МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

ДВНЗ «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 дистанційної науково-практичної конференції
студентів і молодих вчених

ДНІПРО
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Матеріали дистанційної науково-практичної конференції студентів і молодих вчених «Наука і техніка: перспективи XXI століття» (Дніпро, 24 березня 2022р.). Дніпро. ДВНЗ «ПДАБА», 2022. – 143 с.

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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.

Матеріали подаються в авторській редакції.
За зміст, достовірність фактів та інших відомостей відповідають автори.

Затверджено на засіданні кафедри іноземних мов ДВНЗ ПДАБА (протокол № 14 від 14.03.2022).

БУДІВНИЦТВО

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CRÉER UN MODÈLE DE CONSOMMATION D'ÉNERGIE ET D'ANALYSE ÉNERGÉTIQUE DE LA MAISON

Actualité. Un aspect important de la réalisation rapide de la compétitivité internationale de l'Ukraine est l'introduction d'une politique d'État sur l'efficacité énergétique. L'économie énergétique doit faire partie de notre mentalité, de la culture de production et sociale. À l'étranger, l'efficacité énergétique n'est pas seulement l'utilisation de technologies de l'économie de ressources, de récupération, d'installation, par exemple, de fenêtres économes en énergie, d'isolation murale. Il s'agit d'une approche globale de la phase de conception à la mise en service etl'exploitation de l'installation ou de la technologie (équipement) [1, p.10]. L'industrie nationale de la construction a besoin de modernisation et de transformation numérique. À notre époque, une mise en œuvre efficace de BIM - technologie est un enjeu stratégique du développement de l'industrie de la construction. BIM (Building Information Model) – c'est le diminutif d'une modélisation d'information des bâtiments. Dès les premières étapesdu processus de de conception, du début des travaux ainsi que dans l'exploitation des bâtiments existants, il est possible de créer un modèle de consommation d'énergie qui optimise les projets et économise de l'argent pour les clients.

L'objet de cette étude est l'amélioration de l'efficacité énergétique de la maison en créant un modèle de consommation d'énergie Revitet effectuer descalculs de la consommation d'énergie dans Autodesk Insight avec un ajustement ultérieur des facteurs de projet et opérationnels.

Déroulement d'étude. Lors de la création d'un modèle architectural (Fig.1) dans un environnement logiciel Revit est utilisé comme éléments de construction : murs, plancher / chevauchement,plafonds, fenêtres, portes, toits et éléments de mise en forme qui sont spécifiques à ce projet.

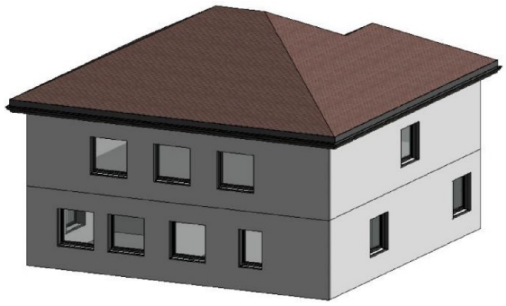

Fig.1 *Modèle architectural du bâtiment*

Revit a mis en place trois approches pour la création automatique d'un modèle de consommation d'énergie basé sur un modèle architectural : éléments de conception, conception mixte, modèle architectural détaillé [2]. Lors du calcul de la consommation d'énergie d'un modèle, des informations sur les conditions météorologiques sont requises, doncavant d'optimiser la consommation d'énergie pour le modèle de bâtiment, il est nécessaire d'établir un emplacement géographique et de sélectionner une station météorologique accessible.

Puis, directement à partir du modèle architectural, créer automatiquement un modèle d'économie d'énergie dans Revit (Fig.2) à l'aide de l'outil Analyse → Optimisation de la consommation d'énergie → Créer un modèle de consommation d'énergie.

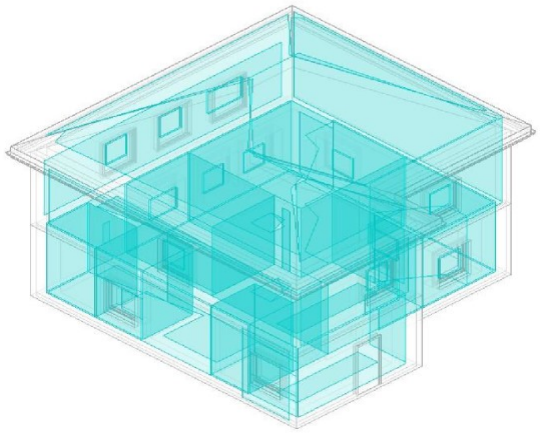

Fig. 2 *Modèle analytique du bâtiment*

Pour calculer et optimiser le modèle de consommation d'énergie, vous devez le télécharger dans Autodesk Insight. Le logiciel cloud Autodesk Insight permet aux architectes et ingénieurs de concevoir des bâtiments plus économes en énergie à l'aide d'outils de modélisation avancés et de données d'analyse du rendement des bâtiments intégrées à Revit [4]. Grâce aux outils d'analyse Revit et Autodesk Insight, vous pouvez identifier, évaluer et ajuster les facteurs de conception et d'exploitation pour améliorer l'efficacité énergétique. Par exemple, dans l' œuvre [3] pour améliorer l'efficacité énergétique de la maisonil a été décidé d'installer des fenêtres supplémentaires en plus de celles existant dans les mêmes ouvertures de fenêtre. Les calculs de la consommation d'énergie sont répétés plusieurs fois tout au long du cycle du projet, ce qui permet d'atteindre les objectifs de consommation d'énergie du projet.

Conclusions et progression des études. Les bâtiments neufs et rénovés nécessitent des solutions modernes d'économie d'énergie. On peut affirmer que l'utilisation de BIM – technologies permet de prendre des décisions plus argumentées, d'améliorer la qualité de la conception et l'efficacité des travaux conjoints tout au long du cycle de vie du projet. Les modèles Revit aident à analyser les technologies d'optimisation énergétique. D'autres recherches porteront sur le développement de modèles d'économie d'énergie dans Revit et sur l'efficacité des bâtiments dans Autodesk Insight.

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COMPARATIVE ANALYSIS OF MICROCLIMATE PARAMETERS OF LOW-FLOOR RESIDENTIAL BUILDINGS WITH DIFFERENT HEATING SYSTEMS

Problem statement. Now more than ever, people want to live in their own houses in more comfortable and more ecological conditions. These conditions are provided by normative parameters of microclimate: temperature, humidity, a level of carbon dioxide, levels of which are under the influence of many factors, particularly of a heating system type. Therefore, it is essential to learn how various heating systems affect the microclimate.

Purpose of the study was to compare the microclimate parameters of low-rise residential buildings with different heating systems, specifically with natural gas-fueled heating, an electric heating system, and a solid-fueled boiler heating. The aim was to get the empirical data by graphs that show the microclimate parameters dependency on actions and conditions; to identify a heating system with a less harmful impact on the microclimate of the buildings and with more economical use. The comparison of the impact analysis of the electric and gas boilers should be conducted in buildings with identical architectural and constructive components and with identical winterization of foundations, walls, roofs.

Results. Three buildings with different heating systems were examined by measuring three microclimate parameters: a level of carbon dioxide, temperature, air humidity. On the basis of the measurements, the graphs of the microclimate parameters to the best possible solution to keep a standard level of microclimate were developed. Some benefits and weaknesses of the different heating systems were detected in order to choose the most appropriate heating system. The buildings with the natural gas-fueled and electric boilers have almost the same microclimate parameters. In option with electric boiler, the level of the carbon dioxide is slightly lower than with gas-fueled boiler, and the boiler temperature of warming up and cooling off dynamics is almost identical; the air humidity does not reach the standard mark in both cases; the more temperature level, the more bottoming out air humidity; the air is extremely dry and it needs humidification. The standard marks of the microclimate parameters of the carbon dioxide and % RH parameters can be reached by using a simple open window. The aeration for 30 minutes is not enough if the level of carbon dioxide and % RH is far greater than the standard mark. But if we keep the open window for 45 minutes, the temperature significantly drops inside the building. The optimum airing mode to keep the microclimate parameters is to airing the room by open the window three times a day for 30 minutes, but it`s inappropriate because the temperature indicators constantly drop. Therefore, there is the best option to install a rotor recuperator 60%. The building with a solid-fueled boiler heating (wood burning) has closer level of carbon dioxide to the standard mark than previous buildings with gas and electric heating systems. It is characterized by some facts that this building is not residential and it was not heated in winter, it is in an ecologically clean area and the main – it has got high-quality exhaust system, nothing gets from furnace inside the building. But the humidity level is low; air is overly dry. All three buildings don`t match the standard level of carbon dioxide, air humidity, temperature. They need the installation of the recuperators 60%.

Conclusion. The study finds that the heating system with the electric boiler is more comfortable and less harmful for the microclimate of the building: in the building with electric boiler the lowest level of carbon dioxide; the most stable temperature and air humidity indicators were defined. They were the closest to the standard, but this option is more expensive during the period of operation. The heating system with a gas boiler goes one step past the microclimate indicators, but it`s more economical. The heating system with the solid-fueled boiler is clearly inferior to the electric and a gas boiler by the microclimate indicators, but it is more economical than the other systems. Obtained scientific-practical results can be used by educational institutions that train specialists in energy audit specialty. The

graphics and the comparative specifications of microclimate can be used by developers and investors in selecting the appropriate heating system.

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TENDANCES ACTUELLES EN MATIERE D'EFFICACITÉ ÉNERGÉTIQUE DES BÂTIMENTS EN RAISON DE L'AMÉNAGEMENT DE L'ÉTAGE MANSARDÉ

Actualité. Grenier ou étage complet? Cette question est posée à de nombreux propriétaires de maisons privées décidant d'augmenter l'espace de vie. Tout d'abord, l'étage mansardé (ou lambrissé) présente de nombreux avantages par rapport à l'étage complet:

- Augmentation de la surface habitable du bâtiment;
- Construction économique, réduction des coûts des matériaux de construction;
- Fonctionnement économique nécessite moins de consommation d'énergie pour le chauffage des locaux;
- Planification non standard de l'étage, aspect esthétique à l'intérieur comme à l'extérieur.

Un autre avantage incontestable, c'est l'augmentation de l'utilisation rationnelle de l'espace de vie dans les bâtiments anciens en raison de la transformation du grenier en espace habitable.

Positionnement du problème. Les publications scientifiques [1,4] indiquent qu'il existe de nombreuses solutions innovantes pour améliorer l'efficacité énergétique grâce au remplacement des systèmes d'ingénierie [1], à la mise en œuvre de façades ventilées à charnières [4], etc.

De plus, il faut ajouter que l'aménagement du grenier en étage mansardé vise non seulement à augmenter la surface habitable, mais également à améliorer l'efficacité énergétique du bâtiment dans son ensemble suite à une isolation supplémentaire de la toiture et des murs, ce qui donne inévitablement lieu à une réduction des coûts de chauffage.

L'augmentation de la surface habitable, en général, due au développement urbain dense, est d'un grand intérêt pour le projet de maison avec un étage mansardé. L'aménagement de l'étage lambrissé conçu à l'origine pour augmenter la surface utile des bâtiments et des structures, au stade actuel de son développement, est considéré par de nombreux architectes comme une opportunité de modifier l'apparence architecturale des systèmes de construction existants.

Selon [3], la perte de chaleur à travers les murs extérieurs dans la maison atteint environ 30%, de sorte que l'utilisation de technologies de stockage de chaleur constitue une tâche urgente. L'inertie thermique d'un mur caractérise sa capacité à absorber et à accumuler la chaleur vers le local. Les fenêtres mansardées y contribuent, car elles présentent des différences significatives par rapport aux dispositions conventionnelles, tant au niveau de la conception que de la qualité des matériaux. Les fenêtres inclinées sont exposées à un rayonnement solaire et à des précipitations accrues, de sorte que les fenêtres à double vitrage soient en verre avec un revêtement de couche de stabilisation de la lumière. Des fenêtres à double vitrage multicouche en verre trempé sont utilisées pour protéger contre les charges de choc. L'efficacité énergétique des fenêtres est considérablement augmentée grâce à l'utilisation d'une conception spéciale de revêtements métalliques qui forment des chambres à air entre le cadre et la surface du revêtement. De plus, une fenêtre mansardée avec une inclinaison de 45° augmente l'éclairement lumineux de 30 à 40 % par rapport à n'importe quelle verticale [5]. L'un des principaux avantages de la fenêtre mansardée en angle est le fait que le flux de lumière solaire n'est pas entravé par les bâtiments ou les arbres à proximité. Par conséquent, l'espace est chauffé plus uniformément. Les fenêtres mansardées sont idéales pour éclairer les sols des combles qui, en plus de leur fonction directe, effectuent également des tâches indirectes en augmentant la transmission de l'énergie solaire pour son accumulation et son utilisation ultérieures.

Récemment, la tendance à installer des panneaux solaires qui a révolutionné le secteur BTP en matière d'efficacité énergétique des bâtiments à l'étranger, est utilisée à petite et à grande échelle en Ukraine. Chaque année, le coût des panneaux solaires diminue, ce qui ne fait qu'inciter davantage à les utiliser plus souvent dans la construction moderne en Ukraine. Dans notre cas, il sera particulièrement efficace d'installer des panneaux solaires à double face qui absorbent de l'énergie à la fois de l'avant et de l'arrière, ce qui est particulièrement productif en raison de la forte luminosité naturelle de l'espace mansardé. Le principal inconvénient est le faible rendement qui dépend directement de la taille du panneau. Selon [2], les facteurs qui peuvent affecter l'installation de panneaux solaires varient du prix initial et de la forte dépendance au climat, en terminant par les dimensions géométriques.

L'aménagement de l'étage mansardé est un problème technique, économique et social très complexe, et nécessite une justification scientifique et la prise en compte d'un ensemble de problèmes organisationnels et technologiques de reconstruction, une inspection détaillée de chaque bâtiment, une analyse comparative approfondie des solutions d'ingénierie alternatives. Les solutions technologiques de construction de toit en mansarde sont assez diverses. Elles sont déterminées par le type de bâtiments, le niveau de gros œuvre, les spécificités de l'élément architectural de la toiture. La violation de la technologie, la moindre imprécision dans l'organisation de la ventilation, de l'étanchéité et de l'isolation, entraînera des conséquences irréparables et des réparations coûteuses.

Conclusion. Sur la base de ce qui précède, il convient de conclure que d'une part, la conception et la construction ou la reconstruction de l'étage mansardé pour améliorer l'efficacité énergétique des bâtiments de faible hauteur nécessitent des recherches de qualité plus détaillées. D'autre part, il convient de noter que la reconstruction du grenier nécessite plus de coûts de main-d'œuvre et de ressources financières que la construction immédiate d'un étage mansardé.

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HOT WATER SUPPLY SYSTEMS OF OPEN AND CLOSED TYPE

Every winter the deterioration of heating systems, the low level of work of public utilities, exorbitant bills for the phantom heat turn our lives into a dull misery. The transition to an autonomous home heating - it is the freedom to choose the optimal temperature mode, hot water all year round.

In the construction of economic and residential buildings are used hot water systems open and closed. Solutions differ in the peculiarities of the laying and the principle of operation. Each has its own advantages and disadvantages.

Open and closed systems operate on different principles. Hot water in a central closed system involves heating the target liquid through a heat exchanger. Water does not interact with the coolant directly, but passes through a special heater. Hot water supply in a central open system implies mixing of cold water and the source coolant. The final product is delivered to the consumer through a common main. The open type of water supply is optimal for low-rise buildings. It is used in cottages, farm buildings, small industrial workshops. An obligatory condition is a long and intensive distribution of hot water [1].

The advantages of the open type systems include:
- low costs for laying the mains;
- ease of maintenance and installation;
- rapid expansion and modernization.

Among the disadvantages are high heat losses and long waiting time to reach the desired temperature.

In a closed system, the water is in continuous circulation, heated from the heating network. This maintains its temperature at 70 degrees. The liquid is suitable for direct water extraction and filling the heating circuit. In contrast to open solutions, closed solutions are more difficult to implement. At the same time they ensure high quality of the final product and minimum heat loss. Closed systems are used in most new buildings, installed in homes after renovation.

Undoubtedly, hot water refers to the necessary benefits of civilization to no less extent than, for example, heating or electricity. Taking a bath, washing dishes - water is needed everywhere.

The hot water system can be organized in two ways: centrally or independently. We often think about why hot water flows from the faucet only during periods of "blackouts". The supply of hot water can be organized by two main schemes: centralized and autonomous.

The centralized system of hot water supply implies a developed system of utilities in the cottage community or in its immediate vicinity. The situation here is completely similar to that with the central heating systems, and heating and hot water supply are so closely linked that one can say with a high degree of certainty: if there is the first, then there is the second [2].

The autonomous system of hot water supply is fully organized on the basis of different types of water heaters. There are two varieties of such a scheme of the hot water system: with a centralized and autonomous supply of cold water. At first glance, there are no fundamental differences: is it all the same how the water enters the water heater, from a water pipe or from a well? However, this is not the case. On the way of cold-water supply to the house depends on the choice of the type of heating device - storage boiler or flow-through unit.

The only advantage of an autonomous hot water system is the absence of hot water out of the owners' control.

Disadvantages of an autonomous hot water system: costs, water heaters consume fuel, whether gas or electricity. Maintenance and repairs. The need to monitor the operation of all devices included in the scheme of the hot water system - water heaters, booster circulating pumps, etc.

Hot water supply in the modern world is an integral part of comfort. Proper organization of the water supply system will not only provide comfort, but also save money on installation and operation.

Arranging the water supply system, it should be kept in mind that there are two completely opposite ways of connecting. This open (open, dead-end) and closed (closed, circular) scheme of wiring pipelines and equipment. In this case, the second option is much more popular than the first. This is due to the ability to regulate and fully control the state of water and its temperature. The open scheme, on the other hand, has been used less and less frequently in recent years. The reason is its complete organizational lag from the advanced technology and the needs of users. Although, admittedly, in terms of the cost of direct installation, the open system is much cheaper.

When choosing an open scheme, a detailed technically and economically justified project should be followed. In addition, the arrangement of such systems has high requirements for the technical characteristics of the coolant, which will be used as hot water. The open hot water system is best suited for small network lengths or when there is a constant flow of hot water [3].

To optimize the use of the open system, some sections of the lines are blocked by stopcocks, which facilitates preventive and repair work and allows you to drain a small section of the pipeline, instead of draining the entire volume. For added protection, open hot water systems are equipped with float sensors and relays for measuring pressure in the pipes. A home hot water system determines the utility bill. The design of an open hot water system is fairly simple and consists only of supply pipes. In open systems of hot water supply water is taken directly from the heating network. Closed system of hot water supply has the following principle of operation: water from the water supply line enters the water heaters, where it is heated. In addition, in open systems for hot water needs comes chemically treated water that has been deaerated, so the corrosion of internal surfaces of pipes is minimal, but the quality of water is lower than in closed systems, because passing through the heating system water acquires a foreign smell and color. Since the open system takes already hot water from the common heating system, and with a closed system - heated through a specially designed water heater, there is a difference in payment, because the tariffs for hot and cold water are different.

Currently, there are no houses with centralized hot water supply, each house has a gas boiler, boiler or double-circuit boiler.

What kind of hot water device is in your apartment or house?

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BASALT FIBER AS AN ALTERNATIVE TO STEEL IN CONCRETE

The most famous material in construction is reinforced concrete. Over the years, it has proven itself in the best way, but time doesn't stand still, technology is developing, so it has become possible to improve reinforced concrete. One of the options for improvement is basalt fiber.

Basalt fiber is a fiber obtained from basalt rock, which has a high melting point, good compatibility with binder solutions, high modulus of elasticity, high tensile strength and significant resistance to chemical attack.

Basalt materials have a higher strength than steel and this property makes than the material of choice in construction. The structure of concrete with basalt fibers approaches to the structure of reinforcement with steel meshes. Basalt fiber reinforcing the structure has a higher degree of dispersion in the reinforced stone, and the fiber itself has a higher strength than the steel mesh. Basalt concrete structures can withstand large stressed deformations, due to the fact that the fiber itself doesn't have plastic deformations during tension, and surpasses steel in elasticity.

The density of basalt (2600kg/m3) is approximately 30% that of steel (7680kg/m3), which means that basalt fiber reinforced polymer is a stronger and lighter structural material than steel. The most important characteristic of basalt, which makes it an outstanding replacement for steel in some applications, is its high resistance to corrosion in both acidic and alkaline environments, in addition to its high hardness (8.5 on the Mohs scale) [1]. This property is advantageous in structures exposed to high saline or humid environments, such as bridge deck top reinforcement, multi-storey car park concrete slabs, foundations and coastal structures.

Basalt fibers are non-flammable and non-toxic, therefore they don't emit toxic gases in fires. In addition, among carbon, glass, and basalt fibers, basalt fibers have the highest bulk integrity and only about 10% strength loss at 600°C [2]. Basalt functions normally in the temperature range from -260 C to +760 C, and in some cases the application temperature can reach even +960 C for many hours without physical damage.

In addition, they have increased frost resistance, crack resistance, impact strength, abrasion resistance, and durability. Basalt fibers are also dielectrics. The use of basalt fiber, made of coarse basalt fiber, for reinforcing concrete allows:

- to increase the graded strength of concrete up to 30%;
- reduce the delamination of the concrete mixture up to 40%;
- reduce the time of primary and final hardening by 25%;
- reduce the weight of concrete products.

When filling the mortar with basalt fiber, not only does the concrete strength increase, but also the control over the cracking of the concrete and the behavior of the material after the formation of cracks occurs. Concrete is given some plasticity, increased tensile strength, impact strength and improved deformation characteristics of concrete.

In a study with the same amount of concrete for both basalt fiber reinforced polymer (BFRP) reinforced concrete beams and steel beams, it is believed that thinner concrete elements can be used in

BFRP scenarios, since mechanical results show that BFRP is much stronger than conventional steel fittings. When analyzing the study data, it turned out that BFRP is a sufficiently profitable building material to be used as a reinforcing material in concrete beams. During testing, it was found that BFRP may also be suitable for other building applications, such as locating desired facades with concrete - sandwich panels [3].

In conclusion, basalt fiber has a huge number of positive characteristics and can be used as an alternative to steel in concrete.

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3D PRINTING USING CONCRETE EXTRUSION: AS A ROADMAP FOR RESEARCH

Large-scale, cement-based additive manufacturing processes, often referred to as 3D concrete printing, have been under development for the last 10 years and more than 30 groups world-wide are currently engaged in research. 3D printing of concrete eliminates the need for conventional forms by accurately placing or solidifying specific volumes of material in successive layers through a computer-controlled positioning process.

The most commonly used is extrusion, typically a small (6 mm to 50 mm in diameter) continuous filament, pumped through a nozzle often mounted on a gantry or robotic arm that positions the material during the build process. The material is typically a high cement content slurry with a maximum particle size in the order of 2-3 mm, although larger aggregates have been used [1].

To date, studies have been ad hoc, focused on demonstrating viability [2]. Currently, 3D concrete printing manufacturing processes are inconsistent and unreliable, requiring experienced machine operators and extreme care in material preparation and composition. Inconsistencies and unreliability arise from the dependence of material properties on process equipment, operating parameters, and the generation of machine instructions from an algorithm to create the desired geometry. The material must flow and extrude through the nozzle, bond with the previous layer, and
retain its shape under the increasing hydrostatic pressure created by the subsequent layer application. Irregularities during printing caused by material changes or problems in the process are detrimental to the success of an assembly and can affect the performance of a component [4].

These issues hinder the reliability of 3D concrete printing, a critical milestone for commercial viability, of which the rheological properties of 3D concrete printing materials are fundamentally important. Active rheology control and active stiffness control will provide new ways to expand the palette of materials for 3D printing applications. Indeed, if these processes are to become common

building practice, engineers will need to understand how to design structures to be made from printed materials, leading to new design codes and standardized test methods [1].

Additive manufacturing could also be a way for humanity to explore space. NASA has launched the 3D Printing Habitat Challenge, which looks at the technologies used to build homes in space, such as on the Moon or Mars. While ambitious, it's too early to tell if 3D printing is a viable solution. What we can say, however, is that 3D printing in construction is about to become a very real global force [3].

The commercial success of 3D concrete printing lies in the reliability of the design and manufacturing process, the ability of architects and engineers to design certified components and building elements, and the value of the manufactured components. Recognizing that design is the final goal and materials are at the heart of manufacturing success, a proposed concept will guide future research in concrete 3D printing.

The software components are designed specifically for specific applications. They will become standardized so that the optimal configuration for a particular mixture characteristic can be easily realized and so that reinforcement and other materials can be used to make composite materials. These operating parameters will be modeled as plug-ins in the software design to provide developers with autonomy production.

Various aggregates are used to create materials to ensure reproducible freshness properties. The setting will be controlled to a fine degree. The bonding of adjacent material will become stronger and will take place over a long period to maximize the working window. Standardized material specification tests will be adopted to ensure that international designs can be produced anywhere in the world.

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ANALYSE DE L'EXPÉRIENCE CHINOISE DE CONSTRUCTION DANS DES TERRITOIRES SISMIQUES SÉCURISÉS

Le rythme de construction d'installations de complexité variable en Chine est nettement plus élevé que dans le monde. Les études géologiques et l'exploration prennent une grande partie du temps de la construction future, donc l'étude de l'expérience de la construction chinoise peut faire gagner beaucoup de temps lors de la construction dans une zone similaire dans d'autres parties du monde [2].

La grande superficie de la Chine et la diversité des conditions naturelles déterminent la diversité des sols et leur représentation dans le pays. Selon les chiffres officiels, les plus grandes villes du pays, et donc construites, sont Shanghai, Pékin, Canton et Hong Kong. Ils sont tous situés à l'est et au sud-

est de la Chine. Ces zones sont dominées par des sols forestiers et argileux. Les ingénieurs chinois doivent également tenir compte de l'importante activité sismique de la région - 60 % du territoire et 80 % des plus grandes villes se trouvent dans des zones sismiquement actives [1, 5]. Par conséquent, leur expérience dans la construction de gratte-ciel en particulier jusqu'à 600 m et plus dans des conditions géologiques aussi difficiles est très intéressante.

Le développement de la sismologie chinoise indépendante a commencé dans les années 1970. Les normes en vigueur jusqu'alors étaient en grande partie une copie des normes correspondantes de l'URSS. La première norme chinoise avec des changements significatifs par rapport au soviétique a été publiée en 1964. La dernière version de la norme a été développée et approuvée en 2010 et est basée sur une quantité importante d'informations statistiques collectées au cours des 100 dernières années d'observations de tremblements de terre en Chine. Cependant, la prévision des tremblements de terre d'une magnitude de 6 ou plus reste un problème important. Les travaux dans ce sens se poursuivent, mais le principe de base de la construction de bâtiments parasismiques reste leur résistance et leur endurance maximales en cas de fort tremblement de terre, même dans des endroits où des tremblements de terre d'une telle ampleur n'ont pas encore été enregistrés [2,5].

Compte tenu de ce qui précède, nous pouvons conclure que le principal problème de la construction parasismique est la composante économique. Les ingénieurs savent comment rendre un bâtiment résistant aux séismes violents, mais seulement à un coût économique important.

Afin de surmonter ces problèmes et de maintenir un équilibre "force-économie" dans la construction en Chine, plusieurs mécanismes de protection du bâtiment ont été théoriquement développés, testés et utilisés dans la pratique. L'un d'eux est l'utilisation d'un matériau isolant pour la fondation. Différents matériaux peuvent être utilisés pour cela, mais le plus courant est un roulement en caoutchouc. Ses avantages sont la durabilité (jusqu'à 100 ans de fonctionnement), la réduction de l'impact des tremblements de terre sur le bâtiment (jusqu'à 0,2 - 0,5 par rapport à un bâtiment non fortifié), peut être utilisé aussi bien dans les bâtiments en briques qu'en béton armé. Il est assez rigide dans le sens vertical et assez souple dans le sens horizontal, ce qui réduit l'impact des tremblements de terre sur le bâtiment. Dans certains cas, l'appui peut être situé à un étage spécifique du bâtiment ou aux points d'attache des ponts reliant les immeubles de grande hauteur [2,3]. D'autres matériaux utilisés comme isolants comprennent le sable, le mortier graphite-chaux, des arbres spécialement conçus et des plaques d'acier [5].

Aussi, des équipes de chercheurs ont mis au point un nouveau type de béton spécifiquement pour la construction de gratte-ciel. C'est ce qu'on appelle le béton sans carbone multifonctionnel. Il se distingue de l'habituel par une stabilité et une stabilité élevées, une faible déformation et un faible coût. Ceci est réalisé en raison du faible rapport entre l'eau et le gel. Les propriétés positives de ce béton incluent également le respect de l'environnement et l'utilisation de matériaux bon marché qui ne nécessitent pas de traitement [3].

Des études sismologiques, des statistiques et des expériences (par exemple sur une table mobile) ont montré que les structures en briques sont généralement moins adaptées aux tremblements de terre et à leur impact sur les structures. Bien sûr, une maison en briques bien conçue peut résister à un tremblement de terre d'une magnitude allant jusqu'à 6, mais cela nécessite une planification détaillée, le renforcement des pièces individuelles et des coûts économiques. Dans cette optique, la loi chinoise commence à restreindre la construction de bâtiments en briques. Par exemple, à Pékin, la construction de maisons en briques est interdite dans toute la ville et les bâtiments en briques existants doivent être renforcés. La méthode de renforcement la plus simple consiste à ajouter des attaches en béton armé dans les directions verticales et horizontales à l'extérieur et à l'intérieur du bâtiment. Cette méthode est efficace, mais en raison de l'imperfection du système de détection des séismes forts, sa faisabilité économique peut en pâtir [4, 5].

L'industrie chinoise de la construction ne se limite pas à l'utilisation de matériaux ou de structures nouveaux et technologiques. Les systèmes dits BIM (Building Information Modeling) sont

activement utilisés dans la conception. Lors de l'utilisation de systèmes BIM, le bâtiment est conçu dans son ensemble avec toutes les communications, les caractéristiques architecturales et de conception, les indicateurs économiques et technologiques. La technologie BIM est celle du modèle 3D habituel d'un bâtiment une base de données est ajoutée selon laquelle chaque élément se voit attribuer une valeur et une relation spécifiques avec d'autres éléments, de sorte que la modification d'un paramètre modifiera les paramètres des autres éléments. Récemment, le modèle 3D habituel a commencé à se développer en modèles 4 ou 5-D, ajoutant plus de temps de construction et d'estimations. De ce fait, le BIM couvre non seulement la géométrie du bâtiment, mais également tout son cycle de vie [3, 4].

L'industrie chinoise de la construction utilise activement les nouvelles technologies, y compris les leurs, dans la construction et la conception de bâtiments de complexité variable, ce qui peut réduire considérablement les coûts et accélérer la construction de nouvelles structures.

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PARAMETERS OF MULTIPHASE FLOWS

Multiphase streams are streams in which substances are in different physical states (phases): liquid, solid or gaseous. Two-phase flow is a special case of multiphase flow, which includes two dissimilar components. These are liquids with solid or gaseous impurities, gases with liquid droplets or solid particles. In the practice of water supply and sewerage quite often encounter the movement of such flows for example, the movement of water in open channels or canals, pipelines, buildings.

Models of two-phase flows «liquid – colloid», «liquid - solid particles», «gas – liquid», «gas - solid particles» and others, are determined by the state of the continuous and discrete phases, the direction of movement and the speed of individual phases. A characteristic feature of the movement of two-phase flows is the process of phase interaction, which affects the occurrence of additional hydraulic losses. The most difficult task is to determine the phase surface during the movement of the «liquid-liquid» system.

The interaction of substances that are different in their state of aggregation determines the mechanism for the transfer of particles by a fluid flow, which in general is a subject to the laws of thermodynamics.

The mass flow rate of the two-phase mixture consists of the mass flow rates of the continuous and discrete phases. For example, the system «liquid - gas or vapor» is the sum of the mass flow rate of the liquid and the mass flow rate of gas or steam. Mass flow rate of steam is the ratio of gas and mixture consumption. The flow rate of a two-phase flow is the total volume of the continuous and discrete phase that passes through the live cross-section of the flow per unit time.

The flow rate of a two-phase flow is the total volume of the continuous and discrete phase that passes through the live cross-section of the flow per unit time.

The main characteristics of two-phase flows and their modes of movement differ significantly from the similar characteristics of individual phases. The emergence of a certain mode of movement depends on the method of mixing the two phases and the method of introducing them into the system. Types of flow during the interaction of the two phases are distinguished visually and physically, depending on the speed, volume content of the phases, the ratio of their densities, wetting the walls of the apparatus and other parameters. The structure of flows also depends on surface forces [1].

The processes of gas bubbling through the liquid, the dispersion of one liquid into another, the film flow of the liquid at the vapor boundary are also worth studying. The general limit of existence of separate modes of two-phase flows can be given approximately in the form of Freud's number.

The movement of two-phase fluids is significantly affected by resistance forces.

When determining the hydraulic resistance of bodies moving in the flow of liquid or gas, it is necessary to establish a relationship between the loss of kinetic energy and the mode of motion. Existing dependencies link the pressure drop overcome by the moving particle and the part of the kinetic energy expended on the resistance to motion.

The total force of resistance of the particle consists of the forces of frontal resistance and frictional resistance. In the two-phase system «gas – liquid» the pressure drop in the co-directional flow per unit height of the apparatus is determined by the phase distribution and associated with the flow regime. The resistance coefficients of gas flow and liquid flow, velocity of gas and liquid, density of gas and liquid, equivalent diameters of gas and liquid are determined depending on the fraction of the section filled with liquid and the specific surface of flow interaction.

Expansion of the gas when the temperature or speed changes a change in the volume content of the gas takes place. The mechanism of change of hydraulic resistance of two-phase system is caused by change of quantity of movement along a flow axis, change of pressure, change of friction owing to action of shear forces. The equations for individual cases are made taking into account the equation of energy.

There are different classifications of two-phase flows. The classification of pressure drop and mass velocity regimes of a single phase has become the most widespread. In the system «liquid – gas» the distinguish horizontally and vertically directed flows. When the gas phase moves, the following modes are observed: foamy, bubble, flat, wavy, ring, emulsion [2, 3].

The basis for a detailed study of the parameters, basic characteristics and laws of motion of multiphase flows are the laws of thermodynamics, the laws of heat and mass transfer, which describe the mechanism of particle transfer by fluid flow, the interaction of different physical states. The mutual influence of individual parameters, the occurrence of additional hydraulic losses, determine the complexity of the processes and require further research.

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TRANSPARENT CONCRETE – ILLUMICON

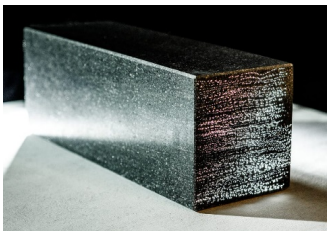
Concrete structures have been leading ones in the construction industry for a long time due to their operational properties. Although concrete is one of the most sought-after materials, it has a very unsightly appearance and usually requires additional exterior finishing.

A transparent concrete - Illumicon is a new type of material and it was created with the development of technological progress. Objects that are created from such concrete have the property of transmitting some of the artificial or natural light rays.

Today, many people believe that transparent concrete has only been developed recently. Indeed, over the last years a lot of new developments of improved light-conducting concrete have appeared, due to the use of modern technologies and materials. But transparent or light-conducting concrete was patented by Canadian Bernard Long back in 1935.

In the 1990s, the first industrial tests of light-concrete samples started to be carried out. And as a result of the work of the Hungarian architect AronLosontsi, the first commercial sample of translucent concrete called Litracon was obtained and patented [2].

After thinking about how to add sunlight to concrete rooms without compromising the strength of the structure, he came up with the idea to modify the internal structure of concrete. The first Hungarian sample was obtained back in 2001, and in 15 years the new technology has spread throughout the world [3].



Light-conducting concrete is a composite material made on the basis of high-strength cement, complex plasticizers and marble chips of small fractions, in the thickness of which there are hundreds of thousands of optical fiber filaments that transmit light through it [1]. Otherwise, the material has all the properties of ordinary concrete: strength, sound

insulation, thermal insulation, water resistance, frost resistance, etc.
The main technical characteristics of light-conducting concrete are as follows:

- compressive strength up to 35 MPa;
- bending strength over 2 MPa;
- water resistance not less than W4;
- frost resistance not less than 75 cycles;
- water absorption no more than 6%.

The effect of transparency is achieved due to the optical fibers located in the body of the material. Due to the property of the optical fiber to transmit the light flux with minimal losses, the light transmission capacity of the new concrete does not depend on the thickness of the product, whether it is a 15 mm thick slab or a 500 mm thick bearing block, the transparency does not change.

The light-transmitting properties of the material depend on the number and diameter of the optical fiber. The fiber diameter of 0.25 mm allows you to see the silhouettes and outlines of objects located directly behind the material.

With a fiber diameter of 3-5 mm, it is possible to distinguish the color shades of the objects located at some distance from the light-concrete structure [1]. Visible dots of fiberglass can be randomly scattered over the surface, can be arranged in a wave-like or linear vertical/horizontal order, can form image contours. In addition to contours, transparent concrete can be of different shades, which allows creating a play of color and shadows.

In the manufacture of translucent concrete, coarse filler is not used, so the optical fiber additionally plays the role of a reinforcing component.

The technology for the production of light-conducting concrete consists in the layer-by-layer imposition of a fine-grained mixture and fiberglass. To obtain the required characteristics, after setting the solution and curing, additional processing is carried out. Transparent light-conducting concrete is ground and polished to obtain the smoothest surface required for maximum light transmission and maximum decorative effect.

