WMCCAU 2024

WORLD MULTIDISCIPLINARY CONGRESS ON CIVIL ENGINEERING, ARCHITECTURE AND URBAN PLANNING

ABSTRACT BOOK

Czech Republic, Ostrava | September 2-6, 2024

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Preface

This is the Abstract Collection of WMCCAU 2024, featuring the abstracts of oral and poster presentations from the World Multidisciplinary Congress on Civil Engineering, Architecture, and Urban Planning, taking place in the city of Ostrava, Czech Republic, during 02-06 September 2024.

The World Multidisciplinary Congress on Civil Engineering, Architecture, and Urban Planning (WMCCAU) emphasizes a multidisciplinary approach that combines innovative ideas and methodologies in the aforementioned and related fields. It serves as a place for discussing the latest trends, solutions, and challenges in these areas, while also seeking inspiration for the future.

WMCCAU is committed to introducing new perspectives and highlighting best practices across a diverse range of fields, including Civil Engineering, Architecture, Urban Planning, Accreditation of Civil Engineering and Architecture, Archaeological Methods and Theories, Architectural Culture, Architectural Design and Methods, Architectural Heritage and Conservation of Historical Structures, Architectural Historiography, Architectural Space, Building Performance Simulations, City and Regional Planning Education, Computer-Aided Design, Construction Management and Engineering, Construction Materials, Economics and Politics, Geotechnics, GIS-Based Modelling for Mitigation Planning, Hydromechanics, Integrated Coastal Zone Planning and Management, Mathematical and Statistical Methods, Public Space, Regional Planning, Risk Management and Mitigation Planning, Social Sciences and Architecture, Structural Engineering, Sustainability in the Built Environment, Theories and Methods, Theories of Vision and Visuality, Transportation, Urban Design, and Urban Sociology.

The primary goal of the congress is to foster a vibrant environment where professionals and experts from around the world can exchange insights, experiences, and knowledge in these fields. Additionally, the congress offers a unique platform for emerging researchers to present their work and engage in meaningful discussions with global experts in these scientific areas.

We would like to express our sincere gratitude for the nearly 150 submissions to WMCCAU 2024 from over 30 different countries worldwide, acknowledging their interest and contributions. We wish you an enjoyable experience at the World Multidisciplinary Congress on Civil Engineering, Architecture, and Urban Planning in Ostrava, surrounded by the city's fascinating industrial architecture and other attractions.

We look forward to welcoming you again at the next event, the 'World Multidisciplinary Congress on Civil Engineering, Architecture, and Urban Planning - WMCCAU 2025,' which will be held in the vibrant city of Ostrava, Czech Republic, from 1-5 September 2025.

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Prof. Dr. Gang-Len Chang, The University of Maryland, United States
(Editor-in-Chief, JOURNAL OF URBAN PLANNING AND DEVELOPMENT)

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Contents

3D-PRINTED CLAY FORMWORK FOR TOPOLOGY-OPTIMIZED CONCRETE ELEMENTS

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ABSTRACT

The use of topology-optimized precast concrete elements leads to material savings and thus to a reduction in the CO2 footprint of a building. Material is only used where it is structurally necessary. The optimum shape of a component is influenced by its structural boundary conditions. This results in a variety of bespoke shapes and geometries. Additive manufacturing techniques such as 3D printing are particularly suitable to produce such formwork.

This paper examines the production of 3D-printed formwork elements made of clay using the example of an optimized concrete ribbed slab. The use of unfired clay as a formwork material is intended to enable a circular reuse of the same material for subsequent prints.

For a simplified analysis of the manufacturing process, work is carried out on a reduced model scale of 1:8 or 1:16. Two manufacturing strategies will be tested. Firstly, a segmented formwork system to produce the ribs without a ceiling slab is investigated, and secondly, individual displacement bodies are produced which are then placed in a wooden formwork and with which the ribs and ceiling slab can be cast at once. In both cases, the clay is kept in a moist state until the concrete is poured.

Both production strategies can achieve a dimensionally accurate result, as the clay does not deform or crack due to drying. In addition, the clay can be easily removed from the finished component after the concrete has hardened and contains only minor impurities.

The production of formwork or displacement bodies for optimized concrete parts from 3D-printed clay is showing promise as an alternative to other materials such as plastic or concrete. As clay and concrete do not form a permanent bond during the curing process, the clay can be recycled. However, further investigations into the processing and cleaning of the dried clay are necessary to make precise statements about the proportion of reusable clay.

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ADAPTATION OF HEAT PUMP OPERATION TO COLD CLIMATE CONDITIONS

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ABSTRACT

Freon-based air conditioning systems are widely used throughout the world and are used to provide heating and cooling year-round. Since the RA regions are divided into warm, temperate and cold climate zones and even into warm zones, the design air temperature in winter is below -10 ℃, so it is necessary to use such systems that can operate at low temperatures. conditions. The article discusses options for making heat pumps work efficiently in cold climates.

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AGENT-BASED MODELLING FOR ENHANCING LIVEABILITY: ADDRESSING OVER CROWDED LIVING CONDITIONS AMONG URBAN MIGRANTS

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ABSTRACT

The migration started 60000 years ago out of Africa; the homo sapiens dispersed across Eurasia. Migration is an everyday act; millions of people migrate to places yearly for a good life, well-being, escape from natural calamities and so on. Cities and Urban areas face a massive influx of population from migration; cities sometimes find it hard to accommodate these migrating people. Millions of people in big cities live without enough space and have a low quality of life. Climate change and urban sprawling make the living conditions worse in cities. In this article the internal migration data of people from 10 rural areas to a city from 2017-2022. Using this data by using regression, we find out the migration rate of the last five years and also the number of people expected to arrive in the city from the ten rural areas by 2023.Using Agent based modelling what kind of accommodation they choose is find out .The result from the study can be used for the city authorities to plan buildings in such a way that buildings are designed which is affordable which does not consume green field and also in such a sustainable way to promote climate resilience.

Corresponding Author: Jobin Josh

AN EXAMPLE OF THE COMBINATION AND POST-PROCESSING OF UAV PHOTOGRAMMETRY AND ULS DATA WITH GOUND-BASED IMAGERY AND MLS FOR USE IN REALITY CAPTURE 3D MODEL APPLICATION

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ABSTRACT

Choosing the right measurement technique and data acquisition method for generating high-resolution, realistic 3d models is challenging nowadays due to the abundance of passive as well as active sensors. One of the passive data acquisition techniques could be capturing images for photogrammetric processing using Structure from Motion (SfM) technology. RGB band images are further used to generate the textures on 3D models. SfM can be used to process images acquired from the air using a UAV (Unmanned Aerial Vehicle) or taken while on the ground. As for active systems, there can be distinguished, among others, LiDAR (Light Detection And Ranging) technology, which was applied in this study through the use of ULS (Unmanned Laser Scanning). The study involved the application of a GreenValley LiAir 50N laser scanner, which was placed on a DJI M300 RTK UAV. Images were captured using a DJI Zenmuse P1 full frame camera, which camera was also mounted on the UAV DJI M300 RTK. The photos were taken in five directions, nadir photos, where the camera was pointed vertically toward the ground, and oblique photos at an angle of approximately 45 degrees facing north, east, south and west. For ground-based images, it was used an iPhone 15 Pro Max equipped with a ViDoc RTK receiver and, additionally, it was performed MLS (Mobile Laser Scanning) using the ToF (Time of Flight) scanner technology of the iPhone 15 Pro Max. The purpose of the survey was to use different measurement technologies and different data recording format, data filtering and different types of ULS and MLS LiDAR data combinations, and photogrammetric data subjected to radiometric improvement. The study also presented the results in the form of photo realistic 3D models, point clouds and digital terrain models.

Corresponding Author: Tomasz Kozakiewicz

AN EXPERIMENTAL INVESTIGATION OF PRESSURE VARIATIONS IN DAM EMERGENCY OUTLET

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ABSTRACT

The ability to lower the reservoir water level as rapidly as possible to a certain level in an emergency is crucial for the structural safety and operational stability of the dam. Water discharge through the low-level emergency outlet at high water levels results in high velocity and pressure fluctuations, along with negative pressure in the outlet conduit. Cavitation induced by the significant pressure drop and pressure fluctuations may damage the structure. An excessive inflow of air into the air vent during emergency gate opening and closing may result in air pockets within the outlet conduit. The formation of air pockets and the occurrence of backflow of air compressed by water waves inside the conduit outlet may decrease the discharge capacity. To analyze the discharge capacity, pressure variation, and water and air flow behaviors in the outlet conduit according to the reservoir water head of up to 31 m, a series of hydraulic model experiments were carried out in this study. The cross-section of the outlet conduit consists of a rectangular cross-section of the upper half and a semicircular cross-section of the lower half. Experimental parameters such as the water level in the reservoir, as well as the opening rates of both the emergency outlet gate and the air vent inflow gate, were considered in the experiments. The results of the present investigation show that strong flow separations occur at the sharp edges of the inlet cross-section of the outlet conduit. A larger and rather stable recirculation flow region is formed along the bottom just downstream of the conduit inlet, while smaller but very energetic vortices are shed from the sharp edge near the ceiling downstream of the conduit inlet. These vortices strongly interact with the airflow inflowing from the air vent, resulting in significant pressure drops and fluctuations. Notably, the maximum magnitude of negative pressure formed near the ceiling downstream of the conduit inlet is comparable to the hydrostatic pressure induced by the water head of the reservoir. Under low water head conditions, free surface flow occurs throughout the waterway, while pressurized flow occurs without the formation of air pockets, even with the air vent gate fully open, in high water head conditions.

Corresponding Author: Joongcheol Paik

AN INNOVATIVE THREE-LAYER MEMBRANE SYSTEM INTENDED FOR THE RENOVATION OF WATER AND SEWAGE INFRASTRUCTURE FACILITIES EXPOSED TO AGGRESSIVE SULFATE ENVIRONMENT

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ABSTRACT

Progress in the repair and protection of water and sewage infrastructure currently focuses on the use of a modern and innovative material in the form of polyurea, distinguished by its fast hardening properties and versatility of use, applied with a spray gun using high-pressure pumps. The development of new building materials is part of an ongoing effort to meet stringent environmental, health and performance standards, with polyurea offering significant improvements by eliminating solvents and volatile compounds (VOCs). The application process includes a detailed protocol (technological regime), starting from inspection and cleaning, through drying, to the application of three layers: a base layer to block moisture, a middle layer of rigid polyurethane to strengthen the structure, and a final sealing and anti-corrosion layer. This method guarantees a monolithic structure without joints, increases strength thanks to the rigid polyurethane and speeds up the repair process, allowing immediate return to service after application. Specifically designed for use in aggressive wastewater environments, this system provides excellent corrosion resistance, making it an ideal solution for wastewater infrastructure components such as reinforced concrete wells, sewage pumping stations and tanks. The ability to adjust the properties of polyurea allows for personalization in terms of environmental aggressiveness, size of the protected structure and abrasion resistance, marking a significant advance in infrastructure maintenance technology.

Corresponding Author: Tomasz Pawlak

ANALYSIS OF SELECTED PROPERTIES OF MORTARS USING WASTE MATERIALS

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ABSTRACT

The development of environmentally friendly mix formulations in the field of materials engineering for the construction sector should be a priority, especially in the context of reducing carbon dioxide emissions. The cement manufacturing sector, a major source of CO2 emissions, may find an alternative in geopolymers, or mixtures based on natural aggregates. In line with the principles of sustainable construction, materials management and the use of recycled raw materials are key. The research conducted included geopolymer mixes using waste materials and cement mixes enriched with recycled fibers. Strength parameters of these materials, such as compressive and tensile strengths, were analyzed. The potential of using granite meal in geopolymers and fibers from wind turbine blades in cement mixes was considered. Preliminary results indicate a beneficial effect of these innovations. Geopolymer mixtures based on blast furnace slag and granite powder were tested. Different percentages of powdered granite were analyzed to determine the optimal mix in terms of strength properties. The powdered granite was a waste material from the stone industry. Such a solution is doubly important for the environment, since geopolymer mixtures do not contain cement and the waste is reused. A huge problem of the issue of waste management and recycling in the world has become wind turbine blades, whose service life is passing and must be replaced. Therefore, the use of finely shredded wind turbine blades in the form of fibers in blends is being considered. Initial tests were based on cementitious mixtures in order to be able to evaluate the usefulness and effectiveness of this innovative solution. The high compressive strength results obtained in both the issue of geopolymers with waste granite and cementitious mixtures with fibers from wind turbine blades motivate to develop the topic and deepen the research. The purpose of the analyses is to develop the optimal proportion of granite in geopolymer mixtures and to estimate the optimal fiber content. Modern technologies such as the ARAMIS high-speed camera system that monitors the destructive testing of the specimen and records photogrammetric data that allows deeper analysis of the test results at any time and anywhere on the plane of the test specimen are also being implemented in the research.

Corresponding Author: Daria Jasińska

ANALYSIS OF THE SUITABILITY OF PHASE VARIABLE MATERIALS FOR IMPROVING THE MICROCLIMATE INSIDE UNDERGROUND DOMESTIC SHELTERS

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ABSTRACT

Due to the war in Ukraine and the real threat of expanding the conflict, the issues of protecting people have become particularly important. One of the most important aspects is providing shelter for the population in the event of a direct threat. This threat may include not only armed conflicts, but also natural disasters (hurricanes, earthquakes, storms, fires), the effects of industrial accidents or air pollution. These may even be situations that do not have the characteristics of a natural disaster, of a small scope, e.g. those affecting households, i.e. destruction and the effects of violent atmospheric phenomena or the actions of vandals (burglary, robbery). Unfortunately, the number and availability of existing shelters that could be used to protect the population are far from sufficient compared to the potential demand (e.g. in Poland they can accommodate only a few percent of the population). This is why there is an increasing interest from private individuals in building their own home shelter.

The best protection against both violent atmospheric phenomena and shock factors is provided by completely submerging the structure in the ground. Such structures are also less exposed to direct hits, fire, fragments or blasts, e.g. in the case of a shock wave. To sum up, the deeper the shelter, the better the protection.

Such a facility should be able to provide safe survival conditions for a minimum of 30 days. The conditions for the ventilation system are strictly defined by the regulations for defensive structures. Protection against contamination is ensured by maintaining positive pressure inside the shelter and using special air filters. The ventilation system is characterized by significant limitations on the amount of external air supplied. The shelter should also be able to completely cut off the external air source for a period of 6 hours. Restrictions on the amount of air supplied from outside and the high density of people staying inside result in intense changes in internal thermal and humidity parameters. Increasing temperature and humidity may lead to extreme climatic conditions. Thermal comfort conditions can be so severely affected that physiological limits for humans are reached or even exceeded, making it impossible for residents to remain or survive in the shelter.

Given this situation, it is very important to try to maintain the most comfortable thermal and humidity conditions for as long as possible.

The aim of the article is to determine the parameters of the microclimate that may prevail in a home shelter buried in the ground. The authors focus on finding a solution that would improve these conditions. For this purpose, the suitability of phase-change materials as cladding is analyzed to extend the period during which the temperature inside the shelter will be within the thermal comfort range. The possibilities of conducting simulations using computer programs that can perform calculations related to heat transfer in the ground are also analyzed in order to best determine the microclimate parameters in the underground structure.

Corresponding Author: Anna Zastawna-Rumin

ANALYZING OF DELAMINATION IN SEMIRINGS ATTACHED TO NON-LINEAR ELASTIC TORSIONAL SPRINGS

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ABSTRACT

Layered inhomogeneous engineering materials are increasingly used in load-carrying structures. Delamination is one of the heavy problems in layered engineering structures since it largely affects their performance and reliability. This fact makes delamination an attractive subject of research in academic circles. In spate of all, there are many unresolved issues in the area of delamination, especially when the engineering structures have more complex geometry, time-dependent mechanical behaviour and boundary conditions. Another issue of interest is delamination under loading conditions that are functions of time. The current paper is focussed on analysis of delamination of a semiring engineering structure attached to non-linear elastic torsional springs that are situated in the semiring plane. The semiring has arbitrary number of circumferential layers made of non-linear viscoelastic materials that are inhomogeneous along the thickness. The semiring undergoes time-dependent bending rotation at a given cross-section. The delamination is treated from view point of the strain energy release rate. A methodology for determination of the strain energy release rate in semirings attached to torsional springs is worked out on the basis of analysis of the energy balance. The results yielded by this methodology are verified by extracting the strain energy release rate from the complementary strain energy. The study presented in the paper provides useful insights into delamination performance of semiring engineering structures which is a premise for enhancing the structural reliability. The effects of various parameters of the semiring geometry, inhomogeneity of layers, non-linear constitutive laws of torsional springs, external loading, number of springs and their locations are examined and clarified.

Corresponding Author: Victor Rizov

ANALYZING THE WINDOW-TO-WALL RATIO IN SCHOOL FACADES OF OSIJEK-BARANJA COUNTY IN CROATIA

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ABSTRACT

This study investigates the relationship between Window-to-Wall Ratio (WWR) and energy consumption in educational buildings, focusing on elementary and high schools in Osijek-Baranja County in Croatia. Given the substantial energy consumption associated with buildings and the imperative to mitigate environmental impact, early design decisions are crucial in shaping building performance. However, limited research exists on the energy performance of educational buildings despite their significance in providing conducive learning environments and promoting environmental consciousness among students. The analysis reveals a significant variability in WWR values and a strong link between WWR and cooling energy consumption, highlighting the impact of architectural design on energy demands in educational buildings. The findings underscore the importance of optimizing WWR to minimize energy consumption and enhance indoor comfort in educational settings.

Corresponding Author: Hana Begić Juričić

APPLICATION OF ADV METHOD FOR MEASUREMENT OF FLOW VELOCITY COMPONENTS IN THE MALINA STREAM

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ABSTRACT

In this article, the results of velocity profile measurements in a stream by using the ADV method (Acoustic Doppler Velocimetry) are presented. The measurements are carried out in the Malina stream (Záhorie lowland). The velocity profile was measured with using the three-dimensional ultrasound probe of ADV device - FlowTracker (SonTek/YSI). The obstacle, represented with 120-liters barrel, was installed into the stream and by this way the velocity profile was modified. First, the undisturbed velocity profile was measured and subsequently there was measured the modification of this velocity profile caused by the obstacle installation. Velocities were measured in the proposed grid of points; the same grid was used for both cases (without the obstacle, with the obstacle). The grid was created by verticals along the cross-section profile and by several value of depth in each vertical. The vertical lines were proposed in distance *1,25; 1,50; 1,75; 2,00; 2,25; 2,50; 2,75; 3,00; 3,25; 3,50; 3,75* and *4,00 m* from the right bank of the stream. Depth of points in each vertical were *0,15; 0,30; 0,45 m* from the water level of the stream. The results of the measurement is a database of v_x, v_y, v_z components in the grid points, from which it is possible to determine the velocity profiles of individual components or resultant of these three components of the point velocity. The measurement results confirmed the suitability and applicability of the ADV method represented by FlowTracker 3D to determine the distribution of point velocity components in the cross-section profile. This method, as one of the few ones, allows obtaining the values of the velocity components at any point of flow directly in the field conditions.

Corresponding Author: Radoslav Schügerl

APPLICATIONS OF LOW-CEILING PHOTOGRAMMETRY USING UAV TO VERIFY THE THICKNESS OF A MINERAL-ASPHALT PACKAGE

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ABSTRACT

Low-ceiling photogrammetry using unmanned aerial vehicles (UAVs) is becoming more and more widely used in engineering works. The use of this method is supported by the possibility of remote measurement quickly and at the same time with appropriate accuracy. UAV measurements are extremely useful over large areas, including construction sites. Such monitoring enables constant control of the progress of construction works, with the possibility of taking measurements.
In the research, the authors verified the possibility of using a tool such as a UAV in the inventory of road investments, i.e. to control the thickness of the mineral-asphalt package. A testing ground was used for this purpose.
Based on the raids performed before and after applying the mixture, the resulting dense point clouds were compared. Thanks to this, the actual thickness of the fresh surface was checked with the design assumptions. Results ranging from 9 to 11 cm were obtained, which indicates satisfactory compliance with the design.

Corresponding Author: Magdalena Wróblewska

ASSESSING THE RESILIENCY PRINCIPLES OF PRISHTINA, KOSOVO

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ABSTRACT

Prishtina is the capital city of Kosovo, which is an eastern European post-conflict developing country, struggling with radical changes regarding urban planning, society, and the political system. Urban planning in combination with local politics that lack visionary urban strategies failed in Prishtina's planning to direct the urban development and transformation of the past two decades toward resilient urban development. To confirm this hypothesis, Prishtina is studied using the city resilience framework developed by the Rockefeller Foundation and ARUP, consisting of four dimensions, twelve categories, and seven qualities, which serves as a tool to assess up-to-date developments of Prishtina in terms of resilient development. The results reveal extensive insufficiencies in terms of resilience, in the urban development, societal, environmental, and political aspects. However, there have been some positive aspects in terms of city's economy and technology developments. The findings presented in this paper can be used as a platform of information for the city administration and urban planners, based on which they can make informed decisions and develop future strategies and action plans to align with resilient urban planning goals.

Corresponding Author: Adelina Tahiri Nela

ASSESSMENT OF THE BEHAVIOR OF A MINERAL-ASPHALT MIXTURE WITH AN INCREASED CONTENT OF RECLAIMED ASPHALT BASED ON FIELD TESTS

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ABSTRACT

The need to protect natural mineral deposits used to produce road aggregates requires the reuse of materials contained in existing surfaces. A specific example of a material reuse policy is obtaining them from reclaimed asphalt from existing mineral and asphalt layers and using it to produce a new mineral and asphalt mixture. The use of reclaimed asphalt reduces the consumption of new aggregates and reduces the amount of new asphalt used in the mixture. Unfortunately, the asphalt contained in reclaimed asphalt has different properties than new asphalt added in the production of a new mixture. In order to assess the impact of reclaimed asphalt on the properties of the new asphalt mixture, it is required to conduct both laboratory and field observations and tests. The paper presents the results of research carried out at the research site, the aim of which was to observe two sections with surfaces with different asphalt layers. An asphalt mixture made of new materials (the so-called reference mixture) and a mixture containing 40% of reclaimed asphalt were observed. In research, among others: Fiber optic sensors were used to measure deformations in mineral and asphalt layers.

Corresponding Author: Magdalena Wróblewska

ASSESSMENT OF THE LEVEL OF DEMAND RESPONSE BASED ON HYDROGEN CHARGING STATIONS IN KOREA

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ABSTRACT

Hydrogen is an environmentally friendly energy that produces heat and electricity with high energy efficiency and does not emit harmful substances. It is already attracting global attention as a key energy for the transition to carbon neutrality. Recently, as the number of transportation facilities using hydrogen as a primary fuel has increased, it has become important to forecast demand with this in mind. In Korea, the 2019 roadmap to revitalize the hydrogen economy sets the goal of providing 67,000 hydrogen vehicles and 310 hydrogen charging stations in 2022, 850,000 hydrogen vehicles and 660 hydrogen charging stations in 2030, and 2.9 million hydrogen vehicles and 1,200 hydrogen charging stations in 2040. However, as of December 31, 2022, the number of registered hydrogen vehicles is approximately 30,000 and the number of hydrogen charging stations is 220, which does not meet the distribution target. The lack of hydrogen charging stations inconveniences hydrogen vehicle users, and hydrogen charging stations continue to experience deficits due to the lack of charging vehicles. Accordingly, in this study, based on hydrogen charging stations in Korea, the utilization rate of hydrogen charging stations and the level of demand response at charging stations were estimated by queuing theory. This is to evaluate the suitability of hydrogen charging station distribution.

