CEN/TC 250/SC3/PT4 Eurocode 3: Design of steel structures. Part 1-6: General Rules: Supplementary Rules for Shell Structures. Brussels: Centr. Secr., 1999. 83 p.
3. ВБН В.2.2 - 58.2 - 94. Резервуари вертикальні сталеві для зберігання нафти і нафтопродуктів з тиском насичених парів не вище 93,3 кПа. Відомчі будівельні норми України. Київ. Держкомнафтогаз, 1994. 98 с.
4. Маневич А. И. Экспериментальное исследование устойчивости подкрепленных цилиндрических оболочек при внешнем давлении. Прикладная механика. 1969. Т. V. Вып. 5. С. 35 - 39.

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CONCRETE WITH MINERAL ADDITIVES

The efficiency of using cement in concrete can usually be estimated by the following properties: workability, strength, durability. [1]:

According to the research, carried out by foreign scientists on Portland cement with the addition of limestone (PLC) and cement with the addition of ash (PAC), the following conclusions can be drawn:

-water consumption and susceptibility to concrete fading with limestone and ash additive is significantly lower than using simple Portland cement;

-in 28 days the compressive strength of concrete based on PLC and PAC with the same concrete composition, as well as the same standard strength of cement, is not lower than with the Portland cement. The strength can be higher if water saturation of cement is lower, the additives reduce water saturation of cement;

-the key durability indicators such as carbonization, waterproofing, and frost resistance in concrete using cement with additives (PLC and PAC) are almost the same as in concrete with Portland cement or Portland slag cement;

-Bernd Wicht studies indicate that concretes with PLC and PAC can have a higher resistance to sulfate aggression and chloride penetration than concretes of the same composition with sulfate-resistant Portland cement; [1]

-pozzolans and materials with hidden hydraulic properties significantly reduce the dangerous reaction between an alkali and a siliceous component due to hydration reactions and the binding of alkalis into insoluble compounds.

New types of modern concrete are emerging due to high achievements in plasticizing of concrete and mortar mixtures, as well as the most active pozzolanic additives - micro silica, dehydrated kaolin, and highly dispersed ashes. The combination of superplasticizers and especially hyperplasticizers on a polycarboxylate basis allows you to reduce the water-cement ratio to 0.24...0.28 and obtain superfluid cement-mineral dispersion systems and concrete mixtures. Currently, the nomenclature of finely dispersed concrete fillers has been significantly expanded. The pozzolanic activity of some mineral additives is presented in the Table 1.

Table 1

The supplement	Pozzolanic activity, mg$Ca(OH)_2$per 1 g of additive
Calcined bauxite	534
Micro silica	427
Blast furnace slag	300
Ash	875
Metakaolin	1000

Pozzolanic activity of some mineral additives [2]

Based on the above, we believe that using ash production waste in place of a part of cement, compatible with a superplasticizer in concrete composition, is relevant.

REFERENCES

1.Johannes Stark, Bernd Wicht. Cement and lime/trans. with German A. Tulaganova. Ed. P. Kryvenko. Kyiv, 2008. 480 p.

2.Dworkin L.Y. Metakaolin in construction mortars and concretes: [Monograph] / L.Y. Dworkin, N.V. Lushnikova, R.F. Runova, V.V. Trojan. K: KNUBiA Publishing House, 2007. 216p.

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POST-WAR RECONSTRUCTION OF HISTORICAL BUILDINGS BY MEANS OF HISTORIC BUILDING INFORMATION MODELLING

War catalyses the development of new, pragmatic strategies aimed at protecting the nation and its citizens from the ravages of war. Many of these innovative solutions will take shape during the renovation phase. It is already worth thinking about the Ukrainian programme of rebuilding after the war, considering all the previous plans for the implementation of sustainable development principles in Ukraine. The basis of this transformation is the principle of post-war reconstruction: "to rebuild better than it was".

Historic buildings should be considered as an integral component of the sociocultural entity, encompassing the values and communities that reside in or use them, in addition to the architectural structure consisting of physical elements such as walls, floors, ceilings, windows, doors, and stairs. These buildings undergo transformations influenced by user actions and conservation efforts. [1]

The objective of reconstruction is to establish a systematic approach for digitally maintaining and managing historical dwellings. The technique presented in this paper focuses on constructing parametric models that offer modelling benefits, allowing for convenient updates to the Historic Building Information Modelling (HBIM). By swiftly converting various data into a real-time information platform and a robust decision-support system, HBIM significantly enhances the efficiency and accuracy of the reconstruction process. One of the key advantages is its ability to synchronise detailed data regarding building materials and their associated environmental impacts. This synchronisation of data within HBIM empowers stakeholders to conduct thorough environmental analyses. It provides a holistic understanding of the ecological footprint associated with various building materials and products. Consequently, informed decisions can be made during the selection of building materials, considering both historical authenticity and environmental sustainability. [2]

Previous methods that incorporated images for digitising historic buildings typically required on-site image capture, which was followed by intricate processes before commencing HBIM development. In contrast, the method outlined in this paper focuses on selecting a suitable image that requires minimal processing to develop the HBIM for the facade of historic buildings. The proposed method encompasses three phases: initiation, modelling, and validation phases, each is essential for developing HBIM (Fig. 1).

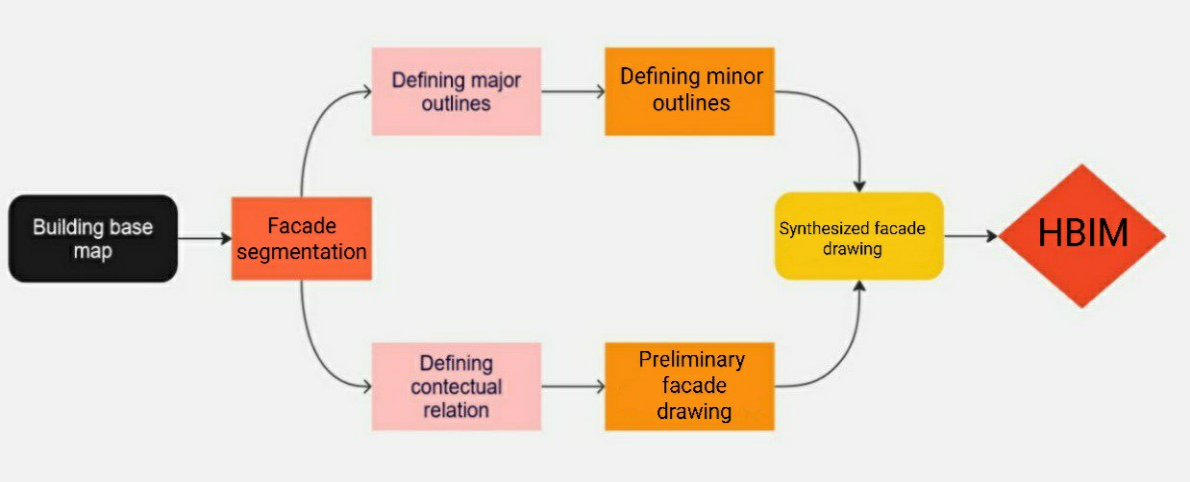

Fig. 1. Methodology of HBIM development, my own research based on [3].

HBIM promotes a data-driven and environmentally conscious approach, thus, its applications contribute to a more responsible and forward-thinking methodology in post-war reconstruction. The careful selection of materials, mindful of both historical and environmental implications, not only preserves the historical building, but also promotes sustainable practices, synchronising with modern environmental standards and concerns. BIM tools allow designers to explore different design options at the initial stages of a project and quickly transfer design data to energy and simulation modelling tools for verification and analysis. This efficiency and speed are invaluable for ensuring a project meets performance and sustainability criteria. HBIM tools enable owners to acquire a holistic visual depiction of their construction projects throughout different phases of renovation. These tools provide real-time insight into the development process. These models are used to coordinate complex renovations of historic buildings, determine material quantities, and identify possible inconsistencies between equipment. [4] The result of a successful historic building renovation project includes improvements in many aspects, including design efficiency, resource management, and project coordination.

REFERENCES

1. K. S. Murillo, K. Fouseki and H. Altamirano. "A sociotechnical approach to users' heritage values and decision-making processes for energy efficiency and thermal comfort in heritage buildings: A pilot study in Mexico City", IOP Conference Series Earth and Environmental Science, vol. 863(1), (2021), 012031. https://doi.org/10.1088/1755-1315/863/1/012031

2.Yasmin Elkwisni, Ahmed E. ElMaidawy. (2023). Historical building information modelling (HBIM) integration with environmental analysis for green rating systems. Mansoura Engineering Journal, 48. DOI:10.58491/2735-4202.3029

3.Elisavet Tsilimantou, Ekaterini T. Delegou, Ioannis A. Nikitakos, Charalabos Ioannidis, "GIS and BIM as Integrated Digital Environments for Modeling and Monitoring of Historic Buildings", Applied Sciences, vol. 10(3):1078, (2022). DOI:10.3390/app10031078

4.Dina Stober, Roko Žarnić, Davorin Penava, Margareta Turkalj Podmanicki. "Application of HBIM as a Research Tool for Historical Building Assessment", Civil Engineering Journal, vol. 4(7):1565, (2018). https://doi.org/10.28991/cej-030919

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MODERN TECHNOLOGIES IN BRIDGE RENOVATION

The renovation of bridges has been significantly influenced by modern technologies, leading to safer, more durable, and longer-lasting structures. Here are some key advancements in bridge renovation technology:

Safety and Durability Enhancements. Civil engineers have focused on improving safety by making bridges more resilient to fire, earthquakes, and high winds. They are also exploring how technology can help monitor new bridges and maintain those already in place. [1]

Many new bridges now have sensors that collect data on their structural behavior and condition, allowing for continuous monitoring and maintenance to extend their design life beyond the previous average of about 50 years. [1]

Use of Advanced Materials and Construction Techniques. The Industrial Revolution brought about the use of industrially produced iron, which paved the way for the development of modern bridges using materials such as steel and reinforced and prestressed concrete. [2]

Innovative new construction materials and advanced construction methods, tools, and software are now available for bridge engineers, enabling more accurate models and detailed analyses of bridges [3].

Intelligent Technology and Information Systems. Intelligent technology based on information technology provides a new opportunity for innovation in bridge engineering, focusing on construction efficiency, management effectiveness, and long-term service [4].

Building Information Modeling (BIM) pairs architects with engineers and construction professionals, allowing for more efficient communication and collaboration throughout the stages of construction. BIM enables engineers and designers to create 3D models that include a wealth of data, from the physical characteristics of a bridge to its functional features [5].

Advanced Construction Methods. Advanced Bridge Construction (ABC) methods, such as building the new structure alongside the old one or underneath it, are being employed, with heavy lifting equipment that can handle more weight and is more compact, facilitating the renovation process [6].

These advancements in technology have not only enhanced the safety and durability of bridges but have also improved the efficiency and effectiveness of bridge renovation projects, ultimately contributing to the development of more resilient and long-lasting bridge structures.

REFERENCES

1.Allsop J. Five modern bridges that are pushing the bounds of engineering // MIT Technology Review. 2021. URL: https://www.technologyreview.com/2021/04/28/1023041/modern-urban-city-bridge-technology-construction-genoa-stockholm-china-seattle/

2.Lomax S., Duffy T. The New Technology of Bridge Design // Structure magazine. 2013. URL: https://www.structuremag.org/?p=760

3.Lee G. Top 5 New Advanced Technologies for Bridge Design // midas Bridge. 2020. URL: https://www.midasbridge.com/en/blog/newstrends/top-5-new-advanced-technologies-for-bridge-design

4.Zhou X., Zhang X. Thoughts on the Development of Bridge Technology in China // Research High Performance Structures: Building Structures and Materials. 2019. URL: https://www.sciencedirect.com/science/article/pii/S2095809919308318

5.U.S. Bridge. Top Emerging Technologies in Construction // U.S. Bridge. 2022. URL: https://usbridge.com/top-emerging-technologies-in-construction/

6.Conexpo CON/AGG /. Technologies To Advance Bridge Construction // Conexpo CON/AGG. 2017. URL: https://www.conexpoconagg.com/news/technologies-to-advance-bridge-construction

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STUDY OF SOIL CONCRETE SAMPLES USING RECYCLING PRODUCTS

We continue to study the physical and mechanical properties of soil concrete samples for low-rise buildings. Taking into account the results of previous studies, such as the selection of the optimal composition of soil concrete, the study of the strength characteristics of soil concrete, which are given in scientific papers [1, 2], it was decided to introduce aggregate for increasing the strength characteristics of soil concrete. The experiment was carried out in the Research Laboratory of the Department of Reinforced Concrete Structures of the PGASEA. In previous studies, the maximum mortar grade for different types of binder was established, namely Heidenberg cement M100 and M75 for Kamianets-Podilskyi cement M75. Since concrete itself requires aggregate, and Ukraine is currently experiencing active hostilities, there is no shortage of recycled products. And after the end of hostilities, there will be a great need to dispose of construction waste, it was decided to use these materials in further research.

At the next stage, the experiment was set up as follows: the type of binder was Kamyanets-Podilsky PC M500, the test cubes were 70x70x70 mm in size, and the aggregate was the recycled products with a fraction of 5-7 mm. The method of manufacturing the samples, the conditions of sample aging, and the test method remained the same as in previous studies [1, 2]. Three aggregate indicators in percent by weight of dry soil and binder, namely: 10%, 20%, 30% aggregate were used (Fig. 1).

a) b)

c)

Fig. 1 Production of soil concrete specimens with dimensions of 70x70x70, using recycled products: a) cubes; 10% aggregate content; b) 20% aggregate content; c) 30% aggregate content.

The cubes were tested at 28 days of age on the UMM-20 press. The general view of the cube tests is presented in Fig. 2, for all three variants.

a)

b)

c)

d)

e)

Fig. 2. Ground concrete specimens with dimensions of 70x70x70: a) general view of the specimens; b) specimens with 10% aggregate content after testing; b) specimens with 20% aggregate content after testing; d) specimens with 30% aggregate content after testing; e) general view of the compression test of the specimen.

The tests showed that the strength of the soil concrete specimens using recycled products as aggregate is lower than that of the soil concrete specimens without fine and coarse aggregate. The low strength of the specimens is explained by the poor adhesion of fine and coarse aggregate to the binder and soil. The failure pattern of the specimens is fully consistent with that of concrete cubes. Compared to the results of previous tests, the strength of soil concrete specimens using recycling products as aggregate is 56.4 kgf/cm^2, while the strength of soil concrete specimens without fine and coarse aggregate is 69 kgf/cm^2. Thus, for further research and field tests of soil concrete beams of composite t-beams, a combined concreting system was adopted, namely, to use conventional heavy concrete in the edge of the compressed zone of the section and soil concrete in the overhangs.

REFERENCES

1. Anastasia Myslytska, Mykola Savytskyi. Investigation of the influence of Portland cement type on the strength of soil concrete samples. IV international scientific and practical conference. Buildings and structures for special purposes: modern materials and structures. Kyiv, April 26, 2023. pp. 37-38.
2. A. Myslyttska, A. Patrusheva. Strength of ground concrete depending on its composition. Science and technology perspectives of the XXI century. Materials of the remote scientific and practical conference of students and young scientists. Dnipro, 2022. pp. 35-36.

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STRUCTURAL HEALTH MONITORING IN GUARANTEEING THE STRUCTURAL SAFETY OF BUILDINGS

Ensuring the safety of buildings and structures is a critical aspect of their design and operation. The damages of structures can lead to changes in their properties and a reduction in their service life [1]. Therefore, there is a need to implement Structural Health Monitoring (SHM) systems for civilian buildings and infrastructure to detect damage in time and avoid accidents. Considering the end-of-life of many objects, such as bridges, towers, architectural monuments and civilian buildings, it is important to develop methods for monitoring and recording damage to extend their service life [2].

Structural health monitoring includes periodic measurements to detect damage and its impact on building elements and structures. This provides up-to-date data on the ability of structures to perform their functions in the future, taking into account their aging and damage caused by the exploitation environment [1]. It implies for the assessment of their technical condition using prototype design models or instrumental building monitoring systems. These systems continuously monitor the characteristics of structures and can be used for early warning of signs of damage and risks of collapse [1].

SHM is used to monitor any building structure over its lifetime under direct or indirect loads. It not only analyzes the condition of structures, but also improves the understanding of their behavior by detecting changes through a system of sensors that collect data. This information helps to plan maintenance and repairs, as well as determine the remaining service life of the structure [1].

Structural damage leads to changes in modal parameters, such as frequencies, mode shapes, and damping coefficients. Vibration methods based on the analysis of these parameters are used to monitor the condition of building structures [1]. Particular attention is paid to natural frequencies, which are determined by modal analysis. Changes in the structural properties of structures cause changes in their frequencies, which becomes an incentive for the use of modal methods in damage detection.

The development of structural health monitoring is linked to advances in digital technology. Initially, monitoring was applied mainly to critical infrastructure, but now it is being extended to

buildings as communities are increasingly dependent on infrastructure systems. Particular attention is paid to the preservation of historical heritage, as it is exposed to various damages. Many studies have considered the determination of building damage using these methods, although there are many problems in their practical application [1].

A typical example is the monitoring of the condition of the structures of buildings in the old housing stock, shown in Fig. 2.1 [1]. The house is located in Latvia, but such buildings are also existing in Ukraine and other Baltic countries. Cracks on the facade and inside buildings often occur due to changes in soil conditions, leaching, or construction work nearby, so constant monitoring can help detect changes and prevent further damage [1]. Assessment of the condition of the structures of an old building can provide options for extending its service life and preventing the development of destruction processes.

Nowadays, it is important to detect damage to monumental structures in seismically active regions. The use of Structural Health Monitoring (SHM) methods allows for an effective response to changes using data from sensors located on the building. For example, the Palazzo dei Consoli in Gubbio (central Italy) is equipped with a network of sensors for monitoring (Fig. 2) [3]. For monitoring, a Bayesian methodology was used, which combines dynamic and static monitoring data, finite element modeling, and visual inspections to monitor the building before and after a low-intensity seismic event. This allows to investigate all factors limiting decision-making, accurately evaluate options and prioritize interventions, avoiding the possible detection of false alarms [3].

Figure 1 - The old multistorey residential building [1].

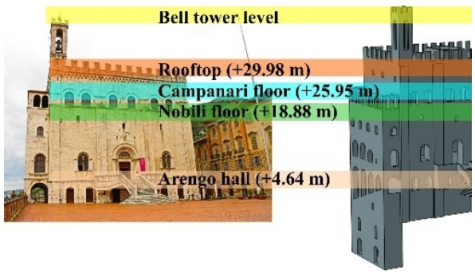

Figure 2 - Palazzo dei Consoli [3].

Thus, ensuring the safety of structures in construction is a necessary component of the design and operation of buildings and structures. Structural health monitoring allows to detect damage in time and extend their service life.

REFERENCES

1. Gaile L., Ratnika L., Pakrastins L. RC Medium-Rise Building Damage Sensitivity with SSI Effect. Materials. 2022. Vol. 15, no. 5. P. 1653. URL: https://doi.org/10.3390/ma15051653.

2. Integrated BIM-SHM techniques for the assessment of seismic damage / S. Castelli et al. Procedia Structural Integrity. 2023. Vol. 44. P. 846–853. URL: https://doi.org/10.1016/j.prostr.2023.01.110.

3. A Bayesian-based data fusion methodology and its application for seismic structural health monitoring of the Consoli Palace in Gubbio, Italy / L. Ierimonti et al. Procedia Structural Integrity. 2023. Vol. 44. P. 2082–2089. URL: https://doi.org/10.1016/j.prostr.2023.01.266.

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NONLINEAR CALCULATION OF EXPLOSIVE LOADS ON BUILDING STRUCTURES OF SHELTERS

When designing buildings and structures, loads are collected in accordance with DBN B.1.2-2:2006 'Loads and Impacts'. Explosive loads in the seventh standard are classified as special types and their values are proposed to be determined by industry recommendations, namely DBN B.2.2-5-2023 'Civil Protection Facilities'. This standard defines the loading schemes for building structures when they are subjected to an airborne shock wave (ABW). The loading schemes defined in this document have some drawbacks. They stem from the fact that the blast load is considered as a result of detonation of a nuclear warhead, the radius of the blast front is much larger than the size of any structure, so this load acts on the entire structure simultaneously, and therefore it is considered as quasi-static with the use of dynamism coefficients that increase the calculated static load on the structure.

In current conditions, such an approach is not quite true: firstly, rocket and artillery charge explosions have a more local impact on the structure, and secondly (as a consequence of the first), there is an uneven, purely dynamic load on the structure which shouldn't be less. In addition, the wavelength of the ABW from the condensed explosive creates a dynamic load, the duration of which is usually proportional to the fundamental frequency of the natural vibration of the structure ω, which is determined by the movement of the structure in the stage of elastic deformation:

$$\frac{d^2T}{dt^2} + \omega^2 \cdot T(t) = \omega^2 \cdot f(t) \quad [1]$$

Thus, the dynamics of impact can be determined both by the resonance effects of structural vibration and by the movement of the ABW front along the surface of the structure.

In order to determine the initial data, when calculating the strength and stability of building structures by modern methods, it is necessary to know the dynamics of load changes in the time-coordinate system, which is set by tabular values or in the form of a load curve P = f(t). Such a calculation mode could be used, for example, in the 'Lira' software package. However, the existing analytical calculation methods allow solving only a stationary problem - to identify the load area from explosion.

To determine the dynamics of the explosive load, the task is to develop a methodology for calculating the spatial and temporal dependence of the excessive load change in the building structure at the moment of explosive blast on it.

The problem of calculating the dynamics of the explosive load on a building structure (e.g., the ceiling of a buried shelter) was solved by jointly solving the equation of the spatial distribution of overpressure in the front of the blast and the dependence of the blast time on the speed of its front movement, which can be expressed by equation. [2]

$$dt = \frac{l}{v} dv; \quad (2) \qquad t = \int_{v_1}^{v_2} \frac{l}{v} dv. \quad [3]$$

Since the velocity of the ABW is constantly changing, equation [2] has a differential form, and its solution [3] is based on the assumption that the simultaneous action of the ABW on the surface of the building structure occurs on the area limited by the length of the shock wave front. Based on this, a graphical-analytical methodology has been developed for determining the spatial and temporal dependence of the excessive load change in the building structure at the moment of explosive blast on it. This dependence is demonstrated as a table or graph, which is a loading curve.

REFERENCES

1. Nalisko M., Sobolev V., Rudakov D., Bilan N. Assessing safety conditions in underground excavation safter a methane-air mixture explosion. E3S WebofConferences 123, 01008 (2019) «Ukrainian School of Mining Engineering – 2019». https://doi.org/10.1051/e3sconf/201912301008

2. Ромашкіна М.А. (2018). Чисельне дослідження напружено-деформованого стану цегляного житлового будинку при запроектних впливах. Будівництво, матеріалознавство, машинобудування. Зб. наук. праць ПДАБА, Вип. 81. С. 168-176.

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CONSTRUCTING GLASS SKYSCRAPERS IN THE FUTURE

Glass skyscrapers have become iconic symbols of modern cities around the world. However, there are ongoing discussions about their energy efficiency and environmental impact. Let's explore the topic further:

Energy Efficiency Challenges: Traditional glass exteriors in skyscrapers can be energy inefficient. They trap heat during summer and lose heat during winter, leading to increased reliance on air conditioning and climate control systems. This results in higher energy consumption and carbon emissions. [1]

Eco-Friendly Innovations: To address the energy efficiency challenges, new glass skyscrapers are incorporating eco-friendly innovations. These include renewable energy generation, solar shading systems, and double-skin facades that provide better insulation and reduce heat transfer. [1]

Mixed-Use Skyscrapers: Urbanization trends have led to the rise of mixed-use skyscrapers, particularly in countries like Japan and China. These buildings combine residential, commercial, and recreational spaces, promoting sustainable urban development and reducing the need for long commutes. [1]

Smart Technology Integration: Smart technology plays a crucial role in the construction of modern skyscrapers. Switchable smart glass, for example, allows users to alter the properties of the glass at the flick of a switch, providing flexibility in controlling light and heat transmission [2]. Additionally, advanced technologies like IoT sensors and prefabrication methods contribute to the transformation of high-rise buildings into smart and sustainable structures [2].

Environmental Concerns: There is a growing debate about the environmental impact of glass skyscrapers. Critics argue that the energy-intensive cooling requirements and the lack of consideration for location and urban planning can lead to poor design, increased carbon emissions, and a reliance on private cars [3] [4].

Sustainable Design Approaches: Architects and engineers are exploring alternative design approaches for glass skyscrapers. These approaches include reducing the proportion of glass in the facade, incorporating long-life materials, and considering the recyclability and maintenance of glass wall assemblies. [5] [6]

It's important to note that the future of glass skyscrapers will likely involve a balance between aesthetics, functionality, and sustainability. Architects, engineers, and urban planners are continuously working towards finding innovative solutions to make glass skyscrapers more energy-efficient and environmentally friendly.

REFERENCES

1.Nicholson-Cole D. Rise of the glass giants: how modern cities are forcing skyscrapers to evolve // CNN. 2016. URL: https://edition.cnn.com/style/article/rise-of-glass-skyscrapers/index.html

2.Smartglass. How Smart Technology Can Transform Skyscrapers // Smartglass. 2023. URL: https://www.smartglassinternational.com/insights/smart-technology-can-transform-skyscrapers/

3.Watson Brown. The future of glass skyscrapers // Australian Institute of Architects. 2019. URL: https://www.architecture.com.au/archives/news_media_articles/the-future-of-glass-skyscrapers

4.Tapper J. Experts call for ban on glass skyscrapers to save energy in climate crisis // The Guardian. 2020. URL: https://www.theguardian.com/environment/2019/jul/28/ban-all-glass-skscrapers-to-save-energy-in-climate-crisis

5.Epstein S. Everyone needs to stop building giant glass skyscrapers right now // WIRED. 2019. URL: https://www.wired.co.uk/article/stop-building-glass-skyscrapers

6.Moroz M. Can we finally say goodbye to glass skyscrapers? // Architecture & Design. 2017. URL: https://www.architectureanddesign.com.au/features/features-articles/can-we-finally-say-goodbye-to-glass-skyscrapers

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ROBOTICS IN THE CONSTRUCTION OF MODERN HOMES

The construction industry is undergoing a transformation with the integration of robotics. Robotics is being used to enhance efficiency, reduce costs, improve safety, and introduce innovative designs in the construction of modern homes. Here are some key insights into the role of robotics in modern home construction:

Labor Shortages and Off-Site Construction: The construction industry is facing a shortage of skilled labor, which has led to the exploration of off-site construction methods. Countries like Japan have embraced off-site construction and are using robotics to build a significant number of homes each year [1]. Off-site construction involves manufacturing components in a controlled environment and then assembling them on-site, reducing the need for extensive manual labor.

Automation and Precision: Robotics enables automation in various construction tasks, leading to increased precision and efficiency. For example, Dusty Robotics has developed a robot that can accurately sketch out the floor plan of a building project, reducing the potential for errors and delays [2]. Additionally, robots can perform tasks like welding and assembly with high precision, allowing for complex designs that would be challenging for humans to construct unaided.

3D Printing: 3D printing technology is revolutionizing the construction industry. Companies like ICON and MX3D are using 3D printing to construct entire homes and bridges with minimal waste and reduced costs [3]. This technology allows for the creation of unique designs and the customization of homes to meet specific requirements.

Efficiency and Safety: Robotics in construction improves efficiency by automating repetitive tasks and streamlining processes. It also enhances safety by reducing the need for workers to perform physically demanding or hazardous tasks. For example, robots can be used to lift heavy materials, reducing the risk of injuries to human workers [4].

Integration with AI and BIM: Robotics in construction is often integrated with Artificial Intelligence (AI) and Building Information Modeling (BIM). AI algorithms can optimize construction processes, while BIM enables the digital representation of a building's physical and functional

characteristics. This integration allows for better planning, coordination, and communication throughout the construction process [5].

Future Prospects: The use of robotics in construction is expected to continue growing, with the construction robots market projected to expand significantly in the coming years [4]. As technology advances, robots are likely to play an even more significant role in various construction tasks, leading to increased efficiency and innovation.

In conclusion, while robotics is transforming the construction industry, human workers will still play a crucial role. Robotics is meant to augment human capabilities, improve safety, and enhance efficiency rather than replace human labor.

REFERENCES

1.Blackman D. Modern construction: Bring on the robots // Building. 2016. URL: https://www.building.co.uk/features/modern-construction-bring-on-the-robots/5079918.article

2.Verma P. These robots might build your house // The Washington Post. 2023. URL: https://www.washingtonpost.com/technology/2023/01/30/construction-companies-robotic-technology/

3.Devitt M. How Robots Are Revolutionizing The Construction of Houses and Buildings // RobotShop Community. 2019. URL: https://community.robotshop.com/blog/show/how-robots-are-revolutionizing-the-construction-of-houses-and-buildings

4.ConstructionPlacements Official. (2023). Rise of the Machines: Robotics in Modern Construction. ConstructionPlacements Official, URL: https://www.linkedin.com/pulse/rise-machines-robotics-modern-construction/

5.Scantar -. Integration of Robotics & AI in Architecture for Future Homes // Robotics Tommorow. 2019. URL: https://www.roboticstomorrow.com/article/2019/10/integration-of-robotics-ai-in-architecture-for-future-homes/14375

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APPLICATION OF INFORMATION TECHNOLOGY IN CONSTRUCTION

Information technology (IT) has become increasingly important in the construction industry, offering various tools and applications to improve work processes and outcomes. Here are some key points about the application of information technology in construction:

Building Information Modeling (BIM): BIM is a digital representation of a building or infrastructure project that allows for collaboration, coordination, and visual

ization throughout the project lifecycle. It provides a centralized platform for architects, engineers, contractors, and other stakeholders to share and manage project information [1].

Construction IT Applications: There are various IT applications available to support different aspects of a construction project. These applications have been designed to address specific problems and automate tasks. Some examples include software for project management, cost estimation, scheduling, design, and documentation [2].

Challenges and Benefits: The adoption of IT in the construction industry comes with challenges such as inadequate training, ineffective use of IT infrastructure, and staff perceptions. However, when implemented effectively, IT can improve efficiency, reduce risk, and increase productivity in construction projects [3].

Automation and Off-Site Manufacturing: Information and Communications Technology and Automation (ICTA) has the potential to automate construction processes and improve efficiency. This

includes the use of off-site manufacturing and prefabrication techniques, which can streamline construction operations [4].

Digital Transformation: Information technology is playing a crucial role in the digital transformation of the construction industry. Technologies such as building information modeling, data-centered construction, and enterprise resource planning are being used to enhance project management, collaboration, and decision-making [5].

It is important to note that the application of information technology in construction is a rapidly evolving field, with ongoing research and development. The use of IT in construction projects can vary depending on the specific needs and requirements of each project.

REFERENCES

1.Fischer M. The Scope and Role of Information Technology in Construction // Doboku Gakkai Ronbunshu. 2004. № 63. C.1-31 URL: https://www.researchgate.net/publication/272535082_The_Scope_and_Role_of_Information_Technology_in_Construction

2.Al-Qazzaz I. Information Technology in Construction // Development of an Integrated Construction Management System for Building Estimation. 2010. C.14-43 URL: https://www.researchgate.net/publication/319744918_Information_Technology_in_Construction

3.H. Gaith F., A. Rashid K. Application and efficacy of information technology in construction industry // Scientific Research and Essays. 2012. № 7. C.3223-3242 URL: https://www.researchgate.net/publication/233747681_Application_and_efficacy_of_information_technology_in_construction_industry

4.J. Skibniewski M. Information technology applications in construction safety assurance // Journal of Civil Engineering and Management. 2014. № 20. C.778-794 URL: https://www.researchgate.net/publication/273295929_Information_technology_applications_in_construction_safety_assurance

5.TDX. Information Technologies application for construction // Life cycle document management system for construction. 2022. URL: https://www.tdx.cat/bitstream/handle/10803/6160/03Nfm03de12.pdf?sequence=3

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THE INTEGRATION OF SUSTAINABLE CONSTRUCTION PRACTICES IN OUR WORLD

The integration of sustainable construction practices, such as green building materials, energy-efficient technologies, and waste reduction strategies, is crucial for the future of the construction industry in order to mitigate environmental impacts, enhance resource efficiency, and promote long-term sustainability.

The construction industry plays a significant role in shaping our built environment, but it also has a considerable impact on the environment. As the demand for infrastructure and buildings continues to rise, it is imperative to adopt sustainable construction practices that minimize the industry's ecological footprint. This involves integrating green building materials, such as recycled materials and environmentally friendly alternatives, into construction projects.

Additionally, implementing energy-efficient technologies like solar panels, efficient insulation, and smart building systems can significantly reduce energy consumption and carbon emissions. Moreover, waste reduction strategies, such as recycling and reusing construction materials, can minimize waste generation and promote circular economy principles within the industry.

By embracing sustainable construction practices, the industry can achieve several benefits. Firstly, it can mitigate environmental impacts by reducing resource depletion, minimizing pollution, and conserving water and energy. This, in turn, contributes to the preservation of ecosystems and biodiversity.

Secondly, sustainable construction practices promote resource efficiency by optimizing material usage, reducing waste, and encouraging responsible sourcing of materials. This not only lowers construction costs but also enhances the long-term economic viability of projects.

Lastly, sustainable construction aligns with societal expectations and regulatory requirements, thereby enhancing the industry's reputation and fostering a more sustainable future.

REFERENCES

1.Akadiri, P. O., Chinyio, E. A., & Olomolaiye, P. O. (2017). Waste minimisation techniques for building construction projects: empirical study. Journal of Engineering, Design and Technology, 15(2), 244-262.

2.Ding, G. K. C. (2017). Sustainable construction—The role of environmental assessment tools. Journal of Cleaner Production, 147, 3-13.

3.Kibert, C. J. (2016). Sustainable construction: Green building design and delivery. John Wiley & Sons.

4.Pacheco-Torgal, F., Tam, V. W. Y., & Labrincha, J. A. (2013). Handbook of recycled concrete and demolition waste. Woodhead Publishing.

5.UN Environment. (2019). Global status report for buildings and construction 2019. URL: https://www.unenvironment.org/resources/report/global-status-report-buildings-and-construction-2019

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BENEFITS OF USING RECYCLED BUILDING MATERIALS IN CONSTRUCTION

Using recycled building materials in construction offers several benefits, making it a greener and more sustainable choice. Recycled materials can help reduce energy use, limit waste, minimize emissions, and are often cheaper than traditional materials. Additionally, incorporating recycled materials into construction projects can help businesses reduce their waste production and limit their reliance on landfill. This approach also contributes to mitigating the environmental impact of the construction industry, which traditionally accounts for a significant portion of all refuse nationwide. [1]

Types of Recyclable Construction Materials

There are various construction materials that can be recycled, including:

- Concrete
- Metals
- Asphalt
- Wood and untreated timber
- Glass
- Paper and Cardboard
- Gypsum
- Masonry

These materials can be repurposed and used in new projects, contributing to a more sustainable and eco-friendly construction process. [2]

Examples of recycled building materials are as follows:

1. Frost King No Itch Multi-Purpose Insulation: Made from 100% recycled denim.
2. Milliken Carpet Tiles with Econyl: Innovative nylon yarn produced from post-consumer waste materials such as fishing nets and textiles.

These examples demonstrate how post-consumer waste can be upcycled into new, durable, and cost-effective building materials, contributing to a more sustainable construction industry. [3]

Incorporating recycled materials into construction projects

Incorporating recycled materials into construction projects offers several business benefits, including reducing material and waste disposal costs, increasing competitive advantage, reducing CO2 emissions, and meeting planning requirements. Recycled materials such as glass, plasterboard, plastics, wood, aggregates, and paper can be effectively integrated into construction projects, complementing eco-design and responding to changes in public policy. [4].

Conclusion. The use of recycled building materials in construction not only aligns with sustainability goals but also presents a practical and cost-effective approach to reducing environmental impact. By repurposing materials and incorporating recycled products, construction projects can contribute to a more eco-friendly and sustainable future.

REFFERENCES

1.ETM Recycling. What are the benefits of using recycled building materials? // ETM Recycling Team. 2021. URL: https://www.recyclingbristol.com/what-are-the-benefits-of-using-recycled-building-materials/

2.Anuj Srivastava. Recycling Construction Materials. // Nearby Engineers. 2022. URL: https://www.ny-engineers.com/blog/recycling-construction-materials

3.Alyssa Ford. 11 Recycled Building Materials Made From Trash. // Familyhandyman. 2023. URL: https://www.familyhandyman.com/list/recycled-building-materials-made-from-trash/

4.Invest Northern Ireland & Nidirect government service. Recycling construction materials. // Nibusinessinfo.co.uk. 2023. URL: https://www.nibusinessinfo.co.uk/content/incorporating-recycled-materials-construction-projects

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AUTOMATED TILE LAYING IN BUILDINGS

Automated tile laying in buildings is an emerging field that aims to improve the efficiency and accuracy of tile installation processes. Here are some key insights into the use of automation in tile laying:

Challenges in Traditional Tile Laying: Traditional tile laying methods often lack a global plan for cutting and reusing materials, resulting in inaccuracies and material waste. Architects face difficulties in accurately calculating and laying out floor tiles, leading to labor and material inefficiencies. [1]

BIM-based Parametric Design: Building Information Modelling (BIM) technology, combined with parametric design platforms, shows promise in automating the generation and optimization of floor tile layout designs. These platforms can automatically generate and optimize tile layouts, reducing design uncertainties and minimizing waste. [1]

Robotic Tile Laying: Robotic systems are being developed to automate the tile laying process. These robots can handle tasks such as spreading mortar, setting tiles, and monitoring tile and installation quality. They can work faster than humans and ensure consistent quality throughout the installation process. [2]

Mechanized and Semi-Automatic Solutions: Mechanized and semi-automatic tile laying machines are also being developed to assist masons in the installation process. These machines use suction pads and spring balancer mechanisms to lift and place tiles on both horizontal and vertical surfaces, reducing the physical effort required by masons. [3]

Benefits of Automation: Automated tile laying offers several benefits, including increased efficiency, reduced labor requirements, improved accuracy, and minimized material waste. It can also help address labor shortages in the construction industry.

To sum up, it's worth emphasizing that although automation can improve the process of laying tiles, skilled labor and human expertise remain essential for maintaining quality and managing intricate tile arrangements. Automation is designed to support and enhance human abilities rather than supplant them.

REFERENCES

1.Automated Layout Design Approach of Floor Tiles: Based on Building Information Modeling (BIM) via Parametric Design (PD) Platform / S. Wu та ін. // MDPI. 2021. URL: https://www.mdpi.com/2075-5309/12/2/250

2.Apostolopoulos D., Schempf H. Mobile robot for automatic installation of floor tiles // Robotics and Automation, 1996. Proceedings., 1996 IEEE International Conference on Volume: 4. Pittsburg, 1996. URL:

3.https://www.researchgate.net/publication/3631805_Mobile_robot_for_automatic_installation_of_floor_tiles

4.Raj Kumar. Semi Automatic Tile Laying Machine // Indiamant. 2023. URL: https://www.indiamart.com/cognisite-technologies/semi-automatic-tile-laying-machine.html

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THE IMPACT OF NATURAL DISASTERS ON THE CONSTRUCTION LABOR MARKET

Natural disasters can have significant effects on the construction labor market. Here are some key points based on the search results:

Shift in labor demand: After a natural disaster, there is often an increase in the demand for labor in sectors involved in reconstruction and recovery efforts. This can draw workers away from other sectors, such as agriculture, and into higher-wage non-tradable sectors like construction [1].

Wage growth: The shift in labor demand can lead to a rise in the marginal product of labor and wages in the agricultural sector. In some cases, employment in the agricultural sector may contract while the construction sector expands, resulting in greater wage growth for agricultural workers [1].

Migration patterns: Natural disasters can also affect migration patterns in the labor market. In the medium to long term after a disaster, there may be an increase in rural labor migration, with workers primarily moving to work within the affected county, particularly in the construction and manufacturing sectors [1].

Resilience of labor market outcomes: In the long term, labor market outcomes appear to be resilient to natural disasters, at least in wealthy countries. However, the economic impacts of natural disasters can

be severe in the short term, suggesting the need for policies that better insure against consumption losses during this time [2].

Challenges faced by the construction industry: The construction industry bears a significant brunt of natural disasters. Construction sites become vulnerable hotspots, material costs surge due to increased demand for reconstruction, and labor shortages arise as workers are displaced or prioritize emergency response efforts. Delays in ongoing projects and a decline in new construction contracts contribute to a slowdown in the industry [3].

Impact on construction costs: Natural disasters can lead to rising supply costs in the construction industry. Building material prices, such as lumber, can increase due to increased demand and reduced availability. Other materials like drywall, concrete, and steel can also become scarce, further complicating the rebuilding process. Construction delays can occur due to labor and supply shortages, driving up rebuilding costs.[4]

In conclusion, it is important to note that the impact of natural disasters on the construction labor market can vary depending on the specific characteristics of the affected area, the population, and public policy.

REFERENCES

1.Kirchberger M. Natural disasters and labor markets // Journal of Development Economics. 2017. С.40-58 URL: https://www.sciencedirect.com/science/article/abs/pii/S0304387816300943

2.Deryugina T. Economic effects of natural disasters // IZA - World of Labour. 2015. URL: https://wol.iza.org/articles/economic-effects-of-natural-disasters

3.State-Wide Effects of Natural Disasters on the Labor Market / T. Chaiechi та ін. // Economic Effects of Natural Disasters. 2021. С.211-224 URL: https://www.sciencedirect.com/science/article/abs/pii/B9780128174654000145

4.Kirchberger M. Natural Disasters and Labor Markets // Journal of Development Economics. 2016. № 125 (1). URL: https://www.researchgate.net/publication/310590817_Natural_Disasters_and_Labor_Markets

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WAYS OF REDUCING THE NON-RENEWABLE CONSUMPTION ENERGY IN CLIMATE CONTROL BUILDING SYSTEMS

The main condition for the functioning of any technology at a given time is the reduction of non-renewable energy consumption in indoor climate control systems.

The improving of indoor comfort is one of the areas for further development of life support systems in buildings.

Modern energy crisis creates a new technological policy based on the principle of energy conservation and strict control of its consumption. Energy consumption analysis for indoor climate control in buildings over the past decade has shown that it has been increased significantly. At the same time it should be expected that the trend of its increase will continue with the planned economic growth. At present, the microclimate systems use energy which is obtained from the non-renewable types of energy (coal, oil, gas) [1].

Reduction of energy consumption in indoor climate control systems can be achieved by means of the following:

- highly efficient thermal protection of the building envelope;
- use of renewable energy (sun, wind, biomass, soil and water heat, etc.);

▪development of highly efficient indoor climate control technology.

The experience of creating the high-performance building envelopes in the world is very large.

The microclimate provision with the use of renewable energy sources is environmentally friendly and it is a modern, highly efficient microclimate technology [2].

One of the promising areas of modern energy development is the use of renewable energy for heat and cooling supply of microclimate systems in buildings based on installations that use insulated combined heat and cold production - absorption heat transformers (AHT). These heat transformers are a thermodynamic system where heat is transformed by means of combined forward and reverse cycles. AHTs have high efficiency, environmental friendliness, quiet operation, ease of maintenance, long service life and full automation.

On the basis of these thermo-transformers, a technology is proposed and a schematic diagram of its operation is developed to ensure year-round microclimate parameters in buildings with the integrated use of solar, wind, and biomass energy, as well as soil and water energy. Due to the instability of this energy, accumulation is provided. Of there is a shortage of renewable energy, a backup energy source is provided.

The analysis of the heat and air balance of the premises showed that the reduction of energy consumption by microclimate systems should be achieved by means of:

▪optimizing air exchange and reducing the amount of supply air to the required minimum,

▪zoning of premises by the area of the working or service area,

▪the use of natural air movement stimuli,

▪monitoring the state of the internal atmosphere and managing its parameters.

In order to solve the problem of reducing energy consumption, it is proposed to provide indoor microclimate by two simultaneously operating systems:

▪a system of year-round provision of thermal comfort in the room due to surface heating (in the transitional and cold periods of the year) and cooling (in the warm period of the year);

▪air conditioning system.

REFERENCES

1. Чесанов Л.Г., Петренко В.О. Стан мікроклімату в приміщеннях за різних технологій опалення. // Зб. наук. тр.: Будівництво. Матеріалознавство. Машинобудування; Вип. 13. Дніпропетровськ: ПДАБА. -2001. -С. 22-25.

2. Крафт Г. Системи низькотемпературного опалення. / Пер. з німецької Булкіна С.Г. -М.: Будовидав, 1983, 108 с.

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HUMIDITY AND AIR MOVEMENT IMPACT ON THERMAL CONDITIONS

The temperature conditions of the room determine its thermal microclimate and limit the other parameters such as humidity and air movement. It is necessary to consider the values of relative air humidity $\varphi_в$, which, in combination with the temperature of three normalization zones, will not have any adverse effect on human well-being and performance.

The boundaries of the range of permissible combinations $t_в$ - $\varphi_в$ must be also taken into account. It is known that low relative air humidity (20...25%) is one of the causes of colds. In addition, it causes increased dust due to excessive drying of objects made of natural materials (wooden furniture, parquet floors, etc.). High relative air humidity (above 70%) also negatively affects human well-being. Even at a comfortable temperature, it leads to increased heat loss from the body, which makes a person feel chilly.

At the same time, the release of water from the skin and lungs decreases, contributing to the exacerbation and progression of pulmonary diseases. Increased air humidity at more than 22°C makes feel stuffy. Based on subjective assessments, the so-called spirit curves were constructed. In mid-latitudes, this curve corresponds to the maximum moisture content of internal air d = 12 g/kg. [1, 3]

For heated premises of residential and public buildings, according to regulatory guidelines [2], the permissible norm of relative humidity of internal air is no more than 65% at a temperature of 18...22°C, and the optimal one is 30...45% at a temperature of 20... 22° C. However, many researchers believe that the comfortable range of relative humidity can be expanded to 55%. An increase in air temperature requires a corresponding decrease in its humidity to enhance heat transfer by evaporation.

At a relatively low ambient temperature, humid air, due to its high thermal conductivity and heat capacity, further increases the heat transfer of the body, which is extremely undesirable. Therefore, as temperature drops, relative humidity values are limited.

Air movement in the area of residential and public buildings within the range of 0.1...0.15 m/s is considered most favorable at a temperature of 20...22°C, and its increase to 0.2 m/s - at more high temperature [2, 3]. With regard to regulatory guidelines [4], it is permissible to increase air movement to 0.3 m/s in the temperature range of 18...22°C.

In the premises of buildings equipped with natural ventilation systems, air movement values are usually within limits close to normal. Such movement will not change the thermal conditions in the premises with an acceptable decrease in internal temperature. An increase in temperature, as it is known, is accompanied by increased ventilation of premises, and, consequently, an increase in the overall movement of air. Therefore, it is of practical importance to analyze the required relative humidity of indoor air during different periods of the heating season with standard air exchange L_n (3 m^3/h per 1 m^2) as required in the guidelines. [4]

The analysis of the data obtained allows us to draw the following conclusions. In conditions of central heating, there is an excess supply of thermal energy for heating, which allows residents to increase the intensity of air exchange and thereby not only eliminate overheating, but also reduce the relative humidity of internal air (from 65...70%) to optimal values. In spring, the desired increase in internal temperature of approximately 2°C should be taken into account.

During most part of the heating period, the relative humidity of the internal air can be maintained within normal limits due to standard air exchange. At low outside air temperatures, a regulated reduction in air exchange allows eliminating excessively dry air.

An unfavorable factor that has a negative impact on the indoor microclimate is the condensation of moisture on the internal surfaces of external fences when the air temperature in the premises decreases during the period of extreme cold. However, at $t_в$ = 15°C and $\varphi_в$ = 42%, the dew point temperature is approximately 12°C lower than the air temperature, which does not create conditions for moisture condensation, provided the thermal properties of the external fences correspond to the design data. At the same time, with more intense moisture releases compared to the calculated ones, condensation of water vapor is possible on the coldest surfaces: windows, places of heat-conducting inclusions in the structure of the outer wall, etc. However, these phenomena are relatively short-term.

Thus, while ensuring the standard value of indoor air exchange due to external air, in buildings of mass construction such values of humidity and movement of internal air are maintained in order not to change thermal conditions due to temperature indicators. Therefore, to calculate necessary thermal conditions, only the temperature factor of the microclimate can be taken into account.

REFERENCES

1. V. G. Bardov, V. I. Fedorenko, Ye. M. Beletskaya i dr.. Osnovy ekologii : uchebnik dlya studentov. vysshikh ucheb. zavedeniy / Pod red. V. G. Bardova, V. I. Fedorenko. - Vinnitsa : Novaya kniga, 2013. – 424 s.

2. Gigiyena i ekologiya. Uchebnik / pod red. V. G. Bardova. - Vinnitsa: Nova kniga, 2006. – 320 s.

3. Zhidets'kiy V. TS. Dzhigirey V. S. Mel'nikov O. V. Osnovi okhoroni pratsí. Pídruchnik. – Vid.5-ye.dop. – L'vív: Afísha, 2002. – 350 s.

4. DBN V.2.6-31:2021 Teplova izolyatsiya ta enerhoefektyvnist′ budivel′.

5.Meteorological conditions. URL: https://jiu-jitsu.com.ua/bezopasnost/lichnaya-bezopasnost/obg-meterologicheskie-uslovia.php

6.Optimal indoor temperature. URL: https://ventbazar.ua/uk/blog/komfortnaya-temperatura-v-kvartire/

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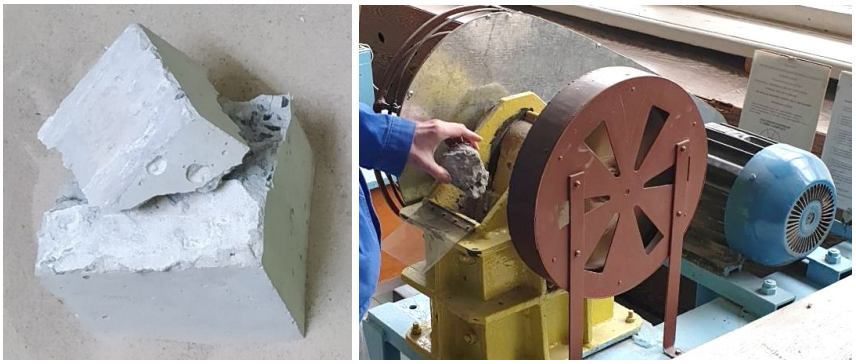
GRAIN SIZE COMPOSITION OF RECYCLED COARSE AGGREGATES

During the design of concrete mixture it is necessary to know such characteristics of aggregates as grain size composition, bulk density, specific density, voids, strength. These properties determine the mass content of the components of the concrete mixture, and also impact its characteristics (W/C ratio, plasticity, density etc.) [1].

A feature of the recycled coarse aggregate (RCA) made from concrete waste is the presence of such new phases as the residual mortar (RM) and the interphase transition zone between it and the natural aggregate [2]. RCA tests were performed to determine the effect of additional components of coarse aggregate on its properties. As a source three series of concrete samples of three different mixtures with different strength classes were made from local materials.

The samples of origin concrete were crushed at the age of 28, 90 and 180 days using a laboratory jaw crusher (Fig. 1). After grinding each mixture was marked according to the following scheme: XX/YY/K, where XX is the number of source mixture, YY is the age at which the source concrete samples and crushed mixes were tested. This work presents the results of determining the grain size composition of the RCA.



a)b)

Fig. 1.a – the split sample a cracked sample of source concrete without structural disturbance; b – laboratory jaw crusher with complex rotation.

Grain size composition of each mix was determined by sieve analysis [3]. Due to the high content of small fractions, unfractionated mixtures of small and large fractions do not meet the requirements [1]. The sieving curves of only the coarse fractions plotted on the standard graph are shown on Fig. 2. As we can see from graph in general, the grain size composition of only coarse fractions meets the requirements of standards in Ukraine.

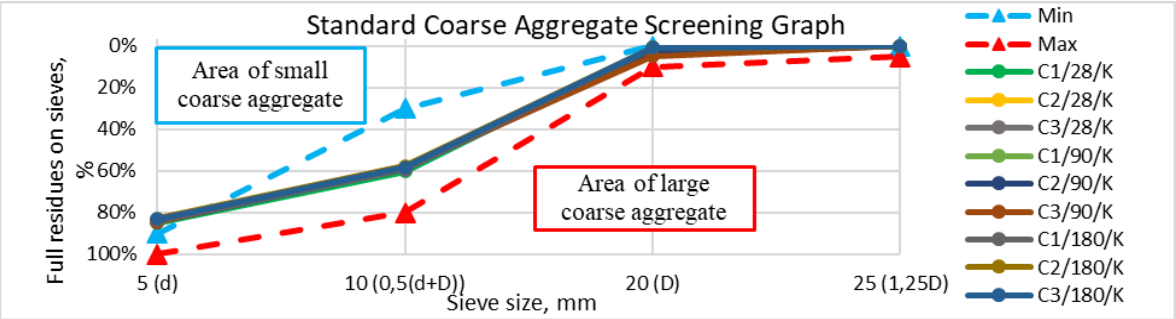
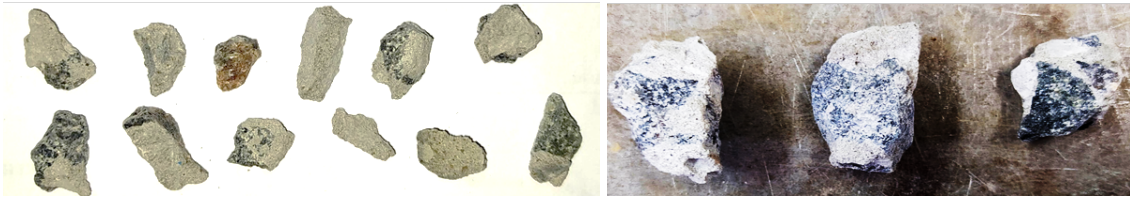


Fig. 2. Sieving curves of only the coarse fractions on the standard graph.

A visual inspection of individual grains of fractionated RCA shows that the content of adhered mortar on the grains of different fractions differs significantly. Almost 100% of grains in the 10-20 mm fraction contain both natural crushed stone and RM. In the vast majority the content of RM is less than 50%. In the fraction of 5-10 mm, a certain amount of grains does not have natural crushed stone at all and in a large number of grains the content of RM significantly exceeds 50% (Fig. 3). Such features obviously determine the different bulk and specific densities of different fractions.



a)b)

Fig. 3. Fractions of RCA 5-10 mm (a) and 10-20 mm (b).

REFERENCES

1. ДСТУ-Н Б В.2.7-299:2013. Настанова щодо визначення складу важкого бетону. Чинний від 2014-07-01. Вид. офіц. 2013.
2. Савицький М. В., Смирнов А. С. Особливості використання подрібненого бетонного брухту в якості крупного заповнювача для бетону. Український журнал будівництва та архітектури, № 6 (018), 2023. С. 111-117. DOI: 10.30838/J.BPSACEA.2312.261223.111.1013.
3. ДСТУ Б В.2.7-71-98. Щебінь і гравій із щільних гірських порід і відходів промислового виробництва для будівельних робіт. Методи фізико-механічних випробувань (ГОСТ 8269.0-97). З Поправкою. Чинний від 1999-01-01. Вид. офіц.

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INDUSTRIAL WOOD-CEMENT-RECYCLED CONCRETE STRUCTURES

The increasing attention to sustainable development and environmental issues in modern construction creates the necessity for the utilization of new materials and technologies. One such innovative approach is the utilization of recycling in the production of wood-cement-recycled concrete structures. This paper is dedicated to exploring recycling technologies and their impact on the characteristics and advantages of industrial wood-cement-recycled concrete structures.

Previous research has focused on various aspects of utilizing secondary materials in construction, including wood-cement-recycled concrete structures. They indicate the potential of utilizing production waste and recycling building materials to reduce environmental impact and resource consumption.

One direction of research is the use of recycled materials such as reclaimed wood and recycled plastic products in the production of wood-cement-recycled concrete structures. This opens up new opportunities for reducing the consumption of natural resources and minimizing waste, thus promoting sustainable material use.

Researchers are also investigating effective waste processing technologies for use in the production of wood-cement-recycled concrete structures. A crucial part of this process is the development of processing methods that ensure the high quality and strength of the resulting structures.

Additionally, research points to the necessity of quality control at every stage of production of wood-cement-recycled concrete structures using secondary materials. This is necessary to ensure compliance with standards and to guarantee the strength and durability of the resulting structures.

Methods of recycling in the production of wood-cement-recycled concrete structures:

Utilization of secondary materials: Various secondary materials such as reclaimed wood, recycled plastic products, etc., can be used in the production process of wood-cement elements.

Processing technologies: To obtain quality wood-cement-recycled concrete structures using secondary materials, it is necessary to develop and implement effective waste processing technologies.

Quality control: It is important to ensure quality control at every stage of production, as the use of secondary materials can affect the characteristics and strength of wood-cement-recycled concrete structures.

Advantages of industrial wood-cement-recycled concrete structures:

Environmental friendliness: The use of secondary materials allows reducing waste and promotes sustainable resource use.

Efficiency: Industrial wood-cement-recycled concrete structures can have comparable strength and durability to traditional structures while reducing the use of natural resources.

The utilization of recycling technologies in the production of wood-cement-recycled concrete structures has great potential for reducing the environmental impact of construction and optimizing resource use. However, to achieve maximum results, further research and implementation of advanced processing and quality control technologies are necessary. The development of industrial wood-cement-recycled concrete structures can be a significant step towards sustainable construction and environmental preservation.

REFERENCES

1.Utilization of Wood Biomass Ash in Concrete Industry Nina Štirmer and Ivana Carević Submitted: 04 January 2022 Reviewed: 10 January 2022 Published: 12 February 2022

2.IEA Bioenergy. Options for increased use of ash from biomass combustion and co-firing. IEA Bioenergy. 2018. Available from: https://www.ieabioenergy.com/wp-content/uploads/2019/02/IEA-Bioenergy-Ash-management-report-revision-5-november.pdf

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TECHNOLOGICAL INNOVATIONS IN CONSTRUCTION AND THEIR IMPACT ON MODERN PROCESSES

Construction is an industry that always strives for development and progress. With the advent of new technologies, construction becomes more efficient, environmentally sustainable and dynamic. The construction sector is improving its methods, processes and materials in order to provide quality and environmentally friendly solutions. Population growth, migration processes create new challenges, which

the construction industry responds to by developing innovative housing concepts. Construction and innovation are deeply interconnected and important to the modern world.

A key factor contributing to the development of the construction industry is technological innovation. One of the bright directions is the introduction of digital technologies and information systems. The use of the BIM (Building Information Modeling) system allows you to create three-dimensional models of buildings and objects, providing more accurate planning and project management. This allows you to reduce construction time and costs, as well as improve interaction between project participants [1].

Another innovation that is actively being implemented in construction is 3D printing. With the help of 3D printers, you can create building elements and details with complex geometry, which allows you to speed up the construction process and reduce its cost. Also, 3D printing allows you to use environmentally friendly materials and reduce construction waste [2].

A promising area of innovation in construction is the use of "smart" materials and systems. For example, self-cleaning surfaces, self-installing materials or solar panels integrated into building structures. These technologies make it possible to create more efficient and environmentally sustainable buildings [3].

It is also necessary to note the importance of innovations in the field of construction management. The use of the project management system, data analytics and artificial intelligence allows to optimize the planning, control and coordination of construction works. This reduces risks and increases the efficiency of projects [4].

Construction and innovation are inextricably linked. Innovations bring significant changes to construction processes, increasing efficiency, sustainability and quality. The introduction of digital technologies, 3D printing, the use of "smart" materials and systems, as well as innovations in construction management open new perspectives for the industry. In addition the development of innovations has a significant potential to improve the quality of life of people, provide them with comfort and strengthen the sustainability of buildings.

REFERENCES

1. Трофименко, Р. І. (2023). Застосування BIM-технології у проектуванні будівельних об'єктів.

2. Шатов, С. В., Маценко, О. М., Скрипка, Є. О., & Даниленко, І. О. (2021). Еколого-економічні переваги переходу на 3d-друк будівельних об’єктів у руслі industry 4.0.