Illumikon can be visually compared to polished natural stone, which allows it to be widely used in finishing work. Transparent concrete can be called rather conditionally, since only the contours of objects behind the structure are visible through it and only when the light flux is directed from the back side. In cloudy weather or in the evening, this material does not differ significantly from the usual one; all its properties are fully revealed only in sunlight or when special lighting is used.

The very first primitive structure made of transparent concrete was the Litrocube lamp, which consisted of blocks. The weight of the product reached 10 kg, and its cost was 570 euros. For the first time, building blocks from this material were used in the construction of the head office of the BMW concern by architect Jürgen Loman [4].

At the moment, products made of translucent concrete are used quite often. Blocks with side dimensions of 1.7 x 1 m or 1 x 2 m are most in demand. The high cost of the material does not yet allow it to be widely used in the construction of buildings. Most often, light-conducting concrete is used in the design of interiors and in the decoration of building facades.

Transparent concrete is a modern material that, in addition to high strength, has excellent decorative properties. Perhaps its only drawback is its high cost. However, using it for decorative purposes, a stunning aesthetic effect can be achieved.

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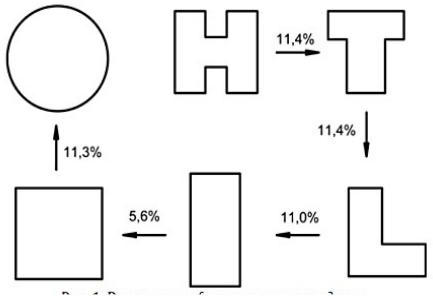
INFLUENCE OF THE FORMATION OF RESIDENTIAL HOUSES ON ENERGY CONSUMPTION

Problem statement. Modern construction is now aimed at reducing the cost of construction objects, in order to spend the smallest number of means for the structure and operation of buildings. That is why different methods of energy efficiency improvement can not be postponed to the background. In the modern world, one of the important problems is excessive energy consumption in the construction industry, including the stages of exploitation of buildings negatively affect not only on the environmental sphere, but also on the economy of construction. This is reduced to the need to save and minimize resources in support of comfortable conditions for staying in the building

*The purpose of research***.** Determination of an energy-efficient and rationally composed volumetric planning decision based on the principles of energy saving for buildings.

Main part. Prospects for designing in construction are possible in compliance with the following conditions: reducing the heat loss of the building and taking into account the environmental component of construction. Construction and design of an energy-efficient building involves taking into account the set of factors, the implementation of which provides efficiency energy efficiency and the choice of a rational architectural and planning decision. The choice of a volumetric planning solution of a building should rely on an energy-efficient form of a building to reduce heat loss. The most relevant and rational use of energy savings has a way to optimize the form of a building that performs the regulation of the energy needs of the building.

The urgency of the construction of energy-efficient buildings is determined by the identification of the most optimal form of a building, which provides not only effective use of renewable energy, but also to preserve energy that enters the engineering networks of the building by distributing energy in the internal space of premises, and orientation aimed at using favorable and neutralization. unfavorable action of the external environment. Also, the heat-energy effect of the climate on the thermal balance of the building can be optimized by the location and area of the translucent openings, adjusting the filtration flows.When accounting for solar radiation and winds on the heat balance of the building, the form must be changed from the sphere, cubic to the parallelogram. But the construction of buildings with a volumetric planning decision in the form of a circle have problems associated with increased consumption and difficulty in its planning. Extracted and compact form without cutting facades is one of the most successful solutions, contributing to a decrease in the specific cost of heat. A successful choice of shape, orientation and size of the building makes it possible to reduce the effect of solar radiation on the shell of the



Pic. 1 Influence of the configuration of the building plan on its energy

building, and therefore, reduce the cost of cooling. With this, there is an improvement in the ecological component, reducing operating costs, which makes the building become more attractive for construction.

Principles of designing a volumetric planning decision must contain an increase in the compactness of the volume Forms of a building to reduce the specific area of the heat transfer surface by using the coefficient of compactness. In calculating compactness of buildings there is a regularity of energy efficiency growth with the same floor area, but various perimeters presented in Pic. 1.

Conclusions. Choosing a building form - is one of the constructive solutions for the construction of an energy-efficient building. The smallest heat consumption and low material capacity have buildings with a form of sphere, a cube, a long parallelepiped with a decrease in the cutting of facades. An unfavorable form is the buildings are narrow, long or in the form of a high tower, for them is characterized by the greatest energy intensity.

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COMPLEX USE OF RENEWABLE ENERGY TO PROVIDEMICROCLIMATE IN BUILDING SPACES

Energy consumption analysis for providing microclimate building spaces has shown a sharp rise during the last decade. Meanwhile, the rise tendency should continue. Fossil fuels (coal, oil, gas) are currently used for microclimate systems work [1]. But, first of all, fossil fuel resources are limited, and secondly, their burning leads to atmospheric pollution with oxides of carbon, sulfur and nitrogen. That's why reducing the use of these fuels will allow to improve the ecological situation.

One of the promising directions of modern energy development is the use of renewable sources of energy (sun, wind, bio materials) for cool and heat supply of the microclimate providing systems in buildings.

Recently, due to the growing ecological problems and conscious necessity to save energy, there is an increasing attention to the use of solar energy for getting heat and producing electricity. Thanks to the implementation of solar collectors for hot water and heating systems, there are new opportunities for energy saving buildings. Solar energy gradually becomes the most important energy source of

humanity. In 50 years solar energy will reach approximately 30% from the generalenergy consumption and 65% of the world's energy consumption will be reached by the end of the century.

Unlike traditional and solid fuels, wind energy does not require human resources for transportation and extraction However, wind is a random and uncontrollable process induced by the influence of the Sun and rotation of the Earth.One of the wind's traits as an energy source is that it is never constant. That is mainly because of the great variability in wind speed. This leads to a wide range of changes of kinetic energy of the wind current, even during short periods of time: from zero energy at calm to numerous times more than the calculated increase of the speed during storms and hurricanes. That is the reason of power instability developed by wind energy machines.

However, wind changes not only its speed, but it's direction as well. In order to use energy in the most complete possible way, a wind wheel must take a specificposition relative to wind flow. Finally, during a predetermined, more or less long period, energy lull takes place, when the speed of the wind is not enough to providewind turbine operation.

Getting energy from biomaterials (wooden, agricultural and home waste) is one of the most dynamically developing fields in many countries of the world. This is caused by two of the bio material qualities: its energy potential and renewability. Besides, money paid to energy generating enterprises for local raw materials stays in the region and promotes its economic development.

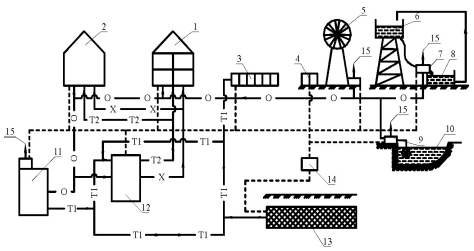
Almost all European Union and EU countries have biomaterial technology and none of them is going to slow down or to stop the development of this field. Ukraine does not show an increase in using biomaterials so far.

Primary biomaterials are a product of solar radiation conversion during photosynthesis. Photosynthesis efficiency is quite low (0,2-0,5%). Despite that the Ukrainian territory alone produces large amounts of biomaterials every year. Depending on organic raw materials qualities, there are different possibilities for its energy use. For using dry biomaterials, the thermochemical technologies are the most effective (direct burning, gasification, pyrolysis, etc.). The most effectivetechnologies for wet biomaterials are biochemical processing technologies with biogas (anaerobic decomposition of raw organic materials) or liquid biofuels (brewing processes) as their byproduct. Wooden waste gasification provides acquiring fuel gas which can be used asgas like fuel in boiler rooms, gas turbines and internal combustion engines.

Among biochemical technologies of liquid organic waste recycling, anaerobic organic raw materials decomposition technologies (having no atmospheric oxygen),are the most commonly used in the world. This technology produces biogas which is 50-60% methane. Produced biogas is extracted from methane tanks volume and it is sent to a gas holder - an accumulator where gas is selected as needed, mainly for the purpose of heating nearby object. Biogas can also be used as fuel in internal combustion engines to produce mechanical and/or electrical energy.

For a complex use of renewable sun, wind and biomaterials energy, there is aschematic diagram of energy flows in the system of integrated use of renewable energy for providing the microclimate of building spaces. This energy diagram is an ecologically safe and energy effective unit consisting of energy consumers and its conversion devices.

Picture 1 presents a scheme of energy current in a system of complex use of renewable energy for providing microclimate of building spaces.



Pic.1 *A scheme of energy current in a complex system of renewableenergy in building spaces*

Where 1 is living and public building; 2 - industrial and agricultural building; 3 - helio system; 4 - solar panels with photo elements; 5 - wind electricity system; 6 - top water reservoir; 7,9 - hydro electrical machine; 8 - lower water reservoir; 10 -river's riverbed; 11 - agricultural waste recycler; 12 - heat absorption converter; 13- ground accumulator; 14 - complex control center; 15 - into power grid; T1 - highpotential heat; T2 - low potential heat; O - electrical energy; X - cold.

Energy consumers (heat, cold and electrical energy) are:

- living and public buildings;
- industrial and factory buildings.

These devices will provide electricity for the complex all year around:

Helio System, solar panels with photo elements, wind electricity machine, hydro electrical machines, agricultural waste recycler, heat absorption converter, ground accumulator, complex control center.

Heat and cold supply of microclimate installations is carried out on more heat- using installations of heat and cold - absorptive conversion machines (ACM). These heat converters constitute a thermodynamic system, which provides heat transformation via combined direct and reverse cycles. ACM have high efficiency, ecological purity, quiet performance, simple maintenance, long term service and full automation.

The ACM technology and the developed scheme of its work is based on the thermal converters. A scheme of all year round provides a microclimate in buildingspaces with a complex use of solar, wind and biomaterial energy, as well as soil andwater bodies' energy. Due to the instability of these energy parameters, accumulation is provided. In case of renewable energy lack there is a secondary energy source provided.

Heat and wind balance analysis has shown that lowering energy use by microclimate providing systems must be achieved by the following:

- air exchange optimization and lowering the amount of intake air to arequired minimum;
- zoning spaces according to working areas and serviced areas;
- using inner air purification and recirculation;
- using natural air movement promoters;
- control of the inner atmosphere state and managing its parameters.

In order to solve the problem of reducing energy costs, it is proposed to ensurethe microclimate in the premises by two simultaneously working systems:

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

- air environment conditioning system.

Improving the microclimate technology required the development of an automated management and control system. It is proposed to provide microclimate parameters regulation and to control indoors and in microclimate systems with the help of microprocessors. Their use allows to increase the controllability level of the system, to use the program energy and wind distribution, developed for proposed mathematical system model, and also to provide registration and processing of the data for energy consumption analysis.

Microclimate parameters regulation is offered according to two level system:

-buildings' microclimate providing system general control;

-buildings' microclimate providing system local control.

System of general and local inner microclimate parameters automated control must include the following:

- indoors and outdoors atmosphere microclimate registration sensors;
- logic control center;
- microclimate providing elements control organs.

Modern energy development suggests new technological policy, which is based on maximum energy saving principle, its strict control and saving environment. The proposed microclimate providing technology is based on natural energy sources. This technology is the most ecologically clean and meets all modern requirements.

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STABILITY MARGIN CALCULATION OF BUILDING STRUCTURES UNDER SEISMIC INFLUENCES

In connection with the clarification of the seismic map of Ukraine, engineers have to assess and convert the building to seismic loads when they work with structures of high responsibility. In accordance with regulated international and national norms [1, 2] when calculating the surface response spectra, as well as assessing the seismic resistance of buildings and structures of nuclear power plants, it is necessary to take into account the interaction of elements of the system "soil - foundation - structure" [3,5].

Test calculations were performed on the example of a chemical unit with the determination of stability, load-bearing capacity and strength of structural elements of support units. The strength characteristics of structural materials under the influence of seismic loads were taken into consideration.

The calculation was based on the propagation of longitudinal and transverse seismic waves in an unlimited elastic medium. Factors that determined the deformed state, the interaction of building elements and the spatial work of the structure were taken into account. The principle of construction of the general geometrical model consisting of elements of higher order was used when modeling.

As a result of preprocessor modeling, a finite element (FE) model was generated. Dynamic model of the structure was developed in order to obtain the calculated effects on the foundations as a part of calculation.

Method of equivalent dynamic characteristics is adopted as a working method for modeling the interaction of the foundation and the structure within the framework. According to this method the problem of interaction between the foundation and the structure is divided into separate tasks:

a) Determination of the calculated seismic action on the foundation based on its shape, depth, soil characteristics, direction of incidence of seismic waves;

b) Determination of equivalent dynamic characteristics of the base, a set of springs and dampers, which are attached to the base plate and characterize the stiffness and energy dissipation in the base.

In order to take into account the maximum share of the masses of the calculation models, 400 forms of oscillations were calculated for each building of the system. It is provided that calculation is stopped when the required share of 95% of the mass analysis is taken into account in the dynamic analysis.

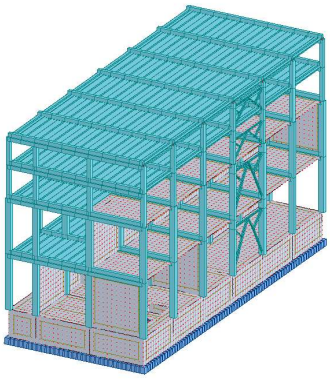

Fig.1. *Overall view of the finite-element model of chemical block*

Obtaining the calculated accelerograms includes the analysis of dynamic models developed within this stage, taking into account the interaction in the system "soil - foundation - structure" [1]. As a result, sets of calculated accelerograms were obtained and calculated for buildings according to the dynamic model of interaction of the structure with the base.

The results of the test calculation on the example of a chemical unit show that in the event of a seismic event at the level of the minimum wage it is expected to maintain the operational safety and the possibility of continuing the operation of TTB buildings without restrictions and additional measures to strengthen structures.

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MONITORING OF LANDSLIDE PROCESSES USING REMOTE METHODS

Landslide processes are one of the most common hazardous exogenous geological processes. Landslides are activated under the influence of natural and anthropogenic factors. The main natural factors are meteorological, hydrological, hydrogeological, seismic, etc. The impact of economic activity is associated with additional load and cutting of slopes during construction work, the creation of dynamic loads on slopes, additional watering of landslide-prone areas caused by excessive irrigation, backwater levels of groundwater reservoirs and other reservoirs and water structures. The increase in humidity and watering of soils near the steep slopes of ravines also leads to the activation of landslide processes. The landslide processes acquired the largest scale on the sea coast of the Odessa region, the right bank of the Dnieper and its tributaries, within the Donbass, Transcarpathia and the Carpathians [1].

As a result, the development of new methods for monitoring landslides is in demand. Monitoring is a system of observations for predicting hazardous natural processes. The problem of landslides is very serious nowadays, and monitoring allows you to keep it under control. [2].

*Relevance***.** The area of distribution of landslide sites within the urban areas of Ukraine is more than 42 thousand hectares. The development of landslide processes causes deformation and destruction of many industrial, engineering, residential and public buildings, which leads to significant material losses.

The aim of the work is to consider modern technologies for monitoring landslide processes using remote methods.

*Object of research***:** remote sensing of the earth's surface.

Subject of research: methods of remote monitoring of landslide processes.

Landslide remote monitoring system is an economic solution for long-term monitoring of large-scale dangerous processes. An automated deformation analysis system allows you to quickly and easily identify critical defects. Most often, they can be prevented or minimized.

To monitor landslides and develop maps of potentially dangerous areas, models based on the relationship between the distribution of landslides and their cause are used. Information about this can be obtained from remote sensing data.

Earth remote sensing is the monitoring of the earth's surface by air and space means, using a variety of imaging equipment. Sounding methods can be passive, that is, use the natural display of objects on the Earth's surface, due to solar activity (analyzes the reflected sunlight), and active use the radiation of objects created by an artificial source (remote sensing devices themselves are capable of emitting a signal or have their own light source)[3]. Radiation also has different wavelengths and can be shortwave (visible, near and mid-infrared) and longwave (microwaves).

The advantage of active methods is that studies are carried out at any time, because they do not depend on sunlight to work. *The advantage of passive methods* is the Landsat satellite, which has been collecting data on the surface of our planet for 40 years, it should be noted that these data are open, which helps different specialists analyze changes in the planet's topography.

Thanks to satellite data, you can monitor subsidence, vibrations of a particular house, forecast indicators and environmental conditions.

Differential radar interferometry techniques have long been used as a tool for detecting small surface changes in remote sensing. This method allows you to measure the vertical displacement of the surface. One of the advantages of this method is the large coverage area of the study area, and the high tracking accuracy is no worse than GPS monitoring. Since the selection of radar data and their

processing is sufficient to calculate the deviations, this method can be widely used in GIS observation systems.

Laser scanning data allows you to collect information about high-risk areas. It provides a more detailed view of objects than aerial photography. The main advantage of laser scanning is that it allows you to see objects through plants and focus on hidden details such as the angle of inclination, the degree of deformation and the extent of erosion. This method is used to create landslide prediction models and improve landscape planning [4].

In Ukraine, at the end of 2014, there were 22953 landslides, of which 1348 [1] were active. Therefore, the development of methods and systems for predicting landslide hazards both at the regional and local levels should be considered an urgent task. Specialists of state bodies from the "Scientific Center for Aerospace Research of the Earth of the Institute of Geological Sciences of the National Academy of Sciences of Ukraine" studied the development of landslides in 129 sections of the Dnieper landslide zone in the capital over the past decade. They used geographic data from different years and aerospace images. As a result, areas prone to landslides were classified and subdivided into three main types: safe, medium risk of danger and dangerous [5].

The method of the Earth's natural pulse electromagnetic field (or ENPEMF) was applied on the territory of the right bank of the reservoir of the Kiev hydroelectric power station. It is effective in conducting studies of landslides both at the stage of their formation and in the process of monitoring. On the basis of the data obtained, thanks to the method in the study area, it was possible to: 1) assess the level of stress-strain state in rocks and study its distribution with depth; 2) to determine the contours of deep foci of stress concentration; 3) to predict the potential limits of the development of landslides into the depths of still unaffected areas [2].

Conclusions. To study the situation and make regulatory decisions in Ukraine, data from remote sensing of the Earth by new generation spacecraft in the visible range and in the infrared spectrum of radiation (IR radiation, "thermal" image) can be used. The use of these methods makes it possible to obtain the necessary information for predicting hazardous geological processes and to respond in a timely manner to a potential hazard.

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JURASSIC PALEOFAUNA IN THE MARBLED LIMESTONES OF EDUCATIONAL BUILDINGS PSACEA

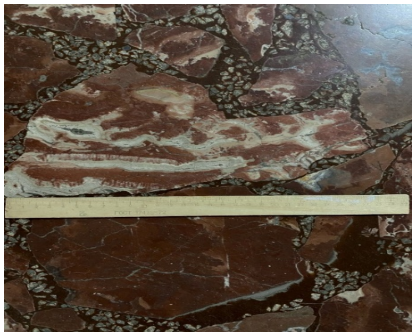
On the territory of Eastern Europe and Northern Asia, red-colored marbles and marbled limestones are very limited. As a rule, this is either the very remarkable Nizhny Tagil's (Sapal's) marbled limestone, attributed to the Lower Silurian Pavda's Formation, or the widely known Lower Jurassic marbled limestones of the Western Caucasus main deposits are located within Georgia [1].

The main goal of this research is to clarify the composition of the paleofauna and the stratigraphic features of this type of sedimentary rocks. The results of the ongoing research can be in demand in the educational process of construction and architectural specialties [2].

In the buildings complex of Prydniprovska State Academy of Construction and Architecture (PSACEA) [6], red-colored marbled limestones are mostly represented by facing stone deposits of Georgia (Salieti, Shrosha, etc.).

Organogenic limestones from the Shrosha and Salieti deposits are of marine origin. They were formed in a warm-water basin at shallow depths in the zone of development of organogenic structures. The remains of large colonies of calcareous sponges and the finds of colonies of calcareous algae can testify to their origin. In the red-colored marbled limestones from Western Georgia, presented in the facing materials of the PSACEA buildings, Lower Jurassic ammonites have not yet been found, unlike brachiopods, gastropods, and also sea lines, urchins and sponges. There are very few well-preserved samples of these paleofauna species. All well-preserved inclusions of the paleofauna were studied with the involvement of profil specialists from well-known scientific organizations.

In the researched samples, shell fragments of a gastropod mollusk, a gastropod, are dotted. In addition to gastropods, there are fairly well-preserved brachiopod shells from a large group of brachiopods. On many samples, cross sections of the stems of sea lilies, crinoids of the genus Pentacrinites, are clearly visible. Sections of spines of sea urchins with a length of spines up to 2.5 cm are also present. Sponges (Porifera) - a type of primitive invertebrates - are very rare in stone samples [5]. Less common are small sponges of sclerospongia, which simultaneously build a skeleton from flint spicules and a calcareous framework. The structure of the sponge is shown in Fig. 1. The length of this sponge is 15-16cm.



Pic.1 *Single sponge (longitudinal section)*

Thus, samples of red-colored marbled limestones from the buildings of PSACEA are very similar to those Jurassic ones that line some metro stations in Eastern Europe [3, 4]. And the remains of marine organisms are almost identical. This, as well as the analysis of their structure, coupled with

the structural and textural features of the rock, with a greater degree of probability allows us to attribute them to the Pliensbachian Stage of the Lower Jurassic.

Conclusion. Red-colored marbled limestones are found fragmentarily in the marble breccia of the floors of the central and old educational buildings PSACEA. Red-colored marbled limestones are very interesting and require closer research. The results of the ongoing research can be in demand in the educational process of construction and architectural specialties.

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REGOLITH AS A MATERIAL FOR THE CONSTRUCTION OF A LUNAR BASE

Regolith is the upper layer of free-flowing inequigranular material that covers the entire surface of the Moon. The properties of regolith are varied in dependence of the place of its extraction. There are two possible applications for regolith.

The first is as an addition to the building mixtures, which entails transporting large quantities of cement mixtures and other components to the Moon.

The second method involves the use of regolith as a raw material for stone casting which can later be used for remelting and further use in the construction of the lunar base. Besides, this method involves the delivery of a large amount of equipment to the moon and we will consider its use later.

First of all, let`s consider regolith as a fine-grained aggregate in the manufacture of concrete on the Moon. To begin with, let`s compare the classic filler sand and regolith. The main characteristic is their particle size. It also directly affects the creation of concrete.

Sand has three fractions: Large (from 2.5 mm); Medium (from 2 to 2.5 mm); Small (from 0.7 to 2 mm). In the process of construction, it is recommended to use sand of different fractions, because sand particles are poorly glued together.

Regolith granulometric composition refers to silty sands (the bulk of the particles has a size of 0.03-1 mm [3]). The color is from dark grey to black with inclusions of large particles that have a

mirror shine. But since fine sand cannot create a sufficiently rigid spatial structure, the use of regolith as a fine-grained aggregate is impossible.

Now let`s analyze the use of regolith as a raw material for processing, for the isolation of various metals, as well as for "stone casting". It is posible to use the regolith as a raw material for stone casting. Stone casting is the production of materials and products by casting from rock melts using the casting method in industrial enterprises [4]. According to scientific investigations, we know that the structure of regolith is similar to our basalt. Regolith is a residual soil which is a product of space weathering of the rock and it can also be used as a raw material for stone casting.

The advantages of stone casting are the following:

1. High resistance to the abrasive wear. Stone casting has a hardness group of 7 and 8 on the Mohs scale, which means that its wear resistance significantly exceeds all steels, rubbers, plastics and everything else;

2. High chemical resistance to most acids and alkalis;

3. Stone casting can work as a load-bearing material and it has performed its protective function perfectly;

4. Low thermal conductivity and low coefficient of linear expansion. This means that Regolith Cast Stone will retain heat;

5. The density of stone casting is 2.8-2.9 g/cm3, which means that the cost of Regolith will be 2.5 times less than the price when using steel;

6. There are also a number of special properties: low water saturation, electrical insulating properties, as well as the fact that stone casting is not the subject to aging and it does not form the radioactive dust when interacting with radioactive substances. And it is relevant in the conditions of the Moon with the impact of solar radiation.

When using this method we need to deliver specially equipped furnaces to the Moon. The estimated melting temperature of regolith is approximately 1500-1700 degrees. Besides, there is also a need for the heat treatment. It`s necessary to have a long heat treatment for achieving a structure that provides all necessary and valuable properties. At the initial stage, both foreign and domestic scientists propose to use solar panels for generating the electric energy. Subsequently, the energy of Helium-3 and other generators can be used. [1]

In conclusion we can state that regolith is excellent as a material for building a lunar base due to the combination of its properties and qualities. But there are some disadvantages which are connected with the fact that regolith requires a lot of effort, such as organization of stone casting production on the Moon, its power supply and many other factors. It means that this material and its manufacturing method may be implemented in the future, because resources on the moon are limited and regolith is an excellent alternative to building materials.

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IS IT POSSIBLE TO BUILD SKYSCRAPERS IN UKRAINE?

Even in many post-Soviet states there are already dozens of high-rise buildings, in Moscow there are hundreds. And in Ukraine, skyscrapers can still be counted on the fingers. As it turns out, there are a number of reasons for this.

The first and most important is man-made, when water got into the ground, for example, the sewer broke through. A significant part of the buildings are built on soils of the second type of subsidence. These are loess soils that function properly only in a dry state, but when moisture enters them, they decrease in volume. They also acquire plasticity and begin to move. If the building has a normal sewage system, drainage, it does not face such a problem. Given that most of the engineering systems have long been in need of replacement, the life span of any building is reduced.

The second reason is when construction work and vibrations from them are going on nearby. If the base is in the public domain, then atmospheric precipitation calmly soaks it, which leads to a change in soil characteristics, especially in the south of Ukraine - Dnipro, Nikolaev, Kherson, partly Donetsk regions, have a common belt - these are loess subsidence soils - all this leads to precipitation of the existing building.

Before construction, it is necessary to do geology and the correct calculation of the load on the foundation, to lay communications with high quality and to build high quality. But with all this, problems can also be associated with man-made disasters, voids as a result of washing out by groundwater, landslides, or as a result of the natural movement of its different layers or construction in the neighborhood - this will not be affected.

The third reason is the addition of floors and an increase in the load on the foundations. When designing, the pressure on the ground from the weight of the house should be less than the bearing capacity of the soil. Often, reconstruction of buildings is carried out without strengthening the foundations or foundations, which leads to disastrous consequences.

The fourth reason is seismicity, which is dangerous for skyscrapers. About 10% of Ukraine's territory is located in the Vrancea Zone. This is a seismically active zone at the junction of the Southern and Eastern Carpathians in Romania. The south-west of Ukraine will fall under its direct influence: Ternopil, Lvov, Khmelnytsky and Odessa regions. Earthquakes from 6 to 9 points can occur here. Therefore, a large area of the south-west and southern part of Ukraine is classified as seismically dangerous. In the Vrancea Zone once every 30 years, powerful earthquakes actually occur, which are felt throughout Ukraine.

Crimea is also characterized by intense (up to 6 points) seismic activity. The epicenters of Crimean earthquakes are almost always located mainly in the Black Sea (mainly between Alushta and Foros).

The fifth reason is inflexible legislation. Unlike, say, neighboring Russia, Ukrainian legislation does not encourage the construction of skyscrapers too much. Until recently, all buildings above 73.5 m fell under the experimental category. That is, their projects required additional approvals and expertise. Only in 2010, the government raised this bar by 26.5 meters - 100. True, this did not change the situation.

It is still more profitable for the developer to build two buildings 99 meters high without additional approvals than one 200-meter skyscraper.

The sixth reason is fire fears. In our cities, fire brigades do not have ladders high enough to extinguish fires on the upper floors in case of emergency, and also to evacuate people from there.

The seventh reason is Expensiveness. Experts say that high-rise construction is at least a third more expensive than usual. In addition to expensive research and expensive equipment, heavy-duty structures have to be laid, especially for foundations and load-bearing elements of the lower floors.

Often, massive load-bearing structures, additional elevator shafts, technical floors and ventilation risers eat up the usable space of the premises. Also, it is important not only to build, but also to keep the "skyscraper".

The maintenance of a skyscraper is significantly more expensive than an ordinary skyscraper. The key factors behind the rise in price are the supply of water to the upper floors and the cost of maintaining high-speed elevators.

The eighth reason is poorly compacted soil. Very often, our builders try to do everything quickly, as a result, unevenly compacted soil begins to sag and the building leans. We had a case when builders poorly compacted the sand and gravel mixture, and during the construction of the sixth floor, surveyors discovered that the building was beginning to heel by a millimeter per day. A catastrophe would have happened if this had not been noticed and, as planned, without additional strengthening of the soil, all 16 floors were built.

It also happens that they chose the wrong place during construction, built a landfill on the site, which happens in Ukraine, used construction waste as backfill, and it sank. In addition, since large buildings and complexes were built mainly in the crisis of the nineties, they were not built with high quality. Now it's all sagging and cracking.

The ninth reason is Traditions. And, finally, the last reason for the low popularity of high-rise buildings in our country was the widespread ban on their construction in the central part of cities. In order to save historic houses from the influence of high-rise buildings, they are being moved to the outskirts. And the land there is many times cheaper than in the center. In this regard, more expensive high-rise construction loses its meaning. It is easier for developers to kick out a few mid-rise buildings, saving on construction and maintenance costs in the future.

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INVESTIGATION OF GEOTHERMAL HEAT EXCHANGER INTEGRATION INTO FUEL FOUNDATION

The original and efficient solution for heating and cooling of office buildings and large industrial facilities are power piles in which one or more pipelines are installed. The first buildings based on them were built in Germany at the end of the last century. With the help of energy piles, it is possible to integrate a geothermal heat exchanger directly into the pile foundation. Piles can be ready-made (driving piles) and made directly on-site (screw or bored piles of monolithic concrete). It is recommended to use the energy piles as a removable storage device for alternating heating and cooling modes. Energy piles can be considered as a profitable investment for investors, because their

installation allows you to combine the cost of the foundation and the installation of the ground heat exchanger and further to save on energy consumption [1].

The aim of the article is to study the effectiveness of the use of integrated geothermal heat exchangers in the pile foundation for the efficient use of energy resources spent on the energy supply of the building, by making economically sound innovative decisions. The methodology for designing an energy-efficient building should be based on a systematic analysis of the building as a single energy system.

Energy efficiency is the useful (rational) use of energy resources to optimize the amount of energy used to maintain a constant level of energy supply of a building or a structure.

Piles, foundation slabs, "soil wall", diaphragms, anchors, basement walls and other structures in contact with the ground can be used as energy-efficient foundations.

The economic feasibility of using energy-efficient foundations is largely determined by the distribution of the temperature field in the soil. In most regions of Europe soil temperatures at depths below 10-15 m remain relatively constant throughout the year. Temperatures of 10-15 ° C prevail at the depth of about 50 m and they are allowed for economical heating and cooling with energy-efficient underground structures [2].

With the help of energy piles it is possible to integrate a geothermal heat exchanger directly into the pile foundation. Piles can be both ready-made (driving piles) and made directly on-site (screw or bored piles of monolithic concrete). It is recommended to use energy piles as a removable storage device for alternating heating and cooling modes. Energy piles can be considered as a profitable investment for investors, because their installation allows you to combine the cost of the foundation and the installation of the ground heat exchanger and further save on energy consumption [4].

An energy-efficient pile is a pile that performs two functions. Its main function is the transfer of load from the structure to the ground base and the secondary function is its use as a ground heat exchanger.

To achieve the maximum savings in the combination of pile foundation and the installation of the ground heat exchanger, it is necessary to use the bored energy-efficient piles of monolithic concrete, since when arranging piles we do half the work of installing ground heat exchanger. Bored energy-efficient piles made of monolithic concrete are piles which are installed with a reinforcing frame with heat-exchanger pipes mounted on it, which is immersed in a well prepared drill hole. Tubes of heat exchangers are usually mounted in the inner part of the reinforcing frame, which avoids damaging the pipes when the frame is immersed in the well. For this purpose, pipes are fastened by using the tightening cable clamps [2]. All the loops are combined on the collector, after the installation of the pile field [1]. The disadvantages of energy-efficient piles are: the use of such piles in low-rise construction is often economically unprofitable, as the scheme and step of the location of energy-efficient piles are determined by the loads from the building. In this case, it is advisable to use a vertical ground heat exchange.

Based on the above mentioned information the advantages of energy-efficient piles outweigh the disadvantages:

- low additional costs for the installation of heat exchanger pipes when using them for a building designed on pile foundations;
- the possibility of using them for heating and air conditioning of the building [2];
- important environmental aspect (heat extraction with the help of self-renewable resources, abandonment of a significant number of other heating methods);
- allowance to reduce expenses of the electric power and gas by 50–70% for heating and conditioning of buildings;
- they have lower running costs during operation, despite the same (or slightly higher) installation costs as conventional systems [5].

Integration of the geothermal heat exchanger into the pile foundation allows it to influence the economy of natural resources and financial economy. It leads directly to complete or partial independence from external heating sources and it makes responsible contribution to the ecology of the planet.

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ARCHITECTURAL AND PLANNING CRITERIA FOR ECO-BUILDINGS, TAKING INTO ACCOUNT THE PRINCIPLES OF SUSTAINABLE DEVELOPMENT

When designing residential buildings it is necessary to ensure a comfortable and safe living environment for people and to use non-traditional, renewable and secondary energy sources, rational system of water use, methods of reducing harmful effects on the environment in the process of construction and operation of the building for this purpose. The actual issue of the design of modern buildings with the principles of sustainable development is the level of energy consumption. Let's consider the ways of increasing the energy efficiency of internal engineering systems.

Sustainability of habitat means such characteristics of the building and the adjacent territory, that predetermine the provision of safety and favorable conditions of human activity, the limiting of the negative activities impact on the environment, the compliance with the rational use of natural resources in the interests of present and future generations.

"Green" construction can be characterized by the following criteria:

1. The architectural and planning concept of the building, which takes into account the effect of the outdoor climate on the thermal and energy balance of the building.

The formation and optimization of the shape, the dimensions and the orientations of the building constitute the architectural and planning concept of the building. Besides that, the direction of the wind and the orientation to the cardinal points are also taken into account here. Attention should be paid to the optimization of translucent enclosing structures, because the sun protection during the warm period and the ensuring heat gain from solar radiation during the cold period regulate the heat balance [1].

2. Energy efficiency of enclosing structures.

The use of energy-efficient enclosing structures, such as opaque enclosing structures with the increased thermal protection, translucent enclosing structures with the increased thermal protection during the cold period, including the use of heat-intensive interglazing screens, "intelligent" translucent double facades, adjustable window filling structures significantly increase the energy efficiency of the building [2, 3].

3. Sources of thermal energy supply.

In recent decades, non-traditional and renewable sources of heat and power supply have been actively used in the world. Energy received from solar collectors, photovoltaic panels, ground heat exchanger, wind power plants, sewage (industrial) drains, etc., can meet the needs of mankind by 20% and reduce CO2 emissions, as well as strengthen the energy independence of the state as a whole. Also, environmentally friendly is the energy of such non-traditional heat energy sources as biofuels and waste incinerators. As a source of primary energy, biomass has the greatest potential among all types of renewable energy;

4. Intellectualization of the building.

Automated control and management of all building life support systems cover the maintenance and administration of individual elements of building functioning systems using the room controllers, thermostatic valves, light sensors, carbon dioxide concentration sensors, human presence sensors, etc. Particular attention is paid to the management of air conditioning and water supply systems of the building;

5. Microclimate and energysaving.

The organization of air exchange and quality control of the microclimate is carried out by installing an air conditioning system. It is also possible to design an air conditioning system based on the use of chilled beams and / or underfloor heating, to equip mechanically controlled ventilation with exhaust air heat recovery or controlled natural ventilation;

6. Rational water use provides the use of water-saving water fittings.

The problem of rational water use and reduction of losses in buildings can be successfully solved by installing sanitary fittings with high water-saving parameters [4]. It is also possible to introduce technologies for the disposal of wastewater and the collection of storm water for the irrigation of the adjacent territory;

7. The environmental safety of the construction and operation of buildings is due to the disposal and sorting of waste.

The main areas of recycling are: waste disposal as a raw material for the manufacture of the original product, the use of waste to obtain any commercial products and the use for construction. Active implementation of the recycling system allows to reduce the consumption of primary material and energy resources.

The topic of environmental safety also includes the protection against the accumulation of radon in the premises of the building, which requires the use of enclosing structures that effectively prevent the penetration of radon from the soil into the building.

The architectural and technical solutions mentioned above provide a high quality of living environment, environmental safety and energy saving.

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STRENGTH OF GROUND CONCRETE DEPENDING ON ITS COMPOSITION

It is a well-known fact that every year the problem of reducing materials' consumption, in the construction industry, the reduction in the volume of transportation of raw materials and products to the construction site, increasing the energy efficiency and environmental friendliness of buildings under construction that meet the requirements for the comfort of residential premises is becoming more acute. The construction of objects for various purposes from local soil materials allows solving the above issues. Thus, as a result of excavation of foundation pits during the construction of building foundations, a significant amount of embankments from soil, mainly clay or sandy materials, accumulates and it becomes necessary to transport them outside the construction site to other territories. At the same time these materials can become the valuable raw materials for the production of products necessary for the construction of buildings under construction.