Corresponding Author: Choong Heon Yang

BASIC DEVELOPMENT ATTRIBUTES OF MODERNIST ARCHITECTURE IN SOCIALIST YUGOSLAVIA

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ABSTRACT

Strong economical growth and multileveled development of the entire society that marked 45 years of existence of former state Yugoslavia transformed social conditions of previously non-developed and neglected rural state to the middle developed European country with significant urban, industrial, infrastructural and cultural progress and permanent rise of life standard. Intensive urbanization and construction of hundreds of thousands of residential units and hundreds of new settlements were realized thanks to massive use of numerous of prefabricated systems created and developed in Yugoslavia, designed and built in accordance to established high standards for housing design and construction technology. Related to the modernist ideas, architects and architecture had important role in changing of society, life conditions and way of life in general. Architecture was understood as one of the most representative reflections of proclaimed ideas for creation of new socialist society oriented to the wide spectra of human needs and public interests of the community. Predominant modernist orientation in architectural, urban design and planning approach wasn't uniform and boring, but characterized with freely defined individualism of architects and numerous architectural schools and directions of architectural thinking oriented to researches, innovations and different attitudes to tradition, internationalization, natural context, human-oriented design, art and visual expressions. Architecture of modernism was very often arrogant to context, urban and natural environment, but in case of Yugoslav modernism is significant and clear tendency of modernism to fully respect context of site topography, tradition of place, views, natural and climate conditions. Critical regionalism and organic modernism tendencies are legible from numerous examples, particularly in touristic architecture and existence of schools of architecture that were promoting modernist interpretation of traditional and vernacular architecture.

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BUILDING ON THE BUILD. UNFINISHED ARCHITECTURE AND CONFISCATED PROPERTY AS NEW PALINSESTO FOR THE CONTEMPORARY ARCHITECTURE

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ABSTRACT

«The co-presence of multiple temporalities opens a narrative space that includes the biography of each object, the context of its reuse, the intentions of those who wanted it and its reception. The materiality of objects, with the traces they bear of their events, welds these aspects together more and better than the eloquence of a text or the impact of a museum exhibition» (Settis, 2022, p. 491).
Over time, the designer has taken on the role of 'defuser' of bad practices that have changed the appearance of places through dynamics that have escaped the action of even the most attentive scholars of social and urban practices. The need emerged to ask we how to change course with respect to the multitude of anonymous, abandoned and unfinished spaces precisely because of the intrinsic potential of what has emerged as a residue, but which contains within itself all the potential of the repertoire (Tavoletta, 2023). As George Simmel wrote in his essay dedicated to Auguste Rodin when speaking of what appears unfinished, «If there were some truth in the theory according to which the user must repeat the creative process within himself, this could not happen more energetically than when the imagination of spectator must complete what is unfinished, transferring into him the productive movement between the work as it appears and what should be its final effect» (Simmel, 2007, p. 86). In fact, precisely in what is crystallized in time, the potential of the possible is present, the vision of a future that can come true in the eyes of the beholder. Pre-existence presents itself as Mary Shelley's Frankenstein where «you can give shape to dark and amorphous substances, but you cannot give birth to the substance itself» (Shelley, ed. 2015, p.5.).
This research aims to analyse the methods of good practices of designing with pre-existence, useful tools for imagining a new and poetic way of "building on the built".

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BULLRINGS: CULTURE, TRADITION AND DIFFERENCES BETWEEN SPAIN AND PORTUGAL

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ABSTRACT

Bullrings are emblematic places of the culture and tradition of each country where bullfights have been held for centuries. These events have been very popular in many parts of the world and have attracted thousands of fans over the years. Bullrings are considered by many to be cultural heritage and an important part of the history and tradition of many countries.

Bullfighting celebrations continue to be important in the culture and tradition of the towns. In many bullrings, bullfights have been prohibited, but, in other parts of the world, bullfights continue to be very popular and successful. However, in recent times, bullrings have been regarded by some as an inconvenient heritage site due to growing opposition to bullfighting and the banning of these events in some places.

The comparative analysis between Spain and Portugal, a country with a bullfighting tradition influenced by Spain, shows that Spain is the country with the most bullrings in the world today, while Portugal has more than 200 bullrings throughout its territory. There are cultural differences in bullfighting between Spain and Portugal, but, as a tradition, bullfighting has deep roots in both countries. Although they share similarities in terms of the practice itself, there are significant cultural differences in both countries. These distinctions can be established from the style of the bullfight, the death of the bull, the clothing of the bullfighters, the use of the horses, the music performed during the festival and the posture or attitude towards the bullfighting activity.

The importance of the resignification of bullfighting as cultural heritage is an integral part of the identity of many regions of Spain and Portugal and, protecting them, guarantees that this tradition is preserved and transmitted to future generations.

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CHARACTERIZATION OF LAMINATED BAMBOO LUMBER USING DIGITAL IMAGE CORRELATION IN MECHANICAL TESTING

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ABSTRACT

The purpose is to investigate the use of bamboo as an outstanding material in terms of sustainability in various technical fields, such as civil engineering. Therefore, the *phyllostachys pubescens* (“Moso” bamboo) culms are further processed into laminated bamboo lumber (LBL) to bring the material closer to technical applications according to European standards. The testing program was divided into three parts. First, LBL was examined in its initial condition. Computed tomography (CT) was used to detect pores and other defects. In particular, the visualization of potential bonding defects between the individual laminate layers of bamboo was of key importance, as this type of defect is expected to have a major impact on the mechanical properties of LBL. Afterwards, the bamboo specimens underwent mechanical testing, including compression, bending, and shear testing. The results were promising for the intended technical applications. The engineered bamboo product LBL exhibited strengths comparable to those of wooden products already used in the targeted areas. Material reactions were recorded during the tests using appropriate measuring devices. In particular, the digital image correlation (DIC) was used to record deformations and strains on the surface of the bamboo specimens. This measuring technology enabled a subsequent visualization of the influence of the applied loads, highly loaded areas (**Figure 1**), and resulting crack progression. During compressive testing, it was observed, that the failure of the specimens often began at the nodal area of the bamboo culm, still clearly visible in the engineered bamboo product. The moisture content of the specimens was determined using the oven-dry method, as the moisture has a proven influence on material properties. After completing the mechanical characterization, the third phase of the study began, including analytical tests of the damaged specimens. The focus was on examining the damaged areas and fracture surfaces to identify the operating damage mechanisms. The research indicates that LBL shows promise as a sustainable alternative to commonly used building materials. Further investigations are necessary to qualify the material for a wide range of applications.

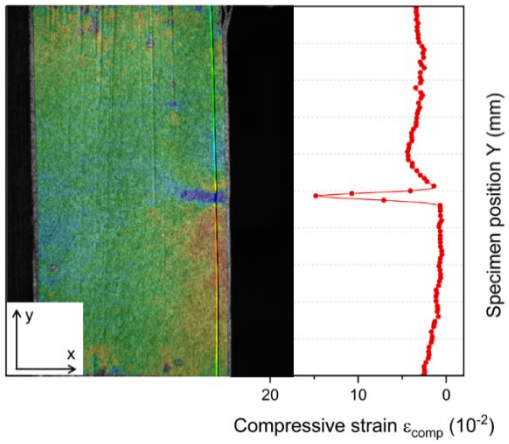

Figure 1: Identification of highly loaded areas during compressive testing of laminated bamboo lumber specimen.

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COMMON SOLUTION OF THE ENERGY DISSIPATION PROBLEM IN SHAFTS UNDER TIME-DEPENDENT ANGLES OF TWIST

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ABSTRACT

The load-carrying constructions in the civil engineering in many cases have members like shafts and axles that are under torsion. The material used for these constructions may have viscoelastic behaviour. This circumstance is an indication for the great importance of analysing of more aspects of viscoelastic work of shafts under torsion. The present paper deals with the energy dissipation problem in viscoelastic continuously inhomogeneous stepped shafts under time-dependent angles of twist. The shafts analyzed in the paper have circular cross-section. Common solution of the energy dissipation problem is derived. Statically determinate as well as statically indeterminate shafts are considered. The viscoelastic behaviour of the shafts is treated by models representing systems of springs and dashpots under time-dependent shear strain. The shafts are continuously inhomogeneous along the radius of the cross-section. Because of this, the shaft properties are continuously distributed along the radius. The common solution for the energy dissipation is obtained by analyzing the stresses and strains in the dashpots of the viscoelastic models (actually, this approach uses the fact that in models with springs and dashpots the energy is dissipated by the dashpots). An example illustrating the application of the common solution is presented. The dissipated energy is derived also by direct integration in the time domain for verification. The dissipated energy in the statically determinate shafts is compared with this in an indeterminate shaft. It is demonstrated that the common solution is applicable also when the shafts are under angles of twist whose number is less that the number of the shaft portions.

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COMPARATIVE ASSESSMENT OF DEFLECTIONS OF VOIDED REINFORCED CONCRETE SLABS

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ABSTRACT

This article presents a comprehensive comparative study of deflection voided reinforced concrete slabs, evaluating the results obtained through Finite Element Method (FEM) analyses of various accuracy and manual calculations, specifically employing the method of strips. Distinct methodologies used for analysis are:

FEM analysis using SCIA Engineer, where voids in the slab are accounted for by adjusting the modulus of elasticity and self-weight of concrete. The slab is modelled by using 2D slab elements, allowing for efficient and relatively fast examination of structural behaviour.

FEM analysis in ANSYS Workbench Mechanical, where voids are modelled within a 3D solid representation of the entire slab. This approach should provide the best representation of a real structure as it models all its elements with their respective physical attributes.

Results of FEM analyses would be compared not only to each other, but also with results of manual calculations, if possible. Calculations that are going to be used are based on the method of strips, a traditional approach for analysing deflection of reinforced concrete slabs.

The comparative analysis encompasses calculations of deflection of voided reinforced concrete slabs with various geometrical properties and boundary conditions. The findings aim to contribute to the engineering community by elucidating the strengths, limitations, and trade-offs associated with each respective type of FEM analysis, as well as manual calculations, when it comes to assessing the deflection of voided reinforced concrete slabs.

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CONCEPT, EVOLUTION AND SYMBIOSIS OF LANDSCAPE MICROCOSMS - FROM CONVENT FENCES TO SUBURBAN VILLAS

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ABSTRACT

Landscapes have always played a fundamental role in shaping local, regional and national identity. They involve a combination of productive needs, cycles, and rhythms of growth that challenge morphologies, flows, and continuities. As an integral part of the landscape, human beings intervene and add utilitarian, symbolic and artistic dimensions, recording memories and defining identities. Sensations, experiences, sounds, aromas, flavors, and surroundings are associated, offering harmony and repositioning in the world.

Experience and layout, regardless of place, time and cultural context, reveal spaces where aesthetic and spiritual satisfaction, production, and recreation are reconciled. Contextualized interpretations of the ways in which the landscape has been used and occupied give rise to unique places where landscape and architecture complement each other harmonious. The multiplicity and spatial diversity stand out, in which buildings, gardens, productive areas and woodlands are organized to create versatile places where production and recreation share the same space, invading each other, and where nature is an object of pure contemplation.

This results in a model for transforming the landscape, as it promotes the multifunctionality of the landscape: production, protection and recreation. Beyond the conception of a structure that organizes a space and sculpts the territory, giving it a certain character and partiality, conditions are generated for the character of the place to emerge - the creation of the ideal landscape. Considering the heterogeneity and multiplicity of variants that make up the landscape, we expanded the reflection by studying the structuring, compositional and program principles of the Convent Fences and Suburban Villas, their relationships and strategies of implantation and integration in and with the landscape. Universes that are a way of enriching and deepening contemporary culture.

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CONCRETE PROJECTION IN MINES. ASSOCIATED RISKS

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ABSTRACT

This article analyzes the risks associated with the application of shotcrete in underground mining galleries, from the point of view of occupational health and safety. In this way, with the awareness of the risks in this activity and in this environment, it is possible to improve and even optimize the behavior of workers to avoid possible accidents during its application. To this end, a cross-sectional study was carried out using direct observation. The data collected were entered into the IBM SPSS 28.0.1.0 (IBM Corp., Chicago, IL, USA) software and subsequently a descriptive analysis was carried out to respond to the objectives of the study and obtain correlations between the verified factors.

To achieve the objectives, bibliographical research was carried out on the topic and international regulations served as the basis for the study. After identifying the dangers and possible causes of accidents or risks, the factors that make up the simplified Risk Assessment methodology were quantified.

This activity carries health risks, such as lung disease due to inhalation of silica contained in the cement. Therefore, the use of protective equipment, such as a hood with a supply of clean external air or masks that completely filter the smallest particles, as well as worker's rotation are of great importance.

This work is original because there is not much literature about the use of this technique in works in underground galleries, with the thermal issue of the environment as the biggest limitation, in contrast to open-air works, where the use of this technique is more common.

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CONSERVATION-BASED METHODOLOGY FOR SULEYMANIYE WORLD HERITAGE AND RENEWAL SITE PROJECT: 'LIVING SULEYMANIYE' APPROACH

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ABSTRACT

The city of Istanbul, a timeless amalgamation of rich history and diverse cultural influences, has harboured various communities and civilizations since its inception. This paper presents methodologies established for the preservation of the Suleymaniye District, one of the World Heritage Sites of the historic peninsula of Istanbul.

Due to its geographical positioning, Istanbul serves as a bridge across different eras, from hunter-gatherer societies to the present, encapsulating a myriad of life dynamics both above and below ground. Recognizing the importance of preserving this historical tapestry for future generations, the planning of Istanbul necessitates conservation-focused strategies. Four distinct regions, including the Historic Peninsula, Sarayburnu and its surroundings, the Suleymaniye Ottoman Residential Fabric, and the Zeyrek Traditional Neighborhood Fabric with its Black Walls, have been acknowledged on the UNESCO World Heritage List. However, the implementation of conservation measures is imperative due to national and international obligations.

The Suleymaniye District, designated as a renewal area in 2006, has undergone a transformation from individual to collective ownership, resulting in substantial losses within the heritage site. To address these challenges, the Istanbul Metropolitan Municipality (IMM) initiated a conservation-based study in 2020, led by the Cultural Heritage Department (IMM Heritage), focusing on reclaiming the Suleymaniye District. This comprehensive study encompasses a 9-hectare timber housing fabric, where two-thirds of the authentic structure has been lost over time. Utilizing a multidisciplinary approach, the project employed comparative examinations to delve into the city's layers, enabling the development of conservation-based strategies for both above-ground and underground cultural assets.

The uniqueness of the study lies not only in its operable system across scales, integrating historical visual and textual sources comprehensively through oral history readings, but also in the search for "authenticity" within the lost texture through these researches. Furthermore, these studies establish the basis for identifying historical continuity, uniqueness, and inherent values that inform contemporary planning approaches. Additionally, the project proposes potential underground cultural asset areas, outlining priority research and conservation actions.

In conclusion, the study aims to create a 'living Suleymaniye,' enriched to meet contemporary living conditions. The holistic conservation method, developed by a multidisciplinary team, spans from the city scale to the building scale whilst embracing archaeological findings and ensuring a comprehensive approach to preserving Istanbul's cultural heritage.

Firstly, we will introduce the current conditions of the Suleymaniye District with a special focus on their historical narratives. Later, we will explain in detail the methodology established for inter-scale and multidisciplinary evaluation of the data gathered for the site. Further, we will describe the approaches established for the preservation of the World Heritage Site. Finally, we will discuss the results of these methodologies through cases within the designated area.

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CONTINUOUS VIBRATION MONITORING SYSTEM IN THE WARSAW METRO AS AN EXAMPLE OF REDUCING EMISSIONS TO THE ENVIRONMENT

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ABSTRACT

The launch of the first finish line in Warsaw was a great event that significantly alleviated the capital's traffic problems, but it also resulted in the emergence of new problems. One of them is the vibrations produced by passing trains in the tunnel next to residential buildings. The problem appeared "with some delay", after approximately two years of operation of the new Metropolis type wagons (previously only Russian-made wagons were used). The residents of Niepodległości street were the first to find out about it. There where after a series of articles in the local press there was a need to identify the cause of the troublesome vibrations. The basis for all assessments and analyzes of the impact of vibrations on buildings and people staying in them are vibration measurements carried out appropriately. Also, forecasts of such impacts and assessment of the environmental impacts of dynamic investments depend on the results obtained from vibration measurements carried out ad hoc in a given case or collected in measurement databases. Thus, the results of monitoring the impact of vibrations on the environment, the results of the above-mentioned assessments and analyzes are significantly dependent on the reliability of the results obtained from vibration measurements. Obtaining reliable measurement results requires the use of specialized equipment for measuring building vibrations in the low-frequency range, and those performing such measurements should have specialized knowledge and experience in performing vibration measurements in buildings. The aim of the research was to determine the impact of metro trains on buildings located in Warsaw at Niepodległości street together with an assessment of these impacts on buildings and especially people in buildings. In this publication, the author presented the results of his own research conducted over the years in the Warsaw metro, as well as the origins and selected results of the continuous vibration monitoring system implemented in the Warsaw metro.

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DEBRIS FLOW MANAGEMENT IN AN ARID REGION, ATACAMA DESERT

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ABSTRACT

The study area, Tacna, Peru, is located at the head of the Atacama Desert; in the south of Peru and north of Chile, whose availability of water to satisfy basic demands is increasingly scarce, but at the same time due to the effects of climate change, in recent years there have been exceptional rains generating debris flows causing damage to the population and significant economic losses. In this sense, our objective is to propose an adequate management of these disasters based on the historical evidence of the last decade of debris flow events in this region. This study was based on describing the assessment variables such as precipitation, water levels in reservoirs, among others, to characterize and describe climate change. In this sense, the selected research design is transactional, descriptive in order to investigate the incidence and the values in which the variables are manifested, characterizing their temporality. In the period 1911 to 2022, several flood events and debris flows occurred in the study area, causing direct and indirect damage to the population and urban and rural infrastructure. However, there is currently no plan with a medium and long-term vision that incorporates structural and non-structural measures to mitigate upcoming events. According to the historical information on abrupt changes in the normality of climatic variables and the presence of the ENSO phenomenon, as well as the identification of events classified as debris flow, we can conclude that our ancestors were very clear about the effect of the natural conditions of the hydrological system and developed their agricultural activities and human settlements in less vulnerable places. They used high terraces above the level of the rivers and dry streams, so that in the event of extreme precipitation events they would not suffer the impacts of nature. Under current conditions, we must affirm that these lessons from our ancestors and the recent evidence of the debris flow were not fully learned, and in the 21st century, we continue to expose ourselves to these events, we develop human settlements at the bottom of the ravines, we make agriculture on river flood terraces, we build roads without crossing elements for dry ravines, among other aspects. In this sense, there is an urgent need to propose a structured risk management program in the face of these events, based on the past information provided by the historical records of the debris flow.

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DEVELOPMENT OF A HYDROGEN CHARGING STATION INSTALLATION GUIDE CONSIDERING THE ACCESSIBILITY OF HYDROGEN VEHICLE DRIVERS

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ABSTRACT

Since 2019, research on hydrogen supply policy and infrastructure development to revitalize the hydrogen economy has been underway in Korea. As the number of hydrogen vehicles increases in the future, the expansion of hydrogen charging stations is required. Developing appropriate size and location guides for hydrogen charging stations is a priority goal when building infrastructure that incurs enormous costs.

In this study, we developed a guide for installing charging stations within efficient travel routes through analysis of domestic traffic volume for hydrogen vehicles. Analysis of vehicle traffic volume data was conducted for highways across the country, and the time range up to 2040 was considered.

The main assumption is that in order to efficiently respond to charging demand, charging facilities were built at existing highway rest area facilities and gas stations rather than at new locations.

The direction of the recent government policy ('19 government), which plans to install and operate hydrogen charging stations mainly at highway rest areas, was taken into consideration. In addition to considering the possibility of long-distance driving of hydrogen vehicles, characteristics such as use as freight vehicles were reviewed from a logistics perspective.

Through this, (1) candidate areas for new charging stations, (2) installation of mobile charging stations, and (3) installation of horizontal charging stations on highways in Korea. (4) A vertical (liquefied) charging station installation method was presented.

Through this, it was confirmed that it may not be reasonable for the highway to detour the route for charging, and therefore it is important to place charging stations within the route that can serve the largest number of customers.

It has been proven that arranging supply differently considering demand and the maximum capacity of the charging station is reasonable under limited overall supply, and at the same time, mobile hydrogen charging can be an alternative for areas with low demand but need for supply.

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DIGITAL IMAGE CORRELATION AS A NON-INVASIVE METHOD FOR DETERMINING DISPLACEMENTS AND DEFORMATIONS IN CEMENT COMPOSITE SAMPLE

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ABSTRACT

Digital image correlation is a modern method used at the laboratory. Authors use this technique to monitor strength tests on cementitious composites. The recording of the test process offers the possibility of repeated analysis of the data obtained, which allows the mechanical properties of the materials to be determined accurately and critical zones in the samples to be identified. The paper discusses the following items:
- a discussion of the differences between traditional strain and displacement measurement methods
- testing process - a description of steps in the testing process using DIC, including specimen preparation, camera and software calibration, image capture during testing, and analysis and processing of the collected data.
- applicability of the method - an analysis of the requirements associated with the preparation of the test site and specimens for testing using DIC, including aspects relating to the graphical preparation of specimen surfaces and the stability of lighting conditions.
- presentation of the advantages of the method.
Measurements of strain or displacement, require interference with the specimen by attaching external measuring sensors or internal strain gauges to the specimen. Digital image correlation allows values for these features to be determined non-invasively. However, this modern tool requires appropriate preparation of the sample surface in terms of graphics. The software processing the camera-derived images compares them and determines the values of the respective changes. For this reason, it is important that the surface is covered with a pattern that is unique and independent of direction. This makes it possible to distinguish areas on the sample and to trace changes in the position of specific points on the sample. It is also important to maintain sufficient image contrast, which is why patterns in the form of black spots on a white background are most commonly used. Traditional methods only allow values to be read in previously fitted strain gauges. Readings in others require repeated tests on subsequent samples, which requires additional materials and time. Digital image correlation allows values to be read at different locations on the samples , as it allows virtual extensometers to be created in the software. This makes it possible to check multiple locations and determine the most stressed zone, as opposed to conventional practices, where pre-determined reading locations are assumed. This method does not run the risk of damaging the sample or sensors by mounting them. Digital image correlation is based on the measurements of a camera or cameras creating a 2D or 3D image. A definite advantage of this method is the possibility of post-processing the data and re-analysing the test run, due to having a record of the images of the individual frames over time. The first step is the aforementioned sample preparation and calibration of the camera and software. Care must be taken to ensure that the lighting conditions are stable. With the sample and test stand prepared in this way, it is possible to proceed to the main stage, which is the execution of the test with simultaneous image recording. The final stage is the analysis of the images, the reading of values such as strain or displacement and data processing.