3. Остапенко, С. (2023). Принципи формування інноваційного середовища з використанням «Smart systems» (Master's thesis, ДВНЗ" Придніпровська державна академія будівництва та архітектури").

4. Лялюк, О. Г., & Осипенко, Р. С. (2023). Особливості імплементації штучного інтелекту в будівництві. Сучасні технології, матеріали і конструкції в будівництві, 35(2), 172-176.

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USING ARTIFICIAL INTELLIGENCE TOOLS IN CALCULATIONS AND DESIGN OF METAL STRUCTURES

At present, the use of artificial intelligence can bring the solution to problems of calculation and design of metal structures to a new level. There are many uncertainties in such tasks which are associated with creating descriptions of the existing object and the design of a new one. There is a need to agree on conflicting criteria for ensuring strength and reliability, cost-effectiveness, safety, installation speed and

other factors, as well as the probabilistic nature of loads, material characteristics and geometric characteristics of cross-sections. The limit state method used to solve this problem has its limitations, related to the analysis of the limit states. The use of artificial intelligence can optimize the processes of data analysis, modeling, forecasting, and automation in tasks of calculating and designing metal structures [1-3].

Chat GPT can explain the fundamental concepts and principles of detailed modeling of structures, as well as clarify when and why detailed modeling may be beneficial or undesirable.

Python with machine learning and data analysis libraries (such as TensorFlow, scikit-learn, pandas) can simplify the design and calculation of structures. It can provide guidance, suggesting calculating force of "50 kN" for connection elements without detailed calculation. For instance, it is necessary to analyze the stress distribution in a beam structure. Starting with a simple model that considers only the main components of the beam (such as the beam itself and the supports) it may provide sufficient accuracy for initial calculations.

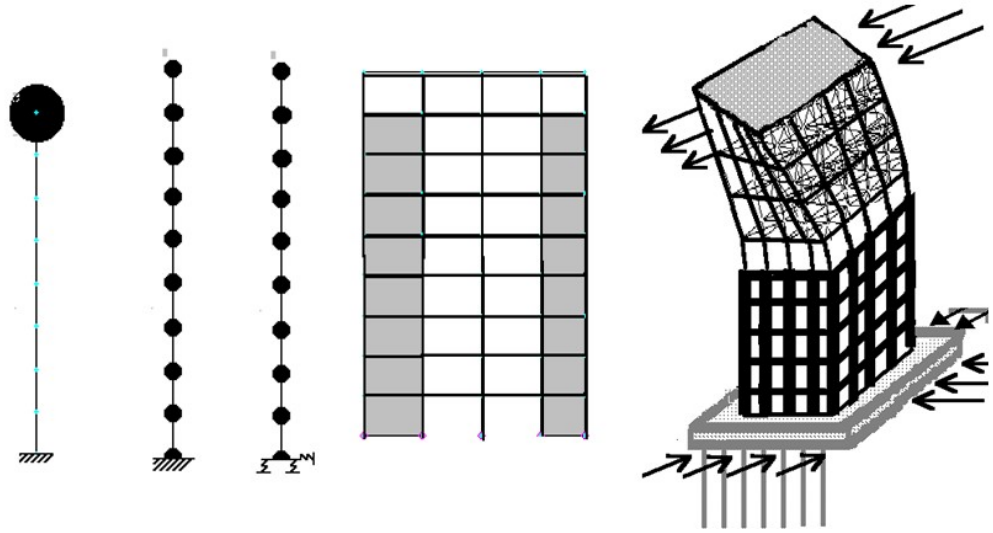

Fig. 1.Options for modeling multi-story frame buildings

This approach is applied in student education to eliminate unexpected errors. As calculations using construction mechanics methods are not performed, standard diagrams and formulas are used.

It all depends on understanding the function of specific structural elements in the collaborative operation of the structural system. In any case, there should be an understanding of the design scheme that, to some extent, can forecast the calculation results.

Specialized tools for engineering modeling help in such tasks. Autodesk Revit, Ansys, Tekla Structures use artificial intelligence methods for modeling and analysis of building structures.

The use of a highly detailed model and a powerful computing complex will not always lead to the correct result. Artificial intelligence suggests that it's better to proceed from simple to complex, predicting calculation results and refining them during the detailing of the design in the next stage. Initially, a flat diagram is created, followed by a spatial one, and then accounting for wall filling, and adjacent subsystems of the foundation, structures, and load fields. (Fig. 1)

When using software packages, there is a distinct issue that arises: the details of the breakdown into finite elements and the methods of node modelling. For example, when defining a relative eccentricity for rods with ends fixed from displacement perpendicular to the plane of action of the moment, the maximum moment within the middle third of the length, but not less than half of the greatest moment along the length of the rod, should be taken as the design moment.

To enable stability checks from the plane using the maximum moment in the middle third of the column element and other compression-bending elements, the breakdown should ensure nodes along the middle third's boundaries, and stability checks from the moment's action plane should be conducted on

the final element with the maximum moment in the middle third of its length. It's essential to ensure that the moment is at least half the maximum.

Therefore, the finite element breakdown scheme of the lower part of columns will give different outcomes – either meeting or not the requirements of the first group of limit states.

Rigid inserts, solids, or translation merges can be applied. For instance, rigid inserts move the flexible part of the element away from the node, creating an infinitely rigid insert between the flexible part and the node. When modeling sheet hinges, transferring forces in specific directions - only vertical, or only horizontal can be used to 'combine movements'. Different ways of modeling floor structures will result in different outcomes.

It becomes even more complicated when calculations are required for progressive collapse, when optimizing the life cycle processes of manufacturing, installation, operation, and application of effective methods of analysis and forecasting the behavior of structures under the influence of external factors.

Artificial intelligence can be introduced at all the above stages of calculation and design both in teaching students and in creating innovative methods of design, monitoring the state of structures in real time, when modelling dynamic features of structural work.

Artificial intelligence can be integrated as a direction for the development of advanced calculations and models aimed at enhancing the reliability and durability of designed buildings and structures (it should be noted that this need arises not only in the design of new buildings and structures, but also in the inspection, diagnosis, and reconstruction of existing facilities).

Artificial Neural Networks can be employed to refine and test calculation models, optimizing various parameters based on training data and real-world performance.

Comprehensive approach is used in application of spatial models, taking into account modeling of nodes, boundary conditions, stiffening on different subsystems of constructions. Finite Element Analysis software, such as Abaqus or ANSYS, uses AI algorithms for spatial modeling, considering factors like node behavior, boundary conditions, and subsystem interactions.

Modeling of non-linear properties and characteristics (elastic and dissipative), taking into account structural non-linearities (gaps, one-sided connections, working, for example, only for stretching or compression, "included" or "off"). Machine learning algorithms, such as Random Forests or Gradient Boosting Machines, can be applied to model non-linear properties and structural behaviors, adapting to complex relationships between variables and conditions.

Genetic Algorithms can optimize the design process of metal structures by providing solutions that meet specified criteria, such as energy efficiency, safety, and weight reduction, while considering spatial and material constraints.

Artificial intelligence tools are used in individual tasks and calculations when selecting a technology in the manufacture of metal structures, transportation, installation and technological processes of construction production, operation and repair, tests of metal structures, technical diagnostics. As a result, Robotics Process Automation combined with machine learning algorithms can automate various tasks involved in metal structure manufacturing, transportation, installation, and maintenance, improving efficiency and accuracy while reducing costs and human errors.

REFERENCES

1.Shengzhe Zhang. Artificial Intelligence and Applications in Structural and Material Engineering / Highlights in Science Engineering and Technology 75. P. 240-245.

2.Computer-Vision and Machine-Learning-Based Seismic Damage Assessment of Reinforced Concrete Structures by Yang Xu,YiLi,XiaohangZheng,Xiaodong Zheng andQiangqiang Zhang Buildings 2023, 13(5), 1258;

3.Pengzhen Lu, ShengyongChen, Yujun Zheng. Computational Intelligence in Civil and Hydraulic Engineering / Computational Intelligence in Civil and Hydraulic Engineering. Volume 2012.

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STABILITY OF HIGH-RISE BUILDINGS

High-rise buildings are structures that have a significant height and span more than 12 floors, or 35 meters. They are designed to accommodate various functions, such as residential, commercial, office, hotel, etc. High rise buildings are exposed to various loads and conditions, such as wind, earthquake, fire, blast, etc., that can affect their stability and performance. Stability is the resistance of a structure to undesirable movements, such as sliding, collapsing, or overturning [1,2]. Performance is the ability of a structure to fulfill its intended functions, such as safety, serviceability, and durability. Therefore, it is important to analyze and optimize the factors and methods that influence the stability and performance of high-rise buildings.

Some of the main factors that affect the stability and performance of high-rise buildings are: Structural system is the arrangement and connection of the structural elements, such as columns, beams, slabs, walls, etc., that support the loads and transfer them to the foundation. The structural system can be classified into different types, such as frame, shear wall, core, outrigger, tube, etc., depending on the distribution and orientation of the elements[3,4]. The structural system should provide adequate stiffness and strength to resist the lateral and vertical loads, as well as the P-Delta effects, which are the additional forces and moments that arise from the interaction between the axial loads and the lateral displacements of the structure. The structural system should also prevent or delay the buckling phenomena, which are the sudden loss of stability and strength of a structure or a member due to the action of compressive forces.

Material is the substance that constitutes the structural elements, such as concrete, steel, timber, etc. The material should have suitable properties, such as density, modulus of elasticity, yield strength, ultimate strength, ductility, etc., that affect the behavior and response of the structure under the loads and conditions. The material should also have adequate durability, fire resistance, corrosion resistance, etc., that affect the longevity and maintenance of the structure.

Design strategy is the approach and methodology that are used to conceive and develop the structure, such as the architectural concept, the structural form, the load path, the analysis method, the design criteria, the optimization technique, etc. The design strategy should consider the functional, aesthetic, economic, and environmental aspects of the structure, as well as the relevant codes and standards that govern the design [5]. The design strategy should also incorporate innovative and advanced techniques and technologies, such as smart materials, sensors, monitoring systems, control devices, etc., that can enhance the resilience and robustness of the structure.

By exploring these factors and methods, one can gain a deeper understanding and appreciation of the stability and performance of high-rise buildings, as well as the challenges and opportunities for improving them. High rise buildings are not only engineering marvels, but also symbols of human achievement and aspiration.

REFERENCES

1.Al-Kodmany, K. Sustainable High-Rise Buildings: Toward Resilient Built Environment, University of Illinois (Chicago), April 18, 2022. pp. 1-2. Frontiers in Sustainable Cities, 4, 782007

2.Council on Tall Buildings and Urban Habitat, 10th world Congress (Chicago), 28 Oct-02 Nov 2019. pp. 3-4. The 50 Most Influential Tall Buildings of the Last 50 Years

3.High-rise building. May 2, 2021. p.1. In Simple English Wikipedia

4.Jan, T.S., Liu, M.W., & Kao, Y.C. An upper-bound pushover analysis procedure for estimating the seismic demands of high-rise buildings, University of Illinois (Chicago), April 18, 2022. pp.3-4. Engineering Structures, 26(1), 117-128

5.Rethinking The Future, RTF (New Delhi), March 20, 2023. pp.1-2. Design Guidelines High rise building

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RATIONAL DESIGN OF BIOPOSITIVE BUILDING CONSTRUCTIONS: IMPACT ON STABILITY AND ECOLOGICAL EFFICIENCY

In the modern world, where attention to environmental issues and sustainable development is growing, architectural projects are increasingly oriented towards ensuring comfort and health of residents, as well as preserving the environment. The concept of biopositive buildings, aimed at improving the quality of life and promoting human health, is becoming increasingly relevant. In this context, rational design of biopositive building constructions plays a key role in ensuring the stability and ecological efficiency of such structures.

Biopositive buildings are structures that take into account the impact of building materials, constructions, and technologies on human health and the environment. Such buildings aim not only to minimize negative environmental impact but also to actively contribute to improving air, water, and indoor environment quality.

Utilization of eco-friendly materials: This includes the use of renewable sources of materials, waste, and biomaterials that have minimal or zero negative impact on the environment and human health.

Optimization of thermal and sound insulation: Rational use of insulated materials and effective insulation helps reduce energy consumption for heating and air conditioning, while ensuring comfort and health of residents.

Maximization of natural lighting and ventilation: Rational placement of windows, light wells, and ventilation systems allows for maximizing the use of natural resources to ensure comfort and health.

Utilization of energy-efficient technologies: Implementation of solar panels, wind generators, geothermal systems, and other alternative energy sources reduces consumption of traditional energy resources and lowers emissions into the atmosphere.

Reduction of energy costs: Application of energy-efficient technologies and constructions significantly reduces energy consumption for heating, conditioning, and lighting, thus reducing emissions into the atmosphere and ensuring building stability.

Improvement of air and water quality: Rational use of natural resources for ventilation and purification of air and water ensures the health of residents and contributes to the stability of building operation.

Rational design of biopositive building constructions plays an important role in ensuring sustainable development and the health of residents. By implementing advanced technologies, innovative approaches, and eco-friendly solutions in construction, significant reduction of the impact of building processes on the environment can be achieved, providing comfortable living conditions for people.

Integration of biopositive principles into the construction process can be challenging due to factors such as the cost of materials and technologies, the need for specialized knowledge and experience in design and construction. However, the development of this direction in construction promotes the implementation of cutting-edge technologies and stimulates the development of eco-friendly solutions.

Biopositive buildings not only reduce negative environmental impact but also have a direct positive impact on the health and well-being of people. Providing a healthy microclimate, using natural materials, and access to natural light and green spaces contribute to reducing the risk of illness and improving quality of life.

Thus, rational design of biopositive building constructions opens up new opportunities for creating a sustainable, environmentally friendly, and healthy living and working environment. The development of this direction in construction is an important step towards ensuring sustainable development and improving the quality of life of modern society**.**

REFERENCES

1.Ortiz, O.; Pasqualino, J.C.; Castells, F. Environmental performance of construction waste: Comparing three scenarios from a case study in Catalonia, Spain. Waste Manag. 2010, 30, 646–654. [Google Scholar]

2.John, G.; Clements-Croome, D.; Jeronimidis, G. Sustainable building solutions: A review of lessons from natural world. Build. Environ. 2005, 40, 319–328. [Google Scholar]

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ENERGY EFFICIENCY IMPROVEMENT IN RECONSTRUCTION OF RESIDENTIAL BUILDINGS (UKRAINE)

While the global community addresses the issue of global warming and attempts to mitigate the consequences of climate change, more pressing scientific and applied tasks have emerged in Ukraine since February 24, 2022.

With the beginning of the Russian invasion in Ukraine, the Russian Federation launched multiple massive and methodical missile strikes against critical infrastructure in Ukraine during the winter period. These strikes caused power and heating cut-off for thousands of consumers.

In addition, the housing stock of Ukrainian cities is largely represented by houses of typical series that do not meet current normative requirements for energy saving. The pipelines for the centralized heat supply systems are worn out due to long-term operation.

Today, we are facing the problem of significant 'aging' of the infrastructure of heat supply systems, further complicated by hostilities. This critically affects the microclimate inside residential buildings. With the external temperature of -5°C, the indoor temperature drops from +20 to +12°C in 24 hours [1].

Modern research in Ukraine pays considerable attention to the reduction of energy costs during the operation of multi-apartment multi-story residential buildings. However, most of these works concern new construction, where the principles of energy efficiency can be taken into account at the design stage and implemented during construction [2].

Regarding reconstruction, research is aimed at individual structural elements, for example, double-glazed windows, which allow for an almost thermally homogeneous outer shell of the house [3]. Scientists are also investigating the modernization of the ventilation system [4] and the heat distribution system [5], studying the use of new materials.

There are a lot of great individual works, but we need one working system, the implementation of which will make it possible to save energy and make existing buildings more autonomous.

This issue concerns millions of Ukrainian families who are currently living in houses of typical series. Reconstruction of these buildings will cost tens of billions of hryvnias, but replacing a similar amount of housing with new ones will cost hundreds of billions of hryvnias.

Improving energy efficiency of buildings requires a comprehensive approach to the implementation of energy-saving measures, in particular:

Insulation of external enclosing structures;

Modernization of the heating system;

Modernization of the ventilation system;
Modernization of energy equipment;
Implementation of home management systems.

Therefore, the formation, assessment, substantiation and selection of rational organizational and technological solutions to the reconstruction of residential buildings, taking into account improved energy efficiency, is an urgent problem to be researched.

REFERENCES

1.Belikov, A. S., Kolesnyk, I. O., Zheleznyakov, Ye. O., &Klymenko, H. O. (2023). "Zabezpechennia umov mikroklimatu z urakhuvannyam konstruktyvnyh osoblyvostey budivel ta sporud u razi avariynykh vidklyuchen teplo postachannya". Ukrayinskyi zhurnal budivnytstva ta arkhitektury, (2312), 7-948. [Ensuring microclimate conditions taking into account the design features of buildings and structures in case of emergency heat supply outages. Ukrainian Journal of Construction and Architecture)]

URL:http://srd.pgasa.dp.ua:8080/bitstream/123456789/10725/1/BELIKOV.pdf

2.Nazarenko, O. M., Beyner, N. V., &Beyner, P. S. (2023). Kompleksnyy pidkhid do proektuvannya energoefektyvnykh budivel na osnovi BIM. Ukrainskyi zhurnal budivnytstva ta arkhitektury, (2312), 66-920. [A comprehensive approach to designing energy-efficient buildings based on BIM]

URL: http://uajcea.pgasa.dp.ua/article/view/277263/272002

3.Sopilnyak, A. M., Kolokov, V. V., Yarova, T. P., Sereda, S. Yu., Sirenko, K. O., & Dunda, V. V. (2023). BIM-energoanaliz budinku z podviynymy viknamy. Ukrainskyi zhurnal budivnytstva ta arkhitektury, (2312), 107-773. [BIM-based energy analysis of a building with double windows. Ukrainian Journal of Construction and Architecture]

URL:http://srd.pgasa.dp.ua:8080/bitstream/123456789/6941/1/SOPILNIAK.pdf

4.Vilinska, L. M., Burlak, G. M., & Gurska, A. V. (2023). Energoefektyvnist' bahatokvartyrnoho zhytlovoho budinku. Ukrainskyi zhurnal budivnytstva ta arkhitektury, (2312), 28-951. [Energy-efficiency of a multi-apartment residential building]

URL: http://srd.pgasa.dp.ua:8080/bitstream/123456789/10728/1/VILINSKA.pdf

5.Kosenko, L. V., Koval, O. O., Yurchenko, Ye. L., &Tymoshenko, O. A. (2023). Energoefektyvnist' systemy opalennya vysotnoho korpusu PDABA. (2312), 66-912. [Energyefficiency of the heating system of a high-ris ebuilding of PDABA]

URL: http://srd.pgasa.dp.ua:8080/bitstream/123456789/9798/1/Kosenko.pdf

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DESIGN AND PSYCHOLOGY EFFECT ON EMOTIONAL STATE

Colors and emotions. Colors have the ability to evoke different emotions. For example, warm colors (red, orange, yellow) can evoke feelings of joy and energy, while cold colors (blue, violet) promote relaxation and peace, green - a feeling of harmony and natural freshness. Choosing a color palette in the interior can adjust our mood to certain emotional goals.

Forms and lines. Geometric shapes and lines also affect perception. Sharp angles and straight lines can create a feeling of tension, while round shapes can be associated with harmony and softness. A well-organized space can promote comfort, relaxation, and a sense of control.

Materials and textures. Touching different surfaces - smooth, rough, warm or cold - also affects our perception. Textures can evoke comfort or even activate tactile sensations. Comfortable furniture adapted to human physiology contributes to comfort and the ability to relax. Hard, hard chairs in public catering establishments help to increase traffic, because customers do not sit for a long time on this type of furniture and leave almost immediately after finishing their meal [1].

Acoustics. Sounds and noises in the room also affect our psychology. Pleasant background music or nature sounds can promote relaxation. Fast rhythmic music makes the heart beat faster, which helps to make decisions as quickly as possible, leaving no time to «think».

Decor and items. Objects that are in our field of vision can cause associations, memories and emotions. Favorite photos, paintings, souvenirs -they fill the space with meaning and can lift the mood or, on the contrary, cause excitement [1, 2].

Lighting. The brightness and color of lighting can also affect our mood. Warm bright lighting can create a cozy atmosphere, and bright white light can stimulate wakefulness. White cold lighting is chosen for office spaces, which forces you to maintain concentration on the process. Soft warm light for residential interiors contributes to the feeling of comfort and coziness.

Greenery. Green helps calm and restore balance. A person feels approximately the same when surrounded by nature. This effect can be reproduced in your own room by placing as many plants as possible.

The arrangement of the furniture. The arrangement of the room can greatly affect your perception. Do it exclusively according to your own sense of comfort, without forgetting about practicality and ease of use. If you like the feeling of coziness in small rooms, then a dense arrangement may be suitable for you. If you like large free spaces, arrange the furniture accordingly [1, 2].

But in any case, place them so that as much light as possible enters the room. Another surprising discovery: low ceilings can reduce stress levels. Designers claim that soft curves and roundness have a better effect on the psychological well-being of residents. They make the space more flexible and help to feel comfortable.

Conclusion. The careful examination of different facets of interior design, including colors, shapes, materials, acoustics, decor, and lighting, emphasizes their influence on our emotional state and overall welfare. Grasping these elements aids in crafting a space that not only aesthetically pleases but also fosters comfort, relaxation, and psychological well-being.

REFERENCES

1. European Design School. Дизайн і психологія. Вплив на емоційний стан. European Design School. 2023. URL: https://eds.ua/blog/article/dyzain-i-psychology-vplyv-na-emoziyny-stan

2. Abdulaieva R. Психологія дизайну: як інтер'єр допомагає боротися зі стресом. RBC-Ukraine. 2024. URL: https://www.rbc.ua/ukr/realty/psihologiya-dizayna-interer-pomogaet-borotsya-1643463394.html

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LES CONCEPTIONS MODERNES DE L'ARCHITECTURE VERTE

L'actualité du sujet. A nos jours, l'humanité s'est trouvée au bord d'un désastre écologique, donc, elle a commencé à réfléchir à la préservation des ressources naturelles et aux problèmes environnementaux. Ainsi, il est nécessaire de trouver de nouvelles façons de résoudre ce problème. L'une des options pour en trouver la solution est le recours à l'architecture verte.

Les grands principes de l'architecture verte sont la construction utilisant des matériaux écologiques et l'exploration de ressources naturelles, telles que les plantes vivantes. Ainsi, le but de ce travail est d'analyser les concepts généraux de l'architecture verte.

La partie essentielle. L'architecture verte est un type et une forme de construction dont l'idée principale est de minimiser l'impact de l'homme sur l'environnement. [1] A la base de l'architecture verte on voit l'interaction entre l'architecture et la nature, par exemple, l'utilisation du paysage naturel.

Pour préserver en maximum le paysage naturel, on peut concevoir la disposition compacte des bâtiments résidentiels ainsi que l'utilisation des technologies qui économisent les matériaux et les ressources naturelles (la lumière, l'énergie éolienne) et des matériaux recyclés (les déchets de chantier, les déchets industriels et des matières plastiques). Dans ce cas, l'utilisation des matériaux recyclés est possible, quand ils sont naturels et ne sont pas toxiques. [2]

Actuellement, il y a une opportunité pour les architectes d'utiliser dans le domaine de l'architecture verte l'aménagement paysager et de construire à partir des plantes elles-mêmes. [3] Cette technologie qui consiste en utilisation des matériaux vivants, à condition de la conception appropriée, permet de créer presque tout, à partir d'une structure autonome jusqu'une petite forme architecturale. Des exemples de cette approche sont présentés sur l'image 1.

L'avantage principal de ce type de construction est une économie considérable des ressources, puisque celle-ci ne nécessite que de l'imagination et du temps. De plus, construire à partir des plantes vivantes est un moyen efficace d'améliorer la biodiversité et de conserver de nombreuses ressources naturelles, car il vaut mieux construire à partir des arbres vivants qu'avec des arbres coupés.

Les formes architecturales (d'après l'œuvre [2]) : a) - la chaise qui a été cultivée par Peter Cook ; b - Le Patient Jardinier sur le campus de l'École Polytechnique de Milan, association artistique Visiondivision.

En guise de conclusion, il faut dire que la tâche principale de l'architecture verte consiste en exploration maximale des zones vertes existantes et celles créées artificiellement tout en respectant l'environnement des villes. La condition nécessaire au développement de l'architecture verte est l'utilisation des ressources naturelles et la construction à partir de matériaux recyclés qui ne sont pas toxiques.

RÉFÉRENCES

1. Зелена архітектура.URL: https://danica.ua/ua/blog/zelena-arhitektura/
2. Бондар А. В. «Зелена архітектура» сучасних міст [Електронний ресурс] / А. В. Бондар, Л. В. Кучеренко, В. С. Редченко // Матеріали XLIX науково-технічної конференції підрозділів ВНТУ, Вінниця, 27-28 квітня 2020 р. URL: https://conferences.vntu.edu.ua/index.php/all-fbtegp/all-fbtegp- 2020/paper/view/10567.
3. Гой Б. В. Розвиток поняття "зеленої архітектури" в сучасному проектуванні та будівництві / Б. В. Гой, Х. О. Катола // Вісник Національного університету "Львівська політехніка". Архітектура. - 2015. - № 816. - С. 99- 108. URL: http://nbuv.gov.ua/UJRN/VNULPARX_2015_816_15

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INFLUENCE OF CLIMATIC CONDITIONS ON ARCHITECTURAL AND CONSTRUCTION SOLUTIONS AND CHOICE OF BUILDING MATERIALS

The design of buildings and structures is a complex process that combines several stages, which are based on the collection of information and analysis of input data. One of the decisive roles in the design process is played by the climatic conditions of the construction site, which include a number of important parameters (characteristics). The characteristics of architectural climatic areas are based on long-term meteorological investigation and presented in DSTU-NB V.1.1-27:2010 Building climatology [1], DBN V.1.1-12:2014 Construction in seismic areas of Ukraine [2] and other normative construction documents.

Let us consider the main parameters, their possible impact on buildings and structures, which are really important when designing the architectural and engineering sections of the project:

- **air temperature** - the influence of too high or low temperatures, or their sharp drop negatively affects the strength of structures. Sudden temperature changes can lead to expansion and compression of materials, which can lead to cracks and other damages; also, violation of the normative indicators of this parameter creates discomfort for people staying in the room;
- **amount of precipitation** - a large amount of precipitation can lead to problems with the formation of sewage and flooding, negatively affects the foundations of the building;
- **snow cover** - in winter, snow can affect the stability of the roof and the general safety of the building;
- **humidity** - this characteristic can affect the condition of building materials and the health of building residents;
- **the salty or acidic level of the atmosphere** in construction areas located near the sea or near a source with harmful emissions affects the strength of metal structures, because the consequence of its violation may be corrosion of the material;
- **wind** - its force and direction can cause mechanical wear of materials, especially on open high buildings, contribute to the appearance of cracks, deterioration of the appearance, and also affect thermal breezes, and its absence - on the need for forced ventilation;

- solar radiation – too high an indicator of this parameter affects the overheating of the room in the summer, which creates discomfort for people who are in the room;

- seismic activity - can lead to a violation of the strength of building structures, which is dangerous for visitors or residents of the building.

When the architect has conducted a deep analysis of the climatic situation, he has the opportunity, even at the design stage, to balance the influence of climatic conditions, as well as to successfully use their useful properties with the help of architectural and urban planning and engineering solutions. Let's consider design solutions that, in turn, affect the choice of building materials:

- **thermal insulation of the house** - in cold regions, it is necessary to use materials with high thermal insulation to prevent condensation and heating efficiency in the building;

- **the temperature fluctuation factor** influences the choice of material for building structures, especially load-bearing ones - the materials used in the project must be resistant to freezing and thawing; repeated cycles of freezing can damage concrete, asphalt, stone and other building materials;

-to **prevent the appearance of corrosion** from a violation of the salt or acid level of the atmosphere, the materials adopted in the project must be resistant to the effects of salt and chemicals;

- building materials should be **resistant to moisture** (especially in regions with high humidity or frequent precipitation) to minimize the risk of flooding, weakening of structures from locking, and also to prevent the appearance of fungi, mold, etc., which are dangerous to health. Design drainage systems must be designed for large volumes of precipitation;

- **the seismic stability of the building** - in the zone of seismic activity, the designed materials and structures must be developed taking into account potential seismic loads;

- **consideration of wind loads** - buildings must be designed taking into account the influence of wind on their stability and heat conservation.

-**snow load solutions** ensure the strength of building structures.

On the basis of the conducted research, it can be concluded that a correct analysis of the climatic conditions of the area is one of the most important factors for construction. The choice of materials, the creation of appropriate and reliable structures, the efficiency of the engineering support system of the house, the long-term preservation of its original appearance, as well as the comfortable conditions of people staying in it depend on the careful analysis of climatic conditions carried out at the design stage.

REFERENCES

1.DSTU-N B V.1.1-27:2010. Budvel'na klimatolohiya [Construction climatology]. K.: Minrehion Ukrayiny, 2010, 127 p. [in Ukrainian].

2.DBN V.1.1-12:2014. Budivnytstvo u seismichnykh raionakh Ukrainy [Construction in Seismic Regions of Ukraine]. Kyiv, Ministry of Regional Development of Ukraine, 2014, 110 p. [in Ukrainian].

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MAISONS ÉCOLOGIQUES: MAISONS FABRIQUÉES À PARTIR DE MATÉRIAUX RECYCLÉS

Objectif de l'étude. Selon les données officielles fournies par le Conseil parlementaire ukrainien des droits de l'homme en janvier 2023, la Russie a détruit plus de 140 000 bâtiments en Ukraine. Cela signifie qu'en moyenne, plus de 380 bâtiments sont endommagés chaque jour par les bombardements et les attaques. Une quantité croissante de déchets de construction, tels que: béton armé, béton, meubles, verre, barres d'armature, bois, briques, etc. restent sur les sites des bâtiments détruits. Cependant, il y a un

côté positif: ces déchets peuvent être utilisés pour le recyclage, ce qui peut contribuer au développement de l'économie ukrainienne [1].

Positionnement du problème. En février 2024, le ministère de l'Écologie a indiqué que l'ampleur des destructions en Ukraine résultant de l'agression militaire russe était déjà comparable à la quantité de déchets solides générés dans le pays au cours d'une année, soit environ 10 à 12 millions de tonnes. Dans ce contexte, les journalistes retracent l'histoire d'Oleksandr de Gostomel, qui s'appelle simplement Mazai. Il a perdu sa maison à la suite d'un tir de missile il y a plus d'un an et est aujourd'hui contraint de se réfugier dans son garage, ayant perdu tous ses biens. Cependant, il existe une initiative qui pourrait résoudre le problème des déchets de construction et aider les gens à retrouver une vie normale. Dans la rue Proskurivska à Gostomel, la reconstruction de cinq maisons a commencé, à l'aide de matériaux de construction écologiques fournis par Neo-Eco Ukraine, en coopération avec la société française Neo-Eco.

Objet d'études. D'ici à la fin de l'année 2024, la première maison à laquelle participe l'entreprise devrait être construite à l'aide de matériaux de construction recyclés. La période de construction dépendra de la rapidité de la coopération avec les autorités locales. Le nouveau complexe résidentiel est conçu pour accueillir 450 appartements, et la priorité sera donnée aux habitants des maisons démantelées [2].

Le concept du projet est basé sur les principes de la ville de 15 minutes de Carlos Moreno, où la plupart des services nécessaires sont situés dans un rayon de 15 minutes de n'importe quel endroit de la ville. Les appartements sont prévus pour avoir un agencement moderne, sans couloirs et avec de petites cuisines, et seront conformes aux normes modernes [3]. Le chauffage sera individuel et l'approvisionnement en eau centralisé. L'ossature du bâtiment sera en béton armé monolithique afin d'améliorer la stabilité de la structure. Compte tenu des conditions actuelles, les maisons disposeront d'un sous-sol spécialement aménagé pour les abris. En outre, il est prévu d'installer des panneaux solaires au-dessus des parkings afin de fournir aux résidents une énergie alternative.

Le bois, le verre et le plastique non réutilisables ont été triés et confiés à des entreprises spécialisées dans le recyclage. Ces matériaux peuvent déjà avoir été transformés en énergie ou en nouveaux produits. Tous les processus de recyclage sont effectués sur place, ce qui permet d'économiser du temps et du carburant puisque les matériaux n'ont pas besoin d'être transportés vers d'autres usines pour être traités. Par exemple, les blocs de béton qui constituaient l'ossature des bâtiments ont été concassés sur place en attendant d'être transformés en nouveaux matériaux de construction. Le processus de revalorisation des déchets de construction nécessite de nombreuses analyses, y compris en matière de sécurité. Ces matériaux sont livrés aux usines de la société mère en Ukraine pour y subir d'autres tests de qualité. Bien que le recyclage des déchets de construction en Europe soit un processus coûteux, il reste néanmoins indispensable. En France, des plateformes complètes de recyclage des déchets sont en place depuis longtemps et le processus a été optimisé.

Conclusion. Selon la méthodologie de l'entreprise française, la construction d'un quartier comprend les étapes suivantes: ***analyse des déchets de construction*** (des experts analysent les matériaux pour déterminer s'ils contiennent des substances nocives; ils déterminent les matériaux qui peuvent être recyclés et ceux qui ne peuvent pas être traités); ***démantèlement*** (tous les matériaux de construction sont triés sur le site de démantèlement, soit manuellement, soit à l'aide d'équipements spéciaux; les déchets de construction sont séparés en différentes fractions, telles que le verre, le bois, le plastique, les briques, la mousse, le béton, le béton armé, l'asphalte); ***utilisation de ressources secondaires*** **(**la réutilisation des déchets de construction permet d'optimiser le budget de réhabilitation des infrastructures de 20 à 25 %; utilisation de technologies innovantes, telles que les panneaux muraux constitués de blocs contenant du bois imprégné d'un produit ignifuge et de la paille de seigle pressée); ***la construction*** (l'utilisation de ressources secondaires pour la construction d'une nouvelle installation) [3]. Plus d'un million de mètres carrés de logements ont été construits selon cette méthode en France

RÉFÉRENCES

1. Як в Україні будують житло з перероблених будівельних відходів URL: https://rubryka.com/article/ekologichna-vidbudova-ukrayiny/.

2. Будинки з сировини.URL: https://dom.ukr.bio/ua/articles/3241/.
3. Безвідходне виробництво. Як французи відбудовують житло в Гостомелі з будівельного сміття URL: https://www.epravda.com.ua /publications/ 2023/ 03/28/698387/.

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L'ARCHITECTURE VERTE COMME SOLUTION POUR RÉSOUDRE DES PROBLÈMES ENVIRONNEMENTAUX ACTUELS

Actualité. Dans le monde moderne, la question la plus pertinente est désormais la relation entre l'hommes et la nature. Encore une année consécutive la planète est couverte de changements, principalement liés au réchauffement climatique. Dans de nombreux pays, les émissions de gaz à effet de serre des bâtiments s'élèvent à plus de 20 %. Afin d'éviter les émissions encore plus importantes dans l'atmosphère, ils existent des mesures d'amélioration de l'efficacité énergétique comme réponse aux conséquences du changement climatique, telles que: la réduction des émissions de gaz à effet de serre, la réduction des gaz formés pendant la production, le transport et l'installation de matériaux de construction, la réduction des émissions de gaz à effet de serre pendant l'exploitation du bâtiment. [1]

Objet d'études. L'architecture est directement responsable de l'écosystème, puisque chacun de ses acteurs affecte l'environnementю [2] Son impact négatif peut être réduit grâce à la construction de bâtiments plus petits à partir de matériaux recyclables et à l'utilisation de technologies très efficaces, ce qui constitue le concept d'architecture verte.

L'architecture verte est constituée de bâtiments capables de réduire leur impact sur l'environnement et la santé humaine. Un bâtiment écologique est conçu de manière à consommer le moins d'énergie possible et à réduire l'impact des matériaux. Ceci est réalisé par le placement de la structure, sa construction, son exploitation et son entretien.

Le concept de «maison passive» est l'une des solutions permettant d'économiser près de 10 fois l'énergie pour le chauffage, l'eau chaude et l'électricité des appareils électriques par rapport aux normes habituelles des bâtiments neufs. L'idée est la performance de l'enveloppe thermique pour récupérer l'essentiel de la chaleur de l'air sortant pour réchauffer l'air entrant: cela signifie une isolation de haute qualité des murs, des toitures, des sols et des fenêtres et portes, une construction sans ponts thermiques et une étanchéité à l'air. [3]

Les maisons sans carbone impliquent d'être placées à proximité de sources d'énergie alternatives: éoliennes ou panneaux photovoltaïques. La quantité d'énergie consommée ne doit pas dépasser la quantité produite et ainsi la maison a la possibilité de se déconnecter du réseau et de travailler de manière autonome, en se fournissant des ressources. [4]

L'une des méthodes d'architecture verte dans le design est la «façade au carré E» développée par Schüco. [4] Le concept consiste à intégrer des panneaux photovoltaïques en silicium amorphe dans les façades des bâtiments pour assurer à la fois la production d'énergie et le vitrage.

Conclusion. Bien entendu, l'esthétique joue également un rôle important dans l'architecture verte. Les bâtiments écologiques existent en tandem avec l'environnement «vert» environnant, non pas en tant qu'éléments séparés, mais en tant que partie de la nature, sa continuation. Une connexion harmonieuse avec l'environnement n'est pas seulement une solution fonctionnelle et écologique, mais aussi visuellement attrayante afin de créer un contexte esthétique favorable, où nature et architecture se complètent, formant un espace ordonné. Nous pouvons observer une telle combinaison dans le projet "STUDIO HOUSE" de Peter Zumthor (Fig. 1).

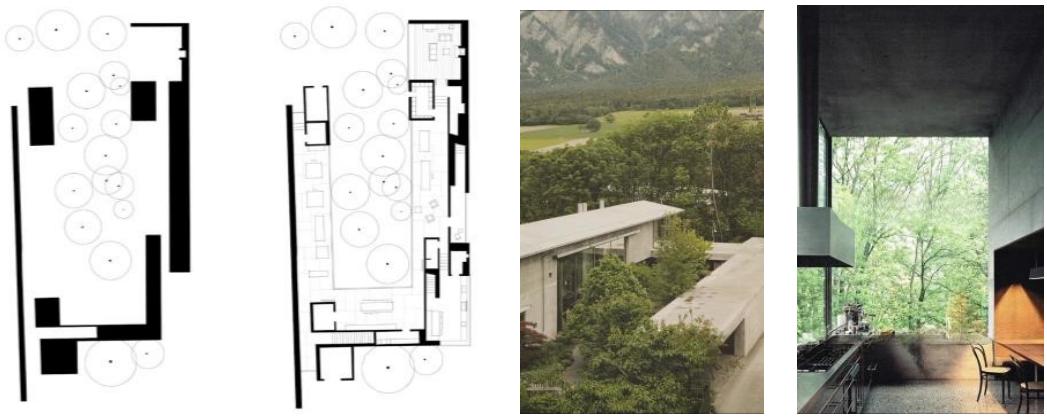

Fig. 1 'STUDIO HOUSE'

RÉFÉRENCES

1.Williamson T. Understanding sustainable architecture. pp. 111-125.
2.Attmann O. Green Architecture. Advanced technologies and materials pp. 24-27.
3.Sayigh A. Sustainability, Energy and Architecture. Case Studies in Realizing Green Buildings [Електронний ресурс]. – Режим доступу: https://www.perlego.com/book/1828171/sustainability-energy-andarchitecture-case-studies-in-realizing-green-buildings.
4.Yudelson J. Green Building trends. Europe [Електронний ресурс]. – Режим доступу: https://www.perlego.com/book/2985053/green-buildingtrends-europe.

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THE SIGNIFICANCE OF COLOUR IN POSTMODERN ARCHITECTURAL AESTHETICS

Introduction. Postmodernism emerges in 1960-1980 because of exhaustion and protest against modernism in architecture, attitude is changing about basic avant-garde values. Postmodernism brought to modern architecture an understanding by its creators of the need for context, eclectics as well as beauty, besides functionality, that has led to greater diversity of colour in architecture.

Literature review. According to research of Chinese scientists, colour is perceived by specialized structures of the visual analyser called cones. Cones are colour-sensitive cells in the retina of the eye that respond to different wavelengths of light. They send signals to the visual cortex of the brain, which is zoned and includes a number of specialized areas. Neurons in more distant areas of the brain, such as the V4 area, have high specificity for different colour shades. The V4 area, located in the posterior part of the frontal lobe, plays an important role in visual processing, including colour recognition and perception. Thanks to the V4 area, we become aware of colours and are able to perceive their variety [1, P. 547-548].

Case study. Based on a study of the neuropsychology of colour perception, Ahmed Hosney Radwan identified in their article "Color in Architecture is it Just an Aesthetic Value or a True Human Need?" (2015) patterns of changes in the emotional state associated with reactions to different colours. In this way, white, which symbolizes cleanliness, is used in sterile areas of medical premises [2, P. 523-533].

The impact of colour on architecture is huge. In the article "Colour as Idea: The Conceptual Basis for Using Colour in Architecture and Urban Design,"(2008) Galen Minah explains how colour decisions,

starting from the conceptual phase to design development, can serve as generative ideas shaping the overall design. The article highlights how colour contributes to defining space, form, and structure, complementing traditional visual elements [3, P. 1-9].

Understanding the importance of using colour in the designing process and studying colour psychology, contemporary architects are increasingly using warm hues to create the impression of a sunny, neighbourly and delicate atmosphere. Tarajko-Kowalska Justyna notes in the article "Yellow colour in European architecture and the built environment" (2021) that with the improvement of technological capabilities and the emergence of new building materials, interest in the use of yellow in architecture is increasing. As yellow is one of the most reflective of colours it strongly contrasts with its surroundings. That`s why it is often used in public buildings to attract people's attention. For example, Charles Moore used yellow and orange colours in designing an urban public plaza Piazza D'Italia in the United States, which is his most prominent work in postmodern architecture. The SIS Building is the United Kingdom's foreign intelligence agency, which was designed by Terry Farrell, and is also coloured in a yellow hue [4, P. 319-324].

Yellow isn`t the only colour used in postmodern architecture. The Walt Disney World Swan and Dolphin Resort designed by Michael Graves is painted in green and orange colours that represent the lush Florida greenery. These colours were also used in the exterior decoration of the House for Essex designed by collaboration between Greyson Perry and FAT Architecture (Figure 1).

In this way, colour is not just an accompanying element of architecture, but an independent unit that affects both the shape and the perception of the object as a whole.

Figure 2. Warm hues in the built environment. Collage by the authors.

Results and discussion. According to research colour is one of the most crucial tools in the creation of architectural objects. It is able to influence human perception by evoking appropriate associations. It emphasizes the shape of the object and is able to highlight the main among the secondary. There is no consensus among the authors of the articles on the superiority of one shade over others, architects use a variety of combinations and contrasts to emphasize a particular style and individuality.

Conclusions. Colour plays a fundamental role in architecture, shaping perceptions and associations with architectural structures. It serves as a universal language of communication, conveying the atmosphere of a space and its intended purpose. Architects and designers select colours based on their

preferences and style, creating unique spaces that influence the emotions and perceptions of individuals. Thus, colour in architecture is not merely a decorative element but also a tool for conveying emotions, creating moods, and directing attention. It holds functional significance in highlighting zones and emphasizing design details, and can also be informed by studies in colour psychology, influencing the psyche and behaviour of individuals within a space.

REFERENCES

1.Liu Y., Li M., Zhang X., LuY., Gong H., Yin J., Chen Z., Qian L., YangY., Andolina I. M., ShippS., McLoughlin N., TangS., & Wang W. Hierarchical Representation for Chromatic Processing across Macaque V1, V2, and V4. *Neuron*. 2020.Vol. 108/ 3. P. 538-550.

2.Radwan, A. H. Color in architecture is it just an aesthetic value or a true human need. *International Journal of Engineering and Technical Research*. 2015. Vol. 4, No 12. P. 523-533.

3.Minah G. Colour as idea: The conceptual basis for using colour in architecture and urban design. *Colour: Design & Creativity.* 2008. P. 1-9.

4.Tarajko-Kowalska J. Yellow color in European architecture and the built environment: traditions and contemporary applications. *The International Conference of the Color Society*. 2021. P. 319-324.

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PREREQUISITES FOR THE FORMATION OF INDUSTRIAL TOURISM IN THE DNIPRO REGION

The article discusses the prerequisites for the formation of industrial tourism in the Dnipro region, examines the chronology of events that have taken place in the region throughout history, and analyses which of them had the greatest impact on the development of the industry. In the course of analysing the tourist potential of the Dnipro region and the historical background of industrial tourism, certain markers and the chronology of events that had the greatest impact were identified.

The **basis** of this study was the works of the historian of the city of Dnipro, M. Kavun, and the historical overview of the development of industry in the Dnipropetrovsk region published on the website of the Dnipropetrovsk Regional Military Administration [1, 2].

The **aim** of this paper is to explore how historical events and stages in the formation of the Dnipro region have influenced the development of industrial tourism in the area.

Case study. In 1775, according to Catherine the Great's decree on the liquidation of the Sich, the lands of the Zaporizhzhia Cossacks were forcibly annexed to the russian Empire. From the second half of the eighteenth century until the beginning of the nineteenth century, the territory of the modern Dnipro region was part of the Novorossiysk Territory of the Russian Empire and regularly underwent changes in administrative boundaries. The processes of further settlement and economic development of the region, the formation of culture and local traditions were actively underway [3].

The actual liquidation was of great importance for the vector of the region's development, as the Cossacks tended to focus on agriculture rather than on various industries of varying complexity. Despite all the opportunities and prerequisites for the development of agriculture, the territories of the Dnipro region have always had significant reserves of mineral resources for the development of the mining industry [2].

Thanks to the activities of O.M. Pol and the involvement of French capital, industrial development of iron ore in KryvyiRih began in 1881. The catalyst for changes in the region's economy was railway construction, which gave impetus to the development of the industrial sector.

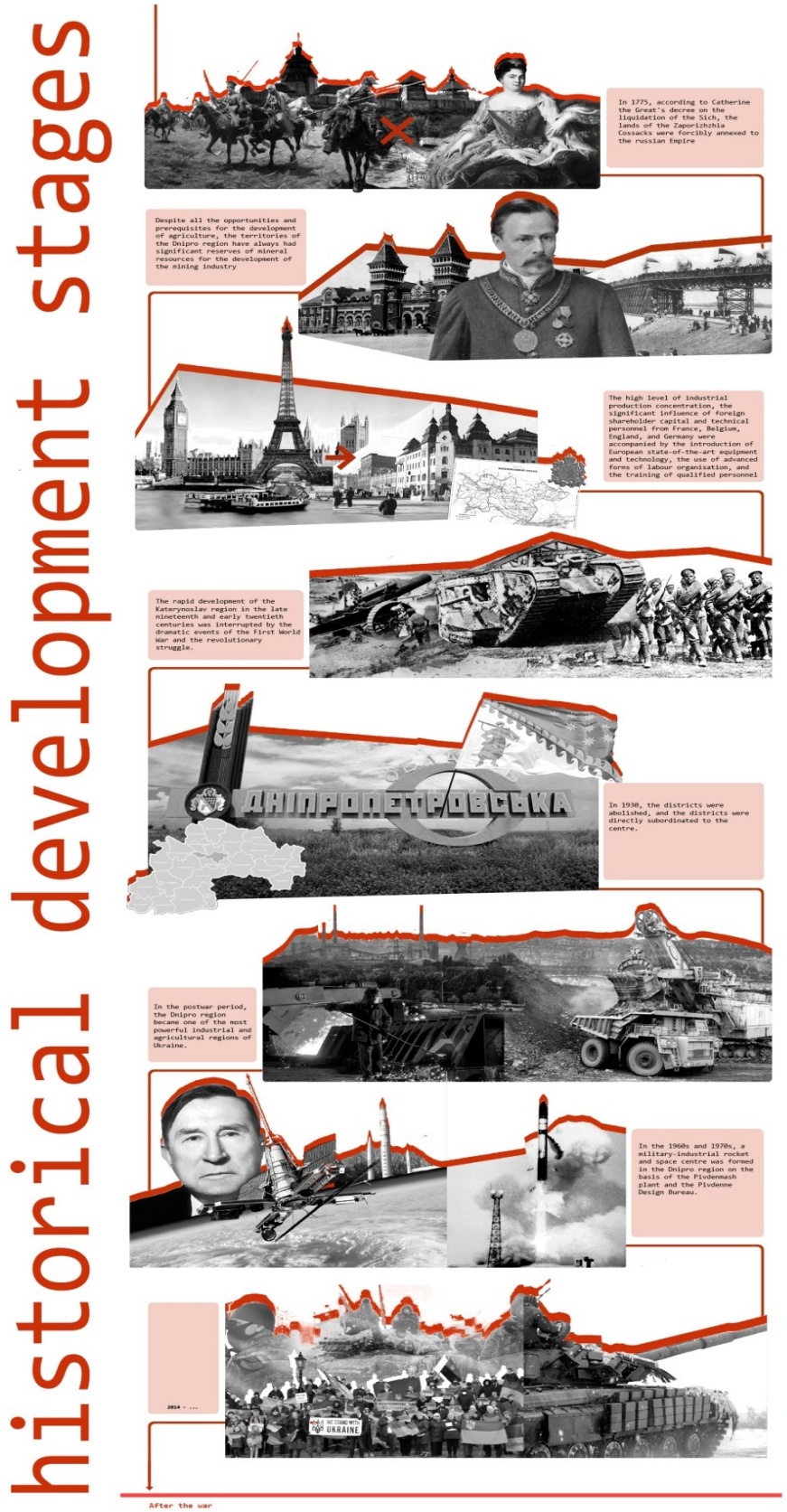

Fig. 1. Key stages of the development of industry in Ekaterinoslav, Dniproperovsk, Dnipro. Author's vision.

The high level of industrial production concentration (one of the first in the world), the significant influence of foreign shareholder capital and technical personnel from France, Belgium, England, and Germany were accompanied by the introduction of European state-of-the-art equipment and technology, the use of advanced forms of labor organization, and the training of qualified personnel [3].

These changes turned the province into a powerful industrial region. The entrepreneurial "fever" led to a significant and rapid accumulation of capital, the formation of the industrial bourgeoisie, and the organisers of the mining industry. The rapid development of the Katerynoslav region in the late nineteenth and early twentieth century's was interrupted by the dramatic events of the First World War and the revolutionary struggle. In some districts of the province, the government changed 12 or more times, in Katerynoslav - 20 times (the largest number among Ukrainian cities) [3]. And later, the events of the Second World War had their impact on the development of the region, whose industry was converted to military use.

In 1930, the districts were abolished, and the districts were directly subordinated to the centre. This system led to a mismatch between regional governance and socio-economic development and was the main reason for the transition to the oblast model of government.

At the time of its creation in 1932, the Dnipro region consisted of 50 rayons and 4 cities: Dnipropetrovs'k (now Dnipro), Zaporizhzhia, Kamianske (in 1936-2016 - Dniprodzerzhynsk) and KryvyiRih, with a population of 4,032,200 people. Later, in 1937 and 1939, part of its territory became part of the newly formed Zaporizhzhia, Mykolaiv, and Kirovohrad regions. Dnipro region received its current borders [2].

In the post-war period, the Dnipro region became one of the most powerful industrial and agricultural regions of Ukraine. The mining, metallurgical, metalworking, machine-building, chemical and other industries of the Dnipro region have reached the leading level in the former USSR in many areas. In the 1960s and 1970s, a military-industrial rocket and space centre was formed in the Dnipro region on the basis of the Pivdenmash plant and the Pivdenne Design Bureau.

In 2014, it was 60 years since the founding of the machine-building plant and 50 years since the design bureau, which brought together leading scientists, highly skilled designers, engineers, constructors, and production workers who solved the most complex issues, created and implemented the latest technologies, determining the world level of many areas and achievements in rocket and space science and technology [3].

In the 1990s, in the wake of the crisis and changes in industry technology, many facilities went into a state of stagnation. Since the outbreak of the war in 2014, a completely new stage of development and formation of not just a separate region, but the entire country has begun, and after its completion, industry and industrial tourism should reach a qualitatively new level of development.

Conclusions. Thus, the study of the history of industry and the identification of the prerequisites for the formation of industrial tourism in the Dnipro region is an important element of its development.

The Dnipro region has enormous industrial resources and capacities that can promote its further development and preserve the region's authenticity. The need for further research on this topic has been identified.

REFERENCES

1. Kavun M. Gubernskyi Misto (1776-1880) // Dnipropetrovs'k: milestones of history. - Dnipropetrovs'k: Hrani, 2001. P. 49-83.

2. History. Dnipro Regional Military Administratio. URL. https://adm.dp.gov.ua/prooblast/dniprope trovshina/istorichna-dovidka

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REVITALISATION DES BATIMENTS INDUSTRIELS DANS LE CONTEXTE DE LA RECONSTRUCTION DE L'UKRAINE

La fin du XXe et le début du XXIe siècle ont été caractérisés par une augmentation significative du développement urbain mondial. Cette tendance est due à de nombreux facteurs sociaux et économiques, mais en même temps, on assiste à une diminution progressive de la quantité de terrains urbains disponibles pour le développement partout dans le monde. Le nombre de nouveaux bâtiments augmente chaque année, mais en même temps, il y a une quantité considérable de bâtiments qui ont cessé d'être utilisés, qui ont été abandonnés, par la suite, et qui se détériorent progressivement.

Ces tendances sont également typiques pour l'Ukraine. Il existe dans notre pays un nombre important de grands bâtiments industriels qui ne fonctionnent pas pour un certain nombre de raisons, notamment à cause du changement de la production. Ces bâtiments et leur destruction progressive entraînent la dégradation des quartiers et l'augmentation du niveau de dépression dans les villes ukrainiennes. Cependant, d'après les recherches [1], beaucoup de bâtiments de ce type font partie des zones historiques centrales des villes, ce qui constitue un problème majeur. La communauté des architectes s'est penchée à plusieurs reprises sur le sort des entreprises et des bâtiments en difficulté. Dans presque tous les cas, la discussion aboutit à une décision difficile: démolir, reconstruire ou revitaliser le bâtiment ou l'ensemble de bâtiments.

Le concept de la revitalisation architecturale est de plus en plus présent dans la littérature scientifique et se définit comme un ensemble de mesures visant à restaurer et à renouveler des objets architecturaux abandonnés ou obsolètes afin de leur redonner vie, fonctionnalité et attractivité dans des contextes urbains ou régionaux spécifiques. Du point de vue de la revitalisation industrielle, il s'agit d'une opportunité de préserver un ensemble de bâtiments qui ont perdu leur pertinence, pour leur offrir une destination moderne qui est plus nécessaire à l'heure actuelle.

La comparaison du concept de la revitalisation avec celui de la reconstruction révèle sa signification plus profonde et sa portée progressive. La reconstruction se concentre avant tout sur la restitution de la fonction et de la forme existantes dans leur aspect original, tandis que la revitalisation cible la modification de l'objectif fonctionnel et la nouvelle utilisation de l'espace. La revitalisation cherche à transformer les espaces urbains qui existent déjà, en créant des lieux publics attrayants et en redonnant une nouvelle vie aux zones défavorisées.

Les objectifs de la revitalisation comprennent le changement de destination d'un bâtiment ou d'un ensemble de bâtiments et leur adaptation à de nouvelles activités, l'application des technologies de construction environnementales modernes, en respectant les exigences de la sécurité et la mise en conformité avec les normes modernes, ainsi que l'aménagement de la zone autour du bâtiment [2].

L'utilisation des technologies et des matériaux respectueux de l'environnement dans le cadre de la modernisation des bâtiments est aussi importante. Dans la mesure où, dans de nombreux pays, la revitalisation est conditionnée par des préoccupations environnementales, les projets dans ce domaine peuvent inclure l'utilisation des technologies vertes telles que les énergies renouvelables, les panneaux solaires et les systèmes du chauffage et du refroidissement à faible consommation d'énergie. L'application des technologies à haut rendement énergétique dans les bâtiments rénovées réduit l'impact négatif sur l'environnement. [3]

Pour créer les conditions d'une revitalisation efficace, afin de développer un ensemble des solutions pour la mise en œuvre du projet, il est nécessaire d'étudier les solutions architecturales et structurelles des constructions existantes du projet en question, d'effectuer une inspection instrumentale de l'état des structures, de réaliser une étude géologique du territoire et d'évaluer la faisabilité économique de l'ensemble des travaux de réparation et de construction.

Dans la plupart des cas, le coût de la réparation ou de la reconstruction d'un bâtiment est nettement inférieur au coût total de la démolition, des travaux préparatoires et de la construction d'un nouveau bâtiment. Après la revitalisation, de vieux bâtiments inutilisés acquièrent une nouvelle signification sociale et une nouvelle fonction. De nouveaux emplois sont créés pour assurer leur bon fonctionnement, ce qui représente un avantage économique important pour la société. En outre, les zones rénovées peuvent être commercialement attrayantes pour la location des magasins, l'emplacement des établissements de sport, de santé, de loisirs et d'autres activités. [4]

L'amélioration des zones environnantes est un élément important de la revitalisation. Le projet d'amélioration est un élément pertinent et stratégiquement important du plan général de la ville. Il permet de transformer les zones adjacentes en parcs, en zones de loisirs calmes et actives ou en lieux de festivals et de concerts. Outre les avantages sociaux et économiques, des solutions d'aménagement paysager réussies pourront améliorer l'esthétique de la ville, créant un environnement écologique favorable et agréable pour les visiteurs.

HafenCity à Hambourg est un excellent exemple de revitalisation d'un site industriel, considéré comme l'un des projets les plus ambitieux de l'Europe visant à transformer les zones industrielles désuètes en un quartier urbain moderne. Cette installation est située sur le territoire de l'ancien port de Hambourg, à proximité du centre historique de la ville. La réussite du projet HafenCity est déterminée par la préservation maximale du patrimoine historique, qui a été utilisé pour créer un lieu moderne, fonctionnel et confortable pour vivre, travailler et passer le temps libre. [5]

Un bon exemple de la revitalisation en Ukraine est l'usine d'art Plateforme à Kiev, qui est le plus grand projet national créé à la place d'une ancienne usine. La majeure partie du territoire de l'usine d'art est utilisée pour des manifestations culturelles: festivals de café et de tatouage, Comic Con, Gogol fest, Halloween, Nouvel An, etc.

En guise de conclusion il faut dire que la stratégie de "repenser" des lieux défavorisés qui implique la revitalisation des sites industriels, contribuera à la restauration efficace et à la création des zones postindustrielles durables, innovantes et viables en Ukraine. Cette orientation stratégique contribuera à la reprise économique durable et au développement des villes du pays. Ce processus aura un impact positif sur l'amélioration des plans urbains, l'infrastructure sociale, la création de nouvelles zones de vie, de divertissement et des activités commerciales, ce qui favorisera une amélioration de l'environnement urbain.

Ainsi, les caractéristiques positives des projets architecturaux liés à la revitalisation des objets de construction seront particulièrement pertinentes et justifiées économiquement et socialement en Ukraine dans le contexte de la reconstruction du pays après la guerre.