The question of determining the rational composition of soil concrete from the standpoint of their strength characteristics was raised in the initial stage of research. The following materials were used as raw materials for the preparation of soil- concrete mixture:

– clay soil taken from a depth of 2-3 m in the village of Novoaleksandrovka, Dnipro region;

– Portland cement M-500 produced by Krivoy Rog Cement Plant PJSC "Heidelberg Cement Ukraine";

– technical water.

Clay soils are used as raw materials in the production of building materials, products and structures and one of the main indicators of their quality is the plasticity number. It is characterized by the ability of clay soil in a wet state under the action of external forces to be molded without the formation of cracks and ruptures and to retain the acquired shape after the removal of these forces. The investigations of scientists [1; 2; 3], show that the lower the soil plasticity number, the higher the strength of the soil concrete obtained from it. The increase in the number of this indicator is required to increase the consumption of cement and the more heterogeneous the prepared soil-concrete mixture is obtained.

As a result of soil concrete samples carried out on the surface, there are separate shells and cavities, which may indicate insufficient compaction of the mixture (Fig. 1).

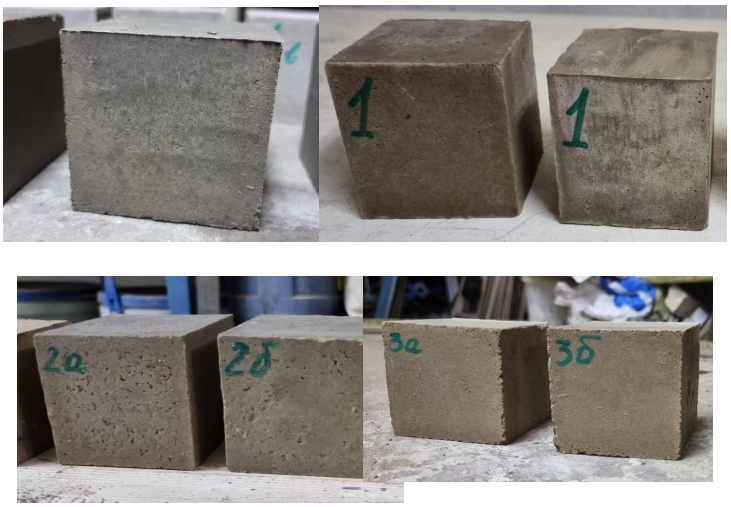

Fig. 1 *Macrostructure of soil-concrete samples surface with different mixes after curing in natural conditions: a) mix №1; b) mix №2; c) mix №3*

Therefore, in future, it is recommended to increase the compaction time or to change. The density of soil concrete density is observed in samples with the highest water content. The density of soil is higher and over it decreases at the initial stages of hardening. First of all, it is connected with the decrease in the initial moisture content of soil concrete in the process of its hardening and hydration of the binder. The density of soils becomes stable and then practically is not changed by 28 days.

In *conclusion,* it is possible to summarize the following:

1. It has been established that the used clay soil has a plasticity number in the range of 8.8-11.4 and belongs to the variety of loams;
2. The highest density value is observed in samples with the highest water content, among the studied soil-concrete compositions;
3. Soil concrete samples where the binder exceeds 15% of the total mass of the dry mixhave the highest strength at the age of 28 days. This applies to samples No. 2 and No. 3 with the compressive strength for No. 2 f_{28days} = 3.7 MPa and No. 1 f_{28days} = 5.43 MPa.

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CIRCULATION PUMP POWER CHANGES IN THE PROCESS OF MORALANDPHYSICAL DETERIORATION OF WATER HEATING SYSTEM

The main Ukrainian residential and industrial fund today has a significant service life, which requires capital work. The life system of these buildings has significant moral and physical deterioration which also requires their replacement. However, there are no government programs of such kind, and the fund owners do not always have resources for the buildings' and life support systems' capital repair. So, residential and industrial buildings are currently in a situation where life support systems have a significant moral and physical wear, but still maintain the microclimate in buildings .The elements of the water heating system deteriorate physically and mentally in the exploitation process. This leads to circulation pump performance changes [1, 2].As a result of this, both the losses in the network and the pressure that the circulation pump creates are changed.

Assessment of the cost replacement for the operation of a circulation water heating system pump during operation is an urgent task in terms of energy saving.

The aim of this work is to evaluate changes in the cost of operating the circulation pump inthe process of moral and physical wear of the water heating system.

Water heating system performance may be changed during the exploitation process, as shown in the Pic. 1.

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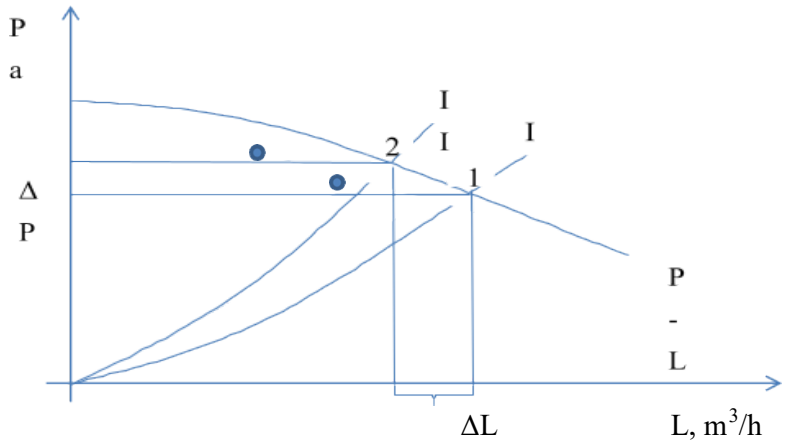

Pic. 1 *Circulation pump schedule for water heating system*

As it is shown by number 1 , the heating system network performance can be changed during exploitation at the initial stage, because calcium and magnesium salts may grow on the outer surfaces of pipelines and it changes the network performance, as it is shown by number 2.If we take into account that the circulation pump performance (P-Z line) is constant, we can see the following :

1. The work point moves from point 1 , to point 2.
2. Along with this, expenditures **L, mt/h** the and pressure **Pa** are changed in the network.

3.We will use this:

$$N = \frac{L \cdot p}{\eta} \quad (1)$$

Formula to count circulation pump power where **L** - is heating agent expenditures, **mt/h.P** - heating agent expenditures, **Pa**;

η – energy conversion efficiency, %.

As a result we can see the following results from the given information :

- Network performance changes during the exploitation of water heating system as a result of moral and physical wear during the exploitation of water heating system;
- Power increases and expends the heating system circulationpump according to formula 1;
- Microclimate efficiency parameters are decreased in buildings and heating systemparameters.

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ECOLOGICAL AND ENERGY-EFFICIENT SOLUTIONS IN THE DESIGN OF RESIDENTIAL AND CIVIL LOW-RISE BUILDINGS

Ecology, ecosystem conservation, international organizations and simply people who aim to take care of the future of the planet today. All this has a special place in our lives, so that the next generations grow up in an ecological state and have a healthy, quality life and a clean environment.

The topic of ecology and environmental protection concerns all people on the planet. Each of us should understand how important and irreversible the indifference of mankind is.

The standard materials used in construction are metal, brick, concrete, slate, cinder block, and for interior work - gypsum board, foam plastic, linoleum and a variety of flooring, plaster, paint for exterior and interior use and so on. It should be noted that these materials are very harmful to human health. As practice shows, nowadays quite a lot of construction materials in which the content of chemically hazardous substances in the free sale exceeds the norms, and do not meet the standards even in public tenders procurement. So the idea arose to replace them with straw, high quality wood, as well as on such buildings to install an autonomous solar power plant on the roof. At first glance, such an Eco-house seems reliable and may seem too expensive, but the design calculates to a minimum its negative impact on the natural environment during construction and operation. Also the materials used in its construction should be of biogenic origin, soft stones of sedimentary rocks, clay bricks, trees, straw and other plant materials. Local building materials should be used, inexpensive in terms of extraction, processing, transportation, allowing technologically to build a house without heavy machinery. The very use of such materials makes an eco-house accessible to the poorer strata of the population.

Nevertheless, in the Ukrainian market for a long time there are construction companies that are guided by the standards of energy-efficient construction, which on the basis of available technical solutions have developed the technology of production of wall panels from available organic material - straw.

Construction begins with the installation of a wooden frame, then the straw is pressed into it using a hydraulic press. After that, the straw is cut and an even panel is obtained. Straw panels have good thermal characteristics, the walls have good thermal properties throughout the year. A standard 40 cm wide straw panel together with a clay interior and a ventilated façade or external clay plaster has a heat transfer coefficient of 0.13 W/m²K, which corresponds to a 2.8 m thick brick wall [1]. A solar panel system is installed on the roof of the house. In a year such an eco-house produces more electricity than it uses, and the excess energy can be sold at a green tariff. This consumption depends on the amount of electricity use and the heated area of the room. Large stained glass windows are very popular in such projects. On a sunny day, the house is filled with warmth. Thanks to the warm wooden floor, which is equipped with a system on the water heating, you can significantly increase the degree of comfort in the house. In Ukraine, the technology of straw construction is rapidly gaining popularity. Although, in my opinion, this new technology is a long forgotten old construction of Ukrainian houses (mazanok) of straw and clay. In architecture, they differed significantly from modern ones, but they were built from available materials and operated for many years [2].

Straw as a wall material also has high thermal insulation properties, such houses do not suffer from "sick building syndrome" due to all-natural, plant-based biomaterials with "low embodied energy" (clay plaster, cobblestone, adobe, wood, sheep's wool, hemp, waste paper and cotton, sand and gravel, stone, unburnt brick, clay, earth). This also includes other natural materials that can be more treated (lime plaster, recycled foam glass, fiberboard, fired brick and sealers, oil-based paints). Natural and insulated straw walls plastered with lime and clay are very important for health, improving

occupants' well-being by introducing fresh air through breathable wall systems combined with ventilation, regulating humidity and providing excellent indoor air purity" [3, 4].

Consequently, the basic principles of green building are:
1) using water, energy and other natural resources efficiently enough;
2) the use of building materials and products is precisely local production;
3) the use of ecologically certified materials in construction when finishing buildings.

The advantages of the interior environment of an eco-building are:
1) sufficient amount of daylight due to large window openings;
2) comfortable temperature conditions and ventilation;
3) healthy living conditions in buildings due to high air quality, thermal and acoustic characteristics of the building envelope.

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INTRODUCTION OF BIM TECHNOLOGIES AS A BASIS FOR CREATION OF COMPLEX INFORMATION MODELS IN CONSTRUCTION MANAGEMENT

*Introduction***.** *Building Information Modeling* (BIM) is the term most commonly used to define a set of parametric tools and processes for creating and maintaining an integrated common database of multidimensional building design, construction and operation databases to improve stakeholder collaboration, reducing the time required to documentation of the project [1].

In most cases, people mistakenly perceive BIM technology. The most common mistake is that they believe that BIM is a single model or database. We must keep in mind that integrated BIM will not be able to replace humans. BIM reduces unnecessary and everyday work and facilitates data processing, but here, people enter data into the model. Another misconception is that people think that BIM models are 100% true, although this is not the case. Because people are able to make mistakes in the information processing process, which in turn affect the final result of BIM.

In the construction industry, the use of BIM can change the interaction between customers, contractors, designers and countless other participants in the construction process. Of course, if these changes occur at a high level, for example, when the customer wants not just to change the way a particular project, but also the whole chain of interaction, changes in project implementation and inter-project coordination can be much larger. It would be a mistake to say that individual design and construction companies do not benefit from the use of BIM (in fact, they receive significant benefits), but the contribution of BIM at the level of overall interaction is even greater, especially for large investment projects.

Basic principles of implementation. For the effective implementation of BIM, changes must affect all areas of the organization. It is not possible to implement the technology separately only in the IT department, production department, at the level of a separate project or a separate specialty. This approach yields some results, but as a result does not lead to significant changes, bringing only a small

share of the benefits that are possible with the full implementation of BIM. There are many examples where the implementation of BIM took place only at the level of performers or only in the IT department, and it gave unsatisfactory results, and sometimes just failed. Often, partial implementation has paid off, such as some savings; however, the most significant benefits that could be gained from full implementation were lost [2].

In the implementation model discussed in this article, the initiative comes from senior managers; the concept developed at this level is communicated by leaders to ordinary employees. The model is based on three interrelated principles.

BIM concept. A clear concept will help to avoid pitfalls that lurk the company on the path of radical change. Without a clear concept and skillful management at the highest level, attempts to implement BIM will lead to a waste of resources. Using the experience of implementing BIM, described in various publications, is useful at an early stage, but there is no single standard that would suit any organization. For the successful implementation of BIM, the company needs its own strategy that takes into account the specific features of its activities.

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There are different approaches to developing the BIM concept. Many articles on the topic of conceptual planning have been published. All of them are more or less applicable in the context of BIM. However, in such an area as the construction of infrastructure (as in any other), there are features depending on the scale of projects (local, sectoral or national). Therefore, management must take into account all the features of the company in the implementation of BIM to take into account the impact of new technologies on every aspect of its activities [3].

Conclusions. BIM technologies are the future of construction, it is an opportunity to achieve almost complete compliance of the characteristics of the future object with the requirements of the customer. This will lead to the improvement of Ukrainian construction in the following strategic solutions: - will bring the construction industry to a new level; - improve the quality of construction control; - will promote the implementation of modern projects in the country. Increasing the level of profitability of construction production is possible with the optimal distribution of resource potential. To solve the problem, the use of information modeling of the building is proposed, the result of which is the optimization of the use of limited production resources. Implementation of the model in practice makes it possible to identify reserves for the release of resources and directions of their use, which will increase the level of profitability of production provided the efficient use of its resource potential.

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MODERN APPROACH TO THE DESIGN AND CONSTRUCTION OF ENVIRONMENTALLY FRIENDLY ENERGY EFFICIENT HOMES

Today, one of the most important topics for the whole world is environmental pollution. Industrialization, huge production of plastic and polyethylene, the use of non-renewable energy sources, a small number of recycling plants and garbage, landfills that pollute water and soil demonstrate the negative development vector of our civilization. Unfortunately, this "vector" leads our civilization to destruction. The construction of houses has a negative impact on the ecology of our planet because of large amounts of plastic and chemicals in construction, deforestation, consumption of large amounts of electricity, water and natural gas during construction and operation.

Architects and engineers must prioritize environmental friendliness in the construction and in the design of residential buildings. Important energy efficiency solutions can be envisaged at the stage of residential building design. In particular, to avoid the problem of insufficient insolation, you should pay much attention to the spatial orientation of the house, take into account the peculiarities of the wind rose area, provide a good location of windows and their sufficient numbers because of the location symmetry and mandatory compliance with typical window sizes in modern construction.

Moreover, when planning the territory, it is necessary to take care of the proper placement of communication networks. In private homes abandoning utilities is a way to the significant increase of efficiency and savings.Therefore, attention should be paid to the possibility of designing individual networks.

Proper spatial zoning plays an important role in the premises themselves. Thanks to it it is possible to achieve preservation and effective distribution of the saved solar energy and heat. Open space is a trend of modern construction, as it helps houses to function as a single energy system.

The first thing that comes to mind when we hear the terms "green building", "ecological housing", etc. is vegetation. This is an important aspect indeed. Therefore, when planning the area for construction, it is necessary to provide the maximum preservation of existing vegetation and its increase.

It is seldom in construction when attention is paid to the environmental friendliness of building materials that are used. It's a pity, because many building materials can be replaced by secondary raw materials or recycled waste. First of all, you should pay attention to locally produced materials. It is cost-effective in the cost of raw materials and transportation. In addition, such materials are more adapted to the local climate and environmental conditions. Depending on the region, it can be: wooden panels as load-bearing structures, animal fur as insulation, bamboo as a floor covering and volcanic pumice as a finishing material with high heat-saving characteristics. The use of recycled and recycled materials should be the basis of modern construction.

Today, an important issue is the rational and efficient use of plastic. That is why the developing technologies in the field of plastic waste recycling are rapidly developing in the world. Leading companies often use secondary raw materials in their products, which are much more profitable economically and environmentally. So, when choosing, for example, plastic windows, doors and balconies in the house, everyone has a real opportunity to prefer the recycled materials. As a siding,

depending on environmental conditions, you can use the recycled plastic with sawdust, glass or even steel (with aggressive environmental influences, for example, near the sea). Recycled glass can also be successfully used as an interior decoration. As for wood, it's a fact that a lot of it goes to landfill. Soviet furniture, waste from wood production, twigs from pruning and felling trees in cities are the things that will rot in landfills or burn in stoves. Recycled wood is an excellent modern material that is used as a floor covering and as wall finishing panels, as well as in the manufacture of furniture, decor items etc.

There are many solutions in energy saving and energy efficiency. Wind turbines and solar panels can fully supply the house with electricity. The use of the Earth's natural temperature by installing a geothermal floor heating system will ensure a constant flow of heat and eliminate the need of using additional energy sources. Glass constructions with honeycomb filler and concrete walls will help to keep warm. Blinds, shutters, special films and screens are very important components of this energy-saving control system. One of the main indicators of the house efficiency is the rational use of water resources. It is necessary to provide the collection of rainwater into tanks and it can be used for domestic purposes.

There can be many ideas for improving the environmental friendliness and energy efficiency of residential buildings, but, first of all, it should be facilitated by the state. Unfortunately, for a large number of residents of the vast majority of countries, including Ukraine, green building is not available due to its cost. Therefore, the governments of the states must create the necessary conditions for the development of the country in the direction of ecological construction, in particular, a favorable credit system, a simplified mechanism of land privatization and temporary tax exemption. But in any case, every resident must be aware of the importance of preserving the environment and take a step towards the ecological construction.

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FEATURES OF THE USE OF ULTRA-HIGH-ENERGY THERMAL INSULATION

Recently, when heating prices are quite high, the issue of energy saving has become increasingly relevant. Insulation of the house is carried out in order to reduce the consumption of energy resources for its heating. It is known that construction of most residential buildings and premises took place according to the standards of the last century, which did not provide for proper insulation. This leads to the fact that a large amount of heat is lost through the structures of the building: roof, windows, and walls. To diminish these costs, it is necessary to insulate the roof, facades and replace the windows with less heat-conducting ones. The choice of a solution for home insulation depends on the design features of the materials used in the construction. The figure below illustrates the average "involvement" of different parts of the house in heat loss [1].

It is possible to conclude that the walls of the house and the roof require the greatest attention, after that – water and sewer facilities, then – windows and doors [1].

The key goal is to conduct research on an innovative product, determine the composition and use. Thermal insulation works are final in the process of construction of objects, and therefore, their rapid and high-quality implementation depends not only on the timing of commissioning of these objects, but also on the quality of products, economic and technical characteristics of objects, comfort in workplaces, the quality of living conditions in buildings under construction and in operation [3]. In a short period of time, the latest developments increasingly began to appear on the market of building materials, regarding thermal insulation materials with a large front of their use. Ultra-thin thermal insulation has proven itself well and is in high demand. It is similar in consistency to paint or mastic. This material is used both for interior and exterior finishing works. The main components of the material are a mixture of ceramic, polymer or glass spheres filled with vacuum or rarefied gas. The principle of operation of this thermal insulation is to dissipate thermal and radiant energy using hollow spheres. Structures and buildings treated with an innovative product do not lose heat in winter and do not accumulate it in summer. One of the properties of ultra-thin thermal insulation (according to manufacturers [2] is that after the mixture dries, its thermal conductivity coefficient is 0.001 W/M*K, and 1 mm retains up to 30-40% of heat, which corresponds to 50 mm of mineral wool). The insulation material is resistant to alkalis and salt, moisture; it does not darken and does not collapse under the influence of ultraviolet light. These properties ensure trouble-free operation of the material on the exterior areas of buildings and structures. The composition is designed for use in regions with harsh climates, its operating temperature is from - 60°C to+260°C [2].

The scope of application of the latest thermal insulation is quite wide: the thinnest layer of insulation can be used on various sections of civil industrial buildings, equipment and pipelines. The liquid composition is especially relevant for highways. It protects the metal from condensation and corrosion and prevents loss of ambient temperature. Also, the low consumption of the paint composition and long service life make ultra-thin thermal insulation cost-effective.

To sum up, it is possible to conclude that in order to pay less for heating the house, it should be insulated. What can insulation do? The thermal insulation layer reduces the cold zone and acts as a protective barrier. Based on the conducted studies of ultra-thin thermal insulation, it can be concluded that most products have significant disadvantages. I believe that this may be the reason that manufacturers use not very high-quality raw materials or the integrity of some components can be disturbed during the manufacturing process of the material or directly during application to the surface [4]. In addition, the disadvantages are the high cost of thermal insulation (approximately 160-200 UAH per 1 liter) and low sound-absorbing properties. On the other hand, after reading some customer feedback, some positive reviews were found. As one person who purchased this insulation said, "Now the walls do not freeze and condensation does not accumulate, when you apply the palm of your hand, you feel warm and dry" [5].

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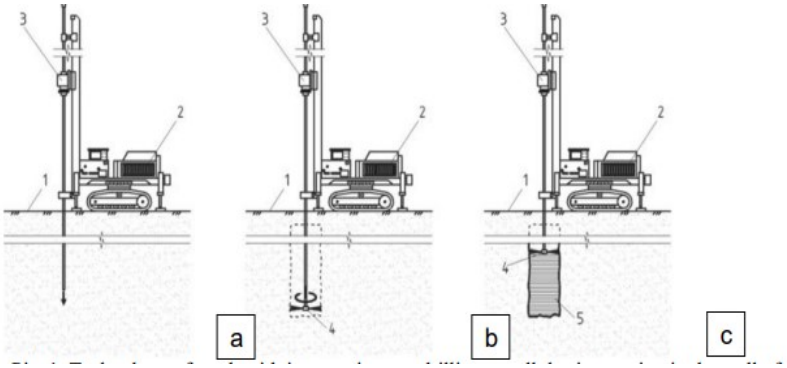
SUBSTANTIATION OF CALCULATION OF THE BASES ON BEARING CAPACITY OF THE BASES REINFORCED WITH SOIL-CEMENT ELEMENTS

Modern urban development is becoming denser and denser due to the lack of free territories in urban centers. This leads to the fact that the centers of large cities are built up with high-rise buildings. Due to the fact that the load on the foundation is quite significant, it is impossible to use shallow foundations. Due to this trend, geotechnical conditions of construction are becoming more difficult. The impact of new foundations on existing buildings, as well as the impact of existing buildings on the stability of open pits when constructing new buildings, must be taken into account. Also, dense construction limits the possibility of using technologies for the installation of foundations with significant dynamic impact. [1].

A possible solution is the installation of pile foundations with technologies with excavation. In the study of world experience, we can identify the method of soil saturation with cement, which results in a material of considerable strength - soil cement. [2]. Due to the use of brown mixing technology of soil saturation with cement, it becomes possible to install vertical cylindrical soil-cement piles of a given length and diameter. Thus, the use of soil-cement piles is the most rational and economical method of laying foundations in the proposed conditions.

According to the technology of installation, soil-cement piles are almost indistinguishable, except for vibro-reinforcement with reinforcing frames or capture of metal profiles [3].



Pic. 1 *Technology of work with jet grouting: a - drilling a well; b - immersion in the well of the jet monitor; c - gradual removal of the monitor from the well; 1 - the surface of the earth; 2 - drilling rig; 3 - boom of the drilling rig; 4 - inkjet monitor; 5 - reinforced soil-cement area*

According to the principle of working in the soil, they are more efficient than bored [4]. Because the friction on the side surface is higher, it is provided by drilling technology without excavation. The load is transmitted on the side surface and the heel of the pile. Also, soil-cement piles are suitable for installation below the groundwater level, which is another advantage over piles, which are arranged with excavation [5].

Thus, thefollowingconclusionscanbedrawn:

1. The method of fixing soils with soil-cement elements, arranged by drilling technology, is one of the most effective and allows performing work in difficult, compressed conditions of landslide-prone slopes.

2. Browning technology allows the consolidation of water-saturated, subsidence and other soils with special properties, which is especially important in the development of areas with complex engineering and geological features.

3. Soil cement elements, arranged by drilling technology, do not lose strength under the influence of groundwater and other factors, but on the contrary, over time, the strength of soil cement increases, which ensures the reliability and durability of the structures.

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GLOBAL CLIMATE CHANGE IS A REALITY AND A WORLDWIDE PROBLEM IN SHAPING THE HYDROLOGICAL REGIME OF RIVERS

Global climate change is a reality and a worldwide problem that affects all regions and affects human livesphoods and security to different extent. Climate change has different consequences for each region: droughts and food security, freshwater scarcity and deterioration of its quality, extreme weather phenomena and natural disasters, changes and migration of fauna and flora, etc.

Climate changes in Ukraine occur in accordance with changes in atmospheric processes in the Atlantic-European sector. Positive deviations of air temperature from the climatic norm, in general for Ukraine, began to show since the late 80s of the last century. Over the past twenty years, the average annual air temperature within the plain part of Ukraine has increased by 0.8^{o}C. The greatest contribution to annual temperature change was made by winter and spring seasons. There was a redistribution of seasonal and monthly values of precipitation. Their amount increased in all seasons (except winter), but most significantly - in spring and autumn. Leveling of annual and monthly precipitation fields takes place.

Changes in the components of the water-thermal balance have caused certain changes in the feeding of rivers. During the last two decades, the share of snow feeding of rivers has decreased by more than 10%. At the same time, the share of underground feeding increases, which is almost equal to the share of snow feeding. Change in the share of rain feeding of the rivers is insignificant.

There have been changes in the intra-annual distribution of river flow. The share of spring floods in intra-annual runoff distribution decreased from 42-53% to 35-37%. The largest share of the intra-annual flow distribution of the country's rivers (except in the northeast) falls on the summer-fall low-water period, which accounts for 44% of the annual volume of flow. The share of winter low-water flow has not changed significantly. There was alignment of the intra-annual runoff distribution.

The hydrographic network of Ukraine consists of rivers, lakes and firths, canals, reservoirs, ponds and swamps. Water bodies account for 4% of the total area of the territory. The saturation of the territory with water bodies is characterized by the coefficients of the density of the river network, lakes, bogs. Such coefficients express the ratio of the length of rivers and streams, the area of lakes and the area of bogs to the area of the river basin. Hydrographic features of the territory depend on climatic conditions (amount of precipitation, evaporation), hydrogeological conditions, relief, soil, vegetation cover, human economic activities (hydraulic engineering construction, melioration, water supply, etc.) [2].

In addition to excessive moisture of the territory, heavy rainfall on the formation of catastrophic floods in the Ukrainian Carpathians is significantly affected by irrational management (total cutting of forests on the slopes, lack of reliable protection of banks, regulating the reservoirs of the upper reaches of rivers, etc.). In the regime of levels of the Crimean rivers there is an increase in April - May as a result of melting snow and in November - December after rains.

The heat and ice regime of Ukrainian lowland rivers depends on the distribution of total solar radiation and is subject to zonal patterns. In the Ukrainian Carpathians and Crimean Mountains, there is altitudinal zonality in the distribution of water temperature in rivers. Stable ice phenomena on the rivers appear in the autumn-winter period for 10-20 days. Ice begins to melt in March, and rivers are free of it in 5-10 days. The rivers change the direction of their channels, erode their banks, and transport sediment. In the flatland rivers, around 90 % of the load is transported as suspended load. The highest turbidity is in the rivers of the Crimea - 1 000 g/m^3, the lowest turbidity is in the rivers of Poesy - less than 252 g/m^3.

Mineralization of river waters of the plain area grows from north-west to south-east from 300-400 mg/l in the area of mixed forests to 600-800 mg/l in the lower reaches of the Southern Bug. The lowest mineralization of the rivers (in the Carpathians) is 200 mg/l. Most rivers have a hydro-carbonate-calcium mineral composition. From north to south, the chloride and sulfate content increases. Waters experiencing economic impact contain compounds of nitrogen, phosphorus, silicon. Waters are also polluted by petroleum products, phenols, pesticides, etc. In areas with a high concentration of industrial enterprises, river waters contain heavy metals. This means that it is necessary to reduce the economic impact on rivers, lakes, reservoirs.

The global increase in water demand has resulted in a conflict between using rivers as water and energy sources and the need to conserve rivers as intact ecosystems [1].

Intra-annual changes in the components of the water-thermal balance led to a significant increase in low-water runoff. Minimum winter average monthly discharges increased almost throughout the country, especially (by 48-49%) in the northeast and east. The changes noted above are even more significant for the summer-fall low-water period, primarily in the southern and southeastern regions. The minimum annual water discharge has increased substantially. Significant changes in the seasonal distribution of annual minimums took place in the rivers of the right-bank part of Ukraine, where the probability of formation of annual minimums during the winter season decreases and, simultaneously, the probability of their formation during the summer low-water period significantly increases.

The data obtained on the characteristics of the current water regime of the country's rivers are used for hydrotechnical and water management design, hydrological forecasting, as well as long-term planning of measures for the use and protection of water resources in Ukraine.

The annual use of billions of cubic meters of water is not only for drinking water, but also for agriculture, manufacturing, heating and cooling, tourism, and other areas of service.

Most international studies predict water scarcity, increasing evapotranspiration and instability of river flows, and reduction of flood flows, including early spring flooding [3].

With thousands of freshwater lakes, rivers, and underground water supplies, it may seem limitless. But population growth, urbanization, pollution, and the effects of climate change are putting tremendous pressure on water supplies and water quality.

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ORGANIZATIONAL AND TECHNOLOGICAL RELIABILITY OF THE CONSTRUCTION OF BUILDINGS AND STRUCTURES USING 3D-PRINTING METHODS

Today, the construction industry is probably facing the biggest choice of future directions of development. The main reasons are demographic changes (population of the planet will reach 11 billion by 2100) and growing global urbanization (as of 2017 half of the population lives in cities, by 2050 the number of citizens will reach 75%). Traditional construction methods will not be able to solve emerging problems. Therefore, new approaches to housing construction and residential infrastructure are required.

Additive Manufacturing is a generalized name for a technology that involves making a product based on a digital model (or CAD model) using layer-by-layer material addition. This is a fundamental difference from traditional production technologies, which are based on the removal of the substance from the workpiece. According to leading experts, additive technologies combine all the main elements that contribute to the transition of industry to a new technological mode - digital production [1].

The principle of operation of construction 3D-printers is to extrude a special mixture, layer by layer, according to a given three-dimensional computer model. The pre-prepared mixture, consisting of cement, filler, plasticizer and other additives, is loaded into the hopper of the device and from there fed to the print head. The mixture is applied to the surface of the site or previously printed layers.It is possible to reinforce products in the following ways: to add fiber to the concrete mixture, to lay reinforcement between layers during the press, to reinforce cavities of products with the subsequent filling of these cavities with concrete. Composite reinforcement is ideal for reinforcing local cavities,

which significantly reduces the cost of construction. Building structures and other concrete and gypsum products of complex geometry can be fabricated with the help of 3D printing. This significantly reduces the cycle time from design to production (approximately 8-12 times), saves money and time due to the lack of formwork, which usually has to be made in advance for each specific building structure.

The advantages of using Contour crafting (SS) technology are obvious - along with a 5-fold reduction in the cost of commercial construction, no waste of building materials, reducing production time, the emphasis on costs is shifted from physical work to intellectual. This means that construction becomes a market for consumers, when the family can design the future house for living. Moreover, for the first time in the construction industry, women and the elderly can be involved in design. Currently, SS technologies can be used to build low-budget housing and temporary housing for victims and rescuers in areas of natural disasters and military conflicts.

"PassivDom" Company has launched a franchise in Ukraine for the production of autonomous houses, where you can live comfortably without being connected to central networks. A house like that consumes almost 20 times less energy than a conventional one,it is powered only by solar energy, and also reuses appropriate waste resources. Housing from PassivDom does not require connection to the power grid, gas or water supply, but the residents continue to enjoy all the achievements of communal civilization. Due to the modularity and ease of installation, the house does not require a special foundation and can be installed on any suitable flat surface [2].

Additive technologies in the industry today are already quite common. However, the construction industry is very conservative and lags behind other industries in terms of the use of 3D printing. 3D printing of buildings has the potential to revolutionize the real estate market and related industries. The main problems, the solution of which will ensure the serious development of additive construction technologies, are:

- lack of a regulatory framework,
- the need to develop a market for building materials for 3D printing,
- the high cost of equipment associated with the lack of production of large series.

Conclusion. Despite the fact that large world institutions and large corporations are engaged in research and development of additive building technologies, there is a great potential for scientific research in this area and their practical application.

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CONCRETE MIXES FOR 3D PRINTING IN CONSTRUCTION

Today, construction is one of the most important industries, providing both economic development and everyday comfort of the population. This industry is one of the leaders in the job

market, both in the country and around the world. At the same time, modern requirements for construction imply further improvement of construction production technologies, their significant transformation. Changes in this area are slow, however, both in typical and individual construction they are gradually taking place. New materials that provide increased comfort, environmental friendliness and efficiency in operationare used, new technologies are introduced to significantly automate the process of implementing projects into reality, as well as to reduce the amount of manpower required, and minimize the risk of occupational injuries.

One of such promising technologies is the use of additive technology for the construction of buildings using 3D construction printing on construction sites. With the use of 3D-printer there is an opportunity not only to create small structures (building blocks, small elements of landscaping and interior design), but also enclosing structures of the building. This technology allows building more complex facilities with reduced time, material and labor costs.

Innovative technologies are implemented in almost every area of human life, but one of the largest industries such as construction, today is characterized by high labor costs and is the least automated. The transition from classic technologies of construction to additive with the help of 3D construction printing can be a solution to this problem. Currently, construction 3D printers are being actively introduced in the construction industry in China, the United States and the Netherlands.

The composition of the working mixture plays an important role in the construction technology of 3D printing. It is based on fast-setting concrete, which may include various additives to improve certain characteristics of load-bearing structural elements (walls, floors), and can be combined with different types of fiber or steel reinforcement [1].

The technology of 3D printing of buildings and structures, of course, is innovative and very promising, but its application has to face a number of problems:

1. The lack of regulatory and legal framework for the construction of buildings using a 3D printer limits its use for mass construction, so large construction companies do not buy construction printers. Today, these devices are used mainly for low-rise and small-scale individual construction, as well as for the manufacture of small architectural forms.

2. High cost of equipment for 3D printing. Indeed, innovative technologies initially have a fairly high price: after a long time, if the technology proves its practicality, it becomes more widespread and becomes publicly available at a more affordable cost.

3. Construction technology using a 3D printer requires special characteristics of the construction site (in particular, for the laying of guide rails requires a flat site, as well as continuous monitoring of their parallelism to ensure high accuracy of printing).

4. Because the size of the printer is limited, the dimensions of the building under construction are also limited.

5. There is no universal mixture for printing due to the fact that different manufacturers use different concrete mixtures, experimenting with the composition of components and their ratio.

6. The requirements for the composition of the concrete mixture are quite high, as the wall structure must meet the conditions of strength and rigidity. However, there is a contradiction, on the one hand, in order to prevent the working mixture from stagnating and solidifying in the print head, a plasticizer additive is used, which increases curing time, on the other hand, it is necessary to ensure rapid setting and curing of the mixture for continuous application of subsequent layers.

7. Construction with this technology is limited to the warm season, which complicates the construction of buildings in the northern regions. Large temporary heating tents are being built for construction in the winter. Despite a lot of current problems, the use of 3D technology in the construction industry has a number of advantages, the main of which are:

- high speed and accuracy of construction
- ease of operation
- relatively low cost of buildings and structures
- minimized use of manual labor

- safety improvement of workers [2].

Conclusion. The successful development of additive technology for the construction of buildings and structures using a construction 3D printer requires comprehensive research aimed at developing effective "construction inks" on various bases, studying their structure and properties.

Many studies and discoveries are required for the complete adaptation of such technology in construction.

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DESIGN AND PLANNING FEATURES OF BUILDINGS WITH A FRAME OF LIGHTWEIGHT STEEL FRAMING BUILDINGS – LSFB

The main priority in modern construction is environmental friendliness, energy efficiency, simplicity at a low cost. Recently, there has been a need for rapid construction of low-rise middle-class buildings for a limited budget. This was the impetus for the creation of the LSFB.

Lightweight Steel Framing structures are mounted from the accepted range of beams. The most common range of beams are C-, Z-, Ω-profiles. Beams are thin-sheet, made of galvanized sheet by cold rolling with bending. They have height dimensions from 100 to 300 mm with a standard width of shelves with a wall thickness of 1.25 mm to 3.0 mm and are made at special factories according to drawings. The design of profiles, their properties and high load-bearing capacity allows them to be used in the construction of load-bearing and enclosing structures. To improve the LSFB profile, additional insulation is used, usually a thermal profile. First of all, these profiles are used for construction:

-running coverage
- wall crossbars
- load-bearing frame of prefabricated buildings
- frameworkof a wall protection
- a frame work of partitions
- constructions of hangar-type buildings, warehouses
- office space
- upgrades to existing premises
- low-rise buildings
- attic floors

Profiles are made up to 4.0 m, so the beam coating and flooring system can be made by connecting beams in one-, two-, multi-span scheme. Installation of profiles is carried out by means of bolts. Holes in the profiles are made at the factory during manufacture in accordance with the drawing.