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EARTHQUAKE LOSS ESTIMATION MODEL FOR ALGERIAN BUILDING CONTEXT

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ABSTRACT

To predict the potential losses, before occurrence of a given natural hazards such as earthquakes, as well as to evaluate the damages once the earthquake has occurred is still a scientific challenges to deal with.

Algeria is located in an active earthquake area that has experienced several strong to moderate earthquakes during the last years. The experience of these events showed that the adequate intervention measures was done after the first in situ inspections, which may take long time to provide information and therefore decreases the chance of saving lives. In order to enhance the quick response and emergency operation, disaster mitigation measures can be done.

The present work consists on a development of an integrated earthquake loss estimation model allowing to estimate the probable seismic damage and their spatial distribution in an affected area by a potential earthquake, according to the existing building context in Algeria. This framework combines a seismic damage assessment approach developed for existing building in Algeria and a GIS system, in order to automatically generate relevant damage maps for decision-making and rescue purposes. This model allows prediction of the expected damages in a given exposed urban area, for a given earthquake scenario according to the signals derived from the GMPE (Ground Motion Prediction Equations), enabling to take the adequate preventive measures. Moreover, it can assess post seismic damages, in the immediate aftermath of an earthquake since its location, magnitude, registered seismic records are already available, which will help to locate the areas expected to be the most affected, and will support the adequate emergency strategies and adaptation pathways. This model arises as a decision-making tool which constitutes a contribution in the urban planning field and crisis management in Algeria.

As it is potentially exposed to significant seismic risk, the urban site of Blida city (Northern Algeria) which represents an important architectural and historical heritage is considered as pilot case.

The results indicate that significant damage and total destruction are anticipated, particularly in the oldest districts characterized by an urban heritage of old unreinforced masonry buildings dating from the 16th to mid-20th centuries. Conversely, less severe damage is expected for newer constructions built during and after the latter half of the 20th century, as they adhere to structural design standards and are constructed on suitable soils.

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ECOLOGY IN THE CONTEXT OF SUSTAINABILITY

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ABSTRACT

Sustainable development and sustainability itself is a very complex concept that combines and intertwines environmental, economic and social areas. The first mentioned environmental area is very important and dominant in this context, as the other two areas can be compensated in a certain way compared to the factors and resulting consequences that have a negative effect on the environment, which are often irreversible. Current trends in environmental care and ecology itself are characterized by the principles of complexity, integration, interdisciplinarity and transregionality. Within ecology, in connection with sustainability, there is also the so-called environmental management, which represents a set of technical tools and methods of environmental management, based on the identification of environmental aspects of products, activities and services of any type of organization, with the aim of adopting and implementing effective proactive measures to reduce them negative impact on the environment as such. The benefit of solving these topics is not only in the area of enlightenment and naming starting points, but also in bringing closer and establishing contexts for possible future research activities. The aim of this article is to define the basic principles and connections within the solved issue of ecology and sustainability as a prerequisite for meeting the needs of the present without jeopardizing the demands of future generations within the framework of sustainable development.

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EFFECT OF BIODEGRADABLE DEXTRIN LU-1400-2 ON SELECTED PROPERTIES OF CEMENT MORTARS

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ABSTRACT

This paper presents the results of a study on the effect of fully biodegradable modified starch in the form of LU-1400-2 dextrin (denoted as d2) and two commercial plasticizers P1 and P2 on selected properties of cement mortars.
The studied cement mortar was enriched with 0.25%, 0.30%, 0.35%, and 0.40% of d2 dextrin, relative to the weight of the cement.
The tests conducted indicate that the admixture of dextrin to cement mortars results in an increase in strength (a 9% increase was observed with 0.25% dextrin) and liquefaction of the mixtures. Whereas, commercial plasticizers were found to decrease compressive strength.
Starch derivatives are a type of natural plasticizer that are more environmentally sustainable than other types. They are produced from renewable sources, such as plants, and their production generates less waste and involves low greenhouse gas emissions. They are produced from renewable sources, such as plants, and their production generates less waste and involves low greenhouse gas emissions. Preliminary studies suggest that dextrins have great potential as natural plasticizers. The increasing popularity of natural plasticizers in the chemical and construction industries is due to a growing interest in sustainability and concern about the harmful effects of traditional chemical plasticizers.

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EFFECT OF WMA ADDITIVES ON ASPHALT AGEING – CASE STUDY

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ABSTRACT

One of the main trends in road construction today is the desire to ensure greater durability of asphalt pavements. The observed increase in road traffic load, especially the increase in the overall structure of heavy truck traffic, and the impact of unfavorable climatic conditions such as long-term high summer and low winter temperatures and the impact of rain and snowfall contribute to the reduction of the durability of asphalt surfaces. An important material factor that also reduces the durability of asphalt surfaces is asphalt aging. In the process of producing the mineral-asphalt mixture, it is exposed to high temperatures ranging from 165°C to even 200°C, which contributes to the loss of the viscoelastic properties of the asphalt. This process deepens during the exploitations of the asphalt pavements, which is exposed to solar radiation and atmospheric waste. To prevent asphalt aging, work is carried out on its modification using e.g. polymers and various types of chemical additives, as well as the use of technologies in which asphalt can be used to produce a mineral-asphalt mixture at a reduced temperature. The most effective solutions of this type include water-foamed asphalt technology. In order to limit the aging of the 50/70 asphalt, synthetic wax dosed at 1.0%, 1.5%, 2.0% and 2.5% by weight and a surface-active agent at 0.2%, 0.4% and 0.6% by weight in relation to the asphalt. The influence of additives on 50/70 road asphalt was tested before and after the water foaming process. The change in the basic parameters of asphalt after technological aging RTFOT and operational PAV was analyzed. A significant impact of additives on the aging process of 50/70 asphalt was found. However, synthetic wax has a more intense effect on 50/70 asphalt and slows down the aging of the binder to a greater extent than when a surface-active agent is used. However, the use of 50/70 asphalt additives before foaming it with water has an even more beneficial effect on slowing down the aging intensity of the binder. To sum up, the use of synthetic wax and surface-active agent as additives to asphalt foamed with water will not only contribute to limiting the aging of the binder and the durability of the asphalt pavements, but will also play an important role in obtaining more environmentally friendly asphalt mixtures as a result of reducing the technological process temperatures their production.

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EFFECT OF SHEAR WALLS LENGTH ON THE BEHAVIOUR OF REINFORCED CONCRETE STRUCTURES

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ABSTRACT

The capital city of Algeria, Algiers and its around is renowned of being a high seismic area. It suffered a large number of seismic events such as Orleans Ville earthquake (Ms¼6.7) which caused over 1,200 deaths in September 1954, El-Asnam earthquake (Ms¼7.2), which caused over 2,640 deaths and damaged more than 20,000 buildings in October 1980 and the 21st May, 2003 earthquake that occurred in Boumerdes and caused 2,278 deaths and 11,450 injuries, and left 250,000 people homeless. Post-seismic observations revealed that, the most affected building were residential constructions which consisted of reinforced concrete frame structure with brick infill walls. In order to reduce risks related to this type of construction, the revised version of the Algerian seismic code, RPA 99 V 2003, limited the usage of reinforced concrete frame structure with brick infill walls for structures up to two stories or 8m height. Otherwise, the usage of shear walls is mandatory to undertake totally or partially the lateral seismic loads. As a result, engineers adopted a new construction system where they use small length shear walls arranged in L shape at the corners of the building. In this study, a series of linear and nonlinear numerical analysis of a typical three stories building, that is usually constructed in Algeria, were performed to assess the effect of the shear wall length on the behaviour of Reinforced Concrete (RC) frame structures. It was noticed that the shear walls which comply with the minimum length and thickness required by the Algerian seismic code, RPA 99V 2003, take fewer lateral loads than the columns. However, for shear walls that respect the minimum length given by Fardis et al. (2009), the majority of the lateral loads is resisted by the shear walls. Furthermore, the Pushover analysis shows that the increase in the shear wall length increases the capacity of reinforced concrete frame structure to resist lateral loads.

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EFFECTIVE BUILDING OPERATION TROUGH THE BUILDING'S DIGITAL TWIN – CASE STUDY

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ABSTRACT

In recent years, many industries have moved forward significantly in terms of digitisation. However, the construction sector is lagging far behind. A suitable solution to move the construction sector forward is the use of the Building In- formation Model (BIM). A building model developed in this way can be used not only for design and construction, but in recent years it has been shown that this model has the greatest benefit in the management and maintenance of t h e building itself. Thanks to modern support tools, it is possible to prevent failures in time and thus prevent the building from being decommissioned. In this context, this paper focuses on supporting digital tools such as: the in- formation model of the building, applications for building management and maintenance, which can be linked to the information model of the building to obtain a "living" building, which can be called the digital twin of the building. This paper also includes a case study that just deals with the connection of an existing building during management and maintenance with a BIM model. The aim of this paper is not only to increase the progress of digitalization in the building sector but also to show what benefits digital tools bring with them what are the future lines of research and what are the challenges associated with this issue.

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ESTIMATION OF POWER REQUIRED BY BELT CONVEYOR MOTORS UNDER VARIABLE LOAD CONDITIONS USING SUPPORT VECTOR REGRESSION

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ABSTRACT

The use of information technology in modern industry is becoming increasingly important to ensure the failure-free operation of devices. This paper describes methods to predict the required power of conveyor motors based on historical data, the current values of selected sensors, and the distribution of mass transported along the conveyor belt. This article studies the behavior of the conveyor belt, located in the Sichuan region of China. The overland conveyor (OLC) is the first in a system of three in-line overland conveyors rated to carry 2400 tons of limestone per hour over a total horizontal length of 12461 meters. Although the local environment of the latter two conveyors has a simple topology, the OLC encounters very hilly terrain.The article describes the tested installation, and the acquisition and processing of the unique data set. Values are predicted using machine learning algorithms. This process produces results that are correlated highly with the real-world measurements of engine power. The results indicate that machine learning models can be used to accurately predict the operational sensory data of real-world machines. Thus, this approach can be used to determine the general operational health of such machines.
Additionally, due to the geometric division of the conveyor route, anomalies such as increased transport resistances can be detected. Furthermore, the degree of wear of the installation can be estimated by assessing the increase in resistance. Finally, the loads acting on the device can be estimated, and thus the remaining life time of components predicted.

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ESTIMATING SEISMIC PERFORMANCE FACTORS FOR A DUAL SYSTEM COMPRIZING OF BUCKLING RESTRAINED BRACE FRAMES AND INTERMEDIATE MOMENT FRAMES

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ABSTRACT

Dual structural system is referred when two different lateral systems are combined together to provide the lateral force resisting system for a building structure. For different structural and architectural reasons, dual systems are used in building structures. The most common types of dual systems include special moment resisting frames (SMRF) combined with eccentric braced frames (EBF) or buckling restrained braced frames (BRBF) in steel buildings and special reinforced concrete moment frames combined with special reinforced concrete shear walls in reinforced concrete buildings. Buckling restrained braced frame is a lateral framing system that are being used in high seismic zones. According to American Society of Civil Engineers (ASCE), a dual system is permitted between buckling restrained braced frames (BRBF) and special moment resisting frames (SMRF) where SMRFs must be capable of resisting at least 25% of prescribed seismic force. Conventionally, dual systems are utilized at high seismic zones. For moderate seismic zones intermediate moment resisting frames (IMRF) can be used instead of SMRF. But, ASCE does not provide any guideline to assess the structural responses when a dual system combining BRBF and IMRF are used in buildings located at moderate seismic zones. This research, shows a methodology to calculate the seismic parameters like Response Modification Coefficient (R), Over-strength Factor (Ω) and Deflection Amplification Factor (C_d) which are not described by ASCE or FEMA guideline. Several archetype sets of building structures are designed following FEMA guidelines with modified R as trial values for different seismic zones. To validate the trial values for R, system over-strength and period-based ductility, nonlinear 3D static (pushover) analyses were performed.

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EVALUATING GEOTECHNICAL PROPERTIES OF COHESIVE SOILS THROUGH SPT AND LABORATORY TESTS IN SUCEAVA SIRET MOTORWAY LOT 4

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ABSTRACT

This study investigates the correlation between Standard Penetration Test (SPT) N-values and laboratory-derived geotechnical parameters for cohesive soils in Suceava Siret Motorway Lot 4. The research focuses on a detailed comparison of in-situ and laboratory test results to enhance the understanding of soil behavior for effective geotechnical engineering and foundation design in the region.Data were collected from 51 boreholes drilled to depths ranging from 6 to 30 meters. The lithology of the site comprises silty clay, sandy clay, clay with gravel, and sandy gravel, predominantly found between depths of 5 to 15 meters. Laboratory tests were conducted to determine key geotechnical parameters, including cohesion, liquid limits, compressibility, and shear strength.

The study aims to establish significant correlations between SPT N-values and these laboratory-derived parameters. Initial findings indicate that SPT N-values can reliably predict soil strength parameters such as cohesion and shear strength. Additionally, the study examines the relationship between the plasticity index and liquid limit to provide practical methods for estimating liquid limits based on plasticity index data.

Understanding the theoretical differences between in-situ and laboratory tests is crucial. In-situ tests like SPT provide immediate, site-specific data under natural conditions, which can reflect the actual behavior of soils under load. Conversely, laboratory tests, conducted under controlled conditions, allow for precise measurement of soil properties but may not always capture the variability and conditions present in the field. By comparing these methods, the study highlights the importance of integrating both approaches to achieve a comprehensive geotechnical assessment.

This paper provides an overview of existing methods and guidelines in scientific literature for evaluating soil strength. It discusses practical issues contributing to soil strength in different regions based on cohesion and friction angle derived from SPT. The study also compares the correlation results of SPT with those from cohesion and friction angle, considering sample numbers and regional differences. Moreover, famous correlations from standard codes in the USA, Jordan, Japan, and the UK are reviewed. The comparison of these standards with local data reveals significant discrepancies, indicating that these standards may not be suitable for soil strength calculations due to regional variations in soil properties.

The research enhances the understanding of geotechnical properties in the Suceava Siret Motorway Lot 4 area, offering practical applications for foundation design and soil classification. The findings contribute to more accurate and efficient geotechnical assessments, supporting successful infrastructure development in Romania.

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EVALUATING THE EFFECTS OF INTRODUCING MEETING POINTS TO RIDESHARING SYSTEM IN LARGE URBAN AREA

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ABSTRACT

Ridesharing is one effective strategy to meet the increased travel demand caused by the rapid growth of populations and the recent trend towards urbanization in large metropolitan areas. Recent studies have leveraged optimization methods and machine learning models to enhance the process of matching multiple riders with similar itineraries. However, ridesharing strategy may increase traffic congestion, gas emissions, and passengers' discomfort due to detours for pickups and drop-offs.

To mitigate the adverse effects of travel detour, we advocate for a novel integration of designated meeting points within the ridesharing system. This approach provides direct travel route from a picked-up meeting point to a dropped-off meeting point without detouring. The locations of meeting points can be on the participants' origin and destination or situated on somewhere within an acceptable distance from their origin and destination. We established meeting points based on the spatial and temporal information of riders and drivers. Specifically, drivers can be affiliated with ridesharing companies or volunteers from the rider pool. We implement a mixed integer linear programming method, aiming to reduce the total mileage of travel detour and potential waiting time, and increase the comfort of passengers with an acceptable maximum walking time between origin/destination and picked-up/dropped-off meeting points. In the model, we simultaneously consider the travel comfort from the perspectives of traffic operators, passengers and drivers. Simulation experiments utilize large-scale travel demand dataset from an urban region to validate our methodology and the efficiency of transportation system is improved by introducing meeting points to ridesharing system. This research intends to offer a strategy and detailed information for planners and policy makers to intervene by incentivizing a conversion, even if partial, of improving the system-wide ridesharing services.

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EVALUATING THE EFFECT OF SWITCHING TAXI DEMAND INTO RIDESHARING MODE: A CASE STUDY IN CHICAGO

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ABSTRACT

Large and growing urban areas are dealing with an escalation of traffic congestion and all its consequences in terms of overall delay experienced by travelers. Ridesharing is a sustainable and practical method to reduce traffic congestion in modern cities. This paper analyzes and quantifies the macroscopic effects of converting a sizeable portion of the taxi rides from conventional direct point-to-point service to a ridesharing modality in a large metropolitan area, making use of an available large set of taxi data from the City of Chicago. We simulate and evaluate pros and cons of various scenarios of ridesharing modalities, starting with a pairing mode, with maximum two passengers, up to a full ridesharing mode, with four passengers per vehicle. In particular, we are aiming to maximize the reduction of total driven miles, yet ensuring an acceptable level of service to passengers by imposing maximum additional waiting time of 15 min and journey time increased by half compared to the traditional cab rides. Results are showing up to more than 50% less total driven miles with only an average of about 11% extra time on vehicle per passenger. Sensitivity analyses are performed to evaluate the effect of ridesharing capacity and service levels with expected yet now quantified trends. The following actions ordered by effectiveness will positively influence the total mileage savings: 1) increase the maximum number of passengers matched together to one vehicle, 2) Increase acceptance of an extra time in relation to the travel time, 3) Increase the waiting time availability of other passengers for ride sharing. The experiment aims to provide tools and detailed information for planners and policy makers to intervene by incentivizing a conversion, even if partial, of the taxi services into ridesharing service, presenting an opportunity to improve traffic conditions and the overall efficiency of transportation system.

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EVALUATION IN THE TRANSPORT SECTOR AND SDGS

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ABSTRACT

This paper aims to verify the impact of transport infrastructures and services on realisation the UN sustainable development goals. The purpose is to propose a methodological literature review of the evaluation tools, on one side, and an analysis of case studies referred to some European countries, in particular Italy and Poland with the geographic dimension of the urban scale. This research gives evidence to the most recent methodologies which help evaluators and policy-makers to measure the link between the transport endowment and public expense allocated on this sector and how they contribute to reach SDGs.
Therefore the research questions are: - how do we measure and evaluate the impact of the transport sector on SDGs? What has been done in Europe to reach the SDGs? Do we have best practices in Europe at urban level with regard to local transport?
The results highlight that the methodologies currently in use are extremely refined and allow us to capture the measurement of impacts and results in terms of SDGs. The scientific methodological review therefore helps us to select the right metrics for each local administration involved. Further, the results obtained indicate that the European Union countries have been improving their transport impact in the last years, even though there are still significant territorial imbalances. The case studies highlight these results. This is particularly true for those inefficient countries, whose results suggest they should improve the transport sustainability mainly by reducing the greenhouse gas emissions, and increasing the sharing mobility in favour of collective modes.

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EVALUATION OF HYDRO-METEOROLOGICAL CONDITIONS AT THE WATER RESERVOIR FOR SUPPLY OF DRINKING WATER IN THE PERIOD SINCE ITS COMMISSIONING

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ABSTRACT

Water availability changes in most European basins are estimated to be relatively small over the next 30 years. However, in the long term, most climate change scenarios assume an increase in average annual river flow and water availability in northern and eastern Europe. In contrast, the average runoff in southern European rivers is predicted to decrease. In particular, some basins in the Mediterranean region, which are already facing water stress, may experience a significant decrease in water availability. (European Environment Agency, 2020).

The World Health Organization (WHO) includes safe drinking water and its abundance among the basic attributes of a healthy environment. At the same time, this organization defines the rights of access to safe drinking water as one of the basic human rights. Although underground water sources are currently mostly used in the Slovak Republic for these purposes, also surface water sources - water reservoirs - are used to supply the population with drinking water.

In today's era of ongoing climate change, it is assumed that the total volume of usable water resources will decrease in this century, and thus the number, respectively, the length of dry periods without precipitation will increase. Providing the population with drinking water during these changes will become increasingly difficult, and water reservoirs will play a significant role in solving this problem. Currently, there are 8 water reservoirs on the territory of the Slovakia, which are used to collect water for the production of drinking water. One of them is the Turček reservoir, from which the districts of Žiar nad Hronom, Prievidza and Handlová are supplied with drinking water. It is located in central part of Slovakia, in the district of Turčianske Teplice, above the village of Turček at the confluence of the Turiec and the Ružová streams. This water structure was completed in May 1996 and has been in full operation since 1997. The construction also provides significant flood protection for the village of Turček and the area below the reservoir, especially the upper reaches of the Turiec stream. It is also an important water source for ensuring minimum flows. The accompanying purpose of the water structure is the production of electricity in 3 small hydroelectric power plants with a total installed capacity of 300 kW.

In this contribution, the hydro-meteorological data from the Turček water reservoir location, which were provided by the operator of this reservoir, are evaluated. These data contain information on daily values of basic characteristics. The period 1997-2021 was analysed, especially the development and trends of precipitation, air temperature, occurrence of a given type of weather during this period and ice cover thickness and duration. The analysis of hydro-meteorological data showed that the average annual air temperature is rising slightly, for the period 1997-2021 it rose by 0.03 °C. The ice cover thickness (both maximum and average value) shows a decreasing trend and decreased by 7.3 cm during the observed period. The same trend is shown by the duration of the ice cover on the reservoir surface. The frequency of precipitation events has been decreasing for a long time, the annual total of precipitation also has a decreasing trend.

The results of this study will serve as a basis for understanding the processes that affect the quantity and quality of water in this reservoir and their connection with ongoing climate change.

Recently, this reservoir also had a problem with the occurrence of cold-loving cyanobacteria. In the next step, changes in the distribution of water quality indicators, which also indicate the occurrence of these organisms, will be evaluated in detail from the collected data. The performed analysis of the development of hydro-meteorological conditions is an important basis for such evaluation and understanding of ongoing processes.

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EVALUATION OF THE BEHAVIOUR OF A MACROPOROUS MORTAR COATING WITH RESPECT TO RISING DAMP

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ABSTRACT

In historic buildings constructed with handmade brick or tile walls, one of the most frequent injuries is the deterioration of the masonry and cladding at the start of the walls as a result of the actions produced by water rising by capillarity, which causes degradation phenomena of the materials due to freeze-thaw cycles and the crystallisation of soluble salts. This is a recurrent problem that has a major impact on the world's architectural heritage, which is why research in this field is extensive and diverse and has focused on analysing different systems to keep the wall dry or at least reduce the water content. When the walls are covered with mortar, research is oriented towards the type of mortar used and its composition, looking for mortars that facilitate the drying of the wall. In the present research, a study was carried out to assess the behaviour of one of these high porosity, macroporous, hydraulic lime repair mortars, by means of laboratory testing of test specimens made with roofing bricks and thick mortar joints, imitating the construction of old masonry. The test specimens were coated with the macroporous mortar and with other types of mortar, cement mortar and lime mortar, in order to better evaluate the performance of the macroporous mortar compared to the other two types of mortar. From the study, it can be concluded that coatings with macroporous mortars behave differently from the other two types of mortar, especially when the masonry has not reached saturation and that they can help to maintain a lower level of moisture in the masonry before saturation is reached.