RÉFÉRENCES

1.Омельяненко В.А Сталий розвиток старопромислових регіонів України:інноваційний вимір. Колективна монограмія [Електронний ресурс] / В.А Омельяненко, М.В.Білошкурський, І.Ю Підоричева, Прокопенко О.В / Суми видавництво «Триторія» 2021 р. – Електрон. текст. дані. – 2021 - Режим доступу: file:///C:/Users/AsusPRO/Downloads/Stalyj-rozvytok-staropromyslovyh-regioniv-Ukrayiny-Trytoriya2021-1.pdf

2. V. Potseshkovskaya, A.N. Soroka Revitalization of urban industrial areas based on sustainable development principles. / V. Potseshkovskaya, A.N. Soroka / Department of Architecture, Faculty of Civil Engineering of St. Petersburg Mining University. [Electronic resource] - URL: https://www.e3sconferences.org/articles/e3sconf/pdf/2021/42/e3sconf_ti2021_08012.pdf

3. Danara Selvina Revitalization of Industrial Buildings. International Journal of Applied Sciences: Current and Future Research Trends (IJASCFRT) 2022 Volume 15, No 1, pp 16-29 [Electronic resource] - URL: https://ijascfrtjournal.isrra.org/index.php/Applied_Sciences_Journal/article/view/1277 4. Кривоконь А.А., Кравчуновська Т.С.Перспективи і переваги зеленого будівництва в україні. ПДАБА Дніпро 26.11 2020[Електронний ресурс] - Режим доступу: http://srd.pgasa.dp.ua:8080/xmlui/handle/123456789/9326

5.Операція «Хафенсіті». Найбільшому урбан-проєкту Європи 20 років [Електронний ресурс] - Режим доступу: https://pragmatika.media/operacija-hafensiti-najbilshomu-urban-proiektu-ievropi-20-rokiv/file:///C:/Users/AsusPRO/Downloads/Stalyj-rozvytok-staropromyslovyh-regioniv-Ukrayiny-Trytoriya2021-1.pdf

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THE USE OF ARTIFICIAL INTELLIGENCE IN NEW ARCHITECTURE

The theses under consideration highlight the application of artificial intelligence (AI) in architecture and offer useful resources for further study.

AI plays a key role in modern architecture, transforming and modifying the way constructions are designed, built and managed. The use of artificial intelligence in modern architecture ensures a faster and more efficient design process. The essence of AI in architecture is to learn from data. Advanced algorithms carefully study extensive architectural data, including building plans, structures, materials and historical architectural aspects. Subsequently, AI uses this knowledge to create innovative architectural projects, offering a variety of options and improvements. AI in architecture also processes a large amount of data, including climatic, geographical and structural characteristics. AI performs the routine tasks of analyzing data and creating variations of projects, which free up time for architects to focus on the more creative and conceptual aspects of design. Machine learning algorithms allow to analyze vast amounts of data, which help architects understand the needs and requests of clients as well as optimize the design of buildings. The procedure for creating architectural projects using AI involves the use of various methods and algorithms to formulate distinctive and creative solutions.

Some of these methods are:

- deep neural networks;
- genetic algorithms;
- recurrent neural networks;
- graphical algorithms.

Neural networks are used to predict and optimize energy and material consumption during construction. In addition, artificial intelligence helps to ensure the sustainable efficiency of buildings by controlling lighting, heating and ventilation systems, that helps to reduce energy consumption and improve user comfort. Technologies both in virtual and augmented realities are used to visualize projects and contribute to clients´ understanding of space and functionality of future buildings. In general, the use of AI in modern architecture offers wide opportunities for innovation and improvements in construction, which contributes to the creation of efficient, energy-efficient and user-friendly buildings.

However, the further, the more actively architects and designers use new technologies in their work, and with development and improvement, these tools will become even more entrenched in their activities. Artificial intelligence is one of the three technologies that will have the biggest impact on the real estate sector in the coming years. [1]

Large design tasks require a creative approach to decision-making, which is considered a skill in which humans are superior to machines. In a new study, scientists examine the problems of complex structures, focusing on multi-level engineering tasks. The study emphasizes the importance of visualization for training AI to observe human actions in modifying bridge designs based on visual information, not just rules that help to create new designs without additional prompts. [2]

‘Artificial intelligence is not just an imitation or repetition of existing solutions’, said Jonathan Kagan, the professor at Carnegie Mellon University and a co-author of the study - It is the study of how

people solve specific problems and create new design solutions. How good can artificial intelligence be for this? In our case, AI did very well'. [2]

'We tried to make artificial intelligence create projects the way humans do, understanding this process: how people approach design, how they plan a sequence of actions, and then, step by step, create a new design', said Ayush Raina, co-author of the study. [2]

Examples of software using AI in architecture:

- Autodesk Dynamo;
- Spacemaker AI;
- Archistar;
- Cityzenith.

Having analyzed this information, it is possible to understand that in a few years AI will not just be an assistant, but also a full-fledged part of the architecture, because human imagination, sense of style and aesthetic perception are combined with the analytical skills of artificial intelligence, creating a symbiosis that promotes to innovative design, providing new opportunities, process optimization and innovative design approaches.

REFERENCES

1. URL: https://commercialproperty.ua/analitics/shtuchnointelektualne-seredovishche/

2.URL:https://ecotech.news/architecture/604-shtuchnij-intelekt-navchivsya-stvoryuvati-arkhitekturni-proekti-bez-uchasti-lyudini.html

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FOREIGN EXPERIENCE IN DESIGNING REHABILITATION CENTRES FOR CHILDREN

The relevance of the chosen topic is due to the urgent need to improve the architectural and planning solutions of rehabilitation centres in Ukraine. Most rehabilitation centres in our country were built in Soviet times and are now morally and physically outdated. These buildings do not meet the modern medical needs of children. Given the psychological trauma and the need for medical rehabilitation due to the military conflict, it is important to study and use international experience.

The goal is to analyse foreign experience in designing rehabilitation centres for children.

Statement of basic material In the modern world, the issue of rehabilitation of children with various physical and mental disabilities is becoming increasingly important. Increased attention to this area is not only a matter of humanitarian aid, but also a strategically important component of society's development. In this context, foreign experience in the design of rehabilitation centres for children becomes particularly interesting and important to study and implement. The design of rehabilitation centres in other countries includes analysing the needs of the target audience, developing individual programmes and using advanced techniques and technologies. Particular attention is focused on creating a comfortable environment that promotes not only physical but also emotional and social development of each child [1].

In this study, we will look at key aspects of the design of rehabilitation centres for children abroad, in particular in Europe, Asia, North America and Africa, to highlight the prospects and opportunities for improving current practice in Ukraine (Fig. 1).

Figure 1. Graphic presentation of rehabilitation centre projects for children

In the practice of foreign rehabilitation centres, a technique is being introduced to associate the centre building with a home. For example, in Budapest, Hungary, in 2015, a rehabilitation centre was built with the aim of creating a simple, safe and comfortable five-storey building connected to the existing rehabilitation centre building by a passage. The first two floors house common areas and a dining room, while the top three floors are used for living quarters. The main goal was to create a simple, safe and user-friendly environment. It has a simple shape with a pitched roof, which is reminiscent of a home. Most corridors have natural light for better orientation of blind residents, and perforated metal panels reduce excessive light. The perforations form braille inscriptions with the words ‘trust’, ‘home’, ‘shelter’ and ‘love’[2].

Another building with such a reception is a hospice for children in Osaka, Japan, built in 2015. The complex is located in a memorial park and is partially open to the public as a public playground. It consists of six residential ‘houses’ connected by ‘streets’ and courtyards of various shapes and sizes. The use of wood, tiles, metal and soft materials creates a cosy, homely atmosphere. Deep canopies protect from the sun, and the design provides natural ventilation. The ‘streets’ lead to a public area with play hills where the children patients can play with local children. The facades have simple proportions and details

typical of traditional houses. Overall, the 'TSURUMI' hospice is an innovative project that seeks to integrate the facility into the urban environment and spread the idea of community support for terminally ill children [4].

This technique was used in the design of a children's hospital in Zurich, Switzerland, but it went beyond the interior. The layout resembles an urban structure with streets, intersections and courtyards that let in natural light. The ground floor is the most public area with the reception area and operating theatres. The second floor is dedicated to the clinic and office space. The top floor is the most private area with four wards for inpatients. The hospital's façade is a combination of concrete frame, wooden, glass and plant inserts, symbolising the diversity of internal functions. The patient rooms have individual roofs, large windows, wooden ceilings and floors, and folding beds for parents, creating a homely atmosphere. In general, the project demonstrates an innovative approach to hospital architecture, focused on the needs of children patients and medical staff [7].

The same effect was achieved at the Welfare Centre in Paris, France, back in 2013. 'Welfare Centre for children and teenagers in Paris'- is an emergency accommodation centre that provides shelter for minors under state care. The main purpose of the centre is to provide practical, educational and psychological support to these children and teenagers. The architects designed the building in the shape of the letter 'L' with terraces for recreational activities on each floor to optimise access to daylight. To emphasise the unified character of the building, the facades are made of white concrete, golden louvres and black metal. The interior space is organised in separate sections for different age groups. Particular attention was paid to creating a cosy, homely atmosphere with designer furniture and poetic navigation symbols. The main staircase serves as the focal point of the interior, as in old residences [5].

Another example is the Children's Rehabilitation Centre in North Bay, Canada. Its main goal is to create a favourable and stimulating environment for the treatment of children with a variety of needs, including physical, speech and communication. The centre is designed as a single-storey building around a courtyard that provides natural light, visual connection to the outdoors and a safe space for therapy and recreation. The architects used natural materials, such as limestone, brick, and wood, which are in harmony with the northern context. One of the most prominent features is a six-metre-high living wall that acts as a biofilter to improve air quality. The interior is enlivened by colourful stained glass windows, local artwork and decorative elements, creating an attractive and stimulating atmosphere for children. Overall, the centre demonstrates a respectful attitude to the environment and a concern for the well-being of young patients [3].

Let's also consider the principle of creating a rehabilitation centre for children in an area that needs it but does not have an appropriate urban planning framework. The 'JIGIYA SO' psychomotor rehabilitation centre in the Republic of Mali is part of a programme to build community infrastructure in West Africa. It is designed to promote integration and raise awareness of disability issues, which in this region are still associated with certain beliefs and traditions. The centre is located in the city of Katia, near the capital Bamako, and is designed for children aged 3 to 15 with disabilities. It provides spaces for individual and group rehabilitation, as well as areas for social integration and support for patients' families. The architectural solution is integrated into the local context and uses locally available materials such as cement blocks, metal profiles and traditional construction techniques. The compact layout with courtyards, shady galleries and landscaping ensures a comfortable microclimate on a limited budget. Energy is supplied by solar panels [6].

Conclusion. The analysis of foreign experience in designing rehabilitation centres for children demonstrates a number of important approaches and innovative solutions that should be taken into account to improve Ukrainian practice.

Firstly, there is a tendency to create a cosy, homely environment that is as close to natural conditions as possible. This is achieved through the use of natural materials, large windows, patios, and landscaping. The layout resembles the structure of a small town with "streets", courtyards, and play areas. Secondly, an environment is created that is focused on the diverse needs of children - physical, psychological, and educational. For this purpose, separate zones or pavilions are provided for different age groups, types of therapy, and education. Thirdly, architectural solutions maximise the use of natural

light and fresh air and create a comfortable microclimate. Sun protection systems, natural ventilation, and green courtyards are used. Fourthly, projects are integrated into the urban environment and open to the local community. Buildings become public spaces for meetings, communication, and games.

All of these approaches can serve as useful examples for the design of modern rehabilitation centres in Ukraine, creating a comfortable, safe and stimulating environment for children's recovery.

REFERENCES

1. I. Kravchenko. Basic differences in organisation of rehabilitation environment for disabled adults and children: analysis of functional structures. Scientific enquiry in the contemporary world: theoretical basics and innovative approach. Vol. 4, USA, L&L Publishing. 2013. - Pages 121-124.

2. Batthyány László Institute for the Blind. A4 Studio URL: https://www.archdaily.com/771020/batthyany-laszlo-institute-for-blinds-a4-studio

3. One Kids Place. Mitchell Architects. URL: https://www.archdaily.com/82958/one-kids-place-mitchell-architects.

4. Tsurumi Children's Hospice. Taisei design Planners Architects & Engineers. URL: https://www.archdaily.com/972238/tsurumi-childrens-hospice-taisei-design-planners-architects-and-engineers?ad_medium=gallery.

5. Welfare Centre for children and teenagers in Paris. Marjan Hessamfar & Joe Vérons architectes associés. URL: https://www.archdaily.com/512588/welfare-centre-for-children-and-teenagers-in-paris-marjan-hessamfar-and-joe-verons-architectes-associes?ad_medium=gallery.

6. Jigiya SO psychomotor rehabilitation centre. URL: https://www.archilovers.com/projects/215625/jigiya-so-psychomotor-rehabilitation-center.html#info.

7. Herzog and de Meuron. Kinderspital, Zurich, Switzerland URL: https://www.herzogdemeuron.com/projects/377-kinderspital-zurich/

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GREEN ROOFS AND WALLS IN BUILDING DESIGN

Relevance. Significant changes in population density and urban environments are contributing to the unprecedented climate change currently occurring in the world. Denser cities result in greater built form, with more hard surfaces and less green space, landscapes areas and permeable surfaces. One way to create a more natural environment in cities and contribute to climate change mitigation and adaptation. Another competing pressure on space is the use of roofs and vertical surfaces of buildings. [3]

Objectives. to investigate the advantages and disadvantages of green roofs and walls in South Korea.

A green roof or living roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It may also include additional layers such as a root barrier and drainage and irrigation systems. [2]

Green walls are created by attaching a frame system from gutters, pockets or mats attached to internal or external walls or fences, in which many small plants are planted. These plants support livelihoods through an irrigation system. «Living» walls can also consist of a mesh of steel ropes, which allows climbing plants rooted in the soil on the ground to slowly cover the wall. [1]

About 90% of the total population of South Korea lives in cities. However, urban forests are extremely insufficient. As a result, the government found a solution to this problem, turning the living environment into green areas, and also introduced a green architecture project. [4]

This project has many advantages. Green roofs are an effective way to increase the number of green areas in limited urban spaces and not only save urban land, but also have various effects, such as reducing pollution, climate control, air purification, energy efficiency and noise reduction. [4]

But before encouraging green roofs, there are a few drawbacks to consider. Landscaping of the roof involves the installation of plants, soil and structures on the roof, so structural support is required, since the roof should be strong enough, to withstand the extra weight. Green roofs are more expensive than traditional ones. Green roofs can be installed only on flat or gentle roofs, because the roots of plants sometimes penetrate through a waterproof membrane and cause leakage of the roof, resulting in structural damage. [4]

Conclusions. Green roofs and walls play an important role in improving the ecology of cities. Therefore, roof greening plans are part of the global Green New Deal [4]. Although the project has its drawbacks, it is actively implemented in South Korea.

REFERENCES

1.Ілляш, О. Е., & Істоміна, Ю. А. (2023). Аналіз екологічних та конструктивних характеристик вертикального зеленого оздоблення будівель. – Полтава: НУПП, 2023. – С. 157

2.Green roof. Wikipedia. URL: https://en.wikipedia.org/wiki/Green_roof (дата звернення: 05.03.2024)

3.Hopkins, G., & Goodwin, C. (2011). Living architecture: green roofs and walls. Csiro Publishing.

4.Ji, Q., Lee, H. J., & Huh, S. Y. (2022). Measuring the economic value of green roofing in South Korea: A contingent valuation approach. Energy and Buildings, 261, 111975. URL: https://www.sciencedirect.com/science/article/abs/pii/S0378778822001463

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CARACTÉRISTIQUES HISTORIQUES ET ARCHITECTURALES DU SITE ARCHITECTURAL «BÂTIMENT PUBLIC»

Le bâtiment n°5 de la rue Sichovy streltsiv à Dnipro a été officiellement inscrit au titre des monuments architecturaux d'importance locale avec l'attribution du numéro personnel (n° 3) en 1996. [1]

Le bâtiment est situé au milieu de la ville dans la zone historique centrale de la ville et fait partie intégrante de l'environnement historique précieux de la partie centrale moderne de la ville. [2] Il est situé avec la façade principale le long de la rue sur la ligne d'alignement dans une rangée de bâtiments denses, qui se transforment en une rangée continue. La maison à deux étages a un plan en forme de L, elle est en brique avec des façades principales, une cour et une riche décoration en stuc de la façade principale. L'extrémité gauche de son aile est ouverte. À droite, un immeuble d'un étage et demi (avec sous-sol) lui jouxte également le long de la ligne d'alignement.

Le bâtiment a une histoire complexe et ambiguë en termes de définition de sa signification historique-architecturale et architecturale-artistique. À l'origine, en 1892, à l'emplacement de l'aile actuelle de la rue, un bâtiment rectangulaire a été construit le long de la rue avec les magasins et les locaux de l'atelier-boutique de photographie d'A.V. Vitlin et de la société "Culture" au premier étage face à la rue. En 1910, lorsque le bâtiment devint la propriété de la 2e Société de Crédit Mutuel de

Katerynoslav, il fut entièrement reconstruit. [3] En particulier, tous les murs intérieurs du deuxième étage ont été démolis et une grande salle d'opération a été aménagée avec un nouveau plafond sur poutres transversales et un grenier avec un toit à pignon et en croupe. La façade principale et l'intérieur de la salle d'opération étaient ornés d'une riche décoration en stuc dans le style "classique" avec une imagerie architecturale et artistique de plus en plus populaire à cette époque - pilastres cannelés à chapiteaux composites, inserts ornementaux en relief, corniche multi-profils tire avec des modules figurés, etc. La date (1910) de mise en service du bâtiment après la reconstruction, déjà en tant que bâtiment de la 2e Société de Crédit Mutuel de Katerynoslav, était indiquée par des numéros en relief sur le tympan (fronton) du fronton voûté, qui complète la façade principale dans le milieu.

Au cours de son existence, le bâtiment a subi plusieurs modifications. Dans les années 1910 (jusqu'en 1917), une aile de cour a été ajoutée à partir du bord de la façade de cour du volume d'origine, grâce à quoi le bâtiment a reçu un plan en forme de L. Après la Seconde Guerre mondiale, le bâtiment abrita la Maison de la Culture du Ministère de l'Intérieur. L'ancienne salle d'opération a été transformée en salle de montage avec scène. Mais en même temps, la décoration architecturale et artistique de l'intérieur de la salle était soutenue par l'imagerie historique « classique ». Dans les années 1950, une autre extension a été construite le long de presque toute la façade sur cour du volume d'origine, qui recouvrait presque entièrement la façade sur cour d'origine. Dans les années 1970, des ajouts ont été apportés à cette extension et au bout de l'aile de la cour. Tous les ajouts ont été réalisés avec des façades d'aspect purement utilitaire. Au début des années 2000, le bâtiment a été préparé pour une rénovation avec la restauration de la façade principale et du hall. Au cours des travaux préparatoires, la décoration historique en stuc de la façade principale et de l'intérieur de la salle, qui était dans un état insatisfaisant, a été presque entièrement démolie, mais avant cela, elle a été soigneusement copiée en vue d'une restauration ultérieure. Cependant, en raison de la fin du financement, les travaux ont été interrompus à l'avenir.

Ainsi, l'importance historique-architecturale et architecturale-artistique n'est représentée que par le volume original avec une décoration historique hautement artistique de la façade principale et de l'intérieur de la salle du deuxième étage.

RÉFÉRENCES

1. Liste des monuments d'urbanisme et d'architecture d'importance locale de la région de Dnipropetrovsk / Approuvé par arrêté du chef de l'administration régionale de l'État du 12 avril 1966 n° 158-r.

2. Plan de référence historique et architectural. Détermination des limites, régimes d'utilisation, régimes de régulation du développement des zones historiques de la ville de Dnipro // Documentation scientifique et de projet / Centre international du patrimoine culturel et des valeurs culturelles // Nauk. conducteur S. B. Revskyi, I. S. Revskyi GAP - Kiev, 2019.

3. Starostin V. S. Sichovich streltsiv, 5 / Encyclopédie de la ville de Dnipro// http://tfde.dp.ua/%D0%A1%D1%96%D1%87%D0%BE%D0%B2%D0%B8%D1%85_%D0%A1%D1%82%D1%80%D1%96%D0%BB%D1%8C%D1%86%D1%96%D0%B2,_5.

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APPLICATION OF SUSTAINABLE DESIGN PRINCIPLES IN ARCHITECTURE

In the modern world, environmental issues and energy efficiency are becoming increasingly pressing concerns. In this context, architects and designers are carefully considering the application of sustainable design principles to create buildings capable of minimizing negative impacts on the environment and ensuring energy savings. Sustainable design optimizes building performance and minimizes negative impacts on building occupants and the environment. We incorporate sustainable design and energy efficiency principles into our construction and modernization projects, balancing cost, environmental, societal, and human benefits that help meet our tenant agencies' mission objectives and functional needs [1].

One of the key principles of sustainable design in architecture is energy efficiency. Buildings designed with this principle in mind aim to minimize energy consumption by employing innovative heating, ventilation, and air conditioning systems. Additionally, the use of renewable energy sources such as solar panels or wind turbines to supplement a building's energy needs is an important aspect [2].

Another crucial aspect of sustainable design is the use of environmentally friendly materials. When constructing buildings, there is a growing preference for materials that do not harm the environment and do not contain harmful chemicals. For example, wood, stone, glass, and recycled materials can be excellent alternatives to traditional building materials such as concrete and metal.

Moreover, sustainable design includes aspects such as optimizing natural light and ventilation, creating greenery on building rooftops to improve the microclimate and reduce the impact of urban environments, and maximizing space while considering ecosystem needs. Green plantations determine and improve the climatic, sanitary and hygienic living conditions in it. In urban planning, they embody the architectural, artistic and sanitary-hygienic component [3]. The negative impact on humans of a number of adverse factors of urban life is significantly reduced by the skillful placement in the city of green spaces, an increase in the area under them, and a well-thought-out system of their rational location.

In conclusion, the application of sustainable design principles in architecture is not only a fashionable trend but also a necessary step towards preserving the environment and ensuring energy efficiency. Implementing these principles requires collaborative efforts from architects, designers, engineers, and clients to create a more sustainable and healthy society.

REFERENCES

1.GSA Design and constructio//Sustainable design//2024. URL: https://www.gsa.gov/real-estate/design-and-construction/sustainability/sustainable-design

2.UGREEN Sustainable Architecture: A Guide for Architects, Interior Designers, and Construction Companies//Economic Benefits of Sustainable Architecture//2024. URL:https://ugreen.io/sustainable-architecture-a-guide-for-architects-interior-designers-and-construction-companies/#:~:text=By%20embracing%20sustainable%20design%20principles,and%20incorporating%20renewable%20energy%20sources

3.Gissen D. Big and Green: Toward Sustainable Architecture in the 21st Century.//Princeton Architectural Press. 2003.

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HISTORICAL STAGES OF OLYMPIC SPORT IN UKRAINE: THE BIRTH OF EXTREME SPORTS

Introduction. Since the beginning of human existence, movement has been the main factor of survival. Every day, people were subjected to trials and extremes, to survival. Over time, the share of extreme in human life has significantly decreased. However, modern man has begun to feel the need for extreme and new experiences again.

Nowadays, we hear more and more about the importance of sports and a healthy lifestyle, and there is a need for self-development among the population. Cultural, social, and technological progress not only increases the importance of sports, physical activity, and extreme sports, but also creates new opportunities for solving modern social problems. The level of development of a country and its image directly depends on physical education and sport and its role in society.

The **objective** of this research is to trace the historical stages of the establishment of Olympic sports in Ukraine and to highlight the significance of extreme sports, which have gained prominence in recent times.

The **analysis of the literature** shows that more and more new trends are emerging and gaining popularity in the sports arena, both at the professional and amateur levels. Some of them are mostly popular among extreme sports (rock climbing, BMX, etc.), for which there are currently no appropriate sports complexes, training locations and grounds. The beginning of the history of sports in Ukrainian science was in 1920, when the need for specialists in sports and physical education arose. More than a hundred years ago, the first Central Sports University of Ukraine was established in Kharkiv, the capital of the Ukrainian SSR at the time, which originated from the State University of Physical Culture of Ukraine. In 1944, it was reformed into the Kyiv State Institute of Physical Culture, which is now the National University of Physical Education and Sports of Ukraine [1].

Results and discussion. On the way to Olympic sport, there were many challenges, including the issue of political and ideological conflict between the International Olympic Committee and the Soviet sport. Most of the IOC members did not recognize the sport of the USSR, but interest in Olympic sports did not subside, and the rankings of research based on the results of the strongest athletes in foreign countries were growing every day. Through the public's interest, Soviet athletes were able to enter the arena of the international Olympic Games in the late 1940s and early 1950s [1]. Even then, Ukrainian athletes accounted for at least 25% of each USSR national team, and the first football tournaments were held in Kyiv with great success. Ukrainian athletes, Olympic champions and famous sports figures initiated the creation of the National Olympic Committee (NOC). On December 22, 1990, a resolution was adopted on the establishment of the NOC, where Valeriy Borzov, a Ukrainian athlete and two-time Olympic champion, was elected president [2].

Along with the popularization of sports and the multiplication of sports achievements, sports science was developing. Professor Volodymyr Abramovych Blyakh, who developed a system of views on the impact of physical exercises on the body of athletes, made a great contribution to sports medicine and preventive medicine. The scientific works consider the impact in three areas: functional, which affects the development and strengthening of important vital systems of organisms - musculoskeletal, nervous, respiratory, cardiovascular; aesthetic, reflected in posture; practical, manifested in the perfection of natural movements and skills - walking, running, jumping, throwing, swimming, lifting weights, etc. In Figure 1, you can see the main historical milestones of the development of Olympic sports in Ukraine: from its inception to the present day, sourced from official documents.

Fig. 1 Main historical milestones of Olympic sport in Ukraine. Author's vision.

In 1990, the Assembly of Founders adopted a resolution on the creation of the NOC, and in 1993, for the first time, Ukrainian teams took part in the Winter and Summer European Youth Olympic Days and the World Universiade. Sports reforms also affected official documents: In 1993, the President of Ukraine issued a decree "On the Development of the Olympic Movement in Ukraine"; in 1994, the Law "On Physical Culture and Sports" was adopted, in which Article 35 "National Olympic Committee" legally enshrined the rights of the NOC as an independent, non-governmental, public organization. In July 2004, Kyiv hosted a stage of the Olympic Torch Relay, where Serhiy Bubka, a prominent Ukrainian athlete (pole vault), Olympic, world and European champion (set 35 world records), and President of the National Olympic Committee of Ukraine from 2005 to 2022, brought the torch to Independence Square. In 2007, the Ukrainian Academy of Sports was established, headed by Nina Umanets, a Ukrainian athlete, silver medallist in the eight at the XXII Olympic Games, five-time world champion. The main goal of the organization, which includes legendary Ukrainian athletes, is to popularize sports and spread Olympic ideals. The Ukrainian Academy of Sports annually determines the winners of the ceremony honouring the best athletes, coaches, organizers, and participants of the Heroes of the Sports Year sports movement.

Also in 2011, the Olympic Stork project for young people was launched, the NOC's patronage of orphanages was innovated, and the Olympic Corner project was introduced. 2012 The Olympic House is opened in Kyiv. 2013 The NOC of Ukraine is recognized as one of the best in the world and is awarded the International Creative Sports Award for its success in promoting sport and Olympic values. In 2019, the NOC of Ukraine became the coordinator of the European Week of Sport events in Ukraine. However, in 2022, after the beginning of Russia's military aggression, in order to provide humanitarian assistance to members of the Ukrainian Olympic community, the IOC, the Olympic Solidarity organization and the EOC established the Solidarity Fund, with the NOC President Serhiy Bubka appointed as its coordinator. [2]

On the list of officially represented Olympic sports, there is also extreme sports, which is one of the most promising areas in the modern field of sports. Extreme sports can be considered as a natural model of extreme stress (O. Karpova). [4] Action sports, adventure sports or extreme sports are activities perceived as involving a high degree of risk. These activities often involve speed, height, a high level of physical exertion and highly specialized equipment. [5] Extreme sports on the Olympic list include: canoeing, kayaking, canoe slalom, BMX, mountain biking, road biking, cycling, biathlon, bobsleigh, skeleton, freestyle, snowboarding, and new sports (rock climbing, break or breakdancing, skateboarding, street and park, surfing) are being added in 2024. In order to attract more viewers, especially young people, the list of "new sports" increasingly includes those that were previously found only on the streets. For the first time in history, breakdancing, which has its roots in the United States (African American and Puerto Rican youth street dance), is now among the extreme sports. For fans of height, speed and tricks, skateboarding, street and park skating were added in 2024.

According to an interview with Dnipro citizens, there is a great demand for sections and clubs, including extreme sports. Among the sports mentioned, the majority are track and field, weightlifting, volleyball, basketball, football, boxing and wrestling, and rock climbing. The data collected revealed several major problems: half of the people surveyed said they did not have a specially equipped training space and/or equipment, and the premises needed to be repaired. The majority of respondents to the question about inclusion said that such conditions were completely absent.

Despite the lack of specialized places to meet extreme sport’s needs, Dnipro has established an Extreme Sports Association headed by Maksym Semenov. Dnipro regularly hosts a bicycle race, and in 2019, a national record of Ukraine was registered - the largest bicycle convoy, about three kilometres long, with about five thousand cyclists from all over Ukraine.

Maxim Semenov believes that extreme activities, including extreme resistance, can help relieve stress. For children and teenagers, this is a great option for learning the world around them and their possibilities in it. For the head of the association, extreme sports is the main way to avoid getting involved in criminal stories and to survive it in a sporty way. For adults who already have daily mental and physical stress in the form of work and household activities, it is a way to relieve stress and get a sense of freedom.

Conclusions. Thus, the goal of the entire hierarchical structure of sports in the country is to attract the population to sports. The increased interest of the younger generation in sports, including extreme sports, increases overall immunity, and the sense of involvement and teamwork has a positive effect on psychological health. The topic of extreme sports and Olympic sports is especially relevant to consider through the prism of the post-rehabilitation component of the military and people who have experienced post-traumatic stress disorder. And Paralympic sports, including extreme Paralympic sports, are gaining momentum in the sports arena. However, the topic of extreme sports is not well understood. Research on this topic is ongoing.

REFERENCES

1. Platonov V. Sports science of Ukraine: chapters of history. Science in Olympic Sport. 2020. - 47 p. DOI:10.32652/olympic2020.3_1

2. National Olympic Committee of Ukraine. History of NOC of Ukraine: History. URL: https://noc-ukr.org/about/history/

3. Oleynyk N.A., Grot Y.I. History of physical culture and sports in Kharkiv region. People, years, facts. Kharkiv. 2002. Vol.1. 376 p.

4. Aleksandrov D. O. Legal psychology. Kyiv. KNT, 2007. 360 p.

5. Extreme sport - definition. Extreme sports feature a combination of speed, height, danger and spectacular stunts. URL: https://en.wikipedia.org/wiki/Extreme_sport#cite_note-Websters-1

МАТЕРІАЛОЗНАВСТВО МАШИНОБУДУВАННЯ

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TECHNOLOGICAL FEATURES OF THE RESTORATION OF THE DESTROYED INFRASTRUCTURE OF THE ROAD TRANSPORT NETWORK

The transport infrastructure consists of a number of buildings that create a system of communication networks of all types of transport. Firstly the transport network meets the needs of production in the transportation of raw materials and finished products, which especially affects the development of the country's economy. Secondly, the transport network meets the needs of regular, non-regular and special passenger transportation.

The development of the economy, the competitiveness of the economy, the quality of life of the population depends on the development, condition and safety during the operation of roadways.

According to the data of the World Economic Forum (WEF), during the calculation, in 2019, of the global index of competitiveness according to the "Transport infrastructure" index, Ukraine took 59th place out of 141. Road transport infrastructure is in the worst condition among other types of transport infrastructure in Ukraine. During 2014–2019, the road quality index was in the range of 2.2–3 points out of a possible 7, the data are presented in the table. While the port infrastructure sub-index was 3.2–3.9 points, air transport infrastructure – 3.7–4 points, railway transport – 3.9–4.3 points. [1]

Table

Indexes	Years				
	2014 -2015	2015 -2016	2016 -2017	2017 -2018	2018- 2019
Quality of the motor transport network, points (1-7)	2,2	2,4	2,4	2,4	3
Railway transport infrastructure, points (1-7)	4,3	4,2	4	3,9	4,2
Air transport infrastructure, points (1-7)	3,8	3,7	3,7	4	4
Port infrastructure, points (1-7)	3,3	3,2	3,4	3,5	3,9

With the beginning of the full-scale war of the Russian Federation against Ukraine, a large number of objects of the transportation network were destroyed, thousands of kilometers of highways were damaged, and a large number of bridges and overpasses were destroyed. Construction organizations face the issue of restoring destroyed objects of the auto transport network, building new objects.

In this situation, for the restoration of construction objects of the motor vehicle network, it will be advisable to implement construction 3D printing technologies. In contrast to traditional methods of restoration and construction of objects, the 3D printing method will, on the one hand, reduce the cost and labor intensity of restoration and construction works, and on the other hand, increase the speed.

For example, a Ukrainian company has developed a stop project - a shelter from debris. To speed up the construction of the facility, the project was developed to use construction 3D printing in the construction process. [2]

a b

Fig.1 Project of a public transport stop printed on a 3D printer - a shelter from debris
a – front view b – back view

In conclusion, it can be noted that the use of construction 3D printing technologies will speed up the restoration and construction of objects. The use of construction 3D printing technologies in the process of restoration and construction of the road network is expedient. With the help of 3D printing technology, you can restore and build roadside facilities, gas stations, public transport stops, etc. It should be noted that existing construction 3D printers require design improvements, development of new and improvement of existing construction mixes. As a result, improvements will increase the quality of construction objects and allow to expand the range of use of 3D technologies in the construction industry.

REFERENCES

1. The current state and prospects of transport infrastructure development in Ukraine. Journal 'Economics and management of the national economy'. URL: http://bses.in.ua/journals/2021/64_2021/4.pdf

2.The concept of a stop-shelter from 3D printing. URL: https://urbisair.com.ua/news/makhno-studio-predstavyly-kontsept-zupynky-ukryttia-z-3d-druku/

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MODERN MATERIALS FOR REDUCING HEAT CONSUMPTION IN UKRAINE

Energy crisis in Ukraine, rising prices for energy sources, and their deficit necessitate the need to improve the quality of thermal insulation of structures and thermal units. One of the ways to address this issue is through the use of special high-efficiency thermal insulation materials capable of providing the desired thermal resistance values for constructions.

Modern material science trends are focused on technologies using organic substances in human life activities. Therefore, the development of thermal insulation materials based on minerals, characterized by low flammability and non-toxicity both during manufacturing and operation stages can be considered a priority. The properties of insulation materials are usually divided into three main groups: physical, ecological, and health-related.

This overview study is analyzing several types of thermal insulation materials that could be effectively used in Ukraine:

Rockwool. This is a type of insulator made from gabbro-basalt rocks, which allows for thermal and sound insulation of various structures or providing fire resistance. Rockwool insulation gained wide popularity at the beginning of the last century. Due to its physical and chemical properties, this type of

insulator serves as the primary energy-saving technology for processing facades, roofs, floors, and engineering networks of both industrial and semi-industrial, as well as residential, facilities. It is produced from rocks that melt at a temperature of 1500°C, after which the molten lava-like mass is drawn into rock fibers using centrifuges, special filters based on platinum or other refractory metals, and strong air currents. Then, various water-repellent additives and plasticizers are added to the obtained fibers, followed by polymerization at a temperature of about 200°C [1].

The thermal conductivity of the material is only 0.035-0.039 W/mK. Rockwool is a sufficiently strong and rigid material capable of withstanding loads of 70 kPa, which is equivalent to about 7 tons.

Cellulose insulation material. Cellulose insulation is made from recycled paper products and has a very high content of recycled material - from 82% to 85%. Initially, the paper is shredded into small pieces, giving it a fibrous texture. Manufacturers add mineral borate, sometimes mixed with cheaper ammonium sulfate, to provide resistance to fire, insects, and mold. Properly installed cellulose insulation cannot settle within the building cavity. It has an average thermal conductivity of approximately 0.040 W/mK (similar to glass wool and rockwool insulation) [2,4].

Hemp-based insulation products. The share of hemp insulation materials in the market can be considered very small in terms of physical volume and cost (both much less than 1% of the total market size). However, hemp insulation materials hold significant prospects for the future considering the increasing environmental awareness of people. The thermal conductivity coefficient of commercially available insulation products made from hemp ranges from 0.038 to 0.043 W/mK.

Hemp wool insulation is non-toxic, does not contain dangerous chemicals and has minimal susceptibility to allergens. It's a healthier option for indoors because it doesn't produce dangerous VOCs (volatile organic compounds). Thanks to the light weight of hemp wool insulation and the relatively simple installation procedure, installation time and effort can be reduced [3].

Unfortunately, the last two types of insulation are a bit uncommon in our region, accounting for approximately 5%.

Conclusion. The primary type of insulation used in Ukraine is expanded polystyrene, accounting for about 40%, while mineral wool and fiberglass products make 30% and 25%, respectively. A significant portion of this preference for energy-intensive insulation products such as polystyrene and mineral wool reflects their significant price advantage over biomaterial-based materials due to their dominance in the market. Since heating and cooling of a building constantly require the largest percentage of energy consumption within the building, it is crucial to focus on preserving as much heat as possible inside the building to reduce this demand. Ideally, this can be achieved by blocking heat flow using materials that will not harm our environment before, during, and after the service life as insulation material.

REFERENCES

1. Thermal insulation materials. Terminological dictionary-reference for construction and architecture / R. A. Shmyg, V. M. Boyarchuk, I. M. Dobryansky, V. M. Barabash; in general ed. R. A. Shmyga. Lviv, 2010. P. 188.

2. Pablo Lopez Hurtado, Antoine Rouilly, Virginie Vandenbossche Maréchal, Christine Raynaud. A review on the properties of cellulose fibre insulation. Building and Environment, 2016, 96, pp.170-177.

3. Journal of Physics and Technical Sciences 52(1) Thermo-Insulation Properties Of Hemp-Based Products. March 2015. URL: https://www.researchgate.net/publication/276424637_Thermo-Insulation_Properties_Of_Hemp-Based_Products

4. Thermal insulation. URL: https://www.engineeringcivil.com/thermal-insulation-of-buildings-principles-types-and-materials.html

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DEVELOPMENT OF OPTIMAL TECHNOLOGICAL PARAMETERS FOR PLASMA COATING DEPOSITION

The problem of using ion-plasma spraying of mold surfaces is being discussed nowadays. Its solution makes it possible to replace scarce and expensive tungsten-containing steels with other materials. 4Х5МФС and 5ХНМ steel grades were chosen as materials for copper alloy die-casting molds in this work. The choice of these steel grades is due to the fact that these steels do not contain tungsten due to its sharply increased scarcity and limited molybdenum content, and they also meet the requirements for the substrate material on which the titanium nitride coating is applied. Coatings were applied to samples for laboratory tests and die-casting mold parts by the condensation method with ion bombardment. Titanium nitride is applied at different partial nitrogen pressures – from 3(10-3 to 1 Pa to determine the required nitrogen pressure, which ensures that the working surfaces of mold parts receive coatings with the best performance characteristics. The coatings obtained at different nitrogen pressures differ in the amount and size of the droplet phase. The largest amount of the droplet phase containing α-Ti is observed in coatings obtained at nitrogen pressures of 3(10-3, 3(10-2 Pa. An increase in nitrogen pressure (4(10-1, 1 Pa) significantly reduces the level of micro distortions of the crystal lattice in the coating, and its plasticity increases. That is why the coating brittleness is reduced to a sufficiently high hardness. The titanium nitride coating obtained at a nitrogen pressure of 1 Pa is the most effective in protecting the working surfaces of mold parts from destruction. Laboratory tests have shown that the titanium nitride coating applied under optimal process parameters increases the corrosion resistance of mold parts to which it is applied by 3 times and the scale resistance by 2–4 times.

Using titanium nitride coating of mold surfaces by the condensation method with ion bombardment has allowed obtaining different performance characteristics. It depends on amount of nitrogen pressure. To increase the stability of molds we should increase its resistance to cyclic temperature stresses and aggressive environments by presence of such layer. This layer can be of wear-resistant materials that can be applied by method of condensation with ion bombardment (CIB).

The development of optimal technological parameters for the deposition of plasma coatings is the process of determining the ideal conditions, such as temperature, pressure, gas composition and others, for applying plasma coatings with maximum efficiency and quality to the surface of the material. This is important to ensure high quality and sustainability.

REFERENCES

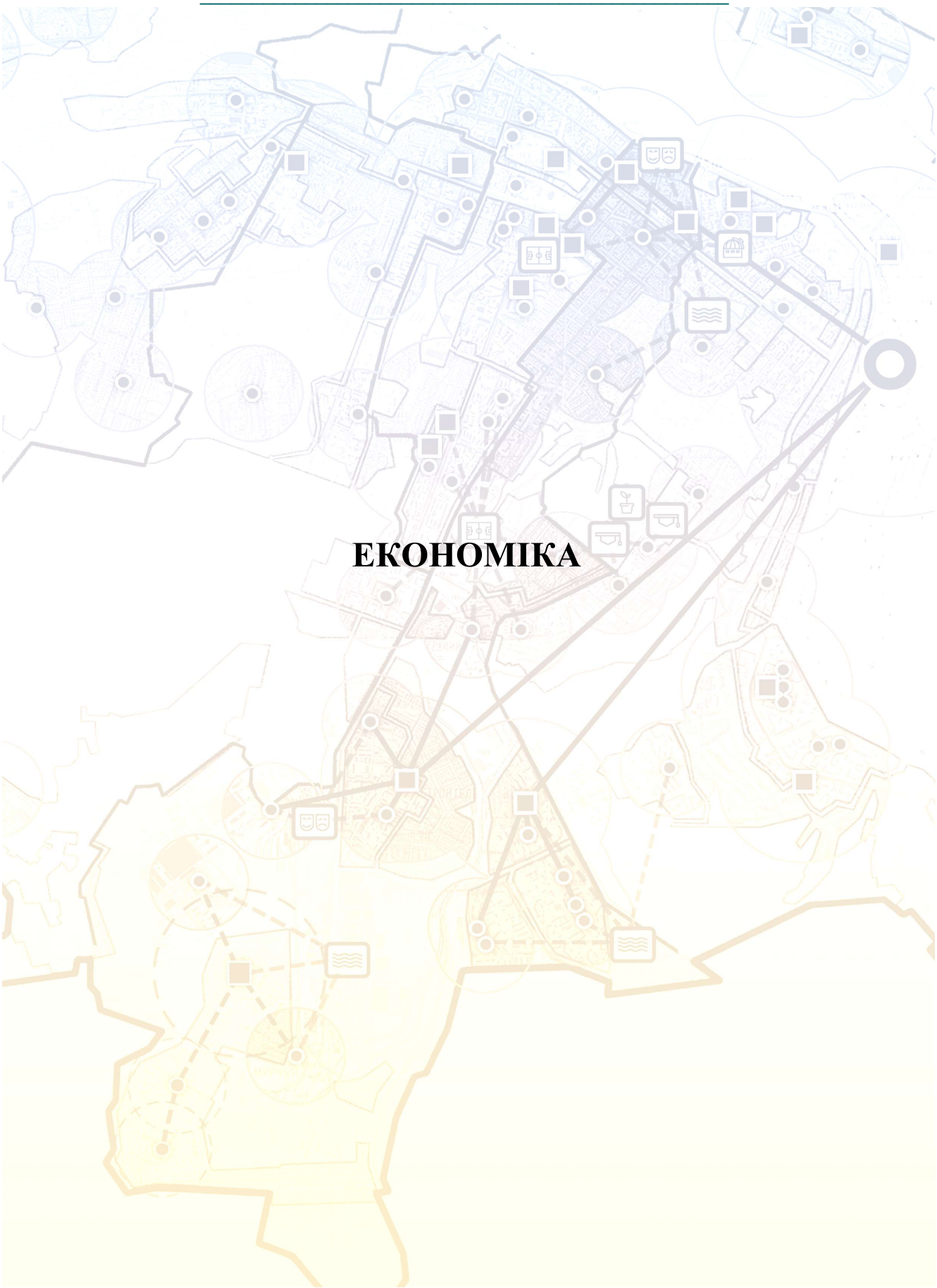
1.L.I. Gladkikh, S.V. Malykhyn, A.T. Pugache, O.M. Reshetnyak, D.B. Glushkova, S.S. D'Yachenko, G.P. Kovtun. Residual Stresses and Structure of Titanium and Chromium Nitride Coatings Obtained by a Method of an Ion-Plasma-Enhanced Deposition // Metallofizika i Noveishie Tekhnologii. 2003, N 6(25), p. 763-776 (in Russian).

2.2. E.I. Tsyvirko, A.A. Pedash. Grinding the structure of internal surfaces of cooling parts, VMD // Visnyk dvizhnoboduvaniya. 2010, N 1, p. 99-103 (in Ukrainian).

3.D.B. Hlushkova, V.A. Bagrov, S.V. Demchenko, V.M. Volchuk, O.V. Kalinin, N.E. Kalinina. Structure and properties of powder gas-plasma coatings based on nickel // Problems of Atomic Science and Technology. 2022, N 4(140), p. 125-130

4.V.S. Vahrusheva, D.B. Hlushkova, V.M. Volchuk, T.V. Nosova, S.I. Mamhur, N.I. Tsokur, V.A. Bagrov, S.V. Demchenko, Yu.V. Ryzhkov, V.O. Scrypnikov. Increasing the corrosion resistance of heat-resistant alloys for parts of power equipment // Problems of Atomic Science and Technology. 2022, N 4(140), p. 137-140; https://doi.org/10.46813/2022-140-137

5.O.M. Vynogradov. Reduction of costs for foundry production .Casting of Ukraine. N 3..2005.



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BUSINESS EFFECTIVENESS AND EFFICIENCY: DIAGNOSTICS, EVALUATION, CONTROL IN CONDITIONS OF UNCERTAINTY

The effectiveness and efficiency of business/economic activity in the private, public-private sector of the economy and at a state-owned enterprise is always the object and, at the same time, the goal of the management of business entities and their stakeholders. Thus, flexible management of business performance and efficiency has always been, is, and will be, as the complexity, dynamism, and uncertainty of the external environment are constantly changing rapidly.

The relationships and interdependencies between external factors affecting the business are becoming more extensive and complex.

The complexity of ensuring and maintaining the desired level of effectiveness and efficiency of the economic activity of an enterprise or business structure in dynamics increases due to the unpredictability of changes in the external meso and macro environment, including trends in world markets. Nowadays these changes occur for a number of well-known objective reasons (influences, challenges), namely: growing economic-political and military-political turbulence at the world level and, in particular, Russia's brutal war against Ukraine, which directly affects the state of the economy of our country. In addition, the rapid development of information technology and artificial intelligence technologies today is both a challenge and an opportunity for business development.

The composition, quality, structure, and architecture of the world economy and, accordingly, national economies up to the level of an individual business entity, are changing rapidly and, obviously, the strongest will win in this "game". The traits of the strongest are flexibility/adaptability; anticipatory rather than reactive control; ability to prioritize and work only with relevant information; access and skillful use of all types of resources – material, financial, informational and intellectual. An important intellectual resource, especially in the era of digitalization of the economy and almost all spheres of human life, is the research potential, which can only be provided by people – specialists of the appropriate level in competent, professional cooperation with artificial intelligence. At the same time, such cooperation is the key to overcome the challenges of digitalization for humans [1].

Thus, in modern conditions, approaches to systematization, analysis and quantitative assessment of a set of specific interrelated indicators that characterize the financial and economic results of business in dynamics and allow making timely, flexible and effective management decisions need to be improved.

Thus, based on the theory of economic analysis, management methods, management accounting [2,3] and the analysis of the current practical experience of domestic and foreign economic entities, it is necessary to develop (or at least improve) a system, mechanism and methodological tools for monitoring, diagnosing and controlling the financial and economic results of business to ensure and maintain the desired level of its effectiveness and efficiency in conditions of uncertainty/stochasticity of external influences.

"Control" is semantically understood as the broad meaning of this term, «control» - management.

To achieve this goal, it is necessary to solve the following tasks:

1.To study the theoretical foundations of economic analysis, management accounting of the results of economic activity, methods of diagnostics and interpretation of the values of indicators of the financial and economic condition of the enterprise and approaches to business management, including diversified business. To determine the problems of using the studied theoretical and practical approaches in the current conditions of unpredictability of environmental influences.

2.To analyze specific financial and economic indicators of a representative sample of enterprises and methods of their monitoring, to systematize and classify the studied indicators, and to characterize approaches to their monitoring.

3.To identify problematic issues in possible approaches to monitor the values of the analyzed indicators, as well as to propose ways to solve the identified problems, taking into account the digital transformation of business.

4.To propose an improved methodical approach, mechanism and tools for monitoring, diagnosing and controlling the financial and economic results of business in conditions of uncertainty of external influences in real-time, at the same time with the possibility of adequate comparison of the results of such monitoring with the strategic goals of the business in order to adjust the strategy in a timely manner.

5.To predict the economic and social effect of the implementation of the proposed approach, mechanism, and tools.

REFERENCES

1. Digitalization: Benefits and Ways to Overcome Challenges. URL: https://razumkov.org.ua/statti/tsyfrovizatsiia-perevagy-ta-shliakhy-podolannia-vyklykiv (Last accessed: 01.12.2023)

2. Golov, S. F. Managerial Accounting: Textbook, 6th ed. Kyiv: Libra, 2018. 524 p.

3. Parshyn Yu.I., Parshina O.A. Osnovy ekonomichnoho analizu, 2020. 180 p. [Fundamentals of economic analysis. Manual, 2020].

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FORMATION AND DEVELOPMENT OF THE ECONOMY OF INDEPENDENT UKRAINE

The Ukrainian economy has a long and varied history, but the current one is referred to as 'transitional'. The economic collapse of the Soviet system had appeared before the political devastation of the USSR began and in independent Ukraine was transformed into a large-scale economic collapse: deep social transformations took place extremely quickly, as a result of which the usual socio-economic structure with the usual social division disappeared. There have been major changes in the system of division of labor, increased socio-economic mobility.

The second period (early 2000s - 2008) is a period of economic growth, expansion of the domestic market, was a credit boom, the flourishing of the banking system, the entry of Ukrainian business groups into international markets, the improvement of the social situation, the growth of incomes, the first attempts to update and restructure fixed assets, the subsequent concentration of property and power in the hands of the most powerful business groups, the final design of the main oligarchic groups, the further integration of the Ukrainian economy into the world.

The third period begins with the global financial crisis of 2008, which is not only affected the economic development of Ukraine (decline in production, reduction of income, crisis of the banking system, devaluation of the national currency), but also revealed systemic imbalances in the economy: domination of monopolies, excessive concentration of capital and power in the hands of oligarchic groups, dependence on budget exports, disproportions in the structure of production and distribution in favor of large capital, a tax system that is deadly for the economy, total corruption and a system of patronage ties between power and capital, a catastrophically low level of economic freedom, low labor productivity

Unfortunately, the problem in the industrial economy is still relevantseveral and requires immediate solutions. Among them are backwardness in innovation, insufficient provision of their own products in the domestic market, dependence on exports of raw materials, low energy efficiency in production, imperfect investment and credit system and standardization problems. These problems hinder the

development of industry and threaten the economic security of the country. Therefore, systemic reforms are needed to stimulate innovation, expand the domestic market, reduce energy costs and improve the investment climate.

However, a significant step in development is digitalization. Digitalization is the process of converting information and services into a digital format, which includes the use of computer technology to increase efficiency, accessibility and data exchange. Internet banking is most remarkable example. The Ministry of Digital Development released the Diya application and web platform in 2019, which have become the primary means of accessing modern and convenient public services. The initial version created the basis for the future expansion of the functionality, since the goal is ambitious: to combine all public services for citizens and business in one electronic space This will simplify and accelerate interaction with the state, ensure transparency and control, and eliminate the possibility of delays or corrupt practices.

REFERENCES

1.Industrial policy of post-crisis economy: col. monograph/edited by Dr. Econ. sciences, prof. L.V. Deineko, Dr. Econ. sciences, prof. M.M. Yakubovsky; NAS of Ukraine, SI "In-t ekon. and forecast. NAS of Ukraine. " Kyiv, 2014. 316 p.

2. Scientific Edition. Baran Volodymyr Danylovych, BARAN Volodymyr Kindratovych, Bunyatyan Kateryna Petrovna and others Economic History Of Ukraine. Historical and economic research in two volumes Volume 2 p. 521-523 [untitled (history.org.ua)]

3. Digital country: Time to forget about paper documents?. Dmytro Ovcharenko [Дія і діджіталізація. Що відбувається в Україні і як працюватимуть документи онлайн / NV

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ECONOMIC SECURITY OF ENTERPRISES IN THE CONTEXT OF DIGITAL TRANSFORMATION

In today's dynamic digital environment, businesses need to adapt to rapid digital changes to ensure successful operation and remain competitive in the market. However, the process of digital transformation poses new challenges for enterprises related to economic security. [1] This paper examines the key aspects of economic security of enterprises in the context of digital transformation, as well as strategies and measures to ensure it.

Digital transformation opens up new opportunities for businesses but also creates new challenges in ensuring economic security. The implementation of a comprehensive digital security strategy, balanced investments in digital technologies, development of digital competencies of personnel, effective risk management, and economic stability are key factors for successful adaptation of enterprises to the digital environment and maintaining their competitiveness.

The process of digital transformation poses a number of challenges to enterprises to ensure economic security. [2; 3]

1. The introduction of digital technologies increases the risk of cyber threats and cyber-attacks, which can lead to significant financial losses and data security breaches.
2. Digital transformation requires significant investment in new technologies, which creates additional financial pressure and requires careful budget planning.
3. Successful digital transformation requires the availability of specialists with new skills and competencies in the field of digital technologies, which leads to additional costs for staff training or search for qualified personnel. [4]

To overcome these challenges and ensure economic security in the context of digital transformation, businesses can take the following strategic steps:

1. Implementation of an information security management system. The development and implementation of a comprehensive information security management system that complies with international standards, such as ISO/IEC 27001, will allow companies to effectively protect their digital assets and minimize the risks associated with cyber threats.
2. Review and optimization of existing business processes with the use of digital technologies. This will improve the efficiency of the enterprise and strengthen its competitive position in the market, which in turn will contribute to economic security.
3. Formation of a digital culture at the enterprise and ensuring continuous development of digital competencies of personnel at all levels.
4. Search for alternative sources of financing (venture capital, crowdfunding) should help enterprises reduce financial pressure and ensure stability during digital transformations.
5. Establishment of partnership relations with scientific institutions and state bodies will stimulate knowledge exchange, innovation development and the use of the synergistic effect to improve the economic security of companies in the digital age.

This comprehensive approach allows not only to respond effectively to the challenges of digital transformation but also to develop a solid foundation for economic security and sustainable development in the long term.

Further research and exchange of best practices in this area will help businesses develop effective approaches to ensuring economic security in the context of digital transformation.

REFERENCES

1. Dergaliuk, B. V. (2023). Vplyv tsyfrovoi transformatsii na zabezpechennia ekonomichnoi bezpeky pidpryiemstva. Ekonomichnyi visnyk NTUU "Kyivskyi politekhnichnyi instytut", 26, 65-68.

[The impact of digital transformation on ensuring the economic security of the enterprise. Economic Bulletin of NTUU "Kyiv Polytechnic Institute". 2023. Issue 26. pp. 65-68]

2. Zhadko, K. S., & Samoylenko, D. M. (2020). Ekonomichna bezpeka pidpryiemstv v umovakh tsyfrovykh tekhnolohii i pandemii. Tsentralno-ukrainskyi naukovyi visnyk, 5 (38), 170-176.

[Economic security of enterprises in the conditions of digital technologies and pandemic. Central Ukrainian Scientific Bulletin. 2020. Issue 5 (38). pp. 170-176]

3. Kovalchuk, A. M. (2020). Finansovo-ekonomichna bezpeka pidpryiemstva v konteksti adaptatsii do vyklykiv tsyfrovoho seredovyshcha. Ekonomichnyi visnyk, 3, 152-159.

[Financial and economic security of the enterprise in the context of adaptation to the challenges of the digital environment. Economic Bulletin. 2020. Issue 3. pp. 152-159.]

4. Kasyanova, N. V., Kravchuk, N. V., & Koval, Yu. L. (2020). Bezpeka pidpryiemstva v umovakh tsyfrovoi transformatsii ekonomiky. Modern Economics, 20, 124-129.

[Kasyanova N. V., Kravchuk N. V., Koval Y. L. Enterprise security in the context of digital transformation of the economy. Modern Economics. 2020. Issue 20. pp. 124-129.]

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THE IMPACT OF INTERNATIONAL TRADE ON THE ECONOMIC DEVELOPMENT OF COUNTRIES

International trade plays a key role in the economic development of countries, contributing to GDP growth, increased production, expansion of sales markets and technology exchange, which in turn helps reduce poverty and improve the standard of living of the population.

In details, the international trade is one of the main driving forces of economic development of countries. Involvement in global trade allows countries to use their comparative advantages and specialize in the production of goods and services with higher added value, which leads to increased production and exports.

In addition, international trade promotes the spread of new technologies and advanced production methods through international supply and cooperation. This helps to increase labor productivity and innovative development of the economy.

Also, international trade creates additional opportunities for entrepreneurs and companies, expanding access to new markets and sources of raw materials, which stimulates investment and production growth.

Ultimately, international trade contributes to the economic development of countries by helping to increase incomes, reduce poverty and improve the quality of life. However, it is important to consider that successful participation in global trade requires the development of competitiveness, infrastructure and effective economic management.

To study the thesis about the impact of international trade on the economic development of countries, the following scientific methods can be used:

1.Statistical Analysis: Analysis of foreign trade data of various countries, including import and export volumes, trade balance, world market share, etc. This makes it possible to identify trends and relationships between international trade and economic development.

2.Econometrics: The application of statistical methods to study the relationships between international trade and economic growth, including dependency modeling, elasticity estimation, and economic forecasting.

3.Case Studies: Analysis of specific examples of countries or regions where international trade has played a key role in economic development, with the aim of identifying reasons for success or failure and summarizing the findings.

4.Empirical Research: Conduct surveys, interviews and questionnaires with international trade participants, and analyze documents and reports to understand their perceptions of the impact of trade on economic development and consider specific examples of impact.

5.Modelling: Creation of economic models that take into account various aspects of international trade and their impact on economic development, which allows you to analyze different scenarios and predict outcomes.

The influence of international trade on the economic development of countries, the following conclusions can be drawn:

1. International trade is a key driver of economic growth: Participation in global trade helps accelerate economic growth by expanding markets, increasing production and investment, and transferring technology.

2. International trade helps reduce poverty and improve living standards: Increasing incomes, creating new jobs and expanding access to a variety of goods and services have a positive impact on improving the quality of life.

3. International trade stimulates innovation: Technology transfer and competition in global markets force companies to invest in research and development, which promotes innovation and improves product quality.

REFERENCES

1.Krugman P., Obstfeld M., Melitz M. International Economics: Theory and Policy. Global Edition: Pearson Education Limited, 2014. 792 c. URL: https://books.google.com.ua/books/about/International_Economics_Theory_and_Polic.html?id=5GSpBwAAQBAJ&redir_esc=y

2.Dollar D., Kraay A. Trade, Growth, and Poverty // Finance Development. 2001. № 3. URL: https://www.imf.org/external/pubs/ft/fandd/2001/09/dollar.htm

3.Rodrik D. The Globalization Paradox: Democracy and the Future of the World Economy. New York: W.W. Norton and Company, 2001. 337 c. URL: https://www.semanticscholar.org/paper/The-Globalization-Paradox%3A-Democracy-and-the-Future-Rodrik/b8ba0461fcf3ca48e4ab8d8f51971cd37b8467c0

4.Robert C. Feenstra, Gordon H. Hanson. Globalization, Outsourcing, and Wage Inequality // American Economic Association. 1996. № 2. C.240-245 URL: https://www.jstor.org/stable/2118130

5.Douglas A. Irwin (2020). Free Trade Under Fire. USA: Princeton University Press. Retrieved from: https://www.jstor.org/stable/j.ctvr0qr9q

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CULTURAL BACKGROUND OF INTERNATIONAL ECONOMIC COOPERATION BETWEEN UKRAINE AND EU COUNTRIES

Ukraine is making steady progress on its way to the European Union. The decision to start negotiations to access the EU is evidence of the successful completion of the "homework" on reforming the Ukrainian economy and legislation. However, the success of international economic cooperation is determined not only by economic factors, but also by cultural, political, and social ones. Particular attention should be paid to cultural differences, which, on the one hand, can be barriers to establishing effective economic cooperation between countries, and on the other hand, can produce synergistic effects in this interaction. [1]

Cultural backgrounds sometimes play a crucial role in shaping international economic relations. Cross-cultural analysis, economic anthropology, cultural studies, and sociology are important theoretical approaches to studying the cultural background of international economic cooperation. They help to identify how cultural differences and peculiarities affect various aspects of international economic activity.