Connection of runs in multi-span system **is carried out in two ways:**

1. Connection of runs on length imposing profiles overlapping.
2. By means of connecting overlays.

Advantages:
1. The most profitable option for wall and blood runs.
2.Do not require additional protection of the coating for use in non-aggressive and mildly aggressive environments. High biostability against fungi and mold.
3. If necessary, additional protection of LSFB structures from the effects of aggressive environments is possible.
4. Holes for connection are made at the factory and do not require additional fastening.
5. The most effective multi-spans cheme, which reduces the cost of steel while maintaining the load-bearing capacity, reduces the cost.
6. Production of a complete set of beams takes place at the factory, such structures are mounted with bolts, which significantly speeds up construction.
7. Possibility of dismantling and reassembly of the building.
8. Easy transportation and the possibility of installation without the use of cranes. LSFB constructions weighless than 100 kg, which allows the crew to raise and lower profiles with out any problems.
9. Lightweight frame with LSFB does not place a heavy load on the foundation or other type of support.
10. Installation does not require welding, so it is considered relatively safe.
11. LSFB buildings have a fairly high resilience in seismic zones.
12. Environmentally safe for humans.
13. Great opportunities for architectural ideas.
Disadvantages
1. In case of fire LSFB structures must be dismantled, they are no longer usable.
2. Durability depends entirely on the quality of manufacture and installation. And the period of operation is 30-40 years and depends on climatic conditions. The short service life is due to non-corrosion resistance of structures.
3. In post-Soviet countries, there are very few building codes for the use of this frame work.
4. Installation errors can be fatal.
5. It is difficult to find specialists involved in the design and installation of such structures.
6. Production of LSFB profiles is carried out only at the factory.

This construction technology is actively used in the west for the construction of cottages and low-rise buildings. In Sweden and Japan, the percentage of such homes is 15%, in the UK 3%, and in the US - 6%. High environmental friendliness, energy efficiency, simplicity and cheapness are the most promising are as of construction, so LSFB designs are a good option for further use. Like any new technology, LSTK profiles need to be improved and solutions found. At the same time, norms should be developed for the construction of structures with thin-walled frames. Then this technology will solve the main problems in the construction industry.

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ANALYSIS OF THE CARBON CONTRIBUTION OF THE LIFE CYCLE OF BUILDING MATERIALS

Today, the construction sector accounts for about 38% of total carbon emissions. As a result, there is a growing need for low-carbon construction design aimed at controlled emission reductions in the construction industry. It is important to minimize emissions from building materials and products without compromising the quality of the building and its structures to avoid major repairs in the future.

Many carbon emissions occur through external walls, slabs and foundations, as well as the frames of the buildings themselves. The study by Takano et al. (2014) showed that the reason for this is the use of concrete and steel, which are carbon-intensive materials. Also, these studies claim that components of external walls account for 41% of greenhouse gas emissions [1].

According to the designers, the embodied carbon should be calculated in the early stages of the project. And based on the previous paragraph, the design of the building should begin with the collection of embodied carbon data for supporting structures and frames.

You can calculate the carbon footprint left by building materials using the Embodied Carbon in Construction Calculator (EC3). Such calculations will help to assess in advance the impact of materials on the environment [2].

Also, to help designers, there is a published list of BuildingGreen, which describes the best materials for environmentally friendly construction.

One of the most popular "eco" materials today is wood. This is a material with an extremely small carbon footprint. And that is why it is actively used in construction.

For example, it is the construction of a residential building in Boston, planned by the architectural studio Generate together with the developer Placetailor. The building is positioned as a structure with zero carbon emissions, due to the construction of parts made of CLT - wood. This material will compensate for the carbon emissions that occurred during construction over the next 60 years of operation. A similar facility is planned in Canada. Namely, this is a new building of Santian College in Toronto, which will be built of the same CLT - wood. In addition, solar panels will be installed on the roof of the building to fully compensate for annual carbon emissions [3].

One of the materials that will also help reduce carbon emissions is precast hemp concrete, which is able to absorb carbon. It was from him that a house was built on the Margent farm in Great Britain.

Reducing carbon emissions is one component of ensuring an environmentally sustainable future. This can be achieved by promoting materials with a low carbon footprint.

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DESIGN OF THE HIGHWAY OF THE III CATEGORY OKHTYRKA – POLOHY IN SUMY REGION

The growth of road transport, their cost, the conditions of organization of transport and traffic safety largely depend on the development and condition of the road network. When driving on a bad road, the speed decreases, fuel consumption increases, the cost of transportation enhances. In addition, the number of accidents increases, car wear enlarges, which leads to increased costs and downtime. On a well-designed and well-built road with a hard and smooth surface, a car can develop high speed and transport cargo that corresponds to its maximum load capacity. Thus, the importance of roads in modern living conditions is growing significantly, and the better the technical condition of roads is, the fuller and more economical use of road transport is.

The road, which is being designed, aims to connect the settlements Okhtyrka and Polohy in Sumy region. It will also serve to more reliably connection of the district road network with roads of national importance. The need for construction is due to the fact that the parameters and technical condition of the road do not meet the requirements of traffic.

Construction of the highway between Okhtyrka and Polohy in Sumy region is intended for their development. In Okhtyrka there are enterprises of light and food industries: OJSC "Okhtyrka Garment Factory", OJSC "Okhtyrka Brewery", bakery, meat processing plant and Okhtyrka Cheese Factory. And in Polohy there is well-developed agriculture, as well as farmers, are engaged in the procurement of milk and meat, so the construction of this highway will contribute to their further development.

The main work consists of two aspects:

1. Designing highway;
2. Designing pavement.

We determine that this highway belongs to the III technical category, the perspective traffic intensity (defined below) is in the range of 1000-3000 cars / day in the transport units given for the car. At the design stage we set the beginning of the route in Okhtyrka and the end of the route in Polohy in Sumy region, through which the highway will pass. We connect the beginning and the end of the route with a straight line (overhead line) and along it we consider a possible option of laying the route. At least two options are compared to choose the best route option. To ensure the stability of the ground at the intersection of the highway with ravines, beams, which drain water from rain and melting snow, we arrange artificial structures.

Designing pavement is a process of taking into account the mutual work of all layers of clothing design. The basic principles of design are:

- the type of coating and construction of clothing must meet the technical and operational requirements for the road of this category;
- the possibility of using local construction road materials;
- the strength characteristics of the layers must differ from each other no more than 5 times;
- the thickness of each lower layer must be greater than the layer above;
- water permeability should decrease in the direction from the upper layers of the pavement to the lower ones.

Thus, having made the calculation, we realized that the selected design satisfies the condition of strength for the allowable elastic deflection.

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ON THE DEVELOPMENT OF WASTEWATER TREATMENT TECHNOLOGY IN THE PRODUCTION OF PLANT PROTECTION PRODUCTS

Today, there is an urgent need for agricultural producers in high-quality, inexpensive and, most importantly, predictable plant protection products. Plant protection products include: pesticides, herbicides, sticking agents, anti-stressants and microfertilizers. In their production we use water as solvents and also for washing out equipment when we switch from one product to another in production. Cleaning of the equipment produces wastewater with a concentration of pollutants at 1%, which is a highly toxic organic product. For this reason, the aquatic disposal of this wastewater is not possible without treatment.

The U.S. Environmental Protection Agency (EPA) estimates that the best way to remove organic substance from water is through sorption treatment. The most affordable technology for removing organic substances from water by means of sorption is to apply granular activated carbon (GAC). Due to the highly developed surface of activated carbons, a wide range of organic compounds, including pesticides, are extracted during water treatment [1]. Studies have shown that when granular activated carbons are used as the first stage of water treatment, the degree of pesticide adsorption on GAC is reduced due to high competition with other large organic substances.

The literature suggests the use of GAC as an additional pretreatment agent with high pesticide adsorption efficiency. In this case, most of the organic matter will be removed in the first treatment stage before using GAC filters. The combination of membrane bioreactor (MBR) and sorption technology on GAC, is used to create a hybrid system [2].

In pesticide/herbicide wastewater treatment processes, treatment of industrial wastewater containing COD from 500 mg/L to 100,000 mg/L has been proven to be suitable. Typically, this process works at suspended solids concentrations of 1-5 g/L (and has retention times of sludge ranging from 8 to 25 days). For retention of sludge of this age, the most appropriate, and most likely the only, technology is MBR [3].

Oxidation is used to reduce the load on the activated sludge and coals. Ozone can be used as an oxidizing agent. Ozone is an unstable gas that easily degenerates from O3 to O2 (equation 1) to produce highly reactive free radicals. Consequently, ozone successfully reacts with and destroys a wide range of organic water pollutants (Equations 2 and 3) [4]. Due to the short reaction time of ozonation, fast treatment of effluents at high loads is possible. A number of studies [4] have proven that ozonation is effective in degrading a number of persistent organic pollutants, including the pesticides 2,4-D, 2,4-DP, MCPA and MCPP in wastewater.

$$3O_2 + \text{ENERGY} \rightarrow 2O_3 \quad (1)$$

$$2O_3 + \text{POLLUTANT} \rightarrow \text{BY-PRODUCT} \quad (2)$$

$$O_3 + H_2O \rightarrow OH\bullet \quad (3)$$

This process was applied to the above compounds at micro concentrations between 0.9 and 6.4 µg/L - removal rates were achieved from 80 to 100%. It was then proposed to use the combined method of ozone with hydrogen peroxide for 2,4-D and 2,4-DP at identical concentrations between 0.9-6.4 µg/L the removal rates were > 95% and > 96%, respectively. These results show that significantly higher removal rates of organic contaminants can be achieved when ozone is combined with hydrogen peroxide. The Fenton process is one of the most efficient methods of oxidizing organic pollutants in industrial wastewater [5]. The Fenton reagent consists of a mixture of hydrogen peroxide (H_2O_2) and divalent iron (Fe_2^{+}). Divalent iron (Fe^{++}) initiates and catalyzes the decomposition of H_2O_2, thus forming hydroxyl radicals (OH^{-}) (Equations 4-5). These two reactions constitute the iron redox cycle, where iron acts as a catalyst. The formation of hydroxyl radicals are: reactions (equations 6 through 9). They can react with pollutants by oxidizing and turning them into byproducts. Hydrogen peroxide can also act as a hydroxyl absorber as well as an initiator during these reactions (equations 7 to 9).

Fe (photo) redox cycle: $H_2O_2 + Fe_2+ \rightarrow Fe_3+ + OH– + OH•$ (4)

Fenton: $Fe^{3+} + H_2O_2 \rightarrow OH•+HOO• + Fe^{2+}$ (5)

$Fe_2+ + OH• \rightarrow Fe^{3+} + OH^{-}$ (6)

$OH• + H_2O_2 \rightarrow H_2O + OOH•$ (7)

$OOH• + Fe^{3+} \rightarrow O2 + Fe^{2+} + H^{+}$ (8)

$• OH + RH \rightarrow R• + H_2O \rightarrow$ products (9)

Hydrogen peroxide and UV (at 200-280 nm) based purification processes generate high concentrations of hydroxyl radicals (OH). Studies show that the UV / H2O2 process is extremely effective in removing a wide range of persistent compounds, including organic pesticides. However, it is worth noting that preliminary treatment methods only prepare the water for deep biological treatment. The results of the technology using membrane bioreactors showed removal of 98% of COD. This shows that the process of purifying water from pesticides/herbicides is extremely complex and requires preliminary modeling of the process, in order to obtain a predictable result.

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SOIL FAILURE PROBLEM IN DNIPRO CITY

According to the data from the State Research and Production Enterprise 'State Information Geological Fund of Ukraine' for the year 2021, in Dnipropetrovsk Region sediments capable of karstification occupy 17,630 km2 (55.3% of the region), and forest soils capable of subsidence occupy 22,270 km2 (69,8% of the region) [1].

Suffusion processes can develop in such conditions. Suffusion can be chemical: - the process of dissolving freely soluble salts in groundwater (if this process becomes large, it turns into karst), and mechanical. In mechanical suffusion, there is a removal of the smallest particles of rocks at movement of underground water. As a result, there are various forms of subsidence: - suffusion failures, saucers, wells, funnels and more.

As a rule, mechanical suffusion develops rather slowly (years, tens of years), but the human-induced mechanical suffusion passes much more intensively. This is observed in the case of removal of sand-clay material in underground reservoirs, at breakdowns of water supply systems, in long-term underground water pumping, during drainage, etc. [2].

The main conditions for the development of mechanical suffusion include:

Heterogeneity of granulometric composition of sandy soils, in which the removal of small particles from the soil column is possible; high filtration flow rate; conditions for the removal of small parts to the surface at the base of slopes, various potholes, construction pits, etc.

Over the past few years, these processes have intensified in the city of Dnipro.

On 28 June 2021, the ground collapsed in the courtyard of the house No. 71 on Yantarnaya Street, which resulted in a sinkhole filled with water. Later, it turned out that the cause was a break in the sewer pipe.

On 16 June 2021, sections of the road fell into the ground on Starokozatskaya Street, which resulted in sinkholes. The collapse of asphalt is associated with heavy rain showers, which led to the subsidence of soil.

On the same day, about 10 meters of fence fell on the embankment near the pedestrian bridge to Monastyrsky Island, and in close proximity, paving slabs began to subside.

In 2019, the foundation of the Hall of Residence No. 2 of Dnipro University of Technology began to subside, and cracks began to appear along the wall; the cause of this incident was the washing out of soil from under the foundation of the hall of residence. [3]

To prevent such situations in the future, certain measures need to be taken:

- Given the engineering and geological features of Dnipro, it is worth using the method of two-stage soil soaking during construction, because the loess soil on which the city is located, 1 m in thickness, can sink a few centimeters only once, and after that subsidence does not recur. In such a manner, we can protect buildings from destruction and cracks.
- Construction of new and replacement of old communications, and modernization of water-bearing ones, in which materials eventually deteriorate at joints of 2 pipes, and leaks and breaks occur. Alternatively, it is possible to lay a new plastic pipeline in the old one.
- Replacing and cleaning old storm drains, and building new ones that can perform their functions one hundred percent. At this stage, the existing storm drains are 30%-capable to cope, which creates the problem of soil subsidence during heavy rain showers.

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ANALYSIS OF THE WATER INTAKE PRODUCTIVITY IN LOCATION NEAR OPEN WATER SUPPLY SOURCES

The construction of new water supply systems and reconstruction of existing systems includes among other the water supply sources and water intake choosing, which is the most appropriate to the technical conditions and water consumers' needs.

Locating near open reservoirs, the infiltration facilities are one of the most economical and convenient water intakes from underground sources. This location allows taking from the aquifers open source water, filtered by the rocks of the bottom and foreshore. It significantly improves water quality and reduces the load on treatment plants.

Infiltration facilities drawing water from underground sources can be vertical in the single or group of wells form and horizontal in the form of perforated pipes submerged in an aquifer and connected to the prefabricated vertical well.

The problem of choosing the most efficient and economical among them arises at the having the opportunity to use various types and scales of infiltration water intakes. The vertical facilities are easy to install and maintain, while horizontal facilities almost do not occupy the surface of territories using water intake areas.

The purpose of the study is to analyze the possibilities of vertical and horizontal infiltration water intakes from underground sources at the same local conditions. Productivity of these facilities and reduction of static water level are the main characteristics for water intake comparison.

The methodological basis for the calculation of these facilities is sufficiently developed and presented in the scientific works. The analysis of determining factors influence on the water intake productivity (head of aquifers [1], wells perfection and influence radius [2]) allowed developing it and provide an opportunity to use it more clearly in the educational process.

The productivity of water intakes at changes in static and dynamic water levels, changes of the distance between the water intake and the cut of open source water, increasing of well radius are analyzed.

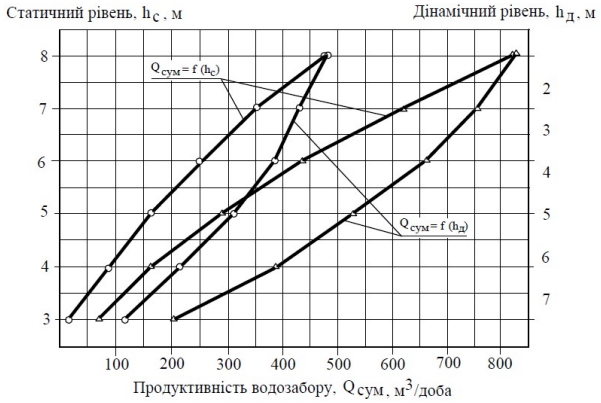

Fig.1 *Changes in water flow rate at the changes of water levels in the aquifer (o-intake with vertical wells; Δ-horizontal intake)*

Analysis of water intake productivity with decreasing distance between wells within the condition 2l≤R≈L gives incorrect results. Instead of reducing the water intake productivity, it insignificant increases (2%). Therefore, the influence of this factor should not be taken into account.

The results show that horizontal infiltration facilities have a higher productivity on the same local conditions and all the considered options for the location of water intake facilities in the aquifer. The difference is about 40%. In addition to technical conditions, the choice of water intake type requires economic analysis of construction and operating costs. The analysis of the research results showed that infiltration water intake facilities are convenient and efficient water intakes thatcan take water in difficult natural conditions. Horizontal infiltration water intakes are characterized by the highest productivity compared to vertical ones.The greatest impact on the water intakes productivity has a decreasing the static water level in the aquifer during water extraction.

On the considered conditions of the study, reducing facilities size in the plan does not affect the water intakes productivity. The potential to raise the considered facilities productivity is increasingthe diameters of wells and drainage pipes.

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METHOD FOR DETERMINING THE AVAILABILITY OF THERMAL ENERGY SOURCES FOR AUTONOMOUS HEATING SYSTEMS

In recent years, we can observe the ever-increasing interest to the questions connected with the transition of centralized heating systems to autonomous heating systems. The main reason of the growing interest of population to this problem is the economic turbulence of recent years, accompanied by a decrease in real incomes of citizens and the increase in utility tariffs. Questions about the effectiveness of autonomous heating systems have been already developed [1, 2]. Now it's time to consider the method for determining the availability of thermal energy sources for autonomous heating systems.

The most popular sources of thermal energy for autonomous heating systems, which are possible to speak about, are electric and gas individual coppers and the air-water thermal pump.

The choice of a truly economically accessible source of thermal energy from autonomous heating systems for the average Ukrainian family is impossible without determining the following parameters:

1. Monthly income of an average Ukrainian family;
2. Time of saving money for buying the heating energy source for the autonomous heating systems;
3. Cost of useful heat energy;
4. Payback sources of heat energy for the autonomous heating systems.

Let's analyse how much time it is necessary to spend for saving money for one of the above-mentioned devices in the average Ukrainian family. Let's assume that we know the level of the monthly income, dollar exchange rate and the equipment price. And let some percent of the monthly money budget be saved for purchase. We use the formula

$$T_{MA} - \frac{C*D}{I*P} \quad (1)$$

with the following components:

C – cost of heat source, $;

D – dollar exchange rate;

I – income level of the average Ukrainian family, UAH;

P – percentage of expenses, %.

Now we have to determine the cost of the required amount of useful thermal energy from autonomous heating.

First of all, we will determine the cost of electricity, which is required by a standard electric boiler for the transfer of useful thermal energy Q_u, kWh to the heating medium. The cost of electricity that is spent by the standard electric boiler for the transfer of useful thermal energy Q_u, kWh to the heating medium is determined by the formula

$$C_{ee} = A_{ec} * C_{eur} = \frac{Q_u}{\eta_{ec}} * C_{eur} \quad (2)$$

with the following components:

A_{ec} – the amount of electricity consumed by the electric boiler, kWh;

C_{eur} – utility rates for electricity, UAH / kWh;

Q_u – useful thermal energy, kWh;

η_{ec} – efficiency of electric coppers.

So, based on current regulatory documents, the net calorific value of 1 m3 of natural gas Qncv, which is supplied to consumers, is 31.8 MJ [3]. For the convenience of further research, we convert this

number from joules to kilowatt hours (1 kWh = 3.6 MJ). Then, 1 m3 of natural gas is burned, the net calorific value Qncv = 8.83 kWh is released.

The cost of gas required for a gas boiler to get the useful heat Q_u, kWh is determined by the formula

$$C_{ag} = V_{ag} * C_{1g} = \frac{Q_{ag}}{Q_{ncvg}} * C_{1g} = \frac{Q_u / \eta_{gc}}{Q_{ncvg}} * C_{1g} \quad (3)$$

with the following components:

V_{ag} – all gas volume, m3;

C_{1g} – price of 1 m3 of gas, UAH;

Q_{ag} – thermal energy released during the combustion of all gas, kWh;

Q_{ncvg} – net calorific value of 1 m3 of natural gas, is 8,83 kWh;

Q_u useful thermal energy, kWh;

η_{gc} – average efficiency of gas coppers is 0,82.

And now, let`s turn to the "air-to-water" heat pump. A certain amount of electricity is used for the operation of the heat pump. The cost of electricity that heat pump spends on the transfer useful thermal energy Q_u, kWh to heating medium is determined by the formula

$$C_{eehp} = A_{hp} * C_{eur} = \frac{Q_u}{COP} * C_{eur} \quad (4)$$

with the following components:

A_{hp} – the amount of electrical energy consumed by the heat pump, kWh;

Q_u – useful thermal energy, kWh;

COP – coefficient of performance;

C_{eur} – utility rates for electricity, UAH / kWh.

Now we have to determine the payback of heat sources. We use the formula

$$P_{hs} = \frac{C*D}{M_S*H_p} = \frac{C*D}{(C_{hUR} - C_u)*H_p} \quad (5)$$

with the following components:

C – cost of heat source, $;

D – dollar exchange rate;

M_S – saved money, UAH;

H_p – heating period, 7 months;

C_{hUK} – utility rates for heat, UAH;

C_u – cost of useful heat energy, UAH.

The value of C_u in formula 5 can be equal to C_{ee}, C_{ag} or C_{eehp}, depending of the heat energy source.

The above mentioned formula prove the effectiveness of the recommended method for autonomous heating systems.

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THE PROBLEM OF ENERGY SAVING AND PASSIVE BUILDING SYSTEMS IN UKRAINE

The problem of energy efficiency in Ukraine is quite relevant and at the national level it needs certain investigation. This requires energy audits of major sectors of the national economy. It would be advisable to conduct energy audits of the largest enterprises. The priority should be given to the development of organizational energy saving measures, which are practically costless.

In this paper, an attempt has been made to analyze the prospects of economic reform directions on the basis of energyefficiency and energy saving, i.e. certain mechanisms of evaluation and development of energy saving programs at the state, regional and sectoral levels, as well as for individual enterprises are proposed.

The current situation. Today, many regional and sectoral energy-saving programs have been developed. Such programs, plans and strategies have also been developed at the state level. Unfortunately, it is hardly an exaggeration to say that quantity has not turned into quality, let alone concrete results. The following reasons of this situation are analyzed.

Firstly, energy conservation programs in Ukraine are not based on the results of energy audits. There are also problems at different levels (from the state to the enterprise):

- at the state level (the Comprehensive State Energy Saving Program, the Energy Strategy – do not take into account the multivariate forecast of economic development);
- at the industry level (the program is usually made by a simple consolidation in one document of energy saving programs of enterprises, which can be inconsistent and incomplete, since the majorityof enterprises are private) [4];
- at the regional level (the program is usually made by simply combining in one document the energy saving programs of enterprises of the region; the drawbacks of the so-called "municipal energy plans" are confirmed by the experience of the city of Kiev, for which measures with an average payback period of more than seven years are proposed) [2];
- energy saving programs of enterprises do not imply introduction of energy management systems, do not provide for development of organizational, i.e. practically costless measures, do not imply analysis of specific energy consumption depending on production volumes, etc.

Secondly, the big problem of all energy conservation programs is the lack of funding.

- mainly budget financing is provided for all programs at the state level, and therefore there is an evident lack of budget;
- private investments were only under discussion, but the issues of attracting them were not elaborated enough;
- there is no "economic mechanism for energy saving", which would include incentives for the implementation of projects in this area.

Thirdly, there are staff problems at all levels (from enterprises to state and industry authorities in the center and regions).

Another problem is related to the level of education in the field of energy efficiency and energy conservation. For example, sometimes people who have no practical experience in energy saving, but

primarily in conducting energy audits and creating energy management services, are involved in teaching; trainings by energy efficiency equipment manufacturers are a marketing tool, because they focus on the products of a particular company, etc. [3] There are practically no specialists with practical experience in implementing energy management services at enterprises, not to mention holding companies. This is largely related to the problem of the lack of effectiveness of a number of programs to implement the international standard ISO 50001 in our country [1]. Western experience is not always acceptable for Ukraine, because the introduction of energy efficient equipment in Ukraine is not always economically viable.

Today, an even greater need is a reasonable choice of the type of energy, especially for heating systems (gas: natural, blast-furnace, coke, biogas (landfills, biofields of water treatment plants, etc.); electricity with and without heat accumulation: electrode boilers, hydrodynamic water heating installations, heat pumps (water, earth, air); coal; biofuels: wood, straw, pallets; oil products; solar systems, etc) [3].

When developing business plans of investment projects, as well as energy saving programs, usually the following risks, associated with investing in energy and energy saving, are not taken into account:

-presence or absence of state (government) guarantees;

-the possibility of non-repayment or delayed repayment of the loan;

-influence of subjective factors, and first of all the negligence of the axiom "the staff shines through";

-possible changes in taxation, customs duties and fees; problems with standardization and certification of equipment, especially imported.

-lack of social guarantees and the need to create new jobs;

-possible changes in the cost of the equipment and commissioning works;

-possible changes in the cost of raw materials, fuel and energy resources;

-possible underutilization of the equipment (operation of the equipment for a shorter time or not at the designed capacity) and noncompliance with the technological charts;

-extremely probable recent changes in exchange rates (devaluation of hryvna), etc.

There are a lot of problems in the methods for controlling the efficient use of energy resources. Most often the value of specific energy consumption is used, without taking into account the volume of production and / or ambient temperature (for thermal production and heat supply).

enterprises). Moreover, traditional inspections do not take into account the level of state-of-the-art technology for different enterprises in the industry.

Thus, the traditional approach to evaluating energy efficiency is flawed both at the state, industry and regional level (macro level) and for individual enterprises (micro level). Unfortunately, without a strong political will and a strong, educated corps of experts in auditing and building energy efficient and passive homes and buildings, nationwide change is impossible.

"The only way to our salvation in politics is through education; it is an ark in the midst of a flood." - Horace Mann.

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THE ROLE OF VISUAL FACTORS IN FORMATION OF SAFE WORKPLACES

Introduction. Visual channel of human perception gives the largest volume of information. The results of research confirm the fact that an average human, no matter what individual characteristics of perception he has, gets more than 80 percent of information that he'd seen, and only near 11% of information he'd heard. Visual information about the object is the key element of operator's work safety. Thus, the visual parameters of working environment determine level of occupational safety. That's why method of visualization is the most effective way to inform workers about system condition and to guarantee fast making of right decisions. At the same time, luck of visual stimulus or visual over stimulations may cause neuropsychological overloading, which increases fatigue [3] and reduces the visual methods implementations.

The aim of the research is to assess the impact of psycho-physiological factors of the labor process and the production environment according to the visual environmental factors and to determine the safety of the system «man – technology – environment».

Results and discussion. In modern production with a high level of automation, the employee monitors and regulates the state of the product and devices remotely most of the working time. They have to make decisions, which are based on information from measuring instruments. This information is provided by the fastest, most flexible and simplest means of learning – using the method of visualization. In a broad interpretation of the term, visualization is defined as the presentation of information in a visual form, which improves the visual assessment of the system state and ensures rapid decision-making. The monotony of work increases with the necessity of constant control of system. In this case, the safety and efficiency of work depends on the psycho-physiological functions of a man. The man's state affects the performance of each stage of work:

- visual quality of the working environment and workplace. Low contrast of important elements reduces the efficiency of visualization and increases the stress on the CNS of the employee. The same effect may be caused by homogeneous or aggressive visual field;
- type, quantity, quality of visualization tools used, and their relevance.

Visual characteristics of the working area and working environment should provide a quick assessment of distances, heights, locations of important parts of the system as well as moving units. Lack of contrast, high level of surface gloss, optical illusions lead to errors in the perception of space, shape, position of objects and direction of movement.

Conclusion. In order to to increase the security by reducing the visual stress it is necessary to study all visual factors in complex.

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PROJECTIONS OF BRUTALISM IN THE ARCHITECTURE OF DNIPRO

Brutalism is a style that originated in the 1950s of the last century in Great Britain. Its emergence was a response to the suffering of the post-war period. The term "brutalism" comes from the French "bétonbrut", which means "raw concrete". This term was introduced by Le Corbusier when he described the technology by which buildings were then processed [1].

Over time, a whole philosophy of brutalism was formed: no paint and plaster, everything is pure and it appears to us as it is - honest and unvarnished [1], [2] For a long time it was believed that brutalism originated in the USSR, but it was not. The term was first used in Britain, but the style fits so well into Soviet architecture that there is nothing surprising in the emerging opinion. Due to the budget of concrete, functionality and monumentality of the buildings, it was very common among Soviet architects [3].

Pavel Nirinberg, Oscar Khavkin, Vladimir Zuev, Evgeny Amosov, Elvina Davydova are people who worked in the brutal style in my hometown Dnipro. They helped the city rise from the ashes after the war. Some were engaged in projects of individual buildings, while others were building entire blocks. After the war, the cities had to be rebuilt, in fact, because the brutalists thought of systems rather than their components. For example, Vladimir Zuev is an architect whose project is the Embankment near the Dnipro River, as well as the Dnepr Hotel, which is located on it. The concrete from which the hotel is built is untreated, clean. All balconies are the same such a repetition of elements is also inherent in brutalism. The building does not have a sharp projection; it is relatively simple by design. The roof is flat, that makes it possible to arrange additional recreational areas on it. There was no need to declare itself in some flashy way, because it is located in the city center [4].

There is another monument of the 1980s - the city circus that is located not far from the hotel. Its author was Pavel Nirinberg, one of the most famous Soviet architects. He described the building like: “The symmetrical volumetric-spatial composition of the circus is designed for visual perception in two perpendicular directions: on the side of the embankment and on the side of transport highway crossing the Dnipro river and leading to the city center. For the first time in domestic practice, the building of the circus has a tented roof of prefabricated reinforced concrete elements.” Due to the fact that the circus resembles a tent, flexible reinforced concrete structures are formed, which is immediately indicative of the style of construction. The author’s idea is very interesting: during the day the circus is a tent and in the evening it is a volcano from which forged animals burst out to freedom. Despite its scale, the building turned out to be light and floating in the air. This circus is one of a kind. There is no analogue to this building in the world anymore [5].

The Dnipro Embankment is full of brutalist buildings. We can see an interesting building that floats above the water nearly a few blocks from the circus. This is the "Poplavok" restaurant by the architect Sergii Brusov. The building is truly legendary. It was the place where the city’s elite could have a rest. It is said that Brezhnev was there many times. From an architectural point of view, the building is extremely interesting. Despite the fact that the restaurant is on water, it has a foundation that is underwater. It corresponds to the principles of modern architecture that Le Corbusier formulated for Brutalism: free layout, flat roof, free façade and “floating” above the ground. "Poplavok" is such an amazing place that it even got into the book with the best constructions in this style on the territory of the USSR. This book was created by French photographer Frédéric Chaubin. After the publication of this book, the work of Sergii Brusov became famous all over the world [6], [7], [8].

The conclusion dwells upon the fact that a large number of imprints of the brutalist style remained in Dnipro. They don't look like European or American buildings. Dnipropetrovsk architects showed the power of their imagination in them, so now we have such a diverse and impressive city.

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SOCIALISATION DES PERSONNES PEU MOBILES PAR MISE EN PLACE DE MAISONS D'HABITATION ACCOMPAGNÉES

Nous ne sommes pas identiques: dans la société, il existe des personnes ayant des besoins particuliers qui ne peuvent vivre vie à part entière dans un environnement inadapté.

Le problème urgent de la société est de créer les conditions d'une vie à part entière pour les personnes handicapées. Malheureusement, cette catégorie a toujours été lésée dans la société au point de ne pas être acceptée. Ils ont commencé à se rassembler dans certaines institutions où ils étaient complètement isolés de la société et ressentaient l'attitude inhumain des autres. Enfin, dans le monde d'aujourd'hui, les gens ont compris que tous les membres de la société ont droit à une vie à part entière. Cependant, les personnes handicapées ont certains nécessités, par exemple les personnes à mobilité réduite, qui ont besoin de conditions de déplacement adaptées, de moyens techniques supplémentaires, etc.

Récemment, il y a eu une tendance dans le monde à organiser certaines institutions de logement accompagné, qui, malheureusement, ne sont pas courantes en Ukraine.

Le logement accompagné est la cohabitation d';un petit groupe de personnes handicapées dans une maison spéciale sous la garde d'assistants (salariés ou bénévoles). Ils sont constamment aux côtés de leurs pupilles, aident dans la vie quotidienne (cuisine, ménage, procédures d'hygiène, etc.), et dans leurs déplacements en ville (travail, études, famille, etc.). En même temps, chaque habitant de la maison a suffisamment de liberté et fait tout son possible par lui-même. C'est très important, car cela permet aux personnes handicapées de se sentir responsables de leur vie, d'être socialisées, de travailler et même d'aider les autres [1].

Une maison accompagnée est une expérience mondiale d'hébergement de personnes handicapées qui ont perdu ou qui ne peuvent plus vivre avec leur famille.

L'essentiel de la vie assistée est ce que les gens vivent dans leur propre chambre et disposent d'une cuisine. Les aider se terminer a là où commencent leurs possibilités.

Contrairement aux internats, où une personne est complètement dépendante d'extérieur sans se développer pas en tant que personnalité et membre à part entière de la communauté, dans le logement accompagné, elle a suffisamment de liberté pour son croissance personnelle, la capacité d'effectuer un certain nombre de tâches dues à certaines limites.

Pour créer les conditions d'une vie à part entière, il faut aménager ces maisons de manière à assurer une bonne circulation, pour des personnes à mobilité réduite. Concevoir des intérieurs adaptés aux besoins de chacun. Cela s'applique aux salles de bains, aux cuisines, aux salles de loisirs et aux pièces à vivre [2].

Il est important qu'en plus du confort fonctionnel, ces pièces procurent un plaisir esthétique. C'est, à mon avis, la tâche d'un architecte moderne engagé dans de tels projets.

Ce projet propose l'organisation de divers ateliers en fonction des capacités des personnes et de la demande de la société pour certains produits. L'organisation d'une savonnerie est proposée, pour la production de produits d'hygiène dont les gens ne peuvent se passer, de serres pour la cultivation de fleurs ou de produits agricoles. L'organisation de telles installations sur le territoire du logement accompagné favorisera la vie à part entière et le travail des personnes à mobilité réduite, leur permettra de se sentir utiles, nécessaires à la société, de ne pas éprouver de pitié et de sympathie pour leurs défaut, mais de se sentir un membre à part entière nécessaire de la communauté.

Ainsi, l'organisation d'un logement accompagné est un moyen de socialiser les personnes moins mobiles et la possibilité de se sentir membre à part entière de la société, et non dépendant, ce qui permet le développement continu de la personnalité.

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LES PERSPECTIVES DUDÉVELOPPEMENT DU TOURISME INDUSTRIEL DANS LA VILLE DE DNIPRO

Après le développement rapide du progrès technologique au siècle dernier, des idées ont commencé à émerger d'explorer les espaces inconnus de l'industrie, de divers territoires, des bâtiments et des structures d'ingénierie pour découvrir de nouvelles connaissances, émotions et expériences, d'où l'émergence du tourisme industriel.

Le tourisme industriel est un type de tourisme actif axé sur les régions industrielles, dans le but d'observer des paysages industriels, de visiter des œuvres d'architecture industrielle, des installations industrielles abandonnées et celles en activité afin de satisfaire aux intérêts cognitifs, professionnels et commerciaux [1, p. 83].

Il existe actuellement 9 types du tourisme industriel:

1) visites de sites abandonnés;

2) visites des zones protégées, des zones industrielles actives et des zones qui ne sont pas conçues pour la présence des gens;

3) exploration des structures souterraines;

4) exploration des toits des bâtiments et des constructions;

5) pèlerinage des objets de vénération religieuse désacralisés;

6) tourisme industriel passif et commercial;

7) urbanisme;
8) psycho géographie;
9) archéologie industrielle [2].

Le tourisme industriel peut inclure les sites d'extraction et de transformation, qui peuvent également être des sites du patrimoine culturel.

Le tourisme industriel, et plus particulièrement, certains types de tourisme industriel, est apparu à la suite de la crise mondiale des régions industrielles des pays développés. Les zones industrielles perdent progressivement leur importance productive pour de diverses raisons: épuisement des ressources locales, crises économiques, augmentation des coûts d'extraction ou de production, problèmes environnementaux, entraînant la fermeture d'entreprises. Les processus de désindustrialisation conduisent souvent au déclin de la région. La solution pour une telle région consiste à réhabiliter les anciennes zones industrielles pour en faire des centres scientifiques, culturels, artistiques et touristiques [3, p. 78].

En guise d'exemple, on peut citer l'Emscher Park, l'un des projets réalisés lors de la réorganisation des zones industrielles de l'ancien centre sidérurgique de l'Allemagne, la région de la Ruhr. L'Emscher Park est une combinaison unique des sites industriels et de l'une des zones les plus respectueuses de l'environnement en Europe, une sorte de liaison verte entre les villes de la Ruhr. Il existe une chaîne de 22 anciens bâtiments industriels qui ont été réhabilités à des usages nouveaux et variés en tant que centres culturels, scientifiques et technologiques [4, p. 244].

L'autreexempleest le parcpaysager industriel de Duisburg-Norddans la Ruhr. Ce parc de 200 acres abritait autrefois l'aciérie Meiderich. Il est devenu le cœur d'un nouveau parc culturel, naturel et récréatif, combinant de hauts fourneaux avec des avenues bordées de fleurs, des restaurants et des salles de concert. L'une des trouvailles les plus originales du parc est la transformation d'un gazomètre en piscine de plongée et le placement de vieilles voitures dans celle-ci. Le parc accueille également des événements musicaux importants, tels que la célèbre Triennale de la Ruhr et le festival de musique électronique Traumzeit [3, p. 80].