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EXPANSIVE SOIL BEHAVIOUR IN TERMS OF CLIMATE CHANGE

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ABSTRACT

Expansive soils show the ability to significantly change in volume (swelling/shrinkage) depending on changes in moisture content. The consequence of these phenomena is a deterioration of the geotechnical parameters of the subsoil resulting in its deformation. Climate change due to global warming is causing extreme weather conditions, such as droughts and heavy rainfalls. These phenomena can affect the properties of expansive soils, and consequently the durability and safety of structures.

This study aimed to analyse the influence of climate change on the swelling and shrinkage of clay soil. In Poland, the expansive soils cover a large part of the country. In this case, the samples were taken from a deposit of clay raw materials in the Lower Silesian Voivodeship. The main analyses were based on a review of meteorological data from the last four decades measured in the same area. On this basis, a significant increase in temperatures was found as well as in the number of days on which high temperatures persisted.

For the laboratory tests, the homogeneously compacted samples with an optimum moisture content, corresponding to the maximum dry density, were prepared. To reflect the trend of climate change over recent decades, samples were stored for five days in a climate chamber at air temperatures of 20°C, 25°C, 30°C, and 35°C, respectively. Additionally, to predict the behaviour of soil with further temperature increases, the samples were also stored at a temperature of 40°C. Then, the swell index (C_S) and volumetric shrinkage (V_S) were determined, which reflect extreme weather phenomena such as heavy rainfall/flood (C_S) and drought (V_S).

The laboratory test results have shown that an increase in air temperature increases swelling as well as shrinkage of the soil, leading to rapid changes in volume and deformation. For the swell index, the percentage difference between the values obtained for the temperature extremes (20°C and 40°C) was 15%. In the case of volumetric shrinkage, the percentage difference in volume changes of the samples between the lowest and highest storage temperatures was as high as 281%.

In conclusion, it was found that in times of intensifying extreme phenomena (droughts/ heavy rainfalls), the range of deformation of expansive soils increases with the air temperature. Taking into account forecasts assuming further global warming, this will lead to increasing deformation of the subsoil as well as structures, which is a serious problem in engineering practice.

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FORECAST MODELS FOR ROAD TRAFFIC NOISE IN THE YEAR 2050 AS A BASIS FOR THE DEVELOPMENT OF MEASURES TO REDUCE NOISE IN URBAN AREAS

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ABSTRACT

The German Climate Protection Act aims to reduce greenhouse gases. The focus is on harmful emissions, while noise, which can also lead to physiological and psychological disorders, has been neglected.
An effective transformation of the transport sector requires long-term developments in the economy, society, politics, and technology. The complexity of these future developments leads to high planning uncertainty. Therefore, the scenario technique is used as a method of futurology.
The aim of this research is to analyse the development of urban noise for the year 2050. The purpose is to provide an instrument for future planning of noise abatement in road traffic.
As a basis, key factors are identified, described, and analysed, whereby a long-term horizon and megatrends are considered. Taking into account greenhouse gas reduction measures, national transport scenarios and socio-economic scenarios are included in order to forecast the development of road traffic noise up to 2050.
Reference and stability scenarios are developed and the qualitative data from these scenarios are converted using statistical analysis into quantitative forecasts. The average traffic volume is calculated using multiple regression equations from the forecasts of traffic performance and traffic volume. The developments of the settlement-structural district types are determined by logarithmic trend lines.
Based on these forecasts, planning situations are created. They deal with typical situations in the development of residential areas. These situations are combined with various road traffic noise sources to form an application case and presented graphically for the future scenarios. These are fictitious development plans in the sense of urban planning, which can be traced back to real planning cases in the future. For each planning situation, a noise immission plan is also simulated and the noise level differences compared.
The noise immission plans for the year 2050 shows that without additional noise reduction measures, no significant reduction in noise levels can be expected. Despite the achievement of climate protection targets in the stability scenario, there are no perceivable differences in noise levels compared to the reference scenario. Therefore, noise reduction measures need to be increasingly considered in mobility concepts and transport development planning, as well as in spatial development planning.

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FORECASTING RIDE-HAILING DEMAND IN URBAN AREAS: A DEEP ENSEMBLE AND TIME SERIES CLUSTERING APPROACH

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ABSTRACT

This paper investigates the increasingly important task of forecasting demand for ride-hailing services, which have significantly disrupted traditional transportation models. Notably, the study concentrates on New York City's Yellow Cab service, which despite the surge in popularity of app-based services, continues to serve a substantial number of commuters. The study highlights the necessity of accurate demand prediction for efficient resource allocation, reduced wait times and improved user satisfaction. Traditional forecasting methods like Historical Average, Exponential Weighted Moving Averaes, ARIMA etc., are examined, alongside the more recent machine learning and data mining techniques, CNN-LSTM and XGBoost. A novel approach, utilizing an ensemble of machine learning models – XGBoost and Convolutional Neural Network – LSTM along with creative feature engineering is proposed for real-time demand forecasting across numerous locations. Furthermore, the study also tries to understand the application of time-series clustering methods and their effectiveness in grouping similar time-series together and extracting clustering features to improve the performance of the model. Additionally, the study observes the ineffectiveness of generalized model to forecast demand in low-demand reasons and presents possible research direction for solving the issue. This study contributes to the growing literature on demand forecasting in the ride-hailing industry and provides insights into the use of time-series clustering for the same.

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FROST EFFECT ON THE FOAMED CONCRETE-SUBSOIL SYSTEM BEHAVIOUR

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ABSTRACT

Foamed concrete has been known in the construction industry for more than a century. However, its application is mainly limited to use as a filling and levelling material. There are known examples of the foamed concrete application in road construction, industrial construction and, less frequently, in building construction. The low use of foamed concrete in the construction process (less than 5%) is related to the lack of knowledge of its behaviour and specifics. Moreover, there is no durability evaluation of this material and, above all, there is a lack of recognition of the properties and behaviour of the foamed concrete-subsoil (FC-S) system, especially in terms of adverse climatic conditions.

The study includes an attempt to identify the behaviour of the FC-S system in sub-zero temperatures that occur during the winter period. The analyses were conducted on samples of frost-susceptible soil with maximum dry density and on the three variants of the FC-S system with different volumetric densities of the foamed concrete layer. To reflect the most unfavourable conditions for frost-susceptible soils, the tests were performed in an open system with free water inflow from the bottom and freezing front from the top. The analyses were based on the currently prevailing climatic conditions in southwestern Poland during the winter period. Therefore, the meteorological data from the last four decades were analysed. On this basis, a significant increase in winter temperatures over recent years was found and the temperature of the last analysed decade was adopted for the tests.

Based on the research results, an increase in the height of the bare soil samples due to the formation of ice lenses was observed. Foamed concrete is characterised by good insulation and frost resistance. Therefore, in all cases of the FC-S system, the foamed concrete layer acted as effective ground protection from freezing and thus from the formation of ice lenses. The varying density of this layer affected the temperature distribution in the subsoil, but in all cases, the temperature in the ground was above zero.

To confirm the effectiveness of the foamed concrete in various climatic and ground conditions, further tests are necessary.

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GEOTECHNICAL ZONING MAP FOR AN INDUSTRIAL AREA IN THE CASTELO BRANCO REGION (PORTUGAL)

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ABSTRACT

Large-scale geotechnical zoning maps (≥ 1/10 000) applied to Regional and Urban Planning, and also to the expansion of cities into new areas, such as new industrial areas, generally follow the classic methodology, which corresponds to the presentation of a Geotechnical Units Map (GUM) in association with extensive tables with the characteristics of the various Geotechnical Units (GU). The GUs are defined based on the different lithological and/or lithogenetic types. The tables associated with the GUMs present the characteristics of the various UGs, from identification properties (particle size distribution, Atterberg limits, geotechnical classifications), in-situ physical parameters (unit weights, water content), shear strength parameters (cohesion and friction angle of soils, uniaxial compression strength in rocks), deformability parameters (deformability modulus and Poisson's ratio, primary consolidation indices and secondary consolidation coefficient). In addition to these parameters, it is common to find geological, geomorphological, geodynamic, and hydrogeological elements, with the development of certain specificities depending on each region. In the present case study, in addition to the GUM, in association with some tables with that vast set of parameters for the area studied, a Geotechnical Zoning Map (GZM) is presented, which is the result of a final document based on a methodology that the authors understand should always be used and standardized for this type of situation, i.e. the final map should be the result of overlaying three partial maps, or three layers, according to the following: 1st Layer – Topographic Map, with perfect reading not only of what is common in this type of maps, but also perfect reading of the urban fabric and road network and others; 2nd Layer - Classic GUM; this layer must be presented in classic symbology for the different lithologies, so that, when overlapping the previous layer, it is possible to observe both; 3rd Layer – GZM, which corresponds to a colour map, with relatively transparent colours, so that when overlaying the previous layers, it is always possible to collect information from the three layers; this last layer will have several colours, the main ones being red, green and yellow, which correspond respectively to Very Poor, Excellent and Intermediate Suitability, concerning Suitability for Urban/Industrial Occupation; other intermediate colours may be used, depending on the classification of each area under study. Therefore, the main objective of this paper is to present a case study with the above situations, but with the advance of applying a methodology that can be implemented with Geographic Information Systems to obtain colour zoning, which will be a consequence of overlaying 3 new analytical maps: i) bearing capacity map for foundations; ii) settlement susceptibility map, and iii) slope stability map. Each of these analytical maps is the result of immense calculations using the parameters of each geotechnical unit for the different places of the territory under study. It should be noted, for example, that different geotechnical units, one made up of clays and the other of sands, which are completely different, can fall under the same Geotechnical Zone. The important point is to define a zoning in which the territory of each zone has the same reaction to any similar action, following what is commonly used for the dimensioning and implementation of urban buildings and/or other similar ones: load capacity, settlements, and stability of the natural slope. Finally, the GZM of the area under study is presented, with an explanation of some final notes.

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HARNESSİNG TERRESTRİAL LASER SCANNİNG TECHNOLOGY FOR REMOTE ESTİMATİON OF CATENARY CABLE TENSİON

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ABSTRACT

In various engineering structures, such as steel masts, chimneys, and bridges, tendons frequently function as crucial load-bearing structural elements. Determining the cable tension in these structures can be achieved directly, typically through the utilization of a dynamometer mounted within the cable's structural system or through various indirect methods. While physical measurements employing a dynamometer offer precision, they are costly and necessitate direct contact with the cable. This approach can be cumbersome, requiring the use of numerous dynamometers corresponding to the number of tendons present.

One of the indirect methods for assessing cable tension in structures is grounded in the catenary theory. This mathematical theory relies on the configuration of a loosely hanging chain between two fixed points. Terrestrial laser scanning (TLS) technology facilitates the remote and effortless acquisition of data for three-dimensional modelling of the cable's shape. The main aim of this research is to showcase the viability of employing TLS technology to estimate cable tension forces in engineering structures. Tests were conducted on a specifically prepared test site, and tension force values, computed based on the catenary theory, were compared with direct measurements obtained using a dynamometer. The conducted research demonstrated a high level of consistency between the results obtained from direct and indirect measurements. The least squares method was employed to ascertain the mathematical function of the catenary based on the point cloud. The conducted research highlighted both the advantages and limitations of the proposed approach for determining cable tension forces using TLS technology.

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HORIZONTAL STIFFNESS OF CONFINED MASONRY WALLS

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ABSTRACT

The article is devoted to the issue of confined masonry walls. Using previous considerations regarding walls filling frames Jasiński (2022, 2023) presented at the WMCAUS 2022 and WMCAUS 2023 conferences. Confined walls are very commonly used in areas subject to seismic influences as an antidote to excessive cracking, displacement and loss of structure integrity. From a structural perspective, confined walls, similarly to walls in buildings with traditional wall construction, may, in addition to walls loaded mainly vertically, also act as a structure stiffener. The work presents an original proposal of an algorithm for determining the stiffness of a single span confined wall in accordance with the European design standards EN 1996-1-1:2010 and the draft Eurocode 6 (prEN 1996-1-1:2017) taking into account the provisions of the standards in force in the USA and Canada.

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IDENTIFICATION AND SUSTAINABILITY OF VALUES OF VERNACULAR ARCHITECTURE IN THE CONTEXT OF ENERGY EFFICIENCY

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ABSTRACT

The global pressure on structures built before 1945, often leads to their demolition or, in better cases, their renovation to meet the current energy efficiency requirements. The process of renovation addressing existing buildings is regulated by legislation and supported by state reform programs such as the Recovery and Resilience Plan. This process is established without regard for the protection of cultural and historical values, neglecting the complexity of sustainability. This phenomenon also impacts rural vernacular architecture, which forms the core of Slovakia's building stock.

This paper aims to propose a methodology objectively defining reasons for adaptation to enhance the energy efficiency of vernacular architecture and indicates the limits of new interventions in identical settlements with a typical rural character. The imbalance between preserving cultural and historical values and the application of new interventions to improve energy efficiency raises questions about identifying, categorizing, and weighting the values of vernacular architecture. The Harmonic Adaptation of Vernacular Architecture (HAVA) method follows three dimensions: cultural, climatic, and sociological.

The research utilized field surveys, historical research, and abstraction methods. The subject of the study was vernacular dwellings from western Slovakia, specifically from the Červený Kameň micro-region. By studying historical maps and visiting the area, representatives bearing authentic regional characteristics were selected. These archetypes of vernacular dwellings were selected, through abstraction method, based on the high degree of authenticity preserved in the envelope of the house.

The focus of the study was primarily on the envelope of the house, which embodies its character and significantly influences its energy efficiency. Considering that vernacular dwellings were built as passive houses, characteristic features were identified and became the subject of identification and protection, as they often disappear during renovations for the reasons mentioned. Features such as orientation towards the cardinal points, object's relation to the terrain, size of openings, thickness and type of masonry, and the shape (compactness) of the object were considered as the studied characteristics defining the "building substance of the archetype."

By examining the building substance of archetype dwellings in the context of settlements, changes in the volume of building substance, land use, and land utilization were identified. The analysis revealed changes in land use in the context of political and sociological changes related to lifestyle. At the same time, it was shown that significant alterations to the envelope of the examined houses were not yet done and therefore are suitable for soft interventions for adaptation that do not require significant changes to the character of the house. The envelope represents the most exposed part of the house, whose characteristic features represent bearers of identity and are in constant contact with users and the wider public. The proposed Harmonic Adaptation of Vernacular Architecture (HAVA) method presents a comprehensive framework for balancing energy efficiency requirements with the preservation of cultural-historical values and societal lifestyles, ensuring a harmonious adaptation process that aligns with environmental sustainability objectives.

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IMPACT OF FREEZE-THAW CYCLES ON COATINGS APPLIED TO THE SURFACE OF ALKALI-ACTIVATED MATERIALS

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ABSTRACT

This paper focuses on the possibility of application of selected types of coatings (synthetic and epoxy) on the surface of alkali-activated materials based on finely ground granulated blast furnace slag with admixture of cement by-pass dust and silica fly ash. Admixtures represent 30% of the binder component (15% fly ash, 15% cement by-pass dust). The mixture is activated with anhydrous disodium metasilicate. The samples were categorized into two series, namely samples stored in water and samples wrapped in foil. Following this, the surface of these two series was modified by two methods, namely brushing with a steel brush, and roughening with a diamond wheel. The properties related to the adhesion of the coating to the surface were investigated before and after 100 freeze-thaw cycles. The adhesion was determined by the cross-cut method and pull-off test for adhesion. In the cross-cut test, it was found that the synthetic coating was less susceptible to surface modification than the epoxy coating. The samples were exposed to 100 freeze-thaw cycles. Then, the cross-cut method was applied to the coated roughened surface and the results of this test were classified into category 3. During the determination of the adhesion of the coatings by the pull-off test on the roughened surface for both methods of sample storage, the character of breakage for the synthetic coating was of the cohesive type, thus it was the tensile strength of the materials, while for the epoxy coating it was the adhesive breakage, thus it was the adhesion between the surface and the coating.

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IMPACT OF GREEN INFRASTRUCTURE ON FLOOD PREVENTION IN URBAN AREA

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ABSTRACT

Intensities of short-term rainfalls are the basic design parameters for the dimensioning and design of urban drainage systems. However, in connection with climate change, there is a change in rainfall characteristics, which are represented i. a. also by increase of the short-term rainfall intensity. This means an increased hydraulic load on urban drainage systems, which can be resolved by increase of the drainage system capacity or by reducing the of rainwater inflow into the drainage system. Currently, within the framework of adaptation measures for climate change mainly the second option is preferred, i.e. reduction of the inflow into the drainage system. This has to be realized prioritizing the green adaptation measures (green infrastructure).

The paper deals with impact of the of green infrastructure implementation in urban drainage system on the operational safety of the urban drainage system from the point of view of the floods occurrence in the urbanized area. As shown by the results of the model study, the biggest effectiveness of green infrastructure in terms of preventing the occurrence of flooding is shown in case of short-term rainfalls with a lower return period (1-2 years). With increase of the return period (up to 10 years), the effectiveness of green infrastructure in terms of the occurrence of flooding decreases.

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IMPACT OF "IN SITU" RESEARCH ON ENERGY EFFICIENCY OF BUILDINGS

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ABSTRACT

The construction sector has been undergoing an energy revolution for several years. The emphasis placed by both European and global countries on reducing energy consumption in this sector is due to the fact that construction accounts for about 40% of total energy consumption. This, of course, involves huge emissions of carbon dioxide into the atmosphere, which translates into a dangerous rise in temperature. There is general agreement among scientists that the main cause of this phenomenon is the increase in atmospheric concentrations of greenhouse gases, such as carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), as a result of human activities such as the burning of fossil fuels, deforestation and agriculture. Among other things, climate change translates into melting glaciers, changes in precipitation, changes in vegetation and ecosystems, or threats to public health. Combating rising global temperatures requires action in a number of areas, including reducing greenhouse gas emissions by switching to renewable energy sources, efficient management of natural resources or, in the main, reducing heat loss in the building sector. The existing building stock generates very high energy consumption through, among other things, heat losses during the heating season through partitions, which were erected at different times and are currently characterized by high thermal insulation ratings. Properly carried out process of thermal modernization of partitions through thermal insulation can bring the expected results of reducing heat losses. In practice, however, thermomodernization activities are often performed inappropriately and inaccurately, which can result in the formation of thermal bridges that cause a reduction in the energy savings assumed by design. A tool that will allow the detection of thermomodernization execution errors are "in situ" tests such as thermal imaging tests, building envelope tightness tests or thermal comfort tests. In the article, the authors presented the most commonly used in practice "in situ" tests of buildings. The results from the measurements are presented. It was also presented how "in situ" surveys can improve the quality of construction work performed and how this translates into energy demand for both new buildings and buildings undergoing deep thermo-modernization. According to the authors, "in situ" as-built testing of the quality of construction work performed should be mandatory in construction practice.

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IMPACT OF MINING WASTE INCORPORATION AS FILLER FOR TOUT-VENANT AS ROAD GEOMATERIAL

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ABSTRACT

Mining waste generation is a growing issue along with management, disposal and recycling problematics. In addition, the environmental risks associated with mismanagement are soil erosion, water contamination and habitats destruction, besides significant economic costs. However, some mining wastes seem to be appropriate to valorise as geomaterials, mostly due to mechanical behaviour related to the extracted ore. Thus, using mining waste as a potential road material is a sustainable strategy for the construction industry and addressing the reuse issue.

This research aims to characterize and identify granite mining residue according to chemical and mineralogical composition, potential of contaminants leaching and physical aspects, then, to incorporate such as filing for granular road materials within different ratios of waste (0%, 25%, 50%, 100%) and with different particle sizes (>0.063 mm, >0.400 mm). The samples created have the designation exemplified by MW25%(0.063) which corresponds to 75% of granular soil + 25% of mining waste passed through a sieve <0.063, by dried weight. Expansibility, oedometric consolidation, hydraulic conductivity, and CBR tests were performed and analysed to assess mechanical viability.

The results characterize the mixtures as silty or poorly graded sands, and A-1-b and A-2-4 (AASHTO), these mixtures have potential in geotechnical applications due to the presence of quartz, kaolinite and muscovite. In terms of granulometric composition, mixtures MW25% (0.063), MW25% (0.400) and MW50% (0.063) are recommended for sub-base, while only MW25% (0.063) meets the Atterberg limits for sub-base, being the other mixtures more suitable for landfill bodies. For the oedometric, MW25% (0.063) presented the best results, and in the CBR test, only MW25% (0.063) exceeded the minimum of 20% required for sub-base, with higher values in mixtures with fines of 0.063. Mixtures with fine materials significantly reduced permeability. MW25% (0.063) is the best option for granular subbase, while the other mixtures, except MW50% (0.063), are suitable for regularization and berm filling layers.

With this, it is expected that the results can contribute to the circular economy, promoting the reuse of waste in construction, creating a balance between economic development and environmental conservation. Although need further investigation over shear strength, more variations of particle size, compaction energy, and waste percentage, in addition to large-scale testing program.

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IMPACT OF WORKS PARAMETERS ON PLASTIC ANCHORS RESISTANCE IN FOAMED CONCRETE

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ABSTRACT

The purpose of the research or work is to determine the load-bearing capacity of plastic anchors in foamed concrete, which is increasingly used in construction markets. The research will be conducted experimentally for the needs of manufacturers and contractors of fasteners. The lack of guidelines causes large differences in the construction market in the approach to determining the pull-out strength of aerated concrete construction connectors. The tests determined changes in the pull-out strength of plastic connectors with different external diameters depending on the anchoring depth used and the installation method. As part of the assembly method, hammering and screwing in plastic connectors is allowed. The tests were carried out on aerated concrete blocks of various thicknesses. As part of the pull-out strength analysis, load-bearing capacity correlations were determined. Traditional driven and screwed plastic connectors made of polypropylene, commonly used on the construction market, from a manufacturer that has a current European Technical Assessment, were selected for the tests. Changes in the tensile strength of concrete were observed depending on the type of connector and type of installation. Additionally, the influence of the anchoring depth has a significant impact on the final load-bearing capacity of plastic connectors installed in foam concrete substrates. The percentage differences in load capacity changes mean that research will continue in the long term. The article presents the results of testing the specific pull-out loads of plastic anchors embedded in foamed concrete. All tests in this article were carried out at normal temperature, without taking into account the effects of concrete and air humidity.