Ukraine shares a common history and cultural ties with some European Union countries that go back a long way. [2] Among the most important common cultural traditions of Ukraine and the European Union are the following:

•Religion. The vast majority of the population of both Ukraine and Europe are Christians.

•European heritage in architecture, art, and literature, as the certain parts of Ukraine being part of certain European countries.

•Common values. Ukraine expresses its commitment to European values, such as democracy, human rights, freedom of speech, and the rule of law which are the basis of cooperation between Ukraine and the EU.

In addition to their commonalities, Ukraine and the European Union have a number of cultural differences that may affect international economic cooperation between the two parties. These include:

•Language differences. Ukraine is a multilingual country with Ukrainian being the most widely spoken language. The European Union has 24 official languages. This language gap can cause misunderstandings, especially when businesses from Ukraine and the EU try to work together.

•Ukraine and the European Union also have different social structures. Ukraine is a more stratified society than most EU countries. This can lead to friction points in business and government dealings.

•Differences in work values. In Ukraine, hard work and dedication to work are more valued, while in the European Union, work-life balance is preferred.

In order to assess the cultural differences between Ukraine and the EU countries, we compared the scores of Ukraine and the EU countries using the Hofstede model along six main cultural dimensions according to the results of the ABC analysis of international trade.

The table 1 illustrates the results of the comparison of Ukraine and the EU countries according to the Hofstede model by geographical structure of exports. The Ukraine indicators are close to 29.6% in group A, 47.2% in group B, and 27.8% in group C.

Table 1

Comparison of Ukraine and EU countries
according to the Hofstede model by geographical structure of exports

Group by ABC-model	Countries	Cultural dimension similar to Ukraine	Total number of indicators	Similarity to the group, %
A	Poland, Italy, Germany, Netherlands, Spain, Hungary, Romania, Czech Republic, Slovakia	16	54	29.6
B	Austria, France, Bulgaria, Belgium, Lithuania, Portugal	17	36	47.2
C	Latvia, Denmark, Greece, Estonia, Finland, Sweden, Ireland, Slovenia, Cyprus, Croatia, Malta, Luxembourg	20	72	27.8

Source: [3]

The summary of the comparison of Ukraine and EU countries, according to the Hofstede model by geographical structure of imports, demonstrates that Ukraine shares similar Hofstede dimensions with 30% in Group A, 38.1% in Group B, and 31.7% in Group C

Table 2

Comparison of Ukraine and EU countries
according to the Hofstede model by geographical structure of imports

Group by ABC-model	Countries	Cultural dimension similar to Ukraine	Total number of indicators	Similarity to the group, %
A	Germany, Poland, Italy, France, Hungary, Czech Republic, Lithuania, Netherlands, Spain, Slovakia	18	60	30
B	Austria, Romania, Belgium, Sweden, Bulgaria, Greece, Finland	16	42	38.1
C	Denmark, Slovenia, Ireland, Latvia, Estonia, Malta, Portugal, Croatia, Cyprus, Luxembourg	19	60	31.7

Source: [3]

In general, 53 out of 162 indicators are close to Ukrainian ones, which is 32.7%. This is even higher than for a significant number of the EU members. For example, the Netherlands does not have a single similar indicator for the individualism-collectivism criterion. Hungary and Slovakia are in the same situation in terms of masculinity-femininity. This once again confirms the conclusion that Ukrainian culture is close to the European one.

In many cases, the similarity of Ukrainian indicators with European ones is greater than even long-standing EU members. Therefore, the existence of certain differences in culture should not hinder Ukraine's progress on the path to EU membership.

On the other hand, the Hofstede differences with Group A main partner (Netherlands, Italy, Hungary) may hold back further improvement of cooperation and require special measures to minimize the possible negative impact of these differences.With the help of appropriate tools including economic, social and political, the risk of misunderstandings and conflicts can be significantly reduced, and successful international economic cooperation can be facilitated.

REFERENCES

1.Grube, L.E.; Storr, V.H. (2015) The Role of Culture in Economic Action. New Thinking in Austrian Political Economy (Advances in Austrian Economics, Vol. 19), Emerald Group Publishing Limited, Bingley, pp. 21-46. URL: https://doi.org/10.1108/S1529-213420150000019002

2.Charter of fundamental rights of the European Union. URL: https://www.europarl.europa.eu/charter/pdf/text_en.pdf

3.The Culture Factor Group. Country comparison tool. URL: https://www.hofstede-insights.com/country-comparison-tool

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE GLOBAL ECONOMY

In the process of searching for new goals, means, methods and tools, humanity is gradually changing. People always strive to simplify their lives in all its manifestations. The constant drive for development has given rise to the concepts of socio-economic progress and the scientific and technological revolution, which affect the economy and society as a whole.

In the second half of the twentieth century, there was a transition from the industrial age to the information age. While the primary problems of the industrial era were related to the change in human employment in production with the help of automation, the information age is characterized by the onset of artificial intelligence.

By definition, artificial intelligence is a computer system that has certain signs of intelligence, i.e., it is able to recognize, understand, find a way to achieve a result, make decisions, and learn. For example, in the United States today, people can already get legal advice on many legal issues from a robot called IBM Watson in a matter of seconds. And with 90% accuracy compared to 70% accuracy made or better "shown" by a human lawyer. Artificial intelligence is also demonstrating its advantages in factory production. As a result of replacing 90% of the employees of a mobile phone factory with robots, the technological process was switched to a round-the-clock mode, labor productivity increased by 250%, and the number of rejects decreased by 80% [2]

However, along with its benefits, artificial intelligence also poses the threat of job losses and lower incomes. Employees are increasingly being replaced by robots that perform the same level of work and, in some cases, even better. Analyzing the pace of e-commerce development, we can conclude that such a profession as a salesperson will soon disappear altogether. While earlier online shopping was mainly for goods that did not require preliminary inspection, today even clothes and shoes are increasingly ordered in online stores. For example, Amazon's store has no staff and is entirely managed by artificial intelligence, which tracks every purchase and automatically invoices customers. The future is not looking good for journalists either. Artificial intelligence has reached this seemingly creative profession as well. Recently, the news spread on the Internet that China had tested a robot that could write articles and notes.

Given the above facts, it becomes clear why artificial intelligence is receiving so much attention. The problem of artificial intelligence became really acute in 2016, when even economists started talking about it. At the World Economic Forum in Davos, the main topics of discussion were directly or indirectly related to artificial intelligence and its impact on the economy. The forum was not about humanoid robots, which people imagined just 30 years ago, but about mechanisms and systems that are similar to the human brain, work on its principle and are capable of self-improvement. Such neural systems can completely change the economy and force people to reorient their activities. Artificial intelligence technologies are not yet fully understood, it is not known how they will affect people and

whether they will get out of control. Therefore, the task of economists is to prevent people from losing their place and getting lost in the technical world [4]

Many large companies are now actively engaged in the development of artificial intelligence. How will it all end? At the moment, we are witnessing a technical growth. On the one hand, the global economy is showing a significant slowdown in its growth. However, on the other hand, in accordance with the exponential relationship, technologies are developing, the pace of which is continuously increasing and may lead to the formation of a technogenic planned economy. And this continues to this day. According to various forecasts, the world's population could become 4.8 times richer by 2050. Some experts are inclined to believe that an economic leap similar to the last two industrial revolutions will take place in the near future. As a result, the economy will double its growth rate every two weeks. It is possible that this leap will be associated with the tremendous development of intelligence and the emergence of artificial superintelligence. If such a superintelligence can be invented, this forecast will not look so fantastic.

In the past, people often reacted with panic to the changes that new eras brought with them. And these fears were mainly related to the fact that there might not be any jobs left for them. History records examples of opposition to the process of mechanization due to similar fears. Well-known economists, politicians, and scholars have repeatedly argued about reducing the negative effects of a shrinking labor market. All of these statements are well-founded and there has always been a way out of a difficult situation, although the current transformation will be completely unlike anything humanity has experienced before in terms of its scale and complexity.

REFERENCES

1.The Coming of the Robots. Technology and the Threat of Future Unemployment. Kyiv: Nash Format Publishing House, 2016. 124 p.

2.Artificial Intelligence: Stages, Threats and Strategies. URL: http://open.kmbs.ua/page.php?_lang=ua&section=articles&category=op-manage&id=19925&alias=shtuchnij-intelekt-etapi-zagrozi-ta-strategiji&.

3.Determination of cyclical dependencies in the economy of Ukraine based on the analysis of individual macroeconomic indicators. Economic Bulletin of the National Technical University of Ukraine "KPI". 2016. No13. URL : http://ev.fmm.kpi.ua/article/view/80084.

4.Marketing aspects of futurological consequences of technologization. Economics. Management. Innovations: electronic professional edition. 2013. No1. URL : http://nbuv.gov.ua/UJRN/eui_2013_1_71.

5.Yudina N.V. Futurology of the Internet space. Marketing of services. Ed. House of Grebennikov. 2014. No 4. C. 164 P. 175.

6.Yudina N. V. "Roadmap" of the enterprise in the context of futurology of the technogenic economy. Traditions and innovations. Innovations and fundamental sciences in the conditions of technogenic economy: collection of materials of interdisciplinary scientific and practical conference, Kyiv, November 25. 2016 K., 2016. URL : http://futurolog.com.ua/publish/2/Zbirnyk.pdf#page=6.

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STRENGTHENING THE EU'S ECONOMIC SECURITY IN THE NEW GEOPOLITICAL ERA

Economic security is emerging as a critical aspect of international politics, with the European Union (EU) facing challenges in a landscape marked by rising protectionism, global subsidy races, and strategic manipulation of interdependencies. To address these challenges, the EU needs a comprehensive strategy that encompasses various aspects of economic security and strategic autonomy. [1]

The EU is increasingly focused on enhancing economic security and achieving strategic autonomy, requiring a balanced approach to navigate the competitive landscape of global power dynamics. This involves addressing risks and vulnerabilities through strategies such as stress tests and data analysis, as well as establishing the European Economic Security Committee to align national security with EU economic policy.

The EU's Economic Security Strategy, released in June 2023 [2], aims to unify economic statecraft tools, focusing on competitiveness, citizen protection, and partnership formation. This strategy emphasises economic resilience and industrial capacity, particularly in green and tech sectors. However, the EU continues to face institutional and strategic challenges in a geopolitical landscape dominated by rivalry. There's a lack of consensus within Europe on the path to economic security, with some advocating for maintaining open, multilateral frameworks, while others call for significant strategic shifts towards domestically focussed industrial policies.

The EU's approach to economic security involves preparing for high-risk events and managing hard economic security risks, such as cyber-attacks and foreign control of critical infrastructure. [3] This includes implementing export controls and investment screening, focusing on technologies critical for national security. The EU's Chips Act is an example of such measures, aimed at reducing dependency on external high-end chip production. [4]

Building resilience and forging strategic partnerships are key components of the EU's strategy. This involves upholding a rules-based international order and engaging with countries seeking flexible partnerships. Trade and investment policies play a crucial role in strengthening the resilience of the EU economy. The EU aims to avoid costly reshoring strategies, instead prioritising trade agreements with third countries and focused investments through the Global Gateway initiative. [5] Addressing institutional and systemic weaknesses is also vital for the EU's economic security.

The new geopolitical realities underscore the need for European public goods in areas such as R&D, defence, security, innovation, energy, and technology. Ambitious reforms are necessary, which possibly lead to progress towards a Fiscal Union and the reform of the Stability and Growth Pact. [6]

The EU's strategy centres around utilizing the euro for geo-economic purposes, requiring significant reforms in the Economic and Monetary Union (EMU) and the integration of the EU's financial system. Promoting the euro as an international currency involves several key steps, including creating a permanent safe asset and committing to limited common debt issuance to finance selected European public goods. [7] This would strengthen the financial system, providing various geo-economic benefits.

In conclusion, the landscape of great power competition requires the EU to adapt its strategies. Maintaining open strategic autonomy, focusing on increased trade, identifying and addressing hard security risks, and deepening economic and financial integration are essential to enhance EU leverage. The new geo-economic reality offers an opportunity for the EU to strengthen its economic integration and address political and institutional challenges. Developing an effective European economic statecraft strategy requires improved risk assessment tools and a collective commitment to strategic economic policymaking.

REFERENCES

1. Charles M. Strategic autonomy for Europe – the aim of our generation speech by president Charles Michel to the Bruegel think tank. Bruegel : European Council, 2020. URL: https://www.consilium.europa.eu/en/press/press-releases/2020/09/28/l-autonomie-strategique-europeenne-est-l-objectif-de-notre-generation-discours-du-president-charles-michel-au-groupe-de-reflexion-bruegel/
2. European Commission and High Representative for Foreign and Security Policy. EUROPEAN ECONOMIC SECURITY STRATEGY. Brussels, June 26, 2023. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023JC0020 .
3. Demertzis M., Wolff G. Hybrid and Cyber Security Threats and the EU's Financial System. *Journal of Financial Regulation*. 2020. Vol. 6, no. 2. P. 306–316.
4. REGULATION (EU) 2023/1781 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 September 2023 establishing a framework of measures for strengthening Europe's semiconductor ecosystem and amending Regulation : REGULATION of 13.09.2023 no. (EU)2021/694.
5. Dadush U. The policy response to global value chain disruption. *Global Policy*. 2023. URL: https://doi.org/10.1111/1758-5899.13220 (date of access: 08.03.2024).
6. Draghi M. Mario Draghi on the path to fiscal union in the euro zone. *The Economist*. 2023.
7. EUROPEAN CENTRAL BANK. The EU's Open Strategic Autonomy from a central banking perspective. Frankfurt am Main : ECB website, 2023. 189 p.

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THE DIGITALIZATION OF ACCOUNTING IN MODERN BUSINESS

The advent of the digital revolution has profoundly impacted various industries, and accounting is no exception. Integrating digital technologies into accounting processes has revolutionized how businesses manage and analyze financial information. A comprehensive review of the digitalization of accounting in modern business, aims to explore the transformative potential of digital technologies and provide insights for organizations seeking to leverage them effectively.

The benefits of digitalization in accounting are not limited to efficiency gains. By adopting cloud-based accounting systems, businesses can enjoy several advantages, such as scalability, cost-effectiveness, and enhanced collaboration. Moreover, integrating artificial intelligence (AI) applications in accounting processes has enabled intelligent data analysis, fraud detection, and predictive analytics. Additionally, blockchain technology offers enhanced transparency, data integrity, and security in financial transactions.

However, along with the benefits, the digitalization of accounting also presents challenges that organizations must address. Data security risks, the need for employee upskilling to adapt to new technologies, and ethical considerations surrounding AI and automation are some challenges businesses face in the digital era. Study contributes to understanding how digitalization is reshaping the accounting landscape and provides valuable recommendations for organizations seeking to embrace digital accounting technologies successfully. By leveraging the transformative power of digital technologies, businesses can improve financial efficiency, decision-making, and overall organizational performance in today's rapidly evolving digital business environment.

The literature on the digitalization of accounting highlights its transformative potential in modern business environments. Researchers have identified various benefits and challenges associated with adopting and implementing digital accounting technologies. Several studies emphasize the automation

capabilities of digital accounting systems. Automation reduces manual efforts, streamlines processes, and minimizes errors in data entry, transaction recording, and reconciliation. This automation allows accounting professionals to focus on higher-value tasks such as financial analysis and decision-making.

The improved accuracy of financial data is another significant benefit emphasized in the literature. Digital accounting systems eliminate human errors and improve data integrity. Accurate and up-to-date financial data enable informed decision-making and enhance the overall quality of financial reporting. Researchers also highlight the importance of audit trails provided by digital accounting systems. These systems document every transaction and change made to financial records, ensuring transparency, accountability, and compliance with regulatory requirements. Additionally, audit trails contribute to fraud detection and prevention, enhancing the control environment. Real-time financial reporting is emphasized as a crucial advantage of digitalization in accounting. Businesses can access real-time financial information, enabling timely decision-making, monitoring financial performance, and adapting to market changes.

Despite the benefits, also identifies challenges associated with digitalization in accounting. Data security risks are a major concern, as storing financial data in digital systems exposes it to cyber threats and unauthorized access. Researchers stress the need for robust data security measures, including encryption, access controls, and regular backups. Employee upskilling is highlighted as a challenge in the digital era. Adopting digital accounting technologies requires accountants and finance professionals to acquire new skills in data analysis, technology utilization, and system management. Providing adequate training and professional development opportunities ensures a smooth transition.

The study highlights the transformative potential of digitalization in accounting. It emphasizes the importance of businesses embracing digital technologies to remain competitive in the rapidly evolving digital landscape. Organizations can successfully adopt digital accounting technologies and enhance their financial management processes by addressing these challenges and leveraging the potential benefits. The effective adoption of digital accounting technologies enables organizations to improve efficiency, accuracy, and decision-making capabilities, leading to better financial outcomes and overall organizational performance. In conclusion, digital accounting technologies have revolutionized the accounting landscape, offering numerous benefits and opportunities for organizations. These technologies can transform traditional accounting practices, improve efficiency, accuracy, and decision-making capabilities, and enhance financial management.

REFERENCES

1.Johnson M., Wilson K. Data security risks in digital accounting: Challenges and solutions. Journal of Information Systems and Technology. 2019. 12(2). pp. 87-104.

2.Garcia P., Patel A. Ethical considerations in using artificial intelligence in accounting: A systematic review. Journal of Business Ethics. 2018. 127(2). pp. 389-405.

3.Smith A., Johnson B. The transformative potential of digitalisation in accounting. Journal of Accounting and Finance. 2018. 42(2). pp. 150-167.

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RELATIONSHIP BETWEEN ECONOMICS AND POLITICS

Politics and economics have a complicated and interwoven relationship. Politics is the study and application of influencing people via the use of power, including governments, elections, and political parties. Economics is the study and manipulation of the economy. Theoretically, economics could be politically neutral, with the perfect economist distancing themselves from political prejudice in order to present objective, neutral data and suggestions for enhancing economic performance. In actuality, however, there is a close bond between politics and economics since many economic issues are politically charged because of divergent viewpoints, and the state of the economy serves as a major political arena. [1]

Political economy is a social science that studies how economic theories impact various socio-economic systems and the execution of public policy. It is frequently used to study the interaction between politics and economics. It also uses economic instruments to research politics, looking at how political factors impact the economy and vice versa. For instance, interest groups and voters can have a significant impact on economic policy, while macroeconomic patterns can influence the course of politics. [2]

Numerous real-world situations demonstrate how politics and economics intertwine. An example of how politics, economics, and other factors intertwine is the COVID-19 epidemic. Public health specialists have long warned about the prospect of a large epidemic, but politicians found it difficult to devote time, resources, and political capital to addressing the distant chance of a future disaster since they were preoccupied with the next election. This illustrates the relationship between politics and the economy and how each influences the other. [3]

Politics and economics are inextricably linked and have a complex relationship. This link, known as political economy, is critical to understanding since it shapes public policy and determines the path of a nation's economy.

REFFERENCES

1.Pettinger T. The relationship between economics and politics. Economics Help. 2020. URL: https://www.economicshelp.org/blog/11298/concepts/the-relationship-between-economics-and-politics/

2.University of Bath. How do politics shape financial landscapes? // University of Bath. 2024. URL: https://online.bath.ac.uk/content/how-do-politics-shape-financial-landscapes

3.Frieden J. The political economy of economic policy. International Monetary Fund. 2020. URL: https://www.imf.org/en/Publications/fandd/issues/2020/06/political-economy-of-economic-policy-jeff-frieden

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TRANSNATIONAL CORPORATIONS AND THEIR DEVELOPMENT PROSPECTS FOR THE FUTURE

Today, people tend to consume a variety of products and goods manufactured by global business corporations. This does not mean that national businesses in the countries of residence cannot offer a better selection of necessary goods. In fact, local firms compete for the right to sell their products in mass

retail stores instead. But living in the era of globalization, it is necessary to understand that there are monopolistic corporations that seek to sell their goods in every country. Therefore, it is vital to understand the concept of TNC.

Transnational corporations - are joint-stock companies whose activities are not limited by the state borders of one country. For example, it is a firm, corporation, company that performs the bulk of its operations outside the country where it is registered, most often in several countries where there is a network of branches, subsidiaries, and enterprises. [1] These are large companies, whose activities are constantly being expanded and interpreted in response to changing market conditions, and whose production is integrated into the world goods and services market. The evolution of international companies occurred as a result of structural and dynamic changes in the world economy during the 19th century. However, some of the companies that characterized TNCs had appeared much earlier. In particular, the British East India Company traces back to as early as 1600, and several other large firms had been around for centuries, but the concentration of capital in production, commerce, banking and credit actions that stimulated the formation of TNCs became particularly intensive by the end of the 19th century.

In order to understand better what companies can be referred to as transnational corporations or 'TNC', it important to analyze what characteristics a business should have to be called 'transnational'. First of all, this business needs to be an economically unified system and operate in several countries. Next, TNC is a group of independent, legally separate enterprises, but this does not mean total autonomy. Some entities can be managed and controlled from a single center. Then, TNCs structural units operate in a diverse legal environment because they are subjects of national laws. And, eventually, transnational corporation is beyond the jurisdiction of a single state, an association of states or an international organization.

Nowadays, more and more transnational companies appear in the world economic rankings like Fortune Global 500. According to the list for 2023, Walmart company takes the first place. With $611.3 billion in revenue in its most recent fiscal year, Walmart tops the Fortune Global 500 for the 10th year in a row. The second place is by Saudi Aramco. The firm, like all large-scale fossil fuel producers, got its revenue rise as oil supply tightened in 2022, partly because of the war in Ukraine. In October 2022, the oil giant unveiled a $1.5 billion sustainability fund as well as plans to build a carbon-capture-and-storage facility. The third place is State Grid - the Chinese-government-owned power company, which meets about 80% of China's electricity needs, reported increases of about 15% in both in revenue and profit in 2022. Second-to-last place went to the Amazon - the e-commerce giant swung from a hefty profit in 2021 to a $2.7 billion loss in 2022. The last place is taken by China National Petroleum - the state-owned fossil fuel firm with the modest growth in 2022 compared to international oil juggernauts such as Saudi Aramco or Exxon Mobil. While revenue only grew about 17% from 2021, profits more than doubled, jumping to almost $22 billion amid a global tightening in oil supply, partly because of the Ukraine war. [3]

Thus, the overview presented above has shown the phenomenon of globalization with its consequences like the appearance of 'TNC' is global reality.

REFERENCES

1.Google (2006) Summary on the topic: Transnational corporations.
URL: https://ukrreferat.com/chapters/pravosnavstvo/transnatsionalni-korporatsii-referat-1.html (Accessed: 25 March 2024)

2.O. O. Ohrimenko, D. D. Silvestrova, (2013). Transnational corporations in the system of world economic relations.
URL: http://www.economy.nayka.com.ua/?op=1&z=2054 (Accessed: 25 March 2024

3.Google (2023) Fortune Global 500 URL: https://fortune.com/ranking/global500/(Accessed: 25 March 2024)

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THE IMPACT OF INFLATION ON THE WELFARE OF THE POPULATION

Inflation is one of the most important economic concepts that affects the life of each person and the economic processes as a whole. It is defined as the increase in the general level of prices for goods and services in a certain period of time. This phenomenon can have a significant impact on the purchasing power of money, incomes of citizens, investment decisions and macroeconomic stability of the country. Variations in inflation can have different causes and consequences, and understanding its mechanisms is key to shaping effective economic policy and financial planning. In turn, inflation is divided into groups: by causes of occurrence, by size, by area of distribution, by temporal nature. The main negative consequences of inflation are falling living standards. The groups with fixed income suffer the most - for example, persons receiving wages or social assistance from the state. There is also a deterioration of expectations regarding the macroeconomic situation in the future, which leads, in particular, to a decrease in business activity (due to the investment component). The most severe inflation in terms of its distribution is hyperinflation.

"Hyperinflation is a type of inflation that is characterized by consumer price growth rates exceeding 50% per month. G. Arises from: significant. overflow of money, signs of channels of money, circulation and leads to a general. unbalancing the economy. Money becomes unsuitable for performing the function of a measure of value, since this measure changes monthly by more than half. They also lose the function of a means of accumulation. Business entities try to get rid of money that depreciates as quickly as possible, as a result of which the speed of their circulation increases, which in turn causes an increase in prices'. [1]

The largest hyperinflation in the world was recorded in Hungary in 1945-1946. During this period, prices rose 41.9 quintillion times. This means that for 1 pengyo in 1944 at the end of 1946, only 1/41.9 quintillion of goods could be bought.

Hungary emerged from hyperinflation thanks to a series of economic reforms introduced in the country after the crisis. One of the most important was the currency reform of 1946, which led to the replacement of the Hungarian pence (an administrative currency that lost its value due to hyperinflation) with a new stable currency - the Hungarian forint. This reform helped restore confidence in the country's monetary system and stop the mess in the economy. In parallel with the currency reform, Hungary introduced large-scale economic measures aimed at stabilizing the financial situation and reducing inflation. These measures included fiscal discipline, fiscal reform, control of the money supply, and other monetary measures. This comprehensive approach allowed Hungary to emerge from hyperinflation and begin the process of economic recovery.

At the beginning of its existence, Ukraine also faced hyperinflation in 1993. The economy then fell by more than 14%, and prices rose by 10,155%. However, so far nothing indicates that the history of 30 years ago can be repeated. Despite the martial law, the NBU predicts that in 2023-2024, domestic GDP will grow within 5-6% per year. The World Bank is more restrained in its forecasts - we are convinced that Ukraine's GDP will grow by 3.3% next year, and by 4.1% in 2024. But at the beginning of a full-scale invasion, Ukraine did not have such positive indicators: "At the beginning of a full-scale war, the consumer price index increased monthly by 3−4%, but over the past 12 months it grew by an average of 1% monthly. This was due to the limited purchasing power of consumers and a stable hryvnia exchange rate, which restrained the growth of import prices and contributed to lowering inflation expectations'. [2] Ukraine managed to get out of inflation at the beginning of a full-scale stabilization process thanks to a set of economic measures aimed at controlling inflation and restoring stability in the economy. Currently, the National Bank has provided information on inflation forecasts: "The further reduction of inflation in 2025 will primarily contribute to the reduction of security risks allowed in the forecast, the National Bank notes. In his opinion, this will provide an overall improvement in expectations, as well as allow to

establish logistics and production processes. Significant factors in reducing price pressure will remain the NBU's interest rate and currency policy measures. At the same time, if the war continues in 2025, the National Bank admits the deterioration of the inflation forecast. The press release states that the forecast for core inflation for 2024 has been improved to 6.4% from 8.6% compared to 4.9% in 2023. Core inflation is projected to be 3.1% in 2025'. [3]

Inflation is a complex economic phenomenon that affects the lives of citizens, the activities of enterprises and the general state of the country's economy. There are several types of inflation, depending on the temporal nature, causes, size and area of distribution. Ukraine and other countries successfully got out of inflation thanks to a comprehensive approach to economic reforms, which included tight monetary policy, fiscal discipline, currency stabilization, structural reforms and international support. These measures helped to reduce inflation, restore confidence in the monetary system and ensure the stability of the economy. However, it is necessary to constantly improve economic policies and monitor inflation trends to ensure sustainable development of the country.

REFFERENCES

1.Encyclopedia Of Modern Ukraine URL: https://esu.com.ua/article-30190

2.New Voice URL: https://biz.nv.ua/ukr/economics/inflyaciya-v-ukrajini-spovilnilasya-do-naynizhchogo-pokaznika-z-pochatku-povnomasshtabnoji-viyni-50340765.html

3.INTERFAX [Electronic source] URL: https://interfax.com.ua/news/economic/962811.html

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INTERNATIONAL TRADE ROLE IN STIMULATING ECONOMIC DEVELOPMENT

International trade performs an important role in stimulating economic development. It helps to increase production, attract foreign investment, expand markets, and improve a country's competitiveness. Consider in more detail:

Increasing production volumes: International trade allows countries to focus on producing those goods and services in which they have a competitive advantage. This leads to increased output and higher productivity.

Expanding markets: International trade provides an opportunity for businesses to increase their markets outside their own country. This allows them to attract more customers and increase their profits.

Attracting foreign investment: International trade helps attract foreign investment into a country's economy. Foreign companies that trade with a given country often invest in production and infrastructure, which contributes to the development of the economy. [1]

Technology and knowledge transfer: International trade facilitates the transfer of technology and knowledge between countries. Companies that trade with other countries can gain access to new technologies and innovations, which can increase production efficiency. [2]

Increasing incomes and improving the lives of the population: International trade can lead to higher incomes and better living standards. Through access to a variety of goods and services, people can meet their needs and improve their living conditions.

International trade has a significant impact on the economic development of countries. It helps to increase production, expand sales markets, attract foreign investment, transfer technology and knowledge, and improve the lives of the population. [2]

In general, international trade is an important stimulus for the economic development of a country. It helps to increase production, attract foreign investment, expand sales markets, and improve competitiveness. It helps countries achieve sustainable economic growth and improve the living standards of their citizens.

REFERENCES

1.Fernández de Córdoba S. Trade and the MDGs: How Trade Can Help Developing Countries Eradicate Poverty // United Nations. 2015. URL: https://www.un.org/en/chronicle/article/trade-and-mdgs-how-trade-can-help-developing-countries-eradicate-poverty

2.IMF Staff. Global Trade Liberalization and the Developing Countries // International Monetary Fund. 2001. № 1. С.1-1 URL: https://www.imf.org/external/np/exr/ib/2001/110801.htm

ДЮДИНА ТА ДОВКІЛЛЯ
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INFLUENCE OF CIVIL SAFETY ON THE DESIGN OF CONSTRUCTION OF RESIDENTIAL COMPLEXES

Civil safety is one of the most important factorsin the design of construction of residential complexes. This is due to the fact that residential complexes are the place of residence of a large number of people, and their safety is important.

The influence of civil safety on the design of residential complex construction is developed in the following aspects.

Construction site selection. Selecting the location of the housing estate, is necessary to consider the risks of emergencies such as fires, floods, earthquakes, man-made disasters, etc. For example, building an LCD in areas with high seismic activitynear industrial enterprises or in places where flooding is possibleis not recommended.

Architectural and planning solutions. Developing the architectural and planning solutions of the housing estate, is necessary to provide the safety of residents in case of emergencies. Such measures include:

Creation of safety evacuation routes from the building in case of fire or other emergency.

Installation of fire alarm and fire extinguishing systems.

Ensuring of safe operation of utility systems such as electricity, water and sewage.

Availability of shelters in case of emergencies.

Life Support Systems. Designing the life support systems of the residential complex, is necessary to provide the possibility of their operation in an autonomous mode in case of disconnection of centralized networks.

Population training. The population should be trained according to the rules of behavior in emergency situations.

In Ukraine, the requirements for safety of residential complexes are regulated by the following normative documents: «Fire safety regulations in Ukraine» (Building code B.1.1.7-2016).

«Building regulations of Ukraine. Safety of people in emergency situations. General requirements" (Building code B.2.2-4-2009).

"The system of ensuring safety of construction projects. Loads and impacts. Regulations of design" (Building code B.1.2-2:2006) and "System of ensuring safety of construction objects. Deflections and displacements. Design requirements" (State standards B.1.2-3:2006). Compliance with the requirements of these regulatory documents will ensure the safety of residents of residential complexes in case of emergencies.

Here are some specific examples of civil safety issues, how they could be taken into account while designing the construction of residential complexes:

LCDs often have fire alarm and fire suppression systems installed to help to prevent the spread of fire in incidentswith fire.

Housing developments often have evacuation exits that allow residents to leave the building safely in incidents with fire or other emergency.

Housing developments often have underground or ground shelters that residents could use in case of emergencies.

Consideration of civil safety issues in the design of the housing development is an important factor that contributes to the safety of residents.

It is important to note that the issues of civil safety in the construction of residential buildings are relevant not only for Ukraine, but also for the whole world. Recently the world has seen increasing in the number of emergencies such as natural disasters, man-made disasters, accidents and terrorist attacks.

According to this, ensuring the safety of residents of residential complexes is becoming more and more relevant.

REFERENCES

1.Electronic database of building regulations of Ukraine, 2009
2. Electronic database of fire safety regulations in Ukraine, 2016.
3. Civil safety: a study guide / K.O. Levchuk, R.Ya. Romanyuk, A.O. Tolok. Dniprodzerzhynsk: DDTU, 2016 . 325 p.

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DEFINITIONS OF INTEGRATED SAFETY IN CONSTRUCTION

Currently, much attention is paid to solving problems of life safety, industrial safety, environmental safety, radiation safety, fire safety, and explosion safety.

In recent years, when considering safety issues, the term “comprehensive safety” has begun to be used, as the safety of various objects or types of production and economic activities in conditions of the combined action of various types of hazards.

The definition of this concept in different fields of activity varies greatly and this causes a certain confusion in terminology, in setting tasks and, ultimately, does not contribute to increasing the safety level of certain objects.

This is especially important when considering an object whose safety must be ensured. For example, it could be a source of danger or the object itself, which should be safe. The safety object can be an entire industry, for example, construction or nuclear energy; in other cases, the objects are a specific structure, for example, a residential building or a physical phenomenon, or an electromagnetic hazard.

There are several definitions of this concept:

“Comprehensive safety” is the safety in conditions of the combined action of various types of danger.

“Comprehensive safety system” is a system that simultaneously performs several safety functions, reducing the risks associated with various types of hazards.

“Comprehensive security assurance” is the coordinated interaction of engineering and technical systems, facilities and personnel involved in preventing unauthorized actions and ensuring the safety of people in emergency situations, implemented in design solutions.

From the above mentioned definitions it is clear that they formulate the concept of integrated security in the most general form, in relation to any object or type of activity.

Construction activities occupy a special place in solving the problem of integrated safety.

In relation to construction activities, it is proposed to consider the concept of comprehensive safety at three levels:

- comprehensive construction safety;
- comprehensive safety of the construction site;
- comprehensive security of a building or structure.

Based on this, the comprehensive construction safety means such organization of construction activities that ensures the formation of a safe and comfortable environment for human activity. At the same time, on the one hand, the created construction projects have such impacts on the environment that comply with certain established standards, for example, with the so-called “green standards”. In this case, we can talk about environmental protection, or, more precisely, about environmentally friendly construction, which ensures the safety of the external environment for the construction site.

With this interpretation, the concept of comprehensive construction safety will be fully complied with modern requirements for construction activities, namely:

- safety;
- consistency and flexibility;
- energy and resource saving;
- quality and efficiency.

Thus, the concept: of "integrated construction safety" can be formulated as a set of forms and methods of organizing construction activities, which ensure compliance with regulations and safety standards aimed at shaping the human living environment, minimizing environmental impacts, taking into account the risks associated with occurrence and elimination of consequences of emergency situations.

REFERENCES

1. DBN 3.2-2-2009 Labor protection and industrial safety in construction. 2012. Kyiv. 122 p.
2. ISO 45001 Occupational health and safety management systems Requirement with guidance for use. 2018. 62 p.

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DEVELOPMENT OF EFFECTIVE METHODS FOR MONITORING HYDROLOGICAL PARAMETERS OF RIVERS AND THE DESIGN OF DATA COLLECTION SYSTEMS TO IMPROVE FORECASTS AND RESOURCE MANAGEMENT

Hydrological parameters play a crucial role in understanding the water cycle and impact the safety and stability of water resources. To effectively manage these resources and ensure reliable forecasts related to them, it is necessary to develop efficient methods for monitoring hydrological parameters and design advanced data collection systems.

Hydrological parameters, such as water level, river discharge, and water temperature, are key to understanding water systems. They determine the water balance and influence ecosystems, the agricultural sector, and industry. Collecting and analyzing these parameters allow for informed decision-making in water management.

The water level in rivers, lakes, and other water bodies determines the water volume and can be an indicator of the water body condition. The quantity of water flowing through a specific river cross-section per unit of time, known as river discharge, is crucial for determining the water balance and predicting potential floods or droughts.

The thermal regime of water is important for determining ecological conditions and the viability of aquatic organisms. The amount of water used for drinking, agricultural needs, industry, and other sectors affects the water resource balance.

The degree of water turbidity, determined by the presence of particles and contaminants in the water, is also a significant parameter.

These hydrological parameters form the basis for studying water systems, their efficient use, and the management of water resources. Monitoring these parameters helps in forecasting and managing water resources, addressing ecological issues in water bodies, and ensuring the sustainable utilization of this vital resource.

New technologies such as satellite imaging, sensors, and IoT systems are revolutionizing the monitoring methods for hydrological parameters. They provide real-time data collection, enabling:

1.Satellite Imaging: Used to determine the area of water surfaces, track changes in water levels, and monitor the location of ice masses in water bodies.

2.Satellite Radiometry: Allows for measuring water temperature and determining water characteristics on the surface.

3.Hydrological Water Level Sensors: Installed in rivers and lakes for real-time water level measurements.

4.Water Temperature Sensors: Used to monitor the thermal regime of water at different depths and levels.

5.Data Collection Systems Using IoT: Combine automated sensors and data transmission systems for instant data collection and transmission to central computing systems.

6.Hydrological Models: Used for predicting river flows, the state of water reservoirs, and the impact of climate change on hydrological systems.

7.Geographic Information Systems (GIS): Assist in analyzing spatial data, including the location of water sources, landscape features, and other factors.

8.Laser or Radar Sensing: Used for measuring water height, river and lake bed topography, and detecting changes in water resources.

9. Monitoring Through Social Media: Used to gather information from users about the state of rivers, floods, or other events, enhancing measurement accuracy and frequency.

Creating effective data collection systems involves integrating various sources of information. Satellite data, automated river sensors, and data from meteorological stations are combined into a unified system that allows real-time monitoring and analysis of water resources.

10.Defining specific hydrological parameters to be measured. Establishing the frequency and accuracy of measurements. Identifying real-time or periodic measurement needs.

Conclusion. Thanks to accurate and up-to-date data, forecasting floods, droughts, and other hydrological events becomes more effective. Water resource management becomes more flexible and adaptive, contributing to the conservation of water ecosystems and ensuring sustainable use of water resources.

The development of methods for monitoring hydrological parameters and data collection systems plays a key role in ensuring the sustainability of water resources and improving the quality of forecasts. The integration of modern technologies allows for effectively addressing problems related to water systems and ensures the sustainable development of society [1,2,3].

REFERENCES

1.United States Geological Survey (USGS) (2006) Benefits of the USGS Stream Gauging Program – Users and uses of US streamflow data. http://water.usgs.gov/osw/pubs/nhwc_report.pdf

2.World Meteorological Organization (2009) Guide to Hydrological Practices Volume II, Management of Water Resources and Application of Hydrological Practices. WMO-No. 168, Sixth edition 2009.

3.World Meteorological Organization (2015) Hydrological information systems for integrated water resources management.

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RECYCLING OF USED OILS USING PHYSICAL METHODS

The problem of utilization of used industrial lubricants (oils) is one of the most pressing and important issues of our time.

According to the Resolution of the Cabinet of Ministers of Ukraine No. 1221 of December 17, 2012 "Some Issues of Collection, Removal, Decontamination and Utilization of Used Oils (Lubricants)", used oils are hydraulic, motor and other lubricants (oils), brake and other insulating and coolant fluids that are no longer suitable for their original purpose [3].

Waste lubricants pose a serious threat to the environment, are classified as hazardous waste, and their management requires a license for recycling or disposal. At the end of their service life, they must be replaced and disposed of. Used oils are water insoluble, chemically resistant, and contain toxic substances and heavy metals. The problem of their disposal is also an issue of environmental safety, as they take a long time to decompose in natural conditions.

However, many operating companies are severely limited in their ability to recover it. Meanwhile, the used oil is not disposed of or disappeared, but is mostly used in heating and cooling systems, posing a threat to humanity and the environment. It is known that one liter of such oil contaminates nearly 1,000 tons of groundwater, destroys soil fertility, and worsens the condition and quality of ecosystems, including heavy metal pollution [1].

Some companies utilize oil by burning it. The combustion of 1 ton of oil is known to produce about 7000 m3 of flue gases containing hydrogen chloride, polyaromatic hydrocarbons, zinc, aluminum, and heavy metals. Combustion products are extremely dangerous [5].

Oil refining is economically unprofitable, and out of 1.6 liters of used product, refining yields only 1 liter of new lubricant. According to statistics, in Ukraine, only 25% of the total consumption of lubricants is recovered, of which only 15%, or about 3% of the total consumption, is regenerated (recycled). For comparison, in developed countries such as the UK, Japan and the US, the share of recycled lubricants (as a percentage of total production) is about 30%.

Waste oil treatment methods include settling, centrifugal cleaning and filtration. Filtration is the process of passing oil through a mesh or porous filter baffle to remove particles of mechanical impurities and resinous compounds [4]. Centrifugal flushing is the most effective and high-performance method for removing mechanical impurities and water from used oil [4]; in [7], the authors propose using jet pumps for centrifugal flushing of oil. Settling is based on the separation of oil, water and mechanical impurities under the influence of gravity [4].

Consequently, the proposed method can be used to regenerate used oils, but more detailed research is needed. Finding methods for recycling or regenerating oil using environmentally friendly technologies will reduce the environmental impact and return it to the technological cycle.

REFERECES

1.Poliakov P.S., Kaleinikov H.E. Heating systems based on waste oils // Вісник НТУ «ХПІ». 2014. № 12. С.159-162.

2.Chernovol A.S., Martynenko A.P. Eliminating the negative impact of used oils on the environment // Наукові записки КНТУ. 2011. № 11. С.238-241.

3.Some issues related to the collection, removal, neutralization and disposal of used lubricants (oils). // Resolution of the Cabinet of Ministers of Ukraine No. 1221 // December 17, 2012

4.Tarabarova A.O. Technologies for utilization of used motor oils // 2020. С.56.

5.Ryzhak V.V., Syhil N.M. Ways to reuse used oils // IX International Scientific and Technical Conference of Young Scientists and Students "Actual Problems of Modern Technologies". Ternopil, 2020. C.180.

6.Bezovska M.S., Zelenko Y.V. Regeneration of used engine oils from railway transport enterprises // 2009. URL: http://ena.lp.edu.ua/bitstream/ntb/4893/1/4.pdf

7.Horovyi M.V., Zavialov A.O. Jet pumps as elements of increasing the efficiency of centrifugal oil purification // 2018. C.302-303.

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IMPACT OF CONSTRUCTION AND OPERATION OF HIGHWAYS ON THE ENVIRONMENT

The construction and operation of roads become one of the main sources ofpotential environmental risks that negatively affect the functioning of ecologicalsystems and, of course, humans [1,2].

As an engineering structure, a road changes natural landscapes, surface and groundwater flow regimes, habitats of flora and fauna and causes changes in the coastlines of water bodies, the microclimate of certain areas. In addition, the road is a source of vibration, noise, electromagnetic and ionizing effects on the environmental components, population and wildlife. The transport sector is the largest source of toxic water, soil and air pollution in many countries [1].

Artificial structures on highways are complex engineering structures.

The design, construction, and maintenance of such structures often raise such environmental issues that require timely and informed solutions. These environmental problems can be associated with the following main factors:

- animals road crossing;
- pollution of permanent and non-permanent watercourses, which negatively affects aquatic biological resources, during the construction and repair of artificialstructures;
- change in the hydrological regime of a watercourse caused by the construction of a bridge [3,4].

Construction and roads repair and artificial structures often leads to river pollution [1]. Sources of water pollution are facilities that discharge harmful substances into water bodies that degrade water quality, limit its use, and negatively affect the condition of the bottom and banks of the water objects.

Studies have shown that the main pollutants in the construction and repair of artificial structures are as follows:

- construction garbage;
- petroleum products in the form of leaks of fuels and lubricants from construction machinery, mechanisms and vehicles;
- paints and varnishes and other chemicals used in construction works;
- corrosion products and paint residues from sandblasting of rebar, steel bridge structures (spans, supporting parts, protecting bridge deck structures, etc);
- wash water from tanks of concrete mixers and dump trucks;
- household wastewater from functioning construction camps, household waste [1,2].

Besides this, stormwater is runoff from the roadway appeared during the operation of artificial structures, especially bridges, has a negative impact on the aquatic biological resources. The most harmful chemical pollutants are oil products. The oil film that is formed on the water surface disrupts all physical and chemical processes in the reservoir: the temperature of the surface water layer rises, gas

exchange deteriorates, the food supply and fish die, and the oil that is settled at the bottom harms all living things in the reservoir for a long time.

Special attention should be paid to bulky waste. This is primarily construction debris from bridge construction and repair: leftovers of building materials and building structures. In addition, in the beds of rivers and canals, you can often see flooded building structures left over from the construction or overhaul of bridges. There are also large-diameter reinforced concrete and steel pipes left over from dismantled bypasses or technological sites when construction work is completed. You can even find flooded boats in riverbeds [2].

It is well-known fact that ecological safety of a motorway includes protection of nature from the impact of the motorway at all stages: construction, reconstruction, operation, maintenance and repair. The main task of modern builders and engineers is to create laws and rules of interaction between nature and man, and, as a result, to prevent environmental disasters in the world.

REFERENCES

1. Енергоефективність та відновлювані джерела енергії. Під заг. ред.А.К. Шидловського. К., Українські енциклопедичні знання, 2007. 560 с.
2. Проектування автомобільних доріг. Ю. Собко, Ю. Сідун, Л. Карасева. Л., Видавництво Львівської політехніки. 2019. 228 с.
3. Навчальний посібник В.І. Братчун, Д.О. Павлюк. Г., ДонНТУ, 2013. 244 с.
4. Основи експлуатації автомобільних доріг та аеродромів. Степура В.С., Белятинський О.А., Кужель Н.В. К., НАУ, 2014. 201 с.

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SAFETY AND POTENTIAL HAZARDS IN HYDROTECHNICAL STRUCTURES

Hydrotechnical structures play a crucial role in managing water resources, providing flood protection, and supporting various industrial and agricultural activities. However, ensuring the safety of these structures is paramount to prevent potential hazards and safeguard both human lives and the environment.

Safety in hydrotechnical structures is a multifaceted concern that involves the careful consideration of design, construction, maintenance, and emergency response. The consequences of failure in these structures can be catastrophic, leading to loss of life, property damage, and environmental degradation.

Understanding and recognizing potential risks associated with hydrotechnical facilities is a critical step in ensuring their safety. These risks may include structural failures, overtopping, erosion, seismic events, and environmental impacts. Thorough risk assessments are essential to identify vulnerabilities and implement effective mitigation measures.

Adherence to international safety standards and regulations is a cornerstone of ensuring the safety of hydrotechnical structures. Compliance with established guidelines helps engineers and stakeholders navigate the complexities of designing and managing these facilities while minimizing risks [1].

Regular inspection and maintenance are vital for ensuring the structural integrity of hydrotechnical structures. Neglecting routine checks and necessary repairs can lead to gradual deterioration, compromising the overall safety of the facility. Case studies illustrating the consequences of inadequate maintenance underscore the importance of proactive care.

Developing comprehensive emergency preparedness plans is essential to respond effectively to unforeseen events. Training programs for personnel, simulation exercises, and the establishment of communication protocols contribute to a swift and coordinated response in times of crisis.

Hydrotechnical projects often have environmental implications. It is crucial to mitigate negative impacts on ecosystems and biodiversity. Incorporating eco-friendly practices, such as habitat restoration and sustainable water management, ensures a harmonious coexistence between hydrotechnical structures and the environment [2].

The integration of emerging technologies can significantly enhance safety in hydrotechnical structures. Monitoring systems, advanced materials, and data analytics contribute to real-time risk assessment and early detection of potential issues, allowing for timely intervention.

Safety in hydrotechnical structures requires collaboration among various stakeholders, including government agencies, engineers, and local communities. Public engagement initiatives foster a culture of safety awareness and enable collective efforts to address potential risks.

Analyzing historical incidents related to hydrotechnical structures provides valuable insights into improving safety practices. By learning from past failures, the industry can implement measures to prevent similar incidents and continuously enhance safety protocols.

Conclusion. Ensuring the safety of hydrotechnical structures is a shared responsibility that requires a holistic approach. By prioritizing compliance with regulations, embracing technological innovations, and learning from past incidents, the industry can create a safer environment for both the infrastructure and the communities it serves. Continuous vigilance, collaboration, and innovation are key to mitigating potential hazards and ensuring the long-term sustainability of hydrotechnical projects [1,2,3].

REFERENCES

1. Sargand SM, Masada T, White K, Altarawneh B. Profile-wall high-density polyethylene pipes 1050 mm in diameter under deep soil cover: comparisons of field performance data and analytical predictions. In: Transportation Research Record: Journal of the Transportation Research Board No. 1814. TRB. National Research Council; 2002. p. 186- 196.

2. Navid H. Jafari, H. Omar Ulloa. Literature Search on Use of Flexible Pipes in Highway Engineering for DOTD's Needs. FHWA/LA.17/638. Dept. of Civil and Environmental Engineering Louisiana State University. 2020 p. 63.

3. Suleiman, Muhannad Taher, The structural performance of flexible pipes (2002). Retrospective Theses and Dissertations. 1033. P.143. URL: https://lib.dr.iastate.edu/rtd/1033.

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STRETCHING AS A MEANS OF FLEXIBILITY DEVELOPMENT

Introduction. Recently, the state of health of students is increasingly deteriorating. According to the researches of N. V. Bohdanovskoi, H. L. Apanasenko, M. V. Dutchak, "the general regularity of the increase in cardiovascular diseases and the deterioration of the body's functional reserves is revealed. In the Decree of the President of Ukraine on the approval of the State-wide program "Health-2020: Ukrainian dimension" it is stated that 61% of the population of Ukraine aged 16-19 years has a low level of physical fitness'. [3] To improve physical fitness, namely the development of flexibility, you can use stretching (the direction of fitness aimed at stretching all muscle groups, increasing flexibility and mobility). That is why the research of stretching as a means of developing flexibility is an urgent problem.

Purpose: to investigate stretching as a means of developing flexibility and to determine its impact on human health under the condition of constant training.

Analysis of literary sources. D. Iu. Andriievska (2022) talks about the importance of stretching as a form of fitness in her article "The role of stretching in the development of a person's physical and psychological state." She cites many arguments regarding the benefits of stretching, the most important of which are: improvement of muscle blood flow, strengthening of strength endurance, and suspension of muscle atrophy processes. [1]

A. M. Harlinska, N. M. Korniichuk, O. V. Solodovnyk (2022) in their study "Modern physical culture and health technologies in physical education" consider variations of stretching exercises, namely: static, dynamic and ballistic stretching. They explore combinations of these exercises when performed, their benefits and advantages over other exercises. The article also provides recommendations and rules that should be followed to achieve the best results. [2]

During the analysis of literary sources, the benefits of stretching and its varieties were clarified, variations of exercises, as well as recommendations for their implementation, were studied.

Research results. According to the results of the study, it was established that stretching, as one of the types of fitness programs, has a positive effect on the human body with regular practice. Stretching exercises are aimed at training muscles and increasing their elasticity, as well as joint mobility and increasing endurance. Regular classes improve blood circulation and reduce heart load. That is why people who have cardiovascular diseases are recommended to perform various stretching exercises. In addition, the improvement of blood flow improves the condition of the skin and muscles, because in this way their metabolism improves and toxins are removed. Researchers have also found that stretching exercises have a positive effect on the psycho-emotional state, the main thing is to enjoy the process and not overload the body, since incorrect execution of exercises, on the contrary, can lead to a deterioration in well-being.

Stretching is recommended as a separate type of physical activity, and as an additional method of helping the body during other types of sports activities. Stretching itself is divided into several types, which differ in load and sets of exercises. Looking at this, everyone can choose an appropriate set of exercises, taking into account their physical capabilities, as well as personal needs and preferences.

Conclusions: During the research of stretching as a means of developing flexibility, it was established that, under the condition of constant training, it has a comprehensive positive effect on the physical and psycho-emotional state of a person. Stretching helps develop flexibility by increasing muscle elasticity and improving joint mobility.

REFERENCES

1.Андрієвська Д. О. Роль стретчингу у розвитку фізичного та психологічного стану людини [Електронний ресурс] / Д. О. Андрієвська. 2022. Режим доступу до ресурсу: URL: https://is.gd/sebmtH

2.Гарлінська А. М., Корнійчук, Н. М., Солодовник, О. В Сучасні фізкультурно-оздоровчі технології у фізичному вихованні: курс лекцій. Житомир: ЖДУ ім. І. Франка. 2022. 68 с

3.Тітова А. С. Фізичний стан, його чинники та залежність від рівня рухової // Редакційна колегія 225. 2021. С. 225-229.

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AN EXPLORATORY ANALYSIS OF RISK, RESILIENCE, AND SUSTAINABILITY MANAGEMENT OF TRANSPORT INFRASTRUCTURE SYSTEMS

Transport infrastructures have a wide range of beneficial impacts on economic welfare and equity, as well as on reducing prices and boosting levels of investment, trade, and productivity. It is estimated that low and middle-income countries will need to invest in new transport infrastructure between 0.5% and 3.3% of their gross domestic product (GDP) annually (US$157 billion to US$1 trillion) by 2030, plus an additional 1.1% to 2.1% of GDP annually for maintenance of existing and new transport infrastructure. Maintenance costs are even more relevant than new investment costs for countries with large transportation networks, such as European countries, with the aggravating fact that failing to perform routine maintenance will result in poor service and will cost 50% more overall because of additional rehabilitation needs.

Transportation networks have a wide geographical extension, exposing each infrastructure asset to stressors such as floods, earthquakes, tsunamis, landslides, hurricanes, wildfires, or extreme temperatures. This exposure, in combination with the inherent vulnerability of transportation assets, have led to huge economic losses in past. Global Expected Annual Damages (EAD) due to direct damage from natural hazards to road and railway assets range from US$3.1 to US$22 billion, and approximately 73% is caused by surface and river flooding. Fig. 1 illustrates these interrelations between risk, resilience, and sustainability in the context of decision support for resilient and sustainable societal developments. It can be observed that a resilient infrastructure system provides benefits to society in terms of economy, livelihoods, safety, and health, but, at the same time, imposes resource consumption and emissions to the environment. Thus, these trade-offs must be well understood when deciding how to optimize the resilience of infrastructure systems while guaranteeing long-term sustainability. These interrelations and conflicts between resilient and sustainable infrastructure systems have been recognized over the past years and have received increased attention. Based on the foregoing outlined challenges, the present study aims to establish a better understanding of the current state of the art in the domain of risk, resilience, and sustainability management, with a focus on flood hazards. This focus is given the challenges posed by climate change effects and the fact that floods generate the largest amount of economic damage for the transport sector among weather-related disasters.

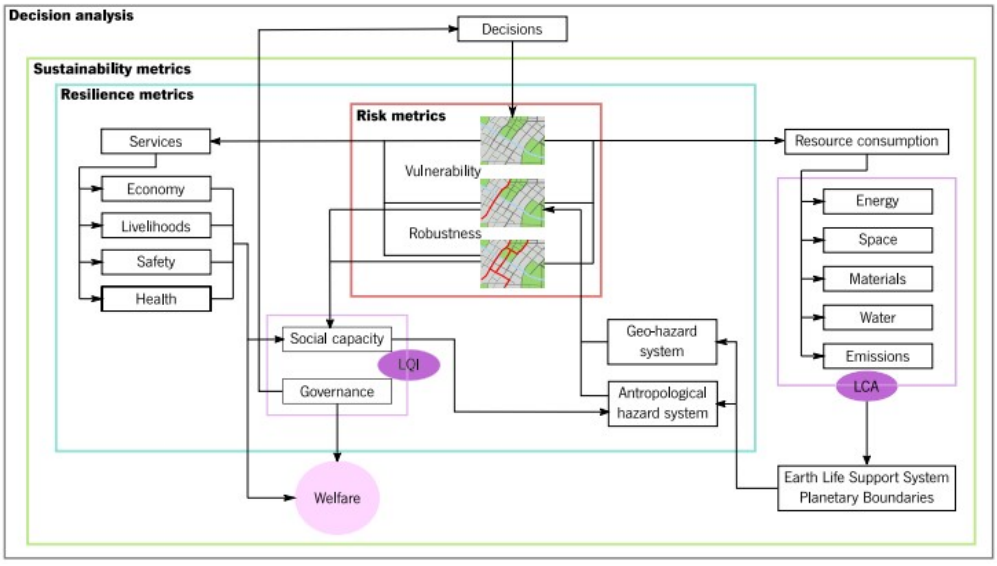

Fig. 1. Connections between risk, resilience, and sustainability with assessment metrics and techniques

This step sets the baseline for conducting analysis, which is a quantitative method for exploring and analyzing large volumes of scientific data, along with science mapping, that can facilitate deciphering and mapping a particular knowledge domain. Two quantitative techniques, namely by terms co-occurrence and coupling networks, were employed to analyze the scientific literature from the emergence of the field in 1990 until 2022. The Scopus database was selected due to its extensive publication coverage within the research domain under study. The term co-occurrence technique is useful for identifying patterns and trends in the research field, studying how different sub-fields are interconnected, finding potential opportunities for bridging the gaps between sub-fields, and searching for approaches in other research domains which can be imported. As depicted in Fig. 2, the relation between exposure or hazard events and the direct consequences is termed vulnerability, and the link between the direct consequences and the indirect consequences is related to the concept of robustness. Essentially, the vulnerability of a system indicates the degree to which exposures generate direct consequences, while robustness characterizes the degree to which a system is able to contain or limit indirect consequences associated with a hazard event. If the indirect consequences of a scenario outweigh the direct consequences, then the system lacks robustness with respect to this scenario. The other two system characteristics which are crucial for the management are resilience and sustainability. When modeling these system characteristics, not only the losses but the capacity of the system (economic, social, and/or environmental) to sustain, adapt, and recover from adverse effects should be considered.

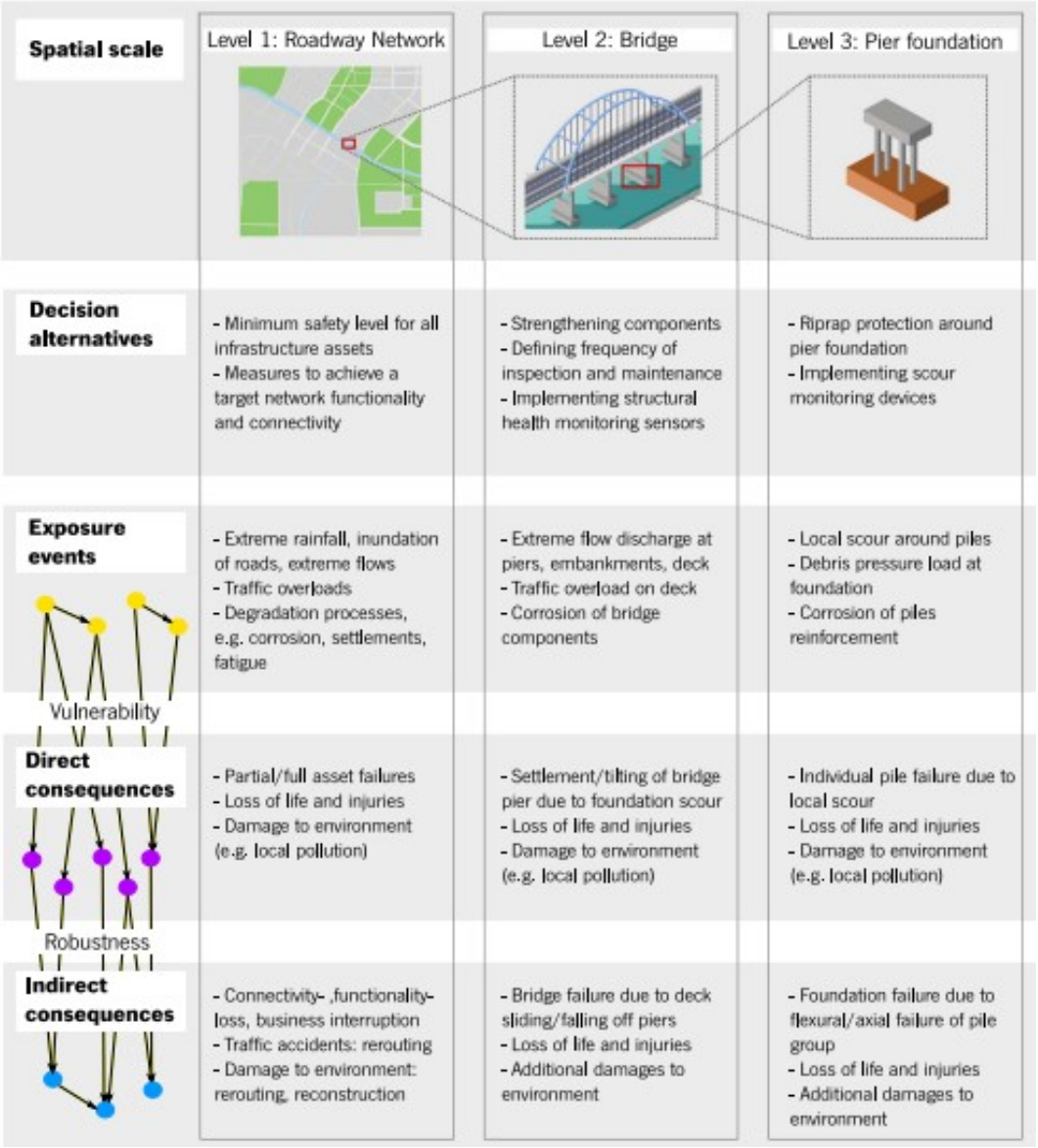

Fig. 2. System representation at different spatial scales

The economic capacity is based on the benefits generates through the provision of services, i.e., mobility for people and goods through taxes or toll roads. In some cases, infrastructure assets such as bridges or viaducts may also provide a cultural and historical value that is transformed into economical service related to tourism.