Nous prendrons également l'exemple de la Ruhr pour étudier une véloroute industrielle dans la région. Le concept de la piste cyclable est très populaire dans le monde, mais une piste cyclable industrielle est très rare. L'idée est de combiner des zones industrielles et des sites connus dans un ou plusieurs pays à des fins touristiques. Dans la Ruhr, par exemple, l'itinéraire comprend le gazomètre d'Oberhausen ou la mine de Zollverein à Essen.

La ville de Dnipro est l'une des plus puissantes villes industrielles d'Ukraine qui dispose des ressources financières pouvant être utilisées à la fois pour le développement d'une solide base matérielle et technique, une campagne publicitaire efficace et pour la création des établissements culturelles et éducatives; en outre, la ville concentre des institutions éducatives et scientifiques où des recherches scientifiques liés au tourisme industriel peuvent être créés et testés empiriquement [1, p. 85].L'usine Interpipe, par exemple, est ouverte au public. Lors des visites guidées, on peut y découvrir des technologies innovantes de fabrication de l'acier et admirer les meilleurs exemples d'art moderne au monde. Les objets potentiellement attractifs pour le tourisme industriel dans la ville de Dnipro sont l' usineYuzhmash (l'usine de la construction automobile du sud) et l'usine qui porte le nom de G.I.Petrovsky.

En guise de conclusion, on peut dire que la ville deDnipro est une région industrielle potentiellement favorable pour le développement du tourisme industriel car celle-ci possède des ressources industrielles uniques qui, à l'avenir, peuvent assurer la formation d'un segment intellectuel et culturel de la région. Ainsi, cette ville fera, probablement, partie du patrimoine industriel de l'UNESCO.

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CONCRETE IN ARCHITECTURE

Concrete is one of the most common and cost-effective materials used in modern construction.

It has been used since ancient times. The main properties that characterize concrete are its high strength and excellent workability.

The purpose of this paper is to give an overview of concrete as one of the main materials used in construction and architecture nowadays.

Concrete was used more as a structural material, covered with decorative plaster or cladding.

However, the significant spread of concrete had to wait for a long time. Only one of the most significant architects of the 20th century, a leading representative of the international modernist style - Le Corbusier - recognized it as the material which is worthy of attention. He was the first to deal with the texture of the material and to stop applying plaster to it. The presence of concrete in architecture should be owed to him. Between 1946 and 1952, Le Corbusier built the famous Marseilles block, which revolutionized design and started a new trend in architecture called Brutalism. "Apparently, you can really treat concrete as if it were a reconstructed stone worth showing in its natural state," Le Corbusier noted. Japanese architects, appreciating minimalism and architectural austerity, led by Tadao Ando made monolithic concrete a universal structural and decorative material. This material was extensively used in deconstructivist and expressionist figures by Zaha Hadid, the first woman architect, awarded the world's most important architectural awards. It is now difficult to imagine any sacred or museum architecture without concrete. Concrete is often used for facade cladding or in interior design. Eventually, it also emerged in private homes. Due to a new design trend, based on minimalism and "roughness" of materials, concrete is no longer negatively associated exclusively with the blocks of grey neighborhoods - the concept of decorative concrete is now evolving [1].

The use of concrete in architecture in the XX century stimulated the creation of buildings on such a scale and in such a form that did not exist before. The originality of the concept and the plastic qualities of concrete generate a strong interest in some of the engineering structures. Intended as a basic type to perform practical tasks, they have a significant artistic value because of the peculiarity of form, placement conditions and unusual perception [2].

Some of the engineering structures, such as bridges and towers, introduced into the landscape of natural or man-made environment, transform it, organizing new landmarks and connections according to the laws set by man. There are two groups among the large number of existing and made of concrete and reinforced concrete engineering structures, which have more significant influence on the organization of architectural space.

The main feature of the first category is the vertical orientation. This group includes industrial towers of various kinds - water towers, television towers, sports towers, etc. The specifics of form of these buildings makes it possible to organize the space of the building. Specificity of the shapes of these buildings make them leading compositional elements of architectural space. Earlier this role was played by the bell towers of cult constructions, watchtowers, and town halls. The versatility of concrete is the main reason for its use in construction. It can be both the construction of a building, and the creation of decorative structures for the already completed structure. In the second type of construction, special architectural concrete is used. It is an architecture where volumetric or flat decorations of any nature, as well as imitation of natural pavement can be created.

The technology of architectural concrete was invented over thirty years ago. Since then, architectural concrete has been able to characterize itself as an irreplaceable tool that has made a significant contribution to the economy, technology and aesthetics of the construction industry in the developed world. Architectural concrete is not a single material. It is a collective term that includes a whole family of materials that can be designed for the most diverse structures, structures and products. Since the introduction of architectural concrete in 1969, this excellent material has been manufactured and successfully used for over 36 years in more than 100 countries. In the years since its introduction to the global construction market, architectural concrete has matured considerably and improved in quality, while the range of its appliation has grown exponentially [3].

Architectural concrete can be divided into monolithic and precast. The first is the elements that are produced in the formwork at the construction site. Such forms are reinforced with different types of reinforcement, mainly steel. They usually create a certain large surface, such as a wall or ceiling [4]. Prefabricated concrete are prefabricated elements, such as concrete slabs or panels or other parts of a building. If monolithic concrete structures are used, the load from them must be taken into account in the structural design of the building. The use of precast parts allows them to be used in finished buildings, for example, during renovations. Due to this, real concrete in an apartment building or already built single-family house can be used.

In conclusion, concrete is a durable, long-lasting material, which is highly popular and important in construction and architecture. There are many technologies on the market that imitate concrete (such as plaster, paint or wallpaper), but they do not reflect the real nature and structure of this material. The best impression is guaranteed by the use of prefabricated elements, which allow fully enjoying the quality and aesthetics of concrete and in rooms where it seems impossible.

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PRESERVATION OF THE CITY`S ARCHITECTURAL IDENTITY IN THE ERA OF GLOBALIZATION

*Introduction.*The main difference between today's time and any other time in history is the presence of pervasive globalization. Globalization is a process of world economic, political, cultural, and religious integration and unification, so it has a very strong influence on architecture. Architecture is an art that reflects and preserves the most striking manifestations of the cultural life of that time when it was born. Architecture could lose its value and attractiveness due to the growth of international culture and the growth of international style in architecture.

Why should the architectural identity of the city be preserved? The importance of preserving the identity of the city comes from the features of the world order in the era of globalization. With the tourism development and with the almost unhindered migration of people in the world, there is a need for cities to maintain their individuality. The creation of a competitive and comfortable environment for residents, preservation, and restoration of historical heritage, establish an image of the city that is attractive to tourists, investors, and citizens.

In this paper, we will consider the concept of "identity" and different variants of interpretation of this term. We will analyze the existing researches on the definition urban environment values from the point of view of human perception. Also, we will determine how the architectural identity of the city can be preserved.

*The main tasks***.**Talking about preserving architectural identity, the first thing to do is to define what identity is. The term "identity" came a long way from psychology into cultural studies and then to theoretical architectural studies. The main peculiarity of this term is in its double interpretation. There are two main definitions of the term "identity":

1. Identity is a set of distinctive features that endow an object with features unlike other objects, thereby helping to stand out from the crowd.
2. Identity is a set of characteristics that help determine the belonging of the research object to a certain group, thereby identifying it.

Combining these two definitions, we can conclude that a city needs to have features in its manifestation that would not be similar to other cities, but at the same time, there should be some features in the city that characterize it.

Speaking about the factors of the identity of the environment, it is also worth mentioning who defines this identity. Since cities exist for people and are created by people, then it is worth exploring the cities from the point of view cities inhabitants. This research approach is quite subjective and depends on the worldview of each person, however, this approach gives a clear vision of how a particular city is perceived by people and what is decisive point for everyone in identifying the environment.

One of the researches that tried to determine what is valuable in the urban environment for citizens was performed by a group consisting of R. Bruce Hull, Mark Lamb, and others [2]. This sociological experiment was held in 1989 in Charleston, USA, after Hurricane Hugo, which almost destroyed the town. After this terrible disaster there was a survey that could help to defined six main features that are valuable for citizens of Charleston.

1. Urban landscaping - 30%
2. Churches and attractions - 27%
3. Living buildings - 19%
4. Public buildings - 6%

5. Places related to important historical events - 6%
6. Other buildings - 5%

Even though this research has been tied to a specific event in the life of people and the city, it displays a list of values that can be analyzed and understood what is more important and valuable for citizens in identifying the environment, and what is less.

Another research examining the human perception of the environment was described in the book "The Image of the City" by Kevin Lynch [1]. In his work, the author divided the material objects of the environment that a person perceives into 5 categories:

1. Paths 2. Edges 3. Districts 4. Nodes 5. Landmarks

The advantage of this type of division of the urban environment into its constituent parts is its complete versatility, in other words, any city can be decomposed into parts using these 5 categories, whether it is New York or Dnipro. These and other research contribute to a broader understanding of what, the urban environment is and what its architectural value is from the point of view of ordinary citizens is. The result of investigation is the so-called architectural code where the main features of the architectural identity will be recorded, to form an urban environment that corresponds to today's issues of identity in the era of globalization.

Conclusion. Thus, globalization is an integral part of today's time, which affects all aspects of human life and has a negative impact on the identity of cities. Applying the unique city code architects and designers could understand better what to focus on in the process of designing new buildings and reconstructing old ones, so that the city does not lose its identity.

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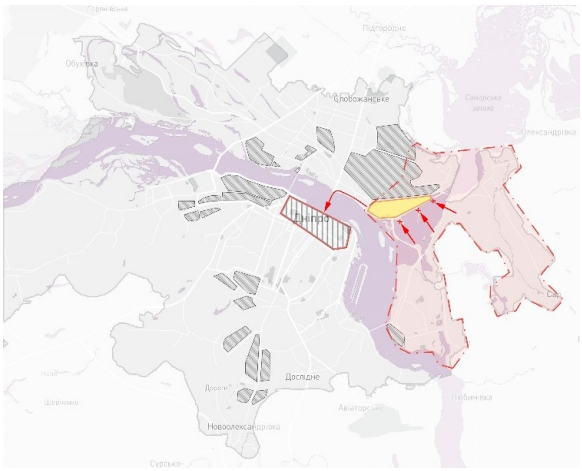
POTENTIEL CACHÉ ET RÉNOVATION DES ZONES INDUSTRIELLES SUR L'EXEMPLE DE LA ZONE INDUSTRIELLE DE SAMARA DANS LA VILLE DE DNIPRO

La culture industrielle que de nombreuses villes ont héritée des temps anciens tombe tôt ou tard en décadence et se révèle incapable de renaître. Cela est dû au développement ou aux possibilités de la ville, ainsi qu'aux besoins des habitants eux-mêmes. Ainsi, nous obtenons une situation où d'immenses zones d'usines écologiquement instables et d'usines abandonnées occupent de vastes zones de la ville, l'empêchant de se développer et de créer un environnement sûr. Cependant, grâce à la rénovation des zones industrielles et à la réorganisation de leur structure fonctionnelle, la ville peut se doter de nouvelles zones utiles à son développement ultérieur.

La ville est un système qui est en constante évolution, dont la formation est facilitée par de nombreux facteurs, notamment le processus historique. Ce dernier crée et assujettit les principaux éléments urbanistiques et visuels de la future ville. Ainsi, un certain zonage apparaît dans les villes, grâce auquel on peut retracer le tissu du développement urbain, qui, à son tour, nous donne une idée de l'organisation de l'environnement matériel et spatial.

Cependant, au fil du temps, le besoin d'amélioration et de développement élargit les possibilités d'aménagement urbain. La recherche de nouveaux territoires et d'identité conduit pour l'essentiel à la densification de la ville par la rénovation de complexes industriels abandonnés ou leur restauration, en tenant compte de nouvelles règles et stratégies de l'aménagement des espaces verts. La rénovation est capable de changer radicalement le zonage fonctionnel de la ville, en transformant les territoires abandonnés des usines au profit du développement durable de la ville.

Une ville progressiste est le résultat de l'interconnexion de toutes ses composantes et d'un zonage compétent des territoires. Cependant, à leur tour, au sein de la ville, les zones industrielles ont tendance à déchirer des zones résidentielles entières, ce qui contribue à l'étalement de la ville. En même temps, on peut remarquer que les zones industrielles occupent une part considérable des aires urbaines, ce qui nuit à la santé des habitants de la métropole [1].



- *territoire de la zone résidentielle de Samara*
- *territoire de la zone industrielle de Samara*
- *territoires industriels de la ville de Dnipro*
- *la partie centrale de la ville de Dnipro*

Ainsi, les districts industriels de la ville de Dnipro représentent environ 23% du territoire de la ville [2]. Cependant, pour le moment, la situation est assez compliquée tant du point de vue économique que du point de vue environnemental. Certaines entreprises ont des territoires abandonnés potentiellement importants. Alors que d'autres exigent un aménagement rapide des espaces verts pour améliorer la qualité de vie des zones résidentielles voisines et de la ville dans son ensemble.

Si l'on parle du potentiel des zones industrielles, la première chose à noter est la taille des terrains. Dans la plupart des cas, les entreprises disposent de territoires gigantesques réaménageables pour les loisirs, ainsi que de structures à vocations fonctionnelles diverses: logements, bureaux, salles de sports, musées, etc.

On peut également remarquer que de nombreuses zones industrielles sont uniques et constituent le patrimoine industriel des villes. Ils créent un aspect et un panorama particuliers de la ville, qui se sont développés à la suite d'événements historiques. Ainsi, les villes acquièrent leur propre identité et peuvent former une marque du territoire, introduisant un modèle de tourisme industriel.

La rénovation est en mesure d'identifier non seulement le potentiel principal, mais également les espaces qui posent également des problèmes dans des zones industrielles. Après avoir analysé l'emplacement du terrain, on peut révéler des côtés négatifs, qui doivent être supprimés grâce au travail effectué.

Prenons, par exemple, le territoire de la zone industrielle de la région de Samara dans la ville de Dnipro. Ce territoire à un relief en pente douce et des réservoirs naturels, au sud il y a une grande artère d'eau de la ville, la rivière de Samara, qui est potentiellement la principale dominante de ce site. Après l'analyse du terrain, on peut constater le problèmeprincipal qu'on peut considérer en plusieurs aspects.

Aspect fonctionnel. Le site a une grande superficie, qui relève principalement de la fonction industrielle et de production. De petites parties du terrain sont habitables, mais leur localisation reste discutable.

Transport. Les transports en commun ne vous permettent pas de vous rendre à un endroit nécessaire sans changer de ligne. De plus, la zone industrielle divise la ville en plusieurs parties, ce qui entrave le développement de la région de Samara dans son ensemble.

Aspectécologique. La production industrielle n'utilise pas de nouvelles technologies destinées à améliorer l'état écologique du site.

Aménagement des espaces verts. Un aménagement paysager contourne le périmètre de la zone. Il existe plusieurs "oasis" vertes. Une petite aire de loisirs est située près de l'eau. Cependant, cet aménagement paysager ne suffit pas.

Aspect social. Malheureusement, la zone industrielle n'a pas été développée depuis longtemps. De nombreuses entreprises sont fermées, laissant de petits entrepôts et des sites abandonnés. La zone n'est pas adaptée à la vie des citoyens qui y vivent.

Cependant, malgré de nombreux problèmes et lacunes, ce quartier, comme beaucoup d'autres, peut commencer à se développer si sa composante fonctionnelle est bien organisée.

La rénovation des quartiers peut consister à améliorer la valeur fonctionnelle de l'emplacement, le compactage des bâtiments, ainsi qu'à améliorer l'aspect architectural du quartier. Les installations de production et les entrepôts peuvent être transformés en musées d'art de la rue et du progrès technologique, etc. Les entreprises existantes peuvent soit être déplacées hors de la ville, soit être soumises à un aménagement des espaces verts.

Pour conclure, il faut souligner que la rénovation des quartiers industriels de la ville est l'un des problèmes les plus importants de l'urbanisme et du développement. Les villes exigent l'utilisation rationnelle des territoires, qui assurera le fonctionnement continu de chaque terrain. Sur l'exemple de l'analyse de la région industrielle de Samara dans la ville de Dnipro, on peut voir comment les méthodes de rénovation intégrées peuvent améliorer la qualité de vie des citadins. En revitalisant les zones industrielles, on peut rendre la ville plus intégrale et autosuffisante.

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PROBLÈMES DE L'ARCHITECTURE MODERNE

Quels sont les principaux problèmes de l'architecture moderne ?

Une belle maison est capable d'égayer et même d'améliorer le bien-être, et de nombreux bâtiments deviennent de véritables symboles de leur époque et la principale, voire souvent la seule décoration de la ville.

Pourtant, l'architecture moderne suscite de nombreuses critiques non seulement de la part des spécialistes, mais avant tout des citoyens ordinaires qui se plaignent de la monotonie des bâtiments, de l'aménagement inconfortable, de la volonté de simplifier au maximum ou, au contraire, de "mettre en avant" les avantages inexistants de tout bâtiment ultra-moderne [1].

L'essentiel de l'objet architectural est oublié. Il se perd, petit à petit,an par an. C'est l'esthétique de la déconstruction qui apparaît, tandis que le concept d'objet architectural, d'ensemble architectural se perd.

Il existe une opinion partagée par les architectes professionnels selon laquelle deux directions sont distinguées pour le développement ultérieur de l'architecture moderne. L'une est traditionnelle utilisant des styles et des faits historiques comme source pour la création de nouvelles formes. L'autre direction est l'architecture moderne réfutant les traditions, ne trouvant des sources de mise en forme que dans les technologies et les matériaux de construction modernes. Ces directions s'opposent, rivalisent, ont des partisans et des adversaires à la fois.

L'architecture de la modernité s'est éloignée du détail historique. Ce sontles idées abstraites et les symboles qui sont devenus principaux, l'utilisation de l'espace à un niveau que tout le monde ne peut pas comprendre et apprécier.

L.Goumilev a introduit le concept "des paysages contenants"dans le langage scientifique. Ce terme permet de comprendre l'importance de la composante physique et géographique dans le processus d'interaction entre la société et l'architecture. Ce sont les particularités de l'environnement naturel qui déterminent les phénomènes sociaux et la formation de l'ordre social des activités architecturales et urbanistiques.

Le métier complexe d'architecte, dans lequel la créativité artistique et technique s'unit à la fois, devient un obstacle à la compréhension de la qualité du produit d'un projet et des conséquences de sa mise en œuvre.

Imaginez que, par exemple, devant vous se trouve un petit immeuble résidentiel du 19^{e} siècle, dont chaque brique est disposée avec toute la tendresse inhérente au bâtisseur. Et juste derrière se dresse un immense immeuble de bureaux, dans les formes duquel la combinaison du métal et du verre est fascinante, mais c'est une beauté froide qui fleurit maintenant dans le monde entier. Il y a une expression : « Une ville est une structure en développement, reflet non seulement du passé, mais aussi du présent et de l'avenir », mais ce serait le cas si un tel développement était réalisé systématiquement, et en dehors desquartiers historiquesde la ville parce qu'il faut préserver le patrimoine sans lequel il n'y aurait pas de nous. De nombreuses règles et réglementations d'urbanisme régissent ces problèmes. Même si nous abordons superficiellement les concepts de base: « Les principales tâches de l'urbanisme moderne sont la création de villes et de villages avec un aspect individuel, la solution des problèmes environnementaux urbains, le dépassement de la monotonie des bâtiments typiques, la préservation et la reconstruction scientifiquement fondée des centres urbains anciens, la préservation et la restauration soignées des monuments culturels, leur combinaison avec des bâtiments modernes».

De plus, l'un des problèmes de l'architecture moderne est la soi-disant inadéquation de la forme, du matériau, de la fonctionnalité ou d'autres points, même parmi les contemporains. Lorsque l'idée de conception est bonneelle-même, mais le bâtiment semble déplacé sur le terrain.

Exemples et anti-exemples d'architecture moderne

Il existe de nombreux bâtiments qui se détachent de l'ensemble général de la rue ou de l'ensemble du quartier. De nombreux exemples pourraient être donnés, mais examinons-en quelques-uns.

Le premier anti-exemple est un complexe résidentiel «Elegant» conçu par le bureau «Arhinzhproekt» à Kyiv, Ukraine. L'immeuble de 32 étages est encaissé dans une rue historique dont la hauteur ne dépasse pas 4 étages. Les experts notent la couleuret la solution architecturale inadéquates, la mauvaise qualité des matériaux, l'encombrement et la violation de l'ensemble général de la rue [2].

Le second sera la solution architecturale du centre multifonctionnel «Nova Victoria» à Londres qui est la base de tout un pâté de maisons. La tentative de «PLP Architecture» de briser le caractère monolithique de l'espace a abouti à une paire de tours tranchées et inclinées avec des éléments massifs rouges, qui étaient apparemment nécessaires pour doter le bâtiment d'une «qualité iconique». Beaucoup de personnes ont qualifié le bâtiment «d'excessif», «d'un désordre dégoûtant», «d'une

agression grossière contre vos sens dès le moment où vous quittez la station de métro». Selon les spécialistes de BD, les formes triangulaires et les «ailettes» en zigzag du centre de bureaux sont inefficaces et monotones [3].

À titre de comparaison, on pourrait montrer des exemples de projets de conception bien choisis, dans la conception desquels les architectes ont pris en compte l'harmonie de l'espace environnant, le choix des matériaux et l'échelle des bâtiments. «CrystalHouses» est lepremierbâtiment de ce type avec une façade en cristal, créée par le MVRDV Architectural Studio (Rotterdam). Pour recréer le style architectural traditionnel de la ville, les experts ont utilisé des briques, des cadres de fenêtres et des planches en verre. La façade ne viole pas l'architecture de la vieille ville et apporte des notes poétiques à la structure du verre.

L'opéra national de Taichung est conçu par le célèbre architecte japonais Toyo Ito. Le bâtiment de six étages du théâtre a une façade entièrement vitrée, qui est décorée d'écrans en acier, au milieu desquels des personnages sont «découpés», ressemblant à un sablier ou à des silhouettes aux courbes complexes. La connexion avec les éléments organiques du corps humain se poursuit dans les intérieurs – le bâtiment est dépourvu de supports et de colonnes internes et ses locaux semblent «couler» les uns dans les autres.

Au fil des ans, le travail des architectes s'est enraciné et a gagné de plus en plus de respect en termes de beauté et de praticité. Certaines œuvres, à ce jour, peuvent annuler toutes les réalisations positives des architectes. Côté activités architecturales et urbanistiques positives, on peutciter les pays scandinaves, les Pays-Bas et l'Israël. En ce qui concernel'Ukraine, il est à noter le Sud de l'Ukraine, Ternopil et Lviv comme des villes qui présentent les résultats positifs des attentes de la société en matière d'architecture.

La situation où «tout peut être construit» a ses propres inconvénients, parfois très importants. Tout d'abord, c'est le fossé toujours croissant entre l'architecture «moderne» et «traditionnelle» qui conduit souvent à leur incompatibilité et à un changement catastrophique non seulement dans l'apparence, mais aussi dans la structure même de l'espace des établissements historiques. Peu de gens peuvent être attirés par un tel mélange éclectique de styles [4].

D'une part, si nous prenons en compte le fait incontestable que les objets nouvellement créés sont plus adaptés pour organiser l'espace de vie le plus confortable pour les gens, la question du changement inévitable de l'apparence existante des villes s'efface. D'autre part, la perception esthétique de l'espace environnant n'a pas encore été annulée, et si un objet moderne est en contradiction avec l'image architecturale établie, cela provoque une tempête du mécontentement, et parfois même une protestation active des résidents locaux.

En guise de conclusion, je peux dire que la recherche de la combinaison optimale des bâtiments nouvellement conçus avec l'environnement historiquement établi est une tâche intéressante et en même temps difficile sur le plan créatif. Selon le rôle du bâtiment nouvellement érigé dans le quartier existant, les principales techniques de l'environnement historique peuvent être utilisées, ou la subordination au quartier environnant et ses caractéristiques stylistiques. Un architecte moderne doit traiter avec soin à la fois les bâtiments historiques et l'architecture en général, en intégrant de nouveaux bâtiments de manière à assurer la coexistence harmonieuse de l'ancien et du nouveau dans l'environnement architectural et spatial de la ville.

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CONCEPT OF INTEGRATION OF SMART CITY SYSTEM INTO URBAN ENVIRONMENT

Like from a fantasy novel, the city that has mind, taste, hearing of its own. First discussions about the “Smart” idea began in the 90’s when it all got clear that the future is up to develop the IT-industry. But in those days it seemed quite fictional, the reason was the lack of technology.

At first a concept was quite simple, it is supposed to be what is now called a steady development. The main idea was to save the environment:

You care about the environment, your kids do the same and so goes on.

But later the concept received some additions and eventually transformed into more complicated multiple-leveled structure. Main idea of this approach is to fill the city with new technologies, so as to make life in the city intuitively understandable and comfortable to all residents and visitors.

All aspects of activity are connected together in cloud – general system that allows to share the data from local perspective in scale of one smart district and to found the wide picture by contacting with multiple smart cities.

The system generates good environment for the economical and ecological processes, increases the value of land, improves quality of life for citizens to live, work and spend their time.

Internet of things.

World examples of Smart cities technologies.

Smart Forest City Cancun (Mexico). Sidewalk (Toronto).

Building blocks of a Smart City.

Operating System (rules and protocols that support the structure and cooperations between system).

Connectivity (transmitions and storage of the data, used by applications or technologies).

Technologies (the connections of elements and sensors that can be remotely monitored and manipulated).

Applications (the user services built with the combination of technologies).

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THE INFLUENCE OF COLORS IN ARCHITECTURE

Colors have a physiological and psychological effect on a person, improving or worsening his well-being, increasing or decreasing his activity.

This paper is an attempt to give an overview of the influence of colors in architecture. The main characteristics of the color, which should be taken into account, are as follows:

1. Color has the ability to highlight an object from the general mass without using complex volumetric solutions.
2. Color unites various buildings into a single whole due to a single color palette.
3. Color affects the emotional-figurative characteristics. It helps overcome monotony in construction [3].

Together with structural elements, the use of colors on the surface also affects the perception of space by a person. “Man needs bright colors to live,” Le Corbusier wrote in 1931. According to Fernand Léger, “they are as necessary as water and fire” [1].

By creating an architectural environment, certain colors can be applied to different surfaces to get different visual effects. For example, using a dark shade on the ceiling creates a feeling of a lower space; if using color on the central wall, the illusion of shortening the space is created; while applying it to all walls visually enlarges the space. If you make only the side walls of the room colored, then the space visually narrows.

The color of industrial, administrative and educational buildings can affect the increase or decrease in productivity; in hospitals, the successful coloring of space can positively affect the health of patients. Color can affect the human body due to the property of color to visually reduce or increase space, create a feeling of isolation or openness of rooms, and the influence of color can be direct, expressed in various sensations from the direct visual perception of a certain color.

For example, *blue* gives a sense of security, positive. It is often used in commercial spaces, such as offices. *Yellow* is a color of positivity, curiosity and fun. It is often used to attract attention. *Red* is the color of energy, impulsiveness, excitement. It is often used in stores, fast food outlets. *Green* causes calmness, well-being, and peace. This color is often used in clinics. *Orange*: is the color of creativity and enthusiasm that is why it is used in offices, schools and studios [3].

But colors do not exist without the presence of light. As Israel Pedrosa says in his book DaCor à Cor Inexistente, “color has nonmaterial existence: it is only a sensation produced by certain nervous organizations under the influence of light, more precisely, an action caused by the action of light on the organ of vision.” Color is closely related to psychological stimuli and can be used in conjunction with the volume and shape of each project [3].

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HISTORY AND DEVELOPMENT PROSPECTS OF OUJDA, MOROCCO

Green and leisure spaces play a very important role in cities around the world, not only ecologicallybut also psychologically and economically.This article considers the importance of these spaces in the city of Oujda, and how they will help the city to improve.

The purpose is to conduct extensive research on the current state of green and leisure spaces in Oujda and to develop a strategy that will be oriented towards this problem, as well as to find a good solution.The research involves methods of logical architectural analysis.

The city of Oujda or capital of the East fights against the problem of unsatisfactory condition of green and leisure spaces. The advantages of the region should be sufficiently usedto eliminate this problem and improve the state of Oujda.The solution taken by the government was to create a development plan andrenewable development regulations every 10 years. In order the development plan to be accepted, the architects are obliged to follow the regulations according to which each inhabitant is granted with 5m² of green space (*Development regulations* of the city of Oujda, 2015).

Morocco's sixth city, Oujda, was founded by Ziri Ibn Attia, the chief of the Zenet of the Magrawa tribe around 944 in the center of the Angad plain. And for 80 years it remained the residence of the dynasty of its founder, and then came to the power of Elmurabitin, then to the power of the Elmuahids, who built a new fortification.After the destruction of the city in 1271 by Sultan Abu YakubElmarini (Mérinide), his son Abu Youssef occupied it in 1325, thus rebuilding the Kasbah, palace, mosque, and thermal baths and finally managed to give it certain prosperity. According to the legend, it is a city with 360 gates which extended from the west of Tairet to the banks of the Isla, with infinity of districts where the vestiges are still found. Mulay Ismail, the great Alaouite sultan, began to restore and organize the city and its region in 1673. Oujda is located on the border with Algeria, as well as a real town on the eastern path of Sigilmass.After its occupation by France on March 24, 1907, Oujda, loyal to the Alawite throne, actually contributed to Morocco's struggle for independence [2, 3].

Oujda with its historical wealth, like all the cities of the world suffers from many problems that disrupt its development. The most dominant problem is the lack of green spaces and leisure which damages the ecology, economy and people of the city.The city has the advantage of a strategic

location, as well as tourist and economic resources, which are poorly exploited. The government has put a strategy to combat this problem by creating a development plan along with a renewable regulation every 10 years, but that is not enough and it is clearly seen in the current situation of the city. For the time being, Oujda benefits from two parks, one is underequipped in the city center, named "ParcLalaAïcha" and the second is located on the border atop of the city "the ecological park of Oujda", which is clearly not enough for a capital with around 500,000 inhabitants.Green and leisure spaces are very important for the city. According to the 'Urbanespora' site, there are 5 reasons to create urban green spaces. The first reason is the decrease in pollution, air pollution, urban warming and periods of extreme temperatures in summer and winter.Green spaces serve as sinks for CO2, gas responsible for climate change. The polluting dust emitted by 15 cars per year can be removedby theses spaces. They can reduce the ambient temperature of cities to 1°C, thus decreasing the urban heat island and, consequently, the harmful smog of cities. The second reason is to increase cohesion and social relationships, because a lot of people like walking in a green park, riding a bike or reading a book in the shade of a tree. According to recent studies, cities with more green spaces promote social cohesion and relationships, as they are meeting points for sharing and creating links between the inhabitants of the city. In addition, green spaces positively influence the behavior of the inhabitants. The third reason is to contribute to compliance with environmental regulations. In recent years, both the European Union and public authorities have recognized the need to guarantee the presence of green spaces in cities in order to improve environmental conditions, the health and well-being of citizens.

One of the initiatives of the European Union is called Green Infrastructure: Improving Europe's Natural Capital (2013), which promotes the design and creation of more natural areas for the sustainable development of countries. Since then, Member States have worked to implement these guidelines by creating new policies that seek ecological, economic and social benefits through natural solutions.In this sense, the Urban Green Index is an indicator that calculates the amount of green space per inhabitant in urban areas and allows measuring the green surface of a city. According to the World Health Organization, approximately 10 -15 m^2 of green space per inhabitant is needed to ensure the health and well-being of the urban ecosystem.The fourth reason is that they promote the well-being of population. Disconnecting for a few minutes from the asphalt and the noise of cars helps our breathing and improves our mood. It is about including nature in the life of cities, because it increases the well-being and health of citizens.

According to the World Health Organization, urban green spaces are essential to people's well-being, both for their physical and emotional state. This regeneration of the spirit makes people who live in cities with more parks and gardens have a better quality of life than those who live surrounded by high levels of pollution.The fifth reason is to increase the attractiveness of cities.Aesthetics can also change our perception of city life. In this sense, the psychological connotations of the greenest cities are numerous.Direct contact with nature also promotes the use of renewable energies and a greener way of life. In addition, recent studies indicate that more and more travelers are opting for sustainable destinations, with cities committed to the environment and nature [4].

As a solution, it has been decided to create a new ecological park in an easily accessible location, where the wealth of this region will be used. The territory will feature a high percentage of green spaces for children and adults, recreation areas. Two rivers 'OuedEnachef' and 'OuadIsli', water sources, plants and trees such as palm trees, etc will be used there. It is possible to create a zoo that will attract not only the inhabitants of the city but also tourists.

Conclusions. The main mechanisms and aspects elaborated in order to solve the problem concerning the lack of green and leisure spaces, which are devastating the city, are to create parks, choose appropriate location, provide the proper use of resources of the region, and use all possible advantages of the city. The planning regulations of the city should be taken into account, providing more green and leisure areas, as well as maintaining the current ones, which will allow conserving the assets.

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RECYCLING TRENDS IN ARCHITECTURE

The 21 century is quite challenging, but it is the time of great opportunities, trends and innovations. Nowadays construction industry is based on the concept of sustainability, which appeared about 30 years ago. For a number of decades, engineers, architects, designers tend to find eco-friendly innovative and inspiring solutions. Recycling is one of them, which is a “reprocessing of waste materials for use in new products” [1].

The *purpose* of this paper is to provide an overview of recyclable materials and architectural masterpieces in urban development, which showcase new possibilities for environmentally-friendly building practices.

The idea of recyclable materials is rapidly becoming an innovative and sustainable option for architects. A lot of common building materials such as concrete, brick, glass, plastics can be produced from previously used materials, which lower a building’s emissions up to 90%.

Recycling of concrete is a modern and effective method. Often, it is construction waste used from the demolition of buildings. Sometimes it can be processed and used as an aggregate (instead of the gravel or crushed natural stone) to manufacture recycled concrete (Pic. 2) or its leftovers can be used (Pic. 1). A variety of colours can be realized with recycled concrete.

For example, the SOS Children’s Villages Lavezzorio Community Center in Chicago was designed with leftover concrete from construction sites located in the neighborhood, where ‘the different types of aggregated concrete created a canvas of different shades on the building’s façade” [2].

The use of bricks in building doesn`t always imply primary use. Some companies have a mission to decrease the world’s waste streams, for instance, startup StoneCycling creates bricks from at least 60% garbage (Pic. 3). They work on developing the next generation of quality and environmentally friendly materials. One of their projects is the house in Rotterdam made from Waste Based Bricks (Pic. 4). Over 22.830 kilo waste, including ceramic, glass and clay, was recycled into new building materials for this project. The company tries to highlight the importance of exploring new ways to use resources of our planet [3].

Nowadays, it is not difficult to find how building materials weren`t lost in construction. A true circular design allows reusing materials at their highest level after functional life.

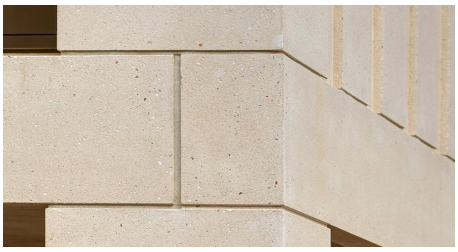
For example, the temporary People's Pavilion, the centrality of the 2017 Dutch Design Week in Eindhoven (Pic. 5), was an experiment in sustainability and material reuse. Concrete prefab foundation piles to make columns seven meters long and cross bracing made of steel rods from a ruined office building were used in this project. Greenhouse supplier lent the glass roof, while the lower glass facade

was saved from office building. Local Eindhoven residents donated PET bottles that were recycled to over nine thousand plastic tiles (Pic. 6). They are shingles at the top at the construction. Different tiles can be produced by sorting the plastic waste, from pastels shades of pink and blue, to a vibrant yellow hue. All materials that were borrowed for the People's Pavilion are reused or returned [4].

Surprisingly, glass is of particular interest in recycling because this process can be repeated endlessly without loss of quality. This includes several stages: washing, sorting, crushing, melting and directly creating of new products. It`s important to know that jars and bottles can be recycled, but not only windows, eyeglasses, crystal glass, light bulbs, mirrors, drinking glasses, fluorescent lighting tubes [5].

The Morrow Royal Pavilion in Las Vegas was created by entrepreneur Scott McCombs using recycled bottles (Pic. 7). The structure is 30,000-square-foot and made from more than 500,000 beer bottles, thanks to which 400,000 cubic yards of dump site were saved, which equals to 8 football fields. The Pavilion is mainly built from durable concrete substitute called GreenStone. Recycled glass aggregate and fly ash, by-product of coal-fired power plants, are necessary for its manufacture. Realm of Design collected beer bottles from hotels in Las Vegas Strip to create material. Firstly, glass was crushed into tiny grains, then mixed with fly ash and poured into mold. GreenStone only needs to dry and harden. After that anything can be made – from columns and balustrades to mantles and fireplaces [6].

Pic. 1 *SOS Children's Villages*



Pic. 2. *Recycled concrete Lavezzorio Community Center*

Pic. 3 *Recycled bricks*

Pic. 4 *House in Rotterdam*

Pic. 5 *The temporary People's Pavilion*

Pic. 6 *Plastic tiles*

Pic. 7 *The Morrow Royal Pavilion*

Conclusions. The world is changing and the construction industry as well as architects must adapt to the needs of new times. Waste should be used as recycled to make our planet resource efficient. Thus, recycling and waste management should not be overlooked by architects and designers.