Corresponding Author: Daniel Dudek

IMPROVING THE POWER OF VAPOUR-COMPRESSION AND TRADITIONAL HEAT GENERATION IN A TWO-STEP CHAMBER FOR DECENTRALIZED HEAT SUPPLY

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ABSTRACT

The research is dedicated to addressing the current challenge of enhancing the capacity and efficiency of decentralised heat supply for public buildings and industrial enterprises, particularly in the context of vapour-compression and conventional heat generation. The proposed two-stage scheme, which incorporates additional cooling of the flows of used energy carrier from the heating network, initial cold water and flue gases, represents a promising avenue for further investigation. The objective of this investigation was to explore potential avenues for enhancing the total heat generation capacity in a two-stage decentralised heat supply scheme, with a view to optimising energy efficiency and the overall capacity of the generated heat flow. The proposed approach also offers a potential solution to the challenge of improving energy performance in the operation of the proposed heat generation scheme. This is achieved by defining the area of rational values of the intermediate temperature of the used energy carrier from the heating network after the condenser at the inlet to the heat generator. The result of analytical research was the established generalized dependence of the intermediate temperature of the used energy carrier from the heat network on the ambient temperature during the heating period and rational values of the conversion coefficient at the heat pump operation. On the basis of the obtained dependences, we have been able to determine the area of rational values of the intermediate temperature of the used heat carrier, taking into account characteristic temperatures of low-potential sources, the increasing of the produced heat, as well as the ratio of water flows at their distribution for municipal and domestic and industrial-technological needs. The results of the analytical study and their graphical analysis provide a solid foundation for the engineering development process, taking into account the specific conditions of heat supply and operational modes of municipal and industrial-technological enterprises.

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INDUSTRIAL CULTURE AND PLANNING OF ILLEGAL DEVELOPMENT AREA IN THE HISTORIC URBAN PERIPHERY THROUGH THE PRACTICE FOR LEGALIZATION OF "OOIWA HIGHWAY NEIGHBORING AREA" IN FUSHIMI, KYOTO

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ABSTRACT

"Ooiwa Highway Neighboring Area" is an illegal development area located near Fushimi Inari Shrine in Kyoto, Japan. Here has long been a suburban farmland, but since the period of rapid economic growth in 1960s, industrial and residential development has been concentrated, and illegal buildings were left. Residents and workers today are not the actors of illegal development, but they would possibly be forced to evicted in the future. Our laboratories have been working with local residents and workers, and local branch office of Kyoto city for several years to implement Machizukuri (community development) practices for legalization.

This paper aims to clarify the way of legalization that should be implemented through detailed analysis of the "Illegality" in this area and field survey of land and building use. In order to legalize and plan for the future of "Ooiwa", which received the expansion of industrial land use in the periphery of the historical city, it is necessary to explore the possibility of valuing its development not merely as illegal destruction of nature and landscape, but as part of the industrial culture of Kyoto.

First, by reviewing the process of illegal development and rectification by Kyoto city, it was found that the illegality of this area lies in the condition of the land, buildings and roads without development permission after the designation of the urbanization control area. There are 2 issues to obtain development permission: the relationship between the site and the road, and the shape and use of the buildings. In order to examine the building issue, we next conducted field survey.

We did a visual survey of the use, number of stories, and height of the current buildings. We also estimated the building coverage ratio and floor-area ratio by determining the confusing site boundaries. In addition, we visited industrial buildings, which are common in this area, and interviewed residents and workers to learn more about their building uses. Although these small to medium-sized factories are not clusters of any particular industry, it became clear that each is essential to Kyoto city's industrial network, including traditional industries. Many of them want to continue their work here, which is close to the center of Kyoto, inexpensive rental costs, and does not raise complaints about noise or odors generated by their work.

"Ooiwa" is partly located in scenic area and it is a big issue how to get the permission from Kyoto city central office for the future plan as semi-industrial town where houses and these factories coexist, which support Kyoto's industrial culture. The establishment of district plan is one effective way to achieve this. These survey results and future plan have been shared with local residents and workers through continuous Machizukuri practices, and finally compiled into "Machizukuri Vision" by local council last year. This document is the basis for the establishment of district plan, so this is a great progress in the process of legalization. With more detailed discussion, we are struggling for the establishing district plan in a few years.

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INFLUENCE OF BLOCK RESISTANCE ON THE MECHANICAL STRENGTH OF BIMSOILS

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ABSTRACT

Bimsoils and soil-rock mixtures refer to complex geologic mixtures of strong blocks and weak matrix that occur in a variety of geologic environments, including faulted and weathered rocks, among other soil-rock combinations. Due to the inherent challenges of preparing samples for laboratory and in situ testing, the matrix is often characterized mechanically, ignoring the influence of the rock blocks. This study addresses this limitation by constructing virtual bimsoil samples in a space of random blocks that represent in situ arrangement, using the finite element method to determine their mechanical strength. In these materials, volumetric block portion is the most relevant variable, the variation of this property and its relationship with the strength of the blocks were evaluated. The model was calibrated using spheres as soil particles. The finite-element method used to simulate the triaxial test overcomes the limitations of traditional testing methods and provides a comprehensive mechanical characterization of bimsoils that includes the effects of both the matrix and the rock blocks. In addition, the results provide an equation for determining the friction angle and cohesion as a function of volumetric block fraction and uniaxial compressive strength. Statistical analysis was performed on the triaxial test data using ANOVA, linear regression, and correlation. We found that the effectiveness of the finite element method in characterizing BIM soils provides valuable insight into their mechanical behavior, paving the way for more accurate and sophisticated engineering applications in bimsoils by integrating advanced analysis methods in the study of complex geotechnical materials.

Corresponding Author: Melissa Parra

INFLUENCE OF GEOMETRIC PARAMETERS ON INTERNAL FORCES IN THE WALLS OF RECTANGULAR TANKS

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ABSTRACT

Rectangular tanks are commonly used in various industries for storing materials and products. The design of reinforced concrete liquid tanks, which must be preceded by a static analysis, is a complex issue requiring specialized knowledge and engineering experience. All types of actions, design situations, and resulting load combinations must be considered, including deformations caused by temperature gradients and the interaction of the bottom plate with the ground. Most tanks are designed and constructed with constant wall thickness, regardless of their rectangular or circular cross-section. However, tanks with variable wall thickness (e.g., trapezoidal cross-section) are rarely designed, despite their optimal fit to stress distribution. For hydrostatically loaded tanks, the load on the walls increases with depth, causing the highest bending moments at the wall-bottom connection, while the value at the top, free edge is zero. Thus, structural and economic considerations favour walls with thickness increasing with depth.

This article presents the results of a verification of static calculations of a monolithic rectangular tank with trapezoidal cross-section walls, comparing it with three other commonly designed tanks with different thickness and wall designs. Static calculations were performed using the finite difference method in terms of energy, employing the condition for the minimum energy of elastic strain stored in a bent plate resting on an elastic base. Traditional calculation methods were used by discretizing the object and creating systems of equations. Analysis of the results shows that constructing walls of linearly varying thickness results in a redistribution of bending moments compared to tanks with uniform wall thickness. This significantly impacts the required reinforcement area. Tanks with linearly varying wall thickness are more economical in terms of material use, aligning with the principles of sustainable construction.

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INFLUENCE OF MODERN MATERIALS ON THE ENERGY EFFICIENCY OF THE THERMAL MODERNIZATION PROCESS

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ABSTRACT

Global policy identifies the need to achieve climate neutrality, especially in the most energy-intensive sectors of the economy, as a key focus. Climate neutrality is closely linked to the reduction of energy demand and the use of materials and technologies with a low embedded carbon footprint. The economic sector with some of the highest energy intensity and CO2 emissions is construction. In the case of newly designed buildings, most countries have already implemented measures to reduce energy demand by introducing a near-zero energy building standard (nZEB standard). The problem is the existing building stock, which requires deep thermo-modernisation measures. These measures will reduce energy consumption in the building sector and thus reduce emissions of harmful gases into the atmosphere. In the article, the authors, using the example of two countries with different climates: Poland and Vietnam, they analysed in terms of embedded carbon footprint the available technologies dedicated to thermal modernisation measures. The countries were chosen for the analysis because of the differences in climate that determine the scope of thermomodernisation measures taken. In the case of Poland, it is a temperate climate, where buildings should be designed to reduce heat loss in the winter season and ensure thermal comfort in the summer season. In the case of Vietnam, it is a humid subtropical climate, where the emphasis should be on protecting buildings from overheating.
The analyses presented here show both traditional and modern innovative technologies used in the thermal modernisation of existing buildings. The analyses carried out by the authors show how modern technologies affect the thermal insulation of building partitions and thus reduce energy consumption. The article also presents analyses of the technologies in terms of the embedded carbon footprint, which characterises the phases of material manufacture. The conclusions presented by the authors allow informed choices to be made when deciding which materials and technologies to use for deep thermo-modernisation measures in existing buildings, so as to reduce energy demand and minimise the embedded carbon footprint.

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INFLUENCE OF SUPPLEMENTARY CEMENTITIOUS MATERIALS ON SULFATE RESISTANCE OF MORTAR MIXTURES

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ABSTRACT

Introduction: Sulfate reaction is a damaging expansive process that deteriorates cement-based structures over time. Various methods have been proposed to mitigate the effects of sulfate attack in concrete. Using Type II or Type V portland cement is an appealing approach to control sulfate attack. Additionally, incorporating supplementary cementitious materials (SCMs) such as class F fly ash, a by-product of coal combustion for electricity generation, has proven effective in mitigating sulfate attack damage. However, future availability of fly ash is uncertain due to the energy industry transitioning towards more sustainable methods of energy production.
Objective: The objective of this work was to seek alternative SCMs that can effectively mitigate sulfate attack while also being environmentally sustainable and economically feasible.
Methods: In this study, ASTM C1012, a globally recognized standard test method for sulfate attack susceptibility, was employed to assess sulfate resistance of mortar specimens. In total, 14 mortar mixtures containing various types and concentrations of SCMs that included silica fume, metakaolin, and a natural pozzolan (pumicite) along with two types of portland cement (Type I and Type I/II) were produced and tested.
Results: The results indicated that Type I/II portland cement had greater sulfate resistance compared to Type I cement in mortar mixtures, regardless of the type and concentration of SCMs used. Additionally, although metakaolin considerably improved sulfate resistance, silica fume and the natural pozzolan used in this study had only limited impact on sulfate resistance of the specimens. When evaluating ternary mixtures, using a combination of 22.5% metakaolin and 7.5% fly ash to replace 30% of Type I portland cement resulted in the greatest sulfate resistance among all mortar mixtures, with a measured expansion of 0.054% after nine months of sulfate exposure.
Conclusion: It is worth mentioning that when using Type I/II portland cement and only 15% metakaolin (as a cement replacement), sulfate resistance was comparable to the ternary mixture with 22.5% metakaolin, 7.5% fly ash, and with Type I portland cement. Overall, the results showed that metakaolin, fly ash, and pumicite can be considered effective SCMs for improving sulfate resistance.

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INFLUENCE OF VERTICAL GREEN SYSTEMS ON URBAN WATER CYCLE

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ABSTRACT

The aim of this study is to define potential benefits and limitations of Vertical Green Systems (VGS) on sustainable urban water cycle. The authors carried out comprehensive literature review, covering irrigation requirements of VGS, sustainable water resources, drought stress responses, and design requirements to provide support for water retention. The research results demonstrated the importance of substrate and plant species selection for water retention, drainage and wastewater treatment. The multifaceted aspects of rainwater use, greywater treatment, stormwater management and fog harvesting as methods supporting irrigation of VGS were duly analysed. The analysis revealed that examining the source of greywater is essential to use it for irrigation of VGS since composition and concentration of chemicals affect substrate properties and plant physiology. Moreover, even though untreated greywater is suitable for irrigation of VGS, the sensitivity of certain plant species should be considered. The design of substrate morphology of VGS affects the rainwater harvesting capacity since horizontal surfaces increase the amount of harvested water. It was also noted that plant growth-promoting microbes (PGPM) can improve stormwater retention capacity of VGS through secretion of plant growth hormones, increase in nutrient uptake, nitrogen fixation and protection from diseases. The literature review revealed the research gap regarding the effect of the diverse climatic conditions on the performance of VGS and their contribution to the sustainable urban water cycle. The study confirmed that a correctly designed VGS can be a valid option for treatment and recovery of urban water and preventing flood risk by eliminating excessive stormwater.

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INFLUENCES OF SOCIAL CONTEXT TO ARCHITECTURE OF YUGOSLAVIA 1945-1990

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ABSTRACT

Architecture of some building, but definitely of some particular area and particular time is never result of accidentally composed circumstances. It is always limited by reality and defined by social and economical conditions. In our travels and visiting of some places we always read and try to understand their history, tradition, way of life and culture through remains of architecture. Cities and their parts planned and developed accordingly modernist principles and authentic modernist architecture from the period of existence of Socialist Yugoslavia are specific, but very honest storytellers which can help as to realize what kind of society was intention to be established. Our duty is to learn to hear, read, see and recognize the value of these tangible stories as specific testimonies about period and civilization that disappeared, but which legacy in many aspects still exist. Those are stories about progressive and avant-garde architecture and urbanism that was in accordance and on the level of some of the best examples of modernism based on universal values tried to be establish in the first half of 20th century as revolutionary change in the history of architecture so far from just stylish determinations. Revolutionary architectural appearance was recognized by the society that believed they launched socialist revolution. Modernist architecture was more or less intentionally recognized as visual and formal manifestation of proclaimed ideas of modernization, urbanization, industrial, cultural, social and economic progress of entire society. Article research relations between social, political and economical conditions from one side and development of extraordinary architectural achievements based on human needs, public interest and artistic excellences as result of similar intentions and movements in this authentic kind of society.

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INNOVATIONS IN THE INTEGRATION OF SPORT EVENTS INTO THE ORGANISM OF A PARIS METROPOLIS

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ABSTRACT

Hosting the Olympic Games is always a stressful test for the world's capitals. Given the nature and size of the event, changes are needed to the transport infrastructure and often to the entire urban fabric of the city, including parts that will not be the direct venue for the Games.
At the same time, however, the Olympic Games challenge new urban concepts and lead to major urban projects. Paris will be the closest venue for the 2024 Summer Olympics and, in addition to new constructions, which is less emphasised than its predecessors, it has set new standards of environmental responsibility and the integration of sport into urban life. The Paris Games will be the first to be covered by the International Olympic Committee's Agenda 2020. It aims to reduce greenhouse gas emissions associated with the Olympics.
This is a major step in changing the paradigm of urban planning in the context of the Olympic Games. Paris 2024 presents the Games as a laboratory for eco-innovation, for example, by building metro stations that are as material-friendly as possible, by applying French know-how, especially in the field of wood construction, by innovations in building, by bringing more green spaces, even more space for pedestrians and cyclists, more accessible amenities, social housing and renovated municipal buildings, it wants a city that increasingly supports the most deprived communities.
Although, it represents a less ambitious programme at the city level compared to former Olympic Games cities (as it plans the least new buildings with only an Olympic Village, an Olympic Aquatic Centre and some temporary modifications), it ranks among the candidates that will be the most environmentally friendly. He wants to show how sporting events of such huge scale and importance can be organised in sustainable way. This environmental ambition is therefore essentially new for the organising city.

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INNOVATIVE APPROACHES TO SENSITIVITY INDICES FOR STRUCTURAL RELIABILITY

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ABSTRACT

The article focuses on the development of innovative sensitivity indices for the global sensitivity analysis of structural reliability. It investigates the effectiveness of two distinct methodologies in assessing the reliability of structural steel components: one based on conditional mean values, and the other on conditional medians of the reliability function. The study aims to evaluate how the input random variables affect the ultimate limit state of a steel beam, employing a double-nested-loop simulation with the Latin Hypercube Sampling method for calculating sensitivity indices. In both methods, the sensitivity indices serve as a robust quantitative assessment of the impacts of uncertainty on model outputs due to variations in model input factors. The research introduces a novel approach, median-oriented sensitivity analysis, as part of Goal-Oriented Sensitivity Analysis methods, tailored for scenarios where median values of input variables are of greater interest than mean values. This approach offers new perspectives, potentially uncovering insights not captured by traditional methods. The application of this method to the Ishigami function demonstrates its practicality and efficiency, highlighting differences in sensitivity metrics when compared to Sobol sensitivity analysis. The study emphasizes the importance of global sensitivity analysis as a tool for identifying critical input variables that significantly affect the reliability and limit states of structures, thereby advancing the field of structural reliability analysis. The findings indicate that both quantile-oriented and Sobol sensitivity analyses are essential components of the broader framework of Goal-Oriented Sensitivity Analysis, highlighting the need for further development to enhance its practicality and utility in future applications.

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INTEGRATING PHOTOGRAMMETRY AND MAGNETOMETRY FOR ARCHAEOLOGICAL RESEARCH AT ARGAMUM, DOBRUJA

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ABSTRACT

This paper presents the results of an integrated photogrammetric and magnetometric survey conducted at the Argamum archaeological site, located in Dobrogea, Romania. Argamum, a significant roman ancient settlement, provides a rich tapestry of historical and cultural data. The primary objective of this study was to create a detailed digital terrain model (DTM) of two specific perimeters within the site, using advanced photogrammetric techniques, and to complement this with magnetometric data to uncover subsurface features.

The photogrammetric survey involved capturing high-resolution aerial imagery using unmanned aerial vehicles (UAVs-PHANTOM IV PRO). The images were processed using specialized software to generate a high-precision 3D model of the terrain. This model provided a detailed and accurate representation of the surface topography, which is crucial for understanding the spatial relationships and structural layout of the archaeological features.

In parallel, a magnetometric survey was conducted to detect and map subsurface archaeological remains. This non-invasive method measures variations in the Earth's magnetic field caused by buried structures and artifacts. The magnetometric data revealed several anomalies, indicative of potential archaeological features such as walls, foundations, and other buried structures.

The integration of photogrammetric and magnetometric data offered a comprehensive view of the Argamum site, combining surface and subsurface information. This multi-method approach enabled a more detailed analysis of the site's layout and provided insights into the distribution and orientation of archaeological remains.

The results of the survey highlighted the effectiveness of using photogrammetry and magnetometry in tandem. The high-resolution DTM facilitated precise mapping and documentation of visible features, while the magnetometric survey added depth by identifying hidden structures. This combined methodology enhances the overall understanding of the site and aids in the planning of future archaeological excavations.

Moreover, the study demonstrated the potential of these technologies to significantly reduce the time and cost associated with traditional excavation methods. By providing a non-invasive means of site investigation, photogrammetry and magnetometry allow for the preservation of the site's integrity while still yielding valuable data.

In conclusion, the photogrammetric and magnetometric survey at Argamum has provided a detailed and multifaceted understanding of the site. This research underscores the importance of integrating modern geospatial technologies in archaeological investigations. The findings contribute to the broader field of archaeological research by showcasing the benefits of combining different survey techniques to achieve a comprehensive analysis of historical sites.

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INTERNET OF THINGS AS A COMMUNICATION TOOL FOR EFFICIENT MANAGEMENT AND OPERATION OF BUILDINGS

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ABSTRACT

The trend of using the Internet of Things (IoT) can be considered a so-called new technological revolution. This fact is confirmed by the ever-increasing number of connected devices around the world in all areas of life. The Internet of Things is defined as the interconnectedness of things, services and users. It is an interplay of intelligent devices and intelligent communication technologies. The flow of information and events generated by the device can be used to simplify management, monitoring and coordination processes. Communication with devices, users and services is key to the Internet of Things. Communication technologies affect the usability of the device. New communication networks are currently emerging for the Internet of Things. These include, in particular, networks for the transmission of a smaller data stream, which is typical for sensors and transducers, to the respective device. The success of these networks depends on availability, low cost, low power consumption, long range and ease of use. The mentioned technological solutions ultimately enable a higher degree of interoperability of users with the internal environment thanks to higher information and evaluation of the internal environment in real time. Thanks to these technologies, it is possible to increase user comfort and efficiency of using buildings as such. The aim of this article is to define the basic principles and connections within the IoT issue in connection with the effective management and operation of buildings as one of the prerequisites for sustainability in the field of construction.

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LOW-CO_2 CONCRETE: STEPTS TWODRDS SUSTAINABLE CONSTRUCTION MATERIALS FOR GREEN ENVIRONMENT

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ABSTRACT

Researchers seek sustainable materials for eco-friendly cement and concrete to reduce CO2 emissions. This paper offers an extensive overview of the research conducted on concrete technology with minimal to zero-carbon emissions. This review paper reviews materials and technologies for lowering the construction industry's carbon footprint, focusing on alternative binders and supplementary cementitious materials (SCMs). Additionally, the paper explores the transformative potential of carbon capture and utilization technologies for sustainability. It also explored life cycle assessments, economic aspects, and financial implications of this technology. Overall, the review summarizes low-carbon concrete in the context of sustainable development and climate change mitigation. It has been found that substituting SCMs for cement reduces carbon emissions in concrete without compromising strength and durability. Materials such as slag, metakaolin, calcined clay, and limestone can replace clinker, eliminating CO2 emissions in cement production. This study highlights challenges, including market adoption and material availability, offering insights for successful implementation.

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METHODOLOGY FOR DISPLAYING SPATIO-TEMPORAL EVOLUTION OF DEM OF WATER RESERVOIRS BOTTOM USING VIRTUAL REALITY (VR)

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ABSTRACT

This paper proposes a novel methodology for visualizing the spatiotemporal evolution of Digital Elevation Models (DEMs) of water reservoirs' bottoms through the implementation of Virtual Reality (VR) technology. Water reservoirs play a critical role in water resource management, and monitoring their morphological changes over time is essential for various environmental and engineering applications. Traditional methods of displaying DEM data often need more immersive and interactive capabilities, limiting the comprehension and analysis of complex spatiotemporal patterns. In this study, we introduce a framework that integrates DEM data processing techniques with VR technology to provide users with an immersive experience of exploring and analyzing the evolving bathymetric profiles of water reservoir bottoms. We describe the data acquisition process, DEM generation techniques, and the development of a VR-based visualization platform tailored for displaying spatiotemporal changes in reservoir morphology. Additionally, we discuss the usability and effectiveness of the proposed methodology through a case study, demonstrating its potential for enhancing understanding and decision-making in reservoir management and environmental studies. Overall, this methodology offers a promising approach for researchers and practitioners to explore and analyze the dynamic nature of water reservoirs' bottoms in an intuitive and immersive VR environment.

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NATURE BASED MODERN CONSTRUCTION TECHNOLOGIES AND THEIR PUBLIC PERCEPTION IN POLAND

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ABSTRACT

The purpose of this article is to present the results of a survey on the state of public awareness in Poland of nature-based technologies in construction and, in particular, opinions on green roof and green building wall technologies in Poland.
The survey was conducted in December 2023 online, using thematic groups on a social networking site that focus on urban ecology and green solutions in construction. 210 people participated in the survey.
The results of the survey showed that although green technologies are gaining interest, there is still a small percentage of respondents who live or have lived in buildings using these solutions. Survey respondents show a positive attitude toward green roofs and walls, considering them an interesting and safe solution. The positive perception of these technologies is due, among other things, to their potential impact on air purification, smog reduction and increased oxygen production.
Respondents recognize and value the aesthetic qualities of green technologies, appreciating their impact on improving the appearance of cities and creating additional places for relaxation, which are increasingly sought after in urban space.
One can see the need to further promote and educate the public about the benefits of green technologies in construction. Their sustainable development can not only positively affect the aesthetics of cities, but also contribute to the creation of greener and more people-friendly urban spaces, in line with the needs of modern society.