REFERENCES

1.P. Gardoni, C. Murphy, Society-based design: promoting societal well-being by designing sustainable and resilient infrastructure, Sustain. Resil. Infrastruct. 5 (1–2) (2020) 4–19.

2.W. Sun, P. Bocchini, B.D. Davison, Resilience metrics and measurement methods for transportation infrastructure: The state of the art, Sustain. Resil. Infrastruct. 5 (3) (2020) 168–199.

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ANALYSIS OF THE IMPACT OF INDUSTRIAL GLOVES ON THE PERCEPTION OF HAND DEXTERITY, FUNCTION AND STRENGTH OF HANDS BY THE EXAMPLE OF THE US CONSTRUCTION INDUSTRY

Work-related hand injuries can have significant functional implications. If a worker sustains amputations to all five digits of one hand, this injury represents an overall impairment of 90% of the upper extremity and, thus, 54% of the whole person. In 2020, over 102,000 workers sustained hand injuries resulting in days away from work, according to the U.S. Bureau of Labor Statistics (U.S. Bureau of Labor Statistics, 2021). A systematic review calculated the total costs of acute hand and wrist injuries consisting of direct costs (healthcare costs, worker's compensation payments) and indirect expenses (lost productivity, accident investigation) could range from $3257 to $169,408. As such, glove wear is a critical component of personal protective equipment (PPE), and the type of glove utilized must be based on the nature of the exposure.

Among those in the building industries, exposure to awkward postures and confined spaces lead to musculoskeletal disorders, which decrease efficiency and increase the risk of injury. The most severe hand injuries in the building industry have been associated with maintenance tasks, roof bolters, and equipment operations. These hand injuries are attributed to exposure to metal parts (e.g., pipe, wire, and nails), metal covers and guards, inserting roof bolts, drilling steel, and maintaining belt conveyors. Injuries to the hands occur almost evenly to both the right hand (48%) and left hand (52%).

To mitigate the direct and indirect injury costs, workers in industrial settings such building and extraction are often required to wear industrial metacarpal gloves as PPE. In some situations, employers provide or mandate PPE gloves to be worn without assessing the glove's impact on the worker's effectiveness in completing various tasks required for the job. Workers wear those gloves to complete various occupation specific tasks, including manipulating tools and equipment. However, if the gloves do not fit well or limit their dexterity, workers may be non-compliant with glove-wearing requirements, thus increasing the risk of severe injuries. Researchers recently identified 16 factors that contribute to PPE non-compliance in the construction industry, including poor risk perception and safety supervision.

Previous studies focused on evaluating the level of mechanical protection offered by metacarpal gloves , but there is limited research examining the impact of metacarpal gloves on manual hand dexterity, strength, and perception of exertion, within heavy-duty industries. Prior pilot research on metacarpal gloves was conducted with a small-sized subject pool (Fig. 1). In this previous pilot study, the participants were predominately student younger females who were asked to complete dexterity tests

(placing and turning tests) and hand strength tests (grip, pinch, and pronation) with bare hands and wearing a selection of metacarpal gloves. While females represent 5–10% of the global building and extraction industry workforce and are known to have differences in hand strength compared to males of the same age, the sample size and age selected for the pilot was not representative of the predominantly male population who typically would wear metacarpal gloves in building industries. The pilot study indicated that a bigger and more diverse set of participants, including males of working age (~23–65 years old), would be needed to generalize the results.

Based on the previous pilot study and shortcomings seen in the literature, this study aims to determine the effect of metacarpal gloves on hand dexterity, hand strength, and perceived exertion by conducting a series of standardized tests and involving a more robust representative sample. The specific objectives of this study are:

1) Quantify hand dexterity achieved while wearing metacarpal gloves, as compared to bare hands, with respect to gender;

2) Quantify gender-specific hand grip strength while wearing a metacarpal glove, as compared to bare hands;

3) Quantify the perceived exertion completing simulated work tasks while wearing gloves, as compared to bare hands, with respect to gender.

We hypothesize an inverse relationship with metacarpal gloves that offer higher levels of mechanical protection (i.e., impacts, punctures, abrasions) will negatively influence hand dexterity and exertion.

Therefore, the safety professional must view glove selection with a holistic consideration of fit, protection, dexterity, type of exposure, cost, and quality.

Fig. 1. Industrial metacarpal gloves selected for testing. All branded labels have been intentionally removed from the figure to prevent bias. The gloves are presented from thinnest (Glove 1) to thickest (Glove 3).

The more protective features the glove has, the less flexible it becomes and the higher its impact on dexterity. Sturdier gloves offer the most mechanical protection but at the expense of reduced flexibility and, thus, decreased dexterity. Conversely, relatively thinner and more flexible metacarpal gloves offer lower mechanical protection but allow much more dexterous function.

Protection against injury is an important mitigation strategy against lost productivity, healthcare spending, and worker's compensation payments. However, these results suggest that employers and safety professionals should consider all aspects of a glove, its potential impact on hand function, and the task requirements when selecting gloves for worker utilization.

REFERENCES

1. Baltimore Therapeutic Equipment (BTE) Technologies, 2023. Rehabilitation equipment. Primus RS. Retrieved February 10, 2023, from: https://www.btetechnologies.co m/rehabilitation/primus/.

2. U.S. Bureau of Labor Statistics, 2021. Number of nonfatal occupational injuries and illnesses involving days away from work by nature of injury or illness and selected parts of body affected by injury or illness private industry, 2020. Retrieved February 10, 2023. https://www.bls.gov/iif/nonfatal-injuries-and-illnesses-tables/case-and-demographic-characteristics-table-r13-2020.htm.

3.Viradia, R., Annie, F., Kali, M., Pollock, F., Hayes, J., 2021. Hand injuries of coal miners in Southern West Virginia: a pilot study on health-care resources in Southern West Virginia. J. Emergencies, Trauma, Shock 14 (1), 18. https://doi.org/10.4103/JETS. JETS_39_19.

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EVACUATION ROUTE DESIGN BASED ON VISIBILITY FOR REDUCING EVACUATION DELAYS

Fire-related incidents continue to pose a significant threat to human life in spite of advancements in fire prevention technology and legislation. It is reported that almost half of the fatalities resulting from fires are caused by delayed evacuation in Ukraine. Recent incidents in which victims were unable to evacuate, in which people lost their lives. When the electrical system stopped, the doors of the train cars closed. Many victims did not know how to open the doors manually, which led to the inability to evacuate. Opening doors and locating evacuation exits is a challenge in many emergency situations. Unfortunately, this has led to tragic outcomes in some cases. [1-3]

Fig. 1 shows the evaluation structure of visual environment, which is closely connected with three factors: environmental conditions, object conditions, and human visual ability. Visual stimulus is defined by the former two factors, while visual sensitivity is defined by the latter. The evaluation of visual response, or visibility, depends on both visual stimulus and visual sensitivity. Visual stimulus is represented by four elements: size (m) or visual angle (arc minutes) of the visual target, adaptation (background) luminance (cd/m2), luminance contrast between the visual target luminance and background luminance (no units), and observation time (milliseconds).

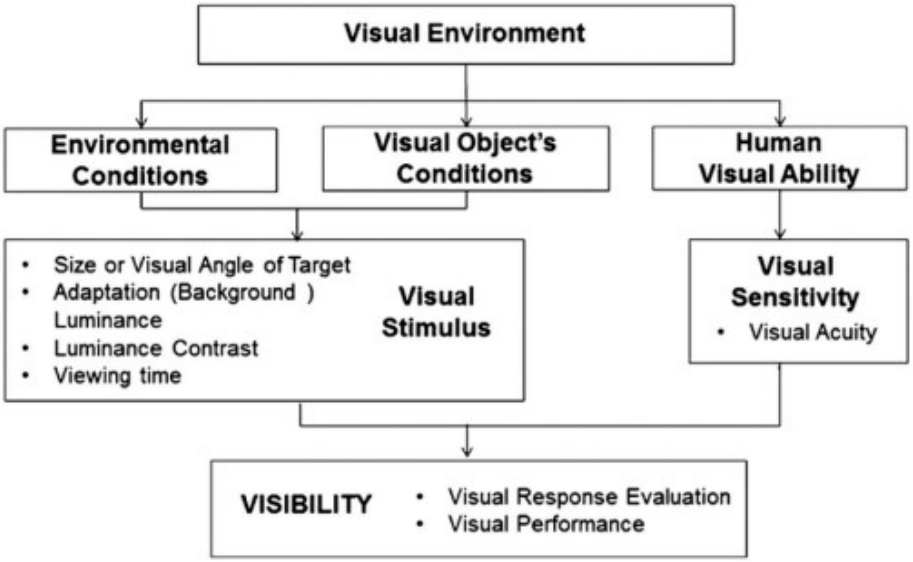

Fig. 1. Evaluation structure of visual environment

If the observation time exceeds 100 ms, the visibility stabilizes no matter of time. By analyzing the relationship between the visual stimulus and visual sensitivity, we can predict the evaluation of visual response, for instance, the visible distance of an emergency light from the evacuee's position or identification of obstacles on the escape road surface and visual performance, such as the walking speed of evacuees in an escape route, in a visual environment. Visual acuity (VA) is a common form of low vision and is commonly used as a measure of visual ability in medical examinations.

The distance between signs and an observer D (m) was calculated using the visible distance V (m) between target, i.e. characters of text information in the sign and the observer's eye, the height H (m) of the character from the floor, the eye height h (m) of the observer, the angle δ (arc degrees) of the center of the character and vertical direction of the observer's eye, and the actual size S' (m) of the character. Fig. 2 depicts the external view. To ensure that the sign's characters would be legible for many people during a disaster situation, the visibility level α′ was set at 0.8.

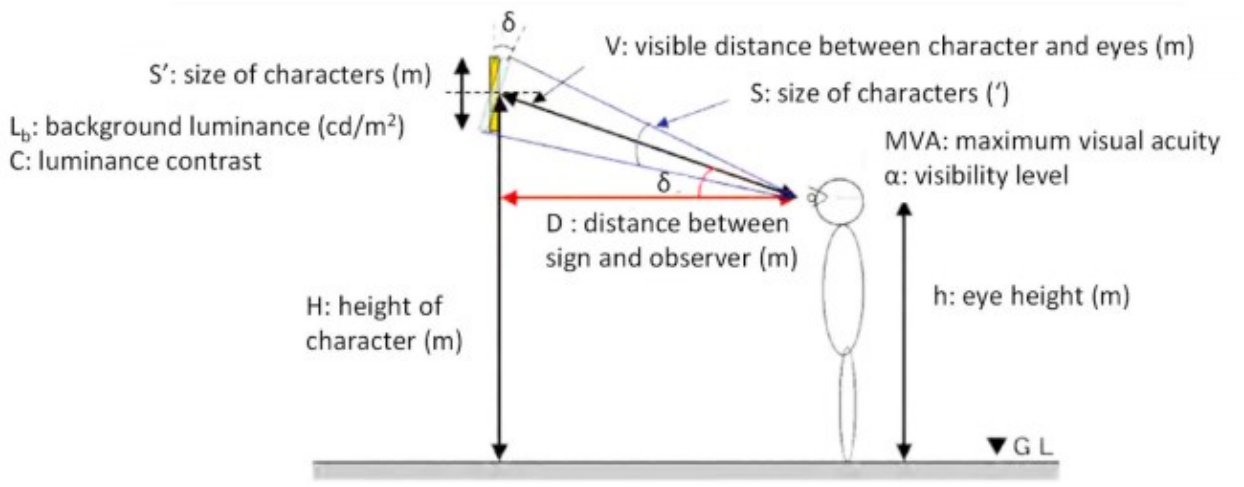

Fig. 2. Physical characteristics required for calculation of visible distance

Visibility is crucial for human behavior during a fire. Large amounts of smoke can severely limit visibility, making it difficult for evacuees to locate escape routes. This can result in unsuccessful

evacuations and increase the risk of casualties. In such situations, the walking speed of evacuees decreases significantly, and it is a crucial visual performance factor. Therefore, it is essential to understand how people behave during fires with smoke and to minimize fire-related casualties. Numerous studies have been conducted on evacuation behavior during fires in large spaces like tunnels. However, most of these studies fail to describe the lighting conditions of the experimental environment.

According to ISO/CIE emergency lighting guidelines, building emergency lighting should provide more than 1.0 lx on the centerline of the evacuation route, have a uniformity ratio greater than 1/40 between the minimum and maximum illuminance, and have an average color rendering index (Ra). This value should be considered the lower limit of the standard, and the sufficient light should be provided in evacuation routes to eliminate any sense of insecurity.

REFERENCES

1. T. Yamada, Y. Akizuki, Chapter 61 Visibility and Human Behavior in Fire Smoke, SFPE Handbook of Fire Protection Engineering, 2016, pp. 2181–2206.

2. Enrico Ronchi, Daniel Nilsson, et al., A virtual reality experiment on flashing lights at emergency exit portals for road tunnel evacuation, Fire Technol. 52 (2016) 623–647.

3. Silvia Arias, Axel Mossberg, Daniel Nilsson, Jonathan Wahlaqvist, A study on evacuation behavior in physical and virtual reality experiments, Fire Technol. 58 (2022) 817–849.

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COMFORT AND SLEEP QUALITY IN FULLY AUTOMATED VEHICLES

Increasingly higher levels of vehicle automation are currently being developed. With the upcoming release of fully automated vehicles, there will be plenty of new opportunities for occupants. In this context, several studies have explored alternative use cases that people wish to engage in while travelling in these vehicles, with sleeping being identified as one of the most popular priorities. Sleep is one of our fundamental daily activities. It takes up a third of our daily time; and good sleep is essential for health, well-being and quality of life. Moreover, daily performance depends highly on sleep quality. Adults are recommended to sleep seven to 9 h daily, although adults often sleep less than recommended. Short sleep durations have been often associated with poorer health. In particular, during the day after a night of poor or abnormal sleep, there are immediate negative physical and cognitive effects, such as concentration and vigilance detriments, memory blanks and irritability.

An optimal sleep environment is key to achieving good sleep quality. In a car interior, accomplishing this ideal sleeping environment is troublesome due to limited space and car movement. However, one of the opportunities in this scenario is the high level of control over the sleep environment. This includes lighting, temperature and air quality, as well as the creation of a specific car seat for the purpose of sleeping, addressing the seat angles, as it is one of the main differences between today's car seat and a bed.

The seat prototype used in the study was positioned inside of a Volkswagen T6.1 Multivan. The interior surrounding of the seat prototype was built to be a comfortable, private space, resembling that of a first-class long-distance airplane cabin. The purpose of the study was to compare the sleep achieved in two different seat positions, a reclined and a flat seat position. The reclined position at 60^0 from the vertical, close to position prior described and a lying position at 87^0, resembling a flat bed angle (Fig. 2). The researchers conducted pilot tests to determine the most comfortable angles for the seat pan and leg support for each backrest position. The seat pan angles were set at 20^0 and 0^0 relative to the horizontal,

while the leg support angles were adjusted to 65 ^{0} and 90 ^{0} from the vertical, for the reclined and the flat position, respectively. Therefore, the seat could be set up in those two positions as illustrated in Fig. 1.

Previous studies suggest that foam stiffness might be one of the critical aspects when it comes to improving sleep quality. Therefore, a foam optimization process was executed by experts, considering previous studies comfort evaluation and participants' feedback comments. The result of this process was a two layered surface with different foam characteristics (Fig. 2). The under layer is made from a traditional foam of 3.9 kPa and 20 mm thickness and the over layer is made from viscoelastic foam of 1.6 kPa of 30 mm thickness.

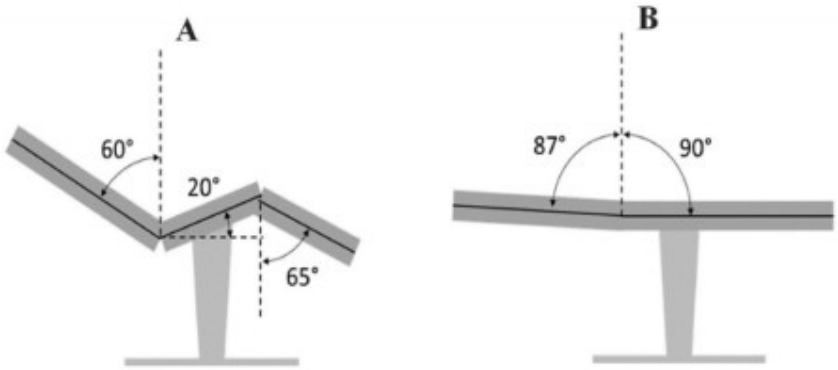

Fig. 1. Configurations for reclined and flat seat conditions. (A) Reclined (B) Flat.

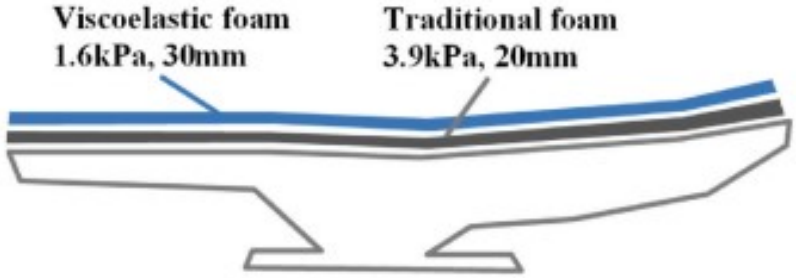

Fig. 2. Side view diagram of seat prototype in flat condition.

Blue area represents the 1.6 kPa layer of foam and grey area represents the 3.9 kPa layer of foam.

In summary, this study provides a comprehensive understanding of sleep quality and quantity in the context of travelling in a fully automated car. By using a real environment instead of a typical lab, the study provided a more realistic view of sleep in this new context. The study's multi-method approach combining subjective evaluations based on questionnaires and multimodal neurophysiological recordings evaluated with machine learning provided a holistic picture of individual comfort and sleep quality. The findings of this study fill some current knowledge gaps in the field of sleeping while travelling by car and have important implications for the development of new technologies and design of car seats. While this study represents a first step towards a better understanding of sleeping while travelling by car, future research is needed to explore the factors that influence sleep quality in vehicles and develop interventions to improve it.

In conclusion, this study has contributed to the understanding of sleep quality in vehicles and its evaluation. Sleep quality was generally within optimal sleep ranges in both seat positions, with the flat position resulting in deeper sleep and quicker sleep onset for participants. The findings suggest that the flat position may be more conducive to achieving deeper and more restful sleep. Moreover, each participant had the opportunity to sleep in both tested seat positions. The majority of participants preferred the flat position for sleeping in the travelling context. These findings may have implications for future car seat designs, suggesting that a flat position may be more conducive to sleep quality while

travelling. A future where people can comfortably sleep inside a car while commuting or going on holidays might be possible with further developments in car seat designs and technology.

REFERENCES

1. Becker, T., Herrmann, F., Duwe, D., Stegmüller, S., Rockle, ¨ F., Unger, N., 2018. Enabling the value of time. Implications for the interior design of autonomous vehicles. Fraunhofer IAO, Cordence Worldwide, Horvath ´ & Partner GmbH.

2. Ib´anez, V., Silva, J., Cauli, O., 2018. A survey on sleep assessment methods. PeerJ 6, e4849.

3. Lantoine, P., Lecocq, M., Bougard, C., Dousset, E., Marqueste, T., Bourdin, C., All`egre, J.- M., Bauvineau, L., Mesure, S., 2022. Influence of car seat firmness on seat pressure profiles and perceived discomfort during prolonged simulated driving. Appl. Ergon. 100, 103666.

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A STUDY OF SMARTPHONE USE EFFECT ON GAIT PERFORMANCE WHILE WALKING UP AND DOWN STAIRS AND ESCALATORS

The increasing use of smartphones has affected the way people walk, with more people talking on their phones or looking down at them while walking. Smartphone use during walking has been reported to distract pedestrians, resulting in safety concerns. We analyzed data from the National Electronic Injury Surveillance System (NEISS) database on injuries in hospital emergency rooms from 2004 to 2010 and found an increase in the percentage of total phone-related pedestrian injuries in public places, with a higher rate of injuries among young adults. Previous studies have found that smartphone use during walking increases the reaction time to visual and auditory targets and reduces efficiency in perceiving and processing environmental stimuli. In addition, numerous studies have shown that the demand for this dual-task influences pedestrians' gait performance; for example, they might have a slower walking speed, shorter step length, increased step width and larger head flexion.

In addition to walking on flat ground, stairs are becoming potentially hazardous areas for distracted walking associated with smartphones, with a higher fall risk and slower walking speed. Compared to walking on a horizontal surface, the workload taken over by the muscles of a single leg is greater when walking on stairs, which results in different locomotion requirements and increases the risk of falls and injuries. Extracted phone-related injury cases from the NEISS database from 2011 to 2019 and found that most injuries occurred at home (21.8%), on stairs (20.6%), or in public places (14.7%). Additionally, questionnaires conducted by the researchers revealed that stairs were perceived as a minor-to-moderate risk distraction environment with high rates of smartphone engagement.

However, most prior studies of distracted walking with smartphone use focused on walking performance on flat ground, where participants were asked to walk on horizontal surfaces such as floors and treadmills, encountering various road events or obstacles. Only a handful of studies have investigated walking performance on stairs with smartphones through a step-deck obstacle in controlled laboratories or through real stair scenarios on a campus.

The participants were asked to wear sports shoes to participate in the experiment. During preparation, the participants wore a pocket near the lower back to place a smartphone for gait assessment. They then practiced normal walking on stairs and escalators and used a smartphone (Galaxy S8+, Samsung, South Korea) during walking for 1–2 trials until they were comfortable with the testing environment. Participants received the auditory information via the built-in speakers, including the voice prompts of the start and end of gait data collection, and the sound of videos and games in walk-video and

walk-game tasks. The smartphones used in the study were prepared by the experimenter, and each participant was asked to manipulate the Galaxy S8+ for approximately 5 min before the experiment.

Participants randomly performed the walk-base task without smartphone use and the three dual-walk tasks using a smartphone to eliminate the effect of experimental order. The experiment balanced the order of the walking tasks, walking environments and walking directions. All conditions were repeated twice. Thus, each participant randomly completed 32 walking trials (4 × 2 × 2 × 2). Subjective walking confidence was measured after each trial. Participants were asked to hold the Galaxy S8+ in portrait orientation with one hand (preferred hand) while walking naturally. The experimenter followed the participants in the nearby zones to ensure the safety of the experimental process. On average, the experiment lasted for approximately 60 min. Fig. 1 shows examples of the experimental scenario.

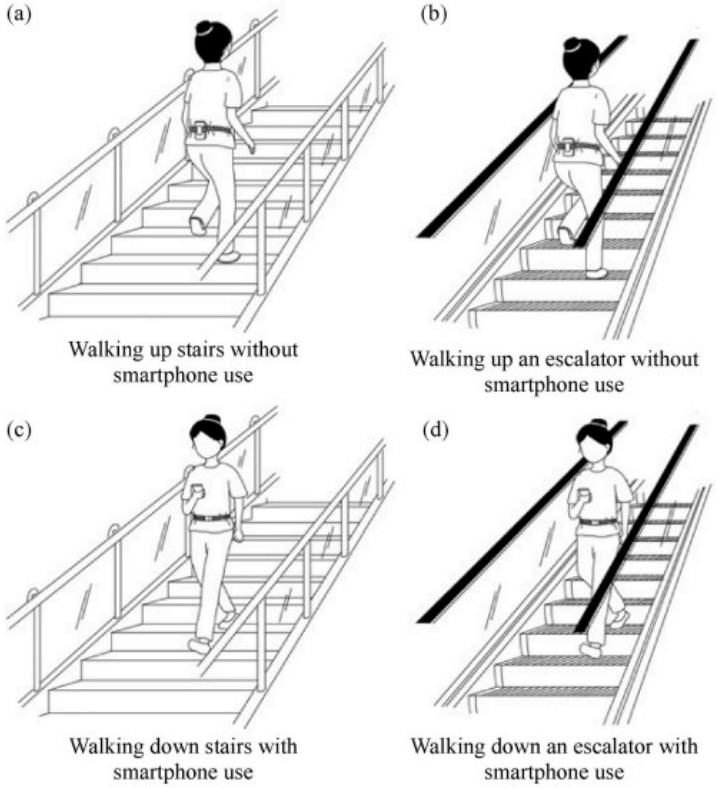

Fig. 1. Examples of data collection scenarios.

The results indicated that the main effects and two-way interactions of the three independent variables had significant impacts (all p-values of Pillai's traces < 0.001) on the six responses (step frequency, acceleration root mean square, step variability, step regularity, step symmetry, and walking confidence). Post-hoc tests showed that walking down stairs without smartphone use resulted in the significantly greatest combination of gait parameters and walking confidence (all ps < 0.001), whereas walking down or up escalators while texting messages almost caused the greatest significant decreases in the combination of gait parameters and walking confidence (ps < 0.05).

Findings indicate that smartphone use during walking on stairs or escalators had a negative impact on gait performance and walking confidence, especially while texting messages or playing games: participants had slower step frequency; reduced RMS; decreased step regularity and step symmetry; increased step variability; and lower walking confidence. Additionally, gait performance and walking confidence decreased when walking on escalators than stairs, as so did except RMS when walking down than walking up. Overall, texting or gaming when walking down escalators resulted in the largest gait performance decrement and the lowest walking confidence. Educational activities are necessary where this behavior is prevalent, from an intervention and prevention perspective. In addition, mobile application developers can incorporate the detection of distracted walking on stairs and escalators to warn smartphone users of the real dangers of their behavior.

REFERENCES

1. Bruyneel, A.-V., Duclos, N.C., 2020. Effects of the use of mobile phone on postural and locomotor tasks: a scoping review. Gait Posture 82, 233–241.
2. Luo, Y., Zheng, H., Chen, Y., Giang, W.C.W., Hu, B., 2020. Influences of smartphone operation on gait and posture during outdoor walking task. Proc. Hum. Factors Ergon. Soc. Annu. Meet. 64, 1723–1727.

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SAFETY RISCOLOGY

The rapid expansion of the technosphere, imbalanced geopolitical, ecological, and biological processes of modern times demand from us a complete reconsideration and deep understanding and study of risk in all spheres of human life and activity. War, non-trivial actions of aggressors force us back to the necessity of risk management on a reactive principle, while not excluding the need for the application of proactive management principles, which complicates the determination of the priority of preventive measures at each stage of activity of subjects and objects of risk, requiring the combination of these principles and again and again rethinking risks in order to develop effective measures of positive-compensatory influence. The actual state of human (humanity's) protection indicates that without creating a "risk science," without creating a corresponding educational discipline, further effective and rational risk management is already impossible.

Wherever there is a human, there is risk. There is no such branch of the economy where risk is absent. To date, the concepts of "risk" and "acceptable risk level" are enshrined and/or interpreted and applied in the Law of Ukraine "On Objects of Increased Danger" [2245-14], in the Civil Protection Code of Ukraine [5403-17], in the "Agreement between the Government of Ukraine and the Government of the United States of America on increasing operational safety, reducing the risk of operation, and strengthening the regulatory systems of civil nuclear facilities in Ukraine" [1198-2023-r], in the "Procedure for risk management of emergencies of a technogenic nature and fires" [z1397-23], as well as in over 30,000 laws, codes, state standards, regulatory and legal acts, orders, and other official documents of the state. One of the first methodological documents in the field of determining technospheric risk is the "Methodology for determining risks and their acceptable levels for declaring the safety of objects of increased danger" [v0637203-02]. Since 2002, this methodology remains the basis for the development of departmental and industry-specific guiding documents for risk analysis of objects of increased danger according to their specificity.

Starting from 2003, Ukrainian legislation in the field of labor protection and hygiene is being reformed to ensure the implementation of European occupational safety standards. The legislature believes that the introduction of a risk-oriented approach into national practice will enable Ukraine to ratify International Labour Organization conventions, which, according to the legislator, provide more rights and guarantees for workers compared to the current national legislation. This includes the "Convention concerning the Promotion of Occupational Safety and Health" under No. 187, signed on June 15, 2006.

In the "Concept of reforming the occupational safety management system in Ukraine" [1], the Cabinet of Ministers of Ukraine declares the problematic issues that have accumulated over the years due to the application of morally outdated non-risk-oriented approach to the occupational safety and hygiene management system, and proposes a way to address them.

In the provisions of the "Concept of risk management of emergencies of technogenic and natural character" [2], the Cabinet of Ministers of Ukraine proposes ways and means to solve the problems of population and territory protection of Ukraine from emergencies, reducing the risks of occurrence, and minimizing the consequences of emergencies of technogenic and natural character. There are also governmental concepts of chemical, radiation, and other types of safety.

Considering the above, it can be argued that the concepts of "risk" and "risk-oriented approach" have fully and completely entered into the management system of our state, and that the reform of the state governance system in this direction began long ago and continues to this day.

It is known that not everything in life can be predicted, but it is desirable to be prepared for everything. This approach is based on the fact that:

a) the risk of a negative event is never zero, and the desire to minimize it at any "cost" can itself become an irrational risky decision;

b) the cost of maintaining assets, the value and level of resource protection, and investments determine the cost price of production (service provision), and consequently, the profit and everything else in the money circulation circle.

This is how modern risk-oriented production and business processes work, various methods, techniques, and management standards that are gradually being implemented in companies in developed countries around the world. Enterprises and companies in our country are not exceptions here; despite the war, they also move in this direction, and it is necessary for us as educators and educational researchers to meet the needs of industries for qualified personnel.

The list of domestic companies (enterprises) implementing and optimizing risk management systems for production and business processes is quite extensive. Here are some of them: PJSC "Ukrzaliznytsia" (Ukrainian Railways); NJSC "Naftogaz of Ukraine"; SE "NNEGC "Energoatom"; LLC "SCM"; PJSC "ArcelorMittal Kryvyi Rih"; PJSC "Dniproazot"; NEC "Ukrenergo"; PJSC "Ukrainian Defense Industry", and it's clear that this list is far from exhaustive.

Considering the demand and novelty of such training directions, the size and complexity of large companies, the number of civil servants and officials of local self-government bodies, it is correct to assert that there is currently and will continue to be a demand for specialists with relevant qualifications.

Returning to the previous analysis, it is worth noting that in conditions of stable demand for specialists with in-depth knowledge of social, financial, and technospheric risk management, such offers from domestic universities in the labor market are completely absent. The consequence of this situation is the employment in leading positions of budget-forming companies and state institutions (establishments), at best, of retrained mechanical engineers who have undergone "unclear courses for non-existent qualifications." This often becomes the root cause of making unpredictable and risky management decisions of unsatisfactory quality with severe socio-economic consequences.

Therefore, just as the absence of statistics on negative events in the past cannot guarantee that they will not occur in the future, the absence of negative events at present cannot indicate that there is no need for employees to acquire specialized competencies for relevant "risk positions".

Moreover, during our research, it was established that in accordance with the requirements of higher education standards of the Ministry of Education and Science of Ukraine for the specialty 263 "Civil Security", in the field of knowledge 26 "Civil Security", graduates must acquire, among others, the following competencies:

- the ability to assess the risks of emergencies on the objects of economic activity and risks in the field of occupational safety;
- the ability to conduct techno-economic analysis, risk assessment, comprehensive justification of projects, plans, decisions, and their implementation in the field of civil security.

Along with this, it was found that in accordance with the requirements of the mentioned standards, graduates of higher education, upon completion of their studies, should demonstrate, among others, the following learning outcomes:

- the ability to choose optimal measures and means aimed at reducing professional risks, protecting the population, preventing emergencies;

- the ability to identify and analyze potential threats of emergencies, accidents, incidents, assess their possible consequences and risks, etc.

Thus, it can be argued that some competencies in "risk-oriented thinking", acquired by students, will enable them to address basic occupational safety issues (issues of providing proper, safe, and healthy working conditions for employees) and civil security, as envisaged by current education standards. Moreover, the state, represented by the Ministry of Education and Science of Ukraine, has provided domestic universities with the opportunity to create and implement educational disciplines with a risk-oriented focus in the field of knowledge 26 "Civil Security".

However, during the study of open sources such as educational programs, work programs of educational disciplines in universities in the field of knowledge 26 "Civil Security", publicly available elements of educational-methodical complexes of disciplines of the specialty 263 "Civil Security", scientific articles, monographs, dissertations, etc., we have found that there is no discipline that comprehensively and in-depth explores the concepts and aspects of phenomena such as risk in the field of technospheric, production, civil security, and life safety. Such a discipline would teach the laws (regularities) of risk, examine the theoretical (methodological, practical) principles of risk management, present to students the modern state position on the concept of "acceptable risk", explain the relationship between riskology and other academic disciplines, and define the required level of formation of certain sets of skills and abilities in students, which is not taught in domestic universities.

Therefore, we propose the introduction of a new educational discipline called "Safety Riskology", and in the future, the establishment of a separate scientific research direction "Safety Riskology".

REFERENCES

1. Approval of the Concept of reforming the occupational safety management system in Ukraine and approval of the action plan for its implementation: Order of the Cabinet of Ministers of Ukraine dated December 12, 2018, No. 989-r. URL: https://zakon.rada.gov.ua/laws/show/989-2018-%D1%80. (Date of application: 2024, March, 26).

2. Approval of the Concept of Risk Management for the Occurrence of Technogenic and Natural Emergencies: Order of the Cabinet of Ministers of Ukraine dated January 22, 2014, No. 37-r. URL: https://zakon.rada.gov.ua/laws/show/37-2014-%D1%80. (Date of application: 2024, March, 26).

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ERGONOMIC STUDIES OF THE WORKPLACE USING MOTION CAPTURE

Musculoskeletal disorders (MSDs) continue to be the main cause for occupational sick leave in countries with no foreseeable improvement. On the contrary, producing companies find themselves confronted with demographic changes leading to increasing average working age and a rise in the share of the population aged 65 and over. At the same time companies have the ethical obligation to protect the health of their workers, and the economic challenge to secure competitiveness. Therefore, companies need to adapt to the changing age structure because physical intensive tasks lead to work-induced impairments which increase with age and result in more employee absences. In order to prevent MSDs, workplaces need to be ergonomically designed and workload needs to be managed (e.g., task distribution) so that individual workers are not overloaded.

Common methods for ergonomic risk assessment usually analyze body posture and physical stress to identify critical work steps and critical workplaces. They compare measured values with fixed threshold values and compute a risk ratio for MSD occurrence for existing processes or for processes

being planned. The practical application of these methods comprises several problems. Firstly, the individual physical capacity is not taken into account and physical limitations, such as age-related loss of range of motion (ROM) or decline in muscle strength, are therefore not considered. Moreover, in the ergonomic assessment of existing workplaces, it is too time consuming and cost intensive to assess every worker at every workstation. As a consequence, the results of one or a few workers are used for ergonomic improvements without taking the individual anthropometry and capacities into account. Additionally, the methods provide only an injury risk score due to bad ergonomic design.

However, the analysis does not show which type of physical workload leads to the overload of which body part, let alone suggest specific counter measures. At the same time most engineers and designers have limited expertise with human factors and ergonomics, which is why recommends that in the future, digital solutions to improve ergonomics need to help the user take decisions to design safe workplaces.

The most prominent methods for the assessment use standardized tests to determine whether a worker can return to work after an illness or injury, or to quantify the course of rehabilitation. Since each assessment takes about 5 h plus follow-up work, the application of these methods is too time-consuming and thus expensive for an entire workforce. There have been several solutions that use motion capture (mocap) systems to digitize existing functional capacity evaluations with the aim of objectifying the assessment. However, they do not substantially reduce the duration of the assessment nor do they provide a comprehensive solution to assess the worker capability and the workplace requirements. Most functional capacity evaluations include a measurement of handgrip strength. Grip strength is important for the execution of assembly and logistics tasks but also because studies have shown that it has a significant positive correlation with muscle strength of various muscle groups.

The goal of the research project was to develop an individual ergonomic analysis to assess and improve workplaces according to the worker capabilities. To achieve this goal, we used a systems engineering approach and divided the project into subsystems that were continuously evaluated and refined during the course of development (Fig. 1). It comprises a capability analysis and a requirements analysis that are performed independently from one another.

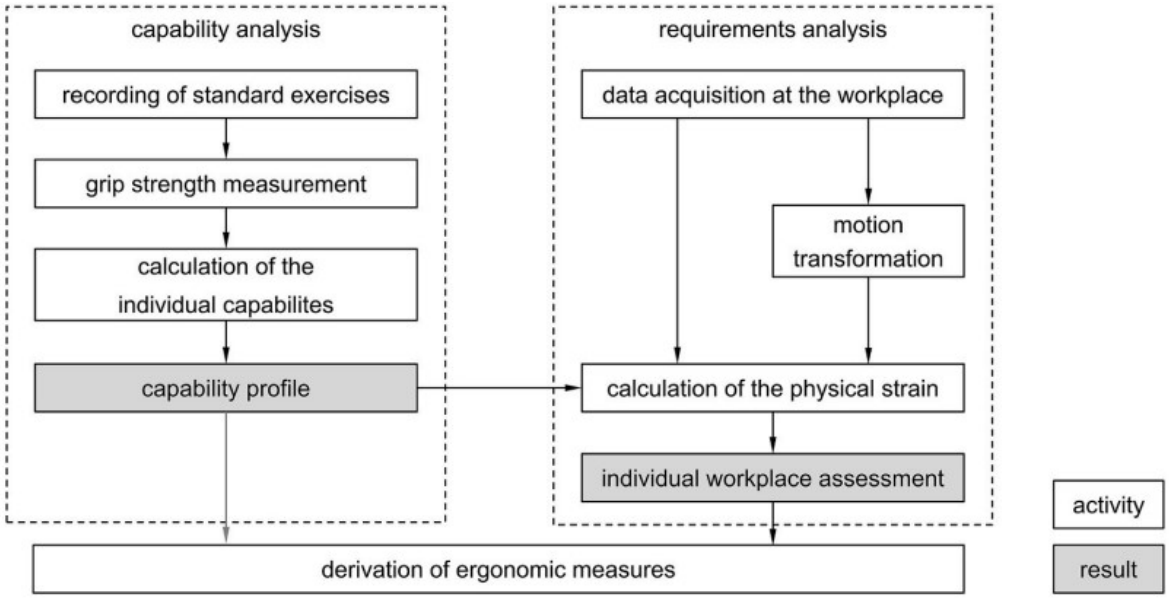

Fig. 1. Structure of the analysis.

The capability analysis assesses the individual joint mobility of a worker with a mocap system and estimates the body strength using a hand grip strength measurement. The requirements analysis assesses the physical strain during a specific working task. In order to do so, a worker wears the mocap system while executing the work task and the assessor records all weights handled by the worker, such as work pieces or tools. After processing the data, the individual physical strain is calculated with the previously

created capability profile. The user can use the original kinematic data to obtain a workplace assessment for the recorded worker or can apply an automated motion transformation to obtain a workplace assessment for all workers whose capability profiles have been recorded.

The application in practice has shown that the capability analysis is easy to apply and is able to detect restrictions in joint mobility and handgrip strength. Furthermore, the requirements analysis provides valid results for assembly and logistics processes which allow the derivation of general and individual ergonomic measures. The assessed workers gave positive feedback, especially about the method addressing their individual capabilities and body size. The mocap system did not interfere with their work, however, it acted as an obstacle to some workers who did not like to wear as many sensors, and because it attracts a lot of attention from coworkers. Since only the motion sequence and the handheld loads are recorded, the analysis hardly requires any preparation time, the time effort can be considered as low and the field of application is only limited by the load types. Especially in comparison to conventional ergonomic analyses, the advantage is obvious. With an additional effort of about 30 min per employee for the capability analysis, the motion transformation enables a worker-individual workplace assessment. Furthermore, the joint-specific risk assessment and catalogs of measure help the user find effective measures to prevent physical overload.

REFERENCES

1. Bortolini, M.; Gamberi, M.; Pilati, F.; Regattieri, A. Automatic Assessment of the Ergonomic Risk for Manual Manufacturing and Assembly Activities through Optical Motion Capture Technology. In Proceedings of the 51st Cirp Conference on Manufacturing Systems, Stockholm, Sweden, 16–18 May 2018; Wang, L., Ed.; Elsevier Science Bv: Amsterdam, The Netherlands, 2018; Volume 72, pp. 81–86.

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PROTECTIVE EARPHONES AND HUMAN HEARING SYSTEM RESPONSE TO THE RECEIVED SOUND FREQUENCY SIGNALS

Human hearing system, including outer ear, middle ear, inner ear, and related nerves depends on sound. Outer ear has the duty to collect the sounds and transfer them to the middle ear via the ear canal and to the tympanic membrane (eardrum). Sound waves pass through malleus, incus, and stapes, reaching to the inner ear. Inner ear includes cochlea and semi-circular canals. Cochlea includes thousands of very thin hair cells in the spiral organ (organ of Corti). When the sound waves enter the inner ear, the hair cell helps in stimulating the sound waves. Hair cells transform the vibrations into electric signals, and waves are transferred to the brain via hearing nerves. Brain transforms the signals into understandable sounds. Confronting with sound damages spiral organ cells. The sensing hair cells are vibrated by acoustic input signals, and then the mechanical vibrations are transformed to an electric form to reach to the eighth brain nerve. Confronting with intense sounds (over 85 dBA) primarily damages outer hair cells that are responsible for the sounds with high frequencies (3–6 kHz).

Ear canal performs like a resonator, turning up the sound. Ear canal resonance depends on its length. The shape and size of ear lobes and the curvature of ear canal affect frequency reactions of the eardrum. Different parts of the base membrane have different widths. High-frequency signals are affected by resonance near the oval window and low frequencies are affected near cochlea. Generally, from 16% to 24% of hearing loss in adults is due to the noise at working places. Human ear is more sensitive to high frequencies than to low frequencies, but people’s sensitivity to higher frequencies decreases with age. Noise-induced hearing loss (NIHL) is the result of long-term exposure to noise that causes cumulative

damage to hair cells of the cochlea. It is bilateral and symmetrical, and it is usually affected by high frequencies (3, 4, and 6 kHz), and then extending to lower frequencies (0.5, 1, or 2 kHz). Hearing damage, as a result of confronting with noise for some years, is extended to both high and low frequencies. According to the Health and Human Services Ministry, when eliminating noise is not possible by engineering controls, proper use of hearing protection devices together with audiometric monitoring is effective in preventing NIHL. Effective hearing protection can be achieved by proper selection of different types of hearing aids, appropriate tests and compatibility, proper use, and continuous attention to their service.

Despite the fact that hearing system protection devices are not considered as the first protective action, they are regarded as a main measure for preventing hearing loss due to their low costs, availability, and effects. Popularization of the use of hearing protection devices prevents NIHL among workers who are exposed to excessive noise. Earplugs are one kind of hearing protection devices that are placed inside the ear to block the ear canal, and they are produced either in molds or by ductile foams. Inappropriate fitting of hearing protectors may have negative effect on noise reduction rate. The research results show that training in the appropriate use of earplugs significantly affects the efficacy of earplugs. The results of the study dealing with an analysis of noise damping rates by earplugs show that in low frequencies and high frequencies (8 and 12 kHz), earplugs have high rate of damping. The performances of hearing protection devices differ from each other in reducing and attenuating the noise. There are various methods for evaluating the performance of hearing protection devices in reducing noise. These methods are divided into subjective and objective aspects. Standard ISO4869–3:2007 suggests the acoustical test fixtures (ATFS). This is an objective method. In this method, hearing tests are done in different frequencies with or without the protective earphone. The attenuation index is obtained out of the difference between open and blocked ears' thresholds.

Hence, sound is one of the most important problems in industrial environment that contributes to hearing loss in the workforce. In addition, improper fitting of hearing protectors have negative effects on noise reduction. This experiment is done by simulating a model of ear canal and evaluating the rate of attenuation in different distances and different frequencies between the earplug and the microphone that is located in an ear as the simulator for receiving the sound, in different materials such as Teflon and cast iron. As a result, the effective frequencies that affect hearing loss and variations of the sound level in different frequencies and distances after placing the earplug are determined.

The results of sound simulation in octave frequency signals showed that there was a significant difference between the received noise by microphone before and after placing the earplug on the model ($P < 0.05$). The result showed that by increasing the frequency, the rates of sound reduction in different conditions had also an increasing trend. By increasing the frequency, the rate of attenuation on the used earplug also showed an increasing trend. By increasing the distance of the microphone from the earplug, the sound level had an increasing trend from the distance of 12.8 mm to 25.5 mm, but it had a decreasing trend at the distance of 31.1 mm. This decreasing trend was quite prominent in frequencies under 500 Hz. The sound level in Teflon showed increasing and decreasing trends for different frequencies at the distance of 25.5 mm, reaching to its maximum rate at the frequency of about 4000 Hz. The peak frequency of 4000 Hz was observed in most existing material states, including metal at the distance of 22.8 mm, Teflon at 17.5 mm, Teflon at 25.5 mm, and combination of metal and Teflon at 25.5 mm. Among different conditions the required level has reached its maximum value, that is, 59 dB, in the metal canal at the related distance of 22.8 mm and in the frequency of 4000 Hz (Fig. 1).

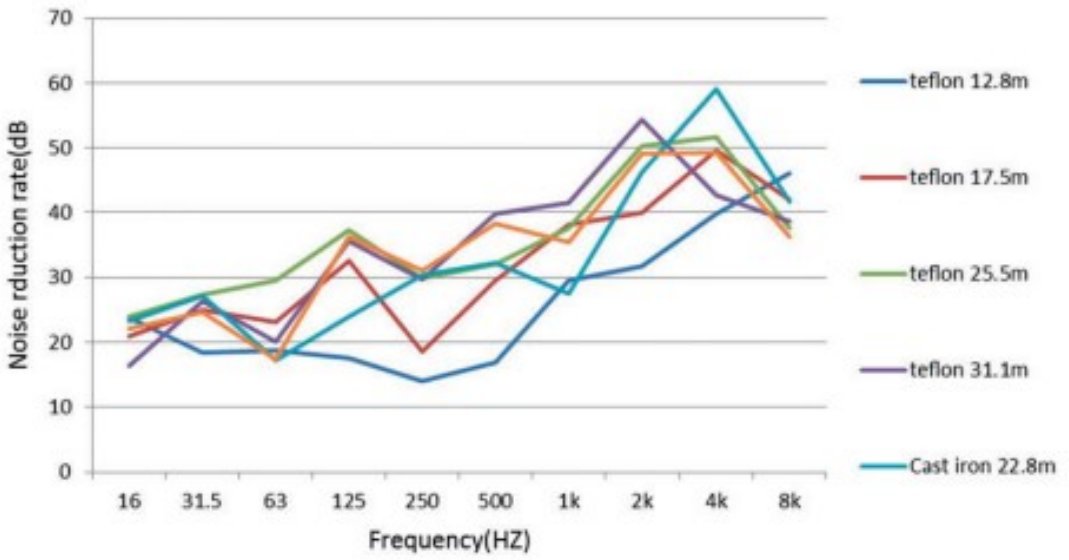

Fig. 1. Rate of sound attenuation (dB) in octave frequencies at different distances in simulated ear canal

As any object facing a sound, the ear acts as a passive filter. A passive filter is a low pass: the high frequencies are more absorbed by the object because high frequencies impose a higher pace of compression–decompression to the object. A contributing factor to this filter system is the contraction of the middle ear muscles which attenuate transmission of sound in the lower frequencies. Since sound level attenuations are different under different conditions at different distances of the simulated canal, the canal length can indicate the reason for the differences in related problems and harms in individuals. Results showed that as the distance between the earplug and the microphone increased, the sound increased up to a distance of 25.5 mm, and after this distance, the sound level had a decreasing trend, especially for frequencies under 500 Hz. The results of this study devoted to the analysis of the damping rate of earplug at different distances of its placement in the ear canal showed that when the distance of the earplug in the ear decreased, the rate of sound attenuation also decreased. This decrease was larger for the frequencies up to 1000 Hz and smaller in comparison with higher frequencies of 2000 Hz.

REFERENCES

1. Tantranont K and Codchanak N. Predictors of hearing protection use among industrial workers. Workplace Health Saf 2017; 65: 365–371.

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STUDY OF WATER CONSUMPTION, POLLUTION, AND OTHER ANTHROPOGENIC INTERVENTIONS IN RIVER ECOSYSTEMS AND DEVELOPMENT OF CONSERVATION STRATEGIES

The study of water consumption, pollution, and other anthropogenic interventions in river ecosystems, as well as the development of strategies for their conservation, is of great importance. River ecosystems are a key element of the natural environment that determines not only the quality of life for humans but also for various plants and animal species. However, population growth, industrialization, and inefficient water use lead to serious anthropogenic interventions in river ecosystems, threatening their

stable functioning. In this context, the study of the effects of water consumption, pollution, and the development of conservation strategies for river ecosystems becomes crucial.

Water consumption in modern megacities and rapidly developing regions is one of the key problems seriously affecting river ecosystems. The continuous growth of the population and intensification of economic activities lead to unstable and inefficient use of water resources, critically impacting the environment.

One of the main problems is the insufficient volume of water to meet the needs of the population, industry, and agriculture. Megacities, in constructing their infrastructure, extensively use water for various purposes such as drinking water, industrial processes, and meeting agricultural needs. This often results in exceeding the natural capacity of water bodies and sources, leading to their depletion [1].

Misuse of water resources is also a problem that requires attention. For instance, a significant portion of water may be lost through water supply and sewage systems due to technical deficiencies or inefficient management of water-consuming enterprises.

This directly impacts river ecosystems. The decrease in the groundwater level leads to the drying up of water bodies and aquifers, threatening the life of aquatic organisms and plants. Changes in water consumption patterns affect the balance of ecosystems, contributing to shifts in the distribution of water resources and the structure of ecosystems.

To solve these issues, it is necessary to implement sustainable water use strategies aimed at optimizing the use of water resources and reducing the negative impact on river ecosystems. It is also important to develop technologies for wastewater treatment and support natural balance in river areas through the preservation of natural corridors, restoration of riparian zones, and regulation of water regimes through natural methods [2].

The overall goal is to ensure a balance between the needs of society and the preservation of nature to provide stable and healthy river ecosystems for future generations.

Anthropogenic emissions and discharges of water-consuming and industrial wastewater are one of the main causes of river water pollution. This leads to a decrease in water quality, poisoning of aquatic organisms, and deterioration of the health of people who depend on these waters.

Pollution of river waters by anthropogenic discharges can result in the poisoning and death of aquatic organisms. Fish, aquatic invertebrates, and plants can be particularly vulnerable to these pollutants. Toxic substances can accumulate in organisms and pass through the food chain, opening pathways for the spread of hazardous compounds in the aquatic environment.

People who use contaminated river waters for drinking, irrigation, or other domestic purposes may face serious health problems. Toxic substances, such as heavy metals or chemical pollutants, can negatively affect human organs and systems, including the kidneys, liver, and nervous system.

Construction of hydrotechnical structures, such as dams, embankments, canals, and other engineering facilities, is an essential component of modern development. However, it can simultaneously have a significant impact on river ecosystems, disrupting their natural processes and balance [3].

One of the main problems is the alteration of the hydrological regime of river systems. Dams and embankments can impound water, creating large reservoirs. This leads to changes in water levels and river flow both upstream and downstream of the structure, affecting water resources and biodiversity.

The migration of aquatic organisms becomes problematic due to obstacles created by hydrotechnical structures. Many fish species have natural migration routes for reproduction and food seeking. Dams and embankments can block these routes, hindering the normal functioning of the ecosystem and leading to a decrease in populations of certain species.

The flooding of large areas is also a consequence of hydrotechnical construction. This can result in the loss of natural landscapes, including wetlands and coastal zones that are crucial for species diversity.

Additionally, hydrotechnical structures can contribute to erosion processes. The altered river flow regime resulting from construction can cause weathering and soil removal in river areas, impacting riverbanks and coastal zones.

To mitigate the negative consequences of hydrotechnical construction, it is crucial to consider ecological aspects and develop strategies aimed at preserving river ecosystems. This may involve the use

of technologies to reduce the impact on aquatic organisms, consideration of natural river flows, and restoration of ecologically important areas.

Preserving river ecosystems requires the implementation of comprehensive strategies that take into account the needs of both the population and nature. This includes rational water use, the implementation of effective wastewater treatment systems, restoration of natural river landscapes, and addressing issues of anthropogenic interference.

Conclusion. Studying the effects of water consumption, pollution, and other anthropogenic interventions in river ecosystems is a crucial stage in understanding the problem and developing effective solutions. Combining scientific research with practical measures is necessary to ensure sustainable development in river regions and preserve natural ecosystems for future generations [1,2,3].

REFERENCES

1.Dunham, J.B.; Angermeier, P.L.; Crausbay, S.D.; Cravens, A.E.; Gosnell, H.; McEvoy, J.; Moritz, M.A.; Raheem, N.; Sanford, T. Rivers are social–ecological systems: Time to integrate human dimensions into riverscape ecology and management. Wiley Interdiscip. Rev. Water 2018, 5, e1291. [Google Scholar] [CrossRef]

2.Millennium Ecosystem Assessment. Ecosystems and Human Well-Being; Island Press: Washington, DC, USA, 2005. [Google Scholar]

3.Vörösmarty, C.J.; McIntyre, P.B.; Gessner, M.O.; Dudgeon, D.; Prusevich, A.; Green, P.; Glidden, S.; Bunn, S.E.; Sullivan, C.A.; Liermann, C.R.; et al. Global threats to human water security and river biodiversity. Nature 2010, 467, 555. [Google Scholar] [CrossRef] [PubMed]

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HUMAN AND ENVIRONMENT. OCCUPATIONAL HEALTH

Environmental protection and occupational health are two interrelated areas that play a crucial role in ensuring human well-being and sustainable development. Environmental hygiene focuses on the effects of the natural and anthropogenic environment on human health, while occupational hygiene is concerned with the health and safety of workers in workplaces. Recognizing and addressing the interrelationships between these two areas is essential to creating a healthier and more sustainable future.

1. The Design of Work Environments Directly Impacts Worker Health: Poorly designed workplaces with inadequate ventilation, excessive noise, or ergonomic inefficiencies can lead to a range of health problems, including musculoskeletal disorders, respiratory illnesses, and hearing loss. Implementing evidence-based design principles that prioritize worker well-being can significantly reduce these risks [1, 2].

2. Environmental Hazards in the Workplace Contribute to Chronic Health Conditions: Exposure to occupational hazards such as chemicals, dust, and radiation can increase an individual's susceptibility to chronic illnesses like cancer, heart disease, and lung diseases. Proactive monitoring and mitigation strategies are crucial to protect workers' long-term health [3, 4].

3. Mental Health Challenges are Increasingly Recognized as an Occupational Health Issue: Stress, anxiety, and depression are prevalent among workers due to factors like demanding workloads, long hours, and lack of control. Integrating mental health awareness and support into occupational health programs can improve employee well-being and productivity [5, 6].

4. Climate Change Poses Emerging Threats to Occupational Health: Rising temperatures, extreme weather events, and changing air quality can introduce new hazards to outdoor work environments.

Adapting occupational health and safety practices to address these evolving risks is essential for protecting workers [7, 8].

5. Technological Advancements Offer Opportunities and Challenges for Occupational Health: Automation and the use of new technologies can create safer work environments by reducing manual labor tasks. However, it is crucial to address potential risks associated with these advancements, such as increased sedentary work and technostress, to ensure worker well-being remains a priority [9, 10].

The five theses presented highlight the intricate relationship between human health and the environment within the context of occupational settings. Poorly designed workplaces, exposure to hazards, and emerging threats from climate change demonstrate how environmental factors significantly impact worker well-being.

However, there is also an opportunity for positive change. Implementing evidence-based design principles, proactive hazard mitigation, and integrating mental health support can significantly improve worker health. Furthermore, technological advancements offer the potential for safer environments through automation while requiring vigilance to address emerging risks like technostress.

By prioritizing a holistic approach that considers both human and environmental factors, occupational health programs can effectively protect workers and ensure their long-term well-being in an ever-evolving landscape.

REFERENCES

1.NIOSH [National Institute for Occupational Safety and Health]. (2023). Preventing occupational musculoskeletal disorders (OMDs). Centers for Disease Control and Prevention. https://www.osha.gov/ergonomics

2.World Health Organization. (2018). Occupational health environment. https://www.who.int/health-topics/occupational-health

3.Centers for Disease Control and Prevention. (2023). National Occupational Health and Surveillance Program (NOHSUP). Centers for Disease Control and Prevention. https://www.cdc.gov/

4.American Cancer Society. (2023). Cancers caused by workplace exposures. https://www.cancer.org/cancer/risk-prevention.html

5.MentalHealth.gov. (2023). Workplace mental health. https://www.cdc.gov/workplacehealthpromotion/tools-resources/workplace-health/mental-health/index.html

6.International Labour Organization. (2023). Mental health at work: A global challenge. https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_856821/lang--en/index.htm

7.International Labour Organization. (2023). Climate change and occupational safety and health. https://www.ilo.org/global/topics/safety-and-health-at-work/areasofwork/chemical-safety-and-the-environment/WCMS_887111/lang--en/index.htm

8.World Health Organization. (2023). Climate change and health. https://www.who.int/teams/environment-climate-change-and-health/climate-change-and-health

9.European Agency for Safety and Health at Work. (2023). Automation, digitalisation and the future of work: Impact on occupational safety and health. https://osha.europa.eu/en/publications/advanced-robotics-and-automation-implications-occupational-safety-and-health

10. National Institute for Occupational Safety and Health. (2023). Psychosocial factors at work. Centers for Disease Control and Prevention. https://www.cdc.gov/dhdsp/health_equity/psychosocial.htm

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EVALUATION OF PROFESSIONAL RISKS ACCORDING TO EUROPEAN STANDARDS

Risk assessment as the main component of the health and safety management system of workers is provided for by the legislative requirements of many countries of the world. In particular, in the international standard ISO 45001, the need for this process is indicated as a basic requirement (clause 6.1.2), which helps to comply with the law, determine work priorities and protect the life and health of employees. [1]

The requirements for a risk-oriented system of employee health safety and risk assessment are declared in the documents of the International Labor Organization, the European Commission, which is the highest executive authority in the EU, and are prescribed in the legislation of most countries. For example, in Great Britain, the fulfillment of this requirement was legally defined 30 years ago.

International Labor Organization Convention No. 155 on Occupational Safety and Health and the Working Environment states that "Employers shall be required, as far as is reasonably practicable, to ensure the safety of workplaces, machinery, equipment and processes under their control, and absence of a threat to health from their side" (Part 4, Article 16, Clause 1).

The framework directive 89/391/EEC, which aims to introduce measures to encourage improvements in the health and safety of workers, lists the following general principles of injury prevention [2]: avoiding risks; risk assessment; overcoming risks at the source of their occurrence; adaptation of work to personality; adaptation to technical progress; replacement of dangerous with safe or less dangerous; development of an agreed general prevention policy; the priority of collective protection measures over individual protection measures; providing appropriate training to employees.