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DÉVELOPPEMENT DE LA CONSTRUCTION DE LOGEMENTS SOUTERRAINS

Les technologies de construction souterraine sont connues à l'humanité depuis l'Antiquité. Ceci est confirmé par les fouilles archéologiques [1], ce qui, à son tour, suggère que dans les conditions de paix des années passées, l'humanité a eu recours à cette méthode de construction plus par la nécessité

que par le désir, car les pirogues étaient souvent un élément caractéristique de l'époque. segments les plus pauvres de la population. Désormais, la construction souterraine est associée soit aux maisons des riches, aux éco-enthousiastes et au roman «Le Seigneur des anneaux» de J. Tolkien, plutôt qu'à quelque chose qui s'applique à la pratique de masse.Cet article présentera un certain nombre d'arguments pointant vers l'erreur de tels jugements, et il sera également démontré que dans le monde moderne une telle construction est non seulement prometteuse, mais aussi économiquement rentable.

Dans le monde moderne, l'humanité est de plus en plus confrontée au problème des ressources limitées, en particulier, la question des ressources énergétiques est extrêmement aiguë. L'une des solutions consiste à développer et à promouvoir le développement de méthodes permettant d'augmenter l'efficacité de tous les objets qui nous entourent, y compris nos maisons. Comme l'une des solutions possibles à ce problème, nous pouvons considérer les technologies de construction souterraine comme l'une des méthodes les plus anciennes et en même temps insuffisamment évaluées pour résoudre ce problème [2].

Il est également important de comprendre que, malgré le manque de couverture de cette question dans la société moderne, il existe un certain nombre de facteurs indiquant la faveur de la société pour de telles innovations.Par exemple, lors d'une enquête menée en 2018, la plupart des répondants a répondu à la question « Aimeriez-vous vivre dans de tels bâtiments » ont répondu « peut-être », et en deuxième place était une réponse affirmative sans ambiguïté. Cela montre que la société peut accepter favorablement de telles innovations, et une demande peut se former pour de telles innovations [3].

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RECONSTRUCTION ET RÉNOVATION DES KHROUCHTCHEVKAS

La question de donner une seconde vie aux immeubles qui ont été construits en masse en URSS jusqu'à la fin des années 70 du siècle dernier devient de plus en plus importante compte tenu du vieillissement moral et de l'épuisement de la durée de l'exploitation. Aujourd'hui, l'état physique des bâtiments devient critique.

Bien sûr, dans l'après-guerre, les bâtiments préfabriqués bon marché étaient un rêve devenu réalité. En seulement 9 ans, de 1955 à 1964, 54 000 000 de personnes, soit près d'un quart de la population de l'URSS, ont obtenu leur logement et, en 5 ans, ce nombre est passé à 127 000 000. Cela ne pouvait que changer radicalement la vie de ces millions de personnes.

Pourtant, au début, les khrouchtchevkas n'étaient conçues que pour 40 à 50 ans de service et étaient considérées comme une solution provisoire. Désormais, ces immeubles ne répondent plus aux notions modernes de logement confortable en raison d'économies de matériaux, d'une mauvaise isolation phonique, du non-respect des normes d'efficacité énergétique en vigueur, d'une planification

controversée, des appartements ayant une petite surface. Aujourd'hui, les khrouchtchevkas sont devenues un problème pour les villes modernes.

Il est à noter que les restrictions d'exploitation pour une période de 50 ans s'appliquent principalement aux réseaux, pas aux structures. Selon les experts, en fonctionnement normal, les khrouchtchevkas persisteront encore de 15 à 20 ans, ayant une solidité une fois et demie supérieure à la conception [1]. Bien que des tuyaux et des fils se détruisent en 50 ans, les immeubles d'habitation en panneaux pourront encore être en exploitation pendant 50 ou même 100 ans, s'ils sont rénovés et entretenus.

De nombreux immeubles sont assez solides. Ils sont situés dans des espaces verts et au fil des ans ont formé l'infrastructure à proximité. De plus, les bâtiments de faible hauteur et les proportions humaines ont un effet positif sur l'état psychologique des personnes. Il faudra de nombreuses années pour aménager de nouveaux quartiers de la même manière.

Selon les concepteurs allemands, la modernisation des khrouchtchevkas représente en moyenne 30% du coût de construction de nouveaux logements [2]. Par conséquent, les bâtiments ne doivent pas être démolis, mais réparés et modernisés.

Il existe déjà de nombreux exemples de la modernisation des khrouchtchevkas dans l'espace post-soviétique. En analysant l'expérience d'autres pays, nous pouvons citer plusieurs éléments d'une reconstruction réussie.

Le problème principal des bâtiments dans notre pays est leur état physique, à partir duquel nous pouvons déduire les points obligatoires de toute reconstruction – révision avec remplacement de tous les réseaux, fenêtres, portes afin d'améliorer l'efficacité énergétique en isolant les murs, en réparant les toits, en imperméabilisant et en renforçant des fondations et des structures. Quel que soit le pays, l'accent est toujours mis sur les aspects de construction, l'efficacité énergétique et la sécurité en général.

C'est le cas de l'Estonie qui a même de l'expérience dans la rénovation de bâtiments économes en énergie et à consommation zéro. Cela est réalisé grâce à l'isolation des murs par des panneaux spéciaux et à l'installation des panneaux solaires qui sont chargés d'approvisionner de l'eau chaude aux résidents de l'immeuble [3].

En ne considérant que le côté visuel de tels bâtiments, la plupart des immeubles préfabriqués n'ont pas d'architecture complexe bien pensée, en raison de l'accent mis par la politique de l'époque sur l'économie de matériaux et la construction rapide en peu de temps. Ce sont le problème du décollement du plâtre ou de son absence et celui de la vue chaotique des balcons des façades qui se sont ajoutés lors de l'exploitation des bâtiments.

Il est nécessaire non seulement de mettre à jour les façades elles-mêmes, d'expérimenter avec leur design, mais également d'introduire un certain code de conception qui établirait des solutions uniformes pour la climatisation et le vitrage des balcons. Pour améliorer l'insolation, on pourrait agrandir les fenêtres, ce qui affectera également l'apparence. Parmi les tentatives réussies de la diversification de la façade figure également l'ajout des balcons, ce qui donnera un espace supplémentaire et la possibilité de solutions intéressantes. Tantôt les étages supérieurs sont reconstruits avec la création des terrasses privées pour les résidents, tantôt des étages entiers sont démolis ou plusieurs secteurs sont supprimés, selon la longueur et la hauteur du bâtiment, comme on peut le voir à l'exemple de l'Allemagne.

Quant à la reconstruction de l'intérieur, un groupe d'entrée transparent représente une solution plus rationnelle que de lourdes portes métalliques. Une visibilité claire des deux côtés réduit le vandalisme et la criminalité à l'intérieur de l'entrée, tout en augmentant la sécurité des résidents qui peuvent voir avant de sortir tous ceux qui se trouvent près de leur immeuble.

Pour la commodité des groupes à mobilité réduite, l'entrée dans l'immeuble doit être au ras du trottoir, ce qui n'est plus du tout prévu dans les khrouchtchevkas.

Il n'y a aucune intimité au rez-de-chaussée. Par conséquent, les résidents essaient souvent de se clôturer avec des rideaux, des stores ou des barreaux. Le problème peut être résolu grâce à la création des jardins privés et de la verdure à proximité de la maison, et le terrain sous les fenêtres est à donner aux habitants des premiers étages. Dans ce cas, non seulement la qualité de vie s'améliorera, mais aussi l'aménagement du territoire qui sera désormais entretenu.

De plus, une certaine partie du rez-de-chaussée peut être destiné à l'implantation de l'ensemble des services ou d'un espace public pour les résidents. Ce sont des salles de sport, des clubs de jardinage, des lieux de rassemblement pour les habitants qui auront un impact positif sur les relations de voisinage et permettront de résoudre plus facilement les problèmes d'organisation.

La composante interne doit avoir des solutions communes tout comme la composante externe. Les panneaux étant des structures porteuses, il est difficile de reconcevoir des appartements individuels, mais il est possible d'en combiner plusieurs en un seul.

En URSS, l'attention a été portée sur le territoire adjacent des immeubles, laissant suffisamment d'espace pour les parcs et les cours, mais ce ne sont pas tous les bâtiments qui étaient concernés. Le problème actuel des vieux quartiers est le manque des lieux de loisirs confortables. Tout d'abord, il est nécessaire d'aménager des espaces de repos, de réserver des espaces pour le stationnement des voitures et des vélos afin de réduire le nombre de stationnements spontanés et de rendre aussi pratique l'utilisation des vélos et des voitures. Du côté de l'ingénierie, un bon drainage est un élément à ne pas négliger.

Malgré le fait que la démolition soit un dernier recours, il ne faut pas oublier qu'elle devient inévitable pour les bâtiments dégradés. Dans ce cas, en construisant de nouveaux immeubles à l'emplacement des vieux, il serait indispensable de conserver un petit nombre d'étages, un aménagement paysager et laisser des voisinages proportionnels à la personne. Avec une telle construction, il n'y aurait pas d'immenses espaces vides, les immeubles auraient des façades plus actives et les quartiers en général deviendraient plus sûrs et plus confortables, bien que la densité puisse rester la même que dans le cas des quartiers avec des bâtiments à plusieurs étages.

La tâche principale est de préserver le patrimoine et tous les points positifs qui existent aujourd'hui, mais de faire en sorte que le lieu réponde aux attentes du présent.

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THE MOST FAMOUS COMPUTER-AIDED DESIGN

Today, it is impossible to imagine modern design in many industries without Computer-aided design (CAD). Computer-aided design is the use of computer-based software to facilitate design processes. CAD software is often used by various types of designers and engineers. CAD software can be used to create two-dimensional (2-D) drawings or three-dimensional (3-D) models. The purpose of CAD is to optimize the designer's workflow, increase in efficiency, and improve the quality and level of detail in the design [1].

Since the 1980s computer-aided design programs reduced the need of draftsmen significantly, especially in small to medium-sized companies. Engineers were able to do their own drafting work, replacing the need for entire departments through the use of this software [3].

Nowadays more and more architects are using AutoCAD. If we had to define what AutoCAD is in a few words, we would say that it is a CAD-type software focused on drawing and modeling in 2D and 3D. It allows you to create and modify geometric models with an almost infinite capacity to develop all types of structures and objects. In otherwords, AutoCAD is a computer-aided drafting program used for a large number of various design processes. Its usage centers around drawing with electronic equivalents of real drawing tools [2].

In addition, the AutoCAD program has a number of commands that help with precision, such as centering lines and marks automatically calculated from your design size and placement. Also, AutoCAD offers a variety of ways to view your design, so you can work on it at every angle.

AutoCAD, just like any other program has various advantages and disadvantages.

Using AutoCAD has a lot of benefits. To begin with when you are using the computer-aided design software, it will save your time and you can make better and more efficient designs in shorter time duration.

Furthermore, with AutoCAD, you can actually create images in 3D. It is even much faster to generate a 3D model than you would have by hand. There is also the possibility of drawing in 2D.

Thanks to this program you can decrease in error percentage. As the CAD software makes use of some of the best tools, the percentage of error that occurred because of manual designing is significantly reduced.

Besides it is useful in many industries and branches. Basically, AutoCAD is used in architecture, electromechanics, civil industry, electronics, and chemistry.

Moreover, for schools and students, Autodesk provides teachers and students a free access license to AutoCAD for a one-year period that can be renewed as long as the school or student who wants to use the software still fulfills the necessary requirements.

On the other hand, there are some disadvantages from using AutoCAD.

Firstly, this is expensive start-up costs. AutoCAD can be very expensive with the initial costs being particularly high. This is because there are hardware costs, software and then the training. You are forced to get good quality computer hardware if you want the software to be functional.

Secondly this program has limited number of possible colors. There are about 256 possible colors on AutoCAD and several textures. This means that you may not be able to come up with quite realistic images the same way as the illustrator programs.

In addition, AutoCAD software can not be used in the complex designs and it cannot be used in Complex Programming.

To sum up, we would like to say that AutoCAD is the most famous computer -aided design. It has a multitude of specialized auxiliary tools which cover every kind of industrial fields related to 2D design and 3D modeling. AutoCAD has remained the basic program in many design industries because it's permanently updated. There's a new version released every year, and new features are always being added. Perhaps this program will help you find your dream job.

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MAIN IDEAS OF BAUHAUS

There are always key trends in construction and architecture specific to any time. The ideas of Bauhaus are still relevant in our time.

The *purpose* of the paper is to overview keys characteristics and application of this trend in human life.

According to the history of school creation, it was founded by Walter Gropius in Weimar on 1 April 1919. It was a merger of the Grand-Ducal Saxon Academy of Fine Art and the Grand Ducal Saxon School of Arts and Crafts for a newly affiliated architecture department. Its roots lay in the arts and crafts school founded by the Grand Duke of Saxe-Weimar-Eisenach in 1906, and directed by Belgian Art Nouveau architect Henry van de Velde. When van de Velde was forced to resign in 1915 because he was Belgian, he suggested Gropius, Hermann Obrist, and August Endell as possible successors. In 1919, after delays caused by World War I and a lengthy debate over who should head the institution and the socio-economic meanings of a reconciliation of the fine arts and the applied arts (an issue which remained a defining one throughout the school's existence), Gropius was made the director of a new institution integrating the two called the Bauhaus [1].

In the pamphlet for an April 1919 exhibition entitled Exhibition of Unknown Architects, Gropius, still very much under the influence of William Morris and the British Arts and Crafts Movement, proclaimed his goal as being "to create a new guild of craftsmen, without the class distinctions which raise an arrogant barrier between craftsman and artist". The early intention was to combine Bauhaus as an architecture school, crafts school, and academy of the arts. Swiss painter Johannes Itten, German-American painter Lyonel Feininger, and German sculptor Gerhard Marcks, along with Gropius, were the faculty of the Bauhaus in 1919. Next year a German painter, sculptor, and designer Oskar Schlemmer headed the theatre workshop, later Swiss painter Paul Klee, joined and Russian painter Wassily Kandinsky joined them. 1922 also very productive for the school, it got a Dutch painter Theo van Doesburg and the school was visited by Russian Constructivist artist and architect El Lissitzky [1].

Bauhaus is a school of building which has its own ideas and the characteristic features that distinguish it from all other schools of architecture and design.

The "Bauhaus Manifesto" says that sculpture, painting and architecture are a single whole and inseparable, and this unity should be available to any person, regardless of his material condition. Thus, design should be accessible and be everywhere - from architectural structures to household items. The Bauhaus also pursued the idea of bringing people together and strengthening high-quality interpersonal connections.

It is the unification of people and their interpersonal relationships that is one of the modern trends both throughout the world and in Ukraine, and now these trends can be traced both in urban planning and in the construction of multi-storey residential buildings.

Architects strengthen interpersonal connections between people with different compositional solutions and methods, as well as thinking through different zoning, for example: the first floor is a great meeting place. That is why, now very often the first floors are divided into separate rooms and rented out to various cafes, shops, offices, beauty salons, etc.

Also, much more attention in architecture is paid to natural lighting, as the psychological state of a person and the perception of space directly depend on his environment. Based on this, panoramic glazing is now popular; it helps let in the maximum amount light into the room. High ceilings in the room also have a positive effect on the emotional state of the people inside; such details are the main link between architecture and man.

Currently, architects who design residential high-rise buildings focus on pure geometric form and refuse to use excess details and décor. They prefer achromatic colors, bright colors are used as accents, and the function is also important, not the appearance of the building, but inside and out.

*Conclusion.*Obviously, these ideas were mainly carried by the Bauhaus architectural school, and now they do not lose their relevance, but are only gaining popularity.

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L'ÉVALUATION DES POSSIBILITÉS DE L'APPLICATION DU PROGICIEL «LIRA» DANS LES CALCULS DES COQUILLES PEU PROFONDES SOUS LA PRESSION EXTÉRIEURE

Les coquilles peu profondes circulaires coniques et les structures constituées de coquilles coniques et de plaques coniques, en raison de la facilité de leur fabrication, sont largement utilisées comme structures basiques des constructions et des structures, en particulier, comme fonds et revêtements des réservoirs cylindriques verticaux. Ces réservoirs, surtout ceux, qui sont utilisés dans les industries chimique et pétrolière, font l'objet d'une responsabilité particulière. Leur destruction, même partielle, outre des dégâts matériels importants, peut entraîner des victimes et une catastrophe écologique [2, p. 251]. A cet égard, la nécessité d'affiner le calcul de telles structures et de leurs éléments, tant au stade de la conception qu'au stade de l'analyse de l'état réel sous l'effet de pression et de déformation lors de leur exploitation, a toujours été et reste une tâche importante et urgente. La charge caractéristique des coquilles considérées est la pression externe, le dysfonctionnement typique se fait voir par la perte de durabilité [3, p. 186].

La déformation et le gondolage des coquilles coniques peu profondes, en raison de la complexité des tâches, n'ont pas été suffisamment étudiés, en particulier, pour les constructions en pente très douce. A notre avis, la solution efficace des problèmes en question n'est possible que par des méthodes numériques utilisant des progiciels basés sur la méthode des éléments finis (MÉF). En Ukraine, le progiciel «LIRA» est le plus répandu et le plus accessible [4, p. 26].

Pour évaluer l'applicabilité du progiciel à l'analyse structurelle, on utilise celui d'«ANSYS» qui a le niveau supérieur.

La première étape de recherche est consacrée au calcul de la déformation et de la stabilité des coques coniques circulaires peu profondes fermées élastiques sous l'effet de la pression extérieure. Toutes les études représentaient une expérience numérique réalisée en parallèle à l'aide des progiciels «LIRA» et «ANSYS».

Lors de la deuxième étape de la recherche, une comparaison approfondie a été faite des résultats de la résolution du problème de stabilité linéaire des coques coniques fermées dans les milieux des progiciels «LIRA» et «ANSYS» avec les données des études analytiques et expérimentales bien connues [1, p. 176-178].

Les tâches principales dues au sujet du travail de recherche en question sont:

•l'étude de l'état de contrainte-déformation (ECD) et de la stabilité dans une formulation géométriquement linéaire des coquilles coniques fermées peu profondes à l'aide des progiciels «LIRA» et «ANSYS».

•la comparaison des résultats des calculs numériques avec les données d'études analytiques et expérimentales bien connues.

•l'évaluation de l'applicabilité du progiciel «LIRA » au calcul des coquilles peu profondes réelles sous l'effet de la pression extérieure [4, p. 28].

Dans les coquilles coniques peu profondes, sous l'action de la pression extérieure, le dysfonctionnement de sa validité se produit principalement en raison de la perte de stabilité, étant donné que les contraintes sont très éloignées des valeurs dangereuses pour son matériau. En fonction de la géométrie de la structure, des conditions de fixation et, en premier lieu, du degré de sa déclivité (flèche relative de levage est H / 2R), le mécanisme du gondolage sera associé au changement de la déformation axisymétrique initiale de la coquille ayant une forme asymétrique. La pression critique dans ce cas-là peut être déterminée pour résoudre le problème de stabilité linéaire basé sur l'approche d'Euler (modèle de bifurcation) [3, p. 113-115].

La recherche en question a ciblé des coques coniques peu profondes avec R = 1 m et l'épaisseur de coque h_o = 0,004m, ainsi que l'influence de l'angle d'inclinaison de la génératrice du cône par rapport au plan de la base inférieure (), qui variait de 030 à 5, sur l'état de contrainte-déformation (ECD) et la stabilité des structures. Les modèles de calcul de la MÉF des objets étudiés ont été construits à l'aide du générateur des grilles du progiciel [4, p. 30-31].

Le nombre d'éléments finis pour les structures considérées, qui ont donné des résultats fiables des indicateurs ECD, ainsi que des charges critiques pour toutes les tâches, était de 6000.

La perte de stabilité dans les deux progiciels s'effectue sous la forme de bosses et de renflements réguliers dans la direction circonférentielle avec une demi-onde dans la direction radiale.

Les valeurs de q^{cr} obtenues à l'aide de «LIRA » coïncident pratiquement avec les résultats de q^{cr} dans «ANSYS » (l'erreur ne dépasse pas 2,3%) [4, p. 32].

Par conséquent, lors de l'utilisation d'un progiciel, il est important de connaître non seulement le module de calcul, mais également de construire correctement le modèle de calcul.

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МАТЕРІАЛОЗНАВСТВО

МАШИНОБУДУВАННЯ

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DOPING OF ELECTROPLATE WITH NANODISPERSED POWDER Ni-ZrO_2

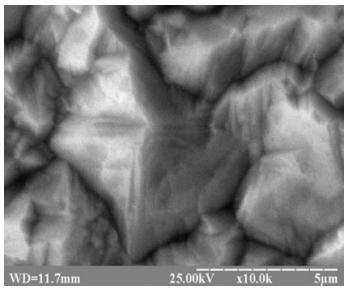
Electrolytic nickel coatings are characterized by high physical-chemical properties: hardness, wear and corrosion resistance. However, the innovative progress in modern industry dictate the ever-increasing demands on the quality characteristics of structural materials that are updated by an intensive search options modification. One of the promising directions in this area is the doping electroplating nanodispersed refractory metal oxides [1, 2]. It seems highly expected that the introduction of a nickel matrix of such materials will improve the electrochemical micro-hardness obtained nanocomposite coatings. Availability of raw materials in the territory of Ukraine determines the priority of use for this purpose nanosized zirconia oxide powder.

Composition and the properties of composite materials obtained by electrochemical methods are determined by the nature and chemical properties of the colloid suspension of the electrolyte is obvious desirability determine size and charge of the particles studied.

Colloid-chemical properties of a suspension of ZrO_2 investigated sedimentation method, which was implemented using digital scales Vibra HT (Shinko denshi). The work identified the sedimentation constant and the radii of the particles. Constructed integral and differential distribution curves, the analysis of which shows that the studied systems are polydisperse. The particle sizes varied in the range of 10^{-8} – 10^{-7} m. Sign electrokinetic potential wase determined by electrophoretic method. Electrophoresis was performed in U-shaped tube with platinum electrodes. The value of ζ-potential was assessed by the Helmholtz-Smoluchowski equation. The ζ-potential was negative, and it value does not exceed –25 mV.

Electrodeposition of nanocomposite materials was carried out on the prepared copper electrode area of 5 cm^2. In the composition of the electrolyte (mol/dm^3): $NiSO_4$ – 1,0; H_3BO_3 – 0,7; NaCl – 0,3 ZrO_2 administered as a microfine powder. In order to break up agglomerates and to obtain zirconia nonodispersion system obtained electrolyte was sonicated for 30 minutes. Electrolytic deposition was carried out at 60 ± 2^0C and a current density of 5 A/dm^2. Electrolysis time was 24 minutes [3].

Galvanodepositions surface morphology was examined by scanning electron microscopy. As follows from the data shown in the figure, the morphology of the coating prepared from nickel electrolyte comprising ZrO_2, differs markedly from the morphology of the nickel coating deposited at similar conditions. The composite material has a homogenous surface with smaller in comparison with nickel-coated seeds. Apparently, the inclusion of an inert zirconia oxide grains inhibit the growth of nickel.



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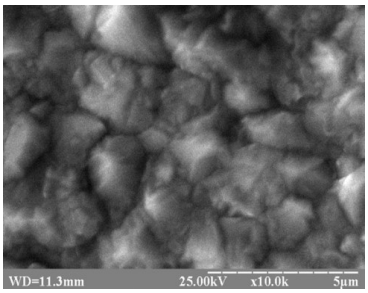

b

Figure 1. *Micrograph (SEM) of precipitation obtained of pure nickel electrolyte (a) in the presence of 1 g/dm^3 ZrO_2 (b) (i = 5 A/dm^2)*

From the data presented in the table, that when administered ZrO_2 particles in the electrolyte increases the microhardness of samples with increasing concentration of the dispersed phase in the electrolyte.

Table. *Hardness precipitation derived from the nickel-based solutions in the presence of ZrO_2*

Concentration ZrO_2 (g/dm^3)	0,0	0,1	0,5	1,0	2,0
Microhardness (kg/mm^2)	214,7	227,4	243,8	267,0	273,4

Presence of nickel in the electrolyte nanosized zirconia leads to the deposition of the nanocomposite coating of nickel with excellent surface morphology and physical-chemical properties. It appears that the composites are formed by mechanical entrainment in the electrolysis process, the dispersed particles near the electrode. The resulting coating is a nickel matrix in which the introduced inert particles of zirconia.

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DESIGN OF REPAIR ENTERPRISE

In order to restore the machine working capacity, it is necessary to organize its storage and warehousing, perform disassembly - washing, defective work, deliver materials and spare parts to the company, restore worn parts, assemble components, units and the machine as a whole, perform tests and painting. The whole set of works performed in a certain sequence, ensuring the restoration of the machine is called the production process of repair. The volume, nature and sequence of repair of construction machinery depend on the design features of the machine, the production program of the repair company and repair methods. Therefore, to cover all repair operations and carry them out in a sequence that ensures high quality work, it is necessary to consider the production process of repair, it is necessary to carefully study the design of the machine being repaired, existing repair methods and methods of repairing worn parts. Thus, the relevance of the work lies in the knowledge of these provisions. This will rationally develop the production process of overhaul of a given machine, which is designed in the form of a diagram and is described in detail in a separate section [1, p. 4].

The purpose of the work is to develop a sequence of design of the repair plant. Overhaul of construction machinery is carried out by repair and mechanical plants. According to the degree of

specialization, there are specialized and universal repair plants. Universal factories repair equipment of various brands.

Specialized plants repair machines for a specific purpose. For example, excavators, tractors or machines based on them, dump trucks, wheel loaders, etc.

As a result of our research, we came to the following conclusions: specialized repair plants are more efficient and can significantly increase the quality and reduce the time of overhaul of construction machinery. Ukraine's industrial complex has a strong material and technical base. The value of fixed assets is 644,767 million ₴ (as of 2007), which is almost 2.3 times more than the value of fixed assets in 2000. The complex employs more than 3.6 million workers, who together brought in industrial profits of 43 700.9 million ₴ (2007), which is 5 times more than in 2001 [2]. The progressive formula for organizing the repair of construction machinery is the aggregate-nodal method. Its essence is that the dismantling of the unit and the unit from the construction machine is sent for repair, and instead units and units that were previously repaired or new are installed. At repair plants of universal and specialized purpose a complex of actions for restoration of a serviceable condition of any object or restoration of its resource is carried out. The largest repair and mechanical plants of Ukraine are: Metinvest - Mariupol Repair and Mechanical Plant, Mykolaiiv Repair and Mechanical Plant, Pershotravensk Repair and Mechanical Plant, Kyiv Research Repair and Mechanical Plant, South Ukrainian Repair and Mechanical Plant, Kryvyi Rih Repair and Mechanical Plant and others.

The source material for the development of the enterprise and its production structure is the scheme of the production process of overhaul of the machine. The repair enterprise, as well as any production enterprise, on the structure is divided into the basic production shops (sites), auxiliary shops (sites) and services, auxiliary sites, management of the enterprise (plant management) and management. Depending on the capacity of the enterprise, the range of facilities under repair, the nature, degree of specialization of the production process and other conditions, the composition of the repair company may change. The main production can be built on a non-shop or shop structure. Taking into account the recommendations for the adoption of a structural scheme of the main production, we determine the composition of the main and auxiliary auxiliary production, management and management of the projected production. Next, it is necessary to develop a scheme of the management structure of the repair company, which is designed and briefly describe the functional responsibilities of structural units [1, p. 4].

Thus, the design process contains the following issues related to the enterprise being designed: a) the purpose of the enterprise; b) subordination (conditionally, but according to the structure of the above bodies); c) types of specialization; d) type of production; e) main indicators (range of products, annual production program).

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ЕКОНОМІКА

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INTERNET MARKETING AND ITS ROLE IN THE WORLD PANDEMIC AND CRISIS

It is a well known fact that Internet occupies one of the most important places in the life of consumers today. The impact of Internet has been intensified by the beginningof the world pandemic in 2019, when many people have lost the opportunity to freely visit public places and general stores of any purpose. It was a hard hitfor entrepreneurs, because many of themworked in the offline environment and they had to start and grow their business in the Internet environment.

Let's review and define the concept of "Internet Marketing". Electronic marketing, Internet marketing and e-marketing are based on electronic technology [5]. It is a set of Internet techniques, aimed at attracting attention to a product or to a service and promoting this product on the network and effective promotion sale [6].

The main difference between regular marketing and Internet marketing can be identified as follows: marketing is attracting and retaining customers and Internet marketing is attracting and retaining customers on the Internet [5].The main elements of internet marketing are the so-called 4P: product or commodity, price, promotion, place of sale [6]. It should be noted that research shows that the average screen time is up to 5h40m per day.This shows that more and more consumers have the opportunity to see online advertising and create a purchase on the Internet [4].

Domestic researchers investigate the importance of Internet marketing in acurrent situation in the country as well as in a pandemic period. For example, the authors of the work "Research Of Internet Marketing Development In A Pandemic Condition" note the trend of Internet marketing implementation in the activities of enterprises in recent years andstate that the pandemic has significantly accelerated this process. Based on the collected primary marketing information from the 2020 survey, the authors conclude that 91.7% of respondents use the services of shopping on Internet platforms. 28.8% respondents made their first online purchase in2020 and 53.1% of respondents said that they increased the number of online purchases in 2020 too. These studies confirm the importance of access for the Internet environment of various companies [3].

Internet marketing is one of the most effective tools of our time for promoting goods and services of companies in different areas. Effectiveness of the channel depends on the correct use of tools and preparation of the site to attract traffic and requests that is from the preparation of the company's website. Great penetration into Internet and the increased user's experience are an impetus for entrepreneurs to create their own website. This site of the company is one of the points of communication with the consumer to provide him with complete information about the proposed products. All these measures should lead to the increasein the efficiency of the company.

Based on research and current trends in online communications it is summarized that the current tools of Internet marketing during the global financial crisis caused by the pandemic includethe following elements: Content Marketing, Quality native publications, Data-driven marketing, Mix TV + digital, SEO-promotion, Targeting in social networks, Banner advertising, Influencer marketing. Summing up this information it is noted that companies will not have a competitive advantage without the use of Internet marketing in modern conditions of developed economy [2].

It is emphasized that the COVID-19 pandemic was the impetus for radical changes. The most affected sectors of the economy are: tourism and apartment booking, hotel and restaurant (HoReCa) business, non-food retail, imports in various fields, advertising, education, business, entertainment and services, some B2B areas.

The pandemic period of the COVID-19 has pushed the Internet marketing to radical changes. The reduction of advertising budgets has prompted producers to turn to social networks, direct e-mail mailings, etc., which are the low-cost channels of communication with consumers. It is also worth

noting the modernization and optimization of Internet sites that are best adapted to needs of customer and improve the quality of content, etc [1].

Taking into account the above-mentioned research, it is clear that Internet marketing has been steadily strengthening its position in recent years. One of the main reasons is the pandemic and the crisis caused by it. And although the entry of businesses into the online environment has occurred before, the pandemic has significantly accelerated this process. Buyers are increasingly choosing online shopping and spending more time online due to the inability to buy offline and this encourages entrepreneurs to communicate with customers through websites and use the online advertising. That is why we can conclude that it is important for companies to develop the online platforms for further development and competitiveness of companies. Therefore, with the right organization and the proper use of Internet marketing tools, entering the online environment opens up new opportunities for businesses, entering new markets, attracting new customers, etc.

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SUSTAINABLE DEVELOPMENT IN UKRAINE

With ever-growing economy of the whole world, one may wonder how long humanity can still develop before our planet is eventually exhausted of all natural resources?

This paper aims to analyze what sustainable development means, its main goals and demonstrate one of the European cities - Copenhagen, as an example, which successfully implemented this strategy in its everyday life.

To prevent that, a set of principles was created. Taking its roots way back in the 17th century, a set of principles eventually led to what is called "**Sustainable development**" nowadays. This term describes a symbiosis between three essential parts of human lives: economy, ecology and society, which meets the needs of the present society without compromising the future of next generations.

In total there are 17 different goals that are required to achieve sustainable development. These goals are:

1) Peace and justice – Strong Institutions.
2) Good Health and well-being.
3) Decent jobs and economic growth.
4) Gender equality.
5) Reduced inequalities.

The other goals are to:

-ensure availability and sustainable management of water and sanitation for all;

-ensure access to affordable, reliable, sustainable and modern energy for all;

-promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all;

-build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;

-reduce inequality within and among countries;

-make cities and human settlements inclusive, safe, resilient and sustainable;

-ensure sustainable consumption and production patterns, and take urgent action to combat climate change and its impacts;

-conserve and sustainably use the oceans, seas and marine resources for sustainable development;

-protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss;

-promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels;

-strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development [1].

On September 30, 2019, the President of Ukraine issued a Decree in which he supported the achievement of the Sustainable Development Goals and the results of their adaptation, taking into account the specific development of Ukraine set out in the national baseline report “Sustainable Development Goals: Ukraine ”.

There is no doubt that majority of carbon emissions come from citiesand they just get bigger and bigger as the time goes on. For this reason, city ofCopenhagen decided to cancel out all of their carbon emissions and become the first carbon neutral capital city by 2025.

Carbon neutrality means that cities create more renewable energy (solar, hydropower, etc) than dirty energy(oil, natural gas) it uses in order to achieve net zero. One of the key solutions for this is bike infrastructure which was under development for the last 12 years with investment of over 300 million dollars. This became world-famous because most of the people in Copenhagen ride bikes on a daily basis.The city also transformed their water ways which was polluted a couple of decades ago.But their biggest focus is energy use, which makes about 80% of their carbon neutral plan. They also utilize heating system which captures leftover heat from electricity productions and delivers that heat to homes across the city. [2]

Overall, city of Copenhagen is just one of the many different examples of how to move towards sustainable development of our country. Of course not all of these methods can necessarily be applicable to our country(at least not yet) they are still worthy options to consider. For example, reducing reliance on cars among Ukrainian citizens and improving bike infrastructure might prove beneficial and become a good start to further changes.

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E-DEMOCRACY IN UKRAINE: PROBLEMS AND CHALLENGES

The opportunities and challenges of e-democracy form central reference points for any reflection on modern democracy and its future. E-democracy as a digital participation of citizens in government processes today has a direct impact on the relationship between citizens and politicians elected by these citizens [1].

The current state of e-democracy as a tool of public administration in Ukraine can be defined as a developing process. The normative and legal support of the phenomenon of e-democracyis developed and major institutions of e-democracy are nominated. But the problems of regional inequality in the implementation and use of e-democracy and the lack of digital literacy in certain categories of the population remain unsolved [2].

The essence of these problems is that citizens must have access to the Internet and the necessary computer skills to participate in e-democracy processes. The technological aspect of these problems is unequal Internet access for cities and villages. More than 1,000 settlements with a population of about 26 million are already connected to broadband Internet access and 98% of Ukrainian cities have access to the World Wide Web. The situation is much more complicated in villages with a smaller population. There are 21.7 thousand small villages in Ukraine, with a population of 8.3 million, or 56% of the total rural population. There is no fixed Internet at all, and the situation is not changing unfortunately [3].

The lack of digital literacy is illustrated by the following statistics. 53% of the Ukrainian population has digital skills below the basic level; 15.1% of Ukrainians do not have such skills at all, and 37.9% of citizens have a low level [4], mostly people aged over 50. So many middle-aged and older people are unable to access online tools of e-democracy in Ukraine. The Computer Literacy Centres are organized in many Ukrainian settlements to solve this challenge.

The problems of territorial limitations of Internet access and lack of computer literacy need to be solved urgently in order to transform Ukrainian society to the state of Information Society. But in spite of these difficulties and unfavorable circumstances the development of e-democracy in Ukraine becomes essential part of national public management and political life.

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NEW TECHNOLOGIES AND GLOBAL RELATIONS

Nowadays people should understand that new modern technologies have penetrated the world. Electronic communication facilities have expanded the areas where the information is exchanged in time. Data processing software and hardware have also been developing rapidly.

The Internet has created an unprecedented need in the fast and sustained information exchange in the military, governmental and private sectors. Information networks are constantly processing private and business information. Such extensive changes in the processes of data collection, information transformation and the dissemination of this information form the basis of the so-called information revolution [1, p. 39].

Therefore, the purpose of the paper is to give an overview of the effect of digital technologies on global relations.

The beginning of the development of information technology is considered to be the 60s of the XX century, simultaneously with the emergence and development of the first information systems. Investments into this sphere led to the rapid growth of the IT industry in the late 1990s [2, p. 123].

Mass media, news, social networks - all these tools inevitably influence and shape the views of the entire population in the world. Thus, people are aware of global events, problems and situations. But does it really mean that all these instruments are bringing only positive?

Firstly, due to such an abundance of information, people are more susceptible to influence and may become the victims of the propaganda. The media literally makes the choice for us. Secondly, the Internet is, of course, a brilliant instrument for any sphere of life. However, we must not forget about the recent Facebook hack and the data leak for more than 533 million users [3]; about Telegram channels where you can monitor insider content about any person; about sites that can forge any document you need, etc.

Having examined the history of the emergence of information technologies in the international relations, it could be obviously concluded that with time, IT is gaining its power and developing fast from year to year. In this regard, the states are forced to take measures to protect their information security and society, as well as to respond to the challenges of the “digital war” with distinction.

Developed countries should make a priority to ensure information security, as well as a quick response to the information threats.

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DIGITALIZATION IN LOGISTIC SPHERE

Nowadays all spheres of human activities are getting more and more automatic and digitalized. Logistics is not an exception.