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NEIGHBOURING AND SENSE OF COMMUNITY IN PARTICIPATORY SOCIAL HOUSING ESTATES IN ALGERIA

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ABSTRACT

Algerian cities experienced after the independence of the country a rapid urbanisation process fostered by population growth. In order to deal with the severe housing shortage resulted, large social public housing programs totally financed by the government were launched across the country during the eighty. Unfortunately, the standardized multistory buildings produced underwent intense deterioration and turned very quickly after their occupancy into sources of nuisance and distress.

The government adopted a new housing policy in 2000 which aims to diversify housing types according to household incomes and encouraging access to housing property. The model of participatory social housing emerged; it was designed for the intermediate groups, allowing them to benefit from a direct financial aid and to borrow credit from banks in order to purchase their dwellings.

Twenty years afterwards, no assessment to date has been established to evaluate the real impact of such strategy. The aim of this paper is to examine whether this type of housing helped to stimulate a participative dynamism among its occupants, to strengthen their commitment, their involvement in the maintenance and keeping of their surroundings . For the purpose of the study we focus our attention on various participatory social housing settlements in Batna and Biskra, two medium-sized cities in eastern Algeria.The investigation is structured in various types of analysis: a spatial analysis , observations ,interviews with public authorities representatives, chief planners and experts . In addition to this, informal interviews with occupants of various participatory social housing settlements were arranged to collect qualitative data. Occupants were asked open questions focusing on their daily life and practices in order to examine their degree of involvement in their neighbourhood’s life.

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NUMERICAL ASSESSMENT OF CFS-SWP WITH DIFFERENT DOOR OPENING POSITIONS

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ABSTRACT

A prevalent method of countering lateral forces in seismic regions for structures made of Cold Formed Steel (CFS) involves employing Shear Walls Panels (SWP) covered with steel sheets. The overall reaction and various failure modes during lateral loading have become apparent, continuing to capture the interest of designers and researchers. Typically, door openings are ever-present in the front and rear elevations where SWPs find their optimal position to ensure lateral stability in CFS structures. These architectural design features translate into reduced areas for lateral load resistance throughout the structure.

Through numerical simulations, this paper discusses the effect of the door opening, with different positions in the SWP, on the shear strength performance of CFS-SWP. A Finite Element (FE) modelling is developed using the ABAQUS software, taking into account material and geometrical nonlinearities, as well as assembled sheathing-to-framing connections.

In order to validate the FE modelling with available experimental data, comprehensive static nonlinear analyses are conducted on CFS-SWP under monotonic load. A good agreement is achieved, namely: nonlinear strength-displacement response, ultimate shear strength, and failure modes. The effect of the door positions is assessed, in which, the opening position is found to have a significant impact on the CFS-SWP performance. The results reveal that the position of the door opening between the central and the edge of the SWP produces better performance than the other positions. However, the position of the door at the edge of the SWP induces additional failure modes in the vicinity of the chord studs and reduces the ultimate displacement more than the shear strength.

Corresponding Author: Idriss Rouaz

O CITIES AND EXTREME WEATHER PHENOMENA: HOW URBAN DESIGN CAN WORK IN MOUNTAIN CITIES AND PROMOTE A SMARTER CITY - THE CASE OF COVILHÃ, PORTUGAL

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ABSTRACT

Covilhã is a mountain city in the central interior of Portugal, currently with around 46,000 inhabitants, relatively close to the Spanish border, with its center at an average elevation of 700 meters. Its location on the slopes of the Serra da Estrela, the highest mountain range in mainland Portugal at around 2,000 meters, was due to its importance as a defensive site in the face of Spanish and Arab raids during the Middle Ages. The settlement is said to have had a fence and later a castle and developed mainly with the increase in the production of home-made cloths, since flocks of sheep grazed in the hills and there was plenty of water, especially in the two streams that ran north and south of the settlement. Until the second half of the last century, the town developed around its medieval core, expanding a little, especially from the 17th century onwards, between two streams that would delimit it to the north - Ribeira da Carpinteira, and to the south - Ribeira da Degoldra, and where the main wool industries would be located. Around the city, the hillsides were wooded, and the city's climate was characterized by four distinct seasons, with winters where it snowed in the city and hot summers. After a major fire at the beginning of the 1980s, most of the trees on the hillside burned down. Since then, especially in the last decade, the four seasons have blurred, with a significant variation in temperature and rainfall, with intense rainfall and hot, dry weather. It is thus in the upper area, with its narrow, sloping streets and narrow sidewalks, that the greatest circulation and mobility problems are felt when it rains heavily, where the water accumulates and/or runs violently into the valley, without being used for any purpose. This article shows some of the solutions proposed for the design of sidewalks and complementary means of using water to produce energy to meet lighting needs, among other ways. While still in the study phase, the aim is to show a rethinking of the urban design of this type of place, where the construction of a smart city is done through urban design and its integration into the circular economy, bearing in mind the use of the characteristics of the place to build "new images of the city".

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OPTIMAL EARTHQUAKE INTENSITY MEASURE OF A TYPICAL ALGERIAN HIGHWAY BRIDGE

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ABSTRACT

This article aims to develop analytical fragility curves for bridge components including piers, elastomeric bearings, and abutments, as well as fragility curves for the whole bridge system for post-tensioned girder road bridges which represent the most common configuration in Algeria that allow the identification of efficient earthquake intensity measures (IMs). Incremental dynamic analysis (IDA) is performed on the bridge to capture the seismic response. Four limit states are defined for each critical component. A total of sixty seismic ground motions used in the non-linear time history analysis are selected and scaled according to soil categories based on the shear wave velocity specified in the Algerian bridge design code. An optimal intensity measure is evaluated and selected through regression analyses and demonstrated across various metrics including correlation, efficiency, practicality, and proficiency. From the results, spectral acceleration at one second Sa10 can be considered the optimal IM. Based on this, damage probability in all four damage states is given for each component of the bridge. Fragility curves are studied for the bridge system. Moreover, the fragility of the entire bridge system is compared to each component's fragility.

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OPTIMAL LOCATION SELECTION MODEL FOR HYDROGEN FUELING STATION CONSIDERING MINIMIZE TRAFFIC VOLUME

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ABSTRACT

Reducing carbon dioxide emissions caused by global warming requires golbal effort. This requires a transition to eco-friendly fuels in the transportation sector, and hydrogen is being considering as an alternative fuel, with each country is developing technology to use hydrogen. However, most of the focus in terms of hydrogen technology is to develop hydrogen fuel production technology. The supply model for hydrogen infrastructure that will use this is equally significant. To develop a supply model for hydrogen charging stations, an estimate of hydrogen demand is required. In the case of hydrogen charging stations, which are part of the hydrogen infrastructure, occupancy rate remains low, therefore many hydrogen vehicles take detours to use hydrogen, increasing travel time. However, the conventional traffic demand forecast model just assign traffic volume to a road route does not considering the location of charging station. For this reason, the optimal location for the hydrogen charging station must be chosen by considering the traffic volume and route of hydrogen vehicles. Accordingly, in this study, traffic volume was assigned to each link using the Gradient Projection Algorithm(GPA) to generate a model for determining the best location for the hydrogen charging station when hydrogen fuel vehicles are introduced. Then, we attempted to optimize the transportation system by reducing traffic volume on the assogned routes rather than travel time. Afterwards, the developed model applied to the toy network to verify the mode. As a result, the new method for optimal hydrogen location demonstrates improved results when compared to overall travel time.

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OPTIMIZATION OF RECTANGULAR TANK CROSS-SECTION USING TRUST REGION GRADIENT METHOD

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ABSTRACT

In various industries, rectangular tanks are commonly used for storing liquids and other materials. The design and optimization of these tanks are crucial for ensuring structural integrity and material efficiency. Traditional designs often utilize constant wall thickness, which does not align optimally with the stress distribution, leading to potential overuse of materials and increased costs. Recent studies have shown that tanks with variable wall thickness, such as trapezoidal cross-sections, can better match stress distributions, particularly under hydrostatic loads, resulting in more efficient use of materials. This research aims to build upon previous studies by introducing an advanced optimization algorithm based on the Trust Region Gradient Method to further refine the cross-sectional design of rectangular tanks. The primary objective is to minimize the material usage while maintaining structural safety and performance under various load conditions, including hydrostatic pressure and thermal effects. The proposed algorithm iteratively adjusts the tank's wall thickness, seeking an optimal configuration that reduces bending moments and material costs.
Initial static calculations is verified using the finite difference method, emphasizing energy minimization conditions for elastic strain in bent plates on elastic foundations. This approach is compared with traditional discretization methods to validate accuracy. The trust region method is then applied to optimize the design, with a focus on achieving a balance between structural integrity and economic feasibility. Preliminary results indicate that the trust region gradient method can significantly enhance the design process, leading to substantial material savings and improved structural performance. The algorithm's effectiveness is demonstrated through case studies comparing tanks with constant and variable wall thickness. This research contributes to sustainable construction practices by promoting designs that use materials more efficiently and meet safety standards.

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OPTIMIZATION OF THE USE OF RENEWABLE ENERGY SOURCES IN STANDARDIZE BUILDINGS WITH NEAR-ZERO ENERGY DEMAND IN POLAND AND THE CZECH REPUBLIC

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ABSTRACT

European Union member states have introduced a model for the design and construction of buildings in the new energy standard of buildings with near-zero energy demand (nZEB standard) since 2020. Following European models, many other countries are introducing the nZEB standard as a binding standard for the design and construction of buildings. Directive 2010/31/EU left European countries free to adopt parametric levels of the nZEB standard. The minimum parametric levels that characterize the nZEB standard are based on the availability of materials and technologies and on the economic calculation that each EU country had to make before adopting the minimum requirements for the nZEB standard. Directive 2010/31/EU only imposed the deadline for the introduction of the nZEB standard as 1.01.2021. The second requirement of the Directive is the need to use renewable energy sources to supply heat, cooling and electricity to buildings to the greatest extent possible. However, the percentage of RES sources used in the overall energy balance is not specified. It is not always possible to cover the total energy demand of buildings with renewable energy sources. Often, RES cover only part of a building's energy demand. In the article, the authors analyzed the regulations for the nZEB standard in selected countries. Two European countries, Poland and the Czech Republic, were selected for further analysis. Using the example of a single-family residential building, an analysis has been carried out on what percentage of energy should be used from renewable energy sources in addition to other energy sources such as gas, district heating or coal, in order to achieve the level of the near-zero energy demand building standard defined for the two analyzed countries. The analysis conducted by the authors can provide guidelines for designing buildings to the nZEB standard in both Poland and the Czech Republic.

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PERFORMANCE OF CAG MODIFIED GEOPOLYMER MORTARS AT ELEVATED TEMPERATURES

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ABSTRACT

Structures are affected by natural and human actions and fires are harmful danger on structure health. High temperatures by the cause of fire can damage the concrete structures by decomposing cement hydration products such as calcium silica hydrate gels. Thus, the structural damages and collapse of structures can be reported. Fire resistance performance of concrete are significant require for the concrete structures which are exposed to fire danger. It is clearly known that, conventional concrete can't exhibit excellent performance against to fire attacks, it can be emphasized that, the geopolymer concretes ensures better fire resistance and durability performance. In this experimental study, ground granulated blast furnace slag (GGBFS) and calcined granite (CAG) modified geopolymer mortars were prepared by Na_2SiO_3 alkali solution and NaOH. The samples were cured during 28 days and 400 ^oC, 600 ^oC, 800 ^oC and 1000 ^oC high temperatures were carried out to samples. Relative unit weight (Uw), relative ultrasonic pulse velocity (Upv), relative compressive strength (fc) were exhibited. At all high temperature, force-midpoint deflections were determined and flexural modulus (fm) were calculated. Moreover, microscope analyses were carried out in order to investigate temperature effect to microstructure. The experimental results reveals that, geopolymer mortars included GGBFS and CAG performs great behaviour against to high temperature. Particularly, the self-healing character of geopolymer mortars has been found out and has been reported the geopolymer mortars modified 50 % rate of GGBFS and 50 % rate CAG performs greater mechanical property after 1000 ^oC,

Corresponding author: Maciej Dutkiewicz

PRACTICAL MEASUREMENT OF GNSS TECHNOLOGIES FROM EMLID AND SOKKIA RECEIVERS AND THEIR COMPARISON

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ABSTRACT

The practical measurement and comparison of GNSS technologies from SOKKIA and EMLID receivers is only a demonstration of how GNSS surveying technology with accuracy of a few centimetres can be used effectively in Czech conditions. Czech surveyors use GNSS technology primarily as a simple data collection in open terrain - it cannot be used in buildings. Most often they are simple measurements such as terrain surveying for the designer, surveying for the purposes of land registry and others. There are several methods for determination of position, i.e. location in defined coordinate and altitude systems (in the Czech Republic they are S-JTSK and Bpv), according to receiver's software using RTK network method (corrections from providers of network of reference stations - such as TOPNET, CZEPOS, and others) or RTK base – rover method or fast static method. The task is to compare the measurement time intervals from each technology and the accuracy of the measurement on the trigonometric points of the Czech state triangulation network. At the end I financial comparison of both technologies is presented.

Corresponding Author: Ondřej Váňa

PROPOSAL FOR THE ROOFING OF THE RUINS OF THE NATIONAL CULTURAL MONUMENT BAROQUE CHURCH IN VILLAGE SEDLIACKA DUBOVÁ IN SLOVAKIA USING METHODICAL DESIGN

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ABSTRACT

In the intentions of the "Project of the UNESCO Department for the restoration of architectural heritage. Interdisciplinarity as the basis of cultural sustainability", from 2020 a specific method of architectural design is applied at the Department of Architecture at the Faculty of Architecture of STU Bratislava, which is professionally called "methodical design". It is based on the exact knowledge of the original state of the monument and the context in which it is located, the execution of relevant monument research, the setting of the framework method of monument restoration, and the subsequent proposal of possible variants of solutions, which in various combinations verify the optimality and feasibility of the proposal.

The paper illustrates the application of the aforementioned approach to the proposal for the restoration of the church building on student term papers and on the dissertation in progress. In the dissertation, the process of getting to know the monument is more thoroughly analysed from the point of view of construction development, the static load-bearing capacity of the preserved masonry, as well as the verification of the possibilities of using wood-based constructions in the design of new roofs. Student works represent a spectrum of other possible creative solutions, using principles resulting from two different framework methods of restoration. The first synthetic-reconstructive framework restoration method indicates the original character of the roofing. The second, analytical-modernist framework method of restoration works with the new character of roofing. These variants differ in varying degrees of intervention and creative activity, in inspiration from the original roofing or a hint of it. All new constructions are designed with the execution of contemporary architectural and structural details and preserve the existing ruin in a preserved state as one of the possibilities of saving the existing building substance for future generations.

Corresponding Author: Filip Bránický

PROTOTYPE FOR ARCHITECTURAL CREATION AND EXPERIMENTATION: METHOD FOR TEACHING ARCHITECTURAL DESIGN

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ABSTRACT

The theme we have developed in this work, learning how to design architectural space using a dynamic and interactive method, using the tools for realizing architectural projects and creative approaches inspired by the visual arts, starts with exploring the concept of scale: scale of representation and real scale — the relationship between the human body and the architectural object.
The aim of the design exercise is to build a real architectural space, using real materials, but with reduced dimensions. An object of approximately one cubic meter, with a certain dimension that you can only enter imaginatively. The apprehension and interpretation of the architectural space will be made individually by those who approach the object after it has been built, but it also functions as a laboratory for those who created it, in the successive stages of construction, choice of materials, definition of geometries (interior and exterior), in successive stages of experimentation-construction.
The objects can be touched, both inside and outside, and can be observed in a wide variety of positions, in order to fully understand their spatial, material, luminous and tactile relationships, etc.
The initial and most important stage of the process is the creation of a project idea for an architectural space that can be inhabited imaginatively (not illusory), taking advantage of all the senses. Senses that also play an active part in the creation of the object itself, and that contribute to the affirmation of the human being as a physical and symbolic reference for architecture.
The student is given the experience, not just of simulating the object from the outside, but of creating a space that interacts with it, similar to what happens in visual arts installations. This theme leads us to para-architectures, hence the name Para-architectural Objects, which go beyond architecture and approach the realm of the arts and their imagery.
This exercise in architectural conceptualization which, through the realization of a physical model, creates a small spatial world, without obeying any functional context or pre-defined place, realized on a dynamic scale and referenced to the human body in an imaginative and creative way, means that the work created acquires architectural, plastic, artistic and symbolic value at the same time, including all the dimensions inherent in the relationship between Dwell-Architecture.

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RESEARCH OF ENERGY EFFICIENCY OF CHILLERS USING INTERMEDIATE REFRIGERANT

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ABSTRACT

The purpose of the study is to study the operating principle of refrigeration machines with an intermediate heat exchanger, to consider the most suitable types, in particular for use in the Republic of Armenia. Currently, such refrigeration units that carry out a cooling cycle with an intermediate heat exchanger have become widespread. The use of systems with an intermediate refrigerant allows you to turn off the refrigerant circuit during the cold season, and transfer heat directly to the environment through an additional heat exchanger for the intermediate refrigerant, which in turn leads to energy savings. The article examines the cycles of refrigeration units operating with an intermediate refrigerant, with the supply of an intermediate refrigerant to the condenser, to the evaporator, both together and without an intermediate refrigerant. The most energy-saving and energy-efficient of them are calculated, in particular, for the hot, temperate and cold regions of Armenia. The results are presented in the form of graphs.

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RESEARCH OF OPTIMAL VENTILATION SCHEMES FOR EDUCATIONAL INSTITUTIONS

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ABSTRACT

The topic of the article is the distribution of air inside a group of rooms (room model is given in the article).
For the group of rooms it is necessary to carry out air distribution, which will meet the modern requirements of human comfort (temperature difference, volume of supply air, noise-vibration), as well as to maintain the architectural-aesthetic integrity of the area.
In order to ensure the necessary parameters of indoor air, it is necessary to make a comparative analysis of air distribution circuits, in particular, ducts, diffusers, inlet and outlet rails.

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RESEARCH OF THE EXISTING POST-TENSIONED ROOF TRUSSES AND THEIR RELIABILITY

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ABSTRACT

The issue of insufficient reliability and, in some cases, the failure of post-tensioned bridge structures, footbridges, and roof trusses, particularly in industrial halls, is one of the current and serious problems of the construction industry in the Czech Republic. The most well-known failures of these structures include the collapse of the Morandi Bridge near Genoa, Italy, in August 2018, and the collapse of the Troja footbridge in Prague in December 2017. Less known are the failures of post-tensioned truss roof structures that occurred in the Czech Republic and Slovakia. Especially in the Czech Republic, there were failures in Tachov (2010 and 2018), Šluknov (December 2023), and Karlovy Vary (March 2024). A common feature of all these failures was the corrosion of the prestressing reinforcement in inadequately grouted cable ducts. Roof structures of this type have been used in more than 100 buildings that are still in operation in the Czech Republic.

In response to this situation, the company Rada Building s.r.o., in cooperation with academic institutions, developed a method to reinforce trusses threatened by corrosion using an external steel structure. The company carries out the reinforcement work during normal operation in the hall below the trusses.

Research on post-tensioned truss structures and the possibilities of their static securing is being conducted in cooperation with the Faculty of Civil Engineering at VSB – Technical University of Ostrava, the Faculty of Art and Architecture at the Technical University of Liberec, and the company Rada Building, s.r.o. The ambition of the research is to analyze the condition of as many trusses as possible embedded in buildings in the Czech Republic and Slovakia using building structure diagnostic methods and to evaluate these surveys. Furthermore, the research aims to verify the actual behavior of such structures through tests on real trusses taken from demolished buildings. VSB – TU Ostrava has several trusses available, and load tests are currently being carried out on them. An important and final part of the research is to find the optimal diagnostic method that would improve the ability to predict the risk of roof failures in operational buildings and to optimize the methods for securing these structures to ensure full static reliability with the lowest possible costs and minimal impact on the building.

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SEISMIC FRAGILITY CURVES OF A RC BRIDGE CONSIDERING THE SOIL-FOUNDATION INTERACTION

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ABSTRACT

Seismic fragility curves for bridges are essential for risk assessment of highway transportation networks exposed to seismic hazards. This study deals with the derivation of the seismic fragility curves of a simply supported RC girder bridge, commonly used (constructed) in Algeria, by considering the soil-structure interaction. A set of accelerograms (ground movements) compatible with the seismic hazard of the site were used as excitations (input) for the evaluation of the vulnerability of the bridge. Nonlinear time history analyses of the modelled bridge are then conducted using the chosen set of ground motions with various intensities representing small, medium, and large intensity earthquakes. The numerical fragility curves considering the SSI interaction (flexible base) were compared to those without considering the SSI interaction (fixed base) to assess the effect of soil-foundation interaction on the different components (piers, elastomeric bearings, and abutments). The results of this study show that the soil structure interaction (SSI) had some effect on the component fragility of this bridge. This effect was judged not very significant at the bridge system level.

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SEISMIC VULNERABILITY AND DAMAGE ASSESSMENT OF AN EXISTING URM BUILDING

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ABSTRACT

This study evaluates the seismic vulnerability of an existing URM building which is currently used as a city hall of one of the biggest cities in the east part of Algeria called CONSTANTINE. To avoid serious damages, in the future, a seismic vulnerability and damage of this kind of buildings is a must. A seismic vulnerability study has been considered. Structural analysis is performed based on the site investigation (including inspection of the building, materials characteristics, etc…). An analytical procedure for the derivation of fragility curves is proposed. Different tools regarding the determination of capacity curves of the structural system by using a nonlinear analysis are implemented and four damage states are defined. The earthquake action is expressed in terms of spectral values; the probabilities of the damage states are obtained considering a lognormal probability distribution. This paper presents the methodology, based on nonlinear and seismic analysis of existing buildings, followed in this study, and summarizes the vulnerability assessment of one of the strategic buildings according to the new Algerian seismic regulation RPA 99/version 2003. As a direct application of this methodology, both, static equivalent method, and nonlinear dynamic analysis, are presented in this paper.