And it is also stated that “the employer must assess all risks for the safety and health of employees, in particular in the selection of work equipment, chemicals or drugs used, as well as the equipment of workplaces”. Therefore, the employer has an obligation to ensure the safety and health of employees in every aspect related to work. The purpose of conducting a risk assessment is to effectively take measures to protect workers.

The risk assessment process consists of [2]: 1) detection of dangers; 2) risk assessment; 3) ranking of risks; 4) documentation of results; 5) periodic review of assessment results.

There are no generally accepted prescriptions for risk assessment. However, there are several principles that should always be taken into account. The assessment process should be structured to ensure coverage of all important hazards and risks. Qualified specialists, as well as managers, should be involved in the identification of hazards in order to understand as precisely as possible what problems exist in the working environment. Once a risk is identified, the assessment should begin by asking whether and how it can be eliminated.

Various approaches and combinations of approaches are used to assess workplace risks. They are usually based on the following elements [2]: observation of the production environment (condition of the floor, safety of machines, temperature, lighting, noise, etc.); definition of tasks performed at the workplace and consideration of them from the point of view of risk assessment; bserving work performance and considering different work patterns to assess the impact of hazards; consideration of external factors that may affect the workplace, for example, weather conditions for workers who work outdoors; study of psychological, social and physical factors that can cause stress at work; consideration of organizational measures.

The results of the observations can be compared with the criteria for ensuring safety and health, which are based on the requirements of legislation, national standards and guidelines, and the principles of the hierarchy of risk prevention.

Risk assessment is not a one-time action. Risk management is a continuous process. The assessment results are reviewed at regular intervals. For example, the company does this on a regular

basis once a year. It is mandatory to review in the event of the appearance of new equipment, production, technological, other changes that have taken place at the enterprise.

Competent employees who are well versed in all the nuances of the operation of mechanisms, equipment, and other objects of evaluation, who are able to see comprehensively, deeply and recognize dangers, should be involved in reviewing the evaluation results. [2] Competence is critical, so when necessary, third-party qualified experts are involved in the evaluation.

REFERENCES

1. ISO 45001:2018 Occupational health and safety management systems Requirements with guidance for use.

2. Five steps of risk assessment. (2023). *Occupational Health.* Vol. 8. pp. 8-13.

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ENSURING NORMAL MICROCLIMATE CONDITIONS TAKING INTO ACCOUNT MATHEMATICAL MODELING OF HEAT EXCHANGE PROCESSES

Human health and performance are greatly influenced by indoor environmental conditions that affect heat exchange with surrounding surfaces. These conditions are determined by a combination of temperature, relative humidity, air velocity, surface temperature around humans, and thermal (infrared) radiation intensity [1].

Building envelopes play a crucial role in creating the indoor microclimate. Similar to clothing, they protect individuals from adverse environmental influences and allow them to live in almost any climatic conditions on the globe [2].

Heat exchange through radiation occurs between surfaces at different temperatures [3, 4,]. The geometric characteristics of shape and their mutual arrangement play a significant role in calculating the radiative heat exchange between heated surfaces. The influence of these characteristics is taken into account by scope coefficients φ, determining the geometric conditions for direct energy exchange between two surfaces in a non-absorbing medium. In accordance with the terminology of Y.A. Surinov [5], this coefficient is referred to as the generalized angular coefficient in certain publications.

It is convenient to use the concept of the irradiance coefficient φ, which is a geometric property.

The spectral composition and intensity of the radiation are also important for evaluating the influence of thermal radiation. Since the intensity of thermal radiation is spatially non-uniform, its evaluation should be done separately for each point. The irradia0nce of a given part of the body depends on its spatial orientation with respect to the source of thermal radiation. This quantity is vectorial in nature and multivalued at each point in space.

Various alternatives need to be considered to select the most appropriate human body model for further experimentation and mathematical modeling.

The problem of ensuring normal microclimate conditions will be considered, taking into account the mathematical modeling of the heat exchange process.

REFERENCES

1. ДСН 3.3.6.042-99.Санітарні норми мікроклімату виробничих приміщень.- К., МОЗ України, 1993.- 8с.

2. Губернский Ю.Д., Кореневская Е.И. Гигиенические основы кондиционирования микроклимата жилых и общественных зданий. М.:"Медицина", 1978.-192 с.

3. Богословский В.Н. Строительная теплофизика (теплофизические основы отопления, вентиляции и кондиционирования воздуха): Учебник для вузов. – 2-е изд., перераб. и доп. –М.: Высшая школа, 1982, 415 с.

4. Уонг Х. Основные формулы и данные по теплообмену для инженеров. Справочник. - М.: Атомиздат, 1979.

5. Михеев М.А., Михеева И.М. Краткий курс теплопередачи. – М.-Л.: Госэнергоиздат. – 1960. - 208 с.

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THE IMPORTANCE OF USING AND SAVING WATER RESOURCES

Water plays a central role in economic and social development; it is vital to maintain health, grow food, manage the environment, and create jobs. Despite its significance, water resources face increasing threats from pollution, overexploitation, and climate change. But, a staggering 2 billion people worldwide lack access to safely managed drinking water, and 3.6 billion people lack access to safely managed sanitation. A lack of clean water and proper sanitation facilities spreads diseases, with millions of deaths each year linked to contaminated water sources. The scarcity of water has emerged as one of the most pressing issues confronting humanity. When water is scarce or polluted, or when people have unequal, or no access to water, tensions can rise between communities and countries. [2,3,5]

Something needs to be done to either render waterusage more effective or make more water available. There is an urgent need, within and between countries, to unite around protecting and conserving our most precious resource [1,4]

Conserving water contributes to environmental preservation by lowering the energy needed for processing and distributing water to households, businesses, farms, and communities, thereby aiding in the reduction of pollution and the conservation of fuel resources. [5]

By using water-saving techniques, we can divert less water from rivers, bays, and estuaries, which helps preserve aquatic ecosystems. It also reduces water and wastewater treatment costs and the amount of energy used to treat, pump, and heat water, thus lowering energy demand and preventing air pollution. [5]

We must act upon the realization that water is not only a resource to be used and competed over – it is a human right, intrinsic to every aspect of life.[3]

By promoting knowledges, fostering collaboration, and implementing evidence-based policies, societies can ensure the availability and accessibility of water resources for future generations.

Responsible water usage is not only a local concern but also a global imperative. It is common knowledge that there is urgent necessity to safeguard our planet’s freshwater resources for generations to come.

REFERENCES

1.Su, Huizhen, et al. "What factors affect the water saving behaviors of farmers in the Loess Hilly Region of China?." Journal of Environmental Management 292 (2021): 112683.

2.Water Supply [Електронний ресурс] – Режим доступу до ресурсу: https://www.worldbank.org/en/topic/watersupply #1

3.Water for peace [Електронний ресурс] – Режим доступу до ресурсу: https://www.un.org/en/observances/water-day.

4.Bognäs, Désirée. "To save water or not?: A study of water scarcity at multiple levels, and people's attitudestowards it in Bangalore, India." (2011).

5. EPA. Saving Water Helps Protect Our Nation's Water Supplies // Energy Star. 2000. URL: https://www.energystar.gov/products/recent_program_updates/saving-water-helps-protect-our-nations-water-supplies

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PHYSICAL PROPERTIES OF NEUTRONS

Neutrons are one of the fundamental building blocks of matter, making up roughly 50% by weight of all material. Only when they are released from atomic nuclei do they constitute a hazardous form of radiation, and there are only two processes that can achieve this separation and produce ‘free’ neutrons: a nuclear reaction and spontaneous fission.

Free neutrons are unstable and have a lifetime of 886 s, decaying by emitting an electron and an antineutrino to become a proton. Neutrons have a magnetic moment, and although quite small, it has a value. Represented by the symbol μ_n, its value is $-0.96623640 \times 10^{-26}$ $J \cdot T^{-1}$, which is approximately 1/1000th of the electron magnetic moment. So, although the neutron is usually thought of as a particle without charge that interacts as though it were a billiard ball, it can be seen that neutrons are more complex entities.

The neutron has a spin of 1/2, and the mass of the neutron is 1.675×10^{-27} kg, which is slightly larger than that of the proton. Neutrons are present in every atomic nucleus with the exception of hydrogen (^{1}H). Neutrons can interact by means of the four common forces: strong nuclear, weak nuclear, electromagnetic (because of their magnetic moment) and gravitational.

Neutrons may be generated by a number of processes, including photoneutron reactions, wherein a high energy gamma ray incident on a high Z target generates neutrons; charged particle interactions, such as a proton impinging on a tritium target; or spontaneous fission in heavy elements. Generally, neutrons are produced with high energies at least above 10 keV, and potentially above 10 MeV, and these fast neutrons are slowed by collisions in matter. These collisions may be elastic, inelastic or non-elastic, and only a small amount of energy may be lost in each collision, and so it will take many collisions to reduce the neutron energy to a low value. Eventually the neutrons will slow to the point where they come to be in thermal equilibrium with the medium through which they are passing, and their distribution of velocities will have a most probable value at 20°C of 2200 $m \cdot s^{-1}$, which corresponds to a neutron energy of 0.0253 eV. Generally, neutrons whose energies are below the sharp drop in the absorption cross-section in cadmium at ~0.4 eV are referred to as thermal neutrons.

When neutrons interact with matter, they undergo a number of collisions with atoms and may be considered to be acting like gas molecules that eventually come into thermal equilibrium with their surroundings. In order to evaluate the most probable distribution of neutron velocities after they have come to equilibrium, a Maxwellian distribution can be assumed.

The kinetic energy distribution of neutrons in thermal equilibrium with their surroundings at temperature T (K) may be written as

$$\frac{n(E)dE}{n} = 2/\sqrt{\pi}\sqrt{\frac{E}{kT}}\exp\left(\frac{E}{kT}\right)d\left(\frac{E}{kT}\right) \quad (1)$$

where n is the total number of neutrons in the system, n(E) is the number of neutrons of energy E per unit energy interval in the range from E to E + dE and k is the Boltzmann constant.

Thermal neutron distributions approximate to a Maxwell–Boltzmann function and can be represented in several different ways. Figure 1 shows thermal distributions in terms of neutron density, n(E), fluence rate, Φ(E), and velocity, n(v). The reference speed, v0, in this case is 2200 $m \cdot s^{-1}$, and the reference energy, kT, is 0.0253 eV.

Relationships among neutron velocity, temperature and energy can be given by

$$T = 1.159 \cdot 10^4 E \quad (2)$$

$$v = 13.83 \cdot \sqrt{E} \quad (3)$$

where E is in eV, v is in km·s–1 and T is in K [2]. Because neutron energies span such a large range, a historical precedent has been established to refer to various energy regions with descriptive terms. There is no general agreement as to the exact energies specified by the following neutron energy classification that is generally used, but the approximate values shown in Table 1 for each region can be assumed.

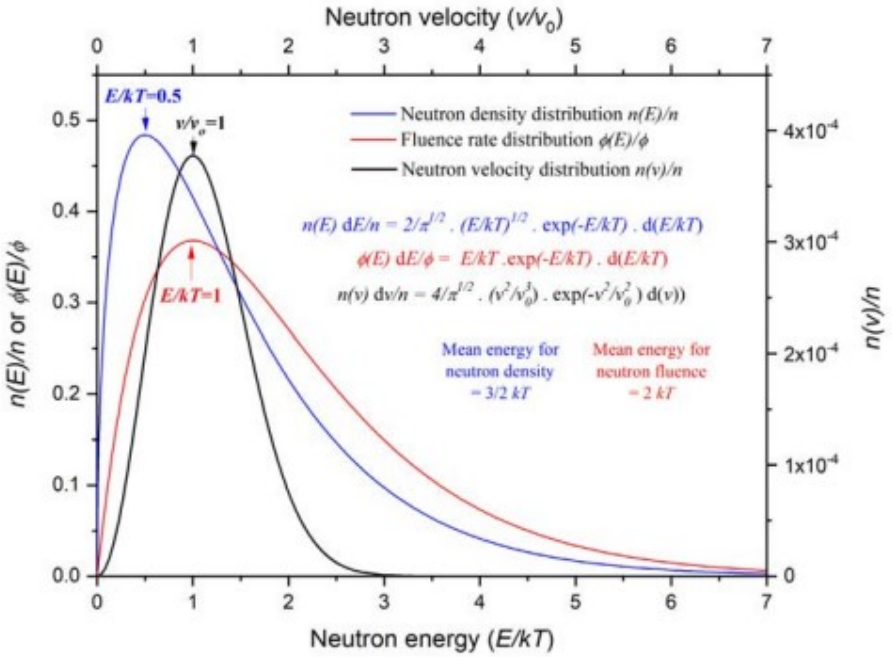

Fig. 1. The thermal Maxwell–Boltzmann distributions in energy, fluence and velocity.

Table 1

Names of neutron energy regions

Name of neutron energy region	Approximate energy range
High energy (or relativistic)	> 10 MeV
Fast	10 keV to 10 MeV
Intermediate	100 eV to 10 keV
Slow	< 1 eV
Epithermal[a]	0.025 to 1 eV
Thermal[b]	0.025 eV
Cold	5×10^{-5} eV to 0.025 eV

Courtesy of National Physical Laboratory.

[a] The epithermal region is sometimes considered to be above the cadmium cut-off energy at 0.4–0.5 eV, corresponding to the energy at which a sharp decrease in the cadmium cross-section occurs.

[b] At 20°C, the peak of the thermal neutron fluence distribution occurs at an energy of 0.0253 eV. The upper bound of the energy of thermal neutrons is sometimes given the cadmium cut-off energy.

REFERENCES

1. Willis, B.T.M. and Carlile, C.J. (2009) Experimental Neutron Scattering, Oxford University Press.

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INFLUENCE OF HUMANITY ON NATURE

In the conditions of scientific and technological progress, the relationship between society and nature has become much more complicated. Man got the opportunity to influence the course of natural processes, conquered the forces of nature, began to master almost all available renewable and non-renewable natural resources, but at the same time pollute and destroy the environment. Human intervention in natural processes is increasing sharply and can cause a change in the regime of soil and underground water in entire regions, surface runoff, soil structure, intensification of erosion processes, activation of geochemical and chemical processes in the atmosphere, hydrosphere and lithosphere, changes in microclimate, etc.

Stages of changes in the biosphere by humanity, which culminated in environmental crises and revolutions, namely:

- the impact of humanity on the biosphere as a normal biological species;
- over-intensive hunting without ecosystem changes during the period of human development;
- changes in ecosystems as a result of processes that occur naturally: grazing, increased grass growth by burning, etc.;
- intensification of the impact on nature through soil plowing and deforestation;
- global changes of all ecological components of the biosphere as a whole.

Human influence on the biosphere can be reduced to four main forms:

- change in the structure of the earth's surface,
- a change in the composition of the biosphere, the circulation and balance of the substances that make it up,
- a change in the energy, in particular thermal, balance of individual regions of the globe and the entire planet,
- changes made to the biota as a result of the destruction of some species, the destruction of their natural habitats, the creation of new breeds of animals and varieties of plants, their relocation to new habitats, etc. [1]

According to a 2018 study in Nature, 87% of the oceans and 77% of land (excluding Antarctica) have been altered by anthropogenic activity, and 23% of the planet's landmass remains as wilderness. [2]

The concept of pollution. Classification of environmental pollution.

Environmental pollution means the entry into the biosphere of any solid, liquid, or gaseous substances or types of energy (heat, sound, radioactivity, etc.) in quantities that have a harmful effect on humans, animals, and plants, both directly and indirectly by. Directly, the objects of pollution (acceptors of polluted substances) are the main components of the ecotope (place of existence of the biotic community): - atmosphere, - water, - soil. [3]

World Environment Day, which is observed annually on June 5, is one of the main ways for the United Nations to draw the attention of the world public to environmental problems, as well as to stimulate political interest and action. Such an event as the celebration of this Day is designed to bring the human factor into the issue of environmental protection. [4]

Today it is very important for people to understand that nature is the only source of all the wealth that man needs for existence. Only a rational, thrifty and reproducible attitude towards nature can save humanity. To preserve life on Earth, man must protect nature. [5]

REFERENCES

1.Humanity and nature. the biosphere. Environment, ecology, 2023. URL: https://osvita.ua/vnz/reports/ecology/21348/

2.Human impact on the environment: habitat fragmantation. Fleischer, Evan (2 November 2019). "Report: Just 23% of Earth's wilderness remains". Big Think. Archived from the original on 6 March 2019. Retrieved 3 March 2019. URL: https://en.wikipedia.org/wiki/Human_impact_on_the_environment

3.Екологічний проект: людина та довкілля. 2023. URL: https://naurok.com.ua/ekologichniy-proekt-lyudina-ta-dovkillya-336218.html

4.Проблематика громадського здоров'я. Борисенко А.В. – заступник директора ДУ «Вінницький ОЛЦ МОЗ України» червень 2020р. URL: http://www.cgz.vn.ua/problematika-gromadskogo-zdorovya/problematika-gromadskogo-zdorovya_462.html

5.Вступ до історії України та громадянської освіти історії України та громадянської освіти// Людина як частина природи. URL: https://uahistory.co/pidruchniki/hlibovska-introduction-to-ukraine-history-and-civil-education-5-class-2022/25.php

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DISCHARGE OF PERSONNEL IRRADIATION DEPENDING ON THE CONDITIONS OF THE LOCATION OF SOURCES OF IONIZING RADIATION

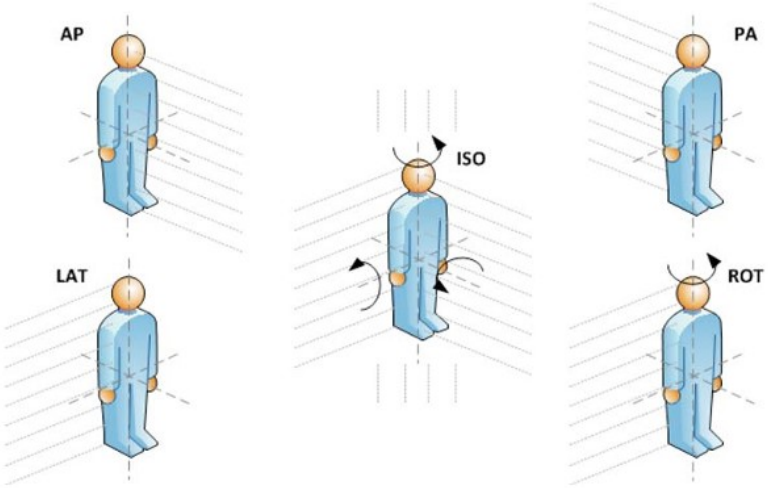
The management of stochastic effects in radiological protection relies on the concept of effective dose (E), established by the International Commission on Radiological Protection (ICRP). Effective dose, derived from equivalent doses to risk organs and tissues, serves as a fundamental parameter for implementing radiation protection principles. However, effective dose cannot be directly measured and requires estimation through dose distribution in the human body, often facilitated by conversion coefficients (CCs). These coefficients relate physical, measurable quantities to protection quantities and are essential for assessing radiation risks in various exposure scenarios.

Conversion coefficients bridge operational quantities defined by regulatory bodies like ICRP and International Commission on Radiation Units and Measurements (ICRU) with physical quantities characterizing radiation fields. Commonly employed physical quantities include kerma free-in-air (Ka), tissue-absorbed dose (DT), and particle fluence (Φ). Conversion coefficients are crucial for evaluating health risks to populations in specific exposure situations and assessing the potential benefits of relocation from high-exposure areas.

This study utilized the Alderson RANDO phantom, an anthropomorphic model widely used in radiation dosimetry experiments. The phantom's organ positions and mass fractions were meticulously determined through a combination of published data and expert consultation. Experimental setups involved exposures on open surfaces using various radionuclides to investigate energy-dependent conversion coefficients. Dosimeters, including thermoluminescent detectors (TLDs) and optically

stimulated luminescence dosemeters (OSLDs), were strategically positioned within the phantom to measure radiation doses accurately.

The results obtained from the experimental investigations shed light on the complexities inherent in radiation dosimetry and its implications for radiation protection strategies. One of the key findings of this study is the significant variation in organ absorbed doses across different exposure geometries.



For instance, in the AP-PA exposures, it was observed that anterior organs received higher doses in the AP-geometry, while posterior organs received higher doses in the PA-geometry, as anticipated. This differential distribution of absorbed doses underscores the importance of considering exposure geometry in assessing radiation risks to specific organs and tissues.

Moreover, the observed differences in effective doses between AP and PA geometries highlight the need for accurate conversion coefficients to translate physical quantities into protection quantities. The factor of more than 2 observed in the conversion coefficients for HP(10) to effective dose (Eeff) between AP and PA exposures underscores the influence of organ proximity to the radiation source and shielding effects on dose distribution. These findings emphasize the importance of considering not only the magnitude of radiation exposure but also its spatial distribution and shielding conditions in assessing radiation risks to individuals.

Another significant aspect of this study is the investigation of a special exposure situation involving the placement of the radiation source in a pocket, which simulates scenarios where individuals inadvertently carry radioactive materials close to their bodies. The results revealed notable differences in organ absorbed doses depending on the location of organs relative to the source, with organs in the lower part of the phantom receiving significantly higher doses compared to those in the upper regions. This stresses the importance of considering the specific anatomical distribution of organs and tissues in assessing radiation risks in real-life scenarios.

Furthermore, the establishment of a specific conversion coefficient for pocket exposure situations provides valuable insights for estimating effective doses in scenarios where individuals come into close contact with radioactive materials. This conversion coefficient, with a value of CC(pocket, ^{137}Cs): 2.5 μSv MBq$^{-1,}$ can serve as a useful tool for assessing the potential radiation risks associated with such exposure scenarios and informing appropriate risk mitigation measures.

Overall, the findings of this study highlight the complexities involved in assessing radiation risks in various exposure scenarios and underscore the importance of accurate conversion coefficients in translating physical measurements into meaningful indicators of radiation exposure and risk. Further research in this area is warranted to refine dosimetric methodologies, improve our understanding of radiation dosimetry in complex exposure situations, and enhance radiation protection practices to safeguard public health and safety.

In conclusion, this study represents a significant contribution to the field of radiation dosimetry by providing experimental data on conversion coefficients for different exposure scenarios. The results

obtained emphasize the importance of accurate conversion coefficients in assessing radiation risks and informing radiation protection strategies.

The meticulous experimental design and analysis employed in this study have provided valuable insights into the complexities of radiation dosimetry and its implications for radiation protection. By investigating various exposure geometries and scenarios, including special situations such as pocket exposure, this study has advanced our understanding of the factors influencing radiation dose distribution and effective dose estimation.

Moving forward, further research is needed to refine dosimetric methodologies, improve the accuracy of conversion coefficients, and enhance our understanding of radiation dosimetry in complex exposure scenarios. By continuing to advance our knowledge in this area, we can better protect individuals and population from the potential harmful effects of ionizing radiation and ensure the safe use of radioactive materials in various applications.

REFERENCES

1.ICRP, 1996. Conversion Coefficients for use in Radiological Protection against External Radiation. ICRP Publication 74. Ann. ICRP 26 (3–4). P. 1–205.

2.ICRP, 2010. Conversion Coefficients for Radiological Protection Quantities for External Radiation Exposures. ICRP Publication 116, Ann. ICRP 40 (2–5).

3.Bernhardsson C. Experimental determination of dose conversion coefficients for external radiation exposure with gamma emitting radionuclides, 2012. – P. 125–133.

4.ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37 (2-4), pp. 1-332.

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ECOLOGICALLY SAFE SYSTEMS OF BUILDING MICROCLIMATE PREMISES

Functioning of life-support systems of buildings is connected with the consumption of heat, electric and other types of energy. It is a well-known fact that production of different types of energy is connected with technological processes. Any technological process leads to the deterioration of environmental situation. Therefore, the main environmental task in the functioning of technological process is to reduce its negative impact on the environment. [2]

At the current stage of development of the construction industry, namely, the installation of life-support systems for buildings, the question of environmental cleanliness inside the premises of the building also raises. Therefore, along with global solutions for the protection of the environment, it is also necessary to address this challenge. [1]

The ways of solving the problems of ensuring indoor climate in buildings by reducing environmental pollution and indoor cleanliness can be achieved by the following methods:

–reducing of the consumption of non-renewable energy (gas, coal, liquid fuels) through the use of renewable energy (solar, wind, etc.);

–reducing of the amount of energy consumed;

–improvement of microclimate technology in order to improve the indoor comfort in buildings. [5]

The amount of non-renewable energy consumption can be reduced by using renewable energy (sun, wind, etc.). One of the promising areas of modern energy development is the use of renewable energy for heat and cold supply of life support systems in buildings on the basis of heat-used installations of combined heat and cold production, absorption heat transformers (AHT). These heat transformers

represent a thermodynamic system where heat is transformed by means of combined forward and reverse cycles. [3]

APT have high efficiency, environmental friendliness, quiet operation, easy maintenance, long service life, full automation. On the basis of these thermal transformers the technology is offered and the principal scheme of its operation is developed for the year-round provision of microclimate parameters in the premises of buildings with complex use of solar, wind and biomass energy, as well as energy of the ground and water bodies. In case of lack of renewable energy, a backup heating is provided. [2]

Reducing of the amount of energy consumed can be done in the following ways:

1. by reducing the thermal capacity of the systems through the use of

–highly efficient insulating building materials for external enclosures,

–technologies related to thermal drainage of buildings (strengthening of thermal protection properties of external enclosures),

–effective insulation of the main routes of the systems. [4]

2. by reducing heat loss due to

–control of heat supply to each premise according to its demand,

–controlling the heat regime of the building according to the set programme with the use of heat supply control systems and metering of the consumed heat energy,

–control of stable operation of the heating system and distribution of the heat carrier by branches, risers and sections in accordance with the technological map of supply to each heater.[1]

3.application of modern environmentally friendly piping systems made of plastic;

4.optimisation of air exchange (reducing the amount of supply air to the normative amount per one working person);

5.zoning of rooms according to the area of the working or serviced zone;

6.utilisation of cleaning and recirculation of indoor air;

7.use of natural stimuli of air movement;

8.monitoring the state of the internal atmosphere and controlling its parameters. [5]

In order to solve the problem of reducing energy consumption in the systems of providing microclimate in the premises, it is proposed to carry out two simultaneously operating systems:

–a system of year-round provision of thermal comfort in the room through the use of heating surfaces (in the transitional and cold periods of the year) and cooling (in the warm period of the year);

–air conditioning system. [3]

Regulation of indoor microclimate parameters is a complex task. The complex of interacting nodes of the proposed system is very complex and, therefore, their interconnected work can be clearly controlled only with the use of computer technology. [1]

It is proposed to regulate the microclimate parameters by a two-stage scheme:

–general control of the system of providing microclimate of premises;

–local control of the indoor climate system.

The system of general and local automatic control of indoor microclimate parameters includes the following blocks:

–sensors for registering the parameters of indoor microclimate and life support systems;

–logic control centre;

–controls for shut-off and regulating valves of the microclimate system. [4]

Modern development of the energy sector dictates a new technological policy, which is based on the principle of maximum energy conservation, strict control over its consumption and environmental protection. The proposed technologies for microclimate control based on natural energy sources are the most environmentally friendly technologies and they meet the requirements of today. [5]

REFERENCES

1.Anselm, Akubue Jideofor. "Building with nature: ecological principles in building design." *Journal of Applied Sciences* 6.4, 2006: 958-963.

2.Lockhart, Andy, and Simon Marvin. "Microclimates of urban reproduction: The limits of automating environmental control." *Antipode* 52.3, 2020: 637-659.

3.Tumini, Irina. "The urban microclimate in open space. Case studies in madrid." *Cuadernos de investigación urbanística* 96, 2014: 1-73.

4.Петров А. Види мікроклімату та його оптимальні показники. URL: https://poltava.to/news/62335/

5.Тарадуда Д. В. "Забезпечення промислової та цивільної безпеки в україні та світі: управління, технології, моделі." Луцьк: РВВ Луцького НТУ, 2016.

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THE INFLUENCE OF VIBRATION FREQUENCY ON DRIVER DROWSINESS, REACTION TIME, AND DRIVING PERFORMANCE

Motor vehicle accidents cause 1.25 million deaths worldwide each year, while the associated injuries lead to 40 million years lost due to disability. Although speeding and intoxication are leading contributors to vehicle accidents, approximately 20% of accidents are due to a loss of attention caused by drowsiness. In the USA alone, 41,000 injuries and more than 800 deaths are caused annually by driver drowsiness. This toll places an enormous burden on society due to lives lost, decreased productivity, as well as additional costs borne by the national healthcare system resulting from the management of disability and rehabilitation. In the context of commercial vehicles, accidents stemming from driver drowsiness or inattentiveness are notably amplified, accounting for approximately 39% of such incidents. This issue is particularly widespread within the trucking sector, where a substantial 47.1% of truck drivers in the United States have acknowledged experiencing drowsiness at some point in their professional trajectory, with 25.4% revealing such occurrences within their first year of operation. Correspondingly, data from Ukraine indicates that a considerable number (exceeding 60) of fatal accidents involving heavy motor vehicles each month are due to drivers either dozing off or succumbing to fatigue.

Distinctions can be made between the definitions of fatigue and drowsiness. Fatigue is characterized as a gradual and cumulative process, linked with a reluctance for exertion, a pervasive sense of weariness, inhibitions, impaired cognitive function, diminished efficiency, and decreased alertness. On the other hand, the term “drowsy” refers simply to a proclivity for falling asleep. Specifically, “drowsiness” denotes the transitional phase between wakefulness and the initial sleep stage. A driver experiencing drowsiness contends with the urge to stay awake, oscillating between varying degrees of alertness and drowsiness. A distinguishing feature between fatigue and drowsiness lies in their fluctuation patterns over short intervals; the former typically lacks rapid fluctuations within seconds, unlike the latter. In line with common experiences, rest and inactivity alleviate fatigue but exacerbate drowsiness.

A driving simulator (Fig. 1) was used to carry out the experiments. A seat obtained from a motor sedan, whose back was inclined at 15^0 to the vertical direction, was mounted at the centre of an aluminium platform (dimensions: 1300 mm × 900 mm × 16 mm). This allowed the participants to be comfortably seated for driving. The platform was designed to have natural frequencies outside of the 1–80 Hz range in order to avoid any confounding influence of structural vibration. The platform was suspended on four air mounting bags. A servo-controlled hydraulic actuator was fixed under the platform at the centre, allowing it to deliver a vertical (z-axis) input vibration to the platform and the seat. A 42-inch video screen was placed 1.5 m in front of the participant to display the driving scenario.

The purpose and the procedure of the experiment were verbally explained to potential participants, and consent to participate was obtained. The experiments were all conducted during the daytime, between 9 a.m. and 1 p.m. Each participant had to attend six sessions, which were held on different days. There

was one non-vibration session (control condition) and five vibration sessions. The order of the sessions differed between participants. Participants were allowed to choose the start time for the experiments but had to keep it the same for all six sessions. Before commencement, participants were instructed to assume a comfortable driving posture and to undertake minimal non-driving physical movement during the sessions. Training was given to the participants about how to properly respond to the reaction time test while simultaneously performing the driving task.

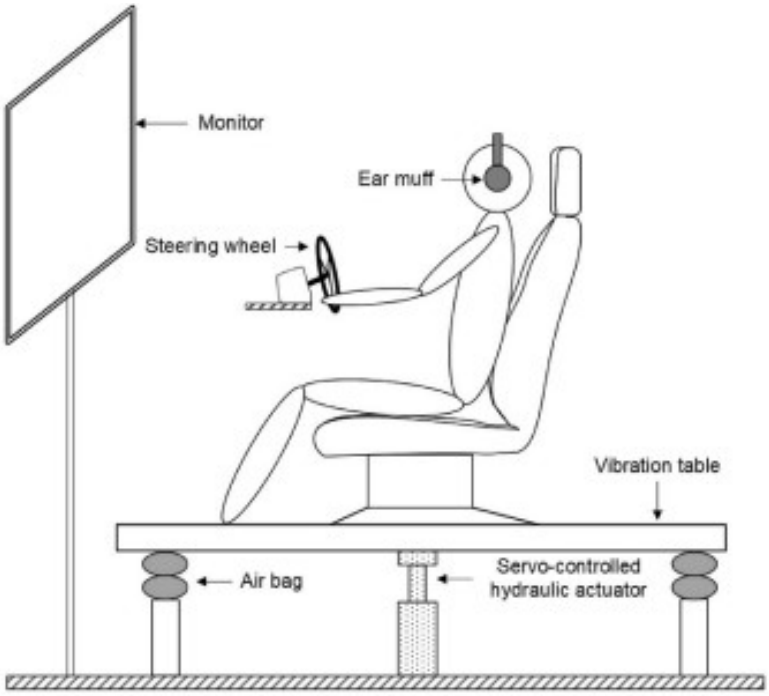

Fig. 1. The schematic diagram of the setup in the laboratory.

This study investigated the effects of vibrational frequency on driver drowsiness by the objective assessment of driving performance. The findings of the behavioural evaluation demonstrated that low-frequency vibration (1–4 Hz and 4–8 Hz) was more detrimental and faster at inducing drowsiness and slowed reaction times than higher-frequency vibration (8–16 Hz, 16–32 Hz, and 32–64 Hz). These results were supported by the subjective reports of drowsiness. The results of this study have important implications for the development of vibration-induced drowsiness contours for road safety and transport vehicle design.

REFERENCES

1. Azizan, A., Fard, M., Azari, M.F., Benediktsdottir, B., Arnardottir, E.S., Jazar, R., Maeda, S., 2016. The influence of vibration on seated human drowsiness. Ind. Health 54, 296–307.

2. Bhuiyan, M.H.U., Fard, M., Robinson, S.R., 2022. Effects of whole-body vibration on driver drowsiness: a review. J. Saf. Res. 81, 175–189.

3. Cicchino, J.B., 2018. Effects of lane departure warning on police-reported crash rates. J. Saf. Res. 66, 61–70.

4. Davidovi´c, J., Pe˘si´c, D., Anti´c, B., 2018. Professional drivers' fatigue as a problem of the modern era. Transport. Res. F Traffic Psychol. Behav. 55, 199–209.

5. Herman, J., Kafoa, B., Wainiqolo, I., Robinson, E., McCaig, E., Connor, J., Jackson, R., Ameratunga, S., 2014. Driver sleepiness and risk of motor vehicle crash injuries: a population-based case control study in Fiji (TRIP 12). Injury 45, 586–591.

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DESIGN OF WOODEN STRUCTURES TO ENSURE STABILITY AND SAFETY DURING A FIRE EVENTS

With growing public interest in sustainable building and with the addition of “mass timber” Construction Types IV-A, IV-B, and IV-C to the 2021 International Building Code (IBC), design professionals are increasingly required to design mass timber building elements to fire-resistance ratings prescribed by the IBC. While many members of the public, and even building design professionals at times, associate wood construction with inherent fire risks, it is feasible and can even be cost-effective to design wood structures for resilience and safety during fire events.

Specialty engineers and architects routinely handle fire protection design. This standard of design is effective and sensical for non-combustible structural materials as many commercially available products can be used to directly obtain a time-based fire-resistance rating. On the other hand, combustible materials, such as wood, used in building structures are not typically covered with sprayed fire-resistant materials and are often intentionally exposed for aesthetic purposes. The charring of a structural wood member, as well as the associated reduction of the member’s cross-section and material properties, necessitates the involvement of a structural engineer.

To properly protect wood structural connections, one must first understand char depth, effective char depth, and char contraction. Wood members exposed to fire develop a char layer that extends into the member cross-section over an exposure time. This char layer can, in turn, act as an insulator for the member, slowing char growth over time. Due to the insulative properties of the char layer, a linear growth rate tends to underestimate char depth under short time frames and overestimate char depth under longer time frames.

Cross-laminated timber (CLT) manufactured with certain adhesives exhibits different char growth behavior due to the tendency for char to fall off as the char depth approaches the glue line. This fall-off behavior leads to a speed up and a slowdown of charring encom. New fire test protocols have been developed and are included in Standard for Performance-Rated Cross-Laminated Timber, to ensure adhesives used in CLT will not result in this behavior.

For determining the fire-resistance rating of a structural member, this conservatively increased loss of structural section is all that is required. However, it becomes necessary to consider the effects of char contraction when unbonded members abut, such as at structural connections or where wood trim is used as an insulative protective layer.

As wood members exposed to fire begin to char, the charred wood shrinks such that the volume occupied by the charred member is less than the original volume of the wood before fire exposure. In fact, the actual thickness of char is approximately 70% of the calculated char depth. This gradual member shrinkage is termed char contraction. Char contraction plays a critical role in determining the fire protection of connections. For two abutting but unbonded members, the joint between the two members grows as char contraction occurs at the abutting corners. The gap that forms at the joint reveals the initially protected faces and allows ignition to occur increasingly at the location where the unbonded members meet. At these abutting edges, recommends using a depth of ignition into the formed gap of twice the calculated approximate char depth (Fig. 1).

Understanding char depths and char contraction make it possible to determine protection times for wood member connections. The presents multiple ways to add time to the fire-resistance rating of wood structural members and to protect connections by adding sacrificial wood, type X gypsum board, or non-combustible materials such as mineral wool or fiberglass insulation. These materials can be used in combination, and their impacts on the fire-resistance times can be considered directly additive.

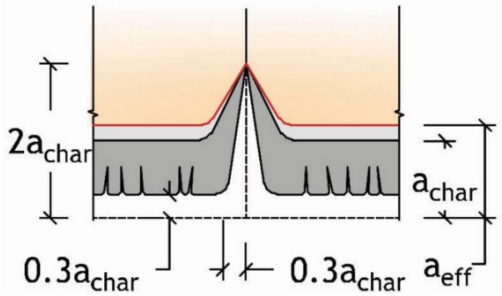

Fig. 1. Char Contraction at Unbonded Abutting Wood Members

Consider the detail in Figure 2, where two similar fire protection designs are used to protect a CLT floor-to-wall connection. This detail shows the char pattern for a 90-minute exposure on each protection scheme (dark gray represents char). The design on the left incorrectly neglects the effects of char contraction; thus, the steel angle becomes exposed to increased temperatures prior to 90 minutes. The design on the figure's right correctly protects against the effects of char contraction between the CLT wall and the 2×12 protection by adding a nominal 2×2 trim piece and successfully providing a 90-minute fire-resistance rating.

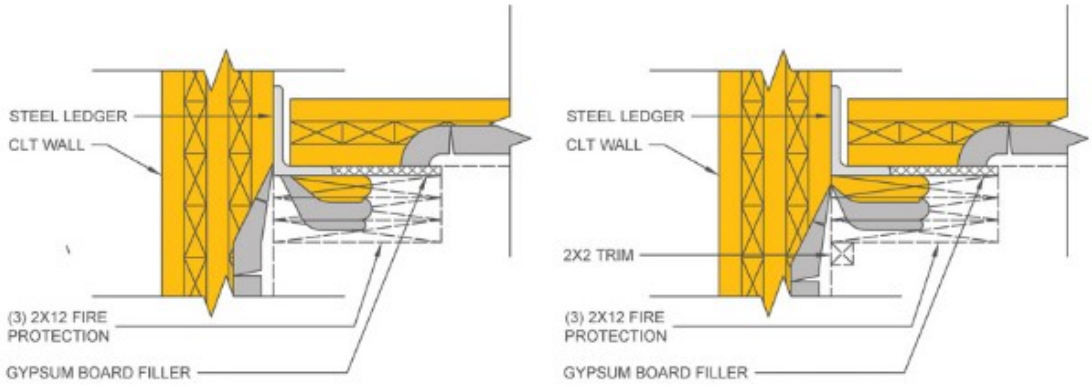

Fig. 2. Effects of Char Contraction on Differently Protected Steel Ledgers

Type X Gypsum Board can also provide fire protection for wood structural members and connections. To establish a fire protection time with gypsum board, a designer should use regulatory values. These values can be directly added when multiple layers of gypsum board are used to protect a structural member or connection. Type X gypsum board can be used for the protection of structural members and connections or, as it has been traditionally used, for the protection of structural assemblies such as a series of floor joists or wall studs.

For the base layer of thermal protection of the gypsum board, which is the layer adjacent to the steel being protected, the time of thermal separation shall equal the time of protection multiplied by 0.50.

As the carbon-neutral and sustainable design market continues to grow, there is an increasing need for structural engineers who can design wood structures for the fire-resistance ratings required by the IBC. Company's are excellent resources for engineers designing mass timber elements and their connections where fire-resistance-rated members and assemblies are required.

REFERENCES

1. Xiao Na. Effects of Complex Flame Retardant on the Thermal Decomposition of Natural Fiber [Text]. United States: Bio Resources. 2014. Vol 9, No 3 pp. 4924-4933.
2. Nine Md J. Graphene-Borate as an Efficient Fire Retardant for Cellulosic Materials with Multiple and Synergetic Modes of Action [Text]. School of Chemical Engineering, The University of Adelaide, ACS Appl. Mater. Interfaces, Australia. 2017. 9 (11). pp. 10160–10168.

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ANALYSIS OF POSSIBLE WATER CONTAMINATION RISK, POTENTIAL THREATS TO USERS' HEALTH

Water consumption and supply play an integral role in our modern daily lives. Water pollution can pose a serious threat to human health and the environment. A detailed analysis of potential water contamination risks is crucial for ensuring the safety and quality of water for consumers.

Identification of Pollution Sources: a thorough examination of pollution sources, such as industrial wastewater, agricultural discharges, municipal waste, and other factors that could negatively impact water quality.

Evaluation of Chemical and Bacteriological Indicators: determining the concentrations of chemical substances and studying bacteriological indicators in water to identify potential hazards to user health.

Analysis of Contamination Pathways: studying possible pathways through which contamination may enter the water supply system and identifying vulnerability points in this process.

Development of Monitoring Systems and Preventive Measures: implementing effective monitoring systems for timely detection of changes in water quality and devising strategies to prevent contamination.

Establishment of Quality Parameters: setting parameters that serve as indicators of water quality and determine its safety for consumers. This may include chemical, physical, and bacteriological indicators.

Adoption of Modern Monitoring Technologies: identifying and implementing modern monitoring technologies, such as sensors, IoT solutions, and automated data collection systems, to obtain real-time and accurate information about water quality.

Creation of a Centralized Monitoring System: developing a centralized system that ensures reliable data collection and analysis from various monitoring sources. This may include sensor networks, laboratory measurements, and data from consumers.

Development of Algorithms and Software for Anomaly Detection: creating algorithms and software for detecting anomalies and unusual changes in water quality, enabling prompt responses to potential threats.

Implementation of Alarm Systems and Rapid Response: developing an alarm system that automatically notifies relevant authorities in case of critical anomalies and ensuring swift responses to water contamination.

Analysis of Monitoring Results for Prevention Strategies: analyzing monitoring results to develop strategies for preventing water contamination. This may involve optimizing purification processes, regular maintenance of infrastructure, and effective risk management.

Involvement of the Public and Consumers: engaging the public and consumers in the monitoring system through informational campaigns, providing access to results, and promoting awareness of the importance of preserving water quality.

Regular Updates and Improvement of Monitoring Systems: continuously updating and enhancing monitoring systems and prevention strategies based on collected data and advancements in technology.

Conclusion. Research into potential water contamination risks highlights the critical role of thorough analysis and monitoring in ensuring water supply safety and user health. Implementation of effective preventive measures and responses helps preserve water as a vital resource and ensures water consumption safety.

It is recommended to further advance monitoring technologies, introduce innovative water purification methods, and enhance education on the importance of responsible water resource preservation and usage [1,2,3].

REFERENCES

1.Wismar, M.; Blau, J.; Ernst, K.; Figueras, J. The Effectiveness of Health Impact Assessment Scope and Limitations of Supporting Decision-Making in Europe; World Health Organization, Regional Office for Europe: Geneva, Switzerland, 2007. [Google Scholar]

2.Adimalla, N.; Li, P.; Venkatayogi, S. Hydrogeochemical Evaluation of Groundwater Quality for Drinking and Irrigation Purposes and Integrated Interpretation with Water Quality Index Studies. Environ. Process. 2018, 5, 363–383. [Google Scholar] [CrossRef]

3.Li, P.; Li, X.; Meng, X.; Li, M.; Zhang, Y. Appraising Groundwater Quality and Health Risks from Contamination in a Semiarid Region of Northwest China. Expo. Health 2016, 8, 361–379. [Google Scholar] [CrossRef]

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DEFORMATION OF PALMAR HAND MEASUREMENTS IN A POWER GRIP BY WRIST ULNAR/RADIAL DEVIATION

An ergonomic power-grip handle designed by considering hand measurements, grip postures, and task characteristics can enhance productivity and usability in power-grip work. Power grips are widely used in various contexts, including manufacturing (e.g., hammering and drilling), vehicle operations (e.g., flight stick maneuvering), and daily living product uses (e.g., cooking and vacuum cleaning). The design of a grip that considers users' preferred grip postures, hand measurements, task characteristics, and usage environments can enhance fit, comfort, satisfaction, and motion efficiency. Additionally, it can increase productivity by inducing proper use of force and reducing physical workload on the upper extremity.

Several studies have investigated the optimal size of power grip for various cylindrical shapes and non-cylindrical shapes of grips by applying hand measurements, such as finger length ratios, and grip postures. Proposed a grip design for a vaginal ultrasound probe by applying finger length ratios to grip circumferences of designated grip sections and reported that the newly proposed grip design improved subjective satisfaction by 13.3%, wrist movement convenience by 2.5%–13.5%, and reduced muscular load by 0.4%–1.3%, compared to the existing grip design. Furthermore, suggested the optimal circumference of a pistol grip by analyzing hand dimensions and contact length and identified that the grip design based on contact length analysis increased usability in terms of perceived comfort and force distribution compared to the existing grip design. Next, measured grip force and contact area of cylindrical handle grips with various diameters (38–83 mm) and proposed an optimal handle diameter design equation based on finger segment length to maximize grip force. Lastly, developed an anatomically shaped power grip handle using discrete cylindrical handle grip postures and hand shapes applied with optimal handle diameter design equations by finger and reported that the newly developed

handle increased contact area by 25%, fit by 35%, grip comfort by 61%, and overall comfort by 54%, compared to the cylindrical handle.

The grip width, grip height, and grip circumference were identified for each finger in the present study as key design dimensions of a power grip. The cross-sectional shape and size of a power grip can significantly affect force exertion, operating posture, and grip comfort when using a hand-held product. A power grip was divided into four cross sections for the four fingers (index, middle, ring, and little fingers; Fig. 1a) and the cross-sectional shape and size of the grip for each finger were represented by the corresponding grip width, grip height, and grip circumference (Fig. 1b).

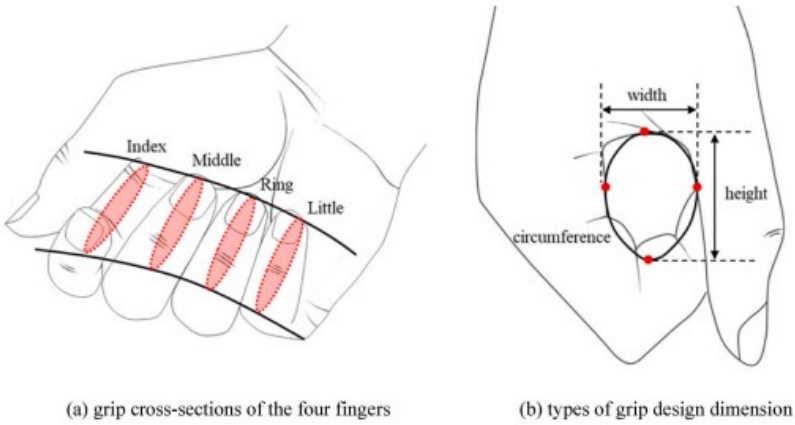

Fig. 1. Power grip design dimensions.

In this experiment, aimed at measuring the palmar hand dimensions by wrist posture, several instruments were utilized, including (1) an angle adjuster for the wrist, (2) a fixture for the elbow, (3) an electrical goniometer, (4) casting material, and (5) a hand scanning system, as shown in Fig. 2. The angle of wrist abduction/adduction of the participant was controlled using an angle adjuster with a stick, while the elbow was fixed at 45 degrees of flexion using an elbow fixture. The stick angle adjuster consisted of a stand with an adjustable handle (diameter = 15 mm) in angle and height to control the radial/ulnar deviation of the wrist in accordance with an experimental condition. The angle of the stick adjuster was controlled using a digital goniometer to ensure that the wrist angle was maintained at the designated angle during the experiment.

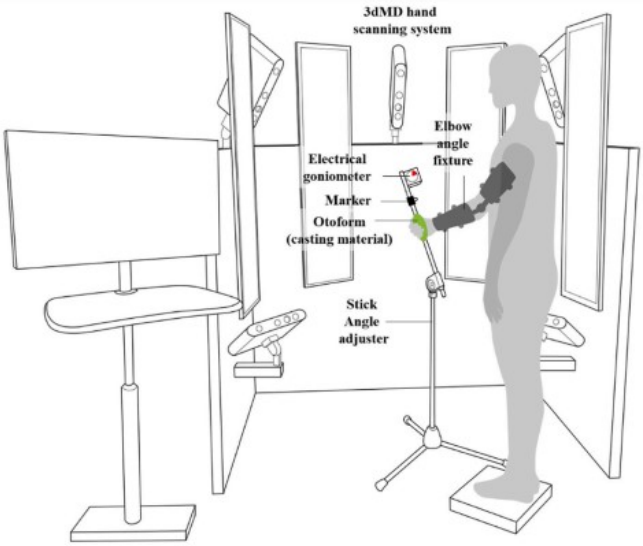

Fig. 2. Experimental layout for palmar hand dimension measurement.

The findings demonstrated the significance of measuring the palmar hand dimensions for grip design, overcoming the limitations of previous studies focused on cylindrical handles. The study identified preferred grip dimensions, including width, height, and circumference, considering finger type, hand size, and wrist posture. The study recommended tapered grip shapes to accommodate wrist radial/ulnar deviations and provided insights for designing grips that accommodate wrist posture variations and hand size. It also highlighted the influence of hand size on palmar hand dimensions, indicating proportional decreases in grip width, height, and circumference with increasing hand size. Future research is needed to explore additional hand postures, evaluate grip performance objectively, and consider diverse populations.

REFERENCES

1. Gonzalez, ´ A.G., Salgado, D.R., Moruno, L.G., Ríos, A.S., 2018. An ergonomic customized tool handle design for precision tools using additive manufacturing: a case study. Appl. Sci. 8 (7), 1200.

ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ

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NEXT GENERATION OF STRUCTURAL HEALTH MONITORING SYSTEM BASED ON AUTOMATION APPROACH

Nowadays the world is moving towards informatization, digitization and it can be seen on the example of Ukraine. The use of information technologies in the construction sector, in particular, for the task of Structural Health Monitoring (SHM), allows to obtain the high-quality information about the state of the object in real time scale. SHM has been a subject of study for over thirty years. During this time a lot of research has been carried out, prototypes of systems have been built, and working solutions that fulfil the task of monitoring have been built. Development of automated SHM is a new step in the development of this technology.

Modern SHM system at the hardware level is based on wireless sensors which are also called as sensor node. The sensitive element of the sensor for building monitoring is usually a 3-axis accelerometer, that allows us to measure acceleration along all axes X, Y, Z. Such digital accelerometers as LIS3DSH, ADXL362, MPU6050, KX023, MPU9255 can be used in monitoring systems too.

The core of the sensor is a microcontroller that must support modern communication protocols based on the IEEE 802.15.4 standard, such as: Bluetooth, Zigbee, Loravan. In addition, the selected microcontroller must have sufficient computing to execute the user program.

To implement an automated approach, it is necessary to use the appropriate data processing algorithms. In general, the damage identification process can be divided into four sublevels. [1]

1. Detection allows you to get information about the presence of structural damage:
   - 1.1. Selection and placement of a wireless sensor;
   - 1.2. Collection of raw raw data;
   - 1.3. Transfer of data to an intermediate node or to a data processing server;
   - 1.4. Data processing and management;
   - 1.5. Monitoring of processed data;
   - 1.6. Making a decision about the current state of the object;
2. Localization is the obtaining of damage location in structure;
3. Degree is the obtaining of a certain metric of the damage severity and/or recommendations for inspection and maintenance;
4. Forecast is the ability to predict probable losses.

Certain data processing algorithms are used at each clarification data level. If the main goal of the system is the use of cheap element base, real-time monitoring and fast system implementation, then you should use statistical methods such as Chi-squared distribution, Euclidean space, Mahalanobis distance, Cluster analysis.

But if it is necessary to create an accurate system and there is enough time to collect data and current state information is available for training, then you can use more powerful methods such as Neural Networks (single, multilayer, convolutional, recurrent). [2]

The obtained results make it possible to spread the concept of automation in SHM. It allows the use of arrays of wireless sensor networks for the purpose of automatic adjustment and autonomous decision-making regarding the current situation. The resulting developments can be used for the educational process.

In addition, SHM can be used as a system for post-emergency situations that occurred as a result of the impact of various elements due to natural disasters, hitting rockets, etc. SHM system is very useful when it is necessary to assess the condition of the building for cases of dismantling rubble and rescuing people.

REFERENCES

1.А.В. Басько, О.А. Пономарьова. Методологія проектування автоматичної системи структурного моніторингу технічного стану будівель та споруд. Вісник Вінницького політехнічного інституту. 2022, №4, С.64–71.

2.An Introduction to Statistical Learning / G. James та ін. Cham: Springer International Publishing, 2023. URL: https://doi.org/10.1007/978-3-031-38747-0 (дата звернення: 26.02.2024).

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AUTOMATED CONTROL OF AIR-DUST MIXTURE PARAMETERS DURING THE GRINDING OF CEMENT CLINKER

The production of cement requires intensive aspiration in the operation of cement mills to increase the productivity and preserve the environment because the dust emitted is hazardous to all living beings. Cement dust and its compounds have harmful effects on the respiratory system; excess exposure can lead to diseases in the upper parts of the lungs and negatively impact the skin and eyes. Prolonged interaction with the dust in the human body can result in chronic conditions such as respiratory tract inflammation and may lead to illnesses like influenza, bronchitis, tracheitis, and even certain forms of cancer. [1] Therefore, it is crucial to purify the air as soon as possible after the grinding of Portland cement.

The regulation of the air-dust mixture density before the aspiration shaft depends on its size. The velocity of the mixture within the shaft in the range of 1-1.5 m/s is allowed for the settling of one-fifth of the total dust and for creating normal conditions for further air purification in cyclones and bag filters. In the shaft, the mixture velocity enables the retention of one-fifth of the dust, establishing normal conditions for the subsequent air purification in cyclones and bag filters.

To assess the efficiency of aspirated air purification, a literature and patent search was conducted. As a result, a copyright sertificate was found. It is proposed to use a photodetector to determine the concentration of the air-dust mixture. [2] The operation of the photodetector is based on the photoelectric effect, comparing the amount of scattered light with the light passing through clean air. This sensor is suggested to be installed on the technological pipeline at various cleaning stages: before the aspiration shaft, after cyclones and after bag filters. Subsequently, all measurements are transmitted to the microprocessor controller MIK-52 and the computer.

By utilizing photodetectors and a hardware-software complex based on the microcontroller MIK-52 at different stages of aspirated air purification, control over the quality of purification can be achieved and the efficiency of the system in the production of Portland cement can be determined.

REFERENCES

1.P.A. Kouzov. Fundamentals of the particle size distribution analysis of industrial dust and crushed materials. Khimiya Publishing House, 1987. 264 p.

2.A.S. No. 972341 / Photometer / B.I. No. 41, 1982 / E.P. Popechitelyev, B.I. Chigirev.

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BIM TECHNOLOGIES IN CONSTRUCTION AND DESIGN ON THE EXAMPLE OF A SKETCH PROJECT OF A RESIDENTIAL BUILDING

BIM technologies in construction and design is a very important topic today. This tool for designing is very important to those of you who would like to start using new soft for modern and accurate designing.

Considering the current realities of Ukraine, the field of construction and design needs high-tech, modern and effective tools for architects and engineers. The design process can contain many mathematical operations of the same type that can be automated by certain means. Autodesk Revit software can serve as such a tool. The program was created for designing, documenting, coordinating, managing the presentation of architectural projects. [1,2] If an architect or a construction engineer can remove the need to "manually" solve many of the same type of computer problems, then he will free up time and resources for more complex, creative and unusual work.

As an example, a sketch project of an apartment building with six floors. The structural scheme is a reinforced concrete frame with monolithic columns, floor slabs and stairs. The foundation is piled with gratings. The outer walls are made of:

-Ceramic brick, b=250mm;

-Insulation, basalt wool, b=150mm;

-Hinged facade subsystem, b=80mm;

-Cladding with facade ceramic granite tiles, b=20mm.

Internal partitions are made of aerated concrete blocks with a thickness of 200 mm. The roof is flat, inverted, insulated.

The sketch project was performed in the Revit. The software allows you to simultaneously create a digital 3D model of the building, 2D drawings of plans, facades, sections and nodes. This provides an opportunity to exchange tasks and materials with such specialists as:

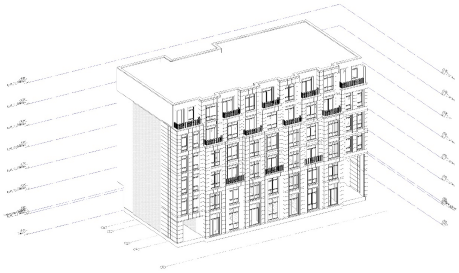
-Civil engineer (designer), providing a digital 3D model of the building with load-bearing structures;

-Designers of engineering networks (water supply, sewerage, electricity, heating, ventilation, etc.), providing a digital 3D model of the building, indicators of volumes and areas of premises, which are calculated automatically by the program;

-3D visualizers. They will receive a digital 3D model of the building, in which every design, element of decoration, facade, landscaping contains information about the visual and physical-physical properties of materials (color, texture, reflection and absorption of light);

-Sales and Customer Service Department. These departments will receive up-to-date information about the design object in the form of drawings, 2D and 3D (see image 1) building schemes;

-Estimate department. They receive information, specifications and tables of general construction materials for the project.



Pic. 1. 3D scheme of the house

Conclusions. Modern problems require modern solutions. BIM technologies in building design solve many similar, straightforward problems. This allows architects and engineers to devote more time to more complex tasks. The fast automated operation of the BIM programms allows to check quickly several options and to choose more economical, technological and up-to-date solution. Such tools help to create more economical, more accurate projects and as well as to build perfect structures.

REFERENCES

1.Salman A., Khalfan M., Maqsood T., Building information modeling (BIM): Now and beyond [electronic resource]. Australasian Journal of Construction Economics and Building, 12 (4) 15-28 URL:https://www.researchgate.net/publication/272491129_Building_information_modeling_BIM_Now_and_beyond

2.Jordani, M. (2010) 'BIM and FM: The Portal to Lifecycle Facility Management', Journal for Building Information Modeling, Spring 2010, 13-16

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OPTIMIZATION OF ORIENTATION IN THE SPACE OF SOLAR PANEL

More than 2 billion people on the planet still rely on coal, wood, oil, and gas for both cooking and heating their homes. Today, the implementation of alternative energy sources, autonomous and decentralized, is more advantageous in many countries, both economically and environmentally. Fossil fuels are becoming yesterday's energy source. Today, other forms of future energy are appearing and one of them is solar energy. Solar power is considered to be one of the most promising directions for obtaining clean electrical energy for consumer power supply, Solar power is. It's development is driven by both purely economic factors, such as constantly rising prices for traditional sources like coal, oil, peat, and gas, and environmental concerns. Eastern Europe is a sunny region, that is why the application of solar photovoltaic panels is particularly relevant here.

A solar photovoltaic system is a solar power station that utilizes the direct conversion of solar radiation energy into electricity. The installation consists of a set of solar modules (panels) placed on a supporting structure or on the roof of a residential building, battery storage, charge-discharge controller, and an inverter for converting DC to AC voltage when necessary. Despite all the advantages of using solar panels, such technologies have certain drawbacks, particularly caused by their dependence on the level of illumination. Solar energy systems are often stationary and therefore operate differently at different times of the day.