Pandemic of COVID-19 has shown us how vulnerable is it and connection with human mind. Next point which pushes this sphere to the automation is human factor. It`s about situation, which happened in Suez Channel in March 2021. It has already proved, that an accident happened due to operator`s mistake. As a result, this traffic jam caused damages of billions. While boat navigation was automatic, there wouldn't an accident and the boat could quietly cross the canal.

So, digitalization will meet next kind of challenges:

1. Automozation processes inside company. It will much reduce the chain of necessary activities.
2. Minimization of mistakes. It is impossible not to consider the human element while the route is drawing up and paperwork. Digital skills afford minimize errors.
3. Cost reduction. The pit stops are reduced, the transporting cargo is simplified, it is much easier to control phases of the work. Also, time is much saved, company`s owners can control employee`s actions and monitor all expenses. All these points help to save a lot.
4. Reducing the burden on manager. A customer can follow his order online, can choose time and date of delivery by himself.
5. Automatization of document management. Time of paperwork will be much reduced because of innovations in logistic companies.
6. Workflow optimization. Users get timely information, it is easily to interact with the company, there is an opportunity to assess the work, leave feedback, get necessary information, etc.

There is a question: is it possible automatization will replace human mind? Sooner or later maybe yes, but these radical measures will not come true in the near future. There is successful experience of the port digitalization, automatic loading and unloading containers in Rotterdam, Qingdao or Long Beach. But despite of all incredible opportunities, all operations are controlled by human. Just in this way digitalization can achieve the highest usefulness.

Conclusion. The new digital era is nowadays a reality. Logistics is transforming into a device which connects digital transactions and delivering corresponding goods. As a result, logistics industry has to adapt to these changes in order to develop and especially for being competitive.

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GLOBALIZATION AS A KEY TO A SUCCESSFUL FUTURE

The fall of the borders which separated countries from each other and the opening of national trades have a vital influence on the stability and prosperity of the world. The integration of markets has become a prerequisite for the preservation of freedom. Today, the economy is accelerating political transformation where there used to be lack of freedom [3].

In recent decades, the participation of individual countries of the world in the global economy has increased. National economies began to be influenced by international economic relations, which contributed to the strengthening of their interconnection. The economy creates common interests for people of different nations. Security and stability on the scale of the world community today can no longer be achieved solely by military means. They are increasingly dependent on the growth of the global economy. Global entrepreneurship creates a common basis for this - for wealth, job preservation and global participation in the implementation of technologies that determine the future. In addition to them, a significant role was played by the actions of such factors as the development of the international division of labor, international production cooperation and foreign trade. Economists call the totality of the processes described above "the internalization of economic life». Thus, globalization is the final stage of the internationalization of economic life in the world. It is accompanied by profound changes in the entire system of international relations [1, 2].

The globalization would not penetrate into all spheres of human life if it did not bring benefits for him It has opened up new opportunities for innovation and entrepreneurship for people and accelerated global economic growth. Benefits that did not exist before globalization have become available to the majority of mankind [3].

To begin with, it should be noted that globalization leads to specialization and the international division of labor. This results in a more efficient allocation of resources, as well as cost reduction and an increase in the standard of living of the population. One of the foundations of globalization is free trade. It is carried out on mutual terms that satisfy both sides of trade transactions. Competition between countries is also intensifying, which stimulates them to develop and introduce technological innovations. Due to increased competition, consumers receive a wide range of products and low prices [1].

It is also important to mention that means of communication and transport are becoming cheaper, access to information and knowledge is becoming easier [2].

Socially, globalization has facilitated the exchange of ideas and cultures, contributing to a world view in which people are more lenient, open and tolerant of one another [4].

Globalization leads to the fact that the efforts of countries are united to solve the universal, global problems of mankind. It helps to maintain peace and security on the planet, develop friendly economic relations between countries, provides opportunities for the settlement of international relations and the development of strategies that affect the population of all countries of the world without exception.

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ANALYSIS OF THE RESUMPTION OF INTERNATIONAL TRADE IN 2021 AND PROSPECTS OF DEVELOPMENT NEXT YEAR

International trade is a set of goods, services and capital traded between two or more countries. It also refers to the organization of international trade between two or more economic spheres. Data collected by various international organizations on the flow of international trade in goods and services between a country and the rest of the world or between two trade zones make it possible to measure and to quantify international trade.

According to the World Trade Organization (WTO), between 1980 and 2019, international trade was increased by 7.8, while gross domestic product (GDP) according to the World Bank was increased by 6.8. This is mainly due to the general reduction of protectionist measures in trade in goods and services. The rapid growth of international trade was accompanied by major changes in its structure: a significant increase in the share of services and industrial products and their weight in the world trade to the detriment of agricultural products. The development of world trade has also led to the increased interdependence and openness of economies [1].

International trade is a driving force in the development of economies around the world. But international trade has declined significantly during the COVID crisis. 2021 has been a year of resumption and recovery of international trade, so we need to examine the data for 2021 to be able to predict the pace of development for 2022. We will consider the latest data of the World Bank for the 2nd quarter of 2021 on the example of the world's leading countries. In the second quarter of 2021, G20 international trade, measured in current US dollars, reached a new high after the record levels which have been recorded in the first quarter of 2021 and in the 2nd quarter of 2021 6.4% were compared to the previous quarter exports and imports of G20 goods increased by 4.1% indicating a slowdown from the rates recorded in the 1st quarter of 2021. As in the previous quarter, the rising commodity prices largely explain this increase, as the international traffic congestion and the semiconductor supply problems have increased pressure on the prices of goods that are sold.

In the countries of G20, which depend on exports of primary goods, the second quarter of 2021 showed the strong export growth due to a combination of rising prices, limited global supply (e.g. copper) and strong demand (especially from China, Japan and Korea). Australia's exports were increased by 10.0% in the second quarter of 2021 due to the increased sales of grain, metals and coal. Brazilian exports were increased by 29.4% due to iron ore and soybeans [2].

The value of trade in goods in North America reached a record high in the second quarter of 2021. Canada's exports grew by 4.7% due to energy and forest products. Imports grew by 3.6%, with metals and pharmaceuticals playing an important role. Mexico also recorded the steady growth this quarter: exports grew by 3.3% and imports grew by 5.1%. In the second quarter of 2021, exports to the United States increased by 6.8% due to the aerospace, the pharmaceutical and semiconductor

industries and high demand from Canada and Mexico. In the European G20 countries, there is an increase in international trade, in particular in aeronautics, agricultural products and pharmaceuticals, thanks to the demand from China and the United States. In the 2nd quarter of 2021, the European Union recorded an increase in exports by 2.8% and in imports by 5.7% (France 1.3% and 2.9%, Germany 1.3% and 6.3%, Italy 4.0% and 6.4%). In the UK, exports grew by 12.3% and imports grew by 11.3% in the second quarter of 2021, a strong recovery after a slowdown in the first quarter [3].

Rising commodity prices have helped imports grow faster than exports to the G20 in the second quarter of 2021. Exports from Japan and Korea grew by 2.7% and 2.2%, respectively, while imports increased by 7.4% and 11.8%, respectively, due to trade in vehicles and spare parts, especially for Korea, after the dizzying growth (18.6%) in the previous quarter.

Growth in exports and imports of services in the second quarter of 2021 for the G20 is generally estimated (based on preliminary information available for the G20 subgroup) at about 4.5% and 4.0%, respectively, and measured in seasonally adjusted US dollars. These figures should be compared with the lower rates recorded in the first quarter (2.9% for exports and imports). IT and business services remained strong. Travel, although still severely affected by COVID-19 measures and threatened with options, showed an improvement in T2. Exports of services from the United States and Canada grew by 3.6% and 1.7%, respectively, in the 2nd quarter of 2021. Imports grew faster (7.2% and 8.0%, respectively) due to trips to the United States and the services of financial institutions in Canada. Brazil's trade in services also grew significantly, with exports and imports up 6.8% and 5.5%, respectively [4].

In Europe, exports and imports of services in Germany grew by 4.2% and 5.4% in the second quarter, respectively, with imports created an increase in travel costs by almost 30%. Tourism and financial services also increased exports of French services (+ 5.6%), while imports remained stable (+ 0.4%) due to lower purchases of transport services. Conversely, trade in services declined in the UK (- 0.4% and -2.2% for exports and imports). Russian exports increased by 5.7% and imports decreased by 7.3% (due to a slowdown in the purchase of business services). Turkey's exports and imports grew by 5.8% and 2.3%, respectively. With the exception of Australian exports (down 0.5%), trade in services continued to grow significantly in the Asia-Pacific region. Korea's exports and imports grew by 8.1% and 15.9%, respectively, while travel imports increased (+ 20.1%) in addition to the continued growth of business services, telecommunications and IT. Similarly, Japanese exports and imports grew by 4.7% and 8.4%, respectively, as travel and business services grew faster than imports. China's exports grew by 7.4%, mainly due to higher transport revenues, while imports increased by 2.3% due to increased purchases of business services and transport. The partial and temporary opening of borders led to an increase in travel imports to Australia (4.5 times more than in the previous quarter, but still at a very low level), which contributed to an increase in imports of all services by 8.9% [5].

Conclusion. Trade growth is expected to slow to 4.0% in 2022, and the effects of the pandemic will continue to be felt, because such pace of expansion will not allow a return to the pandemic situation. The relatively positive short-term outlook of world trade is overshadowed by regional disparities, still weak trade in services and lagging behind immunization schedules, especially in poor countries. COVID-19 continues to pose the greatest threat to business prospects, since any expected recovery can be easily jeopardized by further waves of infection.

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WHAT GREEN JOBS ARE AND WHAT THEIR IMPACT ON THE ECONOMY IS

Nowadays, humanity faces several important tasks. Preventing the onset of dangerous climate change by reducing emissions of harmful substances into the environment is the most important of the global challenges. The next task should minimize the risks of depletion of natural resources through the use of mechanisms that increase energy efficiency in all sectors of the economy (green building, waste management, renewable energy, and transport). Another important part of the task is to ensure sustainable development based on economic growth, social justice and environmental protection. The green economy has become a trend in development and a symbol of a sustainable economy. Modern society protects the environment for future generations and it is characterized by justice and does not allow isolation of any groups of people or countries.

The mentioned problems are closely interconnected and therefore cannot be solved separately. Green jobs are the key to meeting all challenges at the same time.

The UNEP report defines "green jobs" as jobs in agriculture, industry, services and administration that contribute to maintaining or restoring the quality of the environment. Green jobs are found in many sectors of the economy from energy supply to recycling and from agriculture and construction to transportation [1]. Some jobs require education or specific professions such as an environmental scientist, solar engineer, wind project manager or sustainability consultant, while the other positions do not require any background as their role involve working for this sector or an organization.

Jobs should not be only environmentally friendly, but also they should be worthy. For example, jobs are characterized by productive employment, providing adequate income and social protection, respecting the rights of workers and giving them a voice in decisions that affect their lives. Green jobs - are decent work that significantly reduces the negative impact of economic activity on the environment and ultimately leads to sustainable businesses and sustainable economies. Thanks to green work, there is a balance of three main components: economic growth, social responsibility and environmental balance. The sustainable development of the planet as a whole is connected precisely with these three components.

From the point of view of environmentally sound processes, there is a difference between employment in the "green" sectors of the economy in terms of work functions and the production of different types of goods in all sectors.

The report (of the United Nations Environment Programme, the International Labor Organization and the International Trade Union Confederation) mentions that the green economy could create 15 to 60 million additional jobs worldwide over the next two decades and rescue tens of millions of workers from poverty, if appropriate government policies are implemented. In addition, the business case for greening both the economy and the labor market is becoming stronger due to rising energy/commodity prices and growing pressure from clients/politicians on the business community to adopt more sustainable practices and production methods to prevent dangerous climate change. Greening the economy provides great opportunities to open new businesses, expand into new markets

and reduce energy costs. However, it should be noted that the net increase in total employment is less than the total number of potential immediate new jobs that could be created, as new jobs can take the place of existing jobs.

To achieve the desired effect for the country, consolidated actions will be required at national level from all relevant stakeholders in implementing these commitments related to the green economy. As well as effective responses from UN agencies to facilitate this process. Bringing together the expertise of five UN agencies – UNEP, ILO, UNIDO, UNDP and UNITAR – and working closely with national governments, the Partnership for Action on Green Economy (PAGE) offers a comprehensive and coordinated package of technical assistance and services to build socially inclusive green economies.

At the moment, the government of Ukraine does not focus not only on developing "green" jobs, but olso the development of a green economy. Ukraine has policies that promote green jobs through the attraction of investments to the energy sector. That is through 1.Green auctions. 2. Stimulation of production and usage of biofuels. 3. Improvement of energy service company mechanisms. A new Energy Strategy has been approved and requires further improvement of environmental and energy efficiency standards of production, transporting, and usage [4].

Many of the challenges posed by the 21st century are unparalleled in human history in terms of scale, complexity and integration. The solutions to these problems formulated in the MDGs (Millennium Development Goals) must also be comprehensive. These goals include:

1. To eradicate extreme poverty and hunger.
2. To achieve universal primary education.
3. To promote of gender equality and empowerment of women.
4. To reduce child mortality.
5. To improve maternal health.
6. To combat HIV/AIDS, malaria and other diseases.
7. To ensure environmental sustainability.
8. Develop a global partnership for development [3].

The transition to sustainable development and a green economy involves changing the raw material export model of economic development for modernization. The principles of the green economy should not be only in the form of a separate policy, strategy or program, but also as the basis for the long-term successful development of the country, solving socio-economic problems, the necessary quality of life, competitiveness and national security.

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ЛЮДИНА ТА ДОВКІЛЛЯ

ОХОРОНА ПРАЦІ

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EVALUATION OF SMOKE-FORMING ABILITY AND TOXICITY OF FIRE-PROTECTIVE COATINGS

Over the last year, according to statistics, more than 100,000 large and small fires have occurred in Ukraine, as a result of which 73 buildings and 12 units of equipment were destroyed or damaged every day [1]. In this regard, it is important to study the development of effective measures for fire protection of building structures. The cost of such measures is high and can range from 15 to 35 % of the total cost of construction. Fire protection is mostly required for load-bearing enclosures, attics, and wooden structures. Today, a number of effective fire-retardant compounds have been developed at the Department of Life Safety, PSASEA, which are used to reduce their flammability.

As a result of the conducted research, the composition of fire-retardant covering to increase operational properties of wooden designs under high temperatures was defined. The results of tests to determine the coefficient of smoke in accordance with paragraph 4.18 of GOST 12.1.044-89 using "Mixture for fire-retardant coatings" material samples are given in Table 1.

Based on the analytical review of the main groups of fire retardants with higher fire resistance of wooden building structures, a new fire retardant composition is developed, based on the liquid glass. Fire-retardant and sanitary-technical characteristics of the developed fire-retardant coating are identified. Test object is related to the low-hazard class, using materials with moderate smoke-forming ability D2.

Table 1. *Test results to determine the coefficient of smoke*

Sample number	Test mode	Sample weight, kg	Light transmission, %		Smoke emission factor (D_m) for each sample, $m^2 \cdot kg^{-1}$
			initial	final	
1	Smoldering	0,002343	100	50	192,3
2		0,002361	100	48	202,1
3		0,002336	100	52	182,0
4		0,002357	100	49	196,7
5		0,002348	100	50	191,9
Average value (rounded to the nearest whole number)					**193**
6	Combustion	0,002349	100	67	110,8
7		0,002352	100	66	114,8
8		0,002344	100	67	111,1
9		0,002337	100	68	107,3
10		0,002360	100	64	122,9
Average value (rounded to the nearest whole number)					**113**

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OVERVIEW OF THE MODELING CONSEQUENCES OF GAS MIXTURE ACCIDENTAL EXPLOSION AT INDUSTRIAL FACILITIES

Explosions of gas-air mixtures at hazardous production facilities are among the most severe emergencies. The reasons and nature of crash explosions are significantly different. Regularities in individual physical processes that occur during such accidents have been studied in great detail. Namely, they are:

– evaporation of flammable liquids;
– formation of gas-air mixtures (GAM);
– spreading of gas vapors similar to spherical and flat clouds;
– ignition and combustion of GAM in different modes (laminar, deflagration, detonation).

The impact of meteorological and situational conditions on these processes, as well as different combinations of physical processes, gives a significant variance in the severity of the consequences of accidental explosions. In this regard, there are different approaches and methods for predicting the consequences of the destruction of buildings, structures and technological objects, not only in scientific developments, but also in the regulations of the country. It may also depend on the industry. Even some corporations and enterprises in one industry have their own standards for predicting the effects of gas explosions. The normative acts of the Russian Federation, European countries and the USA to determine the consequences of explosions at hazardous facility are analyzed in the work, and the following software packages are developed on their basis: ТОКСИ+Risk, Дефлаграция, FLACS, AutoReaGas, PHAST, SAFETI. The main approaches and differences in the methods to determine the forecast parameters of emergency explosions are found, for example, excess pressure in front shock air wave of the explosion of a gas mixture of hydrogen-air (Fig. 1). The quantitative criteria for explosion resistance, justification of destruction criteria, etc. also affect the divergences.

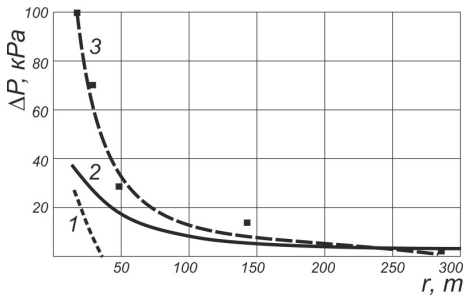

Fig. 1. *Excess pressure: 1 – experiment; 2 – РД 03-409-01; 3 – ПБ 09-540-03*

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SOLUTIONS TO THE PROBLEM OF RADIATION SAFETY ON THE SOUTHERN INDUSTRIAL SITE OF 'PRYDNIPROVSKYI CHEMICAL PLANT'

The presence of huge amounts of waste uranium production on the south industrial site of "PCP" poses a threat to the health and lives of workers, as well as radiation hazards in residential areas of Kam'yanske, Dnipropetrovsk region and Ukraine [1, 2].

This research deals with a number of unsolved aspects of the problem and provides possible solutions. Radiation increases the activity of all biological systems. The main chemical elements constituting the human body are carbon, oxygen, hydrogen, and sulfur. Oxygen plays a major role in the breakdown of carbohydrates and fats for energy supply. This energy is used by the cells to make proteins necessary for the formation of body tissues. Oxygen plays a key role in the formation of enzymes that act as catalysts in biochemical reactions [3].

Since oxygen is present in large amounts inside and outside the cells, a large amount of oxygen under the radiation exposure leads to the destruction of other chemical compounds in cells, since their molecules will strive to return to a stable state. Fats or proteins that are vital for normal functioning of cells can be damaged in the body. When certain proteins in cells are damaged, it may lead to mutation. As a result, the body can be susceptible to cancer [2, 3].

The aim of the study is to improve life safety in radiation-contaminated areas of the former uranium production department of "Prydniprovskyi chemical plant".

The south industrial area, consisting of three tailing ponds such as "West", "Central Yar" and "South-East", was taken for the investigation. The total length of the area is 6342m (Fig.1). To take measurements, it was proposed to divide the entire perimeter of the south industrial site into 7 posts and 30 consecutive sections with a fixed location and a certain length (Table 1-2 and Fig.1) [2].

Table 1. *General information on "Western", "Central Yar" and "South-East" tailing ponds*

Title	Area, m^2	Operation period (years)	Storage, million tons	Activity, Bq	Absorbed dose, μG/h
«West»	60	1949-1954	0,77	$1{,}81 \cdot 10^{10}$	0,1-10
«CentralYar»	24	1950-1954	0,22	$1{,}04 \cdot 10^{14}$	0,12-6,1
«South-East»	36	1956-1990	0,33	$0{,}6710^{14}$	0,18-26,4

Table 2. *Division of the southern part of the industrial site*

Post number	Section number	Length of section (meters)	Absorbed dose, μG/hour	Note
1	27, 28, 29	508	0,02-0,85	
2	1, 2, 30	490	0,09-3,2	
3	3, 4, 5, 6, 7, 8	1186	0,21-8,3	West, CentralYar
4	9, 10, 11, 12	830	0,1-1,9	Crossing over contaminated

				area
5	13, 14, 15, 16	468	0,01-0,84	South-East
6	17, 18, 19, 20, 21, 22	1050	0,1-0,43	
7	23, 24, 25, 26	825	0,05-1,67	

The measurement of RAD and DER gamma-radiation and β-radiation was carried on the territory of the perimeter of each of the tailing ponds based on guard tours, every 20m in the south part of the tailing ponds of the industrial site. The measurement of α-radiation on the perimeter territory was carried out at the checkpoints around the perimeter of the "Central Yar" tailing ponds, with abnormal areas.

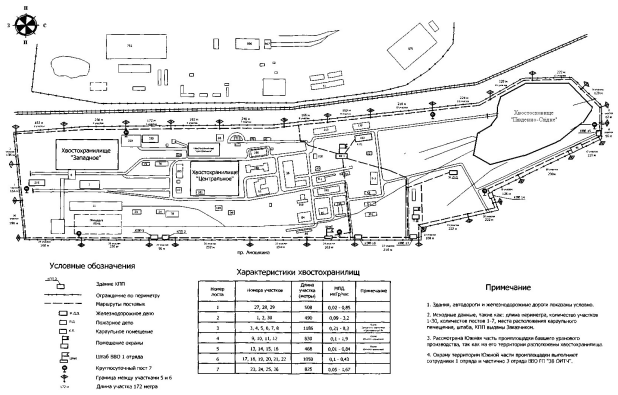

Fig.1 *The layout of sections 1 - 30 in the southern part of the industrial site of the former uranium production "PCP", and the location of the "Western", "Central Yar", "South-East" tailing pond.*

Conclusions. According to the measurement results, people on the territory of the "Central Yar" and "West" tailing ponds are exposed to the highest radiation dose.

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TOXICOLOGICAL PROBLEMS OF DRINKING WATER PURIFICATION

Water is one of the most precious resources and it is the source of life on our planet. It is the essential part of all living organisms and the important component necessary for the maintenance of life and proper functioning. Depending on age, 50%-86% of the human physiology consists of water. Water is found in all types of tissues in our body – bones, lymph, blood, muscles, in the organs and brain. It performs various vital functions, supporting the respiratory process and temperature balance, lubricating the joints, supporting the digestion and metabolism. Moreover, water removes wastes and toxins from the body and performs a protective function for vital physiological organs.

Since water is an essential part of human physiology, its quality is also very important for our life. The quality of the water we use, whether it is water for drinking, cooking, household or for other purposes, has a huge impact on our health, which in turn affects our activity and all spheres of human life. The law quality of the water supply and sanitation system leads to the spread of infectious diseases and epidemics. High water quality contributes to the growth of the economy and maintains a good health [1].

All methods of water purification can be classified into three main categories: physical or reagent-free, where the purification process is carried out by means of physical factors; chemical or reagent, where the purification process takes place by adding chemical reagents; combined methods which include physical and chemical methods [2].

Physical methods include boiling, ultraviolet light, reverse osmosis and electrolysis. Chemical methods include chlorination, ozonation and the use of non-oxidizing reagents. Combination of chlorination and ultra filtration can be given as an example of a combined purification method.

Physical water purification methods, excluding the use of chemical reagents, have some advantages: the absence of secondary contamination, appearing due to the disinfectant chemical and the simplicity of implementation. The disadvantage of physical methods is connected with the fact that purified water can be subjected to secondary contamination, because such methods do not have a long-term (prolonged) disinfecting effect [2].

On the contrary, the advantage of chemical water purification methods is a long-term disinfecting effect, but at the same time the secondary contamination occurs due to the use of chemical disinfectants, which bring the toxic effects. The use of silver and other metals for water purification, for example, copper and tin, can also be connected with chemical methods, because in this case, the metals are used as a disinfectant [2].

Here is a brief review of the toxicological effects of the main drinking water purification methods, their advantages and disadvantages. This review includes an analysis of three physical and four chemical methods.

Physical drinking water purification methods are:

1. Boiling, which has the advantage – the efficiency against most pathogenic microorganisms and the disadvantage – the possibility of secondary contamination;
2. UV (ultra violet) light disinfection, which has such advantage as no secondary pollution of the water (unlike the reagents disinfection) and such disadvantage as low efficiency against a wide range of microorganisms;
3. Reverse osmosis and ultrafiltration, which has some advantages: 100% removal of viruses and bacteria; high environmental compatibility; removal of microbiological contamination and other toxicants as well as heavy metals, organic substances, chlorine. Its disadvantage is the lack of prolonged effect, which limits the use of water directly at the place of production or, otherwise, the water requires the combined disinfection.

Chemical drinking water purification methods are:

1. Chlorination, which has such advantages as high efficiency against 99% of microorganisms and long-term aftereffect. The disadvantages of this method are connected with the formation of trihalomethanes, which have a toxic result expressed by two mechanisms: the release of systemic toxicants and the formation of free radicals, which have a carcinogenic effect;

2. Ozonation has such advantages as high effectiveness against all microorganisms and absence of trihalomethanes as interaction products. The disadvantage of this method is the formation of secondary toxic products;

3. Non-oxidizing reagents method has the following advantage – high efficiency against microorganisms. The disadvantages are the effects on human physiology, which are studied insufficiently, and, as a result, there is the need to remove excess reagent from drinking water;

4. Use of silver and other metals is also a chemical method. The advantages include the fact that the disinfection time takes at least two hours at maximum permissible concentrations (MPC). Its disadvantages are the low effeciency against cysts and the majority of bacteria and viruses [2].

The comparative analysis shows that the safest and the most environmentally friendly drinking water purification method is the physical purification method of reverse osmosis and ultra filtration, because it has the least negative effect. Its only drawback is the lack of prolonged action. So, it is one of the most effective methods, as it has not only a strong disinfecting result, removing 100% of viruses and bacteria – microbiological contaminants, but it also removes other toxicants – heavy metals, organic substances and chlorine.

The most harmful and non-ecological methods are the chemical methods, such as chlorination and ozonation. Despite their high efficiency and decontamination ability, they are toxic.

Chlorination method, which is commonly used, has the strongest toxic influence in comparison with other methods of drinking water purification. It is known that the most widespread method of drinking water disinfection today is chlorination, and it is environmentally unsafe and harmful for the human health, that is why it is also strongly recommended to use other methods of purification to eliminate its side effect. For example, after chlorination, it is necessary to use carbon filters [2].

The comparison of different methods shows that the physical water purification methods are more environmentally friendly and safer than chemical water purification methods.

Thus, it can be concluded that the safest approach would be the combined methods of purification and disinfection of drinking water. Combined water purification methods can give not only a broad effect, but they also reduce the adverse effect of some purification methods.

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DEFORESTATION

Deforestation is a major problem that has emerged in recent decades. Unfortunately, as human needs grow, so does the scale of the problem. Destruction of forests without restoration reduces soil moisture and leads to desertification. Cutting down trees is prohibited for valuable species. But with the help of corruption, the subjects get the right to cut these trees.

Under normal conditions, the soil contains moisture. Humidity must be maintained and this can only be achieved with forest cover. The most important role that trees play is that they cover the soil and retain moisture in it. When the soil heats up, water leaves it, but in the presence of plantations, some of it remains in the ground.

Deforestation disrupts this cycle, moisture evaporates faster, and the absence of trees stops precipitation. The whole process can end with the appearance of a desert. Some of the worst desert conversion rates in sub-Saharan Africa have been associated with deforestation in the forests of West and Central Africa [1].

Climate change is also a consequence of this activity. When these trees are cut down and the ice begins to melt, a change in weather occurs, which directly affects the change in climatic conditions in the polar regions. With the melting of icebergs, the sea level rises, which can lead to intense flooding.

Among the main reasons, first of all, it is worth noting the possibility of using wood as a building material. Also very often forests are cut down for the purpose of building or using land for agricultural lands. Another reason for mass felling is the creation of pastures for farm animals. This problem is especially relevant. On average, one cow needs 1 hectare of pasture to graze, which is several hundred trees [2].

In a new report, experts drew attention to the successes in the fight to conserve forests and afforestation. For example, today more than 56 percent of paper is produced from recycling. For comparison, in 1970 the figure was less than 25 percent. The scale of the use of waste for the manufacture of wooden panels in construction has increased. Globally, protected forest areas have expanded over the past 25 years. The number of newly planted trees is increasing every year, but the total number is still a tiny fraction of what the planet really needs [3].

Deforestation is a serious environmental problem, as it leads to a huge number of negative consequences. These include an increase in the content of carbon dioxide in the air, the disappearance of living organisms, desertification and the formation of swamps. All this is very serious, so there is a need to reconsider their attitude to nature in general, and to forests in particular.

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АВТОМАТИЗАЦІЯ

НОВІТНІ ТЕНДЕНЦІЇ

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THE USE OF RATIONAL APPROACHES FOR MANAGEMENT OF ROBOTIC CONTROL SYSTEMS

Nowadays, robotic control systems continue to be introduced in almost all branches of industry which have not been mastered yet. The application of robotics in small and large enterprises increases economic effect and quality of products that are released. "Know-how" in the field of robotics has an impact by the intersection of industry and innovative technologies which give opportunity and huge potential for joint work of man and machine. However, the introduction of robotics into the technological processes of enterprises entails the need to carry out serious design tasks, as well as to solve the problem of development of optimal control algorithms and use of modern techniques to ensure rational regulation of the work of robotic platforms.

It is known that for the control of automatic and automated control systems it is widely P, PI and PID laws and their choice is based, directly, first of all on the set of tasks which should be implemented. By applying a law of regulation we can obtain both its pluses and minuses, which are reflected in the quality indicators of the technological process.

Applying the P-law of regulation it is possible to get maximum speed on the output based on the ratio t(p) / T(d). But if K(p) is small (in systems with delay), this regulator will not provide high accuracy of regulation and as a result will observe more static error.

By applying PI- the law of regulation it is possible to get zero static error of regulation, low sensitivity to noise in a metering channel, and, moreover, has simple setting - a gain coefficient K(p) and a constant of time T(i) that allows to optimize the value of ratio K(p) / T(i) and get a minimal average-quadratic error.

For the most complex tasks of management the PID-law of regulation is used. These regulators allow optimal quality of regulation, rather than the small time of transition process, and also to provide the monotony of transition process without re-regulation.

But at present days scientific technological processes are not on the spot and robotic platforms with the use of artificial intelligence and neuron network technologies are widely applied. This allows the system to be adapted to turbulent operations. Modern works in addition to the neurocontroller in its composition have intelligent sensors and high-tech engines. The use of these sensors to identify environmental impacts increases accuracy many times and reduces job inertia, allowing them to be used in a much wider area application. The primary converters are used for the robot to be able to receive information about your condition and the condition of the physical environment around you.

Therefore, for a given function, a robot system or platform must provide the necessary level of accuracy and speed, especially when trying to assess the dynamic component of the environment.

Sensory support for the robot is very important in its functioning and performance of the set tasks. The hardware part grows as the intellectual capabilities develop, i.e. today applied methods of artificial intelligence at the lowest level of processing of sensory information. The sensor information in the process is successively transformed from the primary information to the increasingly generalized forms and accordingly to be integrated at the higher levels. There are five levels:

1) primary sensor information (primary signals);
2) touch information elements (for example, pixels of matrix images in STZ);
3) images of objects;
4) verbal signs identified by touch systems;

5) symbols (concept) - the top level of integration [5] .

The introduction of a neural controller and neural network design enables to solve the tasks of adaptive management of robotic platforms, multi- parameter tasks of non-linear optimization and also allows to complete a large number of calculations simultaneously and at the same time interact with one and many others.

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AUTOMATED CONTROL OF OPTIMUM INDOOR CLIMATE PARAMETERS

In recent years there has been a steady increase in the demand for clean, high quality, non-business premises. This trend is caused by an increase in the number of companies, small firms, the expansion of administrative settlements.

The environment in which people work indirectly affects their health, well-being and, as a result, their productivity. Ensuring comfortable and safe working conditions for workers is an important task for employers. So urgent scientific and technological problem at this time is the development and technological implementation of standard systems of automatic control and regulation of microclimate parameters.

The basic principle in the organization of automatic climate control is to meet the objectives of protection, regulation and management. This means that it is important to increase the energy efficiency of existing installations and equipment so that the technological requirements can be met with the lowest possible costs. These systems automatically ensure the specified operating conditions of the process equipment with the appropriate selection of components. They are also integrated seamlessly into the system of centralized control and management of engineering, technology, information and communication systems, in a system of dispatching.

The purpose of this work is to develop a system that will automatically maintain indoor climate parameters at the required level.

Let’s consider a subsystem for maintaining air temperature. According to DSN 3.3.6.042-99 [1], the air temperature in the premises must be 22-24°C in winter and 23-25°C in the warm season. This is the optimum range, which does not cause overheating or overcooling of the organism. To maintain the recommended temperature regime, the room must be equipped with the appropriate cooling or heating equipment.

Temperature sensors, supply- and extract ventilation systems and heating units are used to ensure the required room temperature.

Temperature sensors are used to continuously measure the temperature of the working environment. We can place 4 temperature sensors in different areas of the room, as each room temperature can be different. The average of these sensors is used to control the temperature. Another

sensor is placed on the outside of the room to determine the ambient temperature. Depending on the reading of this sensor, the value of the set parameters of the microclimate changes. During cold weather (temperature below +10°C) the set temperature is 22-23°C, and during warm weather (temperature above +10°C) the set temperature is 23-25°C.

The ventilation system is designed to maintain optimum metrological conditions in the room. In this automation system, the ventilation system is composed of the following devices:

1. Air vents are designed for air flow rate control and air flow interruption. Electrically operated baffles and mechanical baffles for the back-up channel with filter are used. The signal from the microcontroller is transmitted to the electric actuator of the air vent, which controls the air vent. The electric actuator is mounted directly on the clutch shaft by means of a universal clamping, secured by a retainer which prevents the electric actuator body from wrapping. The mechanical interlocks are operated mechanically and must be easily accessible. The door position sensor is designed for monitoring the door's lateral position. The signal from the position sensor is transmitted to the microcontroller depending on the position of the door. The sensor is mounted on the clutch shaft. Two encoders are used per each lock with electric drive.

2. The filters are designed to clean the supply air. Two filters are used. If the main filter gets clogged, a reserve filter is used to ensure uninterrupted operation of the entire climate control system in the room. The back-up filter is separated from the main ventilation duct by means of mechanical shutters.

3. The air pressure sensor is used to detect the clogging of the main filter, i.e., the difference in air pressure. Sensors are installed in front of and behind the filter. Signals from the sensors go to the digital inputs of the microcontroller. The difference between the sensor values can be used to determine the amount of pollutants in the filter.

4. The centrifugal duct fan is designed for supplying clean external air. The fan is controlled by a relay which is connected to the microcontroller via a digital output. The duct fan is powered by a 2-pole asynchronous motor with external rotor with backward curved blades made of galvanized steel.

An electric convector is used to maintain the set air temperature in the room during cold weather. The convector is controlled by a dimmer connected to the microcontroller analogue output. The dimmer enables smooth regulation of the power supply and thus reduces or increases the temperature of the heating element.

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APPLICATION OF INTELLIGENT SENSORS IN AUTOMATIC CONTROL SYSTEMS AND ROBOTIC DEVICES

Today, neither automated process control system can exist without modern sensors. Intelligent sensors are increasingly being used in robotic systems and parameter control systems. Modern primary transmitters are being upgraded from single-functional means for determining the current values of

measured magnitudes into multifunctional automation tools that solve a number of diagnostic tasks, convert measurement information and perform simple control algorithms [1].

Intelligent sensors distinguish from conventional primary transmitters in that a microprocessor is installed in the sensor package - the brain of the sensor, which allows the device to "study" the conditions in which it operates. The sensor is a self-learning microprocessor system capable of processing large amounts of information at high speed. The use of intelligent sensors allows to compensate for non-linearity; to neutralize temperature effect on their operation, this is especially relevant in extreme conditions, for example, at the bottom of a well when drilling for oil or gas, to compensate for the delay in time caused by the degradation of the primary transmitter (inertia) [3].

Modern intelligent measuring transmitters can include several sensors to measure different quantities. This made it possible to make the measuring device compact, as well as to use a smaller number of these sensors in control systems.

Exactly these sensors have found application in robotic systems today. The signal from the primary transmitters comes to the signal transmitter. The enhancer amplifies the signal from the primary transmitter and through the multiplexer goes to the secondary transmitters, and then to the computing device (microcontroller), which performs the necessary conversions and signal processing according to a given algorithm. Through the digital interface, the signal is sent to the operator for its analysis or sensor calibration (interval). The sensors also include a memory for recording parameter values, a network address, information for performing correction functions, automatic calibration and non-linearity compensation, self-diagnostic information and operating mode selection.

In general, intelligent sensors have a number of advantages:

1.The measurement imprecision in the process of transmitting information has been reduced, since instead of a low-voltage signal from the sensor, a digital signal is sent to the controller, which is less affected by electromagnetic clutters.

2. Intelligent sensors have a self-diagnostic function, which allows the operator to respond to an invalidation of the sensor quickly.

3.Ability for the operator to change settings remotely.

4.Ability to keep in memory information about the state and change of technological parameters.

5.The ability to have several sensors of the same type or different types in one device to improve the precision of measurements and measurements of various quantities.