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SELECTED ISSUES OF MEASUREMENT METHODOLOGY IN THE CONTEXT OF ASSESSING THE IMPACT OF VIBRATIONS ON PEOPLE IN BUILDINGS

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ABSTRACT

Vibrations transmitted through soil into buildings have the potential to inflict structural damage or accelerate the building's degradation, while also exerting an influence on the occupants' comfort. These oscillations can elicit annoyance among building inhabitants, and in extreme cases, manifest as disturbances in sleep patterns, headaches, and even neuropsychiatric disorders. Particularly concerning are vibrations within the low-frequency spectrum, ranging from 5 to 25 Hz, as this encompasses resonant frequencies of human internal organs. Despite extensive prior research efforts and the stipulations delineated in regulatory standards, the comprehensive understanding of vibrations' impact on individuals within buildings remains elusive, primarily due to the inherently subjective nature of vibrational perception among diverse individuals. Evidenced by recent amendments in national standards and international ISO norms, ongoing adjustments underscore the evolving comprehension of this phenomenon. The article comprehensively elucidates guidelines essential for the precise execution and thorough analysis of measurements pertaining to the impact of vibrations on individuals situated within buildings that passively receive such vibrations. These recommendations encapsulate a multifaceted approach, encompassing both the requisite specifications for equipment and instrumentation as well as the judicious selection of measurement locations and the meticulous scrutiny of recorded data. A pivotal facet in the measurement methodology of vibrations' impact on individuals within buildings lies in the discerning selection of measurement point locales. Diverse standards proffer disparate directives in this regard, thereby necessitating a comparative analysis elucidated within the article. Moreover, the article delves into the intricacies of choosing the measurement range and applying corrective filters during analysis, underscoring their significance in ensuring accuracy and reliability. Nonetheless, at the core of the methodology lies the critical determination of vibration duration, an indispensable consideration for comprehensive analysis. Finally, the article addresses a crucial aspect concerning data analysis: the frequency of sampling the recorded signal, which holds profound implications for the fidelity and efficacy of subsequent analyses and interpretations. Through an exhaustive exploration of these facets, the article furnishes invaluable insights into optimizing the methodology for evaluating the impact of vibrations on individuals within built environments.

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SENSITIVITY ANALYSIS OF GEOMETRICALLY IMPERFECT SINGLE-STOREY STEEL FRAME STRUCTURE – A COMPARISON OF TWO LOADING MODES

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ABSTRACT

In this study, two methods to numerically analyse a single-storey vertically loaded steel frame structure with initial geometrical imperfections are compared. The first method is deterministic, where the initial imperfections, sway of the frame and local bow imperfections of the columns are based on the corresponding European standard to design steel structures, Eurocode 3 (EC3). The second, probabilistic method, where the imperfections are defined by the random stochastic parameters is using the first order reliability method (FORM) along with numerous numerical finite element analyses in order to estimate the ultimate resistance of the structure. In this FORM method, the statistical values of these input imperfections are derived from the European standard for allowed erection and manufacturer tolerances, and these data corresponds with the experimentally measured imperfections on real structures. Material parameters, as Young's modulus and yield stress are also considered as stochastic variables. Design ultimate resistance based on EC3 is compared with the 0.1% quantile of the stochastic ultimate resistance of the FORM method. In general, assumptions of the deterministic EC3 approach are sometimes considered as overly conservative. The main objective of this study is to verify and evaluate these assumptions by comparison with more precise probabilistic method. Moreover, for both methods (EC3 and FORM), the resistance is determined under two loading modes, one by increasing of the force load, the other by prescribed displacement. The loading conditions of these two loading modes are applied analogically to each other, hence similar resistances for the corresponding method are expected. However, this assumption needs to be verified within the probabilistic analysis conditions, what is the secondary objective of this paper.

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SILHOUETTE OF THE CITY – HISTORICAL AND ARCHITECTURAL LANDMARKS

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ABSTRACT

The present work is part of the doctoral research, in which we aim to study the cores represented by the cult buildings included in the UNESCO heritage and those of major importance for the silhouette of the city, part of which is also included in the List of historical monuments in the county of Suceava in 2004. Although the main landmarks of the territorial evolution of the city of Suceava are provided by the cult edifices, at the same time, the knowledge of some valuable civil and royal monuments that bring new elements in shaping a broad and edifying image on the science of building in our country.

Suceava had an evolution of the urban form of a somewhat concentric nature (sometimes with tendencies towards the shape of a quadrilateral) around an initial nucleus (around the Mirăuți metropolitan church), with subsequent extensions being added (in two phases, depending on the churches founded in the 15th-17th centuries), which became necessary as the city grew.

An important role in shaping the physiognomy of the current landscape is also played by the relief of the city of Suceava and its surroundings. The exploitation of the features of the relief by placing monumental buildings for aesthetic or ideological reasons (the Royal Court, the churches, Alexandru Lăpușneanu's tower), on heights, the contrast of scale between the monuments and the great mass of city buildings, the specific conditions of the development of human agglomerations, were the factors that have led to the crystallization of a complex silhouette of the city of Suceava, where witnesses of the medieval and modern era merge more or less harmoniously with the dominant contemporary ones (tower blocks).

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SMALL-SCALE PHYSICAL MODELLING OF PAVEMENT STRUCTURE

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ABSTRACT

The interaction between the vehicle and pavement makes up the main part of the research, and its consequences are being addressed by engineers around the world. The vibrations generated by moving vehicles around the pavement spread to the subgrade to the environment. These vibrations can influence the integrity of civil engineering structures and buildings. To address these issues, small-scale physical modelling brings benefits, such as size reduction, simplification, or controlled conditions during the test. A physical model was developed to simulate mass for testing the effect of static and dynamic behaviour during the specific occurrences. A gelatin-based material was chosen for the needs of physical modelling, whereas the material parameters of this material were very suitable for the approximation of the dynamic behaviour of soil material. Infrared spectroscopy belongs to the group of non-destructive analytical methods, where the examined sample is not damaged in any way by the analysis while providing information about its composition. However, the real behaviour of the vehicle–pavement interaction system is more complicated as it is influenced by various factors. To describe the behaviour of viscoelastic materials, differential equations of the simplest FEM rheological models are most often used in static or dynamic loads. A standard static plate load test was performed due to the physical model's geometry and material parameters. It is a non-destructive method for determining the static strength of a material. The static plate load test is used to determine the bearing capacity and settlement, which consists of measuring the plate settlement at a given load acting on the plate. The simulation mass surface's dynamic testing aimed to measure the response in time acceleration forms. The analysis of the recorded data was focused on the frequency sensitivity of the investigated area and the dumping. Based on the performed experimental measurements on the physical model as well as the numerical simulation performed in FEM, we can state that the gelatin-based simulation mass is usable for the simulation of the earth environment in contact with building structures. The presented study investigated the possibility of applying simulation mass for physical modelling of a pavement. Future research in this area involves investigating particular pavement construction layers and the whole pavement structure in mutual interaction.

Corresponding Author: Veronika Valašková

STABILIZATION OF MASONRY ARCHES BY HIDDEN PRESTRESSING CABLES WITH THE POSSIBILITY OF CLEARANCE THE SPACE BY REMOVING THE FORGED TIE ROD

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ABSTRACT

Stabilization of baroque masonry structures with flat arches by longitudinal prestressing can be advantageously carried out by deliberately introducing a system of prestressing forces into the structure so that the normal effects of the prestressing force exceed the radial effects. Then the arch is transformed into a prestressed tie beam with a curved centreline. Additional prestressing is possible by the method of substitute cable ducts. Then the construction of the masonry arch becomes a prestressed tie rod supporting the wall pillars and even preventing their further spreading, as happens with the original and unprestressed arch.

The paper is addressed to the professional community, which, especially in the field of monumental Baroque masonry structures, often deals with failures of masonry arches and vaults. These structures are usually broken by cracks in the top. The supporting structures must resist the long term arching force, which has an oblique direction. While its vertical component creates no problems, the horizontal component of the arc force is considerable and, in addition, acts in the long term already to load the dead weight of the vaulted structure. Horizontal displacements at the base of the vault (of the supports) are the most prevalent failures, accompanied first by the formation of transverse cracks in the top section of the vault. Stabilization is a key step for their permanent rehabilitation.

By the additional prestressing, the structure supported by the supports becomes a prestressed tie rod, which in turn prevents further failure development until the pressure reserve is exhausted. The method is so effective that it even allows the original forged tie rod to be removed.

The removal of the forged rod of the masonry arch is an example of the high efficiency of the described method. It is a former Baroque granary adapted into a living space. Two roughly elliptical arches of brickwork of 300/600mm top section span the space with clearances of 6.0m and 6.3m. The masonry is made of solid bricks with lime mortar. The passage height under the arches was insufficient, only 1.72 m. It was raised to 2.4 m after the arch was prestressed and the forged tie rod removed.

The paper contains examples of the structural design, realization and measurement of the deformation response of the structure.

The method can be effectively used to stabilize masonry arches in the case of low stiffness of supports or to free space by removing a forged tie rod. Measurements of the implemented structure show its effectiveness and long-term reliability.

Corresponding Author: Ladislav Klusáček

STRUCTURAL AND SPATIAL CHARACTERISTICS OF PANEL HOUSING ESTATES IN BRNO

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ABSTRACT

Approximately a quarter of the Czech population lives in panel housing estates. Despite such a large residential structure, some data are difficult to trace. The article focuses mainly on panel housing estates in Brno. It aims to make the available data (Czech Statistical Office, cadastre, vector data, etc.) more transparent, even in graphical maps. The panel housing estates Kohoutovice, Lesná, Starý and Nový Lískovec, Vinohrady, and Komárov are described. The selection was based on the maximum possible variety of urban structures and constellations.

The main topic of the text is the structural systems of Brno's panel housing estates (Series G, T0xB, VVÚ-ETA, B70, OP, etc.), and their impact on the form of public space is examined. Among other things, the ratio of built-up and unbuilt-up areas, the percentage of transport, greenery, and the representation of public amenities within a particular panel housing estate were investigated.

It also describes the possibilities of adaptation of a specific structural system and the extent of current reconstructions in a given panel housing estate. On the scale of an apartment (layout changes), an apartment building (extensions, additions), and the whole housing estate (adaptation to increased traffic load, etc.). The most widely observed reconstruction element is the addition of higher floors, mainly in Brno-Kohoutovice.

The ownership structure is also described as houses and public spaces, where the owner can be either a private owner (residents of the house, co-owners, or investors) or public ownership (the city or municipality).

Among the individual settlements, it is possible to observe, for example, the highest percentage of green space, the highest average number of flats in an apartment building, or the highest percentage of urban land. A trend abroad and slowly in the Czech Republic is the comprehensive revitalization of panel housing estates in terms of buildings and public space. Data can indicate the potential development of panel housing estates and the future usability of individual construction systems.

Corresponding Author: Pavel Juříček

STUDY OF THE BEHAVIOUR MOMENT-RESISTING CONNECTION OF SOFTWOOD TIMBER ELEMENTS

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ABSTRACT

Timber moment-resisting connections present opportunities for streamlined architectural design using timber portal frames with rigid knee junctions, enabling open floor plans by eliminating the need for additional bracing or interior columns. This flexibility empowers architects to craft more versatile floor layouts, enhancing spatial aesthetics and functionality. However, moment-resisting connections between timber members, especially crossing ones, present several challenges – complex design, demanding meticulous detailing and precise fabrication and also lack of a detail design format in codes. One of the biggest disadvantages of timber moment-resisting connections made by steel dowels is development of relative rotation due to the timber as well as dowel's elastic-plastic behaviour, i.e., such connection may be referred to a semi-rigid group. The main objective of this study is to conduct a detailed investigation of semi-rigid timber connections by performing experimental tests of L-shape models, including examination of timber strength and stiffness properties. The rotational displacement between joined members was determined using measured distances between surface points by Particle Image Velocimetry (PIV). The experimental results are compared with an equivalent linear calculation model. Different connection models are treated by Dlubal RFEM software tools using experimentally obtained embedment stiffness variables. It is found that the linear behavior of the semi-rigid connection is up to approximately 40% of the connection's design capacity, after which distinctly nonlinear force-deformation relationship develops.

Corresponding Author: Janis Fabriciuss

STUDY ON THE SEISMIC-INDUCED LATERAL SPREADING ALONG THE WATERFRONT FOR TAIPEI BASIN

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ABSTRACT

The Taipei Basin, the political and economic centre of Taiwan, is underlain by soft alluvium soils that are susceptible to soil liquefaction and lateral spreading, particularly along the waterfronts with sloped ground during earthquakes. Therefore, it is crucial to evaluate the damage hazards and risks to infrastructure in areas vulnerable to liquefaction and lateral spreading within the basin. Initially, the data of boring log, groundwater tables, and cross-sections along the Tamsui, Keelung, and Xindian Rivers in the Taipei Basin were collected. Two possible earthquake scenarios with four different intensities, based on aseismic design codes (including design earthquakes and maximum considered earthquakes) and the rupture of the Shanchiao Fault (with moment magnitudes of 7.1 and 7.5), were considered. The spatial damage index for liquefaction was interpolated using the Sequential Gaussian simulation method. The displacement of the lateral spreading was evaluated using the multilinear regression (MLR) model. Subsequently, the approach that combines hazard and vulnerability was used to evaluate the risk of lateral spreading along the waterfront and bridge sites.

It is shown that the risk of lateral spreading induced by the rupture of the Shanchiao Fault is greater than that from design earthquakes and maximum considered earthquakes according to the aseismic design codes. The characteristic earthquake of the Shanchiao Fault has the most significant impact on lateral spreading displacement, and, therefore, must be included in risk assessments. In the scenario of the Shanchiao Fault rupture, the highest risks of lateral spreading are near the banks of the Tamsui River, while the Xindian River area has the lowest risk. Therefore, for buildings, bridges, earthworks, and lifelines located along high-risk waterfronts, implementing countermeasures against soil liquefaction and lateral spreading is essential to mitigate earthquake-induced damage.

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SUBSIDIES ON GEOMORPHOLOGICAL AND GEOLOGICAL-STRUCTURAL ELEMENTS FOR THE KNOWLEDGE OF DEEP AQUIFER SYSTEMS OF HOT SULPHUREOUS GROUNDWATERS IN THE MEDA REGION (PORTUGAL)

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ABSTRACT

The Meda region is a territory in the interior of Portugal, made up of essentially rocky terrain of the Hercynian granite type and the ante-Ordovician schist type. The local population lives essentially from agriculture; only a small percentage lives from services, commerce, and other residual activities. The supply of drinking water to the population is provided essentially from surface water, rainwater, stored in the Ranhados Dam, on the Rio Torto. The most common groundwater is essentially used for agricultural activities and is abstracted from surface aquifer systems, mainly in granite massifs, up to around 100m deep. The waters of these systems have hydrogeochemical characteristics typical of short underground circuits, shallow, with an acidic pH of around 6, dry residue less than 200 mg/L, with the dominant anion being bicarbonate and the dominant cation being sodium and/or calcium. However, there are occasional occurrences of groundwater, which although very rare, are very important due to their specific characteristics; these come from very deep aquifer systems, also associated with percolation along the granite massifs. These rare groundwaters are sulphureous, with the presence of reduced sulphur species, are alkaline due to their pH being higher than 8, have dry residue values higher than 200 mg/L, belong to the sodium bicarbonate facies, have significant concentrations of silica, with SiO2 between 25.0 and 63.5 mg/L, have fluoride values higher than 10 mg/L, and also have the presence of carbon dioxide (total CO2); present several trace elements with relevance to Boron (B), Rubidium (Rb), Strontium (Sr), Cesium (Cs) and Tungsten (W). There is also the particularity that the latter waters are warm, resurfacing to the surface at temperatures higher than normal in the region (15ºC), with the highest temperature at the AC1A Hole of the Longroiva Medical Spa, with 47.4ºC. Geothermometer studies indicate reservoir temperatures of around 78ºC for Águas do Graben, 84ºC for Areola and 115ºC for Longroiva, which are the three main natural discharge sites for these deep aquifer systems. The potential use of these special waters is for thermalism activities and geothermal exploitation, as is already the case at the Longroiva Medical Spa. Therefore, in order to promote the exploration of those waters and new applications, it is necessary to know as accurately as possible the geohydraulic model of the circuit of those waters, and the geomorphological and geological-structural aspects are absolutely central to this process. So, this article, after a brief introduction, presents the main geomorphological and geological-structural characteristics of the region and explains the various details that led to the compartmentalization of the region into three potential exploitation poles: Longroiva Medical Spa, Areola Medical Spa, and Águas do Graben. Finally, some final notes are presented on proposals for new studies to support detailed knowledge of the geogdraulic models of each Pole, as well as some perspectives for new applications on these waters that could promote the development of the municipality.

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THE BARROCAL. DRY STONE TECHNIQUE AND CONSTRUCTIONS

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ABSTRACT

This work aims to publish the dry stone heritage of the Barrocal region, Algarve, southern mainland Portugal. Throughout this work, it was discovered that these buildings are, for the most part, in ruins. Their rehabilitation and dissemination would be possible because they have a great cultural value and a sense of belonging to these places, among the population that still lives in this region.
The methodology for carrying out this work was based on four phases: 1) contextualization of studies developed in Portugal; 2) identification and classification of dry stone constructions, according to their use and typology; 3) registration and analysis of these constructions with the aim of obtaining constructive and geometric data; 4) proposals for conservation and promotion, both of construction techniques and buildings. This survey is original, as it has not yet been carried out from this point of view. There is some work on dry stone, but mainly focused on walls.
The fact that this heritage is not valued and has lost its usefulness means that it is at serious risk of disappearing. With better knowledge of this type of heritage, it is possible to make people value it and develop strategies to promote it, thus managing to maintain it. Through the dissemination of this work, it is hoped that this type of heritage will be valued and preserved. In practice, with the Algarve being the most touristic area in Portugal, the reuse or definition of new functions of this heritage can be an added value for tourist activity.

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THE CALCULATION OF THE SEASONAL PERFORMANCE FACTOR (SPF) OF A DOMESTIC HOT WATER HEAT PUMP INTEGRATED WITH A MECHANICAL VENTILATION INSTALLATION WITH HEAT RECOVERY FOR A RESIDENTIAL PREMISES IN THE ENERPHIT STANDARD

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ABSTRACT

The existing residential premises located in the attic in Poznań, owned by a private person, was qualified for deep energy modernization due to high energy consumption and related costs. The goal was achieved by thermal modernization of the premises to the EnerPHIT standard according to the Passive House Institute in Darmstadt. One of the most important elements of the energy modernization was the installation of mechanical ventilation with heat recovery, which was integrated with the installation of a heat pump for heating domestic hot water.

The article estimates the energy and economic benefits resulting from the integration of an air-water heat pump for the preparation of domestic hot water. with a mechanical supply and exhaust ventilation system with heat recovery. In the summer, the domestic hot water heat pump it receives heat from the air blown into the object's volume, contributing to its cooling, this is the so-called discharge cooling - free of charge, created as a result of heating domestic hot water. In transitional periods and in winter, the domestic hot water heat pump extracts heat from the ventilation air discharged from the building. Exhaust air has a greater energy potential than outside air because it is warmer and more humid.

Simulations were prepared using meteorological data of the Poznan City taken from ministerial resources, which are considering typical meteorological years and statistical climatic data compiled. They take into account the dry and wet bulb temperature variations, relative humidity, moisture content and radiation intensity for different orientations and the angle of incidence for every hour of the year. To calculate the heat demand for preparing hot water, the actual profile of hot water consumption by users was adopted. To calculate the cooling demand daily usage profile of devices and daily attendance profile of residents were made.

Based on the simulations it has been demonstrated that the proposed technical solution has a high application potential for micro scale installations using heat recovery from exhaust air. The presented solutions can be used in the design new buildings (not only residential) with almost zero energy consumption, as well as those with a positive energy balance, and especially for deep energy modernization of existing residential buildings.

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THE CONCEPT OF MONITORING OF LANDSLIDES ALONG THE RAILWAY TRACK LOCATED IN THE CARPATHIAN FLYSCH

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ABSTRACT

The landslides constitute a natural danger to urbanized areas and pose a real threat to both to the human lives and property. Hence, the landslides should be classified as a high-risk danger. The paper presents an original method of determining the critical values of ground deformation based on the results of numerical modelling using the finite element method for a railway track located in the Carpathians.

It is estimated that in the Polish Carpathians there is on average one landslide per 10 km of railway track and one landslide per 5 km of road. Landslides in the Carpathian flysch are particularly susceptible to activation due to the geological structure of subgrade. In flysch formations, the risk of a landslide is related to the alternating layers of sandstone and easily soaked clay shales and long-term hydration of these formations. Another characteristic feature of the geological structure of the Carpathian flysch is the existence of a weathered zones under the soil layers, which are characterized by large fragmentation of the rock. Such a layer of the weathered material laid on the bedrock also has a high susceptibility to sliding, and creating the sliding surface between the weathered material and the bedrock. In most cases, landslides on railway routes do not occur as a result of the natural structure of the subgrade. The very common factor causing landslide movements is connected to the human activity. The occurrence of these landslides is related to changes in ground conditions during the construction of transportation routes. Another cause of these landslides are technical errors made during the construction of the infrastructure.

In the paper, the problem of monitoring of landslides located along the railway track is considered. Railway tracks lying along the slope are exposed to the risk of landslides, especially in areas with a relatively steep slopes. Developing the railway infrastructure on such a slope requires sometimes the cutting of the slope. As a consequence of the change in the shape of the slope surface the subsidence of part of the soil may result in the loss of stability. The most vulnerable are slopes that have a natural predisposition to landslides. The cause of a slope sliding may also be a change in geological and hydrogeological conditions. Landslides may occur both above and below the constructed railway track, partially burying it or causing it to collapse.

Landslide monitoring involves conducting regular observations of areas where typical landslide movements have occurred or where there is a risk of typical landslide movements. The basic classification of methods for observing mass movements can be made according to the type of monitoring. Landslide monitoring methods may simply be divided into in-depth and surface methods. Landslide monitoring should be carried out using the latest usually wireless methods. The main purpose of observing and controlling these areas is to determine the critical state. After exceeding the critical state, the friction forces in the ground might not support the mass of the earth and the ground slides. The critical state is determined on the basis of subsoil in-situ measurements and laboratory tests of the samples obtained in the endangered cross-sections and the numerical modelling. The results of the modelling are implemented into measurement system as the limit values for inclinometers as well as the surface surveying points.

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THE DAMPING OF VIBRATIONS AT THE TRANSFER POINTS OF BELT CONVEYORS USED IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

Construction debris removed from demolished buildings or loose building materials are in many cases transported from mining sites to the places of their processing using belt conveyors. When transporting building materials over longer distances, transport routes are used, i.e. the required number of belt conveyors arranged one after the other. The grains of the transported material are projected at an angle through the end drum of one belt conveyor and fall on the working surface of the other belt conveyor. At the points of material grain impact, the conveyor belt is supported by traditional fixed belt conveyor idlers or by so-called impact bed conveyors. Traditional belt conveyor idlers, fitted with impact rollers, are usually installed in the places of the transfer points of belt conveyors arranged one after the other. These can be used mainly for the horizontal, but also the vertical transport of bulk or piece building materials. The grains of bulk building materials falling on the surface of the conveyor belt at the transfer points or hoppers damage the covering rubber layer and the supporting frame of the conveyor belt and generate dynamic forces that are transferred to the load-bearing track of the conveyor belt. This paper presents a belt conveyor idler of a special design, which consists of placing plastic brackets in structurally modified trestles. Impact rollers can partially absorb the dynamic forces generated by the high potential energy of the building material grains. The paper presents the detected forces acting in the places of mechanical attachment provided by experimental measurements carried out on a laboratory belt conveyor idler attached to the aluminium frame, which simulates the load-bearing carrier track of a conveyor belt. During experimental measurements done on laboratory equipment made of drawn aluminium profiles, a mechanical shock occurs between the weight and the rubberized shell of the impact roller. The weight falls in a free fall from a known height on the casing of the impact roller, thus deriving a dynamic force. This is transferred via the roller axis into the idler and through its supports to strain gauge force transducers, which are mechanically attached between the frame of the laboratory equipment and the supports of the belt conveyor idler. From the values of forces obtained when providing repeated measurements under the same conditions and detected by strain gauge force sensors, values were recorded in the tables presented in the article, and the mean values of the forces generated by the incident weight on the rubber surface of the impact roller were calculated.