The sun does not remain stationary relative to the horizon. Every day it rises and sets, and it occupies different positions in the sky throughout the day. Its position also varies depending on the season. In winter, the sun rises lower, and in summer it rises higher. This fact significantly affects the generation of solar electricity. [1,2] For the most optimal positioning not only during the season but also throughout the day, solar trackers, a movable structure that automatically determines the best position for solar panels and sets it independently, are used. The advantage of solar trackers is the automatic positioning, which allows to achive maximum electricity generation output.

In industrial applications the ground-mounted solar power stations (SPS) with dual-axis trackers and actuators the movable devices for controlling in two axes - changing the tilt angle and azimuth, are used to adjust the optimal tilt angle of the panel with achievements of the highest efficiency of the SPS at the moment. [1,2]

The factors mentioned above lead to the conclusion that, for achieving maximum electricity generation, it is necessary to maintain the optimal arrange angle of the SPS panel towards the sun and also to position the SPS panels towards the sun throughout the day (from sunrise to sunset). Maintaining the optimal position of the solar panel can be achieved by using an automatic system for optimal positioning of solar panels in space. The solution of the above mentioned problem is given in various literary sources such as textbooks, manuals, articles, patents, copyright certificates. [1,2] The application of solar trackers, especially dual-axis ones equipped with automatic adjustment systems for optimal positioning of solar panels in space, is quite costly, as it involves complex technical means requiring qualified maintenance.

One way to reduce costs and to simplify the tracker and control system design is to use a single-axis tracker and to utilize the concept of the "unique angle," which remains fixed throughout the year. This angle is determined separately for each region and it depends on the angle at which solar energy generation will be maximum. If the angle remains fixed regardless of the sun's position, only a small portion of the generated electricity will be lost. To avoid losing this generation, the angle is adjusted depending on the season: panels are lowered during warm seasons and they are raised during cold seasons.

When using a single-axis tracker, it is advisable to perform adjustment using fuzzy logic control. The software and technical capabilities of the Matlab application package are allowed to create the optimal control system for positioning solar panels in space. Since the control system involves the use of a microcontroller, it is advisable to use fuzzy control model for positioning the solar panel in the FCL (Fuzzy Control Language) notation as outlined in the IEC 1131-7 Standard. The FCL language is developed for representing fuzzy control models of programmable logic controllers (PLCs) in the form of structured text that can be interpreted as a high-level language program. The algorithm for the operation of the solar battery using the Matlab software package is provided below.

When developing a program, the Mamdani algorithm is adopted as the fuzzy inference algorithm. Additionally, it is assumed that the model will receive a digital signal from the zenith angle sensor of the solar panel proportional to the zenith angle in degrees. Furthermore, as it is provided in publications, utilizing the optimal values of the zenith angle, which is in the interval from 35° to 45°, the following values are accepted: optimal is 40°, minimum is 35°, maximum is 45°. The output of the system will be the actual value of the zenith angle of the solar panel rotation. To form the rule base of the fuzzy inference system, the input and output linguistic variables are defined in advance: β1 is a "current zenith angle of rotation"; β2 is a "desired zenith angle of rotation."

The fuzzy control model was constructed according to the following rules:

RULE 1. If the "zenith angle is greater than 45°", then "the executive motor of the tracker device should be activated in the direction of a large decrease in the angle";

RULE 2. If the "zenith angle is greater than 43°", then "the executive motor of the tracker device should be activated in the direction of a small decrease in the angle";

RULE 3. If the "zenith angle is 40°", then "there is no need to activate the executive motor of the tracker device";

RULE 4. If the "zenith angle is greater than 37°", then "the executive motor of the tracker device should be activated in the direction of a small increase in the angle";

RULE 5. If the "zenith angle is greater than 45°", then "the executive motor of the tracker device should be activated in the direction of a large increase in the angle";

By accumulating the rule conclusions using the MAX method and employing the Center of Gravity (COG) method as the defuzzification method, a fuzzy control model for positioning the solar panel can be expressed in FCL notation.

REFERENCES

1. Renewable Energy Sources (Polish Experience for Ukraine): educational manual / R. Titko, V. M. Kalinichenko. – Warsaw; Krakow; Poltava: OWG, 2010. – 530 p.

2. Uzhelovskyi V. O., Uzhelovskyi A. V., Tkachov V. S., Satanovskyi D. S. Simulation Model of an Automated Tracking System for Increasing the Efficiency of Solar Panel Systems Utilization. Proceedings of the Third Scientific and Practical Conference of PSACA Students, April 26, 2021, Dnipro: PGASA, 2021. – 250 p.

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THE IMPACT OF MODERN TECHNOLOGY AND ARTIFICIAL INTELLIGENCE ON STYLE IN ARCHITECTURE IN RECENT HISTORY

Changes in architectural thought under the influence of time and newly invented technologies.

At the moment, artificial intelligence (AI) is being introduced into more and more fields. This has also affected construction and architecture. AI is now already helping to design buildings, interiors, making drawings of these buildings, making calculations, etc.

AI is being used to streamline workflows, add efficiency, and assist in decision-making processes within the architectural profession. It has the potential to revolutionize the industry by providing decision support systems for building regulations compliance and enhancing the overall architectural process.

The use of technology in architecture has expanded over the years, with mainstream tools such as Computer Aided Design (CAD), Building Information Modeling (BIM), virtual reality, augmented reality, 3D printing, and machine learning playing vital roles in the design and construction of infrastructure.

AI is seen as an indispensable tool that enriches the field of architecture with innovative designs, blending classical aesthetics with futuristic design. It is expected to shift, rather than replace, human roles in the field, leading to major changes in architecture.

We can't be completely sure how AI will influence architectural thought, where architectural art will turn. Perhaps post-modernism will get a new breath, an influx of thoughts, or maybe abstractionism or hi-tech will have a leading role. In theory, we can expect the return or revival of styles that are no longer used, unpopular styles or compilations of once super-popular styles such as neoclassicism, baroque and gothic.

But it's still worth arguing that the benefits of artificial intelligence are inestimable and obvious. AI optimises many processes, thus speeding up work and at the same time removing a sufficient number of problems that arose earlier. Now human hands can be freed up and by putting the simplest tasks on the shoulders of artificial intelligence, they can do things that humans have never been able to do before. Although it all comes down to the same creation of new things for the sake of progress and so on until humanity stops itself.

REFERENCES

1.Holocomb Durkovic. The Influence of Artificial Intelligence on Modern Architecture // May 18, 2022. URL: https://thehdgroup.com/the-influence-of-artificial-intelligence-on-modern-architecture/

2.Architecture. Artificial Intelligence: how are architects using AI right now and what are they using it for? // 29 February 2024. URL: https://www.architecture.com/knowledge-and-resources/knowledge-landing-page/artificial-intelligence-in-architecture

Medium (James Senibi). The Role of Technology in the Architecture of the 21st Century // Dec 7, 2019. URL: https://medium.com/@senibijames/the-role-of-technology-in-the-architecture-of-the-21st-century-3dd301e9dc50

3.Iransition (Aleksandr Ahramovich). Artificial intelligence in architecture:

4.10 use cases and top technologies // August 15, 2023. URL: https://www.itransition.com/ai/architecture

Achdaily. The Impact of AI Tools on Architecture in 2024 (and Beyond) // December 06, 2023. URL: https://www.archdaily.com/1009545/the-impact-of-ai-tools-on-architecture-in-2024-and-beyond

5.Shnackel. AI's Impact On The Future of Architecture // March 14, 2023. URL: https://schnackel.com/blogs/ais-impact-on-the-future-of-architecture

6.Achdaily. Artificial Intelligence: The Latest Architecture and News // march 14, 2024. URL: https://www.archdaily.com/tag/artificial-intelligence

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THE IMPACT OF THE INTERNET OF THINGS ON EVERYDAY LIFE AND INDUSTRY

The Internet of Things (IoT) has become a game changer in the technology landscape, revolutionizing the way we live, work and interact with the world around us. [1]

What is the Internet of Things (IoT)? The Internet of Things (IoT) is a technological revolution that encompasses a vast network of connected devices, allowing them to communicate and exchange data with each other. [1] This interconnected network extends beyond traditional Internet connections between computers and smartphones to include everyday objects. [2]

The Internet of Things can change our daily lives in ways we never imagined. At its core, the Internet of Things is a network of physical objects equipped with sensors, software and communications that allow them to collect and exchange data. [1] These objects can range from everyday devices such as smartphones, smart home appliances, and wearable devices to more complex systems such as industrial equipment and smart city infrastructure. [1]

From increasing convenience and efficiency to increasing security and sustainability, Internet of Things promises to transform our daily lives and improve our quality of life. [1] For example, smart home appliances can automate tasks, wearable devices can track health indicators, and smart city infrastructure can improve city life. [1]

The Internet of Things is also part of the Fourth Industrial Revolution, transforming industries through the creation of smart cities and, in the future, self-driving cars. [2] It is changing the way businesses operate by offering greater connectivity, resulting in increased accuracy, safety and efficiency. [3]

For example, soil moisture sensors are used to optimize farmers' yields, while thermostats and thermometers are changing the way we live and work. [2] In fact, according to McKinsey [2], in 2019, about a quarter of enterprises used Internet of Things technologies.

While exploring the exciting potential of the Internet of Things, it is important to address the challenges and implications arising from this technological revolution. Security concerns, privacy concerns, and the need for standardized protocols are just some of the challenges that must be overcome to reap the full benefits of IoT. [1]

In conclusion, the Internet of Things is changing various aspects of our lives and industries, promising a future that is more convenient, efficient and sustainable. However, it also brings with it challenges that must be overcome in order to fully realize all the opportunities. [1]

REFERENCES

1.Straight N. What Effect Will The Internet Of Things (IoT) Have On Our Daily Lives? \\ ROBOTS.NET 2023 URL: https://robots.net/tech/what-effect-will-the-internet-of-things-iot-have-on-our-daily-lives

2.Marchant N. What is the Internet of Things? \\ WORLD ECONOMIC FORUM 2021 URL: https://www.weforum.org/agenda/2021/03/what-is-the-internet-of-things

3.How IoT is Changing Every Industry \\ BBC URL: https://www.bbc.com/storyworks/internet-of-things/how-iot-is-changing-every-industry?obOrigUrl=true

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OPTIMIZATION OF ENERGY AND CARBON FOOTPRINT THROUGH THE IMPLEMENTATION OF BUILDING INFORMATION MODELING (BIM) DIGITAL TWINS

Problem Statement. Modern construction is one of the largest consumers of energy and a significant source of greenhouse gas emissions, which significantly impacts climate change and poses a threat to sustainable development. The issue of energy efficiency and carbon footprint has become urgent, demanding the implementation of new technologies and methods to address it. The use of building information modeling (BIM) with the application of digital twins is an important approach to tackling this challenge.

Objective. The objective of this study is to conduct a comprehensive analysis and assessment of the impact of implementing building information modeling (BIM) digital twins on optimizing the energy and carbon footprint of construction projects characteristic of our country.

MainSection. The implementation of BIM technology in construction allows for a detailed analysis of building energy consumption even at the design stage [1]. BIM enables the modeling of various building solutions and determines their impact on the energy efficiency of the building before its realization. Visualization and simulation of different scenarios allow engineers and architects to find optimal solutions to reduce energy consumption during the building's operation [2].

Building information models allow for identifying potential issues with energy efficiency and carbon footprint at the design stage. Through BIM, it is possible to analyze the energy efficiency of different constructions, heating, ventilation, and air conditioning systems, as well as building insulation and the use of natural light [3]. This enables adjustments to be made to the project in its early stages, avoiding additional costs during construction and operation [4].

The analysis of materials during the design and creation of the building information model provides the optimization of the energy and carbon footprint. The results of creating such a model are reflected in the author's (master's) thesis. To build the investigated model of the residential complex in Bucha city, Autodesk Revit 2022 software was used (Fig. 1), and further analysis was conducted on the One Click LCA platform (Fig. 2). The use of this platform has permitted the assessment of the characteristics of the materials used in construction and their impact on the environment, which facilitated the selection of safer materials without compromising the mechanical properties of the object.

Figure 1. BIM model (building information model)

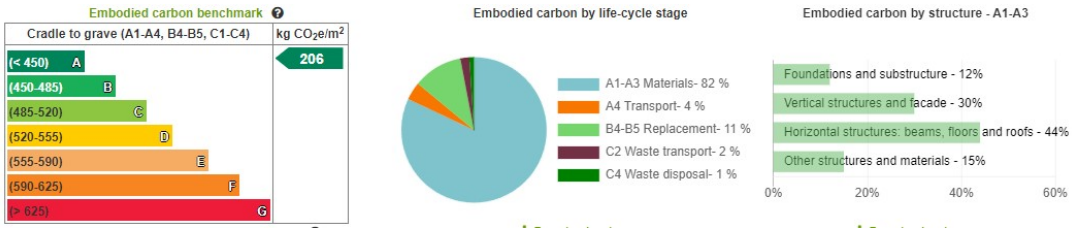

Figure 2. Results of the analysis of characteristics of materials used in construction

Conclusion. The implementation of building in formation models using BIM technology is an important step towards optimizing the energy and carbon footprint of construction projects. These technologies enable efficient resource utilization, emissions reduction, and the creation of more environmentally friendly buildings and infrastructure.

REFERENCES

1.Eastman, C., Teicholz, P., Sacks, R., & Liston, K. (2011). BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors (2nd ed.). Wiley.

2.Succar, B. (2009). Building information modelling framework: A research and delivery foundation for industry stakeholders. Automation inConstruction, 18(3), 357-375.

3.Azhar, S., Nadeem, A., Mok, J. Y., & Leung, B. H. (2008). Buildinginformationmodeling (BIM): A new paradigm for visual interactive modeling and simulation for construction projects. Proceedings of the 12th International Conference on Computing in Civil and Building Engineering, 1-10.

4. Koo, B., Hong, T., & Kuhn, T. E. (2016). Integration of building energy simulation and computational optimization for building design. Energy and Buildings, 128, 31-43.

НОВІТНІ ТЕНДЕНЦІЇ У РОЗВИТКУ НАУКИ І ТЕХНІКИ

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SOME PROBLEMS OF NUCLEAR POWER STATION IN COMBAT ZONE

The approach to the construction of nuclear power plants (NPPs) and other nuclear facilities in various regions should be reevaluated due to the events 2022-2024 in Ukraine. Specifically, a comprehensive analysis of the resilience of NPPs to potential acts of aggression should be conducted.

In history, there have been numerous cases where nuclear energy facilities, including nuclear power plants (NPPs), have been at risk. For instance, in 1981, the Israeli Air Force destroyed the heavy water reactor 'Osirak' in Iraq. During the Iran-Iraq war from 1980 to 1988, the Iraqi Air Force conducted several high-impact airstrikes and launched cruise missiles at the under-construction Bushehr Nuclear Power Plant.

The approach to the construction of NPPs and other nuclear facilities in various regions should be reevaluated [4, 5, 6] taken into account combat events 2022-2024 in Ukraine. Specifically, a comprehensive analysis of NPP resilience to potential acts of aggression must be conducted. In the new reality, where a construction or operational NPP may become a target in a military conflict, the design approaches must be revised. It is evident that the primary targets could include spent and fresh fuel storage facilities, as well as radioactive waste storage facilities [2]. Consequently, these structures should have more fortified designs. Block transformers should also be protected. A backup control room should be located outside the reactor building. The fuel reserve for emergency diesel generators should be substantial. Hazardous components, such as hydrogen receivers, should be built separately for each block and placed on the periphery, away from logistical connections. Each turbine hall should have a highly secure shelter for personnel to take refuge in and evacuate in case of a significant fire or extensive damage. NPPs should have a fully independent fire suppression system, separate from on-site power sources. The security and defense systems of both the NPP and its vicinity should be reconsidered, including protection against aerial and maritime drones, stand-off munitions, underwater saboteurs, and more.

Conclusion. All the above mentioned applies not only to 'classic' NPPs with high-capacity turbines but also to NPPs with small modular reactors [7], as well as all enterprises with hazardous operations. The safety analysis results, considering all these aspects, should be outlined in a standard safety analysis report, typically developed by the design organization

REFERENCES

1. Топчишвили М.В., Ломинадзе Т.А., Церетели И.Д.,,Тодриа В.А.,Надареишвили Г.Ш. Стратиграфия юрских отложений Грузии / Геологический институт им. А.И. Джанелидзе. Труды. Новая серия. Вып. 122, Тбилиси, 2006, 463 с.

2. Сєдін В.Л., Грабовець О.М., Ковба В.В., Ульянов В. Ю., Микало В.В. Використання гірських порід облицювання будівель ПДАБА в учбовому процесі / "Український журнал будівництва та архітектури", № 2 (002), Днепр, 2021, - С. 88-99. DOI: 10.30838/J.BPSACEA.2312.270421.88.755.

4. Гурвич Е.М. Геология в метро / Химия и жизнь, № 11, 2004, - С. 36-41.

5. Ульянов В. Ю., Ковба В.В., Грабовець О.М. / К вопросу о возрасте и видах палеофауны в мраморизованных известняках каменной облицовки учебных корпусов ПГАСиА // Наукова праця в Україні та світі (міжнародна наукова конференція). Видавництво WORLD-CONF.COM // Київ, Україна, 20 лютого 2022. с. 111 - 127.

6. Сєдін В. Л., Грабовець О. М., Ковба В. В., Ульянов В. Ю., Микало В.В. Використання гірських порід облицювання будівель ПДАБА в учбовому процесі. Український журнал будівництва та архітектури. ДВНЗ ПДАБА, 2021. № 2(002). С. 88-98.

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THE LATEST TRENDS IN THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY

The latest trends in the development of science and technology for 2024 span across various domains, reflecting significant advancements and the continuous evolution of the sector. Key areas of focus include sustainable technology, healthcare innovations, space exploration, and advancements in artificial intelligence (AI) and machine learning (ML), among others.

1. Sustainable Technology and Environmental Conservation:

- Sustainable catalysts are gaining attention for their environmental benefits and less reliance on precious metals, aiming to reduce carbon footprints significantly.
- Lithium-ion battery recycling technologies are evolving, with over 800 patents published in 2023, focusing on enhancing battery safety, durability, and reducing environmental impact.
- New energy solutions are also a prominent trend, emphasizing greener transportation and energy usage, including electric vehicles and renewable energy sources. [1]

2. Healthcare Innovations:

- The rise of biomaterials, such as bioelectronic materials for biomedical applications and 3D-printed organs, promises to revolutionize patient care and treatment methods.
- Weight-loss drugs and treatments based on CRISPR gene-editing technology, which have seen significant advancements, including regulatory approvals for sickle-cell disease treatments. [2]

3. Space Exploration:

- The global Artemis program aims to land the first woman and the first person of color on the Moon by 2025, with further plans for sustainable human presence and exploration of other celestial bodies. [3]

4. Artificial Intelligence and Machine Learning:

- Tailored generative AI models are becoming more popular, catering to niche markets and specialized needs, offering privacy and security benefits over large, generalized models.
- The demand for AI and ML talent continues to grow, highlighting the need for professionals skilled in AI programming, data analysis, and machine learning operations (MLOps). [4]

5. Robotic Process Automation (RPA) and Edge Computing:

- RPA is automating repetitive tasks across various industries, while edge computing addresses the limitations of cloud computing by processing data closer to where it's needed. [5]

6. Quantum Computing, Virtual Reality (VR), and Augmented Reality (AR):

- Quantum computing is advancing rapidly, with potential applications in healthcare, finance, and more. VR and AR technologies are increasingly integrated into training and entertainment. [6]

These trends illustrate the dynamic nature of the technology landscape, with innovations aimed at addressing environmental concerns, improving healthcare outcomes, expanding human knowledge through space exploration, and leveraging AI and ML for efficiency and personalized solutions. The continuous demand for specialized talent in these areas underscores the importance of skill development and education in driving future technological advancements.

REFERENCES

1. Behera B., Prasad R. Environmental Technology and Sustainability. India: Elsevier, 2020. 230 c. URL: https://shop.elsevier.com/books/environmental-technology-and-sustainability/behera/978-0-12-819103-3

1.SMART Materials for Biomedical Applications: Advancements and Challenges / K. Kumar та ін. // 15th International Conference on Materials Processing and Characterization (ICMPC 2023) / Northumbria University. England, 2023. C.1-8. URL: https://www.researchgate.net/publication/374505566_SMART_Materials_for_Biomedical_Applications_Advancements_and_Challenges

2.National Aeronautics and Space Administration. (2017). NASA's Artemis Moon Missions: all you need to know. URL: https://www.rmg.co.uk/stories/topics/nasa-moon-mission-artemis-program-launch-date

3.Chui M., Yee L., Hall B. та ін. // The state of AI in 2023: Generative AI's breakout year // McKinsey Global Institute. 2023. URL: https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year

4.Bajaj N. Increasing Productivity: The Effect Of Cloud Integration And Robotic Process Automation // Chemspeed Technology. 2024. URL: http://chemspeed.com

5.Skyrme T. Quantum Computing 2023-2043 // Strategic Advantages of Quantum Computing. URL: https://www.idtechex.com/en/research-report/quantum-computing-2023-2043/912

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APARTMENT HEAT POINTS AS SOLUTION FOR ENERGY EFFICIENT USE OF COOLANT

Existing heating networks do not fully meet the current requirements for regulating heat consumption in buildings. However, they contain significant potential that has to be realized in an energy-efficient manner in the near future yet [1].

The distribution and regulation of heat energy both outside and inside buildings according to demand is one of the main approaches to energy saving [1]. One of the most advanced technical solutions in this area is the use of apartment heat substations (AHS). AHS is a set of fittings and devices designed to produce hot water using heat exchanger and heat from the heating system.

The main advantages of apartment heating systems (HS) are the ability of the consumer to individually regulate the operation of the heating and hot water systems and provide convenient energy metering. Also, hot water consumption will be significantly reduced because hot water will start flowing from the tap in a few seconds and, thanks to its compact design, the hot water systems (HWS) can be installed in any convenient place (for example, instead of a classic boiler). There is also the possibility of flush mounting. The assessment shows that the costs associated with the AHS device will be recouped in up to 5 years at the current level of tariffs. After the payback period, the system with AHS will bring users net savings in operating costs with a significant increase in comfort. The heat energy savings in the operation of apartment buildings with AHS is about 20% respectively [2].

One of the possible reliable options is the use of the EvoFlat FSS apartment heat source by Danfoss, schematic diagram Fig. 1 [3]. This AHS is designed for HWS preparation and connection of a radiator heating system, designed for a maximum operating temperature of 95°C, with nominal pressure of 10 bar.

The module is supplied with such built-in components: differential pressure controller integrated into the main temperature controller (TRS-M), coarse filter, sensor couplings and mounting inserts for heat meters. Simple operation is ensured by combining the hydraulic and temperature control functions of the TRS-M controller. The TRS-M controller with integrated differential pressure controller compensates temperature fluctuations and inlet pressure drops and it always ensures the constant hot water temperature in the system.

If the apartment is designed with underfloor heating, then you can consider the EvoFlat 4.0 M by Danfoss, schematic diagram fig. 2 [4]. This apartment heat point is designed to produce domestic hot water using a flow-through heat exchanger, as well as to connect the underfloor heating circuit in a dependent manner using a mixing unit. It is also designed for a maximum operating temperature of 95°C and a nominal pressure of 10 bar.

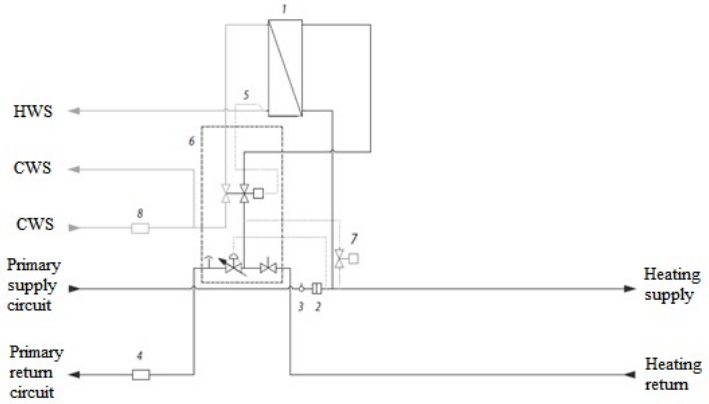

Figure 1. Schematic diagram of the EvoFlat FSS.

1 – Danfoss HB06H-1 plate heat exchanger; 2 - 3/4″ coarse filter N/Nmv=0.6 mm; 3 – sleeve for 1/2″ sensor; 4 – mounting insert for heat meter; 5 – HWS temperature sensor; 6 – hot water temperature regulator TRS-M; 7 – Danfoss FJVR bypass/circulation circuit (optional); 8 – mounting insert for 3/4″ water meter×110 mm.

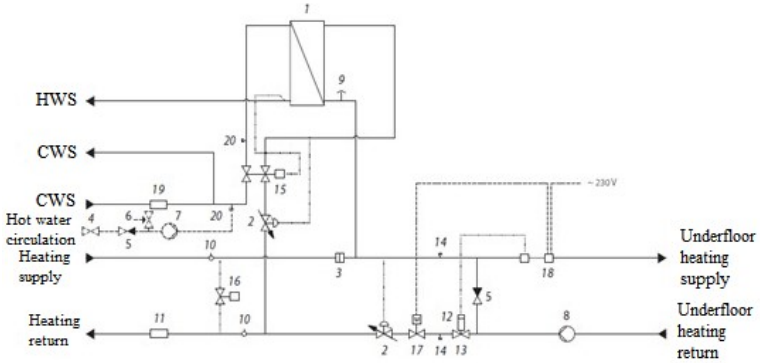

Fig. 2. Schematic diagram of the EvoFlat 4.0 M.

1 – plate type heat exchanger; 2 – differential pressure regulator; 3 – filter; 4 – ball valve; 5 – check valve; 6 – safety valve; 7 – HWS recirculation kit; 8 – pump of the underfloor heating circulation circuit; 9 – air outlet; 10 – sleeve for temperature sensor; 11 – mounting insert for heat meter 3/4″×110 mm; 12 – temperature sensor; 13 – valve of the temperature controller of the underfloor heating; 14 – pipes of the heating circuit; 15 – HWS temperature controller; 16 – summer bypass; 17 – zone valve; 18 – safety thermostat complete with TWA; 19 – mounting insert for water meter 3/4″×110 mm; 20 – HWS recirculation connection point.

The AHS is equipped with an intelligent HWS regulator that adjusts the flow volume depending on the hot water temperature and the volume of water intake. The operation of the HWS controller in combination with the differential pressure regulator ensures uninterrupted operation of the

apartment heat substation under any changes in temperature or HWS flow, as well as pressure in both the primary and secondary circuits in all operating modes. The combined regulator is designed to keep the heat exchanger cold when there is no water drawdown. This significantly reduces the heat loss from the AHS, as the heat exchanger is the largest source of heat loss.

The mixing unit ensures that the temperature of the heating medium is precisely maintained at the required level for underfloor heating between 30 °C and 50 °C.

REFERENCES

1.Pirkov V. V. Modern thermal points. Automation and regulation. K.: II SE "Such Affairs", 2008. - 252 p.

2.Heat point in every apartment: website. URL: https://www.meibes.ua/o-kompanii/articles/2012/12/03/teplovoj-punkt-v-kazhdoj-kvartire/

3.EvoFlat FSS apartment heat points. Technical description. Denmark, Danfoss Technical Documentation, 2023. – 6p.

4. EvoFlat 4.0 M apartment heat sources. Technical description. Denmark, Danfoss Technical Documentation, 2023. – 8p.

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FASHIONABLE WORLDWIDE CONSTRUCTION: TRENDS AND INSIGHTS

The construction industry is constantly evolving, adopting new technologies and trends to meet the demands of the modern world. Here are some insights into the fashionable worldwide construction trends:

3D Printing: 3D printing technology is revolutionizing the construction industry. It allows for the creation of complex structures with greater precision and efficiency. This technology has the potential to reduce construction time and costs while enabling more sustainable practices [1].

Connected Construction Sites: The use of connected technologies, such as Internet of Things (IoT) devices and sensors, is becoming increasingly prevalent in construction sites. These technologies enable real-time monitoring of construction processes, improve safety, and enhance project management [1].

Virtual Design and Construction (VDC): Virtual design and construction technologies, including Building Information Modeling (BIM), are gaining popularity in the construction industry. These tools allow for the creation of virtual environments to visualize and plan construction projects before they are built in the physical world. VDC helps improve collaboration, reduce errors, and optimize construction processes [2].

Sustainability: Sustainability is a key focus in the construction industry. Companies are adopting greener practices, such as using eco-friendly materials, implementing energy-efficient designs, and incorporating renewable energy sources. The goal is to reduce the environmental impact of construction projects and create more sustainable buildings [3].

Smart Cities: The rise of smart cities is influencing construction trends. Smart cities leverage technology and data to improve the quality of life for residents, enhance sustainability, and optimize resource management. Construction projects in smart cities often involve the integration of smart infrastructure, including smart buildings, transportation systems, and energy grids [4].

Automation and Robotics: Automation and robotics are transforming construction processes. Construction robots are being used for tasks such as bricklaying, concrete pouring, and demolition, increasing efficiency and reducing the need for manual labor. This trend is expected to continue as technology advances.

Global Market Insights: The construction industry is a global market, with different regions experiencing varying levels of growth and trends. For example, North-East Asia, including countries like China, Japan, and South Korea, has been a significant contributor to the construction market in recent years.

In conclusion, we should note that these insights are based on the search results and snippets from various sources. The construction industry is dynamic, and new trends and innovations continue to emerge as technology advances and sustainability becomes a priority.

REFERENCES

1.StartUs Insight. Top 10 Construction Trends & Innovations for 2024 // StartUs Insight. 2023. URL: https://www.startus-insights.com/innovators-guide/top-10-construction-industry-trends-innovations-in-2021/

2.Howarth J. 11 Construction Industry Trends to Watch (2024-2027) // Exploding Topics. 2023. URL: https://explodingtopics.com/blog/construction-industry-trends

3.2024 engineering and construction industry outlook / M. Meisels та ін. // Deloitte Research Center for Energy & Industrials. 2024. URL: https://www2.deloitte.com/us/en/insights/industry/engineering-and-construction/engineering-and-construction-industry-outlook.html

4.Majumder S. Staying ahead of the curve: Strategies for keeping up with the latest construction industry trends // Method. 2023. URL: https://www.method.me/blog/how-to-get-ahead-of-construction-industry-trends/

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MODERN INTERACTIVE PEDESTRIAN CROSSINGS

It is a well known fact that every year many accidents, that result in injuries and deaths, occur at pedestrian crossings around the world. That is why the British insurance company Direct Line, in collaboration with the design bureau Umbrellium, has created a "smart crossing", called Starling Crossing (STigmatic Adaptive Responsive LearningING), which will make such road sections safer for pedestrians, cyclists and motorists.

This innovative development differs significantly from traditional crossings because it is not static, it is painted on the asphalt surface and it is constantly changed in accordance with the road situation. As you know, the design of the first zebra crossings with the rules of behaviour appeared in the 1950s. Since then, such markings have remained virtually unchanged, but today, in the 21-st century, roads are significantly different from the roads of the 20-th century.

How does Starling Crossing work? This system uses machine learning to make roads safer and the first prototype of such crossing has now been created on the territory of a television studio in London. The idea to create such a prototype became a necessity for testing different road situations, such as how a digital zebra would react to a cyclist approaching the intersection, to a truck being in a blind spot or to a child running out into the road. The Starling Crossing technology is not just white paint applied to the road surface, but a complex system of video cameras, computer algorithms and multi-coloured lights that signal pedestrians about their behavior in a given situation. These LEDs are protected from damage by special high-strength steel and plastic covers. Video cameras capture images of road users, after which artificial intelligence performs calculations and determines the current risks and then chooses what shape and colour of markings should be shown to the pedestrian at the moment. Three familiar colours are used

for this purpose on the road - white, red and green. Each of them sends a signal about how pedestrians should behave, where dangerous sections of the road are located and where they are safe. These sounds are quite understandable in reality and all the patterns that appear on the asphalt are intuitive and unmistakable.

And, of course, the speed of the Starling Crossing system is impressive, responding to the changes in road conditions in 0.01 seconds. It's enough time to respond properly to instantly changing conditions. But if there are a lot of people on this interactive zebra during "rush hour", it automatically expands and begins to zone pedestrian traffic, as well as car and bicycle stopping lines. When all pedestrians have safely crossed the road, the Starling Crossing pattern simply disappears until it is needed again [1].

This full-scale prototype, temporarily installed in South London, is based on research made by the Transport Research Laboratory. It is designed to support the weight of vehicles, not to slip in a downpour and to display bright markings to be seen during daylight hours. At different day times of the day and in different situations, the road can change its configuration in real time. If a person is distracted, looking at mobile phone, and turns too close to the roadway when a car is nearby, a warning pattern flashes around them, filling their field of vision. If the child unexpectedly runs out into the road, a large buffer zone is created around them so that their trajectory is clear to any drivers or cyclists in the vicinity. In a particularly dangerous situation, when a pedestrian is racing across the street but he is in a blind spot for a cyclist or driver, Starling Crossing is adapted in real time to draw the attention directly to the location and trajectory of the hidden pedestrian. Starling Crossing can track and it can be adapted to pedestrian desire lines over time so that, for example, if most people exiting a metro station end up walking diagonally across the street to the park entrance, the crossing can be converted to a diagonal or even trapezoidal crossing with the appropriate safety buffer zones.

Starling Crossing is a pedestrian crossing built with modern technology which puts people first, by allowing people to cross the road safely anywhere, not just in one place or along a fixed path. Key design principles include seeking for improving the people's perceptions without distracting them, and creating a safe relationship between people and cars so that they can make their own decisions. [2]

Like any other technology Starling Crossing has its advantages and disadvantages.

Besides, we can already see many potential benefits of using smart pedestrian crossings depending on their complexity:

1) Reducing the number of accidents due to improved visibility;
2) Ability to manage urban traffic, reducing congestion and pollution;
3) Adaptation to different street types and traffic situations;
4) Ability to be controlled remotely and dynamically;
5) LED-based designs can be switched on and off on demand.

The main disadvantage of Starling Crossing is its cost and complexity of installation. It can be expensive to install and to maintain and it can become a problem for cities that do not have sufficient budgets for such innovative projects. In addition, the system may be limited in the range of interaction with road users. For example, it can not work on roads with a large number of vehicles or on roads with irregular pedestrian and cyclist traffic.

The costs of maintaining the system, such as maintenance, configuration and software updates, must also be taken into account. As Starling Crossing is a fairly new technology, the cost of installation and operation can be significantly higher than traditional road safety methods. The cost of installing and operating such a system can vary significantly depending on many factors, such as size and complexity of the system, geographic location, labour and technical equipment.

Taking into account the above mentioned information, the specific cost of installing and operating Starling Crossing cannot be determined accurately without considering all the details and conditions. However, the Direct Line company which developed Starling Crossing reports that the cost of installing the system is about £50,000 (i.e. approximately UAH 2210000), and the cost of its operating depends on many factors and must be calculated individually for each installation site. [3]

REFERENCES

1. Interactive pedestrian crossings are the future of roads. URL: https://news.infocar.ua/117143.html
2.Starling Crossing Interactive Pedestrian Crossing. URL: https://umbrellium.co.uk/projects/starling-crossing/
3. A digital zebra crossing could be the future of our roads. URL: https://tomorrow.city/a/smart-zebra-crossing

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AI IN BUILDING PROJECTS

Artificial Intelligence (AI) is revolutionizing various industries, including construction. By leveraging AI technologies, construction companies can enhance efficiency, improve safety, reduce costs, and optimize project management. Here are some key points about the use of AI in building projects:

1. Reducing Costs and Enhancing Efficiency. Robotics, AI, and the Internet of Things can reduce building costs by up to 20 percent. Engineers can use virtual reality goggles and mini-robots to track the progress of construction, plan the routing of electrical and plumbing systems, and develop safety systems for worksites. [1]

AI is used to track real-time interactions of workers, machinery, and objects on the site, alerting supervisors of potential safety issues, construction errors, and productivity issues. [1]

AI is expected to optimize energy efficiency, water supply, indoor air quality, and other performance metrics in building projects, leading to enhanced efficiency and cost savings. [2]

2. Improving Safety. AI is being used to develop safety systems for construction sites. It can track real-time interactions between workers, machinery, and objects on the site and alert supervisors of potential safety issues. By identifying construction errors and potential hazards, AI can help reduce worksite injuries and improve overall safety. [2]

3. Post-Construction Management. AI can be used long after construction is complete. Building managers can utilize AI to collect and analyze data, optimize energy efficiency, monitor indoor air quality, and improve overall performance metrics. By leveraging AI in post-construction management, building owners can enhance the operational efficiency of their facilities. [1]

4. Building Information Modeling (BIM). BIM, when combined with AI, has the potential to create new value in the construction industry. AI can automate various BIM procedures, including design and rule checking, 3D as-built reconstruction, event log mining, building performance analysis, and virtual and augmented reality. By streamlining and automating these processes, AI can enhance the management of complex construction projects. [3]

5. Predictive Maintenance. AI can analyze data from building systems to predict maintenance needs. By identifying potential issues before they occur, AI can help prevent costly breakdowns and improve the overall maintenance process. [4]

6. Optimizing Decision-Making. AI can assist in decision-making processes, such as project scope assessment, bidding strategies, and building code compliance validation. By automating repetitive tasks and analyzing data, AI can streamline processes and improve the speed and accuracy of decision-making. [4]

It's important to note that while AI is transforming the construction industry, it is unlikely to replace the human workforce. Instead, AI will augment human capabilities, improve efficiency, and enable new business models in the construction industry.

In conclusion, AI is revolutionizing the construction industry by reducing costs, improving safety, optimizing project management, and enhancing post-construction operations. By leveraging AI technologies, construction companies can benefit from increased efficiency, improved decision-making, and enhanced overall performance.

REFERENCES

1.Rao S. The Benefits of AI In Construction // Trimble Construction. 2022. URL: https://constructible.trimble.com/construction-industry/the-benefits-of-ai-in-construction

2.Srivastava S. AI in Construction – How Artificial Intelligence is Paving the Way for Smart Construction // Appinventiv. 2024. URL: https://appinventiv.com/blog/ai-in-construction/

3.Pilkington B. The Use of AI in Construction // 2023. URL: https://www.azobuild.com/article.aspx?ArticleID=8598

4.Dockery D. AI in Construction Has Landed // Construct Connect. 2024. № 1. C.1-1 URL: https://www.constructconnect.com/blog/ai-in-construction-has-landed

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SAFETY AND INNOVATION. CONTRADICTIONS IN THE IMPLEMENTATION OF NEW TECHNOLOGIES

Over the past fifteen years, it is known that the number of inventors and rationalizers in Ukraine has steadily decreased, and the scientific potential of our country has declined. Enterprises, institutions, and organizations are not fully conducting patent research as stipulated by state standards; societal and state needs for such production are not being studied. The number of enterprises implementing innovative products is consistently decreasing [1-5].

The pace of development, structure, and material support of the research and development sector do not meet the needs of ensuring the National Security and economic independence of Ukraine, nor do they meet the increasing demand for advanced technologies from various segments of the entrepreneurial and state sectors of the economy.

The domestically proposed research sector developments and certain scientific outcomes, even those of international standards, do not find application in the Ukrainian economy due to the imbalance in the national innovation system, 'irrational behavior of the leadership of certain enterprises,' 'unfair competition,' morally and conceptually outdated regulatory framework, and low receptivity to innovations in the entrepreneurial sector of the economy

The raw material model of Ukraine's economy [5], which relied on competitive advantages of cheap labor and low-cost energy resources, has exhausted itself and led to our failure to increase economic potential and undergo technological transformations. This chain of events significantly lowered the international rankings of our state.

According to reports from the Bloomberg agency (Bloomberg Innovation Index) [6], in the last 15 years, our country has not ascended beyond the 43rd position. In the World Economic Global Competitiveness Index 2008-2022 [3], Ukraine has not risen above the 57th position.

According to The Global Competitiveness Index 2023, among 132 countries worldwide, Ukraine ranked as follows in various categories:

- research and Development - 57th position;
- level of patenting developments - 29th position;
- level of innovation-related financing - 125th position;
- level of investment inflow - 107th position;
- capital turnover volume of joint ventures - 122nd position;

- creation of new enterprises - 65th position;
- level of scientific publications - 97th position;
- GDP level per unit of energy consumption - 116th position..."

The comparatively high level of patent activity, on one hand, and the low number of scientific research (developments) and low growth rate of innovative companies, on the other, indicate that a larger part of new innovative technologies and achievements are either not being implemented or are being exported. The rest of the figures speak for themselves.

The consequence of such an 'innovative' development path is a consistent shift in the Ukrainian economy towards low-tech, non-scientific, energy-consuming, environmentally harmful, and morally outdated productions, gradually transforming our homeland into a raw material and food base for developed countries.

Today, in the global economy, rivalry and cooperation, competition, and cooperation are no longer mutually exclusive concepts. Production crosses national borders and integrates nations into the international economy. Consequently, mechanisms for determining the value of production are changing. In order to participate in such processes and benefit from them, Ukraine must have an appropriate level of scientific, technical, and technological development.

This is why domestic scientists constantly strive to formulate and substantiate national innovation priorities, finding effective mechanisms for the engagement and efficient utilization of innovations.

Low susceptibility to innovation questions.

A classic figure in world tribology, Doctor of Technical Sciences, Dmytro Harkunov, has established that 'Expenditures on repairs and maintenance of machines exceed their cost several times: for cars - by 6 times, for airplanes - up to 5 times, for machines - up to 8 times, and prolonging the service life of machines and equipment, even to a small extent, is equivalent to the introduction of a significant amount of new production capacity [7].

Leaving aside the problems of the development of research and development sector, which require a separate comprehensive analysis, let's try to understand the more 'grounded' issue of low susceptibility to proposed innovations. Let's attempt to dissect the specific mechanisms and contradictions of the mentioned 'susceptibility to innovations' using the example of the domestic 'Technology of friction surface non-disassembly engineering' and its products (hereinafter referred to as the Technology).

The mentioned Technology was developed based on fundamental structural research conducted under the guidance of Doctor of Technical Sciences, Professor Rostyslav Didyk. During the research, decomposition products of minerals forming new surface and near-surface structures of tribologically reconstructed friction surfaces were identified.

The Technology evolved, underwent industrial testing over a long period (2003-2020). Hundreds of tests confirmed the effectiveness of using natural and synthesized minerals as 'tools' of the Technology. Technological fillers (hereinafter referred to as TF) in combination with the application technology allowed extending the resource life of mining, metallurgical equipment, machine parts for automotive and railway transport, machines, and equipment in other industries. The products of the technology helped reduce, and sometimes eliminate a significant amount of repair (regulatory) work, improve operational properties of products in the machine-building enterprises."

We have proven that it is due to the penetration of TF (technological fillers) into the friction zone that the effect of restoring the basic parameters of the working condition of industrial machines and mechanisms occurs and demonstrates a significant increase in their reliability, durability, and consequently, safety. The products of the Technology ensure long, reliable, and safe operation of gear transmissions, rolling and sliding bearings, cam mechanisms, guides, hinges, locks, junctions, supports, components of cylinder-piston groups, gas distribution mechanisms, high-pressure fuel pump components, friction pairs like 'wheel-rail' ('shaft-bushing'), and other assemblies whose components experience mutual displacement (friction) in the presence of lubricants [8].

Thus, we have demonstrated that the Technology represents an effective method of non-disassembly restoration of the working parameters and main operational characteristics of machines and

mechanisms without stopping technological and production processes [8], significantly enhancing reliability, consequently ensuring safety, production, and other processes.

Therefore, for the first time, we have proven that during operation (friction) in the presence of TF on the contact surfaces of parts and in their subsurface layer, it is possible to form and actually forms a relatively hard new structure that shares a crystalline framework with the metal of the part, possessing unique anti-wear and lubricant-retaining properties. This process leads to the restoration of the functional state of friction node surfaces by initiating self-organizational processes in plastic deformation [8].

The aggregate estimated potential for saving fuel and energy resources, resources associated with premature failure of machinery and mechanisms, as well as the unrealized profit (due to downtime for repairs), on a countrywide scale, in monetary equivalent, amounts to ≥ 2.5% of Ukraine's GDP.

For example, on the mainline locomotives of Ukrzaliznytsia (Ukrainian Railways), during regular operation, thanks to the reduction in the wear intensity of wheel rims due to the use of products from our Technology, we have demonstrated a technical outcome and economic effect that allow saving over 700,000 UAH per locomotive, between wheel tire replacements. This calculation is exclusive of the unrealized profit for the company due to locomotive downtime for tire replacements, considering there are over 200 locomotives within the company [9, 10].

The main contradiction in the implementation of the Technology lies in the following:

The reduction of operational costs when applying the Technologies ensures significant economic benefits, allowing enterprises to accumulate funds for production modernization or introducing new production capacities. This undoubtedly attracts and interests all parties involved in the innovation process.

However, the insufficient support for such innovative companies and processes by the state, at the regulatory, legal, and financial levels, makes attempts at independent implementation of domestic energy-saving technologies practically hopeless. This negatively affects the national security and economic independence of Ukraine, significantly hindering the development of new branches of science and technology.

The main paradox lies in the fact that a 100% domestic, state-recognized, scientifically substantiated, repair-restorative, and resource-saving innovative Technology, capable of significantly reducing the operational costs of industrial enterprises today, and consequently allowing industry to accumulate resources for production modernization and the introduction of new facilities, does not find worthy application and a proper place in the Ukrainian economy.

The main reasons for this contradiction are:

Owners of budget-forming industrial enterprises seem to desire but are insufficiently interested in state investment in energy-saving and resource-defining innovations, while the leadership of their enterprises seems obligated to implement innovations but lacks a regulated mechanism for their implementation.

For the managers of enterprises (divisions) who directly make decisions regarding the implementation of Technology products, personal benefits are absent (except perhaps formal appreciation for taking energy-saving measures), while additional trouble and the risk of undistributed responsibility are present.

It is evident that state support is essential here. The state's policy on energy modernization exists and is fundamental. The continuation of the state policy towards energy modernization is the Ukrainian Law "On the Introduction of New Investment Opportunities, Guaranteeing the Rights and Legitimate Interests of Business Entities for the Conduct of Large-Scale Energy Modernization" [327-VIII]. We observe that the fundamental complex of energy-saving (energy-efficient) measures has already been developed by our state and, considering the availability and popularity of such measures in the sphere of heat supply, industrial, and civil construction, it has taken the form of law. Unfortunately, the same cannot be said regarding resource-saving (energy-efficient) "friction overcoming technologies," the development of which our team has considerably progressed.

Likely, an effective way to resolve the primary contradiction in implementing the Technology and simultaneously incentivizing the parties' innovative activities could be a new Ukrainian Law, based on the model of the [327-VIII] Law.

The proposed name for the new law could be: "Ukrainian Law on the Introduction of New Investment Opportunities, Stimulation, Ensuring Rights and Legal Interests of Business Entities for the Implementation of Resource-Saving (Energy-Efficient) Technologies and Conducting Large-Scale Energy Modernization of Industrial Enterprises in the Real Sector of the Economy" (hereinafter referred to as the New Law).

The terminology of the Law could be as follows:

Energy resource service - a combination of technical, technological, and organizational resource-saving (energy-efficient) and other measures aimed at reducing operational costs for the operation of industrial machinery, equipment, specialized technology, transport means, and their complexes or elements, compared to the costs incurred in the absence of such measures, as initiated by the customer of the energy resource service.

Object of energy resource service - industrial machinery, industrial equipment, specialized technology, transport means, their complexes, or elements that are in state, communal, or private ownership, for which a decision has been made by the executive authority responsible for their management regarding the procurement of the energy resource service (in the case of state-owned objects), the executive body of the local council or the local executive authority (in the case of communal ownership), another authorized governing body (in the case of private ownership).

The new Law should take into account the interests of all parties involved in the innovation process, provide ways to address all the aforementioned and unspecified contradictions in this article, and be in harmony with the current legislation of Ukraine.

Regarding the stimulation of widespread innovation implementation, in conditions of war and economic instability, an effective and incentivizing step for large private industrial enterprises towards innovation implementation could be tax incentives concerning funds allocated within their internal investment programs for innovation (innovation capital), with unequivocal reporting on the utilization of such funds and innovation implementation, without the possibility of accumulating these funds and mandatory taxation of their remainder at the end of the financial year.

The new Law should provide the management of state-owned enterprises with a clear mechanism for forming innovative capital and possible methods of its implementation. Subsidiary acts should take into account, including issues of direct financial interest of employees in enterprises concerning the search for and implementation of innovations.

Additionally, it is necessary to:

- timely review existing and develop new regulatory and guidance documents that define standards for searching and making decisions regarding innovation implementation.

– distribute responsibility between the owner and employees during the implementation of innovations.

– implement new comprehensive technical tools and technologies for objective monitoring of the condition of machinery (mechanisms, equipment), including processed TF (new technology). Processed equipment always exceeds the intended resource limits; such control will help prevent emergencies and alleviate managers' imaginary fears.

The legislative initiative (the introduction of such a draft law) in this matter, in our opinion, belongs to the President of Ukraine, as the speed of adoption and the quality of execution of the new Law already determine the level of National Security and economic independence of our Motherland.

REFERENCES

1. On the Strategy of National Security of Ukraine. Decree of the President of Ukraine. Retrieved from https://www.president.gov.ua/documents/3922020-35037.

2.Scientific and Innovative Activities of Ukraine. 2007-2020. Retrieved from https://www.ukrstat.gov.ua/druk/publicat/kat_u/2021/zb/10/zb_Nauka_2020.pdf

3.The Global Competitiveness Index. 2017-2022. Retrieved from https://www.weforum.org.

4.Industrial Property in Numbers. Ukrpatent (State intellectual property service of Ukraine). 2014-2022. Retrieved from https://ukrpatent.org/uk.

5.Sustainable development goals. National Report. Ukraine. 2022. Retrieved from https://www.kmu.gov.ua/storage/app/sites/1/natsionalna-dopovid-csr-Ukrainy.pdf.

6. The Bloomberg Innovation Index. (2009-2021). Retrieved from https:// https://ec.europa.eu/newsroom/rtd/items/713430/en.

7.Triboengenneering (wear and no-wear): a textbook for technical colleges. – 4th impression, revised and complemented. – M.: MAM, 2000. – 610 p.

8. Technology of indiscriminate friction surface engineering. Modific Ukraine.2023. Retrieved from https://modific-tribotech.business.site.

9. Belikov A., Kreknin K., Matsuk Z., Protsiv V., Lubricants for rail transport liquid(plastic) for friction pair «wheel-rail». Naukovyi visnyk Natsionalnoho Hirnychoho Universytetu. 2022. № 1. P. 63–68.

10. Belikov A., Matsuk Z., Shalomov V., Kharchenko V., Improving rolling stock safety through risk-oriented management of wheel-rail friction. Railway transport of Ukraine. 2023. № 3. P. 23–37.

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USE OF INTELLIGENT ROBOTS IN CONSTRUCTION

Smart robots are essential in construction today. They make work faster and safer. They do routine tasks like lifting heavy materials and cutting materials. This gives workers more time for creative tasks and lowers the risk of accidents. [1]

These robots can do precise work using AI and machine learning. This improves the quality of construction. Using them is also better for the environment. They use less energy and emit fewer harmful substances than traditional methods. [2]

Future studies should look at how to use smart robots in modern construction and how they affect the quality, efficiency, and safety of projects. [3]

Optimization

If you use IoT sensors for remote monitoring of equipment health and combine them with the ability to analyze the movement and operation of construction machines, then you can significantly reduce equipment downtime, thereby minimizing machine maintenance costs and optimizing work productivity. The implementation of artificial intelligence technologies will make it possible to choose the most optimal option for planning work during construction due to the improvement of algorithms by the trial and error method of past projects. In addition, this analysis will allow to simulate the results of construction and the final layout for the period of delivery of the object, as well as to develop an effective distribution of materials on the sites. [4]

Predictive analysis

At the stage of project development, computer programs can be trusted to calculate the occurrence of probable risks, the possibility of compliance with technological standards, as well as to simulate the reliability of the application of certain construction methods. Quality software will speed up the decision-making process for a project, and potentially save time and money troubleshooting potential problems. In addition, this type of analytical platform will help to speed up the testing of construction materials used, reducing the period of downtime at the facilities. Information for analytics is collected through sensors

installed on the equipment, processed and produces results both for real-time monitoring and for planning work at the next stages. [4]

REFERENCES

1.Zhang, C., Teizer, J., Lee, J.K., & Eastman, C.M. (2013). Building information modeling (BIM) and safety: Automatic safety checking of construction models and schedules. Automation in Construction, 29, 183-195.

2.Becerik-Gerber, B., & Rice, S. (2010). The perceived value of building information modeling in the U.S. building industry. Journal of Information Technology in Construction (ITcon), 15, 185-201.

3.Akcamete, A., Fischer, M., Kunz, J., & Levitt, R. (2016). Design for safety: employing augmented reality for improved construction site safety. In Construction Research Congress 2016: Old and New Construction Technologies Converge in Historic San Juan - Proceedings of the 2016 Construction Research Congress, 153-162.

4.Iotji.io Prospects for using AI and IoT in construction (April 13, 2020)

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3D PRINTING HOMES IN THE 21ST CENTURY

In the 21st century, 3D printing technology has emerged as a promising innovation for building homes, offering a combination of design flexibility, functionality, cost-effectiveness, and environmental sustainability.

Advantages of 3D-Printed Homes. 3D-printed homes can combine design, functionality, low costs, and environmental concerns, offering an optimal combination of creative design and eco-friendly materials that can be built fast and at a substantially low cost. [1]

These structures have demonstrated resilience, as evidenced by ICON's 3D-printed homes in Mexico's Tabasco state, which remained mostly unaffected by a 7.4-magnitude earthquake.

The use of 3D printing technology for housing projects has been leveraged by organizations like US-based charity New Story, which has funded over 2,300 homes in Mexico, Bolivia, Haiti, and El Salvador. [1]

Sustainable and Affordable Housing. Companies like Saint Gobain Weber Beamix have been experimenting with 3D concrete printing technologies, leading to the development of milestones like the world's first printed commercial housing project, comprised of five homes that meet comfort and stringent construction requirements. [2]

The potential of 3D construction printing for affordable mass housing projects has been demonstrated through successful printed homes, although there are still challenges to overcome before 3D printing becomes the norm for mass housing. [2]

Construction Efficiency and Cost Reduction. 3D printing technology offers the potential for faster construction and cost reduction compared to conventional building methods. For example, concrete printing is faster and becoming cheaper than conventional wood-frame building, potentially addressing the affordable housing crisis. [3]

The use of 3D printing technology for home construction has the potential to drive down costs through efficient use of materials and automated labor, making it useful for emergency housing or to shelter the homeless. [4]

Future Prospects. The development of 3D printing technology for home construction is ongoing, with companies like WinSun exploring the construction of multi-story buildings and aiming to eventually construct numerous affordable homes using 3D printed materials. [5]

The potential for 3D printing technology to disrupt the traditional construction industry and provide affordable, sustainable housing solutions is a key area of interest and investment for various organizations and innovators.

The use of 3D printing technology for building homes holds significant promise for addressing housing challenges, offering sustainable, cost-effective, and resilient housing solutions for the 21st century and beyond.

REFERENCES

1.Gopalakrishnan M. Is 3D printing the future for building homes? // DW - Deutsche Welle. 2021. URL: https://www.dw.com/en/is-3d-printing-the-future-for-building-homes/a-58679995

2.Montjoy V. Towards Sustainable and Affordable Housing: Is 3D Printing the Future or the Present? // Arch Daily. 2022. URL: https://www.archdaily.com/979103/towards-sustainable-and-affordable-housing-is-3d-printing-the-future-or-the-present

3.Morrison J. Can 3D Printing Help Address the Affordable Housing Crisis in the United States? // Smithonian magazine. 2024. URL: https://www.smithsonianmag.com/innovation/can-3d-printing-help-address-affordable-housing-crisis-in-united-states-180983821/

4.Lasky J. A 3D Print-Out You Could Call Home // The New York Times. 2019. URL: https://www.nytimes.com/2019/11/08/realestate/a-3d-print-out-you-could-call-home.html

5.Sevenson B. Shanghai-based WinSun 3D Prints 6-Story Apartment Building and an Incredible Home // 3D Print.com. 2015. URL: https://3dprint.com/38144/3d-printed-apartment-building/

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AI IN THE INTERIORS OF THE FUTURE

Artificial Intelligence (AI) is making significant strides in various industries, including interior design. With the potential to revolutionize the way we approach design, AI offers exciting possibilities for the interiors of the future. Here are some key areas where AI is being utilized:

1. Design Inspiration and Visualization: AI algorithms can sift through vast databases of images, colors, and textures to provide designers with curated selections of ideas and inspiration. AI-powered tools can generate mood boards, suggest complementary color palettes, and propose unique design elements. [1]

2. Virtual Staging and Visualization: AI technology enables virtual staging, where users can place rendered objects into a room virtually to create a mockup and visualization of the interior space. This eliminates the need to physically move and layout furniture, making it attractive to buyers and enhancing the selling process. [2]

3. Optimized Layout and Lighting: AI can optimize the layout of furniture based on how people move through a space and adjust lighting levels according to their needs. This requires capturing devices trained on data, which can provide insights to interior design companies for solving layout problems quickly. [3]

4. Project Management: AI tools oriented toward project management can assist designers in keeping track of budgets, timelines, and other crucial information to ensure smooth and effective project execution. [4]

5. Enhanced Client Interaction: AI can bridge the understanding between designers and clients by collecting data from clients regarding their preferences and connecting them to like-minded interior designers for better guidance. This can improve the overall client experience and satisfaction. [5]

It's important to note that while AI offers valuable assistance and optimization in interior design, it cannot replace the human touch and the ability of designers to connect with clients on a personal level. The future of interior design lies in the collaboration between AI and designers, leveraging the power of technology to enhance creativity and efficiency while maintaining the human element. [5]

As AI continues to advance, we can expect even more intelligent and sophisticated tools and technologies to shape the interiors of the future. The integration of AI in interior design presents endless opportunities for innovation and development, allowing designers to create beautiful, functional, and personalized spaces.

REFERENCES

1.Nimmagadda M. Future of interior design: Role of AI in transforming the way we create spaces // The Times of India. 2023. URL: https://timesofindia.indiatimes.com/blogs/voices/future-of-interior-design-role-of-ai-in-transforming-the-way-we-create-spaces/

2.Wu F. Four Ways Technology Is Boosting Interior Design Internally and Externally // Spiceworks. 2022. URL: https://www.spiceworks.com/tech/innovation/guest-article/boosting-interior-design-internally-and-externally/

3.Nicola G. The Future Of Interior Design: Human Creativity And Artificial Intelligence // Tallbox. 2022. URL: https://www.tallboxdesign.com/ai-interior-design/

4.HOMMÉS Studio. Interior Design Artificial Intelligence and Its Amazing Uses // HOMMÉS Studio. 2023. URL: https://hommes.studio/journal/interior-design-artificial-intelligence-uses/

5.Green C. How AI Will Revolutionize The Interior Design Industry? // Meddium. 2019. URL: https://medium.com/@ciaogreen/will-ai-revolutionize-the-interior-design-industry-1c4834924fef

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ROBOTICS IN THE CONSTRUCTION OF MODERN HOMES

The variety of needs and tasks grows in direct proportion to the development of the social component. At the same time, the variation of robot classifications is increasing, the components of a modern robot are becoming more refined and equal to the cosmic level.

Currently, the field of robotics is divided into consumer, production, and educational fields. Consumer demand for various cleaning robots or drones that help conduct aerial surveys for reconnaissance during hostilities is unabated. [1]

The educational field of robotics in Ukraine is also growing rapidly. More and more often, educational projects are appearing, where you learn to design and program robots with the help of special sets of robotics. With the help of robots, Nova Poshta, Fozzy Group, and medical institutions throughout Ukraine perform their work processes at a first-class level.

Let's consider what kind of robots there are by example: some are sharpened for assembly work they cannot be easily adapted for other applications. In this case, it is called a folding robot.