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IMAGING PROPERTIES OF ORTHOGONAL PROJECTIONS OF HEXAEDR AND OCTAEDR

Problem statement. Among the large number of multifaceted surfaces of the surface of the two Platonic bodies - the hexahedron and the octahedron - attract much attention. During their study, their internal form, their positional and metric properties were studied. It remains unknown which surfaces can be created on their basis, how their orthogonal projections are most rationally constructed and what pictorial properties they possess. In practice, textbooks on descriptive geometry contain information about Platonic bodies mainly in the form of visual images, which contain metric information, but there are no orthogonal drawings as the main subject of research in this science. Hence the goal: on the basis of knowledge of the known structural properties of surfaces to investigate the pictorial properties of their orthogonal projections, constructed without operations of measuring and depositing segments. Therefore, we consistently and systematically consider the constructive properties of these surfaces and the pictorial properties of their orthogonal projections.

The surface of the hexahedron (cube) is a system of 6 congruent, competitive and mutually perpendicular squares. If the faces of the cube are parallel to the planes of projections, then the outlines of its orthogonal projections are congruent squares (Fig. 1). The outline of the orthogonal projection of a cube on a plane perpendicular to its diagonal is a regular hexagon, the diagonals of which coincide with the projections of its six edges. Metric characteristics of the hexahedron: the number of sides of the faces - 4; number of faces - 6; the number of edges is 12, the number of vertices is 8.

The cube surface has one center of symmetry as the point of intersection of its diagonals, 3 axes of symmetry passing through the points of intersection of the diagonals of opposite faces, and 9 planes of symmetry, of which six are diagonal and three are defined in pairs by axes of symmetry.

The surface of an octahedron is a system of 8 congruent, competitive and equilateral equilateral triangles. If the edges of an octahedron occupy the position of level lines in space, then the outlines of its orthogonal projections are squares (Fig. 2).

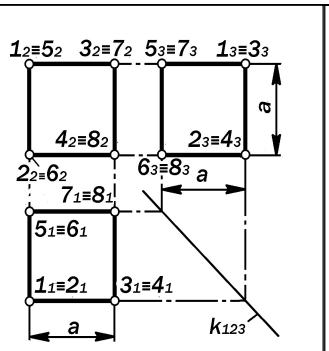

Fig. 1. Graphic model of the hexahedron (cube)

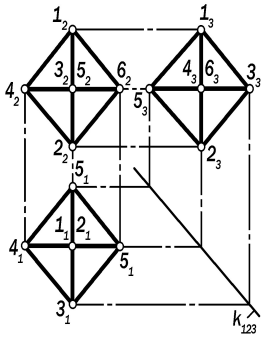

Fig. 2. Graphic model of an octahedron, the edges of which are level lines

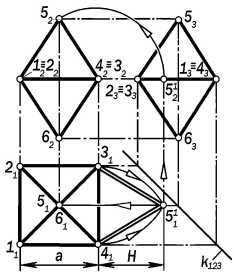

Fig. 3. Graphic model of the octahedron, the faces of which occupy -projectional positions

If the faces of the octahedron occupy frontal and profile-projection positions in space, the outline of its horizontal projection is a square with sides equal to the sides of its triangular faces, and the outlines of its frontal and profile projections are congruent rhombuses whose sides are equal to the heights H of its triangular faces. 3).

Metric characteristics of the octahedron: the number of sides of the faces - 3; number of faces - 8; number of ribs - 12; number of vertices - 6.

An octahedron has one center of symmetry - the point of intersection of its diagonals, 9 axes of symmetry, 3 of which coincide with its diagonals, and 6 - with small diagonals of its rhombic sections, which are determined in pairs by the heights of its opposite parallel equilateral faces and 9 planes of symmetry are determined by these axes.

Between the vertices and faces of both surfaces there is a one-to-one correspondence: the number of octahedron faces is equal to the number of cube vertices and vice versa, the number of octahedron vertices is equal to the number of cube faces with the same number of edges. This circumstance provides an opportunity for constructive mutual transformation of these surfaces into each other.

To transform a cube into an octahedron, it is enough to draw the diagonals of all faces and their points of intersection as the vertices of the desired octahedron, connect them with 12 edges (Fig. 4).

To transform an octahedron into a cube, it is necessary to draw heights and points of their intersection as vertices of the desired cube in each of its faces, to connect them with 12 edges (Fig. 5).

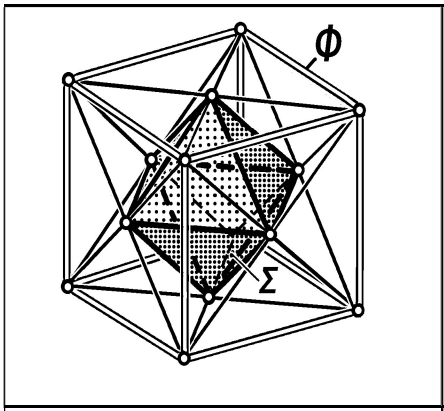

Fig 4. Cube transformation into ***Φ*** octaedr

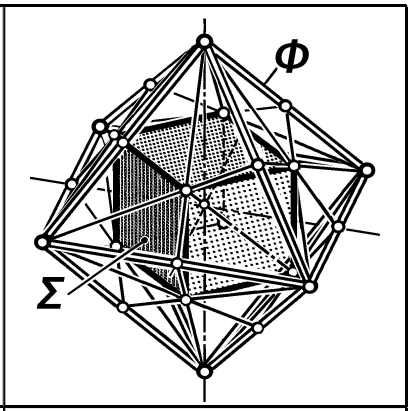

Fig. 5. octaedr transformation into ***Φ*** cube

The property of reciprocity of the surfaces of Plato's bodies is the basis for the construction of regular polyhedra, all the faces of which are the same rhombuses with equal dihedral angles at the same edges. The diagonals of rhombus faces are the edges of pairs of corresponding mutual Platonic bodies. Such polyhedral are called is ozonohedra of these Platonic solids [3].

Conclusion. The concept of systematic understanding of the nature of the object and its orthogonal image is a very effective means of obtaining new creative results in the study of constructive properties of objects and pictorial properties of their orthogonal projections, which promotes professional constructive thinking of creative students.

Abstract. The work is devoted to the system geometric-graphic description of the pictorial properties of orthogonal projections of the hexahedron (cube) and octahedron on the basis of graphic modeling of their known structural properties.

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ЛІНГВІСТИКА

МЕТОДИКА НАВЧАННЯ ІНОЗЕМНИХ МОВ

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ON SOME PECULIARITIES OF TRANSLATION

Translation is one of the oldest types of activity that arose simultaneously with the development of intercultural relations. The history of translation is rooted in Ancient Egypt, which had business contacts with surrounding cultures. Even in ancient times, practical translation activities demonstrated all the features that characterize them nowadays, and led to the formulation of the same problems, which are solved in our generation. The most significant issues of them, which are still of interest to theorists and practitioners of translation, are to develop an attitude towards the original text, use the possibility to apply variable translation solutions, and establish a correlation between accuracy and adaptation trends in translation.

Some researchers propose to build the process of translation in three stages: 1) pre- translation analysis of the original text as a whole; 2) translation itself as a process of establishing and finding interlingual and contextual conformities and re-expressing the original content by means of the target language; 3) general editorial revision [1, p.44]. The essence of the first stage is to clarify the communicative situation (who, and for whom and when, under what conditions and for what purpose created the original text), as well as to determine the subject of the text being translated, its main content, structure, and stylistic uniqueness. The second stage represents a sequential series of operations for the translation of separate small segments of the original text into the target language. At the third stage of translation, the errors revealed when reading the entire text are eliminated: excessive formulations, massive constructions, repetitions, etc.

Translation is one of the branches of art. Each language possesses its own unique peculiarities. Therefore, in order to be a qualified translator, it will be worthful to know the ground rules of translation [2, p.85]. At the same time, problems may always be around for those who are not aware of translation traps. For example, when translating the word with a strongly-pronounced cultural concept, the translator may have difficulties, since all cultures currently in existence are not the same thing. Thus, the translator faces the challenge when he is forced to search for the equivalent word having the closest meaning. In such a case, the reader and context of the wording to be translated shall fall under focused attention and be exposed to thorough analysis, giving rise totake into account the cultural background of the discourse in question. Moreover, such text should be transferred by the translator naturally in style.

In this regard, there are some points to remember, and one main message is that professional translators when performing their duties must become deeply familiar with their language pair for doing their job effectively. Furthermore, they are always required to be armed with tools and materials that help to translate at high quality standards and avoid classic traps appearing in a variety of forms [3, p.25]. It is worthwhile to note some of them.

Not every word is translated literally.

It must be borne in mind that the principle of literal translation does not apply to every word. Sometimes, the colorful phrases and special terms appearing in the text under translation cannot be transferred in the target language using just a few words. In situations of this kind, there is a need to accompany such expressions and words with extended and detailed explanations [4, p.58]. For example, in order to translate the French expression “rêve à deux”, it would be useful to specify thatit describes the dream of a pair of sweethearts being smitten with passion, who plan to spend their future together. Similarly, the same is considered in a case with the Ukrainian word “chomuchka”, which describes a person asking many questions.

The necessity to know about false cognates is obvious. One of the ground rules of translation in any language is that the translator must be aware of precaution he needs to have with false cognates [5, p.42]. Things can be confused when the meaning of a foreign word is inferred by the translator based on the knowledge he has of his native language. For example, “negligee” (dressing gown) in English

can sound “négliger” (to ignore) in French. “Episode” (scene, clip) in Ukrainian sounds “episode” (part of a series (franchise)) in English, etc.

Translating proper names should be avoided.

The language worker have to avoid translating proper names, if he finds them in the original text, be they names of a person or a legal entity. Otherwise, the text can lose its meaning. Therefore, proper names of people and companies should keep their appearance they have in the original text.

In conclusion, it seems fair to say that a good translator must pay great attention to the text being translated by him and try to understand it with utmost care. Furthermore, he should write a new text that will be as detailed as possible to enable the target reader to understand the meaning and message with no confusions or doubts. A well-translated text will be clear and comprehensive. It will never lead to misunderstandings, and the fact that it has been translated will not be noticeablein light of the fact that it will be natural.

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TO THE QUESTION OF INDIVIDUALIZATION IN TEACHING FOREIGN LANGUAGES

It’s a well known fact that teaching the practical knowledge of foreign language is an integral part of modern specialists’ training. Reading original literature on speciality in order to obtain the necessary information is one of the main directions of the foreign language Program for higher technical educational establishments. Special attention is paid to the individualization of training and the organization of independent work.

Independent work in teaching foreign languages exists as one of the ways to optimize the educational process as a way of developing the personality, it’s creative and cognitive activity. Independent reading of literature implies the possession of a certain level of knowledge, skills and abilities that make it possible to read, translate and understand specialty literature, to obtain the necessary information from the text in more rational ways and to formulate conclusions from what has been read. Independent work in reading includes the following:

1. Individual psychological characteristics (professional experience of the reader, which allows to navigate in the text and to highlight the main facts);
2. Level of general development;
3. The ability to read literature in the native language;

4. Interests and needs of the reader. That is, independent reading of foreign texts is a work that takes into account the level of intellectual competence in the development of student's skills and abilities for independent reading of foreign texts [2].

Individualization of teaching provides the form of organizing the training sessions, which is closely related to the search for the most rational ways of teaching and increasing its effectiveness. There is a different understanding of the concept of individualization of teaching (individual work with strong and weak students, different types of tasks for independent work, etc.), therefore, there are also diverse recommendations for its organization.

Analysis of methodological, linguistic and psychological literature and work experience in higher technical educational establishments state that it is advisable to teach reading original scientific and technical literature on the basis of individual learning tasks that are performed in classroom and extracurricular hours. These tasks, which include text, exercises and instructions before completion, are created with such recommendations: differentiated approach to each student, a clearly prepared number of exercises, the use of possible information from texts for speaking and writing activities [1].

Individual tasks take into account the language experience and the individual psychological characteristics of students. They help to plan the educational process in such a way that strong students have the opportunity to work according to their abilities and weak students perform tasks based on their own abilities which, as a rule, are not taken into account in group classes. Individual assignments provide complete independence of students and can be performed regardless of the class schedule, being a factor of self- regulation. When preparing individual tasks, such psychological functions as attention, memory, thinking abilities of the student, etc. are taken into account [3].

For individual reading it is necessary to use the following criteria for selecting texts: level of knowledge, skills and abilities, development of attention, memory, cognitive activity. Original unadapted texts on speciality are of interest for the student (making to understand that they are of professional importance) and for the teacher (the requirement to use information in term papers and theses). The effectiveness of teaching independent reading of scientific and technical texts on speciality in foreign language is determined by three factors: individualization of learning, independence and the nature of the text as educational material.

In modern conditions, individual forms of student's education in universities are increasingly giving way to group (practical) classes, which leads to contradictions between the collective form of education and the individual nature of learning. This determines the development of the foundation for the individual approach to teaching foreign languages.

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TYPICAL DIFFICULTIES IN LEARNING ENGLISH LANGUAGE

English is an international means of communication, because it is where most international conferences, forums, seminars are held, and a huge amount of technical and scientific literature is published. In order to achieve serious learning outcomes, everyone must be motivated. Motivation is a

conscious desire to achieve a specific goal. Without motivation, the initial enthusiasm passes quickly and the process of learning the language ceases to be interesting.

Therefore, before you start learning a language, you need to have a clear idea of what it is for and what opportunities may open up. Knowledge of the language contributes to the development of intellectual potential, broadening the worldview, professional growth, respect and recognition among friends and colleagues.

In learning English, there are some typical difficulties for learners, such as: comprehension, speaking and writing. For example, we know that if adjectives usually follow nouns in the learners' first language, so they may need time and considerable exposure to English in order to become familiar with the usual sequence of information in English noun phrases. Even though they may know and be able to verbalise the "rule", they may be wrong-footed by specific instances. This may cause them difficulty in processing information, particularly in listening to English [1].

The most common mistakes may be like these: sentence position, participle forms, and adjective order, combining adjectives, gradable and ungradable adjectives, adjectives and adverbs [2]. These mistakes are especially common among learners whose first language makes no distinction between adjective and adverb forms. Therefore, one of the main tasks of the teacher is to help the learner to understand and comprehend the specifics of language learning.

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PRE-WRITING ACTIVITIES AS AN INTEGRAL PART OF THE WRITING LESSON

The latest research on techniques in teaching writing has proved that good writing skills will not develop merely from practice exercises in grammar and vocabulary choice. Good writing implies knowledge of the conventions of the written code. That is why the writing activities should be structured in ways that help students learn to produce cohesive and coherent discourse on their way to become self-sponsors of their own writings [3].

We should bear in mind that a typical writing lesson involves: pre-writing activities; planning (organizing for drafting); drafting (a time to indulge plus revising); post-writing (preparing to go public).

Pre-writing activities are defined as "*any structural activities – oral, written or experiential -- that influence active student participation in thinking, talking, writing, and working on the topic under focus in a writing lesson, stimulating higher-level thinking as well as writing skills*" [2]. Pre-writing tasks review and build students' knowledge of relevant vocabulary, relevant grammar points and, most importantly, students' background knowledge, since that is what really generates thoughtful and interesting written work. Pre-writing tasks are a crucial element of successful writing instruction.

Pre-writing tasks usually include:

- discussing the type of writing to be attempted by students: (description, narration, exposition, or persuasion)
- working on a writing model
- analyzing the model's organization and style

- considering the reader's and writer's purpose
- doing a series of exercises that focus on both organizational devices and topics appropriate to that writing function [2].

There are some pre-writing techniques as mental warm-ups that can help students get started on their writing process:

1. Freewriting: There are two types of freewriting -- unfocused and focused. Unfocused freewriting can help you clear your mind so you are ready to concentrate on the task at hand, and focused freewriting can help you come up with it [5].

2. Brainstorming is similar to freewriting in that you write down everything you can think of without considering whether it is valid, good or useable. The difference between freewriting and brainstorming is that freewriting takes on a format that looks something like a paragraph, while brainstorming usually results in a list of words and phraseseas on your topic [1].

2. Clustering, or Mapping, is an invention strategy that can be used to generate ideas for an essay or to plan an essay. There are two types of clusters:

a. The discovery cluster (to discover an essay topic; to find out what you know about the topic)

b. The planning cluster (to plan an essay; to produce supporting ideas)

3.Cubing: Students are given a list of steps on which they are supposed to freewrite for three to five minutes. They must not skip any steps: describe, compare, associate, analyze, apply, argue for/against.

4. Interviewing: This activity involves passing around topics to classmates. Students should write their topics on the top of a blank piece of paper, then pass this paper around to their classmates, asking them to respond to the topic with questions they would expect to be answered by a paper on that particular topic, their feedback on the viability of the topic, comments they might have on the subject a student wants to discuss, etc [3]. This exercise should provide students with two things: new angles and perspectives from which to consider their topics, and feedback from the audience about what they know/don't know about the topic (and thus what information one may need to provide.)

Pre-writing activities play an important role in the organization of the effective writing. They help the students focus on the topic of their written work, stimulate their writing skills and create a gradual shift into other stages of the writing lesson. Therefore, it is vital for learners to plan out prewriting correctly. In such a way, pre-writing would become a key stage in the writing process.

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ABOUT THE CONCEPT "BODY" IN JOHN MAXWELL COETZEE'S NOVEL "WAITING FOR THE BARBARIANS"

There are many anthropological, sociological, psychological studies of the body in modern science. Olga Gomilko argues that the body is the shape of a material substance that distinguishes each individual being and outlines its boundaries between other beings of the surrounding world, which as a whole appears as defined in its materiality [1]. Corporeality is the basic existential of collective being, giving ground to socio-economic, cultural, political dimensions [1].

The relevance of the topic of our study lies in the study of the content of the concept, which is in demand in modern culture. The artistic text, with its specific "transmission" of spiritual ideas through feelings, reflects the urgent needs of people in understanding the phenomenon of the body.

The purpose of our study is to study the content of the concept "Body" as presented by John Maxwell Coetzee in the novel "Waiting for the Barbarians" [3]. This goal involves the following tasks:

1. Reveal the core and peripheral meanings of the concept "Body" in Coetzee's novel.
2. Develop criteria for classifying the meanings of the concept as nuclear and peripheral.
3. Determine the components of the peripheral meanings "clean body", "dirty body", "enjoying body", "frustrated body".

The material for the study of the concept "Body" in our article is the full text of the novel by the South African writer John Maxwell Coetzee "Waiting for the Barbarians".

The content of any concept can be divided into core and peripheral meanings, identified on the basis of a quantitative criterion (frequency of occurrence in the concept sphere or literary text) [4], as well as on the basis of the role of the studied meanings in a literary text). On the basis of the second criterion, the nuclear meanings of the concept "Body" in Coetzee's novel should include the following:

1. The colonized body as an imperial strategy
2. Body subjected to torture
3. Mutilated body
4. Female barbarian body.

If these meanings play an important role in revealing the idea of the novel (a call to shudder at the sight of what imperial conquerors can do with a person and his body), then the meanings studied in our article, although repeated in the novel, perform a less important function for understanding the novel; - disclosure of the inner world of a humane imperial, watching the actions of a much more cruel representative of the imperial authorities.

The study of the motives of a clean, dirty, frustrated and enjoying body allows us to draw the following conclusions:

1. In the novel, these motifs perform the function of revealing the inner world of a humane imperial, who observes the actions of a much more cruel representative of the imperial authorities.
2. A dirty body is the result of the imperial bullying of the barbarians, a consequence of the need to obey the majority. A dirty body is a consequence of an illness and an instrument of pressure on a person who shows independence of views or accidentally gets into the wheel of imperial ambitions.
3. The motive of physical purity is combined in the perception of the judge and the author with the desire for purity of soul, with a keen desire to help the suffering, to alleviate their physical and moral condition, to return them to a natural perception of life before torture.
4. Pleasure in Coetzee's novel is associated with the primary needs of a person (for food and sex), and can also be combined with mental and spiritual pleasure: from connection with nature, other people, from the world on earth).
5. Finally, the motive of a frustrated body is formed due to the impossibility of ridding the world of excessive cruelty, bringing the body and soul of a person after torture to a normal state.

The prospects of our research are the study of the phenomenon of the body and the bodily in the texts of other modern authors in order to identify common patterns in the attitude towards the body in modern culture.

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FORMING PROFESSIONAL TEXT COMPREHENSION COMPETENCE: NOUN CLUSTER RECOGNITION

One of the accepted competencies that has to be acquired as a result of "English for Professional Purposes" course for PhD students is the ability to understand professional texts. This skill is vital not only for those who study for a PhD degree but also for graduates who start their career in the modern competitive world.

In order to master professional vocabulary, whatever the sphere, and be fluent in its use, it is necessary to know ways of and means for professional terms coining so as not to look every terminological unit up in any type of a dictionary. That is why teachers of ESP should present to students various methods of term formation including noun clustering that results in a big number of two-component terminological word-combinations.

It has always been natural for English language academic writing to be abound in word-combinations that include one noun modifying another one or more. The first noun functions as an adjective in such a construction, and is usually called "attributive noun". These constructions, bearing the name of "noun clusters" (they may bear other names, though), are not very difficult to understand if they include two components and if a teacher explains how to decipher the clusters and translate them into the native language. Unless the students are taught some strategies to deal with noun clusters, the latter can slow down reading and comprehension processes.

One of the strategies is giving the students the idea of the classification of two-component noun clusters according to the means of their translation into the native language and supplying the students with plenty of examples. In the case of teaching Aerospace Engineering students or PhD applicants, numerous conference proceedings, such as published in *Acta Astronautica*, may pose as a reliable source of examples of two-component (N+N) clusters. One should always bear in mind that the second noun in a cluster is the central one. The classification of translation, though, is built around the translation of the first noun. There are two major means for translating noun clusters into Ukrainian:

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the first noun is translated as an adjective: air transport – повітряний транспорт; aviation industry – повітряна промисловість; lunar dust – місячний пил; propulsion system – рухова система; rocket fuel – ракетне паливо; space crew – космічний екіпаж; space vehicle – космічний апарат; team task – командне завдання.

– *the first noun is translated as the noun in the Objective Case:* communication delay – затримка спілкування; deployment time – час розгортання; life form – форма життя; satellite constellation – сузір'я супутників; space exploration – дослідження космосу; team performance – продуктивність команди.

The examples of these clusters number hundreds. The less widely spread structures include three noun components (N+N+N), of which the last noun is the major one. For example: space exploration vehicle – апарат для дослідження космосу; team task batteries – комплекти командних завдань; life support systems – системи підтримки життєдіяльності; lunar habitat design – проект житла на Місяці. Theoretically, four component noun clusters are possible as well, but usually the authors of academic papers avoid using them as clumsy and sometimes incomprehensible.

The examples given above show that developing the competence in understanding professional text requires not only the skill of skimming reading, but also the acquisition of certain grammatical phenomena, not least the phenomenon of noun clusters.

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ASSESSMENT AS AN INTEGRAL PART OF LANGUAGE TEACHING

The language teaching process involves a number of procedures assisting to constantly improve the quality of teaching and learning. The term assessment refers to "a variety of ways of collecting information on a learner's language ability or achievement" [1].

The purpose of the paper is to give an overview of the assessment types used in global teaching practice. Sometimes testing and assessment are taken as similar things, but assessment is a much broader concept and it can include not only tests to assess the language proficiency but also such methods of monitoring as observation, simulations or project work. Moreover, assessment is distinguished from evaluation. The latter is about the overall language programme and doesn't deal with the material individual students have learnt. With the widespread communicative language teaching (CLT) principles, assessment has become increasingly useful.

There is always some goal to assess the language ability. Among the main purposes of assessment are:

• selection: e.g. to determine whether learners have sufficient language proficiency to be able to undertake tertiary study;

• certification: e.g. to provide people with a statement of their language ability for employment purposes;

• accountability: e.g. to provide educational funding authorities with evidence that intended learning outcomes have been achieved and to justify expenditure;

• diagnosis: e.g. to identify learners' strengths and weaknesses;

• instructional decision-making: e.g. to decide what material to present next or what to revise;

• motivation: e.g. to encourage learners to study harder [2].

There has been a lot of research activity in language assessment in recent decade by Alderson, Wall, Bachman, Palmer, Cohen, etc. According to the first classification there are *proficiency* assessment, when general language abilities acquired by the learner are assessed, usually by means of some standard commercial language-proficiency tests and assessment of *achievement*, carried out by

the teacher, aims at understanding and monitoring what the students have learned, course content, taking into account course objectives.

Nowadays, in teaching practice the following types of assessments are widely used by teachers: formative assessment and summative assessment. *Formative* assessment is carried out to improve instruction. This types of assessment monitors student learning, takes place during learning, is used by students and teachers and it is not graded. The types of task can be various and include quizzes or anonymous voting; short comparative assessments to see how students are performing against their peers; one-minute papers on a specific subject matter; lesson exit tickets to summarise what students have learnt, or silent classroom polls. Exit slips can take lots of forms, Padlet or Poll Everywhere are also a good example, it is possible measure progress toward attainment or retention of essential content or standards with tools like Google Classroom's Question tool, Google Forms with Flubaroo, and Edulastic, all of which help see what students know. No matter the tool, the key to keep students engaged in the process of formative assessment is asking the questions like this: *What are three things you learned, two things you're still curious about, and one thing you don't understand? How would you have done things differently today, if you had the choice? What I found interesting about this work was… or Right now I'm feeling... Today was hard because...*

Summative assessment is used to provide information on the course outcomes, usually carried out at the end of a course, term, and year. It evaluates student learning, takes place after learning, it is used by teachers and always graded. The tests here are a typical form of assessment product. Summative assessment includes end-of-term or midterm exams, cumulative work over an extended period such as a final project or presentation, end-of-unit or chapter tests, achievement tests, standardised tests. Some types of summative assessments can be much more effective than a standard test. For instance, written summative assessments can be authentic (reflect a wide range of real-world skills that are authentic outside the classroom context); reliable (give similar results across classroom settings, groups of students, and daily conditions); valid (the assessment accurately reflects what students have been taught in the instruction period) [3, 4].

It is obvious that assessment is an integral part of the teaching process. Only through the systematic assessment it is possible to improve language proficiency. Modern era gives a lot of opportunities of integrating new technology into teaching and assessment practice, which sometimes facilitates the life of teachers, however, at the same time, makes them catch up with technological advances.

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THE MENTAL CONSTRUCT “ORIENT” AS A CULTURAL TEXT

Mental construct "East" is a universal sign; in its structure there is figurative associative field, which plays cluster role not only in the Middle East, which is known to border with Southern and Eastern Europe, but also in many countries practicing Islam, Buddhism, Judaism, Christianity. It should be noted that not only Turks, Persians, Kurds and Arabs consider the Middle East their home, but also more than seventy million Christians, including Anatolian Greeks, Assyrians, Copts, Maronites, Armenians, etc.

The concept-construct "Oriental world" correlates with the concept "Orient" and is objectified by cultural senses - Oriental philosophy, Oriental religion, Oriental culture. The concept "East" is qualified as multilevel and multicomponent, as it is verbalized by meanings and values of such concept-constructs as "countries of the East", "cultures of the East", which translate deep meanings and values. The Middle East, the Far East, the Middle East are geographical places inhabited by peoples of various cultures and languages. The East encompasses the vast territories of West, Central, Central, South and East Asia. As rightly noted by A. V. Pustovit "geopolitically, the East is associated with the cultures of ancient India, China, Babylon, Ancient Egypt, national-state formations of the Muslim world. These cultures were original and at the same time had some common features: they were oriented, first of all, on reproduction of the established social structures, stabilization of the established way of life, often prevailing for many centuries. Traditional patterns of behavior, accumulating the experience of ancestors, were regarded as the highest value" [6, p. 26].

The famous Orientalist B.A. Turaev, describing the Ancient East, once wrote that it was "the middle part of the great chain of deserts, cutting through the entire Old World from the Pacific to the Atlantic Ocean and interrupted only by oases, which became dwellings of primitive humanity and cradles of culture. Such oases in this middle part were the basins of big rivers: Nile, Tigris and Euphrates, Jordan, Orontes, as well as the fertile slopes of the Lebanese mountains and the Mediterranean coast" [9].

The concept-construct "East" is a multilevel, multicomponent deep universal cultural text, in which the background associative rows "Ancient East", "Egypt", "Babylon", "ancient Egyptian pharaohs", "pyramids", "Mesopotamia", "Tigris", "Euphrates", "Nile" etc. structure the linearly expanded texts.

The origin of the word "east" and its inner form are of interest. According to the etymological data of G. Orlov, the words - "Vostok" (Russ.), scheid (Ukr.) are borrowed from the Old Slavonic language and correlate in the European languages with the words East (English), Ost (German) [3].

M. Fasmer, analyzing the etymology of the word in question, writes that it is borrowed from Church Slavonic and is a tracing of the Greek word "ἀνατολή": "<...> unlike the Old Russian vstok, stok "east, east wind" <...> Old Slavonic vstok (Supr.) is a tracing of Greek ἀνατολή, like Polish. wschód from Latin oriens <...> [11].

The etymology of the word attracts with its interpretation also in the famous dictionary of N. M. Shansky, who considered that the word "vostok" is not only a borrowing from the Old Slavonic, but "a word-formation calque of Greek anatolē (ana - vs, tolē -tok)" [12] ἀνατολή, which translates as "place of sunrise" [12].

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SOME PECULIARITIES OF THE ENGLISH LANGUAGE QUALIFYING EXAM PREPARATION

Far and away the postgraduate education has a number of features that distinguish it from other levels of education. While the educational subsystems preceding the tertiary schools are based on reasonably advanced didactics, we could see a completely different scheme of things in the realm of higher education and especially postgraduate studies. Therefore, the simple transfer of the goals, content, teaching methods and forms, methods of evaluation of knowledge from previous educational levels to postgraduate education is unjustifiable. In general, the identification of specific features inherent in postgraduate education is still a topical issue that needs special research. The modern psychology and pedagogy consider the educational process from the perspective of the theory of activity. It is well-known that the most important component of activity is motivation, or target orientation. Hence, when determining the principles for creation of any educational program, the question of the target orientation of education arises in the first instance. The actual work plan for the PhD semester of our chair is designed for 90 academic hours, of which two-thirds is allotted to learning to read and understand a scientific text, and one part is allotted to developing oral speech skills. As many years of experience show, the work on general scientific texts during the first semester, i.e. during the period of repetition and in-depth study of grammatical material, as well as the primary accumulation of general scientific vocabulary, makes this stage of learning very important in postgraduate groups, as effective as possible. Considering any grammatical phenomenon, we should place emphasis only on the necessary minimum of formal features of this grammatical phenomenon, i.e. on those formal indicators that provide easier recognition and understanding of such phenomenon in a scientific text.

The particular emphasis should to be placed on the need for an in-depth study of the most frequent general scientific words of broad semantics, outwardly identical words and phraseological units. It is supposed to study not isolated words, but the words in context, i.e. in all the variety of collocations in which they may occur. As you know, PhD students must overmaster a lots and lots of lexical units in an extremely short time, accumulate in their memories a sheer number of free phrases, polysemantic words, fixed expressions; they must obtain strong skills of their instant recognition,

correct understanding and finding correspondences in their native language. An analysis of the potential and communicative activities of PhD students makes it possible to outline program-according ways for the gradual development of their speech skills and abilities.

In a process of studies we use up-to-date comprehensive resources which offer modern teaching approaches toward English for academic purpose. The postgraduate course is aimed at working out reading comprehension, academic writing and communicative skills.

The purpose of Academic English course is to help PhD students to develop the skills they need to have and then to be able to present information at scientific conferences clearly, concisely and with confidence. Also PhD course aims to provide the basic understanding of the different styles of articles in various fields of science and various publications in order to produce a clear and concise summary and to feel more reliant in writing scientific articles.

A complete package of carefully researched materials based on a detailed analysis of academic writing helps to become more confident writer in academic and professional situations. So this course has a strong emphasis on practical activity.

PhD students have to read a lot of scientific publications in order to produce a clear and concise summary and to bring disciplined analysis to data and results, to see cause and effect and to use this to make well-proved solutions of an investigated problem.

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THE TYPES OF FEEDBACK IN EFL CLASSES

A lot of teachers during their teaching career face such dilemmas as – how much feedback to provide or how to give feedback to students not offending but encouraging them, or what kind of feedback to use in classes? Feedback is an integral part of teaching.

Providing students with constructive and instructive feedback can bridge the gap between real and desired outcomes. Teachers use feedback to show students their progress and in order to motivate them. In this paper we are going to examine the types of feedback in EFL classes and their efficiency briefly.

First, it should be noticed that such notions as “feedback” and “evaluation” are not interchangeable. Feedback is the transmission of evaluative or corrective information about an action, event, or process to the original or controlling source [1]. While evaluation is a judgment about something or someone with little or no intention of changing any aspects or behaviors and is intended to be summative. Evaluation is mainly focused on grades. There are a lot of criteria and characteristics of evaluation in education [2].

Feedback can take different forms - oral, written, informal, formal, descriptive, evaluative, peer and self-assessed feedback. Efficient and productive feedback is as important as a mark.

Oral feedback is usually given during a lesson, and it is informal in most cases.

Feedback can be also corrective or non-corrective. As non-corrective feedback it can be an appreciation comment such as “thank you for sharing this awesome idea with us”. Corrective feedback is the most widely-used type of feedback which focuses on learners’ errors (lexical, grammatical, or stylistic). There are a lot of disputes about positive and negative impacts of corrective feedback on language acquisitions among the researchers [3]. This type of oral feedback can be provided either explicitly or implicitly. Repetition is one of the types of easy corrective feedback. Teachers can repeat the incorrect answer given by a student in a different tone, so that the student notices that it is incorrect. This will be a signal to fix the mistake.

In case of critical feedback, it is a good way to apply "sandwich approach" (when you open your feedback with positive comments, followed by some constructive criticism, and then some final positive comments) [4].

Proving facilitation and giving some suggestion or advice, it is better to avoid "You should…" sentences. They make learners feel defensive. It's preferable to start with "I" (e.g., "I suggest using more examples").

As to the written feedback it tends to be given after some complex assignment or task. It usually includes a detailed revision of what has been done and some steps for improvement. Effective written feedback should be written in an understandable manner to motivate the student to get a better result.

Feedback can also be either evaluative or descriptive. Evaluative feedback provides some information about learning (e.g., "well done") but does not convey the information and guidance that students can use to improve. Descriptive feedback provides students with detailed, specific information about improving their learning. It is recommended to be explicit in your comments. This type of feedback shows students "the steps" for self-assessment and self-correction.

Peer and self-feedbacks are rather challenging for students because of fear to be unfriendly and underestimating. However, giving peer feedback students give some advice and suggestions about each other's work, which is extremely valuable. Thus, the teacher should facilitate the above-mentioned techniques as much as possible. Teamwork and groupwork can foster the understanding of its implementation. It should be noticed that students need time to practice, know what the requirements are, and be aware of a final result. Using self-feedback requires students' knowledge and skills of self-reflection and self-analysis. Self-feedback is the highest rank of feedback for learning. The ability of self-feedback shows learner's autonomy in studying, higher-order critical thinking [5] and goal-setting skills. To help students reach autonomy in studying teachers should clarify learning goals and criteria for success, use scaffoldings and provide opportunities for self-feedback. Peer and self-feedback can give students a deeper understanding of the learning goals and outcomes.

To boost students' engagement, different types of feedback can be implemented in EFL classes and in many cases should be tried and mixed experimentally. To figure out which type is the best for this or that class is a challenging and practical task to any teacher. It's worth enhancing your teaching process with new experience and ideas.

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LES COURS DE LANGUEAVEC DES LOCUTEURS NATIFS COMME COMPOSANTE IMPORTANTE DE L'ENSEIGNEMENT INTENSIF DU FRANCAIS

Grâce à la coopération internationale intensive de l'Académie nationale de génie civil et d'architecture de Dnipro (PDABA) avec des organisations internationales francophones, les étudiants des projets francophones, qui étudient le français de manière intensive, ont une bonne opportunité de travailler avec des locuteurs natifs, à savoir, des stagiaires français qui viennent dans notre ville pour un stage professionnel.

L'importance de la communication avec des locuteurs natifs a été évoquée à plusieurs reprises dans des travaux spéciaux sur les méthodes d'enseignement du français langue étrangère (FLE) [1], [2], [3], [4].

Travaillant avec les étudiants et mettant en pratique les connaissances théoriques et les compétences pratiques, les stagiaires donnent aux étudiants la possibilité de communiquer avec eux en français, partagent leurs propres expériences d'études en France, du bénévolat, de la participation à des programmes de mobilité académique et d'échanges internationaux pour encourager les étudiants à essayer leurs propres forces dans des projets similaires.

Pendant les cours avec des stagiaires français, les étudiants ont l'occasion d'échanger sur des sujets aussi pertinents que la possibilité de poursuivre des études dans les universités françaises, les conditions d'admission, les particularités et délais de dépôt des documents, ainsi que la recherche des entreprises pour des stages professionnels.

Grâce au travail avec des locuteurs natifs, les étudiants reçoivent des réponses quasi complètes à leurs questions sur la préparation correcte et efficace des lettres de motivation, qui présentent la carte de visite du futur stagiaire et doivent être rédigées dans le respect de certaines règles. En consultant en commun avec des stagiaires des sites français qui offrent des stages et des emplois aux jeunes diplômés, les étudiants se familiarisent avec les exigences des employeurs français et peuvent évaluer plus objectivement leurs propres opportunités et chances réelles d'obtenir des stages professionnels et même des emplois en France.

Concernant l'importance des cours avec des locuteurs natifs, à notre avis, il faut souligner, qu'il s'agit avant tout de donner aux étudiants la possibilité d'entendre le français qui a ses propres caractéristiques phonétiques dans chaque région de France et d'améliorer leurs compétences acquises de la communication orale spontanée. C'est aussi l'occasion d'obtenir, comme on dit, des informations actuelles sur les régions, la civilisation, l'histoire et la culture de France.

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