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THE EFFECT OF THE DEDICATED BINDER ON THE PROPERTIES OF COLD RECYCLED MIXTURES

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ABSTRACT

The most important priority in the field of environmental protection is the implementation of the principle of closed-cycle materials management in construction. This problem also plays an important role in road construction. Due to the increasing traffic load of heavy vehicles and the impact of climatic factors, the road structure is subject to destructive processes that lead to the loss of its durability in time. Therefore, the roads periodically need to be modernized. Very often, it is necessary to carry out critical activities on the foundation to improve the load-bearing capacity of the pavement structure. As part of these works, large amounts of reclaimed asphalt and aggregate are obtained during milling of the lower structural layers of the surface. Applying the principle of closed-cycled material management, the most effective technology for using this material is its re-construction using deep cold recycling technology. This technology uses hydraulic binder and bituminous emulsion, and currently, more and more often, foamed bitumen. Due to the fact that the materials obtained from road structure layers are of very different quality, it is necessary to use a binder that will be dedicated specifically to the materials used (reclaimed asphalt pavement, reclaimed stone). In experiment Portland cement CEM I 32.5, hydrated lime and cement by-pass dust as a by-product obtained from cement plants were used. All components were mixed in various proportions controlled by experiment plan. The influence of a dedicated binder on absorption, dynamic modulus, phase angle in the specific temperature range and rutting resistance of a cold recycled mixture designed with reclaimed asphalt pavement, reclaimed aggregate and foamed asphalt was examined. The obtained test results were subjected to statistical analysis using the ANOVA test in order to determine the significance of the influence of individual components of the dedicated binder on the considered parameter of the cold recycled mixtures. It was determined that the dedicated binder used for the tested recycled asphalt mixture ensures its most favorable parameters when contains: 40% CEM I 35.2, 20% hydrated lime and 40% cement by-pass dust.

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THE INFLUENCE OF TRAFFIC VIBRATIONS ON BUILDINGS AND HUMAN INSIDE THE BUILDINGS

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ABSTRACT

The intricate relationship between traffic vibrations and the buildings as well as the occupants inside, particularly in masonry buildings, is a multifaceted issue that demands meticulous attention because of its adverse impact on the structural integrity of buildings and the well-being of those living or working in them. This problem is intricate since it involves several areas, including the dynamics of structures, wave propagation in soil, acoustics, and the individual's psychophysical response. Traffic shaking can cause important damage to masonry buildings, including cracking and structural deformation, due to their heavy mass and rigid construction. This damage can compromise the safety of the building and pose a danger to the occupants. Additionally, building occupants may experience discomfort, annoyance, and health issues such as headaches, stress, and sleep disturbances due to the vibrations. Furthermore, low-intensity para-seismic events like mining tremors may endanger human health in a manner akin to how vibrations from traffic do. Vibrations from traffic can cause plaster to crack, structures to be damaged, or even to collapse or fail structurally. To minimize the adverse effects of traffic vibrations on masonry buildings, it is imperative to develop effective strategies that do not compromise the structural integrity of the building. These strategies could involve adding dampers or isolators to the building's foundation or strengthening the structural elements to enhance their resistance to vibrations. Nevertheless, the distinct characteristics of masonry buildings can make it challenging to implement these strategies. Despite the efforts made so far, research on the impact of traffic vibrations on masonry buildings and the occupants inside remains somewhat limited, and further studies are required to achieve a better understanding of the problem. The outcomes from these studies can contribute to the development of better mitigation strategies, thus reducing the impact of traffic-induced vibrations on the well-being of people and the stability of masonry buildings. In general, the impact of traffic vibrations on masonry buildings and their occupants is a significant issue that cannot be overlooked. It is crucial to comprehend the effects of traffic shaking on masonry buildings and the individuals inside them to develop practical strategies that prioritize the safety and well-being of the building residents. So, it is indispensable to pay attention to this issue and implement appropriate measures to minimize its impact on masonry buildings and their inhabitants.

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THE LITHOLOGICAL COMPOSITION OF THE BED SEDIMENTS COLLECTED ALONG THE SF. GHEORGHE BRANCH (KM 85 – KM 15) (STREAMS, ARTIFICIAL CANALS, RECTIFIED MEANDERS, INCLUDING LATERAL CHANNELS AND LAKES), DANUBE DELTA, ROMANIA

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ABSTRACT

The Sf. Gheorghe distributary (the oldest branch of the Danube River) is subject to different hydro-sedimentary impacts due to the anthropogenic meander cut-off plans undertaken in the last decades for navigational purposes. This study aimed to determine the contents of the main lithological levels (*i.e.,* organic matter – TOM%, carbonates – CAR% and siliciclastics – SIL%) in the bed sediments, using the LOI (Loss in Ignition) method. In this sense, a field sediment investigation has been conducted in 58 sampling sites located on the Sf. Gheorghe Arm (km 85 – km 15) (rivers, artificial channels, rectified meanders, including side channels and lakes), during May 2024. The distribution of the organic matter, carbonates and siliciclastics showed a significant spatial variability. The implemented analyses made it possible to distinguish mineral-rich sediments (>15-30%SIL) found especially in river sections, while organic-rich sediments (>15-30%TOM) were mainly identified in lakes. From these outcomes, it seems reasonable to conclude that the sediment deposition and accumulation are strongly influenced by the local hydrodynamic conditions (fluvial and lacustrine environments) which allow the accumulation of a mixture of different sediments. This study enables quantitative evidence related to the main lithological components of the bed sediments within the Sf. Gheorghe Arm (km 85 – km 15), and present a database for future sustainable ecosystem restoration and management measures, to protect and maintain wildlife habitat and biodiversity on the Danube Delta edifice.

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THE ROLE OF ARCHITECTURAL REWRITING IN POST-WAR RECONSTRUCTION: THE CASE OF MOSUL AND THE TIGRIS RIVERBANK

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ABSTRACT

The research aims to explore the methods for rewriting techniques to reconstruct the riverbank of the Tigris River in Mosul, procedure which can recall a series of constant features of the previous settlement involved in the design process, such as permanence, traces, absences, etc. This choice depends on the assumption that reviving city riverbank spaces is an essential phase in the post-war reconstruction, especially for cities with strong connections with rivers – such as Mosul – since riverbanks can become new collective and civil spaces for the post-war life of cities. The definition of rewriting takes inspiration from literary world, but in the academic field of architecture implies a proactive attitude of critically reworking formal characteristics belonging to some features of previous configurations.

Mosul, the second largest Iraqi city, is selected to be the case for this research owing to its special status: the Mosul city was established on the western riverbank of the Tigris River in the 6th Century, across from the archaeological relics of the ancient Assyrian city of Nineveh, which was prosperous during the ancient era. However, it has been severely affected by the civil war between the terrorist organization– the Islamic State – and the Iraqi government from 2014 to 2017. This civil war suffered a substantial economic and development setback and experienced widespread destruction of civil and industrial infrastructure from systematic and extensive sabotage and looting, which represented the loss of those architectures of collective and symbolic importance for the city's identity. In this situation of loss of collective facilities and identity, investigating and applying rewriting techniques not only can suit the urgent need for post-war regeneration but also enhance the consolidated relationships between diversity and unity, past and present, tradition and contemporary.

The research employs the methodologies of literature review, site analysis, case study, and design research to gain a series of practical principles and methods for the rewriting technique. These principles and methods can guide the design work in the reconstruction process, improving the quality of riverbank space with the site logic and spirit. Furthermore, the theoretical outcome of this research has the potential to significantly advance the discipline more broadly.

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THE USE OF MACHINE LEARNING METHODS TO DETERMINE RISK ZONES FOR CONSTRUCTION DISASTERS CAUSED BY WIND - A CASE STUDY IN POLAND

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ABSTRACT

The increasing availability and use of artificial intelligence (AI) methods and algorithms have led to their widespread use in analyses aimed at identifying the decisive factors that influence the course of a studied phenomenon or process. AI algorithms include a wide range of methods. They can be used together or separately. The article describes the use of two Machine Learning (ML) methods, PCA and k-means, to identify parameters that may increase or decrease the risk of construction disasters caused by strong winds in Poland. The analysis was conducted using a unique dataset on construction disasters in Europe, sourced from the General Office of Construction Supervision in Poland for the period 1995-2019. The occurrence of disasters was categorised by voivodeship and cause, with information provided on the number of people injured. ML analyses were conducted to determine whether land development, population density, and weather factors, such as wind, have an impact on the number of recorded disasters.

Corresponding Author: Ireneusz Laks

THE WEB ACCESSIBILITY VIEWER: A TOOL TO ASSIST TRAVELLING PERSONS WITH DISABILITIES

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ABSTRACT

According to the Austrian Federal Disability Act, a disability is defined as the effect of a non-temporary physical, mental or psychological impairment that makes it difficult to participate in social or working life. According to a survey conducted by Statistics Austria in 2015 as part of the micro-census, 18.4% of the population were affected by disabilities. Permanent disabilities are strongly age-dependent, so this figure is constantly rising as society ages, making it more important to make tourism, leisure, and recreational activities accessible to this section of society.

The EU-Interreg funded project CE-Spaces4All aims at the improvement of accessibility of tourism for persons with disabilities, concentrating on three groups with different requirements: persons with mobility impairments (wheelchair users), blind people and persons with visual impairments, deaf people and persons with hearing impairment. Public authorities, tourism development stakeholders and persons with disabilities from seven countries are working together in three European pilot regions (Poland, Austria/Czech Republic, Slovenia/Croatia/Hungary) in a capacity building process to improve conditions for accessible tourism development and independent tourism travel. A key element of the project is the Web Accessibility Viewer (WAV) which serves as a data-driven platform for recording and visualizing architectural, communication and other barriers, for developing tourism strategies and spatial planning, and for developing tools and services for persons with disabilities. The project partners organised field mapping events to capture barriers on-site in the pilot regions and record them on a map.

The WAV is a Geographic Information System (GIS) based online service with a desktop and a mobile application based on QGIS open source software to collect data according to a joint catalogue of barriers developed together with the European Disability Forum, an umbrella organisation of persons with disabilities that defends the interests of over 100 million persons with disabilities in Europe. The WAV comprises tourism-related barriers (for example parking, paths, public transport, tourism facilities, points of interest) from all pilot regions categorised by the three groups of persons with disabilities mentioned above supplemented by an easy-to-understand accessibility assessment with a semaphore system (red: not accessible, orange: partly accessible, green: accessible). Photos of the mapped spots are taken by the respective mapping teams and directly linked with the datasets. The WAV is available in English as well as all the national languages of each project partner country.

Work with the WAV subsequently resulted in a catalogue of barriers that serves as a starting point for further measures, for example for action plans for long-term territorial cooperation on improving accessibility of the pilot regions. Awareness raising events with local and regional stakeholders complement the agenda of sensitising institutions, companies and public administration related with tourism. This will lead towards a better governance for policy and territorial planning of accessible tourism as well as improvement of public services for persons with disabilities.

Corresponding Author: Clemens Beyer

TOWARDS ACHIEVING GREEN BUILDING IN SAUDI ARABIA THROUGH MOSTADAM RATING SYSTEM

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ABSTRACT

Globally, the idea of green buildings is highly well-liked. The negative environmental effects of the building greatly encourage the global spread of the green building paradigm. Sustainable buildings are sometimes referred to as green buildings. Many organizations have created various green building grading systems to assess these buildings during the last few decades. Still, most green buildings certified using these rating techniques are evaluated mostly based on their structure and layout. The life cycle of a green building goes beyond these preparatory stages since its full advantages become increasingly evident as it moves through its operational stages. Nonetheless, it is obvious that very few green construction initiatives have been awarded green certificates that assess the building's operational phases. Thus, this study aims to determine what issues and challenges stand in the way of green buildings being certified during their operating phases. The first step was identifying and analyzing widely MOSTADAM green building grading techniques based on the assessment criteria. After this analysis, a detailed discussion of MOSTADAM guidelines for evaluating green buildings was highlighted. In addition, a case study of the Najran building was included in the analysis. The MOSTADAM was used to analyze this case study building and other international standards to achieve the goal. The study employed organized interviews, and strategies for removing them were also covered. The three primary impediments were the discrepancy of government rules, the market's incapacity to safeguard manufacturers' interests, and the difficulty of complying with technical criteria.

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TRRAFIC MANAGEMENT AS A MEANS OF PROTECTION AGAINST ROAD NOISE

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ABSTRACT

Road noise pollution constitutes one of the primary health threats to residents living near roads. An important aspect is the limitation and counteraction of excessive exposure to road noise. Existing protection measures vary in effectiveness and applicability. One of the potential solutions involves activities related to traffic management.

Based on a review of current knowledge and own analyses, the authors propose noise protection measures focused on the noise source. In the monograph 'Modelling and Assessment of Solutions for Protection Against Road Noise' (2017), Bohatkiewicz J. suggested a classification of noise protection measures, where one group involves reducing noise in the emission zone through: optimizing communication efficiency, planning and managing parking zones, organizing, slowing down and directing traffic, Intelligent Transport Systems (ITS) management and direction systems, traffic calming, and rerouting and combining traffic on certain connections related to traffic organization. Existing relationships between road traffic conditions and road noise allow for the selection and application of the aforementioned measures.

To verify this thesis, the authors conducted studies and analyses on the impact of road traffic conditions on the noise level. To determine these conditions, the Highway Capacity Manual 6th method was used. Meanwhile, road noise was determined based on simulations using the NMPB-Routes and CNOSSOS-EU models.

Traffic management, as well as the potential introduction of autonomous vehicle traffic, can lead to a reduction in road noise emissions. Most research and analysis rely on computer simulation results, due to the small share of autonomous vehicles in current traffic. However, an increase in the number of autonomous vehicles can positively affect road traffic capacity and safety by increasing vehicle flow capabilities. In scenarios of autonomous vehicle traffic, two basic parameters play a key role: speed and vehicle spacing. By optimizing these parameters, the environmental impact can be minimized.

A detailed examination of the impact of road traffic conditions will contribute to the development of new methods for protection against road noise. Choosing appropriate traffic and vehicle management scenarios can significantly reduce road noise emissions.

Corresponding Author: Marcin Dębiński

UNDERSTANDING AND ADDRESSING ON-SITE MOISTURE PROTECTION CHALLENGES IN TIMBER CONSTRUCTION: A COMPREHENSIVE REVIEW OF GERMAN PRACTICES

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ABSTRACT

Wood is increasingly recognized as a sustainable building material due to its renewable nature and ability to sequester carbon dioxide (CO_2) from the atmosphere. As a result, timber construction is gaining popularity, offering environmental benefits and contributing to the reduction of greenhouse gas emissions in the construction sector. However, due to its biodegradability, moisture protection poses a significant challenge in timber construction, particularly during the assembly process, where inadequate protection measures can lead to long-term damage and compromise structural integrity. This study examines the processes that affect moisture protection in timber construction on the basis of site visits to 21 construction projects over the period of three years. During the visits, photographic documentation was created and a self-developed register was used to record the processes of assembly-related moisture protection in timber construction. The analysis focuses on wall and ceiling assemblies, documenting the implementation of moisture control strategies and identifying common sources of error. The study highlights the necessity of comprehensive design and implementation of moisture control measures to fully realize the benefits of timber construction. Furthermore, the study highlights the need for a comprehensive understanding of the processes of moisture ingress and drying in various types of timber construction. In addition, appropriate quality management and easily implementable practices are needed to address this critical point in the assembly process. The systematic investigation presented in this study aims to contribute to the understanding of moisture protection in wood construction and to identify areas for improvement in current practices.

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UPSKILLING THE CONSTRUCTION WORKFORCES AROUND BIM FOR ENERGY EFFICIENCY

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ABSTRACT

Global warming has drastically increased the pressure to reduce energy use in buildings. The European construction sector is facing unprecedented challenges to achieve ambitious energy efficiency objectives and generalize near-zero energy buildings during an economic crisis that is dominated by reduced investments, and a search for cost effectiveness and high productivity. Moreover, the industry is experiencing a digital revolution and the Building Information Modelling (BIM) approach has been gaining interest across Europe. The member states of the EU have implemented many different approaches through regulations and maturity targets, which have to constantly face the traditional low-tech and informal practices of construction businesses.

This poster will provide an in-depth analysis of BIM-related roles and skills for construction professionals to inform current and future training strategies, and with a view to deliver energy-efficient buildings. The methodology included a Europe-wide consultation with experts and practitioners, as well as an in-depth analysis of social media sources used across construction communities, informed by a comprehensive literature review. This has helped to infer the roles and skills that are necessary in delivering a BIM-based project, as well as informing future BIM training and education needs. One of the main findings is that these roles, skills and associated training needs are not static but evolve to reflect the maturity and evolution of technology and the construction workforce.

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URBAN DEVELOPMENT - SPECIFIC ASPECTS OF THE CITY OF SUCEAVA DRIVEN BY THE ORTHODOX CHURCHES

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ABSTRACT

The present paper is part of the doctoral research on the places where monastic churches created urban structures that have been preserved to this day in Suceava municipality. The article briefly presents the period from which are dated the oldest churches that have been preserved over time, namely in the 14th to 17th centuries.

Natural continuity in the urban space does not mean either the destruction or the indiscriminate preservation of everything that is old, but, on the contrary, an integration between what is created new and what is useful as a material or spiritual value from the historical existing.

In the configuration of the medieval city, the church was a polarizing reference point. In this sense, the topological field, as the urbanistic meaning of all religious architecture projects (monuments that have been preserved to this day) constitutes a totality of connected areas configured. Due to the urban texture, these areas are in reciprocal relations with the civic center. It can therefore be stated, based on the topological analysis, that the medieval religious architecture also has an important urban dimension.

The founding activity on the territory of the city of Suceava, during the Middle Ages, materialized through a remarkable series of art and architecture monuments, of which, those that have survived to this day, make up a distinct compartment of the dowry of the national cultural heritage, being formed from only 11 churches that still exist today, from the 24 definitely registered in the documents issued by the royal chancellery.

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URBANGRAPHICA: DIGITAL TWIN FOR ESTIMATION OF PUBLIC SPACES QUALITY

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ABSTRACT

The paper describes methods and process of creating a digital twin of the city on case study of Bratislava called UrbanGraphica. The process is divided into three stages. First stage includes collection of data and modelling of the digital model of the city. The second stage integrates a wide range of information layers from various sources into the model. These collected information layers include data on traffic, vegetation, noise, solar irradiation, historical value of the buildings, shadows, key viewpoints and temperature. In the third stage, these diverse datasets are overlaid to enable a comprehensive scoring system aimed at quantitatively assessing the quality of public spaces. Subsequential validation of this quantitative assessment is based on the comparison with maps of public sentiment, which were obtained from city inhabitants through questionnaires available as open data. This comparative analysis may reveal correlations between the physical and social parameters of the city. Furthermore, these integrated datasets enable the development of advanced machine learning models capable of predicting the popularity of public spaces based on their measurable characteristics. These predictive models are possible to be used to evaluate and refine the design of future public spaces during the planning stages, thereby improving decision-making processes. Additionally, the created digital twin is also utilized for estimating the potential for solar and wind energy production and utilization, thus supporting sustainable development goals of the city. The created digital twin was already published as physical model and as online digital model. Collected data from various sources into one platform provides more comprehensive image of the city. Moreover, utilisation of data analytics and machine learning leads to more responsive and sustainable urban environments, contributing to the well-being of the city inhabitants.

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USEFULNESS OF SWAT MODELING IN URBAN AREAS ON THE EXAMPLE OF POZNAŃ

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ABSTRACT

SWAT (Soil Water Assessment Tool) is a hydrological modelling software widely used in hydrological modelling for agricultural purposes. For the hydrological modelling of urban catchments, programmes dedicated to drainage and sewerage design are mainly used. Green spaces play an increasingly important role in urban planning, including water retention and infiltration. SWAT software can be helpful in planning urban green spaces and assessing their impact. A model for the city of Poznań is presented here as an example. Since in urban conditions there is a need for higher resolution data (areas occupied by urban greenery or buildings are small), the SWAT model was created using soil-agricultural map, Urban Atlas data and DEM with 25m spatial resolution. The main challenges and pitfalls of urban hydrological modelling were:

- Calibration and validation. As calibration can be very difficult at the scale of larger cities (many catchments, sewers and drainage systems), a SWAT model is more useful as a tool for qualitative analysis and comparison purposes.
- Analysed units. SWAT uses catchment areas, while UGS planning has to work within city and district boundaries, so catchment areas of several rivers had to be used.
- Soil nomenclature. SWAT uses USDA nomenclature and there is no explicit relationship between USDA classes and Polish soil nomenclature. Apart from this problem, the urban soil surface is often compacted and clogged, so in case of doubt the hydrological soil group with lower conductivity was used.
- Reclassification of Urban Atlas data to SWAT classes. The highest proportion of impervious area class built in SWAT is 60%, which is too low for city centres at the resolution used, so new classes were created. Land use is most important in urban conditions - slopes and soils are less important than in larger scale rangeland modelling.
- Need for comprehensive maps for the areas analysed - all HRUs (hydrological response units) had to be modelled, whereas in typical SWAT models they are generalised.

The outputs of the model, including surface runoff in given months, infiltration, evapotranspiration and water stress, can be employed to identify areas that are deficient in urban green space services and to inform urban greenery planning.

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VERIFYING THE SHEAR LOAD CAPACITY OF SİMULTANEOUSLY HORİZONTALLY AND VERTİCALLY REINFORCED MASONRY WALLS BY THE V_{RD}–N_{ED} INTERACTION DIAGRAM

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ABSTRACT

The article closes the series of the author's publications on checking the load-bearing capacity of shear masonry walls using V_{Rd}–N_{Ed} interaction diagrams. Considerations published at the WMCAUS 2021, WMCAUS 2022 and WMCAUS 2023 conferences regarding unreinforced, horizontally reinforced and vertically reinforced walls were used. The paper presents the principles of checking the load-bearing capacity of reinforced masonry walls loaded horizontally (shear) and vertically using the provisions of the EN 1996-1-1:2010 standard and the draft Eurocode 6 (prEN 1996-1-1:2017). Similarly to the author's previous considerations, which described method V (when only vertical reinforcement is used), method H (when horizontal reinforcement is used), in the VH method the simultaneity of vertical and horizontal reinforcement was analyzed. Cases a, b and c were also considered, which differ in the course of normal stresses at the wall edges, determining the form of the USL equations. The article concerns the VH method in which the reinforcement is placed vertically and horizontally. Similarly to previous publications by Jasiński (2021, 2022, 2023), the necessary equations determining the load-bearing capacity of the cross-section as a function of the vertical load N_{Ed} are presented. Examples of V_{Rd}–N_{Ed} interaction plots are presented.

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