Works that perform seam welding and have welding equipment along with other material handling facilities such as rotary tables and others as a single unit. Such an integrated robotic system is called a “welding robot”. And those jobs that manipulate huge loads are called “heavy duty jobs”. [2]

During the period of independence, Ukraine showed the world hundreds of thousands of innovative ideas that are in demand both on the Ukrainian market and outside the country.

The authors of a digital clothing store with collections of the most famous brands, an application that saves patients with bipolar disorder, and a platform with millions of investments are Ukrainians! The main obstacle to the development of robotics in Ukraine is the lack of funds, which startups are successfully overcoming. [3]

According to Deloitte surveys, 70% of respondents from Ukraine consider the trend towards the development of robotics important, 28% use AI and robotics to reduce routine work and avoid duplication of processes.

Today's realities lead Ukrainian robotics to mass development of military robotic weapons and applications. The emergence of new educational institutions that will teach children robotics is an important decision for the future of the state. [4]

After all, after the victory of Ukraine on the battlefield, the question will arise regarding the labor force that suffered losses as a result of the war, migration processes, destroyed production facilities and infrastructure. New robotic systems with artificial intelligence are likely to replace outdated production facilities.

REFERENCES

1.Greene T. Ukraine has become the world’s testing ground for military robots // TNW. 2022. URL: https://thenextweb.com/news/ukraine-has-become-worlds-testing-ground-for-military-robots,

2.Amengual J. Why Your Next Home Will Be Built By Robots // Forbes. 2022. URL: https://www.forbes.com/sites/forbesbusinesscouncil/2022/01/24/why-your-next-home-will-be-built-by-robots/?sh=522d7650551f

3.Johnson S. A Ukrainian robot can print this $64,000 house in just 8 hours // Big Think. 2017. № 1. С.1-1 URL: https://bigthink.com/health/a-robotics-company-can-print-this-64000-house-in-just-8-hours/

4.King N. Robots Have an Increasingly Important Role in Construction // SCIAM. 2019. URL: https://www.scientificamerican.com/blog/observations/robots-have-an-increasingly-important-role-in-construction/

ЛІНГВІСТИКА
МОВОЗНАВСТВО
МЕТОДИКА НАВЧАННЯ ІНОЗЕМНИХ МОВ

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CULTURAL COMPONENT IN FOREIGN LANGUAGE TEACHING

The needs of our State for highly qualified specialists capable to be creative, share best practices, and establish business contacts and cooperation with foreign partners based on professional competence and fully-fledged command of a foreign language are reflected in education programs of higher educational institutions. The foreign language of a university specialist is currently both a tool of production and part of culture, as well as means of humanitarizing education. All this involves the use of teaching methods that can provide a fundamental and comprehensive language training. In this regard, here is an attempt to consider the trends in the development of foreign language teaching methods, and to identify the factors that determine the choice of methods at the present stage of instruction activities. Thus, the consideration of trends in the development of foreign language teaching methods allows us to draw the conclusion that there has been a transition from translational teaching methods, whose purpose was to teach vocabulary and grammar, to methods ensuring the mastery of foreign-language communicating competence.

The concept of developing the only linguistic competence in students, which was dominant at the beginning of the 20th century, turned out to be insufficient for foreign language communication. Learning began to be combined with teaching aspects of culture, rules of communication and other information important for communication. In the system of teaching foreign languages, the role of grammar theory has decreased and changed, and the principle of communicative orientation has been introduced. Therefore, the role of interaction and speech activities of students has increased. At the same time, a cultural component is gradually introduced into foreign language teaching. “Most activities are not especially designed for cultural instruction. Cultural elements are very often developed through readings or introduced through listening activities and grammar and vocabulary exercises” [1, p. 8]. Among the methods of mastering a foreign language, the preference started to be given to those that have developmental potential: they awaken thought, hone the means of its expression, enrich feelings and figurative ideas, and improve the general culture of communication and social behavior as a whole. The idea of necessity to go beyond “the techniques of language” and turn to the simultaneous study of the national culture of peoples is currently decisive when choosing teaching methods. “Certainly, the close relationship between the language and culture is vital in teaching and learning a foreign language” [2, p. 206]. It becomes obvious that whatever the textbook or teaching method, it is the information about culture that primarily constitutes the main wealth of education. The teacher should not be limited to narrow language goals. Without addressing the cultural phenomena, language learning is impoverished and reduced to the assimilation of phonetic, lexical, and grammatical features. Certainly, it is necessary to pay great attention exactly to the assimilation of speech mechanisms and training of speech patterns, but the teacher should not forget the golden rule: “There is no need to teach speaking if there is nothing to say”.

The dialectical relationship between language and culture has always been a concern for educators. The question of whether the culture of the target language should be included in language teaching has been the subject of research throughout the history of language teaching methods. The pendulum of opinions has swung against or in favor of the study of culture in the context of language teaching. For example, during the first decades of the 20th century, researchers debated the importance and potential of incorporating cultural components into the teaching curriculum. The emergence of communicative language teaching in the late 70s marks a critical shift in teaching culture as the paradigm transits from the approach based primarily on a shape and structure to a variety of approaches that have caused an unintended side effect: cultural neglect. The recent research has focused on the inextricable relationship between language teaching and culture, especially over the last decade. In addition, the language learning culture is now presented as an interdisciplinary core in many curriculum projects and textbooks. There is

no such concept as 'human nature independent of culture'. Learning a language is understood in certain way as trying to figure out the nature of another people. When learning a foreign language, the meaning of words determines the process of communication. Therefore, as some scientists argue, social interaction is crucial to learning a foreign language for the purpose of communication rather than treating it simply as linguistic conversation. A lack of cultural learning may manifest itself when a student uses an acquired foreign language and realizes that his or her skills, grammar or vocabulary are not sufficient to represent the meanings. The meanings of a word are the segment of personal or social life, which they relate to. Differences in meanings are likely to lead to the misuse of language that cannot be eliminated by the learner's mastery of linguistic components. This error takes place not due to any theory of language, but has relation to the theory of language users. This transfers the problem from the field of linguistics to the field of culture, which means that the process of teaching and learning a foreign language remains inaccurate and incomplete unless it is supplemented by appropriate knowledge about the culture of the target language.

The influence of cultural context on the formation of personality cannot be overestimated. The basic concept of foreign language teaching is that communication is social interaction, and not language exchange. Despite the close relationship between language and culture when learning foreign languages, the study of culture is not included in the objectives of the curriculum. One of the most important reasons for learning a foreign language is the ability to communicate with people who do not speak the same native language. Nevertheless, words alone are not enough in this communication process. The cultural context in which words acquire their value and meaning is equally important. "Learning to coexist in an increasingly globalized environment such ours requires acquiring skills and values that allow all human beings to live in a context strongly marked by cultural and linguistic diversity" [3, p. 221].

Culture in general can be defined as a system of ideas that govern the human attitudes and behavior both individually and in groups. "Culture is a very important element in teaching a foreign language. Language as such is an expression of culture/communication of human beings, which takes place in cultural contexts, and the speakers of a language are culture carriers" [4, p.2]. This concept of culture includes language among other cultural components. Understanding the cultural aspects of language is necessary to know how they are used by those whose native language is different from the target language. The implication is that culture must be integrated into foreign language teaching for its meaningful use to take place.

It is expedient to define some benefits of learning about culture: 1) learning about culture gives students a reason to study the target language as well as gives meaning to the process of learning; 2) from the students' point of view, one of the main problems in language teaching is the idea of native speakers of the target language as real persons. Although grammar textbooks provide the so-called real-life characters, students may consider these situations to be fictitious without background knowledge. In addition to providing access to the cultural aspect of language, learning about culture would help students correlate the abstract sounds and shapes of language with real people and places; 3) the influence of motivation in language learning. In achieving high motivation, cultural activities do play a big role because students enjoy culture-based activities, such as singing, dancing, role-playing, investigation of countries and peoples, etc. In the age of postmodernism and tolerance for different ideologies, religions and subcultures, we need to understand not only other cultures, but also our own one. Most people hold ethnocentric views due to cultural attachment. We believe that cultural awareness will become an important focus on the modern language education reflecting a greater perception of the inextricability of language and culture, as well as the need to prepare students for intercultural communication. The need for a strong commitment to the development of mutually cultural understanding within the audience underlies in making a significant contribution to general human knowledge and cultural sensitivity.

Misunderstandings between language teachers often arise due to such different cultural backgrounds, ideologies and cultural boundaries that limit self-expression. Language teachers must remember that people from different cultures learn things differently. For example, in China, memorization is the most common way of learning a language, which is different from Western ideologies, where the responsibility for freedom of speech is placed on the tool of using and memorizing

vocabulary and grammatical sequences. When the teacher presents language teaching materials such as books and handouts, he must understand that students will perceive them differently depending on their cultural backgrounds. In fact, cultural differences in language use should not only be compared but also contrasted. Visualizing and understanding the differences between them will allow the learner to correctly evaluate the corresponding linguistic connotations. Similarities and contrasts in the native and target languages become useful teaching tools.

The transition from a traditional to an intercultural position in language teaching methods increases students' awareness of the inextricable and interdependent relationship between language and culture, as well as the study of culture as an integral component of language teaching. It also helps teachers develop their intercultural opinions, which can influence their teaching practices and curriculum development. This shift is a challenge that teachers and students have to face in order to achieve the goals of foreign language teaching in our modern world. Developing the ability to interact between cultures using a foreign language goes far beyond the acquisition of language skills. This includes recognizing different cultural norms and values, as well as ways of using a language and interpreting social actions. Understanding how culture shapes the process of meaning-making in interaction requires the use of reflexive and analytical approaches.

REFERENCES

1. Isabel Negro. Teaching culture in the foreign language classroom. Aportaciones para una educación lingüística y literaria en el siglo XXI. Capítulo 27. Universidad Complutense de Madrid. 2013, p. 8

2. Małgorzata Łazicka. The Significance of Cultural Component in Foreign Language Teaching. Kultura i Edukacja No. 6 (106). 2014. DOI: 10.15804/kie. 2014.06.12. www.kultura-i-edukacja.pl , p. 206

3. Rafiyeva Elnura Nizami. Some Issues Related to the Teaching of Culture in English Teaching. Scientific Collection "Interconf" No. 49. Azerbaijan University of Languages, Baku, Republic of Azerbaijan. DOI 10.51582/interconf.7-8.04.2021.020 , p. 221

4. Brunilda Kondi. Language and Culture – Applications for Using Culture in Teaching English as a Foreign Language. Language and Culture, Teaching English as a Foreign Language. English Department, Universiteti i Tiranes, p. 2

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NEOLOGISMS IN THE ENGLISH LANGUAGE

The world is rapidly developing and transforming. New devices and gadgets are emerging, as well as the way our life is changing and becoming more digitized. It is natural that the language is evolving and lexical changes are taking place. It is the language's lexical system, which is the most flexible and mobile, that is always evolving along with the language community's development, enriching itself with new lexical units and reflecting current social trends. New devices or concepts must be given new names, and therefore new words as neologisms appear.

Linguists define neologism as 'a newly developed or coined word that has started to fall into mainstream usage'. [1] According to Global Language Monitor, around 5,400 new words are created every year. [2]

They appear in the language in connection with the development of social life, culture, science, technology and are considered new ones for some time. When the word is fully accepted into everyday usage, it is picked up by dictionaries and is technically no longer a neologism.

Cutting-edge industries and new technology are typically the fields where such words are quite frequent. These words can be found in more popular subcultures, where people are either expressing a common experience unique to their group or simply trying to differentiate themselves from other, more mainstream groups. To express some new ideas or describe a new object., very often neologisms may be created intentionally. There are a number of ways in which neologisms may emerge. Many of them are created through a morphological processes, involving (parts of) already existing words. Linguists sing out the following mechanisms to create a neologism: derivation, back formation, compounding, repurposing, conversion, abbreviation, loan words, reduplication, onomatopeia. [3]

Having analyzed a great number of neologisms in English, it made possible to single out and provide some examples:

1. Digital hangover – a feeling of shame and regret caused by social network photos and other online evidence of one's embarrassing behavior.
2. Cloud computing - is the ability to store data and information or servers accessed is the Internet. We know this term as "cloud data storage".
3. Phablet - a term formed from the merger of two words - "phone" and "tablet". Means a smartphone with a larger screen than a regular smartphone, but still not as big as a tablet. We affectionately call such gadgets "shovels".
4. Gloatgrams - are photos on Instagram that showcase their creator's unique life, travel, or food.
5. iFinger - is a real-life term that refers to the finger that we specifically leave clean we we eat in order to use a smartphone or tablet.
6. Textretary - is a pun from "text" and "secretary". Means a person prints a message for another who is behind the wheel. We don't have an exact corresponding word, but descriptively we can use "navigator-secretary".
7. Digital Detox – Tired of endless social media and Googling? Want to spend time in the real world, not the virtual world? This process of spending time is called "digital detox" or digital detoxification.
8. Catfishing - Wheel communicating online, it's sometimes tempting to exaggerate or embellish wheel describing yourself and your life. In this case, you are engaged in "catfishing".
9. Phone-yawn - is a phenomenon where one person pulls out their cell phone to check the time, for example, causing everyone around them to pull out their phones as well. The "contagiousness" of this action is compared to yawning.
10. Guerilla proofreading - is a thorough or rather scrupulous search for errors in the text of messages and then publicly pointing them out. [4]

To sum up, it is necessary to remember that neologisms emergence is an inevitable process in any language evolution. They usually arise with the development of technology, changes in society or simply, as a result of a creative approach to the use of language. Neologisms can be very diverse - from funny slang words popular among young people to scientific terms that describe sensational discoveries or technologies.

REFERENCES

1. What Is A Neologism? URL: https://www.globallanguageservices.co.uk/what-is-a-neologism/
2. How new words are born. URL: https://www.theguardian.com/media/mind-your-language/2016/feb/04/english-neologisms-new-words
3. Modern neologisms in English. URL: https://enguide.ua/magazine/top-10-neologizmov-v-angliyskom-yazyke-kotorye-vas-rassmeshat

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INTERNATIONAL WORDS IN ENGLISH

Any language is not homogeneous, it consists of different words. English is not exclusion. To analyze the vocabulary stock of international words in English, it is necessary to trace the history of the international words in English, their etymology and meanings, as well as the use in contemporary times.

According to the definition, in linguistics internationalism or an international word is a 'loanword that occurs in several languages with the same or at least similar meaning and etymology. These words exist in several different languages as a result of simultaneous or successive borrowings from the ultimate source'. [1]

It is important to note that international words appeared in English primarily through trade, conquest, cultural exchange, and colonization. As English speakers came into contact with other cultures, they adopted foreign words to describe new concepts, objects, or ideas not previously encountered in their native language. Over time, these borrowed words became integrated into the English vocabulary, enriching the language with a diverse linguistic heritage. The language that has contributed the most international words to English is Latin, primarily due to the Roman conquest of Britain in the 1st century AD and the influence of the Roman Catholic Church during the Middle Ages. Latin was the language of scholarship, science, and administration across Europe for many centuries. Furthermore, during the Renaissance, there was a revival of interest in classical languages, which led to an influx of Latin (and Greek) terms into English. Latin served as a lingua franca among educated Europeans, and its terms were often adopted into English to describe new concepts in science, law, theology, and academia. This historical backdrop made Latin a significant source of international vocabulary in English.

The presence of international words in English serves several meaningful roles:

1. Cultural Exchange and Enrichment: International words are markers of cultural exchange, illustrating the interactions between English-speaking communities and other cultures throughout history. They enrich the language by providing insights into the customs, technologies, and philosophies of different societies.

2. Lexical Expansion: These borrowings expand the English vocabulary, allowing for more precise expression. They fill lexical gaps where a specific concept or object does not have an indigenous English term.

3. Linguistic Diversity: The incorporation of international words showcases the linguistic diversity within the English language, reflecting its global nature and its ability to adapt and evolve by absorbing elements from other languages.

4. Enhanced Communication: By adopting words from a wide array of languages, English speakers can communicate more effectively not only among themselves but also with non-English speakers. This is particularly true in fields like cuisine, music, science, and technology, where specific terms may not have direct English equivalents.

5. Historical Documentation: The presence of words from various languages serves as a historical record, tracing the patterns of trade, colonization, migration, and cultural exchange that have influenced English-speaking populations over the centuries.

Linguists state that in contemporary times the use of international words in English reflects the language's dynamic nature and its role in a globalized world. Here are several key aspects of their use today:

Global Communication. International words facilitate global communication, enabling people from diverse linguistic backgrounds to share ideas, innovations, and cultures more easily. English, with its vast repository of borrowed terms, acts as a lingua franca in business, science, diplomacy, and the internet, bridging communication gaps across the world.

Technological and Scientific Innovation. Many international words in English pertain to technology and science. As global collaboration in these fields accelerates, English adopts terms from various languages to describe new discoveries, processes, and inventions, making these advancements accessible to a wider audience.

Cultural Diversity. The use of international words reflects and respects the cultural diversity of English-speaking societies. These words enrich the language with concepts and nuances specific to different cultures, from cuisine and fashion to philosophy and religion, enabling English speakers to engage with and appreciate global cultures more deeply.

Education. In education international words are crucial for articulating complex theories, concepts, and methodologies that originated in non-English speaking contexts. Their use in scholarly works, lectures, and discussions helps maintain accuracy and depth in various fields of study.

Media and Entertainment. International words permeate media and entertainment, allowing for authentic representation of different cultures and fostering a more inclusive global culture. Words help convey diverse perspectives and stories in music, film, literature, or social media, these

Language Evolution. The contemporary use of international words underscores the ongoing evolution of English. As society changes and global interactions increase, English continues to absorb and adapt foreign words, reflecting current trends, values, and challenges. [2]

Here are some examples of international words that reflect a wide range of cultural, technological and culinary influences on the modern use of the English language:

- Café (French): A small restaurant serving coffee and light meals.
- Sushi (Japanese): A Japanese dish consisting of vinegary rice topped or rolled with various ingredients, such as seafood or vegetables.
- Guru (Sanskrit): A spiritual teacher or guide often used informally to refer to an expert or authority in a particular field.
- Robot (Czech): A mechanical device programmed to perform tasks automatically, often used in manufacturing or as AI assistants.
- Piano (Italian): A musical instrument with a keyboard, played by pressing keys that cause hammers to strike strings.

To sum up, the use of international words in contemporary English is a testament to the language's flexibility and its capacity to grow and change in response to the needs of its speakers. This linguistic adaptability not only enhances communication but also fosters a greater understanding and appreciation of the world's rich tapestry of cultures.

REFERENCES

1. Internationalism. URL: https://en-academic.com/dic.nsf/enwiki/865880
2.English as a global language. URL:https://catdir.loc.gov/catdir/samples/cam041/2003282119.pdf

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SOCIAL – EMOTIONAL LEARNING IN HIGHER EDUCATION: A CRUCIAL APPROACH IN TEACHING ENGLISH

In the dynamic landscape of higher education, educators are increasingly recognizing the importance of not only imparting academic knowledge but also nurturing the social and emotional well-being of students. This paradigm shift has led to the integration of Social-Emotional Learning (SEL) principles into various academic disciplines, including the teaching of English. In our opinion in higher educational establishments, the cultivation of social and emotional skills is not only beneficial for students' personal growth but also enhances their overall academic performance and future professional success.

Social-Emotional Learning involves the development of skills such as self-awareness, self-regulation, interpersonal communication, empathy, and responsible decision-making. In the context of higher education, incorporating SEL principles into English language teaching creates a holistic learning environment that acknowledges and addresses students' emotional and social needs.

Traditional education often focuses primarily on cognitive skills, neglecting the equally important aspects of emotional intelligence and interpersonal skills. SEL, addresses to the whole person, recognizing that academic success is intertwined with emotional well-being.

Integrating (SEL) took place in Prydniprovska State Academy of Civil Engineering and Architecture during English classes where the effective communication was provided by senior teacher S. Levytska and two groups of students, the topic of the practical lesson was “Fortune Tellers”. These English language classes provided a unique platform for developing effective communication skills. Incorporating collaborative activities, the teacher created group discussions so that not only enhanced language proficiency but also cultivated interpersonal skills and the ability to express oneself with empathy and clarity. At the lessons students were offered to use a lot of techniques one of them was Using Creative Writing for Emotional Expression. It can be inferred that Creative writing assignments offered students an outlet for self-expression. Integrating practices helped students to manage stress, improve focus, and enhance self-regulation contributed to a positive and supportive learning environment, because in Ukraine there are constant air alerts and a lot of students cannot cope with their emotions.

According to American Psychological Association, Coalition for Psychology in Schools and Education “Top 20 principles from psychology for teaching and learning“ the emotional well-being of students can influence the quality of their participation in the teaching–learning process, their interpersonal relationships, the effectiveness of their communication, and their responsiveness to climate in the group. Concurrently, the group climate can influence students’ sense of security and acceptance, perceptions of social support, sense of control, and overall emotional well-being. The teacher plays a key role in establishing a climate in which all students are accepted, valued, and respected. Teachers can help facilitate emotional development by: • Using emotional vocabulary – for example, facilitating student labeling of emotions (e.g., happy, sad, fearful, angry), • Promoting emotional understanding of others, such as empathy and compassion, • Monitoring their expectations to ensure they are equally encouraging to all students, regardless of past performance. [2]

Key advantages of using Social – Emotional Learning

1. Improved Academic Performance:

Research indicates that students with strong social and emotional skills perform better academically. By addressing emotional well-being, English language educators can create an environment conducive to effective learning and academic success.

2. Preparation for Professional Success:

Social and emotional skills are highly valued in the professional world. Graduates who have developed strong interpersonal communication, emotional intelligence, and teamwork skills are better equipped to navigate complex work environments and succeed in their careers.

In conclusion, integrating Social-Emotional Learning into English language teaching in higher education is a transformative approach that goes beyond linguistic proficiency. By nurturing students' emotional intelligence, interpersonal skills, and self-awareness, educators play a pivotal role in preparing them not only for academic success but also for a fulfilling and successful future in an interconnected and diverse global society. The incorporation of SEL principles in higher education represents a progressive step towards holistic student development and a more compassionate and empathetic learning environment.

REFERENCES

1. Social and Emotional Learning Market. URL: https://www.marketsandmarkets.com/Market-Reports/social-emotional-learning-market-245017024.html?gad_source=1&gclid=CjwKCAjwzN-vBhAkEiwAYiO7oDSyvZglG3JwEZaAIYyAfZ2tYGkITUnMMZwefuogiGoR5EY0XILOXBoC9t8QAvD_BwE

2.Top 20 Principles From Psychology for PreK–12 Teaching and Learning/ URL: https://www.apa.org/ed/schools/teaching-learning/top-twenty-principles.pdf

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STUDY OF INTERMEDIALITY ON THE SCENAGRAPHY MATERIAL OF THE FILM VERSION OF ‘HAMLET’ BY KENNETH BRANGH

The article is devoted to the study of the scenography of Kenneth Branagh's film "Hamlet" in the aspect of intermediality, namely the connection of the literary text with the film version, the identification of common and different in ideological and thematic content and methods of depicting reality. Ideas of intermediality arose in the works of philosophers of the 19th century. (I. Kant, H. Hegel, F. Schlegel), but they are becoming more and more important nowadays in the works of literary critics as well as in theoretical ones (A. Volkov, M. Ihnatenko, Yu. Lotman, D. Nalivaiko, S. Nahorna, I. Zayarna, L. Heneraliuk), and in practical aspects (L. Kovalova, O. Orlova). Intermediality is considered as a complementarity, cooperation and synthesis of arts, but its research lacks the substantiation of theoretical provisions with the materials of practical studies.

The tasks of the article are the definition of the concept of scene, description and classification of film scenes according to the "filming location" feature; classification of scenography techniques in the film according to the components of the composition; establishing a connection between scenes; description of the semantic functions of the combination of certain techniques; determination of the type of intermediality of "Hamlet" by Shakespear and K. Branagh and the specifics of the ideological and thematic originality of the film version of "Hamlet".

The scene of the film is a minimal, completed part of the action, the criterion for selection of which is the unity of space and semantic completeness. The components of the scene are the interior or natural location, scenery, lighting, computer graphics, actions and speech of the characters, close-up or long-shot of the operator's camera, costumes, props.

The film was shot in 1996 by Kenneth Branagh, director and performer of the role of Hamlet. Production designer – Dante Ferretti. The action of the early medieval play "Hamlet" is transferred in the film to the beginning of the 19th century.

The analysis of the scenes of the film version leads to the following conclusions: 1. The territory of the palace, the river in front of it, the forest, the plain with the mountains behind them, the place of Ophelia's grave are used as location shootings in the film. Some scenes could have been done on a computer. The palace was used for indoor filming, namely: its throne room or ballroom, the corridors of the palace, the bedroom of the royal couple, Polonius' study, Hamlet's study, some corner rooms of the palace. Indoor shooting dominates outdoor shooting. 2. In the creation of scenes in the film, techniques were used that involve the components of the composition: the use of natural elements, the interior, the presentation of the appearance, the thoughts of the hero, the use of close and long shots of the operator's camera. 3. Common pictorial techniques in the film are: the use of the motif of winter and cold, natural disasters; using the interior to reveal the character of the hero; images of close space or far space: for example, a close-up of exterior details or a distant plan of natural space and military preparations and actions; illustration of the hero's thoughts or words with visible scenes; repetition of the motif of informing the king of his grief, along with which he must continue to fulfill his duties. 4. The interaction of scenes with each other has the following options: contrast between scenes and reinforcement of the content of the previous scene by another. 5. The semantic functions of techniques include: emphasizing the uneasiness of the world where the heroes live; unkind feeling, (motifs of winter, cold winter sun); increasing the tension of the scene using the image of an eruption of underground water; selection of details of the appearance (mouth, eye) using a close-up; a holistic view of a scene or zooming in on events with a zooming camera; the actualization of the motive of continuing to perform the duties of governing the kingdom, despite the grief. 6. The intermediality of Shakespeare's tragedy and K. Bran's film version "Hamlet" represents such a relationship-confession of two arts that causes a kind of synthesis of arts in the form of concentration - the art of cinema "absorbs" the means of literature, leaving its own specificity. The film version adds such new meanings to the interpretation of the content of Shakespeare's tragedy as the timeless nature of the main motives and ideas of the work: the transience of existence, delay or haste in the fight against evil, revenge, love and betrayal, the "rottenness" of life built on dishonor.

Prospects for further research into the intermediality of "Hamlet" are the search for new meanings and means of representation introduced by the authors of other film versions in comparison with the literary text; comparing the ideological, thematic and compositional originality of Shakespeare's text with musical versions, paintings, poetry dedicated to Hamlet.

REFERENCES

1.Генералюк Л. Взаємодія літератури і мистецтва. Начерк теорії словесно візуальних інтеракцій / Леся Генералюк // Studia methodologica. – Випуск 29. – Тернопіль: Редакційно-видавничий відділ ТНПУ ім.В. Гнатюка. – С. 81 – 89.

2.Заярна І. Проблеми інтермедіальності в літературі в сучасній науковій рецепції. - Norwegian Journal of Development of the International Science / Учредители: Global Science Center. № 54 . 4, 2021. С. 39 – 43.

3.Ігнатенко М., Волков А. Інтерсеміотика // Лексикон загального та порівняльного літературознавства. – Чернівці: Золоті литаври, 2001. С. 229 – 233.

4.Ковальова Л. «Гамлет» у живописі та ілюстраціях. URL: https://www. 1000журавлів.укр/wp-content/uploads/2018/08/Мист. вітальня. Гамлет-в-живописі-кіно-театрі.pdf (дата звернення: 19.03.2024).

5.Нагорна С. Інтермедіальність та проблема перекодування мистецтв // Література на полі медій. Збірка наукових праць відділу теорії літератури такомпаративістики Інституту літератури ім. Т.Г.Шевченка НАН України /Ред. Гундорова Т. І., Сиваченко Г. М. – К. : 2018. – 633 с.

6.Наливайко Д. Взаємозв’язки та взаємодії літератури й інших мистецтв в аспекті компаративістики // На пошану пам’яті Віктора Китастого: Зб. наук. пр. / НаУКМА; Упоряд. Моренець В.П. – К.: Вид. дім. “КМАкадемія”, 2004. – С.115 – 145.

7.Орлова О. Життя Гамлета у світовому кінематографі. URL: https://www.1000журавлів.укр/wp-content/uploads/2018/09/Гамлет-у-кіно.pdf (дата звернення: 19.03.2024).

8.Сценографія. URL: https://uk.wikipedia.org/wiki/Сценография (дата звернення: 19.03.2024).

9.Заяц А.. Как создаются кинодекорации. URL: https://www.film.ru/articles/ kinoslovar-vyshe-stropila-plotniki (дата звернення: 19.03.2024).

10. Гамлет (фильм, 1996). URL: https://ru.wikipedia.org/wiki/ Гамлет_(фильм,_1996) (дата звернення: 19.03.2024).

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GENDER OF NOUNS IN THE ENGLISH LANGUAGE

What is ‘gender’ in a language? About a quarter of the world’s languages uses gender. In technical terms, gender in languages is just one way of breaking up nouns into classes or categories. A noun is a part of language that names a person, place, thing, idea, action or quality. For example, nouns can refer to an individual name of a person, like Mike or Amrita. Also, it can refer to a place or thing. Examples of nouns might include Sydney, Louis Vuitton, or Qantas. In some languages, nouns, such as Qantas, can be male or female - masculine or feminine.

It’s important to distinguish between grammatical gender and natural gender. Natural gender is simply the biological sex of a person, animal or character. Grammatical gender is a way of classifying nouns. But this doesn’t always match up with the “natural gender” of the person or object being described.

In some languages, grammatical gender is more than just “male” or “female.” Some languages have a ‘neuter’ class. Other languages others have different genders for animate versus inanimate objects. See how this works in other languages. English makes life a little easier for us when it comes to gender and grammar. [1]

Most English nouns do not have grammatical gender. Nouns referring to people do not have separate forms for men (male form) and women (female form). However, some nouns traditionally had different forms. Nowadays, people usually prefer more neutral forms.

male form	*female form*	*neutral form*
actor	actress	actor
chairman	chairwoman	chair or chairperson
headmaster	headmistress	headteacher or head
host	hostess	(social) host (on an aircraft) cabin attendant
policeman	policewoman	police officer
steward	stewardess	(on an aircraft) cabin attendant
waiter	waitress	waiter

Traditional work-roles. Some jobs were normally done by men in the past, and their names had no form for women (e.g. *fireman*, *fisherman*). Some were normally done by women, and their names had no form for men (e.g. nurses and secretaries were almost always women). Nowadays, *fire-fighter* is preferred to *fireman*, and *nurse* is preferred for both sexes instead of *male nurse* for a man. *Personal assistant* (or *PA*) is often used instead of *secretary*. The neutral words are more ‘politically correct’ (not likely to offend anyone):

Two fire-fighters were injured in a blaze at an electronics factory yesterday.

My brother's a nurse in the local hospital. [2]

What is gender-inclusive language? We've had a look why some words are referred to as "she". In fact, we use "man" and words ending in "-man" far more as gendered nouns in English. Let's look at the example of "fireman." We don't really say "firewoman" in English. But women certainly fight fires. The profession of fighting fires was historically a predominantly male job.

At the same time, traditionally feminine nouns such as actress and waitress are becoming less common. There are lots of examples where the masculine term of actor and waiter is now used for both men and women.

That's why language is important. A linguistics professor explains that the language we use doesn't only reflect our culture, but also constructs it. That means that language can set expectations about how people are supposed to be. If you see a job advertised online and it says "Barman needed now!" it implies they are looking for a man, not a woman. Similarly, how many men do you think would apply to an advert asking for "waitresses"? It's the same with fireman or policeman. The more we use these words, the more people expect those jobs to be done by men. But, there are very, very few jobs out there that require one gender to do the role rather than being open to both.

Luckily, you can spot these gender-biased words easily in English. And, it's also very easy to replace them with neutral language. We have a list of examples with gender inclusive words. [1]

In conclusion, understanding the gender of nouns in the English language adds depth to language comprehension and communication.While English lacks grammatical gender as extensively as some other languages, it still exhibits traces of gender distinctions in pronouns, common nouns, and occasionally in job titles or social roles. Recognizing these nuances enhances language proficiency and cultural sensitivity. Moreover, as language evolves, attitudes towards gender and inclusivity continue to shape linguistic norms. Therefore, navigating gender in English necessitates both an awareness of traditional grammar rules and a sensitivity to contemporary language usage, ensuring effective and respectful communication in diverse contexts.

REFERENCES

1. IDP IELTShttps://ielts.idp.com › prepare › art...Gender in English: Masculine & feminine words
2. Nouns and gender - Grammar - Cambridge Dictionary

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ONLINE AND OFFLINE EDUCATION OF MODERN FORMAT LEARNING

Nowadays online education is counterpart to offline education. It has become a necessary measure since Covid epidemic and war in Ukraine as well.

Offline is the traditional way of education and the original method of learning that allows students to have regular face-to-face interactions with their peers and lecturers. However, as much as online education is predicted to be the future of learning, it cannot replace the holistic aspect of offline. Offline education also allows lecturers to monitor the responses and behavior of their students and accordingly address them. Hence, no matter how advanced online education is, offline education will continue to play an important role in the development of students.

Online education provides an excellent opportunity for students who are unable to enroll in traditional classrooms as well as supports students in setting their own pace for studying. Online education include virtual classrooms. Students can easily access learning materials from anywhere as long as they have proper access to an internet connection. Additionally, online classes provide lecturers with a

number of online learning tools including videos, audio, animations, virtual whiteboards, virtual conference rooms and live chats with the students.

On the other hand, offline classes provide students with a practical learning environment within the walls of a physical classroom. It allows students to closely interact with their teachers as well as participate actively in live discussions and debates. Moreover, students can also participate in recreational activities like art and physical education which contributes to the overall mental and physical development of the student.

The most challenging experience for teacherswhile teaching online is the internet network. Because it is an essential factor for implementing online learning, interaction is also the significant elements in the teaching and learning process. English teachers have different perceptionof online learning because it prevents English teachers from participating in class discussions

REFERENCES

1. Modern tools application in training foreign language teachers in Ukrainian language application: challenges and perspectives. URL:https://www.academia.edu/112599425/

2. Online classes vs offline classes. URL: https://leverageedu.com/blog/online-classes-vs-offline-classes/ (15.01.24)

3. Comparative analysis online and offline foreign language learning for programing students. URL: https://www.researchgate.net/publication/367186870 (02.01.23)

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SOME FEATURES OF PHRASEOLOGICAL UNITS OF THE ENGLISH LANGUAGE

The appearance can say a lot about a person, his temperament, habits, social status, etc. People are interested in their own appearance themselves. Representatives of various sciences are interested in human appearance. For philologists it is interesting from the point of view of the linguistic reflection of a person's appearance.

The object of this work is phraseological units of the English language that characterize a person's appearance.

The subject of our research is the semantic features of phraseological comparisonson of the semantic microfield "Person's appearance".

The semantic microfield "General impression of appearance" is a subgroup in which the bases are expressed by adjectives with the general meaning "beautiful" – "ugly":

as good as a god; as pretty as a picture (as a paint); beautiful like a queen; beautiful as a doll ;

as fresh as a flower, as a rose, as a daisy, as a lily; as fair as a lily;

to look great (look like a million dollars);

as ugly as a scarecrow; as terrible as a mortal sin, to be like wrath of god; as terrible as a witch, as a ghost; look like death warned up;

look like as a ghost; as tough as old leather; like a stone; be as sore thumb.

She looks like a ghost – so pale and strangely blank [5].

He looked as tough and sinewy as old leather [4].

She is as cute as button [3].

I stick out like a sore thumb [2].

He looks like he's made of stone [5].

Subgroups with the semantic base dirty can also be included here: black, dirty as a chimney sweep; dirty, black, muddy as devil;

as black, as dirty as a chimney sweep; as black as the devil, as dirty like the devil; to be dirty as the devil.

to get dirty: to get dirty, to be dirty (smeared) like devil.

Semantic analysis allows to reveal important mental features of society. Thus, the English approach the description of general impressions of a person's appearance in detail. The phraseological units is created by the comparisons of the subjects and objects based on positive and negative connotations.

REFERENCES

1. Англо-український фразеологічний словник / Укладач К.Т. Баранцев. К.: Знання. 2005. 1056 с.
2. Ahern C. There's No Place Like Here. London: Hachette Book. 2009. 417 p.
3. Flagg F. I Still Dream About You. New York: Random House. 2010.
315 p.
4. Hannah K. On Mystic Lake. New York: Bantam Books. 1999. 264 p.
5. James E. L. Fifty Shades Trilogy. New York: Vintage Books. 2012. 592 p.

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APPROCHE COMMUNICATIVE ET SES ATOUTS

Quand on parle de l'approche communicative qui date des années 60-70, on met l'accent sur l'apprentissage efficace qui oblige l'enseignant d'amener les élèves à "s'exprimer, dessiner, jouer ou agir de manière à entraîner la compréhension".[4]

L'approche communicative exige l'utilisation des activités qui favorisent la reproduction de vraies situations de communication. La grammaire retrouve sa place "en cours de langue, dans le cadre d'une phase de réflexion en contexte et d'induction des règles syntaxiques [idem].

Arrêtons-nous sur ce dernier point qui est assez intéressant pour les professeurs du FLE. Premièrement, en s'appuyant sur la méthode de français "Latitude 1" on peut trouver la réponse aux demandes des étudiants qui grâce à l'approche communicative ont la possibilité d'acquérir la compétence sociolinguistique qui pousse l'apprenant à déduire et introduire la grammaire dans la situation réelle de la communication.

En analysant la double page tirée de la méthode citée ci-dessus (Unité 4 "Tu veux bien?"), on voit que les étudiants sont invités à apprendre la demande en utilisant la forme du présent des verbes *vouloir* et *pouvoir*, le conditionnel de politesse (*je voudrais, tu pourrais*) et l'impératif. [3]

D'abord on introduit le sujet de la demande par le document sonore authentique (un des principes pédagogiques de l'Approche communicative est l'authenticité). Puis, pour entraîner les étudiants, on propose quelques activités en transformant les phrases en forme plus polie.

1.Je veux un café, s'il vous plait.
2.Tu peux venir lundi?
3.Je peux vous proposer une question?
4.Vous pouvez écrire votre nom, s'il vous plaît?
5.Je veux aller à Bruxelles. [3]

Ensuite, grâce à l'approche communicative, on implique l'apprenant dans une communication en reproduisant le dialogue avec la consigne déterminée où il y a une demande d'amener une personne à la

gare. Dans ce cas-là, l'élève devient un acteur autonome de son apprentissage. [1] Ça s'appelle déjà les interactions dans la classe en prenant en compte le contexte social.

En enseignant la langue française, le professeur du FLE devient "tantôt (selon les besoins et les objectifs d'apprentissage) un facilitateur, tantôt un guide, tantôt un organisateur; alors il encourage, guide, explique, corrige et même répète ce que l'apprenant vient de structurer". [4]

Pour faciliter le travail du professeur, le Guide pédagogique vient à son aide, celui-ci est élaboré spécialement pour les enseignants du FLE qui donne des conseils méthodologiques, des pistes d'exploitation, des références culturelles, la transcription de l'enregistrement (le cas échéant et le corrigé); des tests et leurs corrigés; des activités complémentaires facultatives; les grilles d'évaluation critériés. [2]

Pour voir le résultat de l'apprentissage de l'élève des objectifs de la communication « Demander de faire quelque chose » on introduit la Tâche finale "Bienvenue !" à la fin de l'Unité 4. [3] Ainsi, le professeur s'adresse à ce guide pour prendre le modèle d'accomplissement de cette consigne en expliquant aux étudiants les points forts de la résolution de la situation pour qu'elle soit respectée le mieux.

Ainsi, il y a beaucoup d'aspects à analyser pour se perfectionner et, par la suite, transmettre ses connaissances aux apprenants.

REFERENCES

1.Hymes D. H. Vers une compétence de communication. Paris: CREDIF Hatier. Collection "LAL".1991

2.Latitude 1. Methode de français. A1/A2. Guide pédagogique. Saraly Huck Hoareau, Regine Merieux, Yves Loiseau. Didier. Paris. 2008

3.Latitude 1. Methode de français. A1/A2. Regine Merieux, Yves Loiseau. Didier. Paris. 2008

4.Petithory F. Introduction à l'approche communicative. 2016. URL: https://www.academia.edu/40428409/Approche_communicative

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SOME ADVANTAGES OF USING PODCASTSIN TEACHING A FOREIGN LANGUAGE

One of the interesting tools for learning English in the modern world is podcasts. A podcast is a series of digital audio files (or video files) that a user can listen (watch) on his/her device at any convenient time. Podcasts represent a dialog and are a kind of interview on certain topics. Podcasting is successfully used in the process of teaching a foreign language [1–2]. Nowadays there is a large number of teaching materials specially designed in the form of podcasts. These can be both authentic podcasts created for native speakers and educational podcasts created for learning purposes. Depending on specific learning tasks, they can be used in individual and group work; in the classroom and at home; in project work and in training classes.

More and more teachers prefer to use podcasting in the teaching process because it encourages learning through creative technologies and open lines of communication. In this regard, the following main advantages of podcasting have been identified:

1) relevance of teaching material and variety of topics;

2) podcasts represent a unique repository of authentic language materials;

3) the possibility of slow and repeated playback of podcasts, which is especially relevant for students who fall behind;

4) the possibility of independent work with podcasts at a pace and at any time convenient for the student;

5) saved podcasts can be viewed/listened to anywhere, regardless of the availability of the Internet;

6) the possibility of dialog with podcasters, and therefore the possibility of practicing speaking or writing with native speakers;

7) short time duration of podcasts.

It can be concluded that podcast as a media carrier,along with other resources, is an indispensable technical means of teaching a foreign language, allowing to solve complex tasks of foreign language education. The use of podcasts in teaching demonstrates the mobility of the modern education system as a whole, its adaptive character, i.e., timely adaptation to innovative technologies.

REFERENCES

1.Dudeney G., Hockly N. How to teach English with technology. London: Pearson Education Limited. 2008. 292 p.

2.Gonzalez D. Teaching and learning through chat: taxonomy of educational chat for EFL/ESL. BenitoJuárez: Simon Bolívar University press. 2009. № 4.pp. 33–45.

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PRINCIPLES OF ESP VOCABULARY ACQUISITION

Vocabulary plays a major role in any language acquisition. Language acquisition is commonly seen as an endless process. Students, consciously or unconsciously, acquire new words permanently. The teaching of vocabulary in ESP should not be distinct from the teaching of vocabulary in EGP. For ESP students, mastering technical vocabulary is even more vital as it directly relates to their professional fields ESP teachers should start by introducing words that belong to general language, but which are also frequently used in technical language. The introduction of vocabulary that has specialized meanings in certain disciplines comes second. In the past, vocabulary learning used to be restricted to learning lists of specialized words by heart and to reading and translating technical texts. Nowadays, students have access to more modern methods of learning, which help them develop their language skills. ESP is always a tailored course to address the requirements of specific learner groups to use English for professional communication. It's generally accepted that ESP teachers aren't only responsible for technical terminology instruction, but subject teachers are those who involved. However, it’s the role of ESP teacher for students to help grasp the terms encountered in exercises or texts [1].

In terms of this issue, there is always a series of questions what vocabulary the ESP teacher should teach, how much vocabulary to teach and how to introduce it.

While teaching ESP, certain types of vocabulary are considered – core and non-core, technical and non-technical. Core vocabulary refers to those words that are used in a wide variety of situations. Non-core words have more specific properties than generic. For instance, screwdriver is seen as non-core word, while tool is a core vocabulary. Each subject has words which are either used exclusively in that subject area or common words which acquire new meanings when they are used in that subject area. But, there are also so called semi-technical words which belong to general English but also occur in a technical field. They have one or more meanings in general English and take on extended meanings in technical contexts. Very often, with certain knowledge is the subject area students do not have many problems with understanding the words, but there are situations when it is impossible for students to understand the terms and to use them in sentences of their own. When dealing with texts which contain a lot of new words, it is the teacher’s task to select the ones students might find worth learning, to teach students how

to pronounce them correctly and to explain them as clearly as possible to the students if they do not have any equivalents in the learners language [2].

But how to learn words (terms) to acquire them? The teacher's attention must be paid to the following three aspects: form, meaning, and use. The form includes spelling, pronunciation, the parts that make it up (prefix, root, suffix). Meaning refers to what you are intended to understand. Use is about the grammatical functions of a word and the collocations that go with it. The more students know about a word, the more likely they are to be able to use it correctly in a variety of contexts. One of the greatest challenges students face is that of turning passive vocabulary into active vocabulary. If words are not used, they will be lost. It is clear that vocabulary of any language is so vast and complex that no course could ever cover it. Thus, the teacher defines an approximate number of terms to be acquired in each topic. Showing students how words function in large contexts offered by authentic texts rather than in isolated vocabulary drills leads to solid vocabulary learning. However, it is important that every teacher has to make sure that all the newly-acquired words are receptively and productively automatized [3].

It is necessary to understand that vocabulary is not a target itself. Expanded vocabulary contributes much into the skills of reading, listening and speaking. That is why vocabulary should not be compared with the other language skills, since it is a solid foundation to build the overall language proficiency on.

REFERENCES

1.Dudley-Evans, T., St John, M. J. (2007). Developments in ESP. A multi-disciplinary approach. Cambridge, Cambridge University Press.

2.Schmitt, N., McCarthy, M. (1997). Vocabulary: description, acquisition and pedagogy. Cambridge, Cambridge University Press.

3.Thornbury, S. (2007). How to teach vocabulary. Harlow, Pearson.

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THE EFFECTIVENESS OF USING MOBILE APPLICATIONS FOR FOREIGN LANGUAGE LEARNING

Mobile applications have become increasingly popular for language learning, offering learners the opportunity to study anytime and anywhere. Let's explore the effectiveness of using mobile applications for foreign language learning based on the available information.

According to a review study that explored original, peer-reviewed English studies from 2015 to April 2019, mobile applications used in the learning of English as a foreign language have been found to be beneficial and effective. The study analyzed 16 original journal studies and revealed that mobile learning is becoming a salient feature of education, providing great opportunities for foreign language learning. The key benefits of using mobile applications for language learning include enhancing learners' cognitive capacity, motivation to study in both formal and informal settings, autonomy, confidence, and personalized learning. [1]

Another study focused on the use of mobile applications in learning a foreign language, specifically English, by elderly people. The article discusses the benefits of using mobile applications for learning foreign languages, such as English, by older individuals. The use of mobile apps for learning a foreign language is considered one of the tools that can promote the well-being of older people. It can improve cognitive performance, have a positive impact on mental well-being, reduce anxiety, increase self-confidence, facilitate the development of new social ties, and provide a sense of self-realization. [2]

Furthermore, a study analyzed the learning experiences and outcomes of foreign language students using gamification. The results demonstrated the positive effects of gamification on English as a Foreign

Language educational experiences from university learners. In gamified English learning environments, pleasantness, attractiveness, motivation, and enjoyment were all desirable qualities. However, it is important to note that design features alone do not guarantee learning, even if they may provide an effective and interesting learning environment. [3]

Additionally, a descriptive survey conducted at the Poltava State Medical University explored the implementation of mobile applications in the training of future doctors studying the Ukrainian language. The survey demonstrated that most smartphone and tablet apps can be effectively used for learning new vocabulary, grammar, spelling rules, and developing writing and speaking skills in Ukrainian for foreign students. [4]

While mobile applications offer convenience and flexibility for language learning, it is important to note that students and teachers are not fully realizing the educational potential of mobile devices. A survey found that 60 percent of foreign language students and nearly 14 percent of instructors use smartphones for language learning purposes. However, students need guidance on where to find resources beyond standard dictionary and translation apps. [4]

In conclusion, mobile applications have shown effectiveness in foreign language learning. They provide opportunities for independent and active learning, enhance cognitive capacity, motivation, autonomy, and confidence, and offer personalized learning experiences. However, it is important to provide guidance and support to learners to fully utilize the educational potential of mobile devices.

REFERENCES

1.Kacetl J., Klimova B. Use of Smartphone Applications in English Language Learning - A Challenge for Foreign Language Education // Education Sciences. 2019. № 9 (3). C.179-179 URL: https://www.researchgate.net/publication/334408424_Use_of_Smartphone_Applications_in_English_Language_Learning-A_Challenge_for_Foreign_Language_Education

2.Bustillo J., Rivera C., Guzmán J. Benefits of using a mobile application in learning a foreign language // Sistemas y Telemática. 2017. № 15 (40). C.55-68 URL: https://www.researchgate.net/publication/323710717_Benefits_of_using_a_mobile_application_in_learning_a_foreign_language

3.Gafni R., Achituv D., Rahmani G. Learning Foreign Languages Using Mobile Applications // Journal of Information Technology Education:Research. 2017. № 16 (1). C.301-317 URL: https://www.researchgate.net/publication/320654880_Learning_Foreign_Languages_Using_Mobile_Applications

4.Klimova B. Benefits of the Use of Mobile Applications for Learning a Foreign Language by Elderly Population // Procedia Computer Science. 2020. № 176. C.2184-2191 URL: https://www.sciencedirect.com/science/article/pii/S1877050920321591

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SOME PROCESSES OF TERM FORMATION IN MODERN ENGLISH BUILDING TERMINOLOGY

Formation of new building terms in the English language involves various methods which are widely spread in general language . These methods include :

1.Derivation: Word derivation in modern English building terminology involves the creation of new words through the addition of prefixes, suffixes, or other affixes to existing words. Here are some common examples:

Prefixes:
- "Re-" (e.g., reinforce, rebuild),
- "Pre-" (e.g., prefabricate, precast),
- "Sub-" (e.g., subfloor, substructure),
- "Multi-" (e.g., multifamily, multistory)

Suffixes:
- "-tion" (e.g., insulation, ventilation),
- "-ing" (e.g., roofing, flooring),
- "-er" (e.g., builder, plasterer),
- "-ment" (e.g., improvement, basement);

Combining Forms:
- "Bio-" (e.g., biodegradable, biophilic),
- "Eco-" (e.g., eco-friendly, eco-design),
- "Hydro-" (e.g., hydrophobic, hydroelectric),
-"Thermo-" (e.g., thermodynamics, thermoplastic);

Suffixes indicating Materials or Substances:
- "-ite" (e.g., concrete, graphite),
- "-wood" (e.g., plywood, hardwood),
- "-steel" (e.g., stainless steel, carbon steel),
- "-glass" (e.g., fiberglass, safety glass);

Suffixes indicating Processes or Actions:
- "-ize" (e.g., modernize, standardize),
- "-ify" (e.g., solidify, purify),
- "-ate" (e.g., laminate, insulate),
- "-ify" (e.g., electrify, amplify).

By employing these derivation techniques, the building industry continuously expands its vocabulary to describe new materials, methods, processes, and technologies.

2. Compounding: Combining two or more words to form a new one. For instance, "skyscraper" combines "sky" and "scraper."

3. Acronyms and Initialisms: Forming words from the initial letters or parts of words. For example, "HVAC" (Heating, Ventilation, and Air Conditioning) .Acronyms are formed by taking the initial letters of a phrase or compound term and combining them into a single word. In the building domain, acronyms are often used to refer to organizations, standards, or technical concepts. For example, "LEED" stands for Leadership in Energy and Environmental Design, a green building certification program. Acronyms streamline communication and can become widely recognized shorthand for complex ideas within the building industry.

4. Blending: Merging parts of two words to create a new one. For instance, "brunch" combines "breakfast" and "lunch."Blending is a creative method in English terminology where two words are combined to create a new term, often reflecting a fusion of their meanings. It's commonly used to coin words for new concepts or technologies, making it a flexible tool for linguistic innovation.

5. Back-Formation: Creating a new word by removing affixes from an existing word. For example, "televise" from "television."

6. Conversion: Changing the word class of an existing word to create a new one without adding or removing any affixes. For example, "to concrete" (verb) from "concrete" (noun).Conversion, in the context of forming new building terms, involves using existing words from one grammatical category (such as a noun, verb, or adjective) and applying them to a different category without adding any affixes.

For instance, "to roof" (verb) can be converted into "a roof" (noun), or "brick" (noun) can be converted into "brick" (adjective) as in "brick wall". Conversion allows for the adaptation of words to fit the specific needs of the building domain without introducing entirely new vocabulary.

7. Borrowing: Adopting words from other languages, especially when there's no direct equivalent. For example, "cement" from old French " ciment" or "patio" from Spanish.Borrowings, also known as loanwords, involve adopting terms from other languages into the building domain of English. These borrowed words often represent concepts or technologies that originate from cultures with their own specialized terminology.

For example, English has borrowed "patio" from Spanish and "feng shui" from Chinese to describe architectural features and design principles. Borrowings enrich the building terminology by incorporating diverse linguistic influences.

8. Eponyms: Words derived from proper nouns, often names of people or places. For example, "Galvanized steel" named after Luigi Galvani.Eponyms involve naming architectural elements, techniques, or styles after a person, typically the inventor or popularizer of the concept. For example, "Romanesque architecture" is named after the Roman style of building, and "Palladian windows" are named after the Italian architect Andrea Palladio. Eponyms serve as a way to honor influential figures in the field of architecture and to designate specific building elements or styles associated with their work.

In conclusion it is possible to state that these methods, along with the ever-evolving nature of language, contribute to the continuous expansion of building terminology in English .

REFERENCES

1. Cambridge Dictionary, URL: https://dictionary.cambridge.org

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ARE SOCIAL MEDIA EFFECTIVE FOR LEARNING FOREIGN LANGUAGES?

Nowadays social media takes a big part of our lives, and a lot of people use it in daily basis.

Social media started as platforms, on which users can share thoughts, photos, events etc. But now people use them as source of news, information, business. People can use social medias to learn, improve their skills, discuss topics, search for new information and help. Foreign languages are not exception.

Usage of social media as educational platform can be compared to way, which bilingual children learn. [1] Parents surround children with two or more languages and get result. Social medias can be used the same way. By reading or watching interesting content in foreign language you can easily learn:

1) words, slang, idioms;
2) pronunciation from native speakers;
3) right way to make sentences.

But is this method effective?

To make a conclusion I will analyze some factors as:

1) how popular social medias are?
2) how much time you should allocate on learning?
3) is this method easier than studying with books?

The number of people using social media is over 4.95 billion (data from October 2023) [2] Facebook is the largest social media platform with 3.05 billion monthly active users, YouTube with 2.49 billion monthly active users, Instagram has 2 billion monthly users and TikTok with 1 billion monthly active users.

Scrolling thru social medias people choose what content they like, the same way, that content-creators make content. So, learning in social media can turn into daily routine. Users can watch educational videos in the morning or evening, while checking news. They can learn new information during lunch break or at way home.

The main difference between learning with books or social media is the way of memorizing information. With books people should patiently study paragraphs, memorizing words, on other hand – in social media information can be learned during reading interesting articles or watching funny videos.

In the conclusion I can say that social media(which are used by billion people daily, are free and available to everyone) are effective way to learn words, idioms, slang, rules of building sentences and practicing with understanding accent of native speakers of foreign language.

REFERENCES

1.P.Poramathikul, N. Arwedo, I. Abdulhakim. The Influence of Using Social Media as a Learning Platform by Bilingual and Multilingual Learners on English Speaking Skills. English Language in Focus (ELIF), 2(2), 111-122. URL: https://jurnal.umj.ac.id/index.php/ELIF/article/view/6118/3935

2.B. Dean “Social Media Usage & Growth Statistics” URL: https://backlinko.com/social-media-users#how-many-people-use-social-media .

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LES COURS INTENSIFS ANIMÉS PAR DES LOCUTEURS NATIFS COMME UN PROCÉDÉ EFFICACE DE L’ENSEIGNEMENT DU FLE

La participation des locuteurs natifs ayant une formation spéciale ou connexe, une expérience de travail avec des étudiants étrangers et ayant reçu une formation préalable à l'enseignement du français langue étrangère à l'enseignement d'un cours intensif de langue étrangère dans un établissement d'enseignement supérieur est l'un des moyens d'accroître l'efficience et l'efficacité de l'apprentissage du français dans des groupes d’étudiants qui suivent les programmes de l’étude approfondie du français dans des spécialités non linguistiques de l’académie.

Les cours avec des locuteurs natifs doivent constituer une composante importante de l'apprentissage du français pour des objectifs spécifiques (FOS), ce qui a été souligné à plusieurs reprises dans les études sur la méthodologie de l'enseignement du français [1].

Les cours avec des professeurs bénévoles qui sont des locuteurs natifs de la langue française constituent l'un des principaux axes de coopération des établissements d'enseignement ukrainiens avec la Fédération des échanges France-Ukraine, ainsi que l'organisation et le déroulement des stages linguistiques et professionnels [2], qui sont actuellement réalisés avec le soutien de l'Agence universitaire de la francophonie et sont financés partiellement ou entièrement par ses fonds, à condition que l'établissement d'enseignement supérieur en Ukraine soit membre de cette organisation international à l’échelle mondiale.

Les cours intensifs du français en ligne de courte durée ont généralement lieu à la PAEGCA pendant les vacances d'hiver ou en dehors des heures non académiques en semestre avec une charge de 30 à 60 heures académiques. Ils prévoient la répartition des apprenants en deux niveaux, à savoir, le niveau débutant et le niveau intermédiaire et avancé et se déroulent selon les programmes adaptés à chaque niveau.

À chaque cours d'une durée d'environ 1,5 heure, les apprenants améliorent leurs compétences de prononciation et d'intonation, apprennent des constructions grammaticales largement utilisées, se familiarisent avec un nouveau vocabulaire et des expressions figées, font des exercices d'entraînement appropriés et ont également de nombreuses conversations sur des sujets intéressants: voyages, loisirs et passe-temps préféré, filière ou spécialité d'études à l'académie, métier de rêves, etc.

De bons manuels pour ces cours sont les méthodes françaises "Entre nous -1" et "Prêt-à-parler", qui, en plus des textes et des exercices pédagogiques, contiennent des documents audio et vidéo adaptés au niveau approprié, ainsi que des activités interactives.

Il convient de souligner que ces cours comprennent généralement une composante importante de la civilisation. Ainsi, à chaque cours, les étudiants approfondissent leurs connaissances de la France, de ses régions et des grandes villes, se familiarisent avec les monuments architecturaux et culturels des différentes régions, les traditions et plats locaux, ainsi que des personnalités célèbres du passé et du présent.

De plus, les étudiants ont l'opportunité de découvrir d'autres pays européens francophones, comme la Belgique et la Suisse, ainsi que des pays du Maghreb (l'Algérie, le Maroc, la Tunisie), situés sur le continent africain, qui ont été d'anciennes colonies françaises, et d'apprendre quelques particularités régionales de la langue française.

Le format en ligne qui est très pratique permet d'utiliser activement une large gamme de documents authentiques, en particulier des ressources Internet, telles que des extraits d'émissions de télévision, des films, des interviews, des textes littéraires et des articles de presse, des chansons, des vidéos, etc., ce qui stimule considérablement l'intérêt des étudiants à l'apprentissage d'une langue étrangère et développe également les compétences de perception d'un discours authentique à l'oreille.

RÉFÉRENCES

1. J. Forgeron Le partenariat Académie d'architecture et de génie civil de Dnipro et la « Fédération échanges France – Ukraine» // Другий міжнародний франкомовний колоквіум в Україні «Мови, науки та практики»: Тези доповідей, Дніпро, 3-4 жовтня 2018 р. – Дніпро: ТОВ «Акцент ПП», 2018. – С. 77-78.

2. J.-M. Mangiante Analyse de discours professionnel et conception de référentiels en langue: démarche FOS et ingénierie pédagogique // Другий міжнародний франкомовний колоквіум в Україні «Мови, науки та практики»: Тези доповідей, Дніпро, 3-4 жовтня 2018 р. – Дніпро: ТОВ «Акцент ПП», 2018. – С. 141-142.

ЗМІСТ

БУДІВНИЦТВО

АРХІТЕКТУРА

ЛЮДИНА ТА ДОВКІЛЛЯ. ОХОРОНА ПРАЦІ

Придніпровська державна академія будівництва та архітектури

НАУКА І ТЕХНІКА: ПЕРСПЕКТИВИ XXI СТОЛІТТЯ

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